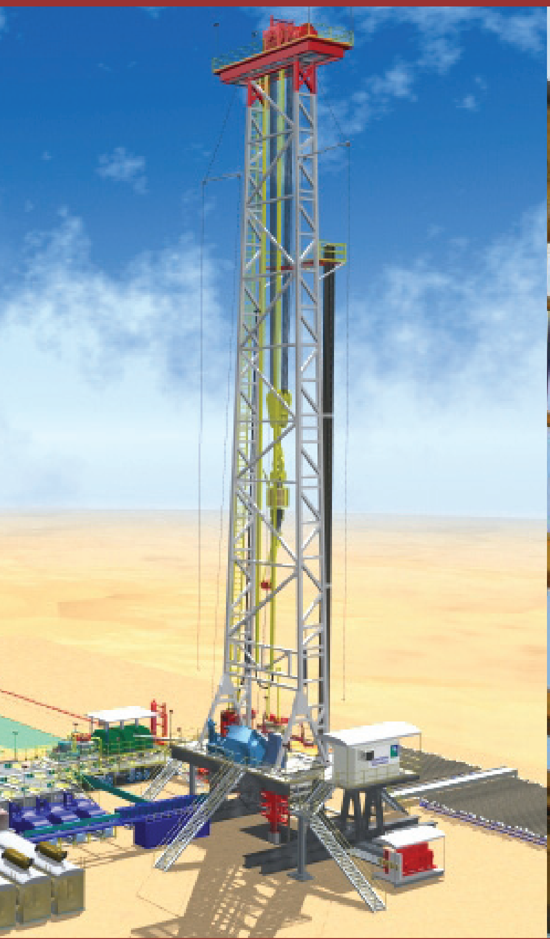
ارامكو السعودية
Saudi Aramco

Instructor Guide

INTRODUCTION TO DRILLING OPERATIONS



Module 4.3
Define the Function of the Blocks, Hook, and Elevators

D&WO HR Training & Competency Development Division
Published by T&D
August 2014

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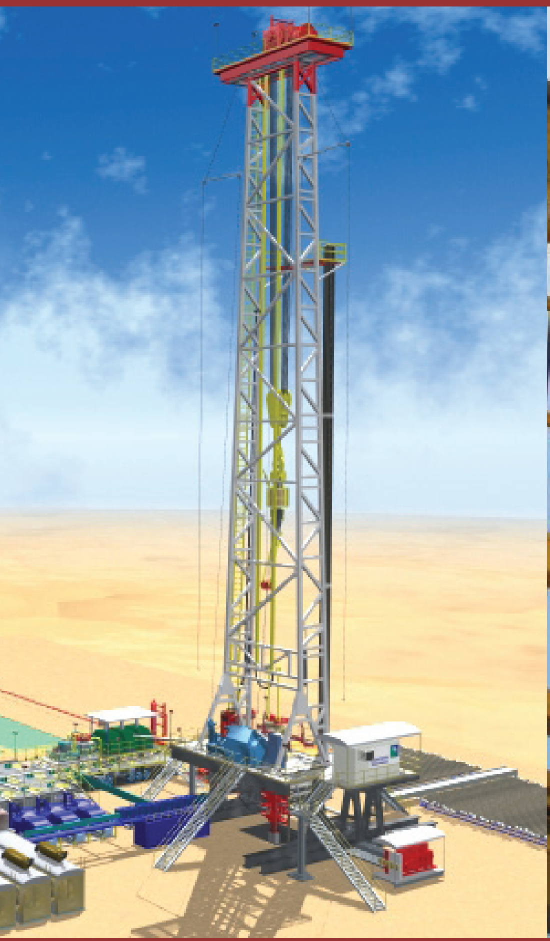
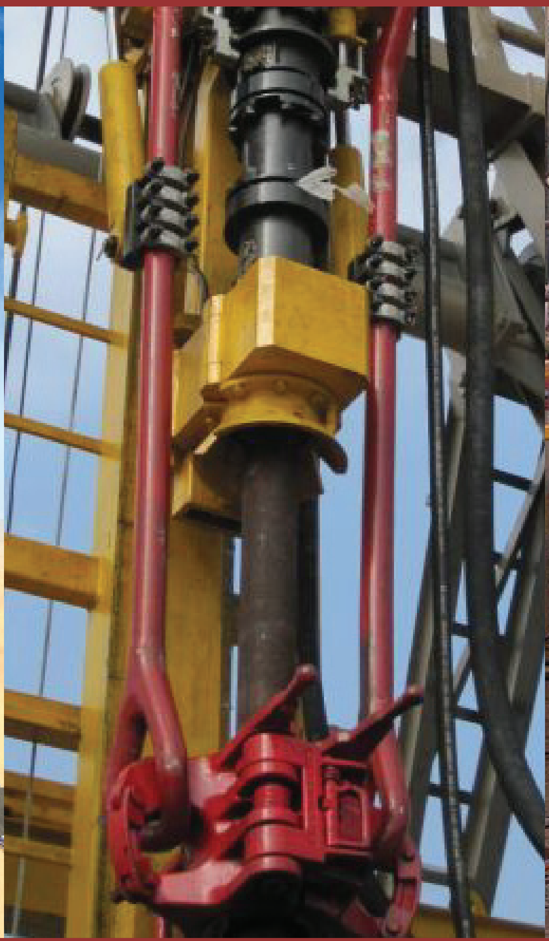
Saudi Aramco

Trainee Handbook

INTRODUCTION TO DRILLING OPERATIONS





Module 4.3

Define the Function of the Blocks, Hook, and Elevators

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Unit 4: State Hoisting System Operating Requirements on a Rotary Drilling Rig

Module 4.3
Define the Function of the Blocks, Hook, and Elevators

INSTRUCTOR GUIDE

Unit 4: State Hoisting System Operating Requirements on a Rotary Drilling Rig

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TRAINEE HANDBOOK

Item	Action	Aid	Time
PREPARATION	Before class, prepare the classroom. Distribute trainee handbooks.	Instructor Guide. Trainee Handbooks.	
INTRODUCTION	Identify and explain the module objectives. Explain new words.	Information Sheets. Glossary. Oil Industry e-Terms Glossary.	1 hr.
OBJECTIVE 4.3.1	Identify types of blocks and sheave design. Have trainees complete the exercise.	Information Sheets, part I. Exercise A.	4 hr.
OBJECTIVE 4.3.2	Identify hook parts and elevator bails, and their purpose. Have trainees complete the exercise.	Information Sheets, part II. Exercise B.	3 hr.
OBJECTIVE 4.3.3	Identify the types of conventional and automated elevators and their purpose. Have trainees complete the exercise.	Information Sheets, part III. Exercise C.	4 hr.
RIG VISIT	Review the function of the main parts of the hoisting system components. Review Rigman maintenance and inspection tasks.	Information Sheets.	4 hr.
REVIEW	Review objectives.	Information Sheets.	1 hr.
WRITTEN TEST	Administer the written test. Score and record the results. Counsel trainees whose performance is unsatisfactory and provide remedial training as required.	Test Sheets. Test Answer Key.	2 hr.
	Estimated time for a class of 8 trainees.		19 hr.

USING THIS MODULE

This module familiarizes trainees with the crown block, traveling block, hook, and elevator components of the rig hoisting system. Trainees learn the function of these components. Use the Saudi Aramco Oil Industry Terms e-Glossary and other online resources to explain new terms or concepts.

The key objectives to emphasize in this module are:

- ❏ function of the crown block, traveling block, and sheaves
- ❏ function and main parts of the hook and elevator bails
- ❏ function of the elevators, and the main differences between conventional and automated elevators

RIG VISIT

Use the training rig as much as possible to show trainees the physical parts discussed in the module and their function. Also use practical demonstrations in place of lectures wherever possible. The information sheets are best seen as reference material for your trainees to review information on the equipment that they have been learning about.

KEY TO EXERCISES

EXERCISE A

1. a. Crown block

   b. Traveling block

2. a. One block is fixed and the other is moving

   b. The crown block has one reave more than the traveling block

3. a. Groove Radius

   b. Tread diameter

4. Both the wire rope and the sides of the sheave's groove wear out quickly.
5. The wire rope flattens.
6. Because large diameter wire rope is less flexible.

EXERCISE B

1. To hang the elevator bails/links.
2. To absorb shocks and hence protect pipe threads.
3. To prevent the swivel or top drive from coming off the hook.
4. It takes less vertical space than the conventional hook and block.
5. If the hook needs repairs, the entire assembly has to be removed.
6. To support the elevator and attach it to the hook.

EXERCISE C

1. a. Bottleneck

   b. Collar-lift
2. a. Center latch

   b. Side door
3. To close the elevator door automatically when loaded.
4. Piping hitting the trigger in the elevator.
5. To handle tubular.
6. To prevent accidental opening of the elevator while lifting piping.
7. Two doors, operated hydraulically.
8. Drives the elevator to different positions.
9. Remotely by the driller through the control system.

Date	Reason
August 2014	First Printing

Enabling Objectives

You will, correctly, and without help, be able to:

4.3.1
Identify types of blocks and sheave design.

4.3.2
Identify hook parts and elevator bails, and their purpose.

4.3.3
Identify the types of conventional and automated elevators and their purpose.

Terminal Objective

Define the function of the blocks, hook, and elevators.

INTRODUCTION

You have learned that the hoisting system consists of drawworks, mast or derrick, crown block, traveling block, and drilling line. The drawworks rotate to ***reel*** in the drilling line and raise the traveling block and drill string. To lower the traveling block, the drawworks rotate in the opposite direction.

In this module you will learn about the two types of blocks and their ***sheaves***. You will also learn about the hook parts and types of elevators.

PART I **OBJECTIVE 4.3.1**

Identify Types of Blocks and Sheave Design

The hoisting system on a rig has two blocks with sheaves. The drilling line loops through these sheaves several times. This system is a common mechanical method to lift heavy weights. In this part you will learn about the blocks and sheave design.

THE BLOCKS

The hoisting system has a crown block and a traveling block. Together they are called "the blocks." Both blocks have sheaves.

Crown Block

The crown block is an assembly of sheaves mounted on a center pin. The center pin is fastened onto steel beams at the top of the derrick. The drilling line is reeved over the sheaves. ***Bearings*** allow the sheaves to rotate as the drawworks reels in or lets out line.

The drilling line transfers rotation of the crown block sheaves to the sheaves on the traveling block. As the drawworks reels in drilling line, the drilling line raises the traveling block. As the driller lets out drilling line from the drawworks, the traveling block is lowered. Figure 1 shows the crown block.

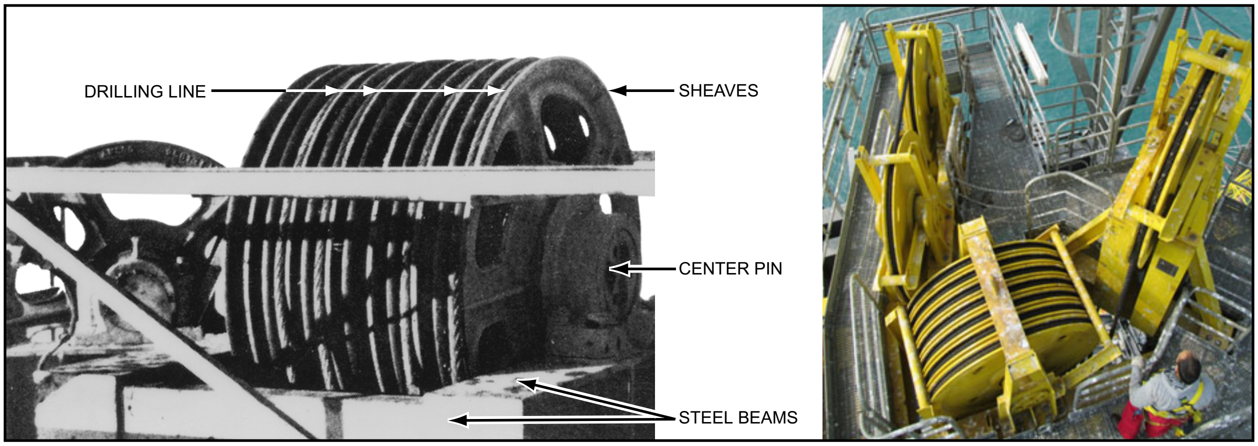

Figure 1
Crown Block

The crown block supports the weight of the traveling block and drill string.

Crown blocks are identified by their load capacity, measured in tons. The capacity depends on the number of sheaves they have, and their diameter. Most crown blocks have four to seven sheaves. The more sheaves they have, the more weight they can support. The drilling line runs several times between the crown block sheaves and the traveling block sheaves. This arrangement can support many times the weight that a single line can support.

Crown block sheaves may be as large as 5 feet in diameter. A larger diameter of the sheaves means that thicker wire-rope can be used. Thicker drilling line means that heavier weight can be lifted.

The crown block always has one sheave more than the traveling block. The drilling line runs from the traveling block over the last sheave to the deadline anchor below the rig floor. On the opposite side of the crown block is the fastline sheave. The moving line from the drawworks runs over this sheave. Figure 2 shows five sheaves on the crown block, and four on the traveling block.

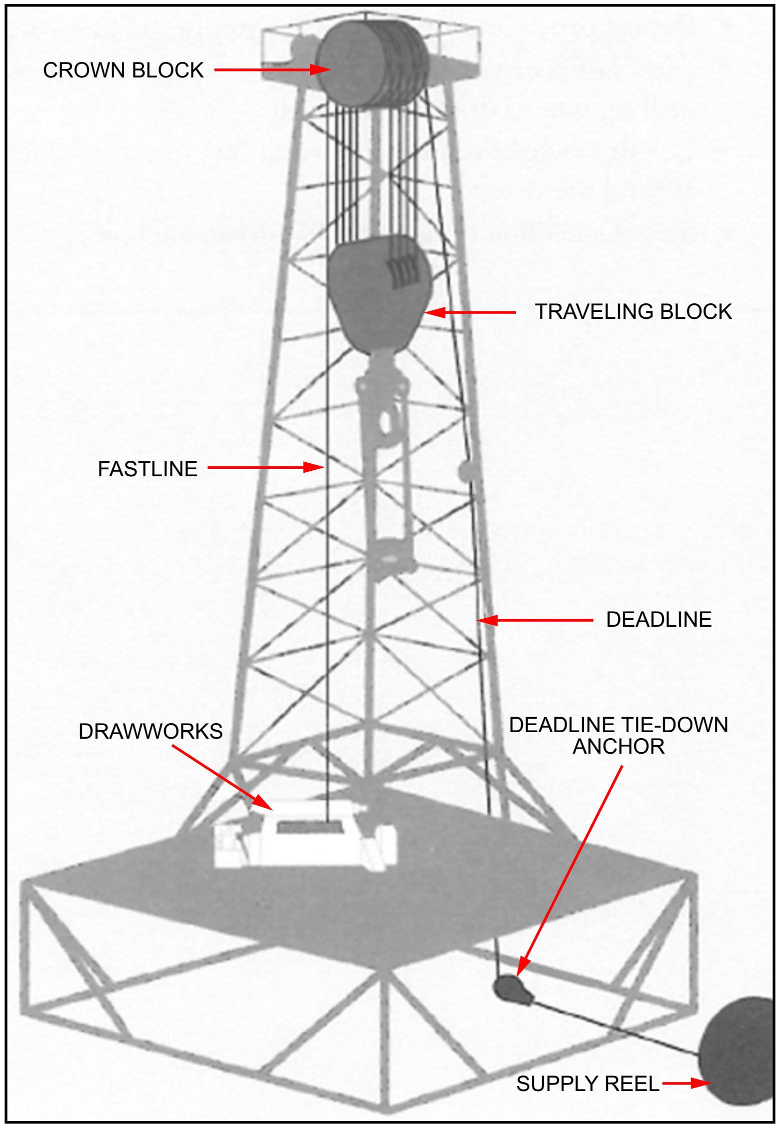

Figure 2
Hoisting System Drilling Lines

Traveling Block

The traveling block has sheaves for the drilling line like the crown block. The sheaves are located within a metal housing for protection as the block travels up and down the derrick. As shown in figure 3, the traveling block also has a hook attached.

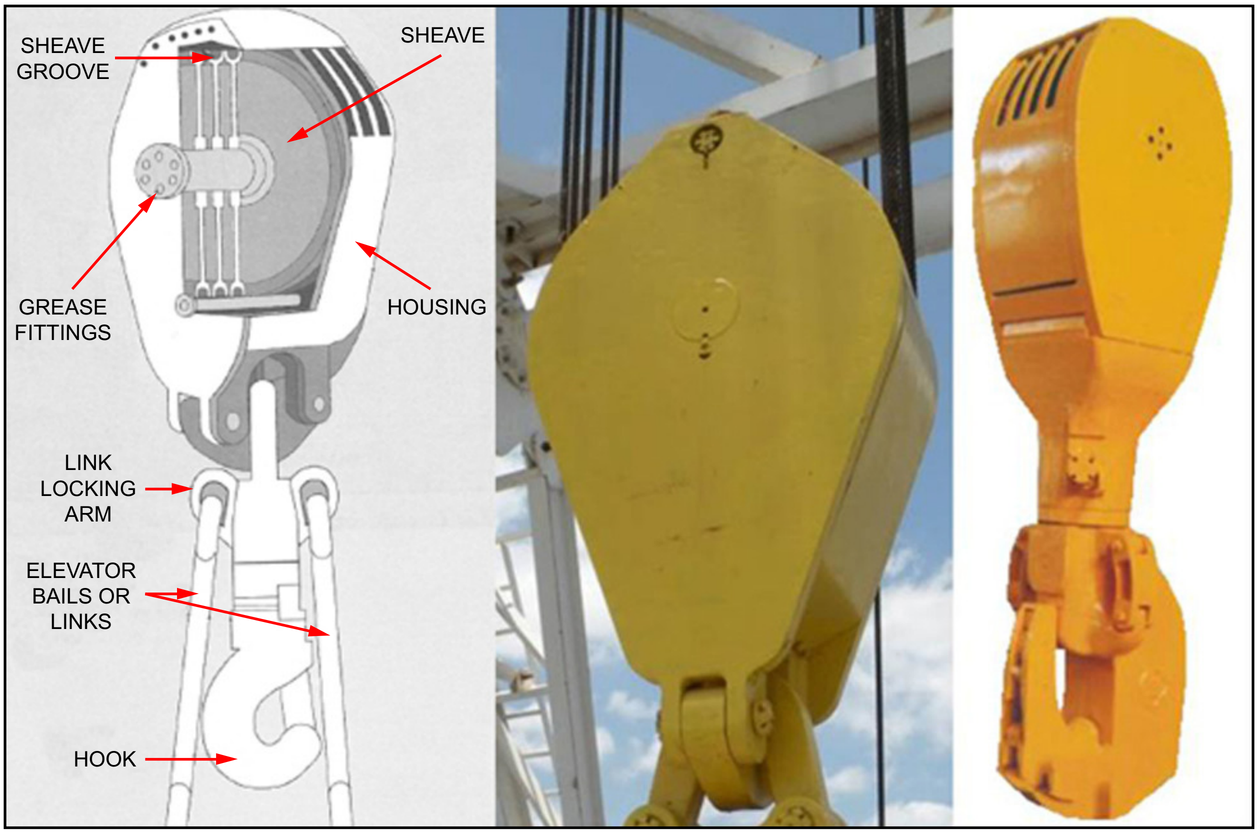

Figure 3
Traveling Block

The drawworks raise and lower the traveling block through the crown block. The drawworks reels in the fastline to raise the traveling block. It reels out line to lower the traveling block. The swivel or top drive is suspended from the hook on the traveling block during drilling. During tripping in and out, the hook suspends the elevators.

The sheaves in the traveling block are the same size as those in the crown block. Like the crown block, the traveling block sheaves also mount on a center pin. Traveling blocks, like crown blocks, are made in many capacities to suit the requirements of different rigs.

Sheaves

Both blocks have sheaves that guide and support the drilling line as it passes through the blocks. The number of sheaves in a block depends on the weight that they must support downhole. A block with more sheaves can support more weight. The actual size of the sheaves is determined by derrick height and the weight that the sheaves must support.

Sheaves are heavy-duty metal disks made of heat-treated or special alloy steel. A grooved edge, or lip, runs around the outside of the disk to guide and hold the wire rope (see figure 4). Sheaves rotate on tapered roller bearings that move around a center pin. The center pin has grease fittings in one or both ends to allow access for lubrication.

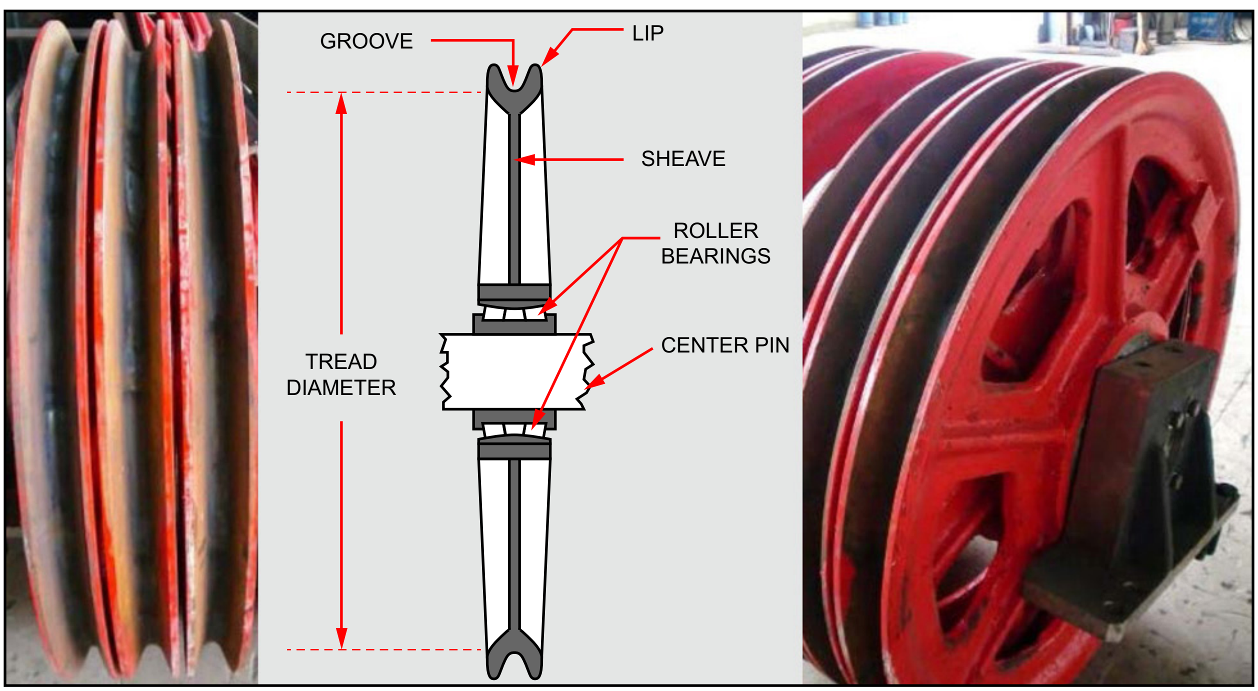

Figure 4
Sheave Construction

There are two sheave design features that determine the drilling line size that can be used. They are:

- ❑ groove radius
- ❑ tread diameter

Groove Radius

Radius is a measurement of the ***groove*** from the center of a circle placed in the groove to the side of the groove. The arrow in figure 5 shows the groove radius measurement. The tool used to measure groove radius is also shown in figure 5.

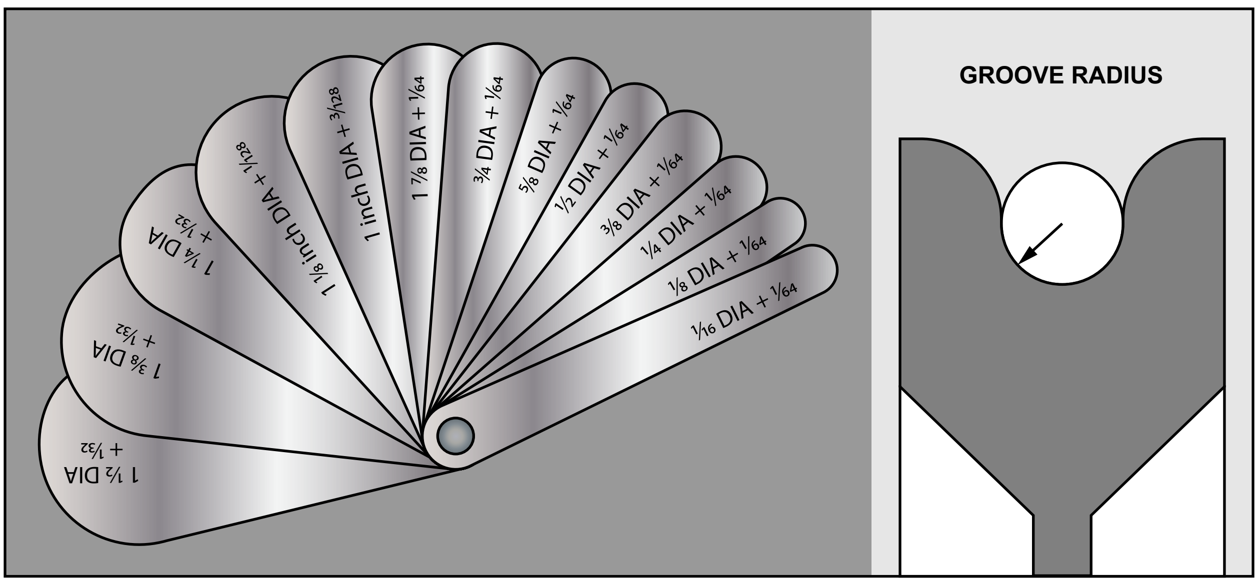

Figure 5
Measuring the Groove Radius

The size or radius of the grooves must be matched to the size of the wire rope reeved through the groove. If the groove radius is too small for the drilling line, both the rope and the sides of the sheave will wear out quickly. If the groove is too big, it will not support the sides of the rope properly. As a result the rope flattens as it passes through the sheave.

Sheave grooves wear with use, even if the right size rope is used. Eventually, their dimensions change as they become worn. Worn sheaves shorten the life of the wire rope. Worn sheaves are sent for re-grooving and reconditioning.

For example, a rig uses a 1 $^{1}/_{4}$-inch drilling line. Manufacturer tables indicate the groove radius must be at least 0.655 inch, but no more than 0.670 inch. If rigmen found the grooves worn beyond the specified maximum radius of 0.670, then the sheaves should be reconditioned.

Rigmen check groove radius regularly. Using the special groove gauge shown in figure 5, they measure the grooves to determine if the sheaves need reconditioning. Manufacturer tables list minimum and maximum groove radius for different wire rope diameters. These tables are used to determine groove radius tolerance.

Tread Diameter

Tread diameter is the measurement of the sheave across its diameter. It is from the bottom of the groove on one side of the sheave to the bottom of the groove on the other side (see figure 4).

Tread diameter determines how much a wire rope has to bend to go around a sheave. The sharper the bend, the greater the stress and wear on the line. A smaller tread diameter will increase wear on the line.

Tread diameter is an especially important factor with large-diameter drilling line (1 $^{1}/_{2}$ inches and larger). Large-diameter line is less flexible than small-diameter line. This means that it will wear quickly if it is constantly running over a smaller tread diameter sheave.

SUMMARY

In this part, you have learned that the term "blocks" refers to both crown and traveling blocks in the derrick. The crown block at the top of the derrick supports the weight of the drilling string, and transfers the movement of the drilling line from the drawworks to the traveling block.

The traveling block moves up and down as the drilling line is reeled in or out of the drawworks. The traveling block has the same diameter sheaves and groove size as the crown block.

You also learned that the groove radius of the sheaves affects wire wear. The tread diameter determines the size of the drilling line that can be used.

EXERCISE A

Directions: *Answer the following questions.*

1. What are the names of the two blocks in a rotary drilling rig?

   a. ______________________________

   b. ______________________________

2. What are the two main differences between the two blocks in a rotary drilling rig?

   a. ______________________________

   b. ______________________________

3. What are the two sheave design features that determine the size of the wire rope?

   a. ______________________________

   b. ______________________________

4. What will happen if the groove radius on the sheaves is too small?

   ____

   ____

   ____

5. What will happen if the sheave groove radius is too large?

____

____

____

6. Why does sheave tread diameter need to be large for large diameter wire rope?

____

____

____

PART II OBJECTIVE 4.3.2

Identify Hook Parts and Elevator Bails and Their Purpose

The hook is a large joining device suspended from the traveling block. Equipment such as the swivel, or top drive, and the elevator bails are suspended from the hook. In this part you will learn about the function of the hook parts.

HOOK PARTS

The hook has the following main parts and features:

- ❑ link locking arms
- ❑ elevator bails (links)
- ❑ positioner
- ❑ shock absorber
- ❑ safety latch
- ❑ flexible pin connection
- ❑ combination hook-block

Link Locking Arms

The hook grasps either a top-drive unit or a swivel during drilling. On rigs that use a swivel and kelly, the hook has two special locking arms. These are used to hang the top of the elevator bails, or links, into each arm. They are then locked in place so they cannot come out (see figure 6). On rigs with a top drive, the elevator links and the elevators are part of the top drive unit.

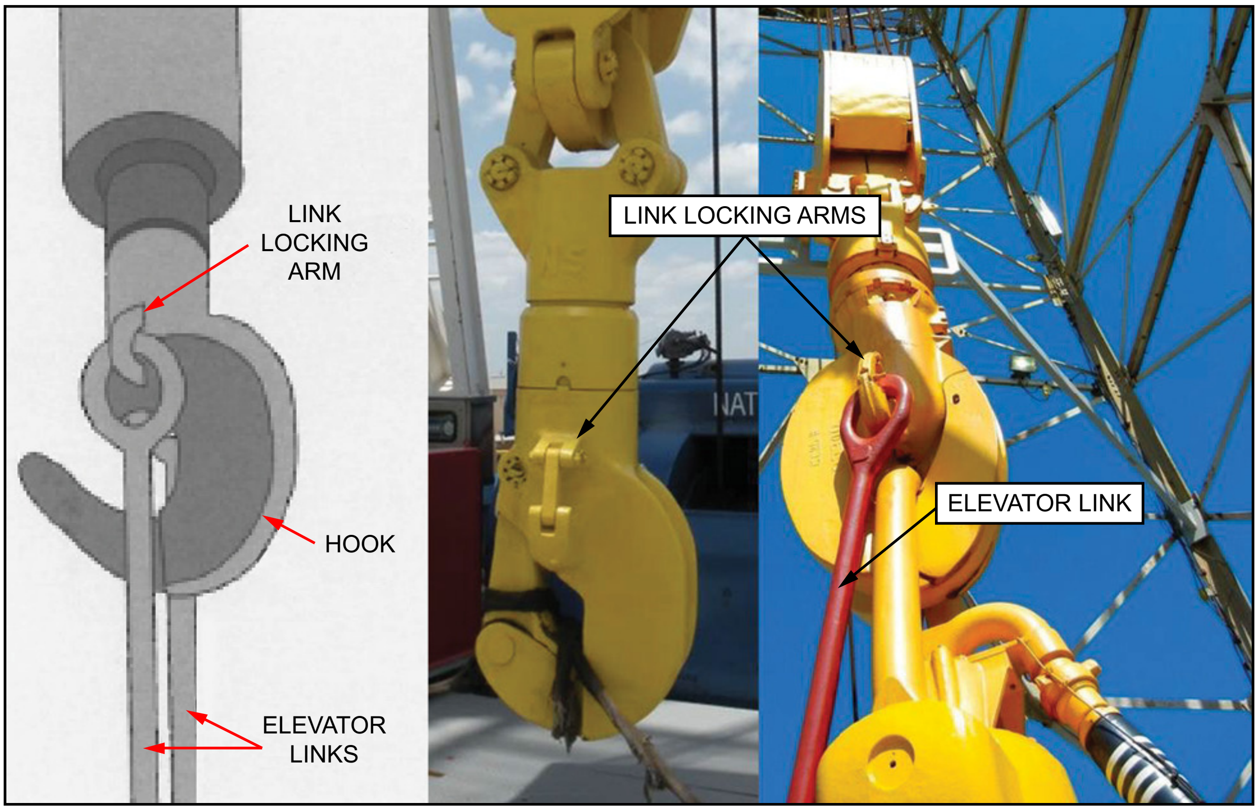

Figure 6
Hook with Link Locking Arms

Elevator Bails (Links)

The elevator bails, or links, are two cylindrical bars that support the elevators and attach them to the hook (see figure 6).

Positioner

Some hooks have a positioner and swivel lock assembly (see figure 7). The positioner allows the hook to rotate on bearings. Rigmen can rotate the hook to the required position and lock it in place.

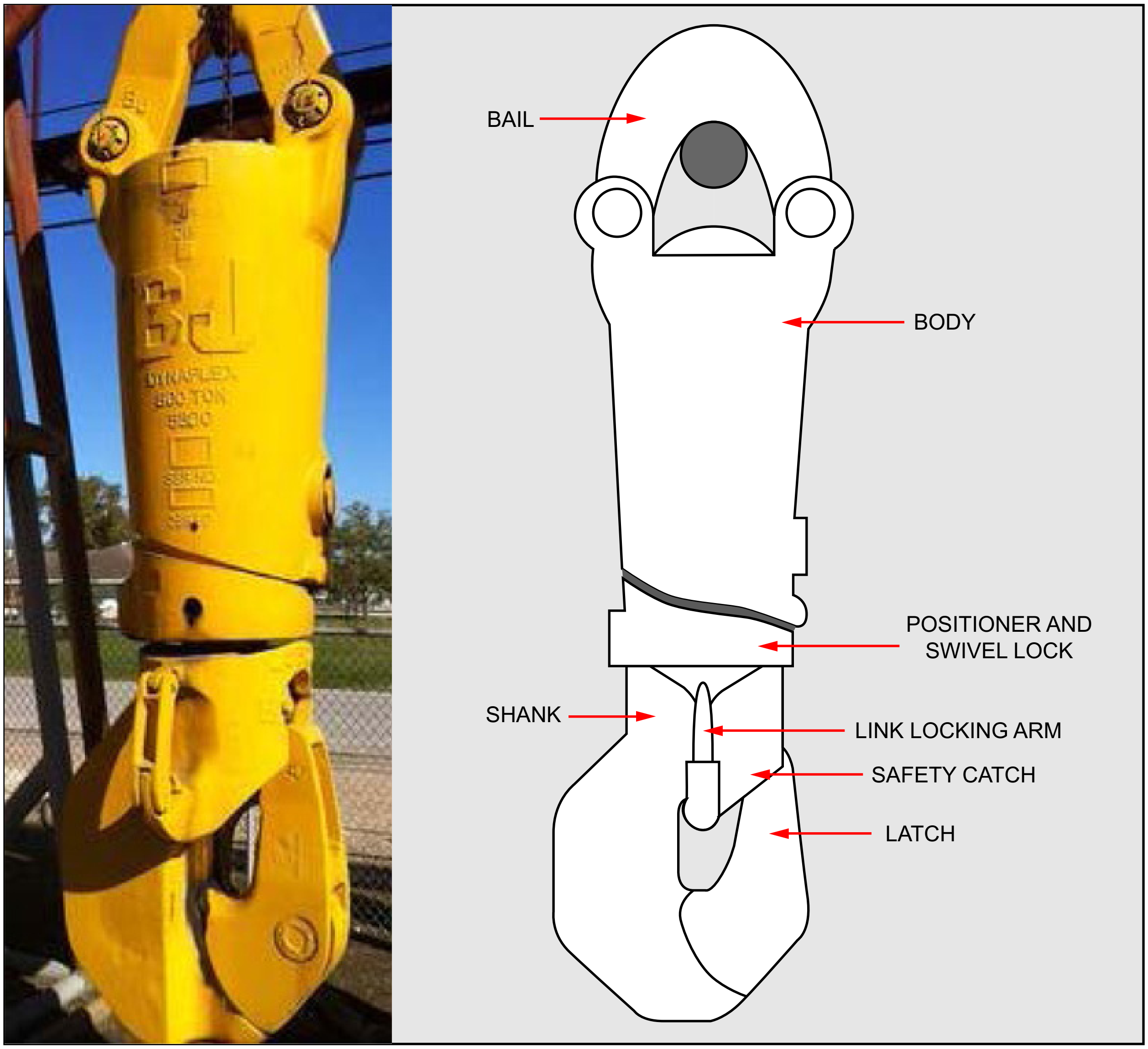

Figure 7
Positioner and Swivel Lock Assembly

Some hooks have an automatic positioner. During trips, when the driller raises the traveling block, the positioner automatically rotates the elevator latches into the correct position. Then the rigman working in the derrick can reach them. It also prevents the hook and the elevator from rotating as the drill string is lowered into the hole.

Shock Absorber

Some hooks have a strong spring inside the body. The spring absorbs much of the bouncing action that occurs when making up and breaking out pipe. This protects the pipe threads by preventing the pipe joints from striking against each other as they are made up or broken out.

Instead of a mechanical spring, some hooks have a hydraulic shock absorber. It uses hydraulic fluid trapped in ***chambers*** to absorb shock.

Safety Latch

The hook has a safety latch to keep the swivel (or the top drive) from coming out of the hook (see figure 7).

Flexible Pin Connection

Some hooks have a pin connecting the hook body to the shank (the top of the hook). This allows for flexible lateral movement. This flexible pin connection keeps the load equal on both elevator links.

Combination Hook-Block

The combination hook-block is a single unit that combines the hook and traveling block (see figure 8). A hook-block takes less vertical space than a conventional hook and block with the same load rating. This is an advantage as it can be used in a medium height derrick or mast.

The combination hook-block is used with some top drives as in figure 8. It suspends the top drive which is attached to the dolly. The whole assembly travels up and down the dolly rails attached to the derrick.

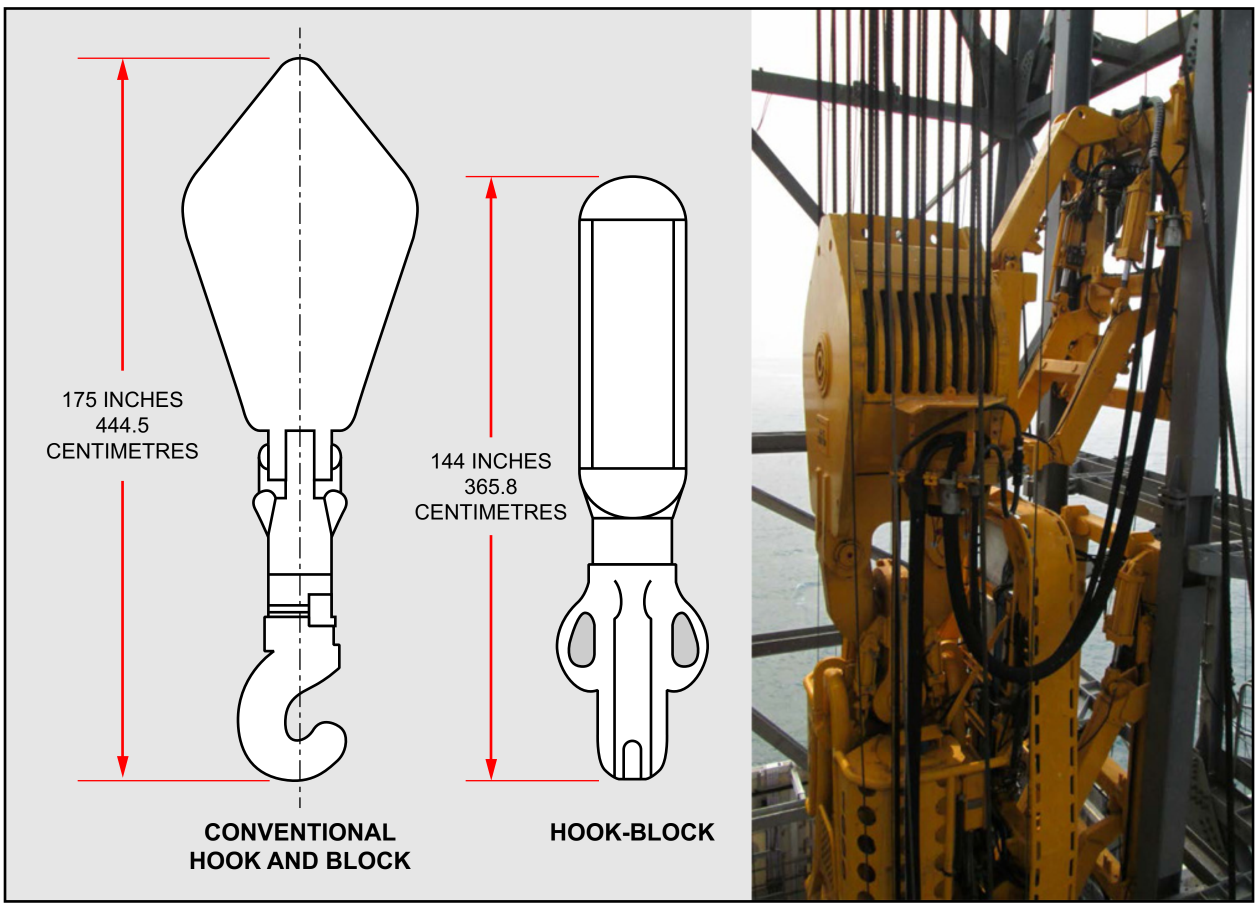

Figure 8
Combination Traveling Block & Hook Compared to Hook-Block

The disadvantage of a combination hook-block is that if the hook needs repair, the entire assembly has to be sent to the shop. With the conventional hook and block, if the hook needs repair, it can simply be replaced with a temporary hook. There is no need to unstring the blocks, and drilling can continue without much delay.

SUMMARY

In this part, you learned about the parts of the hook and their function. Not all the hooks have the same parts or design, but the function of all hooks is to attach the top drive or swivel to the traveling block.

EXERCISE B

Directions: *Answer the following questions.*

1. What is the purpose of the hook link locking arms?

   ____

   ____

   ____

2. What is the purpose of the spring in a hook?

   ____

   ____

   ____

3. What is the purpose of the hook safety latch?

   ____

   ____

   ____

4. What is the advantage of the combination hook-block?

   ____

   ____

   ____

5. What is the disadvantage of the combination hook-block?

____

____

____

6. What is the purpose of the elevator bails?

____

____

____

PART III — OBJECTIVE 4.3.3

Identify the Types of Conventional and Automated Elevators and their Purpose

Elevators are clamps that are used to handle and lift tubular in and out of the hole. There are conventional and automated elevators.

CONVENTIONAL ELEVATORS

Conventional elevators are used in conventional rigs and are manually operated. They have no hydraulic power assisted ***mechanism***. The elevator attaches to the hook or the top drive by the elevator bails or links. The elevator latches onto and grips tubular so that the traveling block can raise or lower the tubular out of or into the hole.

Rigmen working on the rig floor while the elevators are being used, must close the elevators and make sure they are latched around the pipe.

CAUTION
With any type of elevator, it must be ensured that it is properly latched before picking up any tubular. Pipe coming free of the elevator as it is being lifted can cause serious harm.

To be able to latch and grip, elevators have two basic designs. There are also two types of latches.

Elevator Designs

The two basic types of elevator designs are bottleneck and collar-lift.

Bottleneck

The box-end, or top, tool joint of most drill pipe has an 18-degree ***taper*** on the shoulder, as shown in figure 9.

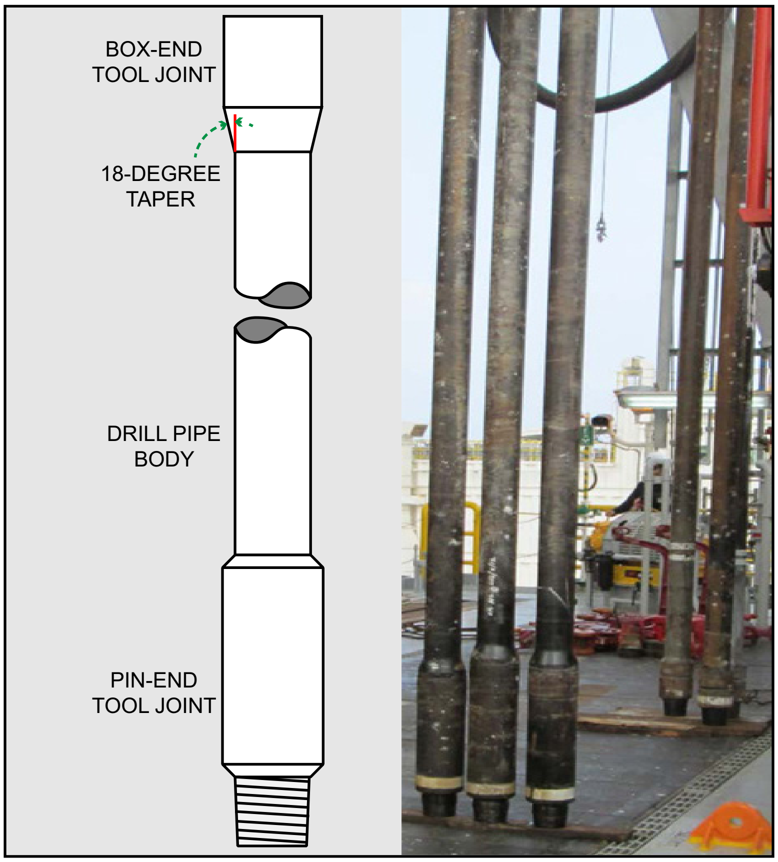

Figure 9
Drill Pipe with 18 Degree Taper

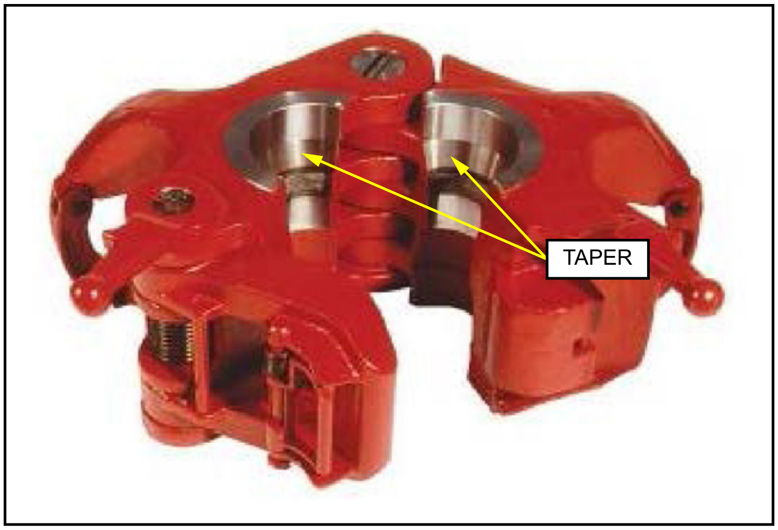

Figure 10
Bottleneck Elevator

This taper helps reduce the risk of the tool joint getting stuck in the hole. Bottleneck elevators have a matching taper on the inside. This allows them to lift the pipe by the tool joint when they are latched on. Figure 10 shows the taper on a set of bottleneck elevators.

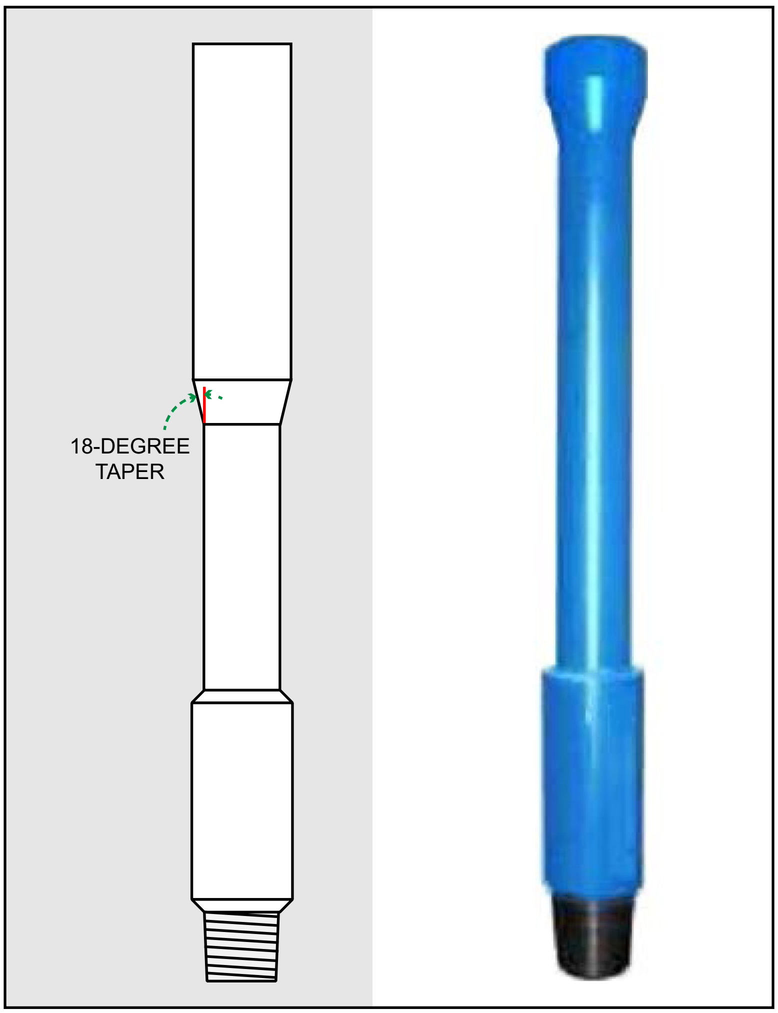

Figure 11
Drill Collar Lifting Sub

Drill collars, unlike drill pipe, are heavy-walled joints of pipe. They are used on the bottom of the string because they are stiff and heavy. Drill collars do not have a taper machined on the outer wall. To lift drill collars, a lifting sub with 18-degree taper is attached onto the top of the drill collar (see figure 11). Bottleneck elevators can then latch on to the sub to lift the collar.

Collar-Lift Elevators

A few drill pipes have a square shoulder on the tool joint box. Because this tool joint has a 90° angle instead of a taper, it requires an elevator that is bored differently from the bottleneck elevator. The collar-lift, or square-shoulder, elevator is machined inside to match the shape of the square shoulders of the tool joint. Figure 12 shows a set of collar-lift elevators.

Do not confuse the term "collar" in collar-lift elevators with drill collars. It has nothing to do with drill collars. Collar-lift elevators are not used to handle drill collars.

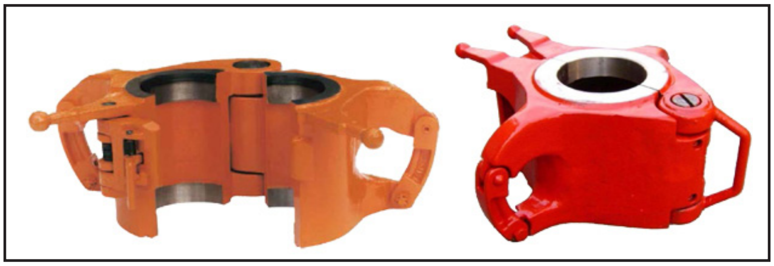

Figure 12
Center-Latch Collar-Lift Elevator

Elevator Latches

Elevator latches come in a number of types and variety of features, but mainly they feature center-latch and side-door types.

Collar-lift and bottleneck elevators are commonly available in a center-latch variety, which opens in the middle (as shown in figure 12), and a side-door type, which opens from one side (see figure 13).

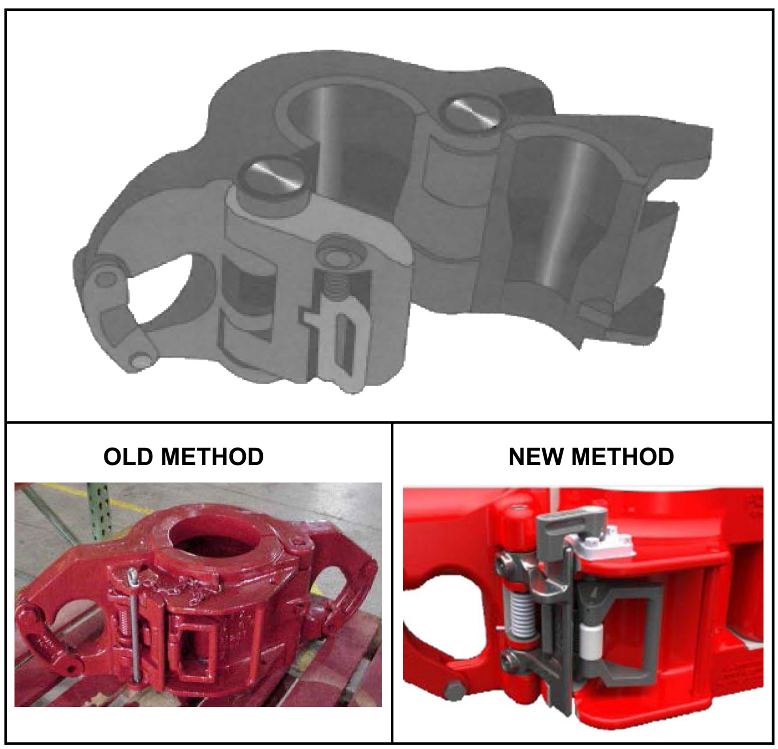

Figure 13
Side-Door Elevator Latch, 18 Degree Type

One type of center-latch elevator has a slanted hinge pin, as shown in figure 14. The purpose of the slanted hinge pin is to automatically close the elevator as it bears (takes) weight. This type of elevator also has a spring that forces the unlatched elevator open, ready to accept pipe.

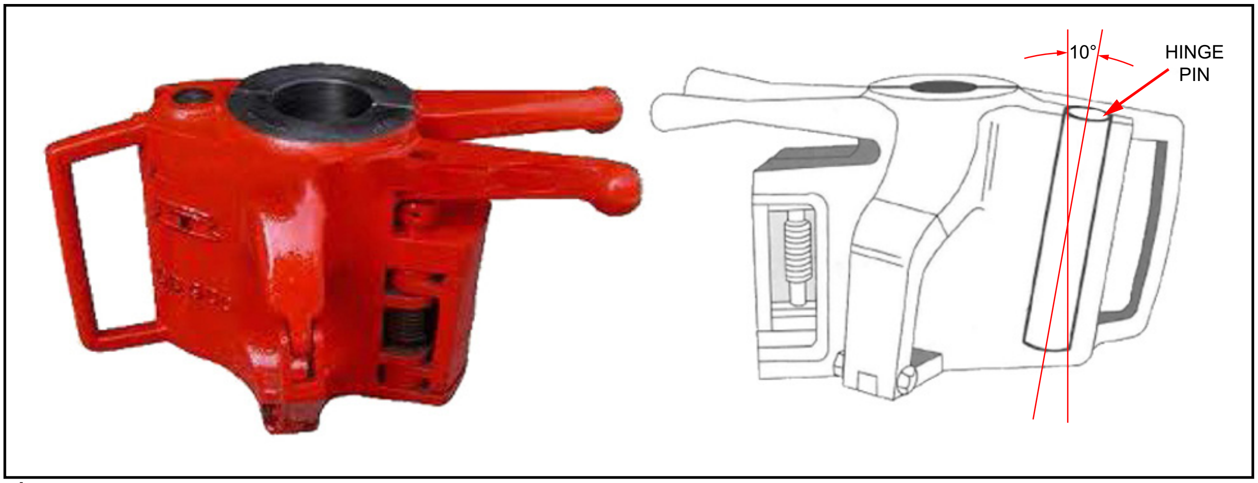

Figure 14
Center-Latch Elevator with Slanted Hinge Pin

AUTOMATED ELEVATORS

These are hydraulically operated double door elevators, powered by the hydraulic power unit (HPU). They are used with automated top drives and attached by bails, or elevator links, to the top drive, as shown in figure 15.

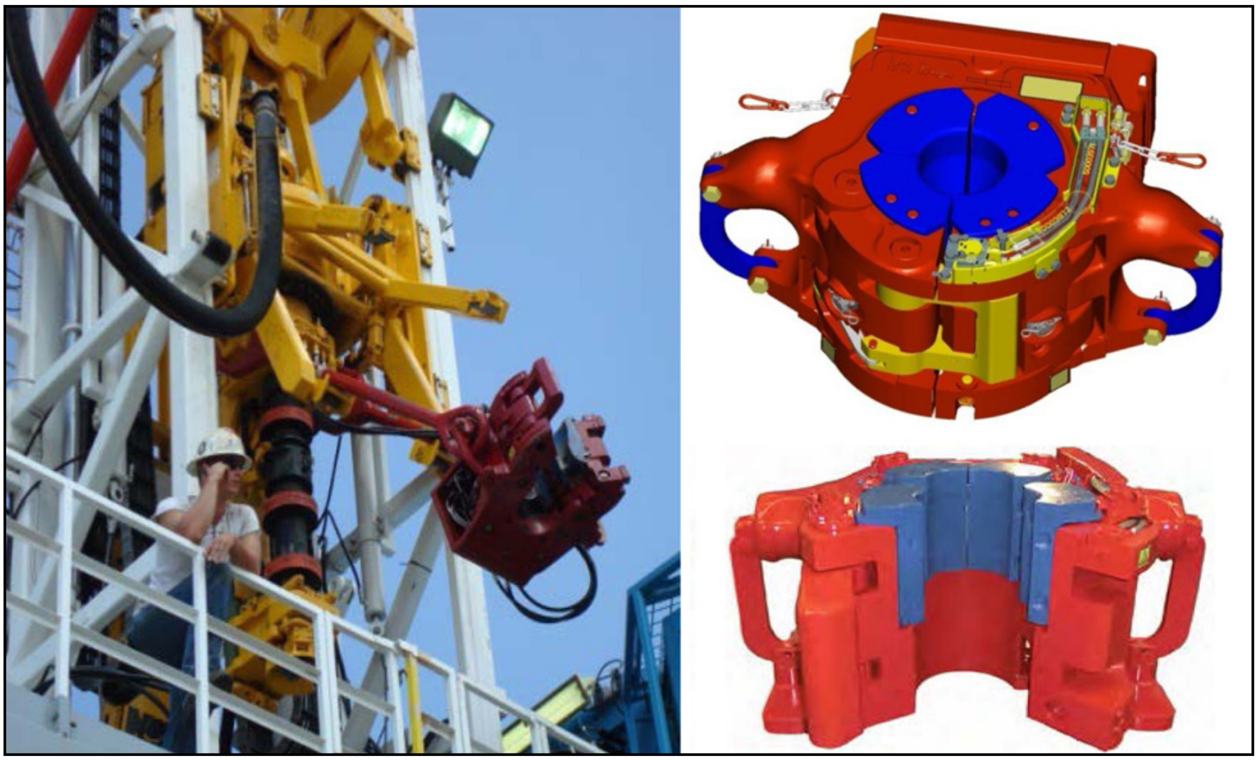

Figure 15
Automated Elevator

The automated elevator models used on Saudi Aramco automated rigs are all the same basic design. They perform the same function as the conventional elevators. They handle different types of tubular for different operations. They are usually supported by a link tilt mechanism. Figure 16 shows that the link tilt mechanism is able to set the elevator to different positions on both sides of the top drive.

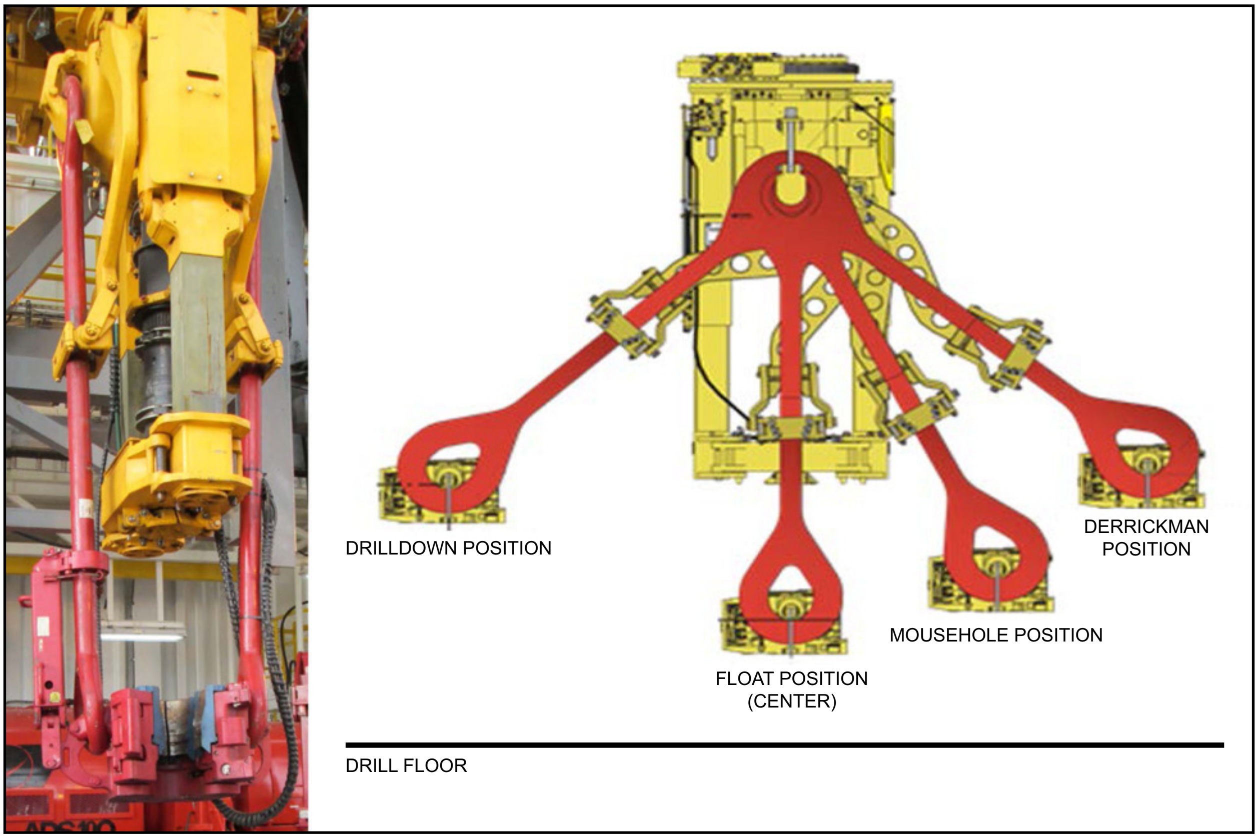

Figure 16
Elevator Link Tilt Positions

A main feature of automated elevators, compared to conventional elevators, is that they can be latched and un-latched from the driller's console. Automated elevators also close automatically when the pipe hits the body bushing.

The automated elevators used on Saudi Aramco rigs have the following main parts. The assemblies and systems are shown in figure 17.

- doors
- door and latch hinge pins
- bushings
- hydraulic manifold
- control system

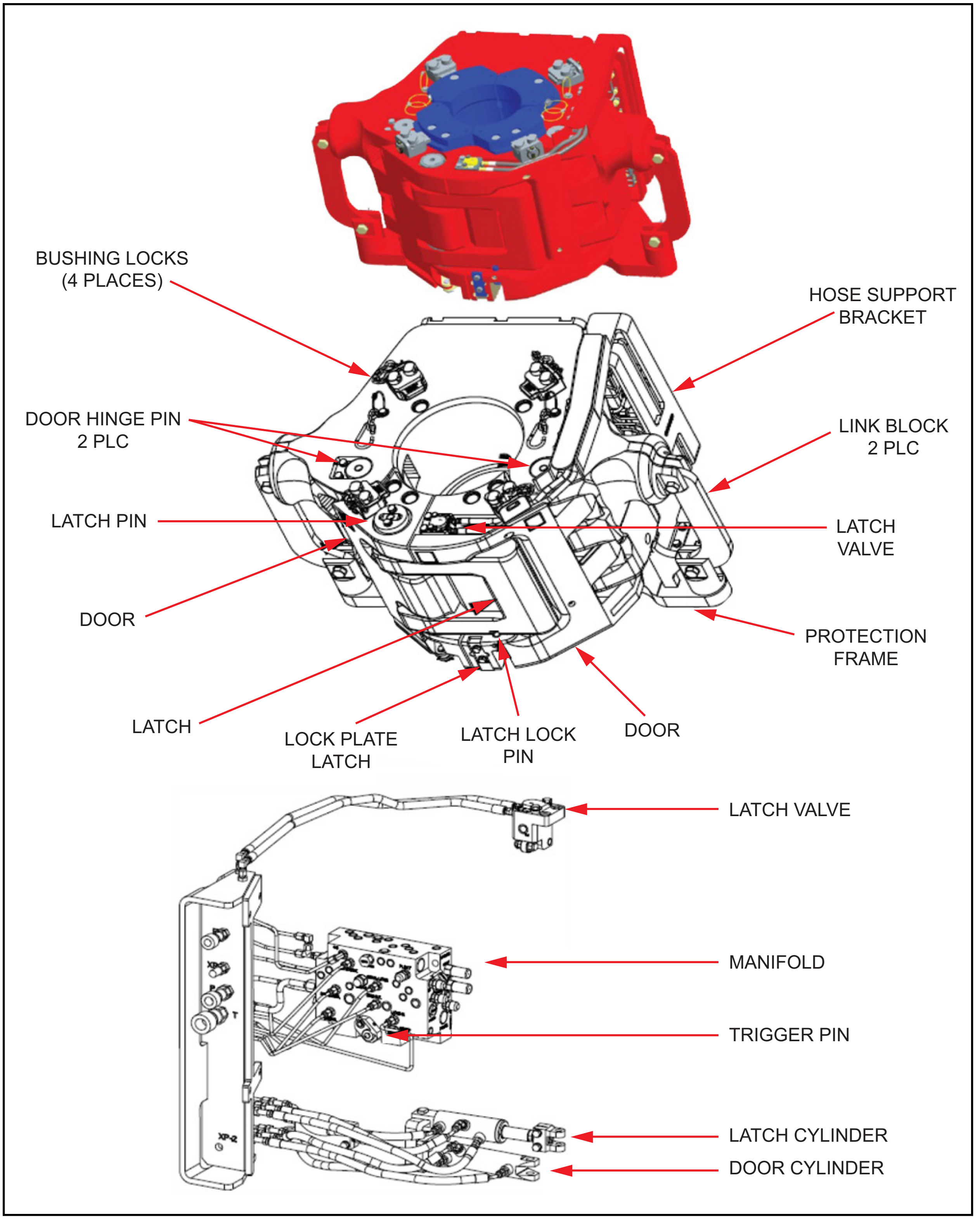

Figure 17
Automated Elevator Main Parts

Doors

The elevator doors can be in one of three statuses:

- open
- closed and latched
- locked

Open

The elevator doors are opened so they can receive pipe. The open elevator doors close only when a trigger is hit by a pipe. This will start the closing cycle. The trigger mechanism bushing lies behind the back segments, directly in the middle of the elevator body (see figure 18).

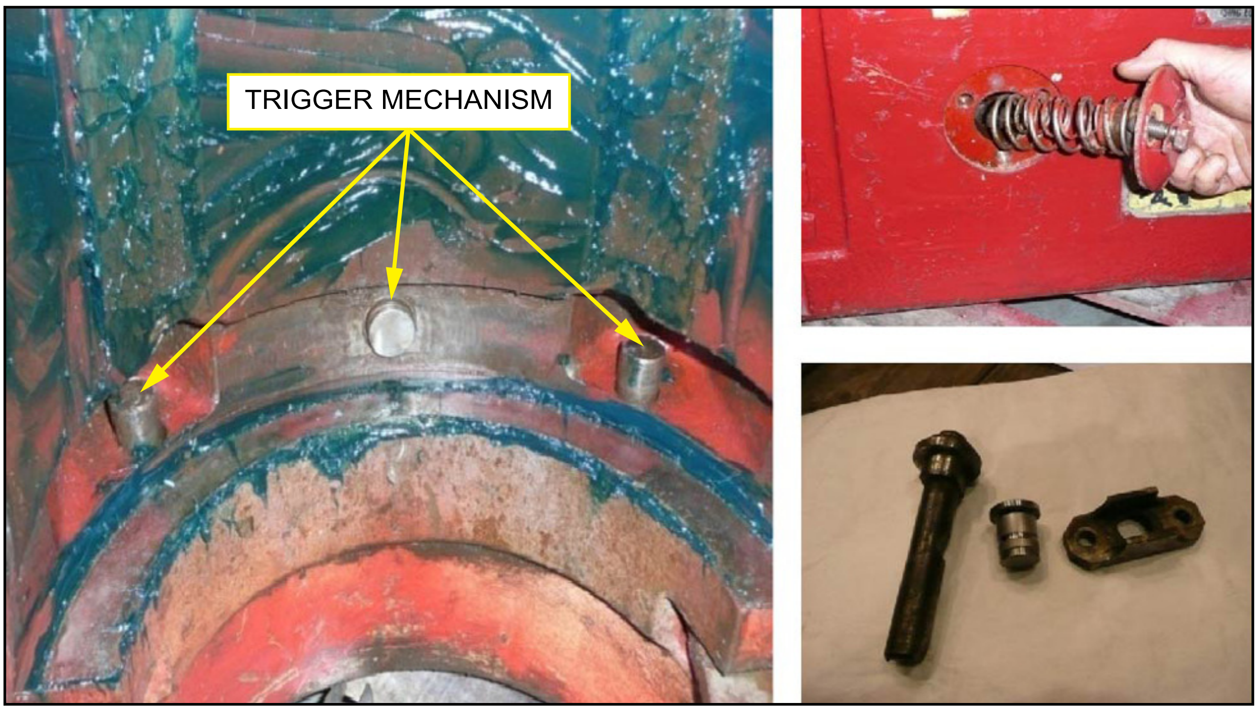

Figure 18
Trigger Mechanism Bushing and Parts

Closed and Latched

The trigger mechanism triggers the doors and latch cylinders to start the closing cycle. The doors and latch operate from a mechanism attached to both ends of a single cylinder which opens and closes them together (see figure 19).

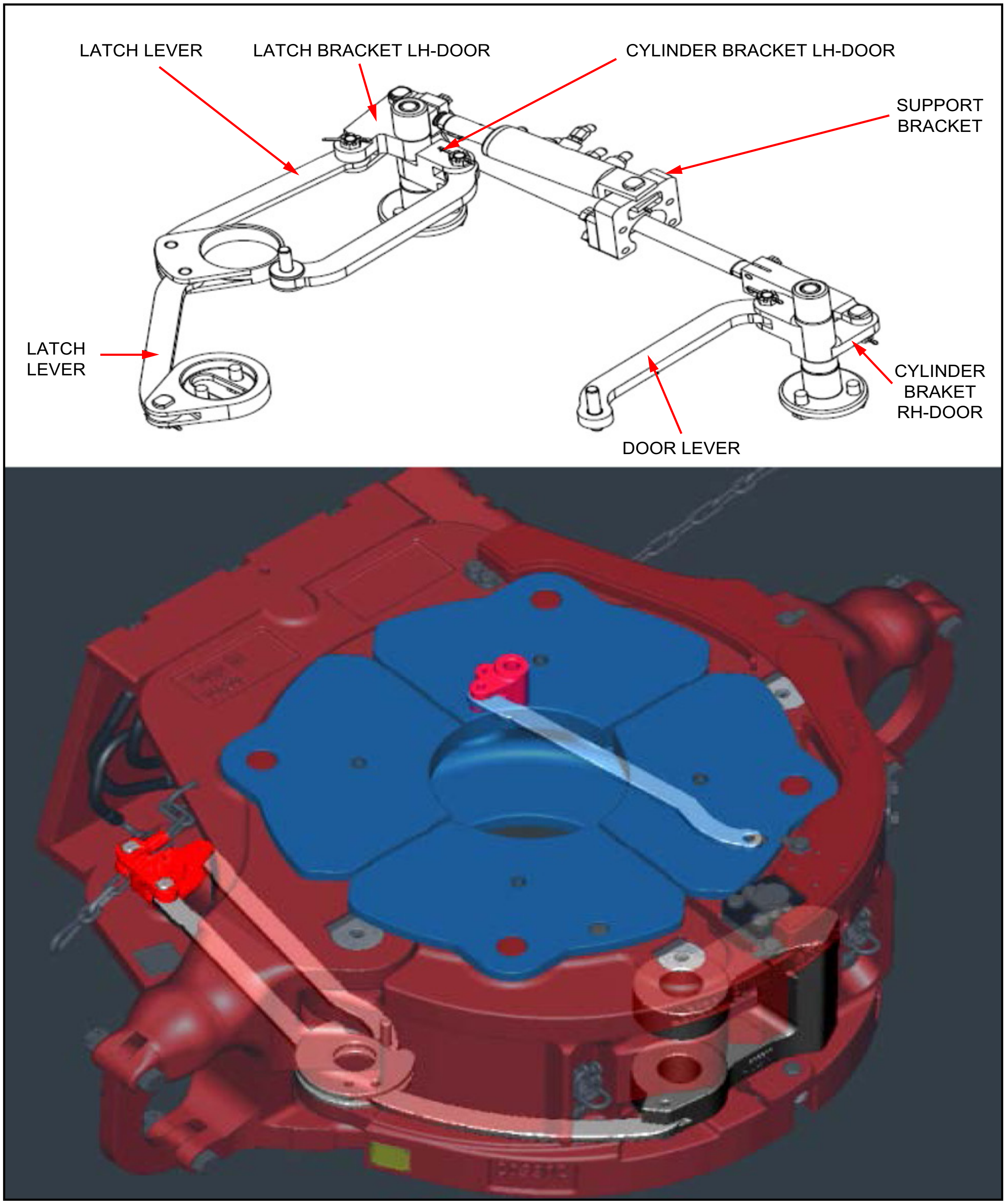

Figure 19
Doors and Latch Mechanism

These mechanisms pivot on the doors and latch pins. When the latch is properly closed, the latch cylinder (see figure 20) signal port sends a signal to the driller's control screen. This "Elevator Closed and Latched" signal informs the driller that the latch is closed.

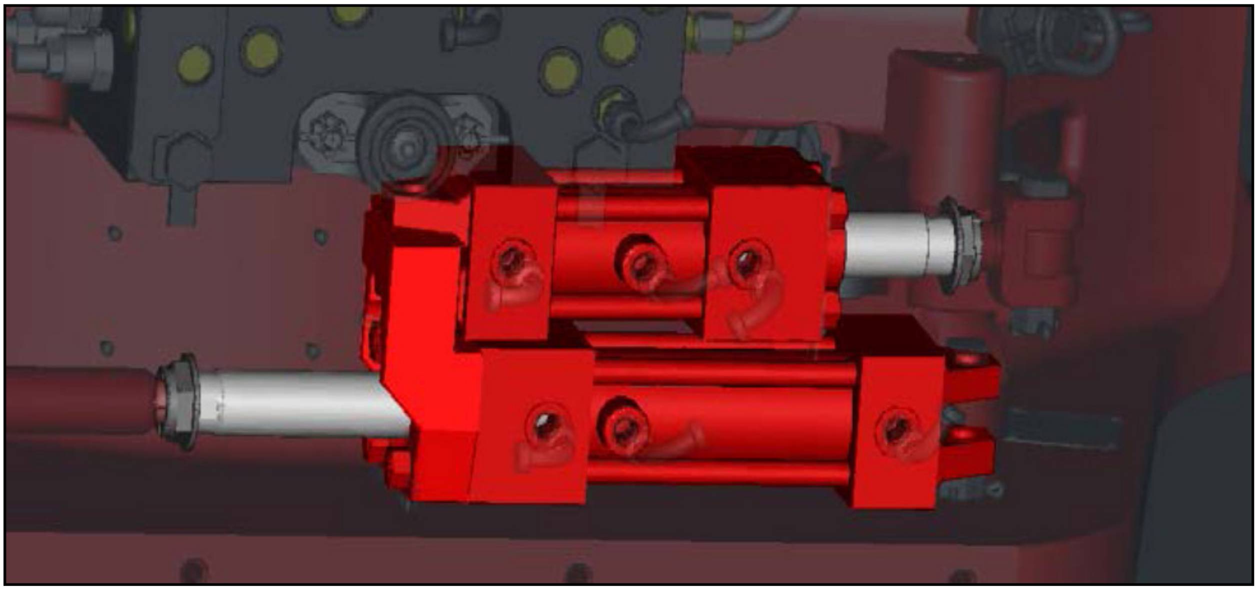

Figure 20
Latch and Doors Cylinders

Locked

A latch lock mechanism locks the elevator. The latch lock engages after the latch is closed and weight is applied. When the elevator starts lifting, the spring loaded bushing in the door is pushed down. This activates the mechanical latch lock to prevent the elevator from opening while lifting load. As long as the elevator is bearing weight, the latch cannot be opened. Figure 21 shows the latch lock mechanism.

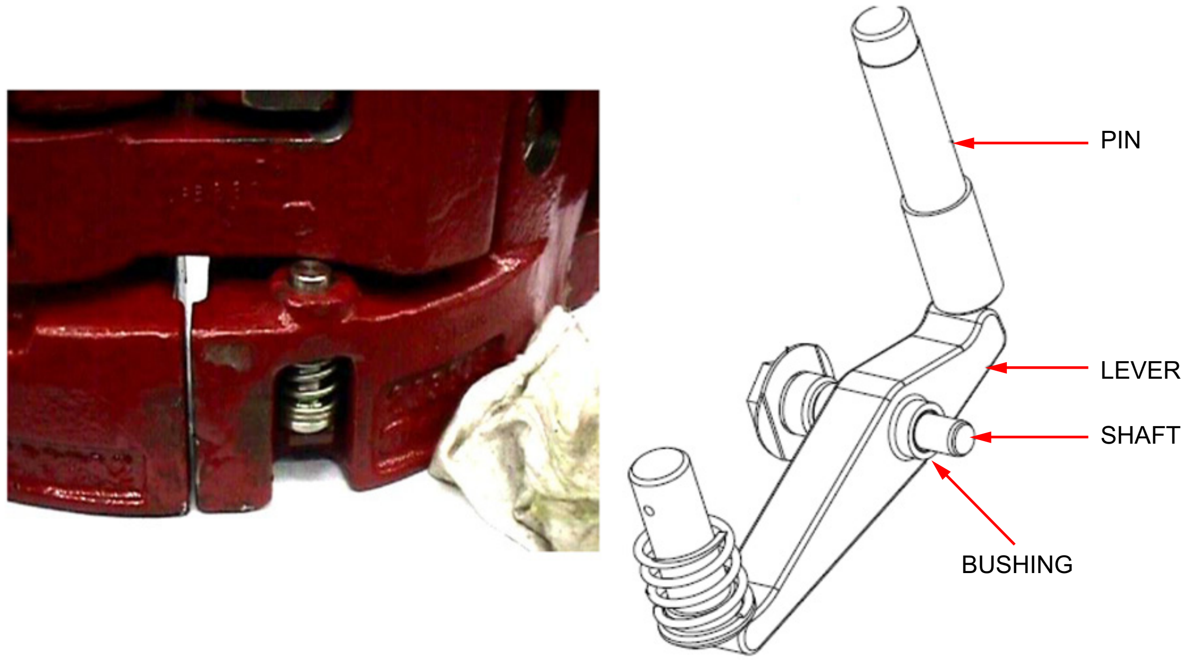

Figure 21
Latch Lock

Door and Latch Hinge Pins

Doors and latch pins act as pivots for the doors and latch and for their mechanisms. There is a grease fitting on top of the pin, and multiple ports for grease to discharge onto the bushings. Figure 22 shows the pins.

Figure 22
Doors and Latch Hinge Pins

Bushings

Most automated elevators are equipped with changeable bushings, or segments. Changeable bushings allow one elevator frame to handle all pipe sizes and type requirements. Bushings are locked into place with spring loaded pins. Figure 23 shows an example of bushings.

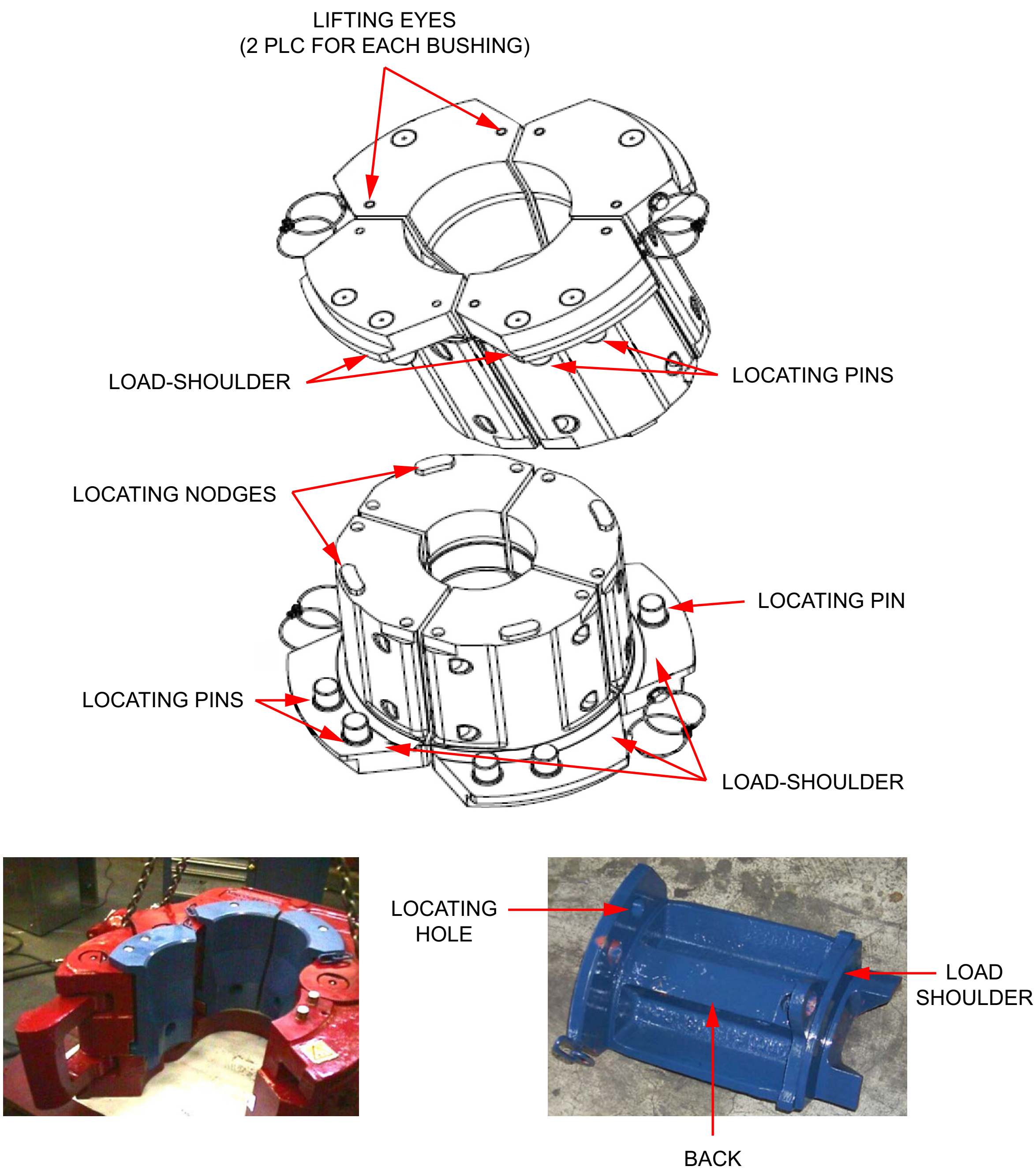

Figure 23
Elevator Bushings (Segments)

Hydraulic Manifold

The hydraulic manifold receives hydraulic pressure and directs fluid to the relevant parts. Functions such as open and close, and the pressure signal that confirms the elevator is closed, require hydraulic pressure to operate. The manifold is shown in figure 24.

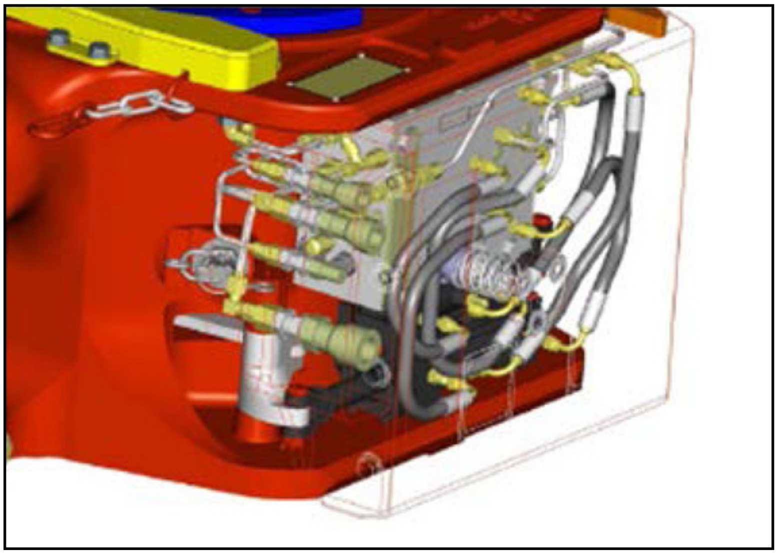

Figure 24
Hydraulic Manifold

Control System

The automated elevator is controlled through the Amphion automation control system. In this system, the elevator status and control functions are displayed on the interface screen as shown in figure 25. Only the driller or assistant driller operates the automated elevator.

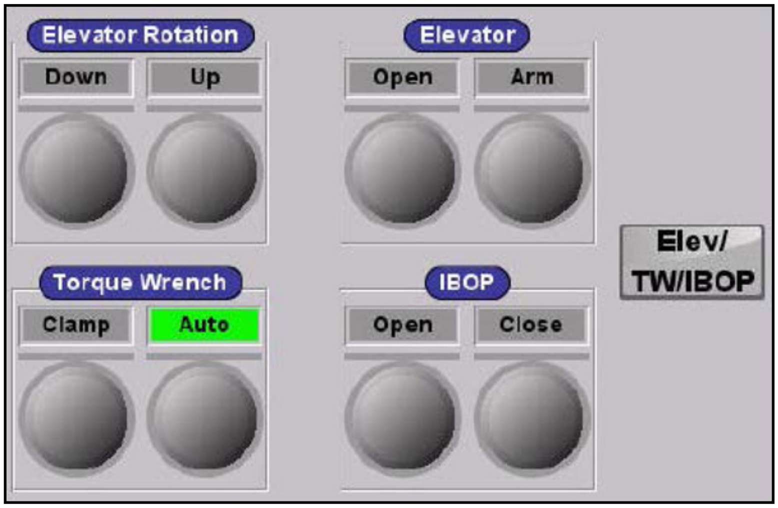

Figure 25
Automated Elevator Control Screen

SUMMARY

In this part, you have learned about conventional and automated elevators. You now know conventional elevators are manually operated to open and close the doors and latches. These elevators have two basic designs; bottleneck and collar-lift. There are also two types of latches; center-latch and side-door.

You have learned about the parts of an automated elevator, and their function. You now know that automated elevators are hydraulically powered and that they are used with top drive systems. They are suspended from the top drive to pick up piping, and controlled through the rig's automation control system by the driller or assistant driller.

EXERCISE C

Directions: *Answer the following questions.*

1. What are the two basic designs of conventional elevators?

    a. ______________________________

    b. ______________________________

2. What are the two types of conventional elevator latches?

    a. ______________________________

    b. ______________________________

3. What is the purpose of the slanted hinge pin in a conventional elevator?

    ____

    ____

4. What causes the automated elevator doors to close automatically?

    ____

    ____

5. What is the function of either the conventional or automated elevator?

    ____

    ____

6. What is the purpose of the lock latch mechanism?

____

____

7. How many doors does an automated elevator have, and how are they operated?

____

____

8. What is the purpose of the elevator link tilt?

____

____

9. How are the automated elevator doors opened?

____

____

Bearing
A machine part which allows another part to turn or slide.

Chamber
A small space inside something.

Groove
A long, narrow cut or channel in a surface.

Mechanism
A mechanical part or group of parts having a particular function.

Radius
A straight line from the center of a circle or sphere to any point on the outer edge.

Reel
To pull in, or let out something by turning a reel or winch.

Sheave
A wheel with a groove for a rope to run on, as in a pulley block.

Taper
To become gradually smaller toward one end.

MAXIMUM: 100

OBJECTIVE 4.3.1

Directions: *For questions 1 through 5, select the correct answer. (10 points each)*

1. The ______________ block is mounted at the top of the derrick.

   a. crown

   b. traveling

   c. elevator

   d. hook

3. The weight that a block can support depends on the number of __________.

   a. grease fittings

   b. elevators

   c. hooks

   d. drilling lines

5. Rigmen check the ______________ on the sheaves regularly, using a special gauge.

   a. tread diameter

   b. height

   c. rotation speed

   d. groove radius

2. The ______________ block is raised and lowered by the drawworks.

   a. hydraulic

   b. crown

   c. traveling

   d. flying

4. The groove radius and tread diameter of the sheave determine the size of ______________ that can be used.

   a. drill pipe

   b. drilling line

   c. drill bit

   d. drill collar

OBJECTIVE 4.3.2

Directions: *For questions 6 through 10, select the correct answer. (5 points each)*

6. The ______________ on a hook are used to hang the elevator bails.

   a. combination hook block

   b. link locking arms

   c. shock absorbers

   d. traveling block

7. The ______________ and swivel assembly on a hook allow the hook to be rotated.

   a. link locking arms

   b. elevator

   c. safety latch

   d. positioner

8. A combination hook-block has the advantage of taking up ______________ than a conventional hook and block.

   a. less space

   b. more space

   c. less weight

   d. more weight

9. The hook is a large curved device suspended from the ______________.

   a. elevators

   b. drawworks

   c. traveling block

   d. air hoist

10. The ______________ in a hook prevents thread damage as connections are made up or broken out.

    a. safety latch

    b. elevator links

    c. shock absorber

    d. flexible pin connection

OBJECTIVE 4.3.3

Directions: *For questions 11 through 15, select the correct answer. (5 points each)*

11. The two basic designs of conventional elevators are the ________________ and collar-lift.

    a. bottleneck

    b. taper-neck

    c. goose-neck

    d. roughneck

12. Collar-lift elevators are designed to lift tool joints with a ________________ shoulder.

    a. tapered

    b. smooth

    c. round

    d. square

13. The purpose of the slanted ______________ in a center-latch elevator is to automatically close the elevator doors as it bears weight.

    a. collar-lift

    b. bushings

    c. hinge pin

    d. manifold

14. An advantage of automated elevators is that they can be controlled from the ________________.

    a. driller's console

    b. crown block

    c. stabbing board

    d. catwalk

15. Changeable ________________ on automated elevators allow the same elevator frame to handle all pipe sizes.

    a. center-latches

    b. collars

    c. bushings

    d. latch pins

Trainee name		Badge No.		Date		Score	

MAXIMUM: 100

OBJECTIVE 4.3.1

Directions: *For questions 1 through 5, select the correct answer. (10 points each)*

1. The ______________ block is mounted at the top of the derrick.

   a. crown

   b. traveling

   c. elevator

   d. hook

2. The ______________ block is raised and lowered by the drawworks.

   a. hydraulic

   b. crown

   c. traveling

   d. flying

3. The weight that a block can support depends on the number of __________.

   a. grease fittings

   b. elevators

   c. hooks

   d. drilling lines

4. The groove radius and tread diameter of the sheave determine the size of ______________ that can be used.

   a. drill pipe

   b. drilling line

   c. drill bit

   d. drill collar

5. Rigmen check the ______________ on the sheaves regularly, using a special gauge.

   a. tread diameter

   b. height

   c. rotation speed

   d. groove radius

OBJECTIVE 4.3.2

Directions: *For questions 6 through 10, select the correct answer. (5 points each)*

6. The ______________ on a hook are used to hang the elevator bails.

   a. combination hook block
   b. link locking arms
   c. shock absorbers
   d. traveling block

8. A combination hook-block has the advantage of taking up ______________ than a conventional hook and block.

   a. less space
   b. more space
   c. less weight
   d. more weight

10. The ______________ in a hook prevents thread damage as connections are made up or broken out.

   a. safety latch
   b. elevator links
   c. shock absorber
   d. flexible pin connection

7. The ______________ and swivel assembly on a hook allow the hook to be rotated.

   a. link locking arms
   b. elevator
   c. safety latch
   d. positioner

9. The hook is a large curved device suspended from the ______________.

   a. elevators
   b. drawworks
   c. traveling block
   d. air hoist

OBJECTIVE 4.3.3

Directions: *For questions 11 through 15, select the correct answer. (5 points each)*

11. The two basic designs of conventional elevators are the ________________ and collar-lift.

    a. bottleneck

    b. taper-neck

    c. goose-neck

    d. roughneck

12. Collar-lift elevators are designed to lift tool joints with a ________________ shoulder.

    a. tapered

    b. smooth

    c. round

    d. square

13. The purpose of the slanted ______________ in a center-latch elevator is to automatically close the elevator doors as it bears weight.

    a. collar-lift

    b. bushings

    c. hinge pin

    d. manifold

14. An advantage of automated elevators is that they can be controlled from the ________________.

    a. driller's console

    b. crown block

    c. stabbing board

    d. catwalk

15. Changeable ________________ on automated elevators allow the same elevator frame to handle all pipe sizes.

    a. center-latches

    b. collars

    c. bushings

    d. latch pins