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The 10 Solids-Control Numbers Every Engineer Must Track

What to measure, the formula, the field target — and the red flag.

Grounded in API RP 13B-1, API RP 13C, EPA 40 CFR 435 and OSPAR.

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Why these 10 numbers

Most solids-control losses are invisible: nothing alarms, nothing trips — the system keeps running while dilution, barite loss and wet discard quietly consume the fluid budget. The engineers who catch it early are the ones who track a short list of numbers on every tour and act on the **trend**, not the snapshot. These are the ten that matter. For each one: what it is, how it is measured, the formula, a defensible field target, and the red flag that says stop and investigate.

The 10 numbers at a glance

#	Number	Formula / method	Watch for
01	**PV / YP**	PV=R600–R300 · YP=R300–PV	PV↑ = fine solids; YP/gels↑ = reactive clays
02	**Low-gravity solids**	Retort + density split (HGS 4.2 / LGS 2.6)	Hold <~5–6 vol% in WBM
03	**MBT**	API titration, bentonite-eq lb/bbl	Rising trend = reactive fines building
04	**API sand content**	Sand tube at the suction pit	Trace only — <~0.5 vol%
05	**Removal efficiency** η	Removed ÷ generated (mass balance)	Sustain 80%+; log discards daily
06	**Dilution factor**	Mud built ÷ hole volume	Benchmark vs offsets; drift = leak
07	**Cone feed head**	h ≈ 19.2 × P ÷ MW (ppg)	≈75 ft; verify with a gauge
08	**Shaker G & screen**	G ≈ stroke × RPM^2 ÷ 70,400	6.5–7.5 G; record API no. (D100)
09	**Centrifuge duty**	G ≈ 1.42×10^{-5} × RPM^2 × D	Log hours, feed, torque, cake
10	**ROC / OOC**	Gravimetric, wet-cuttings basis	OSPAR 1%; dryer ≈ 3–5%

01 Plastic Viscosity & Yield Point (PV / YP)

What it is & how to measure

The two Fann-35 numbers that split mechanical solids loading from chemical/clay effects (API RP 13B-1). PV rises with total fine-solids content and base-fluid viscosity; YP responds to inter-particle attraction — reactive clays and chemical contamination.

Formula / method

PV (cP) = R600 – R300 · YP (lb/100 ft^2) = R300 – PV

Field target

Trend both every tour at standard temperature. Rising PV at constant mud weight = fine inert solids building → a removal problem. Rising YP/gels = reactive clays or contamination → a chemistry problem. The pair tells you which lever to pull.

Red flag

PV creeping up tour after tour while mud weight is constant — the centrifuge/dilution side is losing the fines battle even though every machine is "running".

02 Low-Gravity Solids (LGS)

What it is & how to measure

The volume fraction of drilled solids and commercial clays (SG ≈ 2.6) in the mud — the single quantity solids control exists to minimise. Calculated from the retort test (API RP 13B-1) plus mud weight, by splitting total solids into high-gravity (barite) and low-gravity.

Formula / method

From retort: total solids vol% → subtract the barite fraction computed from mud density (material-balance split of HGS SG ≈ 4.2 vs LGS SG ≈ 2.6).

Field target

Common field practice keeps LGS below roughly 5–6 vol% in water-based mud — and as low as practical on invert systems. Every extra point forces dilution or grinds into colloids.

Red flag

LGS above target with the centrifuge idle or on low hours — you are paying for the machine and still buying dilution.

03 Methylene Blue Test (MBT)

What it is & how to measure

The cation-exchange capacity of the mud expressed as bentonite-equivalent (lb/bbl). It separates the **reactive** clay fraction from inert grind — the part of LGS that builds YP and gels.

Formula / method

API RP 13B-1 titration; report as lb/bbl bentonite equivalent.

Field target

Track the trend against your bentonite additions: MBT rising faster than what you added = reactive drilled clays accumulating and dispersing.

Red flag

MBT climbing while PV/YP climb and shaker screens look "fine" — the damage is happening below screen cut sizes; act on inhibition and fine removal, not coarser screens.

04 API Sand Content

What it is & how to measure

The fastest test on the rig: vol% of particles coarser than 74 µm (200 mesh) by the API sand-content kit. Coarse abrasives destroy pump fluid-ends, bits and downhole tools.

Formula / method

API RP 13B-1 sand-content tube; sample at the suction pit (what the pumps actually see).

Field target

Keep suction-pit sand at a trace — commonly held under about 0.5 vol%. Anything measurable at suction means the surface equipment let it through.

Red flag

Sand at suction while shakers are screened coarse "to keep mud on the screens" — you are trading pump and bit life for screen convenience.

05 Drilled-Solids Removal Efficiency (η)

What it is & how to measure

The share of generated drilled solids your surface system actually removes — the master KPI of the whole train. Computed by mass balance from daily volumes: hole volume drilled, mud built, discard density/volume.

Formula / method

η = drilled solids removed ÷ drilled solids generated (from the daily mass balance).

Field target

Sustained η in the 80%+ range is achievable on a well-run train; every point below shows up directly as dilution volume and waste barrels.

Red flag

η you cannot even calculate — because discard volumes and densities are not being logged. No log, no number, no control.

06 Dilution Factor

What it is & how to measure

Total new mud built per unit of hole volume drilled. It is the money number: dilution is how a weak removal train hides itself inside the fluid budget.

Formula / method

DF = total mud volume built ÷ hole volume drilled (interval-based).

Field target

Benchmark against offset wells on the same interval and mud type; a healthy train drives DF down toward the geometric minimum, not up.

Red flag

DF drifting up interval after interval at the same lithology — someone is diluting around a removal problem instead of fixing it.

07 Hydrocyclone Feed Head

What it is & how to measure

Cones have no moving parts: feed head **is** the machine. Correct head creates the spin that makes the cut; low head turns a desilter bank into an expensive pipe fitting.

Formula / method

h (ft) ≈ 19.2 × P_{gauge} (psi) ÷ mud weight (ppg) — measured at the cone inlet manifold.

Field target

Design intent is about 75 ft of head (roughly 3–4× the cone body pressure rule of thumb). Check it with a gauge — never assume it from pump size.

Red flag

Spray discharge collapsed to a rope, or underflow gone dry — classic overload/low-head signature; the cones are bypassing solids downstream to the centrifuge.

08 Shaker G-Force & Screen Cut Point (API / D100)

What it is & how to measure

Two numbers decide what the first machine removes: deck acceleration and the API RP 13C screen designation (D100 cut). "Mesh" is obsolete — screens are compared by tested cut point.

Formula / method

G ≈ stroke (in) × RPM^2 ÷ 70,400 · screen: use the RP 13C API number (D100 in µm) from the label.

Field target

Typical linear-motion shakers run about 6.5–7.5 G. Screen to the finest API number that keeps 75–80% of the deck wet without flooding — and record the API number, not "mesh".

Red flag

Torn or holed panels left running "until the connection" — a 5 mm hole bypasses more solids than the whole screen removes.

09 Centrifuge Duty: G, Feed Rate & Run Hours

What it is & how to measure

The decanter makes the finest cut (down to a few microns) — but only at the right G, the right feed rate, and enough hours to process the circulating volume. An idle centrifuge is dilution by another name.

Formula / method

G ≈ 1.42 × 10^{-5} × RPM^2 × bowl diameter (in). Barite recovery runs lower G; fines/dewatering duty runs high G. Feed rate sets retention time — and therefore the cut.

Field target

Match run hours to fines generation: the machine must turn over the active system on a defined cycle, logged every tour (hours, feed rate, torque, discharge condition).

Red flag

Wet, sloppy cake or torque creeping up shift over shift — pond/differential mis-set or solids build-up; both end in an unplanned strip-down.

10 Retention on Cuttings (ROC / OOC)

What it is & how to measure

The mass of base fluid clinging to discharged cuttings — the compliance number and the biggest single fluid-recovery lever on non-aqueous mud. Measured gravimetrically (wet/dry retort basis), interval-averaged.

Formula / method

ROC % = base fluid retained ÷ wet cuttings mass × 100 (gravimetric retort method; EPA Method 1674 basis under 40 CFR 435).

Field target

Offshore NE Atlantic (OSPAR): 1% OOC on discharged cuttings. US offshore SBM under EPA 40 CFR 435: interval-averaged base-fluid retention limits by base-fluid type (commonly cited at 6.9% for internal olefin and 9.4% for ester — confirm the current subpart values for your permit). A healthy vertical cuttings dryer holds roughly 3–5% OOC.

Red flag

Discard that glistens. If you can see free liquid on the cuttings, you are shipping mud to the waste pit and inviting a compliance finding in the same barrel.

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