

# **Bit / Bottom hole cleaning**

*Contributed by Peter Aird, Consultant Drilling Supervisor.*

## **Introduction**

Fundamental but often forgotten,

**INADEQUATE BIT HYDRAULICS AND BOTTOM HOLE CLEANING** in both vertical and high inclination wellbores in ***Water or Oil based muds***, will ***cause re-grinding of cuttings*** (i.e. *finer generation at the bit*).

This ***will result*** in the following individual or combined difficulties

- lower ROPs,
- poor hole cleaning
- poor hole condition (*excessive solids, wall cake, build up on wellbore wall*),
- inefficient solids removal (*from the wellbore and at surface.*)
- wellbore instability,
- high drag on trips,
- the use of improper and often misunderstood drilling practices.

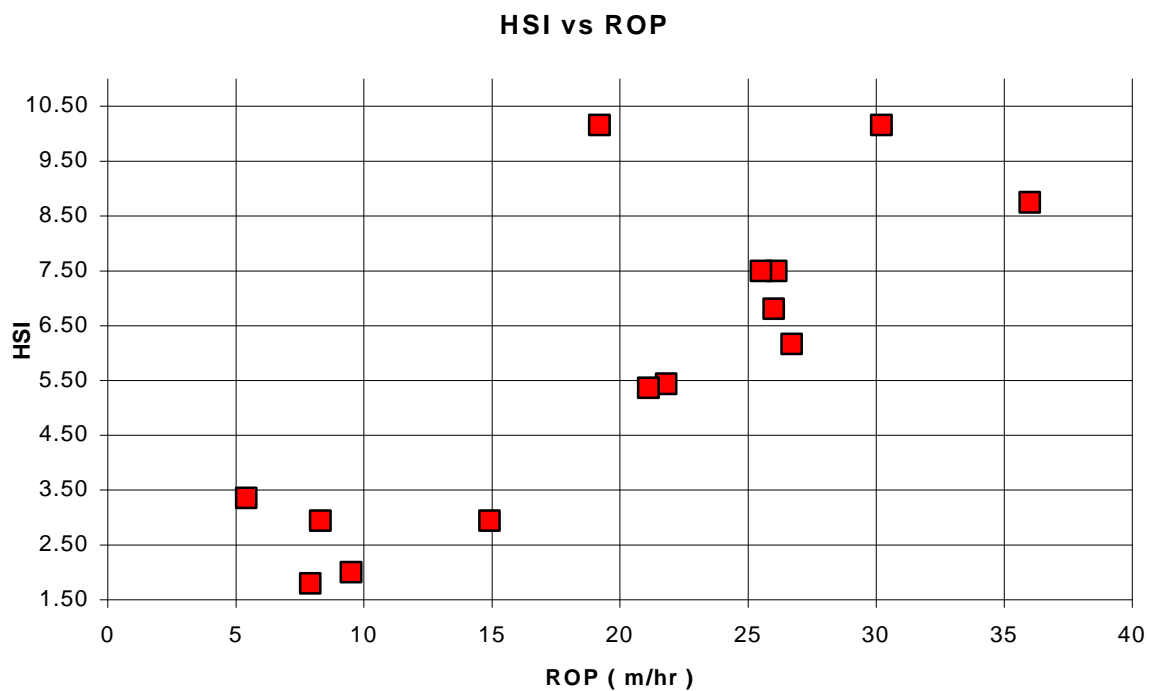
Difficulties that will result, will cumulate in tripping and drilling problems. Often resulting in wellbore instability, hole enlargement, tripping difficulties, and stuck pipe incidents occurring.

## Bottom hole cleaning / ROP.

**Fig 1** illustrates hydraulic horse power per square inch HSI ( *i.e. bit hydraulics / bottom hole cleaning* ) vs. rate of penetration (ROP) when considering a traditional build (20 to 90degrees) and turn to horizontal hole within normally 12¼” and one 14¾” steerable motor assemblies run on *insert bits* in UK, West of Shetland, deep water development drilling operations.

It is important to note that incidences of **tripping and drilling difficulties** as highlighted on the previous page were significantly higher (*i.e. at a ratio of 4:1*) in wells **where poor HSI was employed.**

**Figure 1:** 12¼” Insert bit runs ; (Section length 600 - 900 m)



## Planning considerations

Due to high drillability and soft-medium strength of formations drilled in this section. The drilling section objectives and goals required were:

- BHA designed to drill section in one bit run;
- Smooth wellbore geometry with < 3 degree doglegs;
- High ROPs
- Adequate hole cleaning
- Efficient solids control
- Avoiding wiper trips with steerable assemblies run
- Maximum rotation per stand with minimal orientation (slide drilling)
- Provide a quality hole while achieving the above
- Run and cement casing without problems.

## Results

In sections drilled during a development drilling programme in 1996, all objectives were met with bit /bottom hole hydraulics optimised to suit each well's needs and requirements.

Three 12 ¼" and one 14 ¾" sections were drilled at ROP's in upper quartile performance, for the development with no major hole cleaning, tripping or casing running and cementing difficulties experienced.

This was achieved by a combination of utilising:

- Reviewing actual well *offset* data;
- Hydraulics / hole cleaning simulations;
- Sufficient flow rate sacrificed to facilitate optimised ( *bit/bottom hole cleaning*);
- Good mud management;
- “**Best**” drilling practices.

The objective of cleaning *the bit and the hole* at maximum ROPs without experiencing major drilling, tripping, hole cleaning and / or casing and cementing problems was fulfilled on all development wells drilled during this period.

## **General Considerations**

- Monitor the shakers continuously.
- Nozzles to provide: 4-9 HSI, WBM, and 300-450 ft/sec Jet velocity.  
3-6 HSI, OBM, and 200-350 ft/sec Jet velocity
- Use a combined 6<sup>5</sup>/<sub>8</sub>" / 5" or a 5<sup>1</sup>/<sub>2</sub>" drillstring.
- In simulations, allow 200psi to for motor *on bottom drilling pressure*.
- Optimise mud rheology in simulations and aim for these while drilling.
- Backream only ***as a last resort***.
- Use best practices to ***manage*** fines beds.
- Only rotate into the hole.
- Wipe the drillstring prior to making connections.
- If pro-longed periods of sliding are required, ream each stand (down only) prior to making connections.
- When working string for circulating periods, orientate motor to high side and keep the pipe moving.
- On trips out, pump out if increasing resistance is noted through horizontal / build sections.
- Don't pull faster than you can pump.
- **Circulate clean** when into lower inclination section of wellbore.
- Have mud loggers provide a litho-log for trip out of the hole to aid in recognising increased drag / stuck pipe mechanisms.
- Ensure drillers know what to do, where and when.
- Wiper trip as hole conditions dictate.

Any further information or observations of your own please contact.

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