



# HOISTING AND RIGGING SAFELY

The ability to safely move materials from one location to another is a vital part of many activities at our locations. Hoists are often used when materials are too heavy or bulky to be safely moved manually. Because hoists rely upon slings to hold their suspended loads, slings are the most commonly used materials-handling apparatus.

In part because of the complex nature of the seemingly simple task of lifting an object, an effective program is necessary to lift and move heavy loads safely.

## SELECTION, USE AND INSPECTION OF SLINGS

Workers involved in hoisting and rigging must exercise care when selecting and using slings. The selection of slings should be based upon the size and type of the load, and the environmental conditions of the workplace. Slings should be visually inspected before each use to ensure their effectiveness. Improper use of hoisting equipment, including slings, may result in overloading, excessive speed (e.g., taking up slack with a sudden jerk, shock loading), or sudden acceleration or deceleration of equipment.



There are generally six types of slings: chain, wire rope, metal mesh, natural fiber rope, synthetic fiber rope, or synthetic web. Slings tend to be placed into three groups: chain, wire rope and mesh, and fiber rope web. Each type has its own particular advantages and disadvantages. Factors to consider when choosing the best sling for the job include size, weight, shape, temperature, and sensitivity of the material being moved, and the environmental conditions under which the sling will be used.

The following guide may be useful in selecting the appropriate sling.

## CHAINS

Alloy steel chains are strong and able to adapt to the shape of the load. Care should be taken when using chain slings because sudden shocks will damage them. This may result in sling failure and possible injury to workers or damage to the load. Chain slings must be visually inspected prior to use. During the inspection, pay particular attention to any stretching, nicks, gouges, and wear in excess of the allowances made by the manufacturer. These signs indicate that the sling may be unsafe and must be removed from service immediately.

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#### WIRE ROPE

Wire rope is composed of individual wires that have been twisted to form strands. Strands are then twisted to form a wire rope. When wire rope has a fiber core, it is usually more flexible but less resistant to environmental damage. Conversely, wire rope with a core that is made of a wire rope strand tends to have greater strength and is more resistant to heat damage.

When selecting a wire rope sling to give the best service, there are four characteristics to consider: strength, ability to withstand fatigue (e.g., to bend without distortion), ability to withstand abrasive wear, and ability to withstand abuse.

- **STRENGTH** – Strength of wire rope is a function of its size (e.g., diameter of the rope), grade, and construction, and must be sufficient to accommodate the maximum applied load.
- **FATIGUE (BENDING WITHOUT FAILURE)** – Fatigue failure of wire rope is caused by the development of small cracks during small radius bends. The best means for preventing fatigue failure of wire rope slings is to use blocking or padding to increase the bend radius.
- **ABRASIVE WEAR** – The ability of wire rope to withstand abrasion is determined by the size and number of the individual wires used to make up the rope. Smaller wires bend more readily and offer greater flexibility, but are less able to withstand abrasion. Larger wires are less flexible, but withstand abrasion better.
- **ABUSE** – Misuse or abuse of wire rope slings will result in their failure long before any other factor. Abuse can lead to serious structural damage, resulting in kinks or bird caging. (In bird caging, the wire rope strands are forcibly untwisted and become spread outwards.) To prevent injuries to workers and prolong the life of the sling, strictly adhere to safe and proper use of wire rope slings. Wire rope slings must be visually inspected before use. Slings with excessive broken wires, severe corrosion, localized wear, damage to end-fittings (e.g., hooks, rings, links, or collars), or damage to the rope structure (e.g., kinks, bird caging, distortion) must be removed from service and discarded.

#### FIBER ROPE AND SYNTHETIC WEB

Fiber rope and synthetic web slings are used primarily for temporary work, such as construction or painting, and are the best choice for use on expensive loads, highly finished or fragile parts, and delicate equipment.

Fiber rope slings deteriorate on contact with acids and caustics and, therefore, must not be used around these substances. Fiber rope slings that exhibit cuts, gouges, worn surface areas, brittle or discolored fibers, melting, or charring must be discarded. A buildup of powder-like sawdust on the inside of a fiber rope indicates excessive internal wear and that the sling is unsafe. Finally, if the rope fibers separate easily when scratched with a fingernail, it indicates that the sling has suffered some kind of chemical damage and should be discarded.

Synthetic web slings are commonly made of nylon, polypropylene, or polyester and have the following properties in common:

- **STRENGTH** - Depending upon their size, synthetic web slings can handle loads of up to 300,000 pounds.
- **CONVENIENCE AND SAFETY** - Synthetic web slings adjust to the load contour and hold it with a tight, non-slip grip.
- **LOAD PROTECTION** - Unlike other sling materials, synthetic web is less likely to mar, deface, or scratch highly polished surfaces.
- **SHOCK ABSORBENCY** – Regardless of the construction material, shock loading (e.g., excessive speed, rapid acceleration or deceleration) of slings should be minimized. However, it should be noted that synthetic web slings can absorb heavy shocks without damage.
- **TEMPERATURE RESISTANCE** – The lifting capacity of synthetic web is unaffected by temperatures up to 180 degrees Fahrenheit.
- **ECONOMY AND LONG LIFE** - Synthetic web slings have a low initial cost and a long service life. They are unaffected by mildew, rot, or bacteria, resist some chemical action, and have excellent abrasion resistance. Synthetic web slings must be inspected before use and should be removed from service if found to have acid or



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caustic burns, melting or charring of any part of the surface, snags, tears, or cuts, broken stitches, distorted fittings, or wear or elongation beyond the manufacturer's specifications.

#### SAFE LIFTING PRACTICES

Selection of the sling is only the first step in the rigging process. The next step is learning how to safely use it to hold and move a suspended load. There are four primary factors to consider when lifting a load safely. These are:

- **LOAD SIZE, WEIGHT, AND CENTER OF GRAVITY** – The center of gravity of an object is that point at which the entire weight may be considered to be concentrated. To make a level lift, the hoist hook must be located directly above this point. If the hook is too far to either side of the center of gravity, dangerous tilting will result, causing unequal stress in the sling legs.
- **NUMBER OF LEGS AND ANGLE WITH THE HORIZONTAL** – The smaller the angle between the sling legs and the horizontal, the greater the stress on the individual sling legs. This increased stress effectively decreases the weight that can be safely lifted with any given sling size. Large (heavy) loads can be safely moved by keeping this angle as large as possible and, when necessary, distributing the weight of the load among more sling legs.
- **RATED CAPACITY OF THE SLING** – The rated capacity of a sling varies depending upon the type of material the sling is made of, the size of the sling, and the type of hitch. Workers must know the capacity of the sling, and can obtain this information through charts or tables available through the manufacturer. The rated capacity of a sling must not be exceeded, under any circumstances.
- **HISTORY OF CARE AND USE** – Mishandling and misuse of slings are the leading causes of sling failure. Following the manufacturer's recommendations for proper care and use are essential for maximum sling service life and safety.

#### TRAINING

Workers involved in hoisting and rigging operations should receive training in the following:

- Sling and hitch types
- Sling capacity determination
- Equipment inspection, care, and maintenance
- Load weight and center of gravity determination
- Safe lifting techniques

**THOUGHT OF THE DAY:** Carefulness costs nothing, carelessness costs everything.

