

Line Handling Safety

Work activities in marine terminals start when the cargo vessel enters the port, continue through off-loading and/or reloading, and end with the departure of the vessel. Before any longshoring activity can take place, the vessel must be safely moored to the pier. While the mooring and unmooring of vessels is a routine task for marine terminals, worker injuries and fatalities still occur. The line configuration, equipment, and weather conditions have the potential to create hazards for workers during mooring operations. Employers need to be aware of these potential hazards so they can take steps to address them.

Common Hazards

The most common hazards associated with line handling operations include:

- Slips, trips, and falls from poor housekeeping or environmental conditions, such as snow and ice;
- Struck-by hazards from broken lines or cables (snap-back);
- Sprains and strains from the physical demands of pulling lines;
- Cuts and puncture wounds from frayed or broken wire-rope strands;
- Pinch points; and
- Drowning from falling or being pulled into the water.

Types of Mooring Lines

Mooring lines are made from wire rope and natural or synthetic fibers, and the thickness will vary depending on the size of the vessel. Regardless of the material or size, it is important that all mooring lines be inspected for wear and deterioration. Any lines showing damage should not be used.

Each line is different and can break if it is overloaded, snapping back in the direction of its pull. The only difference is the speed at which the line snaps back. This speed is a result of the type of material and the amount of stored energy that builds up before the line parts. Synthetic lines, despite their durability, are known for catastrophic outcomes because the lines can build up a large amount of stored energy, causing them to snap back with great speed. Wire ropes snap back at a slower speed because of their stiffness, but they are more difficult to handle and have the

potential to cause cuts or puncture wounds from frayed or broken strands. Workers handling wire ropes should never let the rope slide between or along their hands. No matter what the mooring lines are made of, it is important that workers stay out of the line's path to prevent injury in the event of line failure.

Listen for the Warning Signs of Line Failure

Different types of lines have audible warning signs:

- Sisals, manilas, or coir will creak and crack.
- Terylene, terylene-cotton, polypropylene or any of the manmade fibers will creak.
- Wire rope will squeak or crack.
- Nylon will not make noise except for a very loud crack when it parts.

If a rope breaks it will typically snap back towards and past the point to which it is secured. This is the snap-back zone. If you hear any one of these audible warning signs, move away immediately in a direction and to a location clear of the snap-back zone.

Mooring Line Configurations

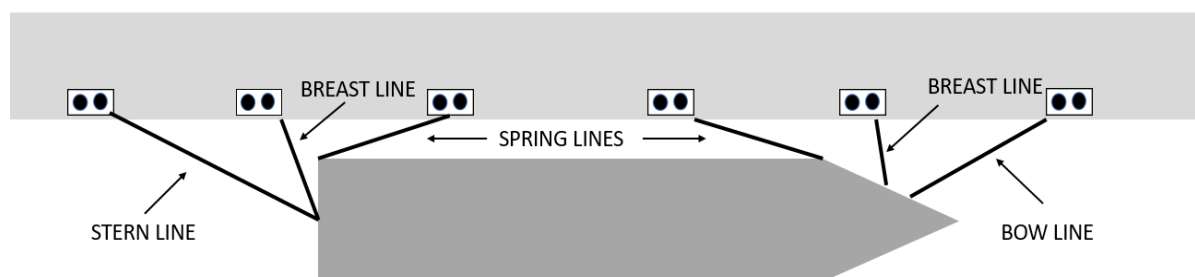
Mooring lines consist of a heavy gauge material and are used to secure vessels to the pier. Their configuration is important to ensure that the vessel remains stable for the safe loading, unloading, and movement of cargo on or off the vessel. The four types of mooring lines are described below, along with a sample mooring line configuration.

- **Bow lines** lead ashore from the fore-end (or forecastle) of the vessel, often at an angle of about 45 degrees to the fore breast lines.
- **Breast lines (or Head lines)** restrain the ship in one direction (off the berth). Therefore, they are secured as perpendicular as possible to the pier at the fore and aft of the vessel. Due to the potential for collisions with shore gantry cranes, breast lines are not usually used in container terminals.
- **Spring lines** prevent longitudinal movement (or surge) of the ship while berthed by restraining the vessel in two directions. Headsprings prevent forward motion and backsprings prevent aft motion.
- **Stern lines** lead ashore from the stern of a ship, often at an angle of about 45 degrees to the aft breast lines.

Other terminology related to line handling includes:

- **Bollards** are strong nautical posts for mooring vessels.
- **Cleats** are devices with two projections pointing in opposite directions to which a line can be tied to secure a vessel.
- **Mooring** refers to tying down a vessel to one place, such as a bollard or cleat, with lines.
- **Heaving lines** are lightweight lines with a heavy knot or other weight near the end that is attached to the heavy mooring line. The heaving line is thrown by the vessel crew onto the dock surface so that line handlers may pick it up and pull it in until safely gaining access to the mooring line.
- **Pig tails** are a piece of rope attached to the heaving line and mooring line.

Sample Mooring Line Configuration



To adequately protect workers, employers must:

- Provide line handlers with and ensure they wear personal protective equipment (PPE) in accordance with 29 CFR 1917, Subpart E. Necessary PPE usually includes:
 - A U.S. Coast Guard approved [personal floatation device](#) (with retro-reflective material if the operation is being carried out at night) (29 CFR 1917.95)
 - Protective footwear (29 CFR 1917.94)
 - Head protection (29 CFR 1917.93)
 - Gloves (29 CFR 1917.95)
- Ensure that cargo, material, or vehicles do not obstruct the work surface during the mooring or unmooring of vessels (29 CFR 1917.16(a)).
- Install grab lines or rails on the sides of permanent structures where walkway or apron widths are insufficient for safe footing (29 CFR 1917.16(b)).
- Have a U.S. Coast Guard approved 30-inch life ring, with at least 90 feet of line, readily accessible at each waterside work area where workers are exposed to drowning hazards. (29 CFR 1917.26(f))

- Generally, ensure that lighting for walking and working areas is of an average minimum light intensity of 5 foot-candles in active work areas and at an average minimum light intensity of 1 foot-candles in other work areas. Supplemental lighting must be used as needed. (29 CFR 1917.123)

In addition, employers should:

- Establish mooring line patterns/procedures and appoint a lead linesman.
- Ensure communication is established between the mooring supervisor and the vessel master at the beginning and that they agree on the final mooring configuration.
- Establish clear communication between vessel crewmembers and personnel performing line handling.
- Inspect mooring lines prior to use and remove damaged lines from service.
- Inspect bollards for wear or damage and ensure they are cleared of ice, snow, and debris.
- Avoid the use of excessively weighted monkey fists.
- Train workers on safe practices and procedures for line handling, such as the identification of authorized employees and commands, signals, and terminology likely to be used.

What workers can do to stay safe during line handling:

- Wear gloves when handling mooring lines and cables.
- Arrive at the pier/dock wearing required PPE.
- Report damaged or worn mooring lines and cables to your supervisor or lead linesman. Do not handle lines or cables that are damaged.
- When receiving a messenger or heaving line, stand at least three feet away from the edge of the dock/pier.
- Never handle a mooring line alone.
- Watch where you step. Don't step into the **bight of the line** or become trapped between a mooring line and a fixed object.
- Handle mooring lines by the throat of the eye or lower (not the crown of the eye) when placing it on a bollard or cleat. Never let your hand or fingers get between the line and the bollard or cleat.
- When more than one line is on a bollard or cleat, "dip the eye" to ensure each line can be easily and safely removed.
- Look for excessive line tension and be prepared to drop the line if necessary.
- Use small breakable lines, approximately six feet behind the eye of the line, to attach to a tow vehicle. Install lines as low as possible to avoid creating tripping hazards.
- Keep the exhaust of engine-powered portable equipment clear of all synthetic lines to avoid melting lines or creating damage.
- Once a line has been placed on the dock fitting, keep clear while the ship heaves around on the line. Stand at a right angle to the line or, if possible, stand behind cover to protect yourself in the event the line breaks.
- Where inset bollards (storm bollards) are used, mark or flag lines to ensure they are clearly seen by vehicles moving under or around the lines.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page (www.osha.gov/workers).

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to help ensure these conditions for America's workers by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.



This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: 1-877-889-5627.



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