Floor hoist systems - safety, function, operation

By Chip Schwamb,
Kennedy Wire Rope & Sling Co.

MOST, IF NOT all drilling rigs, have two or more overhead auxiliary hoists systems located on the floor of the rig. The floor hoist consists of a winch, sheave or block in the derrick and an end termination to attach various material handling rigging at the end of the wire rope. Power can come from varying sources such as air or hydraulics.

Whether a land or water rig, a newbuild or seasoned rig, these winch systems are all but indispensable for handling material from the ground, the substructure, floor and derrick. The floor hoist system is compact in design, allowing products to be moved, placed or released with minimum intrusion on the drilling activity. Below the end termination, a wide variety of slings, shackles and other rigging tools provide maximum versatility in lifting operations.

Material handling systems are identified throughout the oilpatch as a safety concern. Statistics show that many fallen objects, near misses, reportables, lost time accidents and fatalities are traced directly to material handling. Specifically, the latest IADC statistics for land and water rigs show that slings, cranes and floor hoists account for 8 percent to 12 percent of the "occupational incidents," depending on location worldwide. Clearly, the role of the floor hoist and attachments merits significant attention by helping to ensure a safe operation.

A floor hoist provides an overhead lifting function. The capacity of the winch is usually based on the winch manufacturer's designed pulling limit. The wire rope size is then matched up to a design factor based on the maximum pull. However, rarely does one find a weight indicator meter noting the load on the floor hoist wire rope system.

A common question asked in rigging safety meetings is, "How do you know the capacity of your airhoist?" The answer: "When the winch bogs down." Clearly this is not an answer most would like to hear. This becomes even more problematic when the rigging attached below the end termination has less capacity than the winch line pull.

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The floor hoist line end termination is usually a Flemish mechanical spliced eye with a thimble to protect the inside of the eye. The efficiency of a mechanical splice is 95 percent, according to the "Wire Rope Sling Users Manual." Other end terminations could include an eye formed with wire rope clips with a steel thimble to form an eye.

When wire rope clips are correctly installed, the maximum efficiency of the splice is 80 percent, per the "Crosby Group 2005 Catalog" in the "Warnings and Application Instructions" section. This potentially impacts the design factor of the winch load line.

The rigging attached below the end termination also may further impact the capacity of the system. Much like a crane, the floor hoist system capacity is limited by the rigging attached. Once the variables in the system are recognized, safe and functional operations become possible. The goal of reducing or eliminating accidents can be accomplished by rigorous and active training of personnel regarding the basic operation and inspection of floor hoists and the rigging attachments.

The manufacturer of the winch most likely will have information on safe use, maintenance and trouble shooting of the winch. Then the length of wire rope on the hoist winch requires specific review. Most floor winches do not have grooving for the wire rope to track across the drum spool to the next layer and on and off the winch as the system is used. Consequently, the first layer of the wire rope must be even and thread wound to ensure spooling of the layers above. A loose fit or non-thread wind will create spooling problems such as crushing layer-to-layer, kinking, or pull down between wraps, causing damage to the wire rope and resulting in reduced strength and operating problems.

Even with a thread wound, first layer spooling problems may continue. Overhaul weight on an airhoist often is nonexistent. The hoist line must have some load from the sheave to the end termination to counter the wire rope weight opposite between the winch and the sheave. The overhaul weights vary from airhoist chains, split balls, weighted swivels or other rigging attachments.

Temporarily affixed weights are not a solution. The overhaul weight must be positively directly linked into the system. Weighted swivels not only provide overhaul weight but also minimize twist or

torque build-up in the floor hoist line during operation.

Smooth thread winding on the winch drum is easier said than done as loads placed on the floor hoist system vary from very light to approaching maximum safe working load.

The wire rope hoist line runs over a fixed sheave or derrick snatch block secured in the mast structure. The inspection of either the sheave or the block can be difficult due to the location in the derrick. The variables that affect the service life of the block/sheave arrangement include bearing or bushing type, speed of operation, loads placed on the block, environment and corrosion, among others. The condition of the sheave grooving, pins, side plates, bearings and welds must be included in any inspection. The block manufacturers publish maintenance and inspection recommendations as well as the suggested frequency of inspection.

The inspection procedures for the floor hoist wire rope are the same as any running wire rope. The recommendations for retirement of running wire rope is outlined in "API Recommended Practice 9B" and gives a clear review. Visual inspection for broken wires, kinking, corrosion, crushing and signs of other mechanical damage is most common in floor hoist wire rope. Any damage that causes a significant reduction in breaking strength is sufficient reason to remove the wire rope from service.

The floor hoist end termination, again usually a thimble eye, connects to the rigging in a variety of ways. Bolt type shackles, with a nut and cotter key offering secondary securing of the connection, is one method. Grade 8 or Grade 10 alloy chain coupling links with secured pins offer an alternative connection, as do positive locking hooks. All of these connections must be rated for overhead lifting.

The slings attached to the floor hoist running rope vary greatly in capacity, material, function and design. The rigging may be wire rope, braided wire rope, synthetic material, and chain. The slings can be attached to the load in a straight pull, a choke or in a basket.

The most current safety standard regarding slings can be found in the American Society of Mechanical Engineers (ASME) B30.9-2003. The OSHA 1910.184 regulations provide federal statutes regarding slings. "API Recommended Practice 2D" covers slings for offshore crane use. The "API 2D" is most often cited by the US Minerals Management Service for offshore operations. One may use the Wire Rope Technical Board 2nd edition "Wire Rope Sling Users Manual" as a reference, and international agencies such as Det Norske Veritas (DNV) may be a required source.

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The common thread through all of these standards and recommendations is visual inspection of the rigging for damage that may affect the rated capacity. The frequency of the inspection of rigging ranges from a cursory review before each lift to a "daily" inspection to a "periodic" inspection. In addition, the "periodic" inspection includes the requirement to maintain a written record of the condition of the sling based on an interval of no longer than one year in conjunction with the "severity of use." Nearly all of the damage to rigging in floor hoist applications occurs in such a manner that visual inspection can catch the problem. The sling can then be removed from service. Training personnel to recognize the damage to rigging is critical.

Basic inspection for wire breaks in wire rope slings and braided wire rope slings are one retirement factor. Kinking of the wire rope – a permanent deformation of the wires or strands – is also a cause for retirement. Rust bound or corroded wire rope in wire rope slings, as well as heat damage, will cause a reduction in strength, resulting in the sling being removed from service.

Generally, inspection of synthetic slings, such as nylon webbing and polyester round slings, rests on visual searches for damage such as snags, tears, cuts or burns in the fabric. Any popped stitches or heat damage that is discernable is an additional reason to remove synthetic slings from use.

Alloy chain sling removal criteria include stretched links, nicks or gouges in chain or fittings, excessive wear, or deformed chain or components. Evidence of corrosion or heat damage are additional reasons for retirement.

Several common factors for retirement of all slings must also be observed. The severity of the use of any of the slings must be noted. Any overloading of the slings is cause for retirement. All slings must have identifying information such as manufacturer, description and capacity clearly visible. Additional information on the tag may include service date and specific serial number. If the sling does not have a tag or identifying information secured to the sling, no matter the condition, that very fact is cause for removal of the product from service.

The above removal criteria comprise a thumbnail sketch of the rigging that may be attached to the floor hoist line. Any of the above sling types have more or less capacity than the wire rope hoist system. Lifting capabilities are limited to the weakest link in the hoist system, and this fact must always be recognized.

Clearly, visual inspection and training to recognize the conditions for retirement of any damaged component in the floor hoist system is necessary. Operational training of personnel regarding the hoist is also essential for workplace safety. The recognition of body position, pinch points, location of tag lines and control of any load are key factors in a safe operation as well.

From any standpoint, "failure is not an option" must define the use of a floor hoist and rigging arrangement. The floor hoist system is a sound design. Safety in this environment is no different than any other. A clear labeling of the maximum capacity of the winch should be visible. Running rope, sling and fitting inspection training for all personnel involved in material handling is fundamental.

Additionally, proper training for the operation of a floor hoist system, coupled with rigging fundamentals will result in the safe use of this equipment. I have attempted to provide a basic understanding of the function, inspection and operation of the floor hoist as a critical component of all drilling rigs. I sincerely hope this has been accomplished. ■