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MAINTENANCE TIPS

Thickener Underflow Density Control: Maximize Water Recovery and Reduce Costs

Optimize thickener underflow density for 85%+ water recovery. Flocculant dosing, rake torque monitoring, and sludge handling for sand washing plants.

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Thickener underflow density directly controls water recovery efficiency in sand washing operations. Operating at optimal underflow density—typically 60-70% solids by weight—maximizes water recirculation while maintaining pumpable slurry consistency. Too thin underflow wastes water and overloads downstream processes; too thick underflow causes pump cavitation, pipe blockages, and thickener raking failures. This guide provides the technical framework for achieving and maintaining optimal underflow density.

Understanding Underflow Density

Density Measurement Methods

METHOD	ACCURACY	RESPONSE TIME	COST
Marcy Scale (sample)	±2%	5 minutes	₹5,000
Nuclear Density Gauge	±1%	Continuous	₹5-8 lakhs
Coriolis Meter	±0.5%	Continuous	₹8-12 lakhs
Pressure Differential	±3%	Continuous	₹50,000

Target Density Ranges

APPLICATION	TARGET SOLIDS (%)	SPECIFIC GRAVITY	NOTES
Centrifugal pump feed	55-65%	1.55-1.70	Higher reduces pump efficiency
Positive displacement pump	65-75%	1.70-1.85	Can handle thicker slurry
Filter press feed	50-60%	1.45-1.60	Excess water wastes filter capacity
Tailings disposal	50-65%	1.45-1.70	Balance transport vs. storage

Factors Affecting Underflow Density

Feed Variables

VARIABLE	EFFECT ON UNDERFLOW	CONTROL RESPONSE
Feed rate increase	Thinner underflow	Increase bed depth or reduce U/F rate
Finer particle size	Thinner underflow	Increase flocculant dose
Higher clay content	Thinner, slower settling	Increase flocculant, reduce rate

VARIABLE	EFFECT ON UNDERFLOW	CONTROL RESPONSE
Temperature drop	Slower settling	Increase retention time

Operating Variables

VARIABLE	EFFECT	ADJUSTMENT RANGE
Bed depth	Higher bed = thicker underflow	0.5-2.0m above rake
Rake speed	Faster = thinner underflow	0.1-0.3 RPM typical
Underflow rate	Higher rate = thinner	5-15% of feed volume
Flocculant dose	Higher dose = faster settling	20-100 g/tonne solids

Control Strategies

Manual Control Protocol

1. Measure underflow density every 30 minutes
2. Record bed depth (pressure or ultrasonic)
3. Adjust underflow pump speed to maintain target
4. Adjust flocculant if settling changes

Automatic Control

CONTROL LOOP	MEASURED VARIABLE	MANIPULATED VARIABLE	SETPOINT
Density Control	Underflow density	Underflow pump VFD	1.65-1.75 SG
Bed Level	Bed pressure/level	Underflow rate bias	1.0-1.5m
Torque Limit	Rake torque	Underflow rate override	<70% of max

Troubleshooting

PROBLEM	PROBABLE CAUSE	SOLUTION
Underflow too thin	Low bed depth, high U/F rate	Reduce pump speed, build bed
Underflow too thick	Excessive bed depth	Increase pump speed gradually
Pump cavitation	Air entrainment, thick slurry	Reduce density, check suction
High rake torque	Excessive bed compaction	Increase underflow rate immediately
Poor clarity overflow	Insufficient flocculant	Increase dose, check mixing

Water Recovery Optimization

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Water Recovery Calculation:
Feed: 100 m³/hr at 15% solids
Underflow: 25 m³/hr at 65% solids
Overflow: 75 m³/hr (clarified)

Water in feed: 85 m³/hr
Water in underflow: 8.75 m³/hr
Water recovered: 75 m³/hr

Recovery rate: 88%

Improving to 70% underflow solids:
Water in underflow: 7.5 m³/hr
Additional recovery: 1.25 m³/hr (1.5%)
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Conclusion

Optimal thickener underflow density balances water recovery against slurry handling capability. Consistent density control requires attention to feed variability, proper flocculant dosing, and systematic monitoring. Plants achieving 65-70% underflow solids consistently recover 85-90% of process water while maintaining reliable slurry pumping. This optimization directly reduces fresh water consumption and operating costs.

Topics: #Thickener #Water Management #sand washing

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