



WATER & SEWER RISK MANAGEMENT POOL



Lifting & Rigging Safety Program

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District

Accident Prevention Program

Your District Water and Sewer District

The following safety related program is for informational purposes only. The SORT committee hopes that each participating district will look at this program and discuss how it compares to the district's own practices. This program is NOT a complete safety program, but intended as guidelines. There is no guarantee that following a given program will eliminate or substantially reduce the risk of claim or injuries. It is expected that member districts will consider this program and adapt or modify it to fit the district's particular needs and circumstances.

LIFTING & RIGGING SAFETY PROGRAM

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LIFTING AND RIGGING SAFETY PROGRAM

PURPOSE / SCOPE

The purpose of the Lifting and Rigging Safety Program is to ensure that all employees who enter and work with lifting and rigging procedures understand all of the potential hazards that may exist. This program serves as a template that will allow districts to establish requirements for working safely in such an environment. Washington State law changed in 2013 requiring all employers who utilize lifting and rigging to comply with new standards when evaluating and training their employees.

Field management and staff will develop Standard Operating Procedures for work at specific sites and for specific work tasks, which will take into account all safety issues and will define the most effective methods of accomplishing the work objectives safely and efficiently.

This program will explain lifting and rigging operations beyond the ability of manual lifting of one or two employees. This program is concerned with lifting that requires the use of machines and rigging equipment. Lifting operations that require the following will be considered.

- Hydraulics (i.e. construction equipment, cranes and hoists)
- Lifting forks
- Lifting operations in proximity to overhead power lines
- Wire rope (cables)
- Chains
- Slings
- Jack stands
- Hooks, shackles and rings
- Tag lines

Policy Statement

It is the primary policy of the District and its employees to use engineering controls wherever practical to reduce the hazards of equipment failure and uncontrolled movement of loads, causing accidents and damage to materials and property. Where employees must work using hydraulic and/or mechanical means, it is the policy of the District that the employees will comply fully with this Safety Program.

Note: Light bulb icons  are placed throughout this document as an aid for the instructor in order to highlight key points that occur in the, "Test Your Knowledge" section at the end of this document. Feel free to modify, keep or delete these as necessary.

EXEMPTIONS / EXCLUSIONS

All lifting jobs that involve 50 pounds or less are excluded.

HAZARD ANALYSIS



Lifting, for the purpose of this program, refers to the means by which something is picked up in order to be put in place, or how something is moved from one resting place to another. For our purposes, there are two primary means for moving things: mechanical and hydraulic. A mechanical lift is a machine, such as crane or hoist, where lifting power is mechanical or electric. Some examples: come-along or truck-mounted cranes. Hydraulic lifting includes using backhoes, excavators, floor jacks, etc for a source of lifting power. Each piece of lifting equipment has its hazards and limitations

Rigging has to do with the type of gear used to lift an object and how that object is attached to the lifting equipment. The District intends to comply with the law in what is used to rig loads for lifting. The law sets standards for chain, cable, and strap capacities based on size, use and make-up. These standards will be summarized in this program to ensure safety of workers, as well as compliance with those laws. The District will provide rigging equipment of sufficient strength to handle loads that are of sizes and weights commonly lifted. In circumstances where extraordinary-sized loads are to be lifted, the proper equipment will be provided.

Hazard Description

Only properly trained or evaluated riggers should perform lifts. Riggers should plan for any possible failure. Not only can chains or cables break, but gear teeth can wear out, stops can break, welds can break, and mounts can give out. Employees should also consider the support on which the lifting equipment sets. Unstable support can lead to inadvertent movement.

Hazard Evaluation



Riggers should be aware of two potential dangers:

- Equipment failure
- Uncontrolled shifting or movement of a load.

All rigging systems utilized should be doubled to ensure a means of safety controlling a load.

HYDRAULIC LIFTING HAZARDS

Hydraulic lifting relies on hydraulic seals and hoses to be in good condition. Hoses especially are susceptible to failure, causing the load to fall suddenly and result in serious injury or damage. Unintentional movement of the load is also more likely with hydraulic lifting because controls can be bumped accidentally, or moved by persons other than the operator.

When lifting with hydraulic means, employees will observe the following practices:

1. Never rely on a hydraulic jack when work has to be done underneath a load; jack stands or engineered supports are to be used.

2. Never assume a hydraulic equipment operator can see you or understands when or how to move a load; always establish eye contact; turn the equipment off and talk if there is a lack of communication. The ground person should realize that moving suspended material with hydraulic equipment usually requires several maneuvers done simultaneously, so movement may be slow as the operator attempts to perform multiple maneuvers while trying to prevent jerking motions.
3. Never position yourself or any part of your body under a load for any reason.

Employees shall also consider the support on which the lifting equipment sets. Unstable can lead to inadvertent movement.

RIGGING HAZARDS



These hazards apply equally to the chain, cable or strap used to lift, as well as to all other components used to fasten the load for lifting (i.e. hooks, links, rings, etc.). Whether such misuse is due to lack of knowledge or not having the proper lifting equipment available, overloading equipment creates dangerous conditions not only at the moment, but on future jobs when overstressed or even potentially damaged equipment gets used again.

Employers should provide gear that is rated higher than any anticipated load and acquire special equipment for unusually heavy loads. Another hazard is using undersized equipment for a given load.

A hazard can exist if riggers unknowingly use defective or damaged equipment. All rigging hardware must be inspected:

- At the beginning of a job
- Daily
- Or as needed to verify hardware condition.
-

When lifting with rigging, employees will observe the following practices:

1. Never perform lifts with equipment that is not rated for the load.
2. Never perform a lift on an object until you know its weight.
3. Never perform lifts with equipment that is damaged or defective.
4. Never perform overhead lifts with anything other than slings made of adequately sized chain, wire rope, nylon, or metal mesh straps.
5. Never ride on lifting equipment.
6. Never walk or work under suspended loads.
7. Follow restrictions and appropriate procedures when working near overhead power lines.

Methods of Evaluation

In the process of rigging and lifting there are three basic functions that are usually performed: lifting, dragging, and tying down (binding) loads. Each function has standards for equipment use, etc. In lifting operations, it is important to know that regardless of the height of the lift, the same standards for equipment selection apply. In equipment catalogs, and even in the WAC, reference is made to "overhead lifting". This terminology leads one to believe that there may be different rules for lifts that are not considered "overhead".



One might conclude that since an object will not be lifted very high, that a smaller chain/cable or lower rated one will suffice. However, no such distinction exists. There is no minimum height above which a lift is considered overhead; therefore the same standards have to apply on all lifts. So regardless of the lift height, use the proper lifting equipment. At no time is it permissible to drag a load when using a crane.

Exposure Determination

Objects to be moved are usually in open areas of shops, storage facilities, or loading docks, and are rigged for movement by crane or other mobile material handling equipment. Some examples of job titles associated with lifting and rigging hazards are: crane operator, pipe-fitter, pipe layer, storm and sewer contractor, excavator, operator, and warehouse worker. Any job that requires working around cranes, forklifts, construction, or involves lifting or hosting large loads overhead should follow these guidelines.

GENERAL KNOWLEDGE/RESPONSIBILITIES

District

- Employees will receive basic training on selecting the right kind of equipment, how to inspect it periodically for damage, and proper rigging principles to ensure that the load is secure.
- Provide a qualified person to give instructions before, during, and after lifting and rigging operations.
- Assure that employees always perform lifting operations in a safe manner.

Qualified Person/Rigger (WAC 296-155-33700) Note: see, "Training" section.

Riggers must be a qualified person who, by possession of a recognized degree or certificate of professional standing, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating the subject matter. Also has the authorization or authority by the nature of their position to take prompt corrective measures to eliminate them. The person must be knowledgeable in the requirements of this part as applicable to the tasks assigned, including but not limited to:

- "Know and understand of the requirements for slings, rigging hardware, and below-the-hook lifting devices, including their limitations, rigging practices, associated hazards, and inspection requirements;
- "Know and understand the application of the type of hitches used;
- "Know and understand load weight estimation, center of gravity, effect of angle on rigging components, and load turning.



A **qualified person/rigger** (based on WAC 296-155-33705) must inspect the rigging equipment before each day or shift and:

- Consider the application the equipment will be used for, and determine if it's safe for use;
- Remove the equipment from service if using it will create a hazard or meets any of the removal criteria listed in this chapter.
- The rated load of the rigging equipment must not be exceeded.
- All rigging hardware must be inspected in accordance with Table 1, each day before using. If a daily inspection is not feasible because the hardware is in a semi-permanent or inaccessible location, a periodic inspection is allowed instead of daily.

- Rigging hardware must be removed from service when it shows any conditions listed in Table 1, or any other hazardous condition

Table 1

Rigging Hardware Inspection/Removal Criteria:

For all hardware, inspect for the following:



1. Missing or illegible identification.
2. Indications of heat damage, including weld spatter or arc strikes.
3. Indications of heat damage, including weld spatter or arc strikes.
4. Excessive pitting or corrosion.

Load bearing components that are:

- Bent
- Twisted
- Distorted
- Stretched
- Elongated
- Cracked
- Broken

5. Excessive nicks or gouges
6. 10% reduction of the original or catalog dimension at any point.
7. Excessive thread damage or wear, where applicable.
8. Evidence of unauthorized welding or modification.
9. Any other conditions that cause doubt as to the safety of continued use.

On **shackles**, also inspect for incomplete pin engagement.

On **swivels and swivel hoist rings**, check for lack of ability to freely rotate or pivot.

On **compression hardware**, also check for:

- Unauthorized replacement components;
- Insufficient number of wire rope clips;
- Improperly tightened wire rope clips;
- Damaged wire rope;
- Indications of wire rope slippage;
- Improper assembly.

On **swivels**, check for loose or missing nuts, bolts, cotter pins, snap rings, or other fasteners and retaining devices.

On **blocks** check for:

- Loose or missing nuts, bolts, cotter pins, snap rings, or other fasteners and retaining devices;
- Misalignment or wobble in sheaves;
- Excessive sheave groove corrugation or wear

Note: Hooks that can be welded are designed specifically for this purpose, do not use other types.

Any alteration or modification of rigging hardware must be in accordance with the hardware manufacturer or a qualified person and proof load tested to one hundred twenty-five percent. This test must be documented and available upon request. Repair of hooks must be approved by the

manufacturer or qualified person and as follows:

- (a) Cracks, nicks, and gouges may be repaired by a competent person, all other repairs are done by the manufacturer or a qualified person;
- (b) Grind longitudinally, following the contour of the hook;
- (c) Do not reduce the dimension of the hook more than ten percent from the original.

Additional Lifting & Rigging Requirements:

- Welding of rigging hardware is prohibited unless authorized by the manufacturer or an RPE.
- Replacement parts must meet or exceed the original rigging hardware manufacturer's specifications.
- Rigging hardware selection must have the characteristics suitable for the application and environment where it will be used.
- Workers must keep all parts of their body from between the load and any rigging during the lift.
- Intermodal: being or involving transportation by more than one form of carrier during a single journey. If handling intermodal shipping containers at a construction site, the employer must follow lifting/rigging requirements that are applicable to their industry. For example: WAC chapter [296-56](#) , Longshore, Stevedore and other waterfront related operations, Part F, Specialized terminals and the guidelines found in International Organization for Standardization (ISO) 3874 - Series 1 Freight Containers, fifth edition - Handling and Securing.
- All slings in use must meet the applicable requirements for design, inspection, construction, testing, maintenance and operation as prescribed in ASME B30.9-2010.
- All rigging hardware in use must meet the applicable requirements for design, inspection, construction, testing, maintenance and operation as prescribed in ASME B30.26-2010.
- All rigging gear must be used in accordance with the manufacturer's recommendations or a qualified person.
- All below-the-hook lifting devices in use must meet the applicable requirements for design, inspection, construction, testing, maintenance and operation as prescribed in ASME B30.20-2010
- All hooks in use must meet the applicable requirements for design, inspection, construction, testing, maintenance and operation as prescribed in ASME B30.10-2009

Managers

- Reviews and approves critical lifts.
- Clearly defines roles and responsibilities for all persons involved in hoisting and rigging activities.
- Ensures district is in compliance with SOP's and the requirements of the guidelines.
- Tracks regulatory changes and informs the Designated Safety Person.

- Assists in the interpretation of standards in support of compliance and safety improvement efforts.
- Ensures development and administrative oversight for lifting and rigging courses.
- Tracks the compliance status of each piece of equipment, including reviews of conformance, maintenance, repair, inspections.

Employees



- Have the necessary knowledge and experience for critical lifts and the type of equipment used.
- Verify the qualifications of participating personnel.
- Ensure that lift planning is completed and reviews the lift with all participating personnel before the lift begins.
- Complete the pre-use inspection checklist.
- Check the condition of equipment and load.
- Verify load description and condition.
- Be present during the entire lift operation.
- Personal safety and protective equipment to be inspected prior to use to ensure compliance with the applicable standards.
- Understand the limitations of the personal safety and protective equipment.
- Inspection, maintenance and care of equipment.
- Damaged or failed equipment should be reported to the competent person and replaced immediately and removed from the site.
- Must have the necessary training, knowledge, and experience for the class of lift and the type of equipment used.
- Ensure structural integrity of the load, including attachment points.
- When using mechanical means, employees will lift in accordance with manufacturer instructions for the equipment used.
- Employees will be expected to use all appropriate personal protective equipment, and follow the safety practices outlined in this program.
- PPE to be used in accordance with the relevant specifications and requirements.
- Competent person to be continuously aware of the condition of the lifting and rigging equipment in use prior to performing work.
- Prior to storage, all rigging equipment should be cleaned and maintained to standard.

GUIDELINES/RULES

LIFTING



Tying down loads, or binding, is relevant in terms of hauling equipment or materials on trailers and trucks. Lifting jobs will require chains rated "grade 8 or 80". However, when binding loads on a trailer, such as a backhoe or pipe, a different type of chain is required. "Grade 7 or 70" is standard for load tie-downs. Grade 7 chains cannot be used for lifting, and grade 8 chain cannot be used for tying down loads. The reason is that grade 8 chain is an alloy chain and is more brittle than the metal used in grade 7 chain. Grade 7 is more "flexible" and can withstand the side forces exerted on it from going around corners of a load such as a backhoe. So even though grade 8 is stronger in lifting capacity size-for-size, it cannot resist side forces as well as the more malleable grade 7. Thus, these two operations really cannot use the same type of chain.

For overhead lifting, chains are to be Grade 8 alloy steel, and have an adequate working load limit. These chains are marked on each link "G*" (or equivalent marking), and are the only grade approved for lifting and hoisting operations.

Grade 80 chains are a heat-treated alloy chain and each link should be embossed with an 8 or an 80. Various manufacturers produce this chain under a trademark name and designate their brand by incorporating their symbol or initials into the rating stamp.

Grade 70 chain is a high strength carbon steel chain designed for load securing. It has a high strength-to-weight ratio and resists wear due to its hardness properties. This chain should be embossed with G7, 7, 70, or some equivalent marking. However, grade 70 may not be embossed at all. If there is no indication on the chain, Grade 70 chain will usually have a yellow dichromate finish. This is a yellow or gold hue, which indicates the grade and most importantly, distinguishes it from grade 80 chain. Grade 70 chain is not to be used in lifting applications.

Typical Grade 80 Working Load Limits



Grade 80 Chain Slings - Alloy Steel									
Working Load Limit (WLL) in pounds									
		Single-Leg	Single-Leg	Double-Legged Bridle Sling			Triple and Quadruple-Legged Bridle Sling		
									
Nominal chain size									
Inches	mm	lbs	lbs	lbs	lbs	lbs	lbs	lbs	lbs
7/32	5.5	2 100	1 700	3 600	3 000	2 100	5 500	4 400	3 200
9/32	7	3 500	2 800	6 100	4 900	3 500	9 100	7 400	5 200
5/16	8	4 500	3 600	7 800	6 400	4 500	11 700	9 500	6 800
3/8	10	7 100	5 700	12 300	10 000	7 100	18 400	15 100	10 600
1/2	13	12 000	9 600	20 800	17 000	12 000	31 200	25 500	18 000
5/8	16	18 100	14 500	31 300	25 600	18 100	47 000	38 400	27 100
3/4	20	28 300	22 600	49 000	40 000	28 300	73 500	60 000	42 400
7/8	22	34 200	27 400	59 200	48 400	34 200	88 900	72 500	51 300
1	26	47 700	38 200	82 600	67 400	47 700	123 900	101 200	71 500
1 1/4	32	72 300	57 800	125 200	102 000	72 300	187 800	153 400	108 400

The horizontal angle is the angle formed between the inclined leg and the horizontal plane of the load.
Design factor 4 : 1.

(As per ASME B30.9-2003 Sling)

Electrical Lifting Hazards for All Lifting Equipment



Workers should be aware of two primary dangers: equipment failure, and uncontrolled movement of load. When lifting mechanically, one should be aware of what components could fail.

One method that can be used to minimize the hazard of unexpected movement of a load is the use of "tag lines". A tag line is a rope or chain tied onto the end of a load giving the ground person control of the object, while keeping a safe distance from it.

The load can be prevented from swinging, or be moved into position. This is much safer than being close to the load when an unexpected shift occurs.

Power Line Safety Requirements

- If the crane, back hoe or track hoe boom, load, or rigging could get closer than 20/50 feet to an energized power line there are new safety requirements which apply.
- If the crane, load, or rigging cannot get closer than 20/50 feet to the power line even if the crane is operated at its maximum working radius, the 20/50-foot requirement is satisfied.

Table 2



Power Line Safety Requirements Minimum Clearance Distances Table	
Voltage	Minimum clearance distance
up to 50 (kV)	10 (feet)
over 50 to 200	15
over 200 to 345	20
over 345 to 500	25
over 500 to 750	35
over 750 to 1,000	45

- Options 2 and 3 require the following:
 - Conduct a planning meeting with crane operator, & all workers who will be in the area of crane & load
 - This meeting must address the location of the power lines and the steps that will be implemented to prevent encroachment-electrocution
- If tag lines are used they must be nonconductive
 - Erect elevated warning line, barricade, or line of signs, in view of the operator, equipped with flags or similar high-visibility markings
- Options 2 and 3 also requires at least one of the following:
 - Proximity Alarm *
 - Dedicated Spotter that is also a "Qualified Signal Person"
 - Range Control Warning Device
 - Range Movement Limiter
 - Insulating Link *

* Currently, Proximity alarms and Insulating Links do not meet the National Recognized Testing Laboratory (NRTL) requirements.

- If Dedicated Spotter is used, the following requirements must be met: 
- Spotter must be in continuous contact with operator
- Be equipped with a visual aid to assist in identifying minimum clearance distance
- Examples of visual aid include: Clearly visible line painted on ground, clearly visible line of stations, line-of-site landmarks (such as a fence post and building corner)
- Be positioned to effectively gauge the clearance distance
- Where necessary, use equipment that enables spotter to communicate directly with operator, such as radio or telephone
- Give timely information to the operator so that the required clearance distance can be maintained.

LIFTING FORKS

- **Lifting forks** are used in conjunction with construction equipment. They are useful for unloading pallets, pipe, and other loads from trucks or in the storage yard. Check the rating on the maximum rating and do not exceed that rating. If the backhoe will not lift the load, do not use the forks.
- There are many types of hooks for various uses. Still, basic safety guidelines apply to all. There are two primary things to look for when using or inspecting a hook. First, examine the “throat opening”. This is the width of the hook’s opening. For each type, size and grade of hook, there is a designed throat width. By law, if the throat opening is increased by 15% or more, the hook is damaged and must be discarded right away. For example, you are using a 3/81 chain sling with a 3/81 grab hook. The hook has a working load limit of 7,100 pounds. This hook should have a throat opening of 0.511. The 15% maximum increase means that this hook could still be used even if the throat opening expanded to 0.57511, or 17/32”. So if this hook spreads more than 1/32nd of an inch, it is no good.
- Secondly, the hook is also made “flat”. The hook is considered unusable if it is bent or twisted 10% or more out of its original shape. There is not much tolerance because if the steel is bent or twisted, it is no longer structurally sound.
- If master and coupling links are cracked or deformed, the sling is to be taken out of service. If a link is visibly worn, take it out of service and let the Supervisor know immediately. Repairing slings by replacing such links should not be done. The law prohibits replacing these links with either low-carbon steel or mechanical coupling links, [WAC 296-24-29423 (7) (b)]. Lifting slings are required to have welded or forged master links and coupling links that are rated the same as the sling itself.

Applicable SOPs



- Refer to manufacturer’s owner’s manuals regarding specific safety procedures for equipment and/or machinery.
- Use lifting and rigging equipment with enough weight rating for the load.

- Do not perform lifts with equipment that is damaged or defective.
- Do not perform overhead lifts with anything other than slings made of adequately sized chain, wire rope, nylon, or metal mesh straps.
- Do not ride on lifting equipment.
- Never walk or work under suspended loads that are not properly supported.
- Do not use natural fiber or rope for lifting.
- When using mechanical means, employees will lift in accordance with manufacturer instructions.
- Use all personal protective equipment (PPE).
- Never assume an operator can see, hear, or understand when or how to move a load. Always establish eye contact, turn the hydraulic source off and release pressure and talk if there is a lack of communication.
- Use a tag line to minimize the hazard of unexpected movement.
- Defective chains or slings are to be removed from service immediately.
- If any chain stretches more than one-third the length of one link, the chain is to be discarded.
- If a cable choker has ten or more randomly broken wires, do not use it.
- Floor jacks have the capacity imprinted on them. Never exceed the capacity of the jack. Never crawl under anything supported solely by a floor jack. Always use jack a jack stand or other solid support.

Required PPE



- Gloves
- Eye Protection
- Steel toed or appropriate leather work boots
- Hearing Protection
- Approved hard hats
- Safety vests

Prevention Actions

Employees will not:

- Perform lifts with equipment that is not rated for the load.

- Perform lifts with equipment that is damaged or defective.
- Perform overhead lifts with anything other than slings made of adequately sized chain, wire rope, nylon, or metal mesh straps.

EMERGENCY PROCEDURES

Call 911

First Aid Awareness and Actions: Standard First Aid Action should apply.

TRAINING

The following applies to *all construction material handling activities*, including cranes, derricks, powered industrial trucks, excavators, backhoes, loaders, come-a-longs, chain falls, etc. All employers must train & evaluate their employees through both written and practical exams for the lifting and rigging hardware or procedures unique to their district. The modules contained in this sample hazard specific safety program is designed only as a template to assist employers in covering the basic, most widely used or accepted materials common in our industry.

Should your district utilize any other methods not listed here, it would be wise to consult with a third party evaluator for compliance to state law.

Qualified Riggers:



- The employer must make the documentation for whichever option is used available at the site while the rigger or signal person is employed by the employer.

Sample Documentation:

Qualified Rigger _____ Date _____	
Rigging Type: <input type="checkbox"/> Chain Slings <input type="checkbox"/> Wire Rope <input type="checkbox"/> Synthetic <input type="checkbox"/> Metal Mesh	Rigging Hardware: <input type="checkbox"/> Shackles <input type="checkbox"/> Turnbuckles <input type="checkbox"/> Eye Bolts <input type="checkbox"/> Wire Rope Clips
<input type="checkbox"/> Third Party Evaluator _____ <input type="checkbox"/> Employer Evaluator _____ <input type="checkbox"/> Evaluator Signature _____ <input type="checkbox"/> Evaluator Company _____	

Signal Person Certification Requirement: applies only to construction activities which involve cranes, derricks, and powered industrial trucks which have been configured to hoist and lower by means of a winch or hook (See Part L in 296-155 WACS).

REFERENCES/RESOURCES

WAC 296-155-336 through 34025

REVISION RECORD

Revision No.	Revision Date	Approval Date	Change
1.0.0	08-09-07		Initial design.
2.0.0	03-28-13		Revision

APPROVALS

Safety Committee Chairperson	Date	General Manager	Date
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DEFINITIONS

WAC 296-155-33605



Angle of loading means the acute angle between horizontal and the leg of the rigging, often referred to as horizontal angle. See Figures 7 and 22.

Anti two-block device means a device that, when activated, disengages all crane functions whose movement can cause two-blocking.

Basket hitch means a method of rigging slings, where they are passed around the load, utilizing both loop eyes, or the end fittings that are attached to the lifting device.

Below-the-hook lifting device means a device used for attaching loads to a hoist. The device may contain components such as slings, hooks, rigging hardware, and lifting attachments.

Bird caging means the twisting of fiber or wire rope in an isolated area of the rope in the opposite direction of the rope lay, thereby causing it to take on the appearance of a bird cage.

Braided wire rope means a wire rope formed by plaiting component wire ropes.

Bridle wire rope sling means a sling composed of multiple legs with the top ends gathered in a fitting that goes over the lifting hook.

Cable laid endless sling-mechanical joint means a wire rope sling made endless from one continuous length of cable laid rope with the ends joined by one or more metallic fittings.

Cable laid grommet-hand tucked means an endless wire rope sling made from one continuous length of rope formed to make a body composed of six ropes around a rope core. The rope ends are tucked into the body, thus forming the core. No sleeves are used.

Center of gravity means the center of gravity of any object is the point in the object around which its weight is evenly distributed. If you could put a support under that point, you could balance the object on the support.

Choker hitch means a method of rigging a sling in which the sling is passed around the load, then through one

loop eye, end fitting, or other device, with the other loop eye or end fitting attached to the lifting device. This hitch can be done with a sliding choker hook or similar device.

Come-a-long means a mechanical device typically consisting of a chain or cable attached at each end that is used to facilitate movement of materials through leverage.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross rod means a wire used to join spirals of metal mesh to form a complete fabric. See Figure 11.

Design factor means the ratio between nominal or minimum breaking strength and rated load.

Electrical contact means when a person, object, or equipment makes contact or comes close in proximity with an energized conductor or equipment that allows the passage of current.

Fabric (metal mesh) means the flexible portion of the sling exclusive of end fittings consisting of a series of transverse spirals and cross rods.

Fall zone means the area (including, but not limited to, the area directly beneath the load) in which it is reasonably foreseeable that partially or completely suspended materials could fall in the event of an accident.

Flange points means a point of contact between rope and drum flange where the rope changes layers.

Hitch (hitched) means a method of rigging (attaching) a sling temporarily to a load or object for the purpose of lifting.

Hoist means a mechanical device for lifting and lowering loads by winding rope onto or off a drum.

Hoisting means the act of raising, lowering or otherwise moving a load in the air with equipment covered by this standard. As used in this standard, "hoisting" can be done by means other than wire rope/hoist drum equipment.

Hoisting equipment means a machine for lifting and lowering a load and moving it horizontally. The machine may be fixed or mobile and be driven manually, by power, or by a combination of both.

Hook latch means a mechanical device used to close the throat opening of a hook.

Load is the weight of the object being lifted or lowered, including the weight of the load-attaching equipment such as the load block, ropes, slings, shackles, and any other auxiliary attachment.

Load ratings means a set of rated loads for stipulated hoisting equipment configurations and operating conditions.

Master coupling link means an alloy steel welded coupling link used as an intermediate link to join alloy steel chain to master links.

Master link means forged or welded steel link used to support all members (legs) of an alloy steel chain sling or wire rope sling.

Mechanical coupling link (alloy steel chain) means a non-welded, mechanically closed link used primarily to attach fittings to alloy steel chain.

Operational controls means levers, switches, pedals and other devices for controlling equipment operation.

Procedures include, but are not limited to: Instructions, diagrams, recommendations, warnings, specifications, protocols, and limitations.

Qualified person means a person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, successfully demonstrated the ability to solve/resolve problems relating to the subject matter, the work, or the project.

Qualified rigger is a rigger who meets the requirements in WAC [296-155-33700](#).

Rated capacity means the maximum working load permitted by the manufacturer under specified working conditions. Such working conditions typically include a specific combination of factors such as equipment configuration, radius, boom length, and other parameters of use.

Rotation resistant rope means a type of wire rope construction which reduces the tendency of a rope to rotate about its axis under load. Usually, this consists of an inner system of core strands laid in one direction covered by an outer system of strands laid in the opposite direction.

RPE means a registered professional engineer licensed under RCW [18.43.040\(1\)](#).

RPSE means a registered professional structural engineer licensed under RCW [18.43.040\(1\)](#).

Running wire rope is a wire rope that moves over sheaves or drums.

Safety or health standard means a standard adopted under this chapter.

Safe Working Load (SWL) sometimes stated as the **Normal Working Load (NWL)** is the load that a piece of lifting equipment, lifting device or accessory can safely lift, suspend, or lower without fear of breaking. Usually marked on the equipment by the manufacturer and is often 1/5 of the **Minimum Breaking Strength (MBS)** although other fractions may be used such as 1/4, 1/6 and 1/10.

Sling means an assembly to be used for lifting when connected to a lifting mechanism. The upper portion of the sling is connected to the lifting mechanism and the lower supports the load, as described in this part.

Spiral means a single transverse coil that is the basic element from which metal mesh is fabricated.

Standing wire rope means a supporting wire rope which maintains a constant distance between the points of attachment to the two components connected by the wire rope.

Two blocking means a condition in which a component that is uppermost on the hoist line such as the load block, hook block, overhaul ball, or similar component, comes in contact with the boom tip, fixed upper block or similar component. This binds the system and continued application of power can cause failure of the hoist rope or other component.

Vertical hitch means a method of rigging a sling in which the load is attached to the loop eye or end fitting at one end of the sling and the loop eye or end fitting at the other end is attached to the lifting device. Any hitch less than five degrees from the vertical may be considered a vertical hitch.

Wire rope means a flexible rope constructed by laying steel wires into various patterns of multi-wired strands around a core system to produce a helically wound rope.

Working load means the external load applied to the hoisting equipment, including the personnel lifting platform, its contents, and the load attaching equipment, such as lowered load block, shackles, and slings.

TEST YOUR KNOWLEDGE

Note: This test is intended for all employees exposed to lifting and rigging operations. To fulfill state law however, each employer should also consult the, "Lifting and Rigging Employer Evaluation Modules" document. That program provides basic training along with both written and practical examination guidelines. Select the modules representing the rigging hardware your organization has in its inventory.

1. List the two primary methods used in lifting.

= _____

= _____

2. What are two potential dangers each rigger should be aware of?

= _____

= _____

3. Select the statements below that are untrue _____.

A. It is acceptable to lift an item of unknown weight, using grade 80 chain.

B. Never walk or work under suspended loads

C. Always use gear that is rated higher than the rated load.

D. A person may be lifted out of a ditch by riding rigging equipment during hazardous situations.

4. One appropriate method of evaluation suggests that the same standards apply for all lifts, regardless of height.

True

False

5. The qualified person is in charge of lifting & rigging operations.

True

False

6. The qualified person/rigger must do what each day or at the beginning of each shift? List the corresponding letters here:

= _____

- A. Inspect the rigging equipment.
 - B. Thoroughly understand below the hook lifting devices.
 - C. Remove all potential lifting hazards.
 - D. Determine the rated load angle on lifting components to be used.
 - E. Exercises his/her authority to take corrective measures.
 - F. All of the above.
7. Chains lacking a rating stamp may be used in rigging or lifting.
- True
 - False
8. Swivels that have difficulty in turning can still be used.
- True
 - False
9. Employees may take a rest break while a load is suspended.
- True
 - False
10. Employees must follow manufacturer's guidelines for mechanical lifts.
- True
 - False
11. Grade 70 chain may be used for lifting if grade 80 is unavailable.
- True
 - False.
12. What is the working load limit for 3/8" grade 80 chain when used in a single leg, vertical hitch?
- = _____
13. What is the working load limit for 3/4" grade 80 chain when used in a choker hitch?
- = _____
14. A tag line allows a worker to maintain control of an object while remaining close to it.

True

False

15. What is the minimum safe clearance distance the lifting equipment should be from power lines containing between 200-345 volts?

= _____

16. Chains or wire rope may be used as tag lines when working in proximity to power lines.

True

False

17. Other means of effective communication may be used when spotter eye contact with operator cannot be maintained.

True

False

18. Hard hats and gloves are optional for spotters.

True

False

19. Documentation of your training must be kept on file by your employer.

True

False

20. The minimum breaking strength is equal to the Safe Working Load (SWL) rating for all rigging hardware.

True

False

21. Select the appropriate rejection criteria from below:

Twisted link

Heat damage

Stretched or deformed

- Misaligned sheave
- Chain without stamped/I.D.
- Sling hook safety latch bent

22. Written records must be kept of all lifting & rigging hardware inspections.

- True
- False

23. A qualified person is a person who:

- Has knowledge, training & experience
- Demonstrates competent problem solving
- Has a related certificate or degree
- Hired as an apprentice

Student Signature: _____ Date: _____