Skill India
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सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
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SCMS

Participant Handbook

Not For Sale - For Internal Circulation Only

Sector
Mining

Sub-Sector
Engineering Services

Occupation
Field Services - Mechanical

Reference ID: **MIN/Q 0433, Version 1.0**
NSQF Level 4

HEMM Mechanic

Skill Council for Mining Sector

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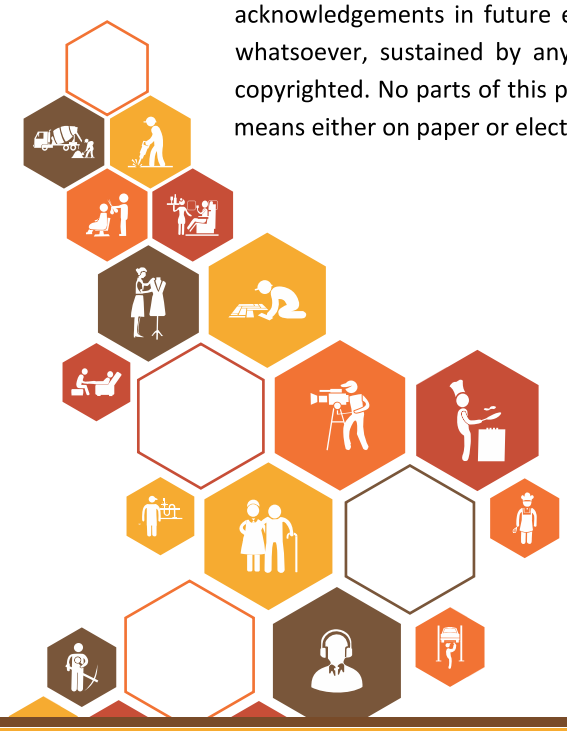

> Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission.

Shri Narendra Modi
Prime Minister of India

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Certificate

CURRICULUM COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

SKILL COUNCIL FOR MINING SECTOR

for the

MODEL CURRICULUM

Complying to National Occupational Standards of
Job Role/Qualification Pack: **HEMM Mechanic** QP No. **MIN/Q 0433 | Version 1.0 | NSQF Level** 4

Date of Issuance: December 14th, 2015
Valid up to: March 31st*, 2017

* Valid up to the next review date of the Qualification Pack

Authorised Signatory
(Skill Council for Mining Sector)

Acknowledgements

SCMS has become operational since January, 2014 with a mandate to support the mining sector through a range of skill development initiatives that includes development of National Occupational Standards and Qualification Packs (NOS/QP) in line with National Skill Qualification Framework (NSQF) with reference to the sectorial job roles to begin with and thereafter to roll out the skill development programs in partnership with accredited Training Providers leading to assessment and certification by SCMS, the objective thus being to ensure adequate availability of skill trained and certified workforce through sound system and process of training, assessment and certification.

The key factors affecting the human resources and skill requirement in the Indian Mining Industry are technology up-gradation, increase in productivity stringent environment and sustainable development framework, globalization and aging profile of workforce and long gestation period for skill acquisition.

Considering the specialization & complexity of job roles in mining sector, a systematic and analytical approach was required for development of the contents corresponding to specified QP/NOS in line with the guidelines of NSQF. Accordingly taking benefit of the available in house competency along with the support of domain experts, SCMS has developed this "**Participant Handbook**" for **HEMM Mechanic**.

I am sanguine that this handbook will lead to successful roll out the skill development initiatives in this area, helping greatly our stakeholders particularly trainees, trainers and assessors etc.

I, gratefully acknowledge support and contribution received from various mining companies in compiling this Handbook without which this would not have been possible.

Further, I wish to place on record our appreciation for the contribution made by entire team of SCMS and the support extended by NSDC team.

It is expected that this publication would meet the complete requirements of QP/NOS based training delivery of **HEMM Mechanic** job role, I would indeed welcome suggestions from users, mining companies, experts and other stakeholders for any improvement in future.

12th August 2016
New Delhi

A.K. Bhandari
Chief Executive Officer

About this Book

This Participant Handbook is designed to enable training for the specific Qualification Pack (QP). Each National Occupational (NOS) is covered across Unit/s. The five NOSs covered across the units are as follows:

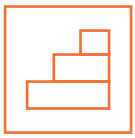
- MIN/N 0491 Diagnose HEMM for Repair Requirements
- MIN/N 0492 Carry Out Service Repair and Maintenance
- MIN/N 0901 Health and Safety

Apart from this, there is an additional unit on basic communication and employability skills.

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



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1. Introduction

SCMS

Key Learning Outcomes

At the and of this module you will be able to :

1. Execute Installation and preventive maintenance activities on HEMM,
2. Install Machines
3. Perform preventive maintenance on HEMM and other vehicles
4. Track and log preventive maintenance activities
5. Execute Installation and preventive maintenance activities on light vehicles and other machine assemblies.

UNIT 1.1 - Introduction

What does an HEMM Mechanic Do?

An HEMM Mechanic ensures end-to-end servicing of HEMM. Performs maintenance and repair activities on various pieces of heavy earth moving machines including but not limited to heavy-duty truck and semi-tractors, material spreader, 6- wheel drive military type vehicles, excavators, skidders, high pressure pumps, 25 ton and smaller bulldozers, graders, cranes, snowmobile groomers, underbody blades, dump bodies, snow plows, crawler tractors and trailers, backhoes, trailers, electronic message boards and signs, street sweepers, aerial towers and man lifts.

An HEMM mechanic also diagnoses, services and repairs various systems that are found on pieces of heavy earth moving machines such as mechanical and computer electronic controls, air brake systems, transmissions, computer controlled automatic and 13 speed manual transmissions, high voltage generators, propane powered equipment, and pneumatic systems.

Repairs and services track drive sprockets, rails, idler wheels, hard bars, track adjusters, hydraulic reversers, final drives, brake bands, steering clutches and hydrostatic transmissions.

Fabricates, modifies, and installs special equipment or replacement parts using mills, lathes, welders, torch sets, plasma cutter and metal cutting saws.

Maintains regular checks and adjustments on things such as fluid levels, hoses, belts, brakes, tires, and clutches; changes filters and oil, and lubricates vehicles and motor driven equipment.

Services, diagnoses, repairs and maintains speed tandem drive axles with air or electric shift, hydrostatic driven, heavy duty multi-axle suspensions, both conventional steel or air springs.

Tunes gas and diesel engines, services valves, fuel filters and turbo chargers, and pressure checks fuel filters, adjust injector heights, fuel racks, governors, etc. Diagnoses problems, disassembles units, repairs or replaces parts, and reassembles units in the following systems:
Brakes: repairs or replaces shoes, pads, drums, hoses, calipers, cylinders, any heavy-duty air brakes.

Cooling: flushes radiators, replaces hoses and thermostat, repairs or replaces radiator and water pump, fan drives, DCA treatment filters, air intercoolers and oil coolers.

Drive: repairs and replaces drive shaft, differential, axle, manual, automatic and sophisticated computer-controlled transmissions, clutches, transfer cases, power take-off systems, transmission reversers, all wheel drive steering axles and final drives.

Electrical: an HEMM mechanic repairs or replaces fuses, batteries, lights, instruments, warning devices, controls and switches, computer controls, modules, alternators, starters, and defective cables and wiring. This will include 12 and 24-volt systems found on military equipment.

Exhaust and Emissions Control: Replaces mufflers, manifolds, catalytic converters, turbochargers, blowers, and pipes.

Heating and Air Conditioning: Repairs or replaces heater cores, condensers, compressors, hoses, and controls; recharges air conditioning systems.

Hydraulic: Repairs or replaces pumps, hoses, valves, winches and cylinders.

Air: Repairs or replaces compressors, air dryers, brake valves, air tanks and hoses.

Steering and Suspension System: Aligns and balances wheels, repairs or replaces tie rods, ball joints, gear boxes, shock absorbers, springs, steering linkage, kingpins, power steering, hoses, pumps, walking beam suspensions and air suspensions.

Coupling Devices: an HEMM mechanic adjusts repairs, inspects and replaces fifth wheel hitches and pintle hitches

Maintains: service logs and records of maintenance performed on vehicles and on motorized equipment, using fleet maintenance and management software

Prepares: work orders and cost materials estimates.

Keeps: tools, equipment, and work area clean, organized, and in good working condition.

Road tests vehicles and performs related work as assigned

Difference between underground & opencast mines

Underground Mining

Underground mining is the process of extracting minerals and ores that are buried too far underground to be mined using surface mining methods. The primary objective of underground mining is to extract ore from underground as safely and economically as possible while producing as little waste or tailings as possible.

Many forms of underground mining exist. However, every underground mine is similar in that it requires a point of entrance from the surface. This entry may be through an adit, mine shaft, or vertical or horizontal tunnel. The average underground mine will include a number of roughly horizontal levels that branch off at various depths from the main point of entry into the mine. A vertical, internal connection between two levels of an underground mine is called a winze when driven downward, and a raise when driven upward.

Type of underground Mining

1. Room and pillar mining: is the most common method of underground mining. Areas support the roof of the mine or columns of coal (pillars) spaced out at regular intervals in rooms from which the coal is mined. The two types of room and pillar mining are conventional and continuous mining.

Figure 1.1 : Room and pillar mining

2. Longwall mining: is a more modern method of underground to extract coal from a coal bed. The technique was developed to replace room and pillar mining and includes the mechanized removal of long panels of coal from a rock face using longwall mining equipment—coal shearers mounted on series of self-advancing hydraulic supports. As the longwall miner advances along the panel, the roof behind the miner's path collapses.

Figure 1.2 : Longwall mining

3. Cut-and-fill stoping: is a method of underground mining used in vertical stopes and in mining high-grade irregular ore bodies. The rock mass surrounding the ore deposit is also usually weak—unable to support loads over an extended stoping height. As the name of the method implies, successive cutting of the ore into horizontal slices is carried out starting from the bottom of the stope and progressing upward, towards the surface. This horizontal slicing leaves a void that is backfilled with material to provide support until all the ore is extracted from the mine.

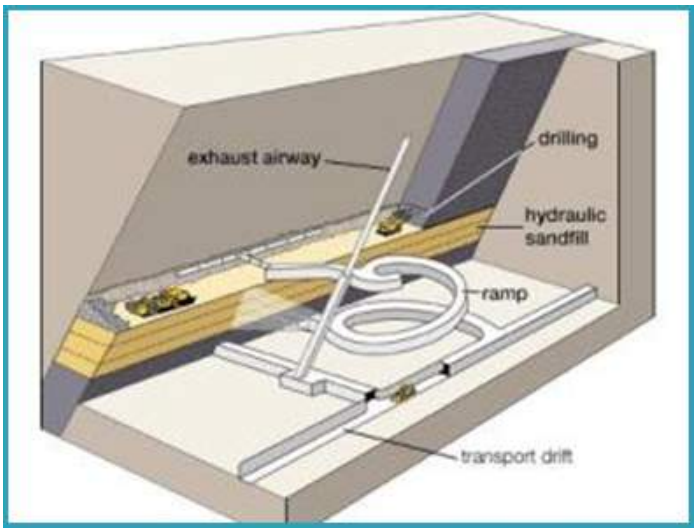

Figure 1.3 : Cut-and-fill stoping

4. Sublevel stoping is an underground mining method that involves vertical mining in a large, open stope that has been created inside an ore vein. Usually the stope operates as the center for production. In sublevel stoping, this is not the case. The stope is not meant to be occupied. Drilling, blasting, and mining are carried out at different elevations in the ore block.

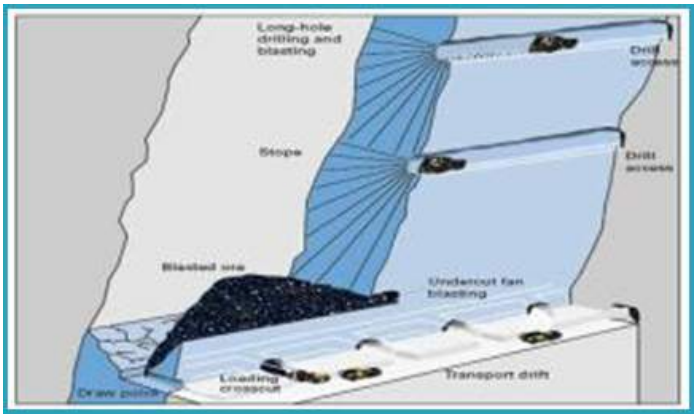

Figure 1.4 : Sublevel stoping

5. Block caving is an underground mining method that permits the bulk mining of large, relatively low-grade bodies of ore. As a sublevel mining process, block caving involves the controlled collapse of ore from under its own weight into chutes or draw points using gravity. In order for a block caving operations to be successful, the rock mass must be able to fracture naturally once an undercut has been applied.

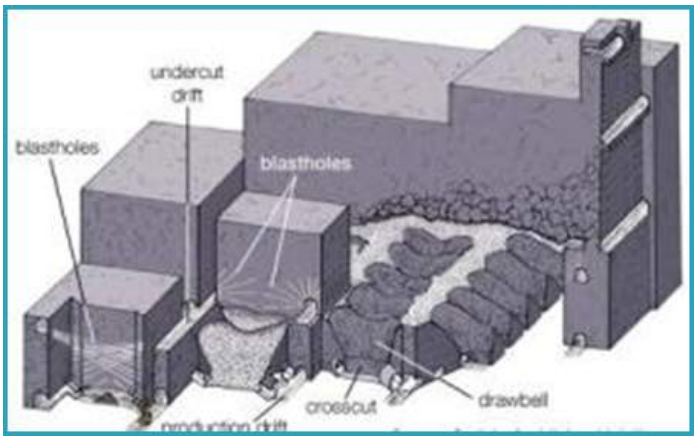

Figure 1.5 : Block Caving

6. Borehole mining is a remote-controlled method of underground mining used to mine a broad range of natural resources and industrial materials. A borehole tool comprised of two pipes—one that delivers a stream of high pressure water, and another that delivers slurry back up to the surface—is used.

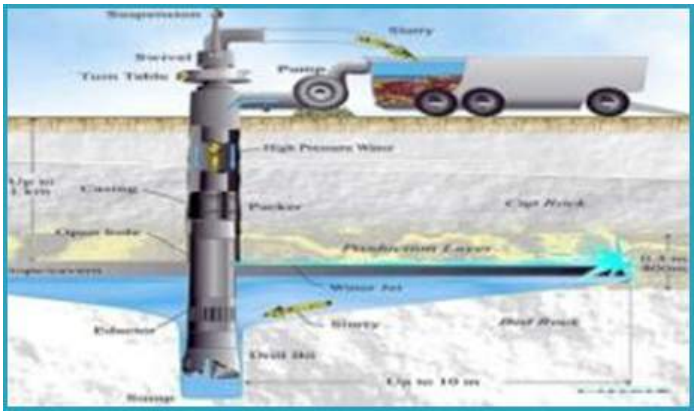

Figure 1.6 : Borehole mining

7. Shaft mining is a form of underground mining using shafts driven vertically from the top down into the earth to access ore or minerals. Shaft mining, also termed shaft sinking, is particularly ideal for concentrated mineral deposits, such as iron or coal, that are deeply imbedded underground.

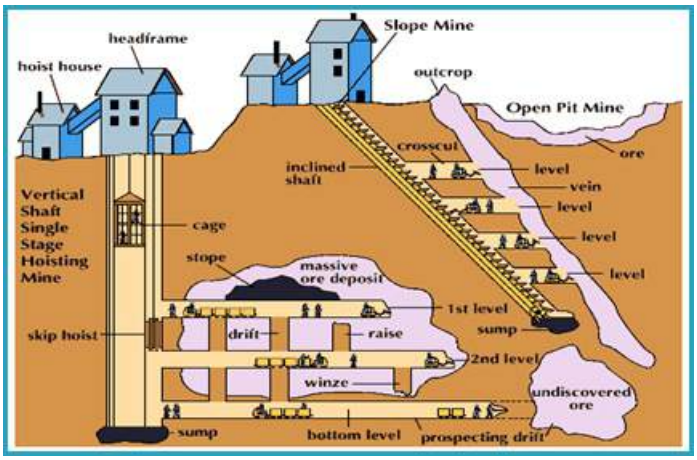

Figure 1.7 : Shaft mining

8. Auger mining is a surface mining technique used to recover additional coal from a seam located behind a highwall produced either by stripping or open-pit mining. Auger mining is especially employed when contour strip mining has been exhausted and the removal of overburden to access additional coal no longer becomes economically feasible. Auger mining can also be utilized in underground mining when faulty or poor roof conditions are present or other problems preclude the use of other underground mining techniques.

Figure 1.8 : Auger mining

9. Vertical crater retreat, also referred to as vertical retreat mining, involves drilling large-diameter holes into the ore body vertically from the top of the mine, as opposed to the conventional blast hole stope method of drilling them in fans from bottom to top.

10. Slope mining is a type of underground mining where the coal bed is located very deep and parallel to the ground and the shafts are slanted. This type of mining is normally carried out when drilling shafts vertically downward becomes problematic.

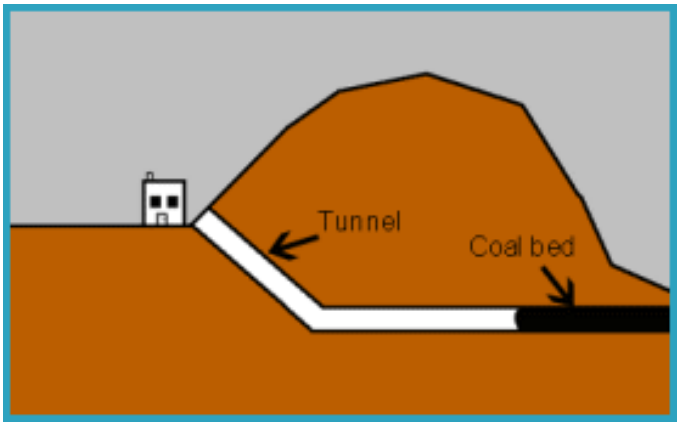

Figure 1.9 : Slope mining

Open-pit Mining

Figure 1.10 : Open-pit mining or opencast mining

Open-pit mining, also known as opencast mining, open-cut mining, and strip mining, means a process of digging out rock or minerals from the earth by their elimination from an open pit or borrow.

The word is used to distinguish this type of mining from extractive methods that need tunneling into the earth. Open-pit mines are used when deposits of commercially helpful minerals or rock are found close to the surface; that is, where the overburden (layer material covering the valuable deposit) is comparatively thin or the material of interest is structurally inappropriate for tunneling. For minerals that happen deep underneath the surface-where the overstrain is solid or the mineral happens as veins in hard rock- underground mining methods take out the precious material.

Open-pit mines that manufacture building materials and dimension stone are usually referred to as quarries. People in few of the English-speaking countries are not likely to make a difference among an open-pit mine and other kinds of open-cast mines, like quarries, borrows, placers, and strip mines.

Open-pit mines are characteristically engorged until either the mineral resource is exhausted, or a mounting ratio of overburden to ore makes more mining uneconomic. When this occurs, the exhausted mines are at times converted to landfills for disposal of solid wastes. Nevertheless, some form of water control is normally required to keep the mine pit from becoming a lake.

Open Cut mines are dug on benches, which portray vertical levels of the hole. These benches are normally on four meter to sixty meter intervals, relying on the size of the machinery that is being utilized. A lot of quarries do not use benches, as they are normally shallow.

Though surface mining encompasses a broad range of mining methods, one common denominator is the removal of overburden using heavy earthmoving machinery. Once the overburden has been removed, large dragline excavators are used to extract the minerals or ore from the earth. Other common types of equipment used in surface mining include wheel loaders, wheel dozers, crawler tractors, motor graders, and heavy-duty dump trucks such as rock trucks and articulated dump trucks.

After a surface mine is depleted, an area called a spoil bank is often left behind. This is the downside of surface mining—it has a devastating effect on the natural topography of the land and, as a practice, is often criticized for the havoc it causes on local ecosystems and the environment. A large part of good surface mining practices today involves implementing a land rehabilitation or land reclamation program in conjunction with mining operations. This is currently carried out with the systematic application of reclamation technology. Reclaimed spoil banks pose little distress and can be easily developed. Other reclamation programs associated with surface mining include restoring ground for agricultural and livestock farming, reforestation, recreation, housing, and industrial site development. The balance between good mining practices and the implementation of a beneficial land reclamation program has also become evident within the mining industry with the passage of regulations and ongoing research and development.

Types of Surface Mining

Quarries are mined similarly to an open-pit mine and with the same types of equipment. The primary difference is that materials or minerals mined from a quarry are used largely in industrial and construction applications.

Figure 1.11 : Quarries

Strip mining is very similar to open-pit mining. In strip mining, access to a mineral seam is undertaken with the removal of the overburden in strips. Given the bulk of material needing to be removed, some of the machinery used in strip mining is some of the largest machinery ever constructed. Two examples are bucket wheel excavators and dragline excavators.

Figure 1.12 : Strip mining