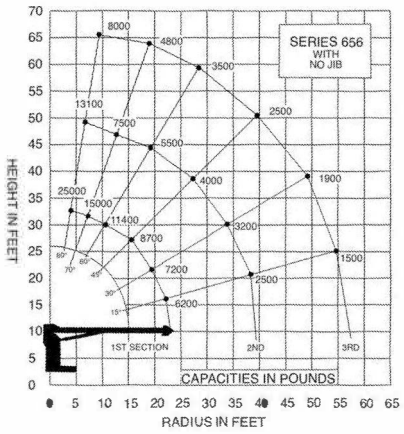
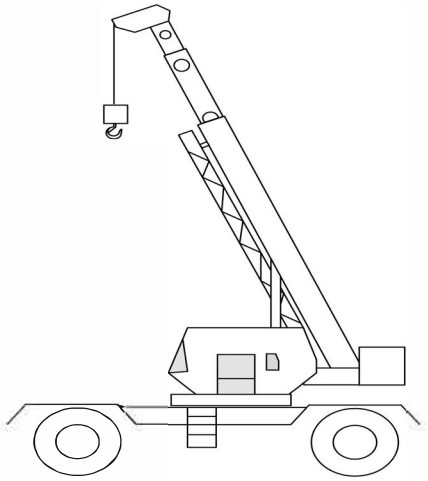
019


SERIES 656
WITH
NO JIB
HEIGHT IN FEET
RADIUS IN FEET
CAPACITIES IN POUNDS
1ST SECTION
2ND
3RD
8000
4800
3500
2500
13100
7500
5500
4000
1900
25000
15000
11400
8700
3200
1500
7200
2500
6200

RIGGING



Carpenters Training Committee for Northern California (CTCNC)

CARPENTER APPRENTICESHIP PROGRAM

Course of Instruction

Year	Class#	Class Title (All classes 36 hours - Four (4) Days)
1	001	Introduction to Apprenticeship I
	002	Introduction to Apprenticeship II **(UBC Fall Protection, UBC Scaffold User, UBC MEWP & Discrimination in the Workplace, Union Benefits Presentation)**
	004	Foundations & Floors
	006	Wood Framing
2	019	Rigging **(This is a Non-Qualification Course)**
	005	Blueprint Reading – Basic
	007	Concrete Formwork **(NCCRC Certification)**
	009	Blueprint Reading – Advanced
3	012	Layout Instruments
	013	Engineered Structural Systems **(UBC Powered Industrial Truck Operator – Rough Terrain)**
	010	Concrete Bridge Building **(NCCRC Certification)**
	017	Introduction to Welding & Cutting
4	014	Commercial Steel Framing
	018	Commercial Concrete
	011	Interior Finish
	008	Exterior Finish
	015	Stair Building
	016	Roof Framing

019

RIGGING

Carpenters Training Committee
for Northern California

This material was produced using the following elements:
Microsoft Word™ 14.3.1
PhotoShop™ 10.0
Xerox™ D125
MOS™ 10.5.8
VectorWorks™ 13
FrameMaker™ 7.0

Opeiu-3-afl-cio-sls 2013

COURSE OBJECTIVES

At the completion of the course, the student will be knowledgeable about the process of rigging, the hardware that is used, and be able to correctly rig a load and direct the crane to safely move the load.

SPECIFIC OBJECTIVES

Upon completion of this class, the student will be able to:

1. Calculate the Working Load Limit of a given wire rope
2. Identify the components of wire rope and inspect wire rope for defects
3. Understand the characteristics of chain used in rigging and inspect for defects
4. Identify the various slings that are used in rigging and inspect for defects
5. Select and correctly use various types of rigging hardware, including shackles, turnbuckles, hooks, eyebolts and rigging beams
6. Tie simple knots used in handling materials
7. Properly rig a load and demonstrate standard hand and voice crane signals to safely move the load
8. Calculate the weight of an object to be lifted
9. Calculate the stress on wire sling in different configurations, such as a single or double basket hitch, a 2-leg bridle hitch or a choker hitch
10. Read a load chart of a given crane
11. Specify the elements of a critical lift
12. Identify the international hand and voice crane signals

CARPENTERS TRAINING COMMITTEE

FOR NORTHERN CALIFORNIA

SEXUAL HARASSMENT & APPRENTICE CONDUCT

Sexual harassment in any form or degree by an employee or apprentice against another individual, regardless of their relationship or respective status, is strictly against the policy of the Carpenters Training Committee for Northern California and will not be tolerated. Any such action or activity shall be reported immediately to the person in charge of the training facility. The matter will be promptly investigated and appropriate action will be taken. Copies of all complaints and actions are to be forwarded to the Director of Field Services.

Apprentices shall not use lewd and vulgar language while they are on the premises of the Carpenters Training Center. Any such action shall be reported immediately to the person in charge of the training facility. The matter will be promptly investigated and appropriate action will be taken.

Any person violating the above policies shall be subject to disciplinary action, which may include suspension or expulsion from the training center and/or cancellation from the program.

Form 154A JB:llr
Opeiu-3-afl-cio-211 3/11/99
Revised 1-31-07

CARPENTERS GRADING AND EVALUATION SCHEDULE

Grading

A uniform weighing system will be used as follows:

1. Class Participation and Attitude. 10%
2. All Tests Except for Final Exam 20%
3. Manipulative Lessons 40%
4. Final Exam 30%

Assignment of grades will be as follows:

1. 92 -100% = **A**
2. 82 - 91% = **B**
3. 73 - 81% = **C**
4. 68 - 72% = **D**
5. Less than 68% = **F**

NOTES:

Date Instructor Name

019 - RIGGING

PRE-TEST

Instructions: In the following true/false questions circle the correct answer.

1.	T	F	The formula for calculating the WLL for a wire rope is 8 x the radius x the radius.
2.	T	F	A point on an object around which all of the weight is evenly distributed is known as the center of gravity.
3.	T	F	The most common type of wire rope used for slings is 6 x 19 (IPS-IWRC).
4.	T	F	When using a shackle for hoisting personnel, a screw pin should be used.
5.	T	F	A hook should be removed from service if it is bent more than 10°.
6.	T	F	The size of an eyebolt is determined from the length of the shank.
7.	T	F	Most cranes are leveled through the use of outriggers.
8.	T	F	Wind has no effect on the capacity of a crane.
9.	T	F	When the operator cannot see the rigger clearly, the rigger must use voice signals.
10.	T	F	There is a formula to calculate the Working Load Limit of nylon slings.
11.	T	F	Turnbuckles are used to level a load.
12.	T	F	Concrete weighs approximately 300 pounds per cubic foot.
13.	T	F	Chain is a better choice than wire rope in rigging that involves high temperatures.
14.	T	F	Wire rope should be removed from service when external wear is $^1/_3$ or more of the original diameter.
15.	T	F	Wire rope is composed completely of wires and strands.
16.	T	F	The way in which the wires and strands are twisted is known as the lay.

17.	T	F	A chain that is to be used for rigging should be grade 6 or better.
18.	T	F	Slings and equipment used for rigging must have a safety factor of 5 to 1.
19.	T	F	A steel fitting placed inside the eye of a wire rope sling to protect it, is known as a grommet.
20.	T	F	Safety is the most important consideration of any rigging operation.

Date Instructor Name

019 - WIRE ROPE CLAMP EXERCISE

You will be given a 3′-6″ length of wire rope of various thicknesses.

Working in pairs, determine the number of clamps needed and the spacing of the clamps.

Correctly install the clamps in the order described below:

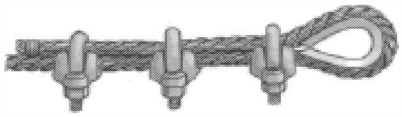
STEP 1

APPLY FIRST CLIP:
One base width from dead end of wire rope -- U-Bolt over dead end -- live end rests in clip saddle. Tighten nuts evenly to recommended torque.

STEP 2

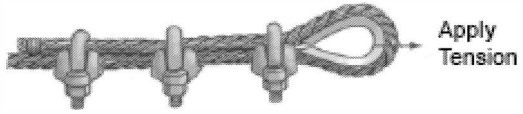
APPLY SECOND CLIP:
Nearest loops as possible -- U-Bolt over dead end -- turn on nuts firm but DO NOT TIGHTEN.

STEP 3



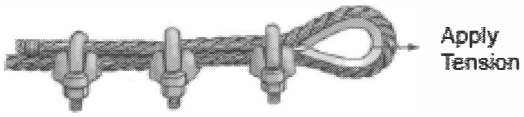
ALL OTHER CLIPS:
Space equally between first two.

STEP 4



Apply tension and tighten all nuts to recommended torque.

STEP 5



Recheck nut torque after rope has been in operation.

Number of clips = The wire rope diameter x 3, + 1 (round up)

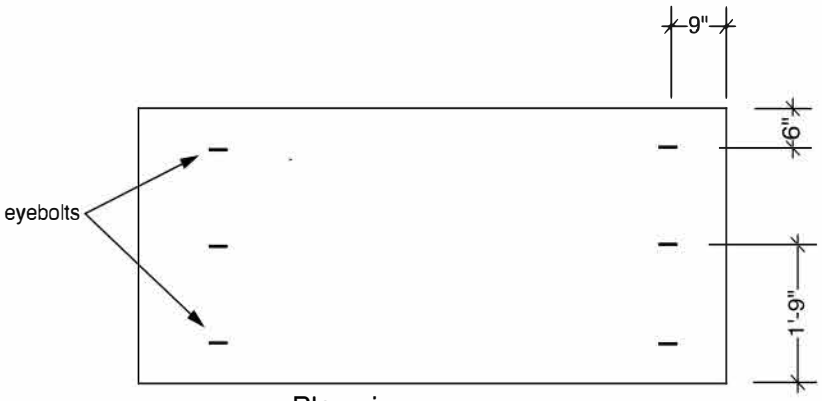
Spacing of clips = The wire rope diameter x 6

Amount of turnback = The number of clips x the spacing of the clips

NOTES:

Date Instructor Name

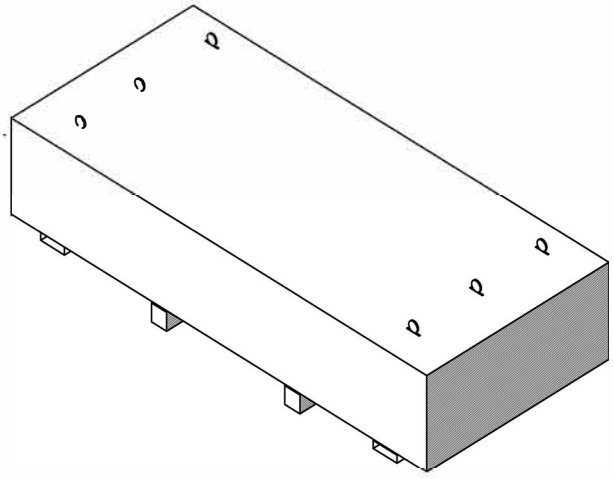
019 - RIGGING BOX



Plan view
Scale 1/2"=1'

Object is 8' x 3'-6" x 1'-6"

If this object is:	Weight
steel	
concrete	
gypsum	



Isometric view
Scale 1/2"=1'

CARPENTERS TRAINING COMMITTEE FOR NORTHERN CALIFORNIA	Rigging Exercise	Date: 09/20/11	Sheet 1 of 1	A1
	Rigging	Drawn By: .dk	Scale: 1/2" = 1'-0"	019

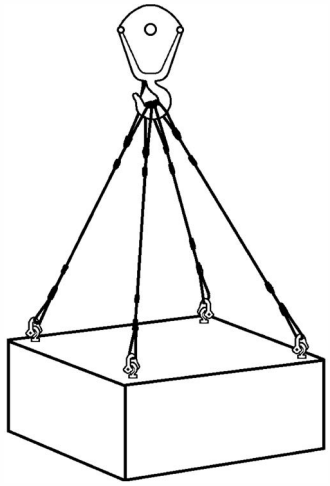
NOTES:

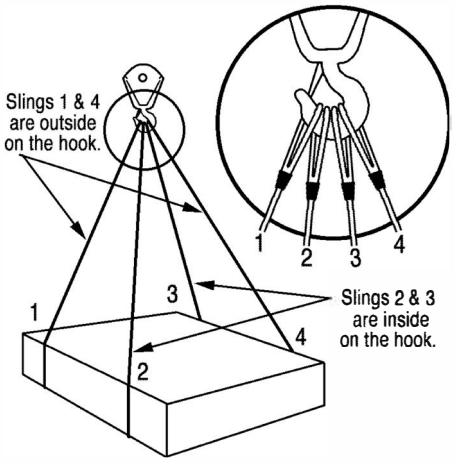
RIGGING CONFIGURATIONS

Date _____ Instructor _____ Name _____

INTRODUCTION

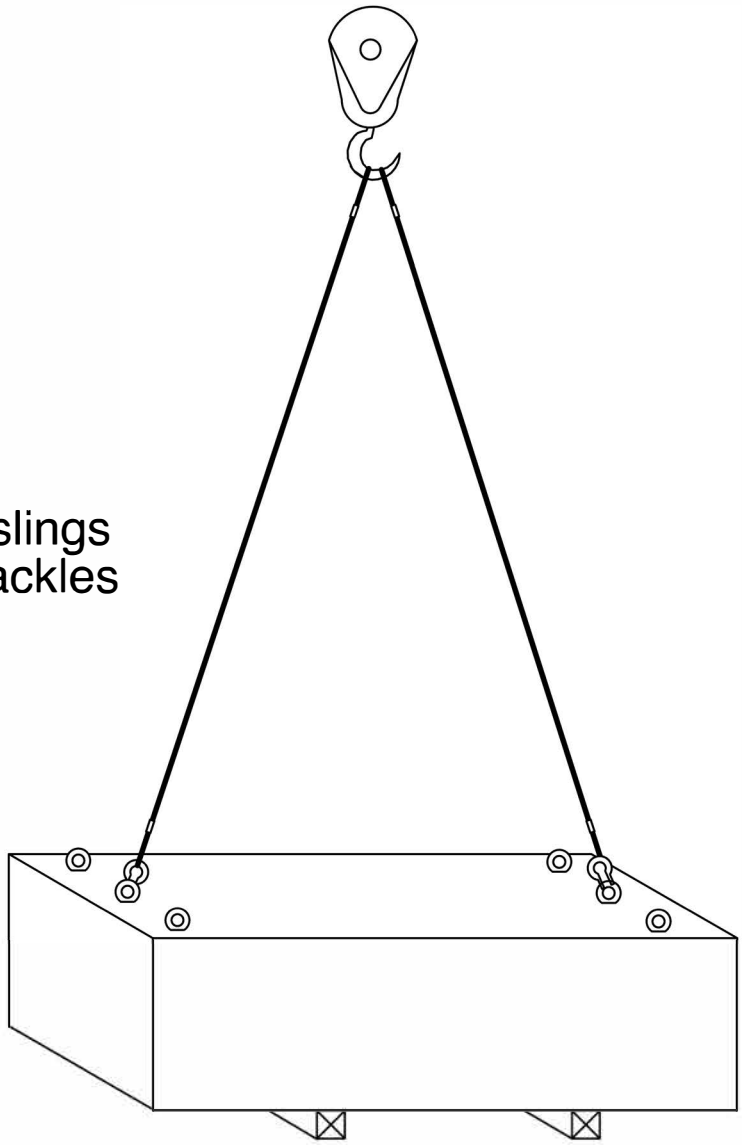
The following pages of six drawings show various rigging configurations. After a demonstration of each example, the student will be asked to correctly rig one of the configurations assigned by the instructor.



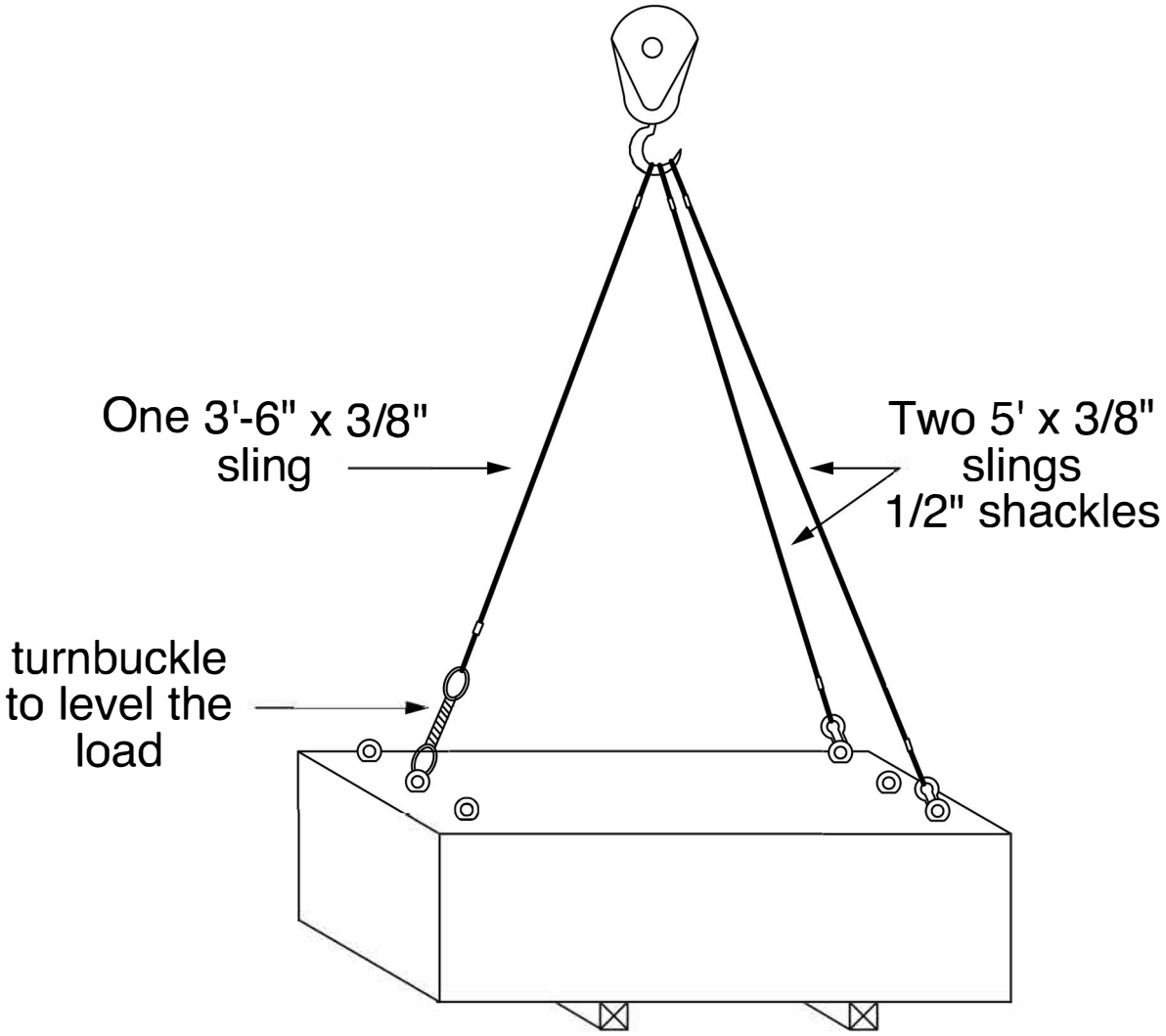


1.

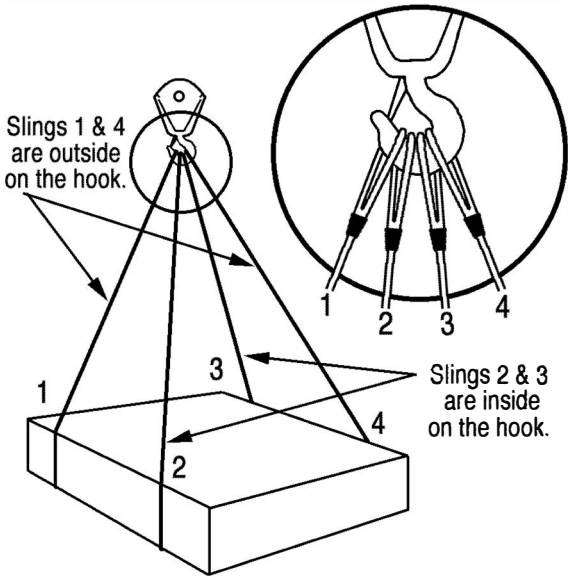
Two 7' slings
1/2" shackles



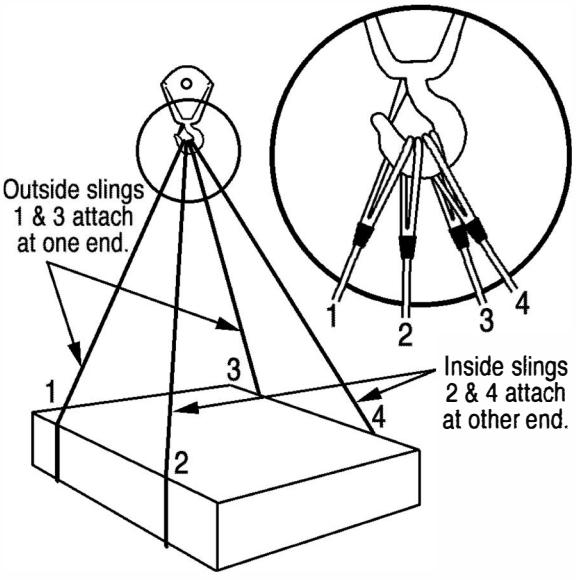
2.


One 3'-6" x 3/8"
sling
Two 5' x 3/8"
slings
1/2" shackles
turnbuckle
to level the
load

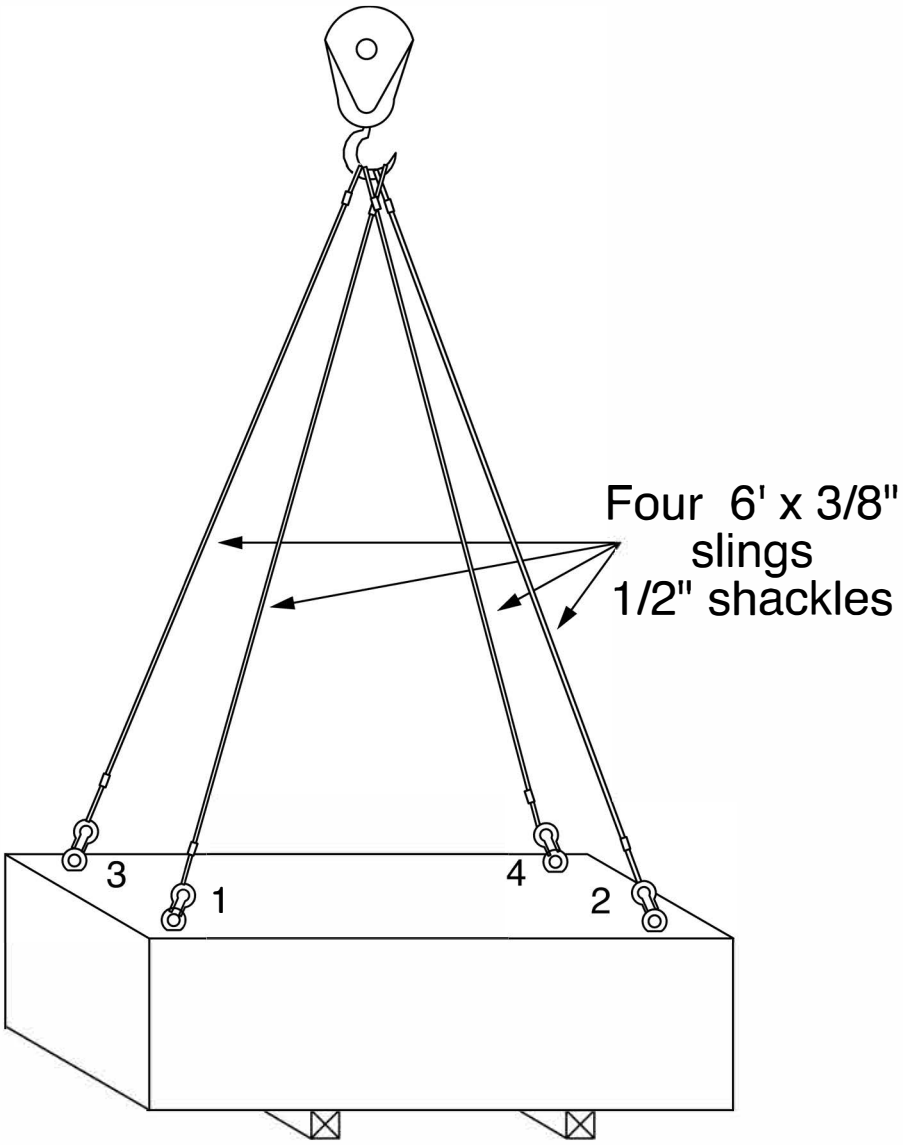
FOUR SLINGS ON A HOOK



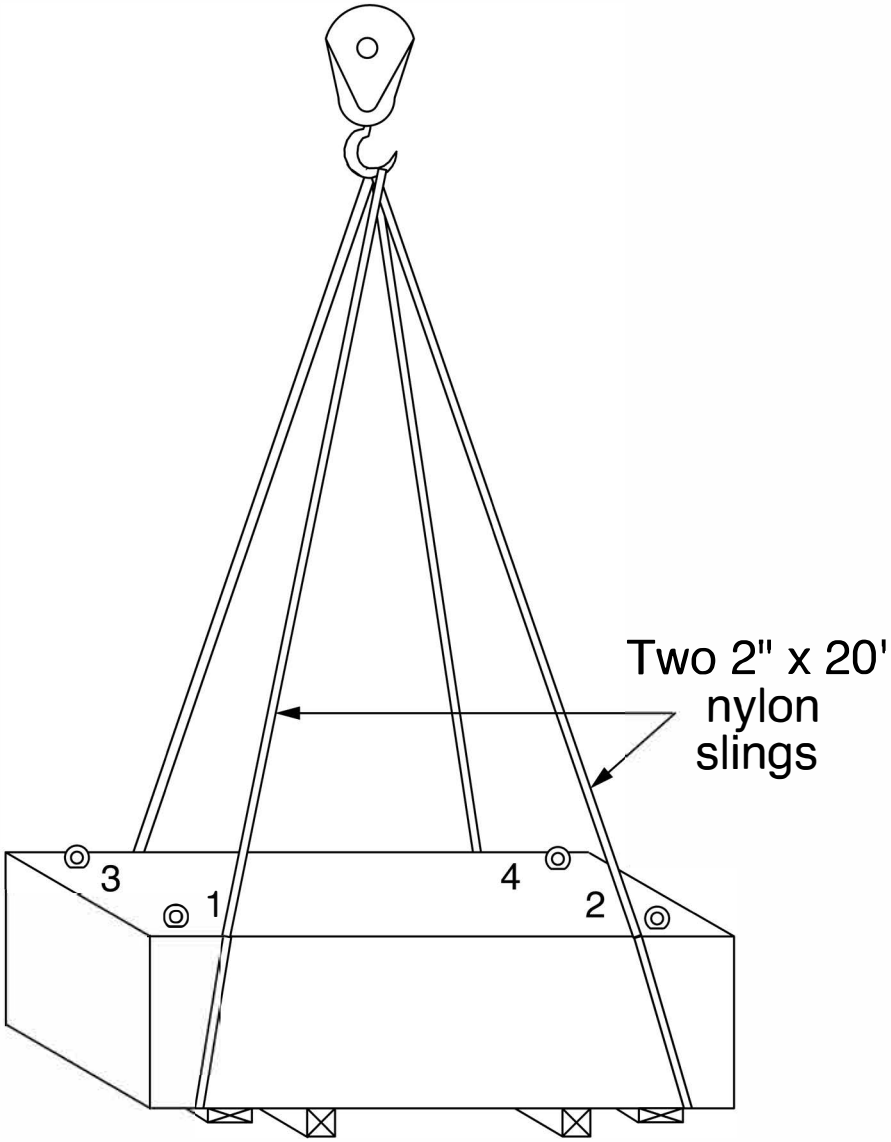
When four slings are used on a hook, either of these options can be used to keep the load balanced and the slings from tangling. In the upper drawing, the order on the hook is 4, 3, 2 and then 1. On the lower drawing, the order is 3,4, 2 and then 1.



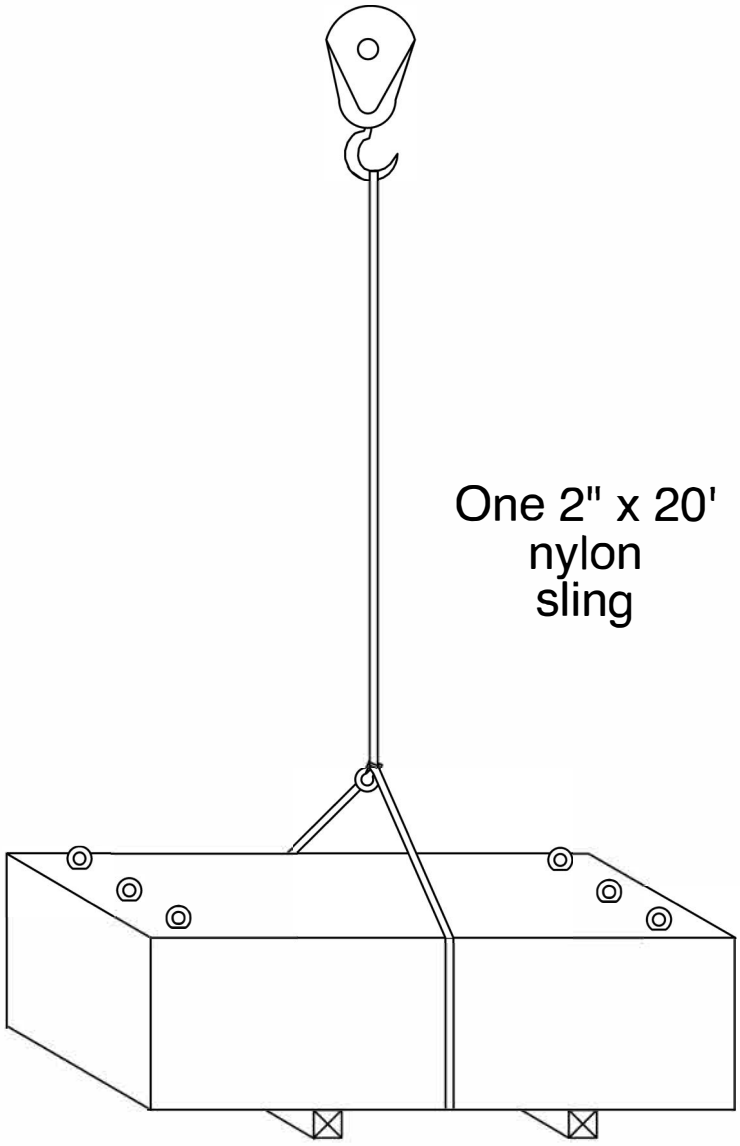
3.



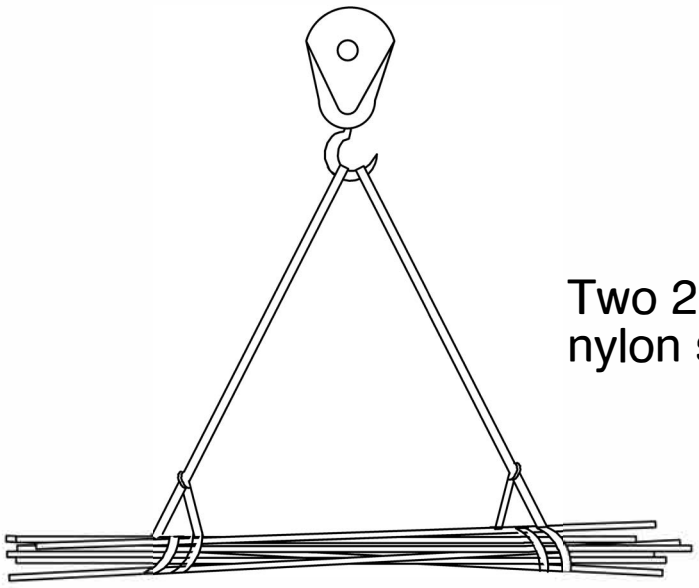
4.



5.



6.



Two 2" x 16
nylon slings

RIGGING CALCULATIONS

Date _____ Instructor _____ Name _____

INTRODUCTION

The following seven drawings show various rigging configurations. The scales will show the amount of stress on the cable. Complete each configuration and record the measurements.

$$\text{Effective Load} = \frac{B}{A} \times W$$

$$\text{Effective Load} = \frac{14"}{7"} \times 2{,}000 \text{ pounds}$$

$$\text{Effective Load} = 2 \times 2{,}000 \text{ pounds}$$

$$\text{Effective Load} = 4{,}000 \text{ pounds}$$

$$\text{Effective Load} = \frac{L}{H} \times \frac{W}{3}$$

$$\text{Effective Load} = \frac{10'}{8'} \times \frac{3{,}080 \text{ pounds}}{3}$$

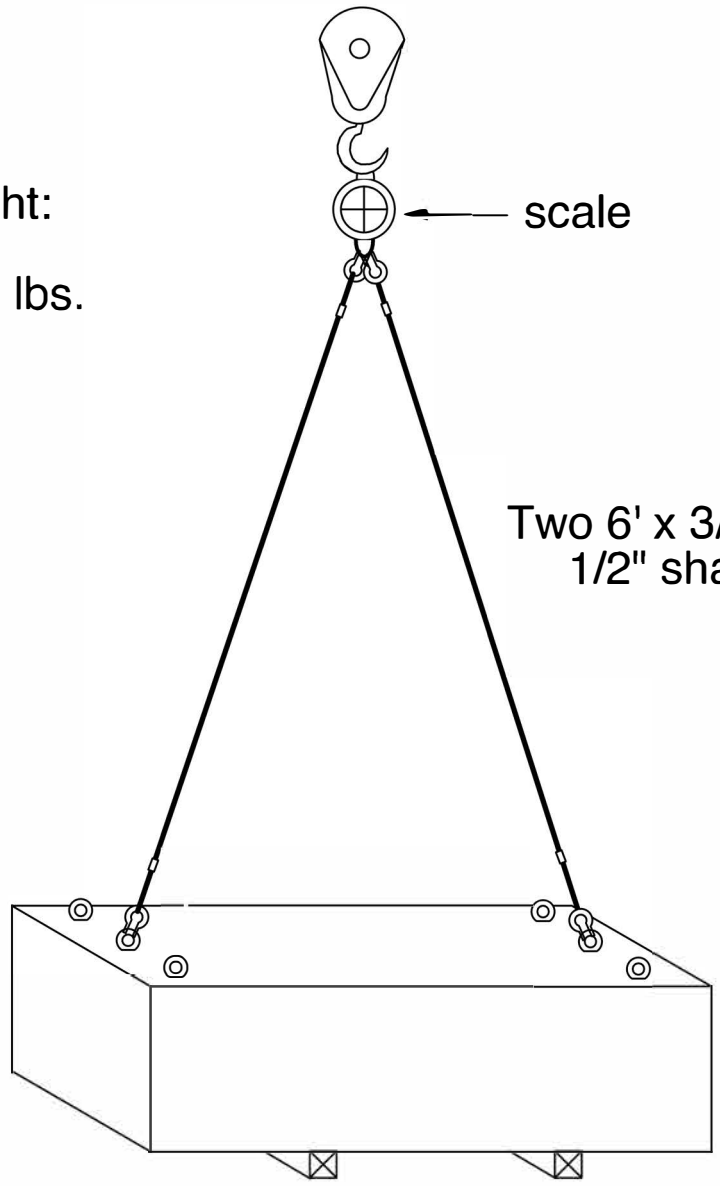
$$\text{Effective Load} = 1.25 \times 1{,}027 \text{ pounds}$$

$$\text{Effective Load} = 1{,}284 \text{ pounds}$$

7.

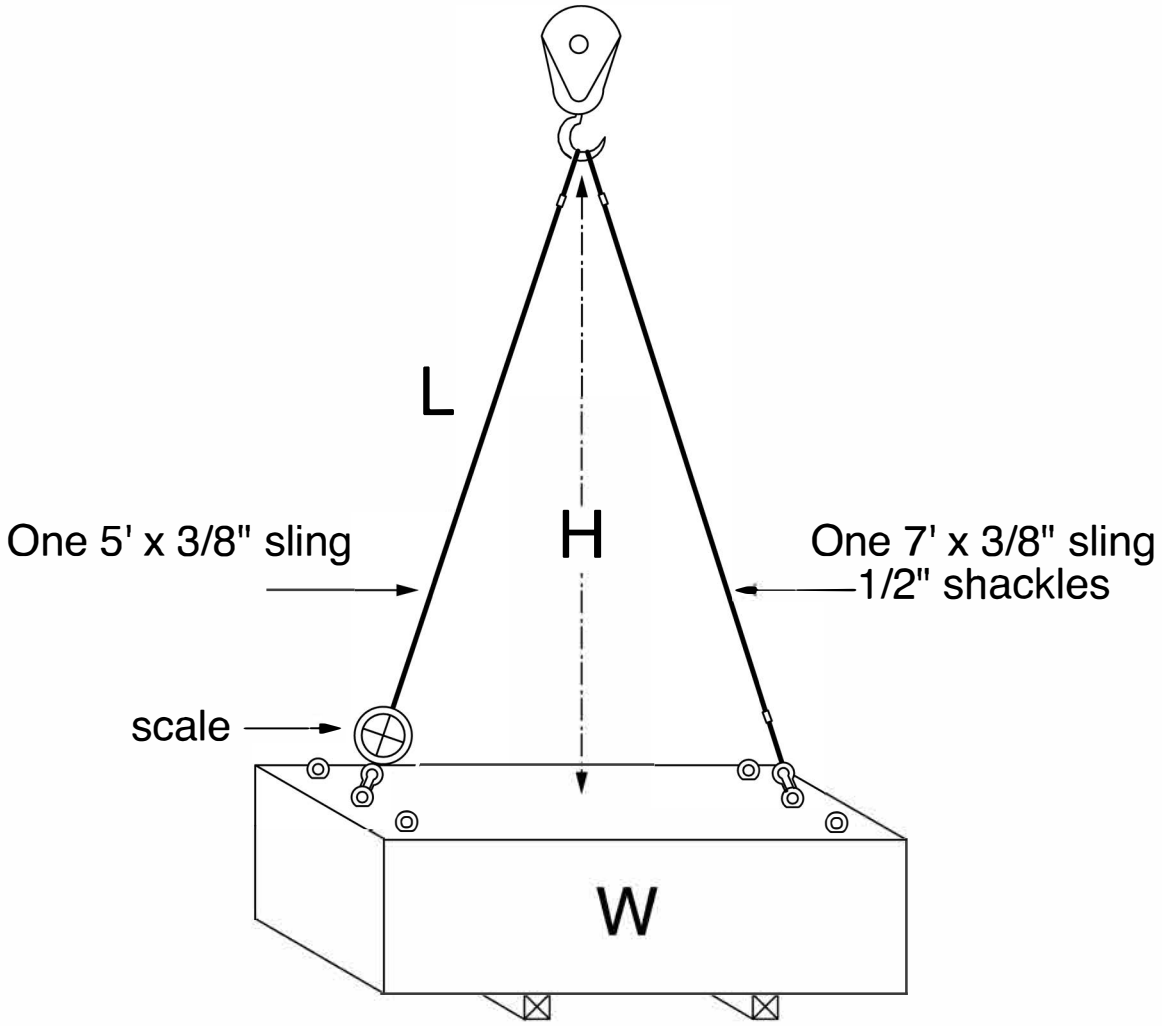
Record weight:

_____ lbs.



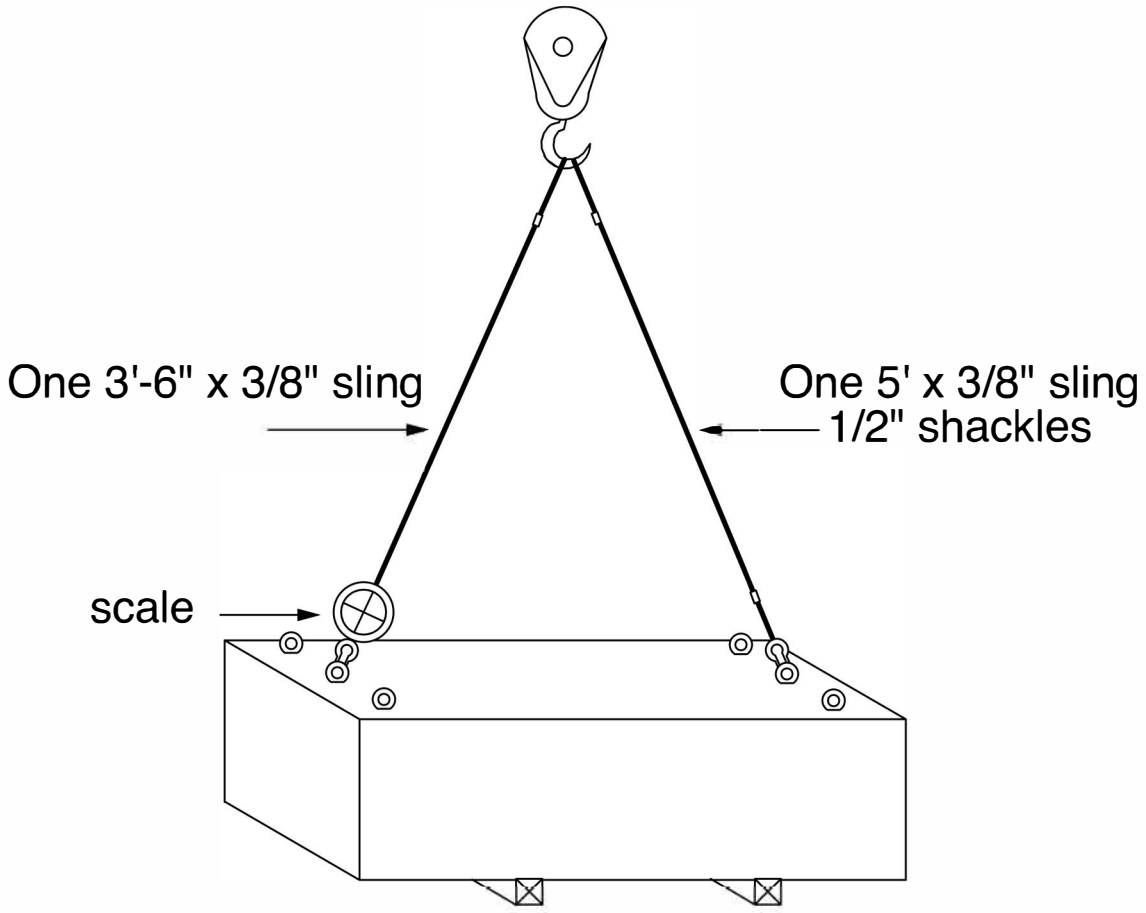
8.

$$\frac{L}{H} \times \frac{W}{2}$$



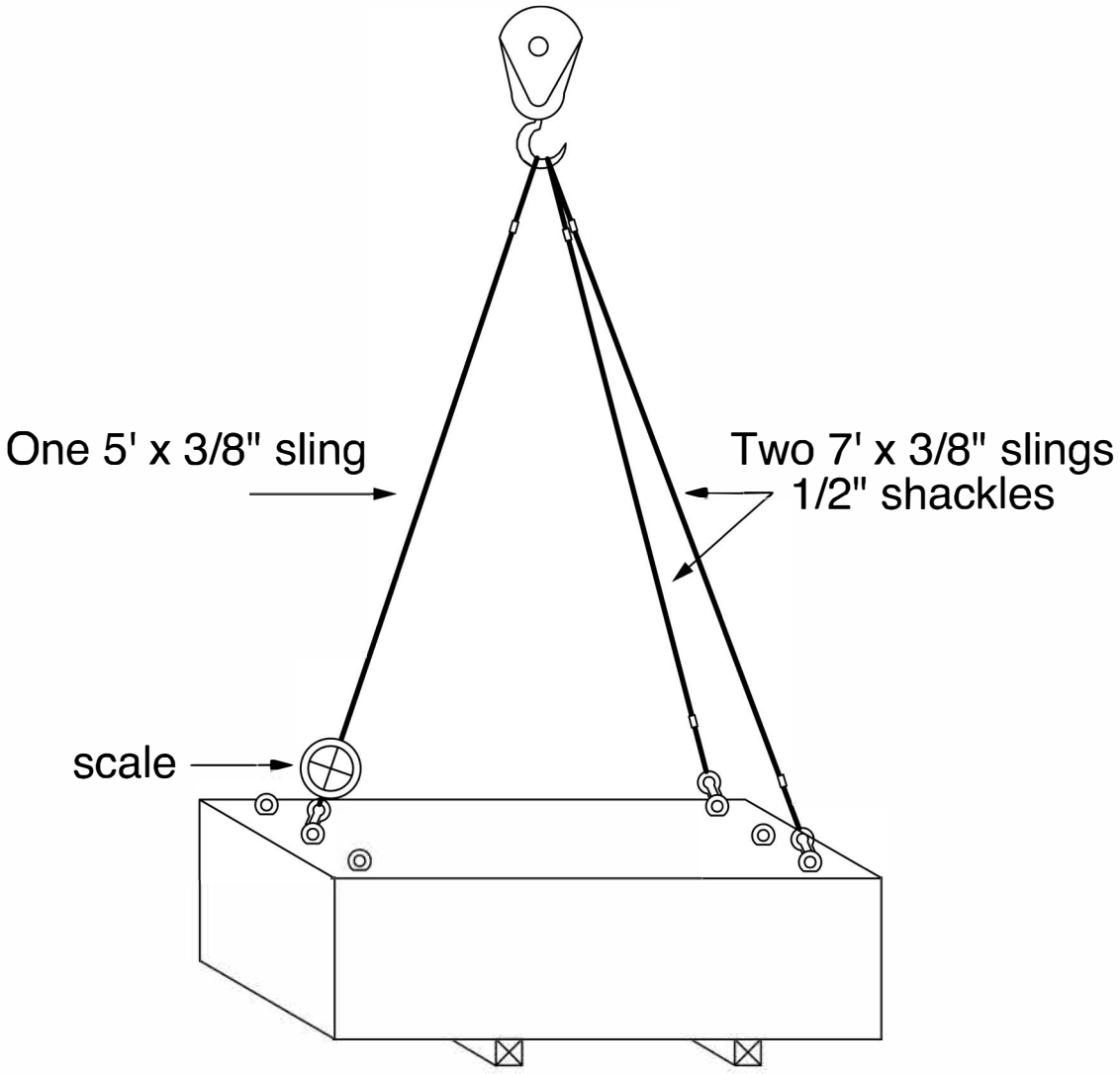
9.

$$\frac{L}{H} \times \frac{W}{2}$$



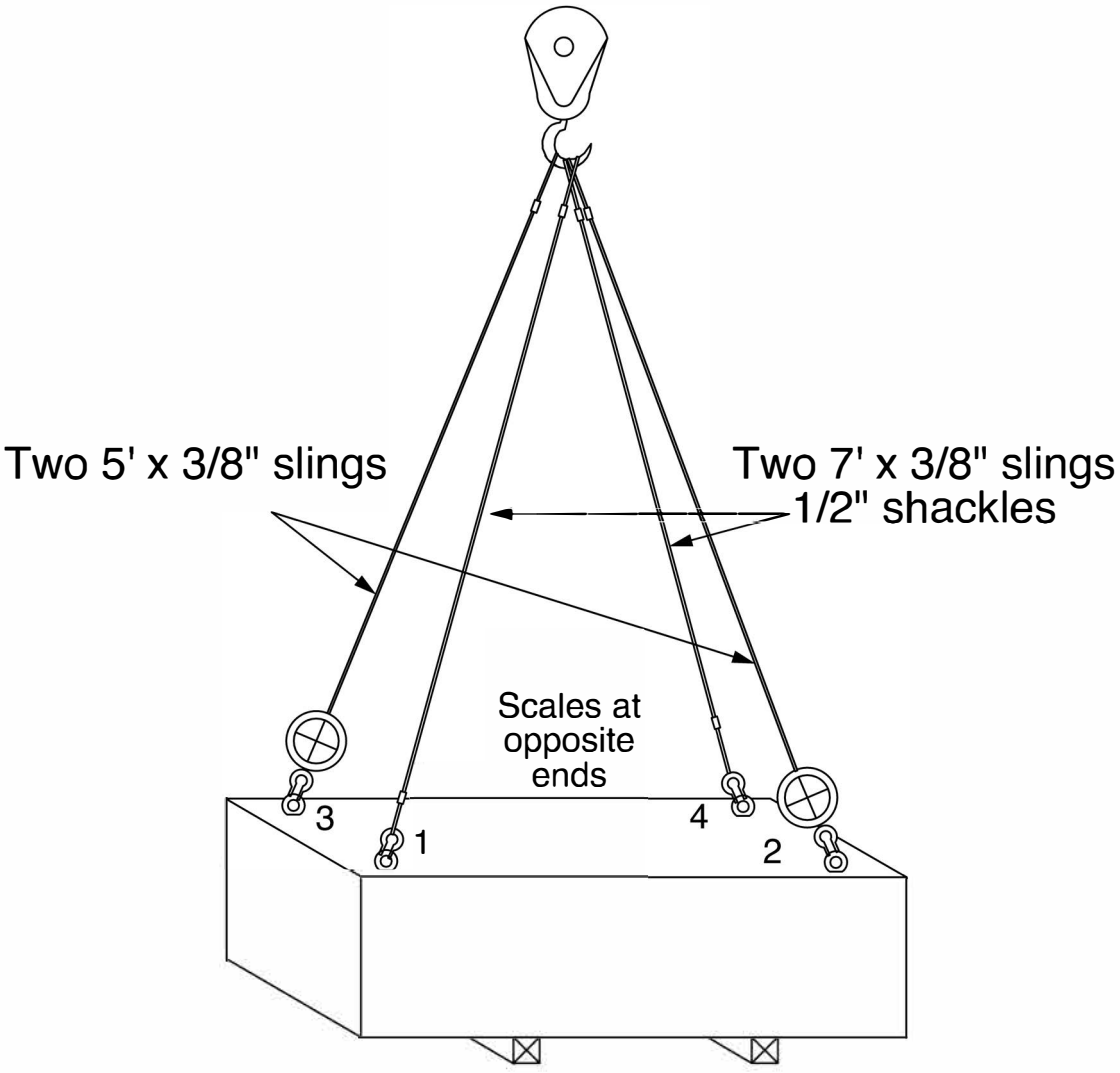
10.

$$\frac{L}{H} \times \frac{W}{3}$$

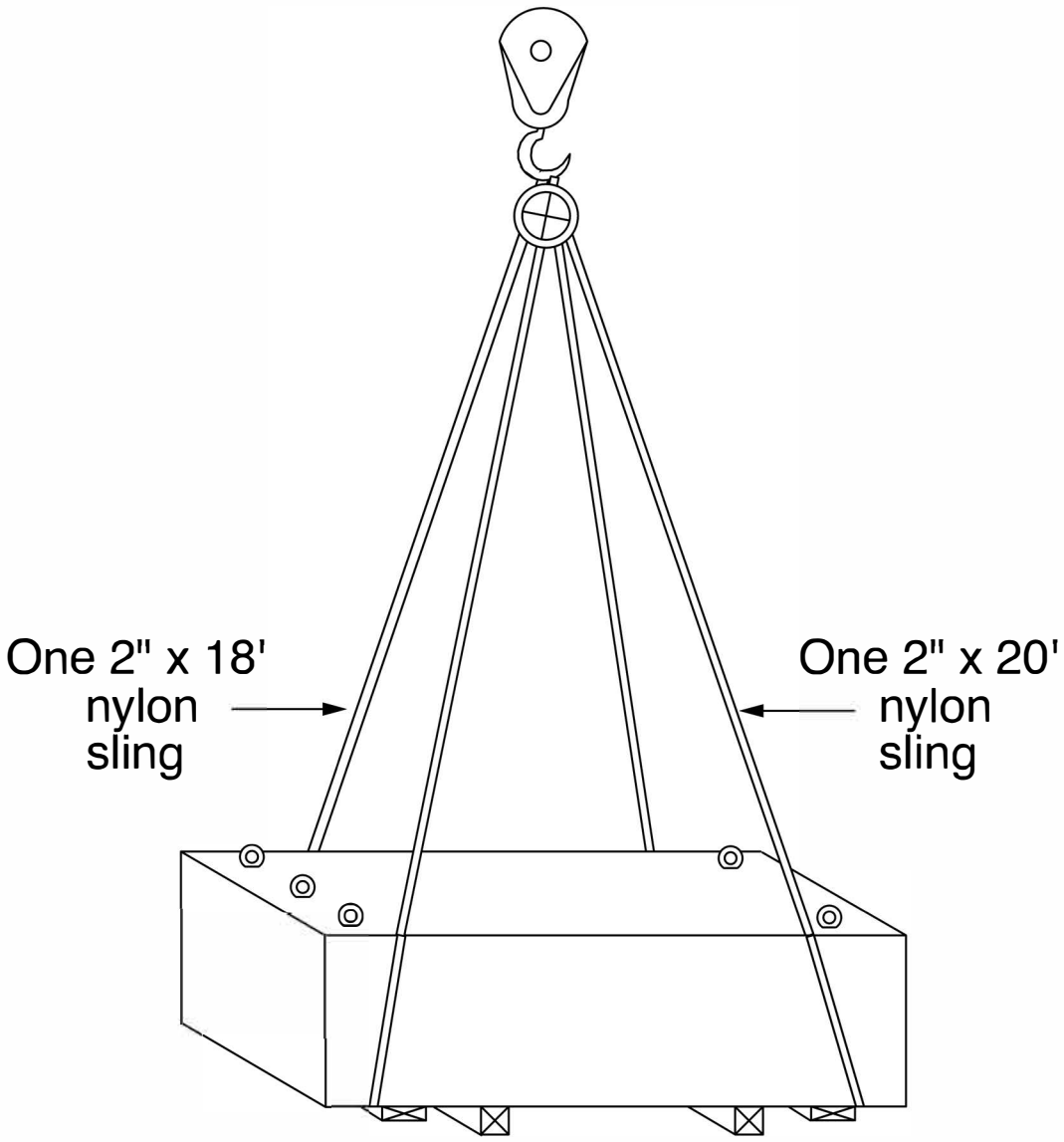


11.

$$\frac{L}{H} \times \frac{W}{2}$$

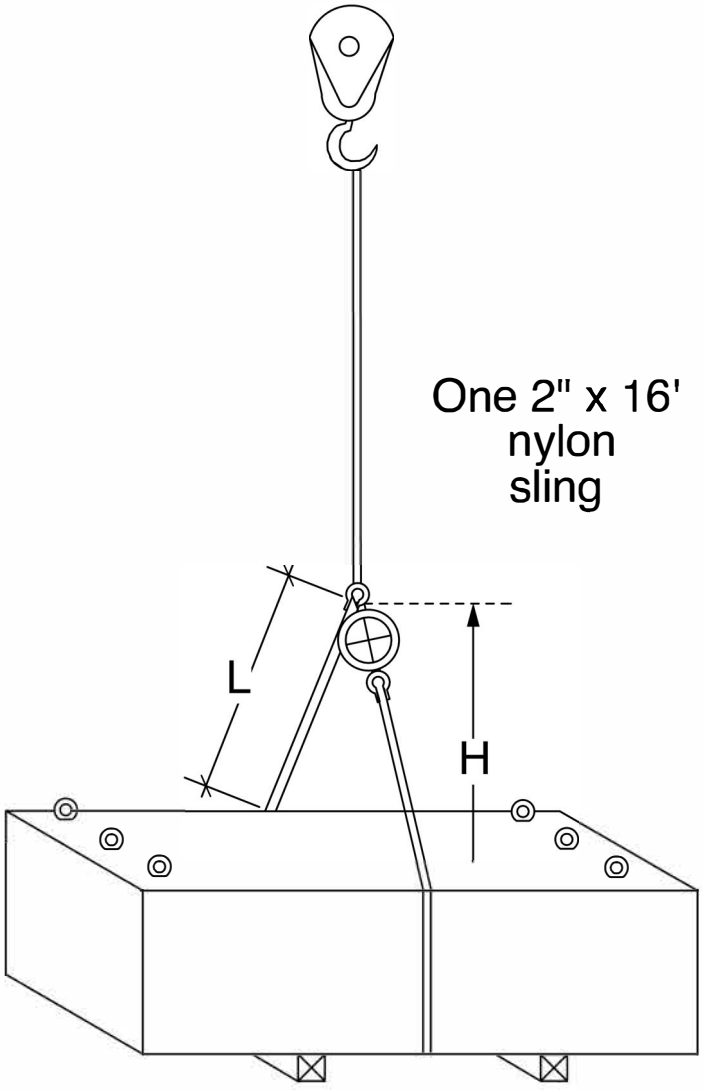


12.



13.

$$\frac{L}{H} \times W$$



Instructions:

Fill in the appropriate information for each of the configurations.

	Weight	Length	Height	Reading	Calculation
Figure 7					
Figure 8					
Figure 9					
Figure 10					
Figure 11					
Figure 12					
Figure 13					

NOTES:

RIGGING TILT UP PANELS

Date _____ Instructor _____ Name _____

In the 013 class, the students laid-out and built one of the tilt-up panels for a BMW dealership in Pleasanton, California. Using the following drawings and specification book information, answer the following questions about the rigging and lifting of panels P-2 and P-20.

1. What is the weight of panel P2? (the pilaster is 9 $^{1}/_{4}$″ deep) _____

   Steps:
   Calculate the volume of the panel as though it is one piece
   Deduct the volume of the large door opening
   Deduct the volume of the smaller door opening
   Add the volume of the pilaster
   Multiply the number of cubic feet times 150 pounds (the approximate weight of 1 cubic foot of concrete)

2. What rigging configuration should be used to lift panel P-2? _____

3. What rigging configuration should be used to lift panel P-20? _____

4. Which side of panel P-2, left or right, is the lightest? _____

5. What is the stress on each cable for panel P-2? _____

6. Calculate the size of wire rope that is needed to rig panel P-2. _____

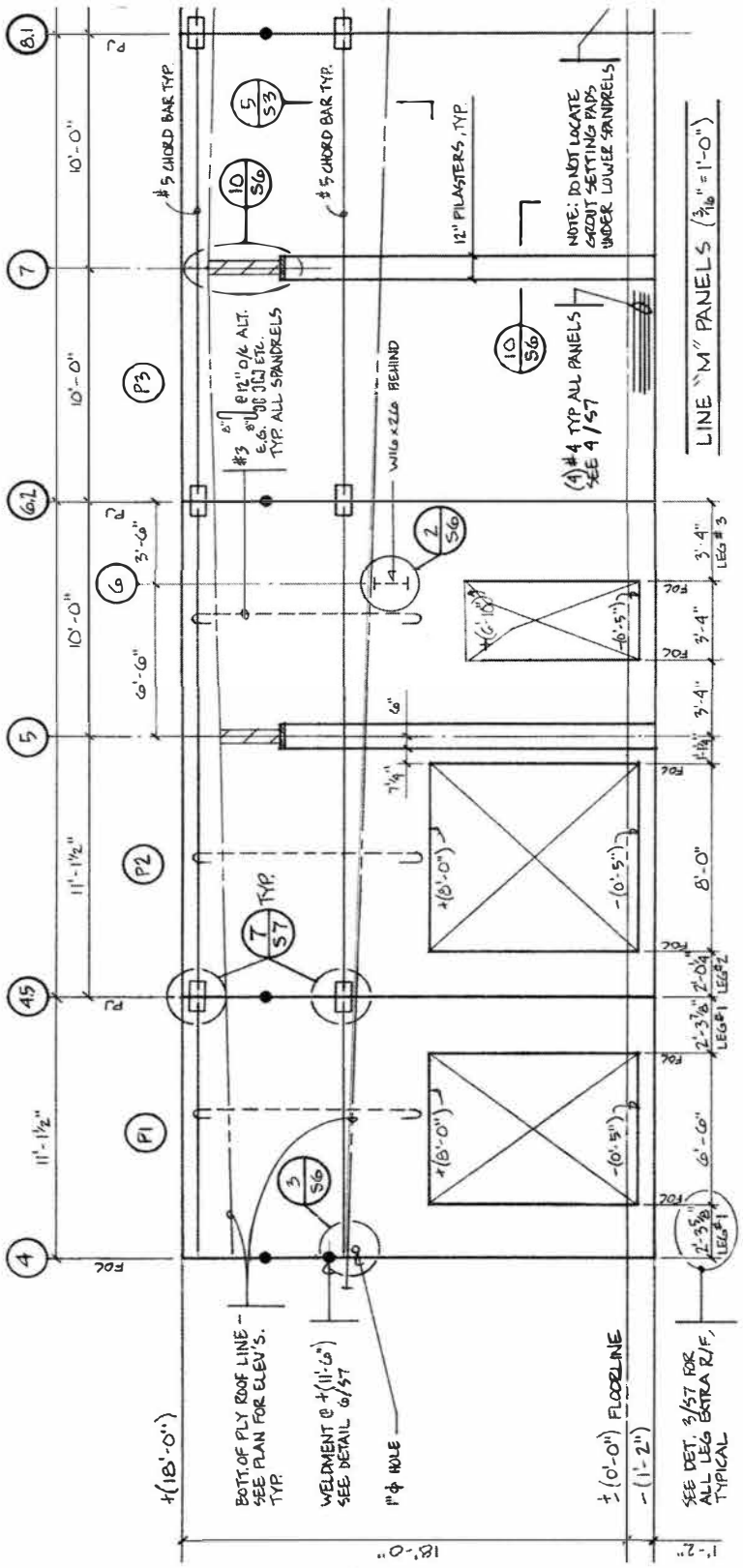
7. The center of gravity on panel P-20 is located how far from the edge of the panel? _____

8. The cables to be used in the rigging need to be at least how long? _____

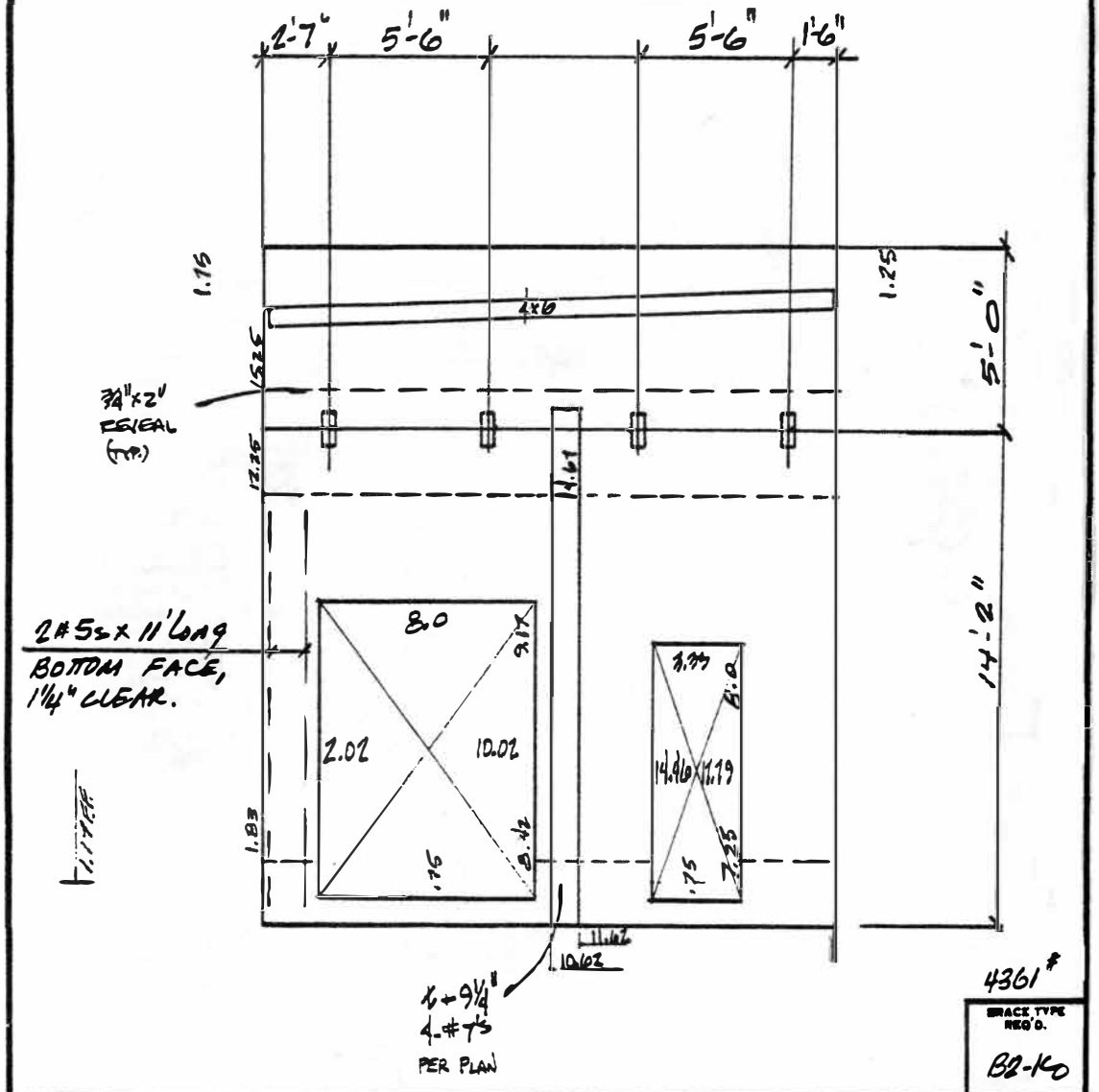
9. The heaviest panel of the building weighs a maximum of how many tons? _____

10. What is the maximum panel height of the building? _____

NOTES:


LINE "M" PANELS (3/16" = 1'-0")
#5 CHORD BAR TYP.
12" PILASTERS, TYP.
NOTE: DO NOT LOCATE CAST SETTING PADS UNDER LOWER SPANDRELS
(4) #4 TYP ALL PANELS SEE 4/S7
#3 @ 12" O/C ALT. @ 16" O/C ETC. TYP. ALL SPANDRELS
W18 x 216 BEHIND
P1
P2
P3
TYP.
BOTT. OF PLY ROOF LINE - SEE PLAN FOR ELEV'S. TYP
WELDMENT @ +(11'-0") SEE DETAIL 6/S7
1" ϕ HOLE
+(18'-0")
±(0'-0") FLOORLINE
-(1'-2")
SEE DET. 3/S7 FOR ALL LEG EXTRA R/F, TYPICAL
LEG #1
LEG #2
LEG #3
18'-0"

EXP. AGG. THK.	STRUCT. THK.	WEIGHT	WIDTH	HEIGHT	NO. REQ'D	PANEL NUMBER OR TYPE
	6"		21'-1½"	19'-2"	1	P2



BRACE TYPE REQ'D. B2-K0

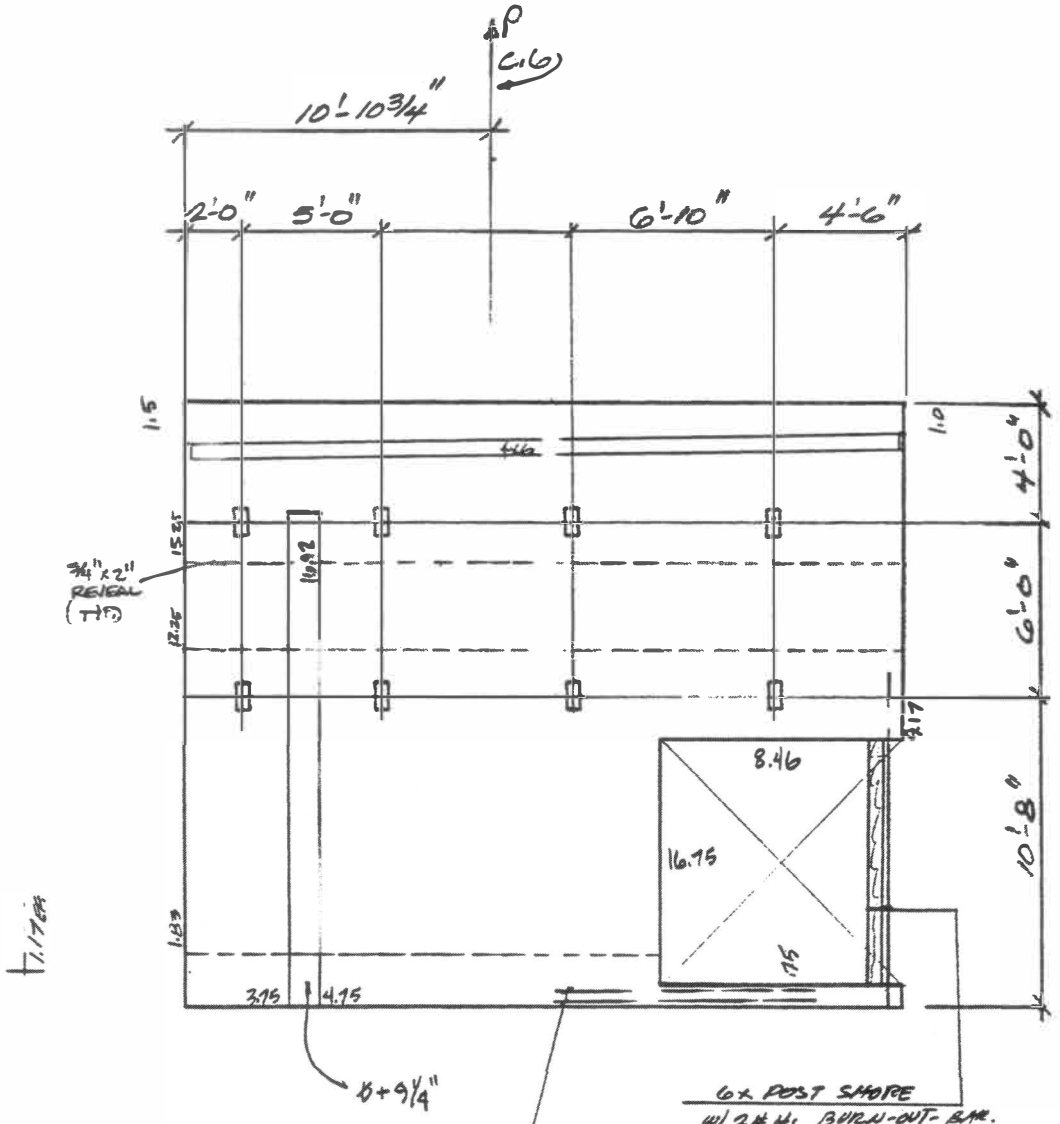
DAYTON SUPERIOR

This drawing is furnished solely for the purpose of clarifying the proper use, installation and application of products supplied only by Dayton Superior Corporation. No responsibility is assumed by Dayton Superior Corporation for the correctness of structural designs or dimensions furnished by others. These drawings are intended merely to supplement the architectural and structural drawings and are to be used only in conjunction with them. In no way are these drawings to be interpreted as shop drawings for panel fabrication.

$\bar{x}$	Δx .55	SCALE: 3"/16	RIGGING DET R-14
$\bar{y}$	2Δx 1'-1"		
PANEL VIEWED FROM: ☒INSIDE ☐OUTSIDE	TAKEOFF BY W.L. DATE 11-25-85	JOB NO. 3710	SHEET 2 OF 16
34	LAYOUT BY RST DATE 12-17		

96901

EXP. AGG. THK.	STRUCT. THK.	WEIGHT	WIDTH	HEIGHT	NO. REQ'D	PANEL NUMBER OR TYPE
	6"	35.7K	25'-2½"	20'-8"	1	P-20



5983

BRACE TYPE REQ'D. B2-K0

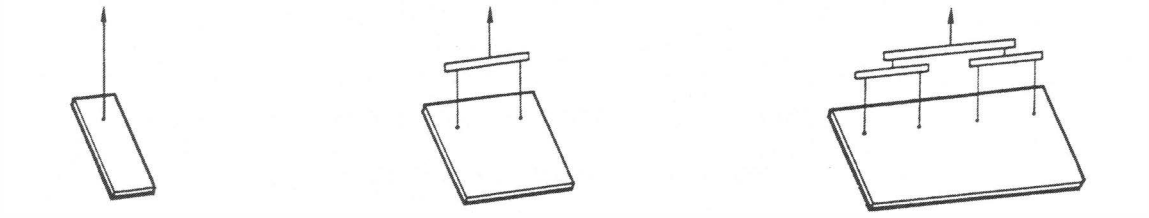
DAYTON SUPERIOR

This drawing is furnished solely for the purpose of clarifying the proper use, installation and application of products supplied only by Dayton Superior Corporation. No responsibility is assumed by Dayton Superior Corporation for the correctness of structural designs or dimensions furnished by others. These drawings are intended merely to supplement the architectural and structural drawings and are to be used only in conjunction with them. In no way are these drawings to be interpreted as shop drawings for detail fabrication.

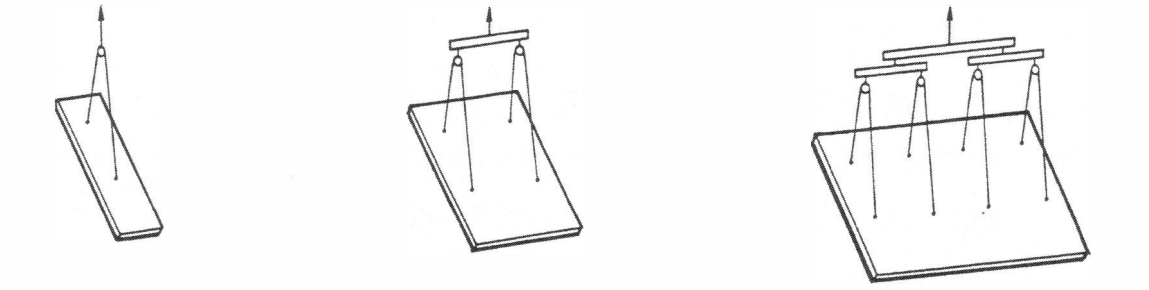
$\bar{x}$ 10.89	Δx 1.71		SCALE: 3" / 16	RIGGING DETAIL R. 24	
$\bar{Y}$ 11.04	2Δx 3'-5"				
PANEL VIEWED FROM: ☒ INSIDE ☐ OUTSIDE	TAKEOFF BY W.L.	DATE 11-25-86	JOB NO. 3710	SHEET 13 OF 16	
46	LAYOUT BY TEST	DATE 12-17			

RIGGING

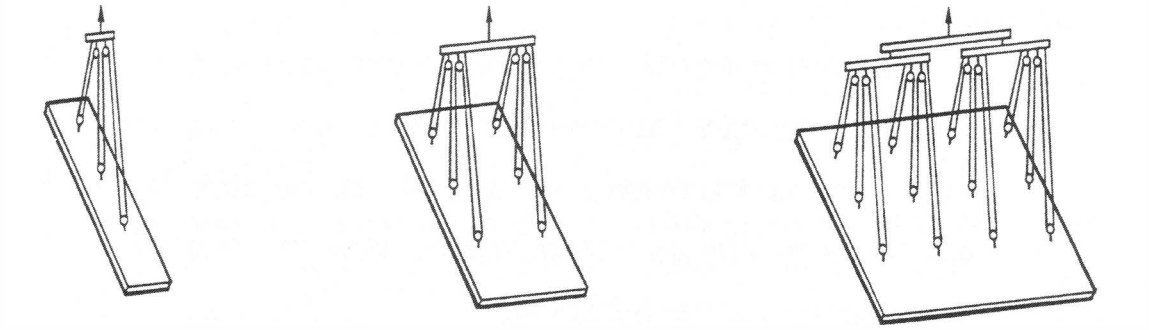
See "Special Instructions" for minimum length of cable to be used in basic arrangement for all rigging shown on this sheet.



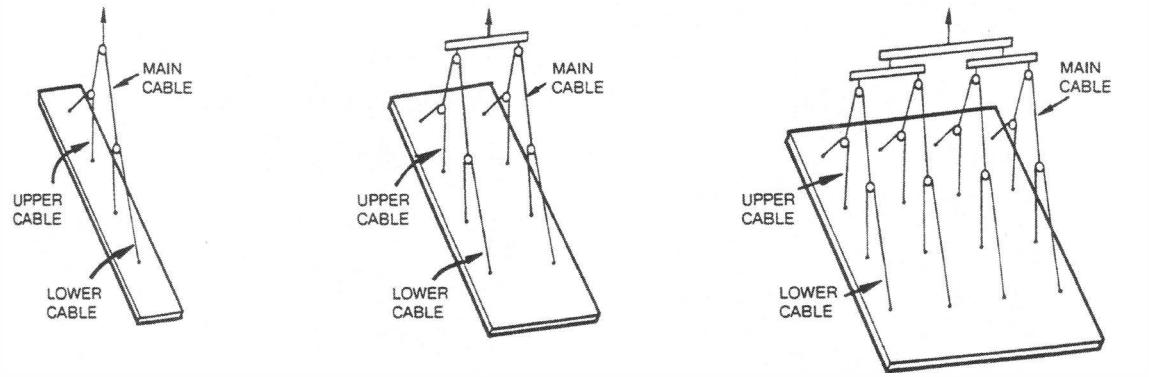
R-11 R-12 R-14



R-21 R-22 R-24



R-31 R-32 R-34



R-41 R-42 R-44

DAYTON SUPERIOR™

SPECIAL INSTRUCTIONS:

Project: EAST BAY B.M.W.

Location: 4355 Rosewood Dr.
PLEASANTON, CA.

Contractor: GALLETTI & SONS

Job No.: 3710

Date: 12-17-85

Bldg. No.:

PANEL CONTRACTOR

1. Panels are viewed as noted on the panel layout sheet.
2. Concrete modulus of rupture (as determined by test beam break) shall be at least 408 P.S.I. prior to erecting panels, corresponding approximately to a compressive strength of 2500 P.S.I. Test specimens shall be truly representative of the actual condition of the concrete in the panel at the time of erection.
3. Panel layouts are based on concrete having a unit weight of 150 lbs. per cubic foot.
4. Bracing designs are based on windload pressure of 10 lbs. per square foot. If this windload pressure does not satisfy local conditions or code requirements contact Dayton Superior Corporation for additional recommendations.
5. Maximum applied brace load 3000 lbs. per brace.
6. All reinforcing steel shown on the attached panel layouts shall be grade 40 and is in addition to the reinforcing steel shown on the Architect/Engineer's Plans unless otherwise noted.

CRANE CONTRACTOR

1. Maximum panel weight 21.0 tons. Maximum insert load 4.6 tons.
2. Maximum panel height 20'-8"
3. Use spreader beams of such length that rigging is at a 90° ± 5° angle with the spreader beam, unless shown or noted otherwise on panel layout sheet. Rigging must be modified when called for on panel layout sheet.
4. Minimum effective cable lengths: (except when noted otherwise on panel layout sheet) shall be:

   For flat pick ____ ft. For 4-high upper cable ____ ft.
   For 2-high 25' ft. Lower cable ____ ft.
   For 3-high ____ ft. Main cable ____ ft.

When clarification or additional information about these erection details is required, please contact the Technical Service Office as indicated below:

☐ **HOME OFFICE**
721 Richard St.
Miamisburg, Ohio 45342
Telephone (513) 866-0711
(800) 252-3680

☑ **WESTERN OFFICE**
9415 Sorensen Ave.
Santa Fe Springs, Cal. 90670
Telephone (213) 946-5504 (714) 522-3442
(800) 423-4665

NOTES:

BOOM TRUCK

- Review the chart on the following page and complete the Exercise

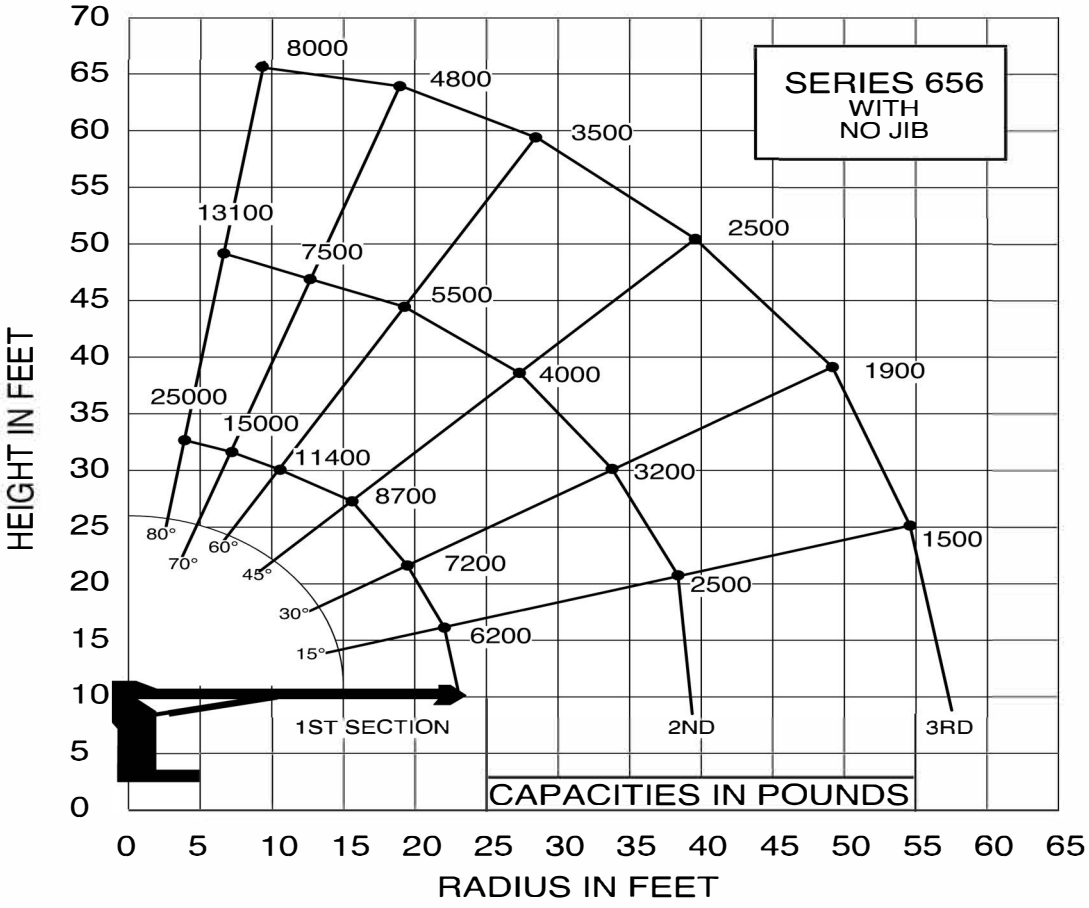
BOOM TRUCK

Date | Instructor | Name

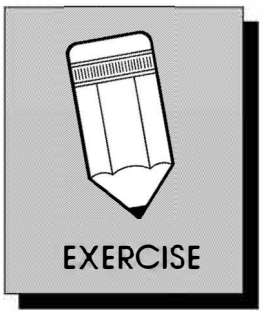
CAPACITY CHARTS

Every crane is required to have a capacity chart that spells out the lifting limitations of that specific crane. The chart deals with, among other things, the length of the boom, the use of the outriggers, the radius of the load and the angle of the boom. The crane operator relies on the charts to safely operate the crane.

Below is shown the capacity chart for the boom truck that will be used for the hands-on training. Use this chart to answer the questions on the next page.



READING THE BOOM TRUCK CRANE CHART



1. According to the chart, with the 2nd section extended, the crane can lift 7,500 lbs. when it is at what angle? _____

2. When the boom is extended out to the third stage and raised to a height of 50′, what is the maximum capacity that can be lifted? _____

3. To be able to lift 8,700 lbs., what height and radius would be used? _____

4. The greater the angle, the _____ the crane can lift.

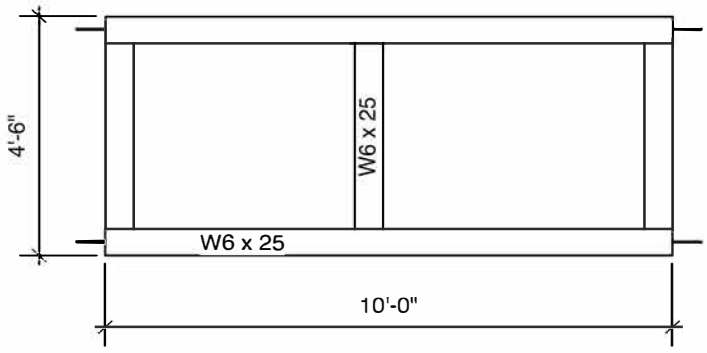
5. Calculate the weight of a concrete beam that is 2′ thick, 4′ wide and 23′ long. Can this boom truck safely lift this beam? _____

6. You are going to lift a unit of plywood onto the roof of a warehouse. There are 55 sheets in the unit and each sheet weighs approximately 60 lbs. With the 2nd section extended to a radius of 35′ and raised to 25′ in height, will the boom truck be able to make this lift?

   _____

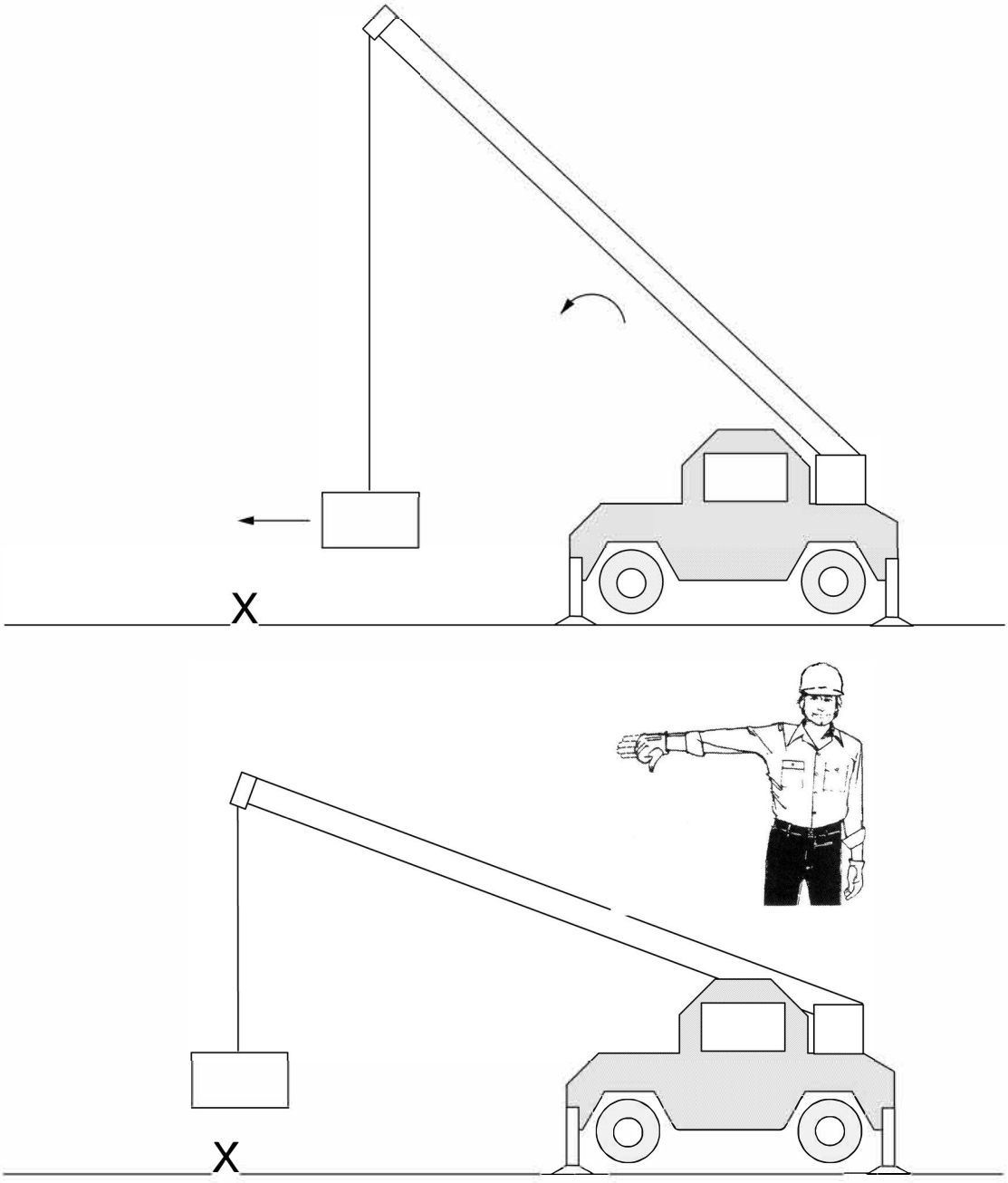
7. The drawing below is the appliance that we will be rigging and lifting. Calculate the weight. If the crane is extended 55 feet at a 15° angle, will the crane be able to lift the appliance?

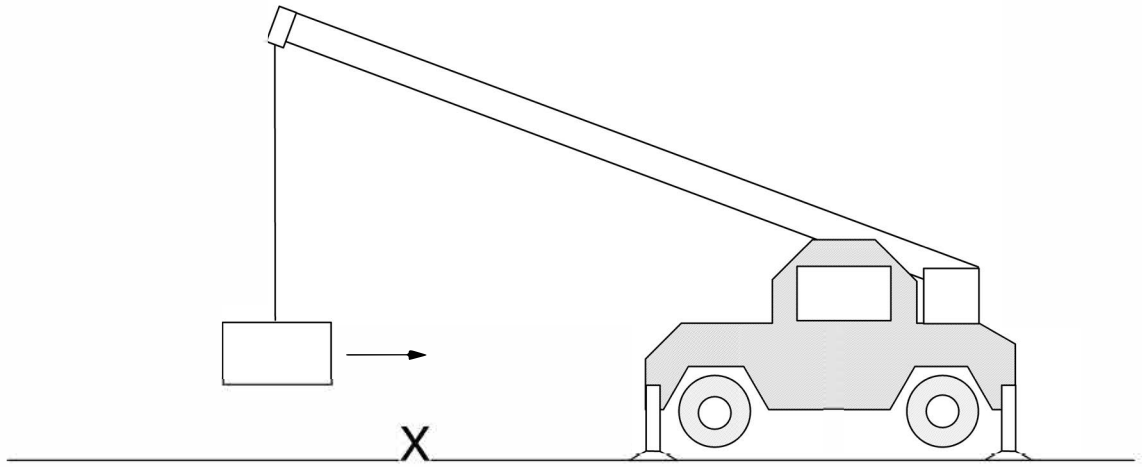
   _____



BOOM MOVEMENT

In order to move a load towards or away from the crane, raising or lowering the boom can best accomplish this. While the boom can be extended or retracted, this puts stress and wear on the boom arm and should be avoided. Raising the boom will bring the load towards the crane, while lowering the boom will move the load away from the crane.

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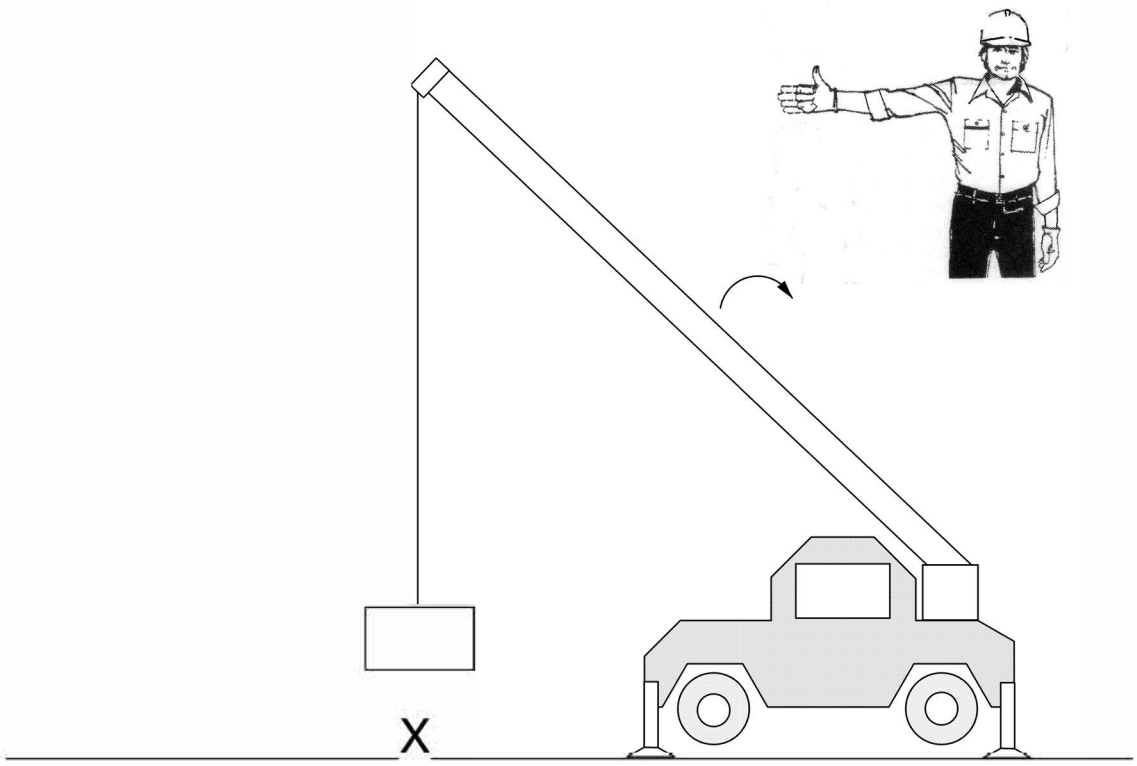
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NOTES:

RIGGING AND SIGNALING

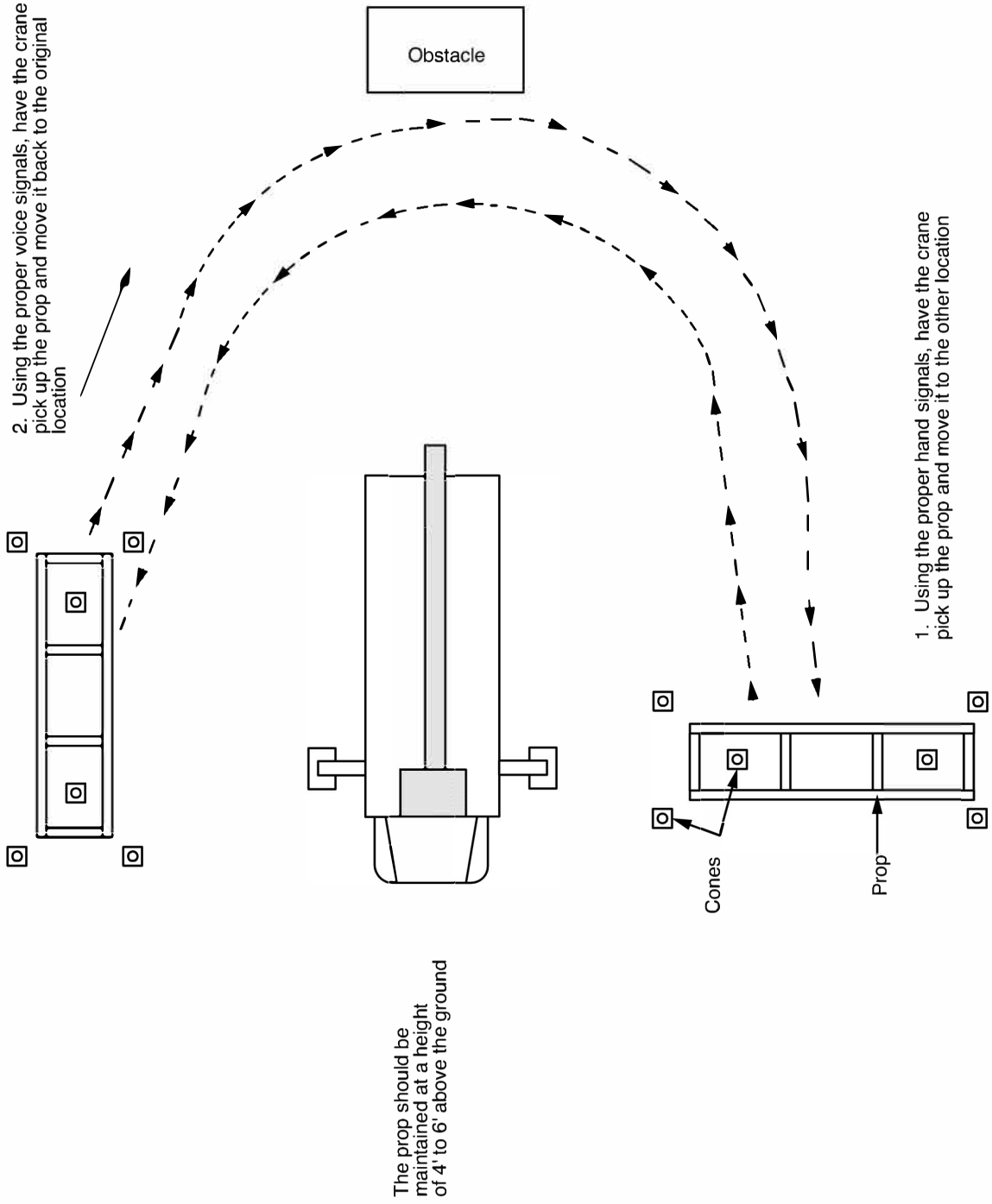
This exercise is designed to give the apprentice experience in rigging a load and signaling the boom truck. The apprentice will rig the load and then signal the crane as it moves the load to a designated location and then back again.

To begin, the apprentice will center the hook over the load and connect the slings to the appliance. When the load is lifted, it should not knock over any of the cones. The load will have a tag line that will be controlled by another apprentice. Using only signals, the apprentice will then direct the crane to swing the load inside the obstacle and place it down within the cones in the second location.

Next, the apprentice will use voice commands and direct the return of the load to the original position. The rigging should then be disconnected.

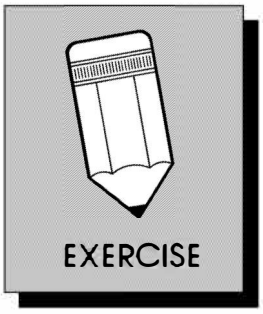
Among other things, the apprentice will be graded on:

1. Checking in with the crane operator
2. Connecting the slings correctly
3. Staying in view of the crane operator, and in a safe location.
4. Giving the proper hand signals
5. Maintaining a safe distance from the truck and any obstacles
6. Maintaining the proper height of the load throughout the lift
7. Giving the proper voice signals

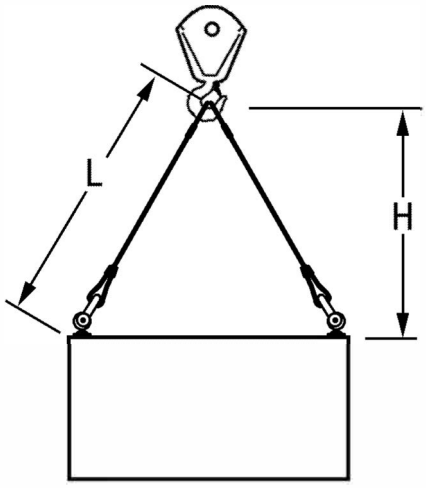

Obstacle
2. Using the proper voice signals, have the crane pick up the prop and move it back to the original location
1. Using the proper hand signals, have the crane pick up the prop and move it to the other location
Cones
Prop
The prop should be maintained at a height of 4' to 6' above the ground

RIGGING SAMPLE PROBLEMS

Date _____ Instructor _____ Name _____



TWO-LEG BRIDLE LOAD



A. Weight = 5,500 pounds

Length = 12 feet

Height = 10 feet

1. What is the stress on each sling? _____
2. What size wire sling is needed? _____

B. Weight = 22,000 pounds

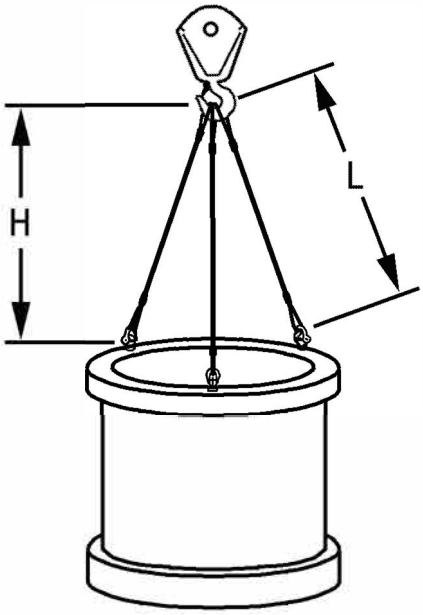
Length = 16 feet

Height = 12 feet

3. What is the stress on each sling? _____

4. What size wire sling is needed? _____

THREE-LEG BRIDLE LOAD



A. Weight = 5,000 pounds

Length = 12 feet

Height = 10 feet

5. What is the stress on each sling? _____

6. What size wire sling is needed? _____

B. Weight = 22,000 pounds

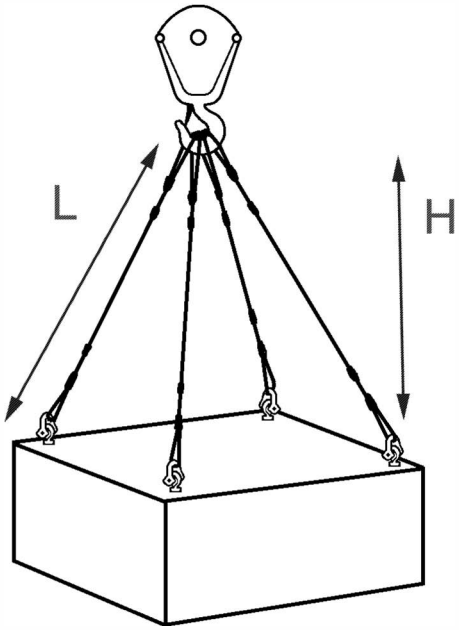
Length = 16 feet

Height = 12 feet

7. What is the stress on each sling? _____

8. What size wire sling is needed? _____

FOUR-LEG BRIDLE LOAD



A. Weight = 4,000 pounds

Length = 20 feet

Height = 10 feet

What is the stress on each sling? _____

What size wire sling is needed? _____

B. Weight = 4,000 pounds

Length = 20 feet

Height = 15 feet

What is the stress on each sling? _____

What size wire sling is needed? _____

NOTES:

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