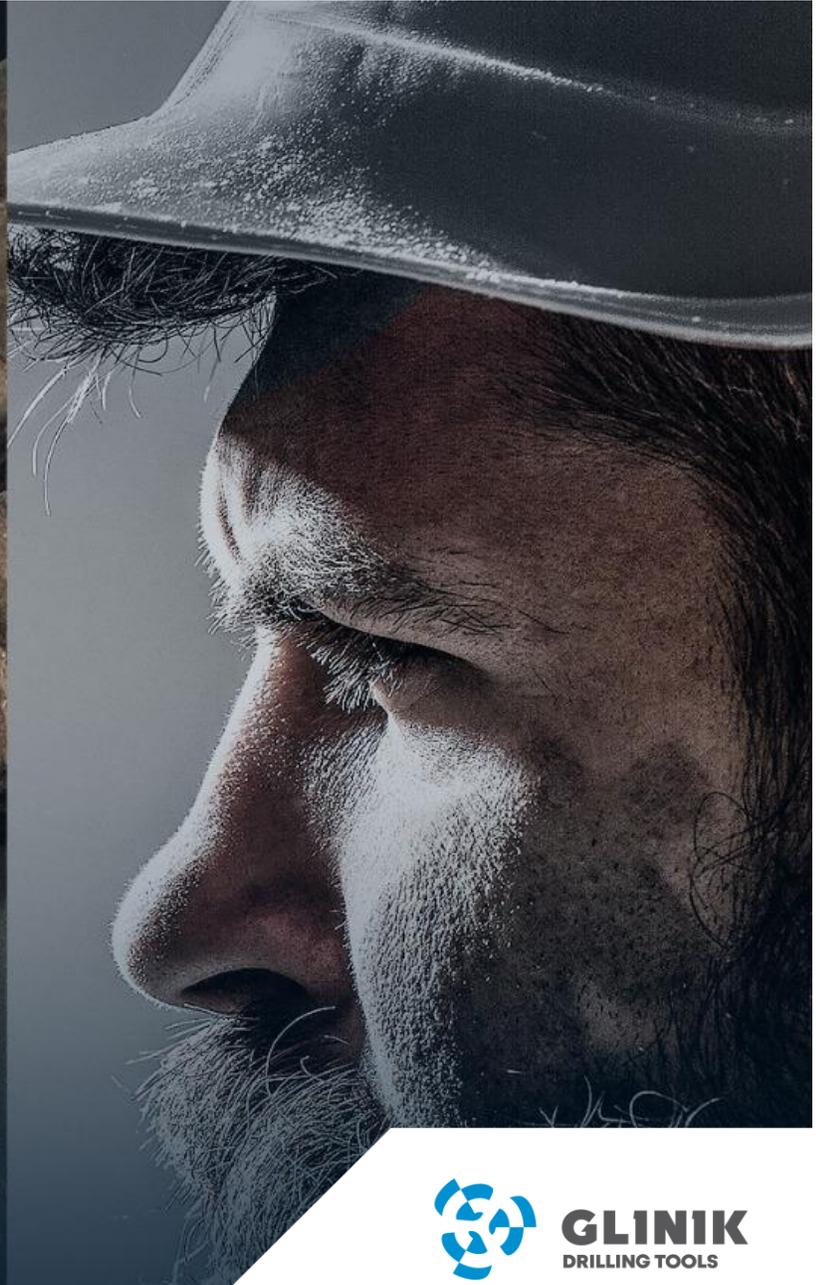


Proper IADC code - a key point for project success ?

presented by
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ENERGY | HDD | MINING & MINERALS | HYDROGEOLOGY | GEOTECHNICS



Selection of IADC for rotary tool ?

First assumptions & final consequences

If our bit selection is based on „we have been doing that for ages”, it is time to ask the question : do you have data to confirm it?

❖ „We have always been choosing IADC 537, let us do this again...”

❖ „Let us repeat IADC code 135 which was successful in our last project ...”

❖ Good decision = being on time, project safety, customer satisfaction, operation effectiveness, results as expected, lower cost per meter, less surprises, good reputation

❖ Bad decision = excessive tool wear, too early tool replacement, hazards on project, stoppages & delays, waste of time and money

IADC classification - IADC code - digit I, II, III & additional IV

KEY FEATURE

I

Cutting structure type
& hardness
dedicated for
formation
hardness

II

Formation
hardness
subcategory

KEY FEATURE

III

Bearing type
& gauge protection

IV

Additional
bit features



IADC classification – digit 1

Cutting structure type & hardness dedicated for formation hardness

KEY FEATURE

1

Milled tooth (MT)
cutting structure



Tungsten Carbide (TCI)
cutting structure

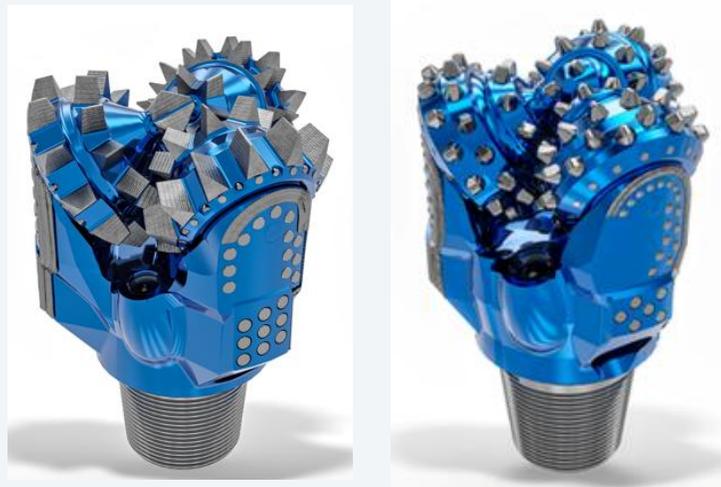


IADC classification – digit II

Cutting structure type & hardness dedicated for formation hardness



Auxiliary description of formation hardness within certain lithology to precise most relevant cutting structures



IADC classification – digit III Bearing type



Non- sealed bearing

- 1- no heel row protection
- 2
- 3- incl. heel row protection



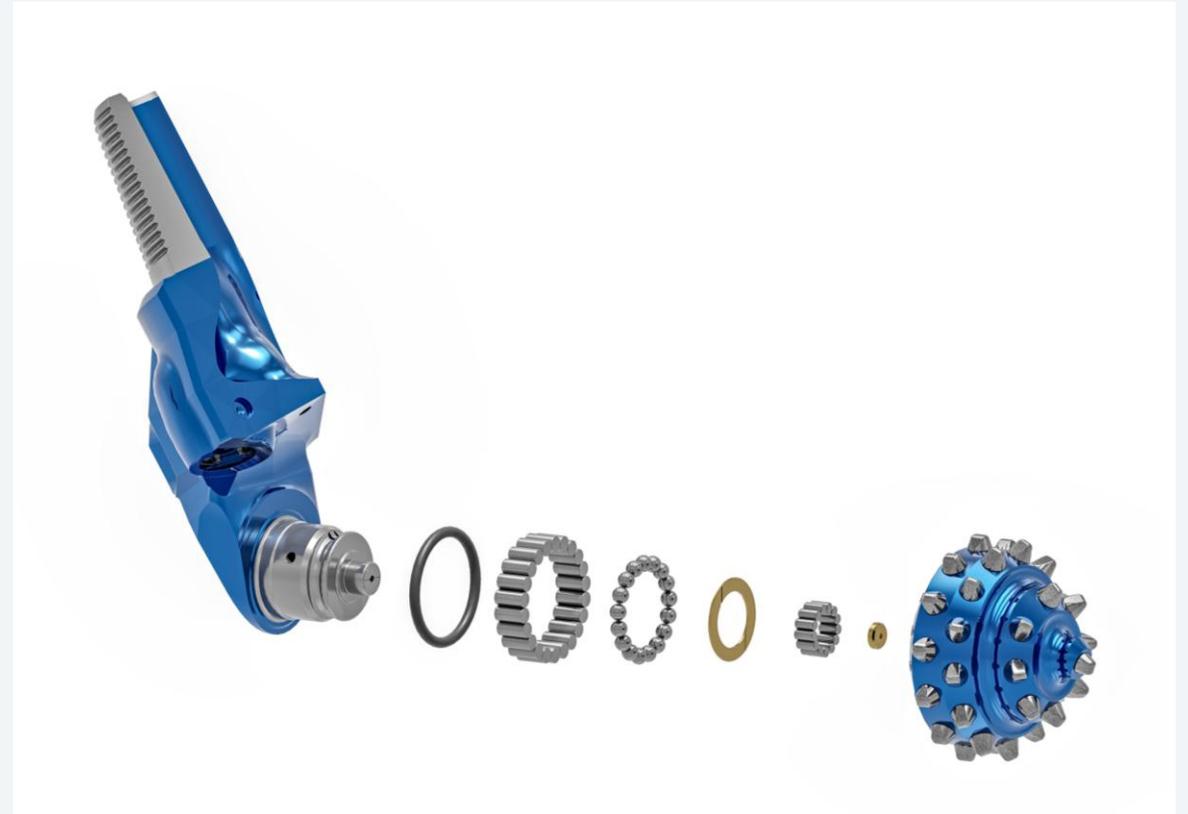
IADC bits classification – digit III Bearing type



Sealed roller bearing

4 - no heel row protection

5 - incl. heel row protection



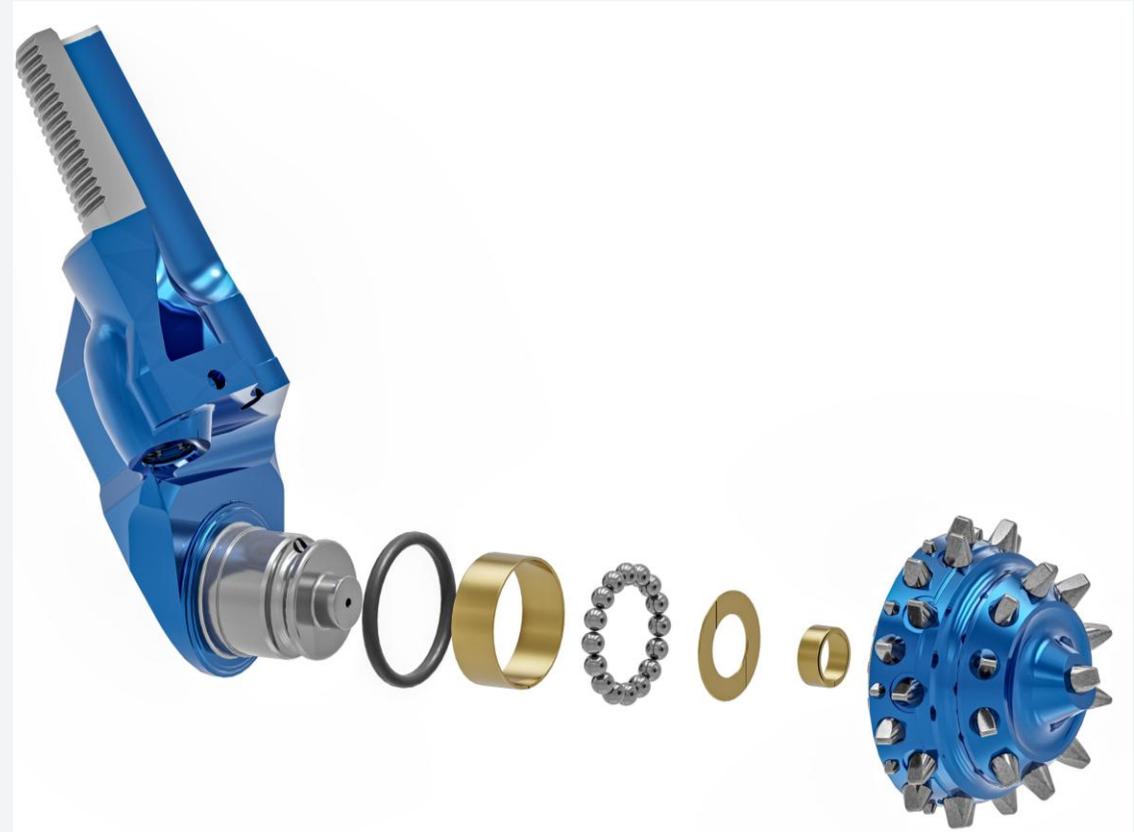
IADC bits classification – digit III Bearing type

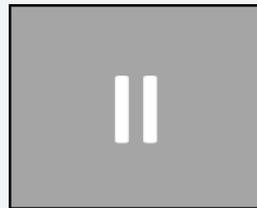
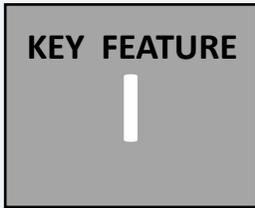


Sealed journal bearing

6 - no heel row protection

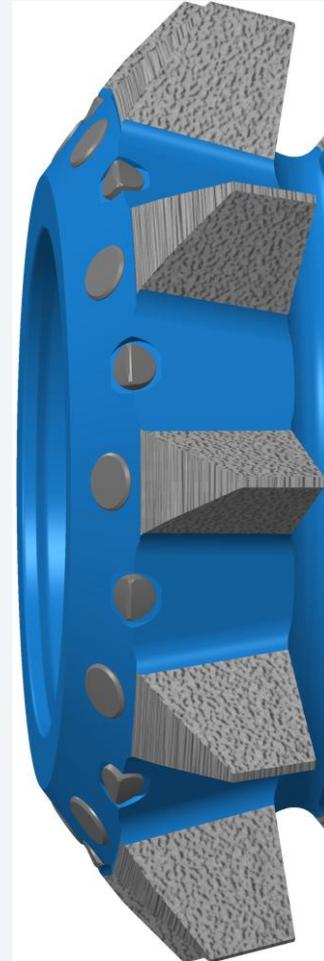
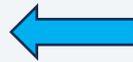
7- incl. heel row protection





Milled Tooth

- 1
- 2
- 3



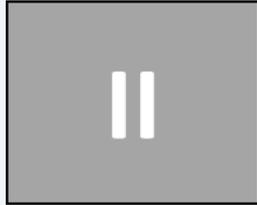
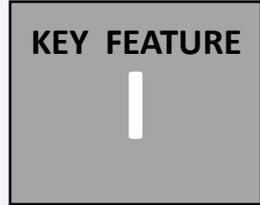
IADC classification – digit I & digit II Cutting structure vs. formation hardness

Codes 11* , 12* , 13* , 14*

very soft, unstratified, poorly compacted formations including soft shale, claystones, mudstone, siltstones, soft sandstone, salt, chalk, gypsum, etc.

Formation compressive strength up to 50 MPa

Long teeth, reinforced with hardfacing for improved abrasion resistance, efficient cleaning in soft and very viscous formations.



Milled Tooth

- 1
- 2
- 3



IADC classification – digit I & digit II Cutting structure vs. formation hardness

Codes 21* , 22* , 23* , 24*

medium hard and abrasive formations including consolidated sandstones, medium- hard shales, tuffs etc.

Formation compressive strength from 60 to 100 MPa

Medium height teeth, quite densely spaced to increase the WOB resistance but still able to be cleaned effectively.

KEY FEATURE

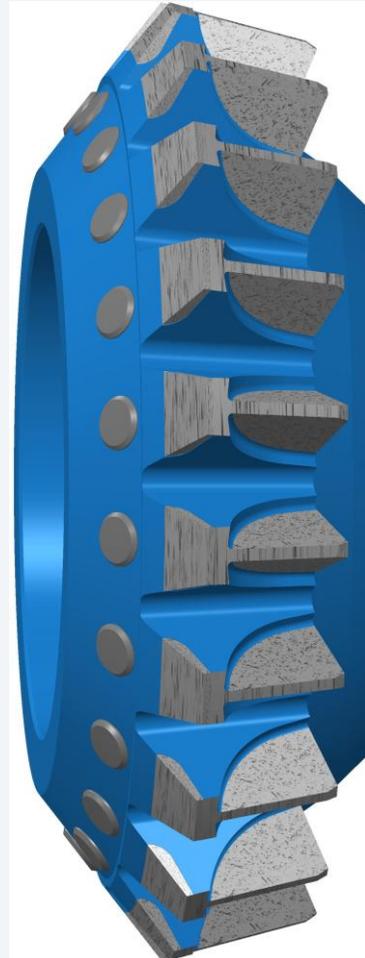


Milled Tooth

1

2

3



IADC classification – digit I & digit II Cutting structure vs. formation hardness

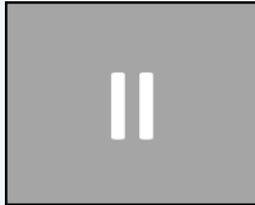
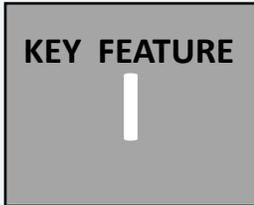
Codes 31* , 32* , 33* , 34*

hard, abrasive, well compacted rocks including andesites, quartz (sandstones), hard siliceous shale, siliceous dolomites, limestone, marble, granite etc.

Formation compressive strength from 110 to 180 MPa.

Short, T-shaped, closely spaced teeth for perfect WOB results and abrasions resistance.

IADC classification – digit I & digit II Cutting structure vs. formation hardness



TCL

4



5

6

7

8

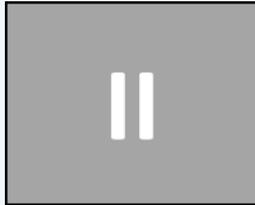
Codes 41* , 42* , 43* , 44*

Very soft, unstratified, poorly compacted formations including sandstone, mudstone, salt, coal, chalk, and very soft limestone etc.

Formation compressive strength up to 40 MPa

Very long, conical TCLs for very high penetration rates and perfect cleaning.

IADC classification – digit I & digit II Cutting structure vs. formation hardness



TCI

4

5

6

7

8



Codes 51*, 52* , 53* , 54*

Medium soft, unstratified formations including sandstone, claystone, marlstone, soft sandy-shale, medium- hard shale, soft anhydrite etc.

Formation compressive strength from 40 to 80 MPa

Long, conical, chisel, densely located TCIs for high penetration rate.

IADC classification – digit I & digit II Cutting structure vs. formation hardness

Codes 61* , 62* , 63* , 64*

Medium hard and abrasive, compacted formations
including quartz- sandstone, limestone, conglomerates,
crystalline dolomites, hard shale, granite, marble etc.

Formation compressive strength from 80 to 180 MPa

Medium short, conical TCIs for full gauge protection.

KEY FEATURE



TCI

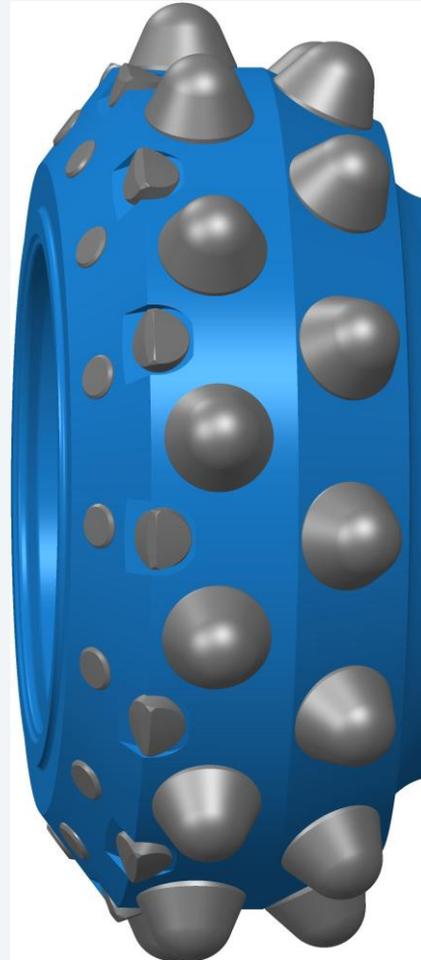
4

5

6

7

8



IADC classification – digit I & digit II Cutting structure vs. formation hardness

Codes 71* , 72* , 73* , 74*

Hard and abrasive formations including: gneiss, diorite, hard shale, limestone, dolomite, basalt, quartzite, syenite etc.

Formation compressive strength from 180 to 280 Mpa
Short, spherical TCIs for crushing formations.

Codes 81* , 82* , 83* , 84*

Very hard, well compacted and abrasive formations including: quartzite, syenite, very hard limestone, cherts, metamorphic rocks like gabbro, hematite, magnetite etc.

Formation compressive strength above 280 Mpa
Very short, ovoid TCIs for crushing formations.

KEY FEATURE



TCI

4

5

6

7

8



Conclusions?

- ❖ **Detailed geological survey** is a KEY factor for proper IADC tool selection
- ❖ COPY- PASTE approach and LET'S REPEAT THE LAST PROJECT approach can be a costly lesson
- ❖ **Generally** in HDD, softer cutting structures are recommended as formations tend to be not that hard as assumed, however geological surprises can happen on every site ...
- ❖ Customer is to define what is expected: when soft formation, and choosing soft tool, we will drill fast, but the bit will use up fast too. When hard bit is chosen, the drilling will be slow, but bit's durability- long.
- ❖ There are **no universal bits codes**.
Too hard bits will not prove suitable for soft rocks- this will end up with balling up, sliding, skimming of the tool.
Too soft bits will obviously get destroyed with hard formations- dropping ROP & losing the gauge.
- ❖ **Roller bearings (code ** 4 & ** 5)** are more resistant against high RPMs than **journal bearings (code ** 6 & ** 7)** in HDD mud motor applications.
- ❖ **Leg back protection** is key in HDD for optimal gauge safety as bits mostly work horizontally.
- ❖ Too little **flushing** can kill each bit