THE SILENT KILLER · STAGE 2

The Blind Spot

Solids-control equipment was built to remove drilled cuttings, not machined wear debris. It does that job well. The problem is what the job leaves behind.

98%
of the metallic wear removed

2%
left in the fluid

Both are true at the same time. Mass scales with the cube of diameter, so one 100 micron chip outweighs eight million half-micron particles. The shakers and cyclones take nearly all of that mass out, the returns look clean, and everyone concludes the system is working. But metal is not worn away by mass. It is worn by the number of hard particles small enough to enter a running clearance, and almost every one of those is still in the fluid.

Of what is left, 84% is sub-4 micron by mass. By particle count it is effectively all of it.

Where it goes

#	Stage	Cut point	4 um	2 um	0.5 um
1	Header Box + Magnet	coarse ferrous	pass	pass	pass
2	Shale Shakers	~74 µm	pass	pass	pass
3	Ditch Magnets	coarse ferrous	pass	pass	pass
4	Sand Trap	settling	pass	pass	pass
5	Desander	~45 µm	pass	pass	pass
6	Desilter	~20 µm	pass	pass	pass
7	Centrifuge	~6 µm	some	pass	pass
8	**High-gradient magnetic filtration, kidney loop**	**<0.5 um**	**95% captured per pass**		

Per 1,000 wear particles entering the flowline

972 reach the pump on conventional solids control alone

49 with high-gradient magnetic filtration in the loop

Why not simply fit a finer filter? Barite, the weighting agent you depend on for well control, is 2 to 74 microns. A mechanical filter fine enough to catch 2 micron wear debris strips the barite out with it. A magnetic field does not sort by size, it sorts by magnetic susceptibility: it takes the ferrous abrasive and lets the barite pass.

Cascade order per Rabia (2001) and Hossain & Al-Majed (2015), validated against a generic P&ID.
Cut points are industry-typical ranges. Counts weighted to a wear-debris size distribution of d^-1.73.
Capture per pass is a property of the unit, not of the rig.

Representative and illustrative. To be confirmed by field data. Not a guaranteed result.