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HEAVY MACHINE OPERATOR



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CBT CURRICULUM

National Vocational Certificate Level 1

Version 1 - November, 2019



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1. Introduction

In order to build the capacity of technical and vocational training institutes in Pakistan through provision of demand driven competency based trainings in construction sector the NAVTTTC, and TEVT Sector Support Program (TSSP) have joined hands together to develop qualifications for construction sector. These qualifications 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 qualifications will be on both demand and supply side.

Based upon this demand of industry these competency-based qualifications for Heavy Machine Operator are developed under National Vocational Qualification Framework (NVQF) (Level 1 to 4). The qualifications mainly cover competencies along with related knowledge and professional skills which are essential for getting a job or self-employed.

The qualifications 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. NAVTTTC has approved the nomination of a Qualification Development Committee (QDC). The QDC consists of experts from the relevant industries from different geographical locations across Pakistan and academicians who were consulted during the development process to ensure input and ownership of all the stakeholders. The National Competency Standards could be used as a referral document for the development of curricula to be used by training institutions.

1.1 Purpose of the training program:

The purpose of the training is to produce skilled manpower for improving the existing capacity of the construction sector. This training will equip trainees with the required skills 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 the youth to find employment in the construction sector.



1.2 Overall objectives of training program:

The Heavy Machine Operator qualification level 1-4 consists of theoretical and practical details required to learn operational techniques of Bulldozer, Wheel Loader, Excavator and Grader machines.

1.3 Competencies to be gained after completion of course:

The detail of the competency standards included in this qualification are given below:

National Vocational Certificate level 1, Heavy Machine Operator in (Construction Sector)

1. Comply with Work Health and Safety Policies
2. Obey the Workplace Policies and Procedures
3. Follow Basic Communication Skills (General)
4. Operate Computer Functions (General)
5. Identify Machine & its Attachments

1.4 Job opportunities:

Heavy Machine Operators (HMO) are in demand across the country and abroad. Their services are required for everything from road and bridge construction, bulldozing, loading and grading, to excavating and much, much more. This is a good career opportunity for a reliable and responsible individual with a strong work ethic. Heavy Machine Operators not only work on regular construction building jobs, but also on infrastructure projects (roads, bridges, canals, dams, railway lines and ports, otherwise called non-building construction), and in mining and timber operations.



1.5 Entry level of trainees:

The entry level for National Vocational Certificate level 1, in “Heavy Machine Operator” (Construction Sector) are given below:

| Title | Entry requirements |
|--|---|
| National Vocational Certificate level 1, in “Heavy Machine Operator” (Construction Sector) | Entry for assessment for this qualification is open. However, entry into formal training institutes, based on this qualification is open. |

1.6 Minimum qualification for teachers:

- Should have completed intermediate and equivalent qualifications.
- Must be a holder of G I certificate in relevant field or DAE in Civil Technology
- Must be able to communicate effectively both orally and in written form.
- Must have at least two 2 years teaching experience.

1.7. Recommended trainer/trainee ratio

Generally, Trainer/Trainee ratio for CBT&A courses is 1:20

1.8 Medium of instruction:

English, Urdu, local language.



1.9 Duration of the course:

The proposed curriculum is composed of **05** modules that will be covered in **210** learning hours. It is proposed that the course may be delivered in **Three months** period.

The distribution of contact hours is given below:

| | | |
|------------------|---|--------------------------|
| Total | - | 210 hours. |
| Theory | - | 46 hours (21.9%) |
| Practical | - | 164 hours (78.1%) |

1.10 Sequence of the modules

Following is the structure of the course:

| NVQF Level | Module # | Title | Category | Theory (hours) | Practical (hours) | Total (hour) | Credits hours | Total Credit Hours |
|--------------------|----------|---|-----------|----------------|-------------------|--------------|---------------|--------------------|
| 1 | A | Comply with Work Health and Safety Policies | Generic | 06 | 24 | 30 | 03 | 21 |
| | B | Obey the Workplace Policies and Procedures | Generic | 04 | 16 | 20 | 02 | |
| | C | Follow Basic Communication Skills (General) | Generic | 10 | 40 | 50 | 05 | |
| | D | Operate Computer Functions(General) | Generic | 10 | 40 | 50 | 05 | |
| | E | Identify Machine & its Attachments | Technical | 16 | 44 | 60 | 06 | |
| TOTAL | | | | 46 | 164 | 210 | 21 | 21 |
| Percentage. | | | | 21.90% | 78.10% | | | |



2. 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> | <p>10</p> | <p>40</p> | <p>50</p> |
| <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> | <p>10</p> | <p>40</p> | <p>50</p> |
| <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> | <p>16</p> | <p>44</p> | <p>60</p> |
| TOTAL | | <p>46</p> | <p>164</p> | <p>210</p> |

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Module-E
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Module E: 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 Machine and manage inventory of tools and equipment.

Duration: 60 Hours

Theory: 16 Hours

Practice: 44 Hours

| Learning Unit | Learning Outcomes | Learning Elements | Duration | Materials Required | Learning Place |
|---|---|--|--|--|----------------|
| LU1. Machine and its sizes | <ul style="list-style-type: none"> • Enlist 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 | Theory – 04 Hrs. Practical – 12 Hrs. Total – 16 Hrs. | <ul style="list-style-type: none"> • Machine Manual • Machines | |
| LU2. Components & attachments | <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 | Theory – 04 Hrs. Practical – 16 Hrs. Total – 20 Hrs. | <ul style="list-style-type: none"> • Machine Attachments | |
| LU3. Capacities & capabilities of Machine | <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 | Theory – 04 Hrs. Practical – 08 Hrs. Total – 12 Hrs. | <ul style="list-style-type: none"> • Machine Manuals | |



| | | | | | |
|--|--|--|---|---|--|
| <p>LU4. Basic tools and supplies associated with Machines</p> | <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 | <p>Theory – 02 Hrs. Practical – 04 Hrs. Total – 06 Hrs.</p> | <ul style="list-style-type: none"> • Tool Kit | |
| <p>LU5. Inventory of tools and equipment.</p> | <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 | <p>Theory – 02 Hrs. Practical – 04 Hrs. Total – 06 Hrs.</p> | <ul style="list-style-type: none"> • Tool record register • Periodic inspection record register | |



4. List of Tools and Equipment

(FOR A CLASS OF 25 STUDENTS)

| Name of Trade | | Heavy Machine Operator | |
|--------------------|--|------------------------|-----------|
| Duration of Course | | Months | |
| Sr. # | Description | Quantity | |
| 1. | Steel-Toed Footwear, | 30 | |
| 2. | Hard Hat, | 30 | |
| 3. | Safety Gloves, | 30 | |
| 4. | Appropriate Safety Glasses, | 30 | |
| 5. | High Visibility Vest, | 30 | |
| 6. | Hearing Protection, | 30 | |
| 7. | Breathing Apparatus, | 04 | |
| 8. | De-Electric Boots and Gloves for Protection from Electrical Shock. | 10 | |
| 9. | Fall Protection, And Other Applicable PPE | 30 | |
| 10. | Site Emergency Response Plan, | 30 | |
| 11. | Fire Extinguishers, | 04 | |
| 12. | Fire Blankets, | 04 | |
| 13. | Respirators, Masks, | 30 | |
| 14. | Fire Hoses, | 08 | |
| 15. | First Aid Kits, Stretchers, WHMIS Book, And Other Related Tools and Gear | 04 sets | |
| 16. | Basic Tools, Such as Grease Gun, Air Pump Etc. | 25 sets | |
| 17. | Hammer, | 05 | each size |
| 18. | Screwdrivers, | 05 | each size |
| 19. | Pliers, | 05 | each size |
| 20. | Self-Locking Pliers, | 05 | each |



| | | |
|-----|--|-----------------|
| | | size |
| 21. | Adjustable Wrench, | 05 each size |
| 22. | Assorted Other Wrenches, Measuring Tape(100m) | 05 each size |
| 23. | Basic Supplies, Such as Grease, Oil, Window Cleaner, Rags, Ice Scraper, Whisk Broom. | 05 each |
| 24. | Color-code cards, utility documentation. Logbooks Service Manuals, OHS Regulation, | 10 sets |
| 25. | MACHINES | |
| 26 | A. Bulldozer. Attachments: - 1. Blades. 2. Ripper | 01 each |
| 27 | B. Excavator (Wheel & Crawler). Attachments: - 1. Buckets. 2. Grappler. 3. Coupler. 4. Thumbs. 5. Pulverize. 6. Lifter. 7. Rakes. 8. Chuck 9. Blades. 10. Ripper. 11. Forks. 12. Adapter. 13. Hammer. 14. Auger. 15. Compactor. 16. Stump Harvester. 17. Driller | 01 each |
| 28 | C. Motor Grader. Attachments: - 1. Angle Blade. 2. Lift Group. 3. One-way Plow. 4. Snow Gate. 5. Snow Wing. 6. Straight Blade, 7. UV Angle Blade. 8. V-Plow | 01 each |
| 29 | D. Wheel Loader. Attachments: - 1. Coupler. 2. Dozer Blade. 3. Boom Poles. 4. Bucket. 5. Fork. 6. Grappler. 7. Snow Blade, 8. Trailer Hitches. 9. Rotary Sweeper. 10. Broadcast Spreader | 01 each |



5. Specification of Machines & Consumable

A. Bulldozer Specification & Consumable

| S.# | Length (mm) | D50A-17 | D65A-8 | D85-18/D85A | D155A-1 |
|-----|---------------------------------------|-------------------|-------------------|-------------------|--------------------|
| 1. | Overall Length | 4765 | 5135 | 5750 | 6880 |
| 2. | Overall Width | 2145 | 3970 | 3725 | 4130 |
| 3. | Overall Height | 2900 | 3020 | 3395 | 3720 |
| 4. | Overall Op Weight | 12240 | 15890 | 23510 | 33690 |
| 5. | Ground Clearance | 315 | 400 | 400 | 500 |
| 6. | Track Shoes Width | 460 | 460 | 560 | 560 |
| 7. | Grade Ability (degree) | 30 | 30 | 30 | 30 |
| 8. | Ground Pressure (kg/cm ²) | 0.62 | 0.67 | 0.62 | 0.77 |
| 9. | Horse Power | 120 | 165 | 220 | 320 |
| 10. | Type of Dozer | Angle | Tilt | Tilt | Tilt |
| 11. | Fuel (LT) | 250 | 320 | 450 | 660 |
| 12. | Engine Oil-SAE 30 (LT) | 30 | 30 | 43 | 71 |
| 13. | Hydraulic Oil (LT) | 87 | 108 | 110 | 164 |
| 14. | Transmission Oil (LT) | 18 | 52 | 122 | 185 |
| 15. | Cooling Water (LT) | 52 | 63 | 79 | 165 |
| 16. | Steering Oil (LT) | 63 | 70 | Nil | Nil |
| 17. | Final Drive Case Oil (LT) | 52 (26 each side) | 62 (31 each side) | 72 (36 each side) | 110 (55 each side) |



B. Excavator Specification & Consumable.

| S# | Specification | PC 120 | PC 150 | PC 200 |
|----|---------------------------------------|-------------------------|-------------------------|-------------------------|
| 1 | Bucket Capacity (m ³) | 0.50 m ³ | 0.55 m ³ | 0.7 m ³ |
| 2 | Operating Weight (Kg) | 12030 kg | 14500 kg | 18000 kg |
| 3 | Overall Length (mm) | 7050 | 8350 | 9380 |
| 4 | Overall Width (mm) | 2500 | 2550 | 2740 |
| 5 | Overall Height (mm) | 2700 | 2900 | 2940 |
| 6 | Swing Speed (rpm) | 20 | 19.6 | 13 |
| 7 | Travel Speed (Km/h) | 3 km/h | 3.2 km/h | 3.5k m/h |
| 8 | Grade ability (Degree) | 25 % to 30% | 35% | 35% |
| 9 | Ground Pressure (Kg/cm ²) | 0.45 Kg/cm ² | 0.47 Kg/cm ² | 0.47 Kg/cm ² |
| 10 | Max. Excavation (mm) | 3060 | 5400 | 6550 |
| 11 | Max. Stockpile (mm) | 4420 mm | 5530 mm | 6255 mm |
| 12 | Max. Stretch (mm) | 7050 mm | 8440 mm | 9850 mm |
| 13 | Horsepower (HP) | 85.4 HP | 86 HP | 106 HP |
| 14 | Fuel Capacity (LT) | 230 LT | 280 LT | 540 LT |
| 15 | Engine Oil (LT) | 11 LT | 24 LT | 24 LT |
| 16 | Hydraulic Oil (LT) | 100 LT | 250 LT | 250 LT |
| 17 | Swing case Oil (LT) | 2.5 LT | 7 LT | 8 LT |
| 18 | Water (Lt) | 15.7 LT | 24 LT | 24 LT |
| 19 | Track Chain Pulley | 20 to 25 mm | 20 to 25 mm | 60 to 100 mm |
| 20 | Final Drive | Each side | Each side | Each side |
| | | 2.5 LTR | 2.5 LTR | 7.4 LTR |



C. Motor Grader Specification & Consumable.

| S.# | Detail | MG 200 | MG 330 | MG 430 | GD-605-A3 |
|-----|-----------------------|---------------------|--------------------|---------------------|--------------------|
| 1. | Heaped Blade Capacity | 3.06 m ³ | 3.9 m ³ | 1.01 m ³ | 3.9 m ³ |
| 2. | HP (Horse Power) | 115 hp | 135 hp | 155 hp | 145 hp |
| 3. | Op/Weight | 9885 kg | 10920 kg | 12220 kg | 12870 kg |
| 4. | Fuel | 210 ltr | 230 ltr | 275 ltr | 250 ltr |
| 5. | Engine Oil | 12 ltr | 13 ltr | 13 ltr | 24 ltr |
| 6. | Hydraulic Oil | 70 ltr | 67 ltr | 67 ltr | 60 ltr R/Fel |
| 7. | Transmission | 40 ltr | 23 ltr | 32 ltr | 30 ltr |
| 8. | Water | 21 ltr | 34 ltr | 46 ltr | 45 ltr |
| 9. | Tire Pressure | 2.25 | 1.8 | 2.6 | 2.45kg |
| 10. | Gear Oil/Final Drive | 2.5 ltr | 3.4 ltr | 3.5 ltr | 26 CTR |
| 11. | Tandem Oil | 48 ltr | 73 ltr | 85 ltr | 72 tr 36X36 |



D. Wheel Loader Specification & Consumable

| S# | Items | WA 450 | WA 320 | WA 200 | 966 F cat | 928 F cat |
|----|-------------------------------------|--------|--------|--------|-----------|-----------|
| 1 | Horsepower (HP) | 237 | 165 | 110 | 220 | 120 |
| 2 | Operating Weight (Kg) | 19100 | 13450 | 92100 | 20905 | 11148 |
| 3 | Bucket Capacity (m ³) | 3.5 | 2.8 | 1.7 | 3.8 | 2 |
| 4 | Grade ability (Degree) | 30 | 35 | 33 | 35 | 35 |
| 5 | Speed/Hour | 34-38 | 38 | 37 | 48 | 45 |
| 6 | Fuel (LT) | 330 | 228 | 170 | 304 | 189 |
| 7 | Engine Oil (LT) | 32 | 19.5 | 24 | 28 | 20 |
| 8 | Hydraulic Oil (LT) | 230 | 89 | 83 | 205 | 100 |
| 9 | Transmission Oil (LT) | 61 | 74 | 35 | 59 | 30 |
| 10 | Cooling Water (LT) | 65 | 20 | 38 | 48 | 41 |
| 11 | F/R Axle oil (LT) | 120 | 48 | 34 | 47 | 50 |
| 12 | Tire Pressure (Kg/cm ²) | 2.8 | 2.5 | 2.5 | 2.8 | 2.5 |



5. List of Stationary

| Sr. # | Description |
|-------|----------------------|
| 1. | Handbooks |
| 2. | Design books |
| 3. | Pencils |
| 4. | Rubber |
| 5. | Sharpeners |
| 6. | Paper cutter |
| 7. | Scissors |
| 8. | Colours |
| 9. | White charts |
| 10. | Brown sheets |
| 11. | White board markers |
| 12. | Permanent markers |
| 13. | File cover and files |



6. Members of the Curriculum Development Committee

| S# | Name | Designation | Contact No | Email | Organization |
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