FACTORY SAFETY MANUAL

Published by

INDUSTRIAL COMMISSION
of
COLORADO

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ORDER OF PUBLICATION

Pursuant to the authority vested in the undersigned members of the Industrial Commission of Colorado by virtue of Section 11 of the Industrial Commission Law of 1915, as amended, we do hereby order and direct that the Safety Rules and Regulations as set forth in this Factory Safety Manual be published in booklet form and we do further order and direct that 10 days after such publication the rules and regulations contained in this Factory Safety Manual shall have the full force and effect of law.

Denver, Colorado, this .... day of ....., 1942.

INDUSTRIAL COMMISSION OF COLORADO:

RAY H. BRANNAMAN, Chairman
WILLIAM I. REILLY
ARTHUR H. KING,
Commissioners.

INTRODUCTION

The primary purpose of this Manual is that it may serve as a guide to Inspectors in observing uniform methods of inspection and to employers and other institutional heads in determining their several responsibilities under the Colorado State Laws governing safe and healthful working conditions for employees. The great majority, at least 90%, of all injuries connected with employment can be prevented by means that are available to every employer and his employees. The actual accomplishment of numerous establishments in this State and in every other State proves this beyond any possible doubt. This Manual is a guide showing the pathway to such achievement.

In the preparation of the Manual generous use has been made of Bulletin No. 20 (Inspection Manual), 1938, U. S. Department of Labor, as well as frequent reference to similar manuals prepared by other states. In the selection of material, and adoption of rules and regulations, careful consideration has been given to industrial conditions in Colorado. Every effort has been made to the end that nothing herein prescribed is in conflict with Colorado State laws governing the inspection of factories. Rules for the guidance of Inspectors, regulations governing standards for the protection of employees and interpretations of factory inspection laws, as they

appear in this Manual, have been adopted by the Industrial Commission of Colorado in accordance with the provisions of Section 11, Chapter 97, Colorado Statutes Annotated, 1935.

A study of the laws of this State governing factory inspection, plainly indicates the inadequacy of the Inspectorate to attempt a state-wide coverage of all industries and institutions included in the scope of their duties. It is the intent of the Commission therefore, that a careful application of the procedure set forth in this Manual will operate to conserve the time of the inspectors and secure the cooperation of employers and institutional heads.

The need for clean and safe working places and for the protection of standards of employment is basically the same for all workers regardless of the type of work at which they are employed. Yet there is a wide variation in the scope of regulations which will provide protection for the workers in different industries or in different places of public assemblage. Such factors have been given careful consideration. The thought of denying Inspectors the right to use experience and initiative in the problems they must inevitably confront, forms no part of this Manual. Nevertheless Inspectors, employers and employees should recognize the need for uniform and well defined regulations and procedure if we are to realize the maximum benefits under our system of safety and health inspections. Upon its adoption and publication by the State Industrial Commission, this Manual becomes binding upon Inspectors, employers and employees alike.

The State's Part in Safety:

Since the full cost of and damage done by accidents and the resulting injuries to employees must be borne by all the people of the State, it is only proper that the State of Colorado acting through the Industrial Commission and its Inspectors, should take an active part in the prevention of such accidents. This is the fundamental reason for the passage of the Act. Actually therefore the Industrial Commission is required to do everything in its power to keep the working people of Colorado from suffering injury while they are at work earning a living. As an agent of the State the Industrial Commission must go beyond mere law enforcement. Not only must employers and their employees be shown how to eliminate work injuries but they must be encouraged by every possible means, including the making of specific suggestions as to practical methods of correcting unsafe conditions and practices. To that end the Industrial Commission solicits the full and earnest support of every employer, every employee and in fact every citizen of Colorado.

Management's Part in Safety:

Safety work in industry must begin at the top. Since every kind of work that men do involves some degree of hazard each produces its share of injuries. But by proper attention to safety almost all injuries can be prevented in any kind of work and in any occupation. Since all authority, executive direction, and determination of policies must come from the management so must the primary drive for safety. The management

must want to eliminate injuries badly enough to make their prevention a vital part of all activities. Prevention must receive continuous attention along with such matters as cost, quality and production.

Very briefly, the more important definite things that the management must do to prevent accidents may be set down as follows:

a. Provide safe plant and equipment.

b. Safeguard all machinery.

c. Place no new machinery or equipment in operation unless full attention has been paid to its safety.

d. Plan and arrange all processes and operations with careful attention to safety.

e. Maintain a system of inspection to discover correctible hazards.

f. Maintain safety minded supervision.

g. Train, educate and stimulate its employees to follow safe methods of work and take a sincere interest in the safety of themselves and their fellow workers.

h. Investigate all accidents to determine how best to prevent a recurrence.

i. Make full report to the proper authorities of all cases of injury.

The Worker's Part in Safety:

Every employee must do his part to keep from getting hurt. The management can do but half the job alone. Each worker must faithfully cooperate with his management to the best of his

ability. Some of the ways in which his help is most necessary are:

a. Faithfully using all safeguards provided.

b. Understanding and carefully following safety rules and safety instructions.

c. Working earnestly on safety committees or other safety activities to which he may be assigned.

d. Seeking always for the safe way of working on each job or activity.

e. Watching out always for the safety of his fellowmen.

f. Reporting all hazardous conditions of which he learns.

The Inspector's Part in Safety:

1. Employers and employees are invited to accept the services of the State Factory Inspector with full confidence in his desire and ability to assist them in the maintenance of conditions and practices which will insure the safety and comfort of the worker and a profitable production program for the employer. In his relationship to the employer and the employee the following factors should guide the Inspector and form the basis upon which he is accepted:

a. To exercise his authority within the limits of the law and with common sense and good will.

b. Through his observance of unsafe conditions or practices, to suggest improved methods and the process of putting them into effect.

c. To keep himself familiar with laws, rules and regulations applying to his work and be ready at all times to explain them to employers and employees.

d. To enlist the cooperation of employers and employees and give careful consideration to suggestions made by them.

e. To inform employers and employees on the advantages of a safety program, the high cost and the effect of unsafe working conditions on production efficiency.

f. To treat confidentially all information which he may have access to during the course of his inspection.

g. To be courteous and considerate at all times, fair and impartial in his findings.

BASIC SAFETY MANUAL INDUSTRIAL COMMISSION OF COLORADO

2. The Law—The Colorado Industrial Commission Law of 1915 sets forth the duty of the employer as regards the safety of his employees as follows:

Section 13. EMPLOYER TO FURNISH SAFE PLACE TO WORK—Every employer shall exercise reasonable care and comply fully with all the requirements of law respecting health and safety and to furnish places of employment which shall be safe for employees therein and to furnish and use safety devices and safeguards, and to adopt and use methods and processes reasonably adequate to render

such employment and places of employment safe, and to do every other thing reasonably necessary to protect the life, health and safety of such employees. Every employer and every owner of a place of employment now or hereafter constructed shall exercise reasonable care to so construct, repair or maintain such place of employment as to render the same safe, in accordance with the statutes of this State in such cases made and provided.

3. Industrial Commission to Administer Laws Regarding Safety—The Industrial Commission is given the duty of inspecting all places of employment, places of public assemblage and buildings where people may be employed at common labor to insure that they are reasonably safe and healthful, and of enforcement of the Act in general and of the rules promulgated under this Act. These duties are set forth as follows:

Section 10. Commission to Adopt Rules—Subject to the provisions of this Act, the Commission may adopt its own rules of procedure and may change the same from time to time at its discretion.

Section 11. Powers and Duties of Commission—It shall also be the duty of the Commission, and it shall have the power, jurisdiction and authority

* * * *

(b) To inquire into and supervise the enforcement, as far as respects relations between employer and employee, of the laws relating to child labor, laundries, stores, factory inspec-

tion, employment of females, employment offices and bureaus, mining, both coal and metalliferous, fire escapes and means of egress from places of employment and all other laws protecting the life, health and safety of employees in employments and places of employment.

(c) To investigate, ascertain, declare and prescribe safety devices, safeguards or other means or method of protection best adapted to render safe the employees of every employment and place of employment, as may be required by law.

(d) To ascertain and fix such reasonable standards and to prescribe, modify and enforce such reasonable orders for the adoption of safety devices, safeguards and other means or methods of protection to be as nearly uniform as possible, as may be necessary to carry out all laws relative to the protection of the life, health, safety and welfare of employees in employments and places of employment.

(e) To ascertain, fix and order such reasonable standards, rules or regulations as provided by law, for the construction, repair and maintenance of places of employment, as shall render them safe.

(f) To adopt reasonable and proper rules and regulations relative to the exercise of its powers and authorities and proper rules to govern its proceedings and to regulate the mode, and manner of investigations and hearings, and to alter and amend said rules from time to time in its discretion; such rules and

regulations, amendments and alterations shall be effective ten days after same are adopted and posted upon the bulletin board in the office of said Commission, in the City of Denver, Colorado. A copy of such rules and regulations shall be mailed or delivered personally to any person making application therefor. The certificate of the Secretary or any Commissioner as to the posting of said notice shall be sufficient proof thereof in any case.

CHAPTER I

In applying the rules and suggestions set forth in the remaining pages of this pamphlet it is urged that employers and employees alike make frequent and careful inspections of their premises. Since this Manual is to be the guide for Factory Inspectors of the Industrial Commission, it should simplify the task of employers and employees in correcting unsafe or unpleasant working conditions. Every rule or suggestion which appears has a direct bearing upon the safety and welfare of employees and therefore upon the efficient and profitable operation of the business in which the firm is engaged. If every place of business in the State of Colorado would study and follow carefully the rules and suggestions hereinafter set forth it would result in a direct saving of millions of dollars every year; and in the name of humanity it would operate to the end that the workman would live to enjoy the fruit of his labor; his mother would have the comfort of his arm in her old age; his wife would not be an untimely widow; his children would have a father

and cripples and hopeless wrecks who were once strong men would not longer be a by-product of industry.

Rule 1.

Every employer should figure the frequency and severity rates for all accidents involving either personal injury or property damage at least once each year.

The injuries that are suffered by the workers in any establishment or occupation constitute a measure of its safety. We must however, take three things into consideration in order to apply this measure. These three things are:

a. The frequency with which the injuries occur, that is the "Frequency Rate".

b. The seriousness of these injuries, that is the "Severity Rate".

c. What injuries to count.

The following definitions for these three things have received national acceptance:

a. Frequency Rate is the number of lost time injuries per million man hours worked. Expressed as a formula it is

$$F = \frac{\text{Nbr. of Accs.} \times 1{,}000{,}000}{\text{Man hours worked}}$$

b. Severity rate is the number of days (including the time charges for permanent injuries) lost per thousand hours worked. Expressed as a formula it is

$$S = \frac{\text{Days lost} \times 1{,}000}{\text{Man hours worked}}$$

c. No matter at what time of day the employee is injured if no permanent disability exists and if at the beginning of the next calendar day he is unable, in the opinion of the doctor, to perform his ordinary duties or the normal duties of some other regularly established job, i.e., a job which is not set up solely to avoid counting the case as a temporary total disability, the injury shall be counted as a temporary total disability, i.e., a lost time injury. On the other hand, if he is able to perform the normal duties of some other regularly established job, the injury shall be counted as a temporary partial disability, and not a lost time injury.

For every day use the frequency rate affords the best measure of performance because each accident might easily "but for the Grace of God" have been very serious or fatal and therefore the constant effort must be to prevent every injury, not just the more serious ones. The following example is included to show how to figure frequency.

During 1938 eighteen lost time injuries occurred in a certain machine shop. The number of man hours worked during the year totaled 216,000. What was the frequency rate? Substituting these numbers in the frequency formula we get:

$$\frac{F=18 \times 1{,}000{,}000}{216{,}000}$$

which gives a frequency of 83 plus. That is the men in that shop suffered 83 lost time injuries for every million man hours they worked.

If the figure for man hours is not available a close enough estimate can usually be made by multiplying the average number of workers by the hours worked per week. and the number of weeks worked.

SEVERITY RATE:

Severity rate takes account of the time lost and of permanent injuries by making a time charge for each injury (as for example the loss of a finger or an eye), in addition to the actual number of days lost from the job. Suppose in the example above the 18 injuries involved a total time loss of 360 days. In addition suppose one injury cost a man his hand. The standard time charge for a hand is 3,000 days so that the total time loss to use to figure the severity is 3,360 days. Substituting this in the formula for severity one gets:

$$S = \frac{3{,}360 \times 1{,}000}{216{,}000}$$

which gives a severity of 15.5. That is a very high rate. It shows the effect a single permanent injury can have. Without the permanent disability the severity rate would be 1.6 plus. For full detailed information on figuring frequency and severity rates see American Standards Association Code Z16.1 entitled "American Standard Method of Compiling Industrial Injury Rates."

Rule 2.

Every employer shall investigate or cause to be investigated every accident involving personal injury or property damage occurring in connec-

tion with the operation of his business and apply such remedies as will prevent a recurrence.

Things to look for in the investigation:

(a) Nature and extent of injury.

(b) The accident—exactly what happened.

(c) Immediate cause of the accident.

(d) Was there an unsafe mechanical condition?

(e) Was there an unsafe act on the part of the employee?

(f) Action taken to prevent recurrence.

Rule 3.

Do not allow materials or objects to remain unnecessarily on the floor surface in such places that will subject employees to the hazards of falls.

Rule 4.

Keep materials and objects that are stored in overhead places secure where they will not fall and cause injury to persons below.

Suggestions on Rules 3 and 4—Check the following:

(a) Height of piles of lumber, bricks, rails, metals, etc.

(b) Strength of supports.

(c) Evenness of supports and their continued stability.

(d) Effect of vibration caused by moving machinery, trucks, etc.

(e) Location—does it extend out into aisles or passageways?

(f) Are materials of even lengths segregated to prevent necessity of sorting or tear down piles?

(g) Danger of cavein.

Rule 5.

Where practicable, all traffic aisles in room housing operating machinery or benches at which persons are at work shall be kept marked with distinctive lines.

Rule 6.

Where practicable, clearly mark the limits of all spaces to be reserved in workroom for inactive storage. Do not allow inactive storage elsewhere in workrooms.

Rule 7.

Provide suitable rack or holders for tools used at benches or machinery.

Rule 8.

Remove or bend over in such manner as to make them harmless, all projecting nails in kegs, barrels, boards or boxes allowed to remain about the work place.

Suggestions—Rules 5 to 8 inclusive, deal with storage and housekeeping—in your inspection check the following:

(a) Are passageways maintained?

(b) Projecting nails.

(c) Objects to slip or stumble on.

(d) Rubbish—oily waste—other inflammables.

(e) Scrap or old material which should be disposed of.

(f) Waste containers.

(g) Dust accumulations.

FLOORS

Rule 9.

All floor surfaces shall be kept clean and maintained in a smooth and non-slippery condition, and free from holes or projections that might cause tripping.

Rule 10.

No floor or platform shall be so loaded as to have a factor of safety of less than four. That is, the weight placed upon a floor or platform should not exceed one-fourth the total breaking strength of the platform or floor.

Rule 11.

Floors other than those directly resting on solid ground, shall when used for storage or loads of persons, equipment or materials under conditions that might lead to overloading, be clearly posted to show the maximum safe loads.

Rule 12.

There shall be no fixed obstructions across or in an aisle that might cause tripping.

Suggestions—Rules 9 to 12 inclusive, having to do with safe floor maintenance—suggest you check for the following in your inspection:

(a) Holes and depressions.

(b) Unevenness, loose boards.

(c) Obstructions such as piping, conduit, patches, etc.

(d) Slipperiness from oil, soap, water, dust, metal trimmings.

(e) Worn places, cracks, warping.

(f) Protruding nails, bolts, splinters.

STAIRS, LADDERS, PORTABLE STEPS, HORSES

Rule 13.

Risers in any given stairway shall be uniform in height.

Rule 14.

Treads in any given stairway shall be uniform in width, except in circular stairways or at turns in other stairways.

Rule 15.

Broken or split treads or treads that are uneven from wear of one-half (½") inch or more shall be replaced or repaired to put them in safe condition.

Rule 16.

Slipperiness of treads, landings or stair approach shall be promptly corrected by means suited to conditions.

Rule 17.

Treads shall be firmly secured and sufficiently strong and stiff under foot for all reasonable conditions of use.

Rule 18.

Stairs, stair landings and stair approaches shall be kept lighted during all times when frequent use of stairs may reasonably be expected. The

lighting shall be so arranged as to be free from shadows and of such intensity that the stairs may be clearly and distinctly visible.

Rule 19.

If stairway is closed on both sides at least one hand rail shall be provided. If width is greater than four feet, handrails to be provided on both sides. If width is greater than eight feet, handrails are to be provided on both sides of stairway and an additional railing in center of stairway, except in cases where in the judgment of the Inspector, a center railing would be impracticable.

Rule 20.

Handrails on stairways shall be not less than 30 inches in height, measured vertically from center of treads and shall be constructed of strong and substantial material.

Rule 21.

Handrails on stairways shall be so constructed as to allow sufficient clearance between railing and walls to permit their free use without danger of hand injuries.

Rule 22.

Where stairways are to be used by females all risers are to be built in solidly or the entire under side of the stairway enclosed.

Rule 23.

Stairways permanently installed, shall not be inclined at an angle of greater than 45 degrees.

Suggestions—The following factors should be checked in your inspection of stairways: (Rules 13 to 23 inclusive)

(a) Uniformity of risers.

(b) Uniformity of treads.

(c) Split, worn or uneven treads.

(d) Slipperiness of treads.

(e) Worn or broken nosing (the front edge of tread).

(f) Lack of hand clearance at railing.

(g) Splinters, protruding nails or bolts.

(h) Railing in need of repairs.

(i) Insufficient lighting.

(j) Stairs too steep or too narrow.

FIXED LADDERS

Rule 24.

Rung spacing on a fixed ladder shall be uniform. This includes the space between the top rung and the landing measured vertically from the top rung.

Rule 25.

Rungs of all ladders shall be firmly secured and maintained in a sufficiently tight condition to prevent turning or other motion.

Rule 26.

Bent rungs of metal fixed ladders shall be promptly replaced or repaired.

Rule 27.

Clearance at back of rungs of fixed ladders shall be not less than six and one-half inches

(6½") measured horizontally from rung to wall or other object.

Rule 28.

Fixed ladders shall be secured with sufficient firmness and in such manner that they will be free from visible motion under normal conditions of use.

Rule 29.

Hand holds shall be provided at the top of each fixed ladder and so arranged that a person using same can conveniently retain hold with either hand when stepping from top rung of ladder to landing place or reverse.

Rule 30.

No fixed ladder shall have a slope outward, that is from the vertical toward the climber, unless such sloping ladder or sloping part thereof be properly caged.

Suggestions—The following factors should be checked in your inspection of fixed ladders (Rules 24 to 30 inclusive):

(a) Uneven rung spacing.

(b) Bent, loose or missing rungs.

(c) Lack of clearance at back of ladder.

(d) Ladder loose.

(e) Lack of hand holds at top of ladder.

(f) Lack of cage on ladders sloping outward.

(g) Slippery rungs or rails.

PORTABLE LADDERS

Rule 31.

Rungs and rung spacing on portable ladders shall be uniform.

Rule 32.

Every precaution shall be taken in the use of portable ladders to prevent slipping of the feet of the ladder.

Rule 33.

Stepladders shall be equipped with a spreader of the type which will lock and securely hold it in the open position when in use.

Rule 34.

Portable steps and saw horses shall be of substantial construction with parts firmly secured and maintained in a safe state of repair. Ladders used in electrical construction or repairs should be of non-metallic or non-conducting material.

Suggestions—The following factors should be checked in your inspection of portable ladders, stepladders, portable steps or saw horses.

(a) Broken, missing or loose rungs in ladders.
(b) Unsound or weak material.
(c) Split or patched rails.
(d) Lack of proper feet to prevent slipping.
(e) Cross grained wood.
(f) Lack of batter (proper slope) on saw horses.
(g) Improper spreader on step ladders.
(h) Lack of proper cross braces.

Rule 35.

Provide safe means of access, suited to conditions, to every overhead point to which employees are called upon to go in connection with their work.

Rule 36.

In addition to the requirement of Rule 35, provide a place reasonably safe or with reasonably safe guard from or on which the work or service in question may be performed. All platforms or scaffolding on which work or service is performed shall be provided with proper toe-boards and railings.

CHAPTER II

MAINTENANCE OF MACHINERY AND HAND TOOLS

Rule 37.

In all factories, mills, workshops, laundries, machine shops or other places where machinery may be used, effective guards shall be supplied for all cogs, gearing, belting, pulleys, shaftings, couplings, set screws, line rollers, conveyors, mangles. All machinery operated by belt drive shall be equipped with belt shifters or other mechanical contrivance for the purpose of throwing on or off belts or pulleys while running, where the same are practical, with due regard to the nature and purpose of such belts or pulleys and the dangers to employees therefrom.

Rule 38.

All band saws, circular saws, rip saws, planers, jointers and other power-driven wood working

equipment shall be equipped with approved types of guards and such guards will be used at all times unless the nature of the work or the shape and size of material make it absolutely impractical. Whenever such guards are removed temporarily to permit the handling of large or irregularly shaped material, they will be promptly replaced as soon as such temporary work is finished.

Suggestions—The following factors should be checked in your inspection under Rules 37 and 38:

(a) Are guards provided for:
Belts, chain and rope drives,
Gears, sprockets, pulleys,
Shafting, set-screws, collars, clutches,
Saws, Planers, Jointers, boring machines,
Grinding wheels,
Punch presses, automatic hammers, drills.

(b) Condition of guards:
Off.
On.
Unsatisfactory to operator.
Can they be removed and replaced handily?
Are they effective as a safe-guard?

(c) Are persons liable to be caught by:
Revolving parts.
Shear points.
Travel of machine (planer).

(d) Slippery floor at machine.

(e) Counterweight dropping if cable breaks.

(f) All parts safely accessible for oiling.

(g) Emergency stop devices.

(h) Lighting.

(i) Ventilation (in case of fumes).

Rule 39.

Every employer shall take heed to the safe condition of the tools provided by both the employer and the employee for the use of his employees and make every reasonable effort to insure that such tools are suited both by safe design and construction to do the work to be done.

Rule 40.

Each employer shall institute and maintain, suited to conditions, a definite system of tool inspection and repair.

Rule 41.

Tools in disrepair shall not be used.

Rule 42.

Portable electric power tools should be equipped with ground wires to maintain at all times an effective ground on the non-current carrying parts of the tools.

Suggestions—The following factors should be checked in your inspection under Rules 39, 40, 41 and 42:

(a) Hand tools:

Dull.

Mushroom heads.

Split or loose handles.

Are they suitable for the work?

(b) Portable electric hand tools:

Grounding.

Insulation, mats, etc.

Guard or enclosure.

Switches in good condition.

Fuses.

Are cords used in wet or damp places waterproofed?

Are operators familiar with hazards?

Fire hazard from overheating, sparks.

Wiring-condition, strung on nails, etc.

ELEVATORS AND ELEVATOR OPERATORS

Rule 43.

In the construction, type, specifications and operation of freight or passenger elevators, dumbwaiters and escalators in places affected by this Manual, the provisions of the American Standard Safety Code for Elevators, Dumbwaiters and Escalators shall apply. In those cities or towns within the State of Colorado where local ordinances have been adopted to govern the construction, type, specifications and operation of elevators, dumbwaiters and escalators, the State Inspector, when he finds unsafe conditions in the construction or operation of such elevators, dumbwaiters or escalators, will report such fact to the proper authority within the city or town having jurisdiction.

Rule 44.

Since this Manual is concerned primarily with the proper methods of inspection, the mainten-

ance and operation of elevators rather than their construction and installation, particular attention is directed to Rules 600, 601, 602 and 603, Section 60 and Rules 610, 611 and 612 of Section 61 of the American Standard Safety Code for elevators which reads as follows:

SECTION 60. RULES FOR INSPECTION AND MAINTENANCE

Rule 600. Responsibility

a. Responsibility for the care, operation, and maintenance should be definitely fixed by statute or ordinance. Where not so fixed, it is recommended that leases for buildings specify such responsibility as between owner and lessee.

Note: It is the unanimous opinion of this committee that this responsibility is as follows:

The Elevator Manufacturer: The responsibility of the elevator manufacturer for failure of the elevator or of any part thereof ceases when the elevator has been put in service and has been approved by the municipal, state, or other body having legal jurisdiction.

The Owner: The owner or his duly appointed agents should be responsible for the safe operation and proper maintenance of the elevator after it has been put in service and has been approved by the municipal, state, or other body having legal jurisdiction.

b. The person responsible for the installation or his agent shall make periodic inspections and maintain in proper working order all parts of the elevator installation.

Rule 601. Inspection

The following is the schedule of inspections recommended: Hoistway doors, car gates, interlocks, cams or equivalent devices for operating interlocks, contacts, control apparatus, controller, automatic stop, limit stops, car and counterweight cables, safeties, guide rails, buffers, elevator machines, and the lighting of the car and of the machine room, in passenger- and freight-elevator installations, shall be thoroughly inspected at least quarterly.

Plunger shoes, by-passes, and piston rods of hydraulic elevators shall be exposed, thoroughly cleaned, and inspected at least once in three years.

Pressure and discharge tanks of hydraulic elevators shall be thoroughly cleaned and internally inspected at least once every three years.

Rule 602. Maintenance

a. Cables, guides, and all parts of machinery shall be kept well lubricated. The oil in bearings and gear casings shall be renewed every six months.

b. Pressure tanks of hydraulic elevators shall be tested at least once every three years with hydrostatic pressure fifty (50) per cent in excess of the maximum working pressure.

Rule 603. Care of Installation

a. Elevator hoistways and pits shall be kept clean. No rubbish shall be allowed to accumulate therein, nor shall any part be used for storage.

b. Hatch covers shall not be used for storage or similar purposes.

c. No material not a permanent part of the elevator equipment shall be permitted on the top or cover of an elevator car.

d. No wire or current-carrying device shall be substituted for the proper fuse or circuit-breaker in an elevator circuit.

e. Freight elevators shall have legible signs posted in the car and at each landing prohibiting unauthorized persons from riding in or on the elevator car.

f. The water level in the pressure tank of a hydraulic elevator should be maintained at about two-thirds (⅔) of the capacity of the tank.

g. A test should be made of safety and governor following the painting of such equipment. It is recommended that a safety test be made after the installation of each new governor rope.

SECTION 61. QUALIFICATIONS AND DUTIES OF OPERATORS

Rule 610. Qualifications of Operators

a. Operators shall be not less than sixteen (16) years of age.

b. Operators shall be free from serious physical or mental defects and shall be selected with consideration for their ability to perform their duties in a careful and competent manner.

Rule 611. Training of Operators

a. One week's training under the direction of a competent operator shall be required before a new (inexperienced) operator is placed in charge of a passenger elevator.

b. Two days training under the direction of a competent operator shall be required before a new (inexperienced) operator is placed in charge of a freight elevator.

Rule 612. Instructions to Operators

a. Always open the service switch of an electric elevator or lock the operating mechanism of a hydraulic, steam or belted elevator before cleaning or oiling any part of your machine or regulator and when placing the elevator out of service.

b. Be sure the operating mechanism is in the "Stop" position before closing the service switch.

c. Make a trial inspection trip each morning before carrying passengers.

d. Report any defects promptly to the person in charge.

e. Do not attempt to make repairs unless competent to do so.

f. Carry no passengers or freight while inspections, repairs, or adjustments are in progress, and operate the car only in response to directions from the inspector or person in charge. Do not move the car when any one is in the pit or on top of the car EXCEPT AS THEY MAY DIRECT.

g. See that the locking device and safe-hoisting attachments are in place before a safe or other heavy concentrated load is moved on or off the car platform.

Do not attempt to raise the car more than a few inches until the "locking device" has been withdrawn.

h. Do not ride in the elevator nor allow others

to ride while a safe or other heavy object in excess of the contract capacity of the elevator is being carried.

i. No hand elevator shall be used for carrying safes or other one-piece loads of weight greater than the normal rated capacity of the elevator.

j. Hoistway doors or gates shall always be closed and locked before the car is started. The car shall be brought to a stop at the landing level before the hoistway door or gate is opened.

k. Keep car gates, if any, closed while car is running, and where no car gates are provided, keep passengers away from the open edge of the car platform.

l. Limit the number of passengers to the contract capacity of the car and do not permit crowding.

m. Do not reverse the operating device suddenly; stop before reversing.

n. Move operating device to the "Stop" position on approaching a terminal landing without waiting for the terminal stopping devices to come into action.

o. If the power goes off while the car is in motion, move the operating device to the "Stop" position and start the car in the usual manner upon return of the power.

p. If the car refuses to stop, do not attempt to jump off. The car will be stopped by the application of the safeties if it attains excessive speed of descent or by the automatic terminal stops at either end of the hoistway.

q. If the car should stop suddenly, call for

the person in charge and operate the machine only at his direction.

r. If the car will not start, return the operating device to the "Stop" position. If the car is apparently overloaded, remove part of the load and try the operating device. If the car still will not move, return operating device to the "Stop" position and notify the engineer or other qualified person.

s. Before allowing freight to be loaded or unloaded, lock the hand-rope on all rope-operated cars.

t. Familiarize yourself with the emergency devices, understand their function, and know how to operate them.

u. Never leave the car in the ordinary course of operation nor leave the operating mechanism unprotected. When going off duty for any reason, even for a few minutes, be sure that the power is disconnected or that the operating mechanism is locked and the hoistway doors are closed. When service is suspended for any reason during the ordinary operating hours, display a "NOT RUNNING" sign at each landing.

v. Always leave a hydraulic elevator operated by a lever at the lower landing with the lever in the position for down motion.

w. Learn these rules thoroughly and keep a copy on your person or in the car.

ELECTRIC WIRING AND SWITCHES

Under the provisions of Section 16, Chapter VI of the Compiled Labor Laws of Colorado, the regulations as laid down in the National Electrical

Code and the National Electrical Safety Code shall constitute the approved methods of installing and maintaining electrical wiring and apparatus in Colorado.

Rule 45.

All permanent wiring shall be installed in a rigid conduit of approved specifications. This shall apply to all wiring including that which is run to working level outlets and wiring so situated as to be in danger of mechanical injury.

Rule 46.

All open wiring shall be properly knobbed, spaced, insulated and secured.

Rule 47.

Cords, pendants or other extension conductors shall not be wrapped around or permitted to come in contact with water pipes, steel columns or other metal fixtures.

Suggestions—In your inspection of electrical wiring or apparatus, check for the following:

(a) Wiring not in conduit.
(b) Wiring which is worn or open.
(c) Extension cords with broken connections.
(d) Extension cords on damp floors, grease soaked or in contact with metal fixtures.
(e) Are switches or lamps exposed to vapor, properly protected.

SWITCHES AND SWITCH BOARDS

Rule 48.

Electric switches shall be of an approved safety

type and shall be so mounted that blades are dead when switch is open. Switches controlling machine tools should be of a type to lock when open.

Rule 49.

Insulating mats or equivalent insulating floor coverings shall be provided at all electrical power control boards unless same are of the "dead front" type or otherwise so arranged that contact with live current-carrying parts is practically impossible.

Rule 50.

Bridging of fuses or other over-load types of current interrupters is prohibited.

Rule 51.

Goggles or equivalent protection suited to conditions shall be provided for and used by all employees doing work of a nature such that the eyes may be endangered.

Rule 52.

Special protective equipment suited to conditions shall be provided for and used by workers exposed to harmful rays from welding, cutting or burning operations.

Rule 53.

Suitable special protective clothing or other equipment shall be worn by employees exposed to the hazard of burns in handling hot or molten metals or substances.

Rule 54.

Suitable special protective clothing or equipment shall be worn by employees exposed to contact with corrosive or otherwise hazardous acids or other chemicals.

Suggestions—In your inspection of personal protective equipment including goggles, masks, respirators, shoes, hats, gloves, aprons and leggings, check for the following:

(a) Is proper type provided?

(b) Is it comfortable to wear?

(c) Is it effective?

(d) Is it used?

(e) Is it properly inspected and maintained?

(f) Do employees wear loose clothing, torn clothing or other apparel which might endanger them?

CHAPTER III

DRINKING AND WASHROOM FACILITIES

Rule 55.

(a) Adequate drinking facilities shall be provided with an abundance of cool, wholesome water from an approved source, so dispensed that there is a minimum chance of contamination.

(b) The use of the common drinking cup or dipper is prohibited. Paper cups which may be immediately destroyed or approved type of drinking fountain are satisfactory.

Rule 56.

(a) Adequate dressing room and washroom facilities shall be provided to permit employees to change clothing before and after work where conditions require it and to properly wash themselves before eating meals or at the end of their tour of duty.

(b) Dressing rooms and washrooms shall be thoroughly cleaned daily and at all times kept in a clean and sanitary condition.

(c) Washrooms shall be provided with running water and plenty of soap.

(d) In plants where the nature of the work requires shower bath facilities, such as foundries, mills, exposure to poisonous fumes or acids, such shower bath facilities shall be provided.

(e) In plants where the work is of such a nature as to produce foot diseases or irritations, proper foot-baths prepared with effective disinfectants shall be provided.

Suggestions—In your inspection of drinking and washroom facilities under Rules 55 and 56, check for the following:

(a) Is drinking water from approved source?
(b) What sort of cups are used.
(c) If a drinking fountain, has it an approved type of mouthpiece.
(d) Are there sufficient water stations and are they properly located?
(e) Are washrooms well lighted
Well ventilated
Kept clean
Large enough?

(f) Are showers needed?
Are they provided?

(g) Are soap and individual towels provided?

(h) Is a foot-bath provided?

(i) Are receptacles provided for paper and other waste material?

LUNCH ROOMS

Rule 57.

In plants where food is dispensed by means of lunch wagons, lunch counters or cafeterias, room shall be provided where the workers may eat their food. The same shall apply in plants where workers carry their lunch with them.

Rule 58.

All rooms wherein lunch is stored, served or eaten shall be adequately screened to keep out flies and other insects.

TOILET ROOMS

Rule 59.

(a) All plants employing both male and female workers shall provide separate toilets for each sex and such toilets shall be conspicuously marked to indicate the sex by which they are to be used.

(b) There shall be provided at least one toilet for every fifteen female employees and at least one toilet for every twenty male employees.

(c) Toilet rooms shall be thoroughly scrubbed and cleaned daily and shall at all times be kept in a clean and sanitary condition. Urinals and

toilet seats shall be cleaned with a deodorizing and non-irritant disinfectant.

LIGHTING

Efficient lighting decreases eye-strain, prevents accidents, increases production and decreases spoilage.

Rule 60.

All offices, workrooms, passageways, exits, stairways, storage rooms and other places where people are employed or obliged to go, shall be adequately lighted either by natural or artificial means so as to eliminate chance of injury and to insure sufficient light for working purposes. The amount of illumination shall be in accordance with the standards approved by the Society of Illuminating Engineers, full consideration being given to the fineness of the work or the particular operation or process.

Suggestions—Check lighting facilities closely and look for the following:

(a) Are windows of sufficient size and location and are they kept clean?

(b) Is the illumination sufficient for the work or location?

(c) Are lights properly placed with respect to point of operation?

(d) Do lights produce glare or shadows?

(e) Do employees complain of eye strain?

(f) Are stairways and passageways properly lighted?

(g) Are light switches conveniently and safely located?

SANITATION

Rule 61.

The management of every industry shall adopt a schedule of clean-up activities suited to its conditions. The frequency, thoroughness and means of cleaning will depend upon the type of plant and work performed. In some industries as creameries, daily cleaning of the entire plant is a necessity. However many fail to realize how beneficial the maintenance of a high standard of cleanliness in even metal working plants may be. The plant that is kept well painted, windows and lights clean and free from oil or other spillage, waste neatly disposed of and orderliness evident in general, produces goods of good quality and at low cost.

Rule 62.

Adequate screening and rat proofing shall be provided against insects and rodents for all such services as lunch, toilet, locker, wash and first aid rooms.

HEATING

Rule 63.

Offices, workrooms, lunchrooms, toilet rooms, dressing and washrooms shall be equipped with proper heating facilities to provide a healthful temperature and to eliminate sudden or extreme changes in temperature. Heating apparatus will be of a type and so situated as not to come in contact with or cause explosion of combustible materials or to cause ignition of inflammable material.

Suggestions—In your inspection under Rule 63 check for the following:

(a) Is proper heat provided?

(b) What type is it?

(c) Is it properly installed?

(d) Are employees required to work or remain where it is damp, cold or drafty?

(e) Is there danger of fire or explosion from heating apparatus?

(f) Do employees complain about heating facilities?

VENTILATION

There is hardly a type of industry in which plenty of fresh air does not contribute to the safety and health of employees and to the efficiency of production.

Rule 64.

Every office, workshop, storeroom, or place of public assemblage or other enclosed space where people are required to work or remain shall be provided with ventilation facilities to furnish a supply of fresh uncontaminated air at all times and to definitely eliminate the danger of such persons being exposed to poisonous or irritating fumes, gases, dusts or vapors.

Rule 65.

In every place or industry where manufacturing processes require the presence of or produce poisonous or irritating fumes, gases, dusts or vapors, there shall be provided ventilation facilities of a type which will arrest such fumes, gases,

dusts or vapors at the point of their origin and exhaust them from the occupied space in such manner as to prevent exposure of the employees or other persons.

Suggestions—Under Rules 64 and 65 check for the following:

(a) Is there a supply of fresh air coming in and proper exhaust of foul air?

(b) Is ventilation (windows, transoms, etc.) so arranged as to prevent draughts?

(c) Are people exposed to poisonous gases, vapors, or dusts. (Monoxide, lead fumes, etc.)?

(d) Is mechanical ventilating equipment provided?

(e) Is it effective?

(f) Does it pick up gases, fumes, dust or vapor at point of origin?

(g) Check health records of employees working with poisonous or irritating substances.

FIRE PREVENTION AND EMERGENCY EQUIPMENT

Rule 66.

All buildings in which people are employed or in which public assemblages are held shall be provided with more than one means of exit other than windows. Such doors or exits shall be located sufficiently remote from each other as to permit escape from opposite portions of the building.

Rule 67.

All doors or exits leading into or from buildings where people are employed or public assemblages held shall be constructed as to open outward, where practicable, and shall not be locked, bolted or fastened during hours when such buildings are occupied.

Rule 68.

Doors or exits leading from buildings used as schools, theatres, lodge-rooms, dance halls or auditoriums shall be equipped with approved type of panic bars which will open such doors when pressure is brought against them.

Rule 69.

All emergency doors or exits leading from buildings in which people are employed or in which public assemblages are held shall be clearly designated by the words "EMERGENCY EXIT" and such designation shall be sufficiently lighted as to be visible at all times.

Rule 70.

All stairways leading from emergency doors or exits which permit egress from a building above the ground floor shall be constructed of substantial material; shall be provided with proper railings and shall be placed at not more than a forty-five degree angle. Railings shall be of metal and shall be not less than 30 inches in height.

Rule 71.

In all buildings where fire extinguishers are installed such fire extinguishers shall be of a type

approved by the National Board of Fire Underwriters for the type of hazard present. Such fire extinguishers shall be inspected regularly and refilled or recharged at least once every twelve months.

Rule 72.

Chemical laboratories or cooking rooms in schools, shall be equipped with fire blankets for use in smothering small fires or extinguishing clothing fires. The use of gasoline torches in chemical laboratories is prohibited.

Rule 73.

The following specifications shall apply to all theatres or places of public assemblage:

SEATS—In theatres or places of public assemblage, seating more than 200 persons, all seats shall be securely fastened to the floors.

Rows of seats between aisles shall have not more than 14 seats. Rows of seats opening to an aisle at one end only shall have not more than 7 seats.

Seats without dividing arms shall have their capacity determined by allowing 18 inches per person.

The spacing of rows of seats from back to back shall be not less than 30 inches. There shall be a space of not less than 12 inches between the back of one seat and the front of the seat immediately behind it, as measured between plumb lines.

AISLES—Must be not less than 30 inches wide.

ENTRANCE — Wherever possible, entrance

should be at the grade level without steps, or shall have ramps to grade.

RAMPS—Must be 5½ feet wide. Slope of same not more than one foot in 12 feet—8⅓%.

PROJECTION BOOTH—Projection apparatus must be enclosed in a fire resistant fixed booth. Must have automatic shutters.

Suggestions—In your inspection for fire hazards, prevention methods and emergency equipment, look for the following:

Hazards—

1. Stairways, exits blocked with stored material, furniture, rubbish.
2. Inflammable material stored or left near furnaces or other heat.
3. Exposed electric wiring near inflammable materials.
4. Doors not constructed to open outward; not equipped with panic bars.
5. Ice, snow or water on steps of fire-escape.
6. Handrails broken or weak.
7. Papers, rubbish, dust in basement.
8. Emergency exit not properly marked.
9. Fire extinguishers of non-effective type.
10. Fire extinguishers not properly charged.
11. No fire blankets available.
12. Paper decorations too close to electric light.
13. Oil, gasoline and paint not properly stored.
14. Fire drills not held.

CHAPTER IV

FIRST AID FACILITIES

First aid equipment should be provided by every employer free of expense to his employees and promptly available for use in case of injury. The facilities needed will depend upon the type of hazards and the number of employees. In all cases it is important that arrangements be made and faithfully maintained such that every injury suffered will receive adequate treatment promptly. The facilities provided, kit, cabinet, first aid room or plant hospital must be conveniently located, kept clean and orderly and arranged to insure reasonable privacy.

When a doctor or trained nurse is not on duty a specific person or persons always available, should be assigned to administer first aid. Such persons should receive specific training for such duties.

The following is a suggested list of minimum requirements for a first aid kit:

INSTRUMENTS

1 pair scissors.
1 pair thumb forceps.
1 tourniquet.
1 graduated medicine glass.

DRUGS

2 ounces aromatic spirits of ammonia.
2 tubes sterile borated petroleum jelly.
2 ounces powdered boracic acid.
2 ounces tincture iodine U.S.P. (ampoules preferred).

Bicarbonate of sodium tablets, 5 grains.
3 collapsible tubes of bicarbonate of sodium, 3 percent.
2 ounces 1 percent solution of picric acid.
2 ounces castor oil.

DRESSINGS

Wooden tongue depressors.
1 dozen assorted sizes sterile gauze bandages.
1 spool adhesive plaster—1 inch by 5 yards.
3 one-half ounce packages of absorbent cotton.
3 one-yard packages of sterile gauze.
Splints of assorted sizes for fractures.
Ice bag.
Hot water bottle.
Soap and nail brush.
Instantaneous coffee.

SAFETY ORGANIZATION AND EDUCATION

The importance of plant organization and education whereby safety mindedness is carried to every employee and full employee co-operation for safety is secured cannot be overemphasized. As previously pointed out safety must begin at the top. The management must actively direct safety work and give it leadership and executive force. Also plant and equipment must be made safe which only management can do. But employee co-operation must be secured and held. The successful promotion of safe practice in any establishment requires that it be considered a full time job. It must receive its share of each day's effort by the plant executive.

No definite program for all types and sizes of establishments can be laid down. It must be

suited to condition. For instance the employment of a full time safety engineer may be justified with as few as 50 men in such highly hazardous work as building demolition, while in a low hazard industry a plant of 1,000 employees might scarcely require one. However, in every establishment a safety committee can be helpful provided the following fundamental conditions are fully realized by the management:

a. A safety committee cannot be a substitute for executive interest. It is a tool of management that will be effective in proportion to the way it is fashioned and directed.

b. Safety committee recommendations must be taken seriously and either complied with or proved to be not suitable.

c. It must be so constituted and conducted as to merit the support and confidence of the employees.

SHOP SAFETY COMMITTEES: When backed by the cooperation of the management, a safety committee composed of manager, foreman or someone in authority and several representatives of workers has proved to be a most effective method of reducing accidents. The functions of such a committee should include the responsibility for periodic inspections of the plant, review and approval of inspection reports, analysis of causes of accidents for the purpose of submitting recommendations to prevent recurrence of similar accidents, instructing new employees or workers transferred to unaccustomed tasks as to the hazards of their work, and promoting the education of all employees in safety practices. The

committee should meet at least monthly and keep a written record of the number and nature of its recommendations, the number carried out, the number incompleted, and the number not acted upon. The members of the committee should be selected from the various departments and should be changed at regular intervals.

SAFETY MEETINGS, CONFERENCES AND SCHOOLS: Plant safety meetings attended by all employees of, if practicable, by employees of a particular department should be held at least semi-annually. The State Inspectors will be ready and willing to take full advantage of every opportunity to address these meetings. Small group safety meetings addressed by the foreman are also recommended. The safety program of an individual plant may be supplemented effectively by safety conferences and schools sponsored by the Industrial Commission, with the assistance of other interested official State and City agencies, and such agencies as organized labor groups, manufacturers' and trade associations, civic clubs and safety organizations. The schools may be open to the public as a whole at which general messages on safety are presented, or may be restricted to specialized industry or occupational groups, open only to "key men," such as the safety men, superintendents and foremen, or may consist of a combination of these two plans with a general school open to all groups, coordinated with special group conference meetings.

SAFETY CODES OF NATIONAL ACCEPTANCE. The American Standards Associ-

ation with offices at 29 W. 39th St., New York City, is a non-profit association of employer-employee, technical organization and State and Federal agencies having an interest in the development of standards in industry. The procedure is such that every group that has an interest in any specific activity or subject dealt with is represented and practically unanimous approval must be secured before the resultant standard can be approved. Under this procedure a large group of safety codes have been developed.

The standards specifically recommended for use are:

A9 —Building Exits Code.

A10 —Manual of Accident Prevention in Construction.

A11 —Code of Lighting Factories, Mills and Other Work Places.

A12 —Safety Code for Floor and Wall Openings, Railings and Toe Boards.

A14 —Safety Code for Construction, Care and Use of Ladders.

A17 —Safety Code for Elevators, Dumbwaiters and Escalators.

A17.2—Recommended Practice for the Inspection of Elevators.

A39 —Safety Code for Window Cleaning.

B7 —Safety Code for the Use, Care and Protection of Abrasive Wheels.

B8 —Safety Code for the Protection of Industrial Workers in Foundries.

B9 —Safety Code for Mechanical Refrigeration.

B11 —Safety Code for Power Presses and Foot and Hand Presses.

B13 —Logging and Sawmill Safety Code.

B15 —Safety Code for Mechanical Power-Transmission Apparatus.

B24 —Safety Code for Forging and Hot Metal Stamping.

B28A—Safety Code for Rubber Mills and Calenders.

C1 —Regulations for Electric Wiring and Apparatus in Relation to Fire Hazard.

C2 —National Electrical Safety Code.

L1 —Textile Safety Code.

O1 —Safety Code for Woodworking Plants.

P1 —Safety Code for Paper and Pulp Mills.

X2 —Safety Code for the Protection of the Heads and Eyes of Industrial Workers.

Z4 —Safety Code for Industrial Sanitation in Manufacturing Establishments.

Z4.2 —Specifications for Drinking Fountains.

Z4.3 —Specifications for the Sanitary Privy.

CONCLUSION

Accidents arise from three fundamental sources. They are: mechanical failure, human errors, physical weaknesses. In the foregoing pages the way has been pointed to the correction of mechanical failures and physical weaknesses. Human errors may never be completely eliminated. We can, however, reduce them materially if we will

observe the working habits of the men on the job and point out to them the correct and safe way of doing their work.

Here are a few of the things men do to invite suffering, loss of time, damaged equipment and even death: Employers, inspectors and employees are admonished to watch workers who may be in the habit of doing any of these:

Working without goggles, hardhats, safety shoes, respirators, safety gloves or other safety apparel even though it is provided for them.

Using worn or partly broken hand tools such as hammers, wrenches, chisels, knives, lifting jacks, saws, shovels, screwdrivers, pliers and tongs.

Permitting tools, scrap iron, rubbish to accumulate and cause falls or cuts.

Removing guards from saws or machinery and failing to replace them before again using the equipment.

Oiling, greasing or repairing machinery while it is in motion.

Jumping on or off of moving cars, trucks, etc.,

Standing between bumpers while coupling cars or material trucks.

Lifting heavy boxes, barrels, bundles with back in a bent position.

Piling material too high.

Riding material hoists.

Riding crane loads.

Placing tools where they may fall on someone below.

Walking across narrow, partially suspended beams.

Failure to clean up their work space.

Use of ladders which are not safe.

Interrupting other working men.

The greatest thing to creating a Life is to Save a Life.

REPORT ALL INJURIES—A SMALL SCRATCH MAY LEAD TO INFECTION, SUFFERING OR EVEN DEATH.

Employers and Employees are penalized for failure to report accidents. Sections 30 and 31, Workmen's Compensation Act of Colorado.

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