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TECHNICAL GUIDES

Fine Sand Recovery: Maximize Yield from Your Sand Washing Operation

Recover fine sand lost to overflow. Equipment options, cost analysis, and implementation guide for improved sand plant profitability.

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Fine sand recovery is critical for maximizing yield and profitability in sand washing operations. The 75-600 micron fraction represents valuable product that is often lost to tailings ponds when not properly recovered. Understanding fine sand recovery methods and optimizing equipment performance enables plant operators to capture this value while maintaining product quality.

Understanding Fine Sand Loss

Where Fine Sand Goes

In typical sand washing operations, fine sand can be lost at multiple points:

LOSS POINT	MECHANISM	TYPICAL LOSS
Log washer overflow	Fines suspended in wash water	5-15% of feed
Screw washer overflow	Fines float over weir	10-20% of feed
Dewatering screen underflow	Fines pass through screen	3-8% of product
Hydrocyclone overflow	Intentional fines removal	Variable
Settling pond	Final destination of losses	Accumulated fines

Economic Impact of Fine Sand Loss

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Example loss calculation:
Feed rate: 150 TPH raw sand
Fines content (75-600µm): 25% = 37.5 TPH
Recovery without fine sand system: 60% = 22.5 TPH recovered
Fine sand loss: 15 TPH
Value: Rs 600/tonne (assuming M-sand grade)
Hourly loss: Rs 9,000
Annual loss (6,000 hours): Rs 5.4 crore

With fine sand recovery (95% efficiency):
Recovered: 14.25 TPH additional
Annual value: Rs 5.13 crore recovered
```

Fine Sand Recovery Methods

Hydrocyclone + Dewatering Screen

The most common fine sand recovery system:

System components:

- Collection sump for wash water
- Slurry pump to feed cyclones
- Hydrocyclone cluster for classification
- Dewatering screen for final product
- Return system for cyclone overflow

Process flow:

1. Wash water collected in sump
2. Pump delivers slurry to cyclone at pressure
3. Cyclone separates fine sand (underflow) from ultrafines (overflow)
4. Underflow dewatered on screen
5. Product joins main sand stream
6. Overflow returns to water circuit

Performance characteristics:

PARAMETER	TYPICAL RANGE	OPTIMIZATION TARGET
Sand recovery (>75µm)	85-95%	>90%
Product moisture	12-18%	<15%
Cyclone cut point	50-100µm	Match spec
Power consumption	2-4 kWh/tonne	Minimize

Fine Material Screw Washer

Alternative for lower-volume or simpler operations:

Operating principle:

- Inclined tank with screw conveyor
- Slurry fed to lower end
- Screw lifts settled material
- Fines overflow weir at low end
- Washed sand discharges at high end

Advantages:

- Simple operation
- Low maintenance
- Effective washing action
- Lower capital cost

Limitations:

- Lower recovery of finest fractions
- Higher moisture in product
- Limited capacity per unit
- Cut point less precise

Sand Classification Tank

Hindered settling classifier for fine sand recovery:

Operating principle:

- Upward water flow creates hindered settling zone
- Coarse particles settle against flow
- Fine particles carried out with overflow
- Product density controlled by water addition

Applications:

- Silica sand classification
- Industrial sand processing
- Where precise size separation required

System Design Considerations

Sizing the Collection Sump

Proper sump design ensures consistent cyclone feed:

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Sump volume calculation:
Minimum retention time: 2-3 minutes
Flow rate: Total wash water + any recycle

Example:
Wash water: 200 m³/h
Retention time: 2.5 minutes
Volume needed: 200 × (2.5/60) = 8.3 m³
Add 25% margin: 10.5 m³ minimum

Practical considerations:
- Sufficient depth for pump suction
- Agitation to prevent settling
- Access for cleanout
- Level control system
```

Pump Selection

Slurry pump requirements for cyclone feed:

PARAMETER	CONSIDERATION	SELECTION GUIDE
Flow rate	Match cyclone capacity	Design + 20% margin
Head	Cyclone pressure + pipe losses	Typically 25-40m TDH
Solids handling	Maximum particle size	Sand slurry duty
Wear life	Abrasive sand slurry	Hard metal or rubber lined
Control	Constant pressure desirable	VFD recommended

Cyclone Sizing

Select cyclone size for target cut point and capacity:

CYCLONE DIAMETER	TYPICAL D50	CAPACITY RANGE	APPLICATION
150mm (6")	30-50µm	20-40 m³/h	Ultrafines removal
250mm (10")	50-80µm	50-100 m³/h	Fine sand recovery
380mm (15")	75-120µm	120-200 m³/h	Coarse sand classification
500mm (20")	100-150µm	200-350 m³/h	High capacity

Dewatering Screen Sizing

Screen must handle cyclone underflow plus rinse water:

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Dewatering screen sizing:
Feed rate = Cyclone underflow (solids + water)
Typical feed: 20-40% solids by weight
Specific capacity: 10-20 t/h/m² of screen area

Example:
Fine sand recovery: 40 TPH
Cyclone underflow density: 40% solids
Screen feed: 40/0.40 = 100 t/h total
Specific capacity: 15 t/h/m²
Required area: 40/15 = 2.7 m²
Select: 1.5m × 2.4m (3.6 m²) screen
```

Optimizing Recovery Performance

Cyclone Optimization

Key adjustments for maximum fine sand recovery:

OBJECTIVE	ADJUSTMENT	TRADE-OFF
Increase sand recovery	Larger apex	More fines in product
Cleaner product	Smaller apex	Lower recovery
Finer cut point	Higher pressure, smaller cyclone	Higher power cost
Higher capacity	More cyclones in parallel	Higher capital cost

Screen Optimization

Maximize dewatering while maintaining throughput:

- **Media selection:** Polyurethane panels with proper aperture
- **Spray bars:** Final rinse removes clinging fines
- **Stroke adjustment:** Higher stroke for better drainage
- **Deck angle:** Slight incline aids drainage
- **Feed distribution:** Even feed across full width

Performance Monitoring

Track these parameters to optimize recovery:

PARAMETER	MEASUREMENT METHOD	TARGET
Overflow solids	Sample and filter	<5% of feed solids
Underflow density	Marcy scale or density gauge	50-60% solids
Product moisture	Oven dry test	<15%
Product gradation	Sieve analysis	Meet specifications
Screen underflow	Collect and measure	<2% of product

Water Circuit Integration

Closed Circuit Operation

Maximize water reuse while maintaining quality:

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Water balance example:
Fresh water: 10% of total
Recycled water: 90% of total
Total consumption: 2-3 m³/tonne sand

Circuit components:
- Primary settling (coarse solids)
- Thickener (fines removal)
- Clear water pond
- Pump station back to plant
```

Managing Fines in Recycle Water

Ultrafines buildup affects product quality:

- **Thickener:** Remove fines before recycle
- **Flocculant treatment:** Accelerate settling
- **Bleed stream:** Purge portion of recycle
- **Settling pond:** Final polishing

Common Problems and Solutions

Problem: Low Recovery Rate

CAUSE	DIAGNOSIS	SOLUTION
Cyclone cut too fine	Fine sand in overflow	Increase apex, reduce pressure
Feed density too low	Dilute underflow	Increase feed density
Screen losses	Fines in screen underflow	Check media condition
Pump issues	Variable pressure/flow	Check pump, VFD settings

Problem: Poor Product Quality

CAUSE	DIAGNOSIS	SOLUTION
Excess fines in product	High -75µm content	Reduce apex, increase pressure

CAUSE	DIAGNOSIS	SOLUTION
High moisture	>18% moisture	Check screen, increase drainage time
Contamination	Clay or organic material	Improve upstream washing
Wrong gradation	Out of specification	Adjust cyclone cut point

Problem: Equipment Wear

COMPONENT	WEAR INDICATOR	ACTION
Cyclone apex	Spray pattern change	Replace when 20% oversize
Pump impeller	Flow/pressure drop	Rebuild or replace pump
Screen panels	Holes, blinding	Replace worn panels
Piping	Thin spots, leaks	Replace worn sections

Economic Analysis

System Cost Components

COMPONENT	TYPICAL COST (RS)
Collection sump	3,00,000 - 5,00,000
Slurry pump	4,00,000 - 8,00,000
Cyclone cluster (4-6)	6,00,000 - 12,00,000
Dewatering screen	15,00,000 - 30,00,000
Structure and installation	8,00,000 - 15,00,000
Total system	**36,00,000 - 70,00,000**

Return on Investment

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Investment recovery calculation:
System cost: Rs 50,00,000
Additional recovery: 15 TPH
Operating hours: 6,000/year
Annual recovery: 90,000 tonnes
Net value (after operating cost): Rs 400/tonne
Annual benefit: Rs 3.6 crore
Simple payback: ~2 months
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Maintenance Requirements

Daily Checks

- Cyclone discharge pattern
- Screen drainage quality
- Pump pressure and flow
- Product moisture (visual)
- Any unusual noise or vibration

Weekly Maintenance

- Inspect cyclone apexes for wear
- Check screen panel condition
- Sample and analyze product
- Verify pump performance
- Clean sump of accumulated material

Monthly Maintenance

- Full cyclone inspection
- Pump wear assessment
- Screen motor and vibrator service
- Calibrate instruments
- Review performance trends

Fine sand recovery systems deliver exceptional returns on investment when properly designed and operated. Regular monitoring and maintenance ensure consistent performance, maximizing the capture of valuable fine sand that would otherwise be lost to tailings.

Topics: #Fine Sand Recovery #Plant Optimization #sand washing

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