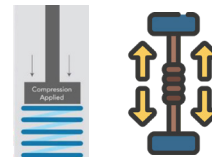


INTRODUCTION

Drilling in Compression occurs when downward force (WOB) pushes the bit into the formation and the drill string below the neutral point is in compressive load. **Drilling in Tension** occurs when the bit is pulled against the formation using downhole reaction forces and the drill string remains in tension. **The ability to drill in tension is a core mechanical skill. It directly affects borehole quality, rate of penetration (ROP), equipment life, safety, and overall drilling efficiency.**



PULL DOWN PRESSURE

Pull-down pressure is the hydraulic force applied by the rig feed system to move the drill string downward and apply weight on bit (WOB). Pull-down pressure generates compressive loading in the drill string and is the primary means of controlling drilling force at the bit.

Excessive pull-down pressure may result in:

- Drill string buckling
- Bent or fatigued drill rods
- Hole deviation and crooked boreholes
- Excessive torque and bit jamming
- Reduced tool life

Insufficient pull-down pressure may result in:

- Bit bouncing or chatter
- Low rate of penetration (ROP)
- Inefficient DTH hammer operation

PULL BACK PRESSURE

Pull-back pressure is the hydraulic force applied by the feed system to resist downward movement of the drill string or to lift it upward. Pull-back pressure places the drill string in tension and is used to control the drilling force.

Practical Effects

Proper use of pull-back pressure:

- Reduces buckling risk
- Improves hole straightness
- Protects rods and threaded connections
- Prevents over-feeding in DTH drilling

THE EFFECTS OF DRILLING IN COMPRESSION

Drilling in compression is a poor practice because it:

- Causes crooked holes
- Leads to rod buckling and damage
- Reduces drilling efficiency
- Increases wear, downtime, and cost
- Raises the risk of stuck tools and borehole failure

Professional drilling is not about maximum force but it is about controlled force.

THE BENEFITS OF DRILLING IN TENSION

A. Good quality and sustainable borehole

- Straighter holes
- Better casing installation
- Improved borehole performance

B. Improved equipment life and reduced operation costs:

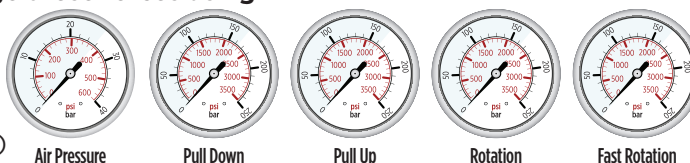
- Extend rod life
- Protect threads
- Reduced downtime
- Lower cost per meter drilled
- Decreased wear on top head



PRACTICAL MANAGEMENT OF THE DRILLING FORCES

Water well drill rigs typically manage these forces using:

- Feed (pull-down / pull-back) hydraulic pressure
- Rotation speed (RPM)
- Penetration rate (feed rate)
- Air or mud flow (hole cleaning)



DTH drilling - Apply only sufficient pull-down pressure to maintain continuous bit-to-rock contact while allowing free hammer operation. **Rotary Drilling** - Weight on bit shall be optimized in relation to rotation speed and mud circulation to maintain stable drilling conditions.

CONCLUSIONS

A skilled driller uses tension to limit compression at the optimum WOB, not to maximize force. Efficient borehole drilling requires controlled application of compressive force at the bit, supported by managed tensile loading of the drill string to maintain stability, prevent buckling, and ensure safe and predictable drilling conditions. Because drilling in tension reduces equipment failure, it is a safety practice, not just a performance technique.

1

Establish Contact

- Apply light pull-down pressure
- Confirm stable bit contact

2

Increase Pull-Down Gradually

- Monitor penetration rate
- Watch for torque increase or vibration
- Avoid sudden pressure changes

3

Control With Pull-Back Apply pull-back to:

- Limit WOB in soft formations
- Control over-feeding in DTH drilling
- Maintain drill string stability

4

Adjust Rotation Speed

As pull-down pressure increases, rotation speed shall be reduced.

Title of Bulletin: Drilling in Tension VS Compression

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