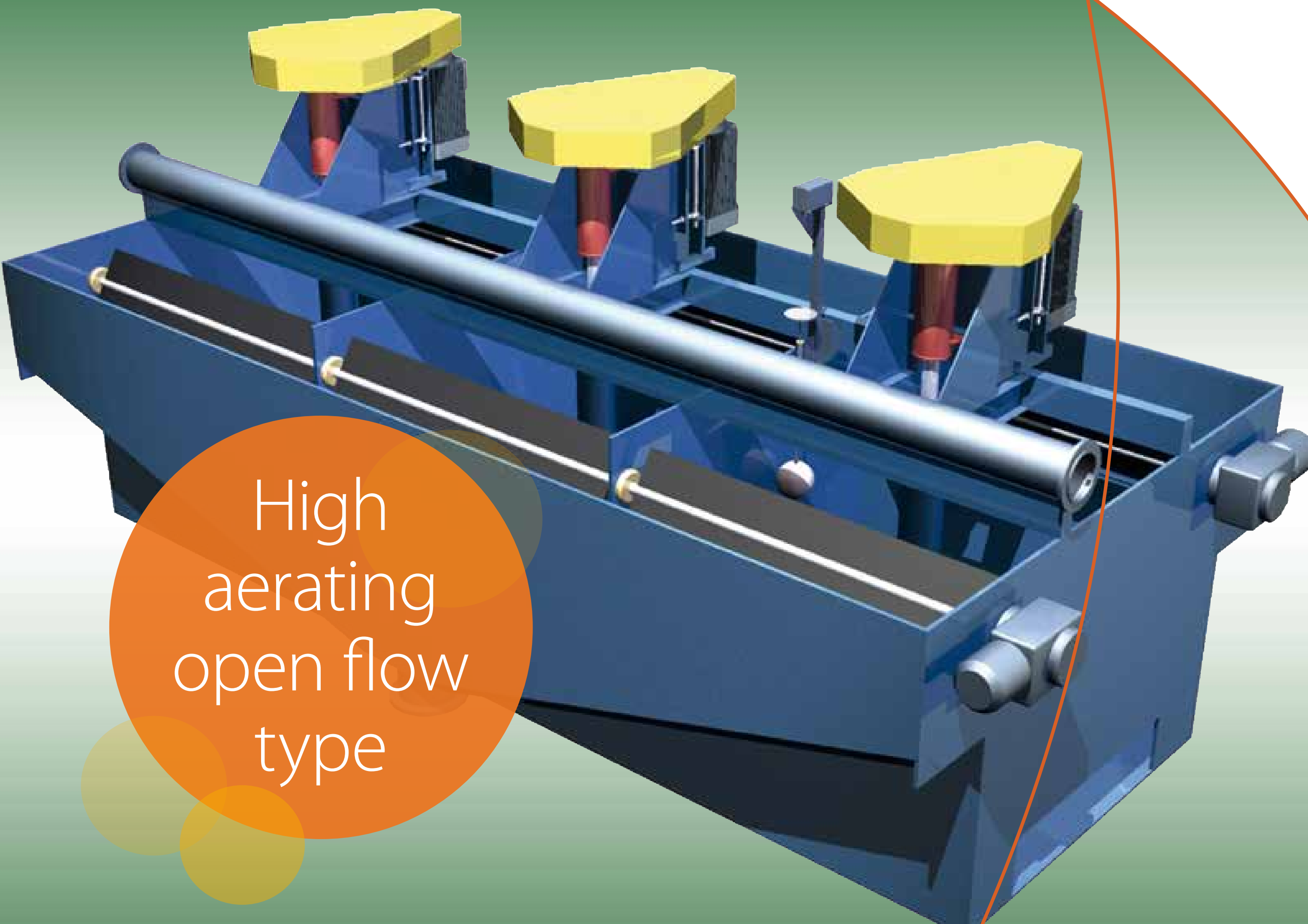
DR flotation machines

metso
Expect results



High aerating open flow type

DR flotation machines

The mining industry has grown and developed over the years and has adapted itself to changing economic conditions. One of the changes has been the transition from cell-to-cell type to open flow type flotation machines.

The high aerating open flow type Metso DR flotation machine was developed specifically to meet modern requirements.

Principle of operation

The Metso DR flotation machine is the first mechanical open type machine to incorporate a vertical circulation of pulp, made possible by combining a "recirculation well" with the distinctive top feed impeller.

This arrangement provides positive vertical circulation of pulp similar to the action in a propeller agitator. Pulp from an intermediate zone of the cell is circulated down into the eye of the impeller, mixed with air, and diffused out over the entire bottom of the cell, creating a uniform upward current.

This principle varies from most other mechanical open type cells which circulate pulp by lifting it up from the bottom of the cell into the centre of a rotating element.

Effective aeration

The primary physical requirement of any flotation machine is to disperse finely divided air bubbles throughout the cell. In a machine, which induces its own air, maximum aeration rate is a function of impeller speed. Aeration rate and pulp mixing and circulation rates are inter-related.

Machines, which are designed to use an external source of air, such as the DR flotation machine, have a controlled aeration rate so that it can be maximized independently of impeller speed. The mechanism design is critical to ensure effective air-pulp mixing and dispersion within the cell.

The low pressure DR flotation machine requires air. An air pipe surrounding the impeller shaft leads directly to the centre of the impeller.

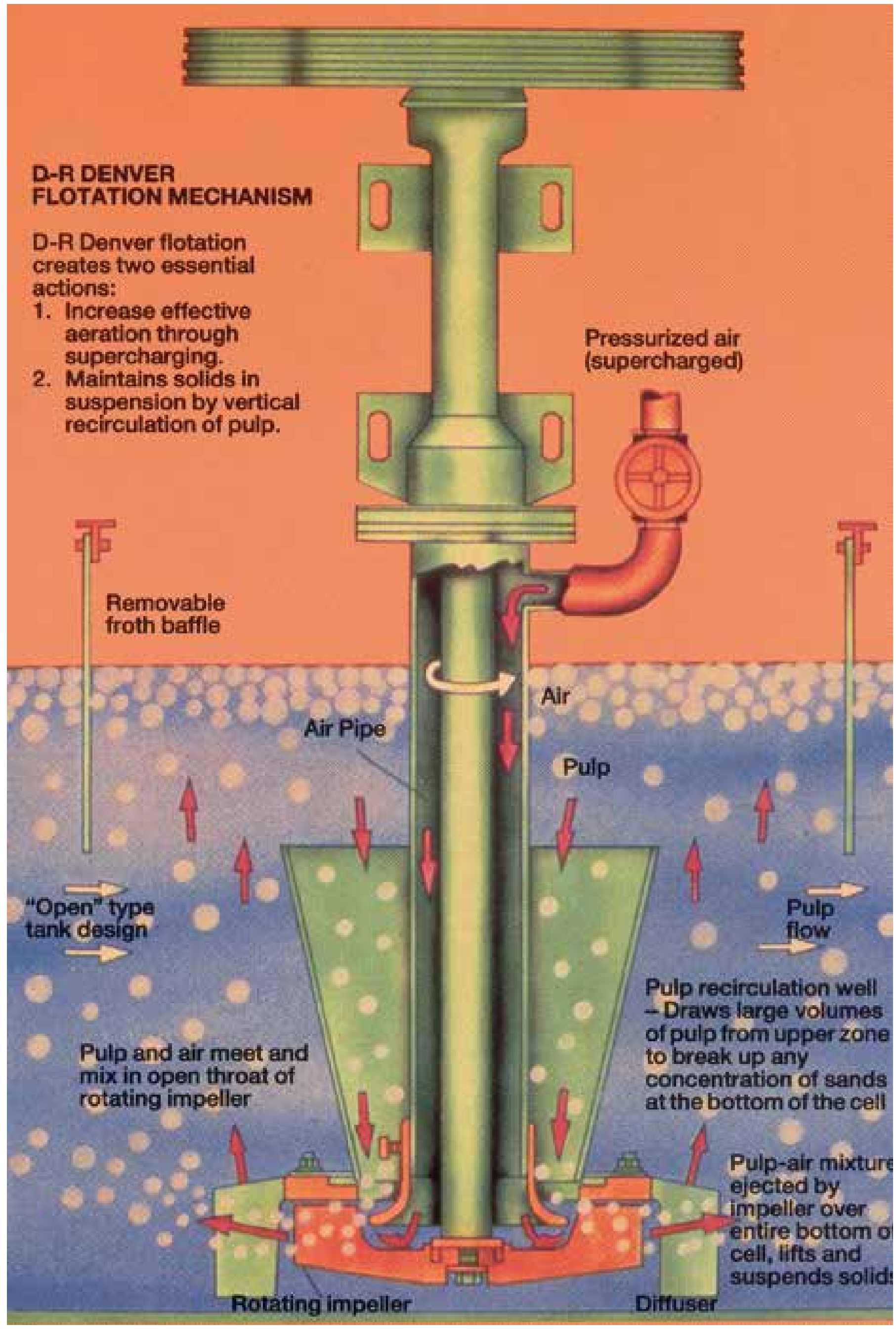
Immediately surrounding this air pipe is the pulp recirculation well which also leads to the open throat of the impeller. Air entering the cell is forced through the vertical curtain of re-circulating pulp and thus a positive air-pulp mixing occurs in the eye of the impeller. This mixture is then subjected to the impeller and is expelled against the diffuser blades, which further mix and shear the air and pulp.

The fluidizing action of vertical recirculation greatly minimizes the dense sands zone at the base of the cell and this also gives reduced interference to the pulp-air mixture as it discharges from the diffuser.

The aeration efficiency of the DR flotation machines is directly related to the volume of air and the volume of re-circulating pulp that is pumped through the impellers.

Power is used effectively as it pumps, shears and re-circulates the air-pulp mixture.

Metso's DR flotation machines are now available in capacities up to 42.5 m^3 (1500 cubic feet) per single mechanism.



Solids suspension

In a cell-to-cell type flotation machine the sanding problem is minimized, as the pulp is 100% mixed in every cell as it passes through the feed pipe and impeller. In a conventional open-type machine, as the pulp progresses from one cell to the next, the coarser, heavier fractions tend to stratify or settle to the bottom of the cell.

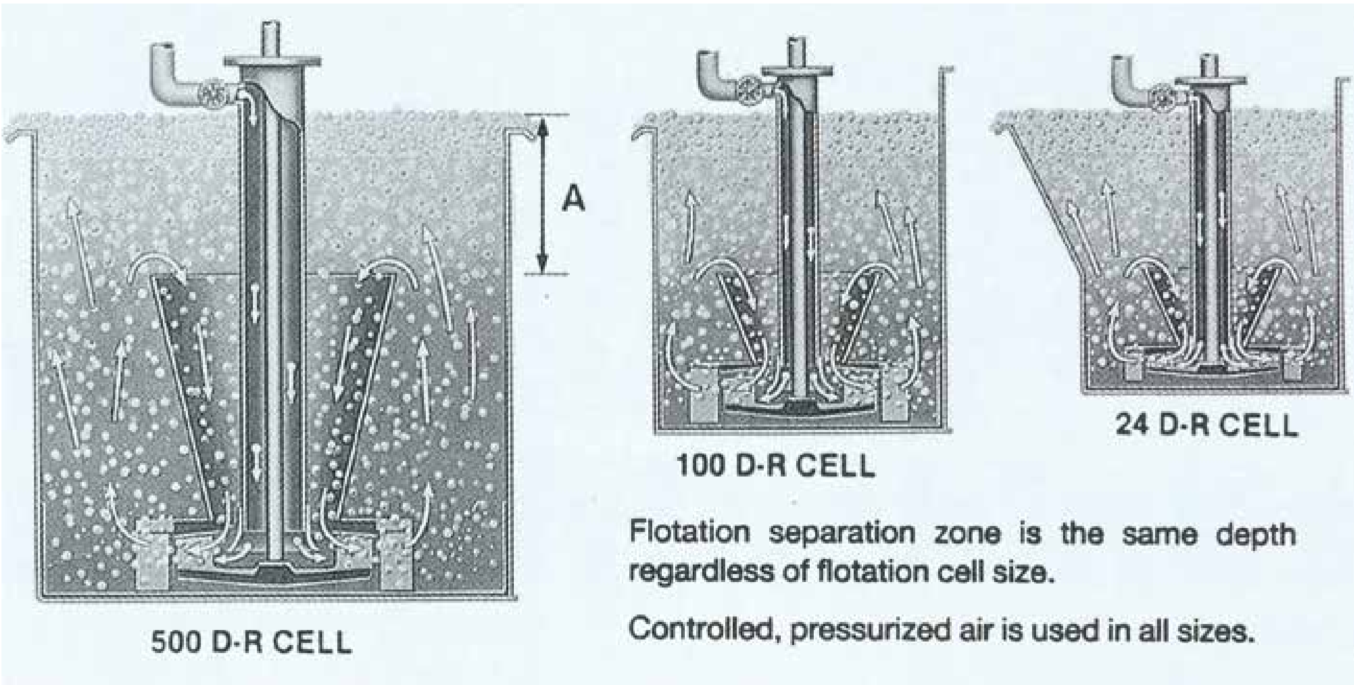
The DR principle of vertical recirculation of pulp effectively minimizes stratification and sanding.

If the pulp is circulated only in the bottom zone of the cell, solids may be kept in suspension, but additional solids from the upper area continue to settle and accumulate in the lower circulating zone until this zone stabilizes at a much higher density. This stratification in the cell causes increased power requirements, accelerates part wear, brings about short-circuiting of pulp, limits the effective mixing of air and pulp in the upper area of the cell, and creates fluctuating operating conditions.

The Metso DR flotation machine provides a fluidizing action to the pulp by vertical recirculation of pulp. Pulp from the upper zone of the flotation cell is brought down through the pulp recirculation well to the impeller, mixed with air and the pumped by the impeller into the cell creating a homogenous mixture in the tank. The action is possible only in flotation machines with "top feed" impellers such as used on Metsos DR flotation machines.

The flotation machine uses power to keep solids in suspension by vertical recirculation of pulp through the impeller. Power is thus used more efficiently than where agitation is caused by mere mechanical rotation.

Large volume DR flotation machines have been field proven. These machines have undergone full-scale plant tests and the results of these tests have justified the installation of large volume flotation machines throughout the world.



Shallow flotation in deep cells

The top vertical recirculation of pulp used by the DR Flotation Machine is ideal for handling all types of pulp containing coarse and abrasive solids or finely ground solids.

In principle, the cell functions as a shallow flotation cell. As the air and pulp are hydraulically lifted to the top of the pulp recirculation well, the mineral laden air bubble has only to travel a short distance on its own to the froth overflow level.

Above are illustrations of three flotation cells.

14.2 m^3 (500 cu.ft) cell
2.8 m^3 (100 cu.ft) cell
1.4 m^3 (50 cu.ft) cell

Note the nominal depth (A) of the flotation separation zone in all the cells is the same in each case.

Intense agitation and aeration occur in the mixing zone at the bottom of the cell. This mixing or vertical recirculation zone provides highly effective retention volume. It is within this portion of the flotation cell that intimate contact of the conditioned pulp and controlled air is made. The re-circulating pulp to the top of the pulp recirculation lifts the mineralized air bubbles hydraulically well. Here a calm separation zone is created. It permits floatable minerals to separate from those, which will not float, and a mineralized froth is formed.

The mineralized air bubble has only a short travel on its own and the action is, in effect "shallow-cell flotation".

Flotation system DR – design

- Open flow tank with intermediate and discharge boxes
- Near bottom located impeller/diffuser
- Separate source of low pressure air
- Level control by weir or dart valves (automatic as option)
- Recirculation well
- Reversible impeller direction of rotation
- Max cell size 14 m^3

DR – Specifications

Model	Cell volume (1)		Connected motor (2)		Air requirements (3)			
	m^3	ft^3	kW	HP	Am^3/min	kPag	Acfm	psig
DR 15	0,34	12	2,2	3	0,4	7	15	1,0
DR 18Sp	0,71	25	4	5	0,7	9	25	1,3
DR 24	1,42	50	5,5	7,5	1,3	10	45	1,6
DR 100	2,83	100	11	15	2,3	10	80	1,6
DR 180	5,10	180	15	20	3,1	14	110	2,0
DR 300	8,50	300	22	30	4,5	18	160	2,6
DR 500	14,16	500	30	40	6,5	18	230	2,6

(1) Active flotation volume

(2) Per cell and applicable up to 1.35 slurry sg. If higher slurry sg, consult Metso

(3) Per cell and applicable up to 1.35 slurry sg. If higher slurry sg, consult Metso

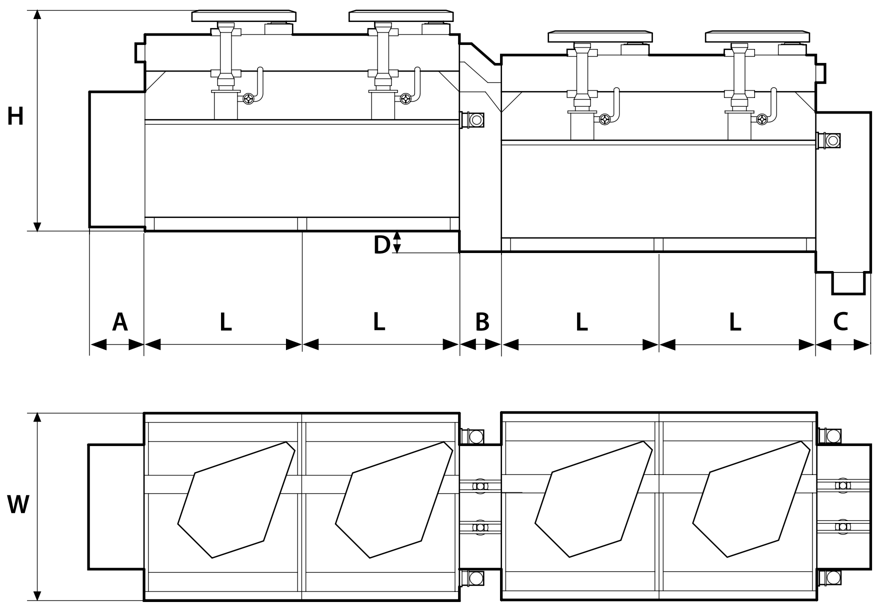
Air requirement is at flotation bank air header, pressure losses from blower to flotation bank should be considered when specifying blower

DR – Cell volumes & hydraulic capacities

Size	Maximum bank feed rate		Maximum cells per bank section (1)
	m^3/h	USGPM	
DR15	25	110	15
DR18 sp	55	240	12
DR24	110	485	9
DR100	215	945	7
DR180	415	1 825	6
DR300	580	2 550	5
DR500	760	3 345	4

(1) Number of cells on same level between connecting boxes

DR – Sizes



Model 1)	Vol./ cell ft³ [m³]	Cells/ unit 2)	A in [mm]	B in [mm]	C in [mm]	D (min) in [mm]	L 5) in [mm]	W in [mm]	H in [mm]	Motor size 3) hp [kW]	Motor size 4) hp [kW]
8	3 (0.09)		6 (152)	11 (279)	11 (279)	6 (152)	19 (483)	16 (406)	44 (1118)	1½ (1.1)	3 (2.2)
15	12 (0.28)	15	8 (203)	15 (381)	15 (381)	6 (152)	28 (711)	24 (610)	64 (1626)	4 (3.0)	7 (5.0)
18	25 (0.71)	12	12 (305)	18 (457)	18 (457)	8 (203)	36 (914)	32 (813)	72 (1829)	6½ (5.0)	14 (10.0)
24	50 (1.40)	9	12 (305)	18 (457)	18 (457)	8 (203)	48 (1219)	43 (1092)	93 (2362)	7 (5.5)	20 (15.0)
100	100 (2.80)	7	18 (457)	18 (457)	18 (457)	8 (203)	62 (1575)	62 (1575)	107 (2718)	10-15 (7.5-11)	-
180	180 (5.10)	6	20 (508)	24 (610)	30 (762)	10 (254)	72 (1829)	72 (1829)	116 (2946)	15-20 (11-15)	-
300	300 (8.90)	5	24 (610)	30 (762)	36 (914)	12 (305)	88 (2235)	88 (2235)	130 (3302)	25-30 (18-22)	-
500	500 (14.20)	4	30 (762)	36 (914)	36 (914)	12 (305)	106 (2692)	106 (2692)	134 (3404)	30-40 (25-30)	-
1500	1500 (36.10)	3	48 (1219)	42 (1067)	54 (1372)	16 (406)	168 (4267)	168 (4267)	172 (4369)	74 (55)	-

1) From size 18 and above Single or Double side overflow.
2) Number of cells without Intermediate box.
3) Single cell drive.
4) Dual cell drive.
5) Length per cell.

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