Upgrading of VRM & Ball Mills with LVT Classifier
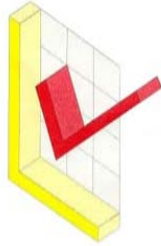
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CLASSIFIER FOR VERTICAL MILL AND BALL MILL

References of LV Technology

Year	Client	Country	Product
2009	TPI	Thailand	Coal Mill
2009	Chinfon	Vietnam	Kiln Upgrade, Raw Mill, Cement Mill, Coal Mill
2008	Bodoquena	Brazil	Kiln Upgrade
2008	Votorantim	Brazil	Coal Mill
2008	Holcim Malaysia	Malaysia	Classifier
2008	IJACI Cement	Brazil	Engineering
2008	Mustehkam Cement	Pakistan	Engineering, Raw Mill, Cement Mill
2008	APIAI	Brazil	Plant upgrade
2008	Achinsk Cement	Russia	Coal Mill
2007	Basel Cement	Kazakhstan	Coal Mill, Cooler

CLASSIFIER FOR VERTICAL MILL
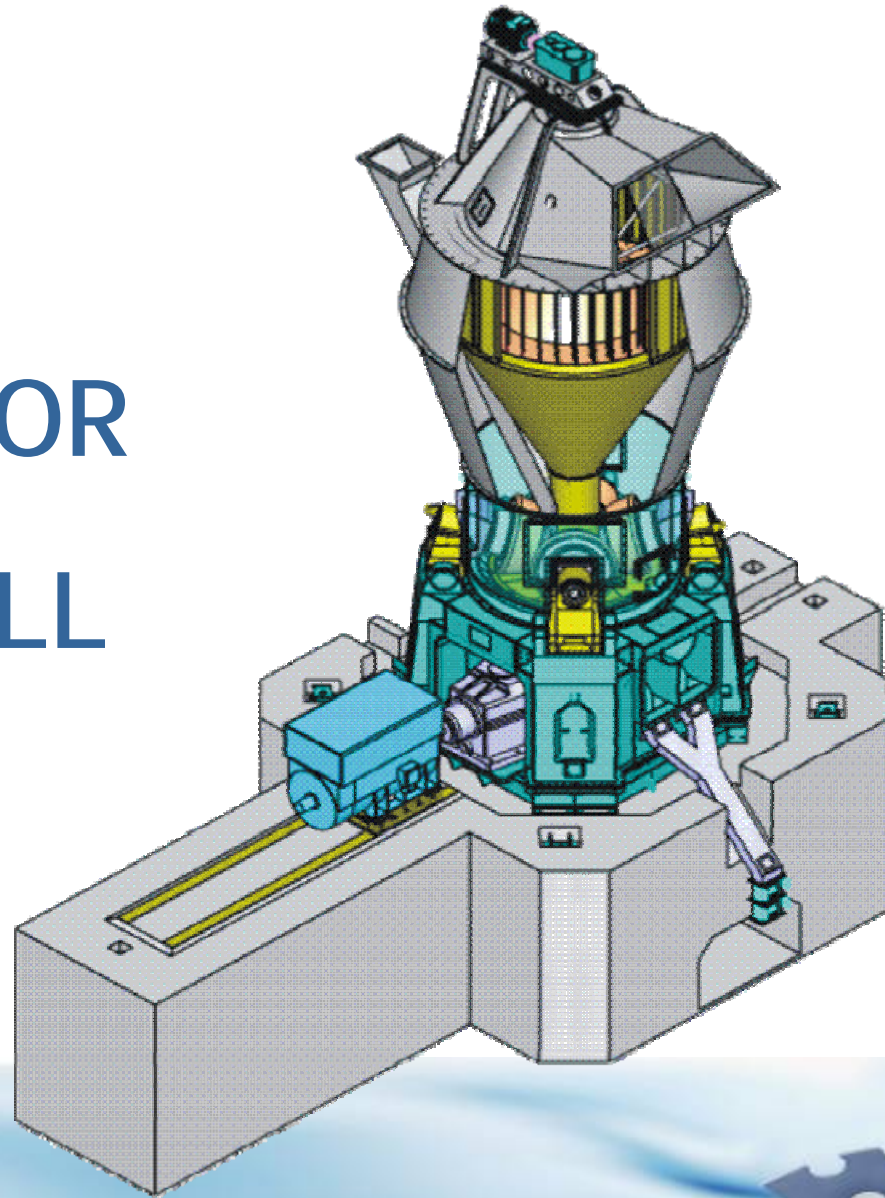
LV Classifier for Vertical Mill
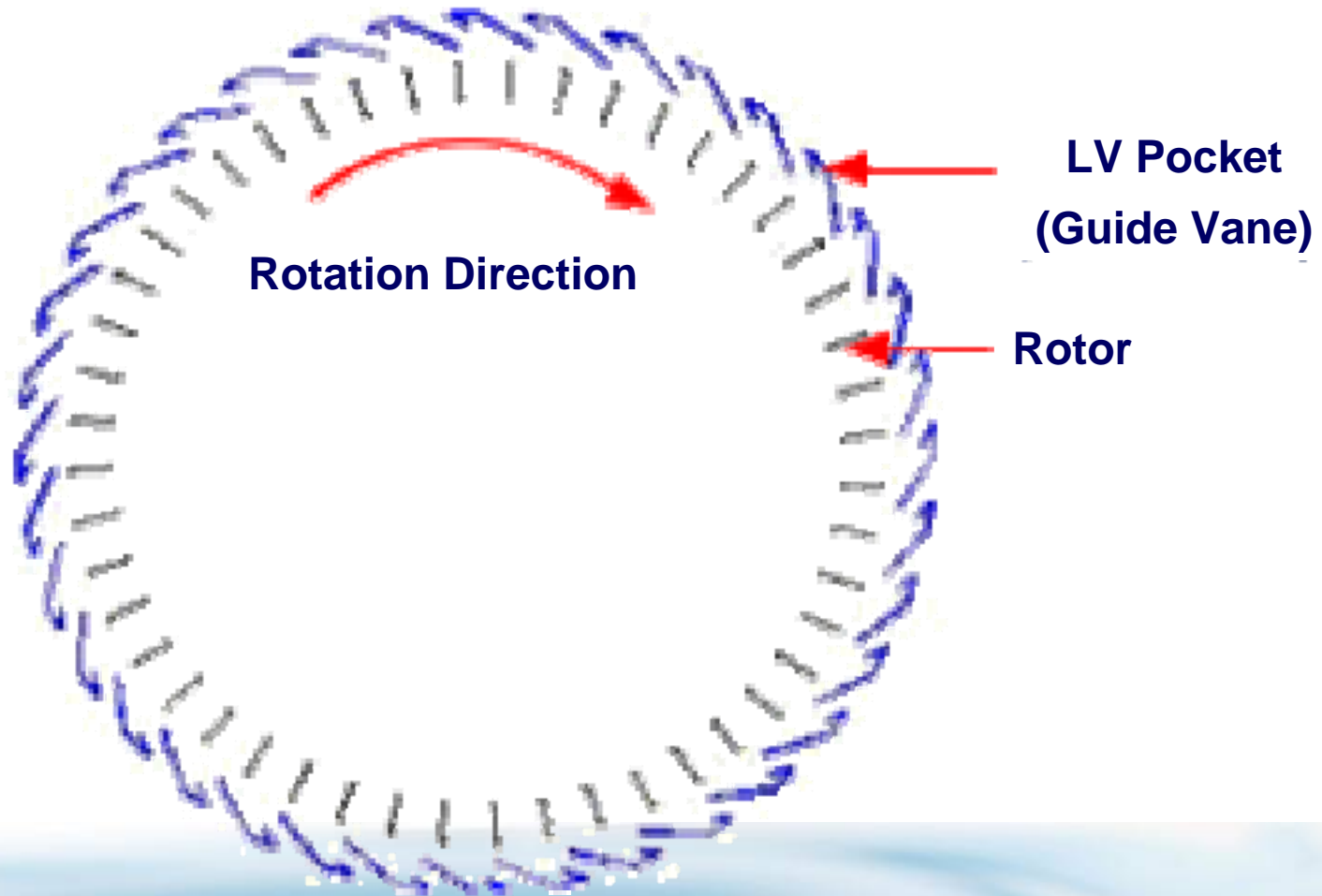
Guide Vane and Rotor

Rotation Direction

LV Pocket
(Guide Vane)

Rotor

LV Pocket

FINE

COARSE
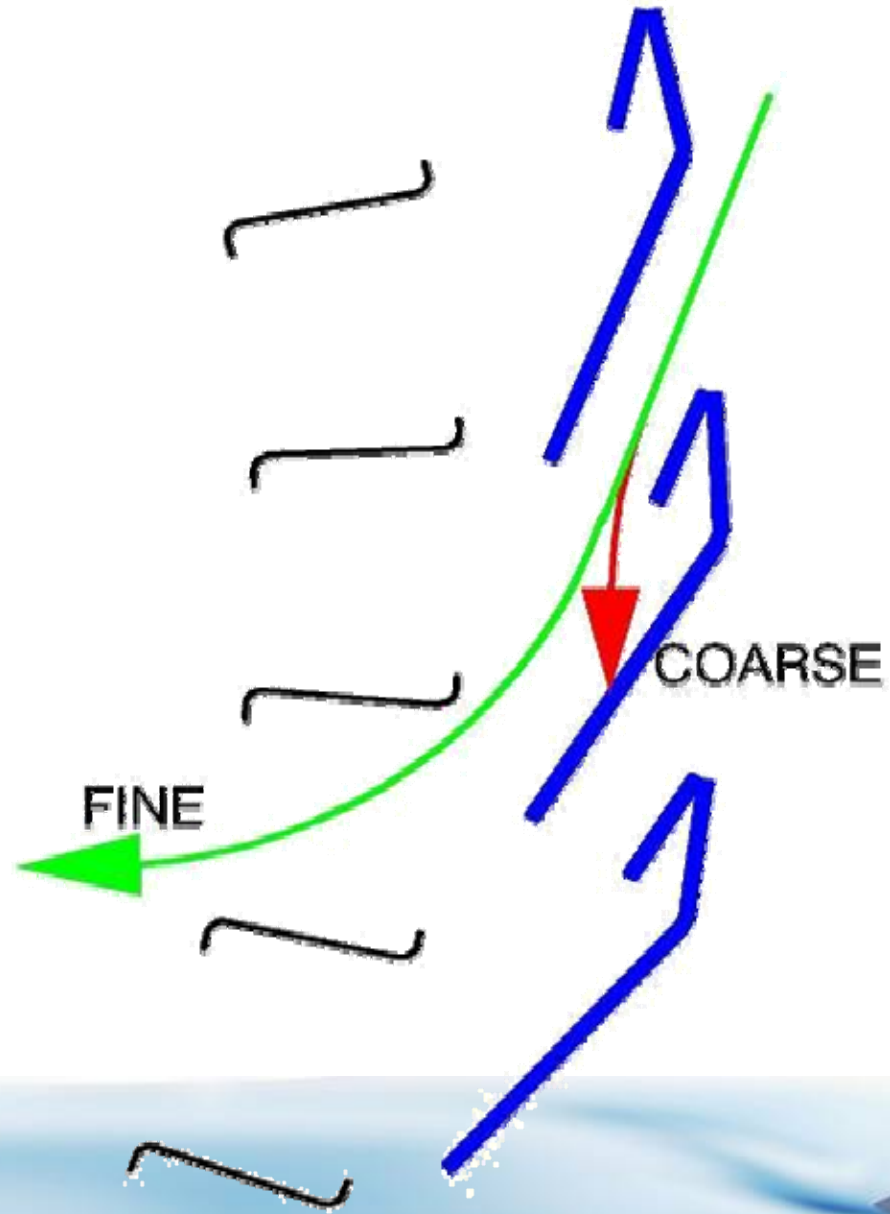
LV Pocket

Force involve in LV Classifier

Centrifugal force

Drag force

Gravity force
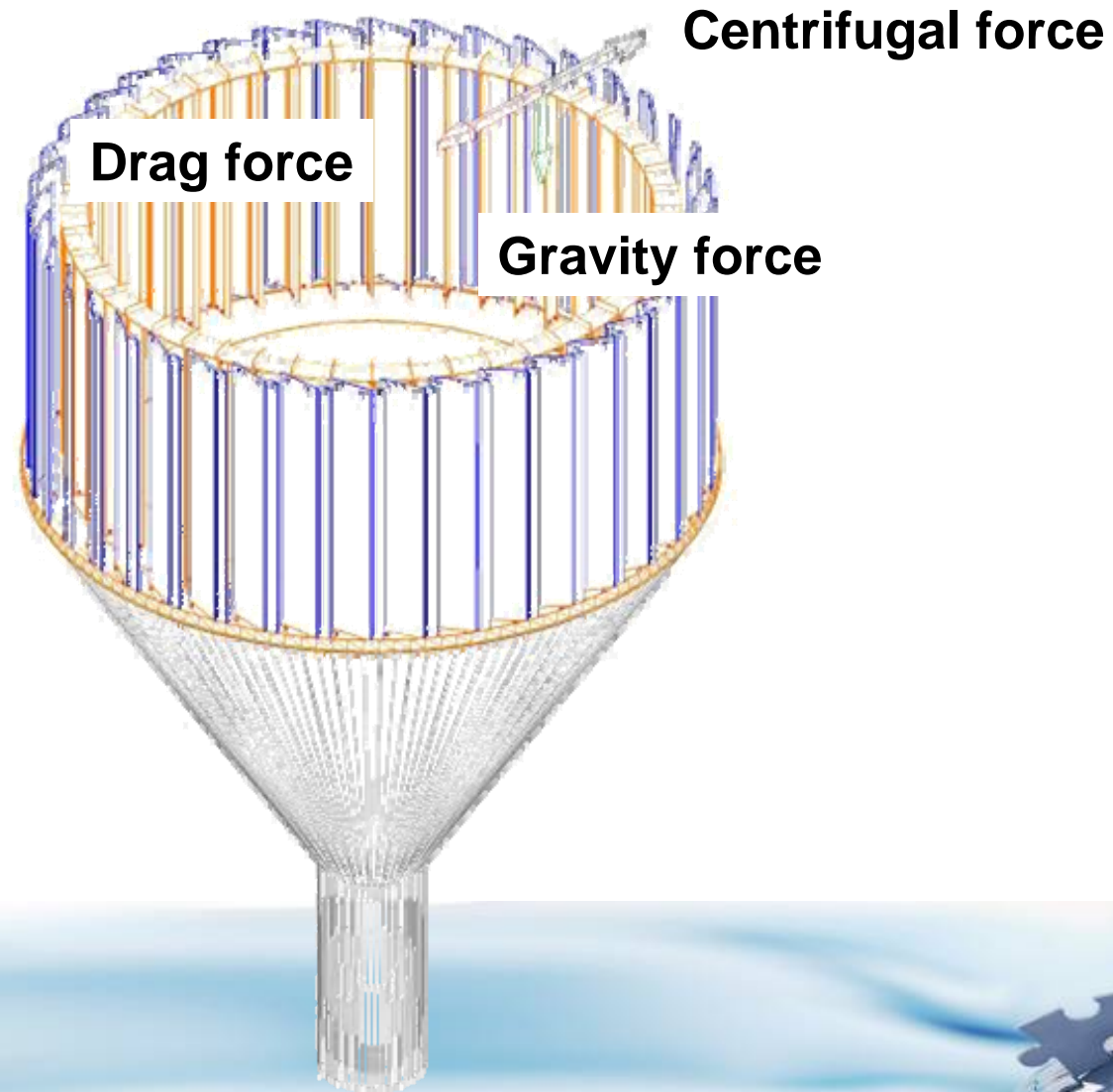
Concept of LV Classifier

The concept of the classifier is to improve the gas and material flow in vertical mills by:

- Unique design of guide vanes - LV pocket
- Unique design of rotor
- The design of the grit funnel

Concept of LV Classifier

LV Classifiers are applied for vertical mills and ball mills.
References are already more than 400 sets supplied to all over the world.
All LV Classifier shows higher production rate about 10-20%
and less specific power consumption about 1.5-5kWh/t,
comparing with other Separators.

Draft force   Centrifugal force

Gravity force

Rotor
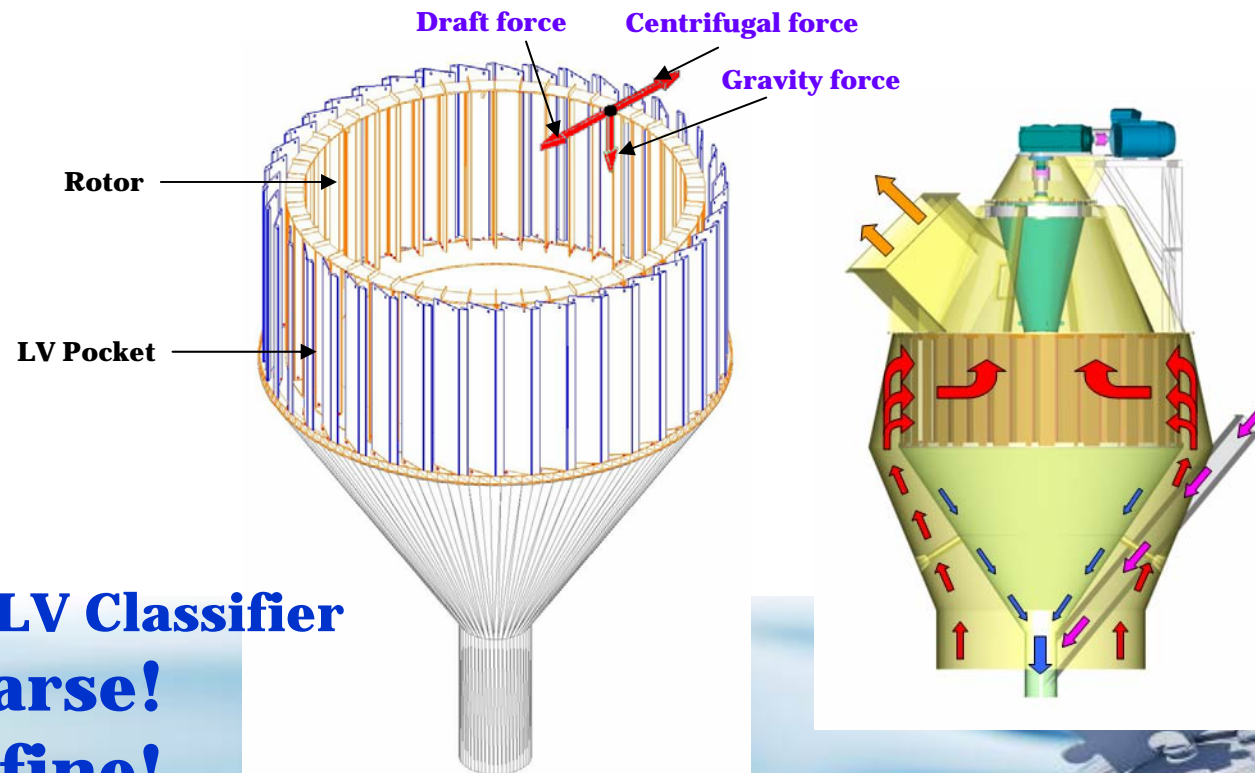
LV Pocket

**Basic concept of LV Classifier**
No fine in coarse!
No coarse in fine!

Part of Your Success

10

1. LV Pocket

Special construction of LV Pocket works as coarse material trap which material is carried by gas from mill mixing with fine.

Coarse material caught by LV Pocket moves down by gravity along LV Pocket to funnel cone without mixing with fine.
This construction makes "no fine in coarse, no coarse in fine".
Since material on mill table has smaller fine portion, vibration becomes smaller.

FINE

COARSE

Rotation
direction

LV Pocket
(Guide vane)

Rotor

Part of Your Success
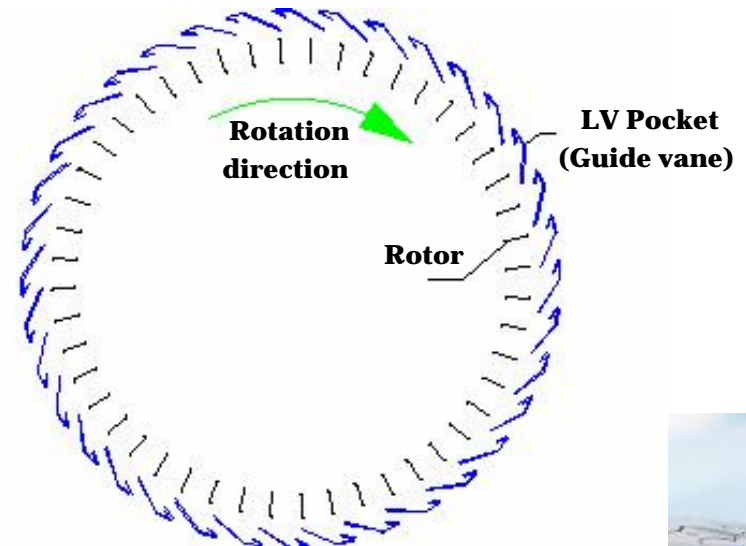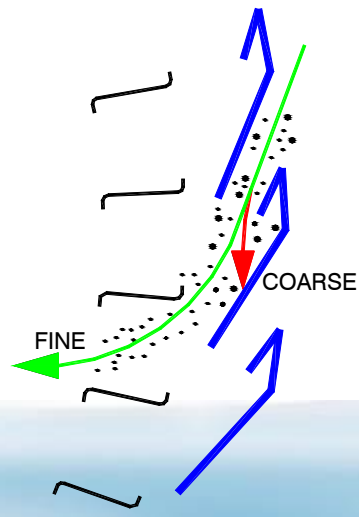
2.Funnel Cone

Funnel cone is not only to collect reject from LV Pocket and to feed material to table but also to control gas speed distribution between Classifier casing and funnel cone. This makes possible to get preferable gas velocity between casing and funnel cone and to eliminate material internal circulation. Pressure loss becomes smaller by reducing internal circulation of material.
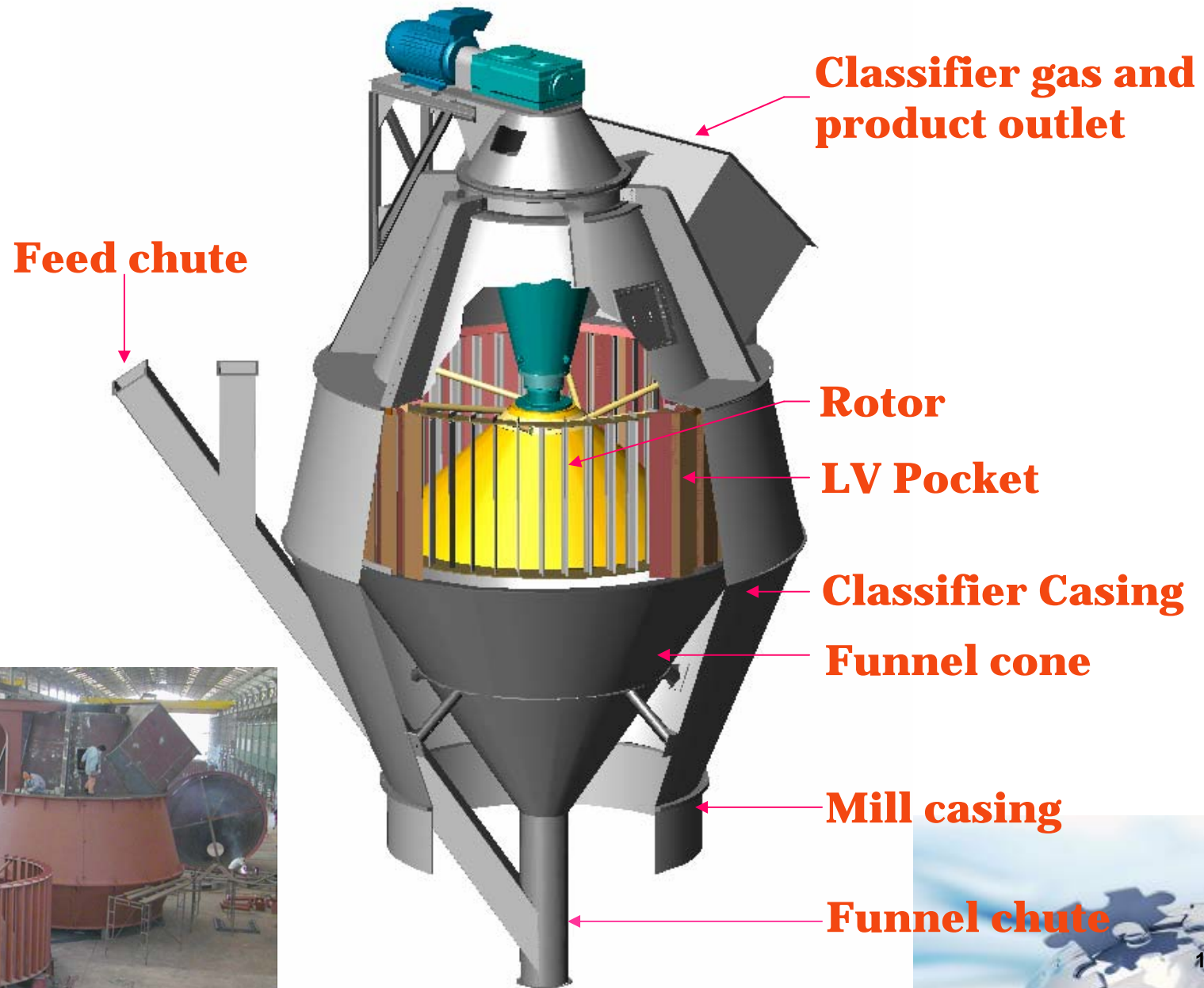
3.Funnel Chute

Reject from funnel cone feed back to center of mill table through funnel chute. The special funnel chute is designed to feed material on to mill table smoothly with minimum height.

This also contributes to reduce mill vibration.

Construction of LV Classifier

Classifier gas and product outlet

Feed chute

Rotor

LV Pocket

Classifier Casing

Funnel cone

Mill casing

Funnel chute

13

Concept of LV Classifier

The concept is based on the idea:

➢ Allow more material to be directed to the classifier by optimising the gas speed

➢ Avoid fines returning to the grinding table and excessive internal material circulation in the mill body by installation of the LV Pocket

➢ Decreases the pressure loss in the mill body and separator. An effect of the reduction of internal material circulation

Benefits of LV Classifier

High efficiency in any good classifier means

NO COARSE IN FINES

In the LV Classifier our aims also is to have

NO FINES IN COARSE

Vertical Roller Mills:

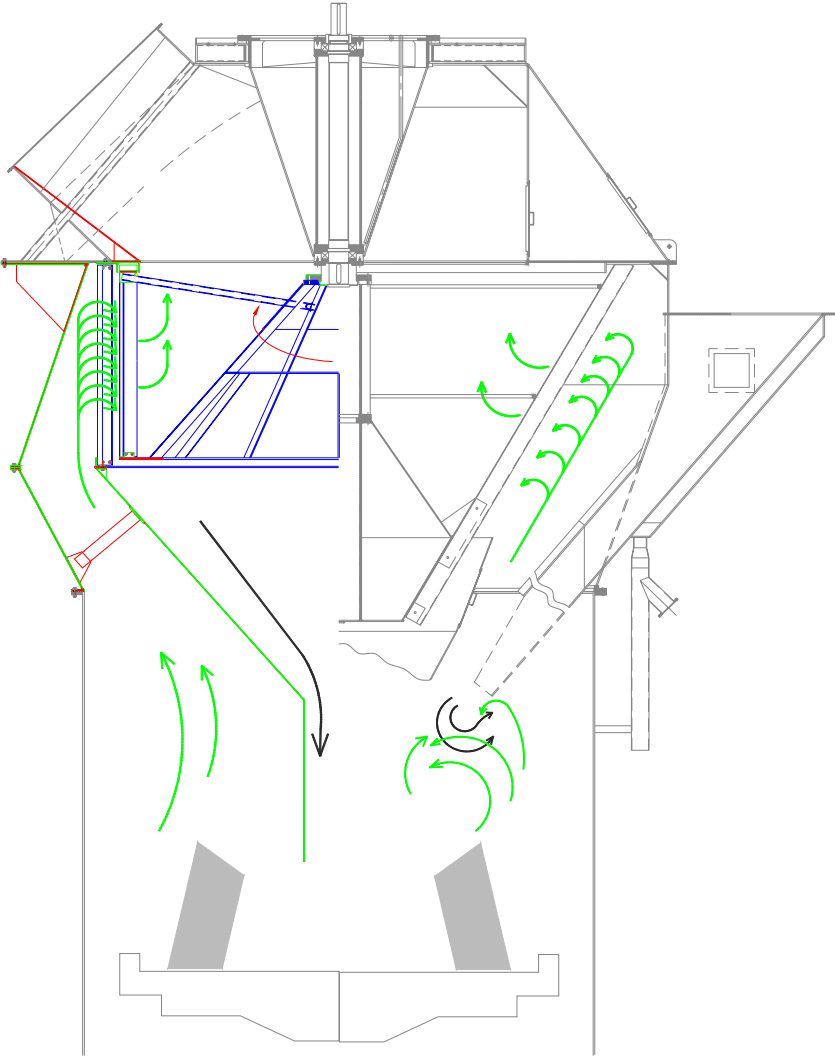|	
Increased production	12 - 30 %
Saving in power consumption of both mill and fan	1.5 – 3.0 kWh/t
Vibration level decreasing	
Cement strength increases	

Before and After Modifications

MODIFICATION BY LV   EXISTING

IHI Vertical Raw Mill

Before
Modification

IHI Vertical Raw Mill

After
Modification

IHI VRM Result

	Before LV	After LV	%	Guarantee
Production	280 TPH	360 TPH	+ 29 %	(325 TPH)
Residue @ 90 micron	12 %	10%	-17%	(10 %)
Specific Power Mill & Fan	14.8 kWh/t	11.9 kWh/t	-24%	(12.5 kWh/t)
Vibration	60-80 micron	20-30 micron	- 2/3	-

Actual Result for LM Mill

Mill		Fuller LM 50.4		LM 63.4	
		Before	After	Before	After
Classifier		LJKS	LVT	LSKS	LVT
Production	MTPH	300	300	617	709
Mill power	KWh	3100	3100	4875	4960
Fan power	KWh	3200	1900	6355	5175
ΔP mill	Mmwg	800	750	850	750
Vibration	Mm/.s	8-10	3-5	8-10	5-7
Residue	% > 90 μ	18	15	12	12
	% > 200 μ	1.5	1.5		
Spec. energy					
Mill + Fan	kWh/MT	21.0	16.7	18.2	14.3
Savings	kWh/MT		4.3		3.9
Increased Production	%	-	0	-	15

Actual Result for Polysius Mill

Polysius 51 - 26		Before	After
Capacity	MTPH	225	275
Residue	% > 90 μ	16	22
	% > 200 μ	5.0	4.0
Mill Power	kWh	2470	2600
Fan Power	kWh	2150	1800
Exit Grain load	gm/m3	360	510
Mill ΔP	mmwg	735	720
External Recir.	Percent	45	30
Spec. Pwr Cons.	kWh/MT	20.5	16.0
Power Savings	kWh/MT		4.5
Increased Production	%		22

Operating Data – Vertical Cement Mill

VR-7, Cement mill		Before	After
Separator		MHI	LVT
Production	t/h	104.4	119.5
Blaine	cm2/g	3325	3406
Specific power consumption			
Mill	kWh/t	20.69	20.81
ID Fan	kWh/t	7.54	5.98
Total	kWh/t	28.23	26.79
Increased production	%		14.5
Power savings	kWh/t		1.74

Mitsubishi Vertical Mill with LV Classifier

Vertical Mill Summary

- **LOWER MILL EXIT GAS VOLUME**
    - *REDUCED MILL PRESSURE DROP*
    - *REDUCED FAN kW*

- **BETTER PRODUCT PSD**
    - *BETTER BURNABILITY*
    - *BETTER CLINKER QUALITY*
    - *INCREASED PRODUCTION*

- **INCREASED GRINDING EFFICIENCY**
    - *HIGHER PRODUCTION*
    - *LOWER VIBRATION*

CLASSIFIER FOR
BALL MILL
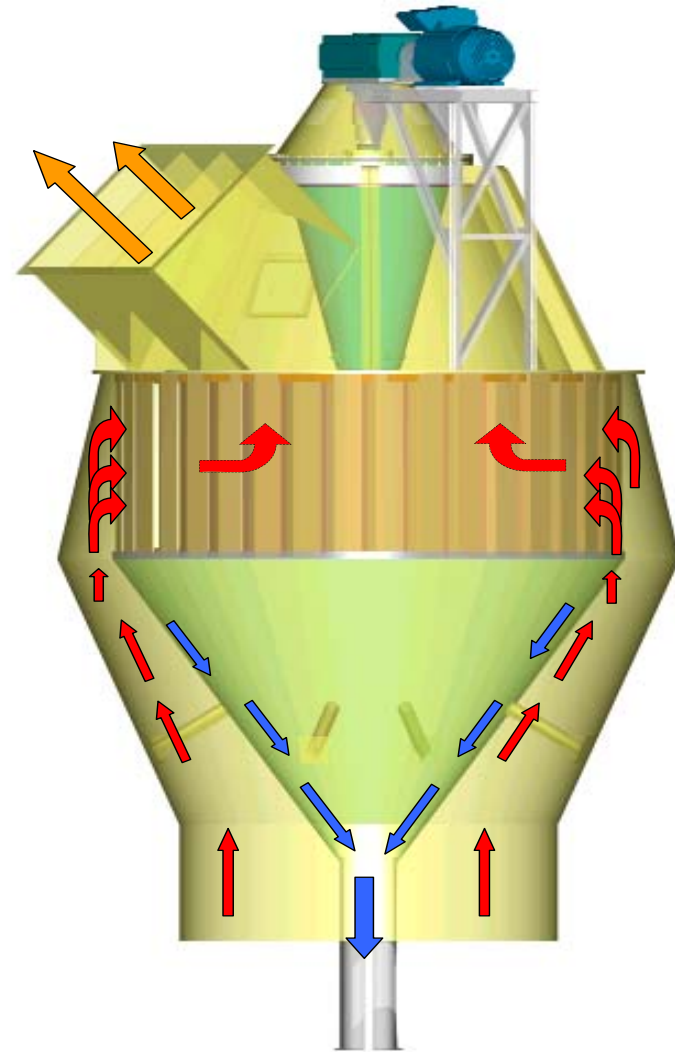
Classifier Circuit
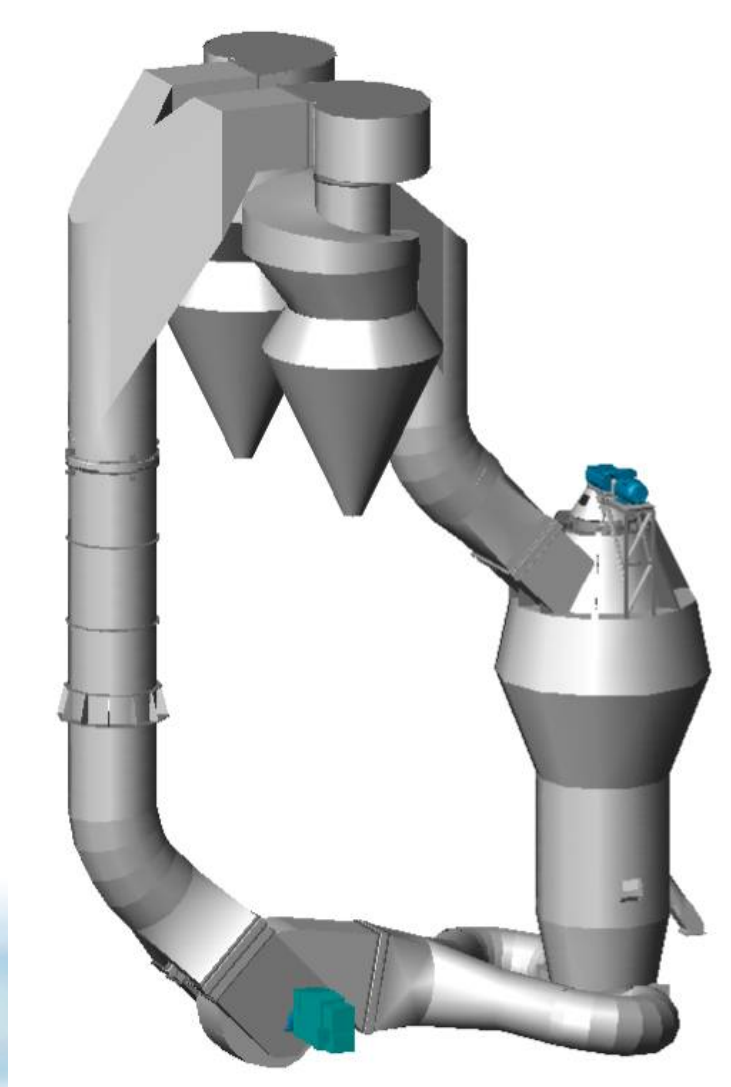
Concept of Classifier for Ball Mill

LVT started to design new Classifier for ball mills in the beginning of 2001.

The concept and construction are very unique applying new technology.

The basic concepts are;

1. Material feed at Separator bottom
2. No bucket elevator system for new grinding plant
3. Fluidizing bed

Concept of Classifier for Ball Mill

(1) Material feed at Separator bottom

Separator feed material should be fed into separator bottom, not into Separator top as usual, and material should goes up into Separator zone from bottom.

This makes possible to get uniform material distribution into whole area of Separator.

Separator rotor and stator can work having same dust concentration in all area. Dust load can be selected higher comparing conventional one accordingly.

This is very unique concept and important point for Separator design.

Concept of Classifier for Ball Mill

(2) Fluidizing bed

Fluidizing bed is applied at Separator bottom.

This arrangement make possible to get shortest bottom casing (cylindrical portion) of Separator with good mixing effect between gas and material in shorter distance.

This fluidizing bed is also designed to separate grit coming from ball mill outlet, such as fraction of steel ball, lump materials, etc. taking out completely from mill circuit.

Concept of Classifier for Ball Mill

(2) Fluidizing bed

This fluidizing bed is also for avoiding build-up material problem as emergency case, by improving aeration properties for feed material at bed bottom, when excess material comes down to bottom of Separator.

It is not requested to clean and to take out built-up dust from the bottom Separator for stopping mill operation. Introducing circulation process gas to top of fluidizing bed area is enough to carry-up dust completely outside of separator.

Air volume and delivery pressure of fluidizing bed fan should be lower as possible.

Concept of Classifier for Ball Mill

(3) No bucket elevator system for new grinding plant

Arrangement of Separator bottom feed contributes also reducing the bucket elevator height for mill outlet.

As for the new mill planning, it makes possible to delete bucket elevator using for outlet of mill.

Mill outlet material is fed directly into Separator bottom without using bucket elevator, by extending Separator lower casing to the level of mill outlet.

When bucket elevator is deleted, ball mill building becomes very simple and lower construction.

Concept of Classifier for Ball Mill

(3) No bucket elevator system for new grinding plant

(Remarks)

LVT applied this type "no bucket elevator plant" for;

*Cement mill for CEMCO / Canada and
* Pozzolane mills / Myanmar, already.

We call this new concept Separator,

"LV Classifier for Ball Mills with fluidizing bed".

Part of Your Success

Concept of Classifier for Ball Mill

Gas outlet

Feed Material

Reject chute

Fluidizing bed

Gas inlet
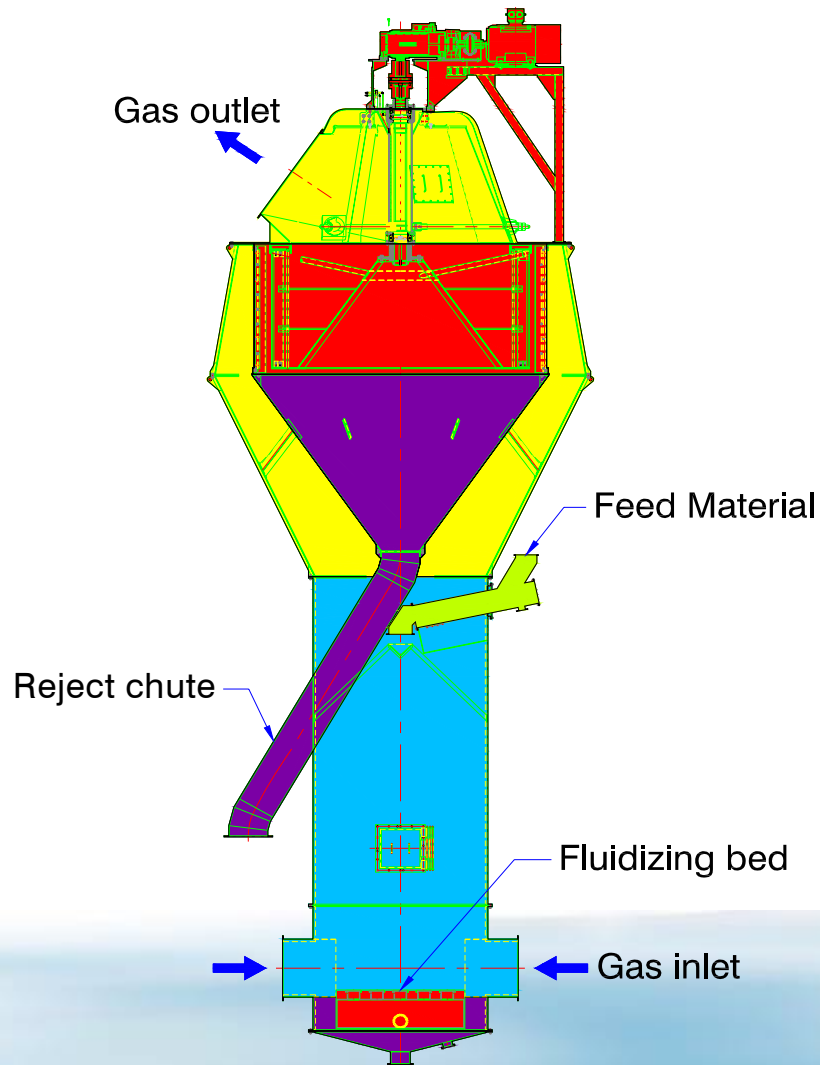
1. **Bottom feed**

2. **Fluidizing bed**

3. **Lower BE height**

LV-Classifier, 1 inlet
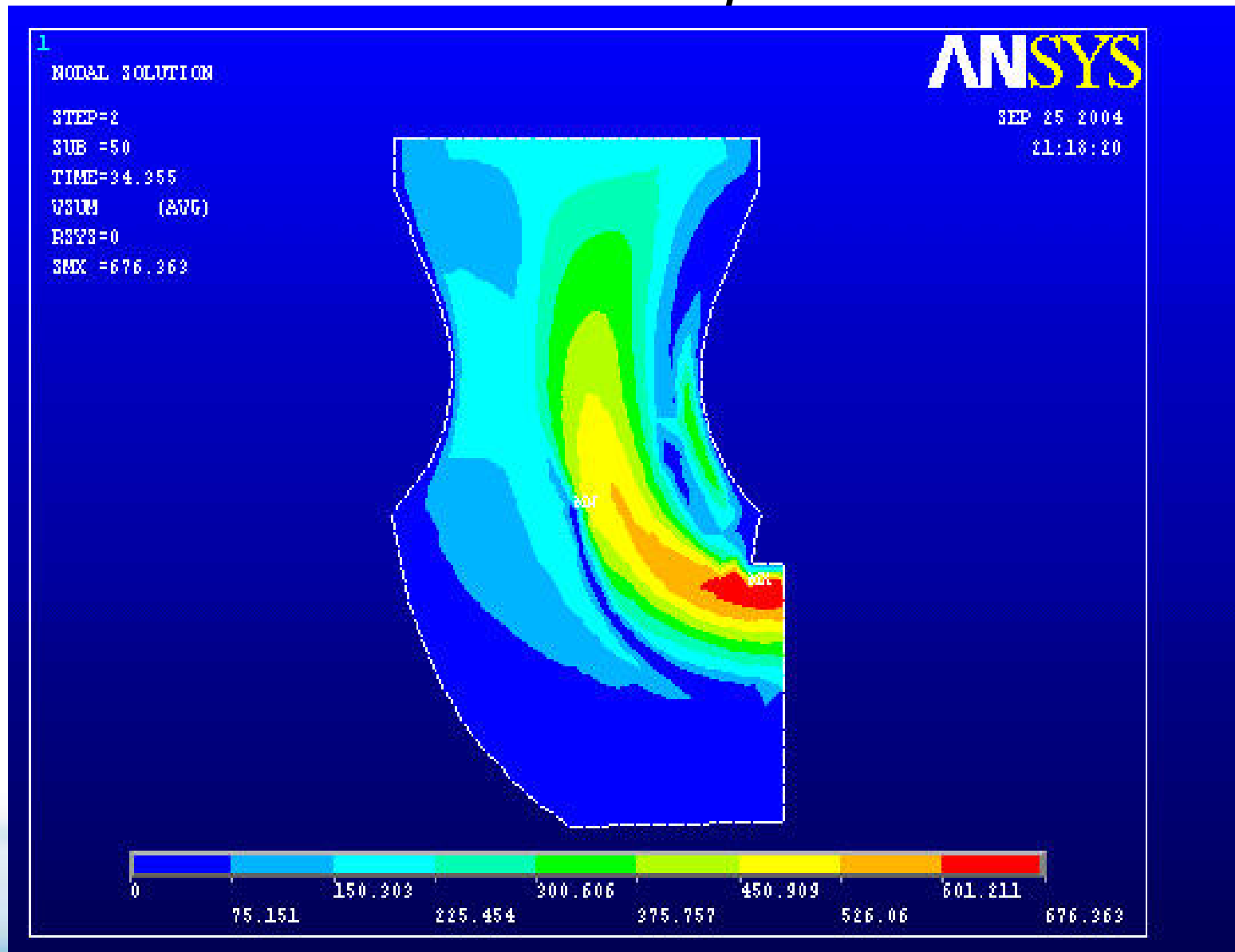
LV-Classifier, 2 inlets
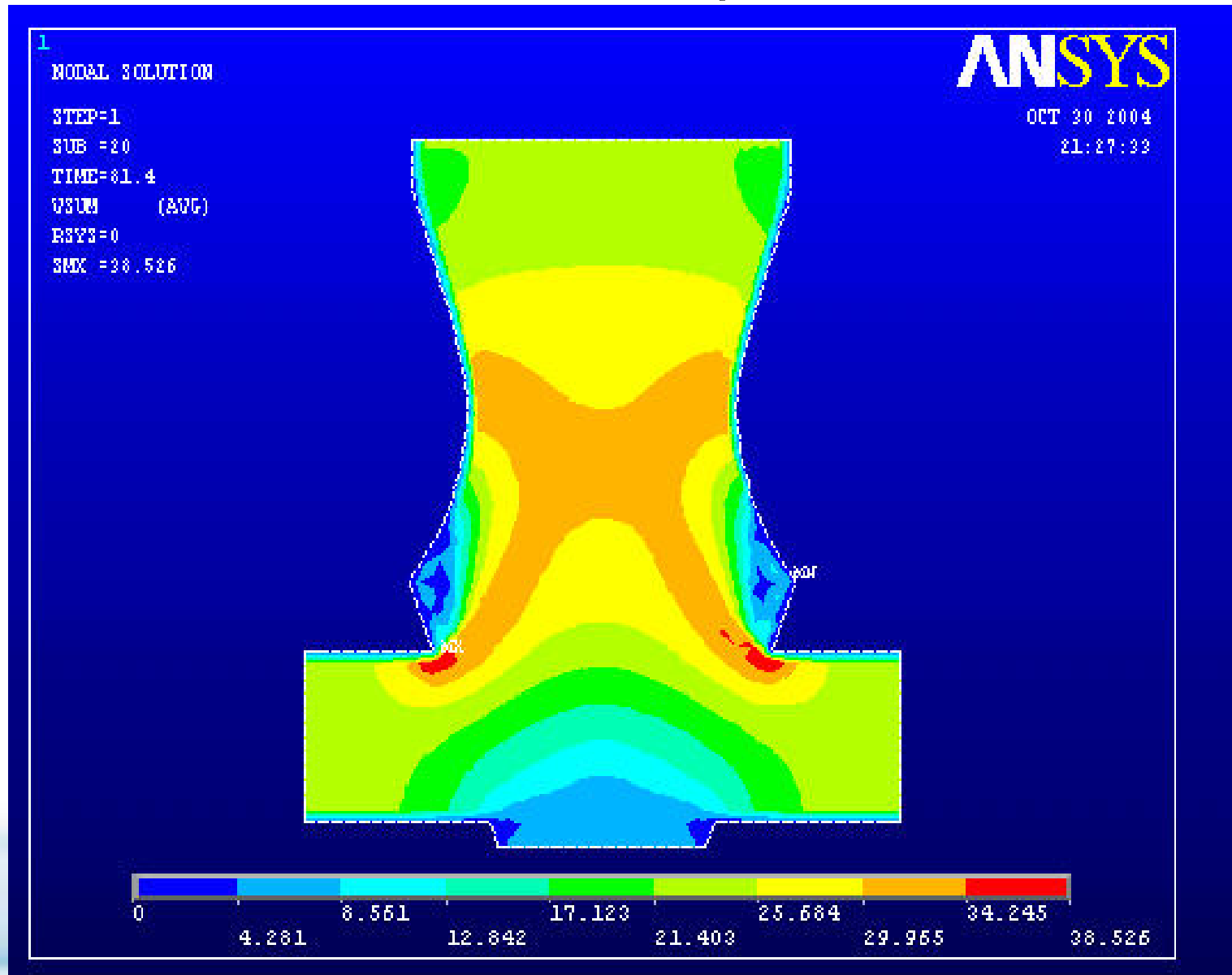
LV-classifier, 2 inlets (3rd generation)
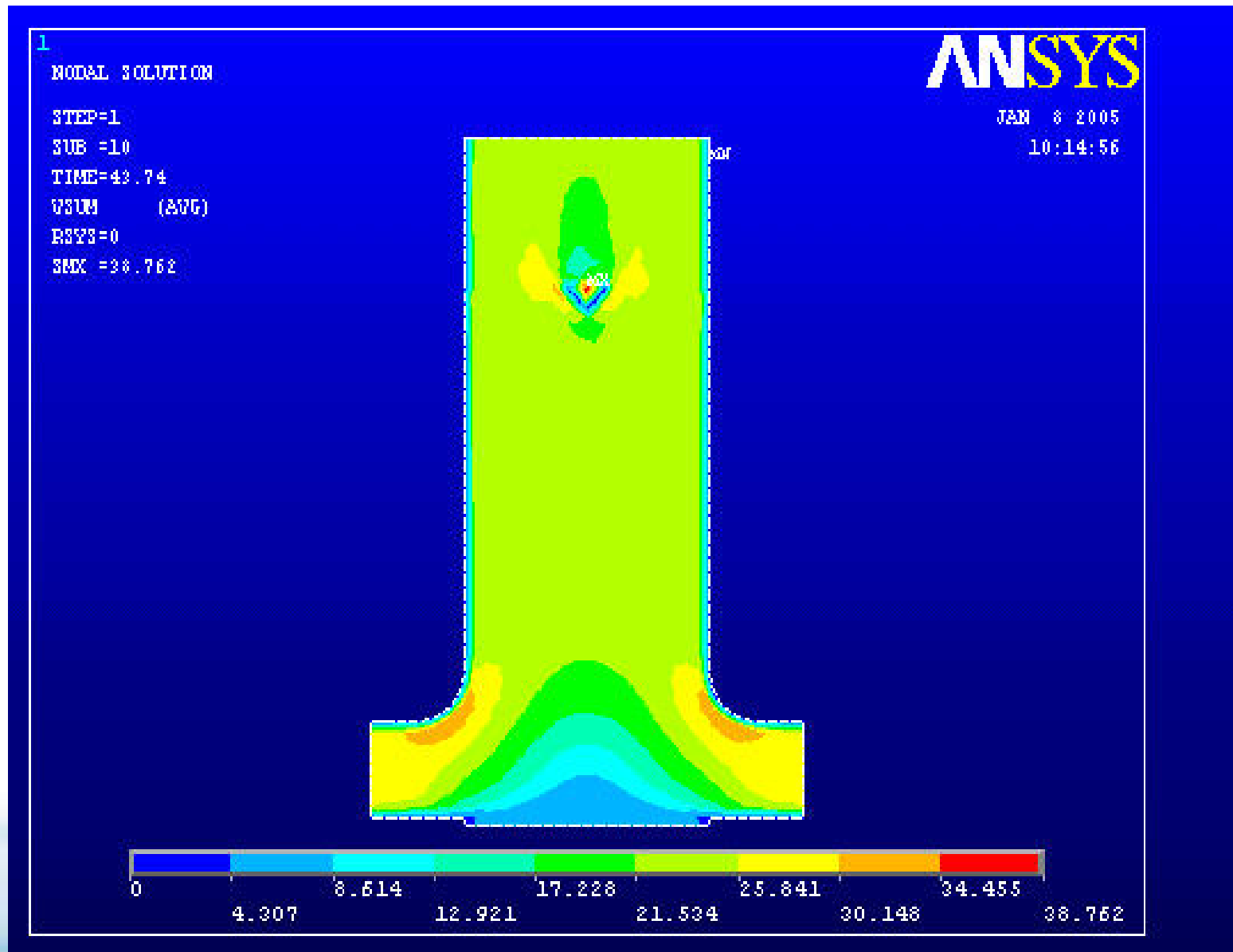
Cement Mill Up-grade
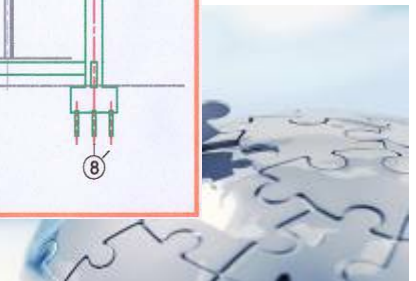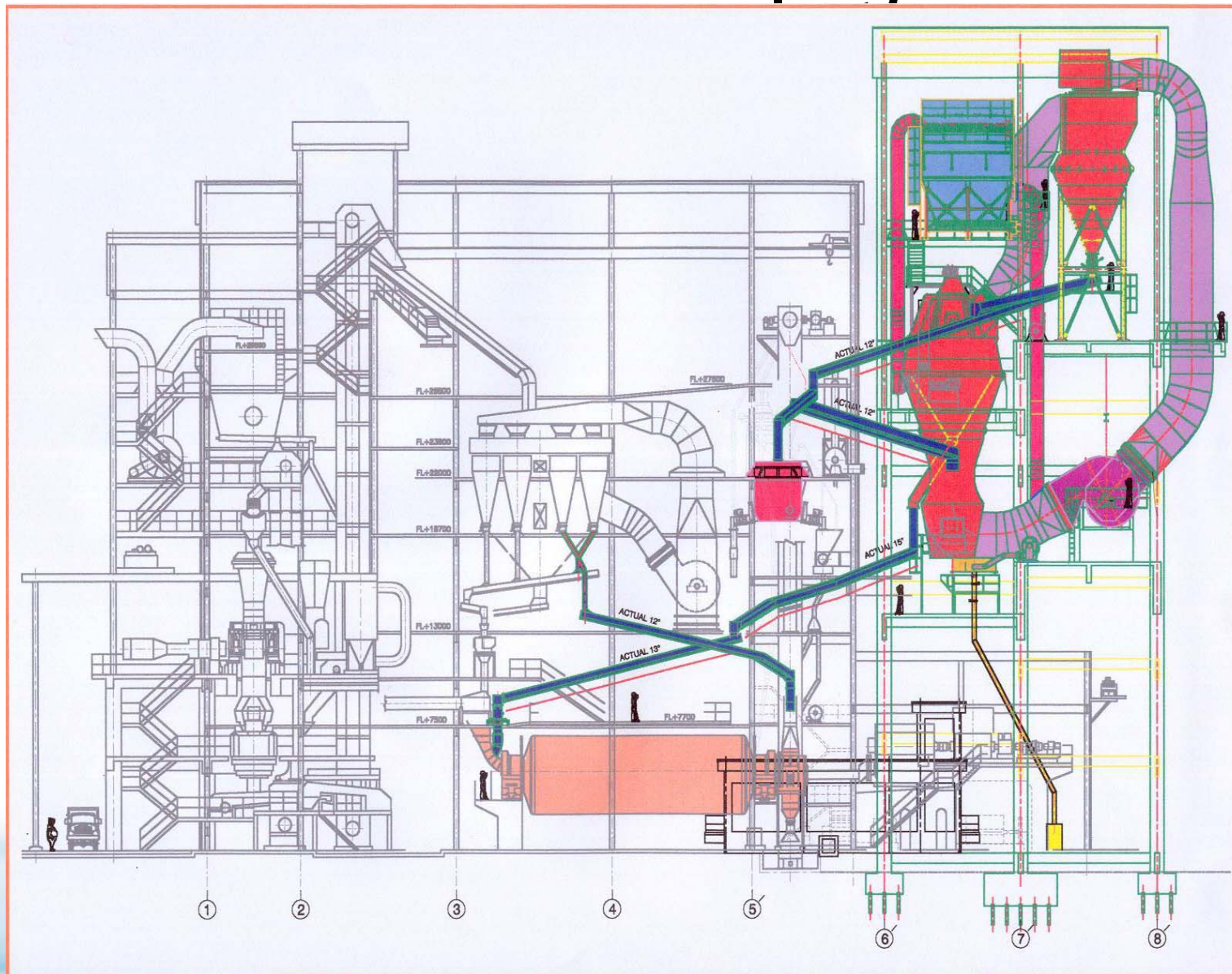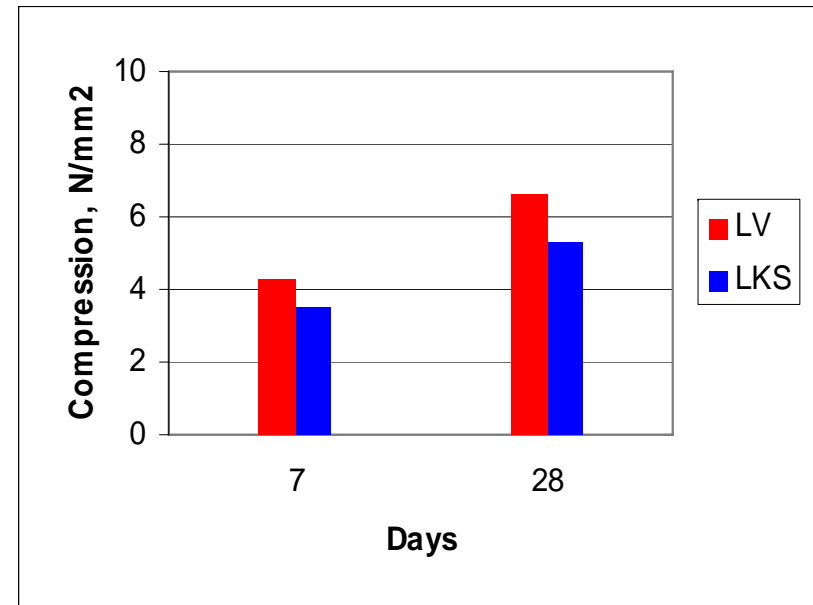
Cement Mill Modification
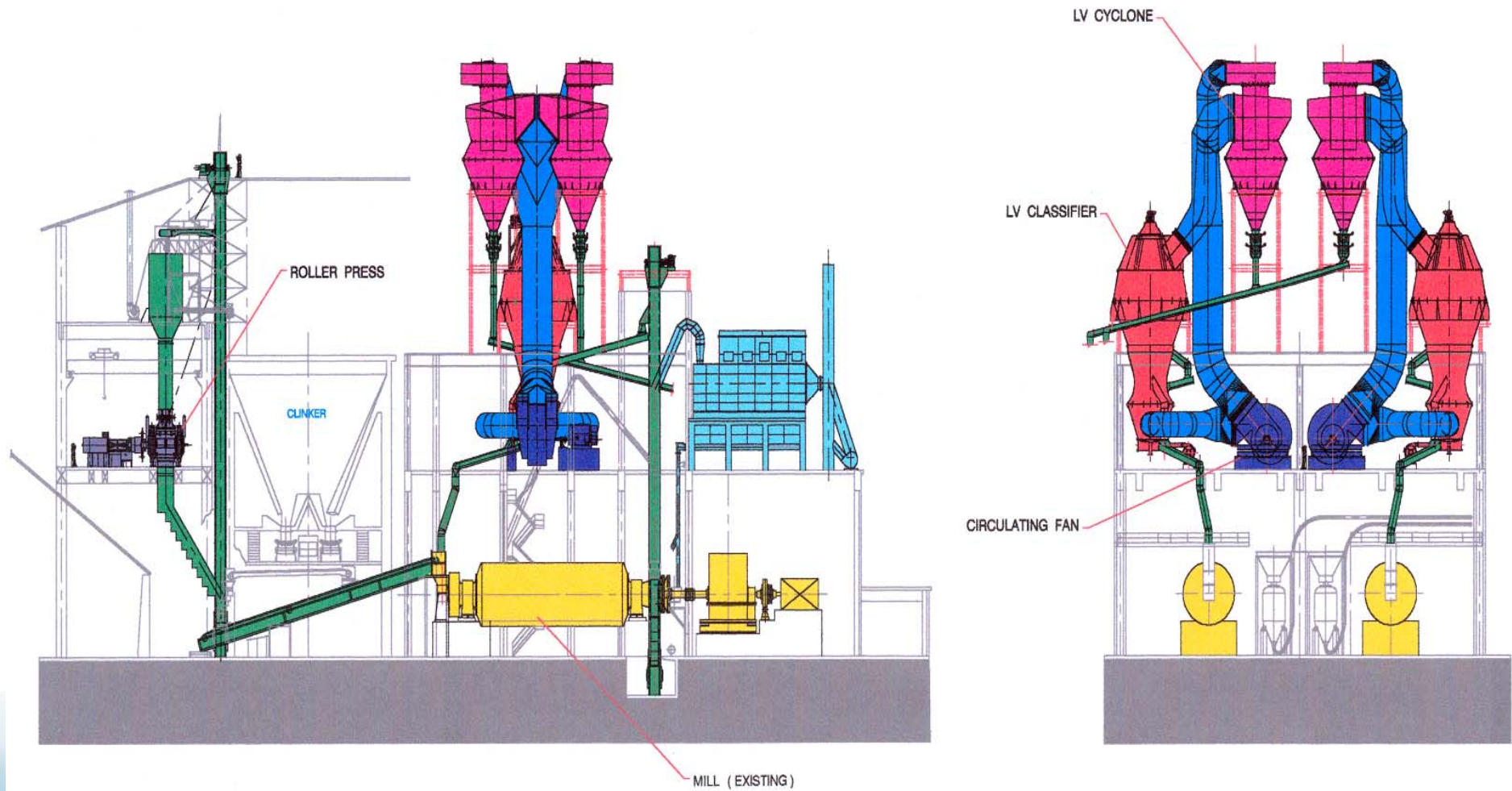
Cement Mill Installation
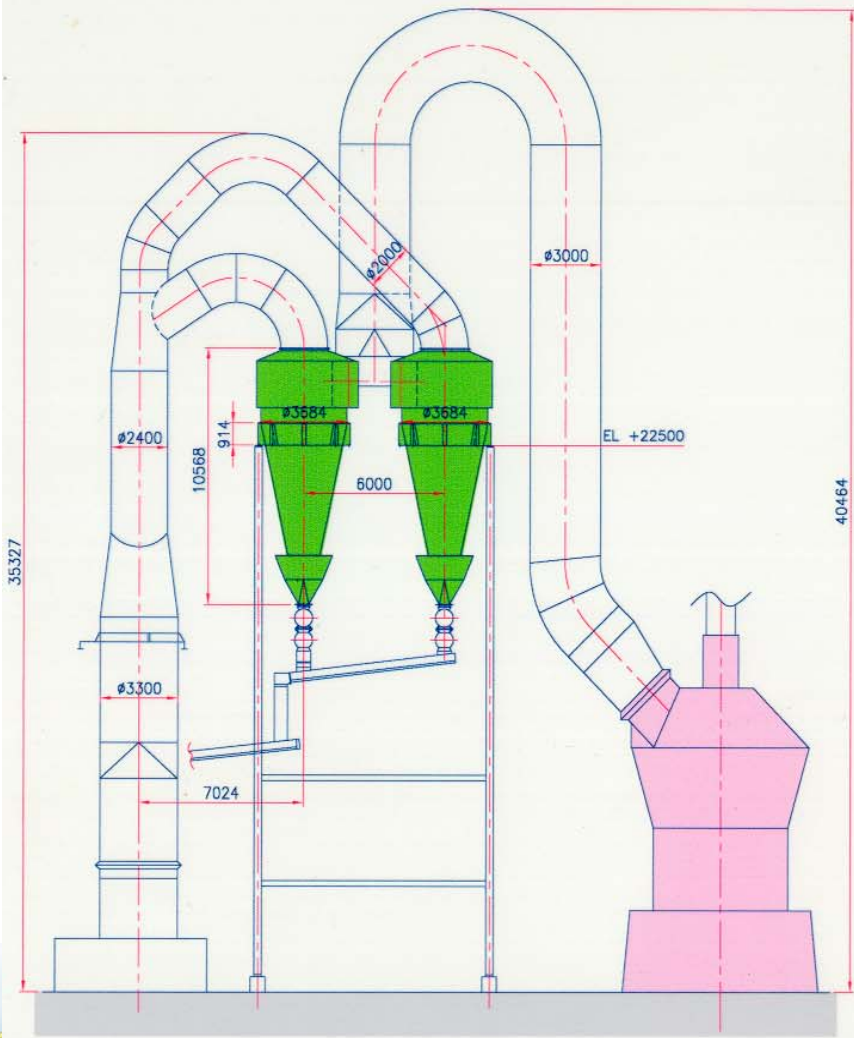

CEMENT MILL
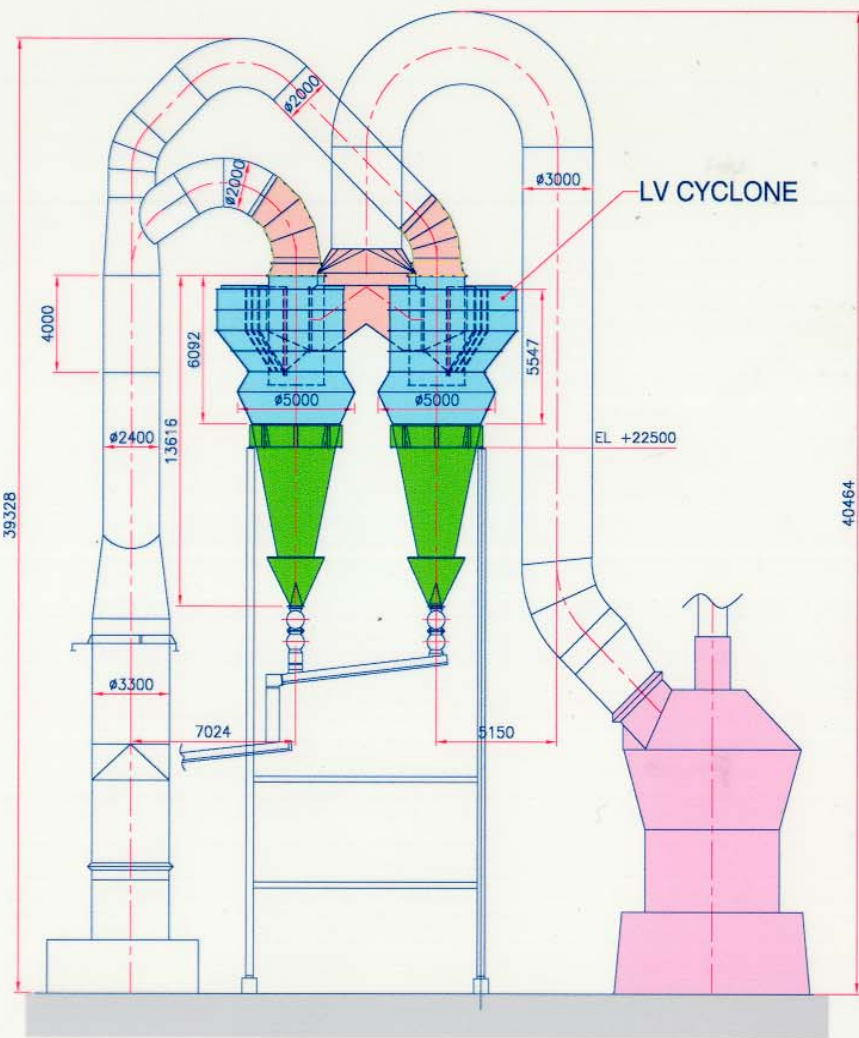APPLYING LV CLASSIFIER
LAY OUT
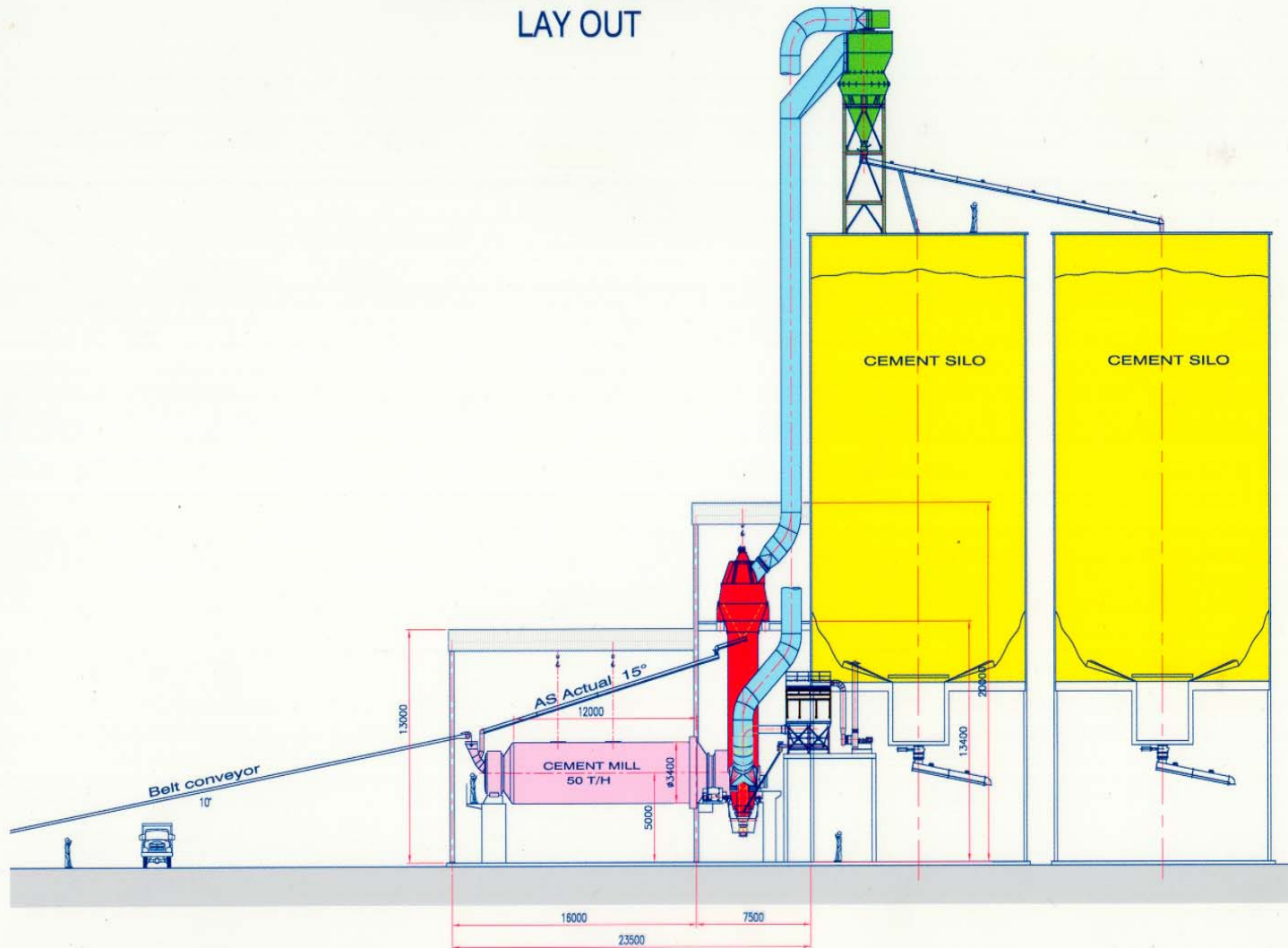
Cement Strenght
Compression
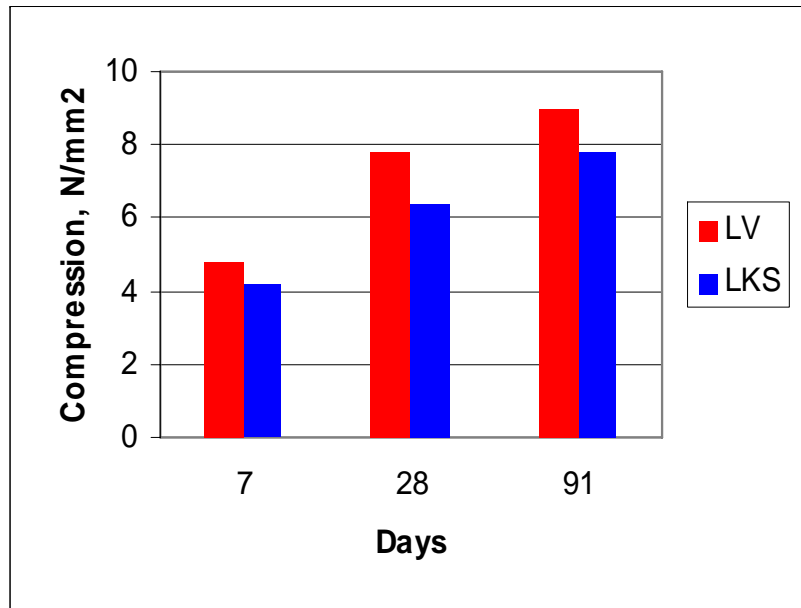
Raw Mill Cyclone Modification



BEFORE MODIFICATION

AFTER MODIFICATION

Concept of Classifier for Ball Mill

Total number of references of LV Classifiers for ball mills

(January 2006)

Category of ball mill	No. of sets	Modification or new	Apply of fluidizing bed	Remarks
Raw mill	11 sets (13%)	Modification	With and without fluidizing bed	
Cement mill	35 sets (42%)	Modification	With fluidizing bed	Including slag
Coal mill	33 sets (39%)	Modification	Without FB	Coal & Petcoke
Others * Fly ash * Lime * Pozzolane	3 sets 1 sets 2 sets (6%)	* New plant * Modification * New plant	With fluidizing bed	Without BE
Grand total	84 sets (100%)			

Concept of Classifier for Ball Mill
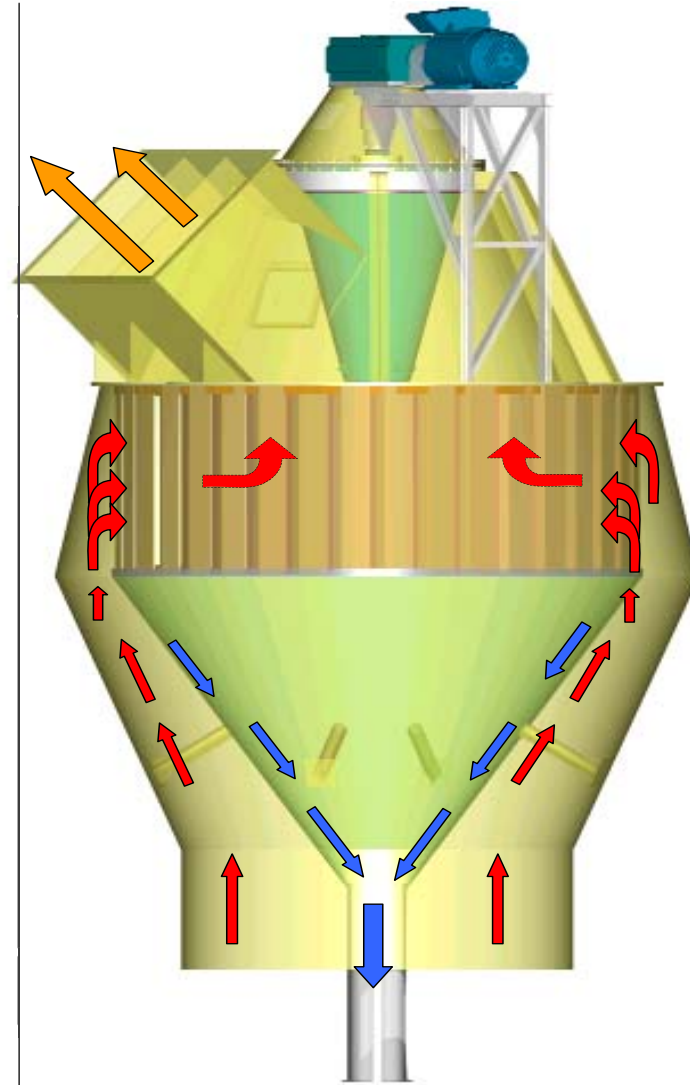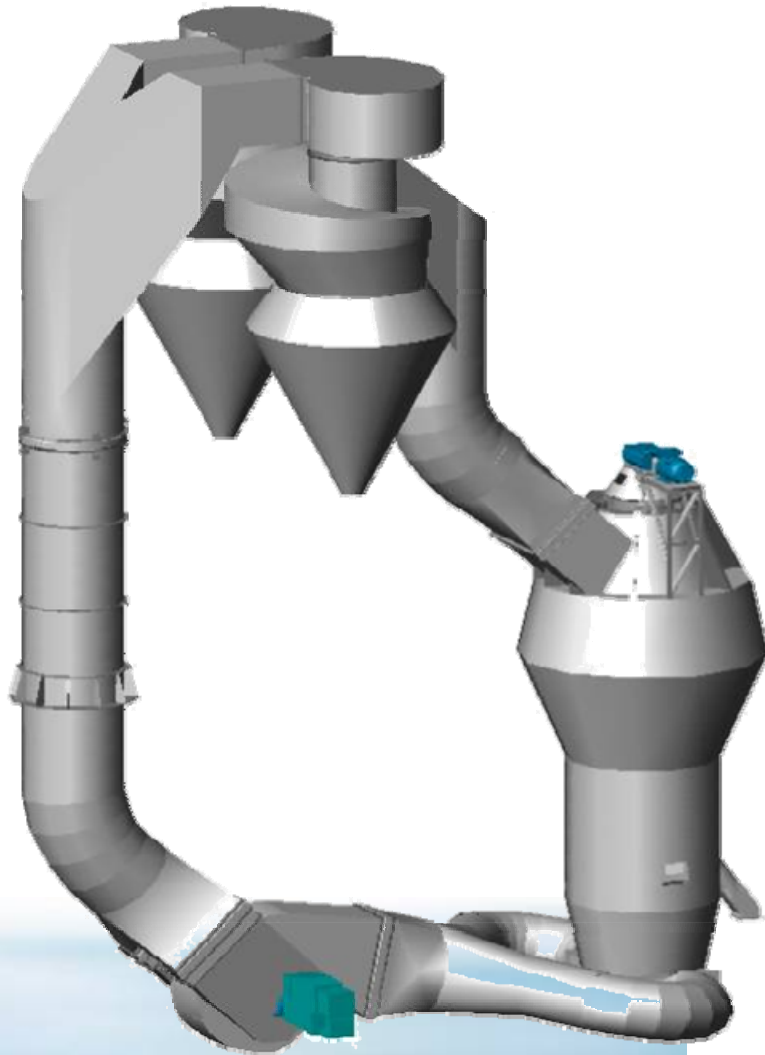
Small LV Classifier to the existing seperator
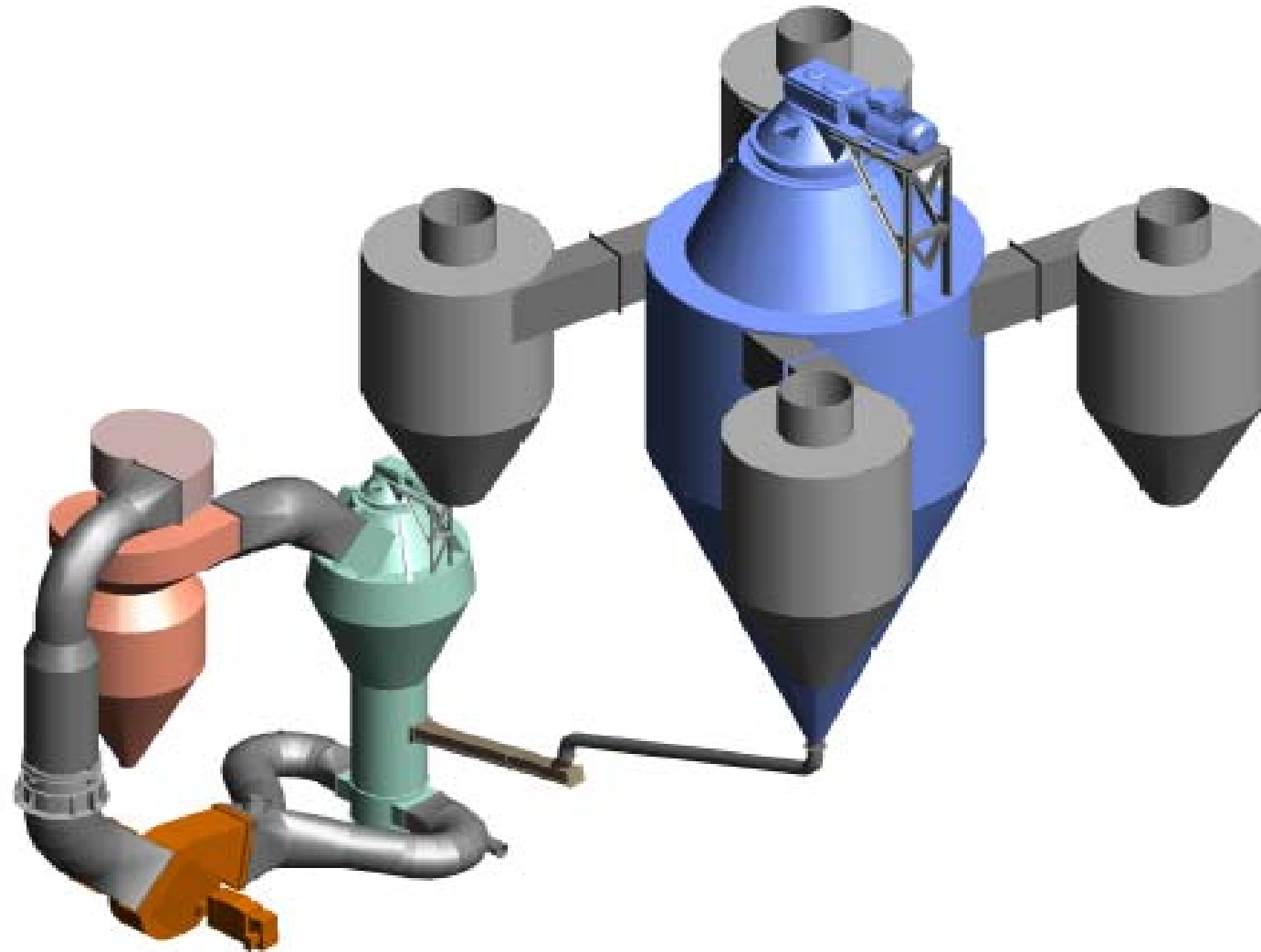
Benefits of Small Classifier

- Low investment cost
- Downtime less than 1 day
- Increased productivity
- Less power consumption
- Flexible operation

L.V. Technology Public Company Limited

If you have any questions please !!

Thank You