



At CENERG GLOBAL TOOLS we offer an extensive line of Rotary Drill Bits with reliable tool life and performance that improves productivity and optimizes drilling cost.

We have a state of the art manufacturing facility in Hyderabad, India managed by a team of highly experienced Engineers. The manufacturing facility is equipped with latest CNC Machines, fully automated Heat Treatment furnaces, sophisticated Metallurgical Labs with all Inspection & Testing facilities. The production process is closely monitored and controlled at every stage of the manufacturing process with ability to produce 18,000 rotary bits per year.

Our range of Rotary Drill Bits cover Blasthole, Water Well, Construction, Oilfield, Workover, Exploration and Directional Drilling applications. The size ranges from 2 3/8" (60mm) – 12 1/4" (311mm) in Steel Tooth and Tungsten Carbide Insert Bits.

Today Customer's unique drilling challenges call for special solutions and Cenerg is well equipped to respond to these challenges and adapt its wide range of products to provide customized solutions to best suit the specific needs.









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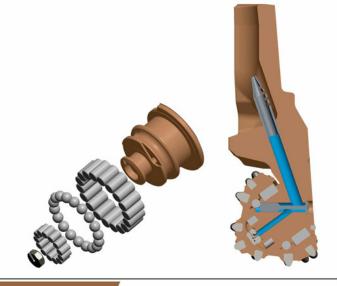
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## **Bearing Types....**

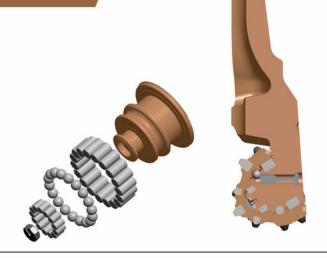
### **Open bearing – Air Circulation**

In this configuration an air passage is provided to the bearing area. The compressed air cools and lubricates the bearings and blows away any drilling debris extending the life of the bearing. This bearing configuration is commonly used in Blasthole Mining applications



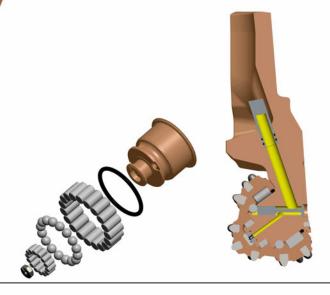
### Open bearing - Air, Mud or Foam Circulation

The standard open roller bearings are without a seal or an air passage. They are ideal for drilling shallow holes, in the hundreds of feet with either foam or mud circulation. These bearing configurations are commonly used in Water Well applications.



### **Sealed bearing – Air Circulation**

Sealed bearings for air circulation are similar to Open Air bearings, only difference being the bearing pack protected with an O- Ring Seal. The lubricant is filled into the bearing and sealed off. This prevents ingress of dirt into the bearing system and leakage of grease. This configuration is used for Mining applications with heavy water injection and ground water conditions.

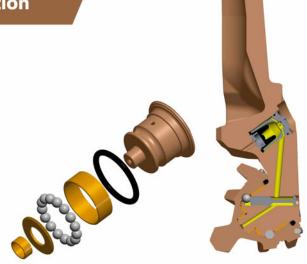


# **Bearing Types**



### Sealed Journal bearing - Mud circulation

In Sealed Journal bearing the Rollers inside the cone are replaced by a Floating Bush made out of special alloys which is silver plated. The bearing Pack is protected with an O-Ring Seal. The bearing lubrication and pressure compensator system is built in. The Floating Bush is highly resistant to heat and galling. Consequently these bearings are very durable and suitable for Oil & Gas as well as Horizontal and Directional Drilling applications



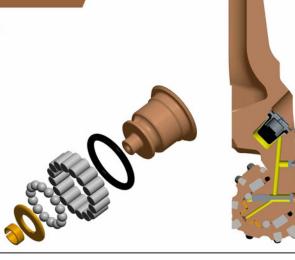
### Sealed friction bearing - Mud circulation

In bearings for Small Diameter Bits instead of the Floating Bush the internal surface of the Cone is silver plated using a special process. This design enables bearing size to be increased in relation to the diameter of the Bit enhancing its durability. This bearing design finds application in Exploration and Workover and Well drilling applications



# Sealed roller bearing – Mud Circulation

While sealed roller bearings have some of the features of Open to Air bearings, the bearing pack is protected with an O- Ring Seal and has lubrication and pressure compensator system built in. This prevents ingress of dirt into the bearing system and leakage of grease. This configuration is used for Mining, Workover and Exploration applications



# Air to Bearing Bit features ...

The cutting structure on the bits is Special features provided for optimized with intermittent pitch cone steel erosion when breaks for efficient rock breakage drilling is abrasive formations. and to reduce vibration Small carbide inserts in between gage to reduce steel wear Customizable gage protection options for maximum endurance Hard metal on nose area of cones to avoid coring while drilling Double gage protection for very abrasive drilling conditions \*\*Customizable shirttail protection options for maximum endurance Single gage protection for normal non-abrasive drilling conditions Non return valve options for water injection drilling and heavy ground water conditions.



1/3rd shirttail protection for non abrasive drilling



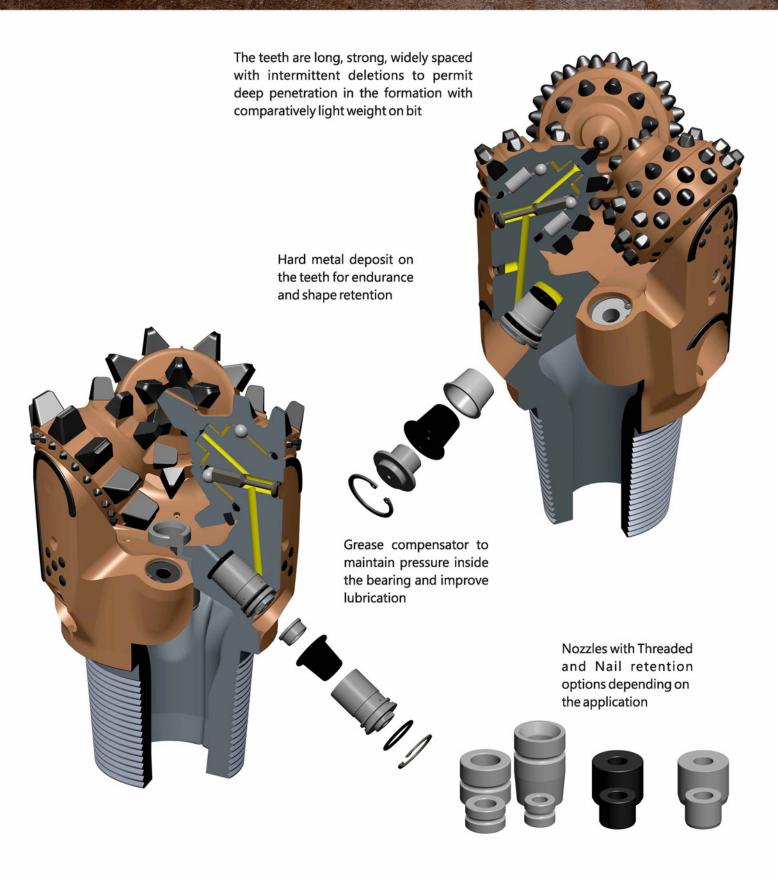
2/3rd shirttail protection for medium hard and moderately abrasive drilling



Full shirttail protection for very hard and very abrasive drilling

# **Sealed Bearing Bit features ...**





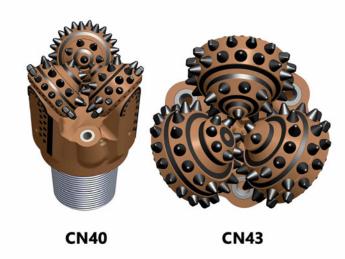
# **Types of Bits....TC Insert**

### Soft formation

#### **CN4X** series

**Application :** For use in less abrasive softer formations with compressive strength ranging between 90 - 150 Mpa, such as shales, limestones, carbonates and most metamorphic formations.

**Cutting profile:** These bits are characterized by large diameter, widely spaced chisel or sharp conical inserts with high projection. This configuration promotes maximum penetration rates in softer formations. Smaller carbide inserts are provided on the gage and inner rows to contain shell erosion and improve performance

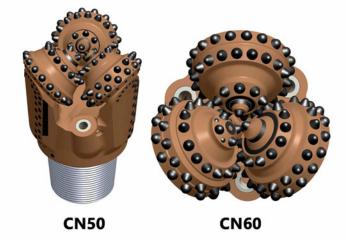


### **Medium formation**

#### CN5X & CN6X series

**Application:** For use in moderately abrasive consolidated formations with compressive strength ranging between 120 – 200 Mpa such as hard limestone, quartzite, granodiorite, and medium grade metamorphic formations.

**Cutting profile:** These bits are characterized by moderately spaced wedge chisel or conical inserts with medium projection. This configuration promotes good penetration rates in medium hard and moderately abrasive formations. Smaller carbide inserts are provided on the gage and inner rows or hard metal is deposited in the nose area to contain shell erosion and improve performance

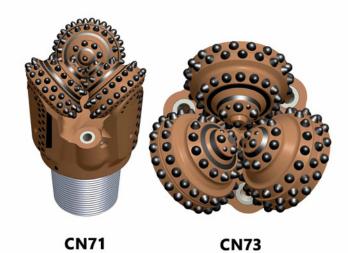


#### **Hard formation**

#### **CN7X** series

**Application :** For use in abrasive consolidated formations with compressive strength above 200 Mpa such as taconite, quartzite and banded iron formations

**Cutting profile:** These bits are characterized by closely spaced conical or spherical inserts with medium to low projection. This configuration promotes good penetration rates in hard, consolidated and very abrasive formations. Smaller carbide inserts are provided on the gage and inner rows or hard metal is deposited in the nose area to contain shell erosion and improve performance



# Types of Bits....Steel Tooth

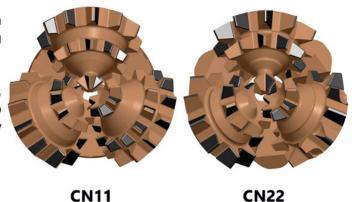


### **Soft & Medium formation**

#### CN1X & CN2X series

**Application :** These tooth bits are designed for optimum performance in formations of low compressive strength ranging below 70 MPA

**Cutting profile:** These soft formation bits are designed with long, slim, strong, widely spaced teeth with intermittent deletions to permit deep penetration in the formation with comparatively light weight on bit.



### **Hard formation**

#### **CN3X** series

**Application :** These tooth bits are designed for medium to hard formations with compressive strength ranging between 70 - 100 MPA

**Cutting profile:** These bits have higher capacity bearings, more closely spaced teeth with increased tooth angles and more gage surface for resisting wear to allow the use of heavier weights required to effectively drill hard formations



**CN33** 

### **Hole bottom flushing options**



Side Jet



Center jet



**Combined** jet

# **Product offering**

# Open bearing – Air Circulation

| Bit Dia | meter |          | Sof      | test |     |     |     |          | Rock | Hard | ness |          |     |     | Har      | dest     |     |
|---------|-------|----------|----------|------|-----|-----|-----|----------|------|------|------|----------|-----|-----|----------|----------|-----|
| Inch    | mm    | 4-1      | 4-2      | 4-3  | 4-4 | 5-1 | 5-2 | 5-3      | 5-4  | -    | 6-2  | 6-3      | 6-4 | 7-1 | 7-2      | 7-3      | 7-4 |
| 5 1/8"  | 130   |          |          |      |     |     |     | <b>√</b> |      |      |      |          |     |     |          |          |     |
| 5 5/8"  | 143   |          |          |      |     |     |     | <b>√</b> |      |      |      |          |     |     |          |          |     |
| 5 7/8"  | 150   |          | 1        |      |     |     |     | ✓        |      |      |      | ✓        |     |     | ✓        |          |     |
| 6 1/4"  | 159   | 1        | <b>√</b> |      |     |     |     | <b>√</b> |      |      |      | ✓        |     |     | ✓        |          |     |
| 6 1/2"  | 165   |          | 1        |      |     |     |     |          |      |      |      | ✓        |     |     |          |          |     |
| 6 3/4"  | 171   | <b>1</b> | <b>√</b> |      |     |     |     | ✓        |      |      |      | <b>√</b> | 1   |     | ✓        | ✓        |     |
| 7"      | 178   | <b>1</b> |          |      |     |     |     |          |      |      |      |          |     |     |          |          |     |
| 7 7/8"  | 200   | <b>√</b> | ✓        | ,    |     |     |     | ✓        |      |      |      | ✓        | 1   |     | /        |          |     |
| 8 1/2"  | 216   |          |          |      |     |     |     | /        |      |      |      | 1        |     |     |          |          |     |
| 8 5/8"  | 219   |          |          |      |     |     |     | ✓        |      |      |      | ✓        |     |     |          |          |     |
| 9"      | 229   | <b>√</b> | 1        |      |     |     |     | ✓        |      |      |      | ✓        | ✓   |     | ✓        |          |     |
| 9 1/2"  | 241   |          |          |      |     |     |     | ✓        |      |      |      |          |     |     |          |          |     |
| 9 7/8"  | 251   | 1        | 1        |      | /   | 1   |     | 1        |      |      |      | 1        | 1   |     | ✓        | <b>√</b> |     |
| 10 5/8" | 270   | 1        | 1        |      | /   |     |     | 1        |      |      |      | ✓        | 1   |     | <b>√</b> |          |     |
| 11"     | 284   |          |          |      |     |     |     | ✓        |      |      |      | <b>√</b> | 1   |     |          |          |     |
| 12 1/4" | 311   |          |          |      |     |     |     | <b>√</b> |      |      |      | 1        | 1   |     | <b>√</b> | <b>√</b> |     |

## **Sealed bearing – Air Circulation**

| Bit Dia | meter |          | Sof      | test |          |     |     |          | Rock | Hard | ness |     |          |     | Har | dest |     |
|---------|-------|----------|----------|------|----------|-----|-----|----------|------|------|------|-----|----------|-----|-----|------|-----|
| Inch    | mm    | 4-1      | 4-2      | 4-3  | 4-4      | 5-1 | 5-2 | 5-3      | 5-4  | 6-1  | 6-2  | 6-3 | 6-4      | 7-1 | 7-2 | 7-3  | 7-4 |
| 6 3/4"  | 171   |          |          |      |          |     |     | ✓        |      |      |      |     | -        |     |     |      |     |
| 7 7/8"  | 200   | <b>√</b> | 1        |      |          |     |     |          |      |      |      |     |          |     |     |      |     |
| 8 1/2"  | 216   |          |          |      |          |     |     | ✓        |      |      |      | ✓   |          |     |     |      |     |
| 8 5/8"  | 219   |          |          |      |          |     |     |          |      |      |      | ✓   |          |     |     |      |     |
| 9"      | 229   | /        | 1        |      |          |     |     | ✓        |      |      |      | ✓   |          |     |     |      |     |
| 9 5/8"  | 244   |          |          |      |          |     |     | ✓        |      |      |      | 1   | <b>√</b> |     |     |      |     |
| 9 7/8"  | 251   | <b>√</b> | 1        |      | <b>√</b> |     |     | <b>√</b> |      |      |      | 1   |          |     |     |      |     |
| 10 5/8" | 270   | <b>√</b> | <b>√</b> |      | <b>√</b> |     |     |          |      |      |      | 1   |          |     |     |      |     |
| 11"     | 284   |          |          |      |          |     |     | <b>√</b> |      |      |      |     |          |     |     |      |     |
| 12 1/4" | 311   |          |          |      | /        |     |     | ✓        |      |      |      |     |          |     |     |      |     |

## Sealed bearing – Mud Circulation

|         |        | 100      |     |     |          |     |     |          |     |     |     | /   |     |      |      |          |     |     |     |     |     |     |     |     |     |     |
|---------|--------|----------|-----|-----|----------|-----|-----|----------|-----|-----|-----|-----|-----|------|------|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Bit Dia | ameter |          |     |     |          |     |     |          |     |     | IA  | DC  | Cla | ssif | icat | tion     |     |     |     |     |     |     |     |     |     |     |
| Inch    | mm     | 1-1      | 1-2 | 1-3 | 2-1      | 2-2 | 2-3 | 3-1      | 3-2 | 3-3 | 4-1 | 4-2 | 4-3 | 4-4  | 5-1  | 5-2      | 5-3 | 5-4 | 6-1 | 6-2 | 6-3 | 6-4 | 7-1 | 7-2 | 7-3 | 7-4 |
| 3 7/8"  | 98.42  | 1        |     |     | 1        |     |     |          |     |     |     |     |     |      |      | 1        |     |     |     |     |     |     |     |     |     |     |
| 4 1/2"  | 114.30 | <b>V</b> |     |     | <b>√</b> |     |     | <b>V</b> |     |     |     |     |     |      |      |          |     |     |     |     |     |     |     |     |     |     |
| 4 5/8"  | 117.50 |          |     |     | 1        |     |     |          |     |     |     |     |     |      |      |          |     |     |     |     |     |     |     |     |     |     |
| 4 3/4"  | 120.65 | <b>V</b> |     |     | 1        |     |     | 1        |     |     |     |     |     |      | 1    | 1        | 1   |     |     |     | 1   |     |     |     |     |     |
| 5"      | 127.00 |          |     |     |          |     |     |          |     |     |     |     |     |      |      |          | 1   |     |     |     |     |     |     |     |     |     |
| 5 1/8"  | 130.17 | ,        |     |     |          |     |     |          |     |     |     |     |     |      |      | ✓        |     |     |     |     |     |     |     |     |     |     |
| 5 1/2"  | 139.70 | 1        |     |     |          |     |     |          |     |     |     |     |     |      | 1    | 1        | 1   | 1   |     |     | 1   |     |     |     |     |     |
| 5 5/8"  | 142.88 |          |     |     |          |     |     |          | 1   |     |     |     |     |      |      |          |     |     |     |     | 1   |     |     |     |     |     |
| 5 3/4"  | 146.00 | 1        |     |     |          |     |     |          |     |     |     |     |     |      |      |          |     | 1   |     |     |     |     |     |     |     |     |
| 5 7/8"  | 149.20 | 1        |     |     |          |     |     |          |     |     |     |     |     |      |      |          |     |     |     |     | 1   |     |     |     |     |     |
| 6"      | 152.40 | 1        |     |     | 1        |     |     |          |     |     |     |     |     |      | 1    | 1        | 1   |     |     |     |     |     |     |     |     |     |
| 6 1/8"  | 155.57 | 1        |     |     | 1        |     |     |          |     |     |     |     |     |      |      |          | 1   |     |     |     |     |     |     |     |     |     |
| 6 1/4"  | 158.80 | 1        |     |     |          |     |     |          |     |     |     |     |     |      |      |          | 1   |     |     |     |     |     |     |     |     |     |
| 6 1/2"  | 165.10 | ✓        |     |     |          |     |     | ✓        |     |     |     |     |     |      | ✓    | <b>√</b> | ✓   | 1   |     |     |     |     |     |     |     |     |
| 6 3/4"  | 171.45 | 1        |     |     |          | 1   |     |          |     |     |     |     |     |      | 1    |          |     |     |     |     |     |     |     |     |     |     |

# **Product offering**



## Sealed bearing – Mud Circulation

| Bit Dia | meter  |     |     |     |     |     |     |     |          |     | IA  | DC  | Cla | ssif | icat     | ion |          |     |     |     |     |     |     |     |     |     |
|---------|--------|-----|-----|-----|-----|-----|-----|-----|----------|-----|-----|-----|-----|------|----------|-----|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Inch    | mm     | 1-1 | 1-2 | 1-3 | 2-1 | 2-2 | 2-3 | 3-1 | 3-2      | 3-3 | 4-1 | 4-2 | 4-3 | 4-4  | 5-1      | 5-2 | 5-3      | 5-4 | 6-1 | 6-2 | 6-3 | 6-4 | 7-1 | 7-2 | 7-3 | 7-4 |
| 7 1/4"  | 184.15 |     |     |     |     |     |     |     | <b>√</b> |     |     |     |     |      |          |     |          |     |     |     |     |     |     |     |     |     |
| 7 3/8"  | 187.32 |     |     |     |     |     |     |     | 1        |     |     |     |     |      |          |     |          |     |     |     |     |     |     |     |     |     |
| 7 1/2"  | 190.50 |     |     |     |     |     |     |     |          |     |     |     |     |      |          |     | 1        |     |     |     |     |     |     |     |     |     |
| 7 7/8"  | 200.00 | 1   |     |     |     |     |     |     |          |     |     |     |     |      |          |     | ✓        |     |     |     |     |     |     |     |     |     |
| 8 1/2"  | 215.90 | 1   |     |     | ✓   |     |     |     |          |     |     |     |     |      | <b>\</b> |     | 1        |     |     |     |     |     |     |     |     |     |
| 8 3/4"  | 222.25 | 1   |     | ✓   |     |     |     |     | 1        |     |     |     |     |      |          |     | <b>√</b> |     |     |     |     |     |     |     |     |     |
| 9 1/2"  | 241.30 |     |     |     |     |     |     |     |          |     |     |     |     |      |          |     | 1        |     |     |     |     |     |     |     |     |     |
| 9 7/8"  | 250.80 | 1   |     | ✓   | ✓   |     |     |     | 1        |     |     |     |     |      | <b>\</b> |     | <b>V</b> |     |     |     |     |     |     |     | 1   |     |
| 10 5/8" | 270.00 | 1   |     |     |     |     |     |     |          |     |     |     |     |      |          |     | 1        |     |     |     |     |     |     |     |     |     |
| 12 1/4" | 311.00 | 1   | ✓   |     | 1   |     |     |     |          |     |     |     | 1   |      | ✓        |     | 1        | 1   |     |     | 1   |     |     |     |     |     |
| 13 3/4" | 349.00 |     |     |     |     |     |     |     |          |     |     |     |     |      |          | 1   |          |     |     |     |     |     |     |     |     |     |

### Open bearing - Air, Mud or Foam Circulation

| Bit Dia  | meter  |          |          | ADO          | Cla      | ssific | catio    | n        |          |
|----------|--------|----------|----------|--------------|----------|--------|----------|----------|----------|
| Inches   | mm.    | 11       | 23       | 32           | 33       | 40     | 50       | 60       | 70       |
| 2 1/2"   | 63.50  | 1        | 1        | <b>✓</b>     | 1        |        | 1        | 1        | 1        |
| 2 5/8"   | 66.67  | <b>√</b> | <b>√</b> | <b>√</b>     | <b>✓</b> |        | <b>√</b> | <b>√</b> | <b>✓</b> |
| 2 7/8"   | 73.02  | 1        | 1        | <b>√</b>     | 1        |        | 1        | 1        | 1        |
| 2 15/16' | 74.61  | ✓        | ✓        | ✓            | <b>√</b> |        | ✓        | ✓        | ✓        |
| 3"       | 76.20  | 1        | 1        | ✓            | <b>√</b> |        | 1        | 1        | 1        |
| 3 1/8"   | 79.37  | ✓        | ✓        | ✓            | ✓        |        | ✓        | ✓        | ✓        |
| 3 1/4"   | 82.55  | ✓        | ✓        | ✓            | ✓        |        | 1        | 1        | 1        |
| 3 3/8"   | 85.72  | ✓        | ✓        | ✓            | ✓        |        | ✓        | ✓        | ✓        |
| 3 1/2"   | 88.90  | 1        | ✓        | ✓            | ✓        |        | 1        | ✓        | 1        |
| 3 5/8"   | 92.07  | ✓        | ✓        | ✓            | ✓        |        | ✓        | ✓        | ✓        |
| 3 3/4"   | 95.25  | 1        | ✓        | ✓            | ✓        |        | ✓        | 1        | <b>√</b> |
| 3 7/8"   | 98.42  | ✓        | ✓        | ✓            | ✓        |        | ✓        | ✓        | ✓        |
| 4"       | 101.60 | <b>√</b> | ✓        | ✓            | ✓        |        | ✓        | ✓        | <b>√</b> |
| 4 1/8"   | 104.80 | ✓        | ✓        | ✓            | ✓        |        | ✓        | ✓        | ✓        |
| 4 1/4"   | 107.60 | ✓        | ✓        | ✓            | ✓        |        | ✓        | ✓        | ✓        |
| 4 3/8"   | 111.10 | ✓        | ✓        | ✓            | ✓        |        | ✓        | ✓        | ✓        |
| 4 1/2"   | 114.30 | <b>√</b> | <b>V</b> | ✓            | ✓        |        | <b>√</b> | ✓        | ✓        |
| 4 5/8"   | 117.50 | ✓        | ✓        | $\checkmark$ | ✓        |        | ✓        | ✓        | ✓        |
| 4 3/4"   | 120.70 | <b>√</b> | ✓        | ✓            | <b>√</b> |        | ✓        | <b>√</b> | <b>√</b> |
| 4 7/8"   | 123.80 | <b>V</b> | ✓        | ✓            | <b>√</b> |        | ✓        | <b>V</b> | <b>V</b> |
| 5"       | 127.00 | <b>√</b> | <b>√</b> | <b>√</b>     | <b>√</b> |        | ✓        | <b>V</b> | <b>V</b> |
| 5 1/8"   | 130.20 | <b>V</b> | ✓        | ✓            | ✓        |        | ✓        | <b>√</b> | <b>V</b> |
| 5 1/4"   | 133.40 | ✓        | ✓        | <b>✓</b>     | <b>√</b> |        | ✓        | ✓        | <b>V</b> |
| 5 3/8"   | 136.50 | ✓        | ✓        | ✓            | ✓        |        | ✓        | ✓        | ✓        |
| 5 1/2"   | 139.70 | 1        | 1        | 1            | 1        |        | 1        | 1        | 1        |

| Bit Dia | meter  |          |          | ADO      | Cla      | ssific   | catio | n  |          |
|---------|--------|----------|----------|----------|----------|----------|-------|----|----------|
| Inches  | mm.    | 11       | 23       | 32       | 33       | 40       | 50    | 60 | 70       |
| 5 5/8"  | 142.80 | 1        | 1        | 1        | <b>\</b> |          | ✓     | 1  | <b>√</b> |
| 5 3/4"  | 146.00 | <b>V</b> | 1        | <b>✓</b> | ✓        |          | ✓     | 1  | ✓        |
| 5 7/8"  | 149.20 | 1        | 1        | 1        | 1        | 1        | 1     | 1  | 1        |
| 6"      | 152.40 | 1        | ✓        | 1        | <b>\</b> | <b>\</b> | ✓     | 1  | <b>√</b> |
| 6 1/8"  | 155.60 | 1        | 1        | 1        | <b>√</b> |          | ✓     | 1  | 1        |
| 6 1/4"  | 158.80 | <b>√</b> | ✓        | ✓        | ✓        |          | ✓     | 1  | ✓        |
| 6 3/8"  | 161.90 | 1        | <b>√</b> | 1        | ✓        |          | ✓     | 1  | ✓        |
| 6 1/2"  | 165.10 | ✓        | 1        | ✓        | ✓        |          | ✓     |    | ✓        |
| 6 5/8"  | 168.00 | 1        | 1        | <b>√</b> | ✓        |          | 1     |    | <b>\</b> |
| 6 3/4"  | 171.50 | <b>✓</b> | <b>V</b> | ✓        | <b>\</b> | ✓        | ✓     | ✓  | ✓        |
| 7"      | 177.80 | 1        | 1        | 1        | 1        |          | ✓     | 1  | 1        |
| 7 1/4"  | 184.00 |          |          | ✓        |          |          |       |    | ✓        |
| 7 3/8"  | 187.00 |          |          | ✓        |          |          |       |    | ✓        |
| 7 1/2"  | 191.00 |          |          | ✓        | ✓        |          | ✓     |    | ✓        |
| 7 5/8"  | 193.60 |          |          | ✓        | 1        |          | ✓     |    | 1        |
| 7 7/8"  | 200.00 | <b>V</b> |          | ✓        | ✓        |          |       | ✓  |          |
| 8"      | 203.00 | 1        |          | ✓        | ✓        |          |       | 1  |          |
| 8 1/2"  | 216.00 |          |          | ✓        | ✓        |          |       | ✓  |          |
| 8 5/8"  | 219.00 |          |          | ✓        | 1        |          |       | 1  |          |
| 9 1/2"  | 241.00 |          |          | ✓        |          |          |       |    | ✓        |
| 9 5/8"  | 244.00 |          |          | 1        |          |          |       |    |          |
| 9 7/8"  | 251.00 |          |          | ✓        | ✓        |          |       | ✓  |          |
| 10"     | 254.00 |          |          |          | ✓        |          |       |    |          |
| 10 5/8" | 270.00 |          |          | ✓        | ✓        |          |       |    |          |
| 12 1/4" | 311.00 |          |          | 1        |          |          |       |    | ,        |

# **Useful Operating Information**

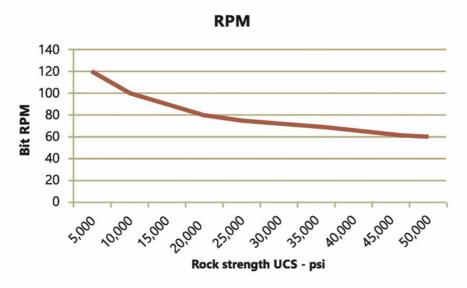
- When a new bit is installed, drill at reduced weight for a short period
- Provide adequate air to the bit to ensure trouble free bearing performance and reduced abrasion wear on cones and shirttails. (recommended is 40 45 psi at the bit)
- Turn the air on before lowering the bit to collar the hole. Keep the air on until the bit is finished drilling and is out of the hole.
- Always rotate the bit when moving in or out of the hole.
- Some indications that the hole is not being properly cleaned are:
  - Increase in torque indication through higher hydraulic pressure.
  - Increase in air pressure.
  - Heavy wear and /or damage indications on shirttails.
- Always rotate when coming out of the hole to:
  - Help in cleaning the cuttings from the hole.
  - Keeps cuttings from entering the bearings around the back face of the cone.
- Never use the hydraulic pressure on the bit for levelling the machine.
- When adding extra drill steel in wet holes, always make three or four cleaning passes to get a cleaner hole bottom.
- Bit cones should be checked periodically to be sure that all are about the same temperature. One hot cone generally indicates that the air passage to that bearing is obstructed. Clean the bit with water and continue drilling
- A bit should never be left down the hole when repairs require lowering the head assembly to the deck. This bit should be substituted by a dull bit to protect the drill pipe threads.
- Properly maintain the drill pipe and its threaded connections. A bent pipe will often cause early failure.
- Blasthole bits drill most economically when sufficient weight is applied to cause spalling of the formation. Selecting correct rotary speed is usually a matter of trial-and-error, depending upon the formation being drilled or use the factory recommended weight and rotation speeds.
- Always record footage drilled, time in the hole, RPM, WOB (weight on bit), air pressure psi, formation drilled and any unusual drilling conditions.
- After the bit is discarded it is necessary to make a comparative analysis of each bit type dulling and causes. Evaluating those findings can increase drilling efficiency while reducing drilling cost and will precisely determine what bit design features are required for the application.





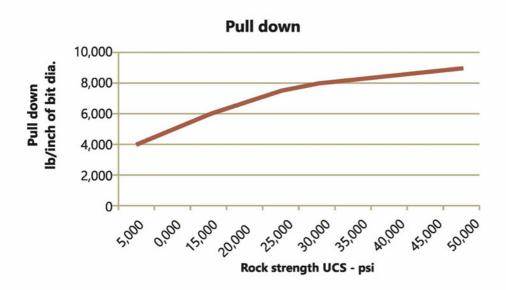
Pull down load is required to adequately push teeth into the rock to break in efficiently. It is the primary factor in rate of penetration. The unconfined compressive strength of the rock determines how much pull down is to be applied.

High UCS rocks may need time for the indenter to break it. Lower RPM is often required for efficient rock breakage.



Rotation is required to move the cutting teeth to the next rock cutting position. The faster you move the teeth to the next position, the faster you will drill. If the rock resists indentation by the teeth, there will be minimal rock breakage, and rate of penetration will not increase proportionally with higher rotation.

For softer rock high RPM is required as Soft rock responds to frequency and for harder rock low RPM is required as Hard rock responds to time



# **Air Requirements**

In rotary blasthole drilling, delivery of air in sufficient volume and at proper pressure is very essential to assure optimum bit performance.

Right amount of air ensures efficient cuttings removal from the hole bottom to the surface. It also reduces the cutting structure wear and bearing erosive wear by means of efficient bottom hole cleaning.

The right amount of back pressure is also required to cool the bearing and to keep the bearing clean from drilling debris.

The air volume provided must be good enough to produce a bailing velocity of 5,000-7,000 ft./min. for dry cuttings; and 7,000-10,000 ft./min. for wet cuttings.

To determine volumetric requirements, and bailing velocity the simple equation may be used.

#### $Q = V/183.35 (D^2 - d^2)$

Q = cubic feet per minute of free air.

V = Annular Velocity feet / min

d = drill pipe outside diameter, inches.

D = hole diameter, inches.

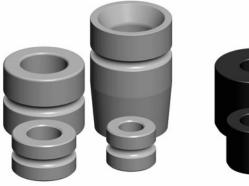
183.35 = Factor for conversion

Hence to determine the bailing velocity the equations is

 $V = Q \times 183.35 / (D^2 - d^2)$  feet per min

#### Nozzle selection

Nozzles should be selected so that the pressure inside the bit is 40-45 psi. The cab operating pressure inside the drills cabin could be higher, depending on the type of drill and CFM of air circulated. Typically, on compressors rated with 80-100 psi bit pressures can be 10 - 25 psi lower than the cab gauge reading.









| 1800 1800 1800 1800 1800 1800 1800 1800  |     |         | i            |         |     |     |     |            |          |        |          |          |          | 2             | NOZZLE SELECTION | SELECT   | NOI      |          |          |         |          |          |          |         |      |      |
|--|-----|---------|--------------|---------|-----|-----|-----|------------|----------|--------|----------|----------|----------|---------------|------------------|----------|----------|----------|----------|---------|----------|----------|----------|---------|------|------|
| Share   Shar   |     |         | Inread       |         |     |     |     | Air        | Pressure | drop a | cross B  | ast-hol  | e bits w | ith varie     | zou sno          | zle size | Air vol  | ume d    | elivered | - CFM ( | cubic fe | et per i | minute)  | grand . |      |      |
| 9km         6km         62         77         8km         78  |     |         | Collinection |         | 200 | 009 | 700 | 800        | $\vdash$ | 9 -    | -        | -        | -        | $\overline{}$ |                  | -        |          | 1900     | 2000     | 2100    | 0 2200   | 0 2300   | 2400     | 2600    | 2800 | 3000 |
| 2 y <sub>8</sub> 10 mm         47         59         71         7         <  |     |         |              | 8 mm    | 62  | 11  |     |            |          |        |          |          |          |               |                  |          |          |          |          |         |          |          |          |         |      |      |
| 8k         11 mm         35         45         55         66         75         7 <th< td=""><td></td><td></td><td>2 7/8"</td><td>10 mm</td><td>47</td><td>59</td><td>11</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>   |     |         | 2 7/8"       | 10 mm   | 47  | 59  | 11  |            |          |        |          |          |          |               |                  |          |          |          |          |         |          |          |          |         |      |      |
| 3 1/4" 127 mm 2 6 34 42 50 58 66 71 71 71 Mm 18 18 12 31 31 44 58 58 64 71 71 71 Mm 18 4 14 68 57 66 73 73 79 79 79 79 79 79 79 79 79 79 79 79 79  | 5   | 9-      | శ            | 11 mm   | 35  | 45  | 55  | 99         | 75       |        |          |          |          |               |                  |          |          |          |          |         |          |          |          |         |      |      |
| 8 8 mm 18 24 31 38 44 58 58 64 71 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7  |     |         | 3 1/2"       | 12.7 mm | 56  | 34  | 42  | 20         | 58       | 99     | 74       |          |          |               |                  |          |          |          |          | 8       |          |          |          |         |      |      |
| 8 9 mm 8 25 62 72 81 9 mm 1 20 mm 8 3 1 1 61 69 78 1 mm 1 20 m |     |         |              | 14 mm   | 18  | 24  | 31  | 38         | 4        | 28     | 58       | 29       | 71       |               |                  |          |          |          |          |         |          |          |          |         |      |      |
| 10 mm 43 51 61 69 78 79 79 79 79 79 79 79 79 79 79 79 79 79  |     |         |              | 8 mm    | 52  | 62  | 72  | 18         |          |        |          |          |          |               |                  |          |          |          |          |         |          |          |          |         |      |      |
| 3 ½²²         11 mm         34         41         48         57         65         73         79         <   | 9   |         |              | 10 mm   | 43  | 51  | 19  | 69         | 78       |        |          |          |          |               |                  |          |          |          |          |         |          |          |          |         |      |      |
| 127 mm 29 33 41 48 54 61 56 62 67 73 79 79 79 79 79 79 79 79 79 79 79 79 79  |     | to<br>c | 3 1/2"       | 11 mm   | 34  | 41  | 48  | 57         | 65       | 73     | 79       |          |          |               |                  |          |          |          |          |         |          |          |          |         |      |      |
| 4 14 mm  | -   | 3%::    |              | 12.7 mm | 59  | 33  | 41  | 48         | 54       | 61     | 29       | 73       | 79       |               |                  |          |          |          |          |         |          |          |          |         |      |      |
| 11 mm 29 36 43 50 56 64 70 76 82   |     |         |              | 14 mm   | 23  | 53  | 34  | 41         | 47       | 51     | 99       | 62       | 29       |               | 62               |          |          |          |          |         |          |          |          |         |      |      |
| 117 mm 29 36 43 50 56 64 70 76 82  |     |         |              | 10 mm   | 35  | 44  | 54  | 65         | 74       | 82     |          |          |          |               |                  |          |          |          |          |         |          |          |          |         |      |      |
| 4 ½**         12.7 mm         22         26         32         38         44         50         56         66         75         83         74         80         75         66         75         66         76         66         76         66         76         66         76   |     |         |              | 11 mm   | 53  | 36  | 43  | 50         | 99       | 49     | 70       | 9/       | 82       |               |                  |          |          |          |          |         |          |          |          |         |      |      |
| 4 ½**         14 mm         21         27         33         38         44         50         56         66         68         74         61         68         74         61         68         74         61         68         74         61         68         74         61         68         74         61         68         76         74         61         68         76         74         61         68         76         74         61         68         76         74         61         76         77         76         76         76         76         76         76         76         77         <   | 7   | .8/2    |              | 12.7 mm | 22  | 56  | 32  | 38         | 4        | 20     | 58       | 99       | 75       | 83            |                  |          |          |          |          |         |          |          |          |         |      |      |
| 175 mm 16 mm 25 25 30 35 40 45 51 56 64 68 72 78 78 79 79 79 79 79 79 79 79 79 79 79 79 79   |     | o to    | 4 1/2"       | 14 mm   |     | 21  | 27  | 33         | 38       | 4      | 20       | 99       | 62       |               |                  | -        |          |          |          |         |          |          |          |         |      |      |
| 17.5 mm 1.0 mm 35 45 53 61 69 76 30 33 36 40 45 51 56 61 66 72 19 mm 130 45 53 61 61 69 76 12 10 mm 28 36 43 51 51 69 67 6 73 80 75 11 mm 28 36 43 51 51 59 66 73 80 75 75 14 mm 28 36 43 51 51 59 66 75 89 89 75 75 89 89 75 75 89 89 75 75 89 89 75 75 89 89 89 75 75 89 89 75 75 89 89 89 75 75 89 89 89 89 89 89 89 89 89 89 89 89 89  |     | 6       |              | 16 mm   |     |     | 20  | 25         | 30       | 35     | 41       | 46       | 51       |               |                  |          |          | _        |          |         |          |          |          |         |      |      |
| 6 5%"   19 mm   35   |     |         |              | 17.5 mm |     |     |     | 22         | 56       | 30     | 35       |          | 45       |               |                  |          |          | 78       |          |         |          |          |          |         |      |      |
| 6 56" 10 mm 35 45 53 61 69 76 77 80 7 76 77 70 70 70 70 70 70 70 70 70 70 70 70  | - 1 |         |              | 19 mm   |     |     |     |            | 50       | 54     | 28       |          | 36       |               |                  |          |          | 2        | 69 1     | 74      | 78       |          |          |         |      |      |
| 6 5%**   |     |         |              | 10 mm   | 32  | 45  | 23  | 19         | 69       | 9/     |          |          | $\dashv$ |               | +                | _        | _        | $\dashv$ | _        |         | 4        |          | _        | _       |      |      |
| 6 \$6**   12.7 mm  |     |         |              | 11 mm   | 28  | 36  | 43  | 51         | 59       | 99     | 73       | 80       |          |               |                  | +        | _        | 4        |          |         | _        |          | 4        | _       |      |      |
| 6 5 kg 1 6 mm 21 27 33 39 44 50 55 59 65 67 74 79 79 79 79 79 79 79 79 79 79 79 79 79  |     |         |              | 12.7 mm | 20  | 56  | 32  | 38         | 4        | 25     | 59       | 65       | 70       | 92            | $\dashv$         | $\dashv$ | -        | $\dashv$ |          |         | $\dashv$ | 4        | $\dashv$ | _       |      |      |
| 6 5%" 16 mm 18 24 31 35 40 47 48 52 59 61 65 69 10 15 mm 18 21 25 30 35 38 44 48 50 55 59 63 10 15 mm 18 24 29 34 40 45 52 24 27 27 21 mm 18 24 29 34 40 45 52 57 62 68 74 48 50 53 24 27 11 mm 18 24 29 34 40 45 52 57 62 68 74 65 71 11 mm 18 24 29 34 40 45 52 57 62 68 74 65 71 11 mm 18 24 29 34 40 45 52 57 62 68 74 65 71 11 mm 18 24 29 34 40 45 33 37 41 45 49 54 56 10 65 71 11 mm 18 24 29 24 28 34 39 44 48 53 57 61 61 66 71 11 mm 18 20 22 25 26 28 32 35 39 43 47 50 11 11 mm 18 20 22 25 25 25 25 25 25 25 25 25 25 25 25  | 6   | 8//     |              | 14 mm   |     | 21  | 27  | 33         | 39       | 4      | 20       | 55       | 29       | -             |                  |          | 6        | $\dashv$ | -        |         | $\dashv$ | _        | $\dashv$ |         |      |      |
| 65%**   17.5 mm   17.5 mm   21   25   30   35   38   44   48   50   55   59   63    19mm   19mm   18   24   29   34   40   45   25   25   24   27    11mm   18   24   29   34   40   45   52   57   62   68   74   75    11mm   18   24   28   34   40   45   52   57   62   68   74   77    11mm   19   24   28   34   39   44   48   53   57   61   66   71    11.7 mm   19   24   28   34   39   37   41   45   49   54   58    11.7 mm   19   20   21   26   28   32   35   39   43   47   50    11.5 mm   17.5 mm   18   24   28   24   28   31   34   38   41    12.5 mm   25 mm |     | to      | 8/5 9        | 16 mm   |     |     | 18  | 54         | 31       | 32     | 40       | 47       | 48       | $\dashv$      | $\dashv$         |          | $\dashv$ | 73       | 3 77     |         | $\dashv$ | 4        | 4        | _       |      |      |
| 6 5%**   19 mm   18   21   25   32   35   39   44   46   49   53   53   22 mm   22 mm   18   24   29   34   40   45   52   57   62   68   74   77   77   77   77   77   77   7   | •   | 1.      |              | 17.5 mm |     |     |     | 21         | 52       | 30     | 35       | 38       | 4        | -             |                  | -        | -        | 29       | 7        | 75      | 79       |          | _        |         |      |      |
| 55 mm 25 mm 18 24 29 34 40 45 52 57 62 68 74 27 17 10mm 18 24 29 34 40 45 52 57 62 68 74 77 127 mm 19 24 28 34 39 44 48 53 57 67 67 68 74 57 127 mm 19 20 22 26 28 32 35 37 41 45 50 127 mm 19 20 22 26 28 32 35 35 39 43 47 50 127 mm 19 20 22 26 28 32 35 35 39 43 47 50 127 mm 19 20 22 26 28 32 35 39 43 47 50 127 mm 19 20 22 26 28 32 35 39 43 47 50 127 mm 19 mm 19 20 22 mm 19 mm 19 25 mm 19 mm 19 25 mm 19 mm 19 25 mm 19  |     |         |              | 19 mm   |     |     |     |            | 18       | 21     | 25       |          | 35       | -             | $\dashv$         | $\dashv$ | $\dashv$ | 99       | 9        | 63      | 67       | 72       | 74       | 78      |      |      |
| 6 5/6"   25 mm   18   24   29   34   40   45   52   57   62   68   74   77   78   78   78   78   78   7  |     |         |              | 22 mm   |     |     |     |            |          |        | 21       | 23       | 27       |               | $\dashv$         |          | $\dashv$ | 45       | 5 47     | 20      | 23       | 54       | 9        | 2       | 02   | 9/   |
| 6 5/6"   10 mm   18   24   29   34   40   45   52   57   62   68   74   77   77   77   77   77   77   7  |     |         |              | 25 mm   |     |     |     |            |          |        |          |          |          |               |                  |          |          | 29       | 32       | 34      | 37       | 39       | 4        | 46      | 51   | 26   |
| 6 5/8"   |     |         |              | 10 mm   |     | 18  | 24  | 59         | 34       | 40     | 45       | 25       | 22       |               |                  | 4        |          |          |          |         |          |          |          |         |      |      |
| 6 %s         12.7 mm         20         22         26         30         33         37         41         45         49         54         58         58         58         58         58         58         58         58         58         58         58         58         58         58         58         58         59         43         47         50           1 1 2 mm         1   |     |         |              | 11 mm   |     |     | 19  | 24         | 28       | 34     | 39       | 4        | 48       |               |                  |          |          | 76       | 10       |         |          |          |          |         |      |      |
| 6 %s         14 mm         20         23         26         28         35         35         39         43         47         50           1 cmm         1 cmm <td></td> <td></td> <td></td> <td>12.7 mm</td> <td></td> <td></td> <td></td> <td>20</td> <td>22</td> <td>56</td> <td>30</td> <td>33</td> <td>37</td> <td></td> <td></td> <td></td> <td></td> <td>9 62</td> <td>99 7</td> <td>71</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>  |     |         |              | 12.7 mm |     |     |     | 20         | 22       | 56     | 30       | 33       | 37       |               |                  |          |          | 9 62     | 99 7     | 71      |          |          |          |         |      |      |
| 6 5/8"         16 mm         19         22         25         28         31         34         38         41           17.5 mm         17.5 mm         20         23         26         29         32         35         38           19 mm         22 mm         16         18         20         22         24         26           25 mm         25 mm         25 mm         16         18         20         22         24         26           25 mm         25 mm         25 mm         25 mm         25 mm         24         26         26   | 5   | 1/4"    |              | 14 mm   |     |     |     |            | 20       | 23     | 56       | 28       | 32       | -             | $\dashv$         |          |          | 54       | 1 58     | 62      | 65       | 69       | 73       |         |      |      |
| 17.5 mm         20         23         26         29         32         35         38           19 mm         10 mm         16         18         20         22         24         26           22 mm         25 mm         16         18         20         22         24         26           25 mm         25 mm         18         18         18         18         18  |     | 2       |              | 16 mm   |     |     |     |            |          |        | 19       | 22       | 25       | $\dashv$      | $\dashv$         |          | $\dashv$ | 4        | 4 47     | 51      | 54       | 57       | 9        | 65      | 69   |      |
| 16     18     20     22     24     26       18     20     22     24     26       18     20     22     24     26       18     20     22     24     26       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30     30     30     30       18     30  |     | 15"     |              | 17.5 mm |     |     |     |            |          |        |          | 20       | 23       | -             | $\dashv$         |          | +        | 14       | 43       | 46      | 49       | 25       | 24       | 82      | 25   | 99   |
| 18   |     |         |              | 19 mm   |     |     |     |            | +        |        | +        | +        | 16       | -             | +                | +        | $\dashv$ | 27       | 7 29     | 32      | 34       | 36       | 33       | 4       | 43   | 46   |
| 25 mm  |     |         |              | 22 mm   |     |     |     | $\uparrow$ | $\dashv$ |        | $\dashv$ | $\dashv$ | $\dashv$ | +             | +                | $\dashv$ | 92       | 20       | 22       | 24      | $\dashv$ | +        | $\dashv$ | %       | 88   | 45   |
|  | - 1 |         |              | 25 mm   |     |     |     |            | -        |        |          | $\dashv$ | _        | $\dashv$      | -                | $\dashv$ | $\dashv$ | $\dashv$ |          | 16      | 18       | 20       | 24       | 56      | 78   | 30   |

# Notes

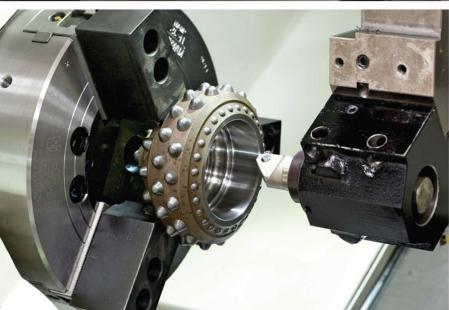
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