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TECHNICAL BULLETIN

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THREAD COMPOUND FRICTION FACTOR

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BACKGROUND

A thread compound traditionally has two primary functions when applied to a rotary shouldered connection (RSC) in a drill string. The first role is the prevention of metal to metal damage (ie. anti-galling) of thread flanks and seal surfaces from the extremely high local contact stresses in the RSC. The second role is to function as lubrication during spinup and makeup of the RSC, reducing friction and thereby ensuring that makeup torque properly loads the seal faces and thread flanks of the connection.

FRICTION FACTOR

The *friction factor* (FF) quoted by a manufacturer refers to the ability of the thread compound to function as a lubricant in making up a RSC in comparison to an API reference compound. This is historically determined by **API RP 7A1** where an “API compound” is considered to have a friction factor of 1.00. Other compounds are then compared against it with a ratio being calculated to reflect increased or decreased frictional properties; this ratio is the friction factor for the tested thread compound. Note that this test method does not simulate actual connection makeup or downhole use and thus does not guarantee RSC service in the field. In particular, other properties of thread compounds such as anti-galling performance or prevention of downhole makeup are **outside the scope and intent of the friction factor ratio**.

USAGE

A compound manufacturer will typically specify the friction factor as a decimal such as 0.90, 1.05, 1.15, etc. The friction factor may be used to adjust the “API recommended” makeup torque by directly multiplying the makeup torque by the friction factor. API recommended makeup torques are intended to induce stresses approximately 60% of torsional yield, thus the intent of the friction factor is to ensure the connection is at a 60% stress state despite the thread compound having modified lubrication properties. Where API connections are replaced by high torque premium double shoulder connections, one must utilize manufacturer specifications. It is critical to realize before applying any friction factor modifiers to a makeup torque that the makeup torque already has compensated for the strength of material and any OD/ID wear, with no modifications being “built in” for thread compounds. The end-user is ultimately responsible for selecting the proper compound and subsequent makeup torque for any specific drilling application. **Improper application of thread compound will render all makeup torque and friction factor calculations irrelevant as the compound will not function as intended.**

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EXAMPLE

NC40 (4” FH) Recommended Makeup (from API 7G) = 15,300 ft-lbs

- This will achieve a *60% stress level* within the connection using the “API reference compound” with a friction factor of **1.00**

Thread Compound	Friction Factor	NC40 MUT Adjusted for Thread Compound	
Bestolife Ultra 3010	FF = 1.00	15,300 ft-lbs X 1.00 =	**15,300 ft-lbs**
Topco JWW *	FF = 1.09	15,300 ft-lbs X 1.09 =	**16,677 ft-lbs**
JetLube KoprKote *	FF = 1.15	15,300 ft-lbs X 1.15 =	**17,600 ft-lbs**

*These compounds have been determined by the manufacturer to result in increased friction compared to the “API reference compound”

In the above cases, these adjusted makeup torques should maintain a *60% stress level* within the connection. Put another way, none of the above compound friction factor modifiers increase or decrease the actual stress load carrying capability of the connection itself.

To summarize:

- Compounds with friction factors **higher than 1.00 increase the amount of friction in the thread** compared to the “API reference compound” thus a connection requires *more* makeup torque to achieve a desired makeup stress level.
- Compounds with friction factors **lower than 1.00 decrease the amount of friction in the thread** compared to the “API reference compound” thus a connection requires *less* makeup torque to achieve a desired makeup stress level.

COEFFICIENT OF FRICTION

The *friction factor* is **not** the same as the *coefficient of friction* and they must not be confused with one another as they are neither interchangeable nor used in the same fashion.

The **friction factor** is a ratio (typically having the symbol FF) used to modify known and/or published makeup torques in a broad way to operationally compensate for the lubrication effectiveness of a thread compound.

The **coefficient of friction** is an engineering property (typically having the symbol μ) used to calculate resistive frictional forces between a pair of static and/or dynamic surfaces in direct contact, for example individual thread flanks or a primary seal face in thread design.

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