Fan Retrofit / Upgrades in a Cement Plant

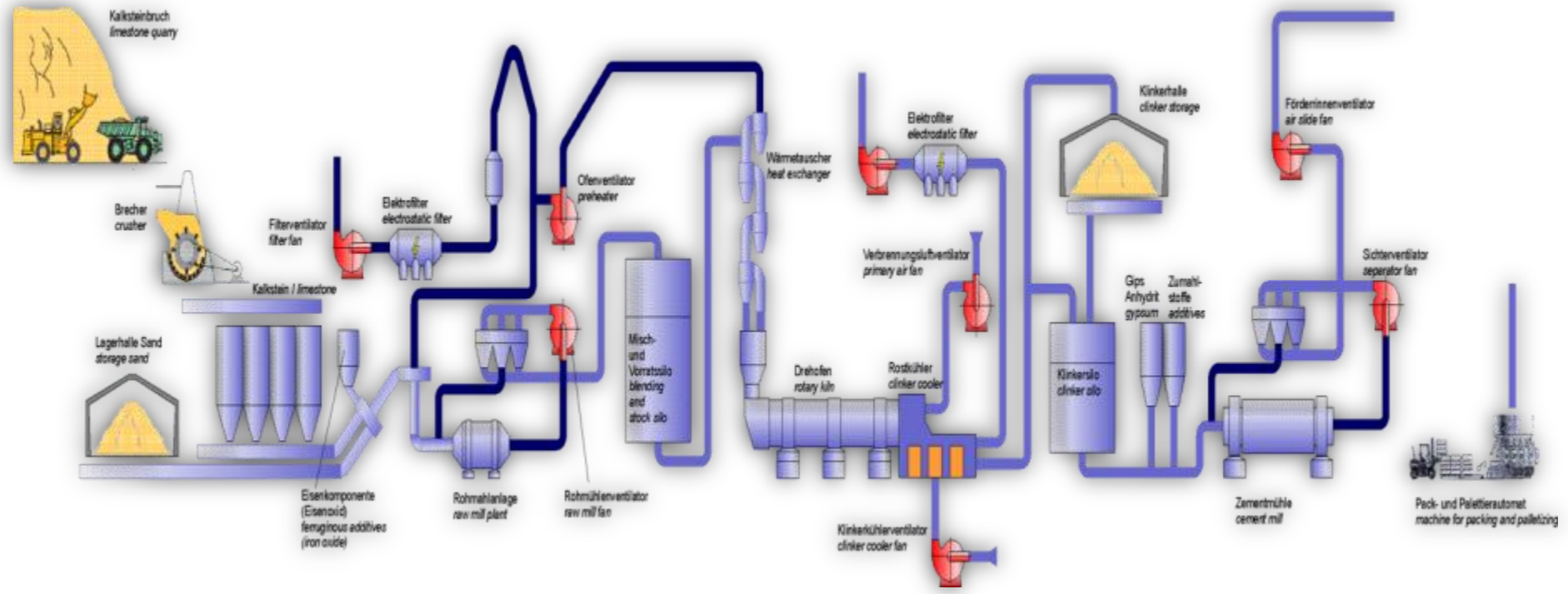
Presentation by :

- Ferdinand Rogoschweski : MD, Reitz do Brasil Ltda
- K Prasad Rao : MD, Reitz India Ltd

Reitz group companies world wide

With subsidiary companies located all over the world and manufacturing plants in Germany, Switzerland, India and China, the REITZ group guarantee that you will receive precisely the right support required in order to carry out your plans for the international stage - all performed with the typical high standards of REITZ and with the prevailing conditions of the respective country taken into account.

Process Flow and major Fans in a Cement Plant



Power Consumption of Fans in a Cement Plant

- Average specific Power consumption in a Cement Plant of 5000 TPD : 90 kwh per ton (OPC Production 3200 Blaine)
- Specific Power consumption for fans : 28 kwh per ton
- This reflects that 31% of power consumption in a Cement Plant is through fans only…
- There is enough potential to save adequate energy by retrofit and upgradation of fans…

Process Fans in a Cement Plant

- Pre Heater Fan
- Raw Mill Fan
- Raw Mill Bag House Fan
- Cooler Fans
- Cooler ESP Fan
- Cement Mill Separator Fan
- Coal Mill Fan
- Coal Mill Booster Fan

Retrofitting and up-gradation of equipment

- Retrofit is a word used frequently in Cement Plants for up-gradation of its equipment or plant.
- During Fan retrofitting, we look at the past performance of the fan and then upgrade the equipment to achieve best performance.
- Improving efficiency is the main criteria for retrofit and up-gradation of fans.
- To look at the minimal shut down period of change over.
- Example: Change of only rotor of the fan takes around five days of shut down; whereas change of complete fan takes around 15 to 30 days.
- Since the working fan is earning revenue in a Cement Plant, a short shutdown period makes Retrofit a superior and cost-effective solution.

Options of Fan Retrofit

Situation 1: The existing fan is not an efficient one perhaps due to difference between design and actual parameters. *Retrofitting helps* with little modification in impeller, *by trimming or by tipping*, that gap can be closed with minimum expenditure.

Situation 2: If solution 1 doesn't suffice, then to meet the expected requirement of flow and pressure, *the old impeller is replaced with a new one*. This way, the investment required and the payback period will be minimum.

Situation 3: If changing of just the impeller is not enough, it is possible *to retrofit it with a completely new fan* by mounting on existing foundation.

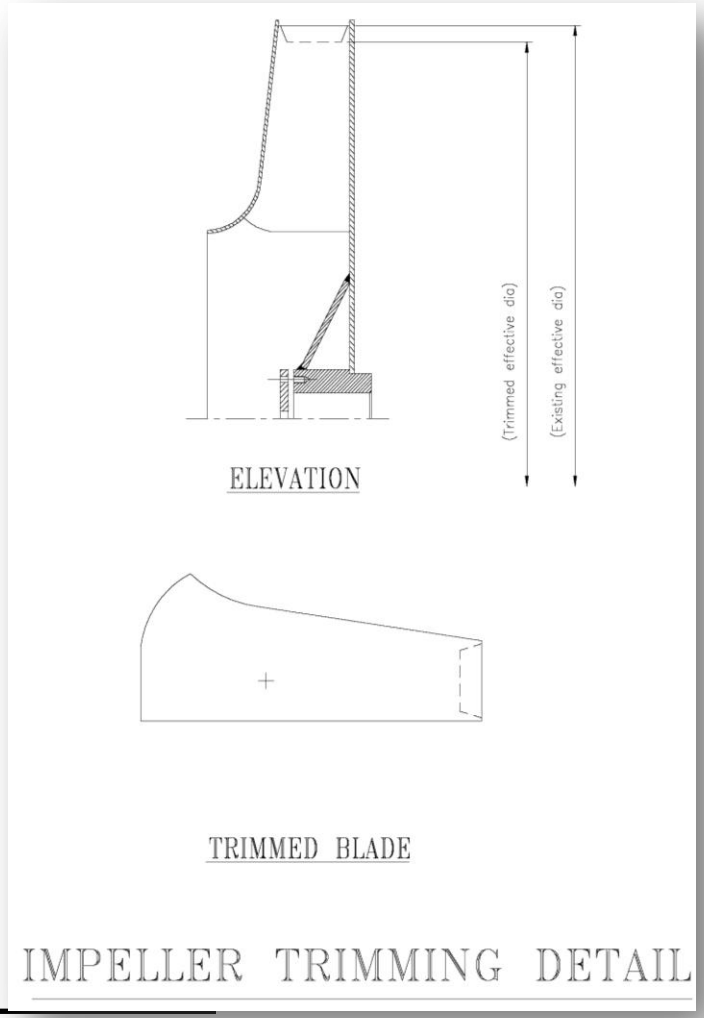
Situation 1
TRIMMING OR TIPPING OF IMPELLER

Techniques using the method of trimming or tipping of impeller to change the performance of fan are widely used and is the cheapest option.

• Due to trimming of impeller blades or increasing the impeller effective diameter by tipping the blades the geometrical similarity is disturbed and fan laws or affinity laws are not applicable for recalculation of parameters.

• With trimming or tipping the impeller of the fan the change in flow, pressure and power generally follow the same proportions, which are applicable for change in speed. Relation between change in impeller diameter and that of flow, pressure and power are

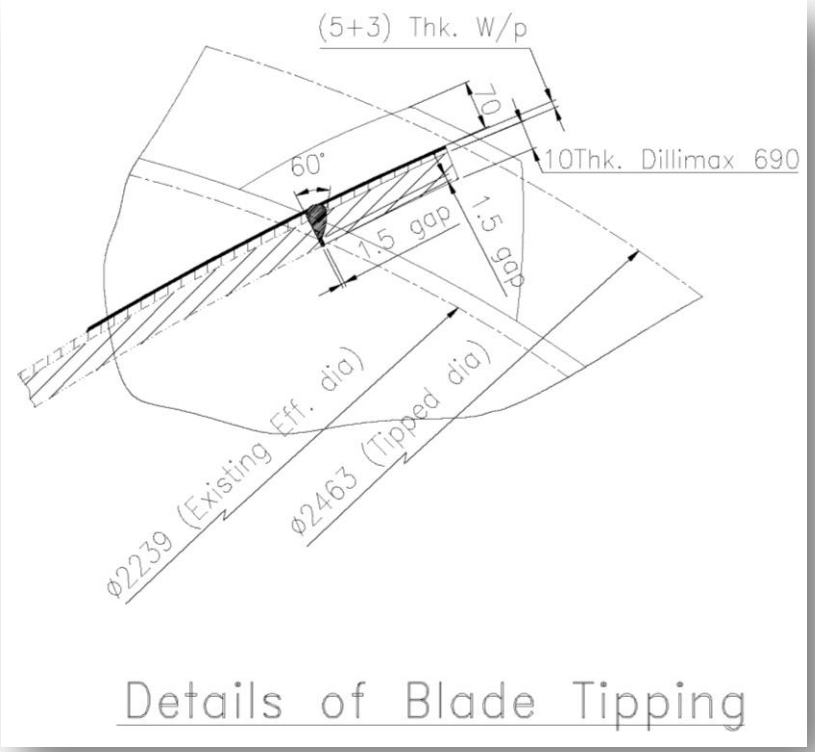
– *Change in flow* is directly proportional to *change in impeller diameter*.
– *Change in pressure* is directly proportional to (*change in impeller diameter*) ^{2}
– *Change in power* will be directly proportional to (*change in impeller diameter*) ^{3}



Situation 1
TRIMMING OR TIPPING OF IMPELLER

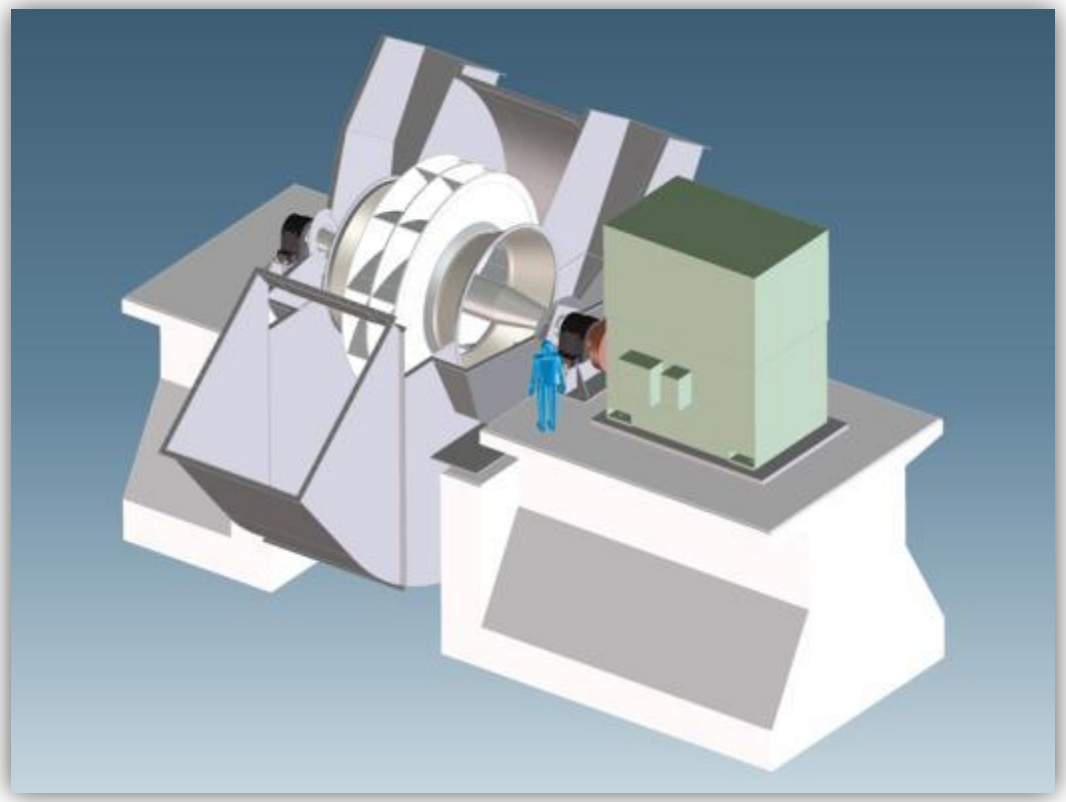
• If the change in impeller diameter is restricted to smaller extent, then change in efficiency may be considered as negligible.

• Since the fan is a low speed machine, trimming or tipping can be done to avail appreciable change in flow and pressure, without appreciable loss in efficiency. As a thumb rule, we can always consider that 10% change in impeller diameter by this method.



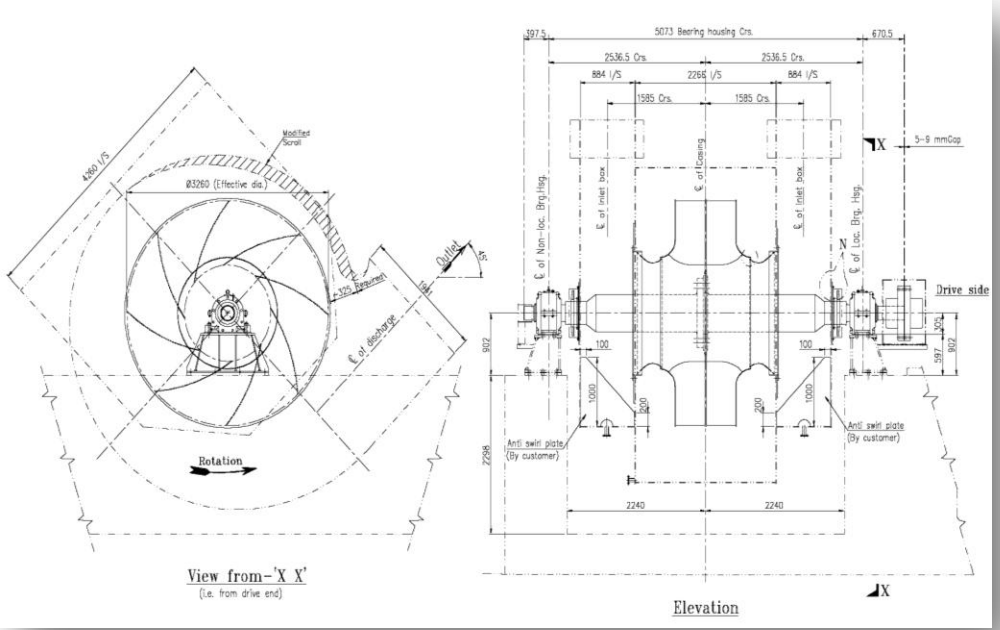
Situation 2
REPLACEMENT OF OLD FAN ROTOR WITH A NEW ONE

- New Impeller is designed close to the existing size to enable to fit inside the casing easily.
- If the designed diameter of the retrofitted impeller is bigger and if it is difficult to place the impeller in existing fan casing then modification of the existing fan casing at its throat portion, keeping the cut off clearance at required level.
- The cut off clearance between fan impeller and casing may vary between 5% and 20% depending on flow and pressure combination.



Situation 2
REPLACEMENT OF OLD FAN ROTOR WITH A NEW ONE

- The role of inlet cone is also very important for fan performance. That's why, all the retrofitted impellers will accompany the matching inlet cone.
- To keep the expenditure and down time minimum, keep all the existing components unchanged to maximum possible extent. We look for change of impeller, inlet cone and shaft while other components will remain unchanged.
- Again, while retrofitting, we look for use of existing coupling and motor. In India and also in Middle East and South East Asian countries, Reitz has carried out retrofit of over 800 fans in Cement plants and our success rate is 100%.



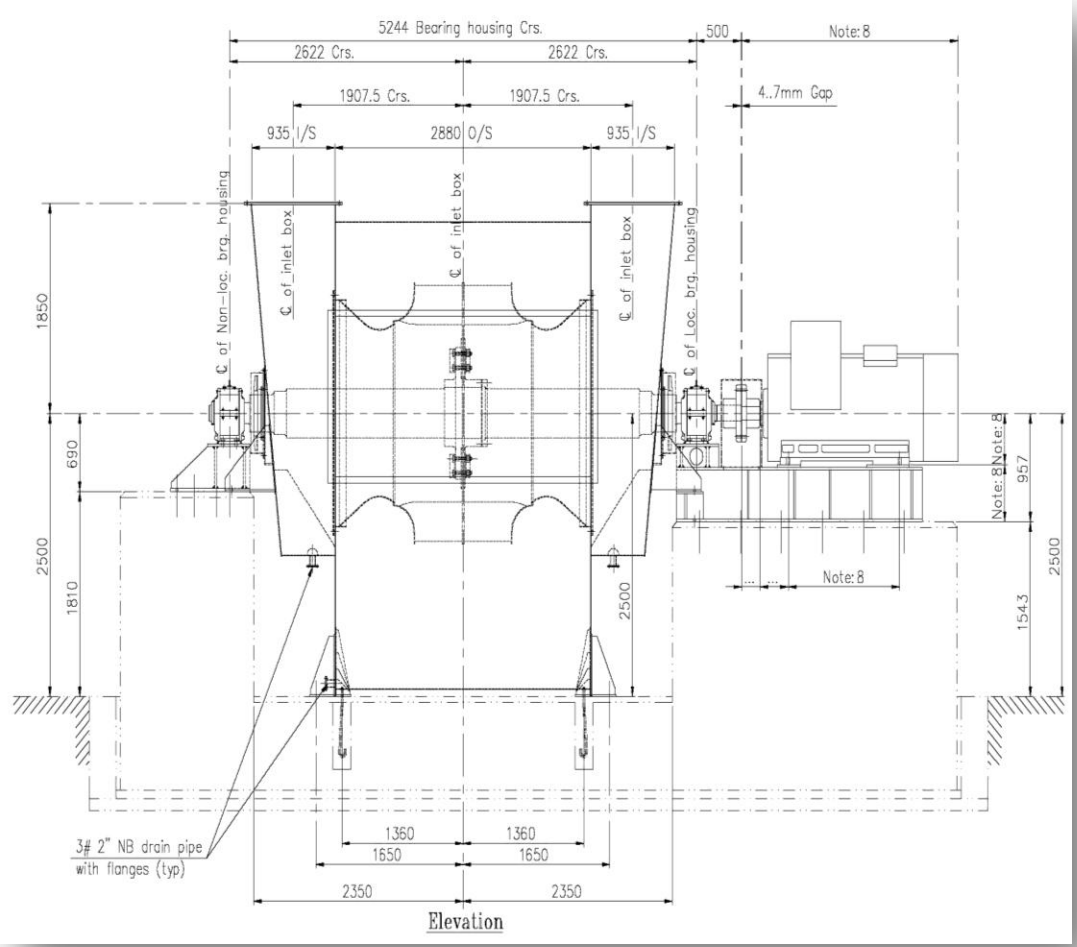
Raw Mill Fan (Retrofit) – Holcim Philippines

Situation 3
REPLACEMENT OF OLD FAN WITH A NEW ONE ON EXISTING FOUNDATION

This is the costliest proposal for retrofit and generally, it is the last option to be chosen.

If Customer has demanding plans to upgrade the plant capacity to a maximum possible extent, then the change of fan may be a necessity. Also, in some cases, due to change in process requirement, change of design of impeller is also necessary to ascertain trouble free mechanical operation. In above cases, complete change in fan may be required.

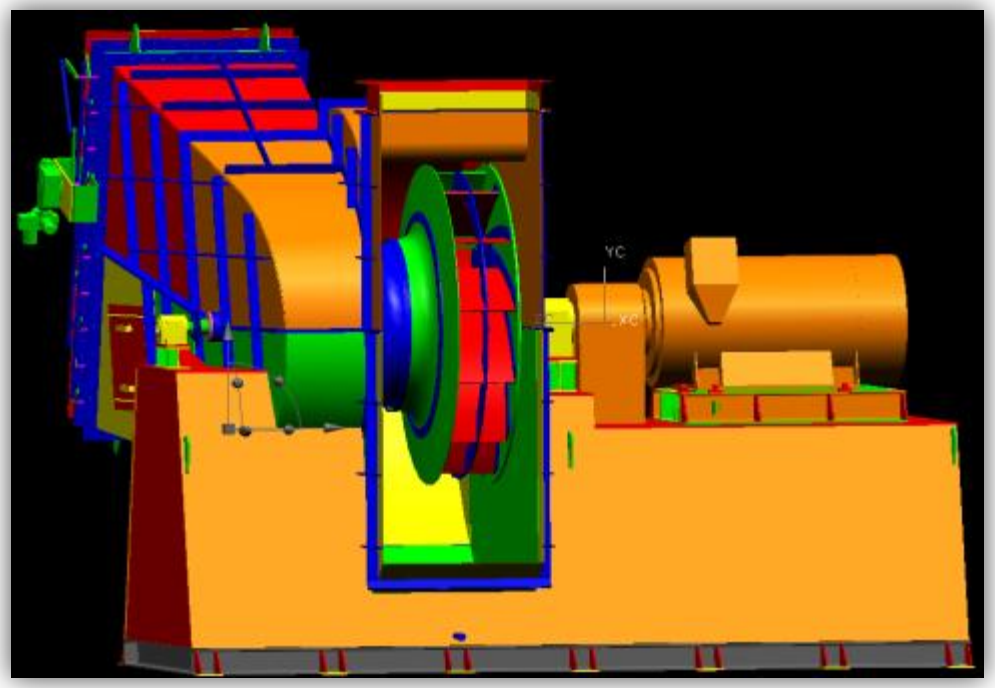
As per our experience, some fans in cement plant need special care while designing the impellers.



Situation 3
REPLACEMENT OF OLD FAN WITH A NEW ONE ON EXISTING FOUNDATION

For example, following cares are needed while selecting the fans in cement industries.
– Cooler compartment fans: Since these fans are handling atmospheric air and now-a-days, cement manufacturers are able to keep the cooler region dust free, any design of impeller will be suitable for this application. However, with our past experience, we avoid using aerofoil bladed impellers.

– Cooler ESP Fan: Though this fan is handling hot gases and with clinker dust, still any design of impeller (except aerofoil) will be suitable for this application. In this case, to get better life from impeller, it is necessary to armour the impeller on wear prone areas.



Situation 3
REPLACEMENT OF OLD FAN WITH A NEW ONE ON EXISTING FOUNDATION

Preheater Fan: If the dust handled by this fan is mild in nature, but behavior of the dust varies from plant to plant. Based on customer feed back we design the impeller with or without armouring.

But if the fan is handling lot of dust, impeller is designed such that accumulation of dust on impeller blades is avoided. This can be done by keeping the blade angle above 40 degrees. If the blade outlet angle is high then the impeller is having self cleaning property of blades.

Examples:
Raw Mill Fan - Star Cement Co. LLC, RAK – U.A.E

Components replaced : Impeller, Shaft & Inlet Cone

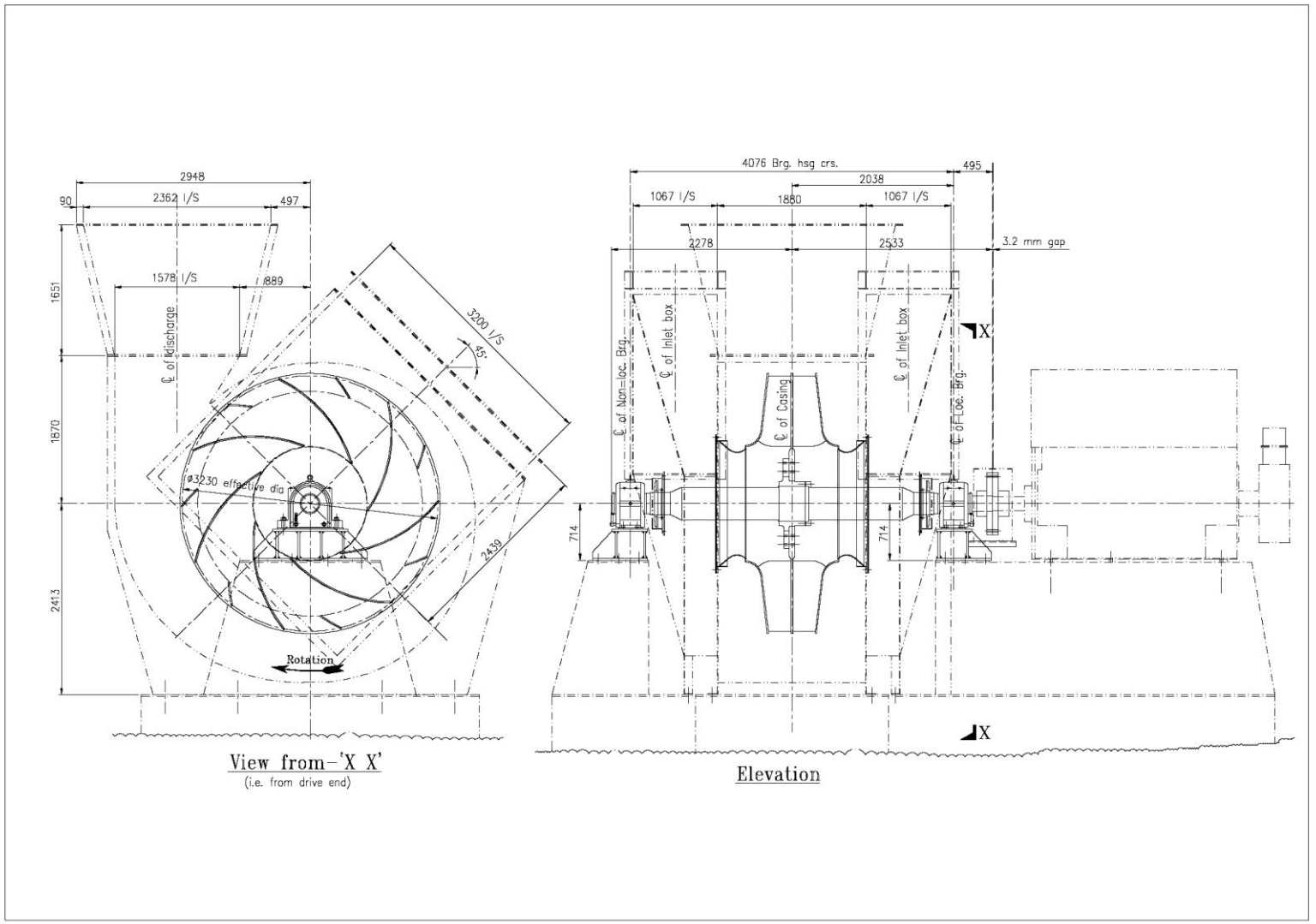
Reason for retrofitting : Improving Efficiency & Increasing Capacity

	Before Retrofitting	After Retrofitting
Flow	646,322 m^3/Hr	660,960 m^3/Hr
Static Pressure	1280 mm WG	1204 mm WG
Power	2907 kW	2520 kW
Fan Speed	980 rpm	980 rpm
Efficiency	77.5%	86.0%

Savings

378 kW (-13%)
ROI 3-8 months

Bag House Fan – Holcim ACC Retrofitted the Impeller and Shaft



Bag House Fan – Holcim ACC

Components replaced : Impeller, Shaft & Inlet Cone

Reason for retrofitting : Improving Efficiency & Increasing Capacity

	Before Retrofitting	After Retrofitting
Flow	300,000 m^3/Hr	330,000 m^3/Hr
Static Pressure	300 mm WG	270 mm WG
Power	448 kW	309 kW
Fan Speed	945 rpm	980 rpm
Efficiency	54.8 %	78.5 %

Savings

139 kW (-31%)
ROI 3-10 months

Cooler Vent Fan -JK Corp

Components replaced : Impeller, Shaft & Inlet Cone

Reason for retrofitting : Improving Efficiency & Increasing Capacity

	Before Retrofitting	After Retrofitting
Flow	245,000 m^3/Hr	466,000 m^3/Hr
Static Pressure	330 mm WG	172 mm WG
Power	367 kW	297 kW
Fan Speed	985 rpm	980 rpm
Efficiency	60 %	73 %

Savings

70 kW (-19%)
ROI 5-16 months

Cooler ESP Fan- Ultratech Cement

Components replaced : Impeller, Casing & Inlet Cone

Reason for retrofitting **:** Power Saving & Increasing Capacity

	Before Retrofitting	After Retrofitting
Flow	780,000m^3/Hr	780,000 m^3/Hr
Static Pressure	150 mm WG	180 mm WG
Power	501 kW	474 kW
Fan Speed	500 rpm	509 rpm
Efficiency	63.5 %	80.7 %

Savings

27 kW (-5%) ROI
10-32 months

Waste Gas Fan - India Cement Ltd

Components replaced : Impeller, Casing & Inlet Cone

Reason for retrofitting : Improving Efficiency

	Before Retrofitting	After Retrofitting
Flow	414,000m^3/Hr	414,000 m^3/Hr
Static Pressure	900 mm WG	900 mm WG
Power	1463 kW	1424 kW
Fan Speed	950 rpm	950 rpm
Efficiency	69.4 %	77.26 %

Savings

39 kW (-3%) ROI
13-42 months

Cooler ESP Fan – India Cements Ltd

Components replaced : Impeller, Shaft & Inlet Cone

Reason for retrofitting : Improving Efficiency

	Before Retrofitting	After Retrofitting	Savings
Flow	591,000 m^3/Hr	732,960 m^3/Hr	
Static Pressure	80 mm WG	150 mm WG	
Power	390 kW	428 kW	38 kW (+ 10%)
Fan Speed	600 rpm	678 rpm	
Efficiency	33.0 %	70.0 %	

Cooler ESP Fan - Orient Cement

Components replaced : Impeller, Shaft & Inlet Cone

Reason for retrofitting : Improving Efficiency

	Before Retrofitting	After Retrofitting
Flow	294,000 m^3/Hr	390,000 m^3/Hr
Static Pressure	70 mm WG	100 mm WG
Power	190 kW	135 kW
Fan Speed	710 rpm	745 rpm
Efficiency	29.5 %	78.7 %

Savings

55 kW (-29%)
ROI 5-15 months

Summary:
Advantages of Retrofit/Up-grade of Fans

- **Increase reliability**
- **Save cost**
- **Increase productivity of the plant**
- **Replace obsolete internals**
- **Help the Environment**

Retrofit Projects - Testimonials

ADITYA BIRLA

STAR CEMENT

Date : 23.06.2012

TO WHOM SO EVER IT MAY CONCERN

This is to inform that M/s. REITZ MIDDLE EAST F.Z.E., Sharjah - UAE, supplied 2 nos. high efficiency double inlet retrofit impellers of diameter 2962 mm for the existing Flakt-woods make Raw Mill fans. The motor capacity of each Raw Mill fan is 3500KW. These impellers are designed and manufactured by Reitz India Limited, Hyderabad, India.

These impellers were installed and commissioned during May, 2012. Reitz Middle East guaranteed a total power savings of 430 KW/hour for both the fans together. The power savings achieved by us is well above the guaranteed 430KW/hour.

We wish Reitz Middle East all success in all their future endeavors.

For Star Cement Co. LLC.

23.06.2012

(Mr.T.V.S.Chidambaram)

Chief Operating Officer.

RAW MILL FANS RETROFITTING

Buyer	:	Star Cement Co. L.L.C.
Location	:	Ras Al Khaimah, UAE
Contract No.	:	4500040028 Dated 15.11.2011
Equipment	:	Raw mill fans
Date of PG test	:	11.06.2012 and 12.06.2012
Duration of PG test	:	26 hours

Parameter	Unit	Guaranteed Performance Value	Tolerance Limit	Achieved Performance Values during PG test
Raw mill fan 1- Motor output power	kWh	170	-	520
Raw mill fan 2- Motor output power	kWh	260	-	515

The achieved performance values are much higher due to the following:

i. Retrofitting of the raw mill fans impeller.
ii. Process optimization of the raw mill operation.
iii. Plugging the false air ingress through raw mill main star feeder, across mill body and across raw mill cyclones.
iv. Both raw mill fans performance is found to be matching with designed characteristic curves.
v. The PG test reports for raw mill fan 1 and raw mill fan 2 as given by Ritz Middle East FZE, Sharjah are attached as Annexure 1 and Annexure 2 respectively.
vi. The summary sheet of operating parameters and energy meter readings is attached as Annexure 3.
vii. The copy of Purchase order is attached as Annexure 4.

Thus Reitz Middle East FZE, Sharjah has successfully achieved the performance guarantees.

For Star Cement Co. L.L.C

For Reitz Middle East FZE

21/06/12

STAR Cement Co. L.L.C.
P.O. Box: 32371
Ras Al Khaimah,
United Arab Emirates

Tel.: +971 7 2448950
Fax: +971 7 2448960

Web.: www.starcement.net
E-mail: star-rak.salesoffice@star.adityabirla.com
cementrak@starcement.net

B K BIRLA GROUP OF COMPANIES

Century Cement

(Prop. : Century Textiles & Industries Ltd.)
P.O. Baikunth - 493116, Dist. Raipur (C.G.) India
AN IS/ISO 9001 : 2000 & ISO 14001 COMPANY
Ph. : 07721-261222-26, 261485, 261252 (EPBX), 261233, 261474, 261304 (Sales), 261245 (Purchase)
Fax : 07721-261230 (Genl.), 261229 (Sales), 261356 (Pur.), 0771-2424001 (Raipur Office)
E-mail : ..... @webmail.centurycement.co.in (Insert Dept. name before @)
i.e. : accounts, civil, drawingoffice, edp, electrical, instrument, kiln, mechanical, mines, packingplant, personnel, powerplant, process, purchase, qualitycontrol, sales, stores, pvhari, glshri, Raipur Office : cent_rpr@sify.com
website : www.centurycement.co.in

BIRLA GOLD

January 30, 2009

TO WHOMSOEVER ITMAY CONCERN

This is to certify that we are using Reitz India make heavy duty centrifugal fans for our various processes for last one decade and all the fans are working satisfactorily.

In recent past, we have replaced impellers for 2 No. old preheater fans with Reitz impellers to get enhanced performance and better efficiency. We have found that performance is better than expected.

The design parameters of the preheater fans are –

Duty Parameters	Design	Operating
Flow rate	2,88,000 m^3/hr	2,82,404 m^3/hr
Static pressure	610 mm WG	525 mm WG
Temperature	290 deg. C	305 deg. C
Fan shaft power (without / with dust)	584 / 620 KW	466.45 KW
Fan speed	900 rpm	795 rpm
Static efficiency (without / with dust)	81.9 / 77.2%	86.6%

Regards,

For Century Cements,

Alok Patni
Joint President (Plant)

Thanks and looking forward to Greener Future