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**GENERAL ORDERS ON  
EXPLOSIVES**

**Effective September 26, 1953**

**Issued by  
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Madison**

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## GENERAL ORDERS ON EXPLOSIVES

### INTRODUCTION

This issue of the General Orders on Explosives replaces regulations dealing with the storage, transportation, and use of explosives which became effective on March 27, 1933, and which combined for the first time all of the Industrial Commission's orders on these subjects.

Each of the three sections of these regulations had been promulgated and revised by different code committees at various times but were printed in one issue for convenience.

When it became apparent that there was need for an almost complete revision, a new advisory committee was nominated by various interests and appointed early in 1952 to make recommendations for such action. This committee was composed of the following members:

- PROF. E. R. SHOREY, University of Wisconsin, Madison; Chairman.
- PHILLIP S. BANASZAK, Wisconsin Highway Commissioners Association, Jefferson.
- C. M. FELLMAN, Montreal Mining Company, Montreal.
- B. O. HENDERSON, Wisconsin State Highway Commission, Madison.
- J. A. JOHNSON, U. S. Bureau of Mines, Duluth, Minnesota.
- W. A. KNOLL, Pickands Mather & Company, Ironwood, Michigan.
- TED KURTZ, Wisconsin State Industrial Union Council, Milwaukee.
- M. A. NICE, Institute of Makers of Explosives, Wilmington, Delaware.
- H. T. RITTMAN, Institute of Makers of Explosives, Wilmington, Delaware.
- W. H. RYAN, Wisconsin Road Builders Association, Janesville.

PROF. W. A. ROWLANDS, University of Wisconsin, Madison.

JOHN ZANCANARO, Wisconsin State Federation of Labor, Milwaukee.

A. W. USADEL, Wisconsin Industrial Commission, Madison; Secretary.

F. D. Bickel represented the Institute of Makers of Explosives for Mr. Nice at the advisory committee meetings.

The advisory committee met in Madison on March 25 and 26, April 29, and December 4, 1952. The proposed orders were considered at public hearings held by the Industrial Commission in Eau Claire, Superior, Hurley, Wausau, Milwaukee, Green Bay, Platteville and Madison.

Comments and suggestions originating from the hearings were considered at the last committee meeting and the revised code was adopted by the Industrial Commission on July 24, 1953, published in the official state paper on August 27, 1953, and became effective September 26, 1953. The old orders were repealed on the latter date.

## SECTION I

### GENERAL ORDERS ON EXPLOSIVES

#### Order 650—Scope.

These orders shall apply to the storage, handling and transportation of explosives, but shall not apply to the interstate transportation of explosives. This code shall not apply to the military or naval forces of the United States, or the militia of any state thereof, nor to the police or fire department of any city provided they are acting within their official capacity and in the proper performance of their duties.

#### Order 651—Construction of Orders.

Failure on part of superintendents, foremen, bosses, and other persons having control of any place of employment, or of any employee and of any operations, to carry out any duty prescribed in these orders is violation of such order by the employer.

#### Order 652—Definitions.

(a) The term "superintendent" when used in these orders shall mean the person having a general supervision of the work.

(b) The term "foreman" when used in these orders shall mean a person who at any one time is charged with the immediate direction of the work.

(c) For the purpose of these orders, an explosive is defined as any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion, i.e., with substantially instantaneous release of both gas and heat, unless such compound, mixture or device is otherwise classified by the Industrial Commission of Wisconsin.

(d) The term "magazine" means any building or other structure of approved construction used for the storage of explosives.

(e) The term "approved" shall be held to mean approved by the Industrial Commission.

(f) The term "primer" when used in these orders shall mean a capped fuse, detonator, or detonating device inserted in a cartridge of explosive.

(g) The term "barricade" when used in these orders shall be held to mean natural features of the ground, such as hills, timber of sufficient density that the surrounding exposures can not be seen when the trees are bare of leaves, or an "efficient artificial barricade" consisting of an artificial mound or properly revetted wall of earth of a minimum thickness of 3 feet at the top.

(h) The term "blaster" shall mean any person or persons holding a certificate of competency issued by the Industrial Commission.

(i) The term "person" when used in these orders shall be held to mean and include a firm or body corporate as well as natural persons.

(j) The term "building" when used in the Quantity and Distance Table shall mean and include only a building occupied in whole or in part as a habitation for human beings, or any church, schoolhouse, railroad station, mercantile building, garage, factory, or other building where people are accustomed to assemble, except operating buildings.

(k) The term "railroad" when used in the Quantity and Distance Table shall mean and include any steam, electric or other railroad tracks which carry passengers for hire.

(l) The term "highway" when used in these orders shall be held to mean and include any public street, public alley or public road.

(m) The term "detonator" means any kind of blasting cap used for detonating a high explosive.

(n) The term "blasting cap" means a small metal tube or shell closed at one end, loaded with a detonating charge, whose minimum strength shall be equivalent to one gram of 80% mercury fulminate and 20% potassium chlorate mixture, used in detonating high explosives. One end of this tube shall be open for the insertion of safety fuse.

(o) The term "electric blasting cap" means a blasting cap with an ignition head inserted into and sealed in the open end with two projecting wires for electric firing.

(p) The term "delay electric blasting cap" means an electric blasting cap with a timing element interposed between the ignition head and the detonating compound.

#### Order 653—Storage of Explosives Within Cities and Villages.

(a) No dynamite of more than 60% rated strength shall be kept or stored for sale in any building, storeroom, ware-room, or in or on any premises within the corporate limits of any city or village. Any other storage permitted under this order shall be approved by the chief of the fire department.

(b) Not more than a total quantity of 50 pounds of dynamite for sale or use shall be kept or stored in or on any premises within the corporate limits of any city or village. Such 50 pounds or less of such dynamite shall be kept and stored in a magazine made of fire-resistive materials or of wood covered with sheet iron and mounted on wheels or skids, and kept locked except when opened necessarily for use by authorized persons. Such magazine shall be plainly marked EXPLOSIVES, and located within a building, on the floor nearest the ground level, and within 10 feet from an outside entrance.

(c) Not more than a total quantity of 50 pounds of gunpowder and black powder may be kept or stored in any building or on any premises within the corporate limits of any city or village. Such powder shall be kept in closed metal canisters placed in a separate magazine constructed and located as described in paragraph (b) of this order.

(d) Not more than 7,000 detonators may be kept or stored on any premises within the corporate limits of any city or village. In no case shall explosives and detonators be kept or stored in the same magazine.

Detonators shall be kept or stored in a similar, but separate magazine, similarly placed, in accordance with the specifications provided for in paragraph (b) of this order.

(e) Anyone storing explosives or detonators within the corporate limits of any city or village shall notify the chief of the fire department of the place, extent and manner of such storage.

(f) Blasting operations within a city or village may store up to a maximum of 24 hours explosives requirements, but where such 24 hours requirements exceed 50 pounds, permission shall be obtained in advance from the chief of the fire department and the explosives shall be stored in a magazine as described in Order 657.

**Order 654—Storage Outside Corporate Limits of Cities and Villages.**

All explosives in excess of the supply authorized to be stored in cities and villages shall be kept or stored in specially constructed magazines located outside the corporate limits of cities and villages according to the Quantity and Distance Table.

This order shall not apply where the requirements of this table can be met within such corporate limits.

**Order 655—Location of Magazines.**

(a) All magazines in which explosives are kept or stored shall be located at a distance from buildings, railroads and highways in conformity with the following Quantity and Distance Table, unless otherwise authorized by the Industrial Commission.

The Quantity and Distance Table governing the keeping and storage of explosives is as follows:

**QUANTITY AND DISTANCE TABLE**

EXPLOSIVES		DISTANCES IN FEET (UNBARRICADED)			
Pounds Over	Pounds Not Over	Inhabited Buildings	Passenger Railways	Public Highways	Separation of Magazines
2	5	140	60	60	12
5	10	180	70	70	16
10	20	220	90	90	20
20	30	250	100	100	22
30	40	280	110	110	24
40	50	300	120	120	28
50	75	340	140	140	30
75	100	380	150	150	32
100	125	400	160	160	36
125	150	430	170	170	38
150	200	470	190	190	42
200	250	510	210	210	46
250	300	540	220	220	48
300	400	590	240	240	54
400	500	640	260	260	58
500	600	680	270	270	62
600	700	710	290	290	64
700	800	750	300	300	66
800	900	780	310	310	70
900	1,000	800	320	320	72
1,000	1,200	850	340	330	78
1,200	1,400	900	360	340	82
1,400	1,600	940	380	350	86
1,600	1,800	980	390	360	88
1,800	2,000	1,010	410	370	90

QUANTITY AND DISTANCE TABLE—Continued

EXPLOSIVES		DISTANCES IN FEET (UNBARRICADED)				
Pounds Over	Pounds Not Over	Inhabited Buildings	Passenger Railways	Public Highways	Separation of Magazines	
2,000	2,500	1,090	440	380	98	
2,500	3,000	1,160	470	390	104	
3,000	4,000	1,270	510	420	116	
4,000	5,000	1,370	550	450	122	
5,000	6,000	1,460	590	470	130	
6,000	7,000	1,570	620	490	136	
7,000	8,000	1,600	640	500	144	
8,000	9,000	1,670	690	520	150	
9,000	10,000	1,730	740	540	156	
10,000	12,000	1,750	780	550	164	
12,000	14,000	1,770	810	560	174	
14,000	16,000	1,800	840	570	180	
16,000	18,000	1,880	870	580	188	
18,000	20,000	1,950	940	630	196	
20,000	25,000	2,110	1,000	680	210	
25,000	30,000	2,260	1,050	720	224	
30,000	35,000	2,410	1,100	760	238	
35,000	40,000	2,550	1,140	800	248	
40,000	45,000	2,680	1,180	840	258	
45,000	50,000	2,800	1,220	880	270	
50,000	55,000	2,920	1,260	910	280	
55,000	60,000	3,030	1,290	940	290	
60,000	65,000	3,130	1,320	970	300	
65,000	70,000	3,220	1,350	970	310	
70,000	75,000	3,310	1,350	1,000	320	

QUANTITY AND DISTANCE TABLE—Continued

EXPLOSIVES		DISTANCES IN FEET (UNBARRICADED)				
Pounds Over	Pounds Not Over	Inhabited Buildings	Passenger Railways	Public Highways	Separation of Magazines	
75,000	80,000	3,390	1,380	1,020	330	
80,000	85,000	3,460	1,410	1,040	340	
85,000	90,000	3,520	1,440	1,060	340	
90,000	95,000	3,580	1,460	1,080	350	
95,000	100,000	3,630	1,490	1,090	360	
100,000	110,000	3,670	1,540	1,100	370	
110,000	120,000	3,710	1,580	1,110	390	
120,000	130,000	3,750	1,620	1,120	410	
130,000	140,000	3,780	1,670	1,130	430	
140,000	150,000	3,800	1,700	1,140	450	
150,000	160,000	3,870	1,740	1,160	470	
160,000	170,000	3,930	1,780	1,180	490	
170,000	180,000	3,980	1,810	1,200	510	
180,000	190,000	4,020	1,840	1,210	530	
190,000	200,000	4,060	1,870	1,220	550	
200,000	210,000	4,155	1,910	1,240	570	
210,000	213,000	4,200	1,960	1,270	590	
230,000	250,000	4,310	2,020	1,270	630	
250,000	275,000	4,430	2,080	1,300	670	
275,000	300,000	4,550	2,150	1,340	720	
	Maximum Quantity Permitted			1,380	770	

*Maximum Allowed.* No quantity in excess of 300,000 pounds, or in the case of blasting caps, no number in excess of 20,000,000 caps shall be kept or stored in any magazine in this state.

*Blasting Caps—Quantity Equivalent to Weight.*

1,000 caps shall be considered as equivalent to  $1\frac{1}{2}$  pounds of explosives for computing explosives content of detonators in a magazine.

(b) Magazines in which more than 50 pounds of explosives are kept and stored shall be detached from other structures.

When two or more magazines are located on the same property, each magazine must comply with the minimum distances specified from inhabited buildings, railways, and highways, and in addition they shall be separated from each other by not less than the distances shown for "Separation of Magazines," except that the quantity of explosives contained in cap magazines shall govern in regard to the spacing of said cap magazines from magazines containing other explosives. If any two or more magazines are separated from each other by less than the specified "Separation of Magazines" distances, then such two or more magazines, as a group, must be considered as one magazine, and the total quantity of explosives stored in such group must be treated as if stored in a single magazine located on the site of any magazine of the group, and must comply with the minimum distances specified from other magazines, inhabited buildings, railways, and highways.

(c) Whenever a magazine is screened from buildings, railroads or highways, either by natural features of the ground, or by a barricade as described in Order 652(g), of such height that any straight line drawn from the top of any side wall of the magazine to any part of the building to be protected will pass through such intervening natural or efficient artificial barricade, and any straight line drawn from the top of any side wall of the magazine, to any point 12 feet above the center of the railroad or highway to be protected, will pass through such intervening barricade, the applicable distances, as prescribed by the Quantity and Distance Table in paragraph (a) of this order, may be reduced one-half.

(d) Explosives magazines, except detonator magazines as provided in Order 656(b), shall not be located nearer than 200 feet from any operating building of any mine or quarry, or from any mine shaft, tunnel, or slope opening at the surface.

**Order 656—Construction and Maintenance of Magazines.**

(a) Magazines for storing high explosives, except detonators, shall be constructed of brick, poured concrete, concrete block or hollow clay tile (walls not less than 6 inches thick) with openings filled with sand or screenings (less than  $\frac{3}{8}$  inch), or of metal, lined with 4 inches of brick or wood. For magazines built of metal heavier than 14 gauge, the equivalent ratio of metal to the wood lining shall be  $\frac{1}{8}$  inch of metal to one inch of wood. Wood frame construction may be used if the construction consists of walls 6 inches apart filled from sill to plate with sand and the structure completely surfaced on the outside with not less than 26 gauge metal or an equivalent fire-resistive material, such as asbestos cement sheathing or shingles.

The doors shall be constructed of  $\frac{3}{8}$  inch thick boiler plate lined with three layers of  $\frac{7}{8}$  inch hardwood, or if metal is less than  $\frac{3}{8}$  inch thick, lined with four layers of  $\frac{7}{8}$  inch hardwood or equivalent.

A bullet-resistant ceiling consisting of a tray of sand 4 inches thick or equivalent, shall be provided at the level of the plate line if the dynamite can be shot into through the roof of the magazine. A 2 inch space shall be provided between the tray and the walls of the building.

(b) No detonators shall be stored in any magazine containing other explosives. Buildings for storage of detonators and blasting supplies, or black powder magazines, shall be constructed of metal and lined, or of wood construction covered with metal or fire-resistive material. The door shall be fire-resistive and kept locked.

A waterproof box of equivalent construction, or as described in Order 657, painted red and conspicuously marked EXPLOSIVES shall be considered as complying with this order for storage of not more than 7,000 detonators. Such storage shall be in accordance with Order 653 (b). For more than 7,000 detonators use the Quantity and Distance Table.

(c) All nails in the interior of the magazines shall be countersunk.

(d) Each magazine shall be ventilated and the vent openings shall be screened to prevent sparks of fire passing through them, except that magazines containing only black powder may be constructed without openings for ventilation. Ventilation openings shall be located at the top of the magazines and below the floor line, and a 2 inch opening shall be provided between the floor and the wall, except at the door, for complete air circulation. Where magazines do not have a ceiling, the vent opening shall be protected by a deflector.

(e) Magazine doors shall be kept closed and locked except when opened for transacting business.

(f) The ground around the magazines, within 25 feet in all directions, shall be kept free from rubbish, dead grass, shrubbery or other flammable materials.

(g) Signs with the words EXPLOSIVES—KEEP OFF legibly printed thereon in letters approximately 3 inches high, shall be posted at all times on the premises on which the magazines are located. Such signs shall be located so that a bullet fired directly at them will not strike any magazine.

(h) Magazines shall be kept clean and dry.

(i) Magazines shall be in charge of a person especially appointed for the purpose, who shall have in his possession the keys of the magazine and shall be responsible for the safe storage of explosives contained therein.

(j) Explosives shall not be handled near open lights, fire, flame, or sparks. Only an electric flashlight or electric lantern shall be used in a magazine if artificial light is needed. Smoking or carrying matches, lighters or other flame-producing devices shall not be permitted in a magazine.

(k) Fibre, rubber, or wooden tools shall be used to open explosives cases except that "slitters" may be used to open fibre-boards cases. Cases shall be opened outside the magazine.

(l) No flammables, except wood wedges and fibre, rubber or wooden mallets, nor any sparking metal tools or implements, shall be kept or stored in any magazine containing explosives.

(m) Explosives shall be stored so that the oldest stock is readily accessible and can be used first.

Note: Complete plans for all types of magazines are available from the U. S. Bureau of Mines, explosives manufacturers, and the Institute of Makers of Explosives.

#### Order 657—Storage, Daily Supply.

Where explosives in excess of immediate requirements are removed from a magazine and delivered in the vicinity of a blasting operation, they shall be kept in a stout, tight box constructed of nominal 2 inch plank, covered with not less than 26 gauge sheet metal or other fire-resistive material, and equipped with hinged lid, or in a small portable building similarly covered. Not more than 24 hours' supply of explosives shall at any time be kept or stored therein. If this daily supply exceeds 50 pounds, it shall be located not less than 200 feet from the work in progress and from buildings, railroads, and highways, except by special permission of the chief of the fire department in cities and villages. Except when necessarily opened for use by authorized persons, such box shall be locked. Each such box shall be painted red and be conspicuously marked EXPLOSIVES.

#### Order 658—Portable Magazines.

When work is of a temporary nature, the magazine shall be constructed in accordance with specifications in Order 656, except that 4 inches of sand or equivalent will be accepted if the capacity of such magazine is not more than 6,000 pounds. Such magazine shall be subject to all orders applying to permanent magazines, except that ventilation requirements shall be waived.

#### Order 659—Explosives Unfit for Use.

When it is necessary to destroy dynamite or detonators, the handling and destruction of the explosives shall be deferred until a representative of an explosives manufacturer, of the U. S. Bureau of Mines, or of the Wisconsin Industrial Commission has been consulted.

Note: These explosives may be fresh material from containers which have been broken during transportation, usable material for which there is no further need on the job, or they may consist of material which has deteriorated or which has become unfit for use through some sort of damage. Frequently, deteriorated



rated explosives are much more hazardous than those in good condition, and hence, require special care in handling and disposal.

(b) Empty cases, paper and sawdust from deteriorated explosives, and sweepings may be explosive, and shall be destroyed separately by burning. Such burning shall be conducted in a safe location where no damage or injury will result in the event of an explosion.

(c) In case magazine floors become stained with nitroglycerin they shall be scrubbed well with a stiff broom, hard brush, or mop, using a solution mixed in the proportion of 1½ quarts of water, 3½ quarts of denatured alcohol, one quart of acetone, and one pound of sodium sulfide (60% commercial). The liquid shall be used freely to decompose the nitroglycerin thoroughly. If the magazine floor is covered with rubberoid or any material impervious to nitroglycerin, this portion of the floor shall be thoroughly swept with dry sawdust and the sweepings taken to a safe distance from the magazine and destroyed by the method described in the above paragraph.

#### **Order 660—Transportation of Explosives.**

These orders shall apply to the transportation of explosives in the state of Wisconsin in intrastate movements, as they are applicable.

(a) Motor trucks or vehicles when used for transporting explosives, shall be marked or placarded on both sides and the rear with the word EXPLOSIVES in letters not less than 6 inches high, or shall conspicuously display a red flag with the word DANGER printed, stamped, or sewed thereon in white letters at least 6 inches high, mounted above the highest point of the vehicle.

(b) Motor vehicles transporting explosives shall be handled in a safe and careful manner.

Only careful, qualified men who have been selected and regularly designated by the employer shall drive, load, or unload a vehicle transporting explosives.

No person shall be permitted to ride upon, drive, load, or unload a vehicle transporting explosives while smoking or under the influence of liquor.

(c) No sparking metal tools or flammable or corrosive substances shall be carried in the bed or body of vehicles transporting explosives, except that service trucks carrying small quantities of explosives in approved containers are considered as complying with this order.

(d) Only necessary stops shall be made by motor vehicles loaded with explosives. They shall stop at all railroad grade crossings, except urban street railway crossings, and their speed limit shall be 45 miles per hour.

(e) The vehicle used for transporting explosives shall have a tight floor. If there is any exposed sparking metal on the inside of the body, it shall be covered or protected with non-sparking material so that the explosives containers will not come in contact with the exposed sparking metal. Trucks used for the transportation of explosives shall be clean and free from surplus oil and grease, shall have wiring completely insulated, fuel and exhaust lines free from leaks, and all necessary precautions shall be taken to prevent the truck from catching fire. A fire extinguisher equivalent to a one and one-half quart carbon tetrachloride type, a four pound dry chemical type, or a four pound carbon dioxide type fire extinguisher shall be mounted in an accessible place in the cab of every motor vehicle transporting explosives. (Two extinguishers may be carried instead of one to secure the above required capacity). In open trucks servicing any job with explosives, a tarpaulin shall be used to cover explosives and the sides of the body shall be high enough to prevent cases from falling off.

(f) Detonators may be transported in the same motor vehicle with high explosives only as follows: The detonators shall be packed in authorized I.C.C. specification outside shipping containers, or in prescribed inside I.C.C. packages in an outside box made of one inch lumber lined with padding material not less than ½ inch thick, or a box made of not less than 12 gauge sheet metal lined with plywood or other similar material not less than ⅜ inch thick so that no metal is exposed. Hinged covers and fastening devices are required on boxes. These boxes shall be loaded in motor vehicle so that contents of the box will be immediately accessible for removal.

(g) Explosives may be transported on any truck or any semi-trailer attached to a tractor. Under no conditions shall explosives be transported in any "full" trailer, or any form of "pole" trailer.

(h) Cases of explosives shall not be dropped, slid, or otherwise roughly handled.

#### **Order 661—Certificates of Competency.**

(a) No person shall be permitted to prepare explosive charges or conduct blasting operations, and no employer shall employ any person for such purposes unless such person holds a valid certificate of competency issued by the Industrial Commission after a determination of fitness by examination.

(b) Persons authorized to prepare explosive charges or conduct blasting operations shall comply with all provisions of the General Orders on Explosives, and shall use every reasonable precaution to insure the safety of the workmen and general public. They shall not delegate the work of preparing explosive charges or conducting blasting operations to a person who does not hold a certificate of competency, except under their direct supervision. A person not holding a certificate of competency may act only as a helper.

(c) The certificate of competency shall be cancelled by the Industrial Commission in cases of violations of safety practices.

#### **Order 662—Detonators and Primers.**

(a) Only a crimper shall be used for attaching fuse to blasting caps. The employer shall furnish and keep in accessible places, ready for use, crimpers in good repair. Capped fuses shall be made up only as required.

(b) No fuses shall be capped with blasting caps in any magazine, but approved benches shall be provided at a safe distance from such storage place where all fuses shall be capped. All fuse ends shall be trimmed immediately before capping.

(c) All cap and fuse and electric primers shall be made as recommended by the manufacturer. Primers consisting of less than one cartridge shall be made by inserting the cap

in the end of the cartridge. They shall be made just prior to loading in borehole.

**Note:** The manufacturer's recommendations are found on "case inserts" in every case of explosives.

#### **Order 663—Use of Explosives.**

(a) Explosives shall be handled in a careful manner as described in this order.

(b) There shall be one blaster in charge of blasting in each section of any operation. He shall enforce these orders and directions and personally supervise the fixing of all charges and all other blasting operations and shall use every precaution to insure safety.

(c) Explosives shall not be distributed or handled during the known approach or progress of an electrical storm. If work has been started it shall be stopped and employees shall go to a safe distance from the blast area until the storm has passed.

(d) Explosives shall be conveyed in original shipping containers, in approved covered wooden boxes or sacks provided for that purpose.

(e) Detonators shall be conveyed separately from other explosives in approved containers provided for that purpose. The carrying container for capped fuses shall be of rigid construction and provided with a hinged cover. If containers are of metal, a lining of felt, or similar material, shall be provided.

(f) After loading is completed, all surplus explosives and supplies shall be returned at once to the daily supply magazine as specified in Order 657, observing the rules used for distribution.

(g) Special orders for use of explosives in tunnels.

(1) Explosives used in tunneling shall be Fume Class 1 as classified by the Institute of Makers of Explosives and the users shall post evidence in a conspicuous place showing compliance with this order.

(2) Explosives shall not be lowered into any tunnel on the same conveyance with detonators or primers.

(3) While explosives are being taken through air locks, no men other than the lock tender and the carrier shall be permitted in the lock.

(4) Explosives shall not be left or placed near electric wires.

(5) Before explosives or detonators are delivered to a tunnel face, all power current shall be cut off within 50 feet of the face. All illumination shall be by battery lamps or floodlights only.

(6) In a tunnel or shaft no blast hole shall be loaded until a round of holes is completely drilled.

(h) Before loading any blast holes, they shall be checked with a tamping pole or other equivalent device to make sure they are in proper condition and proper size for loading of explosives.

(i) There shall be no smoking, open flames, sparks, or use of matches or lighters within 100 feet of place where explosive charges are being prepared with the exception of carbide lamps where this is the type of illumination used in mines.

(j) All tamping poles and dollies shall be constructed of wood or flexible plastic pipe with no exposed metal parts, except that non-sparking metal spikes may be used where necessary to load rough holes and that non-sparking metal connectors may be used for extending the length of tamping poles.

(k) Explosives shall be tamped only by light taps of the tamping rod. Excessive ramming shall be avoided. The primer shall not be tamped.

(l) A blast hole shall not be loaded adjacent to a hole being drilled. In a mine drift or crosscut heading, no blast hole shall be loaded until a round of holes is completely drilled.

(m) All blast holes shall be stemmed to the collar wherever practicable. Otherwise, they shall be stemmed sufficiently to minimize possibility of injury to personnel from flying materials.

(n) Before drilling is commenced on any shift, all remaining holes shall be examined with a wooden stick for unexploded charges or cartridges, and if any are found, same shall be refired before work proceeds.

(o) Blast holes shall not be started in bootlegs or at location of holes previously blasted.

(p) All explosives cases, wooden and fibreboard, and all liners and packing material shall be destroyed by burning twice weekly at a distance not less than 200 feet from magazines, dwellings and other structures. All persons shall retire to a place of safety as soon as the pile is ignited.

#### **Order 664—Firing Blasts with Cap and Fuse.**

(a) The use of any fuse having a nominal burning rate of less than one foot in 40 seconds is prohibited. Each new supply of safety fuse shall be tested for rate of burning by cutting off three, 3 foot lengths, dividing the burning time of each by three, and averaging the result. Any fuse which has a burning rate varying more than 10% from one foot in 40 seconds shall not be used.

(b) The minimum length of fuse to be used for a single shot shall be 30 inches. When five or more shots are to be lighted by one person, the minimum length shall be 48 inches and two capped "warning" fuses shall be used for each blast. They should be 24 inches long. "Warners" shall be placed so personnel will not be injured by flying fragments.

(c) At least two men shall be present at each location where cap and fuse blasting is done.

(d) Lighting of fuse before placing primer in position in the drill hole is prohibited.

(e) The use of cap and fuse for firing mud cap charges is prohibited unless charges are separated sufficiently to prevent one charge from dislodging other shots in the vicinity.

#### **Order 665—Firing Blasts with Electricity.**

(a) Before loading an electrical blast, all portable or temporary electric circuits within 100 feet shall be disconnected.

When blasting is contemplated near high voltage lines and there is danger that the lines will be damaged by flying debris, the power company shall be notified in advance. Precautions shall be taken to prevent blasting lines from being thrown into contact with a power line.

(b) Before stemming holes, the caps shall be tested for circuit with a blasting galvanometer equipped with silver chloride cell. In case a cap wire is broken, a new primer shall

be inserted. The leg wires shall be kept short-circuited until they are connected into the blast.

(c) All circuits shall be tested with a blasting galvanometer before firing.

(d) Blasts connected in single series or parallel series may be fired by power lines or blasting machines as recommended by the manufacturer. Blasts connected in parallel shall be fired only with a power line or a special blasting machine designed for the purpose and only with an adequate supply of delivered current. Blasting machines shall be tested periodically to insure their ability to develop their rated capacity. If defective, they shall not be used.

(e) Only well insulated copper leading wire, 14 gauge or larger, and approved by the Industrial Commission shall be used. When firing with a blasting machine the leading wires shall be kept disconnected and short-circuited, except when firing the blast.

(f) (1) When firing with a power circuit, a firing switch shall always be used. This switch shall be locked in the "open" or "off" position at all times except when firing a blast. It shall be so designed that the firing lines are short-circuited when the switch is in the "off" position.

(2) The box shall be kept locked except when blasting and no person shall have access to it except the blaster.

(3) On the power side of the switch, a 5 foot lightning gap shall be provided which shall be closed by a "jumper" only at the time of firing.

(4) No electric firing shall be done with a power line current of less than 110 volts nor more than 550 volts.

(g) The entire firing circuit shall be insulated and no ground shall be permitted. All parts of the blasting circuit shall be protected from accidental contact with power lines, pipe lines, or other sources of extraneous current.

(h) Before adopting any system of electrical firing the blaster shall conduct a thorough survey for extraneous currents and if 0.15 volts or more is detected, such extraneous currents shall be eliminated before any holes are loaded.

Periodic check surveys shall be made for extraneous currents. Where electric haulage is used, all rail bonds shall be properly maintained and all rails and pipe lines shall be cross-bonded and grounded.

(i) In shaft, tunnel, or caisson blasting, only electrical firing shall be used except as modified in Order 665 (j) (4) and all electrical equipment shall be grounded with a resistance to ground of not more than one ohm.

(j) (1) Electric blasting caps shall not be stored or transported in the vicinity of an operating radio transmitter unless they are in their original package or coiled as specified by the manufacturer. If not in their original package, they shall be kept in a special metal-covered container as described in Order 660 (f).

(2) Electric blasting caps shall not be used or handled in the vicinity of a known operating radio transmitter within the following distances:

Power (Watts)	Distance (Feet)
5- 25	100
25- 50	150
50- 100	220
100- 250	350
250- 500	450
500- 1,000	650
1,000- 2,500	1,000
2,500- 5,000	1,500
5,000- 10,000	2,200
10,000- 25,000	3,500
25,000- 50,000	5,000
50,000- 100,000	7,000

(3) All known mobile transmitters, or those under control of operator of plant, within blasting area shall be shut off.

(4) If for any reason, a mobile or permanent transmitter can not be shut off, the following test shall be made to determine if a hazard exists. A #47 radio pilot lamp shall be inserted into the blasting circuit in place of the electric detonator. If any glow is observed in the lamp the blast shall be primed with cap and fuse or detonating fuse.

**Order 666—Firing Blasts—General.**

(a) *Surface Blasting Out of Doors.*

Before any blast shall be fired, a prearranged, audible warning signal shall be sounded and all personnel required to retire to a shelter house designed for the purpose or equivalent, but in no case shall the persons be less than 300 feet away when the blast is fired.

If shelters are not available, persons shall retire to a safe distance. In no case shall this distance be less than 500 feet. In any case, the required distance shall be paced or measured.

All access roads or travelways shall be guarded before the warning signal is given and all personnel shall remain in place of safety until "all clear" signal has been authorized by the blaster in charge. Where highways or buildings are located within the danger zone, employees shall be sent in each direction to warn the public when shots are to be fired. The persons giving the warning shall proceed not less than 500 feet from the blast and warning shall be accomplished by waving a red flag. A sign with the words STOP—BLASTING printed in letters approximately 3 inches high, shall be used in addition to the flag.

STOP—BLASTING signs and flags shall be used only for duration of the blast and until danger from flying material and misfires is past.

*(b) Tunnel Blasting.*

All persons shall retire from tunnel and shaft or to a distance of 1,500 feet from the face of a tunnel being blasted. During shaft sinking operations, the provisions of paragraph (a) apply.

Whenever blasting is being done in a tunnel, at points likely to break through to where other men are at work, the foreman or person in charge shall, before any holes are loaded, give warning of danger to all persons who may be working where the blasts may break through, and he shall not allow any holes to be charged until a warning is acknowledged and men are removed.

*(c) Special Blasting Operations.*

(1) When chambering blast holes at the bottom, persons shall retire not less than 75 feet from the collar of the hole at right angles to its axis and away from any ledge of rock.

(2) When blasting in a building, the charge shall be properly placed and covered if necessary to prevent damage to persons or property. Passageways shall be guarded manually or by visual or audible signal. Warnings shall be sounded and persons shall retire to a sheltered place. Guards shall not be required to use flags or signs.

(3) When using explosives under mats or for shooting wells and post holes, it shall be the duty of the blaster to make certain that all persons are under cover or beyond danger from flying material.

**Order 667—Precautions After Blast.**

(a) When firing by cap and fuse, a timed minimum of 15 minutes shall have elapsed before any person is permitted in the blast area. However, if not more than 25 pounds of explosives are involved, the blaster shall determine the length of the minimum period. In any case, when a misfire is known or suspected, no person shall enter the area for at least 30 minutes.

Before resuming operations, the blaster shall examine the area for misfired shots, unexploded or burning dynamite. In case burning dynamite is observed, no attempt shall be made to extinguish it but persons shall retire to a safe place and remain there at least 60 minutes.

(b) When it is possible to refire a misfired hole safely, it shall be disposed of in this manner. If this can not be done, an attempt shall be made to insert a new primer after removing the stemming with a jet of water or air. A rubber or copper pipe shall be used for this purpose.

The handling of misfires shall be attempted only by blasters thoroughly experienced with this work.

**Note:** Whenever such a blaster is not available, the manufacturers shall be contacted for further advice.

**Order 668—Blasting in Cities and Villages.**

When blasting operations are conducted within the confines of villages and cities, shots shall be screened with blasting mats to hold or catch flying material. Shots shall be spaced, located and charged with explosives in a manner as to minimize the danger of flying material. Short interval delay firing shall be used in all inhabited areas. Permission for the use of explosives is subject to the approval of the proper local authorities.

**Exception:** Blasting operations may be conducted in existing quarries and other locations without the use of blasting mats, provided buildings, thoroughfares and persons are not subject to the danger of flying material and charges of explosives are kept as light as practicable with the nature of the work.

**Note:** Additional precautions to be taken for the safe storage and use of explosives are provided in the Appendix.

## SECTION II

### ORDERS RELATING TO UNDERGROUND MINES

#### Order 669—General.

The handling, transportation, and storage of explosives above ground shall be governed by Section I of these orders. All orders or parts of orders in Section I which are in conflict with this section shall not apply to underground mines.

#### Order 670—Underground Storage of Explosives.

(a) Magazines for the underground storage of more than one day's supply of explosives shall be located at least 200 feet from any shaft or connecting winze or raise. When only one day's supply is to be stored, this distance may be reduced to 100 feet. Detonator magazines shall be located 50 feet from any shaft, winze, or raise and 25 feet away from any explosive storage magazine. Such magazines shall not be adjacent to any power circuit other than lighting circuits, nor shall they be located so that accidental explosion of their contents may cut off the escape of persons working underground.

All underground magazines shall be so located and so protected as to prevent accidental impact from vehicles or falling objects.

(b) Sufficient explosives may be stored within a mine to meet the estimated requirements of such mine for 7 days.

(c) Not more than one shift's supply of explosives shall be kept for immediate use in any working place at any one time and not more than one day's supply may be kept in box type magazines on any level at any one time.

(d) Underground magazines shall be located in separate rooms or drifts in which no persons other than powder men are employed. Drift magazines shall be completed by the installation of a nominal 2 inch plank wall (and door) covered with sheet metal or equivalent fire-resistive material,

or of masonry construction with a metal door. The drift opening shall be completely closed. Nails used in the interior of this wall shall be countersunk.

Magazines in open stopes shall be constructed with wooden walls 2 inches thick covered with sheet metal or equivalent.

Box type magazines shall be a tight box constructed of nominal 2 inch plank or equivalent with a hinged cover.

Detonator storage underground shall be in drift type or box type magazines. When the box is located in the capping house, the storage shall be limited to 3,000 detonators.

(e) All underground magazines shall be plainly marked, **EXPLOSIVES**.

(f) Detonators and dynamite shall not be stored in the same magazine.

(g) Magazines shall be kept clean and dry and empty containers and packing shall be removed from the mine at least once a week.

(h) No flammables, except wood wedges and fibre, rubber or wooden mallets, nor any sparking metal tools or implements, shall be kept or stored in any magazine containing explosives.

(i) Magazines shall be lighted from the outside, or by portable storage battery lamps, or by permanent interior lights provided with explosion-proof fixtures. Open flame lamps, loose matches, lighters, and flame-producing devices shall not be carried into any explosives magazine. No smoking shall be permitted while handling explosives.

(j) Fibre, rubber, or wooden tools shall be used to open explosives cases, except that "slitters" may be used to open fibreboard cases. Cases shall be opened outside the magazine.

(k) Explosives shall be stored so that the oldest stock is readily accessible and can be used first.

(l) When underground magazines are accessible through unlocked slope or tunnel entrances they shall be locked.

**Note:** Complete plans for all types of magazines are available from the U. S. Bureau of mines, explosives manufacturers, and the Institute of Makers of Explosives.

#### Order 671—Explosives Unfit for Use.

The requirements as set forth in Order 659, Section I of this code shall also apply to underground mines.

**Order 672—Certificates of Competency for Supervisory Staff.**

All general foremen and shift foremen shall qualify as blasters. They shall instruct the miners in the provisions of these orders and in the use and handling of explosives.

**Order 673—Detonators and Primers.**

(a) Only a crimper shall be used for attaching fuse to blasting caps. The employer shall furnish and keep in accessible places, ready for use, crimpers in good repair. Capped fuses shall be made up only as required.

(b) No fuses shall be capped with blasting caps in any magazine but approved benches shall be provided at a safe distance from such storage place where all fuses shall be capped. All fuse ends shall be trimmed immediately before capping.

(c) All cap and fuse and electric primers shall be made as recommended by the manufacturer. Primers consisting of less than one cartridge shall be made by inserting the cap in the end of the cartridge. They shall be made up at the face just prior to loading into the borehole, except that the primers for stoping in wet areas, sinking, or drifting may be made up in the central capping house immediately before use in the quantity needed for any one blast and carried to the face in a substantial covered wooden box.

**Note:** The manufacturer's recommendations are found on "case inserts" in every case of explosives.

**Order 674—Use of Explosives Underground.**

(a) Explosives of Fume Class 1, 2, and 3 shall be used in blasting underground. Underground atmospheres to which men are subjected shall conform to the requirements of Order 320 (b) of the General Orders on Mines.

(b) Explosives shall be conveyed in original shipping containers, in approved covered wooden boxes, or in sacks provided for that purpose.

(c) Detonators shall be conveyed separately from other explosives in approved containers provided for that purpose. The carrying container for capped fuses shall be of rigid construction and provided with a hinged cover. If containers are of metal, a lining of felt, or similar material, shall be provided.

(d) Explosives and detonators shall not be placed where they may be struck by vehicles or subject to contact with live wires.

(e) No explosives shall be transported on underground locomotives, but they may be transported in a mine car, or in a truck, if carried in their original shipping containers or in a container as described in (b) and (c) above. No one but the train crew, driver, or powder man shall be allowed to ride on a train or truck carrying explosives. One empty car shall be interposed between the locomotive and the powder car and insulated couplings shall be used.

(f) In sinking a shaft or winze, no other material shall be carried on any cage, skip or bucket on which dynamite and detonators are handled and only those members of the crew needed for blasting may travel with such explosives or remain on the bottom while explosives are being lowered. Explosives shall be handled only in their original shipping packages or in approved containers as described in (b) and (c) above.

(g) When lowering explosives for storage in underground magazines or transferring explosives from level to level, no persons other than the attendants shall ride, nor shall any other material be handled in any cage or conveyance which is loaded with explosives. Dynamite and detonators shall not be lowered or hoisted together on any conveyance. A miner or powder man may transport 50 pounds of dynamite and capped fuses, or less, in approved containers when transporting explosives.

(h) In addition to the requirements provided in this order, the provisions contained in paragraphs (h) to (p) inclusive of Order 663, Section I of this code shall also apply to underground mines.

**Order 675—Firing Blasts Underground with Cap and Fuse.**

(a) The use of any fuse having a nominal burning rate of less than one foot in 40 seconds is prohibited. Each new supply of safety fuse shall be tested for rate of burning by cutting off three, 3 foot lengths, dividing the burning time of each by three, and averaging the result. Any fuse which has a burning rate varying more than 10% from one foot in 40 seconds shall not be used.

(b) A minimum fuse length for all blasts except boulder blasts shall be 7 feet. In boulder blasting where single shots are fired, the minimum fuse length shall be 30 inches. Where five or more boulder blasts are shot at one time, the minimum fuse length shall be 48 inches.

(c) No man shall "spit" more than fifteen fuses in a round of shots except when using a water-resistant or waterproof ignitacord.

(d) Where a carbide lamp or similar lighter is used in spitting fuses, a second light shall be kept burning as a safety measure, and such extra light shall be placed a safe distance from the blast.

(e) At least two men shall be present at each location where cap and fuse blasting is done.

(f) Lighting of fuse before placing primer in position is prohibited.

(g) The use of cap and fuse for firing mud cap charges is prohibited unless charges are separated sufficiently to prevent one charge from dislodging other shots in the vicinity.

#### **Order 676—Firing Blasts Electrically Underground.**

(a) Electric detonators shall not be handled within 100 feet of a portable radio transmitter.

(b) Only electric or delay electric blasting caps shall be used in operations as follows:

(1) In sinking shafts or winzes or driving raises over 50 feet high, except that in such raises ignitacord may be used with cap and fuse firing.

(2) In cutting shaft stations.

(3) In drifts, crosscuts, storage pockets and pump sumps where there is not enough protection for the men from flying rock or concussion.

(d) In addition to the requirements of this order, the provisions contained in paragraphs (b) to (f), inclusive of Order 665, Section I of this code shall also apply to underground mines.

#### **Order 677—Firing Blasts Underground—General.**

Persons about to fire shots shall cause warning to be given in every direction and all entrances to the place or places where shots are to be fired shall be guarded.

The miners doing the blasting shall not retire to a dead-end drift or crosscut in selecting shelter from fly rock and blasting gases.

#### **Order 678—Precautions After Underground Blasting.**

(a) When firing by cap and fuse, a timed minimum of 15 minutes shall have elapsed before any person is permitted in the blast area. However, if not more than 25 pounds of explosives are involved, the blaster shall determine the length of the minimum period. In any case, when a misfire is known or suspected, no person shall enter the area for at least 30 minutes.

Before resuming operations, the miner shall examine the area for misfired shots, unexploded or burning dynamite. In case burning dynamite is observed, no attempt shall be made to extinguish it but persons shall retire to a safe place and remain there at least 60 minutes.

(b) When it is possible to refire a misfired hole safely, it shall be disposed of in this manner. If this can not be done, an attempt shall be made to insert a new primer after removing the stemming with a jet of water or air. A rubber or copper pipe shall be used for this purpose.

The handling of misfires shall be attempted only by miners thoroughly experienced with this work.



SECTION III  
OTHER STATE DEPARTMENT ORDERS  
ON EXPLOSIVES

MOTOR VEHICLE

**General order MVD-211. In The Matter of Transportation of Explosives by Motor Vehicle**

Pursuant to the authority in me vested by Sections 194.38 and 194.43, Wisconsin Statutes,

**IT IS ORDERED:**

That drivers and vehicles used in the transportation of explosives in Wisconsin be and the same are hereby subject to the following regulations:

This order is applicable to all vehicles as defined in Section 194.01, Wisconsin Statutes, when such vehicles are involved in the transportation of Class A and B explosives as such explosives are defined in I.C.C. regulations which are or may be in effect at time of movement, and the provisions of this order shall apply to all such vehicles involved in the transportation of such explosives within the State of Wisconsin.

**I. Minimum Driver Requirements**

**Specific Minimum Requirements for Drivers of Vehicles Transporting Explosives.** No person shall drive, nor shall any motor carrier require or permit any person to drive, any motor vehicle used in the transportation of explosives unless such person possesses the following minimum qualifications:

**A. Mental and Physical Condition.**

1. No loss of foot, leg, hand or arm.
2. No mental, nervous, organic, or functional disease, likely to interfere with safe driving.
3. No loss of fingers, impairment of use of foot, leg, fingers, hand or arm or other structural defect or limitation, likely to interfere with safe driving.

**B. Eyesight.** Visual acuity of at least 20/40 (Snellen) in each eye either without glasses or by correction with glasses; form field of vision in the horizontal meridian shall not be less than a total of 140 degrees; ability to distinguish colors red, green and yellow; drivers requiring correction by glasses shall wear properly prescribed glasses at all times when driving, provided however that until January 1, 1954, a visual acuity, either without glasses or by correction with glasses, of at least 20/40 in one eye and 20/100 in the other eye will be acceptable under this section with respect to any person working as a driver on the effective date of this section or who was working as a driver at any time within six months prior to such effective date.

**C. Hearing.** Hearing shall not be less than 10/20 in the better ear, for conversational tones, without a hearing aid.

**D. Liquor, Narcotics and Drugs.** Shall not be addicted to the use of narcotics or habit-forming drugs, or the excessive use of alcoholic beverages or liquors.

**E. Age.** Every driver shall be not less than 21 years of age.

**F. Driving Experience.** Every driver shall be experienced in driving some type of motor vehicle (including private automobiles) for not less than one year, including experience throughout the four seasons.

**G. Driving Record Must be Checked.** In addition to the other qualifications required by this part, motor carriers shall in the employment and use of drivers and from time to time thereafter in continuing drivers in their service give due consideration to the following factors where they exist:

1. Violations of laws or regulations governing the operation of motor vehicles of which the driver is guilty, especially as to those violations which tend to establish a disregard for regulatory requirements and for the public safety.
2. The driver's accident record insofar as it tends to establish a lack of concern for or indifference to his own or the public's safety.

3. Violations of criminal laws of which the driver is guilty, especially with respect to those offenses which tend to demonstrate his unfitness in the public interest to be a driver of a motor vehicle.

Motor carriers shall maintain and preserve as a part of each driver's personnel record a summary of all driver acts and offenses which are within the purview of this section. In addition to the periodic review of such records as contemplated by this regulation, motor carriers shall specifically review the individual record of a driver when he is involved in a serious accident to the end that reckless or accident-prone drivers may not continue to drive vehicles as a hazard to the public safety.

**H. Driving Skill.** Every driver shall be competent by reason of experience or training to operate safely the type of motor vehicle or motor vehicles which he drives.

**I. Knowledge of English.** Every driver shall be able to read and speak the English language.

**J. Knowledge of Regulations.** Every driver shall be familiar with the rules and regulations hereby established pertaining to the driving of motor vehicles.

## II. Driving Rules

**A. Duty of Driver to Inspect Equipment.** No motor vehicle shall be driven unless the driver thereof shall have satisfied himself that the following parts and accessories are in good working order; nor shall any driver fail to use or make use of such parts and accessories when and as needed:

- Service brakes
- Parking (hand) brake
- Steering mechanism
- Lighting devices and reflectors
- Tires
- Horn
- Windshield wiper or wipers
- Rear-vision mirror or mirrors

## B. Driver Forbidden to Operate When:

1. *Ill or Fatigued.* No driver shall drive or be required or permitted to drive a motor vehicle while his ability or alertness is so impaired through fatigue, illness or any other cause as to make it unsafe for him to begin or continue to drive.
2. *Under Influence of Alcoholic Beverages.* No driver shall drive or be required or permitted to drive a motor vehicle, be in active control of any such vehicle, or go on duty or remain on duty, when under the influence of any alcoholic beverage or liquor, regardless of its alcoholic content, nor shall any driver drink any such beverage or liquor while on duty.
3. *In Excess of Maximum Permitted Driving Time.* No driver shall operate a motor vehicle carrying explosives for more than 10 hours in any period of 24 consecutive hours.

**C. Smoking and Use of Liquor.** No person shall be permitted to ride upon or drive a vehicle transporting explosives, while smoking or while under the influence of liquor or narcotics or harmful drugs.

**D. Engine Off and Vehicle Secure.** No explosive shall be loaded into or on or be unloaded from any motor vehicle with the engine running; and in every case, the hand brake on such motor vehicle shall be securely set and all reasonable precautions taken to prevent movement of the motor vehicle during loading or unloading.

**E. Vehicles Not to be Left Unattended.** No vehicle transporting any explosive or other dangerous article shall be left unattended upon any public street or highway except when the driver is engaged in the performance of normal operations incident to his duties as the operator of the vehicle to which he is assigned.

**F. Packages Capable of Repair in Transit.** Any package of explosives found injured or broken in transit may be repaired and reentered when this is evidently practicable and not dangerous. When a box containing any explosive is so damaged that it cannot be repaired it should be rein-

forced by stout wrapping paper and twine, placed in another strong box, and surrounded by dry, fine sawdust, or dry and clean cotton waste, or elastic wads made from dry newspapers. The box cover should then be securely attached. A ruptured can or keg should be enclosed in a grain bag of good quality, and boxed. Injured packages thus protected, and properly marked with name of contents and consignee's name and address, may be carried to destination; provided, however, that the motor carrier, if himself the shipper, need not mark his own name and address on the package.

**G. Disposition of Unsafe Broken Packages.** In the event any leaking package or container cannot be safely and adequately repaired for transportation or transported, it shall be stored pending proper disposition in the safest and most expeditious manner possible.

**H. Caution Passing Fires.** Motor vehicles transporting explosives shall not be driven past fires of any kind burning on or near the highway or other thoroughfare until after due caution shall have been taken to ascertain that such passing can be made with safety.

**I. Avoidance of Congested Places.** Drivers of motor vehicles transporting explosives shall avoid, so far as practicable, driving into or through congested thoroughfares, places where crowds are assembled, street car tracks, tunnels, viaducts, and dangerous crossings. So far as practicable, this shall be accomplished by prearrangement of routes.

**J. Parking in Congested Places.** Except where the necessities of the operation make impracticable the application of this rule, no motor vehicle transporting any dangerous or less dangerous explosive shall be parked on any public street adjacent to or in proximity to any bridge, tunnel, dwelling, building or place where persons work, congregate or assemble; provided, however, that this rule shall not be so construed as to prohibit such motor vehicle being parked near persons loading or unloading any such motor vehicle.

**K. Warning of Nearby Persons.** In the event of an accident involving any motor vehicle transporting any explosive every available means shall be employed to prevent individuals other than those employed in the protection of persons

or property or in the removal of hazards or wreckage, from congregating in the vicinity; such means shall also be employed to prevent smoking, to keep flames away, and to safeguard against the aggravation of the hazard present, and to warn other users of the highway. In the event that any motor vehicle laden with or carrying dangerous explosives is entangled with another or with any other object or structure, until the lading, together with any fragments thereof, be removed to a place at least two hundred feet (200) from the vehicle (and preferably two hundred feet (200) from any habitation). In the event of fire involving a motor vehicle laden with any explosive, every practicable effort shall be made to give warning of danger of explosion to habitants in the vicinity and to other users of the highway.

**L. Unnecessary Stops.** Only necessary stops shall be made by motor vehicles loaded with explosives.

### III. Vehicle Requirements

**A. Floor and Body.** Vehicles used for transporting explosives shall have a tight floor. If there is any exposed sparking metal on the inside of the body, it shall be covered or protected with non-sparking material so that the explosives containers will not come in contact with the exposed sparking metal.

**B. Freedom from Dirt.** Trucks used for the transportation of explosives shall be clean and free from surplus oil and grease.

**C. Fire Extinguishers.** A fire extinguisher equivalent to a one and one-half quart carbon tetrachloride type, a four pound dry chemical type, or a four pound carbon dioxide type fire extinguisher shall be mounted in an accessible place in the cab of every motor vehicle transporting explosives. (Two extinguishers may be carried instead of one to secure the above required capacity.)

#### D. Emergency Electrical Equipment.

1. There shall be carried at least one spare electric bulb for each kind of electric lamp where such electric lamp is used for any of the lighting devices required by Wisconsin Statutes.

2. There shall be carried at least one spare electric fuse of each kind and size used for any of the electric circuits on the vehicle.

**E. Use of Open Trucks.** In open trucks servicing any job with explosives, a tarpaulin shall be used to cover explosives and the sides of the body shall be high enough to prevent cases from falling off.

**F. Marking of Vehicles.** Motor trucks or vehicles when used for transporting explosives shall be marked or placarded on both sides and the rear with the word EXPLOSIVES in letters not less than six inches high, or shall conspicuously display a red flag with the word DANGER printed, stamped or sewed thereon in white letters at least six inches high, mounted above the highest point of the vehicle. These markings shall be in addition to all markings required by MVD-204.

**G. Fire Prevention Measures.** All electrical wiring shall be completely insulated, fuel and exhaust lines free from leaks, and all necessary precautions shall be taken to prevent the vehicle from catching fire.

#### IV. General Additional Requirements

**A. Materials Carried in Conjunction with Explosives.** No sparking metal tools or flammable or corrosive substances shall be carried in the bed or body of vehicles transporting explosives, except that service trucks carrying small quantities of explosives in approved containers are considered as complying with this order.

**B. Speed Limit.** The maximum speed of vehicles coming within the scope of this order shall be 45 miles per hour.

**C. Transportation of Detonators.** Detonators may be transported in the same motor vehicle with high explosives only as follows: The detonators shall be packed in authorized I.C.C. specification outside shipping containers, or in prescribed inside I.C.C. packages in an outside box made of 1-inch lumber lined with padding material not less than 1/2-inch thick, or a box made of not less than 12-gauge sheet metal lined with plywood or other similar material not less

than 3/8-inch thick so that no metal is exposed. Hinged covers and fastening devices are required on boxes. These boxes shall be loaded in the motor vehicle so that contents of the box will be immediately accessible for removal.

**D. Restrictions Regarding Use of Trailer.** Explosives may be transported on any truck or any semitrailer attached to a tractor. Under no condition shall explosives be transported in any "full" trailer, or any form of "pole" trailer.

No carrier or driver shall be prosecuted for violation of any provision of these rules and regulations if such violation is a result of compliance with the Safety Rules and Regulations promulgated by the Interstate Commerce Commission.

**Note:** Nothing contained in this order shall be construed as prohibiting any motor carrier from carrying additional safety equipment or enforcing additional rules and regulations relating to safety of operation, not inconsistent with this order.

#### PUBLIC SERVICE COMMISSION

Pursuant to the provisions of section 14.65, Statutes, the Public Service Commission has cooperated with the Industrial Commission and Motor Vehicle Department in the preparation of safety regulations relating to the transportation of explosives. It is our understanding that the Industrial Commission and the Motor Vehicle Department will issue separate orders with each covering the area of jurisdiction of the particular department, but that these orders will be combined in a single pamphlet to be known as the General Orders on Explosives.

The Public Service Commission is of the opinion that the provisions of the orders relating to the transportation of explosives by motor vehicle are proper and necessary for effective safety regulations under the provisions of Chapters 101 and 194, Wisconsin Statutes.

JAMES R. DURFEE, *Chairman*

W. F. WHITNEY, *Commissioner*

GEORGE P. STEINMETZ, *Commissioner*

## Appendix

### SAFETY RECOMMENDATIONS

This is the latest revision of "Don'ts" adopted by the Institute of Makers of Explosives, May 5, 1951. These rules can also be found on "Case Inserts" in every case of explosives.

1. Don't purchase, possess, store, transport, handle, or use explosives except in strict accordance with organizational, local, state, and federal regulations.

2. Don't store explosives anywhere except in a magazine which is clean, dry, well ventilated, properly located, substantially constructed, and securely locked.

3. Don't allow persons under eighteen years of age to handle or use explosives, or to be present where explosives are being handled or used.

4. Don't leave explosives lying around where children can get them.

5. Don't allow leaves, grass, brush, or debris to accumulate within twenty-five feet of an explosives magazine.

6. Don't smoke or have matches, open lights, or other fire or flame, in or near an explosives magazine, or have them nearby while handling or loading explosives.

7. Don't shoot into explosives with any firearm, or allow shooting in the vicinity of an explosives magazine.

8. Don't store any metallic tools or implements in an explosives magazine.

9. Don't drop, throw, or slide packages of explosives or handle them roughly in any manner.

10. Don't open kegs or cases of explosives in a magazine.

11. Don't open kegs or wooden cases of explosives with metallic tools. Use a wooden wedge and wooden, rubber, or fibre mallet. Metallic slitters may be used for opening fibre-

board cases, provided that the metallic slitter does not come in contact with the metallic fasteners of the case.

12. Don't store or leave packages of explosives which have been opened without replacing the cover.

13. Don't use empty explosives cases for kindling.

14. Don't permit any paper product used in the packing of explosives to leave your possession. Accumulations of fibreboard cases, paper case liners, cartons, or cartridge paper should be destroyed by burning after they have been carefully examined to make sure that they are empty.

15. Don't use explosives that are obviously deteriorated.

16. Don't attempt to reclaim or use fuse blasting caps, electric blasting caps, or any other explosives that have been water-soaked, even if they have dried out. Consult the manufacturer.

17. Don't carry explosives in pockets of clothing.

18. Don't make up primers of explosives in a magazine or near excessive quantities of explosives.

19. Don't force cartridges of any explosives into a borehole or past any obstructions in a borehole.

20. Don't allow explosives, or drilled holes while being loaded with explosives, to be exposed to sparks from steam shovels, locomotives, or any other source.

21. Don't spring a borehole near another hole loaded with explosives.

22. Don't load a sprung borehole with another charge of explosives until it has cooled sufficiently.

23. Don't tamp with metallic bars or tools. Use only a wooden stick with no exposed metal parts.

24. Don't use combustible material for stemming.

25. Don't allow near the danger area of a blast any persons not essential to the blasting operations.

26. Don't fire a blast until all surplus explosives are in a safe place, all persons and vehicles are at a safe distance or under sufficient cover, and until adequate warning has been given.

27. Don't return to the face until the smoke and fumes from the blast have been dissipated by adequate ventilation.

28. Don't attempt to investigate a misfire too soon. Follow all applicable rules and regulations, or, if no rules are in effect, wait at least an hour.

29. Don't drill, bore, or pick out a charge of explosives that has misfired. Misfires should be handled only by a competent and experienced man.

30. Don't abandon any explosives. Dispose of or destroy them in strict accordance with the methods recommended by the manufacturer.

31. Don't store cases of dynamite so that the cartridges stand on end.

32. Don't leave dynamite, black blasting powder, or pellet powder in a field or any place where livestock can get at them.

33. Don't take surplus quantities of permissible dynamite, black blasting powder, or pellet powder into a mine at any one time. These explosives deteriorate rapidly in a damp atmosphere.

34. Don't use black blasting powder or pellet powder with permissible explosives or dynamite, nor dynamite with permissible explosives, in the same borehole in a coal mine.

35. Don't tamp pellet powder in a borehole hard enough to crush the pellets, because of danger of premature explosion.

36. Don't store blasting caps or electric blasting caps in the same box, container, or magazine with other explosives.

37. Don't leave blasting caps or electric blasting caps exposed to the direct rays of the sun.

38. Don't insert a wire, a nail, or any other implement into the open end of a blasting cap to remove it from a box.

39. Don't strike, tamper with, or attempt to remove or investigate the contents of a blasting cap or an electric blasting cap.

40. Don't try to pull the wires out of an electric blasting cap.

41. Don't connect blasting caps or electric blasting caps to Primacord except by the methods recommended by the manufacturer.

42. Don't attempt to fire a circuit of electric blasting caps except by an adequate quantity of delivered current.

43. Don't use in the same circuit electric blasting caps made by more than one manufacturer.

44. Don't handle explosives during the approach or progress of an electrical storm. All persons should retire to a place of safety.

45. Don't make electrical connections without first making sure that the ends of the wires are bright and clean.

46. Don't allow electrical connections to come in contact with other connections, bare wire, rails, pipes, the ground, or other possible sources of current or paths of leakage.

47. Don't have electric wires or cables of any kind near electric blasting caps or boreholes charged with explosives except at the time of, and for the purpose of, firing the blast.

48. Don't use electric blasting caps in very wet work unless they have adequate water resistance and suitably insulated leg wires.

49. Don't use any means other than a blasting galvanometer containing a silver chloride cell for testing electric blasting caps, singly or when connected in a circuit.

50. Don't use damaged leading or connecting wire in blasting circuits.

51. Don't use duplex leading wire except for single shot firing.

52. Don't tamper with or change the circuit of a blasting machine in any way for any purpose.

53. Don't spare force or energy in operating a blasting machine.

54. Don't store fuse or fuse lighters in a wet or damp place, or near oil, gasoline, kerosene, distillates, or similar solvents.

55. Don't store fuse near radiators, steam pipes, boilers, or stoves.

56. Don't handle fuse carelessly in cold weather. If possible, it should be warmed slightly before using to avoid cracking the waterproof coat.

57. Don't use short fuse. Cut fuse long enough to extend beyond the collar of the hole and to allow time to retire safely from the blast. Never use less than 2 feet.

58. Don't cut fuse until you are ready to insert it into a blasting cap. Cut off an inch or two to insure a dry end.

59. Don't cut fuse on a slant. Cut it square across with a clean, sharp blade. Seat the fuse lightly against the cap charge and avoid twisting after it is in place.

60. Don't crimp blasting caps to fuse with a knife or with the teeth. Use a standard cap crimper and make sure that the cap is securely fastened to the fuse.

61. Don't use fuse and blasting caps in wet work without having a thoroughly waterproof joint between the fuse and cap.

62. Don't kink fuse in making up primer or in tamping a charge.

63. Don't hold the primer cartridge in the hand when lighting fuse.

64. Don't light fuse in any borehole until the holes contain sufficient stemming to protect explosives from sparks from the end spit of fuse or a flying match head.

65. Don't try to light fuse with burning paper, other inflammable refuse, or improvised torches.

66. Don't light fuse near blasting caps or any explosives, other than those being used in the blast.

#### Literature on Explosives

All explosive manufacturers have pamphlets or handbooks available for distribution to users of explosives giving very complete information on the proper use and storage of explosives. A particularly informative pamphlet is one entitled, "Safety in the Handling and Use of Explosives," issued by the Institute of Makers of Explosives, 250 East 43rd Street, New York 17, N. Y.

#### Use of Explosives

The safe handling of explosives depends entirely upon the strict observance of safety rules. The blaster should not only be familiar with all the rules but should observe them

in practice. It is the employer's duty to provide proper storage facilities, blasting accessories and to employ only qualified men to handle the explosives. The employer is also responsible for strict enforcement of the safety rules. Lack of interest and discipline will soon or later result in infractions of the rules.

#### Storage of Explosives

The American Table of Distances is considered a standard on which should be based the location of magazines in relation to surrounding improvements such as dwellings, railroads and highways. A magazine location should be selected with a view to both accessibility and safety. A good location is in an isolated ravine where the surrounding hills provide protection and such location permits the reduction of distances to surrounding improvements.

Improper storage results in very rapid deterioration of explosives, particularly by the absorption of moisture and extremes in temperatures. A magazine properly constructed to provide good ventilation and insulation is required.