

STATE OF NEW JERSEY
DEPARTMENT OF LABOR
~~Harry C. Harper~~, Commissioner **Percy A. Miller, Jr.**

C. George Krueger
Deputy Commissioner

ELECTRICAL SAFETY RULES
relating to

Grounding of utilization Equipment
Balance Coils (Auto transformers)
Limiting Voltages on Lighting Circuits

Bureau of Electrical Equipment
Trenton, New Jersey
Issue of March 15, 1941

-1-

Due to the serious consequences to those employed about electrically driven machines and equipment in industry through the lack of effective grounding measures and through the use of balance coils (auto transformers), the following rules have been adopted by the Department of Labor of New Jersey. These rules apply to all industrial plants, sand pits, mines and quarries.

Such protective measures are required by the National Electrical Safety Code and the National Electrical Code. These regulations are to supplement but in no way to waive the requirements of the national codes.

Rule 1 - Every portable electrically operated device or motor driven conveyor, portable elevator, air compressor, hammer, portable drill, grinder glue pot, heater pump, and other portable tools and devices, including portable hand and stand lamps, but not including desk or office fan motors, other electrically driven office equipment, and pressing irons, shall have their framework effectively grounded by means of an additional insulated flexible conductor carried within the cable walls, said conductor to have the same carrying capacity as the conductor supplying the device or machine. This grounding wire shall be clearly distinguish-
ed as a non-current carrying safety grounding conductor, said ground-wire to be securely attached to the framework of the device or machine in an approved manner. Each such portable electrically driven conveyor, tool or device shall be connected to the source of electrical energy by means of an approved non-reversible polarity type plug or connecting device which will positively insure the completion of circuit and ground connections in proper relationship to each other.

Lamp-holding sockets and receptacles shall be polarized by being so wired to the permanent wiring and flexible cords that the screw shells shall be connected to the identified grounded wire of the circuit (not to the grounding wire which grounds the equipment frame). Small portable tools such as drills, reamers, grinders, glue pots, etc., shall not be operated on an ungrounded circuit having voltages or exposed to voltages over 150 volts to ground, or on a potential greater than 150 volts to ground. When, in the judgment of the Commissioner of Labor, it would be impractical to provide circuits operating at less than 150 volts to ground without unreasonable expense, the Commissioner may permit higher voltages to be used, but not exceeding 250 volts to ground. In conductive locations which contain wet or acid conditions or other highly conductive mediums, voltage on such small portable tools shall never exceed 150 volts to ground.

NOTE - 220 volt direct current, single phase or multiphase motors may be operated on circuits not exceeding 150 volts to ground if the generator or transformer secondary supplying such circuits has a neutral point which is grounded.

Rule 2 - All non-current carrying metal parts of fixed equipment such as the frame and metal exteriors of generators, motors, transformer cases, compensators, controllers (including handles and levers), switch cabinets, panel boxes, and cabinets, lighting fixtures other fixed appliances, conduit, armor of cable, metal raceways and the like, shall be permanently and effectively grounded in an approved manner. (See

Table 1 for proper sizes.) Exempted from this rule are metal enclosures with approved insulated linings, such as the lined covers of surface type snap switches and the lined shells of sockets.

Rule 3 - All metal guard enclosures at or around electric motors, shall be effectively bonded to the framework of such electric motor by means of a conductor of a size and in accordance with the Table following these rules. A separate ground wire may, in special cases, be required for grounding such guard structures in lieu of bond to motor frame.

Rule 4 - Where a wire is used as the grounding conductor required in Rules 2 and 3, it shall be protected against mechanical injury by means of proper enclosure in protective metal duct of approved type. This duct shall be bonded to ground wire at each end.

Rule 5 - Except as required by Rule 6, the metal wire enclosures of a wiring system may be used as grounding conductors for the grounding of equipment supplied through them, and pipe may be used for grounding such enclosures, and when so used must be of the size specified in Table 1. Where an interior wiring system operates at over 150 volts to ground and pipe, conduit, armored cable, or raceway is used as the grounding conductor for fixed equipment, conduits, armored cable, raceway and fittings, approved bonding jumpers or other approved devices shall be used. Such bonding jumpers shall not be required with properly cleaned threaded joints, made up tight, or pipe, conduit or fittings, nor where approved threadless joints are made up tight on pipe, conduit or fittings, nor when two locknuts are used.

Rule 6 - In chemical plants where the product manufactured or handled sets up a chemical reaction (corrosion) on the metal parts of electrical systems, and in plants where excessive moisture exists, a separate insulated ground wire having a carrying capacity equal to that of the respective circuit conductors shall be provided, (this ground wire may be limited to a maximum of 1/0) and same shall parallel each circuit and be connected to the framework of all electrical devices and appliances on these circuits. The ground wire shall be carried to the water pipe system and the connection shall be located on the street side of the water meter or on the water pipe near the equipment to be grounded, in which case the connection with the piping system shall be made continuous and permanent by joining all parts of the piping system which are liable to become physically disconnected, such as at meters and service unions, by means of a suitable shunt whose joints, current carrying capacity, and mechanical protection shall be not less than that required for the grounding conductor. Where practicable the point of connection shall be readily accessible. All splices in this ground wire shall be made first mechanically perfect, and then, soldered and taped and lead covered where ground wire is lead covered. This ground wire shall be lead covered if on porcelain knobs or may be included in the conduit carrying supply circuits and shall, in every case, be bonded to the conduit in which it is carried at two points, approximately at each end of such conduit runs.

Rule 7 - Auto transformers used as balance coils are prohibited from further use in new electrical installations in all industrial plants, except as permitted in Rule 8.

Rule 8 - Two-coil insulated type transformers having entirely independent primary and secondary windings shall be used for subdividing electrical circuits for lighting loads or other purposes and the secondaries of such transformers shall be permanently and effectively grounded in an approved manner. Such circuits for 2-wire shall have one leg grounded, and for 3-wire the middle leg shall be grounded.

Existing installations of balance coils (auto transformers) are subject to change in accordance with Rules 7 and 8 when individual specific orders are issued by the Department of Labor for their discontinuance.

In special cases transformers in which a part of the turns are common to both primary and secondary circuits, ordinarily known as auto transformers or balance coils, may be used for the purpose of subdividing electrical circuits for lighting loads or other purposes provided they are connected to a grounded service system, and one wire of the primary circuit connected to the auto transformer is an identified grounded wire, and if this wire goes through to the derived secondary system so that this secondary (auto transformer) is solidly grounded.

NOTE - These rules (7 and 8) are not intended to and do not apply to auto transformers employed purely for motor starting purposes, or phase changing as 2 to 3 phase, or vice-versa, nor to auto transformers used in connection with direct current 3-wire generators.

Rule 9 - All single phase, two and three wire services shall be grounded where the potential to ground does not exceed 150 volts.

Multi-phase systems having one wire common to all others, the identified common conductor ~~should~~ be grounded.

Two wire direct current systems need not be grounded.

Three wire direct current systems shall be grounded at the neutral wire.

The grounding connections, including electrode and grounding conductor, shall be permanent and effective and shall always be made on a continuous metallic underground water piping system if one is available.

The size of the wire or pipe used for grounding interior conduit, armored cable, metal raceway, fixed equipment and the like, shall be no less than that given in the following table:

TABLE NO. 1

Capacity of Automatic Overcurrent Protective Device in Circuit, Ahead of Equipment, Conduit, etc., Not Exceeding (Amperes)	SIZE OF GROUNDING CONDUCTOR		
	Copper Wire No.	Rigid Conduit Steel Pipe (Inch)	Nominal Diameter or Electrical Metallic Tubing (Inch)
30	14	1/2	1/2
60	10	1/2	1/2
100	8	1/2	1/2
200	6	1/2	1
400	4	3/4	1 1/4
600	2	3/4	1 1/4
800	0	1	2
1000	00	1	2
1200	000	1	2

For grounding fixtures and portable equipment and for grounding wires which accompany the circuit wires to equipment, the ground wire need not be larger than the wire supplying the equipment.

Rule 10 - Lighting equipment shall not be operated on an ungrounded circuit or on a potential greater than 150 volts to ground. Every lighting, appliance, and branch circuit shall have one wire continuously identified, grounded and connected to each lamp or appliance on the circuit, except that two-wire branches tapped from the outside wires of a three-wired d.c. or single phase circuit within the same premises will be permitted if no fuse is omitted and no single pole switches or sockets are used. In new installations it is recommended that lighting equipment be not used where the potential is greater than 150 volts..

Rule 11 - Elevators - All electric elevators, the frames of all motors, elevator machine controllers, and the metal enclosures for all electrical devices in or on the car or in the hoistway shall be grounded in accordance with these rules.

For elevators other than electric, where any electrical conductors are attached to the car, the metal frame of the car, if normally accessible to persons, shall be grounded in accordance with these rules.

Rule 12 - Live parts of rotating equipment of more than 600 volts, except slip rings and brush rigging which do not extend beyond the frames of induction motors, shall not be exposed to accidental contact where accessible to unqualified persons.