Compliance Guide II for MSHA's Regulations on Diesel-Powered Equipment Used in Underground Coal Mines

U.S. Department of Labor
Mine Safety and Health Administration

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U.S. Department of Labor

Mine Safety and Health Administration
4015 Wilson Boulevard
Arlington, Virginia 22203-1984

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Dear Member of the Mining Community:

I am pleased to provide you with a supplement to the Compliance Guide for the Mine Safety and Health Administration's (MSHA) regulations that establish approval, exhaust gas monitoring, and safety requirements for the use of diesel-powered equipment in underground coal mines. This Compliance Guide is intended to provide information and assistance to the mining community, including diesel equipment manufacturers, in complying with these important safety and health requirements. Comments on the Compliance Guide, as well as any further questions, are welcome.

We are also pleased to report that 85 percent of the diesel engines included in our inventory will be approved by November 25, 1999. The remaining 15 percent are older engines for which the manufacturers are unlikely to seek approval. MSHA does not believe any more of these engines will be approved even after the compliance date of November 25, 1999. We have posted a listing of approved engines on our homepage at [http://www.msha.gov/s&hinfo/diesel.htm]. If you have an approved engine but are unable to get an approval plate, the Approval and Certification Center will issue a letter which MSHA will accept for compliance purposes until you receive the plate. Contact George Saseen at (304) 547-2072 for assistance.

We understand that you may have additional questions, especially as we approach the final compliance date. We encourage you to review the Compliance Guide, view the MSHA Internet Home Page, or contact your local District Office if you have specific questions or difficulties complying with the regulations. We remain available to answer specific questions or assist you in resolving technical compliance issues at your mine.

Thank you for your interest in making our Nation's mines safe and healthful places to work. Sincerely,

Sincerely,

J. Davitt McAteer
Assistant Secretary for
Mine Safety and Health

Mandatory Safety Standards

Section 75.1909 -- Nonpermissible diesel-powered equipment; design and performance requirements

Q. How many portable fire extinguishers are required on a maintenance truck with one 5 gallon diesel fuel can? How many are required on a diesel fuel transportation unit?

A. All diesel-powered machines are required to have at least one 10A:60B:C portable fire extinguisher (§§75.1907(b)(2) and 75.1909(a)(2)). Two portable fire extinguishers must be installed when a 5 gallon diesel fuel safety can is carried on the vehicle (§75.1906(h)). Diesel fuel transportation units must have at least two portable fire extinguishers (§75.1906(h)). For diesel fuel transportation units that are towed (trailers), the towing vehicle must have at least one portable fire extinguisher (two extinguishers if the towing vehicle carries a safety can). Also, if the trailer portion of the diesel fuel transportation unit does not have its own two portable fire extinguishers, two portable fire extinguishers must be installed on the trailer before it can is disconnected from the towing vehicle.

Q. Section 75.1909(a)(3)(ii) requires the fuel tank to be protected from damage by collision. The fuel tank on our pickup truck is located 10-12 inches above the ground. Is this adequate to protect it from damage by collision with the floor?

A. This is a performance oriented standard. If the pickup travels on good road surfaces, protection by location may be adequate. OEM's do not consider mine conditions for fuel tanks on commercial vehicles. The operator should consider conditions in the mine which may cause the potential of a ruptured fuel tank and fire and take appropriate measures to prevent damage to the tank. This is not to be done on a trial and error basis. A damaged fuel tank on a pickup truck constitutes a violation of Section 75.1909(a)(3)(ii) and demonstrates the need to provide additional protection for similar vehicles operating on the same roadways.

Q. Section 75.1909(a)(6) requires that all hydraulic tank fillers and vents be located to prevent spillage or leaks from contacting hot surfaces. Does this include the engine oil filler?

A. Yes. All hydraulic tanks, fillers, vents, and lines fall under the scope of §75.1909(a)(6). Oil tanks, fillers, vents, and lines, including those for the engine, are covered by this section. The requirement is based on fire accident data. Hot surfaces include the exhaust manifold, piping, muffler, and exposed brake discs or drums. These surfaces can reach temperatures which exceed the autoignition temperature for these fluids. Because this regulation is performance oriented, an operator cannot rely on a trial and error approach. If an operator believes that the location of the tanks and the methods used for filling (including funnels, quick disconnect fittings, and extended filler tubes) will prevent spillage, then <u>as long as no spillage occurs</u> the operator has complied with Section 75.1909(a)(6). However, if spillage onto hot surfaces does occur, then the operator must adopt other methods.

Q. Section 75.1909(b)(5) requires lights on both ends of the vehicle. For pickup trucks that have two headlights on the front, can one of these lights be removed?

A. No. For machines equipped with two headlights on the front by the original equipment manufacturer (OEM), both headlights need to be maintained. Machines equipped with only one headlight on the front and back of a machine by the OEM are acceptable.

Q. I have been advised that the service braking systems on some of my mining equipment do not comply with the requirement that a single failure in the hydraulic system not result in the loss of all braking capability. What means are available to help me come into compliance with this requirement?

A. Section 75.1909(b)(6) requires "service brakes that act on each wheel of the vehicle and that are designed such that failure of any single component, except the brake actuation pedal or other similar actuation device, must not result in a complete loss of service braking capability." Any service brake system design in which a single broken hydraulic line results in the loss of all braking ability is prohibited. The system must provide the same type of brake performance found in automobiles which have a dual piston master cylinder that provides independent application of the front and rear wheels. However, many existing diesel-powered mining vehicles use a single piston master cylinder or pump to actuate all of the machine's brakes through a common hydraulic line. These braking systems must be modified to comply with the rule.

Designs other than the dual piston master cylinder found on automobiles can be used. Machine manufacturers have developed retrofit kits, using specialized components, which meet the requirements of the rule.

For existing machines, mine operators should contact equipment manufacturers for assistance in meeting the requirements of §75.1909. Equipment manufacturers may offer retrofit kits as well as engineering advice. Equipment manufacturers can provide assistance in complying with safety requirements for their products. Rebuild shops may modify the equipment or operators may make changes in-house. However, operators are cautioned that some modifications to the brake system may impose significant engineering difficulties.

Q. Do pins or bolts connecting service brake pedals and other service brake linkages require two means of preventing the pins or bolts from falling out?

A. Yes. Section 75.1909(b)(6) requires "service brakes that act on each wheel of the vehicle and that are designed such that failure of any single component, except the brake actuation pedal or other similar actuation device, must not result in a complete loss of service braking capability." This requirement covers both the hydraulic components and the mechanical linkages of the service brake system. The mechanical components that are of concern are those components that secure pins and other linkages together.

Service brake systems frequently consist of a foot pedal mounted to a base plate. A brake control valve is mounted on the opposite side of the base plate from the pedal. The brake

pedal connects to the base plate and to the brake valve usually through two or more linkages. These linkages consist of pins or shafts and various types of retaining devices that transmit force from the pedal to the brake valve. The pins or shafts by themselves do not present any significant likelihood of failure. However, the retainers used to secure the pins or shafts do have a reasonable likelihood of failure. These components are typically nuts, cotter keys, or "E" clips.

Several aspects of these components need to be considered in deciding if they meet the regulation. First, not all linkages are critical in the operation of the service brake system. the rule covers only those connections that could fail and cause the loss of all service braking capability. Second, there are many ways to provide two means to prevent a shaft or pin from falling out. Welding an end cap on a pin would be considered acceptable so would a nut with a cotter key. If using a nut and cotter key, the nut needs to be tight and the design must positively prevent it or the shaft from rotating as the brake pedal moves. The mine operator must ensure the cotter key is correctly sized for the hole in the shaft. The cotter key should be corrosion resistant. Maintenance personnel should not reuse cotter keys. A common lockwasher is not considered acceptable since it would fail when the preload on the nut was lost. Two cotter keys to secure a shaft are acceptable under the rule. However, when using two of the same device the possibility that both devices will fail in the same manner and at the same time becomes more likely. In particular, we consider the use of two "E" clips to be unacceptable since only a spring force holds them in place and they can be pushed off at the same time. Finally, there are many possible designs. The mine operator must evaluate each design to decide whether it provides the performance required by the rule as requested. Also, since modifications to the brake system may impose significant engineering difficulties, we recommend mine operators rely on the equipment manufacturer for guidance in meeting this requirement.

We do recognize an exception to this requirement. Linkages in the braking systems of commercial, on-highway pickup trucks that are typically used in underground coal mine operations meet SAE and DOT requirements. We will accept these designs as meeting the requirements of the regulation without modification. Maintenance personnel must visually check the linkages of these vehicles during the weekly maintenance checks under §75.1914(f).

Q. We have a six wheeled road grader, typically used in the construction industry, that does not have brakes on the front wheels. Although §75.1909(b)(6) requires brakes that act on each wheel, we consider there are other ways to provide the same safety that would be provided by front wheel brakes. Will MSHA evaluate petitions for modification of the requirement for front wheel brakes on graders?

A. Yes. MSHA will consider the grader’s use and vehicle design characteristics including the weight distribution and steering geometry when reviewing petitions for modification to determine if the alternative method will provide the same degree of protection that would be achieved by the installation of brakes on the front wheels. However, all other §75.1909 braking requirements must be met. Depending on the equipment used and the

mining conditions encountered, at a minimum, alternate methods should include: 1) limiting the maximum speed to less than 10 mph by physically blocking out gear ratios that provide higher speeds, 2) providing training for grader operators to lower the moldboard to provide additional stopping capability in emergency situations, 3) training operators to recognize the appropriate speeds to use on different roadway conditions and slopes, and any other terms or conditions necessary to provide the same degree of safety as the standard.

Q. A heavy duty machine is equipped with a supplemental brake system. This system has a separate brake release control as required by §75.1909(c)(4), however, this control by itself does not supply release pressure to the brakes. To get pressure to release the brakes the operator must push on the tram pedal. The circuit then charges an accumulator that ensures the brake is fully released before fluid is directed to the tram motors. Does the tram pedal constitute a second control to release the brake that is prohibited by the rule?

A. No. Since the operator must release the brake with a single lever and expects the machine to move when the tram pedal is activated, this arrangement complies with the rule. No other machine control may release the brake. Note that without the accumulator in the system the brakes could drag. This would not comply§75.1909(c)(6). The brakes must be released before the machine is trammed and while it is being trammed.

Q. Some diesel-powered roof bolters have spring applied service brakes that automatically apply when the tram lever is released. Do these brakes suffice as supplemental brakes?

A. No. Diesel-powered roof bolters are defined as heavy duty equipment under the regulations and as such must be provided with a supplemental brake system meeting the requirements of §75.1909(c).

However, the service brake system on roof bolters typically consists of the same kind of spring applied brake that is used as a supplemental brake on other types of equipment. Common components between the service and supplemental brake systems are not prohibited. Therefore, this type of service brake system may be modified to function as a the supplemental brake system as well. This can be accomplished: 1.) with the addition of a separate control that only applies and releases the supplemental brake, and 2.) the addition of a hand pump to release the brakes while towing the vehicle. Both the service and supplemental brake systems must be meet all the respective requirements for each type described in the rule.

Q. If the supplemental brakes, required by §75.1909(c)(5), are manually released to tow a vehicle do the brakes have to automatically reapply when the vehicle is started?

A. Yes. The supplemental brake system must be fully functional when the machine is operating. If the supplemental brakes have been released manually, they must automatically apply when the machine is restarted. If an operator fails to manually release the pressure holding the supplemental brakes released, it would not be possible for

the brakes to apply within 5 seconds of engine shutdown as required by §75.1909(c)(1). Further, if the manual release could override the brake system before the equipment is started, operator error could cause precisely the types of accidents and injuries that the final rule is intended to prevent.

Section 75.1910 -- Nonpermissible diesel-powered equipment; electrical system design and performance requirements

Q. Is there a need to provide insulation over wiring studs, bolts, battery terminals, and other connectors in starting circuits?

A. Yes. MSHA recognizes that on all diesel-powered equipment the charging and starting circuits present significant risk of fire. Typically, starting and charging system components are located in the engine compartment, where they are in close proximity to potential fuel sources. Electrical faults in these circuits have been the source of serious electrical fires. The regulations address this risk by requiring overcurrent protection, a manual disconnect device, and the insulation of exposed, ungrounded connectors in the starting and charging circuit. Further, all ungrounded connectors in other circuits located in the engine compartment must be insulated to protect against the risk of fire caused by the close proximity of the electrical circuits to potential fuel sources. Exposed connectors can be insulated with electrical insulating coatings, sealers, covers or boots.

Q. Do the wiring studs, bolts, and other connectors in electrical circuits installed in on-highway vehicles, other than those in the starting and charging circuits and the engine compartment, need to be provided with insulation? Are the wires sized and fused adequately? Are the wires adequately protected from damage?

A. Commercial on-highway pickup trucks sold in the U.S. must comply with U.S. Department of Transportation and Society of Automotive Engineers (SAE) standards for electrical wiring systems. With some exceptions as described under the next question, MSHA has determined that these systems comply with 30 CFR 75.1910 for use in underground coal mines. The SAE standards require use of cables selected for a number of factors, including: ambient operating temperature and temperature rise potential (both during fault conditions and intermittent operation); the effects of exposure to fuels, lubricants, and other chemicals and fluids to which the cable may be exposed; mechanical strength; and, expected service life. The SAE standards also address cable connections such as terminals and splices, as well as wiring harness construction, routing and protection. Therefore, the electrical circuits and connectors are properly insulated, sized, and fused, and they are adequately protected from damage except for the areas described under the next question.

Q. What changes do I have to make on the electrical circuits on commercial pickup trucks to meet the regulations?

A. Commercial pickup trucks may not comply with four provisions of §75.1910: 1) the fuse required between the battery and starting motor, §75.1910(b); 2) the fuse required between the battery and alternator, §75.1910(e); 3) the disconnect switch required as

close as practical to the battery, §75.1910(d); and 4) the insulation of all ungrounded connectors located in the starting and charging systems and in the engine compartment, §75.1910(f). If ungrounded connections in the engine compartment are completely enclosed in a box that holds only electrical components, insulation is not required. Finally, no modification is required for the OEM connectors located outside of the engine compartment.

Q. What electrical protection is required for alternators?

A. The alternator must be protected by an overcurrent device to comply with Section 75.1910(e). First, for commercial pickup trucks, the wire installed by the vehicle manufacturer is considered adequate for compliance. However, a fuse or other overcurrent device must be installed in the wire. The fuse can either be rated for the output of the OEM alternator, or be the next higher size fuse if no fuse is manufactured exactly at the alternator output rating, or the fuse size specified by the pickup truck manufacturer. Second, for all other heavy duty, light duty, and portable equipment the wire size and fuse rating must conform to the National Electric Code (NEC), 1968. NEC specifies that the wire must be protected at no greater than 125% of its rating and the Code also permits the next higher size fuse when the exact fuse rating is not manufactured. In either case, if the alternator manufacturer provides written documentation based on the duty cycle of the alternator, that wire and/or fuse sizes different than that specified by NEC are appropriate, then the alternator manufacturer recommendations are acceptable for compliance.

Q. We are taking the bed off a pickup truck and installing a compartment to transport personnel. We are adding our own wiring and lights for this compartment. What regulations do these lighting circuits have to meet?

A. Any mine operator installed wiring on commercial pickup trucks must meet all the requirements of §75.1910. For overcurrent and short circuit protection and wiring size, in particular, §§75.1910(a) and (f) reference §75.513-1 and §75.518-1. These sections reference the National Electric Code, 1968, specifications for circuit protection and wire size.

Q. Is there a need to provide insulation over wiring studs, bolts, battery terminals, and other connectors in branch circuits, in addition to the starting circuit, on diesel-powered equipment other than commercial pickup trucks?

A. Yes. Section 75.1910(f) is intended to prevent ungrounded connectors from arcing. This can be accomplished by insulating the connectors with electrical insulating coatings, sealers, covers or boots or by completely enclosing the electrical connections in a box containing only electrical components.

Q. We have looked at fuses for protecting the starting circuit and have found fuses other than the those listed by MSHA on its homepage, to provide adequate protection. Specifically, we have installed a Littelfuse, Inc. Megafuse 225 on an Isuzu pickup truck with a QD 60 engine. Is this acceptable?

A. Yes. The MSHA fuse listings provide a source for acceptable fuses for specific engines, starters, system voltage, and types of wire and insulation. Other fuses can provide equivalent or better protection. By better protection, MSHA means the fuse will interrupt the circuit sooner under a given load. Although the Megafuse 225 provides better protection by opening sooner than the fuse MSHA lists, it is more likely to interrupt the circuit during the winter months when the engine is harder to crank. The next larger size Megafuse, the 250, provides less protection than the fuse MSHA lists and does not comply with §75.1910 for starting circuit protection.

Q. Can the OEM battery cables in commercial pickup trucks be used with the fuses listed on the MSHA homepage for engines in these vehicles?

A. Yes. The OEM battery cables in commercial on-highway pickup trucks sold in the U.S. meet SAE specifications. These specifications include tests of the cables after they are conditioned to at least 110°C. The fuses listed on MSHA's homepage are sized for battery cables rated at 90°C. Since the OEM battery cables are tested after being conditioned to a higher temperature they are considered acceptable for use with the fuses listed by MSHA.

Q. Section 75.1910(d) requires a circuit-interrupting device that can deenergize all power conductors. Does a removable fuse or plug installed in the wire from the battery meet the requirement for a disconnect switch?

A. No. Fuses, plugs, and similar devices may not be recognized as a switch in an emergency situation. In addition, fuses and plugs have tight fits to be electrically efficient making them difficult to disconnect. Also, the fuse or plug assembly must be grasped tightly by the user to make or break connections. In an emergency situation, the assembly and associated wiring may become extremely hot and the user may suffer contact burns to the hands while disconnecting the cable. Further if the circuit is disconnected under load, an electrical flash could result that may injure personnel.

To comply with Section 75.1910(d) the switch must be a manual switch. A push button or rotatory switch, a manual reset circuit breaker, or contactor relay may suffice in this application provided: 1) it is placed in each ungrounded (power) conductor; 2) located as close as practicable to the battery terminals; 3) properly selected and installed in a circuit, in order that it may be operated within its electrical ratings safely and without damage under full load; 4) not automatically reset after being actuated; and 5) be designed or otherwise mounted in a manner which precludes its closing by force of gravity. The switch should be placed between the battery and fuse to allow the fuse to be changed with the power off. The switch must be designed to safely open the circuit under load in emergency situations. MSHA has evaluated several switches for different circuits and will list acceptable switches on the MSHA diesel information web page. To determine the acceptability of other switches, please contact Arlie Massey or Bob Boring at the Approval and Certification Center, 304-547-0400.

Section 75.1911- Fire Suppression System for diesel-powered equipment and fuel

transportation units

Q. If a mantrip is only required to have a manual fire suppression system installed by §75.1909 but an automatic fire suppression system is required by §75.380(f)(5)(i), does the fire suppression system need to only meet the requirements for fire suppression systems under §75.380 or does it have to meet all the requirements under §75.1911? Also, the system currently used is not a stand alone system that would meet the requirements of 75.1911(f). Wouldn't removal of the automatic portion of the fire suppression system to comply with 75.1911(f) be a decrease in safety by not providing automatic detection of fires?

A. If an automatic fire suppression system is installed on a diesel-powered machine, it must meet all §75.1911 requirements. The requirements in §75.1911 define a well engineered system specifically for diesel-powered equipment. Systems that do not meet §75.1911 requirements are not as well engineered and may not provide operators with the degree of fire suppression system effectiveness they expect. This could compromise safety. Further, automatic fire suppression systems that meet all of the requirements of §75.1911 are readily available.

Section 75.1914 -- Maintenance of diesel-powered equipment

Q. If an outby electric roof bolter is converted to diesel power, do the panic bars have to be maintained on the vehicle?

A. Yes. If an outby electric roof bolter is converted to diesel power and the machine was equipped with a panic bar from the original equipment manufacturer, the panic bar is considered to have been supplied as a safety device and, therefore, must be maintained under §75.1914(a).

Q. What types of devices are considered safety devices under §75.1914(a)?

A. Components that reduce the risk of injury to workers or reduce the risk of fire or explosion are considered safety devices. Devices that only protect machinery from damage are not safety devices. For example, a governor that prevents an over speed condition that, if it occurred, would result in failure of nonessential machine component or voiding of a warranty would not be considered a safety device. However, if the failure of the governor permitted an over speed condition that could cause the machine to break apart and possibly injure nearby personnel, it would be considered a safety device. Similarly, with over temperature devices, if exceeding the temperature limit would only cause machine damage and not increase the risk of fire or otherwise endanger personnel it would not be considered a safety device.