

# BRODERSON CRANES 7.45 TON

**TRAINEE:** \_\_\_\_\_

**Signature**

**Date**

**INSTRUCTOR:** \_\_\_\_\_

**Signature**

**Date**

# BRODERSON CRANES

The Broderson Crane, is a hydraulically operated piece of equipment. Its primary use is to hoist and swing heavy loads at various radii within the refinery.

The Broderson Crane is operated with various control levers, steering wheel, accelerator, and brake pedal all located in the operator's cab.

This training module will give you the information and skills needed for the safe use of the Broderson Cranes.

## TERMINAL OBJECTIVE

Learner will understand hazards of crane operations and demonstrate safe setup and operating procedures to be employed in the refinery.

## ENABLING OBJECTIVES

- Demonstrate good understanding of machine capacities.
- Demonstrate appropriate pre-start & pre-operational checks.
- Demonstrate proper direction and movement of controls to get desired results.
- Demonstrate safe driving habits.
- Demonstrate proper machine set-up.
- Demonstrate smooth maneuvering skills.
- Demonstrate ability to smoothly operate while following hand signals.
- Demonstrate ability to accurately interpret load charts.

## TEACHING/LEARNING ACTIVITIES

- Introduction to course content, and viewing of video tapes.
- Study manuals including practice exercises.
- Obtain unit work clearances and discuss hazards of working in live units.
- Make pre-start and pre-operational inspections.
- Instructor to demonstrate proper operating techniques.
- Learner to familiarize herself /himself with the controls.
- Learner to practice safe driving techniques.
- Practice proper machine set-up under instructor's direction.
- Demonstrate ability to follow hand signals. Operate crane in smooth fashion.
- Lift heavy loads in practice area to demonstrate boom and chassis deflection and variance in machine re-actions to imposed loads.

## EVALUATION

Learners will be given a written exam, which requires a passing score of 80%.

Learners will be given a Hands-on Performance Test to fulfill all operator requirements. A passing score is 90%

# THE 7.45 TON BRODERSON PRE-EXAMINATION

Date: \_\_\_\_\_ Name: \_\_\_\_\_

## SUBJECT: THE 7.45 TON BRODERSON

1. The Broderon has \_\_\_\_\_ outriggers. 10
  - a. 6
  - b. 7
  - c. 4
  
2. If the engine fails to start in 30 seconds, wait \_\_\_\_\_ minutes before trying again. 10
  - a. 3
  - b. 1
  - c. 2
  
3. The maximum angle the boom can be raised is 10
  - a. 35°
  - b. 70°
  - c. 125°
  
4. The forward/reverse lever must be in the \_\_\_\_\_ position to start the crane. 10
  - a. neutral
  - b. forward
  - c. reverse
  
5. The main boom has \_\_\_\_\_ sheave(s). 10
  - a. 2
  - b. 3
  - c. 1
  
6. A \_\_\_\_\_ part line is necessary to reeve the traveling block. 10
  - a. 4
  - b. 2
  - c. 3
  
7. In **Rear steer**, the steering wheel turns the rear wheels to the right when 10
  - a. it is turned right.
  - b. it is turned left.
  - c. it is pulled.
  
8. Pulling the hoist control lever 10
  - a. raises the hook.
  - b. lowers the boom.
  - c. lowers the hook.
  
9. The rotating, three section boom is \_\_\_\_\_ controlled. 10
  - a. radio
  - b. hydraulically
  - c. manually
  
10. What is the diameter of the hoist cable on the 7.45 ton Broderon \_\_\_\_\_ 10
  - a. 1/2
  - b. 9/16"
  - c. 5/8"

## 7.45 TON Broderson

7.45 TON Broderson cranes, are a hydraulically operated piece of equipment. Proper operation is always a must. The objectives of this program are to instruct you in understanding the hazards of crane operation, safe setup, and operating procedures.

The 7.45 ton Broderson crane comes with hydraulic power steering. Tire size and inflation specifications are located on the load chart provided with each crane.

It has a hand lever-operated, forward-reverse selective gear transmission, with a separate manual transmission 3 or 4 speed gear shifter, and an engine speed accelerator pedal. The Broderson also has a torque converter.

The 7.45 ton Broderson crane is front wheel drive with standard rear wheel steering or optional four wheel steering.

The Broderson has on its instrument panel such familiar gauges as alternator, oil pressure, engine temperature, fuel level and light switch. On the dash is the horn button. The instrument panel also has a converter temperature gauge and hour meter.

Outside, there are four outriggers, hydraulically operated, and a rotating, three section, hydraulically telescoping boom. The hydraulic fluid level is to be checked when the boom is fully retracted and outriggers are in the raised position.

The Broderson is designed for efficient materials handling.

See the Broderson load chart for load capacity. This program is **divided into six sections:**

- Section 1: Pre-Start Checks
- Section 2: Pre-Operational Checks
- Section 3: Dimensions and Technical Data
- Section 4: Driving Procedures
- Section 5: Crane Loading Capacities
- Section 6: Operation of Crane Controls

Check the engine coolant system to be sure it is at its proper level. This will insure that it will not overheat while you're working and cause damage to the engine. Be careful! Never open a hot radiator - this could be a scalding hazard.

Check to see that the engine fuel tank is full. Remember, the Broderson Cranes run on diesel fuel!

How about those tires? Are they properly inflated? Are they worn or damaged? Be sure to thoroughly check them visually.

Check the battery. Visually inspect the battery for damage, such as cracks and corrosion. Check the battery cables (remember, acid could be present!).

During your inspection, note damaged or loose equipment or leaks. Check the signal lights, mirrors, and all glass. Inform the garage of any problems.

*Stop now and work practice exercise #1.*

Now you're ready to go to Section 2.

Set the parking brake, make sure the forward/reverse lever is in neutral. Turn the key to "on" and verify the fuel tank level. With the electric switch on, activate the starter motor and if engine fails to start in 30 seconds, wait at least two minutes to allow the starter motor to cool.

When engine is running, immediately check the oil pressure gauge. If there is no oil pressure indicated within 10 to 15 seconds, turn off the engine and check the lubricating system. The minimum oil pressure should be about 30 psi at idle. At normal operating speeds, the oil pressure should be between 40 and 50 psi.

Now check the voltmeter's operation by turning on the headlights creating a current drain. The dial pointer should show an immediate discharge and then slowly return to the second green area or the charge position.

Check the coolant temperature gauge to see if it is working properly; it should never exceed 212°.

Check the following items: horn, lights, turn signals, emergency flashers, and the torque converter temperature. Check accelerator and brake pedal for smooth travel of operation. Make sure the hour-meter is working.

Check ease of movement for each of the hydraulic control levers. Move them one at a time both by pushing and pulling. They shall return to the neutral position when released.

With the boom in the horizontal position, lower the ball or two-part-block about two feet. Make the following visual inspections:

Check the hook for a properly operating safety latch and any sign of distortion.

Check the ball and or two-part-block and boom head sheave for any sign of abnormal wear. There is one sheave in the block and one sheave in the boom head.

Inspect the ball, becket, and hook for proper installation (also check for damage). If the two-part-block is installed, verify the becket is properly installed.

Check the hoist cable for wear of 1/3 the original diameter of outside individual wires. Check for evidence of heat damage, kinking, crushing or any other damage resulting in distortion of the rope structure. Wire rope **shall** be taken out of service if any of these conditions exist.

In running ropes, six randomly distributed broken wires in one lay, or three broken wires in one strand in one lay, **shall** be taken out of service.

Check the winch for a properly wound cable and general condition.

Here is how to shut down the crane, should the need arise during operation. All loads should first be lowered to the ground. Turn key switch to "OFF". Pull the engine shutdown knob to kill the engine. After engine has stopped, push knob all the way back in.

*You may now stop and work Practice Exercise #2.*

Now that you have covered the pre-operational and daily pre-start checks, we are ready to look at some facts about the dimensions and the technical data of the Broderson Crane.

The 7.45 Ton Broderson is 6 foot 6 inches wide, 12 foot 5 inches long, and 7 foot 2 inches tall.

The boom can be raised to a maximum angle of 70° from horizontal.

Driving procedures for the 7.45 Ton Broderson).

A steering wheel, a forward/reverse shift lever, a manual transmission gear shifter, an accelerator pedal and a brake pedal are used in driving the Broderson.

The Broderson is equipped with a parking brake. To apply it, pull the lever up. Push down to a horizontal position to release the brake. The knob on top of the lever is to adjust the brake.

When parking on an incline/decline, use both parking brake and outriggers. Otherwise it will be necessary to chock the wheels to guard against accidental movement. **Never leave the machine unmanned while a load is on the hook.**

There is a forward/reverse hand lever to the right. It must be in the center or neutral position to start the crane.

Push the brake pedal and accelerator toward the floor to activate

Always come to a complete stop before changing the direction of travel. Failure to do this will cause undue strain on transmission or possible bodily injury.

The Broderson **should not be** used as a towing vehicle.

There are maximum road speeds for forward and reverse modes of operation. They vary with the brand of engine in the Broderson. Consult your manual for engine brand and gear speed ranges. However, let conditions of the road dictate your speed.

A word of caution when turning; do not continue to pull the steering wheel after the wheels are turned to the maximum steering angle. Such practice will cause excessive heat and wear to the power steering pump and actuator.

Remember, when driving and maneuvering the rear steering Broderson, it handles differently from an auto or pickup.

*Now stop and work Practice Exercise # 3*

Section 5 will acquaint you with the load capacities of the Broderson. You will need to understand these in order to properly and safely-lift with the crane.

The main boom has one sheave, which is used to reeve up the traveling block for handling capacity loads. It is absolutely necessary to reeve this block up with a 2-part line to handle loads in excess of 9,000 pounds.

Capacities vary with boom angle and boom length. Always consult your load chart for proper load capacities at the radii you will be working. The greater the radius the lower the lifting capacities. The load chart is mounted in a conspicuous place inside the Broderson.

Broderson I.C. 80-1D cranes come equipped with four outrigger-type stabilizers that are operated hydraulically with 2 levers. When using the outrigger portion of load chart, outriggers must always be fully extended. Note, crane outriggers should be set on a firm surface and crane should be level within one-percent.

Now let's discuss load ratings and maximum lifting capacities. Each Broderson is equipped with a load rating chart displayed in full view of the operator. The 7.45 ton Broderson load chart is rated for loads involving 360° rotation.

Loads on rubber shall be transported at slow speeds (three mile-per-hour maximum). The boom should be retracted to the shortest possible length and centered over the front. The load shall be tied off to prevent swinging. An escort should be used with this type of load.

Rated loads are the maximum lifting capacities as determined by the boom length, ground conditions, operating radius and proper handling. They do not exceed 75% of the actual tipping capacity.

These ratings depend also on freely suspended loads, with the Broderson supported on a firm, level and uniform surface.

The operating radius is the horizontal distance from the center of rotation of the crane to the center of the vertical hoist line or center of gravity of the load.

The weight of all load-handling devices such as hooks, blocks, slings, etc, shall be considered as part of the load.

Bear in mind that the type of hook-up used when making a lift will affect the safe working strength of your slings.

Load lifting capacities are limited by several conditions which are, boom length, boom angle and radius. Note: before lifting any loads on rubber, consult your load chart.

Remember, because the Broderson is longer than it is wide, the stability and loading capacity of the machine is greatly decreased when a load is moved from the front to the side of the machine.

Always handle the load as close to the ground as possible when rotating the boom.

Never carry a load from a fully extended boom.

Never lift personnel with a Broderson!

*Stop now and work Practice Exercise # 4.*

Section 6 will instruct you on the proper use of the control levers for operating the Broderson.

Before you begin, you should always double-check yourself to make sure that you are familiar with all the controls and that you are sitting in a comfortable position. This will help to minimize operating errors.

This crane is a hydraulically operated unit. Power for operation is supplied by a hydraulic pump, coupled to the engine crankshaft. The pump operates whenever the engine is running.

The hydraulic control valves direct the flow of hydraulic fluid. Sometimes it may be necessary to increase or decrease engine RPM's to operate hydraulic cylinders that control various functions of the crane.

All crane functions are controlled by individual levers located in front and to either side of the steering wheel.

Do not fully engage controls quickly, as this can cause damage to the lift block assembly. Damage to the cable can be caused by letting the levers snap back to neutral position. Always feather the control levers in and out.

Pulling the ball or block against the boom tip is called "two blocking" and *is extremely dangerous*.

To prevent two-blocking, enough cable must be let out when extending the boom to keep the block or ball from wedging against the boom tip.

A word of caution; Always operate the hoist lever in conjunction with the telescope lever when extending the boom. This will also help to prevent two-blocking.

Another word of caution; Don't side pull or drag the load with the boom.

Side pulling or dragging can cause boom failure or crane tipping.

Always look before lowering the outriggers; to be sure there will be no injury to personnel and no damage to property. Expect a slight jerk or side movement when outriggers are extended or retracted.

Never operate without making certain all the area is clear of obstructions and personnel. **Barricade the counterweight swing radius and outriggers.**

#### **Finally, these safety points:**

Know your crane's vital dimensions, height, width, and weight. Knowing them will help when facing load weight limits and checking overhead clearances.

When cable is raised or lowered and the lever is put in neutral position, the automatic brake will hold the cable and load as long as the lever remains there in neutral.

When using the winch, make certain the hoist cable winds evenly as that will assure smooth lifting and avoid kinking. Always use a tag line when rotation of the load is hazardous.

Never operate within 10 feet of 50,000 volt (or less) power lines.

The steering control is in the form of a wheel, just like a forklift. In rear steer, the rear wheels will turn to the right when the steering wheel is turned to the left.

The swing control lever operates the rotation of the boom either clockwise or counterclockwise.



Pulling the lever will swing the boom to the left or counter clockwise. Pushing the control will swing the boom clockwise.

Pushing the boom lever will lower the boom and pulling it will raise the boom.

Pulling the hoist control lever will raise the hook. Pushing it will lower the hook.

The telescope lever is pushed to extend the sliding sections and pulled to retract them!

*Don't forget to do practice exercise #5.*

## 7.45 TON BRODERSON-5 PRACTICE EXERCISES

### PRACTICE EXERCISE NUMBER 1

Date: \_\_\_\_\_ Name: \_\_\_\_\_

#### SUBJECT: 7.45 Ton BRODERSON

1. The Broderon has \_\_\_\_\_ outriggers.
  - a. 6
  - b. 7
  - c. 4
  
2. Be sure to check all fluid levels, lights, and essential operating equipment \_\_\_\_\_.
  - a. twice a month.
  - b. twice a day, morning and evening.
  - c. at the beginning of each shift and before each use.
  
3. The hydraulic fluid level should be checked when \_\_\_\_\_.
  - a. the boom is fully retracted and outriggers are in the raised position.
  - b. the boom is fully extended and outriggers are in the raised position.
  - c. the boom is fully extended and outriggers are in the lowered position.
  
4. The rotating three- section boom is \_\_\_\_\_ controlled.
  - a. manually
  - b. radio
  - c. hydraulically

## PRACTICE EXERCISE NUMBER 2

Date: \_\_\_\_\_ Name: \_\_\_\_\_

SUBJECT: THE 7.45 Ton Broderson

1. If the engine fails to start in 30 seconds, wait \_\_\_\_\_ minutes before trying again.
  - a. 1
  - b. 2
  - c. 3
  
2. If the engine has no oil pressure in 10 to 15 seconds after starting \_\_\_\_\_.
  - a. turn off the engine and check the lubricating system.
  - b. gun the motor to get the oil pump working.
  - c. let the engine idle until the pressure increases.
  
3. If there is \_\_\_\_\_ broken wires in one strand in one lay the cable shall be taken out of service.
  - a. two
  - b. three
  - c. one
  
4. When you have to shut down the crane during normal operation, \_\_\_\_\_ always.
  - a. remove all of the load
  - b. keep all of the load
  - c. have a forklift support the load
  
5. When the individual wires in the cable have wear of \_\_\_\_\_ the cable shall be taken out of service.
  - a.  $\frac{1}{3}$  the original diameter
  - b.  $\frac{1}{2}$  the original diameter
  - c.  $\frac{1}{4}$  the original diameter

### PRACTICE EXERCISE NUMBER 3

Date: \_\_\_\_\_ Name: \_\_\_\_\_

**Subject:** 7.45 Ton Broderson

1. The maximum angle the boom can be raised is \_\_\_\_\_ .
  - a. 25°
  - b. 135°
  - c. 70°
  
2. When parking on an incline, use \_\_\_\_\_ .
  - a. the parking brake.
  - b. the outriggers.
  - c. both a. & b.
  
3. The forward/reverse lever must be in the \_\_\_\_\_ position to start the crane.
  - a. forward
  - b. neutral
  - c. reverse
  
4. The Broderson should \_\_\_\_\_ used as a towing vehicle.
  - a. not be
  - b. occasionally
  - c. always be

## PRACTICE EXERCISE NUMBER 4

Date: \_\_\_\_\_ Name \_\_\_\_\_

### SUBJECT: THE 7.45 TON BRODERSON

1. The main boom has \_\_\_\_\_ sheave(s).
  - a. 1
  - b. 3
  - c. 2
  
2. A \_\_\_\_\_ part line is necessary to reeve the traveling block.
  - a. 2
  - b. 4
  - c. 5
  
3. The crane has four outriggers which are controlled \_\_\_\_\_.
  - a. hydraulically.
  - b. electrically.
  - c. manually.
  
4. The outriggers are controlled by \_\_\_\_\_ in the cab.
  - a. 2 levers
  - b. 1 lever
  - c. 3 levers
  
5. When transporting loads on rubber, the boom shall be \_\_\_\_\_.
  - a. extended to the longest possible length and centered over the rear.
  - b. retracted to the shortest possible length and centered over the front.
  - c. retracted to the shortest possible length and centered over the rear.
  
6. The operating radius is the \_\_\_\_\_ distance from the center of rotation of the crane to the center of the vertical hoist line when positioned over the center of gravity of the load!
  - a. diagonal
  - b. vertical
  - c. horizontal

**PRACTICE EXERCISE NUMBER 5**

Date: \_\_\_\_\_ Name: \_\_\_\_\_

**SUBJECT: 7.45 TON BRODERSON**

1. The swing control lever operates the \_\_\_\_\_.
  - a. outriggers.
  - b. rotation of the boom either clockwise or counterclockwise.
  - c. boom angle.
  
2. In Rear steer, the steering wheel turns the rear wheels to the right when \_\_\_\_\_.
  - a. it is turned right.
  - b. it is turned to the left.
  - c. it is pushed.
  
3. Pulling the hoist control lever \_\_\_\_\_.
  - a. raises the hook.
  - b. lowers the boom.
  - c. lowers the hook.
  
4. The telescope extend/retract control is pushed to \_\_\_\_\_.
  - a. retract the sliding section.
  - b. lower the outriggers.
  - c. extend the sliding section.

## PRIMARY USE/PURPOSE

A Broderson consists of a rotating superstructure, boom, mounted on a chassis equipped with axles and rubber-tired wheels. Its primary purpose is to hoist and swing heavy loads at various radii within the refinery.

## OPERATING RULES

The following rules are a fundamental guideline. Because of variations in equipment, these rules may not apply specifically to your vehicle. However, all cranes follow the same basic safety rules and you, as the operator, are solely responsible for safety when in control of the machine.

1. Do not lift loads over peoples' heads.
2. Do not drag the load on the ground.
3. Do not lift personnel.
4. Do not leave a suspended load unattended.
5. Do not lift beyond the capacity of your machine.
6. For "Pick and Carry" operations, do not exceed 1/2 of the "on rubber" capacity of the chart.
7. Do not two-block.
8. Do not allow the boom to come in contact with any structure or object!
9. Do not attempt to repair your own crane.
10. Do not work alone when operating the crane.
11. Do not enter an operating unit without a Unit Work Clearance and a spotter!
12. Never leave the operator's cab while the engine is running.
13. Do not take the keys from the machine except in the parking area.
14. Keep the boom a **minimum** of 10 feet from any high power lines.
15. Do not attempt "on rubber" lifts unless all criteria for lifting on rubber has been met and the load is within the rated capacity for the radius at which you will be working!
16. Do not experiment.

## PRE-START CHECKS

The following checks will only take a few minutes at the start of each shift and are absolutely necessary to ensure safe operation. Any abnormalities or malfunctions should be reported immediately to the foreman or mechanic.

1. Check all fluid levels.
  - a. Fuel
  - b. Engine oil
  - c. Engine coolant
  - d. Hydraulic oil (This should be checked with all cylinders retracted.)
2. Tire condition and pressure.
3. Rope condition.
4. Sheaves.
5. Drums.
6. Boom extensions.
7. Fire extinguisher (It should be full and the gauge should show adequate pressure).
8. Housekeeping (Be sure cab and equipment is clear of mud, debris and oil.)
9. Be sure that mirrors are tight and at the appropriate angles for safe viewing.
10. All pins.
11. Check for any fluid leaks.
12. Check for any broken glass or guards, any structural damage, and cracked welds.
13. Check hoses for cracks or leaks.
14. Be sure all lights are working.
15. Check for any loose bolts.
16. Report anything else that seems out of the ordinary.



## SAFE OPERATING PROCEDURES

Familiarize yourself with the location and purpose of all controls. They should all be clearly marked, although their locations may vary somewhat on different equipment. For more information, see the Operator's Manual for your equipment.

### **Before Moving Equipment Check-Out From The Garage!!!!!!**

1. Start the engine and check oil pressure and charging systems. If your gauges display no oil pressure or a discharging condition, shut off the engine and notify the garage.
2. Check the brake pedal and accelerator for smoothness of operation. Also, check the hand brake for proper adjustment.
3. Check the hydraulic control levers, one at a time, for ease of movement. They should return to neutral when released. Report any abnormalities.
4. Lower the hook and check the dead end connection, safety latch, and hook for distortion.
5. Warm up the equipment for a few minutes to prevent damage, to provide smoothness of operation, and to help the machine live longer.
6. Test the anti-two block device, if so equipped.
7. To drive the Broderson:
  - a. Lower the boom.
  - b. Depress the service brake.
  - c. Put the main gearbox in the desired gear.
  - d. Shift the forward-reverse lever into the desired direction.
  - e. Release the hand brake and the service brake.
  - f. Press on the accelerator
8. Watch for traffic. Do not shift the transmission while in motion
9. When you reach your destination:
  - a. Stop the vehicle.
  - b. Shift the forward-reverse lever and the main gearbox to neutral.
  - c. Set the handbrake.
  - d. Raise the boom so no one walks into the downhaul ball and hook.

## Setting the Outriggers:

10. Look to see that there are no obstructions.
11. If you're on soft ground, you might need to distribute the ground bearing pressure by cribbing.
12. **On the Broderson:**  
Push the outrigger levers forward, either individually or simultaneously, until all four outriggers are all the way down. Release the levers as soon as the outriggers are down. Continued pressure could damage the machine.

## Craning Functions

Before performing any function, be sure there are no obstructions and that you and your crew have a good "game plan". All of the controls are clearly marked. Before you begin, be sure you are familiar with their functions to avoid any unpleasant surprises.

13. To swing the boom left, pull the appropriate lever toward you. Remember. **Never Drag A Load On The Ground.**
14. To swing the boom right, push the control lever away from you.
15. To raise the boom, pull the control lever toward you.
15. To lower the boom, push the lever away from you.
17. To extend the boom, push the appropriate control lever (or levers) away from you. **Remember to Lower the Hook At The Same Time to Avoid Two-Blocking.**
18. To retract the boom, pull the control lever(s). Raise the hook simultaneously to avoid dragging the hook or load.

## Raising The Outriggers

19. Reverse the procedure used to lower the outriggers. Be sure that they are all the way up to prevent possible damage or serious injury.
20. Secure the machine. Get out and check to see that no obstructions have been placed in your way.  
Parking
21. When parking under the shed, make sure the boom and hook are up and out of the way of truck traffic (approximately 10').
22. Shift both transmission levers to neutral.
23. Set the hand brake.
24. Turn off the switch and pull the kill lever.
25. Leave the machine clean for the next operator.
26. Notify garage attendant when returning Broderson.

## HYDRAULIC CRANE LOAD CHART INTERPRETATION

### Factors affecting capacity:

Before the machine is put into operation, the operator must know the capacity under all conditions and configurations. Load chart capacities are based on almost ideal conditions seldom achieved under actual working conditions, and as such it is extremely important to not only know how to determine the capacity from the chart but also to recognize the factors which can reduce the capacity below what the chart says. The rated capacities of mobile cranes are based on both strength and stability. It is extremely important to know the difference for in one case the structural components of the crane will fail and in the other case the crane will tip over.

Do not use stability to determine lifting capacity. Use the load chart.

The outrigger loads are highest at short radius, the boom loads drop as the radius is increased then they rise again as the boom approaches horizontal. The loads causing overturning drop as the radius is increased. In summary, at short radii the ratings are based on boom or outrigger strength while at long radii stability and hydraulic pressure are governing factors.

The manufacturer accounts for these variable factors by providing a load chart that limits the maximum allowable loads to values below the critical loads. If the operator exceeds these limits he could be in trouble. Hydraulic cranes, unlike friction machines, do not all have load ratings based on stability. In most cases their ratings depend on strength and hydraulic pressure limits. Therefore, the hydraulic crane operator who waits for signs of tipping to warn him of an overloaded condition will often bend the boom, exceed the pressure limits or cause severe damage to his/her machine before any signs of tipping occur.

The ability of a mobile crane to lift is also affected by the quadrant in which it is working. Lifting quadrants are defined as "over front", "over rear", or "over the side". The load which can be safely lifted will vary considerably from quadrant to quadrant. It is the operator's responsibility to see to it that rating plate ratings are not exceeded regardless of the quadrant in which he is operating.

It is also especially important when swinging through quadrants not to carry loads from an area of higher rating into an area of lower rating without first raising the boom to bring the load in within a safe operating radius.

Another important factor to consider is whether or not outriggers are being used. Capacities are given on the load chart to account for this.

The load carrying capacity of a crane is also significantly affected by the length of boom, and its angle in relation to horizontal.

The crane's lifting capacity is also dependent upon the counterweights. Operating with too little will permit the crane to tip forward and operating with too much will cause the crane to tip backward more easily. Increasing the counterweight to lift loads in excess of chart capacities will reduce the possibility of tipping forward but the lift will increase the structural loads to the point of collapse. The counterweights must be correct for the machine. Never add counterweight in excess of manufacturer specifications.

Capacities of swing-away boom extensions are normally based solely on boom angle and therefore boom length and radius are incidental considerations.

### ACTUAL VS EFFECTIVE LOAD WEIGHT

Under normal conditions anything hanging below the boom tip is considered load. When the main load block is being used for hoisting, and the jib (or swing-away) is erected, the effective weight of the jib may be calculated higher than its actual weight. Crane manufacturers use different methods of calculating the jib weight.

When the main block is being used and the jib (or swing-away) is stowed on the boom, its effective weight may be less than its actual weight.

Check load chart data very carefully.

### LOAD ON BOOM

Every crane has specific rules for its boom and jib makeup, however it can be safely assumed that everything under the boom tip is load.

This will include the object being lifted, slings and any rigging components, the hook and hoist block, and the hoist wire rope below the boom tip.

If the jib is erected it is considered part of the load, as well as its attachment rigging. The headache ball and hook are also included. The crane load chart must be followed closely as some types of cranes will double the jib weight as part of the load.

### NET AND GROSS CAPACITY

Two terms are also used when discussing crane capacity. Gross capacity is the net capacity plus all attachments, rigging components, blocks, hooks, etc. Net capacity is the load weight the crane can lift safely.

## STATIC AND DYNAMIC LOAD

When the load on a crane is suspended in a non-moving situation it is called the static load.

When the load begins to move extra stresses are imposed on the crane. This could be caused by hoisting, lowering and stopping, or rapid swing causing the load radius to increase. A sudden lift or stop is called impact loading and should be avoided, as it can easily increase the load by up to 30% or more. Extreme impact loading can amount to 100%, or more. This can be very dangerous.

## CAPACITY CHARTS

A crane load chart is used to indicate the maximum capacity of the crane under every permissible configuration. The ability to use the load chart correctly is critical to the safe operation of the crane.

Crane manufacturers place the capacity charts in readily accessible locations in the cab. They should not be removed.

The three basic crane chart configurations will be:

1. Boom extension and/or jib not installed.
2. Lifting from boom extension or jib.
3. With or without outriggers set.

Do not use stability to determine lifting capacity. Use the load chart.

A crane is rated at its maximum capacity load with its shortest boom section, lifting at the minimum radius.

Load charts include: Type of crane base, type of crane configuration, quadrant of operation, length of boom, angle of boom, load radius permissible line pull.

Boom angle, load radius, and boom length are critical factors to consider in load charts. When calculating capacity and any of these factors do not match the crane set up, the lower value on the load chart must be used. It is not permitted to guess or mathematically calculate in-between chart values (interpolate).

## CAPACITY CHART NOMENCLATURE

Boom length is measured from center of boom hinge pin to center of sheave pin.

Operating radius is the horizontal distance from rotation axis to center of load block with the load suspended.

Boom angle is the angle between horizontal and bottom of the boom.

Maximum capacity on rubber is without use of outriggers.

Boom point elevation is the distance from ground to center of boom point-sheave.

## IN BETWEEN VALUES

**Radius**-Frequently the measured load radius falls between numbers shown on the load radius chart. When this occurs the chart number used must be the higher radius value.

**Boom length**- Occasionally the crane will be equipped with a boom that does not match the machine boom length chart. When this occurs, the chart load rating used must be from the next highest number.

**Boom angle**- Another factor for capacity charts is the boom angle. If the actual boom angle does not match the angle shown on the load rating chart, the value used must be the next lower number.

## RANGE DIAGRAM

The range diagram included on all mobile cranes is a side view of the crane with its full range of configurations. It shows the crane placement, boom length, boom angle, load radius, jib and jib offset, and load heights, needed to lift and place the load.

Each chart is marked off with horizontal lines indicating boom tip height, vertical lines indicating load radius lines, radial boom angle lines and boom tip arcs that trace the position of the boom for each boom length as the radius and boom angle change.

If different jibs are used they would also be indicated on the diagram.

## NUMBER OF HOIST LINES

A crane will often have to be equipped with more than a single hoist line. If the load lifted weighs more than the safe working load of the wire rope the crane will have to be reeved with more line parts.

## CALCULATING CAPACITIES

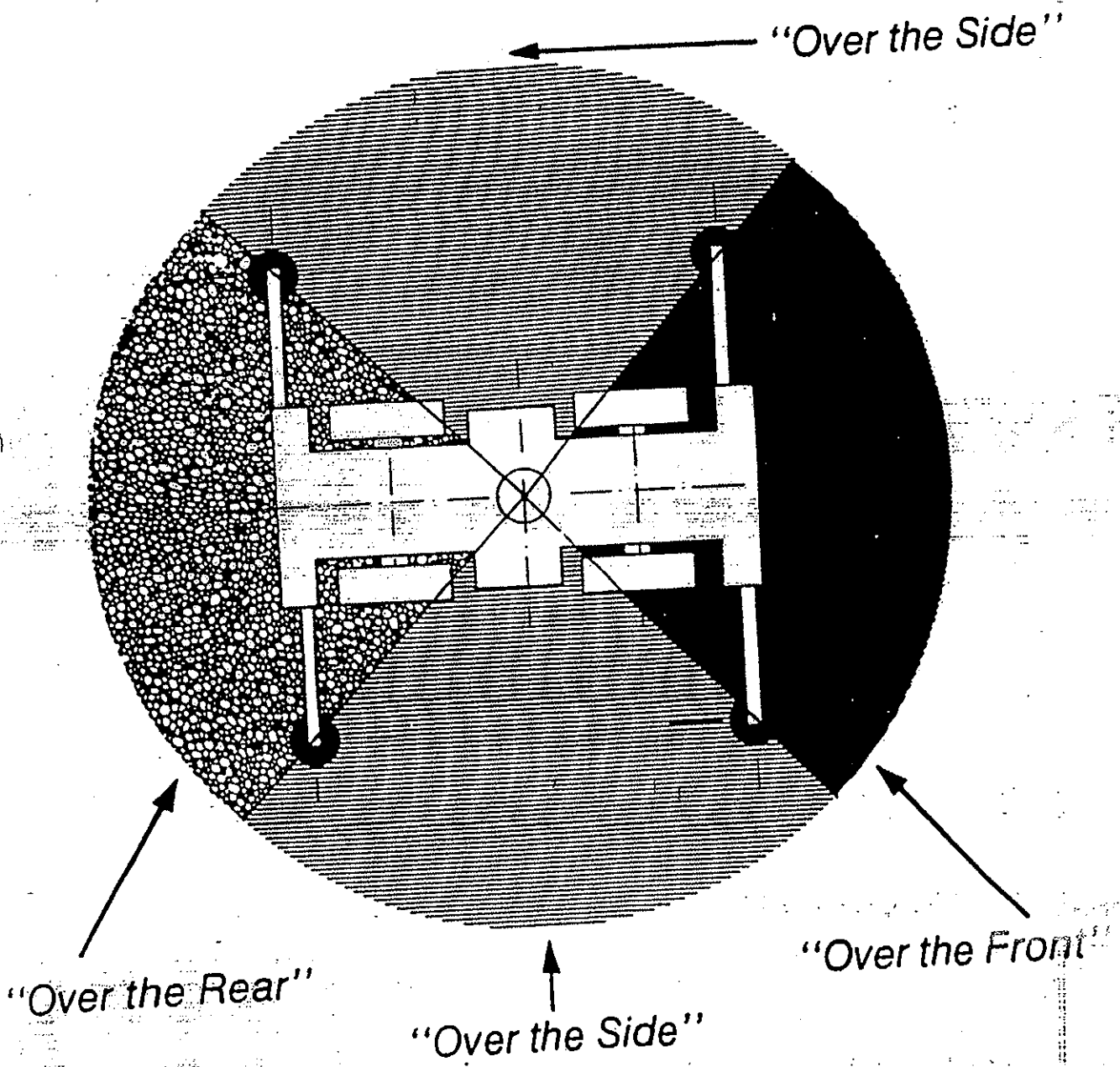
The following basic requirements are used to calculate capacities:

Use the load capacity chart and find the gross allowed capacity for the applicable boom length, boom angle, load radius, on or off outriggers, and quadrant of operation.

Use the load chart notes to determine the parts of hoist line needed and which hook to use.

Use the load chart notes to determine load deductions; hook block, headache ball, slings wire ropes, any other rigging etc.

The actual net load weight will be the gross capacity minus the deductions.





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