

Chapter Ind 8

FLAMMABLE LIQUIDS

Ind 8.001	Scope	Ind 8.37	Foundation, ground, dikes, surroundings
Ind 8.01	Classification of liquids	Ind 8.38	Tanks labeled
Ind 8.02	Manufactured liquids	Ind 8.39	Material of aboveground tanks
Ind 8.03	Definition of container	Ind 8.40	Construction of tanks
Ind 8.04	Permits	Ind 8.41	Valve near tank
Ind 8.05	Permits required	Ind 8.42	Pipes in rooms with open flames
Ind 8.06	Use of flammable liquids without permit	Ind 8.43	Pumps required
Ind 8.07	Application for permits	Ind 8.44	Gravity and pressure feed restricted
Ind 8.08	Inspection before covering	Ind 8.45	No connection to drains
Ind 8.09	Modification of requirements	Ind 8.46	Valve in drawing-off pipes
Ind 8.10	Appeal	Ind 8.47	Pumps
Ind 8.11	Hazardous heating and lighting	Ind 8.48	Requirements for piping
Ind 8.12	Storage in public places	Ind 8.49	Extinguishers required
Ind 8.13	Storage near exits	Ind 8.50	Tank vehicles
Ind 8.14	Exits required	Ind 8.51	Permits and requirements
Ind 8.15	Handling in building occupied by families	Ind 8.52	Exceptions to sections Ind 8.43 and Ind 8.44
Ind 8.16	Aboveground storage in buildings	Ind 8.53	Heating
Ind 8.17	Special storage room in buildings	Ind 8.54	General requirement
Ind 8.18	Storage of class I liquids	Ind 8.55	Marking of containers
Ind 8.19	Storage of class II liquids	Ind 8.56	Gasoline dispensing or vending devices
Ind 8.20	Manufacturing plants	Ind 8.57	Buildings, equipment, operation
Ind 8.21	Kettles, vats, tanks, etc.	Ind 8.58	Location of unloading point
Ind 8.22	Ventilation	Ind 8.59	Railroad sidings
Ind 8.23	Stationary tanks in buildings	Ind 8.60	Requirements and restrictions for unloading
Ind 8.24	Storage of barrels and drums	Ind 8.61	Piping, type of material
Ind 8.25	Smoking prohibited	Ind 8.62	Underground piping
Ind 8.26	Lighting and electric installation	Ind 8.63	Pipe joints
Ind 8.27	Storage in wheeled tanks	Ind 8.64	Valves
Ind 8.28	Storage outside of buildings	Ind 8.65	Tests
Ind 8.29	Underground storage	Ind 8.66	Filing of plans
Ind 8.30	Material underground tanks	Ind 8.67	Unloading operations under I. C. C. regulations
Ind 8.31	Venting of underground tanks	Ind 8.68	Entering tanks
Ind 8.32	Filling pipe	Ind 8.69	Lighting; tools
Ind 8.33	Pipes to drain to underground tanks	Ind 8.85	Construction of containers
Ind 8.34	Deliveries to storage tanks	Ind 8.86	Marking of containers
Ind 8.35	Aboveground tanks	Ind 8.87	Storage inside buildings limited
Ind 8.36	Venting of aboveground tanks	Ind 8.88	Storage in connection with oil burning equipment
		Ind 8.89	Special storage building
		Ind 8.90	Storage outside buildings
		Ind 8.91	Elevated stationary tanks

GENERAL INFORMATION

Ind 8.001 Scope. (1) The provisions of this code shall apply to all new plants, stores, equipments and installations storing, handling, and (or) using flammable liquids; and they shall also apply to existing plants, stores, equipments and installations which may constitute a life or fire hazard, except insofar as, on special applications, the industrial commission may waive strict compliance, when in its opinion the requirements of these orders cannot reasonably be fulfilled.

(2) These orders shall not apply to shipments of flammable liquids in interstate commerce, where the regulations of the interstate commerce commission shall govern, nor to shipments by the military or naval forces of the United States.

(3) Nothing contained in these orders shall be construed as limiting the capacity of tanks in motor driven vehicles or in engine driven portable equipment.

(4) This code contains orders which apply specifically to the liquids classified in section Ind 8.01. Compliance with certain of these orders may be required by the industrial commission for liquids having higher flash point, when necessary to abate a hazard created by large volume of a storage or the nature of a process, particularly if conducted at temperatures above the atmospheric range.

Ind 8.01 Classification of flammable liquids. (1) For the purpose of this order, flammable liquids are divided into 3 classes according to the flash point, as follows:

(a) *Class I.* Liquids with flash point at or below 25 degrees Fahrenheit (—4 degrees Centigrade) closed cup tester.

(b) *Class II.* Liquids with flash point above that for class I and at or below 80 degrees Fahrenheit (26.6 degrees Centigrade) closed cup tester.

(c) *Class III.* Liquids with flash point above that for class II and at or below 200 degrees Fahrenheit (93.3 degrees Centigrade) closed cup tester.

(*Exceptions:* Sections Ind 8.001 (4) and Ind 8.04 (1).)

(2) The flash point shall be as determined with the Elliot, Abel, Abel Pensky, or the Tag closed cup testers, but the Tag closed cup tester (standardized by the United States bureau of standards) shall be authoritative in case of dispute. All tests shall be made in accordance with the methods adopted by The American Society for Testing Materials.

Note: Representative examples of the classes of flammable liquids are:

CLASS I	CLASS II	CLASS III
Acetone	Alcohol	Amyl alcohol
Benzol	Amyl acetate	Fuel oil
Carbon bisulphide	Ethyl acetate	Kerosene
Collodion	Methyl acetate	Turpentine
Ether	Methyl alcohol	
Gasoline	Toluol	
*Naphtha		

* Some naphthas fall in class II or III.

Ind 8.02 Manufactured liquid compounds and commodities included. Any manufactured liquid or fluid commodity, such as paint, varnish, dryer, cleaning solution, and polishing liquid which contains flammable liquids shall be considered a flammable liquid and shall be classed by section Ind 8.01 according to the flash point of the mixture.

Ind 8.03 Definition of container. A container shall be any can, bucket, barrel, tank or other vessel, except stationary or fixed tanks, tank vehicles and tank cars in which flammable liquids or mixtures are stored or kept.

Ind 8.04 Permits. (1) All persons handling or storing flammable liquids of any flash point in excess of 8,000 gallons shall submit to the industrial commission full information and plans on their proposed installations and methods of storing and handling such liquids for its consideration, and no such installation shall be made without the approval of said commission.

(2) Application for the installation of new bulk oil stations and for storage and use of more than 8,000 gallons of flammable liquids must be made, in writing, to the industrial commission. Such applications must give full information on the following points:

(a) Number, size, capacity and contents of all tanks.

(b) Construction of tanks—gauge of metal, kind of manhole, kind and size of safety vents, regular and special. Emergency shut-off valve.

(c) Distance between tanks.

(d) Kind of foundation.

(e) Method of electrical grounding of tanks, tank cars and trucks.

(f) Size and construction of pump house. How ventilated.

(g) Size, construction and use of warehouse.

(h) Describe ladders, stairways and elevator platforms.

(i) Extent and direction of slope on bulk station site.

(j) A sketch, map or blue print, drawn to scale, must show the proposed location of all tanks, also all buildings, railway tracks, streets, highways, streams and other bodies of water within 150 feet from such tanks.

(k) Form SB-9 "Application For Installation Bulk Storage Flammable Liquid Tanks" and is furnished by the Industrial Commission, 1 West Wilson Street, Madison.

(3) Persons storing, retailing, handling and (or) using class I or II liquids in quantities less than 8,000 gallons shall obtain approval in writing from the chief of the fire department, if there is one, otherwise from the industrial commission, certifying that the type, class or kind of article or thing mentioned has been examined and approved by him, or his authorized deputy or assistant, found to be in conformity with these orders and that it may be kept, stored, manufactured, sold and transported within his municipality.

(4) The chief of the fire department in every city, village or town is by statute a deputy of the industrial commission and as such is authorized to issue permits under paragraph (3) of this order.

(5) Where, by local ordinance, regulatory jurisdiction and power in the matter of storage, handling and use of flammable liquids has been conferred on the inspector of buildings or other municipal department, such department may act in the same manner and to the same extent as the chief of the fire department.

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Ind 8.05 Permits required. (1) Except as hereinafter provided permits shall be obtained: (a) For the storage or handling of a total quantity of more than one gallon of class I liquids in any dwelling, apartment house or tenement, and in excess of 5 gallons in any other building, and in excess of 10 gallons outside of any building.

(b) For the storage or handling of a total quantity of class II liquids in excess of 5 gallons in any dwelling, apartment house or tenement, and in excess of 10 gallons in any other building, and in excess of 25 gallons outside of any building.

(c) For the storage or handling of a total quantity of class III liquids in excess of 55 gallons.

Ind 8.06 Use of certain flammable liquids without permit. Unless storage of quantities in excess of those given in section Ind 8.05 is to be maintained for 30 days or more, nothing contained in these orders shall require the owner or occupant or his agent to obtain a permit for the use by him of paints, oil, varnishes or similar flammable mixtures.

Ind 8.07 Application for permits. All applications for permits to handle, sell, or store flammable liquids, except as otherwise provided in section Ind 8.04, shall be made in writing, to chief of the fire department. He shall forthwith satisfy himself as to the safety of the plan, installation and arrangement, through investigation, or through inspection of the premises to be used for such storage, sale or use and the means of distribution, or by other means. If the conditions surrounding an arrangement are, in his opinion, such that the intent of these orders can be observed, then he shall issue a permit, which permit shall not be transferable.

Ind 8.08 Inspection before covering up installation. Before any installation is covered from sight, a notification in writing shall be given the chief of the fire department, who shall, within 48 hours after the receipt of such notification, inspect the installation and give his written approval or disapproval. Upon failure of the chief of the fire department to inspect within the specified time, the installation may be covered.

Ind 8.09 Modification of requirements. Except as to matters within the jurisdiction of the industrial commission as provided in sections Ind 8.001 and Ind 8.84, the chief of the fire department shall have power to modify any of the provisions of these orders upon application in writing by the owner or lessee, or his duly authorized agent, when there are practical difficulties in the way of carrying out the strict letter of these orders provided that the spirit of these orders shall be observed, public safety secured, and substantial justice done. The particulars of such modification when granted or allowed and the decision of the chief of the fire department thereon shall be entered upon the records of the department, and a signed copy shall be furnished the applicant, and one copy transmitted to the industrial commission.

Ind 8.10 Appeal. Within 10 days after written notification by the chief of the fire department to the owner or occupant to correct or remedy any hazardous conditions, or upon his refusal to issue a permit applied for, an appeal, stating specifically the questions which the appellant desires to have passed upon, may be taken. A copy of all such appeal papers shall be served upon the chief of the fire department when such appeal is taken. Such appeal shall be heard by the industrial commission.

Ind 8.11 Hazardous heating and lighting appliances. The industrial commission or chief of the fire department may prohibit the use of any type, kind or make of heating or lighting appliance using flammable liquids, which has not been tested by some impartial, competent authority, and found to be properly safeguarded to protect life and property.

STORAGE IN BUILDINGS

Ind 8.12 Storage in public places. No class I or class II liquids shall be kept or stored in any schoolhouse, religious, amusement or other building used for public assembly, except by special permission of the industrial commission or chief of the fire department.

Ind 8.13 Storage near exits. No class I or II liquids shall be stored within 10 feet from any stairway, elevator, or exit except when in a space separated from such stairway, elevator or exit by a fire-resistive wall or partition having not less than one hour fire-resistive rating.

Ind 8.14 Exits required. In all stores, jobbers' plants and manufacturing plants, in which flammable liquids are stored, at least 2 exits shall be provided, one of which shall be remote from the point of storage.

Ind 8.15 Handling in buildings occupied by families. The mixing, storing or handling of flammable liquids of class I and II in open containers is prohibited in any store in any building housing more than 2 families, provided that this shall not apply to drug stores where flammable liquids are used in making and compounding medicines.

Ind 8.16 Aboveground storage limits in buildings. (1) **INSIDE BUILDINGS; OTHER THAN SPECIAL ENCLOSURES.** The storage of flammable liquids inside buildings, in other than special rooms or enclosures, shall be limited as follows:

(a) *Frame buildings:* 1. Class I—In sealed containers or safety cans of not more than 5 gallons capacity—total quantity, 5 gallons.

2. Class II—In sealed containers or safety cans of not more than 5 gallons capacity, and in barrels, drums, or tanks not exceeding 60 gallons capacity—Total quantity stored in this manner, 275 gallons.

3. Class III—In sealed containers or safety cans not exceeding 5 gallons capacity, in barrels and drums not exceeding 60 gallons capacity, and in tanks not exceeding 275 gallons capacity—total quantity stored in this manner, 550 gallons.

(b) *Buildings other than frame:* 1. Class I—In sealed containers or safety cans of not more than 5 gallons capacity—total quantity, 10 gallons.

2. Class II—In sealed containers or safety cans of not more than 5 gallons capacity, in drums and barrels not exceeding 60 gallons capacity, and in tanks not exceeding 110 gallons capacity—total quantity stored in this manner, 550 gallons.

3. Class III—In sealed containers or safety cans not exceeding 5 gallons, in drums or barrels not exceeding 60 gallons, and in tanks not exceeding 275 gallons capacity—total quantity stored in this manner, 1100 gallons.

(2) **SPECIAL STORAGE ROOM; SEPARATE FIRE-RESISTIVE BUILDING.** In a special storage room or separate fire-resistive building, conforming to section Ind 8.17, the storage of class I liquids shall be limited to a total of 110 gallons in original sealed containers or safety cans, and the storage of class II and III liquids is unlimited except that the

capacity of individual containers shall not exceed the quantities set forth in Table I as follows:

Table I.—Maximum Capacity of Individual Containers for Class II and III Liquids in Various Types of Buildings

Class of Liquid	Type of Building	Capacity of Individual Containers (Gallons)		
		Not Enclosed	In Room	In Special Enclosure
Class II	Frame	60	275	2,000
	Ordinary	110	275	5,000
	Fire-Resistive	110	275	5,000
Class III	Frame	275	275	8,000
	Ordinary	275	2,000	15,000
	Fire-Resistive	275	10,000	25,000

(3) **SPECIAL STORAGE, GARAGES:** (a) A garage may store an additional quantity of not to exceed 60 gallons of gasoline in an approved standard portable wheeled tank, constructed in accordance with section Ind 8.27. Such wheeled tank, however, shall not be used for dispensing gasoline to the public.

(4) **STORAGE OF FUEL FOR OIL BURNERS.** Approved domestic oil burners may be supplied by gravity from two connected inside or outside storage tanks, provided neither tank exceeds 275 gallons capacity and a valve is provided within 6 inches of each tank.

(5) **SPECIAL MODIFICATION FOR INDUSTRIAL USE.** In certain processes, such as petroleum or coal tar by-products refining, paint and lacquer manufacturing, and others where use of flammable liquids in large quantities is a basic feature, the limits of this order may not be practical. In such cases the industrial commission will give consideration to application for reasonable modifications.

Ind 8.17 Special storage rooms or buildings. (1) Special storage rooms or buildings, where required by other orders of this code, for storage, handling, or use of flammable liquids, shall have walls of solid masonry at least 8 inches or of concrete at least 6 inches thick and otherwise be of not less than two-hour fire-resistive construction as specified by sections Ind 51.05 and 51.06 of the Wisconsin state building code.

(2) Door openings to other rooms or buildings shall be provided with incombustible, liquid-tight sills at least 6 inches high, and such openings shall be protected with standard automatic or self-closing fire doors. Windows shall be standard fire windows (wired glass in metal sash and frame). Wood floor surfacing may be used.

(3) Special storage rooms or buildings shall be equipped with approved ventilation system. Floor drains, if provided, shall not lead to the municipal sewer system.

(4) There shall be no openings to rooms below. Heating shall be by steam, vapor or hot water, direct or indirect radiation, and the source of heat shall be from a point outside the room or building itself.

(5) A special enclosure within the meaning of this order shall be at least 6 inches larger on all sides than the tank. The walls of the enclosure shall be constructed of reinforced concrete at least 6 inches thick, or of solid masonry at least 8 inches thick, and shall be bonded to the floor and carried to a height of not less than one foot above top of tank. The space between tank and enclosure shall be completely filled with sand or well tamped earth. The top of the enclosure shall be of reinforced concrete at least 5 inches thick or of equivalent construction, except where the floor or other construction immediately above the tank is of fire-resistive construction, and capable of withstanding a load of 150 pounds per square foot.

(6) Instead of an enclosure as above described, the tank may be encased in reinforced concrete not less than 6 inches in thickness applied directly to the tank so as to completely eliminate any air space.

Ind 8.18 Storage of class I liquids. (1) Storage in a safety can of not over 5 gallons capacity is permitted in any part of the building.

(2) Except as otherwise provided, class I liquids shall be kept in storage tanks underground or outside of buildings and no discharge system shall have outlet inside buildings unless in a special room in accordance with section Ind 8.17, or as provided in section Ind 8.43.

(3) In garages and manufacturing plants the chief of the fire department may permit the storage of class I liquid in an approved, portable, wheeled tank, when the nature of the business requires such storage and the discharge therefrom, but not more than one such wheeled tank shall be permitted on any floor.

Ind 8.19 Storage of class II liquids. No container of class II liquids of over 5 gallons capacity may be used to fill other containers and appliances, unless outside of the building, or in a special fire-resistive room as defined in section Ind 8.17, or from an approved portable tank, and all drawing, except from safety cans, shall be by pump as hereinafter provided.

Ind 8.20 Manufacturing plants. (1) **EXISTING INSTALLATIONS:** Existing manufacturing plants where persons are employed above the second story shall have all walls, windows, floors and ceilings of at least one-hour fire-resistive construction. Elevators, stairs and other wells or vertical openings when communicating to rooms in which class I or II liquids are stored or handled in containers permitting escape of vapor, shall be in enclosures having equal fire-resistance, with openings protected by approved automatic self-closing fire doors.

(2) **NEW INSTALLATIONS:** In manufacturing plants hereafter established in any building in which persons are employed above the second story, construction and arrangement of all rooms in which class I or II liquids are stored or handled in containers permitting the escape of vapor, shall be in accordance with section Ind 8.17.

Ind 8.21 Kettles, vats, tanks, etc. Kettles, vats, tanks, saturators and other vessels used in manufacturing processes, and containing more than 5 gallons of flammable liquids shall not be located within

10 feet from combustible material, nor within 10 feet from any exit, unless two or more exits are provided, and all combustible floors under and within a radius of 10 feet shall be protected with noncombustible covering. All kettles and other open vessels shall be provided with substantial covers, arranged to close automatically in case of fire, or which can be easily and readily placed in position.

Ind 8.22 Ventilation. (1) Rooms in which class I or II liquids are used in open containers, and also rooms in which class I, II or III liquids are heated or otherwise treated in such a manner as to produce flammable vapors, shall be well ventilated.

(2) Where natural ventilation is not sufficient, the chief of the fire department, if there is one, otherwise the industrial commission, may require mechanical exhaust ventilation through vent openings in the wall, located at the floor level near each such container or heating device from which vapor may escape. Such vent opening shall be opposite to any door or other air inlet and shall be covered with $\frac{1}{2}$ inch mesh No. 16 galvanized wire and shall be kept clear of all obstructions.

(3) A non-combustible duct not less than 20 square inches in area shall be provided from each vent opening. Such duct shall be built into the walls or floor, or securely fastened thereto, and constructed so as not to be subject to mechanical injury.

(4) Each duct shall lead, either independently or in combination, to and through a non-sparking fan of sufficient size to change the air in the room completely every 5 minutes. Such fan shall operate continuously.

(5) All discharge outlets of vent ducts shall be provided with 12 inch mesh or equivalent non-corrodible wire screen and shall be so located that they will not affect adjacent property.

(6) Any other efficient system of ventilation may be used, provided that such a system has been approved by the chief of the fire department or the industrial commission.

Ind 8.23 Stationary tanks in buildings. (1) **CONSTRUCTION.** (a) Tanks for class II or III liquids of 110 gallons or less capacity, if galvanized, shall be of not less than No. 16 U. S. standard gauge with all joints welded or locked, double seamed or riveted, and made tight by some approved method. Steel tanks not galvanized shall not be less than No. 14, U. S. standard gauge.

(b) Tanks for class II and III liquids of over 110 gallons capacity shall be of thickness specified in section Ind 8.29 and shall be vented as hereinafter required.

(2) **DRUMS USED AS STATIONARY TANKS.** Original barrels or drums may be used until contents are drawn, if substantially placed to prevent tipping or rolling with pump inserted through a close-fitting connection in side or head.

(3) **SUPPORTS.** Tanks shall be set on a firm foundation, and those exceeding 2,500 gallons capacity shall be supported independently of the floor construction, unless the floor construction is such as will safely carry the super-imposed load.

(4) **GRAVITY FEED PROHIBITED.** Tanks shall be located below the level of any piping to which they may be connected, or if this is

impracticable, arrangements satisfactory to the industrial commission shall be made to prevent siphoning or gravity flow in case of accident to the equipment or piping (except as provided for domestic fuel oil in section Ind 8.16.)

Ind 8.24 Storage of barrels and drums. (1) Barrels and drums containing class I or II liquids stored outside of any building shall not be piled upon each other more than two high unless in approved metal racks, nor stored in any passageway nor beneath any window, and no open lights shall be permitted in any such storage yard. Such drums and barrels shall preferably be stored on open platforms.

(2) Drums or barrels for flammable liquids shall have caps, plugs and bungs tightly closed immediately after the container is emptied.

Ind 8.25 Smoking prohibited. In all rooms or parts of buildings which contain flammable liquids or in which vapors from flammable liquids are present, or in which flammable liquids are used in any manufacturing process the lighting of matches and smoking is prohibited. Suitable NO SMOKING signs shall be posted.

Ind 8.26 Lighting and electrical installation. (1) Flammable liquids shall not be drawn or handled in the presence of open lights, flame or fire and only when lighting is by daylight or by incandescent electric lamps installed in compliance with the Wisconsin state electrical code.

(2) All electrical work, materials, and installation in service pumps, in pumphouses, at tank car unloading points, at truck tank loading points and elsewhere where flammable vapors are liable to be present, shall comply with and have the safeguards as specified in the Wisconsin state electrical code for hazardous locations.

Ind 8.27 Wheeled tanks. No portable wheeled tanks for the handling of flammable liquids inside of buildings shall exceed 60 gallons capacity. Tanks shall be of iron or steel, at least 3/16 inches thick with all openings at the top and screened with not less than 30 x 30 (preferably 40 x 40) non-corrodible wire mesh or its equivalent. Wheels shall have nonferrous tires and tanks shall be hung to prevent tipping over in ordinary usage. Liquids shall be drawn from such tanks by means of pumps, or other approved means.

UNDERGROUND STORAGE

Ind 8.28 Storage outside of building. Except as otherwise herein permitted, the storage of flammable liquids shall be outside of buildings, in underground tanks or aboveground tanks as hereinafter provided.

Ind 8.29 Underground storage. (1) Underground tanks shall be spaced at least one foot apart and shall have the top of tank not less than 2 feet below the surface of the ground, and below the level of any piping to which the tanks may be connected, except that in lieu of the 2 foot cover, tanks may be buried under 12 inches of earth and a cover of reinforced concrete at least 5 inches in thickness provided, which shall extend at least one foot beyond the outlines of tank in all directions; concrete cover to be placed on a firm, well tamped earth foundation. Where necessary to prevent floating, tanks

shall be securely anchored or weighted. Where soil conditions require, a firm foundation shall be provided.

(2) Where a tank cannot be entirely buried, it shall be covered with earth to a depth of at least two feet with a slope on all sides not steeper than 1½ feet horizontal to one foot vertical.

(3) The limit of storage permitted shall depend upon the location of tanks with respect to the building to be supplied and adjacent buildings or property lines shown in table II as follows:

Table II.—Maximum Capacity of Tanks for Underground Storage

Location	Maximum Allowable Capacity	
	Class I, II and III Under 100°F. Flash Point	Class III Above 100°F. Flash Point
If top of tank is above the lowest floor, basement, cellar or part of any building which is:		
(a) 5 feet to 10 feet away.....	550 gallons	50,000 gallons
(b) 11 " " 20 " "	2,000 "	75,000 "
(c) 21 " " 25 " "	5,000 "	100,000 "
(d) 26 " " 30 " "	15,000 "	150,000 "
(e) 31 " " 40 " "	20,000 "	200,000 "
(f) 41 " " 50 " "	50,000 "	500,000 "
(g) more than 50 " "	Unlimited	Unlimited

(4) Tank located beneath a building shall be below all portions of that building and is limited in capacity only in respect to other buildings as given in table II.

Ind 8.30 Material of underground tanks. (1) Tanks shall be constructed of galvanized steel, of open hearth steel, or of wrought iron of a thickness not less than that specified in table III.

(2) Tanks of open hearth steel or wrought iron thinner than No. 7 gauge shall be galvanized.

(3) For class III liquids, if adequate internal bracing is provided, tanks of 12,001 to 30,000 gallons capacity may be built of steel plate ¼ inch thick.

Table III.—Underground Storage Tanks

Capacity (Gallons)	Minimum Gauge (U. S. Std.) or Thickness of Material	Weight of Material (Lbs. per sq. ft.)
1 to 285.....	16	2.50
286 to 560.....	14	3.125
561 to 1,000.....	12	4.375
1,001 to 4,000.....	7	7.50
4,001 to 12,000.....	¼ inch	10.00
12,001 to 20,000.....	⅝ inch	12.50
20,001 to 30,000.....	⅜ inch	15.00

(4) With the approval of the industrial commission, tanks of copper or other suitable material may be used if after the necessary handling incident to installation they are equivalent in strength, rigidity, durability and tightness to the steel or iron tanks described above.

Ind 8.31 Venting of underground tanks. (1) An open metal vent pipe arranged for proper draining, or an automatically operated vent, shall be provided for every tank which may contain flammable vapor. The lower end of the vent pipe shall not extend through the top into the tank for a distance of more than one inch.

(2) Vent openings shall be provided with approved non-corrodible flame arrestor and shall be of sufficient area to permit escape of air or vapor during the filling operation. Vent openings shall in no case be less than one inch diameter. Flame arrestors shall be accessible for examination and repair. Vent pipes shall be provided with weather-proof hoods and terminate outside of building not less than 12 feet above top of fill pipe, or, if tight connection is made in filling line, to a point one foot above the level of the top of the highest reservoir from which the tanks may be filled and not less than 5 feet, measured horizontally and vertically, from any window or other building opening. Where a power pump is used in filling storage tanks and tight connection is made to the fill pipe, the vent shall be not smaller than the fill pipe.

(3) The vent pipe from two or more tanks of same class of liquid may be connected to one upright with the connection not less than one foot above the level of the top of the highest reservoir from which the tanks may be filled.

(4) Vent and fill pipes when used in connection with domestic oil burners need be but 2 feet from wall openings and vent pipe but one foot higher than top of fill pipe.

Ind 8.32 Pipes to drain to underground tanks. Where underground tanks are used, all pipes carrying flammable liquids, except in dry cleaning plants, shall pitch toward tanks without any traps or pockets and shall enter tanks at the top.

Ind 8.33 Filling pipe. The end of the filling pipe for underground storage tanks for class I, II and III liquids shall be carried to an approved location outside of any building, but not within 5 feet from any entrance door or cellar opening; this filling pipe shall be closed by a screw cap or other tight-fitting cap.

Ind 8.34 Deliveries to storage tanks. Deliveries of flammable liquids of class I, II and III, where practical, shall be made directly to the storage tank through the filling pipe by means of a hose or pipe between the filling pipe and barrel, tank vehicle or tank car from which such liquid is being drawn.

ABOVEGROUND STORAGE

Ind 8.35 Aboveground tanks. (1) Tanks for the storage of class I, II and III liquids at marketing stations, wholesale storage, port terminals and other properties where flammable liquids are stored in quantities, shall not be placed nearer to the line of adjoining property, which is or may be built upon, than the distances given in table IV, nor less than double these distances for the storage of crude petroleum.

Table IV.—Minimum distance of outside aboveground tanks for class I, II and III liquids other than crude petroleum to line of public highway or property which may be built upon

<i>Capacity of Tank (Gallons)</i>	<i>Minimum Distance to Line of Property or Highway (Feet)</i>
18,000 or less	20
21,000 " "	25
31,000 " "	30
45,000 " "	40
64,000 " "	50
80,000 " "	60
128,000 " "	75
200,000 " "	85
265,000 " "	100
500,000 " "	150

(2) Where tank capacities exceed 500,000 gallons, the distance between any such tank and a public highway or property line shall be determined by the industrial commission upon investigation.

(3) In particular installations the distances given in table IV may be increased at the discretion of the industrial commission after consideration of the special features such as:

(a) Topographical conditions.

(b) Nature of occupancy and proximity to buildings on adjoining property and height and type of such buildings.

(c) Capacity and construction of proposed tanks and kinds of liquids to be stored.

(d) Degree of private fire protection provided and facilities of the fire department to cope with oil fires.

(4) At marketing stations and elsewhere, the truck loading racks and platforms shall be separated from tanks, plant buildings and property lines; such separation distance to be approximately one-half the distances specified in table IV, but need not be over 100 feet.

Table V.—Minimum distance of outside aboveground tanks for class I, II and III liquids to nearest building (other than bulk oil storage station warehouse and pump house)

<i>Capacity of Tank (Gallons)</i>	<i>Minimum Distance to Nearest Building (Feet)</i>
1,000 or less -----	10
1,001 to 3,000 -----	15
3,001 to 18,000 -----	20
18,001 to 21,000 -----	25
21,001 to 31,000 -----	30
31,001 to 45,000 -----	40
Over 45,000 -----	Distances as in Table IV

(5) The warehouse and pump house at bulk oil storage plants, if of not more than 2,000 square feet floor area shall be located not nearer than 10 feet to oil tanks. This distance shall be increased 3 feet for each additional 2,000 square feet of floor area or major fraction thereof.

Table VI.—Minimum distances between aboveground storage tanks (applies to all classes of liquids)

<i>Capacity of Tank or of the larger of two tanks between which distance is to be measured (Gallons)</i>	<i>Minimum Distance between tanks (Feet)</i>
18,000 or less -----	3
24,000 " " -----	5
48,000 " " -----	10
75,000 " " -----	13
100,000 " " -----	15

Over 100,000 Distance equal to the diameter (or greatest horizontal dimension if tank is not cylindrical) of the tank or of the larger of the two tanks between which distance is to be measured.

(6) Tanks shall not be staggered but shall as far as practical be placed in rows both ways so that open spaces provided by above table shall extend through the entire installation for penetration of foam or water streams.

Ind 8.36 Venting of aboveground tanks. (1) Each aboveground tank having individual capacity exceeding 100 gallons, shall have approved venting facilities.

(2) No form of emergency relief construction shall be required on vertical tanks with cone roofs having a slope of less than 2½ inches in 12 inches where the strength of the joint between the roof and the

shell is no greater than that of the weakest vertical joint in the shell.

(3) All individual operating vents and all combination type vents, which incorporate both operating and excess pressure relief features, shall be equipped with approved flame arrester type equipment. Emergency relief vents designed specifically to relieve excessive internal pressure and which will not emit vapor until pressure equals $\frac{3}{4}$ inch of water above the pressure at which the operating vent will open, need not be equipped with flame arrestors. Covers for manholes, handholes and gauge openings shall be made tight-fitting.

(4) Operating vents. Operating vents shall in no case be less than $1\frac{1}{4}$ inches in diameter, and where a power pump is used in filling tanks and a tight connection is made to the fill pipe, the vent shall not be smaller than the fill pipe. If tanks are inside of buildings, vents must terminate outside of buildings not less than 12 feet above top of fill pipe, and not less than 5 feet measured horizontally and vertically from any window or other building opening.

(5) In tanks where the entire dependence for relief is placed upon some form of emergency relief construction other than a weak seam, it shall have a capacity as prescribed by the industrial commission, who will give consideration to the design and construction of the tank as it affects the pressure which the tank may safely withstand as indicated in table VII.

Table VII.—Emergency relief of excessive internal pressures in aboveground tanks

Capacity of Tank (Gallons)	Minimum emergency relief capacity required cubic feet per hour	Approximate diameter* in inches, of free circular opening (unobstructed by valve discs, etc.) required to discharge petroleum vapors at the given rates for the following allowable internal pressures.			
		3 inches of water	1 lb. per sq. in.	5 lbs. per sq. in.	25 lbs. per sq. in.
1,000	16,000	4	$2\frac{1}{2}$	$1\frac{1}{2}$	1
4,000	44,000	$6\frac{3}{4}$	$3\frac{3}{4}$	$2\frac{1}{2}$	$1\frac{3}{4}$
18,000	88,000	$9\frac{1}{2}$	$5\frac{1}{2}$	$3\frac{3}{4}$	$2\frac{1}{2}$
25,000	105,000	$10\frac{1}{4}$	6	4	$2\frac{3}{4}$
56,000	160,000	$12\frac{3}{4}$	$7\frac{1}{4}$	5	$3\frac{1}{4}$
100,000	230,000	$15\frac{1}{4}$	$8\frac{3}{4}$	6	4
155,000	290,000	$17\frac{1}{4}$	$9\frac{3}{4}$	$6\frac{1}{2}$	$4\frac{1}{2}$
222,000	330,000	$18\frac{1}{4}$	$10\frac{1}{2}$	7	$4\frac{3}{4}$
475,000	395,000	20	$11\frac{1}{4}$	$7\frac{3}{4}$	5
735,000	410,000	$20\frac{1}{2}$	$11\frac{1}{2}$	$7\frac{3}{4}$	$5\frac{1}{4}$
Unlimited	410,000	$20\frac{1}{2}$	$11\frac{1}{2}$	$7\frac{3}{4}$	$5\frac{1}{4}$

*Based upon an orifice coefficient of 0.7 and vapor specific gravity of 2.5.

(6) Except for tanks specially constructed to withstand higher pressures, the emergency relief area for vertical tanks shall be as given for an allowable pressure of 3 inches of water, and for horizontal tanks shall be as given for an allowable pressure of one pound per square inch.

(7) Definitions. For the purpose of this section Ind 8.36 the following definitions shall apply:

(a) Operating vents, are considered to be those vents which have both pressure and vacuum valves and which are designed to function while tanks are being filled or liquids withdrawn from tanks, and to handle normal fluctuations in internal pressures due to changes in temperatures.

(b) Emergency relief vents, are considered to be those vents which operate only against pressure, and which are designed to relieve excessive internal pressures such as would be created by heat of fire in the vicinity of tank.

(c) Combination vents, are considered to be those vents which are designed to serve both as operating vents and emergency relief vents.

Ind 8.37 Foundations, grounding, dikes, surroundings. (1) All tanks shall be electrically and effectively grounded to permanent moisture. Such ground connection shall be made with a copper wire not smaller than No. 8 gauge. The best ground is to an extensive underground water piping system; other acceptable grounds are, an electrode driven to a depth of not less than 8 feet, consisting of a $\frac{3}{4}$ inch galvanized iron or steel pipe, or a steel or iron rod not less than $\frac{3}{4}$ inch least cross section dimension, or an approved non-ferrous rod not less than $\frac{1}{2}$ inch in diameter.

(2) During the entire process of filling a truck tank from storage tanks such truck tanks shall be bonded to the loading line with a copper wire not less than No. 6 size.

(3) Electric lines operating at more than 300 volts to ground shall not pass over flammable liquids storage tanks and shall be kept at least 15 feet horizontally from such tanks. When the voltage is below 300, a clearance, both vertically and horizontally of not less than 8 feet, shall be maintained.

(4) Tanks more than one foot above the ground shall have foundation and supports of concrete or masonry. No combustible material shall be permitted under or within 10 feet from any such storage tanks, except stairways to and walks on top, these preferably to be of iron or steel.

Note: Fixed ladders 20 feet or more in length and making an angle greater than 75 degrees with horizontal shall be provided with a cage or basket guard as specified in general orders on safety issued by the industrial commission.

(5) Bulk and filling station grounds shall be kept free from weeds, dead grass and leaves, and all other combustible waste materials.

(6) Each tank containing crude oil or other liquids which have a tendency to boil over, and each individual tank exceeding 50,000 gallons (1,200 barrels) in capacity; also all individual tanks and groups of tanks, with individual tank capacity of less than 50,000 gallons but installed on the bank of a river or other body of water, or on sloping ground exposing property below, shall be adequately and properly diked, or surrounded by retaining wall.

(7) When deemed necessary by the industrial commission, on account of topography or nearness to buildings or property of high value other individual tanks or groups of tanks may be required to be

adequately and properly diked or surrounded with a curb or retaining wall to prevent the discharge of flammable liquids onto other property.

(8) Dikes or retaining walls required shall be of earth or masonry so constructed as to afford adequate protection.

(a) The capacity of dikes or retaining walls if of concrete, shall be of a capacity to contain the contents of tank or group of tanks. Earthen dikes shall preferably have a flat top, 3 feet wide and shall have a slope consistent with the angle of repose of the materials of which they are constructed. Earthen dikes shall be built to contain $1\frac{1}{4}$ times the capacity of tank or group of tanks.

(b) Such retaining wall shall not be higher than one-half the height of the tanks.

Ind 8.38 Tanks labeled. Aboveground tanks for class I and II liquids shall have painted conspicuously upon their sides in letters at least 5 inches high, the wording "FLAMMABLE—KEEP FIRE AWAY".

Ind 8.39 Material of aboveground tanks. (1) Tanks (including tops) shall be constructed throughout of open hearth steel or wrought iron of a thickness in accordance with the following requirements. No open tank shall be used.

(a) *Horizontal or vertical tanks not exceeding 1,100 gallons.* Horizontal or vertical tanks not exceeding 1,100 gallons capacity shall be constructed of material having a minimum thickness as shown in table VIII.

(b) *Horizontal tanks over 1,100 gallons capacity.* Tanks having a diameter of not over 6 feet shall be made of at least $\frac{3}{16}$ inch steel. Tanks having a diameter of over 6 feet and less than $11\frac{1}{2}$ feet shall be made of at least $\frac{1}{4}$ inch steel.

(c) *Vertical tanks over 1,100 gallons capacity.*

1. Tanks of this class shall be of such material and so constructed as to have a factor of safety of at least 2.5.

2. The minimum thickness of shell or bottom shall be $\frac{3}{16}$ inch. The minimum thickness of roof shall be $\frac{1}{8}$ inch.

3. The thickness of plates shall be in accordance with the following formula:

$$t = \frac{2.604 \times H \times D \times F \times S}{T \times E}$$

Where,

t = thickness of plate in inches.

H = height of tank in feet above the bottom of the ring under consideration.

D = diameter of the tank in feet.

F = factor of safety (taken as 2.5)

S = specific gravity of liquid stored (water = 1).

T = tensile strength of plate in pounds per square inch.

E = efficiency of vertical joint in ring under consideration.

(2) The ultimate tensile strength of the steel shall be taken as 55,000 pounds per square inch, and the shearing strength of rivets shall be taken as 40,000 pounds per square inch.

Table VIII

<i>Capacity (Gallons)</i>	<i>Minimum Thickness of Material (U. S. Std. Gauge)</i>
1 to 60 -----	16
61 to 560 -----	14
561 to 1,100 -----	12

(3) Roofs or tops of tanks shall have no unprotected openings. Roofs or tops shall be firmly and permanently jointed to the tank and all joints shall be riveted and caulked, brazed, welded, or made tight by other means satisfactory to the industrial commission. Approved, liquid-tight, floating roofs may be used.

(4) With the approval of the industrial commission tanks of copper or other approved material, or tanks of special tested design may be used if after necessary handling incident to installation, they are equivalent in strength, rigidity, durability and tightness to steel or iron tanks described above.

Ind 8.40 Construction of tanks. (1) Tanks shall be riveted, welded, or brazed, and shall be caulked or otherwise made tight in a mechanical and workmanlike manner, and if to be used with a pressure discharge system shall safely sustain a hydrostatic test at least 1½ times the pressure to which tanks may be subjected. Top of tank shall be securely fastened to top ring, with joints of equal tightness to those between rings. Tanks shall be covered with asphaltum or other non-rusting paint or coating. All pipe connections shall be made through flanges or metal reinforcements securely riveted, welded or bolted to the tank and shall be made tight.

(2) Tanks shall be constructed entirely of metal, including top, sides and bottom; all openings shall be made liquid and vapor tight, except breather vents, which shall be protected as provided in section Ind 8.56. Gaskets used shall be such as are not affected by heat or contents of tanks.

(3) The covers for manholes, handholes and gauge holes shall be made tight fitting and normally kept in place.

Ind 8.41 Valve near tank. (1) Where tanks are aboveground there shall be a valve located at tank in each filling and discharge pipe. In case 2 or more tanks are cross-connected, there shall be a valve near each tank in each cross-connection. Tanks containing different classes of liquids (as defined in section Ind 8.01) shall not be cross-connected.

(2) In addition to the valves required in the preceding paragraph, there must be an emergency shut-off valve in each pipeline connection below the liquid level, which may be operated both manually and by an effective heat actuated device. Such emergency shut-off valve shall not be required on crude oil tanks, on tanks at refineries, or on tanks at those terminals where, for safety, adequate facilities are provided to transfer a product from one tank to another.

PIPING AND OTHER APPURTENANCES

Ind 8.42 Pipes in rooms with open flames. Piping carrying class I and II liquids, unless without joints or connections, shall not extend through any room which contains any open light or fire or electrical equipment.

Ind 8.43 Pumps required. Except as permitted in section Ind 8.52 flammable liquids shall be drawn from tanks by pumps so constructed as to prevent leaking or splashing, or by some other system approved by the industrial commission, with controlling apparatus and piping so arranged as to allow control of the amount of discharge and prevent leakage or discharge inside of the building by any derangement of the system. When inside a building, the pump or other drawing off device shall be located on or above the grade floor, preferably near an entrance or other well ventilated place or in a fire-resistive room constructed according to section Ind 8.17. Such inside pumps shall not be used as a public drive-in service station.

Ind 8.44 Gravity and pressure feed restricted. (1) Except as permitted in section Ind 8.52, no tanks, drums or other containers inside a building, or discharging inside a building, shall be provided with a faucet or other bottom-drawing device which will permit the gravity flow of liquids inside the building. Pipes shall not terminate any point lower than the level of the supply.

(2) Original metal containers or drums approved for shipment of flammable liquids by the interstate commerce commission may be used to discharge under air pressure, provided they are securely held in place while in use, and provided that the air pressure used within such containers shall not exceed 7 lbs. per square inch. In such cases, there shall be a relief valve provided in the tank attachment set at 7 lbs. Empty drums and empty containers shall be promptly removed from the building.

Ind 8.45 No connection to drains. All connections from tank to any house or sub-surface drainage system shall be so arranged as to prevent the flow of liquid or leakage of gases to such system, unless approved flammable liquids collectors are provided.

Ind 8.46 Valve in drawing-off pipes. All drawing-off pipes terminating inside of any building shall have valves at the discharge end; when delivery is by gravity, pipe shall have a shut-off valve, (which shall preferably be of the automatically closing type) and in addition shall have an emergency valve at the tank.

Ind 8.47 Pumps. (1) Pumps delivering to or taking supply from aboveground storage tanks shall be provided with valves on both suction and discharge of pump. Internal combustion engines and electric motors unless of approved explosion proof type, shall not be placed beneath tanks or elsewhere within the line of vapor travel.

(2) Where electric current is available, internal combustion engines shall not be installed in connection with flammable liquid pumping equipment.

Ind 8.48 Requirements for piping. (1) All piping used in systems for flammable liquids shall be standard weight wrought iron. Steel or metallic pipe or tubing suitable for working pressures up to 100 pounds per square inch may be used. For higher working pressures extra heavy pipe and fittings shall be used. No pipe or tubing less than ½ inch internal diameter shall be used. Outside piping shall be protected against any mechanical injury when within 8 feet from the ground. Inside piping shall be rigidly supported. Defective and leaky piping shall be made tight forthwith or replaced.

(2) Metal tubing less than ½ inch inside diameter may be used with oil burners designed for use with tubing smaller than ½ inch.

**REFINERIES, JOBBING PLANTS, MANUFACTURERS,
PERMIT AND REQUIREMENTS**

Ind 8.49 Extinguishers required. (1) At bulk stations, also manufacturing plants with comparable facilities, a quantity of dry sand or other non-combustible absorbents, together with pails or scoops, shall be provided.

(2) At service stations, and elsewhere where retail sales are made, approved chemical extinguishers of a type effective on oil fires shall be available to operating personnel in one of the following units:

(a) One foam type extinguisher of 2½ gallon capacity, which shall be protected against freezing.

(b) One carbon dioxide (CO₂) extinguisher of not less than 15 pounds gas capacity.

(c) One dry compound extinguisher of not less than 15 pound capacity.

(d) One carbon-tetrachloride extinguisher of one gallon capacity.

(e) Two carbon-tetrachloride extinguishers of not less than one quart capacity each.

(f) Two loaded-stream extinguishers of not less than 1¾ gallon capacity each.

(3) For the purpose of this order, service stations, bulk or wholesale stations, storage terminals, and other stations where flammable liquids are stored and handled in quantities of more than 8,000 gallons, are hereby defined and classified as follows:

<i>Class</i>	<i>Above Ground Storage Capacity</i>
A -----	8,001 to 50,000 gallons
B -----	50,001 to 150,000 "
C -----	150,001 to 500,000 "
D -----	over 500,000 "

(a) Each Class A, B, C, and D station in any city, town or village that has equipped its fire department with one or more portable devices having foam producing capacity of 300 g.p.m. or more, shall provide, in addition to any requirement for hand extinguishing units, a supply of foam producing material suitable for use in the local fire department's equipment. The place and manner of storage shall be agreed upon between the respective owners or operators of such stations and the respective local fire chiefs. If an agreement cannot be reached, the matter shall be referred to the industrial commission for decision. The quantity of foam producing powder provided shall

be not less than 500 pounds by a class A station, 1,000 pounds by a class B, 2,000 pounds by a class C and 4,000 by a class D station. The industrial commission or the fire chief may prorate the amount of powder or foam producing liquid to each owner or operator depending upon the total storage capacity of each tank of flammable liquid in each city, village or town. The amount to be furnished shall be determined after the fire chief has made an inventory of the total capacity of all tanks and each owner or operator notified in writing as to their proportionate share.

Example: An operator having storage capacity of 300,000 gallons in a city where 800,000 gallons was the total for the city, would furnish $\frac{3}{8}$ of the total amount of powder or foam producing liquid requested by the fire chief or industrial commission.

Note 1: It is not intended to exclude mechanical foam, produced by introducing air and a liquid foam producing agent into the water stream from a special nozzle. Where the fire department has equipment of this kind, the amount of liquid substituted for the specified weight of powder shall be such as to produce an equal quantity of foam; in the absence of detailed data, one gallon of such foam producing liquid will be, for the purpose of this order, considered the equivalent of 15 pounds of powder.

Note 2: Where an approved stationary foam extinguishing system is installed, the supply of foam producing materials at that station need not exceed that required for effective operation of such system.

(4) The industrial commission and the respective fire chiefs may require other additional fire extinguishing equipment as follows:

(a) At bulk stations of any class as defined in section Ind 8.49 (3).

(b) At retail or wholesale stations where cars or trucks are stored, or tire shops or repair shops are conducted, or spray painting is carried on, or a combination of these is present, and where any other special fire hazards exist.

Ind 8.50 Tank vehicles. (1) Every tank vehicle used for transportation of flammable liquids via any highway in this state or for delivery of flammable liquids to or from any destination in this state, whether in commerce or in distribution, within this state shall meet the following requirements:

(a) *Cargo tank construction.* 1. The cargo tank shall be of substantial and workmanlike construction and of sufficient strength and tightness to retain the liquid to be transported. A cargo tank conforming to the criteria set forth in paragraphs 211 and 212, 221 and 222 or 231 and 232 and paragraphs 241, 242, 251 and 261 of NFPA No. 385 or conforming to the criteria set forth in subsections -11 to -17, inclusive, of either of the following I.C.C. tank vehicle specifications MC 300, MC 301, MC 302 or MC 303, shall prima facie be deemed to meet this requirement.

(b) *Bulkheads and baffles.* 1. Every cargo tank having a total capacity in excess of 1500 gallons and used for the distribution of class I and class II flammable liquids to service stations or other premises to which the public is invited shall be divided into compartments, no one of which shall exceed 1200 gallons; provided that any cargo tank in use in this state as of the effective date of this order may be used in aforesaid distribution if no compartment thereof has a capacity exceeding 3000 gallons and if the tank vehicle otherwise conforms to all the requirements of this order; provided further that in this distribution deliveries from any compartment the capacity

of which exceeds 1200 gallons shall be measured into the receiving tank or container by meter. A construction tolerance of 10% shall be allowed for capacities of individual compartments or tanks.

2. Bulkheads or compartments shall not be required in any cargo tank used for transportation service, regardless of total capacity, which, when loaded and transporting its cargo over streets and highways will contain not less than 80% of the total tank capacity, and will discharge its entire contents at one unloading point, provided such cargo tank is not used for the delivery of flammable liquids to service stations or other premises to which the public is invited.

Note: In areas requiring seasonal reduction in weight, the 80% requirement shall be waived during the period in which such restriction is in effect.

3. Every cargo tank, and every compartment over 90 inches in length, shall be provided with baffles, the number of which shall be such that the linear distance between any two adjacent baffles, or between any tank head or bulkhead and the baffles nearest it, shall in no case exceed 60 inches.

4. The cross sectional area of each baffle shall be not less than 80% of the cross sectional area of the tank and the thickness of such baffles shall be not less than that required for heads and bulkheads of the cargo tank in which installed.

5. Cargo tanks with compartments carrying flammable liquids of different classes shall be provided with an air space between compartments and this air space shall be equipped and maintained with drainage facilities operative at all times.

(c) *Vents.* Each cargo tank or compartment shall be provided with a vacuum and pressure operated vent with a minimum effective opening of 0.44 square inch, and shall also be provided with an emergency venting facility so constructed as to provide a minimum free-venting opening having a net area in square inches equal to 1.25 plus 0.0025 times the capacity of cargo tank or compartment in gallons. If the emergency venting facility operates in response to elevated temperatures, the critical temperature for such operation shall not exceed 200° F.

(d) *Valve and faucet connections.* Draw-off valves and faucets shall have discharge ends threaded, or they shall be designed so as to permit being tightly connected to hose extending to fill-pipe.

(e) *Emergency-discharge control.* 1. The outlets of each cargo tank or compartment used for transportation of class I and II flammable liquids shall be equipped with a reliable and efficient shut-off valve located inside the shell; or in the sump when it is an integral part of the shell; and designed so that the valve must be kept closed except during loading and unloading operations.

2. The operating mechanism for the valve shall be provided with a secondary control, remote from the fill openings and discharge faucets, for use in the event of accidents or fire during delivery operations.

3. The control mechanism shall be provided with a fusible section which will permit valves to close automatically in case of fire.

4. In every case there shall be provided, between the shut-off valve seat and discharge faucet, a shear section which will break under strain unless the discharge piping is so arranged as to afford the same protection and leave the shut-off valve seat intact.

5. This requirement (e) shall not apply to any cargo tank no compartment of which has a capacity exceeding 400 gallons.

(f) *Assembly.* Every cargo tank shall be adequately supported upon and securely attached to or be a part of the tank vehicle upon which it is carried.

(g) *Static protection.* 1. Cargo tanks, and vehicle chassis, shall be electrically bonded.

2. Provision shall be made in the tank structure of the vehicle for the bonding of vehicle to the fill-pipe during truck loading operations.

Note: Drag chains, formerly specified for the purpose of eliminating static charges, have been shown by experience to be ineffective under present-day conditions where common hard surface materials such as asphalt, or bituminous macadam and dry concrete are essentially nonconductive.

(h) *Protection against collision.* Draw-off valves or faucets projecting beyond the frame at the rear of a tank vehicle shall be adequately protected against collision by bumpers or similar means.

(i) *Lighting.* No lighting device other than electric lights shall be used on tank vehicles. Lighting circuits shall have suitable over-current protection (fuses or automatic circuit breakers). The wiring shall have sufficient carrying capacity and mechanical strength, and shall be secured, insulated, and protected against physical damage, in keeping with recognized good practice.

(j) *Fuel system.* Fuel tanks shall be so designed, constructed and installed as to present no unusual hazard, and shall be so arranged as to vent during filling operations and permit drainage without removal from their mountings.

(k) *Exhaust system.* The exhaust system, including muffler (or silencer) and exhaust line shall have ample clearance from the fuel system and combustible materials, and shall not be exposed to leakage or spillage of product or accumulations of grease, oil or gasoline.

(l) *Fire extinguishers.* Each tank vehicle shall be equipped and maintained with at least one approved hand fire extinguisher of a type suitable for extinguishing flammable-liquid fires. Fire extinguishers shall be kept in good operating condition at all times, and they shall be located in an accessible place on each tank vehicle.

(m) *Auxiliary internal combustion engines.* Internal combustion engines, other than those providing propulsive power, installed or carried upon a tank vehicle transporting class I and II flammable liquids for the purpose of providing power for the operation of pumps or other devices shall be constructed, installed and protected so as not to present an ignition hazard. Conformity with the criteria set forth in paragraphs 501 to 508 inclusive of NFPA No. 385 shall prima facie be deemed compliance with this requirement.

(n) *Auxiliary electric generators and motors.* Electrical equipment, installed or carried upon a tank vehicle transporting Class I and II flammable liquids, for the operation of pumps or other devices used for the handling of product and operating product handling accessories shall be constructed, installed and protected so as not to present an ignition hazard. Conformity with the criteria set forth in paragraphs 511 to 516 inclusive of NFPA No. 385 shall prima facie be deemed compliance with this requirement.

(o) *Proper repair.* Tank vehicles shall not be operated unless they are in proper repair, devoid of accumulation of grease, oil or other flammables, and free of leaks.

(p) *Filling and discharging tank vehicles.* 1. The driver, operator or attendant of any tank vehicle shall not leave the vehicle while it is being filled or discharged. Delivery hose, when attached to a tank vehicle shall be considered to be a part of the tank vehicle.

2. Motors of tank trucks or tractors shall be shut down during making and breaking hose connections. If loading or unloading is done without the use of a power pump, the tank truck or tractor motor shall be shut down throughout such operations.

3. The cargo tank shall be bonded to the fill-pipe when loading. The bond-wire connection shall be made prior to opening the dome covers. It shall be maintained in place during the entire filling operation and the dome covers shall be securely closed before the bond-wire is disconnected from the cargo tank.

4. No external bond-wire connection nor bond-wires integral with a hose are needed for the unloading of flammable liquids into underground tanks.

5. In every cargo tank or compartment sufficient space shall be left vacant to prevent leakage or distortion by expansion of the contents due to rise in temperature in transit. No cargo tank or compartment shall be loaded to a volume in excess of 99¼% of its total capacity including the construction tolerance permitted in paragraph (b) 1.

(q) *No smoking.* Smoking by tank vehicle drivers, helpers, repairmen, or other personnel is prohibited while they are driving, making deliveries, filling, or making any repairs to tank vehicles.

(r) *Protection against intermixing.* 1. In the event that a tank vehicle is used alternately for the transporting of class I or II and class III flammable liquids, no cargo tank or compartment on such vehicle which has, on the prior loading, contained class I or II flammable liquids shall be loaded with class III flammable liquid until such cargo tank or compartment and the piping and any accessory delivery equipment connected thereto has been flushed or otherwise cleared of class I or II flammable liquids.

2. In the event that compartments are connected to a common outlet, no compartment so connected shall contain class I or II flammable liquids while any other compartment on the vehicle contains class III flammable liquid, unless adequate provision is made to avoid intermixture.

3. In the event that a tank vehicle is equipped with a meter, or meters, for the purpose of measuring the quantity of fluid withdrawn from a tank vehicle, no such meter shall be alternately used for the measurements of class I or II and class III flammable liquids unless the meter and its accessory equipment has been flushed or otherwise cleared of class I or II flammable liquids prior to being used for delivery of class III flammable liquid.

4. In the event that a tank vehicle is equipped with a pump for the purpose of discharging from or loading into, the tank of such vehicle, no such pump nor its accessory equipment, including hose, shall be alternately used for the handling of class I or II and class III flammable liquids unless such pump and its accessory equipment has been flushed or otherwise cleared of class I or II flammable liquids prior to being used for delivery of class III flammable liquid.

(s) *Ignition hazard cargo prohibited.* Spark emitting items, such as batteries for delivery, shall not be hauled or delivered on flammable liquid tank vehicles, unless covered by a carton and placed in a non-sparking compartment.

(t) *NFPA.* "NFPA No. 385" as cited in this order means the "Recommended Regulatory Standard for Tank Vehicles for Flammable Liquids", Edition of May, 1954, as published by the National Fire Protection Association.

(u) *I.C.C. Tank vehicle specifications.* "I.C.C. Tank vehicle specifications" as cited in this order means the specifications for cargo tanks to be mounted upon and form a part of tank motor vehicles for transportation of flammable liquids as prescribed by the interstate commerce commission of the United States in part 78 of appendix D to part 197 of its motor carrier safety regulations, revised, effective July 1, 1952.

Ind 8.51 Refineries and casing head or natural gasoline blending plants—permits and requirements. (1) No permit shall be granted for the establishment of a new plant or an addition to a plant for distilling, condensing, or blending within the limits of any city, town or village until after a survey has been made by the industrial commission and an investigation made of all hazardous conditions connected therewith.

(a) If there are no schools, churches, hospitals or assembly halls within 500 feet and no other buildings than those of the plant within 300 feet from the proposed distilling, condensing or blending plant, and other conditions are consistent with the spirit and intent of these location orders, the industrial commission shall grant a permit for the location desired; provided also that a guarantee to maintain an open space 300 feet wide on all sides shall be given by the applicant.

(2) The above shall not apply to so-called crank case oil reclaiming plants of not more than 55 gallons vat capacity; such reclaiming plant shall be in a room in compliance with section Ind 8.17. If over 55 gallon vat capacity, it shall be in a separate one story building of fire-resistive construction throughout.

Ind 8.52 Exceptions to sections Ind 8.43 and Ind 8.44. (For gravity feed to domestic type oil burners see section Ind 8.16(4). The industrial commission may permit the storage and gravity flow of flammable liquid in refineries, and in manufacturing and jobbing plants where the nature of the manufacturing process requires such storage and flow, and also the storage and gravity flow of commodities of classes II and III in stores, plants and establishments, where the nature of the liquid will not permit pumping; provided that the contents of tanks holding class I liquid shall be sufficient only for one day's operation and such storage shall be in a room in accordance with section Ind 8.17.

Ind 8.53 Heating. (1) In all such plants in which flammable liquids are stored, or handled, heating shall be by steam, vapor, hot water, direct or indirect radiation.

(2) All boilers, furnaces, open flames, electric motors, other than those approved for hazardous location, and all spark emitting devices, shall be separated from flammable liquids and processing areas by a solid masonry fire wall without openings. The heating plant shall not be below grade level.

SERVICE STATIONS

Ind 8.54 General requirements. Every gasoline service or filling station shall comply with the following: Ind 8.55 to Ind 8.57, inclusive.

Ind 8.55 Marking of containers. (1) Portable containers of class I and II flammable liquids as defined under section Ind 8.01 shall be identified as follows:

(a) Containers of class I and II petroleum products shall be painted vermilion red and otherwise marked as specified in the Wisconsin "Red Can Law" (Section 168.11, Wis. Stats.)

(b) Containers of class I and II liquids other than petroleum products shall be painted some distinguishing color other than red and the name of the liquid contained shall be plainly stenciled on the container in letters not less than one inch high.

(c) Containers of class I and II liquids other than petroleum products shall be plainly marked with the word "danger" and the name of the liquid contained in letters not less than one inch high.

Ind 8.56 Gasoline dispensing or vending devices. (1) All gasoline gauging or vending devices shall be of approved type substantially secured to concrete or masonry foundations suitably located and of proper design and dimensions to normally prevent any portion of motor vehicle from colliding with the device.

(2) Systems wherein continuous air pressure is maintained on the gasoline storage tank in connection with gasoline dispensing or vending device are prohibited.

(3) The use of aboveground gasoline storage tanks in connection with gasoline dispensing or vending devices is prohibited.

(4) Devices which discharge by gravity shall be so designed that it is impossible to retain in the measuring compartment materially more than 10 gallons of liquid, and so that it is not possible to lock the device without draining the measuring compartment.

(5) Glass cylinders of so-called visible pumps shall be protected by substantial wire or expanded metal screen.

(6) Coin-operated gasoline devices are prohibited.

(7) At any service station where automatic nozzles are installed on gasoline pumps, the nozzles shall be operated manually except where the type of automatic nozzle and hold-open device is approved by Underwriters' Laboratories, Inc.

(8) Only owners, operators or trained employees shall dispense gasoline to the general public, except that the industrial commission may approve self-service under competent supervision if construction and supervision standards outlined in section Ind 8.56 (8), (9) and (10) are adhered to:

(9) Approval must be obtained for all service stations to be converted to self-service and all newly constructed self-service stations. Applicants must submit plot plans in triplicate showing distances from property lines, construction of building and other data as required by the flammable liquids code of Wisconsin.

(10) In addition to other requirements of this code, the following requirements must be adhered to:

(a) A driveway of 24 feet shall be provided between pump islands and between any pump islands and building. Not more than four pumps shall be placed on one island.

(b) Sufficient clearance shall be allowed as an exit driveway that will permit cars to leave the premises without interfering with service or incoming cars.

(c) Where oil, windshield and air services are available, separate areas shall be provided and located so not to interfere with entry or exit of cars.

(d) All pumps shall be equipped with approved self-closing nozzles and hold-open devices on such nozzles shall not be permitted, subject to paragraph (7).

(e) A master switch shall be installed at a central control point that will disconnect the electric power to all gasoline pumps.

(f) If a central control tower is installed it must be elevated to a height that will provide an unobstructed view of all pump islands.

(g) An approved fire extinguisher shall be provided at each pump island.

(11) SUPERVISION. The operator of a self-service station shall comply with the following supervisory requirements:

(a) Agree in writing that requirements of section Ind 8.56 of this code have been met and will be maintained.

(b) If a central control tower with public address system is provided, one supervisor must be on duty in this tower at all times station is open. In addition, there shall be one instructor and one attendant for the first six islands, or fraction thereof, on the driveway at the pump islands at all times the station is open and cars are being serviced. There shall also be one additional instructor or attendant for each additional three pump islands or fraction thereof.

(c) If a central control tower is not provided there shall be one supervisor on duty in addition to one attendant for each 2, or fraction pump islands, all of whom must be on duty at the pump island at all times station is open and cars are being serviced.

(d) Personnel required in section Ind 8.56 (11) (b) and (c) shall be in addition to any cashiers that are employed. Supervisors, instructors, or attendants shall not act as cashiers. Personnel shall be 18 years of age or over.

(e) A responsible supervisor must be on duty at all times the station is open.

History: 1-2-56; am. Register, December, 1958, No. 36, eff. 1-1-59.

Ind 8.57 Buildings, equipment, operation. (1) Provision shall be made by grading driveway, raising door sills, or some equally effective means to prevent gasoline spillage from flowing into the interior of station buildings.

(2) Drainage from crank cases shall be kept in a suitable tightly closed metal container, not exceeding 55 gallons individual capacity, and 110 gallons shall be the maximum storage permitted above ground in a building.

(3) "NO SMOKING" signs and "STOP MOTOR WHILE FILLING" signs shall be prominently posted to be readily visible at points where gasoline is handled or sold.

TANK CAR UNLOADING

Ind 8.58 Location of unloading point. (1) No tank car unloading point of class I and II liquids shall be located within 35 feet from the line of property of other ownerships and a clear space as provided in section Ind 8.35 from tanks and buildings of same ownership, shall be maintained.

(2) The topography of the unloading site shall be such that vapors will not flow toward adjacent building openings, basements, cellars, or pits. Where the topography is such that vapors might flow toward adjacent buildings, the unloading site shall be not less than 100 feet from such buildings excepting railroad right of way.

Ind 8.59 Railroad sidings. Only sidings equipped with facilities for piping liquid from tank cars to permanent storage tanks shall be used in connection with tank car unloading operations. Sidings used for this purpose shall not be common to other users, or they shall be provided with necessary derails, or with warning signs in accordance with part 4, section 561 of the interstate commerce commission regulations on the transportation of explosives and other dangerous articles by freight.

Ind 8.60 Requirements and restrictions for unloading. (1) Liquids having a flash point below 150 degrees F. shall not be withdrawn from tank cars from bottom outlets, but shall be unloaded through dome (manhole) only.

(2) Bottom outlet unloading of fuel oil will be permitted subject to the written approval of the industrial commission and concurrence of the local fire chief.

(3) The use of compressed air to discharge the contents of tank cars shall be prohibited, but this shall not be construed to prevent the use of a standard system employing an inert gas, such as carbon dioxide or nitrogen, as pressure generating medium for this purpose.

(4) Unloading from tank cars to tank trucks, or of tank trucks to tank cars, or to any other portable container is prohibited.

(5) Before unloading operations are started and before any connection or contact is made with piping or other unloading equipment, the tank car or other transport shall be electrically bonded in an effective manner.

(6) Permanent electrical connection of not less than No. 0 copper cable shall be made between the rail on which the tank cars stand and the piping system used in connection with handling of flammable liquids.

(7) This connection may be accomplished in one of two ways: The rails may be bonded by means of standard rail bonds, and connected to the permanent piping system with No. 0 electric cable connections at each end of the loading or unloading section; or a similar connection may be made between each rail on which cars stand and the permanent piping system.

(8) At marketing stations and elsewhere where flammable liquids are handled, a separate pump and piping system shall be used for class III liquids.

Ind 8.61 Piping, type of material. All piping shall be of the standard wrought iron or steel pipe for working pressures under 100 pounds; for working pressure in excess of 100 pounds, extra heavy pipe and fittings shall be used.

Ind 8.62 Underground piping. (1) Where piping is buried it shall be located below the frost line. Such pipes may be in conduit, when placed in city streets or elsewhere where other piping is installed.

(2) Pipe lines shall be installed beneath all other piping. Piping shall rest on a solid foundation or otherwise securely installed so as to minimize the possibility of undue stress at joints due to settling. All piping shall be coated with asphaltum or other corrosion-resistive material.

Ind 8.63 Pipe joints. Joints may be welded or of the ordinary screw type; where joints are of the latter type, they shall be made up with lamp black or shellac or some other substance suitable for the purpose. Provisions shall be made to care for expansion and contraction in the line.

Ind 8.64 Valves. (1) A shut-off valve shall be installed immediately at the pump in the discharge line therefrom. There shall also be a shut-off valve conveniently located at point of connection to storage tank. If liquid is pumped from tank car to a storage tank located at an elevation higher than the pump suction line, a check valve shall be installed.

(2) Valves shall be readily accessible and plainly marked to indicate contents of the pipe line.

Ind 8.65 Tests. Piping after installation shall be tested for 30 minutes at a pressure 50% in excess of the working pressure and shall be proven tight.

Ind 8.66 Filing of plans. Complete records in the form of plans and profiles showing the location of flammable liquid pipe lines with respect to other piping in city streets and areas where other piping systems are installed shall be filed in the office of the city engineer, or director of public works, otherwise in the office of the city or village clerk.

Ind 8.67 Unloading operations under interstate commerce commission regulations. (1) The unloading of tank cars and all operations in connection therewith shall be in full accord with the rules and regulations of the interstate commerce commission. (See part 4, section 561 of the interstate commerce commission, regulations for transportation of explosives, etc., effective January 7, 1941.)

(2) Unloading operations shall be under constant supervision of a reliable person properly instructed and responsible for careful compliance with the regulations of the United States and of this state.

Ind 8.68 Entering tanks. No manhole in connection with flammable liquid tanks shall be entered for any purpose by any one not equipped with the life line and belt and with a fresh air mask or self-contained oxygen respirator. In no case shall any tank be entered without having another person stationed at the manhole ready and capable of rendering assistance if needed.

Note: It is recommended that the condition of the air in any tank be determined with an approved gas detector.

Ind 8.69 Lighting; tools. No open flames or spark emitting devices shall be permitted in or near such manhole. Artificial lighting in such manhole shall be restricted to approved, self-contained portable electric lights or electric hand flashlights.

1102
**STORAGE AND HANDLING OF FLAMMABLE LIQUIDS
ON FARMS**

Storage and handling of flammable liquids on farm properties, for use in connection with farm vehicles, equipment, and appliances, shall be in accordance with the following requirements:

Ind 8.85 Construction of containers. Flammable liquids shall be stored only in standard closed portable containers, drums or barrels, or in standard aboveground or underground tanks. All containers shall be made of metal and shall be substantially constructed. All openings, except vents, shall be fitted with caps or plugs and shall normally be kept closed.

Ind 8.86 Marking of containers. As specified in the state "Red Can Law" gasoline shall be sold, purchased or stored only in containers painted *RED* and plainly labeled "GASOLINE". Kerosene and fuel oil shall not be kept in red containers.

Ind 8.87 Storage inside buildings limited. (1) Except as permitted in connection with standard oil burning equipment, the storage of flammable liquids in all but separate detached buildings used exclusively for oil storage, is limited depending on class of liquid as follows:

(a) Class I liquids such as gasoline, naphtha, etc. Maximum total of 5 gallons in tightly closed containers of not more than one gallon capacity, or in safety cans of not more than 5 gallons capacity.

(b) Class II liquids such as alcohol, alcohol base anti-freeze solutions. Maximum total of 60 gallons in tightly closed containers or safety cans not exceeding 5 gallons capacity, and in drums, barrels or tightly covered tanks.

Note: Empty containers present essentially the same hazard as filled or partly filled containers, and should be removed from buildings when empty.

Ind 8.88 Storage in connection with oil burning equipment. Fuel oil for use in connection with oil burning equipment may be stored either inside or outside buildings to extent of standard fuel oil storage tanks of not more than 275 gallon individual capacity. When installed inside of a building tanks shall have vent pipe and filling pipe extending to safe place outside of building.

Ind 8.89 Special storage building. Special storage buildings which shall be used exclusively for storage of flammable liquids, may be of frame construction if located at least 75 feet from all principal farm buildings (houses, barns, granaries, machine sheds, etc.) hay and straw stacks, and other severe exposures. Where such building is constructed throughout (including roof) of incombustible material (sheet metal or steel frame, masonry, or concrete) the clearance specified may be reduced to 50 feet.

Note: It is recommended that such storage buildings be as small as practicable. Storage in such buildings should be limited to containers of not more than 60 gallon individual capacity so that they can be moved in case of severe exposure from fire in some adjacent building. Pumps used in connection with underground tanks may be installed in such building.

Ind 8.90 Storage outside buildings. (1) Storage outside of buildings, in standard aboveground or underground tanks shall be in conformity with the following requirements:

(a) *Underground tanks.* Underground tanks shall be located at least 10 feet from the nearest building, and shall be buried at least 2 feet underground. Tanks shall be constructed throughout of metal at least 3/16 inch thick if not galvanized. If tanks are galvanized, they may be of the following thickness:

Capacity (Gallons)	<i>Minimum Thickness and Weight of Material Gauge (U. S. Std.)</i>	
		<i>Lbs. per sq. ft.</i>
1 to 285 -----	16	2.50
286 to 560 -----	14	3.125
561 to 1,100 -----	12	4.375

1. Each tank shall have a vent pipe (at least 1 inch in size) extending to a height of at least 12 feet above ground and fitted at the top with a goose neck or other weather proof hood.

2. Pumps in connection with underground tanks shall be located at least 15 feet from all principal buildings and other severe exposures. For protection against weather and theft, pumps may be enclosed in an incombustible locked housing.

Note: It is recommended that lock be applied directly to pump thus eliminating need for enclosure.

(b) 1. *Aboveground tanks.* Aboveground containers shall not be larger than 500 gallons individual capacity. Tanks other than standard drums and portable containers shall be constructed of metal at least 14 gauge (U. S. Standard) thickness.

2. Tanks of larger than 60 gallon individual capacity shall be located at least 75 feet from all principal buildings, and other severe exposures. For containers of smaller than 6 gallon individual capacity specified clearance may be reduced 50 feet.

Ind 8.91 Elevated stationary tanks. (1) Elevated storage tanks (standard so-called farm tanks) designed and arranged to dispense liquid fuels by gravity directly to farm vehicles on the farm premises shall be in conformity with the following requirements:

(a) Tanks shall not have individual capacity in excess of 560 gallons and shall be located at least 75 feet from all principal buildings and severe exposures.

(b) Tanks shall be constructed throughout of open hearth steel or wrought iron at least 14 gauge (U. S. Standard) thickness.

(c) There shall be a shut-off valve at the tank outlet, and such valve shall be arranged for locking. The tank shall have a vent opening at least 1½ inch in diameter and the opening shall be protected with a standard type vent or combination vent and fill pipe head.

Note: As protection against weather as well as theft, it is recommended that the tank be designed to include a small hinged covered metal box or housing for the tank outlet valve. Such housing should be arranged for locking.

(d) Gravity delivery hose shall be fitted at the delivery end with a self-closing shut-off nozzle, and a suitable hook or other device for supporting the nozzle when not in use, shall be provided.

(e) The supporting structure for the tank may be of steel, reinforced concrete, or wood. It shall be designed to support safely the loading involved.

(f) There shall be no cabinets or enclosed spaces of any kind beneath the tanks. A small well-ventilated convenience cabinet (not more than 8 cubic feet volume) for measures, pails, funnels, etc., may be mounted on the tank supports.

(g) Fire safety precautions: 1. The tank shall be permanently electrically grounded to permanent moisture. Such ground connection shall consist of a copper wire not smaller than No. 8 size connected between the tank and an underground water pipe or electrode driven at least 8 feet into ground. The electrode may be a standard grounding rod or a length of iron rod or pipe at least $\frac{3}{4}$ inch in diameter.

2. The area under and within at least several feet of the tank shall be kept free of dry grass, weeds and other combustible material. It is recommended that the tank site be covered with crushed stone, gravel, or cinders to retard the growth of grass or weeds.

3. Tanks shall be plainly labeled in letters at least 5 inches high "FLAMMABLE—KEEP FIRES AWAY—NO SMOKING IN THIS AREA".

Note: It should also be a strict rule that the motor of vehicle must be shut off while fuel tank is being filled.

4. If the tank site is on ground sloping toward principal buildings, hay or straw stacks, hay fields, etc., an earthen dike of sufficient size to hold at least the capacity of the tank shall be provided to keep liquid from flowing toward buildings, etc.

