It should be the policy for all pinions/bullgears for API applications have a hunting tooth gear combination. This is to assure that the same gear teeth are not continually in contact which could cause run in wear. If the gear teeth did not have the hunting tooth combination they should be marked as to the pinion teeth and bullgear teeth matching so that if run in wear did occur, the gears could be reassembled in the same manner after disassembly.

Tooth repeat frequency = \(( F_m \times N_a ) / ( N_g \times N_p )\)

Where:
- \( F_m \) = Mesh frequency ( \( N_p \times \) Speed of pinion)
- \( N_a \) = Product of prime factors common to number of gear and pinion teeth
- \( N_p \) = Number of pinion teeth
- \( N_g \) = Number of gear teeth

As you can see, if you have a true hunting tooth combination, the \( N_a = 1 \)

If there is a knocking noise especially at low speed and load it could be at the hunting tooth frequency - the frequency that a particular tooth on the bull gear contacts a particular tooth on the pinion. GMF - gear mesh frequency is the number of teeth on bull gear times bull gear speed, also the number of pinion teeth times pinion speed.

Repeating tooth frequency = \((GMF) \times (N) / (No. of Pinion teeth) \times No. of gear teeth\)

Where \( N \) = least common multiple between the number of teeth on the pinion and gear, usually a small number.

If there are no common factors other than one, the equation then is:

Hunting tooth frequency = revolutions per second of the pinion divided by number of bull gear teeth

Also = revolutions per second of the gear divided by number of pinion teeth

This is true for hunting tooth combination only. In other words there are no common factors besides one.

If tooth repeat frequency is a problem you should be able to hear it. Repeating tooth frequency can often be found by simply counting against a watch second hand.

Example 1
No. of bull gear teeth = 257
No. of Pinion teeth = 34
Bull gear speed = 1200 rpm
Gear ratio = 257/34 = 7.5588....
Pinion speed = 1200 x 7.5588 = 9070 rpm
Gear mesh frequency = 257 x (1200/60) = 5140 Hz
also = 34 x (9070/60) = 5140 Hz

Common factor = 1
It is always best to have a hunting tooth combination, that is every bull gear tooth eventually mates with every pinion tooth.

Hunting tooth frequency = \((1200 / 60) / 34 = (9070 / 60) / 257 = 0.588 \) Hz

This is close to once every two seconds and could be checked by timing the noise one hears in the gear - as one gear is being moved in the bearing at light loads there could be one poor tooth on the pinion gear
contact the “worst” bull gear tooth at that low frequency.

This is the rate that a particular bull gear tooth mates with a particular pinion tooth. If there is not a hunting tooth combination, the numbers will have a common factor.

Example 2 – change Example 1 to 260 bull gear teeth, keeping 34 pinion teeth and 1200 rpm speed. Common factor is 2 as 34 / 17 = 2 and 260 / 130 = 2.
Still at 1200 rpm, gear mesh frequency = 260 x 20 = 5200 Hz
Tooth repeat frequency then would be: 5200 x 2 / (260 x 34) = 1.18 Hz (close to once per second)

If the gear is taken apart and put back together, different teeth may then mate during operation and the gear may not run the same. There generally is a wear-in time depending on gear tooth accuracy.

In the examples above the gear manufacturer should have no problem making the bull gear with 257 teeth – a prime number – always my recommendation for speed increasing gears along with downmesh orientation. The speed would be slightly different for the pinion – be sure it can be accommodated.

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