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HEAVY MACHINE OPERATOR



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LEARNER GUIDE

National Vocational Certificate Level 1

Version 1 - November, 2019



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Introduction

Welcome to the Learner's Guide for the Heavy Machine Operator Programme. It will help learners to complete the Programme and to go on to complete further study or go straight into employment.

The *Heavy Machinery Operator* Programme is to engage young people with a Programme of development that will provide them with the knowledge, skills and understanding to start this career in Pakistan. The Programme has been developed to address specific issues, such as national, regional and local cultures, the manpower availability within the country, and meeting and exceeding the needs and expectations of their customers.

The main elements of the learner's guide are:

- **Introduction:**
 - This includes a brief description of guidelines to use it effectively
- **Modules:**
 - The modules form the sections in learner's guide
- **Learning Units:**
 - Learning Units are the main sections within each module
- **Learning Outcomes:**
 - Learning outcomes of each learning units are taken from the curriculum documents
- **Learning Elements:**
 - This is the main content of learner's guide with detail of the knowledge and skills (practical activities, projects, assignments, practices etc.) The learners will require to achieve learning outcomes stated in the curriculum
 - This section will include examples, photographs and illustrations relating to each learning outcome
- **Summary of Modules:**
 - This contains the summary of the modules that make up learner's guide
- **Frequently asked Questions:**
 - These have been added to provide further explanation and clarity on some of the difficult concepts and areas. This will further help learners in preparing for assessment.
- **Multiple Choice Questions for Self-test:**
 - These are provided as an exercise at the end of learner's guide to help in preparation for assessment

Overview of the program

Course: Level 1 Heavy Machinery Operator	Total Course Duration: 210 Hours
Course Overview:	
<p>In order to build the capacity of technical and vocational training institutes in Pakistan through provision of demand driven competencies based trainings in construction sector the NAVTTC, and TEVT Sector Support Program (TSSP) have joined hands together to develop training courses for construction sector. These trainings will not only build the capacity of existing workers of this sector but also support the youth to acquire skills best fit for this sector. The benefits and impact of development of these training courses will be on both demand and supply side.</p> <p>Based upon this demand of industry these competency-based trainings for Heavy Machine Operator are developed under National Vocational Qualification Framework (NVQF) (Level 1 to 4). The training courses mainly cover competencies along with related knowledge and professional skills which are essential for getting a job or self-employed.</p> <p>The training courses are also in line with the vision of Pakistan's National Skills Strategy (NSS), National TVET Policy and NVQF. This provides policy directions, support and an enabling environment to the public and private sectors to impart training for skills development to enhance social and economic profile.</p> <p>The purpose of the training is to provide skilled manpower to improve the existing capacity of construction sector. This training will provide the requisite skills to the trainees to operate Heavy Machines. It will enable the participants to meet the challenges in the field of construction industry. Further, to improve the skill level of the Operators and prepare them for the construction industry to meet the market competition nationally and internationally. The core purpose of this qualification is to produce employable Heavy Machine Operators who could operate Heavy Machines according to national and international standards. In addition, this qualification will prepare unemployable youth to employ in construction sector.</p>	

Overview of the Curriculum for Heavy Machine Operator:

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of Modules
<p>Module A: Comply with Work Health and Safety Policies</p> <p>Aim: After completing this module, the learner will be able to know skills and knowledge required to apply general work health and safety requirements in the workplace. Communicate work and health safety assess at work place. It describes generic work health and safety responsibilities applicable to employees without managerial or supervisory responsibilities.</p>	<p>LU-1: Work safely at work place LU-2: Communicate work health and safety (WHS) assess at work place LU-3: Minimize risks to personal safety at work place LU-4: Minimize risks to public safety</p>	06	24	30
<p>Module B: Obey the Workplace Policies and Procedures</p> <p>Aim: After completing this module, the learner will be able to obey the workplace personal appearance and hygiene, follow work ethics, Demonstrate the workplace behavior, Communicate the workplace policy and procedure and review the implementation of workplace policy and procedures.</p>	<p>LU-1: Obey the workplace personal appearance and hygiene LU-2: Follow work ethics LU-3: Demonstrate the work place behaviours LU-4: Communicate workplace policy & procedures LU-5: Review the implementation of workplace policy & procedures</p>	04	16	20

<p>Module C: Follow Basic Communication Skills (General)</p> <p>Aim: After completing this module, the learner will be able to listen attentively, develop non-verbal communication, and identify communication barriers, interview preparation for job and different communication platforms in the workplace and throughout your career</p>	<p>LU-1: Adopt effective listening to skills LU-2: Develop nonverbal communication with peers LU-3: Prepare for Interview to get a job LU-4: Use communication platform at workplace LU-5: Identify communication barriers to improve interpersonal skills</p>	10	40	50
<p>Module D: Operate Computer Functions (General).</p> <p>Aim: After completing this module, the learner will be able to have skills and knowledge required to setup a computer system, organize files in folders, and shutdown a computer system.</p>	<p>LU1. Set up the computer for use LU2. Organize files in folder LU3. Shut down computer system</p>	10	40	50
<p>Module E: Identify Machines and Its attachments</p> <p>Aim: This competency standard covers the skills and knowledge required to Identify Machine and its sizes, identify components & attachments, identify capacities & capabilities of machine, identify basic tools and supplies associated with machine and manage inventory of tools and equipment.</p>	<p>LU-1: Identify machine and its sizes. LU-2: Identify components & attachments LU-3: Identify capacities & capabilities of machine LU-4: Identify basic tools and supplies associated with machines LU-5: Maintain inventory of tools and equipment.</p>	16	44	60
TOTAL		46	164	210

HEAVY MACHINE OPERATOR



Module-E

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Module E: Identify Machine & its Attachments

Objective: This competency standard covers the skills and knowledge required to Identify Machine and its sizes, Identify components & Attachments, Identify capacities & capabilities of Machine, Identify basic tools and supplies associated with Machines and Manage Inventory of tools and equipment.

Duration: 60 Hours

Theory: 16 Hours

Practice: 44 Hours

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Identify Machine and its sizes.	The student will be able to: <ul style="list-style-type: none"> • Enlisted name of different heavy machines • Enlist crawler machines • Enlist wheeled/tire machines • Check specifications of crawler machines • Check specifications of wheeled/tire machines 	<ul style="list-style-type: none"> • Define common Heavy Machines & Industry terminologies. 	Manufacturer's Catalogue Available machines on site

WHEEL LOADERS



Wheel Loaders are a type of heavy machinery used in construction, as well as for many other non-construction tasks. They have sturdy tires equipped with large, rugged treads that allow for optimum maneuverability. Common types include mini, small, large and super wheel loaders; skid steers; front loaders and backhoe loaders.

BULL DOZERS

BULL DOZERS are large and powerful tracked heavy equipment. The tracks give them excellent ground holding capability and mobility through very rough terrain. Wide tracks help distribute the bulldozer's weight over a large area (decreasing ground pressure), thus preventing it from sinking in sandy or muddy ground. Extra wide tracks are known as *swamp tracks* or *LGP* (low ground pressure) tracks. Bulldozers have transmission systems designed to take advantage of the track system and provide excellent tractive force. Because of these attributes, bulldozers are often used in road building, construction, mining, forestry, land clearing, infrastructure development, and any other projects requiring highly mobile, powerful, and stable earth-moving equipment. Another type of bulldozer is the wheeled bulldozer, which generally has four wheels driven by a 4-wheel-drive system and has a hydraulic, articulated steering system. The blade is mounted forward of the articulation joint, and is hydraulically actuated.

The bulldozer's primary tools are the **blade** and the **ripper**. The word "bulldozer" is sometimes used inaccurately for other similar construction vehicles such as a large front loader.

The bulldozer **BLADE** is a heavy metal plate on the front of the tractor, used to push objects, and shove sand, soil, debris, and sometimes snow. Dozer blades usually come in three varieties:

1. A straight blade ("S blade") which is short and has no lateral curve and no side wings and can be used for fine grading.
2. A universal blade ("U blade") which is tall and very curved, and has large side wings to carry more material.
3. An "S-U" (semi-U) combination blade which is shorter, has less curvature, and smaller side wings. This blade is typically used for pushing piles of large rocks, such as at a quarry.

Blades can be fitted straight across the frame, or at an angle, sometimes using additional 'tilt cylinders' to vary the angle while moving. The bottom edge of the blade can be sharpened, e.g. to cut tree stumps.

RIPPER is the long claw-like device on the back of the bulldozer. Rippers can come as a single (single shank/giant ripper) or in groups of two or more (multi shank rippers). Usually, a single shank is preferred for heavy ripping. The ripper shank is fitted with a replaceable tungsten steel alloy tip, referred to as a 'boot'. Ripping rock breaks the ground surface rock or pavement into small rubble easy to handle and transport, which can then be removed so grading can take place



EXCAVATORS

EXCAVATORS (hydraulic) are heavy construction equipment consisting of a boom, dipper (or stick), bucket and cab on a rotating platform known as the "house". The house sits atop an undercarriage with tracks or wheels. They are a natural progression from the steam shovels and often mistakenly called power shovels. All movement and functions of a hydraulic excavator are accomplished through the use of hydraulic fluid, with hydraulic cylinders and hydraulic motors. Due to the linear actuation of hydraulic cylinders, their mode of operation is fundamentally different from cable-operated excavators which use winches and steel ropes to accomplish the movements.

Excavators are used in many ways:

- Digging of trenches, holes, foundations
- Material handling
- Brush cutting with hydraulic saw and mower attachments
- Forestry work
- Forestry mulching
- Construction
- Demolition with hydraulic claw, cutter and breaker attachments
- General grading/landscaping
- Mining, especially, but not only open-pit mining
- River dredging
- Driving piles, in conjunction with a pile driver*-
- Drilling shafts for footings and rock blasting, by use of an auger or hydraulic drill attachment
- Snow removal with snowplow and snow blower attachments



GRADER.

Graders are commonly used in the construction and maintenance of dirt roads and gravel roads. In the construction of paved roads they are used to prepare the base course to create a wide flat surface upon which to place the road surface. Graders are also used to set native soil or gravel foundation pads to finish grade prior to the construction of large buildings. Graders can produce inclined surfaces, to give cant (camber or side slope) to roads. In some countries they are used to produce drainage ditches with shallow V-shaped cross-sections on either side of highways.

Steering for a motor grader is typically accomplished via a steering wheel or joystick controlling the angle of the front wheels, but many models also allow frame articulation between the front and rear axles, which allows a smaller turning radius in addition to allowing the operator to adjust articulation angle to aid in the efficiency of moving material. Other implement functions are typically hydraulically powered, and can be directly controlled by levers, or by joystick inputs or electronic switches controlling Electrohydraulic servo valves.



A more recent innovation is the outfitting of graders with grade control technologies, such as those manufactured by Topcon Positioning Systems, Inc., Trimble Navigation, Leica Geosystems or Mikrofyn for precise grade control and (potentially) "stakeless" construction. Manufacturers such as Deere have also begun to integrate these technologies into their machines out of the factory.

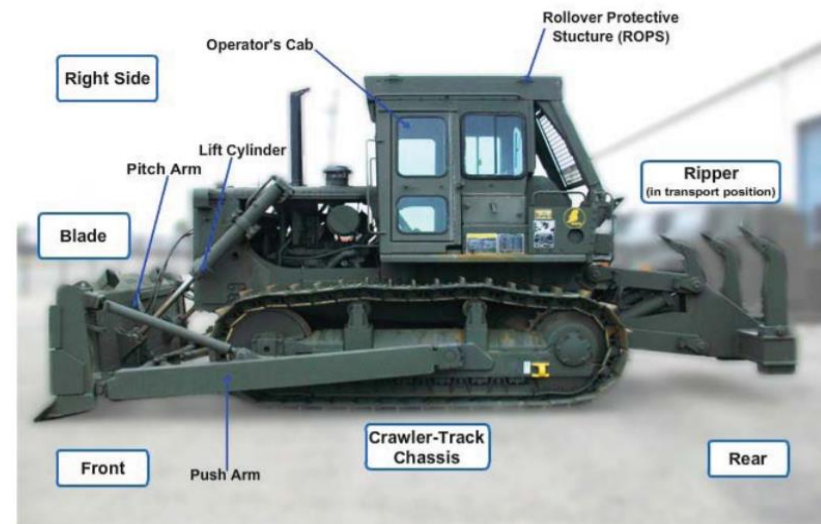
Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU2: Identify Components & Attachments	The students will be able to: <ul style="list-style-type: none"> Enlist different components Enlist different attachments 	<ul style="list-style-type: none"> Describe Heavy Machines Attachments, their Purpose and Capabilities. 	Manufacturer's Catalogue Available machines on site

Major components of Bull Dozer

The tractor is the body of the bulldozer. It encompasses the cab where the controls are located. The controls are of the "stick" variety; these control the right and left track, along with various other similar controls that lift and/or articulate the blade and the ripper. The Engine Bulldozers are always high-powered diesels, mainly because of the torque necessary to move through very rough terrain.

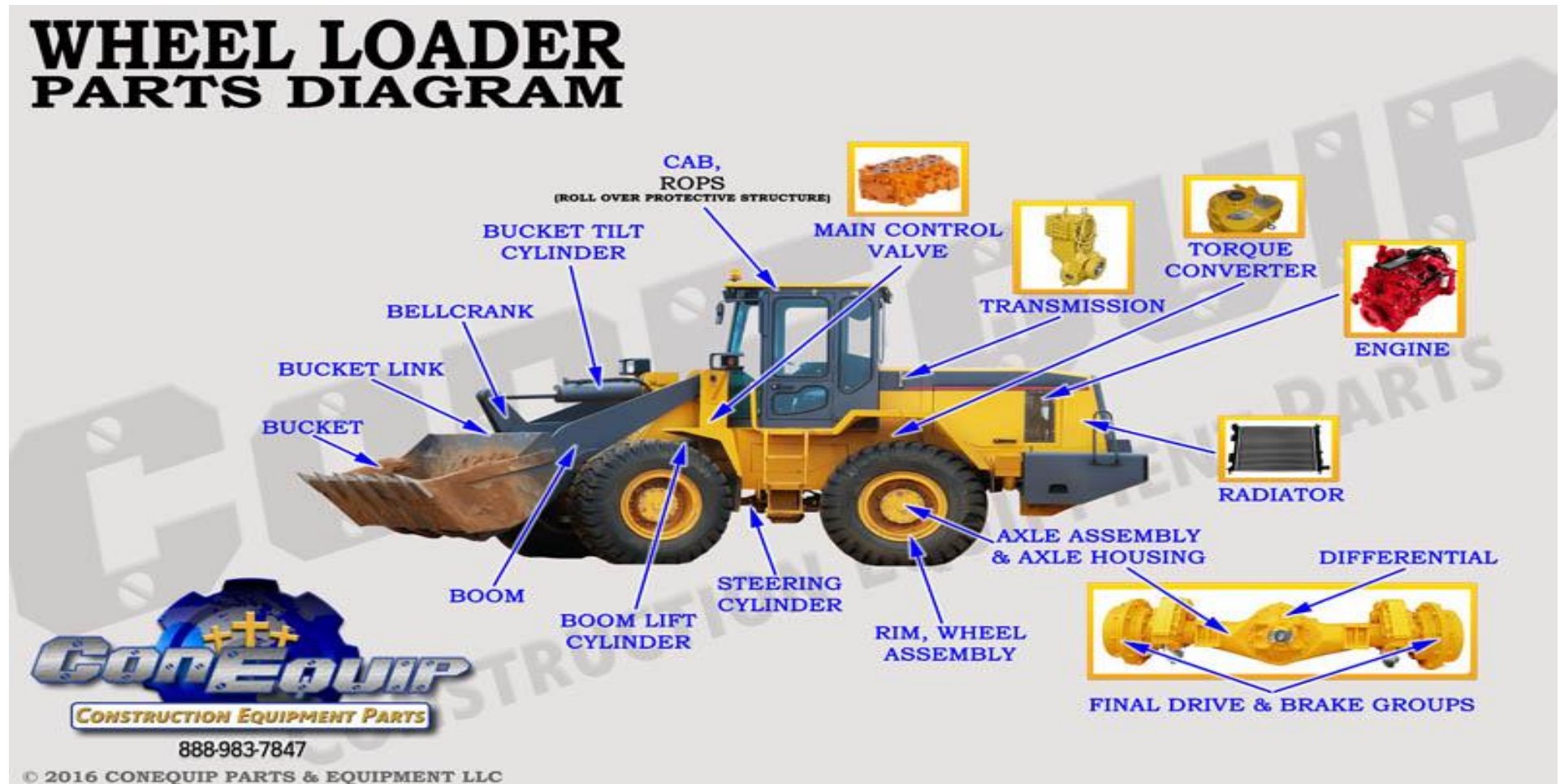
The Tracks Located on either side of the body, the tracks are made of heavy metal links that create powerful traction. The individual tracks are very wide, and added to the already large footprint of the body, a Bulldozer can move in, over, or through nearly any obstruction. The blade is located at the front of the tractor, and is able to lift up and down via hydraulic arms that are commanded from inside the cab.

The Ripper is actually an option, as bulldozers don't typically come with this construction appliance. The name ripper describes what it does, which is to create enormous tears in the ground by clawing itself across the ground. This system is particularly useful for laying long lengths of underground pipe.



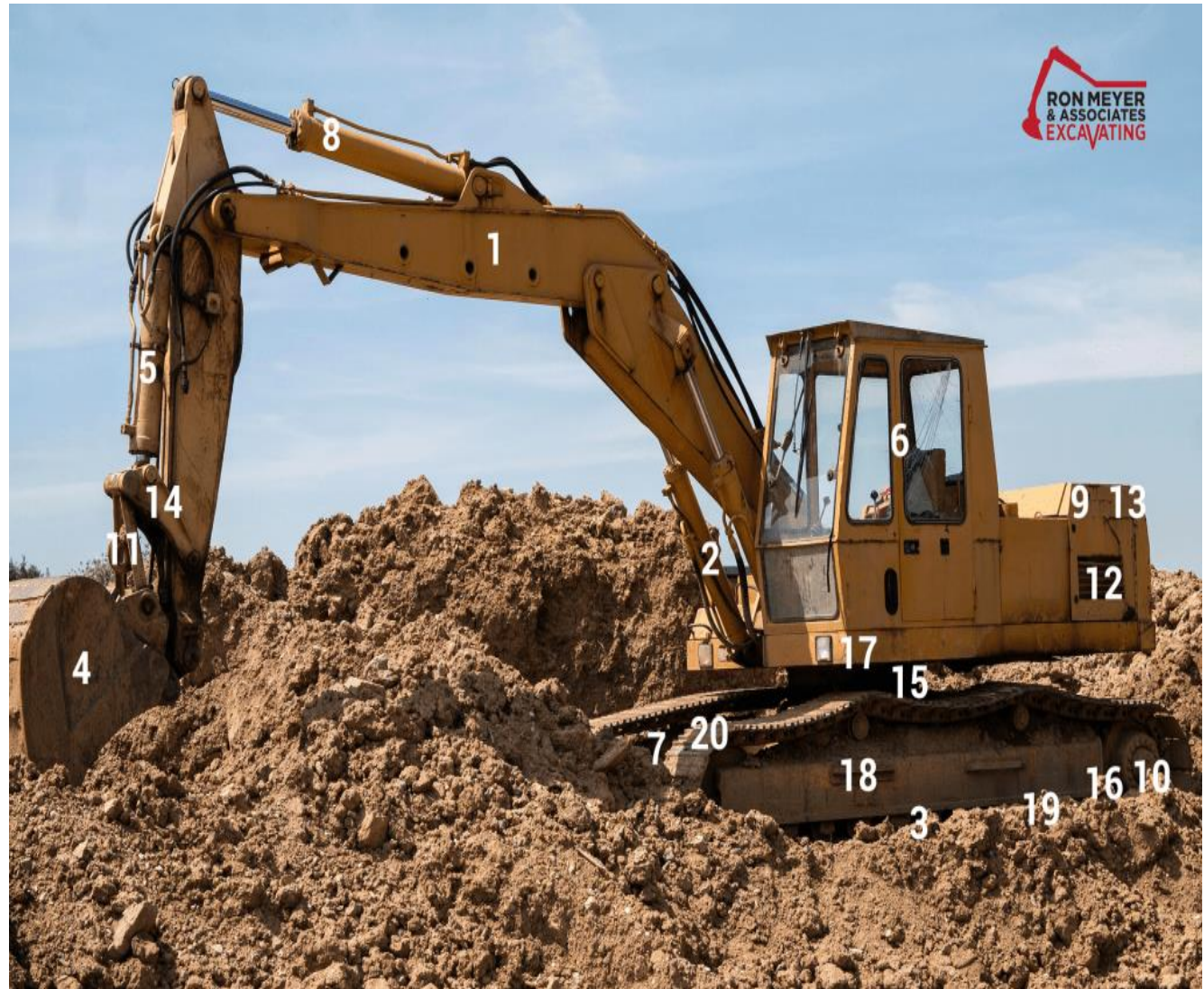
Major components of Wheel loader

The major components included in a loader are the engine (diesel in almost all cases), the hydraulic components (such as pumps, motors and valves) and the transmission components (gearbox, axles, wheels/tracks, pumps, motors, etc.). The engine runs both the hydraulics and the transmission, and these in turn move the front attachment (a bucket, forks, sweeper, etc.) to manipulate the material which we are handling (sand, gravel, cereal, manure or anything else) and the wheels or tracks to move the machine around the jobsite.



Major components of Excavator

1. Boom
2. Boom Cylinder
3. Bottom Roller(s)
4. Bucket
5. Bucket Cylinder
6. Cab, ROPS
7. Car Body
8. Dipper, Arm, Stick, Crowd Cylinder
9. Engine
10. Final Drive, Reduction Assembly
11. H-Link
12. Main Control Valve
13. Main Hydraulic Pump
14. Side Link, Dog Bones
15. Slew Ring, Swing Gear, Swing Bearing
16. Sprocket
17. Swing Reducer, Swing Drive & Motor
18. Track Adjuster, Tensioner
19. Track Chain, Rails
20. Track Pad, Grouser Pad



Major components of Grader

MISCELLANEOUS

Rubber Couplings
Starters and Alternators
Decal Sets
Universal Joints
Lights
Starters and Alternators
Decals
Tandem Chains &
Sprockets
U-Joints
Lights

BRAKES

Linings
Brake Drums
Discs and Plates
Seals

HYDRAULICS

Hydraulic Pump
Piston Pump Parts
Hydraulic Cylinder
Seal Kits
Cylinder Rod Lock Nuts

CIRCLE DRIVE

Circle Shoes
Mouldboard Brackets
Wear Strips
Circle Drive Gears

EXHAUST SYSTEMS

Engine Pre Cleaners
Mufflers and Pipes
Exhaust Extensions
Rain Flaps

TRANSMISSION

Pump
Gasket Kits

RIPPER ASSEMBLY

Scarifier Points
Scarifier Shanks
Ripper Points
Ripper Shanks

ENGINE

Crankshafts and Bearings
Camshafts
Pistons, Rings and Liners
Water and Oil Pumps
Pulleys and "V" Belts
Gasket Kits
Filters and Injector Nozzles
Compressors and Parts

EDGES

Heat Treated Blades
Black Blades
Serrated Blades
Overlays & Underlays
Plow Bolts & Nuts
Bolt On Edges
Plow Bolts & Nuts
TLC Component
Protection

FRONT AXLE

Pins and Bushes
Bearings
Centre Pins
Ball Joints
Duo-Cone Seals



Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU3: Identify capacities & capabilities of Machine	The students will be able to: <ul style="list-style-type: none"> • Check capacity as per manufacturers specifications • Check capability as per manufacturers specifications • Ensure proper capacity of machine • Ensure proper capability of machine 	<ul style="list-style-type: none"> • Describe Common Heavy Machine Capabilities, Advantages & Limitations 	Manufacturer's Catalogue Available machines on site

Dozers:

Dozers, also called bulldozers, are powerful diesel-powered crawler tractors equipped with a front mounted blade. Not only are dozers use to **drift** and side cast material, they are also used to clear land by moving debris, boulders, and trees. In addition, dozers are used to push and pull other heavy equipment.

Dozers are usually rated by size and power. The pull developed at the **drawbar** is expressed in pounds or as **drawbar horsepower**. The **drawbar pull** is greatest in the lowest transmission gear range. Although the specifications for dozers may vary among different manufacturers, the maximum speeds are seldom in excess of 8 mph.

Low Track Dozer

The low track dozer is commonly used for grading.

High Track Dozer

Designed with a high drive system, the high track dozer has an elevated drive sprocket. This specific type of dozer is commonly used for pushing in muddy conditions.

Wheel Loader:

This type of machinery is a variation on the tractor and is designed for more laborious work. The biggest difference between the two can be seen in their steering systems. Most wheel loaders' steering systems use a hydraulically actuated pivot point, which allows the front and rear axle to bear more weight than automotive steering systems.

Wheel loaders have a square bucket, called the loader, which is maneuvered by flexible arms. The loader is either a permanent fixture or an attachment secured to either the front or back of the machine. This kind of machine is able to dig with the backhoe and remove the unearthed material with the loader.

Excavator:

Modern hydraulic excavators come in a wide variety of sizes. The smaller ones are called mini or compact excavators. For example, Caterpillar's smallest mini-excavator weighs 2,060 pounds (930 kg) and has 13 hp; their largest model is the largest excavator available (a record previously held by the Orenstein & KoppelRH400), the CAT 6090, which weighs in excess of 2,160,510 pounds (979,990 kg), has 4500 hp, and a bucket as large as 52.0 m³.

Hydraulic excavators usually couple engine power to (commonly) three hydraulic pumps rather than to mechanical drivetrains. The two main pumps supply oil at high pressure (up to 5000 psi) for the arms, swing motor, track motors and accessories while the third is a lower pressure (~700 psi) pump for pilot control of the spool valves; this third circuit allows for reduced physical effort when operating the controls. Generally, the 3 pumps used in excavators consist of 2 variable displacement piston pumps and a gear pump. The arrangement of the pumps in the excavator unit changes with different manufacturers using different formats.

GRADER,

GRADER also commonly referred to as a **road grader** or a **motor grader**, is a construction machine with a long blade used to create a flat surface during the grading process. Although the earliest models were towed behind horses or other powered equipment, most modern graders contain an engine so are known, technically erroneously, as "motor graders". Typical models have three axles, with the engine and cab situated above the rear axles at one end of the vehicle and a third axle at the front end of the vehicle, with the blade in between. Most motor graders drive the rear axles in tandem, but some also add front wheel drive to improve grading capability. Many graders also have optional attachments for the rear of the machine which can be ripper, scarifier, blade, or compactor. In certain countries, for example in Finland, almost every grader is equipped with a second blade that is placed in front of the front axle. For snowploughing and some dirt grading operations, a side blade can also be mounted. Some construction personnel refer to the entire machine as "the blade". Capacities range from a blade width of 2.50 to 7.30 m (8 to 24 ft) and engines from 93–373 kW (125–500 hp). Certain graders can operate multiple attachments, or be designed for specialized tasks like underground mining.

In civil engineering, the grader's purpose is to "finish grade" (to refine or set precisely). The angle, tilt (or pitch) and height of the grader's blade can be adjusted to achieve precision grading of a surface. The "rough grading" is performed by heavy equipment or engineering vehicles such as scrapers and bulldozers.

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU4: Identify basic tools and supplies associated with Machines	<ul style="list-style-type: none"> • Check standard tools supplied with machines • Check spares/consumable materials • Adopt manufacturers specifications for tools and supplies 	<ul style="list-style-type: none"> • Describe basic Tools, Supplies & Lubricants associated with Heavy Machines. 	Manufacturer's Catalogue Available machines on site Hydraulic oil kan Engine oil kan Tool kit

A standard tool kit is supplied with every machine according to its type and function like tool kit supplied with motor grader is different from the tool kit of excavator as in excavator you need to install and uninstall the attachments for some specific jobs. The basic components of machine are almost the same like engine system, hydraulic system and electrical system but the only difference comes in their functioning.

It is very important to make sure that tools and equipment are properly insulated as if a screwdriver is not insulated it will give electric shock when opening any electrical system or if the steel stairs used to enter or exit machine are not properly insulated with rubber padding it will become slippery and operator will fell while entering or exiting the machine

Storage of tools is very important and for their storage a dedicated space is given in the machine mostly inside the operator cabin as loose tools will get lost or can roll inside cabin and make problems for operator in applying brakes or using any levers or stick

Storage of equipment is very important and for their storage a dedicated space is given in the machine mostly inside the operator cabin like fire extinguisher hanger, rope hanger etc.

Cleaning of tools is also very important as dirty tools may not function properly and can cause problems in case of emergency for example if a plier gets rusty it will not grip the nut properly or a dusty screw driver will not make a hard grip when opening a tight screw

Standard supplies and tools for Bull Dozer as per manufacturers specifications

Bulldozer Oils included 15w/40 E7 or E9, 10w/30 Low Saps Engine Oil – 10w Hydraulic Oil – EP80w/90 GL4 or GL5 Gearbox Oil – CAT 10w, CAT 30w Transmission – Steering Fluid and Caterpillar suitable Bulldozer Brake Fluid and Antifreeze Blue Concentrate or Red OAT 5-year Antifreeze Coolant

Standard supplies and tools for wheel loader as per manufacturers specifications

- DIESELFLEET CD+ 15W-40
- GEAR OIL ALCAT 30
- KROONTRAK SUPER 15W-30
- DRAULIQUID DOT 3
- MOS2 GREASE EP 2
- UNIGEAR HS GL-3/GL-5 80W-90

Standard supplies and tools for Excavator as per manufacturers specifications

Excavator includes 15w/40 E7 or E9 Engine Oil, Hydraulic 10w Oil, Hydraulic 30w Hydro/trans – EP80w/90 GL4 or GL5 Gear – Transmission – Steering Fluid and Brake Fluid and Antifreeze Blue Concentrate Coolant

Standard supplies and tools for Grader as per manufacturers specifications

Engine Oil top tier 15w/40 E7 or E9 – Road Grader 10w Hydraulic Oil – 80w/90 GL5 Tandem Oil, Circle Housing Oil, Axle Oil, 10w Transmission Fluid, 80w/90 Differential Oil, Drive Oil, Engine Gearbox Oil, Road Grader Grease and Road Grader Antifreeze Red Long Life Concentrate (coolant), Chain Case Oils, Hub Oil, Planetaries Oil along with Screen wash and Brake & Steering Fluid.

The importance of using the correct Fluids & Filters:

Using the right fluids and filters in your equipment is crucial for achieving optimal performance. Choosing the right products and maintaining them correctly will lead to enhanced performance, healthy emissions systems and improved fuel economy. Choosing the wrong kinds and neglecting upkeep can result in less efficient operation and even damage to your equipment. With so many options on the market, determining the right fluids and filters can be a complex task. Even among seemingly similar options, the cheaper and lower-quality alternatives can cause operational issues. Picking the products recommended by your equipment's manufacturer ensures you get the right ones.

Choosing the right oil for your machine

For a piece of motorized equipment to operate at its best, you must use the right kind of engine oil. The oil must also be clean and have the proper viscosity to lubricate the engine parts that make the machine function. High-quality oil helps ensure longer service life for the engine.

If you fill an engine with the wrong kind of oil, the engine could overheat, and parts could deteriorate and fail. For example, an oil grade that fails to maintain the right viscosity during a heat wave could pass like water through the engine. Consequently, the metal parts within the engine would grind against one another and overheat. Problems like this could lead to the costly replacement of components, and possibly the replacement of the engine.

To ensure peak performance for your equipment, be sure to use only the cleanest and highest-quality oil in your equipment's engine. You should also change the oil at least quarterly to keep it from getting dirty or losing its proper consistency. When you purchase oil for your motorized equipment, check the product label to ensure the oil grade is best suited for the machine in question.

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU5: Manage Inventory of tools and equipment.	<ul style="list-style-type: none"> • Check number of tools and equipment as per record • Report for faulty tools and equipment • Generate demand for defective tools and equipment • Maintain record of all tools and equipment 	<ul style="list-style-type: none"> • Describe Inventory management procedure of Tools & Equipment. 	Log book

8 Tips for effective equipment inventory management

<https://www.chegroom.com/blog/tips-efficient-equipment-inventory-management/>

1. Know what you have

Do you know exactly what equipment is in your inventory? You might have an idea, even though we believe the combined value of all your supporting equipment is probably higher than you'd expect. Even if you have an overview, is it a living thing? A list of the equipment in your inventory from a year ago is worth less than the paper it is printed on. Your equipment inventory list should be:

Complete: include all of your assets

Accurate: provide enough information – value, location, capabilities, ...

Up-to-date: always reflect your changing inventory

2. Track how it is used

Once you know what you have, the next step is knowing exactly how it is being used. There are several questions you should be able to answer for each piece of equipment in your inventory:

- **How** often is it used?
- **Who** uses it?
- **When** and **where** is it used

When you know what you have and how it is used you can make informed decisions about your current and future equipment management strategy.

3. Right asset, right place, right time

If you have multiple locations, how should you divide your assets between them? An equal division sounds logical but is not effective, as demand for equipment is unlikely to be the same everywhere. With accurate and up-to-date usage data you can deploy your assets where they are needed most. Why have equipment gathering dust in one place when there is a shortage elsewhere? Demand and supply fluctuate over time as well. Offering a discount might let you make money on items that weren't going to be used anyway, or you can rent extra equipment yourself to bridge short periods of increased demand.

4. Don't spend more – spend smarter

One way to ensure that the right equipment is available at the right time is to buy more of everything. But this is inherently wasteful – some of the extra equipment will be put to good use, while the rest will simply sit in storage. We can avoid this waste, based on the information we gathered in the earlier steps. By prioritizing your spending on the equipment that is used most you can get the most out of it.

5. Fix things before they break

Would you rather:

A: Spend an hour every week making sure your equipment is in great shape.

B: Spend a day every month repairing equipment that has broken down.

Even looking simply at time spent maintenance is clearly the best choice. And while equipment always seems to break down at the worst time possible, you can plan your maintenance ahead of time. Equipment that is used all the time is obviously more valuable to your business than equipment that is used once a week. But it is also more likely to break down, so it is in higher need of regular maintenance. Plan maintenance based on need, instead of a fixed schedule for all equipment, to make optimal use of your time. And because you know when your equipment is most likely to be idle you can schedule maintenance to reduce its impact on the rest of your business.

6. Find underlying issues

If an important piece of equipment breaks down once, it's an annoyance. But what if it keeps breaking down, over and over? Now that you have data on your equipment, use it! Look for trends so you can find underlying issues instead of scratching the surface. Perhaps the breakdowns are caused by an employee who didn't receive the proper training and has been using the equipment the wrong way. In this case replacing the equipment won't solve the problem.

7. Buy the best

Inevitably equipment will have to be replaced or upgraded. But here again you can use the information you've gathered to spend your money smarter.

- Which brands cause the most issues?
- Which equipment is liked best?
- Which equipment loses you the most time and money by breaking down?
-

8. Use the right equipment inventory system

You can of course try to keep track of this information with pen and paper, for instance using an equipment sign-out form to know who's using the gear. Spreadsheets are another option – but that option has drawbacks as well. Using a modern, user-friendly equipment inventory system is the best solution for your business. It automates a lot of the background work, so you can focus on the things that really matter.

Multiple Choice Questions

Question 1 Which machine is used for ripping soil?

- A Bull Dozer
- B Wheel Loader
- C Excavator
- D Grader

Question 2 Why is it important to know the capacity of machines

- A To ensure that the Machine is suitable for working
- B To be able to work more quickly and without any hazard
- C To prevent any hazard or damage to machine due to overload
- D To demonstrate good working skills

Question 3 Why is it important to choose best lubricants

- A To avoid risking the money waste
- B To prevent machinery from breaking down
- C To avoid low quality working
- D To ensure that the sound of the machine is fine

Question 4 Which TWO of the following are causes of machinery break down?

- A Un even working areas
- B Wrong selection of machine as per the capacity and capability of machine

- C Water seepage in Machine blade
- D Use of Low-quality supplies and lubricants

Question 5 What is the importance of maintaining a log book?

- A Prevent expensive repair works from happening
- B Helps you create specialized maintenance programs
- C Prevent problems regarding warranty claims
- D It increases the safety of operators

Question 6 Is the following statement true or false?

“The correct time to use PPE is after starting the job”

- A TRUE
- B FALSE

Question 7 Which of the following is a part of Bull Dozer?

- A Boom
- B Stick
- C Bucket
- D Blade

- Question 8** Which is the best machine to use for excavation?
- A Grader
 - B Wheel Loader
 - C Excavator
 - D Bull Dozer
- Question 9** Which one of the following is a leveling Machine?
- A Grader
 - B Wheel Loader
 - C Excavator
 - D Bull Dozer
- Question 10** What is the correct machine to use for dumping materials from one place to other?
- A Grader
 - B Wheel Loader
 - C Excavator
 - D Bull Dozer
- Question 11** Is the following statement true or false?
- Wheel Loader has an articulated blade at the front.
- A TRUE
 - B FALSE
- Question 12** Which TWO of the following machines can be used for grading the earth?
- A Grader

- Question 13** When demolishing a building what attachment is used in excavator?
- B Wheel Loader
 - C Excavator
 - D Bull Dozer
- Question 14** Why it is important to take health & safety training?
- A Bucket
 - B Jack hammer
 - C Blade
 - D Ripper
- Question 15** What is the procedure for reporting any damage or maintenance of heavy machinery?
- A It is the operator's responsibility to know how to operate heavy equipment safely
 - B Operators must know the proper use and limitations of specific equipment.
 - C Operators should know the safe operating practices of specific equipment available in the manufacturer's instructions.
 - D Safety features such as kill switches, guards, shields, reverse alarms, roll bars, or control bars must not be modified or removed
- Question 15** What is the procedure for reporting any damage or maintenance of heavy machinery?
- A Email
 - B Log Book
 - C Phone Call
 - D Verbally

FREQUENTLY ASKED QUESTIONS (FAQs)

<p>1. What is Competency Based Training (CBT) and how is it different from currently offered trainings in institutes?</p>	<p>CBT is an approach to vocational education and training that places emphasis on what a person can do in the workplace as a result of completing a program of training. Compared to conventional programs, the competency-based training is not primarily content based; it rather focuses on the competence requirement of the envisaged job role. The whole qualification refers to certain industry standard criterion and is modularized in nature rather than being course oriented.</p>
<p>2. What is the passing criterion for CBT certificate?</p>	<p>You shall be required to be declared “Competent” in the summative assessment to attain the certificate.</p>
<p>3. What are the entry requirements for this course?</p>	<p>The entry requirement for this course is 8th Grade or equivalent.</p>
<p>4. How can I progress in my educational career after attaining this certificate?</p>	<p>You shall be eligible to take admission in the National Vocational Certificate Level-3 in Leather Products Development Technician (Pattern Maker). You shall be able to progress further to National Vocational Certificate Level-4 in Heavy Construction Machinery Operator Course; and take admission in a level-5, DAE or equivalent course (if applicable). In certain case, you may be required to attain an equivalence certificate from The Inter Board Committee of Chairmen (IBCC).</p>
<p>5. If I have the experience and skills mentioned in the competency standards, do I still need to attend the course to attain this certificate?</p>	<p>You can opt to take part in the Recognition of Prior Learning (RPL) program by contacting the relevant training institute and getting assessed by providing the required evidences.</p>
<p>6. What is the entry requirement for Recognition of Prior Learning program (RPL)?</p>	<p>There is no general entry requirement. The institute shall assess you, identify your competence gaps and offer you courses to cover the gaps; after which you can take up the final assessment.</p>
<p>7. Is there any age restriction for entry in this course or Recognition of Prior Learning program (RPL)?</p>	<p>There are no age restrictions to enter this course or take up the Recognition of Prior Learning program</p>

8. What is the duration of this course?	The duration of the course work is 1,510 hrs. (11 months)
9. What are the class timings?	The classes are normally offered 25 days a month from 08:00am to 01:30pm. These may vary according to the practices of certain institutes.
10. What is equivalence of this certificate with other qualifications?	As per the national vocational qualification's framework, the level-4 certificate is equivalent to Matriculation. The equivalence certificate can be obtained from The Inter Board Committee of Chairmen (IBCC).
11. What is the importance of this certificate in National and International job market?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTTC). These standards are also recognized worldwide as all the standards are coded using international methodology and are accessible to the employers worldwide through NAVTTTC website.
12. Which jobs can I get after attaining this certificate? Are there job for this certificate in public sector as well?	You shall be able to take up jobs in the local or overseas construction companies in heavy machinery operator job profile.
13. What are possible career progressions in industry after attaining this certificate?	You shall be able to progress up to the level of supervisor after attaining sufficient experience, knowledge and skills during the job. Attaining additional relevant qualifications may aid your career advancement to even higher levels.
14. Is this certificate recognized by any competent authority in Pakistan?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTTC). The official certificates shall be awarded by the relevant certificate awarding body.
15. Is on-the-job training mandatory for this certificate? If yes, what is the duration of on-the-job training?	On-the-job training is not a requirement for final / summative assessment of this certificate. However, taking up on-the-job training after or during the course work may add your chances to get a job afterwards.
16. How much salary can I get on job after attaining this certificate?	The minimum wages announced by the Government of Pakistan in 2019 are PKR 17,500. This may vary in subsequent years and different regions of the country. Progressive employers may pay more than the mentioned amount. The heavy Machinery Operator normally earns 20,000 to 25,000 in the start.
17. Are there any alternative certificates	There are some short courses offered by some training institutes on this subject.

which I can take up?	Some institutes may still be offering conventional certificate courses in the field.
18.What is the teaching language of this course?	The teaching language of this course is Urdu and English.
19.Is it possible to switch to other certificate programs during the course?	There are some short courses offered by some training institutes on this subject. Some institutes may still be offering conventional certificate courses in the field.
20.What is the examination / assessment system in this program?	Competency based assessments are organized by training institutes during the course which serve the purpose of assessing the progress and preparedness of each student. Final / summative assessments are organized by the relevant qualification awarding bodies at the end of the certificate program. You shall be required to be declared "Competent" in the summative assessment to attain the certificate.
21.Does this certificate enable me to work as freelancer?	You can start your small business by purchasing your own heavy construction machine and can start earning 50,000 per month. You may need additional skills on entrepreneurship to support your initiative.

MCQ's Answer Sheet:

Question # 1 = B	Question # 11 = A
Question # 2 = D	Question # 12 = A
Question # 3 = C	Question # 13 = B&C
Question # 4 = A	Question # 14 = A&B
Question # 5 = B	Question # 15 = A
Question # 6 = B	
Question # 7 = A&D	
Question # 8 = B	
Question # 9 = A	
Question # 0 = B	

