Multotec Spiral Concentrators

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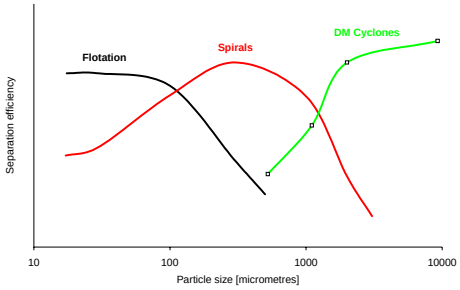
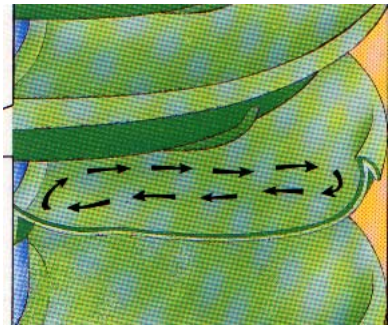
Multotec Spiral Concentrators--Coal





Types of Coal Spirals Available:

- SX4—Single-stage, 4-turn spiral
- SX7—Two-stage, 7-turn spiral
- Available in single start, double start and triple start configurations
- Up to 12 spiral assemblies or 36 starts in a bank

What are Spirals?

- Flowing film concentrator
- Relatively low capital cost (+/- $700-$900/tph capital for single stage)
- Virtually no operating cost (reagents, consumables, power, wear)
- Handle oxidized/weathered coal
- Robust and simple to operate
- Generally treat 1.0 x 0.1 mm (16 x 150 Mesh)
- Allow heavy media cyclones to clean down to 1 mm—more efficient desliming and media recovery
- Allow froth flotation to clean minus 150 Mesh—better flotation of finer particles

Unique Feature of Multotec Coal Spirals:
Auto Reject Channel

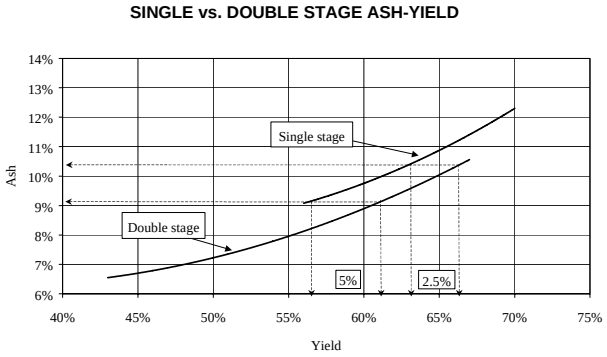
- Improved removal of high density particles without auxiliary splitters
- Improved removal of misplaced material through circular transversal flow
- Higher reject capacity
- Less sensitive to beaching of coarse particles

Operating Criteria

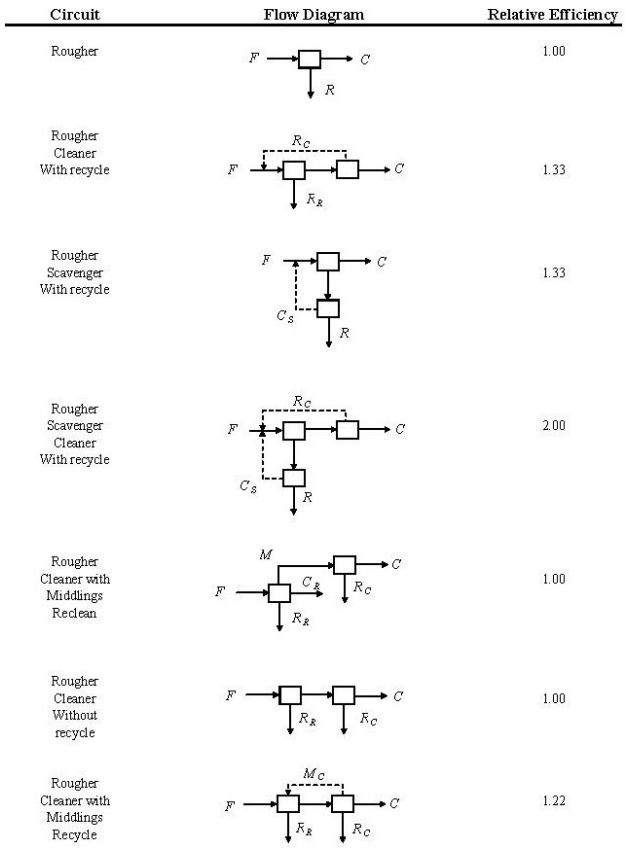
FEED SIZE	-1.0+0.1	mm
DRY FEED	2.5-3.5	TONS
SLURRY VOLUME / START	35	GPM
FEED % SOLIDS	25 - 35	W/W

Multotec Spiral Concentrators--Coal

Benefits of Two-Stages of Coal Spirals

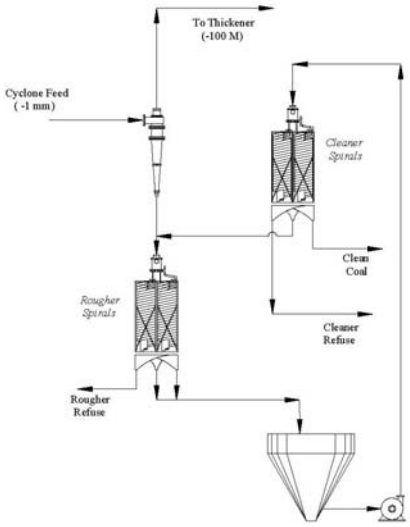


Prinsloo and Abela. 1998



Luttrell et al., 1998

- Two-stages found to be more efficient than single-stage (Prinsloo and Abela, 1998)
- Improvements between 2.5 and 5 percentage points in yield at same ash
- Luttrell et al. (1998) found the rougher-cleaner with middlings recycle circuit to be the most cost-effective of the more efficient circuits from a theorectical perspective. In practice, they calculated a 3.8% yield increase at the same ash content.



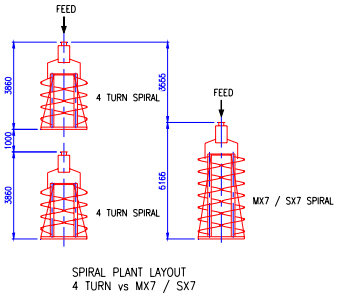
Rougher-cleaner with middlings recycle as two stages of spirals

Prinsloo, T.R., and Abela, R. L. 1998. Multiple Stage Fine Coal Spiral Concentrators. *Proceedings of the International Coal Preparation Congress*, Brisbane.

Luttrell et al. 1998. Improving spiral performance using circuit analysis. Minerals & Metallurgical Processing. November, Vol. 15, No. 4, pp. 16-21.

Multotec Spiral Concentrators--Coal

Benefits of Two-Stage Coal Spirals (SX7)



SPIRAL PLANT LAYOUT
4 TURN vs MX7 / SX7

- Advantages of double stage circuit, but in one spiral assembly
- Reduce cost while improving performance
- Reduction in capital equipment cost, overall plant height and floor area

SX7 Two-stage Coal Spiral

- Four spiral turns followed by removal of a primary refuse
- Remixing of middlings and clean coal followed by three spiral turns
- Stream is split into secondary refuse, middlings and clean coal
- Middlings to be recycled to feed

Recent Performance Data

- Recent efficiency values achieved with SX7 in plant circuits (1 x 0.1 mm)
  - 0.094 at 1.83 separating gravity (generalized probable error, Epm = 0.051)
  - 0.122 at 1.82 separating gravity (generalized probable error, Epm = 0.067)
  - Note: typical single-stage Epm ~0.10

Multotec Spiral Concentrators--Coal

Benefits of Two-Stage Coal Spirals (SX7)

Overall Plant Benefits

- Allows DMC to process only down to 1 mm size—more efficient desliming, more efficient media recovery

- Often allows coarse coal circuits to operate at higher separating gravities because the finer fraction is cleaned more efficiently—greater recovery of coarser, lower moisture coal (incremental inerts=moisture + ash)

- *Coal Leader*, July 2003 reports:

  - Spiral circuit yield increase of 5.7%.

  - At 45 tph, this increase at $25/ton and 5,500 tpy gives $350,000/year

  - Spiral cutpoint dropped to 1.66 s.g., allowing the heavy medium s.g. to increase giving 13 tph more clean coal in that circuit for a total impact of $1.79 million per year.

  - Cost for the spiral installation was $140,000.

- *Coal Prep 04*, Bethell and Dehart:

  - Hobet processes 5.4 million raw tpy

  - Addition of SX7 spirals, clean coal effleunt cyclones, and fine wire sieving

  - Plant yield increased by 28 tph or 105,000 tpy

  - At a market value of $35/ton, a net revenue increase of =/-$3.7 million/year will be realized, providing a payback of +/-3 months on the capital spent

- As of November 2004, installed capacity is 636 SX7 starts, treating approxiamtely 1,590 tph at 2.5 tph/start