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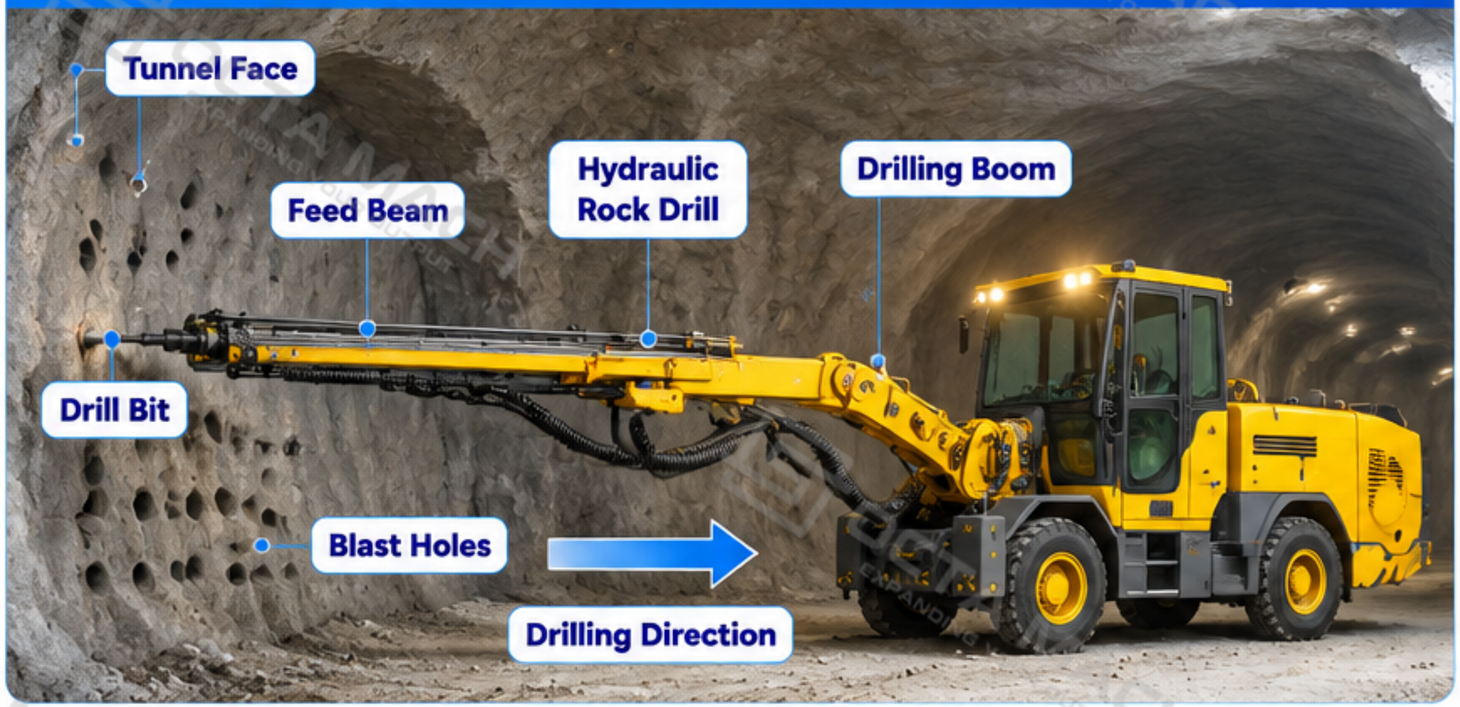
Underground Face Drilling

Understanding Drilling Tasks and the Excavation Cycle

Face Drilling Setup



Main Drilling Operations

1. **Face Inspection and Marking**
   Review the tunnel face, geological conditions and approved blast-hole layout.
2. **Jumbo Positioning**
   Position and stabilize the drilling jumbo at the working location.
3. **Boom Alignment**
   Align the boom and feed beam with each marked hole position.
4. **Rock Drilling**
   Use percussion, rotation, feed and flushing to drill the planned holes.
5. **Hole Verification**
   Check completed holes against specified positions and depths.

How the Rock Drill Advances

Percussion
Delivers impact energy to fracture the rock.

→

Rotation
Turns the drill bit to maintain cutting action.

→

Feed
Advances the drill string into the rock.

→

Flushing
Removes rock cuttings from the hole.

Drilling Operation Output



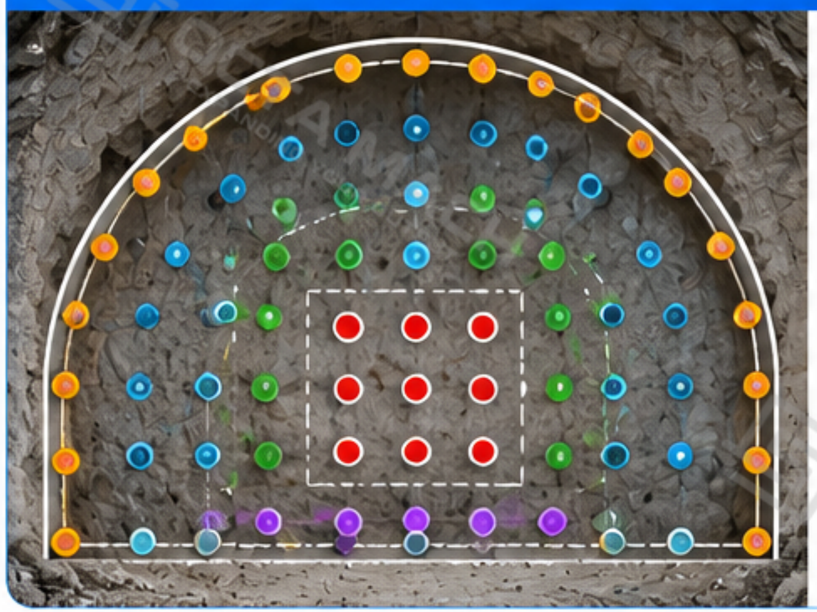
- Positioned holes
- Specified drilling depth
- Face ready for the next planned excavation activity

The drilling jumbo positions and advances hydraulic rock drills at planned face locations to complete blast holes to the specified positions and depths.

Blast-Hole Types and Their Functions

Understanding Hole Positions and Their Roles in Underground Excavation

Blast-Hole Layout on Tunnel Face (Example)

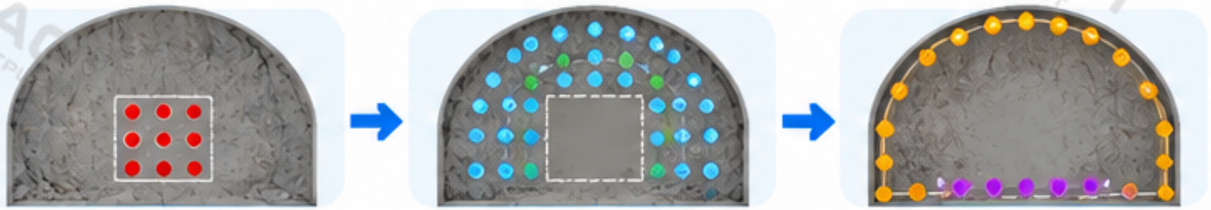


- **Cut Holes** (Initial opening)
- **Production Holes** (Main rock breakage)
- **Perimeter Holes** (Profile control)
- **Lifter Holes** (Bottom and floor)
- **Auxiliary Holes** (Extend breakage)

Hole Types and Main Functions

Hole Type	Main Function	Typical Features
Cut Holes	Create the initial opening or free face for rock breakage.	• Centrally arranged • Smaller spacing, precise depth
Production Holes	Break the main rock mass surrounding the cut.	• Mainly distributed in the middle area • Larger range, higher rock removal
Perimeter Holes	Define the excavation boundary and control the final tunnel profile.	• Along the tunnel contour • Closer spacing, controlled charge
Lifter Holes	Break the lower section of the face and floor area.	• Arranged at the bottom • Matched to the floor profile
Auxiliary Holes	Extend the breaking area between the cut and surrounding holes.	• Placed between cut and production holes • Adjusted based on rock conditions

How Different Holes Work Together



1 Create an Opening

Cut holes form the initial free face.

2 Expand the Breakage

Production and auxiliary holes break the main rock mass.

3 Form the Final Profile

Perimeter and lifter holes control the tunnel contour and floor.

Key Considerations for Hole Planning

- Determine hole types, positions and quantities based on the excavation profile, rock conditions and blast design.
- Match drilling diameter and depth to the approved blasting plan.
- Coordinate the arrangement of cut, production, perimeter, lifter and auxiliary holes to ensure effective and controlled rock breakage.

Different blast holes work together: the cut establishes the opening, production and auxiliary holes enlarge the breaking area, and perimeter and lifter holes control the final tunnel profile.

Single-Boom vs. Multi-Boom Drilling Arrangements

How Different Boom Configurations Handle Face Drilling Tasks

Equipment Configuration Comparison



Single-Boom Drilling Jumbo

A single-boom Drilling Jumbo has one independently controlled drilling assembly mounted on a self-propelled carrier. The boom is repositioned across the tunnel face to drill different hole groups according to the planned layout. The same assembly completes the required holes through successive positioning. It is suitable where one boom can reach the designated drilling positions.



Three-Assembly Multi-Boom Jumbo

The three-assembly multi-boom configuration shown in the product material has two heading drilling assemblies and one dedicated cut-hole assembly. The two heading assemblies handle conventional blast holes; the dedicated cut-hole assembly is designed for larger-diameter drilling. Different drilling tasks are assigned to separate assemblies within the same machine setup.

Drilling Task Comparison

Comparison	Single Boom	Three-Assembly Configuration
Drilling Assemblies	1	3
Conventional Holes	One assembly	Two heading assemblies
Cut-Hole Drilling	According to selected setup	Dedicated assembly
Hole Positioning	Sequential repositioning	Separate boom positioning
Task Arrangement	One drilling task at a time	Different tasks assigned to separate assemblies

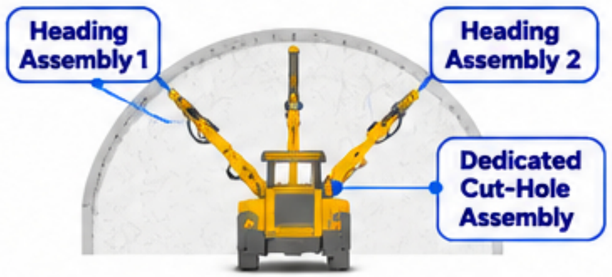
How Drilling Tasks Are Distributed

Single-Boom Configuration



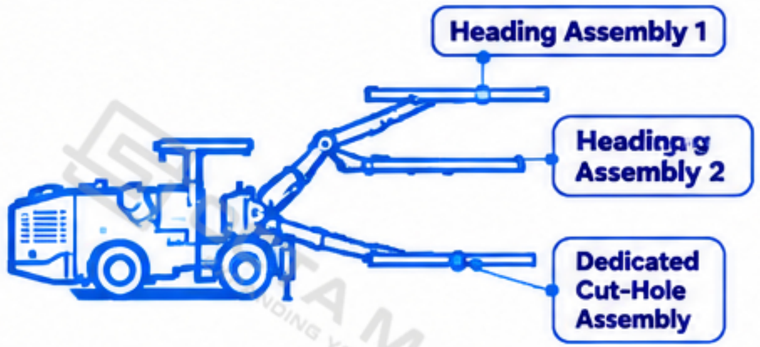
Sequential positioning

Multi-Boom Configuration (Threee Assemblies)



Separate task assignment

Understanding the Configuration



The three assemblies have different assigned roles; their specifications should be evaluated separately.

A multi-boom configuration is not simply an upgraded single-boom machine; it assigns different drilling tasks to separate assemblies for coordinated face drilling.

Hole Diameter, Drilling Depth and Tool Matching

Matching Drilling Tools and Machine Capacity with Hole Specifications

Key Drilling Tools and Components



Drill Bit

Determines the required hole diameter.



Drill Rod

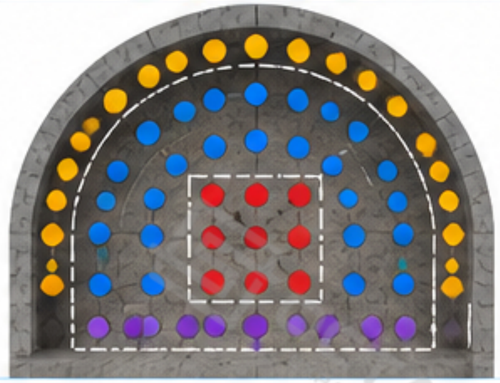
Must match the required drilling depth and feed arrangement.



Hydraulic Rock Drill

Provides impact, rotation and feed for efficient drilling.

Understanding Hole Specifications



- **Hole Diameter:** Determines the required drill bit and drilling assembly.
- **Drilling Depth:** Must reach the specified depth within equipment capacity.
- **Configuration Matching:** Conventional blast holes and large-diameter cut holes require different drilling assemblies and operating capacities.

Single-Boom Drilling Parameters

Technical Parameters	Unit	Configuration 1	Configuration 2	Configuration 3
Hole Diameter	mm	32–45	32–64	32–64
Reaming Diameter	mm	76–102	76–115	76–115
Drill Rod Length	mm	3,100	3,100 / 3,700	3,700 / 4,300
Drilling Depth	mm	2,800	2,800 / 3,400	3,400 / 4,000
Impact Power	kW	14	18	18
Impact Pressure	bar	115–140	170–210	170–210
Rotation Torque	N-m	975	1,050	1,050

Multi-Boom Drilling Parameters

Technical Parameters	Unit	Heading (Composite Beam)	Cut-Hole Assembly
Drill Rod / Shank	–	R38 / T38	T60
Hole Diameter	mm	38–64	127–180
Impact Power	kW	18	35
Maximum Rotation Torque	N-m	1,050	2,285
Drilling Depth	mm	6,000	6,300
Feed Force	kN	15	20

Selection Guidelines

Confirm Hole Requirements

Determine hole diameter, drilling depth and hole type (cut/production/perimeter).

Select Drilling Tools

Match drill bit, drill rod and drilling assembly to the hole specifications.

Verify Machine Capacity

Check impact power, rotation torque and feed force against the required drilling task.

Key Takeaway

- Match hole diameter and drilling depth to the appropriate drilling assembly and tools.
- Conventional blast holes and large-diameter cut holes should use dedicated configurations.
- Verify that the selected configuration meets the required power, torque and drilling depth for the actual rock conditions.

Select the drilling tools and machine configuration based on the hole diameter, drilling depth and blasting plan to ensure efficient, safe and reliable face drilling.

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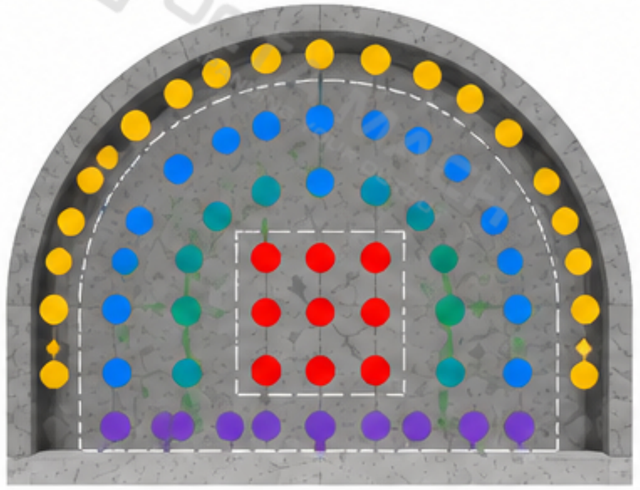
Blast-Hole Pattern and Drilling Considerations

How Tunnel Geometry and Rock Conditions Influence Hole Layout

Key Factors Affecting Blast-Hole Layout



Illustrative layout only

- **Cut Holes** (Initial opening)
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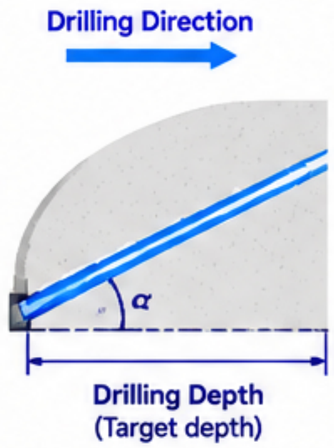
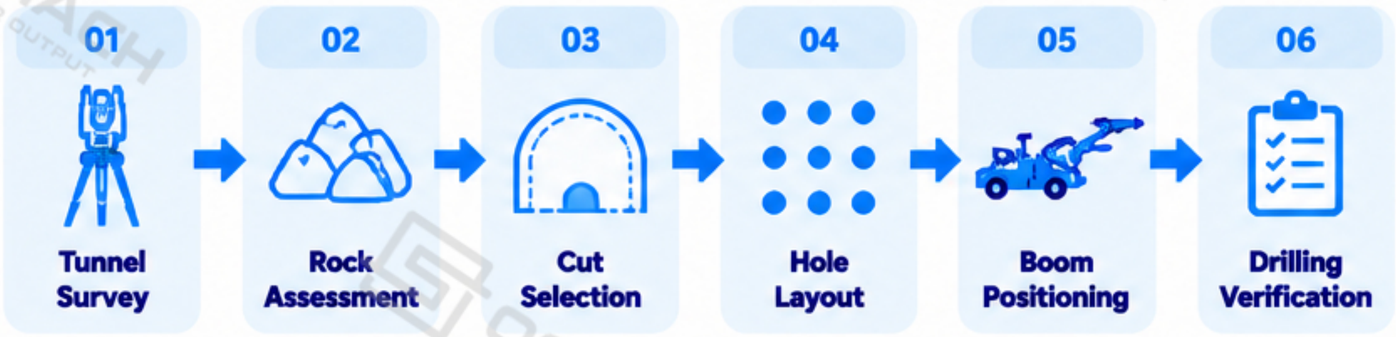


Engineering Factors to Review

Planning Factor	Engineering Consideration
Tunnel Cross-Section	Tunnel width, height and excavation profile
Rock Conditions	Rock strength, joints, fractures and groundwater
Cut Arrangement	Initial opening position and cut-hole configuration
Hole Diameter	Required diameter for each hole group
Drilling Depth	Target hole depth and planned excavation advance
Hole Spacing and Burden	Determined by the approved blast design
Perimeter Control	Hole alignment along the required excavation boundary

Drilling Pattern Planning Sequence



Engineering Note

Hole positions, spacing, burden, drilling angles, explosive charges and firing sequences must follow the approved project blast design and be determined by qualified blasting personnel. Diagrams in this guide explain drilling arrangements only; they are not an executable blasting pattern.

Tunnel geometry, geological conditions and the approved blast design must be considered together when planning face drilling.

Face Drilling Checklist and OCTA MACH Support

Confirm Drilling Requirements Before Equipment Deployment

Face Drilling Checklist

Inspection Item	Confirmation
Tunnel cross-section has been confirmed	☐ Yes
Rock and geological conditions have been assessed	☐ Yes
Approved blast-hole layout is available	☐ Yes
Hole types and quantities are specified	☐ Yes
Required hole diameters are confirmed	☐ Yes
Target drilling depths are defined	☐ Yes
Drill rods and bits are compatible	☐ Yes
Required boom coverage is sufficient	☐ Yes
Flushing water supply is available	☐ Yes
Drilling sequence has been reviewed	☐ Yes

Project Information for Technical Review

Project Information	Customer Details
Project Name	–
Application	Tunnel / Mine Development
Tunnel Width × Height	–
Rock Type and Conditions	–
Required Hole Types	–
Conventional Hole Diameter	–
Cut-Hole Diameter	–
Target Drilling Depth	–
Required Excavation Advance	–
Preferred Configuration	Single Boom / Multi-Boom
Available Drilling Tools	–

Documents to Share

- Tunnel cross-section drawings
- Geological survey or face mapping
- Approved blast-hole layout
- Hole diameter and depth schedule
- Required excavation advance
- Underground equipment access information

Engineering Support from OCTA MACH



Drilling Jumbo Solutions
Single-boom and multi-boom configurations for underground mining and tunnelling.

Configuration Evaluation
Recommend a suitable machine and drilling assembly based on project requirements.

Technical Consultation
Review tunnel dimensions, rock conditions and hole specifications with your team.

Share your tunnel drawings and drilling requirements with OCTA MACH to discuss the right equipment arrangement for your underground face drilling operations.