Kiewit

On the Spot Lift Plan

OVERHEAD CRANE

EQUIPMENT UNIT #: _____

THIS BOOK IS TO REMAIN WITH THIS MACHINE

LIFTING CRANE SAFETY TO NEW HEIGHTS

Form no. 584-OC

Rev. 5/2022

OVERHEAD CRANE INFORMATION

MAKE: _____

MODEL: _____

SERIAL NUMBER: _____

CRANE EQUIPMENT NUMBER: _____

NUMBER OF HOIST(S): _____

CAPACITY (EACH HOIST): _____

CRANE CAPACITY: _____

ADDITIONAL CRANE SPECIFICS:

_____

_____

_____

_____

_____

_____

6. LIFT PLANNING

Policy

Crane lifts, at a minimum, will be classified into either of two categories: critical lifts or general lifts. Each type of lift will require a different level of planning. A Lift Director shall be designated for all critical lifts to communicate the lift plan and coordinate the safe execution of the lift. Payload weight and center-of-gravity (COG) must be determined for all lifts.

The Project Manager is responsible for ensuring that proper lift planning is performed in accordance with these statements.

Procedures and Practices

For Overhead Cranes, Critical Lifts are:

- Any lift that will pose additional risk to personnel, the public, or negatively impact the project schedule. Refer to Crane Planning/Approval Matrix in the CCPPM for determination of responsibilities.
- Any multiple cranes and/or multiple hook operations
- Any lifting of personnel.

All other lifts will be considered a General Lift.

General Lift Procedure

All general lifts will be planned utilizing Section 1 of the appropriate "On the Spot Lift Plan" form at a minimum.

- Overhead Cranes 584OC

An "On the Spot Lift Plan" is to be completed for each load lifted unless the loads are repetitious. When the loads are repetitious, an "On the Spot Lift Plan" will be completed for the lift that has the most risk or the lift that uses the highest percentage of the load chart. When the crane's location, max load and/or max radius changes, a new "On the Spot Lift Plan" shall be completed.

For Tower and Overhead Cranes, any lift in excess of 90% of the crane's capacity at the given radius as posted in the load chart for the specific crane and its configuration requires additional lift planning, utilizing this form 584OC or 584TC (Section 2, back page).

General Lift Plan Considerations

No matter which classification the lift falls under, there are basic elements that must be considered for all lifts.

- Weight of the load.
- Radius of lift.
- Crane capacity.
- Crane setup.
- Crane/LMI Configuration.
- Size of the load.
- Center of gravity of load.
- Rigging necessary to lift the load.
- Environmental conditions (i.e., wind, weather).
- Operator skill.
- Communications.

1. AUTHORIZED OPERATOR PROGRAM

Policy

Only operators authorized through the Company and its subsidiaries' Authorized Operator Program and/or trainees under direct supervision of these Authorized Operators are allowed to operate cranes. Operators are to be authorized by an Authorized Examiner. The Authorized Examiner has the responsibility to verify the qualification of crane operators. If the operator candidate cannot meet these qualifications, the Authorized Examiner has the authority to disqualify the operator candidate from being Qualified to run the crane.

Only maintenance and vendor personnel Qualified by the Equipment Operations Manager shall operate cranes when troubleshooting, assembly/disassembly, inspections, or testing is required.

The Project Manager is responsible for ensuring that only Qualified personnel are permitted to operate the crane as well as making sure the Manufacturer's, Company, and Regulatory Agency requirements are met.

For permanently installed Overhead and Gantry cranes in a facility; and/or Mechanic Truck cranes, the operator designation process shall include the following:

- A thorough review of the operator's manual.
- A demonstration and discussion of the specific crane or hoist the employee will use (A Qualified individual may conduct this demonstration and discussion). An evaluation of the employee's ability to operate the crane (a Qualified individual may conduct this evaluation).
- An evaluation of the employee's ability to use safe-rigging techniques.
- A passing grade on the written exam.
- The names of all designated operators shall be posted on the equipment or readily available on the jobsite.
- Be trained on the use of the "On the Spot Lift Plan" for the proper crane type (Form 584).

Kiewit Crane Operations Expectations

•As an authorized Kiewit Crane Operator, you are expected to keep the safety of yourself and all people in your proximity in mind.

•Crane information page must be filled out prior to starting lift plans.

•Section 1 (& section 2 when appropriate) of the On the Spot Lift Plan filled out completely prior to lift.

•For rigging operations, at least one person involved must be a Qualified Rigger. This also applies to subcontractor crane operations.

•All signals given to the operator (voice or hand signals) are to be given by a Qualified Signal Person only. This also applies to subcontractor signal persons.

•Crane crews are expected to work in conjunction with the crews they support. Operations start cards should include crane crew input just as this On the Spot Lift Plan should have crew input.

•Blind Lift operations must be addressed during On the Spot Lift Planning and Operations Start Card planning.

•If at any time, the safe operation of the crane is in question, the Operator is expected to stop all crane operations until the circumstance has been resolved.

NOTES

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10. LIFTING IN THE BLIND

Policy

A Qualified person shall be in charge of any blind lifting activity and will make determinations regarding rigging, communications, placement of personnel, and other decisions as specified.

The Project Manager is responsible for ensuring all blind lifting operations are managed in accordance with industry standards and the following statements.

Procedures and Practices

Blind lifting is defined as any time where the crane operator does not have direct line of sight with all, or part of the object being moved. During any blind lifting activity, the following guidelines shall be followed. See Chapter 32 for more detail on training requirements.

- The signal person shall not "relay" crane signals.
- Voice communication between the signal person and the crane operator shall be established by a dedicated, secure two-way radio or other similar means.
- The crane operator and the signal person shall agree upon standard voice signals before the blind lifts are started. The ASME B30.5 standard shall govern all voice communications as listed below and as outlined in Chapter 9.
  - All directions to the crane operator by the signal person shall be given from the operator's directional perspective (e.g., "swing right" shall mean swing to the operator's right).
  - Each series of voice signals shall contain three elements stated in the following order:
    - Function, Direction
    - Speed and/or Distance
    - Function, Stop command
- If at any time communication is disrupted (including the release of the microphone key), the operator shall stop all crane movements until communication is restored and a proper signal is given and understood.
- All personnel involved in a blind lift activity shall receive clear direction from the person in charge of the lift. The person in charge of the lift shall be certain that all crewmembers understand their duties.
- The path for the lift shall be reviewed by a Qualified person, signal person and crane operator. Any potential for rigging snags or load contact with structural components shall be addressed, and a plan shall be in place to minimize this hazard.
- If using spotters (All spotters shall be Qualified signal persons):
  - Spotters shall be positioned away from any potential hazard due to a snag or load contact.
  - Spotters shall be instructed to only give a **STOP** signal to the crane operator as they are not the designated signal person.
- Personnel are not to work directly under a blind load. Every effort must be made to avoid placing personnel in a hazardous situation during blind lifts.

SECTION 1

Name: _____

Date: _____

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EMERGENCY POWER DISCONNECT

1. **DESCRIPTION** of lifted object(s): _____

_____

2. **WEIGHT** of the object to be lifted:

3. How was the Weight of the object obtained? _____

4. **TOTAL WEIGHT** of all rigging being used:

5. **TOTAL LIFTED LOAD:**
(Determined by adding lines 2 & 4)

6. What is the **RATED CAPACITY** of slings?
(In this configuration)

7. What is the Rated Capacity of the **CRANE**?

8. What is the Rated Capacity of the **HOIST**?

9. Divide Lines 5 by 7 for % of **CRANE CAPACITY**.
If over 90%,the back of this page (Section 2) must be completed. %

10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

☐ Verify that Overhead Utilities **ARE NOT** a hazard.

☐ Verify if wind speed or weather is a factor for this lift.

☐ Verify if lift will pose additional risk to personnel or project schedule.

☐ Verify the Center of Gravity of the load is determined.

☐ Verify rigging is properly sized and adequate for the load and load control.

☐ Verify there is adequate clearance for the crane and the load path.

☐ Attach a separate sheet with additional details for Critical Lift Plan
(as per procedure on inside cover).

Confirm a completed Operations Start Card is signed by the Superintendent and reviewed. Any lift above 95% requires Regional Equipment Manager or his / her designees approval.

<u>Superintendent and Operator Reviewed</u>

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☐ Verify rigging is properly sized and adequate for the load and load control.

☐ Verify there is adequate clearance for the crane and the load path.

☐ Attach a separate sheet with additional details for Critical Lift Plan
(as per procedure on inside cover).

Confirm a completed Operations Start Card is signed by the Superintendent and reviewed. Any lift above 95% requires Regional Equipment Manager or his / her designees approval.

<u>Superintendent and Operator Reviewed</u>

Superintendent Signature: _____

Operator Signature: _____

SECTION 1

Name: _____

Date: _____

Prior to use, operator must verify the location of the
EMERGENCY POWER DISCONNECT

1. **DESCRIPTION** of lifted object(s): _____

_____

2. **WEIGHT** of the object to be lifted:

3. How was the Weight of the object obtained? _____

4. **TOTAL WEIGHT** of all rigging being used:

5. **TOTAL LIFTED LOAD:**
(Determined by adding lines 2 & 4)

6. What is the **RATED CAPACITY** of slings?
(In this configuration)

7. What is the Rated Capacity of the **CRANE**?

8. What is the Rated Capacity of the **HOIST**?

9. Divide Lines 5 by 7 for % of **CRANE CAPACITY**.
If over 90%,the back of this page (Section 2) must be completed. %

10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

☐ Verify that Overhead Utilities **ARE NOT** a hazard.

☐ Verify if wind speed or weather is a factor for this lift.

☐ Verify if lift will pose additional risk to personnel or project schedule.

☐ Verify the Center of Gravity of the load is determined.

☐ Verify rigging is properly sized and adequate for the load and load control.

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9. Divide Lines 5 by 7 for % of **CRANE CAPACITY**.
If over 90%,the back of this page (Section 2) must be completed. %

10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

☐ Verify that Overhead Utilities **ARE NOT** a hazard.

☐ Verify if wind speed or weather is a factor for this lift.

☐ Verify if lift will pose additional risk to personnel or project schedule.

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(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

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☐ Verify if wind speed or weather is a factor for this lift.

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10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

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10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

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(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

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☐ Verify if wind speed or weather is a factor for this lift.

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(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

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(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

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SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

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Qualified Rigger:_____ Crew: _____

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SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

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SECTION 2

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Date: _____

Prior to use, operator must verify the location of the
EMERGENCY POWER DISCONNECT

1. **DESCRIPTION** of lifted object(s): _____

_____

2. **WEIGHT** of the object to be lifted:

3. How was the Weight of the object obtained? _____

4. **TOTAL WEIGHT** of all rigging being used:

5. **TOTAL LIFTED LOAD:**
(Determined by adding lines 2 & 4)

6. What is the **RATED CAPACITY** of slings?
(In this configuration)

7. What is the Rated Capacity of the **CRANE**?

8. What is the Rated Capacity of the **HOIST**?

9. Divide Lines 5 by 7 for % of **CRANE CAPACITY**.
If over 90%,the back of this page (Section 2) must be completed. %

10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

☐ Verify that Overhead Utilities **ARE NOT** a hazard.

☐ Verify if wind speed or weather is a factor for this lift.

☐ Verify if lift will pose additional risk to personnel or project schedule.

☐ Verify the Center of Gravity of the load is determined.

☐ Verify rigging is properly sized and adequate for the load and load control.

☐ Verify there is adequate clearance for the crane and the load path.

☐ Attach a separate sheet with additional details for Critical Lift Plan
(as per procedure on inside cover).

Confirm a completed Operations Start Card is signed by the Superintendent and reviewed. Any lift above 95% requires Regional Equipment Manager or his / her designees approval.

<u>Superintendent and Operator Reviewed</u>

Superintendent Signature: _____

Operator Signature: _____

SECTION 1

Name: _____

Date: _____

Prior to use, operator must verify the location of the
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6. What is the **RATED CAPACITY** of slings?
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7. What is the Rated Capacity of the **CRANE**?

8. What is the Rated Capacity of the **HOIST**?

9. Divide Lines 5 by 7 for % of **CRANE CAPACITY**.
If over 90%,the back of this page (Section 2) must be completed. %

10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

☐ Verify that Overhead Utilities **ARE NOT** a hazard.

☐ Verify if wind speed or weather is a factor for this lift.

☐ Verify if lift will pose additional risk to personnel or project schedule.

☐ Verify the Center of Gravity of the load is determined.

☐ Verify rigging is properly sized and adequate for the load and load control.

☐ Verify there is adequate clearance for the crane and the load path.

☐ Attach a separate sheet with additional details for Critical Lift Plan
(as per procedure on inside cover).

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9. Divide Lines 5 by 7 for % of **CRANE CAPACITY**.
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10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

☐ Verify that Overhead Utilities **ARE NOT** a hazard.

☐ Verify if wind speed or weather is a factor for this lift.

☐ Verify if lift will pose additional risk to personnel or project schedule.

☐ Verify the Center of Gravity of the load is determined.

☐ Verify rigging is properly sized and adequate for the load and load control.

☐ Verify there is adequate clearance for the crane and the load path.

☐ Attach a separate sheet with additional details for Critical Lift Plan
(as per procedure on inside cover).

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9. Divide Lines 5 by 7 for % of **CRANE CAPACITY**.
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10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

☐ Verify that Overhead Utilities **ARE NOT** a hazard.

☐ Verify if wind speed or weather is a factor for this lift.

☐ Verify if lift will pose additional risk to personnel or project schedule.

☐ Verify the Center of Gravity of the load is determined.

☐ Verify rigging is properly sized and adequate for the load and load control.

☐ Verify there is adequate clearance for the crane and the load path.

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9. Divide Lines 5 by 7 for % of **CRANE CAPACITY**.
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10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

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☐ Verify if wind speed or weather is a factor for this lift.

☐ Verify if lift will pose additional risk to personnel or project schedule.

☐ Verify the Center of Gravity of the load is determined.

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☐ Verify there is adequate clearance for the crane and the load path.

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10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

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☐ Verify if wind speed or weather is a factor for this lift.

☐ Verify if lift will pose additional risk to personnel or project schedule.

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9. Divide Lines 5 by 7 for % of **CRANE CAPACITY**.
If over 90%,the back of this page (Section 2) must be completed. %

10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

☐ Verify that Overhead Utilities **ARE NOT** a hazard.

☐ Verify if wind speed or weather is a factor for this lift.

☐ Verify if lift will pose additional risk to personnel or project schedule.

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☐ Verify there is adequate clearance for the crane and the load path.

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10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

☐ Verify that Overhead Utilities **ARE NOT** a hazard.

☐ Verify if wind speed or weather is a factor for this lift.

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(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

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If over 90%,the back of this page (Section 2) must be completed. %

10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

☐ Verify that Overhead Utilities **ARE NOT** a hazard.

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Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

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SECTION 2

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Date: _____

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Qualified Rigger:_____ Crew: _____

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Qualified Rigger:_____ Crew: _____

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9. Divide Lines 5 by 7 for % of **CRANE CAPACITY**.
If over 90%,the back of this page (Section 2) must be completed. %

10. Are there any obstacles in the travel path of the load? Yes No
(If yes, address them on Operation's Start Card)

Crane Operator: _____ Crew:_____

Qualified Rigger:_____ Crew: _____

Qualified Signal Person: _____ Crew: _____

SECTION 2

LIFTING CRANE SAFETY TO NEW HEIGHTS

Date: _____

☐ Verify percent of Capacity used _____ %.

☐ Verify that Overhead Utilities **ARE NOT** a hazard.

☐ Verify if wind speed or weather is a factor for this lift.

☐ Verify if lift will pose additional risk to personnel or project schedule.

☐ Verify the Center of Gravity of the load is determined.

☐ Verify rigging is properly sized and adequate for the load and load control.

☐ Verify there is adequate clearance for the crane and the load path.

☐ Attach a separate sheet with additional details for Critical Lift Plan
(as per procedure on inside cover).

Confirm a completed Operations Start Card is signed by the Superintendent and reviewed. Any lift above 95% requires Regional Equipment Manager or his / her designees approval.

<u>Superintendent and Operator Reviewed</u>

Superintendent Signature: _____

Operator Signature: _____

SECTION 1

Name: _____

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Prior to use, operator must verify the location of the
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1. **DESCRIPTION** of lifted object(s): _____

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3. How was the Weight of the object obtained? _____

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5. **TOTAL LIFTED LOAD:**
(Determined by adding lines 2 & 4)

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(In this configuration)

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Crosby® USERS GUIDE FOR LIFTING

ASME VERSION (12/20)

RISK MANAGEMENT

DEFINITION

COMPREHENSIVE SET OF ACTIONS THAT REDUCES THE RISK OF A PROBLEM, A FAILURE, AN ACCIDENT

ASME B30.9 (SLINGS) AND ASME B30.26 (RIGGING HARDWARE) REQUIRES USERS TO HAVE TRAINING.

USERS SHALL BE TRAINED IN THE SELECTION, INSPECTION, CAUTIONS TO PERSONNEL, EFFECTS OF ENVIRONMENT AND RIGGING PRACTICES.

ALL SLINGS AND RIGGING HARDWARE REQUIRE PROPER IDENTIFICATION.

RIGGING HARDWARE AT MINIMUM TO BE IDENTIFIED WITH NAME OR TRADEMARK OF THE MANUFACTURER.

SEE ASME B30.9, ASME B30.10 AND ASME B30.26 FOR FULL INFORMATION

REFER TO CROSBY GROUP CATALOG AND OTHER PRODUCT APPLICATION INFORMATION.

TERMINOLOGY

WORKING LOAD LIMIT (WLL)

THE MAXIMUM MASS OR FORCE WHICH THE PRODUCT IS AUTHORIZED TO SUPPORT IN A PARTICULAR SERVICE.

PROOF TEST

A TEST APPLIED TO A PRODUCT SOLELY TO DETERMINE INJURIOUS MATERIAL OR MANUFACTURING DEFECTS.

ULTIMATE STRENGTH

THE AVERAGE LOAD OR FORCE AT WHICH THE PRODUCT FAILS OR NO LONGER SUPPORTS THE LOAD.

DESIGN FACTOR

AN INDUSTRIAL TERM DENOTING A PRODUCT'S THEORETICAL RESERVE CAPABILITY; USUALLY COMPUTED BY DIVIDING THE CATALOG ULTIMATE LOAD BY THE WORKING LOAD LIMIT. GENERALLY EXPRESSED AS A RATIO, e.g. 5 TO 1.

Load Rated®

FOR ADDITIONAL SUPPORT

Crosby®

P.O. Box 3128
Tulsa Oklahoma 74101
Phone: (918) 834-4611
1-800-777-1555

thecrosbygroup.com
crosbygroup@thecrosbygroup.com

BLOCKS & FITTINGS FOR WIRE ROPE & CHAIN

CROSBY® FITTINGS
LEBUS® McKISSICK®
CROSBY IP® NATIONAL®

THE BASIC RIGGING PLAN

PLAN EVERY LIFT. THE QUESTIONS TO ANSWER BELOW ARE JUST A GOOD STARTING POINT BEFORE THE MATERIAL MOVING ACTIVITY BEGINS. ADD QUESTIONS FROM YOUR PAST EXPERIENCE OR JOB SPECIFIC REQUIREMENTS.

1. WHO IS RESPONSIBLE FOR THE RIGGING?
2. HAS COMMUNICATION BEEN ESTABLISHED?
3. IS THE RIGGING IN ACCEPTABLE CONDITION?
4. IS THE RIGGING APPROPRIATE FOR LIFTING?
5. DOES THE RIGGING HAVE PROPER IDENTIFICATION?
6. DOES ALL GEAR HAVE KNOWN WORKING LOAD LIMITS?
7. WHAT IS THE WEIGHT OF THE LOAD?
8. WHERE IS THE LOAD'S CENTER OF GRAVITY?
9. WHAT IS THE SLING ANGLE OF LOADING?
10. WILL THERE BE ANY SIDE OR ANGULAR LOADING?
11. ARE THE SLINGS PROTECTED FROM CORNERS, EDGES, PROTRUSIONS AND ABRASIVE SURFACES?
12. ARE THE WORKING LOAD LIMITS ADEQUATE?
13. IS THE LOAD RIGGED TO THE CENTER OF GRAVITY?
14. IS THE HITCH APPROPRIATE FOR THE LOAD?
15. IS A TAG LINE REQUIRED TO CONTROL THE LOAD?
16. WILL PERSONNEL BE CLEAR OF SUSPENDED LOADS?
17. IS THERE ANY POSSIBILITY OF FOULING?
18. WILL THE LOAD LIFT LEVEL AND BE STABLE?
19. ANY UNUSUAL ENVIRONMENTAL CONCERNS?
20. ANY SPECIAL REQUIREMENTS?

THE RIGGING MUST BE USED WITHIN MANUFACTURER'S RECOMMENDATIONS AND INDUSTRY STANDARDS THAT INCLUDE OSHA, ASME, ANSI, API AND OTHERS.

RESPONSIBILITY

USER RESPONSIBILITY

1. UTILIZE APPROPRIATE RIGGING GEAR SUITABLE FOR OVERHEAD LIFTING.
2. UTILIZE THE RIGGING GEAR WITHIN INDUSTRY STANDARDS AND THE MANUFACTURER'S RECOMMENDATIONS.
3. CONDUCT REGULAR INSPECTION AND MAINTENANCE OF THE RIGGING GEAR.
4. PROVIDE EMPLOYEES WITH TRAINING TO MEET OSHA, API AND ASME (B30.9, B30.26, ETC.) REQUIREMENTS.

MANUFACTURER'S RESPONSIBILITY

1. PROVIDES PRODUCT AND APPLICATION INFORMATION
2. PROVIDES PRODUCT THAT IS CLEARLY IDENTIFIED
   - NAME OR LOGO
   - LOAD RATING AND SIZE
   - TRACEABILITY
3. PROVIDES PRODUCT PERFORMANCE
   - WORKING LOAD LIMIT
   - DUCTILITY
   - FATIGUE PROPERTIES
   - IMPACT PROPERTIES
4. PROVIDES PRODUCT TRAINING AND TRAINING RESOURCES

INSPECTION OF RIGGING HARDWARE

INSPECTION FREQUENCY PER ASME B30.26

A VISUAL INSPECTION SHALL BE PERFORMED BY THE USER OR DESIGNATED PERSON EACH DAY BEFORE THE RIGGING HARDWARE IS USED.

A PERIODIC INSPECTION SHALL BE PERFORMED BY A DESIGNATED PERSON, AT LEAST ANNUALLY. THE RIGGING HARDWARE SHALL BE EXAMINED AND A DETERMINATION MADE AS TO WHETHER THEY CONSTITUTE A HAZARD. WRITTEN RECORDS ARE NOT REQUIRED.

SEMI-PERMANENT AND INACCESSIBLE LOCATIONS WHERE FREQUENT INSPECTIONS ARE NOT FEASIBLE SHALL HAVE PERIODIC INSPECTIONS PERFORMED.

REJECTION CRITERIA PER ASME B30.26

MISSING OR ILLEGIBLE MANUFACTURER'S NAME OR TRADEMARK AND/OR RATED LOAD IDENTIFICATION (OR SIZE AS REQUIRED)

A 10% OR MORE REDUCTION OF THE ORIGINAL DIMENSION

BENT, TWISTED, DISTORTED, STRETCHED, ELONGATED, CRACKED OR BROKEN LOAD BEARING COMPONENTS

EXCESSIVE NICKS, GOUGES, PITTING AND CORROSION

INDICATIONS OF HEAT DAMAGE INCLUDING WELD SPATTER OR ARC STRIKES, EVIDENCE OF UNAUTHORIZED WELDING

LOOSE OR MISSING NUTS, BOLTS, COTTER PINS, SNAP RINGS, OR OTHER FASTENERS AND RETAINING DEVICES

UNAUTHORIZED REPLACEMENT COMPONENTS OR OTHER VISIBLE CONDITIONS THAT CAUSE DOUBT AS TO THE CONTINUED USE OF THE SLING

ADDITIONALLY, INSPECT WIRE ROPE CLIPS FOR:

1. INSUFFICIENT NUMBER OF CLIPS
2. INCORRECT SPACING BETWEEN CLIPS
3. IMPROPERLY TIGHTENED CLIPS
4. INDICATIONS OF DAMAGED WIRE ROPE OR WIRE ROPE SLIPPAGE
5. IMPROPER ASSEMBLY

ADDITIONALLY, INSPECT WEDGE SOCKETS FOR:

1. INDICATIONS OF DAMAGED WIRE ROPE OR WIRE ROPE SLIPPAGE
2. IMPROPER ASSEMBLY

ADDITIONAL REJECTION CRITERIA AND INFORMATION PER ASME B30.10 - HOOKS

- ANY VISIBLY APPARENT BEND OR TWIST FROM THE PLANE OF THE UNBENT HOOK
- ANY DISTORTION CAUSING AN INCREASE IN THROAT OPENING OF 5%, NOT TO EXCEED 1/4"
- MISSING OR ILLEGIBLE RATED LOAD IDENTIFICATION
- MISSING OR ILLEGIBLE HOOK MANUFACTURER'S IDENTIFICATION OR SECONDARY MFG. IDENTIFICATION
- HOOKS SHALL NOT BE RETURNED TO SERVICE UNTIL APPROVED BY A QUALIFIED PERSON
- HOOKS REQUIRE A WRITTEN RECORD OF THE PERIODIC INSPECTION, MINIMUM OF ONCE PER YEAR

INSPECTION OF SLINGS

INSPECTION FREQUENCY PER ASME B30.9

A VISUAL INSPECTION FOR DAMAGE SHALL BE PERFORMED BY A DESIGNATED PERSON EACH DAY OR SHIFT THE SLING IS USED. A COMPLETE INSPECTION FOR DAMAGE SHALL BE PERFORMED PERIODICALLY BY A DESIGNATED PERSON, AT LEAST ANNUALLY.

REJECTION CRITERIA PER ASME B30.9

MISSING OR ILLEGIBLE SLING IDENTIFICATION; EVIDENCE OF HEAT DAMAGE; SLINGS THAT ARE KNOTTED; FITTINGS THAT ARE PITTED, CORRODED, CRACKED, BENT, TWISTED, GOUGED, OR BROKEN; OTHER CONDITIONS, INCLUDING VISIBLE DAMAGE, THAT CAUSE DOUBT AS TO THE CONTINUED USE OF THE SLING.

WIRE ROPE SLINGS

EXCESSIVE BROKEN WIRES, FOR STRAND-LAID AND SINGLE PART SLINGS, TEN RANDOMLY DISTRIBUTED BROKEN WIRES IN ONE ROPE LAY OR FIVE BROKEN WIRES IN ONE STRAND IN ONE ROPE LAY

SEVERE LOCALIZED ABRASION OR SCRAPING, KINKING, CRUSHING, BIRDCAGING

ANY OTHER DAMAGE RESULTING IN DAMAGE TO THE ROPE STRUCTURE

SEVERE CORROSION OF THE ROPE OR END ATTACHMENTS

DOCUMENTATION THAT THE MOST RECENT PERIODIC INSPECTION WAS PERFORMED SHALL BE MAINTAINED

INSPECTION RECORDS OF INDIVIDUAL SLINGS ARE NOT REQUIRED

CHAIN SLINGS

CRACKS OR BREAKS

EXCESSIVE WEAR, NICKS OR GOUGES

STRETCHED CHAIN LINKS OR COMPONENTS

BENT, TWISTED OR DEFORMED CHAIN LINKS OR COMPONENTS

EXCESSIVE PITTING OR CORROSION

LACK OF ABILITY OF CHAIN OR COMPONENTS TO HINGE FREELY

WELD SPATTER

A WRITTEN RECORD OF THE INITIAL INSPECTION REFERENCING INDIVIDUAL SLING IDENTIFICATION IS REQUIRED

A WRITTEN RECORD OF THE MOST RECENT PERIODIC INSPECTION SHALL BE MAINTAINED AND SHALL INCLUDE THE CONDITION OF THE SLING

WEB SLINGS

ACID OR CAUSTIC BURNS

MELTING OR CHARRING OF ANY PART OF THE SLING

HOLES, TEARS, CUTS OR SNAGS

BROKEN OR WORN STITCHING IN LOAD BEARING SPLICES

EXCESSIVE ABRASIVE WEAR DISCOLORATION AND BRITTLE

OR STIFF AREAS ON ANY PART OF THE SLING, WHICH

MAY MEAN CHEMICAL OR ULTRAVIOLET / SUNLIGHT DAMAGE

DOCUMENTATION THAT THE MOST RECENT PERIODIC INSPECTION WAS PERFORMED SHALL BE MAINTAINED

ROUND SLINGS

ACID OR CAUSTIC BURNS EVIDENCE OF HEAT DAMAGE

HOLES, TEARS, CUTS, ABRASIVE WEAR OR SNAGS THAT EXPOSE THE CORE YARNS

BROKEN OR DAMAGED CORE YARNS

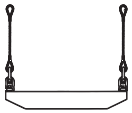
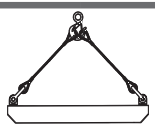
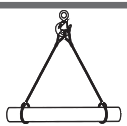
WELD SPATTER THAT EXPOSES CORE YARNS

DISCOLORATION AND BRITTLE OR STIFF AREAS ON ANY PART OF THE SLINGS, WHICH MAY MEAN CHEMICAL OR OTHER DAMAGE

DOCUMENTATION THAT THE MOST RECENT PERIODIC INSPECTION WAS PERFORMED SHALL BE MAINTAINED

WIRE ROPE SLING CAPACITIES - TONS (2000 LBS.) - FLEMISH EYE

BASED ON 6 X 19 AND 6 X 36 EIP STEEL, IWRC (FOR FIBER CORE DEDUCT APPROXIMATELY 15%) WITH DESIGN FACTOR OF 5

WIRE ROPE SIZE INCHES						
	STRAIGHT-LINE HITCH (SINGLE LEG)	SINGLE CHOKER	TWO LEG SLING VERTICAL	TWO LEG SLING 60˚ ANGLE OF LOADING (HORIZONTAL ANGLE)	TWO LEG SLING 45˚ ANGLE OF LOADING (HORIZONTAL ANGLE)	TWO LEG CHOKER 60˚ ANGLE OF LOADING (HORIZONTAL ANGLE)
1/4	0.65	0.48	1.3	1.1	0.9	0.8
3/8	1.4	1.1	2.9	2.5	2.0	1.8
7/16	1.9	1.4	3.9	3.4	2.7	2.5
1/2	2.5	1.9	5.1	4.4	3.6	3.2
9/16	3.2	2.4	6.4	5.5	4.5	4.1
5/8	3.9	2.9	7.8	6.8	5.5	5.0
3/4	5.6	4.1	11.0	9.7	7.9	7.1
7/8	7.6	5.6	15.0	13.0	11.0	9.7
1	9.8	7.2	20.0	17.0	14.0	13.0
1-1/8	12.0	9.1	24.0	21.0	17.0	16.0
1-1/4	15.0	11.0	30.0	26.0	21.0	19.0

FOR SLING ANGLES OTHER THAN THOSE SHOWN, USE THE RATED LOAD FOR THE NEXT LOWER ANGLE OR A QUALIFIED PERSON SHALL CALCULATE THE RATED LOAD.

ANGLE OF LOADING OF LESS THAN 30 DEGREES IS NOT RECOMMENDED. THE CAPACITY OF A BRIDLE AT A 30 DEGREE ANGLE OF LOADING IS SAME AS THE STRAIGHT-LINE HITCH.

RATED LOAD BASED ON PIN DIAMETER NO LARGER THAN ONE HALF THE NATURAL EYE LENGTH OR NOT LESS THAN THE NOMINAL SLING DIAMETER.

BASKET HITCH CAPACITY BASED ON MINIMUM D/D RATIO OF 25/1.

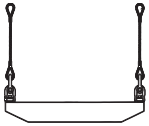
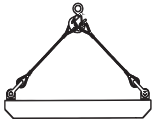
FOR CHOKER HITCHES, THE ANGLE OF CHOKE SHALL BE 120 DEGREES OR GREATER.

OSHA REQUIRES THAT ALL WIRE ROPE SLINGS HAVE PERMANENTLY AFFIXED IDENTIFICATION MARKINGS THAT SHOW MAXIMUM LOAD RATING. ALWAYS USE THE INDIVIDUAL SLING TAG TO VERIFY THE SLINGS CAPACITY. CHART ABOVE IS FOR GENERAL PLANNING INFORMATION ONLY.

WIRE ROPE SLING CAPACITIES - TONS (2000 LBS.) - FLEMISH EYE

5A

BASED ON 6 X 19 AND 6 X 36 EEIP (EXTRA EXTRA IMPROVED PLOW STEEL), IWRC WITH DESIGN FACTOR OF 5

WIRE ROPE SIZE INCHES						
				TWO LEG SLING		TWO LEG CHOKER
	STRAIGHT-LINE HITCH (SINGLE LEG)	SINGLE CHOKER	TWO LEG SLING VERTICAL	60˚ ANGLE OF LOADING (HORIZONTAL ANGLE)	45˚ ANGLE OF LOADING (HORIZONTAL ANGLE)	60˚ ANGLE OF LOADING (HORIZONTAL ANGLE)
1/4	.71	.52	1.4	1.2	1.0	.90
3/8	1.6	1.2	3.2	2.7	2.2	2.0
7/16	2.1	1.6	4.3	3.7	3.0	2.7
1/2	2.8	2.0	5.5	4.8	3.9	3.5
9/16	3.5	2.6	7.0	6.1	5.0	4.5
5/8	4.3	3.2	8.6	7.5	6.1	5.5
3/4	6.2	4.5	12	11	8.7	7.9
7/8	8.3	6.1	17	14	12	11
1	11	8.0	22	19	15	14

FOR SLING ANGLES OTHER THAN THOSE SHOWN, USE THE RATED LOAD FOR THE NEXT LOWER ANGLE OR A QUALIFIED PERSON SHALL CALCULATE THE RATED LOAD.

ANGLE OF LOADING OF LESS THAN 30 DEGREES IS NOT RECOMMENDED. THE CAPACITY OF A BRIDLE AT A 30 DEGREE ANGLE OF LOADING IS SAME AS THE STRAIGHT-LINE HITCH.

RATED LOAD BASED ON PIN DIAMETER NO LARGER THAN ONE HALF THE NATURAL EYE LENGTH OR NOT LESS THAN THE NOMINAL SLING DIAMETER.

BASKET HITCH CAPACITY BASED ON MINIMUM D/D RATIO OF 25/1.

FOR CHOKER HITCHES, THE ANGLE OF CHOKE SHALL BE 120 DEGREES OR GREATER.

OSHA REQUIRES THAT ALL WIRE ROPE SLINGS HAVE PERMANENTLY AFFIXED IDENTIFICATION MARKINGS THAT SHOW MAXIMUM LOAD RATING. ALWAYS USE THE INDIVIDUAL SLING TAG TO VERIFY THE SLINGS CAPACITY. CHART ABOVE IS FOR GENERAL PLANNING INFORMATION ONLY.

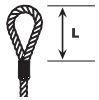
WIRE ROPE SLING CONNECTIONS AND HITCHES

CONNECTION TO FITTINGS

USE A THIMBLE TO PROTECT SLING AND INCREASE D/d

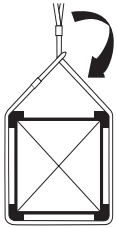
NEVER PLACE EYE OVER A FITTING WITH SMALLER DIAMETER OR WIDTH THAN THE ROPE'S DIAMETER.

NEVER PLACE A SLING EYE OVER A FITTING WITH A DIAMETER OR WIDTH GREATER THAN ONE HALF THE LENGTH OF THE EYE.

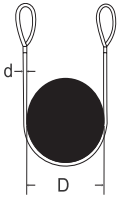


CHOKER CAPACITY

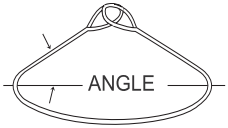
A CHOKER HITCH HAS 75% OF THE CAPACITY OF A SINGLE LEG SLING ONLY IF THE ANGLE OF CHOKE IS 120 DEGREES OR GREATER. A CHOKE ANGLE LESS THAN 120 DEGREES CAN RESULT IN A CAPACITY AS LOW AS 40% OF THE SINGLE LEG.



BASKET HITCH CAPACITY



A BASKET HITCH HAS TWICE THE CAPACITY OF A SINGLE LEG ONLY IF D/d RATIO IS 25/1 AND THE LEGS ARE VERTICAL.



CAPACITY % OF ANGLE SINGLE LEG	
90	200%
60	170%
45	140%
30	100%

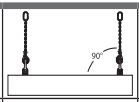
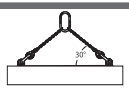
MULTIPLE LEG SLINGS

TRIPLE LEG SLINGS HAVE 50% MORE CAPACITY THAN DOUBLE LEG SLINGS (AT SAME SLING ANGLE) ONLY IF THE CENTER OF GRAVITY IS IN CENTER OF CONNECTION POINTS AND LEGS ARE ADJUSTED PROPERLY. THEY MUST HAVE AN EQUAL SHARE OF THE LOAD.

QUAD (4 LEG) SLINGS OFFER IMPROVED STABILITY BUT PROVIDE INCREASED CAPACITY ONLY IF ALL LEGS SHARE AN EQUAL SHARE OF THE LOAD.

CHAIN SLING CAPACITIES (LBS) - DESIGN FACTOR OF 4

GRADE 8 (80)

CHAIN SIZE (IN.)						
CHAIN GR - 8 DESIGN FACTOR 4:1	STRAIGHT-LINE HITCH (SINGLE LEG)	SINGLE LEG CHOKER HITCH	TWO LEG OR BASKET HITCH	60° ANGLE OF LOADING (HORIZONTAL ANGLE)	45° ANGLE OF LOADING (HORIZONTAL ANGLE)	30° ANGLE OF LOADING (HORIZONTAL ANGLE)
1/4 - (9/32)	3500	2800	7000	6100	4900	3500
3/8	7100	5700	14200	12300	10000	7100
1/2	12000	9600	24000	20800	17000	12000
5/8	18100	14500	36200	31300	25600	18100
3/4	28300	22600	56600	49000	40000	28300
7/8	34200	27400	68400	59200	48400	34200
1	47700	38200	95400	82600	67400	47700
1-1/4	72300	57800	144600	125200	102200	72300

GRADE 10 (100)

CHAIN GR - 10 DESIGN FACTOR 4:1	STRAIGHT-LINE HITCH (SINGLE LEG)	SINGLE LEG CHOKER HITCH	TWO LEG OR BASKET HITCH	60° ANGLE OF LOADING (HORIZONTAL ANGLE)	45° ANGLE OF LOADING (HORIZONTAL ANGLE)	30° ANGLE OF LOADING (HORIZONTAL ANGLE)
1/4 - (9/32)	4300	3500	8600	7400	6100	4300
5/16	5700	4500	11400	9900	8100	5700
3/8	8800	7100	17600	15200	12400	8800
1/2	15000	12000	30000	26000	21200	15000
5/8	22600	18100	45200	39100	32000	22600

FOR SLING ANGLES OTHER THAN THOSE SHOWN, USE THE RATED LOAD FOR THE NEXT LOWER ANGLE OR A QUALIFIED PERSON SHALL CALCULATE THE RATED LOAD.

ANGLE OF LOADING OF LESS THAN 30 DEGREES IS NOT RECOMMENDED. THE CAPACITY OF A BRIDLE AT 30 DEGREES ANGLE OF LOADING IS SAME AS THE STRAIGHT-LINE HITCH.

RATED LOADS BASED ON COMPONENTS OF PROPER SHAPE AND SIZE. COMPONENTS MUST SEAT PROPERLY IN THE LOAD HOOK. FOR CHOKER HITCHES, THE ANGLE OF CHOKE SHALL BE 120 DEGREES OR GREATER. ALWAYS USE THE INDIVIDUAL SLING TAG TO VERIFY THE SLINGS CAPACITY. CHART ABOVE IS FOR GENERAL PLANNING INFORMATION ONLY.

CHAIN SLING CONNECTIONS AND HITCHES

CONNECTION TO FITTINGS

USE MASTER LINKS TO COLLECT SLINGS AND TO CONNECT TO HOOK

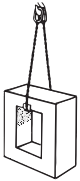
USE GRADE 8 (80) OR GRADE 10 (100) FITTINGS THAT MATCH THE WLL OF THE CHAIN AND OFFER PROPER SECUREMENT.

CHOKER CAPACITY

A CHAIN CHOKER HITCH HAS 80% OF THE CAPACITY OF A SINGLE LEG SLING ONLY IF THE ANGLE OF CHOKE IS 120 DEGREES OR GREATER. RATED LOADS FOR ANGLES OF CHOKE LESS THAN 120 DEGREES SHALL BE DETERMINED BY THE SLING MFG OR A QUALIFIED PERSON.

NO LOSS IN CAPACITY RESULTS IF A CROSBY CRADLE GRAB HOOK IS USED WHEN ANGLE OF CHOKE IS 120 DEGREES OR GREATER

BASKET HITCH CAPACITY



A TRUE BASKET HITCH HAS TWICE THE CAPACITY OF A SINGLE LEG ONLY IF THE LEGS ARE VERTICAL. NOTE THAT THE BASKET IS FORMED BY USING A CHAIN SLING WITH TWO MASTERLINKS AT EACH END CONNECTED TO THE HOOK.

HORIZONTAL CAPACITY % OF ANGLE SINGLE LEG	
90	200%
60	170%
45	140%
30	100%

MULTIPLE LEG SLINGS

TRIPLE LEG CHAIN SLINGS HAVE 50% MORE CAPACITY THAN DOUBLE LEG CHAIN SLINGS (AT SAME SLING ANGLE) ONLY IF THE CENTER OF GRAVITY IS IN THE CENTER OF THE CONNECTION POINTS AND LEGS ARE ADJUSTED PROPERLY. THEY MUST HAVE AN EQUAL SHARE OF THE LOAD.

QUAD (4 LEG) CHAIN SLINGS OFFER IMPROVED STABILITY, BUT DO NOT PROVIDE INCREASED CAPACITY. THE CAPACITY OF A FOUR LEG CHAIN SLING IS CONSIDERED THE SAME AS A THREE LEG CHAIN SLING.

WEB SLING AND ROUNDSLING CAPACITIES

WEB SLING IDENTIFICATION INCLUDES:

SLING TYPE:
TC - TRIANGLE CHOKER
TT - TRIANGLE TRIANGLE
EE - EYE AND EYE
EN - ENDLESS

NUMBER OF PLIES: 1 OR 2
WEBBING GRADE: 9 OR 6
SLING WIDTH (INCHES)

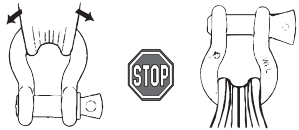
EE 2-9 04 X 12 ← SLING LENGTH (FEET)

ROUNDSLING IDENTIFICATION INCLUDES:

SLING NUMBER: 1-13
SLING NUMBERS ARE FOR REFERENCE ONLY, SOME ROUNDSLINGS HAVE DIFFERENT RATINGS.

SLING COLOR: PURPLE, GREEN, YELLOW, TAN, RED, WHITE, BLUE, ORANGE
SLING COLOR IS NOT FOLLOWED BY ALL MANUFACTURERS AND SOME COLORS HAVE MORE THAN ONE RATED LOAD.

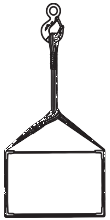
FOLDING, BUNCHING, OR PINCHING OF SYNTHETIC SLINGS, WHICH OCCURS WHEN USED WITH SHACKLES, HOOKS OR OTHER APPLICATIONS WILL REDUCE THE RATED LOAD.



BUNCHING PINCHING

CHOKER CAPACITY

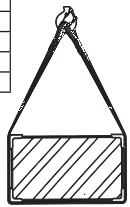
A CHOKER HITCH HAS 80% OF THE CAPACITY OF A SINGLE LEG SLING ONLY IF THE ANGLE OF CHOKE IS 120 DEGREES OR GREATER. A CHOKE ANGLE LESS THAN 120 DEGREES WILL RESULT IN A CAPACITY AS LOW AS 40% OF THE SINGLE LEG.



BASKET HITCH CAPACITY

HORIZONTAL ANGLE	CAPACITY % OF SINGLE LEG
90	200%
60	170%
45	140%
30	100%

A TRUE BASKET HITCH HAS TWICE THE CAPACITY OF A SINGLE LEG ONLY IF THE LEGS ARE VERTICAL



MULTIPLE LEG SLINGS

TRIPLE LEG SLINGS HAVE 50% MORE CAPACITY THAN DOUBLE LEG SLINGS (AT SAME SLING ANGLE) ONLY IF THE CENTER OF GRAVITY IS IN THE CENTER OF CONNECTION POINTS AND LEGS ARE ADJUSTED PROPERLY. THEY MUST HAVE AN EQUAL SHARE OF THE LOAD.

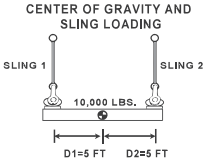
QUAD (4 LEG) SLINGS OFFER IMPROVED STABILITY BUT PROVIDE INCREASED CAPACITY ONLY IF ALL LEGS SHARE AN EQUAL SHARE OF THE LOAD.

NEVER PLACE A SYNTHETIC SLING EYE OVER A FITTING WITH A DIAMETER OR WIDTH GREATER THAN ONE THIRD THE LENGTH OF THE EYE.
CONSULT MANUFACTURER OR QUALIFIED PERSON WHEN EXPECTED LOAD ON SYNTHETIC SLING IS EXPECTED TO EXCEED 80% OF THE SLING RATED LOAD.

CENTER OF GRAVITY AND SLING LOADING

WHEN LIFTING VERTICALLY, THE LOAD WILL BE SHARED EQUALLY IF THE CENTER OF GRAVITY IS PLACED EQUALLY BETWEEN THE PICK POINTS.

IF THE WEIGHT OF THE LOAD IS 10,000 LBS., THEN EACH SLING WILL HAVE A LOAD OF 5,000 LBS. AND EACH SHACKLE AND EYEBOLT WILL ALSO HAVE A LOAD OF 5,000 LBS.



WEIGHTS AND MEASURES

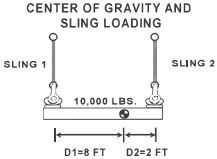
UNIT WEIGHT STEEL = 490 LBS/FT^3
UNIT WEIGHT ALUMINUM = 165 LBS/FT^3
UNIT WEIGHT CONCRETE = 150 LBS/FT^3
UNIT WEIGHT WOOD = 50 LBS/FT^3
UNIT WEIGHT WATER = 62 LBS/FT^3
UNIT WEIGHT SAND AND GRAVEL = 120 LBS/FT^3
UNIT WEIGHT COPPER = 560 LBS/FT^3
UNIT WEIGHT OIL = 58 LBS/FT^3

1 CUBIC FT. = 7.5 GALS
1 METRIC TON = 1.1 US TONS
1 KILOGRAM = 2.2 LBS

1/2 INCH = 12.7 mm
1 INCH = 25.4 mm

CENTER OF GRAVITY AND SLING LOADING

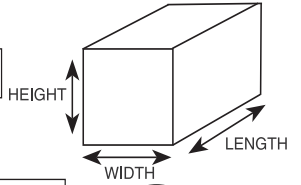
WHEN THE CENTER OF GRAVITY IS NOT EQUALLY SPACED BETWEEN THE PICK POINTS, THE SLING AND FITTINGS WILL NOT CARRY AN EQUAL SHARE OF THE LOAD. THE SLING CONNECTED TO THE PICK POINT CLOSEST TO THE CENTER OF GRAVITY WILL CARRY THE GREATEST SHARE OF THE LOAD.



SLING 2 IS CLOSEST TO COG. IT WILL HAVE THE GREATEST SHARE OF THE LOAD.

SLING 2 = 10,000 X 8 / (8+2) = 8,000 LBS.
SLING 1 = 10,000 X 2 / (8+2) = 2,000 LBS.

VOLUME OF RECTANGLE = HEIGHT x WIDTH x LENGTH

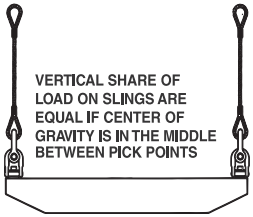


VOLUME OF SPHERE = 3.14 x (DIAM. x DIAM. x DIAM.) / 6

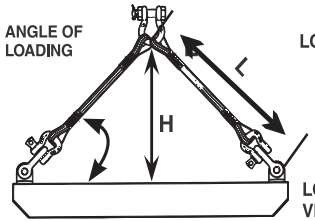
VOLUME OF CYLINDER = 3.14 x (DIAM. x DIAM. x LENGTH) / 4

SLING ANGLES

TWO LEGGED SLING - WIRE ROPE, CHAIN, SYNTHETICS

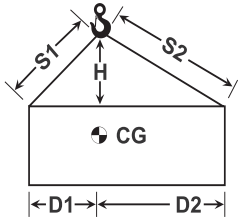


VERTICAL SHARE OF LOAD ON SLINGS ARE EQUAL IF CENTER OF GRAVITY IS IN THE MIDDLE BETWEEN PICK POINTS



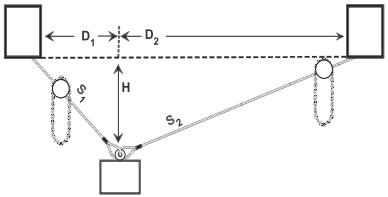
ANGLE OF LOADING (A) DEGREE	LOAD ANGLE FACTOR = L/H
90	1.000
60	1.155
50	1.305
45	1.414
30	2.000

LOAD ON EACH LEG OF SLING =
VERTICAL SHARE OF LOAD X LOAD ANGLE FACTOR



LOAD ON SLING CALCULATED
TENSION 1 = LOAD X D2 X S1/(H(D1+D2))
TENSION 2 = LOAD X D1 X S2/(H(D1+D2))

ANGLE OF LOADING OF LESS THAN 30 DEGREES ARE NOT RECOMMENDED REFER TO ASME B30.9 FOR FULL INFORMATION



LOAD ON SLING CALCULATED
TENSION 1 = LOAD X D2 X S1/(H(D1+D2))
TENSION 2 = LOAD X D1 X S2/(H(D1+D2))

CROSBY SHACKLES

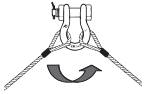
NOMINAL SIZE (IN) DIAMETER OF BOW	CARBON MAXIMUM WORKING LOAD TONS(t)	ALLOY MAXIMUM WORKING LOAD TONS(t)	INSIDE WIDTH AT PINS (INCHES)	DIAMETER OF PIN (INCHES)
3/16	1/3	——	.38	.25
1/4	1/2	——	.47	.31
5/16	3/4	——	.53	.38
3/8	1	2	.66	.44
7/16	1-1/2	2.6	.75	.50
1/2	2	3.3	.81	.63
5/8	3-1/4	5	1.06	.75
3/4	4-3/4	7	1.25	.88
7/8	6-1/2	9.5	1.44	1.00
1	8-1/2	12.5	1.69	1.13
1-1/8	9-1/2	15	1.81	1.25
1-1/4	12	18	2.03	1.38
1-3/8	13-1/2	21	2.25	1.50
1-1/2	17	30	2.38	1.63

CROSBY HOIST HOOKS

CARBON MAXIMUM WORKING LOAD TONS(t)	CODE	ALLOY MAXIMUM WORK-ING LOAD TONS(t)	CODE	THROAT OPENING WITH LATCH	DEFORMATION INDICATOR A - A
3/4	DC	1	DA	.88	1.50
1	FC	1-1/2	FA	.97	2.00
1-1/2	GC	2	GA	1.00	2.00
2	HC	3	HA	1.12	2.00
3	IC	*4-1/2 /5	IA	1.06	2.50
5	JC	7	JA	1.50	3.00
7-1/2	KC	11	KA	1.75	4.00
10	LC	15	LA	1.91	4.00
15	NC	22	NA	2.75	5.00
20	OC	30	OA	3.25	6.50
25	PC	37	PA	3.00	7.00
30	SC	45	SA	3.38	8.00
40	TC	60	TA	4.12	10.00
*320 EYE HOOK IS NOW RATED AT 5 TONS(t)					

USE SCREW PIN SHACKLES WHEN PICKING AND PLACING. TIGHTEN PIN BEFORE EACH LIFT

USE BOLT TYPE SHACKLES IN PERMANENT OR LONG TERM INSTALLATIONS



120° MAXIMUM INCLUDED ANGLE. SHACKLE PIN MUST BE PLACED IN HOOK WHEN USED AS A COLLECTOR. USE ONLY SCREW PIN OR BOLT TYPE SHACKLES

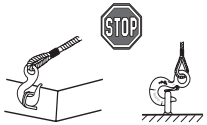
VISUAL VERIFICATION OF PROPER HOOK ENGAGEMENT IS REQUIRED IN ALL CASES

MAKE SURE SLINGS ARE IN BASE OF THE HOOK AND THAT THE LATCH IS NOT FOULED

90° MAXIMUM INCLUDED ANGLE

WHEN SLINGS PLACED INTO HOOK, THE MINIMUM ANGLE OF LOADING IS 45°

DO NOT TIP LOAD, SIDE LOAD OR BACK LOAD HOIST HOOKS

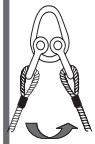


CROSBY SHACKLES AND HOIST HOOKS ARE RATED IN METRIC TONS(t)

CROSBY LINKS AND RINGS

WORKING LOAD LIMITS IN LBS. ARE FOR USE WITH WIRE ROPE AND SYNTHETIC SLINGS AT A DESIGN FACTOR OF 5

SIZE OF LINK IN INCHES	G-341 CARBON	A-341 ALLOY	A-342 ALLOY
1/2	2900	7000	7400
5/8	4200	9000	9000
3/4	6000	12300	12300
7/8	8300	15000	15200
1	10800	24360	26000
1-1/8	N/A	30600	N/A
1-1/4	16750	36000	39100
1-3/8	20500	43000	N/A
1-1/2	N/A	54300	61100
1-5/8	N/A	62600	N/A
1-3/4	N/A	84900	84900
2	N/A	102600	102600



120° MAXIMUM INCLUDED ANGLE FOR PEAR SHAPED LINKS AND MASTER LINKS

THE USE OF A COLLECTOR RING INSURES THAT THE SLINGS WILL BE IN THE BASE OF THE HOOK

CROSBY TURNBUCKLES 13

CROSBY HEAT TREATED TURNBUCKLES ARE SUITABLE FOR CRITICAL APPLICATIONS, WORKING LOAD LIMITS ARE IN LBS. USE JAW OR EYE END TURNBUCKLES FOR OVERHEAD LIFTING. HOOK STYLE TURNBUCKLES ARE FOR GUYING OR "PLUMBING UP"

SIZE	WORKING LOAD LIMIT JAW AND EYE 5/1 DESIGN FACTOR	WORKING LOAD LIMIT HOOK END FITTING. 5/1 DESIGN FACTOR
1/4	500	400
5/16	800	700
3/8	1200	1000
1/2	2200	1500
5/8	3500	2250
3/4	5200	3000
7/8	7200	4000
1	10000	5000
1-1/4	15200	N/A
1-1/2	21400	N/A

LOAD APPLIED SHOULD BE IN LINE AND IN TENSION
TURNBUCKLES SHOULD NOT BE SIDE LOADED

TURNBUCKLES MUST BE SECURED TO PREVENT UNSCREWING DURING THE LIFT, AND FOR LONG-TERM INSTALLATIONS. SHOULD BE ADJUSTED WITH A PROPERLY SIZED WRENCH, USED ON THE WRENCH FLATS OF THE TURNBUCKLE BODY

CROSBY SHOULDERED G-277 AND S-279 EYE BOLTS

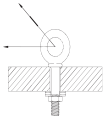
SHANK DIAMETER (IN.)	WORKING LOAD LIMIT IN-LINE PULL (LBS.)	WORKING LOAD LIMIT 60 DEGREES SLING ANGLE (LBS.)	WORKING LOAD LIMIT 45 DEGREES SLING ANGLE (LBS.)	WORKING LOAD LIMIT/ANGLE LESS THAN 45 DEGREES (LBS.)
1/4	650	420	195	160
5/16	1200	780	360	300
3/8	1550	1000	465	380
1/2	2600	1690	780	650
5/8	5200	3380	1560	1300
3/4	7200	4680	2160	1800
7/8	10600	6890	3180	2650
1	13300	8645	3990	3325
1 - 1/4	21000	13600	6300	5250
1 - 1/2	24000	15600	7200	6000

CROSBY HR-125 HOIST RINGS

THREAD SHANK SIZE U.N.C. (IN.)	WORKING LOAD LIMIT AT ALL ANGLES (LBS.)	TORQUE (FT - LBS)
5/16	800	7
3/8	1000	12
1/2	2500	26
5/8	4000	60
3/4	7000	100
7/8	8000	160
1	10000	230
1 - 1/4	15000	470
1 - 1/2	24000	800
2	30000	1100

SHOULDER EYE BOLTS

- NEVER EXCEED WORKING LOAD LIMITS.
- NEVER USE REGULAR NUT EYE BOLTS FOR ANGULAR LIFTS.
- ALWAYS USE SHOULDER NUT EYE BOLTS FOR ANGULAR LIFTS.
- FOR ANGULAR LIFTS, ADJUST WORKING LOAD AS SHOWN ABOVE.
- ALWAYS TIGHTEN NUTS SECURELY AGAINST THE LOAD.
- ALWAYS APPLY LOAD TO EYE BOLT IN THE PLANE OF THE EYE.



SWIVEL HOIST RINGS

- WHEN USING LIFTING SLINGS OF TWO OR MORE LEGS MAKE SURE THE FORCES IN THE LEG ARE CALCULATED. SELECT THE PROPER SIZE SWIVEL HOIST RING TO ALLOW FOR LOAD IN SLING LEG.
- ALWAYS ENSURE HOIST RING IS FREE TO ALIGN ITSELF WITH SLING.

- ALWAYS ENSURE HOIST RING IS PROPERLY TORQUED TO REQUIRED VALUE.

CROSBY EYE BOLTS AND HOIST RINGS

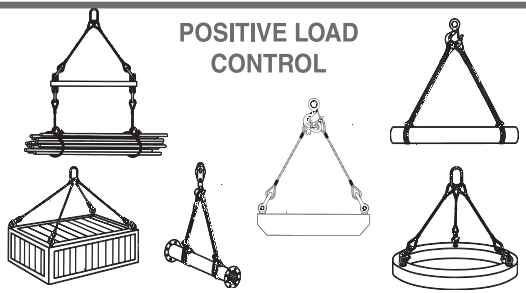
OPERATING PRACTICES - ASME B30.9

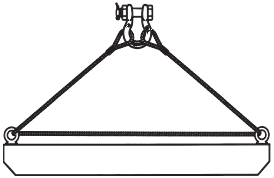
WHENEVER ANY SLING IS USED, THE FOLLOWING PRACTICES SHALL BE OBSERVED.

1. SLINGS THAT ARE DAMAGED OR DEFECTIVE SHALL NOT BE USED.
2. SLINGS SHALL NOT BE SHORTENED OR LENGTHENED BY KNOTTING OR TWISTING.
3. SLING LEGS SHALL NOT BE KINKED.
4. THE RATED LOAD OF THE SLING SHALL NOT BE EXCEEDED.
5. SLINGS USED IN A BASKET HITCH SHALL HAVE THE LOADS BALANCED TO PREVENT SLIPPAGE.
6. SLINGS SHALL BE SECURELY ATTACHED TO THEIR LOAD.
7. SLINGS SHALL BE PROTECTED FROM EDGES, CORNERS, PROTRUSIONS AND ABRASIVE SURFACES TO PREVENT SLING DAMAGE.
8. DURING LIFTING, WITH OR WITHOUT LOAD, PERSONNEL SHALL BE ALERT FOR POSSIBLE SNAGGING.
9. ALL EMPLOYEES SHALL BE KEPT CLEAR OF LOADS ABOUT TO BE LIFTED AND OR SUSPENDED LOADS.
10. HANDS OR FINGERS SHALL NOT BE PLACED BETWEEN THE SLING AND ITS LOAD WHILE THE SLING IS BEING TIGHTENED AROUND THE LOAD.
11. SHOCK LOADING SHOULD BE AVOIDED.
12. A SLING SHALL NOT BE PULLED FROM UNDER A LOAD WHEN THE LOAD IS RESTING ON THE SLING.

INSPECTION: EACH DAY BEFORE BEING USED, THE SLING AND ALL FASTENINGS AND ATTACHMENTS SHALL BE INSPECTED FOR DAMAGE OR DEFECTS BY A COMPETENT PERSON DESIGNATED BY THE EMPLOYER. ADDITIONAL INSPECTIONS SHALL BE PERFORMED DURING SLING USE WHERE SERVICE CONDITIONS WARRANT. DAMAGED OR DEFECTIVE SLINGS SHALL BE IMMEDIATELY REMOVED FROM SERVICE.

LOAD CONTROL





REEVING THROUGH CONNECTIONS TO LOAD INCREASES LOAD ON CONNECTION FITTINGS BY AS MUCH AS TWICE.

DO NOT REEVE!

Crosby

WIRE ROPE CLIPS

G-450
U-BOLT
CLIP

NEVER SADDLE A DEAD HORSE.

NEVER USE MALLEABLE CLIPS FOR ANY CRITICAL APPLICATION

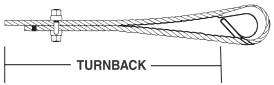
FOR ELEVATOR, PERSONNEL HOIST, AND SCAFFOLD APPLICATIONS, ANSI A17.1 AND A10.4 DO NOT RECOMMEND U-BOLT CLIPS. CROSBY RECOMMENDS FIST GRIP CLIPS FOR TIE OFF LINES FOR FALL PROTECTION.

G-429
FIST GRIP
CLIP

SIZE (IN.)	NUMBER OF CLIPS	TURNBACK LENGTH (IN.)	TORQUE FT-LBS.
1/8	2	3-1/4	4.5
3/16	2	3-3/4	7.5
1/4	2	4-3/4	15
5/16	2	5-1/4	30
3/8	2	6-1/2	45
7/16	2	7	65
1/2	3	11-1/2	65
9/16	3	12	95
5/8	3	12	95
3/4	4	18	130
1	5	26	225

SIZE (IN.)	NUMBER OF CLIPS	TURNBACK LENGTH (IN.)	TORQUE FT-LBS.
3/16	2	4	30
1/4	2	4	30
5/16	2	5	30
3/8	2	5-1/4	45
7/16	2	6-1/2	65
1/2	3	11	65
9/16	3	12-3/4	130
5/8	3	13-1/2	130
3/4	3	16	225
1	5	37	225

SOME STANDARDS MAY REQUIRE A MINIMUM OF 3 WIRE ROPE CLIPS. THE NUMBER OF CLIPS IS BASED UPON USING RRL OR RLL WIRE ROPE. 6 X 19 OR 6 X 36 CLASS, FC OR IWRC; IPS OR XIP, XXIP, ALSO APPLIES TO ROTATION - RESISTANT RRL WIRE ROPE. 8 X 19 CLASS, IPS, XIP, XXIP SIZES 1-3/4 INCH AND SMALLER. IF A PULLEY (SHEAVE) IS USED FOR TURNING BACK THE WIRE ROPE, ADD ONE ADDITIONAL CLIP. CLIPS ARE 80% EFFICIENT UNDER 1" AND 90% 1" AND ABOVE.



1 APPLY FIRST CLIP ONE BASE WIDTH FROM DEAD END

2 APPLY SECOND CLIP AS NEAR THIMBLE AS POSSIBLE

3 APPLY ALL ADDITIONAL CLIPS EVENLY BETWEEN THE FIRST TWO

CALCULATING WEIGHTS

The general information about weights of materials is contained in the DATA and FORMULAS (Section V) of this manual. Information from that section will be used in the following examples to arrive at an object's estimated weight.

1. Flat Objects (square, rectangular and round)

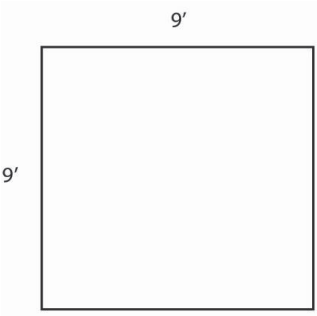
Length in feet x Width in feet x Weight per square foot = Estimated weight of object

A. Given: Steel plate

9' long

9' wide

1" thick, weight per square foot = 40 lbs.



A. Solution:

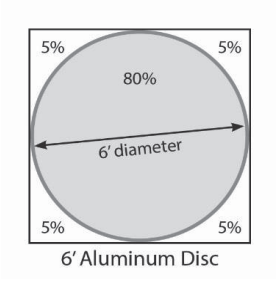
9' x 9' x 40psf = 3,240 lbs.

B. Given: Aluminum disc

6' diameter

2" thick, weight per square foot = 28 lbs.

The area of a circle is 80% of the square



B. Solution:

6' x 6' x .80 x 28psf = 806 lbs.

NOTE: The 80% calculation method is a faster and slightly more conservative approach than the traditional formula using Area of a Circle (πr^2). To illustrate the traditional method of πr^2 x psf: 3.1416 x 3^2 x 28psf = 3.1416 x (3 x 3) x 28 = 792 lbs.

When estimating the weight of tubular, solid or shaped objects it is often quicker to arrive at the weight of the item per running foot, then multiply that value by the total of all lengths of the same tubing combined.

CALCULATING WEIGHTS

2. Hollow Tubing (square, rectangular)

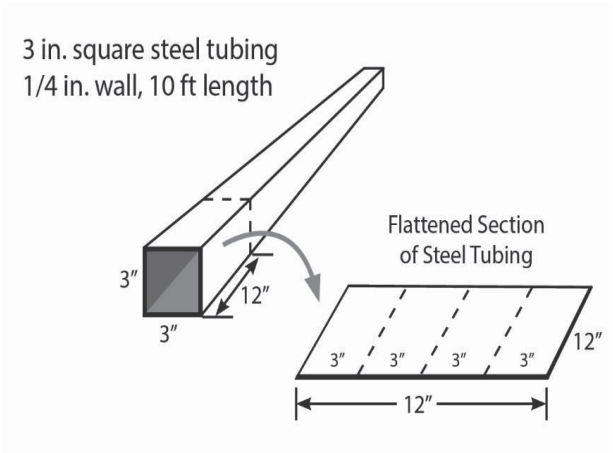
Length (1') x Width in feet x Weight per square foot = Estimated weight of object

A. Given: Steel tubing

3" square, 1/4" wall thickness

10' overall tube length

1/4" thick plate, weight per square foot = 10 lbs.



A. Solution:

1' x 1' x 10psf = 10 lbs. per running foot

10prf x 10' tube length = 100 lbs. tube weight

When estimating the weight of tubular, solid or shaped objects it is often quicker to arrive at the weight of the item per running foot, then multiply that value by the total of all lengths of the same tubing combined.

CALCULATING WEIGHTS

3. Hollow Pipe (round)

Length (1') x Circumference in feet x Weight per square foot = Estimated weight of object

A. Given: Steel pipe

18" round, 3/8" wall thickness

20' overall pipe length

3/8" thick plate, weight per square foot = 15 lbs.

Convert inches to feet: 18"/12" = 1.5'

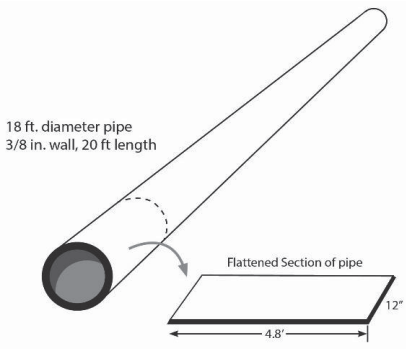
Circumference = 3.2 x diameter

A. Solution:

3.2 x 1.5' = 4.8'

1' x 4.8' x 15psf = 72prf

72prf x 20' tube length = 1,440 lbs.



NOTE: The use of 3.2 for (π)Pi in the field provides a faster and slightly more conservative approach than when using the traditional value of 3.1416, so, using the traditional value: 3.1416 x 1.5 = 4.7, 1 x 4.7 x 15 = 70.5, 70.5 x 20 = 1,410 lbs.

The difference of 1,440 – 1,410 = 30/1,410 = 2%, puts the field estimate at 2% above the more traditional calculation; however, the speed, simplicity and conservative result is to the rigger's benefit. Choose either method for general purpose use. If the final estimate with a 2% overage makes a difference for the selection of the rigging or LHE, then the more exacting approach may be desired.

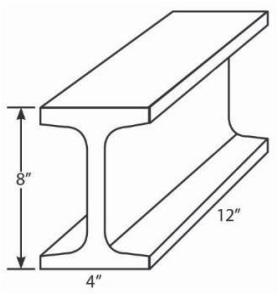
When estimating the weight of tubular, solid or shaped objects it is often quicker to arrive at the weight of the item per running foot, then multiply that value by the total of all lengths of the same tubing combined.

CALCULATING WEIGHTS

PRINCIPLES (cont.)

4. I-Beam

A. Given: 4” x 8” Steel Beam



4” Flange ave. thickness = .426”, so,

.426” x 40psf steel plate = 17.04psf

8” Web ave. thickness = .271”, so,

.271” x 40psf steel plate = 10.84psf

Convert inches to decimal feet, so,

Flange = 4”/12” = .33’, Web = 8”/12” = .67’

A. Solution:

Top flange = 1’ x .33’ x 17.04psf = 5.62prf

Web = 1’ x .67’ x 10.84psf = 7.26prf

Bottom flange = Top flange = 5.62prf

So,

5.62 + 7.26 + 5.62 = 18.5 lbs. per running foot

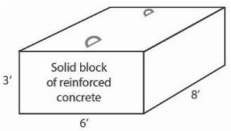
NOTE: Yes, most steel books have the weights/foot for I-beam, H-beam Wide Flange and other shaped products. We just need to be prepared to perform a quick field estimate as needed. Once the pounds per running foot has been estimated, multiply by the total number of running feet of the beam.

CALCULATING WEIGHTS

PRINCIPLES (cont.)

When estimating the weight of an object that has common or uniform properties, like concrete or wood, it is generally simplest to estimate the volume (height x width x length) and then multiply that value by the approximate weight per cubic foot of the material type. In this case, use 150 lbs. per cubic foot (pcf) from the DATA and FORMULAS Section V of this manual.

5. Solid reinforced concrete block



A. Given: 3' x 6' x 8' concrete block

3' x 6' x 8' = 144cf

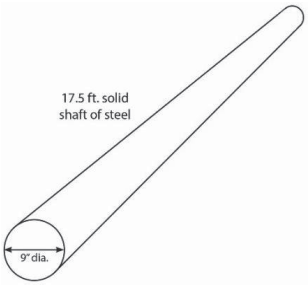
Solid block of reinforced concrete = 150pcf

A. Solution:

3' x 6' x 8' = 144cf

144cf x 150pcf = 21,200 lbs.

6. Solid steel shaft



A. Given: Steel shaft, .75' x 17.5'

Length = 17.5 ft.

Steel weighs 480 lbs. per cubic foot

Use formula as shown on 1B above for a round object: d x d x .80

A. Solution:

.75' x .75' x .80 = .45sf

.45sf x 17.5' length = 7.875cf

7.875cf x 480pcf = 3,780 lbs.

NOTE: The 80% calculation method is a faster and slightly more conservative approach than the traditional formula of: πr^2 x L x pcf, so, using the traditional method:

3.1416 x (.375 x .375) x 17.5 x 480 = 3,711 lbs., which is about 2% less than the estimate.

Load Weights - Calculating

Materials and Liquids - Pounds / cu. ft.			
Aluminum	165	Iron Casting	450
Asbestos	153	Lead	708
Asphalt	81	Lumber - Fir	32
Brass	524	Lumber - Oak	62
Brick	120	Lumber - RR Ties	50
Bronze	534	Oil, Motor	58
Coal	56	Paper	58
Concrete, Reinf.	150	Portland Cement	94
Crushed Rock	95	River Sand	120
Diesel	52	Rubber	94
Dry Earth, Loose	75	Steel	480
Gasoline	45	Water	63
Glass	162	Zinc	437

Pounds / sq. ft.	
Steel plate	
• 1/8"	5
• 1/4"	10
• 1/2"	20
• 1"	40
Aluminum plate	
• 1/8"	1.75
• 1/4"	3.50
Lumber	
• 3/4" Fir	2
• 3/4" Oak	4

Pounds / gal.	
Gas	6.0
Diesel	7.0
Water	8.3

- 7.5 gallons of liquid to a cubic foot
- 27 cubic feet to a cubic yard
- 2,000 lbs = 1 U.S. ton

Formulas and Information

- H = Height • W = Width • L = Length • d = diameter • r = 1/2 diameter • π = 3.2 (approx.)
- Area of square or rectangle = LW • Vol. of cube = HWL • Area of circle = πr^2 • Circumference = π d
- The area of a circle is approx. 80% of its diameter squared (diameter x diameter)
- Load Weight (to estimate) ___ Volume in cu. ft. x 500 lbs. x density factor .02, .05, .10, .20, .30 etc.

Weights of Seamless and Welded Pipe

Nominal Pipe Size	Schedule Number											
	STD	X.S.	10	20	30	40	60	80	100	120	140	160
	WT.	WT.	WT.	WT.	WT.	WT.	WT.	WT.	WT.	WT.	WT.	WT.
2"	3.65	5.02				3.65		5.02				7.46
2.5"	5.79	7.66				5.79		7.66				10.01
3"	7.58	10.25				7.58		10.25				14.31
3.5"	9.11	12.51				9.11		12.51				
4"	10.79	14.98				10.79		14.98		18.98		22.52
5"	14.62	20.78				14.62		20.78		27.04		32.96
6"	18.97	28.57				18.97		28.57		36.42		45.34
8"	28.55	43.39		22.36	24.70	28.55	35.66	43.39	50.93	60.69	67.79	74.71
10"	40.48	54.74		28.04	34.24	40.48	54.74	64.40	77.00	89.27	104.13	115.65
12"	49.56	65.42		33.38	43.77	53.56	73.22	88.57	107.29	125.49	139.68	160.33
14"	54.57	72.09	36.71	45.68	54.57	63.37	85.01	106.13	130.79	150.76	170.22	189.15
16"	62.58	82.77	42.05	52.36	62.58	82.77	107.54	136.58	164.86	192.40	223.57	245.22

Pipe weights shown above are given for a lineal foot of plain end pipe. To convert lbs/ft to metric: 1 lb/ft = 1.49 kg/m

Weights of Seamless and Welded Pipe

Nominal Pipe Size	Schedule Number											
	STD	X.S.	10	20	30	40	60	80	100	120	140	160
	WT.	WT.	WT.	WT.	WT.	WT.	WT.	WT.	WT.	WT.	WT.	WT.
2"	3.65	5.02				3.65		5.02				7.46
2.5"	5.79	7.66				5.79		7.66				10.01
3"	7.58	10.25				7.58		10.25				14.31
3.5"	9.11	12.51				9.11		12.51				
4"	10.79	14.98				10.79		14.98		18.98		22.52
5"	14.62	20.78				14.62		20.78		27.04		32.96
6"	18.97	28.57				18.97		28.57		36.42		45.34
8"	28.55	43.39		22.36	24.70	28.55	35.66	43.39	50.93	60.69	67.79	74.71
10"	40.48	54.74		28.04	34.24	40.48	54.74	64.40	77.00	89.27	104.13	115.65
12"	49.56	65.42		33.38	43.77	53.56	73.22	88.57	107.29	125.49	139.68	160.33
14"	54.57	72.09	36.71	45.68	54.57	63.37	85.01	106.13	130.79	150.76	170.22	189.15
16"	62.58	82.77	42.05	52.36	62.58	82.77	107.54	136.58	164.86	192.40	223.57	245.22

Pipe weights shown above are given for a lineal foot of plain end pipe. To convert lbs/ft to metric: 1 lb/ft = 1.49 kg/m

Decimals

$.1 = \frac{1}{10}$ $.01 = \frac{1}{100}$ $.001 = \frac{1}{1000}$

To change inches into feet

Divide by 12

e.g. 39 ins. = $\frac{39}{12}$ ft. or 3.25 ft.

5/8 ins. = $\frac{5/8}{12}$ ft. or $\frac{.625}{12}$ or .052 ft.

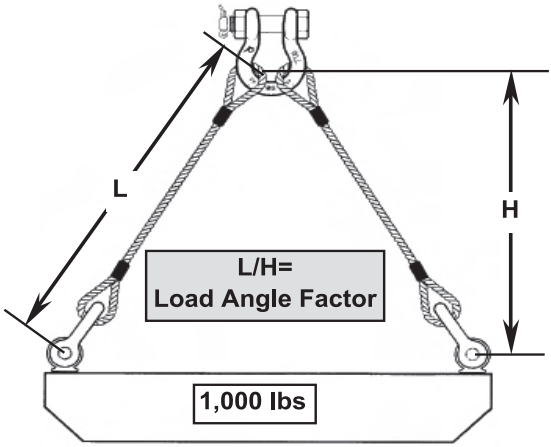
Parts of a foot in decimals

1 in. =	.083 ft.	7 in. =	.583 ft.
2 in. =	.167 ft.	8 in. =	.667 ft.
3 in. =	.250 ft.	9 in. =	.750 ft.
4 in. =	.333 ft.	10 in. =	.833 ft.
5 in. =	.417 ft.	11 in =	.917 ft.
6 in. =	.500 ft.	12 in. =	1.000 ft.

Rounding off

Can be done and be correct enough for the job.

- Generally use first 4 numbers and the rest 0's.
  e.g. 7,834,421 use 7,834,000
  242.346 use 242.3
- If 5th number is 1 to 4 leave 4th number as is.
  If 5th is 5 to 9 add 1 to 4th number
  e.g. 65973 use 65970
  65976 use 65980



Sling Angle	Load Factor	Sling Angle	Load Factor
90 Deg.	1.000	45 Deg.	1.414
85 Deg.	1.004	40 Deg.	1.555
80 Deg.	1.015	35 Deg.	1.742
75 Deg	1.035	30 Deg.	2.000
70 Deg.	1.064	25 Deg.	2.364
65 Deg.	1.104	20 Deg.	2.924
60 Deg.	1.155	15 Deg.	3.861
55 Deg.	1.221	10 Deg.	5.747
50 Deg.	1.305	5 Deg.	11.490

In this example, both slings support half the load or 500 pounds. Due to sling angles, a load factor must be applied to account for mechanical tension in the slings. The **LOAD ANGLE FACTOR** is calculated as follows.

L = 25'
H = 21.25'

$$\frac{25'}{21.25'} = 1.176$$

Sling angle is near 60 degrees
500 lbs X 1.176 = 588 lbs per sling

Crane Wire Rope Replacement Criteria

Standard Crane Wire Rope

1) In running ropes, six (6) randomly distributed broken wires in one lay, or three (3) broken wires in one strand in one lay.

2) One outer wire broken at contact point with the core of the rope which has worked its way out of the ropes structure and protrudes or loops out from the rope structure.

3) Wear of one third of the original diameter of outside individual wires.

4) Kinking, crushing, birdcaging or any other damage resulting in distortion of the ropes structure.

5) Evidence of any heat damage from any cause.

6) Valley breaks

Rotation Resistant Wire Ropes

1) Two (2) broken wires in six (6) rope diameters or four broken wires in thirty (30) rope diameters.

2) One outer wire broken at contact point with the core of the rope which has worked its way out of the ropes structure and protrudes or loops out from the rope structure.

3) Wear of one third of the original diameter of outside individual wires.

4) Kinking, crushing, birdcaging or any other damage resulting in distortion of the ropes structure.

5) Evidence of any heat damage from any cause.

Replacement Criteria for Slings

Synthetic Web Sling Replacement Criteria

1. Acid or caustic burns.
2. Melted or charred.
3. Snags, punctures, tears or cuts.
4. Distorted, cracked or broken fittings.
5. Broken or worn stitches.
6. Excessive abrasion - visible red warning fibers.
7. Tag missing or is illegible.
8. Pitting corrosion of fittings.
9. Ultraviolet sunlight damage.
10. Other apparent damage which reduces the strength and efficiency of the sling.

Wire Rope Slings

1. Missing or illegible tags.
2. 10 randomly distributed broken wires in one rope lay or 5 broken wires in one strand in one rope lay.
3. Kinking, crushing, birdcaging or other damage resulting in deterioration of the wire rope structure.
4. Evidence of heat damage.
5. Damaged end attachments.
6. Severe corrosion or pitting of the wires.
7. Hooks opened more than 15% of the normal throat opening or bent more than 10 degrees from the plane of the hook.
8. For multi-part slings with less than 8-part and cable laid, 20 broken wires in one rope lay, 20 per braid in one rope lay, or one broken strand.
9. For multi-part slings with 8-parts or more, 40 broken wires in one rope lay, 40 per braid in one rope lay, or one broken strand.

Alloy Chain Slings

Removal From Service Criteria

1. Evidence of heat damage from welding, cutting or high voltage or electrical contact.
2. Heated above 1000 degrees F (538 degrees C).
3. Excessive Pitting or corrosion.
4. Evidence of stretch or the lack of ability of the chain to hinge freely.
5. Cracked or deformed master links, couplings or components.
6. Hooks or end fittings are cracked or deformed.
7. Missing or illegible tag.

Specific Usage

NOTE: (Consult your District Policy and/or Site Plan regarding the use of chain slings.)

- Protect the sling from small D/d ratios. When D/d ratio falls below 6:1, reduce basket hitch capacities.
- Sling legs shall be straight with no twist.
-**DO NOT** point load hooks.

When choke hitch ratings are not listed on the sling, the choke hitch rating shall be 80% of the vertical hitch capacity.

Alloy Chain Slings

Chain slings are heavy, tough, expensive, and require special inspection consideration. They are well suited to working in adverse environments and under extreme temperatures. Only alloy steel chain in grades 80, 100 or higher shall be considered for use. Chain slings are assembled to a 4:1 design factor. Chain sling assemblies can be purchased in a variety of configurations for use in specific purposes or for general use. Typical nomenclature for chain slings indicates their basic construction: number of sling legs, type of master link, and end connections. DOS, ADOS, QOS and TOG are typical descriptions of chain sling assemblies. See Table1 for examples. Manufacturer's catalogues contain coding for special assemblies.

Table 1

#Legs	Master Link	Hook Type	Codes
1 = S	O = Oblong	S = Sling	SOS
2 = D	O = Oblong	G = Grab	DOG
3 = T	O = Oblong	F = Foundry	TOF
4 = Q	O = Oblong A = Adjustable	S = Sling	AQOS

1. Removal from Service Criteria
   a. Evidence of heat damage from welding, cutting or high voltage electrical contact.
   b. Heated above 1000°F (538°C).
   c. Excessive pitting or corrosion.
   d. Evidence of stretch or the lack of ability of the chain or components to hinge freely.
   e. Cracked or deformed master links, couplings or components.
   f. Hooks or end fittings are cracked or deformed.
   g. Missing or illegible tag.

Weld spatter

NOTE: Periodic Inspections require a written record of the condition of the sling.

2. Specific Usage

   NOTE: (Consult your District Policy and/or Site Plan regarding the use of chain slings.)

Interlink wear

- Protect the sling from small D/d ratios. When D/d ratios fall below 6:1, reduce basket hitch capacities according to Figure 4.
- Sling legs shall be straight with no twist.
- Do not point load hooks.
- When choke hitch ratings are not listed on the sling, the choke hitch rating shall be 80% of the vertical hitch capacity.

Replacement Criteria for Hardware

Hardware Inspection

1. Significant deformation.
2. More than 5% wear in throat or eye of hook and other critical areas of hardware. More than 10% wear in other areas.
3. Cracks, nicks or gouges.
4. Any modification by cutting or welding.
5. Substituted shackle pin.
6. Evidence of heating or bending
7. Improperly installed hardware or malfunction of items such as safety latches, locking devices, swivel bearings and installation of wire rope clips and wedge sockets.

Verbal (Voice) Signals

Hoisting

Up - "Hoist" **Down** -"Lower"

Bridge Travel

"Bridge North" or "Bridge East"
Should be labeled clearly in the area the directions desired for travel
(North, South, East and West)

Trolley Travel

"Trolley West" or Trolley South"
Should be labeled clearly in the area the directions desired for travel
(North, South, East and West)

Verbal Crane Signals

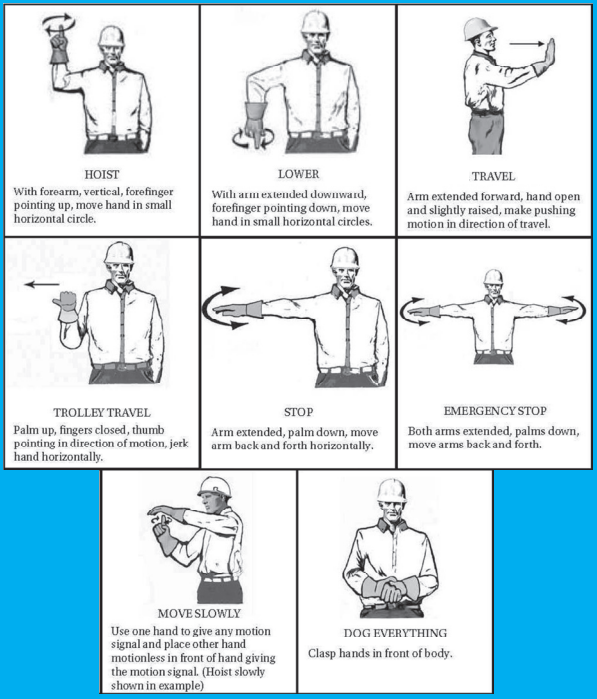
Verbal signals are necessary when the operator cannot clearly see the signal person. This may be due to line of sight or because the distance from the signal person is too great to clearly see the signals.

Each series of voice signals shall contain three elements stated in the following order:

- Function and Direction
- Distance and/or Speed
- Function and Stop command

Prior to beginning operations, the lift director (if there is one), operator and signal person shall contact each other and agree on the voice signals that will be used.

OVERHEAD CRANE HAND SIGNALS



LIFTING CRANE SAFETY TO NEW HEIGHTS