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Rail Safety

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Preface

TM 4-14.21, *Rail Safety*, provides authoritative safety information for rail operations conducted by United States (U.S.) Army rail operating personnel both within the United States and at overseas duty stations. It describes both general safety guidelines and procedural rules for conducting operations in a safe manner. It provides basic information for commanders and staffs of operating units and for staff officers of higher headquarters. This publication applies to a range of military operations and supports Army doctrine reference publication (ADRP) 3-0, *Unified Land Operations*, and Army doctrine publication (ADP) 4-0, *Sustainment*. The intent of this TM is to provide a baseline safety standard for all United States Army rail operations.

The principal audience for TM 4-14.21 is all members of the profession of arms. Commanders and staffs of Army headquarters serving as joint task force or multinational headquarters should also refer to applicable joint or multinational doctrine concerning the range of military operations and joint or multinational forces. Trainers and educators throughout the Army will also use this publication.

Commanders, staffs, and subordinates ensure that their decisions and actions comply with applicable United States, international, and in some cases host-nation laws and regulations. Commanders at all levels ensure that their Soldiers operate in accordance with the law of war and the rules of engagement. (See FM 27-10.)

TM 4-14.21 uses joint terms where applicable. Selected joint and Army terms and definitions appear in both the glossary and the text. Terms for which TM 4-14.21 is the proponent publication (the authority) are italicized in the text and are marked with an asterisk (*) in the glossary. Terms and definitions for which TM 4-14.21 is the proponent publication are boldfaced in the text. For other definitions shown in the text, the term is italicized and the number of the proponent publication follows the definition.

TM 4-14.21 applies to the Active Army, Army National Guard/Army National Guard of the United States, and United States Army Reserve unless otherwise stated.

The proponent of TM 4-14.21 is the United States Army Training and Doctrine Command. The preparing agency is the Combined Arms Support Command, G-3 Doctrine Division. Send comments and recommendations on a DA Form 2028 (Recommended Changes to Publications and Blank Forms) to Commander, United States. Army Combined Arms Support Command, ATTN: ATCL-TS (TM 4-14.21), 2221 Adams Ave, Fort Lee, VA 23801-2102; by email to usarmy.lee.tradoc/mbx.leee-cascom-doctrine@mail.mil; or submit an electronic DA Form 2028.

Introduction

Throughout history the ability to move forces and cargo by rail has proven to be a valuable asset. The successful use of a railway system can dramatically reduce the logistical footprint and be a source of cost savings. Even a small train can move as much as a single Army truck company. It is a key mode of transportation to be used for throughput of cargo. However, rail operations are inherently dangerous. The rules, procedures, and guidelines found in this manual greatly mitigate these dangers.

In an effort to meet current and future war time demands, the rail force structure of the past, comprised of four rail companies and one rail battalion, was transformed into the Expeditionary Railway Center (ERC), the only remaining rail organization in the Army. It is comprised of a headquarters and five separate, deployable railway planning and advisory teams. It is capable of conducting rail network capability and infrastructure assessments, rail safety assessments, and using these assessments to inform and advise the combatant commander on the employment of rail in a theater of operations. Additionally, the ERC is capable of partnering with host nation (HN) rail organizations and advising and assisting in the effective management of its railway system.

This manual is a companion manual to Army techniques publication (ATP) 4-14, *Expeditionary Railway Center Operations*, which focuses on the operation of a railway. Many useful topic discussions and definitions related to these safety rules can be found there. These rules have been prepared in accordance with Federal Railroad Administration Regulations found in Code of Federal Regulations Title 49, Part 214, and the General Code of Operating Rules (GCOR).

TM 4-14.21 contains 7 chapters.

Chapter 1, *General Instructions*, describes some over-arching safety protocols and an accident/incident overview including reporting procedures.

Chapter 2, *Railway Equipment Precautions*, provides some safety guidelines for moving equipment, standing equipment, engines, and other specialty equipment and operations.

Chapter 3, *Railway Track and Yard Precautions*, provides safety considerations specific to working on a railroad track itself, or within a rail yard.

Chapter 4, *Maintenance Precautions*, discusses safety topics during the maintenance of rail equipment and track maintenance.

Chapter 5, *Loading and Unloading Precautions*, introduces the safety rules specific to loading and unloading operations for all kinds of equipment, including precautions to be taken while working with cranes.

Chapter 6, *Fire Prevention and High Voltage Electrical Wire Precautions*, discusses fire prevention, what to do in the case of an on-board train fire, and safety precautions while working around electrical power lines.

Chapter 7, *Wreck Train Precautions*, covers the highly specialized, and especially dangerous mission of wreck train operations.

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Chapter 1
General Instructions

There are many hazards that exist during railway train operations, including human errors, recklessness, mechanical failures, collisions, and wrecks. Operating rules and safety rules have been formulated over time to mitigate those dangers. This chapter explains some general safety concepts and guidelines to be followed.

OPERATING AND SAFETY RULES

1-1. Within Army rail safety (and within this manual), there are rules that are operational in nature. These operating rules provide specific and sometimes procedural guidance on the safe way to physically operate a railway. The design of these rules has been formulated gradually. Other rules are general safety rules that offer guidelines on personal conduct while performing one's duties. Safety rules simply require applying common sense precautions when operating in hazardous surrounding.

RULE APPLICABILITY

1-2. These rules apply to:

- Any Active Duty, Reserve, or National Guard U.S. Army personnel working or operating on, in, or around rail equipment, railroad tracks, or rail yards.
- Government service civilians or contractors working for the Army on, in, or around rail equipment, railroad tracks, or rail yards.
- Any individual working on, in, or around rail equipment that is owned, leased, or operated in any capacity by the U.S. Army.

RESPONSIBILITIES

1-3. The installation and each individual worker (whether government service civilian, Soldier, or contractor) share joint responsibility for ensuring that on-track safety is provided.

Installation Responsibilities

1-4. The installation's leadership has the following responsibilities:

- Provide proper training of every worker.
- Provide copies of stated rules to every worker.
- Supervise to ensure that the appropriate safety rules are being followed by the workers.
- Follow appropriate procedures to resolve safety challenges promptly and adequately.
- Investigate safety violations, accidents, and incidents appropriately.

Individual Responsibilities

1-5. Individual workers are responsible for complying with these rules. Employees will maintain a copy of stated rules in close proximity to include the most current changes, amendments, and general orders.

1-6. Personnel are responsible for their personal safety and are accountable for their behavior. Personnel will take every precaution to prevent injury to themselves, other personnel, and the public. They will challenge any dangerous condition or unsafe practice. They will refuse any directive to violate a safety rule and promptly notify a supervisor or manager when the safety provisions to be applied at the job site do not comply with the safety rules.

1-7. Personnel will be aware of and work within the limits of their physical capabilities and not use excessive force to accomplish tasks. Good judgment is required in fulfilling job responsibilities safely.

1-8. All personnel are responsible to ensure their personal medical condition does not interfere with their ability to safely perform their duties.

1-9. Personnel with medical conditions (such as cardiovascular disease including high blood pressure, uncontrolled diabetes, sleep disorders including apnea, visual impairment, hearing impairment, or any other condition that would cause impairment) that may adversely affect their ability to work safely will inform their medical practitioner of their job duties.

1-10. The medical provider will determine that any prescribed treatment including medication will not impair the worker from safely performing their job duties. The worker will notify their physician or medical provider if prescribed treatment and/or medication is affecting their ability to safely perform their job duties. The worker will consult with medical providers before taking any over-the-counter medications in order to receive advice on how it will affect them. Furthermore, the worker will allow for a test period between taking any new over-the-counter medications and working in order to learn how that medication will affect them.

ACCIDENTS AND INCIDENTS

1-11. Rail accidents and/or incidents (may also be known as train accidents) involve any collision, derailment, or injury as a result of the operation of any rail equipment. Rail accidents will be reported as Class A through Class E accidents and identified as engineering, mechanical, transportation, or other, as appropriate on DA Form 285 (Technical Report of U.S. Army Ground Accident [block 63]), or within the ReportIt Army Accident Reporting System. At the local level, rail incidents not meeting the Class E or higher accident threshold will be reported using local serious incident report formats.

1-12. Rail accidents and/or incidents include:

- Accidents/incidents occurring while loading, off-loading, or receiving services.
- Damage to Army property handled as a loaded commodity.
- Damage and all injuries to Army personnel occurring while operating or riding rail equipment.

1-13. Rail accidents do not include accidents that are reportable under other major categories; for example, aircraft, missile, or chemical material accidents.

1-14. The following information covers trains and rail equipment under the jurisdiction of the Department of the Army:

- Equipment operated and exclusively controlled or directed by the Army. This includes rail equipment furnished by a contractor or another government agency when operated by Army train personnel.
- Equipment lent or leased to non-Army organizations for modification, maintenance, repair, test, contractor training, research, or development projects for the Army. Under test by Army agencies responsible for research, development, and test of equipment.
- Equipment lent or leased by the Army to a non-Army organization for maintenance, repair, test, contract training, or experimental projects will not be charged to the Army if the non-Army organization that has operational control of the equipment has assumed the risk of loss. (This information does not negate the engineer or crew responsibility to report any applicable rail accident, injury, or death involving commercial or government owned property to the proper authorities.)

NOTIFICATION REQUIREMENTS

1-15. Army rail safety rules require timely reporting of all accidents, incidents, and injuries. Complete and accurate reporting will be a priority.

1-16. Any and all Army rail accidents and incidents are to be reported to the Transportation Branch Rail Safety Office (2221 Adams AVE, Fort Lee, VA 23801, defense switch network 539-7467, Commercial

804-765-7467, usarmy.lee.tradoc.mbx.rail-safety@mail.mil) within 24 hours of occurrence, per Transportation Branch Rail Safety Office Accident/Incident Reporting Policy. Information obtained from these notifications and reports are used to identify problem trend areas in order to "develop accident prevention measures" for the entire fleet (AR 385-10, *The Army Safety Program*, DA PAM 385-40, *Army Accidents Investigations and Reporting*.

1-17. Every worker has an absolute right and obligation to report accidents, incidents, and injuries to the appropriate authority. Harassment or intimidation of any person that is calculated to discourage or prevent such person from receiving proper medical treatment or from reporting an accident, incident, injury, or illness will not be permitted or tolerated. Further, holding personnel accountable, through reasonable disciplinary actions, for rules violations reinforces the serious nature of their actions.

RECORD KEEPING

1-18. The person in charge of any rail equipment involved in an accident and/or incident will retain all records relevant to the equipment. Records include, but are not limited to, event recorder download, DD Form 862 (Daily Inspection Worksheet for Diesel-Electric Locomotives and Locomotive Cranes*)*, records of air tests, any hazardous material records, radio logs, crew and passenger lists and statements, alcohol and drug tests, drawings or photographs made at the scene of the accident, articles of shipment, and other material which might be of assistance in investigating and determining the cause of the accident. The person(s) responsible for these records' custody shall make these records available upon request to the authorized safety investigator(s).

1-19. The information on the trains' data recorder will be saved as soon as possible for use by the accident investigator or any assigned accident investigation board. If the incident was so minor that no formal investigation is required at the time, the information on the data recorder will be saved before any rail equipment involved is put back into service, in the event that an investigation is ordered at some point in the future.

RAIL ACCIDENT INVESTIGATION

1-20. In addition to the normal procedures required for investigating Army accidents, as outlined in AR 385-10 and DA Pam 385-40, rail accidents require a copy of all data recorder information to be forwarded to the Defense Non-Tactical Generator and Rail Equipment Center, Aspen avenue, Building 1701, Hill Air Force Base, Utah 84056, defense switch network 777-5913, Commercial (801) 777-5913, within 48 hours of the accident.

1-21. All rail accidents and/or incidents may be investigated by the Transportation Branch Rail Safety Office (contact information above), to determine if possible safety violations were the cause of the accident/incident.

JOB BRIEFING

1-22. A job briefing is a meeting that takes place before performing a task that requires the coordination of two or more personnel, where all parties involved discuss the tasks to be performed, individual responsibilities, expectations, and any special instructions. The following information is discussed during a job briefing:

- Updates or changes to rules or policies.
- Job(s) to be done or move(s) to be made.
- Responsibility of each worker.
- Additional instructions due to an unusual situation.
- Specific reminders due to hazardous condition, unusual practices or processes.
- Method of protecting work performed on or near the track and the time when the protection will be in effect.

1-23. If necessary, conduct additional job briefings as the work progresses or as the situation changes.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

1-24. Personnel will wear government-approved personal protective equipment (PPE) when working in designated areas, performing designated duties, or when specified by a supervisor. Personnel entering designated areas or working near personnel wearing safety equipment will also wear the required safety equipment.

HEARING PROTECTION

1-25. Personnel will wear approved hearing protection devices in areas designated by signs or outstanding instructions, or as specified by a supervisor. In some cases, personnel are required to wear dual protection devices, which consist of ear plugs and ear muffs.

Service, Repair, And Mechanical Facilities

1-26. When working in or around the following service, repair, or mechanical areas, personnel will wear hearing protection under the following conditions:

- When working in open-sided or enclosed car and locomotive shop buildings.
- When working in open-sided or enclosed areas where cars are repaired or locomotives are fueled or serviced.
- When working close to or within areas where load testing, sand blasting, or grit blasting equipment is in operation.
- When working in or around mechanical facilities designated by a sign or instructions.

Moving or Standing Locomotives

1-27. When working within 100 feet of moving or standing locomotives, personnel will wear hearing protection under the following conditions:

- When on an idling locomotive and any engine room or air compressor doors are open, or when inside any engine compartment.
- When inside the cab of a moving or standing locomotive with any window or door open or partially open, and a whistle is blowing or required to be sounding, including whistles of approaching or passing trains.
- When at locations where a locomotive whistle is likely to blow, such as:
  - On the locomotive nose or platform.
  - On the ground within 100 feet in front or to the side of the locomotive.
  - On the side of a car within two car lengths of the locomotive.
  - At a crossing being flagged.

Exception. If personnel are in the cab with the doors and windows closed, hearing protection is not required.

Roadway or Work Equipment

1-28. Personnel will wear hearing protection when within 100 feet of operating roadway or work equipment.

Jet Blowers or Pile Drivers

1-29. Personnel will wear hearing protection when within 150 feet of operating jet blowers or pile drivers.

Other Equipment and Tools

1-30. Personnel will wear hearing protection when operating or within 15 feet of any of the following equipment or tools in operation:

- Air-operated tools.
- Air or air/hydraulic jack.
- Welding or cutting equipment (oxy-fuel, gas, or electric).
- Abrasive wheel grinder or sander (pedestal, bench, or portable).
- Air lance or nozzle (for blowing compressed air).
- Chain saw.
- Nail gun (air or power-operated).
- Power saw, planer, router, or joiner.
- Other equipment or tools powered by:
  - Air.
  - Combustion engine.
  - Electric.
  - Hydraulic.
  - Pneumatic.
  - Steam.

GLOVES

1-31. All trainmen, enginemen, switchmen, brakemen, carmen, maintenance of way (MOW) or other personnel required to operate in, around, under, or on rail equipment or tracks will wear appropriate leather work gloves.

1-32. Personnel will wear appropriate gloves at all times while working in glove-designated areas and when handling materials that may injure the hands (for example, loading timber and working with chains and pulleys, chemicals, and diesel fuel).

HARD HATS

1-33. Hard hats will be worn at all locomotive, car and MOW facilities and work sites, where active rail car loading is being accomplished, and in other designated hard hat areas as specified by the supervisor.

1-34. Hard hats are not required in:

- Office areas and lunch rooms.
- Vehicles or equipment that provides overhead protection against falling objects.
- Areas exempted with documentation by the appropriate supervisor.
- For train, yard, and engine personnel except when performing work or service with MOW, at derailments and overhead work is being performed.

1-35. Only liners that do not interfere with fit and function of the hardhat can be worn. Baseball or similar type caps will not be worn under hardhats. Altering of hardhats or hardhat suspensions is prohibited. Hardhats will not be worn backwards, unless attachments being used are designed for such use and suspension is reversed. Bump caps will not be used to fulfill hardhat requirements.

EYE PROTECTION

1-36. Personnel will wear installation approved eye protection in all designated areas or when specified by a department, except when personnel are in a closed: motor vehicle, locomotive cab, lunch room, or office building. Types of eye protection and areas that require them include:

- Safety Glasses. Personnel will wear spectacle or wrap around type, 100 percent safety glasses (in accordance with Occupational Safety and Health Administration standards) when on duty at locomotive or car repair and servicing facilities and MOW work sites, shops, and facilities. Personnel requiring corrective lenses will wear either installation approved prescription safety glasses, shatter-proof prescription glasses with side shields or coverall type safety goggles. When performing procedures specified in outstanding instructions, personnel will wear face shields and coverall type safety goggles or safety glasses with side shields.

- Other Glasses. Train, engine, yard, and all other personnel on duty and in an area where rail operations may occur will wear prescription glasses with side shields or nonprescription safety glasses.
- Eye Protection in Hazardous Areas. Personnel will wear eye protection when working in or near areas designated as hazardous to eyes (for example, derailment cleanup areas and areas where wrecking crews or maintenance gangs are performing duties that may be hazardous to eye).
- Dark Lenses. The wearing of dark lenses under insufficient lighting conditions is prohibited, except when engaged in an operation requiring dark lenses.
- Contact Lenses. Personnel will not wear contact lenses when working in areas where welding or chemicals may cause a splash, mist, or vapor hazard. Under other conditions, personnel may wear contact lenses with Occupational Safety and Health Administration approved wrap around safety glasses.

1-37. Additional eye protection requirements include:

- Personnel will use face shields in addition to eye goggles when performing certain designated operations, such as handling hazardous chemicals (such as, acids and caustics) and participating in abrasive wheel grinding.
- Personnel will not face or watch electric or oxy-fuel welding or cutting operations unless wearing approved eye protection.

PROPER ATTIRE

1-38. Personnel will wear clothing that allows them to perform their duties efficiently and safely. Clothing will not interfere with vision, hearing and free use of hands and feet.

1-39. Do not wear excessively loose or ragged clothing, neckties, finger rings, or other jewelry while operating or working with machinery. Hair, including beards, will be worn in a manner to permit safe performance of duties.

1-40. Personnel should wear a suitable shirt that provides protection from sun, insects, abrasions or scratches. Shirts will have at least quarter-length sleeves and cover the back, shoulders, chest and abdomen. Shirts will not be unbuttoned, torn or baggy. Anyone working around equipment or moving machinery in which a shirt might become entangled will have their shirt tails tucked into their trousers. Shirts should be loose enough to allow freedom of movement, but not too loose so that they will snag easily or catch on cars, engines, tools, machinery or other equipment. When working outside and/or around cars, engines, equipment or machinery, wear trousers, which cover the legs. Short trousers (cut-offs or shorts) are prohibited and will not be worn while on duty.

ENHANCED-VISIBILITY WORK WEAR

1-41. Enhanced-visibility work wear is to be worn at all times when working in, on, around rail equipment, tracks, active mechanical shops, at derailment sites, grade crossings, on work trains, or at intermodal facilities. Acceptable enhanced visibility work wear is defined as a vest, shirt, jacket, sweatshirt, raincoat, radio waist belt/harness, or hard hat/cap with bright colored, high-visibility striping or markings incorporated into the clothing item.

1-42. Enhanced visibility work wear when worn at night or during periods of reduced visibility must have reflective material striping or markings incorporated into the clothing item. Roadway workers working on or near track, will wear at least one item of enhanced visibility work wear when:

- Performing highway flagging operations.
- Setting on and setting off hi-rail vehicles at grade crossings.
- Working around mobile equipment (off-track) unless separated from the equipment by a natural or manmade barrier.

APPROPRIATE FOOTWEAR

1-43. Personnel who routinely work in the field, on uneven terrain, on or near tracks, on cars, engines, or other rail equipment will wear "lace-up" footwear that covers their ankles, approximately six inches or more in height, and has a defined heel. A "defined heel" means that the back of the heel is at an approximate right angle from the sole of the shoe and from the ground when standing. The front of the heel will not be at an angle of less than 45 degrees from the sole of the shoe to the ground.

1-44. Footwear with heels commonly called "riding heels" are not appropriate footwear and do not satisfy this requirement.

1-45. Personnel working on bridges are required to wear safety steel-toe footwear that conforms to the American National Standards Institute and Federal Railroad Administration footwear requirements.

1-46. Unless personnel work exclusively in the office, they will not wear:

- Thin-soled or high heeled shoes.
- Sandals.
- Athletic (sports) or similar type shoes.

RESPIRATORS

1-47. When conditions require wearing a respirator, personnel will receive a proper fit test and instructions, including demonstrations and practice on how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Respirators will provide a good face seal. Respirator users will not have facial hair that protrudes under the respirator seal or interferes with respirator valve functions. When respirators are required, there must be a respiratory protection program that meets all elements of the required program in accordance with AR 11-34, The Army Respiratory Protection Program and Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.134.

WHEN PPE IS NOT REQUIRED

1-48. PPE is not required:

- When performing office tasks in office areas.
- Inside highway or hi-rail vehicles when windows are completely closed.
- Inside passenger-carrying rail cars.

UNAUTHORIZED PERSONNEL

1-49. If an unauthorized person or persons are found on installation property, they will be immediately told to leave the premises, unless confronting the person(s) would be unsafe. If the person(s) refuse to leave, or if confronting the person(s) would be unsafe, notify the designated supervisor and request assistance from the appropriate authorities immediately.

SEVERE WEATHER PRECAUTIONS

1-50. When there is a storm, an indication of a storm, high water, or any other inclement weather situation that may cause an unsafe condition, the train dispatcher must issue a slowdown or restricted speed order.

1-51. After severe storms, a designated MOW worker must inspect areas suspected of, or having a history of problems before train operations may commence.

1-52. When a train is approaching a MOW worker patrolling track, the patroller must:

- Stop the train and notify the engineer that conditions ahead are unknown.
- Patrol the track ahead of train movement through the storm area.

1-53. Personnel will take precautions to avoid slipping on snow, ice, wet spots, or other hazards caused by inclement weather. When hazards underfoot conditions exist:

- Keep your hands free while walking, and keep them out of pockets for balance.

- Take short, deliberate steps with toes pointed outward.
- When stepping over objects, such as rails, be sure your front foot is flat before moving your rear foot.

Chapter 2

Railway Equipment Precautions

Great care must be given while working around railway equipment. This chapter provides rules for personnel working on, in, or around different kinds of railway equipment.

GENERAL PRECAUTIONS

2-1. When personnel are near passing trains or equipment, they will:

- Move away from the track to avoid being struck by car doors or protruding or falling articles.
- Stand clear of all tracks when trains are approaching or passing in either direction.
- Not stand on one track while trains are passing on an adjacent track.
- Not rely on other personnel to notify them of an approaching train, engine, or other equipment unless the other worker's duties include providing warnings.

2-2. Personnel will maintain a safe distance from equipment and not:

- Foul (see paragraph 3-1 on page 3-1) tracks closely in front of, or behind equipment, or close to the end of equipment.
- Go between equipment if the opening is less than 50 feet.
- Cross track in front of or behind standing equipment unless there is at least 20 feet between the worker and the equipment.

2-3. Personnel will not get on, cross through, crawl, sit, or lie under cars, locomotives, or other equipment, regardless of whether they are standing or moving, unless duties require and proper protection is provided.

2-4. Personnel will not give a signal to move an engine or car if he or she is between two cars, between two engines, or between a car and an engine.

2-5. Personnel will visually inspect any equipment they are working with, on, or in. They will not use defective safety appliances installed on equipment, such as loose, damaged or missing hand holds, ladders, grab irons, sill steps, or crossover platforms. When a defective safety appliance is observed, warn other personnel and report the defect to the supervisor.

MOVING EQUIPMENT

2-6. Personnel will not break seals, remove hasps, open or close freight car doors, or perform other work while cars are in motion.

2-7. Personnel will not ride on moving equipment unless their duties require or they have proper authority. Do not get on or off moving equipment except in emergency. When getting off equipment in emergencies, personnel will observe ground conditions to ensure safe footing. Do not alight between the rails, on tie ends, or immediately ahead of switches. When alighting, make sure you are clear of the engine or car. When getting off moving equipment (in emergencies only), the trailing foot (foot opposite from the direction of movement) will strike the ground first, directing you away from the equipment.

2-8. Personnel will avoid riding on tank cars. If necessary, use extreme caution by positioning themselves on the outer edge of the crossover platform and maintain a three-point contact. Three-point contact consists of both feet and one hand or both hands and one foot. Do not ride on the side ladder of a tank car.

2-9. Personnel will not ride on flat cars or bulkhead flat cars, with single vertical handholds or rail cars equipped with in-deck handholds. Personnel may ride on flat cars with dual vertical handholds (ladder

type). Do not get on or off a flat car while it is moving. Personnel will not ride on the deck of a loaded flatcar. Personnel may ride on the deck of an empty flat car by: facing and looking in direction of movement, sitting or kneeling in the center of the car.

2-10. Do not ride on loaded bulkhead flat cars. When riding empty bulkhead flat cars, position yourself on the side of the deck behind the bulkhead, using provided safety appliances. Maintain a three-point contact with a firm grip on the grab iron and face the direction of movement.

2-11. Do not ride on cranes, ditchers, other machines, or rail cars on which machines are mounted.

2-12. Personnel will not ride, stand, or place any part of their body on or between the side or the end of a car and lumber, pipe, or other lading that could shift. Personnel will not be in a position where they can be struck by improperly or non-secured drop ends that may fall inward. Personnel will not use the end gate of a gondola for a hand hold.

2-13. Personnel will not go out on a ledge, running board, or any other outside part of a moving locomotive, crane, or any other moving roadway equipment.

2-14. When riding on cars, engines, or other equipment, personnel will ride on designated steps, ladders, or platforms. When riding on the side of an engine, car, or other equipment, face the direction of the movement and maintain a three-point contact. Do not ride on the ends of moving cars except when operating hand brakes or when side clearances are too close. Do not sit with feet projected over the sides or ends of cars or equipment. When moving over a street or highway crossing, do not ride on sill step, lower rung or ladders, or engine steps. Position yourself high enough on the side of the equipment so not to be struck by a highway vehicle that does not stop at a highway grade crossing. Do not ride on the side of a car or engine that is next to a structure. Do not position yourself or knowingly allow others to position themselves between a structure and moving car(s) or engine(s) when clearance is minimal and debris (such as snow, ice, water, or mud) prevents clear observation of the track condition.

STANDING EQUIPMENT

2-15. After giving a signal to stop equipment movement, personnel will keep clear until all equipment has come to a complete stop.

2-16. After equipment has come to a complete stop, use proper wheel chocks in all cases where required. When chocking cars:

- Wait until movement stops and the slack adjusts before placing the chock.
- Place the chock while standing to the side of the equipment.
- Keep fingers and hands clear of the wheel tread, top of the rail, and other pinch points.
- Use only a sound wooden chock, metal chock or chock made from plastic or composite material designed for chocking cars; do not use a track spike.
- Do not chock moving rail equipment, except in an emergency.

MOUNTING OR DISMOUNTING STANDING EQUIPMENT

2-17. Personnel will follow these precautions when getting on or off standing equipment:

- Ensure equipment is fully stopped before mounting or dismounting.
- Personnel will not place feet on knuckles, the uncoupling lever, drawbar assembly, or any cushioning drawbar device.
- Personnel will not jump from equipment.
- Maintain a three-point contact.
- Always use the provided safety appliances (sill step, side ladders, handholds) for getting on and off equipment.
- Guard against injury by looking out for unsafe footing, obstructions, or equipment moving on other tracks.

- Keep hands free of all objects that may hinder a secure handhold. Always maintain a secure grip on the handholds on engine platforms or while using appliances on the equipment. Be prepared for sudden movements.
- When practical, get on or off equipment on the side away from the main track or close clearances.
- Face the equipment and use the side ladder or steps, maintaining a three-point contact. Feet will be securely placed.
- Observe ground conditions to ensure safe footing when stepping off equipment.
- Use extreme care during wet, muddy, snowy, or icy conditions and at night in unlit areas.
- When getting off equipment, do not step between rails, on tie ends or immediately ahead of switches. Make sure you are clear of the engine or cars.
- Do not step or jump from one freight car to another, moving or standing.

CROSSING STANDING EQUIPMENT

2-18. When duties require personnel to cross through a standing train or cut of cars, they will:

- Request three-step protection from the engineer.
- Choose equipment carefully, using only cars with ends equipped with a crossover platform and hand holds. Do not loiter on crossover platforms.
- Maintain a firm hand hold on railings and grab irons, while remaining aware of your position.
- Keep hands and feet free of objects. Do not step or place hands or feet on coupler, coupler lever or sliding sill.
- Be prepared for sudden movement at any moment, maintaining a three-point contact while walking across the end of the car.
- As you detrain on the opposite side, be alert for movement on adjacent tracks.

2-19. While within the limits of a designated mechanical facility, when crossing between standing equipment that is not under blue flag protection (see Chapter 4 for Blue Flag Protection), personnel may cross within 20 feet of standing equipment, provided:

- Speed limit for all equipment on the track is 5 miles per hour (MPH) or less.
- Check for movement is made prior to crossing track.
- Distance is sufficient to allow safe passage should there be unexpected movement.
- Designated walkways are used, when available.

THREE STEP PROTECTION

2-20. The following three step protection will be followed whenever there is a need for a crew member to step between standing equipment. The locomotive engineer will be advised and then provide the following actions:

- Center the Reverser.
- Apply the Air brake(s).
- Generator Field Switch to the OFF position.

2-21. The engineer will ACKNOWLEDGE that all of these steps have been performed. The crewmember requesting the protection will not enter the area between standing equipment unless the acknowledgement has been received. The crewmember requesting the three step will notify the engineer to release from three step. Once the three-step protection has been removed, the crewmember will request the protection again if he should need to re-enter the area between standing equipment. Three step protection applies only to the person requesting the protection.

2-22. Personnel will know that protection is provided before mounting standing equipment to make inspections or records, apply or remove placards, or perform any other duties that require them to climb on or around cars or locomotives.

ENGINES

2-23. While working on or about engines, personnel will:

- Know that all workmen are in a safe position before starting an engine.
- Keep safety guards in position and fastened.
- Keep engine room, cab, running boards, catwalks, steps, and grab irons clean and free from oil, grease, rags, debris, obstructions, snow, ice, and sand.
- Place material or equipment on engines where it will not create a hazard while being transported.
- Open the control switch and main battery switch, remove the starting fuse, and block the contactors open before repairing switches, contactors, or other high - voltage equipment. Place a sign or label identifying the reason why the battery switch is blocked open and who to contact before placing back in service.

2-24. While working on or about engines, personnel will not:

- Use metal-cased lights when working on electrical equipment.
- Put face or hands near the main generator or any high voltage equipment while it is working under load.
- Add oil to the crankcase while the engine is running.
- Smoke or have an open flame in the engine room.
- Work on electrical equipment while wearing a ring or wristwatch.
- Pull fuses while they are under load.
- Open ground relay protective knife switches when ground relay is tripping.
- Manually operate high-voltage contactors while the engine is in motion, even though the power plant supplying that particular cabinet is shut down.
- Use hands, feet or improvised objects to close or open contacts while under electrical load.
- Open high-voltage cabinet when the engine is running, other than idling.

***Exception*.** This does not apply to mechanical force for inspection purposes.

OPERATING HAND BRAKES

2-25. Personnel operating hand brakes will inspect the pawl, ratchet, and brake wheel for defects. Personnel will have firm footing and hand hold to prevent slipping, falling, or injuries (such as sprains or strains). While applying or releasing vertical type hand brakes on box cars, personnel will:

- Not use end ladders to go up or down the car.
- Not step directly from the side ladder to the brake step, nor from the brake step to the side ladder without first placing feet firmly on the end ladder tread.
- Not brace any part of their body against another car.
- Have one hand securely grasping the hand hold while the other hand is operating the brake.
- Place the left foot on the end ladder tread and the right foot on the brake platform.
- Obtain firm footing and never place feet in a wheel or on a hand brake lever or pawl.
- Not place stress on hand brakes at the moment when coupling impact may move the car.
- Not hold brake tension on a moving car by hand without using a pawl and ratchet.
- Use caution when releasing hand brakes.
- Obtain help when necessary.
- Avoid being struck by the brake wheel when the pawl is released.
- Avoid having their clothing or hand caught in spinning brake wheel.

2-26. While applying or releasing vertical type hand brakes on flat cars, personnel will:

- Not brace any part of their body against another car.
- Ascend the side ladder on the car.

- Place the left foot on the side ladder tread and the right foot on the brake platform.
- Have one hand securely grasping the hand hold while the other hand is operating the brake.
- Obtain firm footing and never place feet in a wheel or on a hand brake lever or pawl.
- Not place stress on hand brakes at the moment when coupling impact may move the car.
- Not hold brake tension on a moving car by hand without using a pawl and ratchet.
- Use caution when releasing hand brakes.
- Obtain help when necessary.
- Avoid being struck by the brake wheel when the pawl is released.
- Avoid having their clothing or hand caught in spinning brake wheel.

COUPLING AND UNCOUPLING

2-27. Personnel will not go between or in front of a moving engine or car to uncouple, open, close, or arrange knuckles or couplers; to manipulate other appliances; or for any other reason.

2-28. Never place any part of the body on or between a coupler and car's end sill, even if the car is equipped with standard draft gear arrangements, sliding sill arrangements, or an end-of-car cushioning device. Personnel near cars equipped with movable center sills will take precautions to avoid injury in case of movement, even though the car is standing.

ADJUSTING COUPLERS, KNUCKLES, OR LOCK PINS

2-29. Before adjusting couplers, knuckles, or lock pins on cars or engines, personnel will make sure all movement has ceased and that the cars are spaced apart by at least 50 feet, or further if necessary. Always guard against unexpected car movement. Never use feet to adjust couplers and knuckles.

2-30. Before adjusting a coupler, personnel will make sure that the coupler will move without applying excessive force. If not, obtain assistance, which may include using a coupler alignment strap. To adjust a mismatched coupler without using a device, follow this procedure:

- Stop the movement.
- Allow at least 50 feet of working room between the equipment and obtain positive confirmation of protection from train movement in all directions.
- Wait for the movement to stop completely and for the slack to adjust and settle. (Be alert for unexpected movements from liquids sloshing in tank cars).
- Check for other equipment movements on the same track.

2-31. Adjust the coupler as follows:

- Establish good footing and hand holds to avoid stumbling, and keep fingers and hands clear of pinch points.
- Make sure the knuckle is secured. (Keep your feet clear of the area beneath the knuckle unless the knuckle is secured.)
- Stand to the side of the knuckle and lean against it. Do not lift.
- Step clear of the equipment (without fouling the adjacent track), then signal the person controlling the engine to proceed with the coupling.

2-32. Follow this procedure when using a coupler alignment strap:

- If necessary, set a sufficient number of hand brakes to secure the stationary car(s).
- Separate misaligned couplers by at least 50 feet.
- Keeping one foot outside the rail, close the knuckle on the stationary car and place one end of the strap on top of the coupler and stand clear.
- Move the locomotive or other cars toward the stationary car(s) and stop movement within 3 feet.
- After movement has stopped, keeping one foot outside the rail, place the other end of the strap around the second knuckle and again stand clear.

- Slowly separate the cars once again to remove slack from the strap and align the couplers; quickly stop the movement when the alignment is complete to avoid breaking the strap.
- If necessary, provide for slack in the strap and, while keeping one foot outside the rail, remove the strap. Stand clear of the movement and couple cars.
- Release any hand brakes set for this procedure.

USING AN UNCOUPLING LEVER

2-33. Always use an uncoupling lever to uncouple cars. Never operate an uncoupling lever on a car or engine while riding on another car or engine. Never operate an uncoupling lever with your foot.

2-34. Use the uncoupling lever to open knuckles when possible. If personnel will use hands to open the knuckle on standing equipment, keep both feet from between the rails if possible. Make sure the knuckle pin is in place before putting your hand on the knuckle.

REPLACING A COUPLER KNUCKLE

2-35. When replacing a coupler knuckle, follow this procedure:

- Separate the equipment by at least 50 feet.
- Make sure the equipment is stopped and secured.
- Communicate with the engineer and other crew members to understand the work.
- Make sure the knuckle pin is in place and open the knuckle while keeping feet clear of the area under the coupler.
- Remove the pin and set it within easy reach.
- Remove the knuckle from the coupler.
- Dispose of the knuckle, holding it as close to the body as possible, where it will not become a tripping hazard.
- Holding the uncoupling lever up, move the knuckle thrower back into the coupler recess as far as it will go.
- Obtain the correct knuckle type.
- Lift the knuckle carefully and place it into the coupler pocket.
- Insert the knuckle pin into the pin hole, close the knuckle, and make sure it locks properly.

COUPLING AND UNCOUPLING BRAKE PIPES OR AIR HOSES

2-36. Personnel will close both angle cocks and valves before manually uncoupling brake pipe or air hoses. Avoid being struck or burned when coupling or uncoupling air, auxiliary air hoses. When required to open an angle cock to exhaust air or reduce brake pipe pressure:

- Firmly grip the air hose near the glad-hand.
- Place the air hose against your thigh.
- Turn your face away and open the angle cock slowly.
- Do not turn the angle cock on moving equipment.

2-37. Personnel will not try to couple air hoses unless:

- The equipment has stopped.
- Crewmember has requested three step protection.
- The engineer has acknowledged.

2-38. Personnel handling air hoses will anticipate unexpected movement and place one foot between the rails and the other foot outside of the rail for balance.

HOISTING EQUIPMENT

2-39. Only authorized personnel are permitted to operate cranes, hoists, and mechanical lifting/pulling devices. Before authority is granted, personnel will be trained in the rules and procedures regarding the

equipment's operation and use. When rules for operation and care are furnished by the manufacturer, they will be observed.

EQUIPMENT INSPECTION

2-40. All hoisting equipment will be inspected daily before use and periodically as required in accordance with prescribed documentation or checklists provided by equipment manufacturers or local command policies. If defects are found, they will be corrected or equipment will be removed from service. Maintain a record of inspections on equipment and have records available upon request. Operators will be familiar with the safe lifting capacity, at minimum and maximum radius and with or without outriggers, as specified on the placard. The operator will not handle loads that exceed the loads specified at various radii.

2-41. Personnel using chain and wire rope lifting devices will inspect the device daily for defects that might make them unsafe for service. Personnel will immediately report any defects to the supervisor in charge. Correct any defects before using the lifting devices again. If using chains continuously and operating them over sheaves or pulley, lubricate the chains as often as possible. Conditions such as the following are reason for replacement:

- Wear, nicks, cracks, breaks, gouges, bends and weld splatter.
- Elongation: Will not exceed 15%.
- Discoloration from excessive temperature.
- Deformed or bent throat opening of hooks.
- Chain links and attachment do not hinge freely to adjacent links.
- Latches on hooks, if present, do not hinge freely, seat properly or are permanently distorted
- Missing or unreadable sling identification tag.

2-42. Wire ropes, lifting chains, ropes, slings and capacities shall be used, inspected, tested and marked in accordance with TB 43-0142, *Safety Inspection and Testing of Lifting Devices.*

2-43. Machines with live booms, such as locomotive cranes or draglines, will lower the boom for inspections.

2-44. When working with or around equipment or material being hosted by a crane, rope, wire rope (or cable), or other tackle, personnel will:

- Use only cranes with valid inspections/load tests.
- Use only wire rope or slings with valid inspection tags.
- Not go under the load or boom.
- Maintain a safe distance to avoid being hit by flying parts if the equipment breaks or the magnetic crane fails.
- Not step over or straddle wire ropes that might be tightened at any moment.

HOISTING PERSONNEL

2-45. Do not use cranes and derricks to raise or lower personnel or any personnel platforms. Only raise and lower personnel in an approved aerial basket designed for that purpose.

HOISTING LOADS

2-46. Operators will not attempt to drag the load from outside of the boom radius.

2-47. When any unusually heavy pull, drag, or lift is started, personnel working with or near the machine will be a sufficient distance away from the machine to prevent being injured by failing rope, chain, wire rope, sling, or tackle.

2-48. When handling heavy loads using chains or slings, remove buckets and magnets from machines.

2-49. When equipment is being handled by chains, wire ropes, care will be taken to avoid injury in case of breakage. Loads will not be suspended from booms unless the work requires it. In such cases, keep the load

secured and as close to the ground as possible. Loads being transported from one point to another will be landed on a flat car or other conveyance to release the weight from the boom during transit.

2-50. Keep chains free of twists or kinks, and make sure grab hooks fit the chain and are placed on the hitch so that no side strain occurs during the lift. Do not use “patent links”, “repair links”, or “figure eight” links when repairing lifting chains. Do not use welding to repair chain links, grab hooks, sling hooks, or rings.

2-51. Personnel will stay clear of loads being suspended and carried and will not ride on loads or lifting tackle. Personnel will not be under the crane boom, dragline, or similar machine when it is lifting or suspending a load.

2-52. Do not carry loads suspended from booms unless the work requires it. In such cases, keep the load secured and as close to the ground as possible. Loads being transported from one point to another will be landed on a flat car or other conveyance to release the weight from the boom during transit.

2-53. The operator will not leave the machine controls during the lift nor leave the load suspended when absent from the machine. The operator will never leave the machine with the master clutch engaged.

2-54. The operator will raise or lower the load steadily and gradually and not drop or jerk the load or tackle.

2-55. During a lift, the helper or supervisor in charge will act as the signalman or assign a competent ground man to the machine. When the machine is near pole lines, structures, or workmen, the ground man will direct each machine movement by giving signals to the operator to ensure safe work. Both the signalman and operator should know all approved signals and should use only those signals. Anyone can give emergency stop signals. The operator will immediately recognize and act upon the signal. See figure 7-1 on page 7-3.

2-56. The ground man is responsible for directing and safe-guarding all machine movements and will always be visible to the operator. Before signaling boom or machine movement, the ground man will see that the load, cab, or boom will not come in contact with nearby wires, structures, or other objects and persons. However, the machine operator and supervisor are still jointly responsible for safe operation.

2-57. The ground man and those in the vicinity will:

- Position themselves where they cannot be caught between the load being handled and an obstruction.
- Stay clear of loads being suspended.
- Not be under the crane boom or similar machine when it is lifting or suspending a load.
- Not stand near or in line with a wire rope, rope or chain under tension or one that might be tightened at any moment.
- Not walk or stand in the path of a load being handled by a crane, hoist or wrecker.

2-58. When equipment with booms, leads, wings, or other attachments is being handled in a work train or wreck train, the operator will remain on the machine during all movements of the train unless the machine has been securely blocked to protect against swinging or other movements that may cause an accident. Properly block machines mounted on top of or working from flat cars to prevent the machine from moving when cars are being switched or moved. Do not block the machine when it is being used and is under the control of an operator. For more safety guidance on wreck trains, see chapter 7.

2-59. When trains are passing a work area on adjacent tracks, operators will make sure:

- They do not operate pile drivers, cranes, derricks, roadway machines, or work equipment.
- Swing brakes on machines (so equipped) are set.
- Tongs, buckets, loads, or lines come to rest on the ground or car.

Exception. Machines or equipment specifically designated by the officer in charge of the work gang may continue to operate while trains are passing on an adjacent track only after direct coordination and an understanding of movements has been agreed upon between the officer in charge and train crew.

Chapter 3

Railway Track and Yard Precautions

Maintaining safety on or about railway equipment is only half the battle. Safety must also be maintained while working on or around the railway trackage and within the rail yards. Foremen or others in charge of personnel working on or about the tracks will require the personnel to be alert and watchful and to keep out of danger.

TRACK FOULING

3-1. Track fouling is any infringement on track clearances or accumulation of material on a track to the detriment of the track's function. Personnel will avoid fouling a track except when necessary to perform their duties. Before fouling a track, they will determine that on-track safety is being provided. In any other situation, workers will not leave machines, tools, or other objects near tracks where:

- They could be struck by trains.
- They would create a close clearance.
- People might stumble over them.

3-2. Do not leave cars or engines standing where they will foul adjacent tracks or cause injury to others riding on the side of a car or engine. When machines, tools, material or other equipment may foul adjacent tracks, notify the proper authority immediately. They will arrange to restrict movement on the affected track(s) until the work is completed and the fouling hazard is eliminated.

CROSSING TRACK

3-3. Except when duties require, personnel will not cross tracks at a location other than specified crossings.

3-4. Do not stand, sit, or walk between the rails of a track unless required by assigned duties. When standing, walking, or working between or near tracks, personnel will keep a careful lookout for trains, locomotives, cars or other moving equipment and expect movement at any time, on any track, in either direction.

3-5. Personnel will look in both directions before crossing or stepping into the clearance of a track. The clearance of a track is the space immediately around and between the rails of the track that would cause the track to be fouled if material was collected there. Personnel will look in both directions and know the way is clear when walking out of doorways leading across tracks or around corners or obstructions. Personnel will step over, and not on top of the rail, frog, switches, or guardrails when walking near or crossing tracks.

WARNING

Do not step on rails. Rails can be extremely slippery, especially during wet conditions, and severe injury may result from any falls.

3-6. Personnel will walk straight across tracks when possible. Keep a careful lookout in both directions for moving equipment and do not rely on hearing the approach of a train or equipment.

3-7. At track crossings on a U.S. installation that the installation commander determines are hazardous beyond the current markings or protection (R15 series traffic control signs, R15 signs with lights, or R15

signs with lights and gates), only law enforcement personnel shall perform traffic control duties. When necessary to flag crossings, do not allow vehicles to proceed over grade crossing unless it is properly flagged. The worker conducting the flagging will be the only one giving directions.

3-8. Bells and whistles will be used before occupying grade crossings.

BROKEN RAIL

3-9. Trains, engines, and on-track equipment will not pass over broken rail. If a track defect is discovered and passing over the broken rail cannot be avoided, equipment will not proceed until a qualified MOW foreman determines it is safe and can watch the movement. The MOW foreman will specify the speed to move the equipment over the rail, but not to exceed 5 MPH. The MOW foreman will be in a position in which he can observe the train movement, condition of track and signal the equipment to stop if necessary. When broken rails are located on a curve, do not permit a train to pass over the break unless the break has been secured on both sides of the rail with joint bars or approved clamps. When broken rails are located on straight track, stop the train at least 200 feet before the broken rail and notify the engineer when it is safe for train movement.

3-10. When rail is under tension or compression, close observation will be made to determine whether rail is too tight to safely perform work:

- At point where there has been a derailment.
- In periods of high or low temperature.
- At location where rail is kinked or damaged.
- Before beginning to renew rail or to remove part of fastenings from one or more rails.

SWITCH AND DERAILER USE

3-11. All personnel will be on the lookout for derailers on all sidings or other tracks.

3-12. Switches have different physical operating characteristics, and personnel will be familiar with the procedures for properly lining each type of switch. Personnel will follow these general rules when handling switches and derailers:

- Always remember that the ease with which a switch operates will change depending on weather, temperature, maintenance, and other operating conditions.
- Before lining the switch, visually inspect it, and make sure it is not damaged, locked, or spiked and that points are not fouled by ballast, ice, snow, or other material.
- While handling a switch or derailer, keep hands and feet clear to avoid being caught or struck by the switch lever handle or ball.

3-13. Switch locks are installed on certain track switches at the base or the pedestal of the rail. Should a switch lock not work properly, do not use hand, feet, or other objects to release the mechanism. Rather, simply report the condition to the proper authority.

3-14. Unauthorized persons will not unlock or handle switches.

3-15. When a switch is to be operated by hand, equipment will not pass the following limits:

- Trailing point movement: Stop movement not less than 50 feet from switch points to prevent tension being placed on switch points and switch handle.
- Facing point movement: Stop movement a sufficient distance from the switch points to prevent binding of switch points.

3-16. If any switch is found hard to operate, defective, or in need of maintenance, do the following:

- Report the switch to the proper authority, including its exact location and problem to determine if the switch in question should be taken out of service until repairs can be made.
- Properly label the defective switch with a warning tag describing the defect.

3-17. The switch will remain out of service until an inspection and repairs can be completed.

CAUTION

The switch handle may be under compression and may swing up or around when released from the keeper slot.

3-18. Spike and apply the "Switch Out of Service" tag to any inoperable switch or switch requiring maintenance.

CAUTION

Do not rely solely on tags for identifying spiked switches. Report the switches to a supervisor.

3-19. Before operating a switch, take a firm stance and be alert for conditions that might cause loss of good footing. Place one foot slightly in front of the other. Use either the two-hand or the mast-support method to lift the lever handle out of the base.

3-20. When using the two-hand method:

- Stand facing the switch stand and place both hands near the end of the handle.
- Lift up the switch handle, keeping your back as straight as possible and your legs bent.
- After lifting the handle (by either method), keep your body clear of handle movement.

3-21. When using the mast-support method:

- Stand beside the handle away from the handle movement.
- Place one hand on the mast and the other hand on the end of the handle.
- Stand parallel to the handle and slowly pull the handle through the line of travel.
- After completing the above move, stand as close to the handle as possible, leaving room for the handle to clear the body, and push the handle down.
- Once the handle is down, secure it with a lock or hook, whichever applies.

3-22. Never use your feet to operate a switch or to secure the handle.

3-23. Before operating a ground-throw switch, take a firm stance and be alert for conditions that might cause loss of footing. Then, do the following:

- Stand parallel to handle movement, with your stance centered over the lever arm handle; if the switch is equipped with a foot latch, keep your foot on the latch until you move the lever toward the one-half position.
- Stand as close as possible to the lever arm, placing one hand on your knee or on top of the switch staff for support.
- Place your other hand on the handle and lift up slowly and smoothly.
- Once the lever has traveled at least to the straight up position, reposition your feet and hands so that lever movement may be completed with a pushing motion.
- If necessary, complete the last six inches of movement by placing one foot near the end of the lever and stepping down until the lever arm is latched.

CAUTION

Avoid using your feet to push the lever arm down during wet, ice, or snow conditions, or if oil, grease, or other such contaminants are present.

3-24. Do not manually operate a spring switch when springs are compressed by the wheels, except in an emergency. In an emergency, personnel will keep clear of the handle when it is released.

3-25. Avoid contacting switch heaters or switch rails with any part of body when heaters are operating.

RAILWAY YARD PRECAUTIONS

3-26. Only authorized drivers are permitted to operate train yard vehicles. Compliance with all other vehicle rules from chapter 2 also apply to operating any kind of yard vehicle. Reckless or careless driving is prohibited.

3-27. When rules for operation and care are furnished by the manufacturer of a specific piece of equipment, they will be observed.

3-28. All vehicles will obey all speed limits in and around installation rail yards. Additional caution will be used when men or equipment are performing loading or unloading operations (see chapter 5).

3-29. Riders shall not be permitted on vehicles unless provided with a seat. Riding sidesaddle on yard vehicles is prohibited. Vehicles designed for one person will not be occupied by more than one person. Where provided, seat belts will be worn. Do not make adjustments or disable any speed limiting device.

3-30. All the safety rules regarding the crossing of tracks found earlier in this chapter are especially important to follow within a rail yard due to the high volume of moving and standing equipment confined in yards.

Chapter 4

Maintenance Precautions

There are special rules, precautions, and procedures to be followed in order to provide for a safe environment while conducting maintenance on both rail equipment, and the rail trackage itself. This chapter discusses these rules.

SAFETY TRAINING AND QUALIFICATION

4-1. On-track safety training will be conducted annually for all U.S. Army MOW personnel. Personnel who are required to provide protection for themselves or others will be GCOR and Army rail safety rules qualified annually. The personnel must be familiar with the installation's operations and track layout.

4-2. All MOW contractors working on or around tracks on the installation, who do not have the appropriate qualifications, or whose qualifications have lapsed, will be accompanied by a GCOR and Army rail safety rules qualified pilot. The pilot must be familiar with the installation's operations and track layout.

ON-TRACK SAFETY CHALLENGE PROCEDURE

4-3. Follow this procedure to resolve an on-track safety challenge:

- The MOW worker informs the foreman that he or she does not believe that the protection afforded workers complies with the on-track safety procedures.
- The foreman reviews the on-track safety procedures with the worker to verify that the proper procedures have been applied.
- If the worker making the challenge is still not satisfied that the on-track safety procedures comply with the MOW rules, the foreman contacts the next level supervisor.
- The next level supervisor reviews the on-track safety procedures and determines whether the on-track safety procedures are being properly applied.
  - If the next level supervisor determines that the on-track safety procedures are not being properly applied, the MOW foreman modifies the on-track safety procedures to ensure proper protection of personnel.
  - If the next level supervisor determines that on-track safety procedures are being properly applied, the challenging worker will perform the assigned duty. If the worker still refuses to perform the assigned duty, discipline may be assessed.

TOOLS AND MACHINERY

4-4. Give the operation of tools, equipment and machinery your full, undivided attention and wear required PPE. Use the correct tool or equipment for the task to be accomplished in accordance with the manufacturer's operating instructions. Improvised, altered or shop-made tools or equipment are prohibited unless approved through departmental procedures. Unauthorized use of tools, equipment and machinery is prohibited. Do not operate machinery equipped with safety guards unless the safety guard is in the proper place and in good condition. Portable power tools, machinery and equipment will not be operated without required safety guards.

TOOL INSPECTION

4-5. Personnel will be familiar with the manufacturers and/or the governmental inspection or operating procedures and specific safety rules for the tools and equipment to be used. Prior to use, tools and

equipment will be inspected for conditions that might cause the tool or equipment to fail. Conditions to inspect for include, but are not limited to:

- Broken, bent, frayed, deformed, cracked, loose, improperly wedged, or damaged handles (wooden handles will not be taped).
- Cracks, burrs or mushrooming.
- Excessive wear or cuts.
- Missing guards or parts.
- Exposure to excessive heat (as noted by difference in color or a warped shape) that could affect the hardness or temper of the equipment or tool.
- Damage from welding or cutting (as noted by cut marks, pits, or gouges).

TOOL PLACEMENT

4-6. Personnel will place tools in safe, secure locations and avoid doing the following:

- Placing objects where they are likely to fall or be knocked off.
- Placing tools or other objects on ladder rungs, hand holds, running boards, steps, uncoupling levers, or other safety appliances.
- Sharp edged tools should not be left lying on benches or in other places where they may cause injury.

4-7. Tools and other objects will not be left between rails when trains are approaching. If unable to move such items, immediately stop the train and report the hazard to the supervisor, or yardmaster. Arrange to restrict movement on the affected track(s) until the fouling hazard is eliminated.

SWINGING AND STRIKING TOOLS

4-8. When assisting or working near a worker using a swinging and striking tool, safely position yourself to avoid injury. When possible, be at least twice the length of the handle away from the tool. When striking nails and track spikes, ensure they are well started before striking a full blow. Do not stand on the same side as striker when holding a bar, cutter, or punch. Chip detectors, devices that utilize magnets incorporated into an electric circuit and are used to provide early warning of impending failure, will be used on track chisels, drift pins, or similar struck tools.

JACKS

4-9. Only approved jacks will be used to lift cars or locomotives. When necessary to jack a locomotive, car or other heavy equipment in order to remove trucks, wheels, or couplers, it will be determined that the jacks are of sufficient capacity. Only jacks and jack-stands that are properly inspected, tested, and marked shall be used. Follow these precautions when using jacks:

- Ensure that sufficient footing exists.
- Use sufficient sized blocking under the jack.
- Ensure that the jack is properly placed and level.
- Do not jack metal against metal, except when using track jacks or vehicle jacks.
- When mechanical, hydraulic, or air jacks are used, a piece of wood, a minimum of one-half inch and maximum of one inch thick, large enough to cover the jack head, will be inserted between the jack head and the load; special rubber pads, may be used when using stationary jacks.
- When in the process of jacking, do not crawl or place any part of your body under the load or in the line of applied force.
- Block or crib load incrementally as it is raised; position yourself in a manner that will keep you clear of the load, and will not allow your hands between the load and cribbing.

4-10. Follow these precautions when jacking up equipment:

- Chock the wheels to prevent movement, before jacking up the end of the car, locomotive, or locomotive crane; on stationary floor jacks, wheel blocking shall be placed immediately after the lift before other work commences.

- After jacking, place the stand or blocks under the load where there is sufficient strength to support the car, locomotive, or locomotive crane.
- Lower load until a portion of it rests on the stand or blocks; if self-locking mechanism or load holding rings are used, additional blocking is not required.
- Do not work on or go under equipment that is not protected by stands, blocks, load rings or positive locking.

4-11. When trucks are under car, use the proper tool to remove or position the center pin.

4-12. Mechanical track jacks or step jacks will not be used by locomotive or car departments. Track jacks will be inspected before using for:

- Cracked base.
- Broken pawl lever.
- Missing ratchet or operating lever pins.
- Any debris in the ratchet mechanism.

4-13. When operating a track jack, worker will:

- Not strike the jack with tools to force it under a load.
- Place the jack on an even and firm surface to prevent shifting or kicking out.
- Place lifting surface fully under the load.
- Use only a lining bar to operate a mechanical track jack.
- Not straddle, sit or stand on the lining bar.
- Keep clear of pinch points.
- Not operate the jacking lever with more than two people.

COMPRESSED AIR TOOLS AND EQUIPMENT

4-14. Personnel will only use compressed air equipment for authorized tasks. Air connections will be secured and will not be uncoupled without first closing the air valve and relieving line pressure, unless equipped with quick disconnect. Whip checks or hoses equipped with check valves in both ends will be used. Wire will not be used in air or hydraulic couplings in place of clip pins. Air lines used to blow dry or clean, shall be restricted to no more than 30 pounds per square inch. Personnel will not:

- Direct air jets toward any person.
- Apply an air nozzle or jet against the body of anyone.
- Use compressed air or gas for cleaning clothing.

WORKING ON OR ABOUT EQUIPMENT

4-15. After performing engine maintenance, make sure no tools are left lying near electrical or rotating equipment. Keep hands out of radiator shutters and all other equipment that engages automatically. Personnel will use caution when entering confined spaces such as locomotive engine compartments, maintenance pits, and tunnels.

4-16. When conducting electrical safety high potential, commonly abbreviated hipot, tests:

- Place warning signs at each corner and each entrance of the engine being tested.
- Before conducting the test, remove from the engine all portable lamp cords attached to a power source other than the engine.
- Do not touch the engine while standing on the ground.
- Do not touch the ground while standing on the engine.
- Keep unauthorized personnel away from the engine while performing the test.

4-17. While working on air brake rigging on engines, cars, or other equipment, personnel will cut out the air brakes until repairs are complete.

4-18. Before moving any equipment in a repair facility, all personnel involved in the move will thoroughly understand what will happen and what the hand signals mean. When repositioning cars with a car mover in response to hand signals:

- The person giving hand signals will always have visual contact with the operator of the car mover associated with the move.
- The operator will immediately stop the move if the person giving the hand signals disappears from view.
- Cars will be coupled to or chained to the car mover.

4-19. Do not move a defective car except to clear the track. Ensure that the movement will not cause any personal injury. Promptly report defective cars to the supervisor or yardmaster.

4-20. Personnel will label damaged or defective rail cars, engines, machines, switches, valves, or other apparatus with a danger sign, tag, or banner. The worker who placed the sign will remove it when safe to do so. Never operate rail cars, engines, machines, switches, valves, or other apparatus with attached danger signs, tags, or banners.

MAINTENANCE OF WAY (MOW)

4-21. ***Maintenance of way*** **(MOW) is the operations that railroads conduct to construct, maintain, repair, and in some cases, demolish and remove, railroad infrastructure, including the trackage itself, that results in the railroad running dependably and safely.**

MOW WORKERS

4-22. For the purpose of these rules, the terms MOW worker, contractor, and roadway worker, irrelevant of their status (military, Department of Defense employee, or contractor), are interchangeable and will be referred to only as MOW workers. Additionally, the terms supervisor, foreman and worker (in order of authority) will be used throughout this document and the terms apply to all government civilians and Soldiers performing MOW work.

4-23. MOW rules compliance is required from everyone including MOW workers, roadway workers, a lone worker, a gang of workers, or contractors (not necessarily associated with the railroad) that during the course of their duties on United States Army Material Command (USAMC) installations, or Installation Management Command (IMCOM) installations, work on or have equipment within six feet of the nearest rail (therefore fouling the track).

Note. A MOW worker or MOW machine is considered to be fouling a track when within six feet of the field side of a rail.

4-24. Because red is a universal stop signal on a railroad, MOW workers will not wear red clothing when their duties require them to be on or near tracks (GCOR Rule 1.8).

4-25. Each foreman is responsible for their gang and must:

- Supervise and can engage in all work performed by their gang.
- Ensure work does not:
  - Result in an unstable or unsafe track condition.
  - Create a hazard to employees working on or near the track.
  - Result in a negative environmental impact.
- Make required reports.
- Call on other foremen for assistance, if necessary.

4-26. When called away from work unexpectedly, the foreman must:

- Assign the most reliable person to be in charge.
- Provide definite instructions as to the work to be performed.
- Notify the supervisor.

- Clearly identify the form of MOW protection provided.

4-27. Work that would make a track or structure unsafe must not be performed until a qualified individual has taken charge. When track work will affect the operation of signals, notify a signalman in advance. In addition, avoid short-circuiting tracks and report any signal component damage to the signalman. When performing work near track circuits, take precautions to avoid damaging:

- Bond wires.
- Underground wiring.
- Other signal appliances.

MOW EQUIPMENT

4-28. From a safety perspective, all motorized equipment operating on the rail will be treated like an engine or train operating on the rail.

4-29. On-track MOW equipment will not exceed a speed of 10 miles per hour. On-track equipment moving over a hand-operated switch will not exceed 5 miles per hour or track speed, whichever is more restrictive. Operators will look out for rocks or unforeseen obstructions and be prepared to stop should the route unexpectedly change.

4-30. No worker may operate a MOW machine without first:

- Having been trained in accordance with the GCOR and these Army rail safety rules.
- Having been informed of the safety procedures applicable to persons working near the machine.
- Acknowledging full understanding of those safety procedures.

4-31. The equipment operator's manual, which includes instructions for safe operation, shall be provided and maintained with each machine large enough to carry the document. If the manual cannot be contained in the machine, local policies will specify where the manuals will be kept. A machine operator will have a clear understanding of the information contained in the associated manual prior to operating a MOW machine. A worker will not be considered qualified to operate a unit of on-track equipment without having been trained and certified to be competent in the operation of that machine. If applicable, operator training will be recorded on their DA Form 348, Equipment Operators Qualification Record. This training may be accomplished on-the-job through peer instruction or through a combination of classroom training and peer training. Local certification will be established prior to operating MOW machinery. New or relief machine operators who have not, within the past year, operated the type of equipment to which they will be assigned, will be certified by the proper authority. When approved to begin operation, such operators will be observed by the instructor for a period which is extensive enough to determine the operator's competency level.

4-32. Only workers qualified on the GCOR and Army rail safety rules may operate hi-rails on track. In addition, worker s must be qualified on the safe operation of the hi-rail by a designated supervisor.

4-33. The operation of a contractors' hi-rail equipment must include an installation qualified pilot. All hi-rail equipment will be inspected in accordance with Code of Federal Regulations Title 49, Part 214.523. To prepare a hi-rail for on-track operation, visually inspect the guide wheel arrangement to ensure:

- There is no uneven or undue wear of the guide wheels.
- Safety pins and other wearing parts are in good condition.
- Guide wheels turn freely.

Note. Do not use guide wheel assemblies that have been damaged or that have uneven flange wear until they have been inspected and repaired.

4-34. After placing a hi-rail in the on-track position:

- Walk around and inspect the vehicle to ensure all guide wheels are down on the rail with flanges inside the rail.
- Ensure all safety pins are locked in place.

- Secure the front tires in the straight-ahead position using the steering wheel lock located on the steering column.

4-35. While operating a hi-rail vehicle on track:

- Ensure that headlights are on.
- Turn on rotating amber lights (if equipped).
- Ensure that the equipment's radio is on and set to the proper channel.
- Fasten seat belts.

4-36. Track shunts are not always effective in maintaining a shunt in the track circuit and cannot be depended on to actuate block signals, interlocking signals or highway crossing signals. Therefore, do not use track shunts for protection while operating on track. When working in the approach to a grade crossing equipped with automatic warning devices, operators of hi-rail vehicles may turn off their shunts, if equipped, and if the vehicle is stopped in the approach to allow employees to perform work.

MOW JOB BRIEFING

4-37. A job briefing will be conducted prior to any MOW worker fouling any track. A job briefing is complete only when each MOW worker acknowledges understanding of the on-track safety procedures and instructions. Job briefings include all information related to on-track safety. The job briefing is given to every MOW worker who will foul the track. In addition to other safety issues, the minimum on-track safety information will include:

- Designated MOW foreman.
- Type of on-track safety provided.
- Track limits and time limits of track authority.
- Track(s) that may be fouled.
- On-track safety provided on adjacent tracks, if any.
- Procedure to arrange for on-track safety on other tracks, if necessary.
- Method of warning when on-track safety is provided by a lookout.
- Designated place of safety where workers clear for trains.
- Designated work zones around machines.
- Safe working/traveling distances between machines.

4-38. The MOW foreman will give a follow-up job briefing whenever:

- Working conditions or procedures change.
- Other workers will enter the working limits.
- On-track safety is changed or extended.
- The main track has been cleared and on-track safety or authority is to be released.

4-39. A lone worker will participate in an on-track safety job briefing with his supervisor or yardmaster or other designated and qualified workers at the beginning of each duty day. This briefing will include:

- Planned itinerary.
- On-track safety procedure to be used.
- Job briefing per MOW rule above.

Exception. When communication has failed, an on-track safety job briefing will be conducted as soon as possible after communication is restored.

4-40. Before acting under the authority of a track warrant, or any other written authority to occupy a main track, the MOW foreman of that work gang will read the authority aloud to the worker to make them aware of its contents. When traveling in convoy under one authority, the MOW foreman will hold a job briefing with all operators and include information contained in the authority. Should any operator including the MOW foreman fail to comply with a written authority, any worker who has been made aware of the contents of the authority will immediately remind the operator or foreman of the contents.

ON-TRACK SAFETY METHODS

4-41. On-track safety can be provided for MOW workers by establishing working limits (in most cases) for them to work within, and preventing other trains to enter into. The following methods can be used to provide on-track safety:

- Exclusive track occupancy.
- Inaccessible track.
- Individual train detection (ITD).
- Train approach warning (TAW).
- Red flag protection.
- Blue flag protection.

4-42. The foreman of the MOW work group, or the lone worker, determines the type of on-track safety to be used. The type of on-track safety will comply with these provisions, as well as:

- GCOR.
- Army rail safety rules.
- Installation timetable.
- USAMC or IMCOM general orders.
- USAMC or IMCOM special instructions.
- Installation standard operating procedures.

EXCLUSIVE TRACK OCCUPANCY

4-43. Exclusive track occupancy provides workers with on-track safety by establishing working limits on controlled tracks and giving the work gang exclusive rights to occupy the track within those working limits.

4-44. Exclusive track occupancy can be established by the following methods:

- Direct traffic control (DTC). DTC is a verbal authorization system defined by the GCOR used to authorize trains (including work trains) to occupy main tracks through the use of radio communication. DTC can be used as a stand-alone safety system in unsignaled territories.
- Track warrant control (TWC). TWC is an authorization system defined by the GCOR and used to authorize trains (including work trains) to occupy main tracks through the use of written track warrants. TWC can be used as a stand-alone dispatching and safety system in unsignaled territories, or it can be supplemented with automatic block signaling (ABS) to increase flexibility and traffic capacity.
- Automatic block signaling (ABS). ABS is a block system that consists of a series of signals that divide a railway line into a series of blocks and then functions to control the movement of trains between them through automatic signals. ABS operation is intended to allow trains moving in the same direction on a single rail line to follow each other in an overall safe manner, preventing catastrophic accidents such as rear-end collisions.
- Automatic block signaling-track warrant control (ABS-TWC). ABS-TWC is an authorization system used to authorize trains (including work trains) to occupy main tracks. It is the combination of TWC supplemented with ABS to increase flexibility and traffic control.

Note. If personnel receive a track warrant that has a line 18, "joint with", they will establish communication with those workers previously granted a track warrant before entering joint working limits.

- Track bulletin Form B. A track bulletin is a written notice issued by the train dispatcher that contains information on all conditions that affect safe train movement. A track bulletin Form B is a track bulletin that can be used to establish working limits on main tracks or sidings. Personnel will display yellow-red flags at the designated working limits (GCOR Rule 5.4.3)
- Track removed from service. A track can be removed from service through a track bulletin issued by the train dispatcher. At that point, the dispatcher may authorize a work gang to occupy

the track (or section of track) for their work. Other trains cannot use the track removed from service unless receiving permission directly from the train dispatcher and taking all direction from him.

***Note*.** Movement of trains and MOW machinery within working limits established through exclusive track occupancy will be made only under the direction of the MOW foreman or train dispatcher. Train movements will be at restricted speed or track speed, whichever is more restrictive, unless a higher speed has been specifically authorized by the MOW foreman or train dispatcher.

INACCESSIBLE TRACK

4-45. Inaccessible track provides workers with on-track safety by establishing working limits on non-controlled tracks by making the track physically inaccessible to trains and other on-track equipment at each possible point of entry. Non-controlled track consists of:

- Yard tracks.
- Industrial leads.
- Non-controlled sidings.
- Main track within yard limits which are not governed by controlled signals.

4-46. The MOW foreman or lone worker establishes inaccessible track working limits using one of the following methods:

- Place a flagman with instructions and the capability to hold trains and equipment at the working limits.
- Affix a switch or derailer to the track at the working limits marked by red flags 150 feet in advance of the device. Tag the switch or derailer and lock, spike, and/or clamp it securely. MOW workers will use a MOW or personal lock so train service employees cannot unlock it.
- Establish discontinuity in the rail to prevent movement into the working limits; red flags will be placed 150 feet in advance of the discontinuity.
- Request permission from the train dispatcher to establish working limits through exclusive track occupancy methods on controlled tracks that connect directly with the uncontrolled track that needs to be made inaccessible.
- Affix a remote controlled switch with a locking device at the working limits.

INDIVIDUAL TRAIN DETECTION (ITD)

4-47. ITD provides a lone worker with on-track safety when all the following conditions are met:

- The lone worker is trained and qualified on GCOR and Army rail safety rules.
- Only routine inspection or minor repair is being performed. The lone worker may not occupy any position or engage in any activity that would interfere with the ability to detect the approach of train or equipment in either direction.
- The lone worker is not inside the limits of a:
  - Manual interlocking.
  - Control point.
- The lone worker can visually detect the approach of trains or equipment moving at maximum speed and can move to a place of safety at least 15 seconds before its arrival.

***Note*.** The place of safety will not be on a track unless working limits have been established on that track.

- No power-operated tools or machines are in use within hearing range.
- The lone worker's ability to hear and see approaching trains and equipment is not impaired by:
  - Background noise.

- Lights.
- Inclement weather.
- Passing trains.
- Other physical conditions.

- The lone worker has completed a written statement of on-track safety. When using ITD, the lone worker will produce the completed statement of on-track safety upon request.

4-48. A lone worker has the right to use on-track safety procedures other than ITD if the lone worker feels the situation requires it.

TRAIN APPROACH WARNING (TAW)

4-49. TAW provides workers with on-track safety that can be used by MOW work gangs to perform routine inspections or other minor corrections, without establishing working limits. TAW may also be used to provide warning on adjacent tracks for large scale maintenance work.

4-50. TAW may be used to provide on-track safety when all the following conditions are met:

- The MOW foreman has designated one or more lookouts to provide warnings of all approaching movements.
- Each lookout is briefed, familiar with, and equipped to provide a TAW.
- A lookout can give a TAW in time to allow each worker to move to a previously arranged place of safety at least 15 seconds before the arrival of a train, engine or other railroad equipment.
- Each MOW worker is in a position to receive the TAW.

4-51. Lookouts:

- Will not be assigned other duties while functioning as a lookout.
- Will remain at their duties until the MOW foreman either determines that protection is no longer necessary or sends another look-out to relieve them.
- Will devote their entire attention to detecting approaching trains and engines and warning the workers.

***Note*.** The MOW foreman may provide a TAW by acting as the lookout himself as long as the foreman is not performing other duties.

4-52. The lookout's method of communicating a TAW will be distinctive and clearly understood, regardless of noise or work distraction. The method that a lookout will use to warn workers will consist of:

- Blowing a whistle and/or sounding an air horn.
- Verbally communicating by radio or other means to warn workers (do not rely solely on radio communication if used).
- Touching the worker as a warning.

4-53. Table 4-1 identifies the minimum distance required for the maximum authorized speed to provide workers the minimum 15 seconds necessary to clear the track prior to the arrival of a train or engine.

Table 4-1. Maximum speed to minimum distance figures

Maximum Authorized Speed in MPH	*Distance in Feet*	*Maximum Authorized Speed in MPH*	*Distance in Feet*
5	110	35	770
10	220	40	880
15	330	45	990
20	440	50	1,100
25	550	55	1,210
30	660	60	1,320

Note. A lone worker or a work group working at or within 150 feet of a road crossing on a main track equipped with operable automatic warning devices may use the warning provided by bells and flashers as the TAW as long as the activation of the devices can be clearly seen and heard by all MOW workers and a minimum of 15 seconds advance warning is provided.

RED FLAG PROTECTION

4-54. Red flag protection is a piece of the on-track safety methods, exclusive track occupancy through a track bulletin Form B, and inaccessible track, already discussed. As discussed, under these methods, red flags, or yellow-red flags, are used to mark working limits.

4-55. Red flag protection is limited to establishing on-track safety on any main track or siding, and NOT within yard limits (GCOR Rule 6.13). When within yard limits, utilize blue flag protection (see paragraph 4-66).

Note. When there are two or more tracks, protection must be provided in both directions on all affected tracks.

4-56. Generally, red flags are placed 150 feet in advance of working limits, or any utilized safety devices, such as switches or portable derailers. When a train is seen or heard approaching before a flagman has reached the required distance, the flagman must perform one of the following procedures:

- If it is day and there are no adverse weather conditions:
  - Continue in the direction of the approaching train.
  - Flag the train with a red flag.
- If it is night or there are adverse weather conditions such as fog or a storm:
  - Leave a burning red fusee on the rail.
  - Continue in the direction of the approaching train.
  - Give stop signals with another burning red fusee.

4-57. After red flags (or red lights during hours of darkness) are placed, one flagman must remain at the job site to watch for approaching trains. When a train approaches from either direction, the flagman must go toward the approaching train and flag it with a red flag (or light).

Note. Flagmen must devote their entire attention to watching for approaching trains and on-track equipment and flagging them as prescribed by these rules. Flagmen must continue to flag approaching trains until relieved by the foreman or by another flagman carrying the MOW foreman's instructions.

4-58. The MOW foreman may relieve flagman when:

- The track has been made safe for normal speed.
- The train dispatcher advises that protection has been provided.

4-59. When flag protection is no longer required, the MOW foreman will:

- Notify the train dispatcher.
- Send a worker to remove all flags and/or lights from the rail.

4-60. When a MOW worker is alone and required to flag with red flags or red lights, the worker must follow these steps:

- Place a red flag or red light ½ mile from the obstruction in both directions.
  - However, if the direction of the first train is unknown, the MOW worker must go in the direction in which trains will be moving down grade.
  - When there are two or more tracks and only one of the tracks is affected, the MOW worker must first go against the current of traffic, unless it is known that a train will arrive first from the opposite direction.

- After flags or lights have been placed, return to the point of obstruction and remain there until relieved.
- If a train approaches, go toward the train and flag with hand signals.

BLUE FLAG PROTECTION

4-61. Blue flag protection will be followed whenever there is a worker or workers (other than the train crew themselves) working on, about, around, or under rail equipment for any length of time, primarily within the yard limits of a rail yard. Under blue flag protection, working limits (or lockout positions) will be identified at either end of the area where the work will be conducted. These lockout positions will then be marked with blue flags that can be clearly seen during the day. At night, display blue lights with the flags.

4-62. Following the placement of the flags (and/or lights), portable derailers may be placed at the lockout positions as additional safety lockout devices. Any of these devices installed must be removed BEFORE the blue flags themselves are removed.

4-63. One, single, common authority will be established to govern blue flag protection. This authority, and only this authority, will:

- Communicate with all personnel under blue flag protection regarding the blue flag protection.
- Control the blue flags and the lockout devices themselves.
- Be responsible for the safety of all personnel under blue flag protection.

4-64. Workers will not work on track or rail equipment until both ends of the work area have been physically marked with the blue flags.

4-65. The only person who is authorized to remove the blue flags and lockout devices, is the person who installed them in the first place.

ON TRACK EQUIPMENT

4-66. On-track equipment may be operated as a train if all of the following conditions are met:

- The on-track equipment consists of at least 4 axles and is capable of fully shunting the track circuits.
- All rules governing the movement of trains and engines apply.
- The worker (site employee) is qualified on the rules applying to the movement of trains and engines (GCOR, Army rail safety) and accompanies the movement.
- A supervisor or their appointed designee approves the movement.

4-67. On track equipment will be prepared to stop when approaching railroad crossings, drawbridges, and the end of multiple main tracks not protected by signal appliances. Movement may proceed only in accordance with the GCOR and Army rail safety rules.

4-68. When approaching and moving over a switch or a crossing, on-track equipment will be under full control and prepared to stop quickly. A lookout will be kept for rocks or unforeseen obstructions and be prepared to stop should the route unexpectedly change. On-track equipment will not be operated through a spring switch or variable switch in trailing position. The switch will be operated by hand and the rules governing hand operated switches apply.

4-69. On-track equipment will not obstruct a road crossing until the way is seen to be clear by the operator of the on-track equipment. On-track equipment will be brought to a full stop before proceeding over a road crossing where the view of the approach is obstructed, or where the traffic is heavy, such that the operator of the on-track equipment, at the point where a stop will be initiated, cannot determine that the way is clear. At such crossings, on-track equipment will only proceed over the crossing under protection of a flagman.

WORK ZONE

4-70. When working with on-track equipment, spacing guidelines will be adhered to in order to prevent contact between machines and to prevent machines from contacting workers. When work or travel conditions dictate that the machine spacing will be less than the guidelines require, the machine operators and foreman will have a thorough understanding of the specific task, the conditions under which the task is to be done and how the task is to proceed. In addition, the operator of a machine approaching workers, who are fouling the track, will communicate with the workers before getting closer than 15 feet of them. Before a reverse move of more than 15 feet is made, the operator will ascertain that a backup alarm is activated and/or the appropriate horn or whistle signal is sounded. In addition, the operator will observe that the track is clear of persons and machines before the reverse movement is made.

4-71. When MOW workers' tasks require that they occupy the center of the track, they will not enter a machine's work zone without first communicating with the operator to establish safe work procedures. Unless a different understanding is established through a job briefing, this work zone extends from a point 15 feet in front of the machine to a point 15 feet behind the machine.

4-72. Maintain greater intervals between large machines such as ballast regulators, tampers, cranes and yard cleaners. Weather and/or rail conditions may require additional separation distance. A track car following a moving train or another track car must comply with the following distance restrictions:

- The track car must remain at least 500 feet behind a train.
- The track car must remain at least 200 feet behind a track car.

ON-TRACK EQUIPMENT INTERACTION

4-73. When two or more track cars are moving on the same track, the operators of all cars must agree upon and use a predetermined signal to stop that is easily seen and understood. When necessary to slow or stop on-track equipment during travel, the operator will signal the following equipment operators either by radio or hand signals. If a radio is used, the machine operator transmitting will be assured that the following equipment operators have received and understood the message transmitted. If hand signals are used, the signal will be continuous until it is verified that the following equipment operators have observed and understood the movement is to be slowed or stopped. If machines are to be bunched when stopped, all workers will remain clear of the track until the entire movement has stopped unless otherwise instructed by the MOW foreman. After stopping, the lead machine operator in the consist will dismount that machine and assume a position that is visible to the following machine operator as well a s to anyone who could step into the path of the next approaching machine. The dismounted operator will spot the following machine using hand signals. This procedure will be used by each successive operator to spot the following machine.

Note. All equipment will be properly secured when left unattended.

4-74. When a train is to pass a track car on an adjacent track, the track car must stop. When a track car is stopped, secure it against movement and stand clear of all tracks. When there are more than two tracks, if it is not practical to stand clear of all tracks, personnel may clear onto a track that has positive on-track protection after securing the track car against movement.

4-75. Trains will sound their locomotive whistle and ring their bell when approaching MOW workers or contractors on or near the track, regardless of local whistle prohibitions. To give trains advance notice of MOW workers on or near the track, each worker fouling a track will wear brightly colored enhanced visibility work wear, as described in paragraph 1-41, on page 1-6.

REMOVING ON-TRACK EQUIPMENT FROM TRACKAGE

4-76. When removing on-track equipment from a track, it must be moved to a location where it will not be struck by passing trains or create a safety hazard. When on-track equipment is stored on track, the on-track equipment nearest to each switch will be chained and locked to the rail as well as blocked, except where the track is equipped with a derailer within 100 feet of the nearest on-track equipment.

TRACK MAINTENANCE

4-77. Track and structures must be maintained in accordance with Unified Facilities Criteria 4-860-03 (13 Feb 08).

4-78. When contractors or others, not under installation MOW supervision, are performing work on or near tracks, the MOW foreman responsible for the area in which work is being performed must determine that:

- Contractors or others comply with Army rail safety rules and standards.
- Work is being performed on proper authority.
- Work is being performed under proper protection to ensure safety of track and movement of trains.

TRACK INSPECTIONS

4-79. MOW workers patrolling and inspecting track must frequently advise the train dispatcher or yardmaster of unusual track conditions and their locations.

4-80. When performing a walking track inspection, walk:

- On the track structure.
- Against the direction of traffic, where applicable.

Note. When walking against the direction of traffic, workers must know that trains may operate in either direction and must watch for trains approaching from both directions.

SWITCH INSPECTIONS

4-81. Notify the track manager and the rail manager or yardmaster when:

- A switch has been run through.
- It is necessary to spike a switch.

  or
- The switch is ready for use.

4-82. MOW foreman and signal maintainers are jointly responsible for the inspection and maintenance of insulated rail joints, switch rods and gauge plates. Maintain insulated rail joints in good condition. Ensure that:

- There is enough drainage.
- Bolts are tight.
- Ties are properly spaced and tamped.
- The signalman is immediately notified when replacing rails or adding joints in track

4-83. Where track circuits are in use, maintain ballast sections to ensure circuits are not affected. Report all defective track conditions to the track maintenance manager, yardmaster or track supervisor immediately.

INSTALLING RAIL

4-84. Before lifting rail using rail tongs, mark the center of the rail to ensure stability. When rail is being lifted or moved, all workers must face the direction of rail movement. When crane operators lift or move rail, they must:

- Accept signals only from the designated ground man or tong man.
- Use a spreader bar when rails are greater than 48 feet in length.
- Ensure the hoisting line is in a vertical position over the center of the rail.

4-85. Do not strike rail with a hammer, maul or any other tool. Use rail tongs, rail forks or lining bars to move rail into position. Spike, bolt and anchor all rail before the close of each day.

4-86. When drilling bolt holes:

- Remove joint bars from the rail before drilling; do not drill holes in rail through holes in joint bars.
- Drill bolt holes to the approved diameter and provide proper spacing.
- Do not torch-cut bolt holes.
- Ensure the exact positioning of all bolt holes using the proper template or indexing bar and fillet block.
- Use an approved coolant.
- Carefully grind to remove all burrs and fins.

4-87. Do not install a rail that has extra bolt holes in a main track. However, it is permissible to leave the bolt holes that result from field welding a joint.

SPIKING RAIL

4-88. When two workers are spiking along the same rail, each must spike on their side of the rail, and both must face the same direction.

4-89. One worker spiking alone may spike over the rail.

INSTALLING OR REMOVING RAIL ANCHORS

4-90. Do not use spike mauls in lieu of sledge hammers to install or remove rail anchors.

4-91. When using a sledge hammer to remove rail anchors, place your foot on top of the rail anchor to prevent the anchor from flying and causing an injury.

SIGNAL SYSTEMS, SIGNS, AND CROSSINGS

4-92. Remove vegetation, trees and other removable obstacles that obstruct the view of grade crossings, signals, or signs.

4-93. MOW foreman must ensure MOW signs are in the proper position, in good condition, and standing plumb. Do not, without proper authority, change the standard location of any sign.

4-94. When a highway crossing warning apparatus fails to indicate the approach of trains, post a watchman or flagman at the crossing until repairs are made, or until otherwise directed. Workers must immediately report the failure of a highway crossing warning apparatus to the track or signal manager, yardmaster or supervisor.

4-95. Signal employees are responsible for the proper installation, maintenance, and inspection for safe condition of:

- Signals.
- Highway crossing warning systems.
- Other signal-related equipment, as assigned.

Note. Signal personnel shall not perform work that interferes with the safe passage of trains without proper protection.

4-96. Signal employees are responsible for reporting all defects found and repairs made during inspections. Signal employees must not perform work that:

- Causes improper signal indications.
- Causes activation failures of crossing warning systems.
- Defeats signal locking circuits.

4-97. Signal employees promptly investigate and correct any known or reported signal system failure. If unable to correct a failure, immediately notify the signal manager and yardmaster. Failures must be given preference over all other work. Prioritize and correct failures in the following order:

- Failures involving the safety of train movements.
- Failures involving highway crossing warning systems.
- All other failures.

STRUCTURE INSPECTIONS

4-98. Installation MOW personnel will ensure the following structures are inspected according to AR 420-1, *Army Facilities Management*, and Directorate of Public Works policy, at a minimum of quarterly:

- Bridges.
- Culverts (4 feet or more in diameter).
- Waterways.
- Other load-bearing structures.

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Chapter 5

Loading and Unloading Precautions

Of particular importance to safety in rail operations is loading and unloading precautions. Loading and unloading operations come with an added degree of difficulty, as they are conducted by personnel outside of the rail operating organization, and it is likely that they will be unfamiliar with the rules in this manual. Rail personnel must be vigilant and aid the units' leadership, as the responsibility that operations are conducted in a safe manner is shared between the two. This chapter discusses topics related to safe rail loading and unloading.

LOADING AND UNLOADING PRECAUTIONS

5-1. When opening or closing rail car doors, keep fingers clear of the edge or door jamb, casting, or rail on which the door travels. Keep your body clear of the door opening to avoid injury from falling freight. Make sure the door is properly tracked before opening it. If the door is off track, take precautions before opening it. Car doors must be closed and secured prior to movement unless deemed to be safe to move by mechanical personnel to shop track.

Note: Blue Flag Protections will be implemented in accordance with procedures in Chapter 4.

5-2. Personnel who load or unload vehicles on flatcars are responsible for:

- Removing and clearing platforms, boards, chains and devices, loading and unloading ramps, similar appliances or connections, vehicles and other obstructions.
- Personnel will remove or flatten protruding nails, screws, staples, or loose ends of metal bands or wire before removing materials or supplies from or placing them in a keg, barrel, or box.
- Make sure persons in, on or about cars have vacated cars before allowing switching.
- Avoid damaging lading of partly loaded cars.
- If cars are equipped with bridge plates, raise and lock the bridge plates before releasing the cars for movement.

5-3. Personnel will not walk between tractors, trailers, or any other equipment during loading or unloading operations.

5-4. When loading or unloading trailers and a ground-man or tie-down crew is utilized, drivers will not back up equipment until they receive a hand signal indication that it is safe to make the move.

5-5. Personnel will not load or unload a truck trailer while the tractor is being coupled or uncoupled, or when a tractor is coupled and the engine is running.

5-6. Follow these rules when working with bridge plates, station trucks, gangplanks, or skids:

- Ensure that they are strong enough for the load.
- When placing them between a car and platform, lower them by hand or slide them into position unless using a lift truck.
- Properly place and secure devices before using.
- When lifting or placing bridge plates, prevent the plate from slipping or falling.
- Keep hands and feet clear of the plates.
- When removing gang planks, bridge plates, or skids, remove nails, cleats, or other fastening devices to a safe place, do not leave fastening devices in cars or on platforms.

5-7. If cars are equipped with bridge plates, raise and lock the plates before moving the cars.

5-8. Before coupling to or moving cars on tracks where cars are being loaded or unloaded, personnel will ensure:

- Platforms, boards, tank car couplings and connections, conveyers, loading or unloading spouts, similar appliances or connections, vehicle, and other obstructions are removed and clear.
- Plug-type and swinging doors on the cars are closed and secured.
- Persons in, on or about cars have vacated cars before switching the cars.

5-9. Please see chapter 6 for loading and unloading precautions as they relate to working around high voltage electrical wires.

LOADING SPECIFIC PRECAUTIONS

5-10. When loading material on flat cars, be careful to secure the load properly. Take precautions to prevent the load from becoming unevenly distributed which may cause the car to overturn or derail. Do not handle cars with improper or uneven loads if the load could shift or fall from the car or the car could derail or overturn.

5-11. Before loading trailers with detachable bogies, personnel will make sure the pins securing the bogies to the trailer body are in place and locked. Before loading a container or chassis assembly, ensure that all chassis locks are in place and secure. Do not park bogies where they will protrude into roadways or where they are hazardous to passing vehicles or equipment.

5-12. Tie-down personnel will stay clear of the diagonal strut of “pull -up” hitches to avoid injury in case the hitch is knocked down inadvertently. Personnel will not manually open hitch jaws until ensuring that the diagonal-strut indicator shows “locked”.

5-13. To lower a knockdown hitch properly, complete these steps, making sure to stand clear of the stanchion:

- Stand on either side of the stanchion with your legs positioned to give solid support.
- Using a sledge hammer, strike the unlocking knockdown lever located between the upper diagonal struts.
- Make sure this action causes the knockdown lever to retract the diagonal locking plunger, causing the stanchion to fall.

5-14. If this procedure fails, “bad order” the hitch until a railroad maintenance worker repairs the hitch and returns it to service.

Note. Never use a pry bar to force the hitch down. Also, never place a bar between the locking plunger and the locking plate to try to retract the locking plunger.

5-15. When containers without chassis are loaded on flat cars, personnel will inspect the containers and make sure all corners are secured and locked in the corner castings. Before releasing stack cars to be moved from the ramp, stow inter -box connectors in storage boxes.

UNLOADING SPECIFIC PRECAUTIONS

5-16. Personnel will not work on the ground near cars when other personnel are unloading ties, timbers, or other materials. Personnel unloading such materials will ensure that no one is on the ground near the car being unloaded.

5-17. When unloading rail:

- Do not drop rail from cars.
- Distribute rail in the upright position.
- Do not leave unloaded rail in contact with rail in the track.
- Do not obstruct a grade crossing; cut or bury the rail through grade crossings.

5-18. Personnel unloading ballast must:

- Wear respirators.
- Report cars with defective doors to the supervisor.
- Use the proper tool for opening and closing ballast doors.
- Regulate the ballast flow so that ballast does not go above the top of the rail.
- Plow ballast from between the rails.
- Clean ballast from switches as soon as possible.
- Ensure cars are completely unloaded, with doors closed and locked, before they are released as empties.
- Use dust control methods, where applicable.

5-19. Personnel will observe these rules when dumping loads or working around dump doors:

- Before opening the dump door on a car, ensure that all persons are clear on both sides and that no one is inside the car.
- Do not close dump doors of empty cars while cars are in motion.
- Do not be on or inside a car when it will be "shaken" or bumped to loosen gravel or material.
- Do not ride in air dump cars.

MATERIAL PLACEMENT

5-20. Materials being prepared for loading, or being placed after unloading, except out-of-face replacement materials, must be stacked in an orderly manner and placed:

- Not less than 15 feet from the center of a main track.
- Not less than 12 feet from the center of all other tracks.

5-21. Do not place materials:

- On any public highway or sidewalk.
- Where it might cause injury.
- Where it might cause environmental damage.

5-22. Drums and other containers containing chemicals must be:

- Properly labeled with permanent markings.
- Stored in an upright position.
- Properly sealed.

CRANE PRECAUTIONS

5-23. Workers are not allowed in or on cars when loads are being lifted by crane, unless there is room and opportunity to clear any side or end drift of the load.

5-24. When using a crane to load or unload material and it is necessary to stabilize the load, workers must use tag lines.

5-25. Workers are not allowed in cars that are being loaded or unloaded by use of a crane and magnet or bucket.

5-26. At points where side loaders or cranes are used, personnel will not walk between the trailer and flat car during any step of the loading or unloading cycle, except to raise or lower landing gear after all other movement has stopped.

5-27. Groundmen will stay clear of lifting arms at all times. Never go under a hoisted trailer or container. Groundmen must be in the operator's view at all times when the operator is moving the side loader or crane or maneuvering the lift arms.

5-28. Lift truck and crane operators will:

- Sound the horn when necessary to protect movement (for example, when rounding corners, backing up, approaching persons).
- Protect movement either by turning the machine and facing the direction of the movement or having a person precede the movement when vision is obstructed.
- Face the direction in which the crane is moving when using portable cranes.

5-29. Load rigging supervisor will ensure:

- Crane operator is familiar with the load to angle ratio chart (see table 7-2 on page 7-21 and table 7-3 on page 7-22).
- That wire ropes, hooks, and clevises are properly rated for the load.
- That the load is inspected for security prior to lifting.

5-30. Please see chapter 6 for crane precautions as they relate to working around high voltage electrical wires.

Chapter 6

Fire Prevention and High Voltage Electrical Wire Precautions

In any safety discussion, fire prevention should be a part. But in railroading, fire prevention takes on an especially important role. This chapter discusses fire prevention topics as it relates to Army rail, as well as precautions that must be taken around high voltage electrical wires.

GENERAL INSTRUCTIONS

6-1. Personnel will sound the fire alarm and summon help, when available, before trying to control and extinguish a fire.

6-2. Fire protection devices will be provided, inspected and maintained as required by local, state, and federal fire codes and regulations. Tampering with such devices is strictly prohibited.

6-3. Every worker will know how to operate the fire protection equipment at the work location.

6-4. Use an electric flashlight, electric lantern, or any other artificial light (as opposed to open flames) around any placarded rail car.

6-5. If overheated wheels are detected, personnel will stop the train to allow the heat to equalize throughout the wheels. Check the journal to ensure that it is not overheated and that no fire danger to the car's floor or body exists. Notify the supervisor so that the car can be properly inspected.

REPORTING

6-6. Immediately inform the supervisor if you question the safe condition of gas connections, motors, wiring, gasoline or oil burning devices and vehicles, or tools and equipment.

6-7. Personnel will report to their supervisor:

- Excessive buildup of grass, weeds, and underbrush around buildings, structures, bridges, trestles, and approaches.
- Accumulation of combustible materials and debris.

6-8. If a fire occurs on a locomotive, stop the locomotive as soon as possible, evacuate the crew, and report the fire to the dispatcher.

6-9. If a fire occurs on a train (other than on the locomotive), the crew will promptly notify their supervisor or the engineer directly.

6-10. If a fire occurs near the right-of-way, the engineer will promptly report it to the dispatcher unless the fire is being controlled. If crew members think the fire may spread to a bridge or other structure, they may stop the train and help extinguish the fire, if this action will not endanger the crew or train.

PRECAUTIONS DURING FUELING OPERATIONS

6-11. When dispensing gasoline to gasoline fueled equipment, personnel will:

- Move motor cars, roadway equipment, and work equipment out of the motor car house or garage before fueling the vehicle (This does not apply to equipment in the shop for repair).
- Stop the vehicle's engine before refueling.

- Make sure the hose nozzle on the refueling can is always touching the side of the fill opening of a tank to prevent a hazardous static electricity charge; if personnel use a gasoline can, it will be equipped with a standard pouring spout.
- Avoid spilling fuel. If fuel does spill, allow it to dissipate before starting the engine.
- If artificial light is necessary to fill the fuel tank, use an electric lantern or flashlight.

WARNING

Smoking or setting fires near the equipment being fueled is prohibited.

6-12. When fueling is necessary during use, the engine will be stopped and sufficient time allowed for engine to cool. Tools will be removed from the immediate work area and placed where fuels cannot spill on any hot surfaces or ignition sources. Move fuel containers at least 20 feet from the work area before starting engine.

FUSEES AND FLARES

6-13. Fusees/flares will be stored:

- In approved containers in motor vehicles and other designated equipment.
- In flagging kits or racks in engines.
- In the original shipping container in a storage cabinet.

6-14. Fusees/flares will be:

- Used for signaling purposes only.
- Placed by hand; fusees/flares may be dropped off moving trains only in emergencies or under flagging conditions.
- Kept away from high temperatures, fire or open flames.

6-15. Fusees/flares are not to be placed in locations where they may become wet. Fusees/flares showing evidence of having been soaked in water, oil, or otherwise damaged will not be used, but rather disposed of properly. When lighting fusees/flares, hold the end to be lighted down and away from your body, striking away from the body to prevent burns or fire dropping on your hands, feet, or clothing. Do not place lighted fusees/flares on open bridge decks, trestles, approaches, wood decked cars or use them near flammable or combustible material. Extinguish the fusees/flares after giving hand signals. If possible, extinguish by tapping the lighted end on a rail.

EXPLOSIVES

6-16. Use, possession, or transporting of explosives not presented for shipment is not authorized.

6-17. When transporting explosives in railroad cars or other vehicles, use proper care and follow Department of Transportation and the Bureau of Alcohol, Tobacco, Firearms, and Explosives instructions.

6-18. Do not smoke around explosives.

HIGH VOLTAGE ELECTRICAL WIRE PRECAUTIONS

6-19. Personnel will immediately report wires found broken, crossed, or on the ground to their supervisor. Do not consider any wire dead until positive information has been received that it has been de-energized and is safe to handle. Only authorized and trained persons are allowed to handle electric power, light, or high-voltage wires.

6-20. Repairers working in high voltage areas will consider arc flash possibilities prior to opening electrical panels and calculate the safe arc distance. Arc flash is a hazard to workers working on high

voltage circuit breakers, switches, and connections. When arc flash possibilities exist, the worker must use appropriate protective equipment and clothing.

MAINTAINING PROPER CLEARANCES

6-21. When performing work near electrical power lines, including loading and unloading operations, the clearance shown in table 6-1 below will be maintained between personnel, their tools and equipment, and the nearest power line.

Table 6-1. Power line safe clearance distances

Operating Voltage	*Distance in Feet*
0 – 5,000	4
5,000 – 15,500	6
15,500 – 25,000	7 ½
25,000 – 35,000	9
35,000 – 50,000	12

Table Note: For voltages over 50,000 volts, add ½ inch for each 1,000 volts.

6-22. Do not throw steel or cloth tapes, ropes, or strings over wire line to measure overhead clearance. A civil engineer is required to measure overhead clearances using the proper instruments.

6-23. When necessary to perform work that will not permit maintaining the clearance outlined, notify the installation power or controlling authority and have them turn off the power supply for the affected district. Do not start any work until authorized by the installation power or controlling authority. Do not turn the power back on until authorized by a supervisor. When performing work near a 2,400-volt or greater signal line that will not permit the clearance outlined, notify the signalman to switch the power off that portion of line. Do not start work until the signalman says that the power has been switched off. Make sure the signalman understands not to switch power on again until advised by the supervisor in charge of the work. If the power will be switched off, equipment will be kept at least one half the clearance distance indicated, but in no case may the clearance be less than 4 feet.

WHEN USING CRANES

6-24. Do not operate crane booms over power lines at any time. Do not operate them under power lines unless proper clearance is maintained. If proper clearance cannot be maintained, shut off the power and ground power lines before performing work.

6-25. If crane booms will be operated near energized lines, the following clearances will be maintained.

- For lines rated 50 kilovolts (kV) (50,000 volts) or below, minimum clearance between the lines and any part of the crane or load will be 10 feet.
- For lines rated over 50 kV, minimum clearance between the lines and any part of the crane or load will be 10 feet plus ½ inch for each 1 kV over 50 kV, or twice the length of the line insulator.
- If in transit with no load and boom lowered, the equipment clearance will be a minimum of 8 feet for voltages less than 15 kV and 10 feet for voltages 15 to 50 kV; for voltages 50 to 470 kV, the clearance will be increased ½ inch per kV in excess of 50 kV.

6-26. A person will be designated to observe equipment clearance and give timely warning for all operations when it is difficult for the operator to observe clearance.

6-27. At stationary worksites, crane operators will place at least three orange cones along the minimum clearance line to mark the minimum safe working distance to overhead power lines.

ENERGIZED WIRES AND POWER LINES

6-28. Personnel will not handle an electric light, power, or wire if it is or is suspected to be in contact with other electric light or power wires. If an emergency requires personnel to separate live electrical wires,

personnel must find some sort of non-conductive material to do so. Personnel will not get closer than 5 feet to the wire being handled.

6-29. Personnel will avoid working on energized circuits whenever possible. Use proper safeguards if duties require work on energized circuits. Use only approved nonmetallic cased flashlights around electrical equipment.

6-30. Conductive articles of jewelry and clothing will not be worn in locations with exposed energized parts. Examples of conductive articles are metal watches, rings, bracelets, metal headgear or clothing with conductive thread.

6-31. Personnel will lockout a disconnected electrical switch before doing maintenance or repair work. Do not remove a lock unless authorized by the person who placed it.

6-32. Dead wires can accumulate an induced current of high voltage or become crossed with live wires. Personnel will ensure that presumably dead wires are thoroughly grounded at the point where work will be done. Do not start work until it is verified that wires are properly grounded.

Chapter 7

Wreck Train Precautions

Personnel engaged in the operation of wreck trains and wreck cranes are inherently involved with some of the most complex and dangerous operations on any railroad. They must be familiar with these Army rail safety rules. This chapter discusses the complexities involved with wreck train operations.

WRECK TRAINS

7-1. A *wreck train* is a specially configured train tailored to conduct wreck recovery operations (ATP 4-14). It usually consists of a locomotive, a wreck crane, tool cars, and enough bunk and cook cars for personnel required for a particular wreck.

WRECK TRAIN PREOPERATIONAL CHECKS

7-2. Experience has proven that there are a number of potential hazards inherent to wreck train operations. Safety and maintenance preoperational checks to be performed before these operations are of extreme importance.

7-3. Engine fuel, lubricants, and water should be checked and brought to the proper levels. Open gears and fittings should be greased. Power stoppages and mechanical failures caused by inadequate servicing can cause damage and injury.

WRECK CRANES

7-4. Wreck cranes should have air brakes, hand brakes, and generators for electricity and lights. Cranes should be capable of self-propulsion in either direction. The following paragraphs discuss preoperational checks that must be performed on wreck cranes before operations.

DECKS AND PLATFORMS

7-5. Wreck crane decks and platforms must be kept free of grease, wire ropes, chains, buckets, barrels, loose tools, and similar items. Machinery guards over open gears should be in place. Handholds and steps must be kept clean, secure, and marked as appropriate.

BRAKES, CLUTCHES, AND SWITCHES

7-6. The action and effect of all braking devices, clutches, and the engine cutoff switch should be checked and required adjustments made. On assuming his post, the crane operator will test the working condition of these controls and his ability to operate them quickly and automatically in an emergency. Crane operators must ensure that all dogs, pawls, and braking equipment are capable of effectively braking a weight of at least one and one quarter times the weight of the full rated load. If the load is heavy enough that this testing procedure cannot be accomplished because one and one quarter times its weight will overload the crane, then a larger crane with a greater capability should be utilized. Outriggers are used when testing a crane's rated capacity, but the rated capacity for the crane should be that given without outriggers.

WIRE ROPES

7-7. The crane should have an adequate quantity of the following to meet capacity lift requirements:

- Wire Ropes.

- Falls.
- Sheaves.
- Pulleys.
- Other miscellaneous hoisting equipment.

7-8. Blocks and wire ropes should be clean, free of dirt and sand, and properly lubricated at all times. Wire ropes and rope are kept free of kinks and are stored coiled. A crane operator, before beginning any lift operation, will inspect wire ropes and wire ropes for broken wires, fractures, and flat or pinched spots. Sheaves and drums are checked for wear and proper line placement.

CRANE SAFETY

7-9. Statistically, a crane is a potentially dangerous instrument. One-third of the injuries sustained in crane accidents result in fractures or severed limbs. Many of those injured are crane operators. Most crane accidents are preventable because they are, to a large measure, the result of actions, conditions, or situations directly under the control of the operating crews. Crane work must be the coordinated activity of a team of skilled workers. The operator, wreckmaster, riggers, and others assume control of lifts, movements, and similar actions. It is important that individual control responsibilities are clearly defined and the procedure for transferring them is thoroughly understood.

7-10. Crane operators MUST be sure of the following:

- Only authorized persons enter the crane cab.
- No one is in or about the crane before it is started.
- No hoist is made while anyone is riding on the load.
- A warning signal is sounded before traveling (moving the crane) or when the load approaches near or over other persons. NEVER lift over personnel.

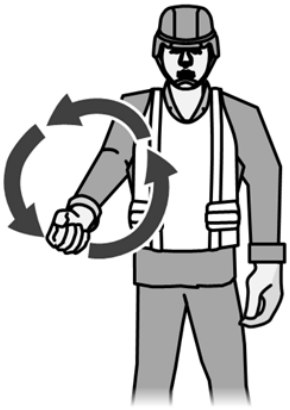
SIGNALS

7-11. The wreckmaster, or someone designated by him, is responsible for giving signals. The responsibility for giving an emergency stop signal belongs to anyone on site who considers such a signal necessary. Copies of authorized signals should be posted in obvious places so wreck train personnel may become familiar with them. Crane and derrick operators must wait for a clear signal from the designated signalman before operating the equipment. If there is any doubt or confusion regarding the signal given, the operator must stop operations and clarify the signal before making another move. Figures 7-1 thru 7-34 on pages 7-3 to 7-19 show standard hand signals that can be used when operating cranes and derricks, when visibility permits. Lights or lanterns can be used to give signals during periods of darkness.

ATTENTION: Raise and extend the arm overhead. Move it to the right and left. *(Do not make a circular motion; that is a different signal.)*

ATTENTION (Night): Raise and extend the arm overhead with the wand pointed up. Move it to the right and left. *(Do not make a circular motion.)*

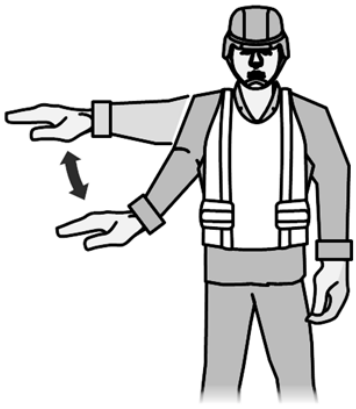
Figure 7-1. Signal for attention



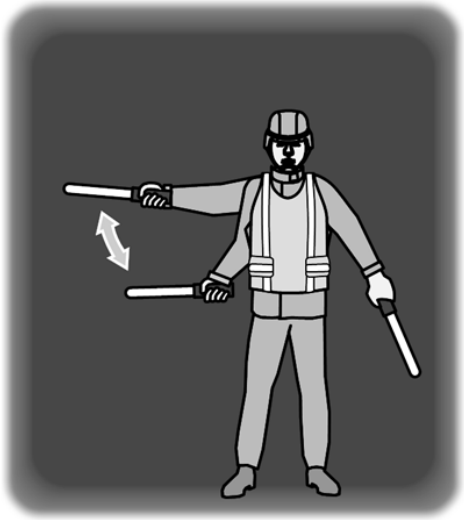
START ENGINES: Raise and extend either arm overhead. Point at the vehicle with the other hand and rotate the arm in circular motion.

START ENGINES (Night): Raise and extend either arm overhead with the wand pointed up. Point at the vehicle with the other wand, and rotate the arm in circular motion.

Figure 7-2. Signal for start engine

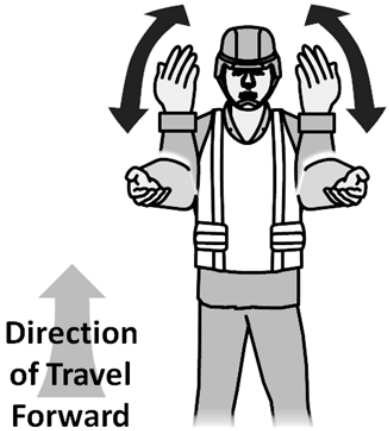


DECREASE SPEED, SLOW DOWN (Day): Extend the arm horizontally sideward, palm facing down, and wave arm downward several times, keeping the arm straight. (The arm is not moved above the horizontal plane.)

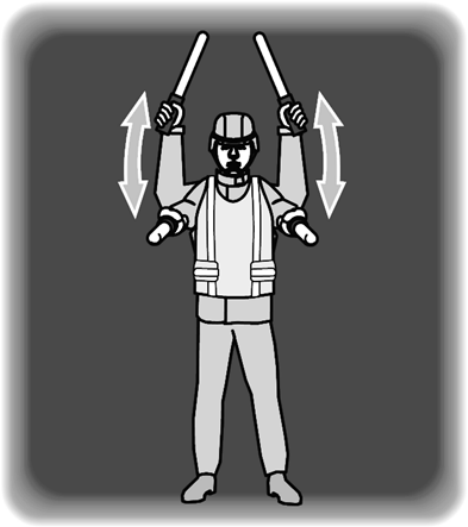


DECREASE SPEED, SLOW DOWN (Night): Face the vehicle, and hold the right wand out to the side, horizontal at shoulder level. Swing the wand to waist level, holding it horizontal. Repeat the swinging motion until the vehicle has slowed to the appropriate speed.

Figure 7-3. Signal for decrease speed and slow down

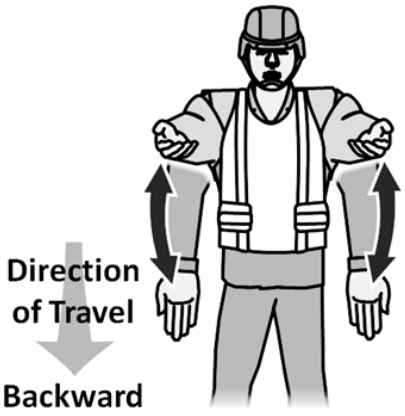


MOVE FORWARD (Day): With both hands, palm up, holding the arm horizontally to the front, point toward vehicle operator. Then beckon by repeatedly motioning upward, moving the hands to the side of the head.

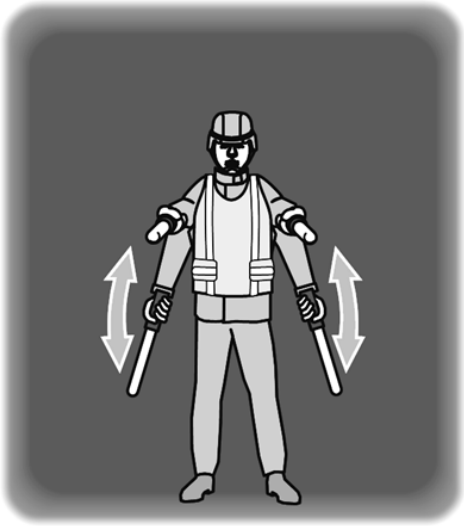


MOVE FORWARD (Night): Hold both wands in front of the body at shoulder level with tips pointed at the vehicle. Then beckon by repeatedly motioning upward, moving the wands to just above the side of the head.

Figure 7-4. Signal for move forward

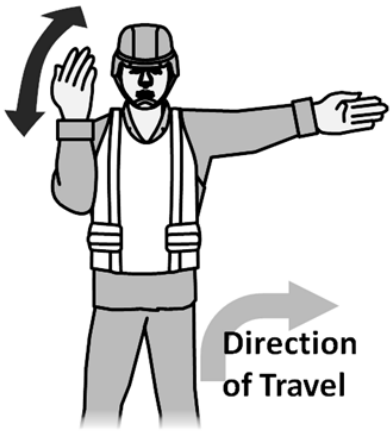


MOVE BACKWARD (Day): Raise the hands repeatedly form sides to chest level with the thumbs out and palms upward. (Sweep the hands in a slight forward and back pushing motion.)

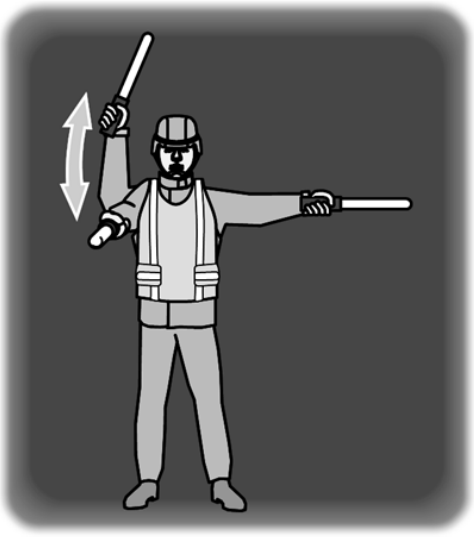


MOVE BACKWARD (Night): Raise the wands repeatedly form sides to chest level. (Sweep the wants in a slight forward and back pushing motion.)

Figure 7-5. Signal for move backward

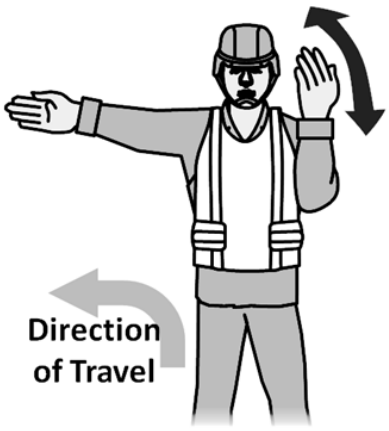


TURN RIGHT (Day): Extend the arm closest to the direction of travel horizontally, palm towards traffic to the indicated which way to turn. With the other hand, make the Come Forward signal.

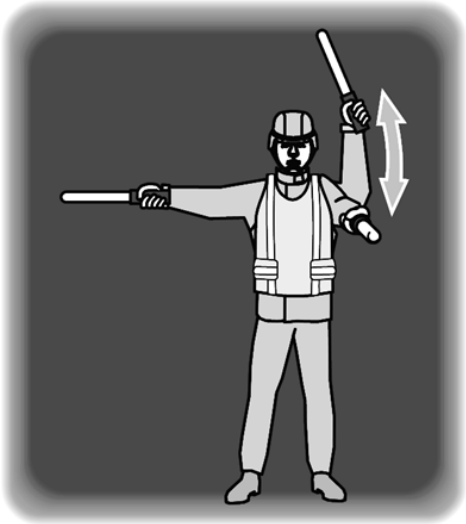


TURN RIGHT(Night): Extend the arm closest to the direction of travel horizontally, with the wand pointed to indicate which way to turn. With the other wand, make the Come Forward signal.

Figure 7-6. Signal for turn right



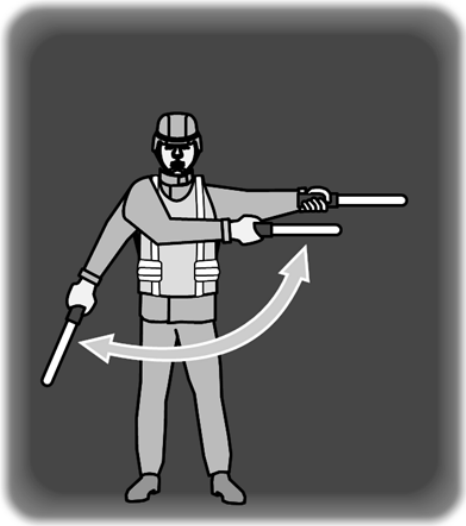
TURN LEFT: Extend the arm closest to the direction of travel horizontally, palm towards traffic to the indicated which way to turn. With the other hand, make the Come Forward signal.



TURN LEFT(Night): Extend the arm closest to the direction of travel horizontally, with the wand pointed to indicate which way to turn. With the other wand, make the Come Forward signal.

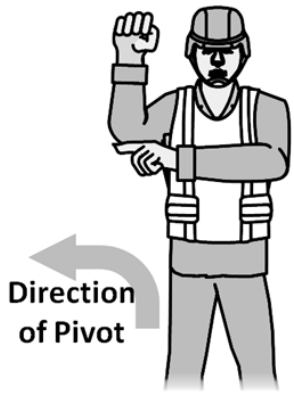
Figure 7-7. Signal for turn left

PIVOT RIGHT, Track Vehicles: Clench the left fist at head level, and point the index finger of the right hand in the direction of steer. *(Operator stops right track while the left track moves forward into the turn.)*

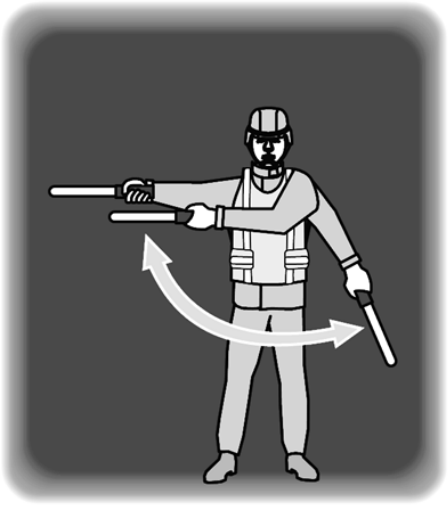


PIVOT RIGHT, Track Vehicles (Night): Extend the arm closest to the direction of travel horizontally, with the wand pointed to indicate which way to turn. With the other wand, make a repeated swing from the side of the leg to just under the extended wand.

Figure 7-8. Signal for pivot right

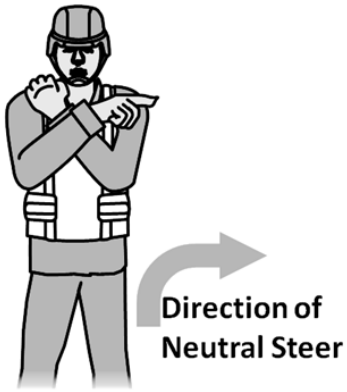


PIVOT LEFT, Track Vehicles: Clench the right fist at head level, and point the index finger of the left hand in the direction of steer. *(Operator stops left track while the right track moves forward into the turn.)*



PIVOT LEFT, Track Vehicles (Night): Extend the arm closest to the direction of travel horizontally, with the wand pointed to indicate which way to turn. With the other wand, make a repeated swing from the side of the leg to just under the extended wand.

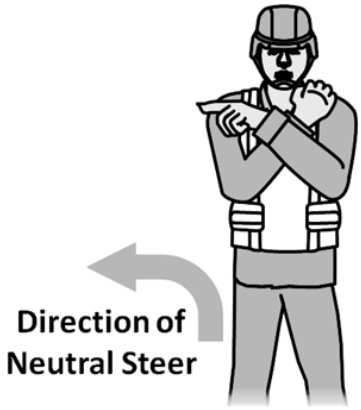
Figure 7-9. Signal for pivot left



NEUTRAL STEER RIGHT, Track Vehicles: Cross the left wrists beside the neck with clenched fist. Point the index finger of the right hand toward the left. *(Operator moves the right track in reverse, while moving forward with the left track.)*

NEUTRAL STEER RIGHT, Track Vehicles (Night): Place the left wand against the right side of the neck. Extend the right arm horizontally toward the direction of travel, with the wand pointed to indicate which way to turn.

Figure 7-10. Signal for neutral steer right

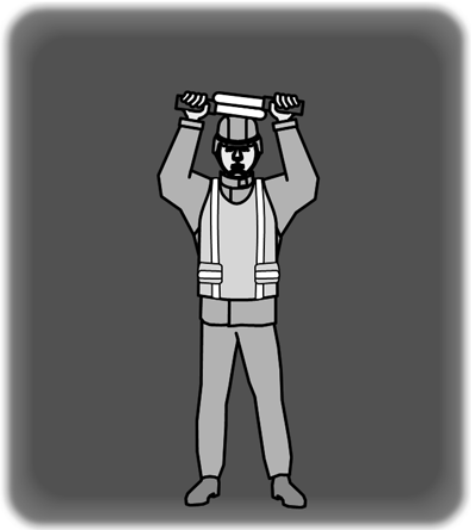


NEUTRAL STEER LEFT, Track Vehicles: Cross the right wrists beside the neck with clenched fist. Point the index finger of the left hand toward the right.
(Operator moves the left track in reverse, while moving forward with the right track.)

NEUTRAL STEER LEFT, Track Vehicles (Night): Place the right wand against the left side of the neck. Extend the left arm horizontally toward the direction of travel, with the wand pointed to indicate which way to turn.

Figure 7-11. Signal for neutral steer left

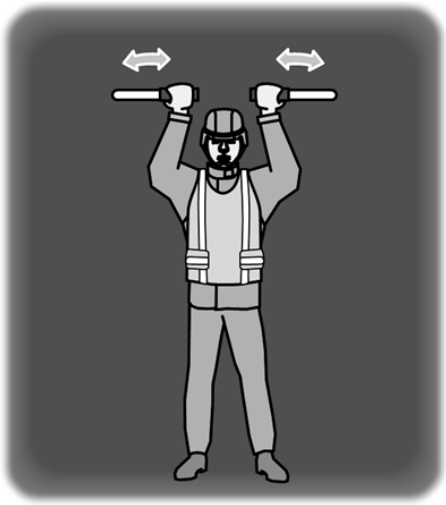
BUTTON-UP: Place both hands on top of the helmet, palms down, one on top of the other. Have the arms and elbows back on the same plane as the body.



BUTTON-UP (Night): Place both wands on top of the helmet, one on top of the other. Have the arms and elbows back on the same plane as the body.

Figure 7-12. Signal for button-up

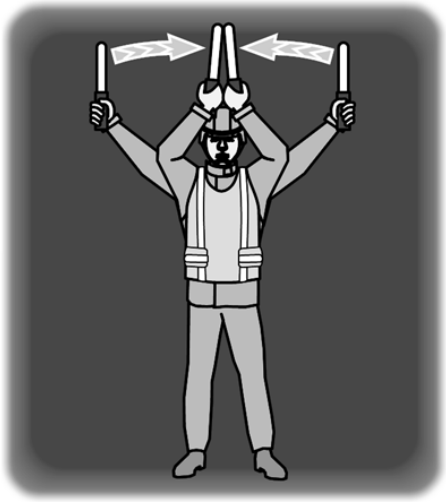
UNBUTTON: Start from the button-up signal; then separate the hands, moving them slightly back and forth in a slicing motion. Have the arms and elbows back on the same plane as the body. Repeat as needed to ensure having the driver's attention.



UNBUTTON (Night): Start from the button-up signal; then swing the wands outwards, moving them slightly back and forth in a slicing motion. Repeat as needed to ensure having the driver's attention.

Figure 7-13. Signal for unbutton

CLOSE THE DISTANCE & STOP: This Far To Go - Extend the forearms to the front, palms inward and separated (to about 3 or 4 feet of width). Bring palms together as the crane approaches the target stop point. The crane stops when palms come together.



CLOSE THE DISTANCE & STOP (Night): This Far To Go - Extend the wands over head, tips pointed upward and separated (to about 3 or 4 feet of width). Bring wands together as the crane approaches the stop point. The crane stops when wands touch, or flip to Stop signal.

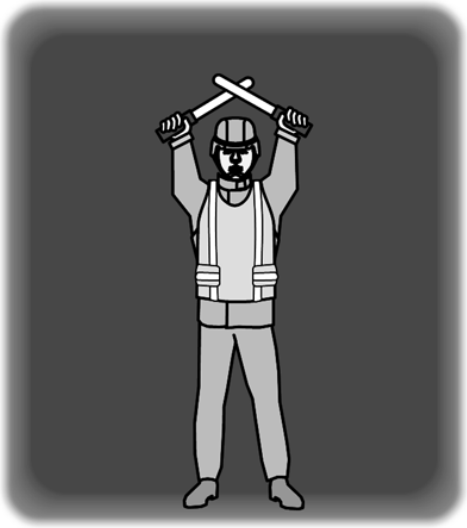
Figure 7-14. Signal for close the distance and stop

EMERGENCY STOP: Raise either arm with clenched fist. The other hand may point to the cause for the emergency. *(Only for use when the guide sees a safety issue or threat to the operation.)*

EMERGENCY STOP (Night): Raise either arm with wand held horizontally. Place the other hand with wand held diagonally across the chest. The other hand may briefly point to the cause for the emergency, but must repeatedly return to the chest.

Figure 7-15. Signal for emergency stop

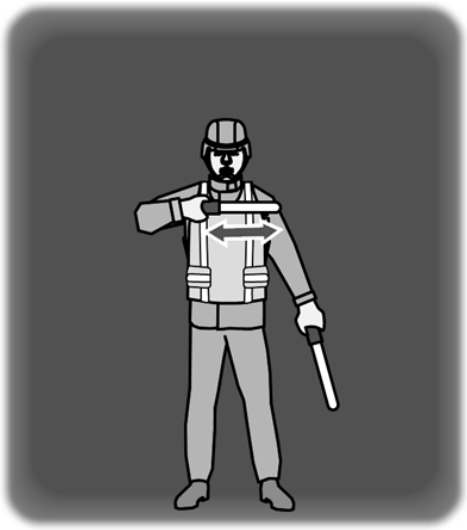
STOP: Clasp hands together palm to palm just below the chin.



STOP (Night): Cross wands over the head.

Figure 7-16. Signal for stop

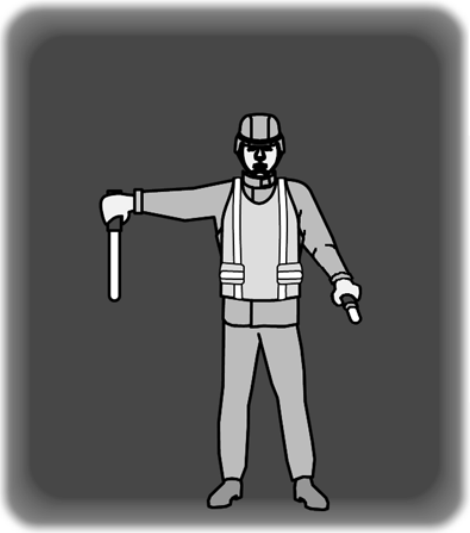
STOP ENGINES: Extend an arm horizontal under the chin, hand open, palm down, and move the arm across the body in a throat-cutting action.



STOP ENGINES (Night): Hold a wand horizontal under the chin, and move the arm across the body in a throat-cutting action.

Figure 7-17. Signal for stop engine

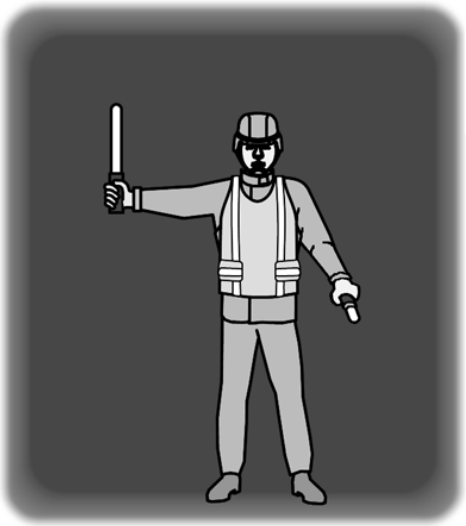
LOWER SPADE/OUTRIGGERS: First, point at the spade with the index finger of the left hand. Then, extend the right arm to the side, clenching a fist, and point the thumb downward.



LOWER SPADE/OUTRIGGERS (Night): First, point at the spade with the wand of the left hand. Then, extend the right arm to the side, and point the right wand downward.

Figure 7-18. Signal for lower spade/outriggers

RAISE SPADE/OUTRIGGERS: First, point at the spade with the index finger of the left hand. Then, extend the right arm with the arm slightly bent upward at the elbow while clenching a fist, and point the thumb upward.



RAISE SPADE/OUTRIGGERS (Night): First point at the spade with the wand of the left hand. Then, extend the right arm to the side, and point the right wand upward.

Figure 7-19. Signal for raise spade/outriggers

PAYOUT THE WINCH CABLE: With the arm bent, bring the hand in front of the chest. Move the hand down and away from the body at belt level, circling back to the chest. The circular motion is continued until the stop signal is given.

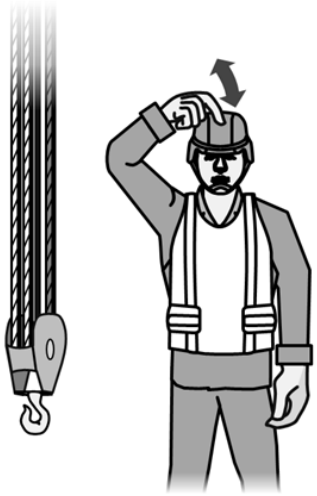
PAYOUT THE WINCH CABLE (Night): With the arm bent, bring the wand in front of the chest. Move the wand down and away from the body at belt level, circling back to the chest. The circular motion is continued until the stop signal is given.

Figure 7-20. Signal for payout the winch cable

INHAUL THE MAIN WINCH CABLE: Point at the operator with the index finger and rotate the arm in circular motion.

INHAUL THE MAIN WINCH CABLE (Night): Point at the operator with the wand, and rotate the arm in circular motion.

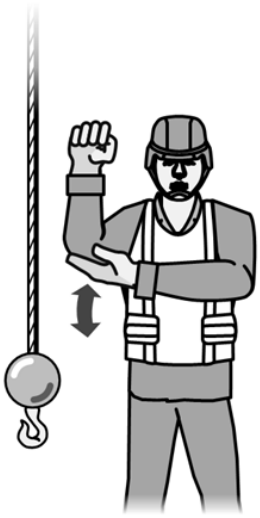
Figure 7-21. Signal for inhaul the main winch cable



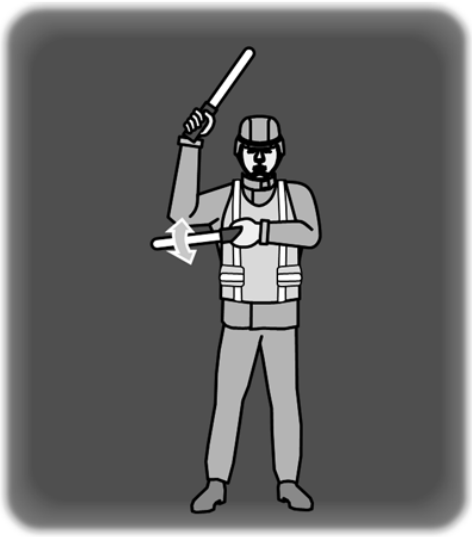
USE MAIN LINE: Tap the top of the helmet with the forefinger, three or four times.

USE MAIN LINE (Night): Tap the top of the helmet with the tip of the wand, three or four times.

Figure 7-22. Signal for use the main line



USE WHIP LINE: Tap the elbow of the raised forearm, three or four times.



USE WHIP LINE (Night): Tap the elbow of the raised forearm, three or four times with the wand.

Figure 7-23. Signal for use the whip line

RETRACT THE BOOM: Extended the index and center fingers upward, with the back of the hand facing the operator. Move the hand in toward and a way from the chest, bending the elbow slowly in a pumping action.

RETRACT THE BOOM (Night): Hold the wand against the chest, with the lighted end touching the chest. Move the wand away from the chest and back again, bending at the elbow slowly in a pumping action.

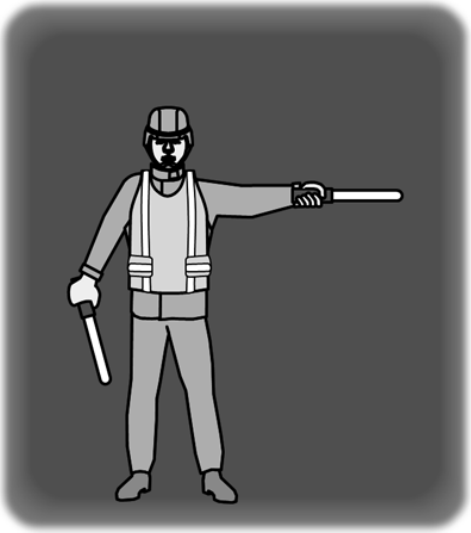
Figure 7-24. Signal for retract the boom

EXTEND THE BOOM: Extend the index and center finger upward, with the palm of the hand facing the operator. Move the hand away from the chest and back again, bending at the elbow slowly in a pumping action.

EXTEND THE BOOM (Night): Hold the wand against the chest, with the lighted end pointing outward. Move the wand away from the chest and back again, bending at the elbow slowly in a pumping action.

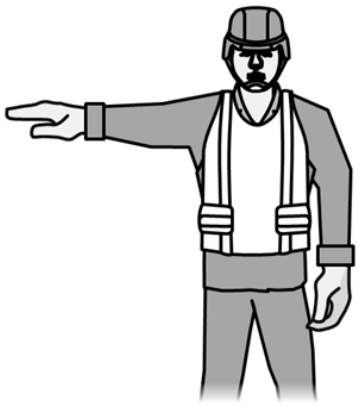
Figure 7-25. Signal for extend the boom

SWING BOOM, RIGHT: Extend the left arm to shoulder level, with the whole hand pointing in the direction that the operator must traverse.

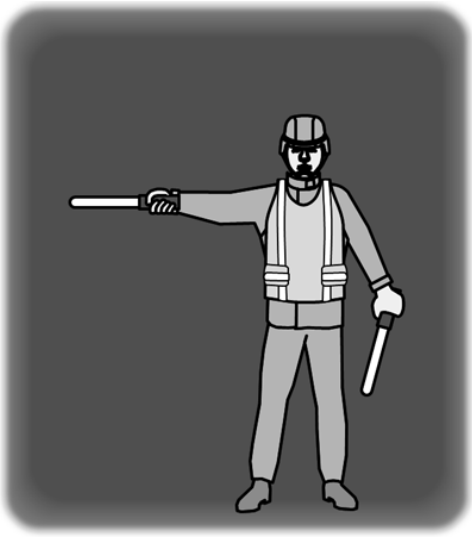


SWING BOOM, RIGHT (Night): Extend the left arm to shoulder level, holding the wand horizontal in the direction that the operator must traverse.

Figure 7-26. Signal for swing the boom to the right



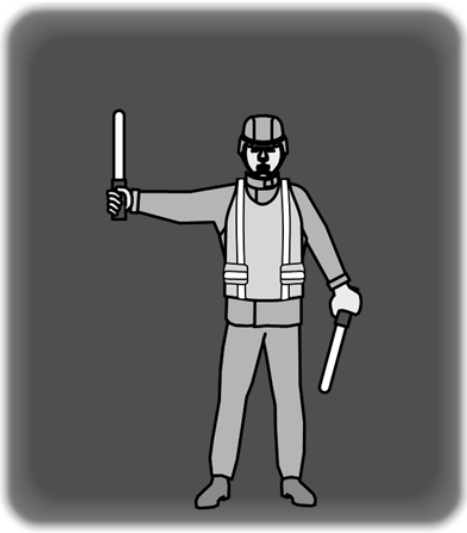
SWING BOOM, LEFT: Extend the right arm to shoulder level, with the whole hand pointing in the direction that the operator must traverse.



SWING BOOM, LEFT (Night): Extend the left arm to shoulder level, holding the wand horizontal in the direction that the operator must traverse.

Figure 7-27. Signal for swing the boom to the left

RAISE THE BOOM: Extend an arm to the side, with the fist clenched, and point the thumb upward. This signal may be made with either hand.



RAISE THE BOOM (Night): Extend an arm to the side, with wand pointed upward. This signal may be made with either hand.

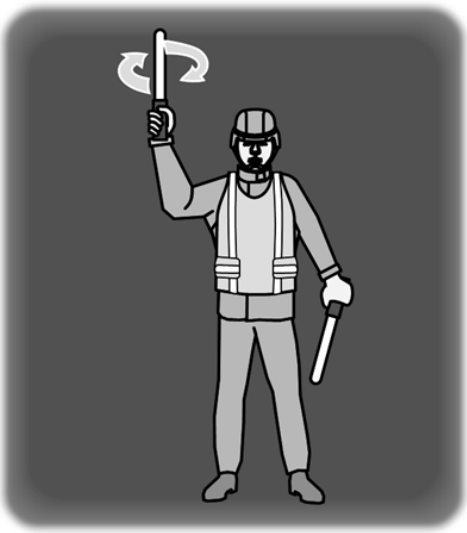
Figure 7-28. Signal for raise the boom

LOWER THE BOOM: Extend the arm to the side, with the fist clenched, and thumb pointed downward. This signal may be made with either hand.

LOWER THE BOOM (Night): Extend an arm to the side, with wand pointed downward. This signal may be made with either hand.

Figure 7-29. Signal for lower the boom

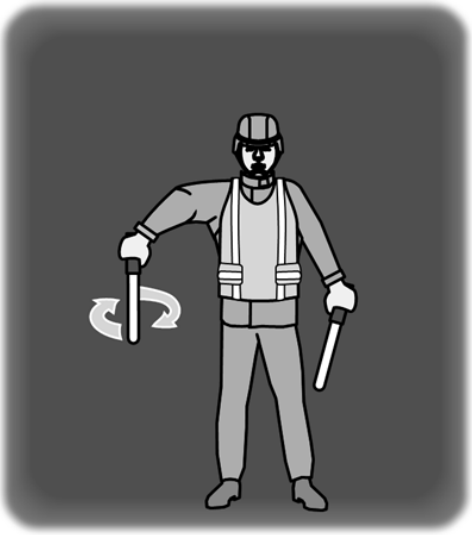
RAISE THE HOIST CABLE: Hold out the arm to the side, bent upward at the elbow, and extend the index finger from a fist. Rotate the hand slowly. This signal may be made with either hand with rotation made in either direction.



RAISE THE HOIST CABLE (Night): Hold out the arm to the side, bent upward at the elbow, and point the wand upward. Rotate the hand slowly. This signal may be made with either hand with rotation made in either direction.

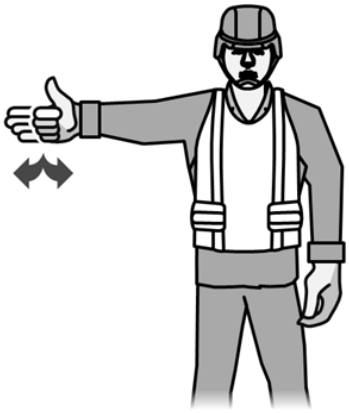
Figure 7-30. Signal for raise the hoist cable

LOWER THE HOIST CABLE: Hold the arm downward and out slightly from the side, extend the index finger from a fist, and rotate the hand slightly. This signal may be made with either hand with rotation made in either direction.

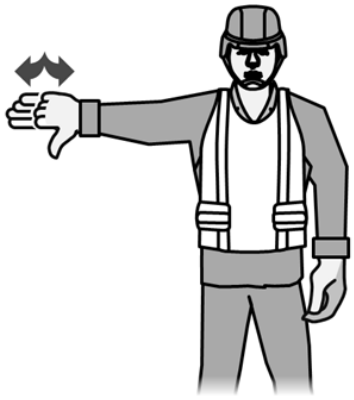


LOWER THE HOIST CABLE (Night): Hold the arm downward and out slightly from the side, with the wand pointed down, and rotate the wand slightly. This signal may be made with either hand with rotation made in either direction.

Figure 7-31. Signal for lower the hoist cable



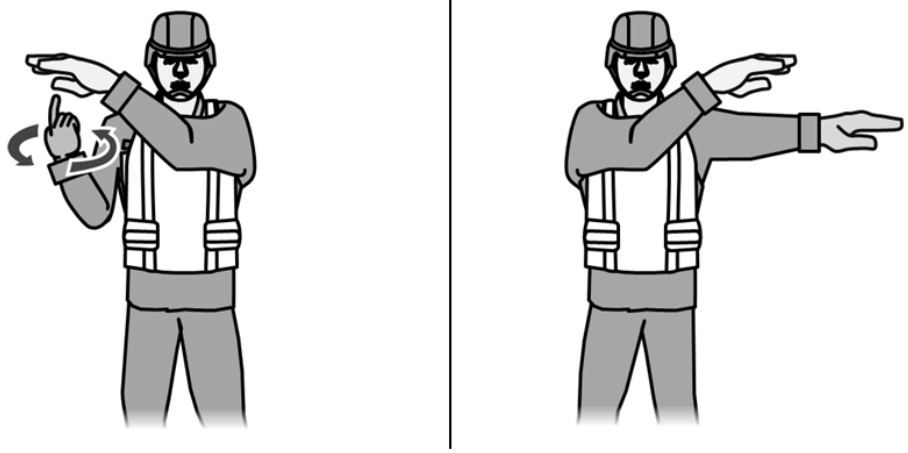
RAISE BOOM & LOWER THE LOAD: Extend arm, thumb pointed up, flex fingers in and out as long as load movement is desired. *(This moves the load horizontally toward the crane.)*



LOWER BOOM & RAISE THE LOAD: Extend arm, thumb pointed down, flex fingers in and out as long as load movement is desired . *(This moves the load horizontally away from the crane.)*

(There is no night time signal for conjoined Hoist & Boom movement.)

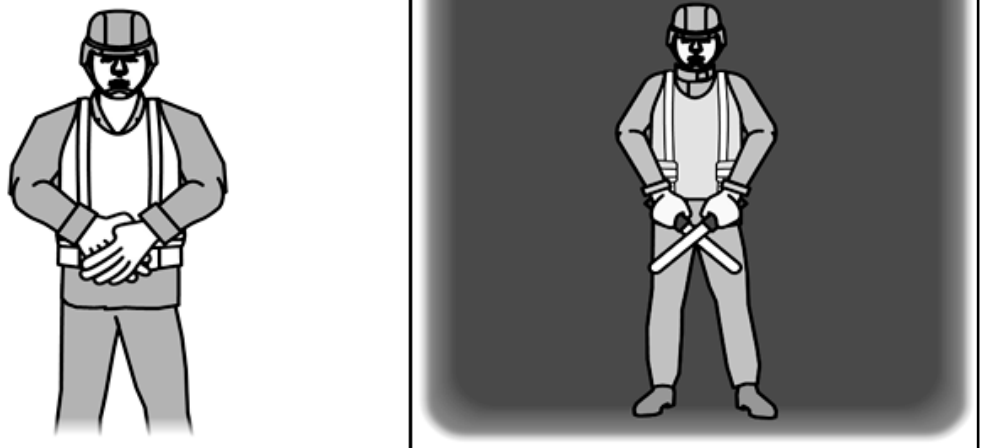
Figure 7-32. Signal for raise boom, lower load & lower boom, raise load



MOVE SLOWLY: Use one hand to give any motion signal, and hold the other hand motionless palm down just above the signaling hand (e.g., Hoist UP - Slowly, and Swing Boom Right - Slowly).

(There is no night time conjoined signal for movement and move slowly.)

Figure 7-33. Signal for move slowly



DOG EVERYTHING: **Clasp hands in front of the lower body.** *(Stop, shift to park, set brakes, and lock all other systems to prevent further movement. Turning off the engine or power is a separate signal.)*

DOG EVERYTHING (Night): **Cross wands in front of the lower body.** *(Stop, shift to park, set brakes, and lock all other systems to prevent further movement. Turning off the engine or power is a separate signal.)*

Figure 7-34. Signal for dog everything

OVERHEAD POWER LINES

7-12. Wreck crane operations under or near electric power lines are extremely hazardous, as discussed in chapter 6. A closed electric circuit and a difference in voltage are required for the passage of electric current. When a crane boom or wire ropes come in contact with a live power line, the crane, wire ropes, boom, and load become electrically charged. A person on the ground steadying a swaying load or touching any part of the crane becomes part of this closed electric circuit and can be instantly electrocuted or be critically burned. The crane operator is responsible for keeping his crane boom and/or wire ropes away from power lines. He is relatively safe while in the cab. Should he step off the crane and have one foot on the crane step and one on the ground, he also could be electrocuted or burned.

MOVEMENT IN TOW

7-13. Wreck cranes are powered for independent movement by gear-driven wheels. When cranes are moved in tow, in work or wreck trains, operators must take the following precautions to avoid damage to the crane, the train, or wayside objects.

- Secure the rotating deck parallel to the centerline of the track.
- Fasten the deck at front and rear ends with tie bars provided.
- Lower the boom to the traveling position, preferably pointing to the rear.
- Place transmission lever in NEUTRAL position.
- Disengage driving gears so wheels will turn freely.
- Use hand crank to draw the gear assemblies out of mesh.

SAFE LOAD PRECAUTIONS

7-14. Wire ropes and tackle must not be overloaded. When making heavy lifts, crane or derrick operators must be sure of the following:

- Boom is properly positioned.
- Boom is as high as possible.
- Hoist wire ropes have greater capacity than the load to be lifted.
- Hoist wire ropes have no kinks or broken wires.
- Crane is level and outriggers are in place.
- Brakes are in good working order.
- Load to be lifted is properly slung (rigged).
- Load is kept near the ground when traveling and not lifted higher than necessary.
- The swing is started slowly when swinging loads.
- Loads are not left hanging on the hook.

7-15. The *safety factor* is the ratio of the strength of the rope to the working load (ATP 4-14). For example, a wire rope with the strength of 10,000 pounds and a total working load of 2,000 pounds would be operating with a safety factor of 5. It is not possible to set exact safety factors for cranes with various types of wire rope as this factor can safely vary with conditions. The proper safety factor depends not only on the loads applied, but also on the following:

- Speed of operation.
- Type of fittings used for securing the rope ends.
- Length of the wire rope.
- Acceleration and deceleration.
- Number, size, and location of sheaves and drums.

7-16. The safety factors given in table 7-1 have been established, by experience, as the minimum required for an average operation. Larger safety factors are desirable for greater safety and more efficient operation.

Table 7-1. Safety factors

Use	*Minimum Safety Factor*

Table 7-1. Safety factors

Use	*Minimum Safety Factor*
Guys	3.5
Miscellaneous hoisting equipment	5.0
Derricks	6.0
Slings	8.0

LOAD FORMULAS

7-17. Safe working loads are selected from mathematically determined tables (tables 7-2 and 7-3 on page 7-22). However, the following formulas are basic methods for determining safe working loads (in tons) for hooks, chains, ropes, and wire rope (diameter in inches).

- Hooks. Where the hook starts to arc, the square of the diameter.
- Chains. Eight times the square of the diameter of one side of the link.
- Rope. Square of the diameter.
- Wire rope (cable). Eight times the square of the diameter.

Table 7-2. Safe working loads of slings (part 1)

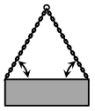
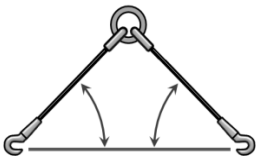
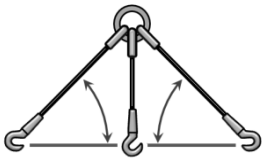
Chain Slings (Loads in Pounds)								
Size of Chain (inches)	*SINGLE*	*DOUBLE*						
		 5º	 10º	 15º	 20º	 30º	 45º	 60º
3/8	2700	470	940	1450	1850	2700	3800	4700
7/16	3450	600	1200	1750	2350	3450	4900	5900
1/2	4500	780	1570	2300	3100	4500	6350	7800
5/8	6900	1200	2400	3550	4700	6900	9750	12000
3/4	10100	1750	3500	5200	6900	10100	14000	17500
7/8	14000	2400	4900	7250	9600	14000	19500	24000
1	18600	3200	6500	9650	12700	18600	26000	32000
1 1/8	23400	4000	8000	12000	16000	23400	33000	40000
1 1/4	28800	5000	10000	15000	19700	28800	40500	50000
1 3/8	34500	6000	12000	17800	23500	34500	49000	60000
1 1/2	40800	7000	14000	21000	28000	40800	57500	70000

Table 7-3. Safe working loads of slings (part 2)

Wire Rope Slings (Loads in Pounds)

Table 7-1. Safety factors

Use	*Minimum Safety Factor*						
Size of Rope (inches)	*SLIP NOOSE*	*TWO-END BRIDLE SLING*			*THREE-END BRIDLE SLING*		
							
		When Angle is			*When Angle is*		
		45º	*60º*	*75º*	*45º*	*60º*	*75º*
3/8	3200	2200	2800	3000	3400	4200	4600
1/2	5400	4000	4800	5200	6000	7200	7800
5/8	8400	6000	7200	8000	9000	10800	12000
3/4	12000	8400	10200	11400	12600	15400	17000
7/8	16000	11400	14000	16000	17200	21000	24000
1	22000	15000	18000	20000	22000	26000	30000
1 1/8	26000	19000	23000	26000	28000	36000	40000
1 1/4	32000	23000	28000	32000	36000	42000	48000
1 3/8	40000	28000	34000	38000	42000	52000	58000
1 1/2	46000	32000	40000	44000	48000	60000	66000

NOTES:

- Loads are based on slings in good condition.
- Take up slack and start the load slowly.
- Keep slings free from twists, knots, and kinks.
- Lift from the center of hooks, never from the point.
- Distribute the load evenly on all legs of the sling.
- Inspect slings regularly.
- DO NOT OVERLOAD.

HOISTING AND LIFTING MATERIALS

7-18. Wire rope (cable) is used on wreck cranes for hoisting. Manila or sisal rope, because it is easy to handle, is carried for hand or tag lines, minor lashing, and rigging. All spare rope (both fiber and wire) should be kept coiled when not in use. The sizes of rope used by the U.S. Army are designated as inches in diameter.

7-19. In the case of the ERC performing an advise and assist mission in a foreign territory, unmarked and unrated gear may have to be used in foreign hands, but it is preferable to always use marked hooks and chains. Grade 80 chain and fittings is the minimum recommended for lifting in the US. Do not use non-metallic rope if at all avoidable. Wire ropes should be marked with a colored strand, which should be documented and traceable back to the manufacturer.

FIBER ROPE

7-20. Fiber rope is made by twisting vegetable fibers or man-made fibers together. The rope consists of three elements: fibers, yarns, and strands. The direction of twist of each element is reversed to prevent the

elements from unraveling under load strain. Fiber rope is named for the kind of vegetable fibers of which it is composed. Manila rope (made from the fibers of plantain leaves) and sisal rope (made from the fibers of aloe leaves) are two types commonly used in military service. Manila rope is superior to other fiber ropes in elasticity, strength, and wear qualities. It is smooth and runs well over blocks and sheaves.

7-21. The minimum breaking strength of manila and sisal rope is much greater than their safe working capacity. The difference between the two is the safety factor. The safe working capability (in tons) for a given size of manila rope is approximately equal to the square of the diameter in inches, using a safety factor of four. Under no circumstances should fiber rope be loaded to more than twice its rated safe working capacity. As rope deteriorates, the safe load is one-half of the value shown in table 7-4.

Table 7-4. Properties of manila and sisal rope

		No. 1 Manila		*Sisal*	
Nominal diameter (inches)	***Circumference (inches)***	***Breaking strength (tons)****	***Safe load (tons)* FS = 4***	***Breaking strength (tons)***	***Safe load (tons) FS = 4***
¼	¾	0.27	0.07	0.22	0.06
½	1 ½	1.32	0.33	1.06	0.26
¾	2 ¼	2.70	0.67	2.16	0.54
1	3	4.50	1.12	3.60	0.90
1 ¼	3 ¾	6.72	1.69	5.40	1.35
1 ½	4 ½	9.25	2.31	7.40	1.85
2	6	15.50	3.87	12.40	3.10
3	9	32.00	8.00	25.60	6.40

* Breaking strength and safe loads are for new rope used under favorable conditions

WIRE ROPE

7-22. Wire rope is made of steel or iron wires twisted to form strands. The strands may be wound around each other or twisted over a central core of fiber or steel rope. The direction of twist of each element of the rope is known as the "lay" of that element. Regular lay, the accepted standard for wire ropes, denotes ropes in which the wires are twisted in one direction to form the strands. Strands are twisted in the opposite direction to form the rope. In regular lay ropes, the wires are almost parallel to the longitudinal axis of the rope. Due to the difference in direction of the strand and rope lays, regular lay ropes are less likely to kink and untwist than ropes constructed with other lays. They are also easier to handle. Overloaded wire rope breaks a strand at a time. To prevent corrosion and internal abrasion, boom wire rope should be lubricated with lubricants thin enough to penetrate to the inner strands.

7-23. Fiber cores are standard for most constructions of wire rope, but are not as strong as ropes with wire cores. A fiber core supports the strands, supplies internal lubrication, and contributes to the flexibility and resiliency of the rope. Wire core ropes are less suitable than fiber core ropes for operations where shock loads are frequent. Wire rope constructions are designated by the number of strands in the rope and the number of wires in each strand. Therefore, a rope composed of six strands of 19 wires each is a 6 x 19 rope. This is the standard hoisting wire rope and is more universally used than any other rope construction.

CHAINS

7-24. Chains are composed of a number of metal links connected together. The links are made of a round or oval piece of rod or wire welded into a solid ring after being joined to the connecting link. Chain size is determined by the diameter of the rod composing the links. While chains may stretch under excessive loads, individual links will bend only slightly. Chains with bent links may suddenly break under load. Since chains are resistant to abrasion, they are often used to lift heavy objects with sharp edges that might cut wire rope.

BLOCKS

7-25. A block is a shell or frame, which holds one or more grooved pulleys, called sheaves. The sheaves revolve on a center pin or axle. A fixed or swivel-type hook is attached to one end of the block and often an eye is attached to the other.

Types of Blocks

7-26. Block sizes are determined by the length of the shell (frame) in inches and by the number of sheaves it contains. Single, double, triple, and quadruple blocks contain one, two, three, or four sheaves respectively. Blocks can be identified by their construction and the manner in which they are used. These two types of blocks are conventional and snatch.

- Conventional block. A conventional block is constructed for fiber or wire rope, which must be reeved or threaded through the sheaves. This is the type block found on crane booms.
- Snatch block. A snatch block, also called a gate block, is constructed so that one side opens to permit a wire rope or rope to be placed over the sheave without reeving through the block. It is easily identified by the hinge and lock on one side. It is normally used in making rigs to obtain mechanical advantage where the wire ropes or ropes are continuous lines and cannot be threaded through the sheave.

Classification

7-27. Blocks are classified according to the manner in which they are used. These two types of blocks are fixed and running.

- Fixed block. This block is fastened to a stationary object. It does not affect mechanical advantage. Sometimes called a leading block, it does permit a change in direction of the wire rope.
- Running block. This block (also called a traveling block) is fastened to the object to be moved or lifted. This block does produce a mechanical advantage.

Wire Rope Considerations

7-28. The largest size wire rope that can be used on a block is determined by the diameter of the sheave, depth of the groove, and the size of the opening through which the line passes over the sheave. The proper size is the largest one possible that fits the sheave groove and still has clearance between the frame and the sheave. This diameter is usually from one-eighth to one-ninth the shell length. The use of multiple sheave blocks increases the weight that can be lifted (mechanical advantage). This increase depends on the number of sheaves in the sheave blocks and the number of parts of wire rope between the blocks.

HOOKS

7-29. Railway wreck cranes are equipped with two slip hooks (one large and one small). The large hook is rigged to the triple block on the main boom hoist. On steam cranes, the small, single hook is rigged to the single-hoist line over the sheave at the end of the boom. Slip hooks are made so the inside curve of the hook is an arc designed to be used with wire or fiber rope and chains. Hooks usually fail by straightening, thereby releasing the load. Any deviation from a perfect inner arc indicates overloading. Safe working loads of drop-forged steel hooks of various sizes are shown in table 7-5. This information is very useful on foreign or domestic unmarked hooks. Properly marked load ratings can be generally relied upon.

Table 7-5. Safe loads on hooks

Diameter at beginning of arc (in)	*Inside diameter of eye (in)*	*Length of hook (in)*	*Safe load on hook (lbs)*
1	1 ¼	6-7 1/8	3,400
1 ½	1 ¾	10 11/32	8,000

Table 7-5. Safe loads on hooks

Diameter at beginning of arc (in)	*Inside diameter of eye (in)*	*Length of hook (in)*	*Safe load on hook (lbs)*
2 ¼	2 ¾	14 13/16	13,600
3	3 1/2	19 3/4	24,000

CRANE RIGGING

7-30. Wreck crane rigging includes all the combinations of wire rope, rope, and tackle used to raise or move heavy loads. Rigging may be used to change the direction of pull or to take advantage of favorable terrain features. Various combinations of wire ropes, blocks, and pulleys may be rigged to create mechanical advantage. To employ crane rigging effectively, wreck crew personnel must understand the various parts and how effort and resistance are distributed among them. When effort is exerted on one end of a wire rope or a rope, there is equal resistance applied at the other end. Tackle must be used if the resistance (object to be moved) exceeds the effort available. This difference is supplied by the mechanical advantage of rigging.

7-31. The heavy load (main) hoist raises and lowers the big block on the crane boom. The main hoist consists of a number of wire rope wire ropes running from the load block, or traveling block, or running block, up to the peak of the boom, through sheaves, and down to the main hoist drum in the crane cab. The number and size of wire ropes vary with the lifting capacity of the crane. The auxiliary hoist line raises and lowers the hook at the end of the boom. Wire ropes for this line run through the sheaves of the light load hook to the sheaves at the tip of the boom, then to the auxiliary hoist drum. These wire ropes vary with the lifting capacity of the light load hook.

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Glossary

SECTION I – ACRONYMS AND ABBREVIATIONS

ABS	automatic block signaling
ABS-TWC	automatic block signaling-track warrant control
ADP	Army doctrine publication
ADRP	Army doctrine reference publication
AR	Army regulation
ATP	Army techniques publication
USAMC	United States Army Material Command
DA	Department of the Army
DA Pam	Department of the Army pamphlet
DD	Department of Defense
DTC	direct traffic control
ERC	Expeditionary Railway Center
GCOR	General Code of Operating Rules
HN	host nation
IMCOM	Installation Management Command
ITD	individual train detection
kV	kilovolt
MOW	maintenance of way
mph	miles per hour
PPE	personal protective equipment
TAW	train approach warning
TM	technical manual
TWC	track warrant control
U.S.	United States

SECTION II – TERMS

***maintenance of way**

The operations that railroads conduct to construct, maintain, repair, and in some cases, demolish and remove, railroad infrastructure, including the trackage itself, that results in the railroad running dependably and safely. Also known as MOW.

safety factor

The ratio of the strength of the rope to the working load (ATP 4-14).

wreck train

A specially configured train tailored to conduct wreck recovery operations (ATP 4-14).

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By Order of the Secretary of the Army

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