UNDERGROUND CONSTRUCTION TECHNOLOGY
THE UNDERGROUND UTILITIES EVENT | JANUARY 25-27, 2022 | FORT WORTH, TEXAS

Track IV-B HDD

Nozzle Selection for Optimum Tooling Performance & Life

radius
TOOLS FOR HDD PROFESSIONALS

Epiroc

Riff Wright / GM

radius
TOOLS FOR HDD PROFESSIONALS

Riff Wright / GM

radius
TOOLS FOR HDD PROFESSIONALS

Bruce Beatty / Genius

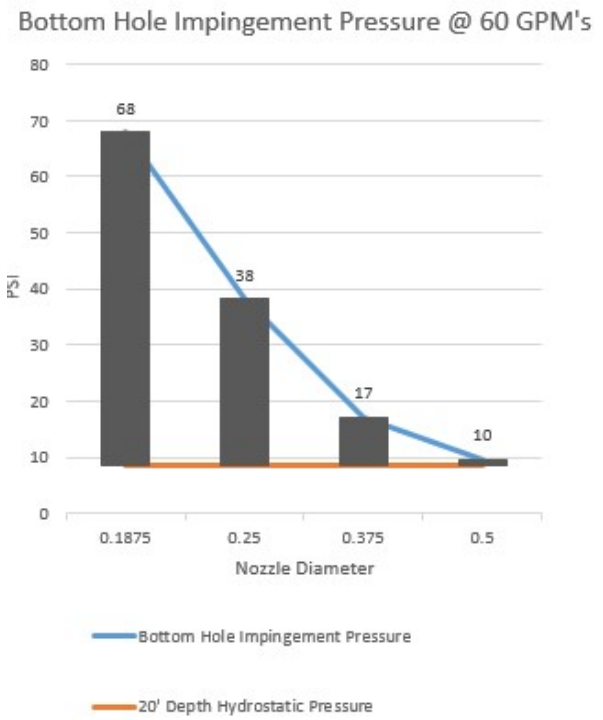
Epiroc

Nozzles – What are they

- Interchangeable Orifices for Air or Mud
  - Nozzle ID's from 5/32 to 1 3/8
  - Retention styles
    - Snap Ring
    - Aluminum Nail or Steel Nail
    - Threaded cap
  - Materials
    - Carbide
    - Mild Steel
    - Hardened Mild Steel
    - Delrin

Nozzles – What they do

- They allow for selecting the correct jet size to produce the optimum bottom hole cleaning pressures based on your drilling parameters.
- Lets assume that you are drilling with a 5 ½ inch diameter bit at a depth of 20 feet with 60 GPM flow of mud weighing around 8.5 pounds per gallon. Other assumptions are made on typical pipe OD & ID and total system configuration pressure losses.
  - The Hydrostatic pressure at 20' will be around 9 PSI.
  - The impingement pressures on the formation are the following:
    1. 10 PSI using ½ (.5") nozzles
    2. 38 PSI using ¼ (.25") nozzles
    3. 68 PSI using $^{3}/_{16}$ (.187") nozzles



As you can see the impingement pressure is very close to the hydrostatic pressure using a ½" nozzles, and there is very little pressure to clean the formation face. Of course, I have made many assumptions, but as you can see the larger the nozzle the lower the pressure will be to remove the cuttings away from the bore face.

Nozzles – Increase of nozzle Jet pressure

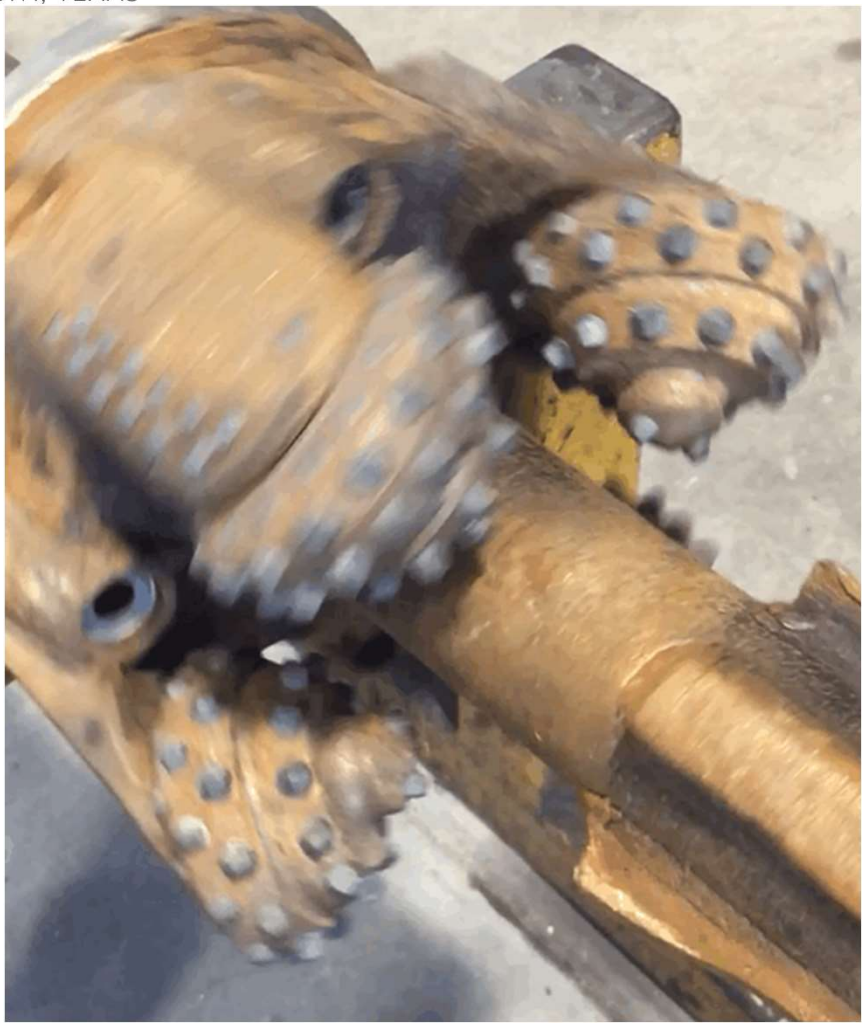
- Greater bottom hole cleaning force
  - Reduction in cutting regrinding
- Longer bit life
  - Less shirttail erosion
  - Longer protection of Seals
  - Longer cutter life
- Reduction in wasted available WOB & Torque resulting in increased drilling efficiency.

Nozzles – Impact of using incorrect sized nozzles

Summary

- The cheapest component of a cutting tool, the nozzles, can have the greatest impact on life and performance.
  - Increased chip evacuation results in
    - Increased penetration rates
    - Longer tool life
    - Reduction in wasted applied Weight on Bit and rotational Torque
  - You can only drill as fast as you can evacuate the cuttings.

Questions?



Riff Wright / GM
Radius HDD
rwright@radiushdd.com
(817) 304-3762

Bruce Beatty
Epiroc USA LLC
bruce.beatty@epiroc.com
(303) 513-1231