DRILL BITS
and what you don’t know
AGENDA

1. DRAG BITS
2. CLAW BITS
3. TRI – CONE BIT
4. PDC BITS
DRAG BITS

PERFORM WELL IN SANDS AND CLAYS
DRAG BIT RETIPPING

THE GOOD
THE BAD
THE UGLY
THE CLAW BIT

DESIGNED FOR SANDS, CLAY AND GRAVEL
KEN CLAW
CAN CLAW
MILL CLAW
QUICK CLAW
GEO INSTITUTAS
TRI – CONE BIT

BEARING DESIGNS
Tricone Bit Bearings Explained

What is the difference between sealed bearing bits and non-sealed bearing bits in Tricones?

The bearings are what make the cones on a Tricone spin. There are four common types of bearings - standard open roller bearings, air-cooled roller bearings, sealed roller bearings, and sealed journal (friction) bearings. We'll look into these different types of bearings, and try to explain the differences.

(The cone pictured to the left is a cut away of a roller bearing.)
Open Roller Bearing

Ball Bearing

Roller Bearing

Ball Retaining Plug
Air Blast

Thrust Sleeve  Thrust Button

Ball Bearing
Roller Bearing
Ball Retaining Plug
Air Passage Ways
Air Filter
Sealed Roller Bearing

- Ball Bearing
- O' Ring Seal
- Roller Bearing
- Ball Retaining Pin
- Grease Reservoir
- Reservoir Tip
- Diaphragm
Journal / Friction Bearing

- Ball Bearing
- Floating Bush
- Radial Seal
- Ball Retaining Pin
- Grease Reservoir
- Reservoir Cap
- Diaphragm
IADC CODES

EVERY TRI-CONE BIT HAS A IADC CODE
First Digit:

1, 2, and 3 designate STEEL TOOTH BITS with 1 for soft, 2 for medium and 3 for hard formations.

4, 5, 6, 7 and 8 designate TUNGSTEN CARBIDE INSERT BITS for varying formation hardness with 4 being the softest and 8 the hardest.
Second Digit:

1, 2, 3 and 4 are further breakdown of formation with 1 being the softest and 4 the hardest.
Third Digit:

This digit will classify the bit according to bearing/seal type - see information on different bearing types - and special gauge wear protection as follows:

1. Standard open bearing roller bit
2. Standard open bearing roller bit, air-cooled
3. Standard open bearing roller bit with gauge protection which is defined as carbide inserts in the heel of the cone
4. Sealed roller bearing bit
5. Sealed roller bearing bit with gauge protection
6. Journal sealed bearing bit
7. Journal sealed bearing bit with gauge protection
EXAMPLES

IADC 111 -- SOFTEST FORMATION – OPEN BEARING MILLTOOTH
121 -- MEDIUM FORMATION – OPEN BEARING MILLTOOTH
211 -- VERY SLIGHTLY HARDER MILLTOOTH OPEN BEARING
114 -- SOFT FORMATION – SEALED ROLLER BEARING
416 -- SOFTEST TCI BIT – SEALED JOURNAL BEARING
PDC BITS

• What makes a PDC Bit cutters
• body
• Design attributes
• Drilling parameters
Synthetic Diamonds

**High Pressure** and **High Heat** is the most common way synthetic diamonds are produced. Using a press, pressures of 725 tons/square inch and temperatures of 3000º F are maintained for one hour to create the diamonds.
• Cutter
  – Diamond Table
  – Base
PDC Cutter
0° Chamfer
PDC Cutter
12° Chamfer
PDC Cutter
16º Chamfer
PDC Cutter
20º Chamfer
Cutters

Carbon Bases

Modified  Honeycomb  HM160
PDC Cutter Bases
Quality & Performance

- High quality
- Crisp, clear grid
- Optimal bonding
PDC Cutter Bases
Quality & Performance

• Poor quality
• Undistinguished & vague
• Poor bonding
EVALUATING CUTTER DAMAGE

CHIPPED CUTTER
EVALUATING CUTTER DAMAGE

heat checked
EVALUATING CUTTER DAMAGE

LOST CUTTER
EVALUATING CUTTER DAMAGE

GRAVEL DAMAGE
Mechanical Design Attributes

- Rake and Drag of cutter is critical
- Impact of cutter is CRITICAL
Rake & Drag

- Drag angle on outside cutter is different than the rake angle in interior
- Drag angle on outer cutter is reduce shock to it
Rake & Drag
Rake & Drag
PDC Bit Body
Matrix vs. Steel

By Definition a Matrix is:
1. a material in which something is enclosed or embedded
2. something within or from which something else originates, develops or takes form
PDC Bit Body
Matrix vs. Steel

• Two different materials
PDC Bit Body
Matrix vs. Steel

- Poor quality body material leads to failures
PDC Bit Body
Matrix vs. Steel

• Serious erosion problems
3 Wing PDC Bit

- 3 blade PDC
- 3 wing matrix body
  (Russian made PDC)
6 Wing PDC Bit

- Typical bottom circulation ports
- Small “junk” slots
  - Poor cutting removal
5 Wing PDC Bit

Steel body
• Better circulation ports for cutting removal

• Placement of these ports make it extremely difficult to plug

• Larger junk slots due to wing design

• Longer wing to make better hole
PDC Drilling Parameters

- For optimum bit life and penetration rate

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight on bit</td>
<td>1000 lbs./inch of bit diameter</td>
</tr>
<tr>
<td>RPM</td>
<td>80 – 120 RPM (harder formations=slower RPM)</td>
</tr>
<tr>
<td>Circulation</td>
<td>Min. 10 GPM (more is better)</td>
</tr>
</tbody>
</table>
PDC vs Hammer

- Penetration Rates are comparable
- 5 inch Hammer – 5000.00  5 1/8 bit--- 550.00
- 5 1/8 PDC --- 1750.00
- Fuel consumption using hammers are 27-28 gallons/hr depending on rig
- Fuel consumption using PDC 10-12 gallons/hr depending on rig
- Savings of fuel --- 400.00 per day or more
QUESTIONS
For more information call
Kevin Christensen
P.O. Box 4155
Williston, ND 58802
800.421.2487
palmerbit.com