







Participant Handbook

Sector

Infrastructure Equipment

Sub-Sector

Equipment Operations

Occupation

Operator

Reference ID: IES/Q0102, Version 2.0

NSQF Level 3



Junior Backhoe Operator

Edition, September 2022

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Skilling is building a better India.

If we have to move India towards development then Skill Development should be our mission.



Shri Narendra Modi Prime Minister of India

Acknowledgements

This Participater Guide has been developed with the efforts of all the stakeholders in the industry; equipment manufacturers, customers/end users as well as training organisations who are proactively involved in this pioneering project to transform the skill landscape in the infrastructure equipment sector.

We wish to acknowledge with gratitude the following organisations who whole heartedly supported us with their technical inputs as well as valuable feedback at different stages in our endeavour to bring out this Guide. We are confident this will go a long way in enabling our Trainers to deliver time bound quality skill training to our operators and mechanics.



About this book -

With the renewed focus on infrastructure projects, the demand for construction equipment is bound to get better. The backhoe loader market will see an increased demand which in turn will lead to larger number of skilled operators being needed to operate these machines.

To address the future sector demand, this Participant Handbook is designed to enable training for the specific Qualification Pack (QP). Each National Occupational (NOS) is covered across Unit(s).

Key Learning Objectives for the specific NOS mark the beginning of the Unit(s) for that NOS. The symbols used in this book are described below.

Symbols used -



Key Learning Outcomes



Steps



Tim



Tips



Notes



Unit Objectives

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Employability & Entrepreneurship Skills















1. Introduction

Unit 1.1 - About the programme

Unit 1.2 - About the product



Key Learning Outcomes 👸



At the end of this module, you will be able to:

- 1. Familiarize with one another
- 2. Outline the program expectations
- 3. Familiarize the role of Junior Backhoe Operator
- 4. Identify different parts of the backhoe along with their uses
- 5. List the primary controls of the backhoe and their uses

UNIT 1.1: About the Programme

– Unit Objectives 🏻



At the end of this unit, you will be able to:

- 1. Understand training curriculum design
- 2. Know one and all
- 3. List expectations from the training

-1.1.1 Overview of the Book -

The training curriculum will help you to:

- 1. Assist in carrying out pre-operation checks. General introduction to backhoe loader machine, basic working of engine, hydraulic and electrical systems, operational controls and instrument panel, preparing machine for operations
- 2. Assist in operating a backhoe loader. Starting of backhoe loader moving to worksite and carrying out earth digging, load lifting and dumping; parking and shutting down the machine; post-operative checks
- 3. Assist in maintenance and troubleshooting. General maintenance procedures and periodic service schedule of a backhoe loader; common faults and their diagnosis; reports and documents
- 4. Comply with worksite health and safety guidelines. Health, safety and environment policies; personal protective equipment, fire-fighting equipment, basic first aid for common injuries at work site

UNIT 1.2: About the Product

- Unit Objectives 🏻



At the end of this unit, you will be able to:

- 1. Know history of backhoe loaders
- 2. Understand the basic features and use of backhoe loaders
- 3. Identify the various parts of backhoe loader and their use
- 4. Understand the safety features of backhoe loaders

-1.2.1 Brief History of Backhoe Loaders -

- 1. 1940s. First backhoes are developed and tested
- 2. 1950s. Hydraulic powered backhoe loaders enter the market
- 3. 1971. First 'over center' backhoe is introduced offering a much more smooth ride and better maneuverability than older models.
- 4. 1980s. Four-wheel drive backhoe loaders are introduced

Today backhoes are manufactured by many companies in India and abroad.

1.2.2 Brief Specs, Features and Performance

Backhoe loaders are actually very powerful and versatile tractors. They have large wheels for driving on all terrain and a rotating cab for the operator. Backhoe loaders can perform many tasks, like lifting and moving supplies or digging earth.

The three main parts in a backhoe loader are:

- 1. Tractor
- 2. Loader, is attached to the front of the tractor which is used to lift and move the earth or other materials. There are many tools and attachments for the loader, including extensions so the loader can lift materials very high, and street sweeping brushes.
- 3. Backhoe is used for digging in rock and earth, or to lift heavy weights. There are 3 parts and 3 joints in the backhoe. There are also many tools that can be attached to the backhoe, such as hammers for breaking asphalt and grapples for pulling out tree stumps.

- 1.2.2.1 General Backhoe Loader Specifications

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Make	ABC	
Model	3054T	
Gross Power	88 hp	65.6 kw
Net Power	85 hp	63.4 kw
Displacement	244.1 cu in	4 L
Power Measured @	2200 rpm	
Number of Cylinders	4	

Operational

•		
Operating Weight 4wd	15763.1 lb	7150 kg
Fuel Capacity	33.8 gal	128 L
Turning Radius	17.6 ft in	5350 mm
Tire Size Front - 2wd / 4wd	11Lx16,12PR/	12.5/80x18,10PR
Rear Tires Size 2wd/4wd	19.5x24,10PR	/19.5L24,10PR

power shuttle

Transmission

Type

Number of Forward Gears	4	
Number of Reverse Gears	4	
Max Speed - Forward	20.4 mph	32.8 km/h
Max Speed Reverse	20.4 mph	32.8 km/h

Backhoe

Dig Depth - Std	14.4 ft in	4390 mm
Dig Depth - Ext	18.1 ft in	5510 mm
Reach From Swivel - Std	18.5 ft in	5650 mm
Reach From Swivel - Ext	21.9 ft in	6675 mm
Bucket Dig Force - Std	14712 lb	6673.3 kg
Bucket Dig Force - Ext	14586 lb	6616.1 kg
Load Height - Std	11.9 ft in	3613 mm
Load Height - Ext	13.7 ft in	4175 mm
Reach at Load Height - Std	2.8 ft in	862 mm
Reach at Load Height - Ext	2.5 ft in	751 mm

Table 1

- 1.2.2.1 General Backhoe Loader Specifications ————

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L	.va	ч	c	

Bucket Capacity	1.3 yd3	0.96 m3
Bucket Width	89.1 in	2262 mm
Bucket Breakout Force	10138.9 lb	45.1 kN
Lift Capacity at Full Height	6384.6 lb	2896 kg
Clearance at Max Dump Height	8.3 ft in	2544 mm
Reach at Max Dump Height	2.7 ft in	835 mm
Dig Depth	5.3 in	135 mm

Hydraulic

Pump Type	LSPC, closed center	
Pump Flow Capacity	43.1 gal/min	163 L/min
Relief Valve Pressure	3300.2 psi	22754 kPa

Dimensions

Transport Length	22.9 ft in	6974 mm
Transport Width	7.7 ft in	2352 mm
Transport Height	11.8 ft in	3585 mm
Height to Top of Cab	9.1 ft in	2770 mm
Wheelbase	6.9 ft in	2100 mm
Ground Clearance	0.97 ft in	297 mm

Table 1

1.2.3 Names of Parts & Controls, Panels

A backhoe loader has following different parts:

- 1. Loader arm
- 2. Cab
- 3. Hydraulic oil tank
- 4. Battery compartment
- 5. Boom
- 6. Fuel tank
- 7. Stablisers
- 8. Kingpost
- 9. Dipper

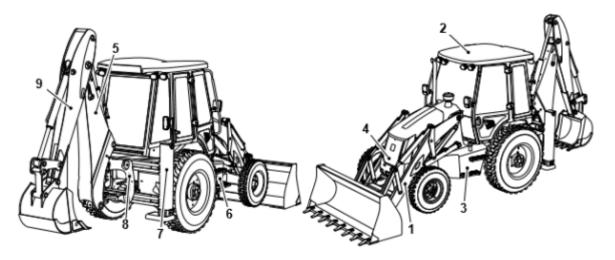
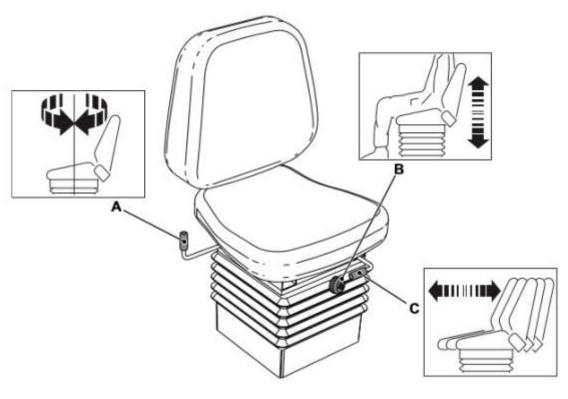


Fig 1

1.2.3.1 Seat Controls



- Fig 2
- **(A)** To **swivel** pull the lever backwards, swivel the seat all the way around to face the opposite direction then release lever. Make sure the seat fully latches into the locked position.
- **(B)** Whilst seated, turn the **weight** adjustment dial until your weight is shown in the scale just beside the knob. This will set the seat to the most suitable support for your weight. The dial is calibrated in kilograms (kg).

To move the seat front and back ,lift the lever and slide the seat to the position you are comfortable, release the lever to lock the seat. Make sure the seat is locked in position in order to avoid any accidents.

1.2.3.2 Drive Controls

Steering Wheel – Used to change driving direction

Accelerator Pedal – Used to increase / decrease engine speed

Hand Throttle Lever – Used to increase or decrease the engine speed as required when working with the excavator.

Foot Brake Pedals – Used to slow or stop the machine.

Park Brake Lever – Use it to engage the park brake before leaving the machine.

Transmission Lever (4-Speed Syncro Shuttle Transmission) – Used to put engine in forward (F), reverse (R) or neutral (N) mode. The engine will only start if the lever is at neutral.



Fig 3

Horn – The button is used to activate the horn and functions only when starter switch is set to on position.

Gear Lever (Syncro Shuttle Transmission) – Used for manual gear selection[.]

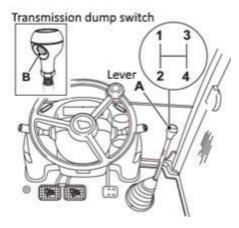


Fig 4

1.2.3.3 Switches

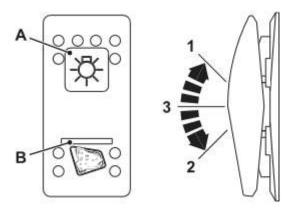


Fig 5 (three position rocker switch)

Side Lights and Headlights – Three position rocker switch with backlight. The switch functions operate when the starter switch is in the ON and OFF positions.

Position 1: OFF (Backlight OFF)

Position 3: Side Lights ON (Backlight ON)

Position 2 (starter switch in the ON position): Headlights ON (Backlight ON)

Position 2 (starter switch in the OFF position): Side Lights ON (Backlight ON)

Hazard Warning Lights – Two position rocker switch with backlight. The switch functions operate when the starter switch is in the ON and OFF positions.

Position 1: OFF (Backlight OFF).

Position 2: ON (Backlight ON). A light on the instrument panel flashes with the outside lights.

Beacon (if fitted) - Two position rocker switch. The switch functions operate when the starter switch is in the ON and OFF positions.

Position 1: OFF

Position 2: ON

1.2.3.3 Cont... —

Four Wheel Drive Selector (4WD machine only) – Three position rocker switch. The switch functions operate when the starter switch is in the ON position.

Position 1: 2-wheel drive - Two wheel braking

Position 2: 4-wheel drive - All wheel braking

Position 3: 2-Wheel drive - All wheel braking

Front Work Lights – Two position rocker switch. The switch functions operate when the starter switch is in the ON position.

Position 1: OFF

Position 2: Work Lights ON

Rear Work lights – Three position rocker switch. The switch functions operate when the starter switch is in the ON position.

Position 1: OFF

Position 3: Outer Worklights ON

Position 2: Inner and Outer Worklights ON

Servo Control – Two position rocker switch, spring loaded to position 1. The switch functions operate when the starter switch is in the ON position.

Position 1: OFF

Position 2: Servo Control ON

Kingpost Clamps – Two position rocker switch with backlight. The switch functions operate when the starter switch is in the ON position.

Position 1: OFF (Backlight OFF)

Position 2: ON (Backlight ON)





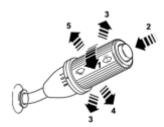
- 1.2.3.3 Cont... -

Starter Switch – It is operated by the starter switch. It has four positions. Always set the switch to '0' while removing the key.



Multi-Purpose Steering Column Switch

- 1 Windscreen Wiper
- 2 Push button: Not used
- 3 Direction Indicators
- 4 Headlights
- 5 Headlight flash



1.2.3.3 Cont... -

Front Console

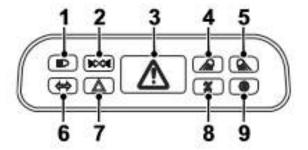


Fig 6

- 1 Main Beam
- 2 Side Light
- 3 Front Work Light
- 4 Master Warning Light
- 5 Rear Work Light
- **6 Direction Indicators**
- 7 Hazard Warning Lights
- 8 Four Wheel Steer (optional)

Speedometer

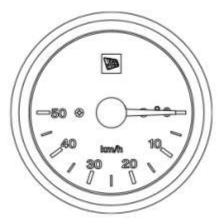


Fig 7

Indicates the road speed in Kilometres per hour (km/h).

- 1.2.3.3 Cont...

Side Console

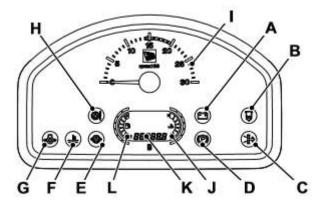


Fig 8

- A No Charge
- B Water in Fuel
- C Air Filter Blocked
- D Park Brake Engaged
- E Transmission Oil Pressure Low
- **E** Coolant Temperature
- G Engine Oil Pressure Low
- H Transmission Oil Temperature High
- I Analog RPM Meter
- J Coolant Temperature Gauge
- L Fuel level Gauge

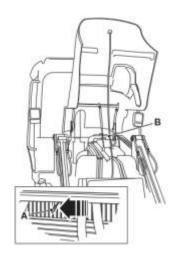
- 1.2.3.4 Access Panels

The access panels give you access to parts or areas of the machine that are not required during machine operation

Engine Cover

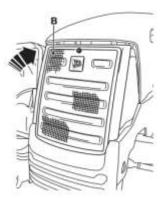
A Handle

B Cable



Front Grille

B Top of the Front Grille



Side Panels

F Bolts

G Side Panel

H Front Chasis

J Grille Housing

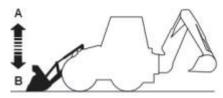


1.2.4 Layout of Systems and their Working

Loader Controls

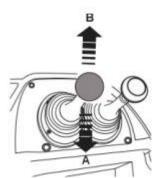
1 Raise

To raise the shovel A, pull the lever straight back. As the shovel rises, it will stay at the same angle to the ground. This is due to the parallel linkages on the loader arms.



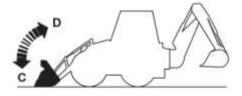
2 Lower

To lower the shovel B, push the lever forward. The shovel will stay at the same angle to the ground as described in Raise.



3 Roll Forward

To roll the bucket forward C, push the lever to the right.



4 Roll Back

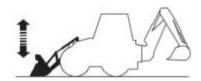
To roll the bucket back D, pull the lever to the left.



1.2.4 Layout of Systems and their Working

5 Float

To make the shovel 'float' across the ground, push the lever forwards as far as it will go and leave it there.

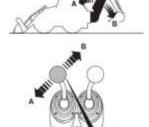




Excavator Controls

1 Raise Boom

To raise the boom A, pull the lever diagonally left and towards you. Before raising the boom check that it is clear overhead.



2 Lower Boom

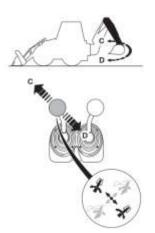
To lower the boom B, push the lever diagonally right and away from you.



To slew the boom to your left C, push the lever diagonally left and away from you.



To slew the boom to your right D, pull the lever diagonally right and towards you.



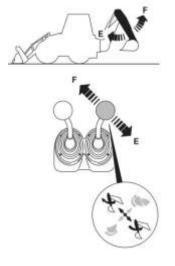
1.2.4 Layout of Systems and their Working

5 Dipper In

To bring the dipper in E, pull the lever diagonally right and towards you.

6 Dipper Out

To push the dipper out F, push the lever diagonally left and away from you. If the boom is already up, check that it is clear overhead before swinging the dipper out.

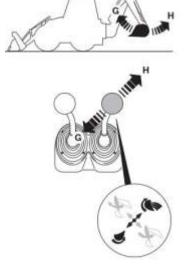


7 Close Bucket

To close the bucket G pull the lever diagonally to your left.

8 Open Bucket

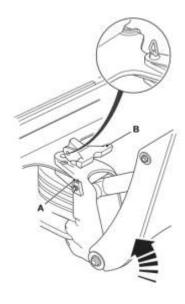
To open the bucket H push the lever diagonally to your right.



1.2.5 Safety Features

Boom and Slew Locks

Engage the Boom lock and slew lock of the backhoe loaders while traveling in road for safety reasons.



A Boom Stop

B Boom Lock

Beacon (if fitted)

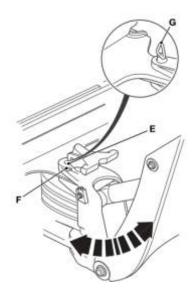
A Beacon

B Plug

C Cab Roof Socket

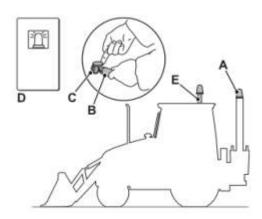
D Switch

E Beacon Extension Mount



E Hole (in the kingpost), F Hole (in the mainframe)

G Slew Lock Pin

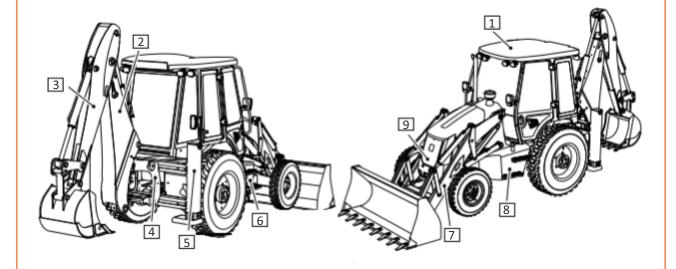


Exercise



Briefly answers the following questions.

Label the different parts of the backhoe loader in the following figure.



List some drive controls of backhoe loade	r.
	<u> </u>
What all parts does the multi-purpose ste	ering column switch controls?
	·
List the various loader controls.	,
	

Exercise	
Which two locks are used for safety while driving the backhoe loader?	
	- -
	-
	_

Tips 🖳

- Visit a construction site.
- Inspect the different backhoe loaders parked and their features

_ Notes 📋	
	
	
	







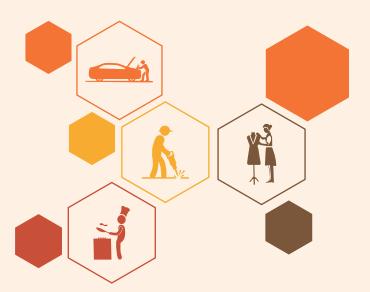




2. Assistance in Pre-ops Checks on Backhoe Loader

Unit 2.1 – Pre-ops Checks of the Machine and its attachments

Unit 2.2 – Inside the Engine Compartment and Cabin



Key Learning Outcomes

At the end of this module, you will be able to:

- 1. Assist the backhoe loader operator in physically checking the backhoe loader for problems / defects from outside
- 2. Assist in checking parts controls inside of backhoe loader for signs of trouble

UNIT 2.1: Pre-ops Checks of the Machine and its attachments

Unit Objectives



At the end of this unit, you will be able to:

- 1. Check the backhoe loader for cleanliness
- 2. Visually inspect various parts of the backhoe loader

2.1.1 Check for Cleanliness



- Step 1 Clean the windows, light lenses and rear view mirrors.
- Step 2 Remove dirt and debris, especially from around the linkages, rams, pivot points and radiator.
- Step 3 Clean the cab steps and handhold and make sure that it is dry.
- Step 4 Clean all safety and instructional labels and assist in replacing any that are missing or cannot be read.

2.1.2 Do a Machine Inspection



- Step 1 Inspect the machine throughly for any missing parts or damaged parts.
- Step 2 Make sure that the attachment is secure and in good condition.
- Step 3 Make sure that all pivot pins are securely correctly in place.
- Step 4 Inspect the windows for cracks and damage. Glass splinters can blind.
- Step 5 Check for oil, fuel and coolant leakages underneath the machine.
- Step 6 Check for cut rubber and penetration by sharp objects.
- Step 7 Make sure that all of the access panels are closed and secure.
- Step 8 Make sure that all of the filler caps are installed correctly.

UNIT 2.2: Inside the Engine Compartment & Cabin

Unit Objectives



At the end of this unit, you will be able to:

- Know the parts of engine that you need to inspect as per the conditions
- 2. Check fuel and coolant levels

2.2.1 Operating Environment

Operating in Low Temperatures

- 1. Use the correct viscosity engine lubricating oil.
- 2. Use the correct viscosity hydraulic oil.
- 3. If available use a low temperature diesel fuel.
- 4. Use the correct coolant mixture.
- 5. Check if the battery is at full charge.
- 6. Install a cold weather starting aid. In very low temperatures, -18°C and below, additional starting aids such fuel, oil and coolant heaters, may be needed.
- 7. Before starting the engine, check and remove the snow in the engine compartment in order to avoid the snow entering into the air filter.

Operating in High Temperatures

- 1. Use the correct viscosity engine lubricating oil.
- 2. Use the correct coolant mixture.
- 3. Check the coolant system for any leaks.
- 4. Remove dirt and debris, if any, from the radiator/oil cooler and the engine.
- 5. Check the fan belt.
- 6. Check the air vents to and from the engine compartment for any blockage. Clean the vents if it is blocked.
- 7. Check the engine pre-cleaner (if fitted).
- 8. Check the battery electrolyte level.

Operating in Dusty or Sandy Areas

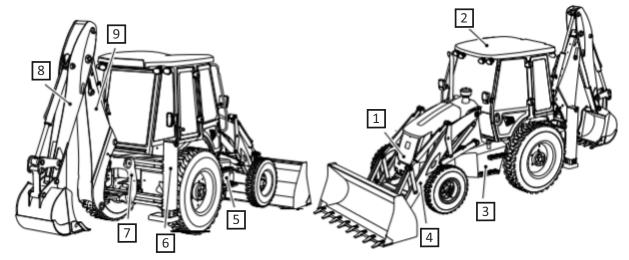
1. Securely tighten the hydraulic oil tank filler cap to prevent sand and dust from entering the hydraulic system.

Exercise



Briefly answer the following questions:

1. Identify and label the parts of Backhoe Loader in the figure given below.					



- 2. What are the drive controls of a Backhoe Loader? List out any five of them.
- 3. What parts are controlled by a multipurpose steering column switch?

Exercise	
4. Name the variou	s loader controls.
5. Which safety lock	ks are used while driving the Backhoe Loader?
	

Tips



- Visit a construction site.
- Observe a backhoe loader in operation and talk to an operator

Notes 📋	











3. Assistance in Backhoe Operations

Unit 3.1 - Inspection of worksite and safety

Unit 3.2 - Standard operations

Unit 3.3 - Reporting & documentation



– Key Learning Outcomes 🙄



At the end of this module, you will be able to:

- 1. Assist the backhoe operator in inspecting the worksite for safety
- 2. Understand symbols and signs for guiding the backhoe operator
- 3. Assist the backhoe operator in performing various backhoe and loader operations
- 4. Follow the instructions from manufacturer for safety operation of the machine.
- 5. Work carefully so as not to put the health and safety of self or others at risk
- 6. Assist the backhoe operator in maintaining a checking/maintenance logbook to record all activities
- 7. Inform the backhoe operator of problems that are beyond scope of junior backhoe operator's role
- 8. Understand importance of reporting
- 9. Identify and understand backhoe loader pre-use checklist
- 10. Identify and understand backhoe loader worksite inspection checklist

3.1: Inspection of Worksite & Safety

-Unit Objectives



At the end of this unit, you will be able to:

- 1. Assist the backhoe loader operator in inspecting the worksite for safe operations
- 2. Understand the communication symbols used to guide the backhoe loader operator
- 3. Understand symbols used for site safety

3.1.1 Inspection of the Worksite

Following are the main points to be noted for worksite inspection:

- There could be dangerous materials such as asbestos, poisonous chemicals or other harmful substances buried on the site. If you see any signs of toxic waste, advise the backhoe operator immediately.
- Assist the backhoe operator to check any gas line, water lines or drains that are laid underneath the ground on the work site with the help of the local public. If there are, obtain a map of their locations and follow the advice given by the suppliers.
- Hand dig trial holes to obtain precise pipe locations. Any cast iron pipes found should be assumed to be gas pipes until contrary evidence is obtained.
- If a gas leak is suspected, assist the loader operator to contact the local gas company immediately and warn all personnel on the site.
- Safety equipments like extinguisher, PPE, eye wash, First aid kit, etc.



Fig 14

3.1.2 Signals to Guide a Backhoe Loader Operator

The signaler should stand in a secure position where he/she can see the load and can be seen clearly by the driver and should face the driver if possible. Each signal should be distinct and clear.

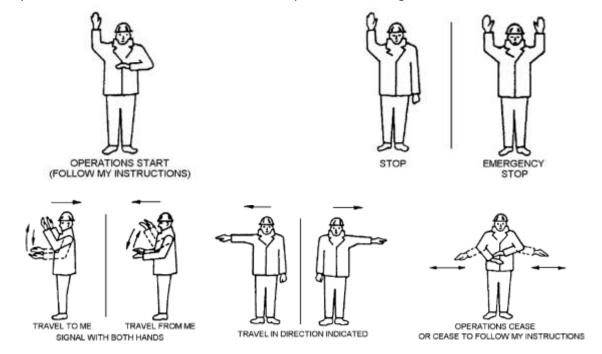


Fig 15

3.1.3 Sample Site Safety Notice



Fig 16

UNIT3.2: Standard Operations

- Unit Objectives 🏻 💆



At the end of this unit, you will be able to:

- 1. Remove and install a bucket in the backhoe
- 2. Assist the backhoe operator in digging, load lifting and dumping

3.2.1 Assisting with the Backhoe

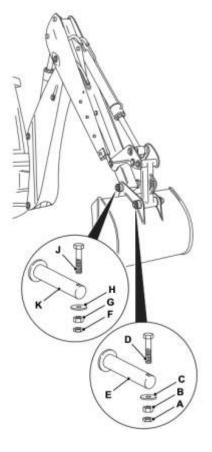


Assist in Removing the Bucket

- **Step 1**–Block the bucket to prevent its movement.
- Step 2—Remove the lock nut A, nut B and spacer C. Remove the bolt D from the pivot pin. Then remove the pivot pin E.
- Step 3—Remove the lock nut F, nut G and spacer H. Remove the bolt J from the pivot pin. Then remove the pivot pin K.
- Step 4-Let the backhoe operator carefully lifts the dipper clear of the bucket using controls.

Assist in Installing a Bucket

- Step 1—Position the bucket, set the bucket flat on level ground, using a suitable lifting device.
- Step 3-Let the backhoe operator line up the holes in the dipper and tipping link with the holes in the bucket. Fit the pivot pin K. Insert the bolt J. Fit the spacer H, nut G and secure by tightening the lock nut F. After the dipper pivot pin has been locked in, fit the tipping link pivot pin E, bolt D, spacer C, nut B and lock nut A.



3.2.2 Assist in Operations

While Digging

- Make sure that the stablisers are maintaining contact with the ground as the backhoe operator starts to dig.
- Make sure that operator can swing the backhoe without any obstacles around the machine. Clear all the people near backhoe. For added protection, place a barricade around the swing area.
- Inform the backhoe operator if the bucket is too close to the stablisers.
- On a delicate surface (such as concrete, or stone work) or on sandy, loose, or soft ground, place plywood under the stabilisers to help distribute the load over a wider area.

While load lifting

- Before lifting, inspect the machine to ensure there is no damage or other factors that could impede lifting capacity.
- Check the surrounding area for obstacles or hazards within the lift zone.
- Make sure the machine is positioned where tracks are stable with no voids or soft ground underneath. That could cause the machine to rock.
- Make sure all bystanders are out of the swing radius of the boom.
- Rigging should be inspected before each use for damage or wear.
- Ensure the load is properly secured to the carrier.

UNIT3.3: Reporting and Documentation

– Unit Objectives 🧖



At the end of this unit, you will be able to:

- Identify and understand a backhoe loader pre-use checklist
- 2. Identify and understand a backhoe loader worksite inspection checklist

- 3.3.1 Pre-Use Checklist

Before starting engine, check the following:				
		STATUS		
WALK-AROUND ITEMS (VISUAL)	OK	NO	N/A	REMARKS
Walk-around inspection (warning decals, capacity plate, etc.)				
Forks/locking pins, carriage, mast or boom				
Wheels, tires & lug nuts (condition/pressure)				
Engine (check oil level & for leaks)				
Transmission (check oil level & for leaks)				
Engine belts (check for adjustment/wear)				
Air cleaner (check indicator, clean or change as required)				
Radiator (check coolant level & for leaks)				
Hydraulic tank (check oil level & for leaks)				
Fuel tank (secure, valve open & fuel level)				
Overhead guard/ROPS (no damage)				
Seatbelt				
After starting engine, check the following:				
	STATUS			
START-UP ITEMS	OK	NO	N/A	REMARKS
Engine (does it sound normal?)				
instruments (check for normal readings)				
Exhaust system (check for leaks & excessive smoke)				
Wipers & lights (spotlights, turn signals, etc.)				
Horn & backup alarm (strobe lights)				
All hydraulic controls (normal operation – lift, tilt, etc.)				
Transmission & clutch (direction & speed range)				
Brakes (parking & service brakes)				
Steering (all modes)				
Note anything abnormal or in need of repair:				
Operator Name:				-0.00
Vehicle #: Hour Meter Reading:				Date:

3.3.2 Worksite Inspection Checklist _____

		STATUS	1 2	- 39
VISUAL INSPECTION	OK	NO	N/A	REMARKS
Underground utilities (see phone number below)				
Overhead obstructions & high voltage conductors				7
Inadequate ground support for weight of machine				
Drop-offs & holes				
Debris				1 2 1
Presence of unauthorized persons				
Presence of unauthorized vehicles/traffic				PAIS AND
Other possible unsafe conditions:	7		1	12 2
				120
				-2
				_ S
Any problems or hazardous conditions that aft prior to commencing work.	ect me saret	y or ope	erations s	nau de reported and correct
Phone number to call before digging:				
Note anything abnormal or in need of repair:		_		
Operator Name:		7		
				ites

Exercise 🔯			
Briefly anwer the following question	ns.		
What all do you inspect in a worksite			
List steps to remove the bucket from	n a backhoe.		
Mention the meaning of these symb	ols against the box provided.		
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Following are recommended tips:

• If a fibre optic cable is cut during loader operations, do not look into the end of it as your eyes could be permanently damaged.

Notes 🗐 ——		











4. Assistance in Routine Maintenance

Unit 4.1 – Basic maintenance and schedules

Unit 4.2 – Reporting & documentation



Key Learning Outcomes



At the end of this module, you will be able to:

- 1. Understand the basic maintenance and maintenance schedules
- 2. Do basic troubleshooting of the backhoe loader
- 3. Understand the importance of machine logs and reporting

4.1: Basic Maintenance and Schedules

Unit Objectives



At the end of this unit, you will be able to:

- 1. Do basic machine maintenance tasks
- 2. Interpret and understand a maintenance schedule

4.1.2 Cleaning the Machine

Observed the following points while cleaning the backhoe loader:

- Always dilute detergents as per the manufacturer's recommendations, otherwise damage to the paint finish may occur.
- When using a steam cleaner, wear safety glasses or a face shield as well as protective clothing. Steam can cause serious personal injury.
- Ensure that the engine air intake, alternator, starter motor and any other electrical components are shielded and not directly cleaned by the high pressure cleaning system. Do not aim the water jet directly at bearings, oil seals, the engine air intake or electrical and electronic components such as the engine electronic control unit (ECU), alternator or fuel injectors.
- Never use water or steam to clean inside the cab. The use of water or steam could damage the on-board computer and render the machine inoperable. Remove dirt using a brush or damp cloth.
- · Safely disposal of debris created from machine cleaning.
- When cleaning is complete move the machine away from the wash area, or alternatively, clean away the material washed from the machine.

4.1.3 Greasing the Machine

Observed the following points while greasing the backhoe loader:

- The machine must always be greased after pressure washing or steam cleaning.
- Greasing should be done with a grease gun. Normally, two strokes of the gun should be sufficient.
- Stop greasing when fresh grease appears at the joint.
- Use only the recommended type of grease.
- Do not mix different types of grease, keep them separate.

4.1.4 Sample Schedule -

The following schedule calls for regular maintenance and lubrication jobs. The intervals (hourly) given in the schedules must not be exceeded. If the machine is operated under harsh and rugged conditions (i.e. very high and low temperature, dust, water, snow etc.), decrease the time intervals.

Pre-start Cold Checks, Service Points and Fluid Levels

	Operation	10	50	10011	500	1000	2000	6000
ENGINE								
Coolant Quality and Level.	- Check							
Cooling System.	- Drain / Refill							
Oil level.	- Check							
Oil and Filter (2)(3)	- Change							
Air Cleaner Outer Element (4)	- Change							
Air Cleaner Inner Element (4).	- Change							
Water Separator and Engine Fuel Filter.	- Drain							
Water Separator Fuel Filter.	- Change							
Engine Fuel Filter ⁽²⁾ .	- Change							
Front End Accessory Drive (FEAD) Belt Condition	- Check							
Front End Accessory Drive (FEAD) Belt	- Change							
Engine Mounting Bolts for Tightness	- Check							
All Hoses - Condition	- Check							
Radiator ⁽⁴⁾	- Clean							
Breather Gauze	- Clean							
Valve Clearances(5)	- Check / Adjust							
Oil Filler and Dipstick Seals®	- Check / Adjust							
Rocker Cover and Injector Seals(%)	- Change							
Injectors ⁽⁶⁾	- Change							
Injector(s) Leak Off Rail ⁽⁵⁾	- Change							
High Pressure Fuel Lines(6)	- Inspect							
TRANSMISSION, AXLES AND STEERING								
Transmission Oil Level.	- Check							
Transmission Oil®	- Change							
Transmission Filter	- Change							
Axle Oil Level (incl. Hubs when applicable) Front ⁽⁷⁾⁽⁸⁾	- Check							
Axle Oil (incl. Hubs when applicable) Rear (7)(0)	- Change							
Tyre Pressures and Condition	- Check							
Wheel Nut Security.	- Check							
Front Hub Bearings	- Check							

Transmission Strainer	Operation - Clean	10	50	100 ⁽¹⁾	500	1000	2000	6000
Steer Axle Movement and Shimming ⁽³⁾	- Check							
Steer Axle Pivots and Linkages(3)	- Grease							
Drive Shafts®	- Security and Grease							
Front Axle Main Pivot	- Grease							
HYDRAULICS								
Oil Leveli ¹⁰ :	- Check							
Oil	- Sample, Change							
Oil Filter	- Change							
Rams - Chrome Condition	- Check							
Hydraulic Oil Cooler	- Clean							
Hydraulic Oil Strainer	- Clean							
Hydraulic Tank Filler Cap (with integral filter)	- Check							
Servo Joystick Lever Bush (6)	- Check/Grease							
BRAKES								
Brake Fluids Level	- Check							
Brake Fluids Level	- Change							
Park Brake	- Check / Adjust							
ELECTRICS								
Battery Electrolyte Level (if applicable)	- Check							
Wiring for Chaffing/Routing	- Check							
Battery Terminals for Condition and Tightness	- Check							
BODYWORK AND CAB								
All Pins and Bushes	- Check / Grease							
Door/Window Hinges	- Lubricate							
All Cables	- Lubricate							
Cab Heater Fresh Air Filter (if applicable)(4)	- Clean / Change							
Air Conditioner Condensor (4)	- Clean							

4.1.4 Sample Schedule

Cab Air Conditioning Recirculation Filter (if fitted)	Operation - Clean/Change	10	50	100 ⁽¹⁾	500	1000	2000	6000
Kingpost clamp .	- Check / Adjust							
Door - Fit and Catches	- Check							
Cab Seat - Operation	- Check							
Windscreen Washer Fluid Level (if fitted)	- Check							
Condition of Paintwork	- Check							
Stabiliser Legs (Sideshift)	- Check / Adjust							
Machine Generally	- Check / Clean							
Wear Pads (with Extended Dipper) (if fitted)	- Grease							

- (1) First 100 Hours Service only, to be completed by your Distributor.
 (2) If operating under arduous conditions, change the engine oil and filter every 250 hours.
- The oil service interval will be affected if there is a high sulphur content in the fuel. Refer to Fuel System for more information.
- (4) If operating in dusty working environments, change more frequently. Change the inner element whenever the outer element is being changed.
- (5) Jobs which should only be done by a specialist.
- (6) After a major transmission repair, the new oil should be run to operating temperature and changed again to remove any contamination which entered during the repair. Change the oil and filter after a further 100 hours if the oil was heavily contaminated because of, or from the failure (e.g. water contamination).
- (7) Check for leaks every 50 hours, check level if leaking.
- (8) After a hub repair, the new oil should be run to operating temperature and changed again to remove any contamination which entered during the repair. Change the oil again after a further 100 hours to remove any bedding-in wear. This is which entered during the repair. Orienge are on again asset particularly important if new brake plates have been fitted.

 (9) The extes and driveshafts are factory greased with a high performance grease, if during service a standard grease is that the interval must be reduced to every 50 hours, contact your Distributor for advice.
- (10) Check the hydraulic fluid level with the loader and backhoe in the travel position.

UNIT4.2: Reporting & Documentation

Unit Objectives



At the end of this unit, you will be able to:

- Maintain a checking/maintenance logbook to record all activities
- 2. Inform backhoe operator of problems that are beyond the scope of a junior backhoe operator

4.2.1 Maintaining Machine Logs

Machine log maintains the history of the entire machine. It acts as a guide in times of emergency when the backhoe loader goes out of order. The log helps the technician ascertain the condition of the machine, what parts consumables, etc., have been changed.

Date	Hours	Service Procedures

4.3.2 Informing Supervisor if Problem is Unresolved

It is important to inform the backhoe operator if you are unable to resolve a problem that has occurred with the backhoe loader. The backhoe operator is adequately trained and well informed to tackle the situation. In case he is unable to do so he will consult the dealer for a solution or whatever he believes that is appropriate to tackle the situation.

Inform the backhoe operator in the following cases:

- The machine is not functioning properly and the junior operator unable to ascertain the problem
- Even after diagnosing the junior operator is unable to rectify the faults
- The required spares and or consumables are not available
- The junior operator is not trained to do a specific task

Tips



Following are recommended tips:

- Visit a construction site and have a detailed look at the backhoe loader in the presence of the operator
- Always follow recommended safety guidelines and warning signs by the manufacturer

Exercise Briefly anwer the following questions. How do you fix engine over-heating? What are the possible causes of engine/coolant leakage? What is the importance of maintaining machine logs? Why should the operator inform the supervisor if he / she is unable to resolve issues with a backhoe loader?

Tips



Following are recommended tips:

- Visit a construction site and have a detailed look at the backhoe loader in the presence of the operator
- Always follow recommended safety guidelines and warning signs by the manufacturer

— Notes 🗒 ————	











5. Worksite Health & Safety

Unit 5.1 – ESH policies and guidelines

Unit 5.2 – Types and uses of PPE

Unit 5.3 – Common hazards and preventive measures

Unit 5.4 – Segregation and disposal of waste

Unit 5.5 – Basic fire-fighting equipment and use

Unit 5.6 – Common injuries and appropriate first aid



Key Learning Outcomes



At the end of this module, you will be able to:

- 1. Understand the safety guidelines and precautions a junior backhoe operator has to follow
- 2. Identify and understand the use of Personal Protective Equipment (PPE)
- 3. Understand measures that can help avoid site mishaps
- 4. Operate safely with waste at work
- 5. Administer first aid for common injuries on worksite

5.1: ESH Policies and Guidelines

– Unit Objectives 🥝



At the end of this unit, you will be able to:

- 1. Understand the safety precautions that a junior backhoe loader needs to follow while at work
- 2. Understand the various Dos and Don'ts while working with the machine

5.1.1 Safety Precautions to be Taken -

It is of vital importance for every employer and employee involved in machine operations and maintenance to safeguard themselves, learn safety procedures and encourage safe practices within their workplace. This prevents many accidents taking place due to carelessness and ignorance.

The **Junior Backhoe Operator** too has a duty to:

- 1. Be responsible and careful to avoid himself or others life getting into risk, including members of the public.
- 2. The operator must co operate with his employer or any other person to perform their legal duties in health and safety.
- 3. Not interfere with or misuse any safety device or equipment.
- 4. Not intentionally or recklessly interfere with anything provided in the interest of health, safety and welfare.
- 5. Follow operating procedures and the manufacturer's instructions which apply to the care and safe operation of the machine they are responsible for.
- 6. Inform about the situation which is risk to the health and safety for himself or others immediately to the Backhoe operator.
- 7. Immediately report any defects in plant and equipment which might endanger safety.

5.1.2 Do's and Don'ts During Operation

Do

- Comply fully with instructions given by the backhoe loader operator
- Follow the manufacturer's instructions (operator manuals) for the specific backhoe loader you are assisting on
- Take safety precautions when assisting on the machine prior to, during and after work

Don't

- Assist on machine unless you have received appropriate training and are authorised to do so
- Ignore hazards
- Misuse, tamper or interfere with your machine and any associated safety equipment provided
- Endanger your own health and safety, or that of anyone else, by being negligent

UNIT5.2: Types and Uses of PPE

Unit Objectives 6



At the end of this unit, you will be able to:

Know about common personal protective equipment and their use

5.2.1 Personal Protective Equipment

PPE is equipment worn to minimise exposure to a variety of hazards.

List of PPE Equipment:

- Safety gloves
- Safety footwear
- **E**ye protection,
- Protective hearing devices (earplugs, muffs) hard
- Safety helmets
- Respiratory protecting equipment
- Safety harnesses and
- **Full body suits.**

Safety Helmets (Don'ts)



Eye Protectors



Fig 26

- **5.2.1 Cont...** -

Ear Protectors
Protective Gloves
Safety Footwear
Protective Clothing





Fig 26

5.3: Common Hazards & Preventive Measures

– Unit Objectives 🏻 🏻

At the end of this unit, you will be able to:

- 1. Identify the common hazard at work site
- 2. Understand the necessary Dos and Don'ts that may help avoid accidents

5.3.1 Accident Prevention and Control Do's and Don'ts

Common accidents with backhoe loaders are overturns, falls, runovers and colloid with other objects and fellow persons. By following some basic Do's and Don'ts many of such accidents can be prevented:

Do

- Wear all protective clothing and personal safety equipment issued to you or required by your working conditions
- Understand and follow safety procedures when working on site and using plant and work equipment
- Ensure you are fully aware of the job requirements and how they need to be carried out Know where to get help. Know the first aid and emergency procedures
- Study the manufacturer's operator's manual for using your plant and equipment. If the manual is not provided, ask your supervisor or the suppliers of the plant / equipment to supply one
- Report faulty / unsafe plant or equipment and any dangerous incidents
- Use the plant equipment safely so as not to affect its stability
- Ensure you watch out for others who are affected by your actions
- Ensure all personal injuries, no matter how slight, are reported and entered in the accident book (or equivalent)
- Attend all training courses being organized by your employer. It is possible to learn new techniques and safety practices at any age!!

Don't

- Use plant or work equipment that you have not been trained to use
- Throw or drop objects from plant or work equipment
- Attempt to carry out work on moving parts of plant or work equipment with the safety guards removed
- Indulge in horseplay on plant or work equipment
- Attempt to operate any type of plant or work equipment under the influence of drugs, alcohol or any other substance, which affects your health or judgment
- Ignore warning instructions or safety signs.

5.4: Segregation and Disposal of Waste

Unit Objectives



At the end of this unit, you will be able to:

- 1. Identify different types of waste and there segregation
- 2. Understand the procedure for correct disposal of waste

5.4.1 Waste Management

Waste management is an approach that aims to reduce the waste, recycling and safe disposal of hazardous waste for environmental and economical beneficial. A junior backhoe operator needs to remember some basic waste management rules:

- Use ONLY authorised waste disposal sites.
- Never store lubricants in open or unlabelled containers.
- Never pour used engine oil into sewers, drains or on the ground.
- · Look out for the proper bin (black in case of general rubbish) in case of non-industrial waste at your worksite. Most bins clearly mention the waste that can go in it.



Fig 27

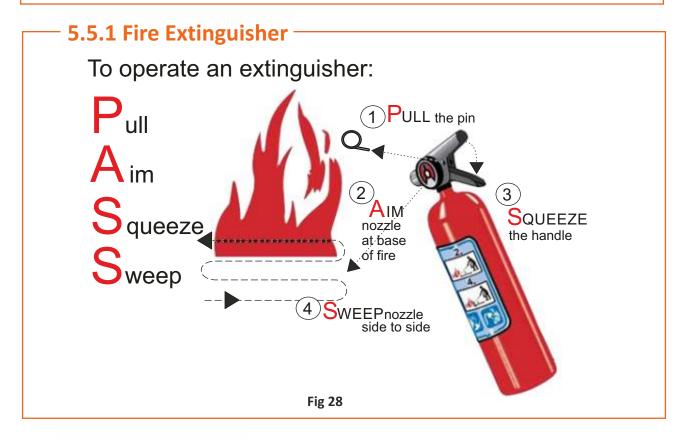
5.5: Basic Fire-Fighting Equipment and Use

Unit Objectives ©



At the end of this unit, you will be able to:

- 1. Identify different types of fire-fighting equipment
- 2. Understand the procedures of correct operations of these equipment



5.5.2 Sand Bucket



Fig 29

5.6: Common Injuries and Appropriate First Aid

Unit Objectives



At the end of this unit, you will be able to:

- 1. Identify the various items of the first aid kit
- 2. Administer first aid for common injuries

5.6.1 Basic First Aid Kit ——

A junior backhoe operator must have basic knowledge of emergency medicines that can be used as primary medical service for cuts, wounds, fever, etc.



Scissors



Glove



Tweezers



Anticeptic wipes



Roller Bandage



Thermometer



Alcohol



Antibiotic ointments packets(approx 1g)

Fig 30

5.6.2 Administer Aid

EMERGENCY FIRST AID ABC'S OF IMMEDIATE FIRST AID ACTION A Open the Alrway BCheck for Breathing CCheck for Circulation MOUTH TO MOUTH RESUSCITATION # EYE INJURY CHEMICAL BURNS OF THE EYE Please one with one and skill readinglow or clear sector for 15 minutes. OBJECT IN EYE (PARTICLE): If choking victim can cough, speak or breathe, do not interefere. Call a paramedic. IF VICTIM CANNOT BREATHE ELECTRIC SHOCK 1 Memore skiller from source of shock. 3 Call for medical seeks 2 mages require to around read SHOCK DUE TO INJURY YOUR LOCATION ABC

Fig 31



Briefly anwer the following questions.
How can the junior backhoe operator help create a safer work place?
List some common PPE?
What precautions a junior backhoe operator has to follow when dealing with waste?
What makes up a basic first aid kit?
What makes up a basic first aid kit?
What makes up a basic first aid kit?
What makes up a basic first aid kit?
What makes up a basic first aid kit?
What makes up a basic first aid kit?

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Following are recommended tips:

Wash the skin exposed to oil in a warm soapy water. Do not use petrol, diesel fuel or paraffin to clean your skin

— Notes — —









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