# UNIT - 2

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1) Describe surface plant and equipment used in shaft sinking:-

Ans → In shaft sinking a number of surface and equipment are required to support the excavation, hoisting, ventilation, and construction work. these installation are placed at the surface near the shaft collar and play a vital role in ensuring safe and efficient sinking operation.

1 Headgear.
- A tall steel or reinforced concrete structure built above the shaft collar.
- provides support for the hoisting system.

2 Hoisting System.
- Winders / Hoists: Used to raise muck and lower materials, men and equipment into the shaft.
- Hoisting ropes & Drums: Strong steel wire ropes wound on drums of the winder to lift and lower loads.

3. Boilers / power Supply Unit.
- provides compressed air, steam or electricity for drilling machine, pumps and other equipment.
- Modern sinking often uses diesel.

4. Air Compressors.
- Supply compressed air for pneumatic drills, Sinking machines, and other tools used at the bottom

5. Ventilation plant
- large surface fans connected by ducts or airways to provide fresh air and remove dust, fumes, and blasting gases.
- Essential for workers safety at the sinking face

6. pumping System.
- High-Capacity pumps installed to handle underground water inflow.
- pipes are laid down the shaft to discharge water to the surface.

7. Muck Handling and storage facilities.
- Ore bins, hoppers, or dump truck at the surface to collect muck hoisted from the shaft.
- Sometimes Conveyors are used to transport muck away.

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2. list the factors influencing the choice of type of shaft.

Ans→ The factors influencing the choice of type of shaft in mining

1. Depth of deposit :- Deeper deposits usually require vertical shaft, while inclined shaft are suitable for moderate depth.
2. Dip of the ore body :- Steeply dipping ore bodies favor vertical shaft, while gently dipping seams may use inclined shaft.
3. Shape and size of ore body :- Narrow ore bodies suit vertical shaft, while thick and extensive ore bodies may be better served by inclined shaft.
4. Geological Condition: Nature of surrounding rock, stability presence of faults, joints & folds influence shaft design.
5. Water Condition: presence of groundwater, water-bearing strata or aquifers may dictate shaft type and support system.
6. Ventilation requirements :- Choice of shaft must allow efficient intake and exhaust of air
7. purpose of shaft :- Whether the shaft is for men materials hoisting of ore or ventilation only.

3. Write factor governing the site of shaft

Ans location of mineral body (coal seam) → shaft should be closed to the ore body as far as possible. middle of the ore body is an important site for shaft sinking because it reduce haulay distance and insure balance development.

ii. Water level :- It is an also important factor which decide the sellection of shaft site generally the area where ground water level is low selected for shaft sinking because is reduce dewatering cost creating

iii. Rock condition and gelogical disturbance. The shaft is sink that area where geological disturbance is not present because geological disturbanced area create lot of problem the time of shaft sinking.
e.g :- Access shipage of water
weak side / eroption of gas.

iv Transport facilities for material and man power. Generally shaft are sunk at those areas which are easy accessible by road, railway & convers because these area provide easily facility / transpotation.

v. Topography :- Generally flat or gentally slopy areas are selected for shaft shinking because low-lying area are affected by flood.

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4. Explain type of shaft - vertical, Incline and Compound (with diagram)

Ans:- Type of shaft in mining

1. Vertical shaft

The straight downward shaft is known verticle.

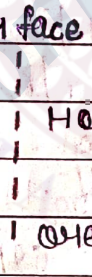
Uses: Common for deep mines and steeply dipping ore bodies

Advantages:

- faster hoisting of ore, men and material
- Easy for ventilation arrangement.
- long-term economical for large

Disadvantages:

- Costly to Sink intially
- Difficult in water-logged or weak ground.




2 Inclined shaft

A shaft driven at an angle (usually along the dip of the ore body)

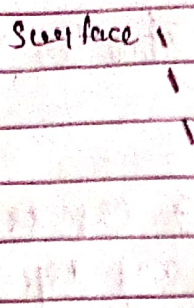
- Uses: Suitable for shallow to medium-depth deposits and gently dipping seams.

Advantages

- Can follow the ore body directly
- Cheaper for shallow depths.
- Easy for track-laying and transportation

Dis

- longer length than vertical shaft to reach the same depth.
- less efficient hoisting at large depths.




3. Compound shaft

A Combination of vertical and inclined shaft. part of the shaft is vertical and part is inclined

Use s:

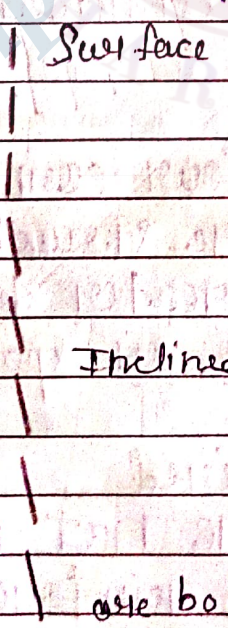
When surface condition favour vertical sinking but the ore body dips at an angle.

Adv

- Combine benefits of both types
- vertical portion allows efficient hoisting inclined portion follow the ore body.

Dis

Complex and costly construction.



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5. Differentiate Rectangular shaft vs Circular shaft

Ans:- A rectangular shaft has a cross-section that is either rectangular or square

- It is the oldest and most traditional type of shaft used in mining

→ construction

- Comparatively easier to sink because blasting and excavation along straight line simple
- Timber and lining can also be placed conveniently, especially in weak ground

Adv

- Simple design: The shape is straightforward so construction requires less specialised equipment.
- Cheaper initial cost: At shallow and medium depths, it is more economical to sink than circular shaft.

Dis

- Weak corners :- The four corners of the rectangular section are structurally weak. Under high pressure at greater depth these corners may crush or spall, causing instability.
- more Support required

Since the wall are not naturally strong heavy timbering or reinforced concrete lining is needed increasing the maintenance cost.

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- Circular
- A circular shaft has a circular cross-section.
- It is considered the modern and most scientific type of shaft especially in deep mines.

Construction

- Sinking is comparatively difficult and costly because the excavation requires more precise drilling and blasting.
- Specially shaft-sinking equipment is usually required

Adv

- Uniform strength :- Circular shape distributes the ground pressure equally in all direction making it very strong and stable.
- less support required :- Because of its natural strength only minimal concrete lining or support is required

Dis

- Difficults to partition - Making separate compartments is more complicated than in rectangular shaft.
- High initial cost :- The excavation and construction process is costly, especially when modern shaft-sinking method are used.

Q1 What is walling scaffold, Sinking kibble and rider?

Ans- A walling scaffold it is a suspended working platform which is used to support workers or material at the time of making of shaft lining.

It provide a shape and stable platform and keep workers away from the button of shaft

* Construction Design :- It is made of steel frame with wooden member the cross-section of are generally 0.3×0.3m. this platform has an opening is 2m×2m for parallel of the sinking bucket this scaffold is suspended by chain from two rope hanging in the shaft and it is raised or lower of with the help of double brum.

The dia of scaffold is stilly less then finished diameter of the shaft. In this scaffold steady at the time of working walling scaffold having made in such an way that it allow sinking and walling operation at the same time.

unit -3

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* Kibble in sinking shaft

It is a bucket like container which is used to a heart broken rock tools in small equipment of sinking shaft.

It is made of the steel it shaped is generally cylindrical and slitely conical It is equiped with lighting are for the attachment to the winding rock and chain.

It size is generally 0.3-1.5 $m^3$ and usually depends on shaft side and hosting system.

* Rider in sinking shaft :- A rider is an arrangement of sinking shaft which is wed to guide the bucket during its travel. It is used to prevent unwonting swinging during its travel the rider serve its purpose only between the bricking scoffold end the surface.

It enable bucket to be raise and lower to greater speed and greater safety.

2 What is shaft centering arrangement?

Ans It is the method to maintain the center line of the shaft during the time of sinking living. The vertical axis and radius of the shaft each from time to time generally once in everyday at the time of such checking a plumb bob wire is suspended from the surface in the shaft and the radius is measure with the help of like wooden radius rod. At the decking table a flower is built with the help and channel. In this plot from a like section and slid roller at the one end of the rail pulley it attach over this pulley plumb wire is pass from a reel on the reel and channel there are two marks which centrized when the plumb wire is exactly the center of the shaft. after lowering the plumb wire. shaft center mark can be obtained and the button of the shaft after checking the vertically and marking radius the plumb wire is rest to the surface and the section of rail with down the hole ~~on~~ centering arrangement is provide to the ground level so that is can not distrub shaft sinking.

3. Describe the general arrangement of shaft sinking.

Ans When a shaft is to be sunk certain surface and underground arrangement are made so that sinking can proceed safety and efficiently.

1. Surface Arrangements.

At the surface, a number of plants and equipment are installed

- Headgear: A tall steel or timber structure built over the shaft mouth. It carries pulleys over which winding ropes pass.
- Winding Engine: Installed near the shaft to wind the rope and operate the kibble
- kibble: Used for lowering men, material and hoisting muck from the shaft bottom.
- Boilers: provide energy for the winding engine compressors and pumps.
- Air Compressors: Supply compressed air for rock drilling machine and pneumatic tools.
- pumps: To handle water inflow from the shaft

2 Shaft collar and protection

- The shaft mouth is strengthened with stone masonry to prevent collapse at the surface
- fencing and covers are provided for safety

iii) Botton Arrangements
- Drilling and blasting: Rock is drilled and blasted to break rock.
- Mucking out: Broken rock is loaded into kibble and hoisted to the surface.

iv) Walling
As sinking proceeds the shaft wall are lined.
- Support ground
- prevent water seepage
- provide smooth sides for future installation of guides, cages and pipe.

v) Guides, pipes and fittings.
- Guides for kibble are installed to keep conveyances steady.
- pipes are fixed along the shaft side.

vi) progress of sinking
The process is cyclic
a. Drill holes in shaft botton
b. charge and blast
c. muck out
d. Support
e lower scaffold and support.

4. Explain shot firing in shaft Sinking - arrangement of holes, charging, firing and and safety precautions.

Ans In shaft sinking shot firing is the method of breaking rock by drilling, charging with explosives and blasting at the shaft bottom. Since a shaft is a confined space the arrangement of holes charging, firing and safety precaution are very important

1. Drilling and Arrangement of holes.
- At the shaft botton after muck removal, holes are drilled in a systematic pattern using pneumatic rock drills
- The number, depth and direction of holes depend
- shaft diameter
- Nature of rock
- Required depth of advanced

Types of hole in shaft sinking
- Cut holes - drilled nearly vertical at the shaft center ; they start the breaking.
- Relieving holes - drilled around the cut holes to enlarge the cavity.
- Stoping holes - drilled toward the shaft periphery to break the remaining rock.
- Perimeter holes :- drilled close to the shaft side help maintain correct shaft diameter and shape.

11.) Charging of Holes.
- Holes are cleaned with compressed air to remove dust and water.
- Explosives in are inserted.
- Detonators and fuses are fixed for firing.
- Charging is done carefully, starting from cut holes to perimeter holes.

111.) Fire short
- All workers are withdrawn to the surface before firing:
- Shorts are fired either:
→ By safety fuse and detonator
→ I

iv.) Safety precaution
1. Before drilling
- check for gas
- only trained blasters are allowed to handle
→ During charging
- Use wooden tamping rods
- Avoid excessive force while inserting explosive
→ Before firing
- withdraw all men tool and equipment from shaft bottom.
- Singnal to surface before firing.

→ After firing
- wait for sufficient time
- ventilate shaft with fans or compressed air
- misfires must be dealt with only by authorized blasters.

5. Temporary lining vs permanent lining.

Ans

| | Temporary lining | Permanent lining |
|---|---|---|
| (i) | provided to give immediate support to freshly excavated ground during shaft or tunnel sinking | Constructed to provide long-term stability, duration and smooth passage. |
| (ii) | Short-term (only until permanent lining placed) | long-term (remain throughout the life of the shaft) |
| (iii) | Timber, light steel section lagging board, wire mesh or shotcrete. | Concrete masonry, cast iron segments or precast concrete |
| (iv) | Comparatively, weaker-designed only to hold ground temporarily. | Strong and durable-designed to withstand long-term ground pressure water and wear. |
| (v) | Quick and easy to install as immediate protection is required. | Slower, requires careful workmanship and curing for durabili |
| (vi) | Less expensive | More expensive due to stronger material and permanent natur |
| (vii) | Rough finish not meant for smooth surface | Smooth finish, provides proper profile and safe working passage |
| (viii) | Protects workers during excavation from sudden falls of ground or water. | Ensures safety of operation transportion and ventilation during the mine. |