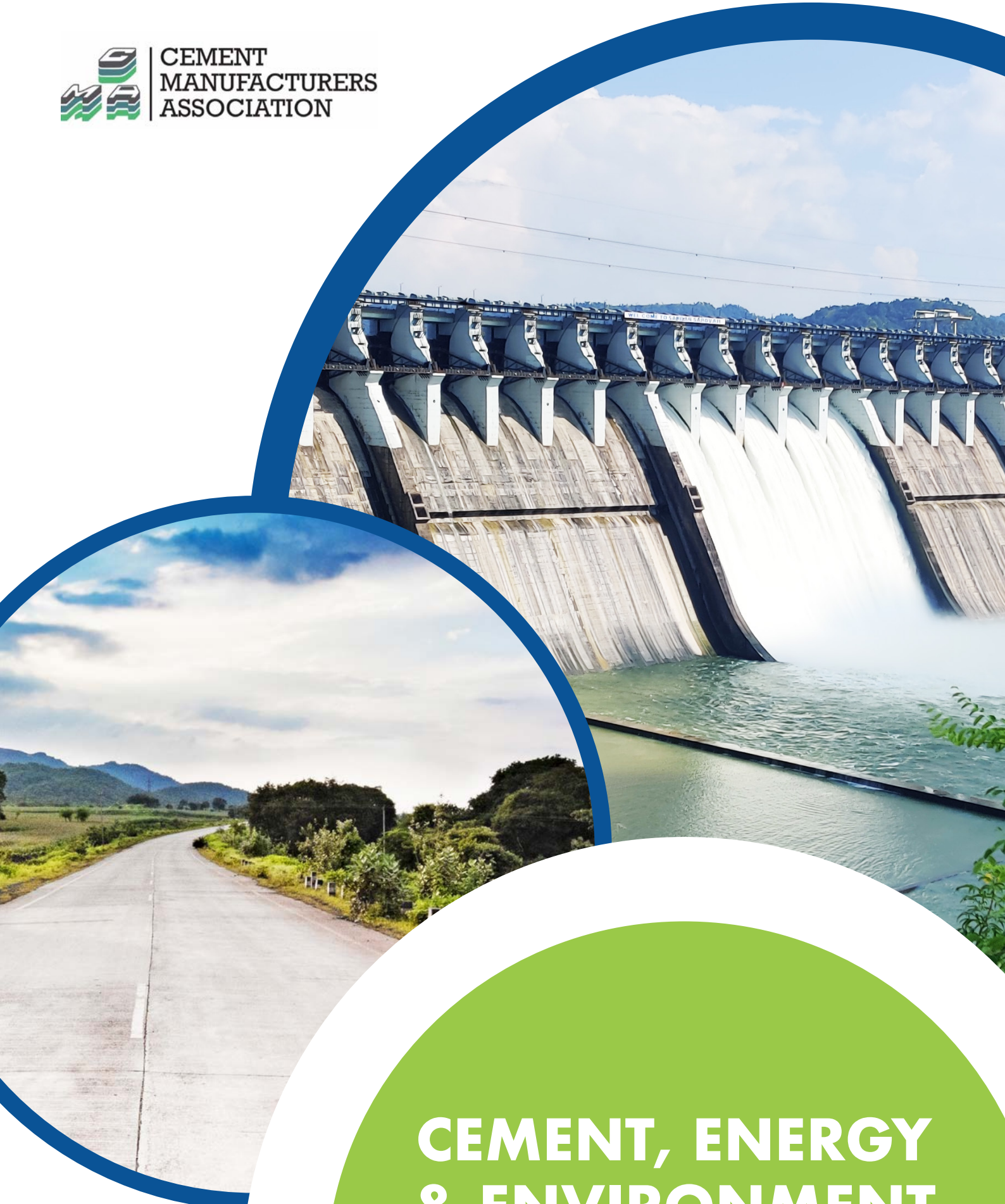
CEMENT MANUFACTURERS ASSOCIATION



CEMENT, ENERGY & ENVIRONMENT

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EDITORIAL

At the outset, I would like to extend my good wishes to all our readers and trust you are doing well. We are happy to share with you the January-June 2021 edition of the *CMA Cement, Energy and Environment Journal*. Over the years, we have endeavoured to share with you the developments in the Cement Industry from the technology perspective to energy efficiency to AFR and much more. It has been our effort to keep you updated not only on the developments within the Cement Industry but also its response to the changing landscape and environment around us. I do hope you continue to find value in the *Journal*. I would like to thank the contributors to the *Journal* and invite many more experts to share their experiences in the Cement Industry, which can be fruitful learnings for all of us.

I wish you a good read! Stay safe!

APARNA DUTT SHARMA
SECRETARY GENERAL

Editor: K K Roy Chowdhury

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By K K Sharma, U K Sharma & Ketan Goel
Invotech Industrial Solutions Private Limited

Abstract

Compressed air is a very useful tool in cement manufacturing process. It is used to provide the energy to move materials and items of equipment. However, it is a very expensive form of energy. The air is almost always compressed by electrically-driven screw compressors. Unfortunately, only 10 per cent of the electrical energy input goes for producing useful mechanical work. The remaining some 90 per cent is lost as heat with compression and idling losses being the greatest. Owing to this, Compressed air is such an expensive form of energy.

Introduction

India is reckoned as the second largest cement producer in the world, which accounted for over 12% of the global installed capacity as of 2020. India's overall cement production capacity was nearly 545 MT in FY20. Of the total capacity, 98% lies with the private sector and the rest with public sector. The top 20 companies account for around 70% of the total cement production in India. Further, as India has high quality and quantity of limestone deposits, the cement industry promises huge potential for growth. The demand of cement industry is expected to reach 550-600 MT per annum (MTPA) by 2025 because of the expanding demand of different sectors, i.e. housing, commercial construction, and industrial construction.

The above data may be enough to assume at what level cement manufacturing units must be using Compressed air in their production facilities. It is too easy for Companies to take compressed air for granted for their use and abuse to grow. Such abuses become ingrained in the way the cement factory is operated. However, in order to survive in a tough competitive environment, many companies are searching for ways to make savings in their production. Such savings can often be found in their existing compressed air systems, which have generally been in place for years. Up to 60% of energy costs can be saved through optimization at both the production facility and system level. Even small gains in efficiency and reduction in consumption

can translate into significant cost savings. However, companies can only achieve this target by considering the compressed air system as a whole. Similarly, use of Compressed air must be carefully controlled and not abused. Further, cement companies also have to pay heed towards the aspect of energy management.

Energy management

Energy management is the means to control and reduce any organization's energy consumption. It is reckoned that Industry uses more energy than any other end-use sector, consuming about one-half of the world's energy requirement. Controlling and reducing any organization's energy consumption is important because it enables to reduce costs which increase as energy costs rise. Similarly, it has other aspects also, as under

- **Reduce** carbon emissions, environmental damage, cost-related implications of carbon taxes and carbon footprint to promote a green, sustainable image
- **Recognition** of any company as a "green company"
- **Reduce risk** of energy price increase or supply shortages which seriously affect profitability or even sometimes make it impossible for any business/organization to continue
- **Improves/increases productivity** and can provide the products to customers at minimal cost
- **Gives** competitive advantage to organization/company
- Improve operational reliability and control

What are the costs of compressed air generation?

Compressed air costs are normally expressed in Nm^3 (at 1.0 bar and 20 °C to ISO 6358 or, for many compressor manufacturers, in m^3 to ISO 1217:2009, Annex C). These can be determined using the sum of fixed and variable costs and using the annual delivery output of the compressor station

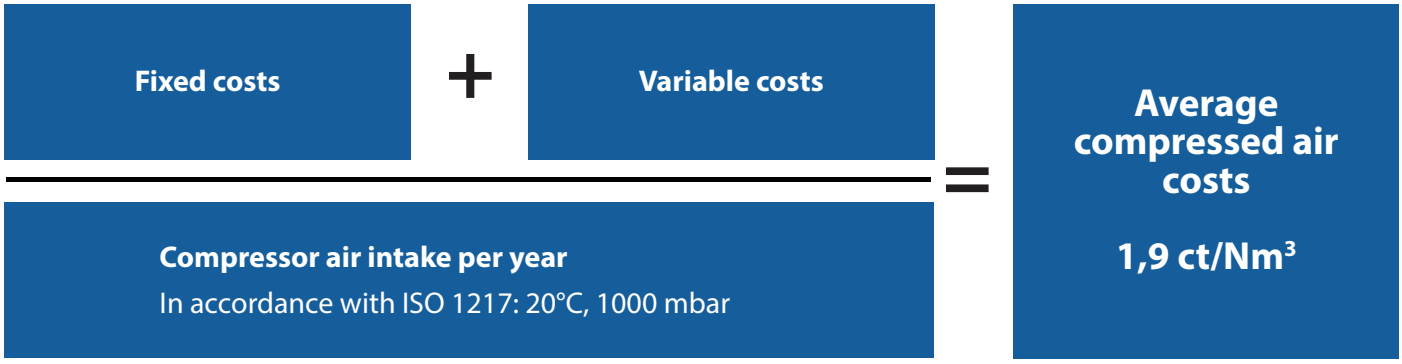


Figure showing calculation of average compressed air costs

Annual (p.a.) fixed costs include

- Depreciation of the investment made
- Interest rate
- Space utilization costs

Variable costs are made up of

- Energy costs over the full-load periods and no-load times of the compressors
- Costs of consumables such as oil, coolant etc. p.a.
- Maintenance and costs

The largest part of the costs, at approx. 75%, is taken up by the energy costs. In order to generate 1 Nm^3 of compressed air, modern compressor stations require between 100 and 120 Wh/Nm^3 (compressed air index [kWh/Nm^3])

How much do leakages cost?

Even small leakage offers the potential for significant savings. The table below shows how much air is lost as a result of leakages with a specific hole diameter and what additional costs are incurred:

p1 (rel.)	Leakage rate in Nl/min					
	0.5 mm	1.0 mm	1.5mm	2.0 mm	2.5mm	3.0mm
3 bar	9	36	81	145	226	325
4 bar	11	45	102	181	282	407
5 bar	14	54	122	217	339	488
6 bar	16	63	142	253	395	569
7 bar	18	72	163	289	452	651
8 bar	20	81	183	325	508	732

p1 (rel.)	Costs/year					
	0.5 mm	1.0 mm	1.5mm	2.0 mm	2.5mm	3.0mm
3 bar	€ 90	€ 361	€ 812	€ 1,444	€ 2,256	€ 3,248
4 bar	€ 113	€ 451	€ 1,015	€ 1,805	€ 2,820	€ 4,061
5 bar	€ 135	€ 541	€ 1,218	€ 2,166	€ 3,384	€ 4,873
6 bar	€ 158	€ 632	€ 1,421	€ 2,527	€ 3,948	€ 5,685
7 bar	€ 180	€ 722	€ 1,624	€ 2,888	€ 4,512	€ 6,497
8 bar	€ 203	€ 812	€ 1,827	€ 3,248	€ 5,076	€ 7,309

Note: 1 Euro equals 88.65 Indian Rupee as on 25-02-2021

Table 1/2: Leakage costs within one year for operation 24 h/365 days, calculated using compressed air costs of 1.9 ct/Nm³.

The point at which a leakage is identified as a loss depends on the ratio of leakage to overall consumption. Major leakages – where the air leak is clearly audible – are costly and supposed to be rectified immediately. Similarly, medium and small leakages (leakages with a hole diameter of less than 0.5 mm) which can be detected simply by using professional leakage detection equipment are also supposed to be rectified promptly. It is a thumb rule that 20% of the detectable leakages in existing systems account for up to 80% of the avoidable costs. Therefore, it is felt prudent that leakages be fixed immediately which will ultimately save energy as well as cost of production.

Energy efficient solution

We at IISPL, took this issue as a challenge and started identifying the ways for eliminating routine wastes, which cause higher energy consumption in cement process industry. We also studied on means to provide best and economic solution to cement industries so as to save production cost as well as conserve natural resources. Having done in depth study, Invotech Industrial Solutions Private Limited has recently developed a product called Arrest Master ABS for enhancing energy efficiency. It can be used to cool down the area rapidly with less air consumption but gives output 7 to 8 times as compared to normal air consumption. It is a special design Nozzle, works on COANDA EFFECT.

Arrest Master ABS uses little amount of compressed air to deliver high volume output. Arrest Master ABS, is a compressed air boosting device, which has been designed in a way so as to give trouble free & maintenance free service as there is no moving part in it. It can also be used to cool down bearing housing, cutting hot material, cooling of lathe machine jobs etc.

Arrest Master ABS: Compressor air saving Nozzle System- For Kiln Shell, Bearing housing cooling

Bearing housing cooling by Energy efficient device (Arrest Master ABS)
Input @ 6 Bar = 11 CFM, Output= 77 CFM, Atmospheric contribution= 66 CFM

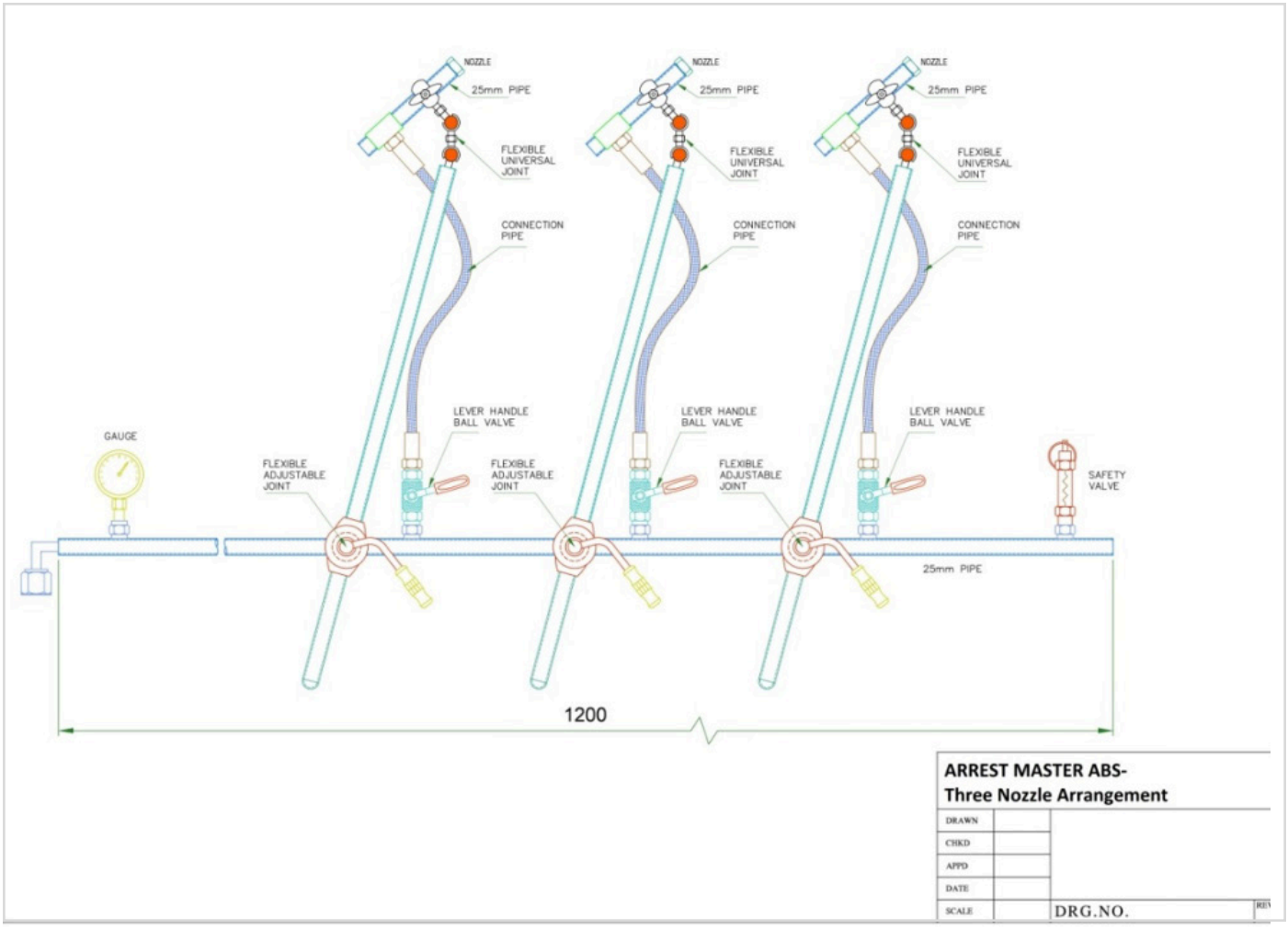
Product highlights of arrest master abs

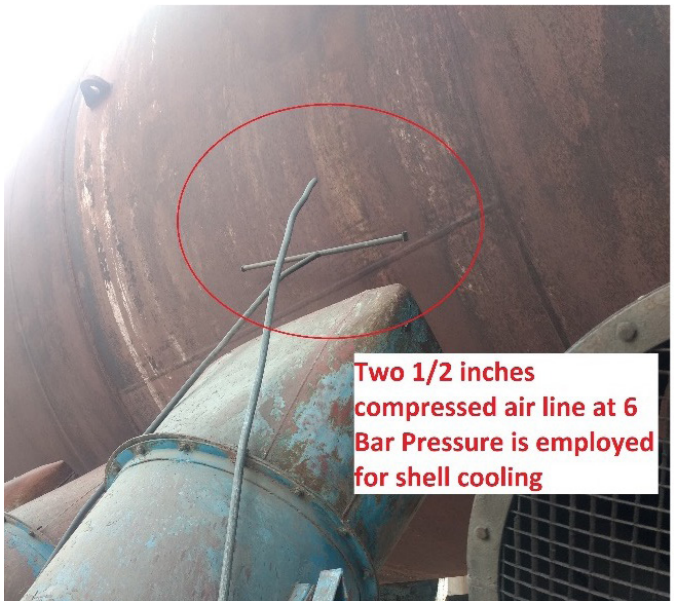
- Energy efficient device
- Provides efficient cooling
- User friendly & ready-to-use modules
- Easy installation and Relocation

Power consumption comparison of abs v/s fad & axial fan

	Cooling By	Consumption	Power cons.	Per day Cons.	Power Rate	Power Cost	Yearly cost
A	½ inch pipe (With compressed air)	100 CFM	20 KW	480	6	2880	950400
B	By Axial fan (5.5 KW motor)		5 KW	120	6	720	237600
C	ABS	11 CFM	0.2 KW/CFM	52.8	6	317	104544
	ABS savings V/S FAD ½ inch pipe	9 times less power cons with compare ½ inch pipe line air					
	ABS saving V/S Axial fan	2.25 times less power consumption with compare with Axial fan					
	Payback period	22 Days (Compare ABS V/S Axial fan)					
	Pay back Pd.	3 Days (Compare ABS V/S FAD ½ inch)					

Arrest master abs- three nozzle arrangement





Conventional practice

Air output = 200 cfm by two ½ inch lines

Total consumption= 200 cfm

Arrest master abs- three nozzle arrangement at kiln shell

Air inpu t= 11 cfm/nozzle

Air output = 77cfm/ nozzle

Total output = 231 cfm

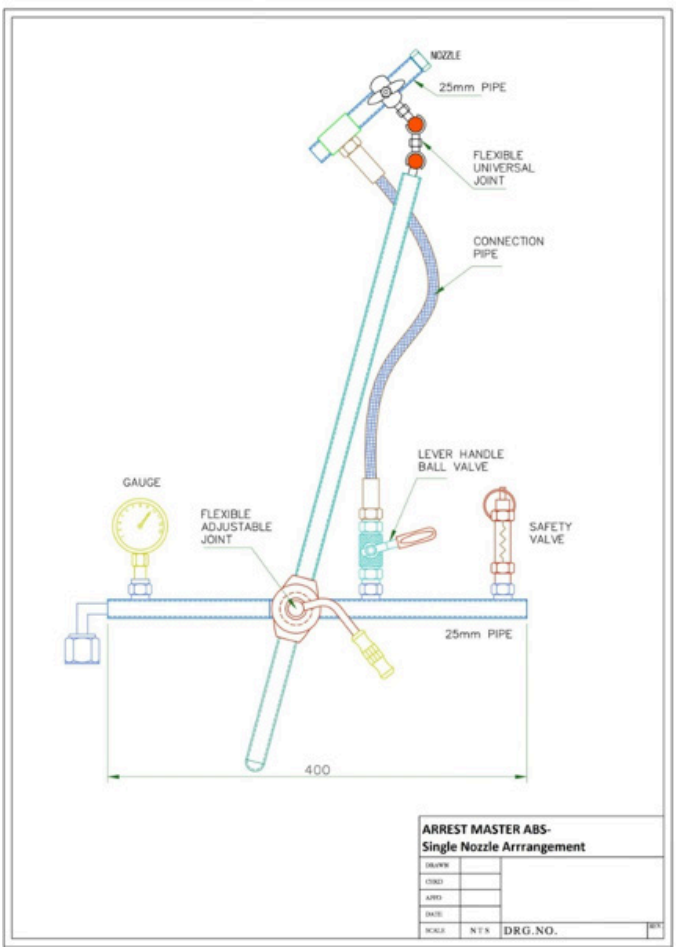
Total air consumption = 33 cfm

Arrest master abs- three nozzle arrangement for kiln shell

Launched Arrest Master ABS System at

16th NCB International Seminar on Cement, Concrete & Building Materials held from and 03rd to 06th December, 2019 at Manekshaw Center, New Delhi.

Arrest master abs- single nozzle arrangement



Conventional practice

Air output = 100 cfm by ½ inch line

Total air consumption = 100 cfm

Arrest master abs- single nozzle arrangement at bearing housing

Air input = 11 cfm/nozzle

Air output = 77 cfm/nozzle

Total air consumption = 11 cfm

Invotech Industrial Solutions Private Limited keeps itself abreast of latest development in Cement/Power Industry so as to cater the need of the Industry using latest technology and quality systems. Also, with a view to retain the requisite competitive edge in the market, participated in various Seminars, details as under

- 15th & 16th NCB International Seminar on cement, concrete & building materials held from 5th to 8th Dec, 2017 and 3rd to 6th Dec, 2019 at Manekshaw Center, New Delhi.
- "National workshop cum technology exhibition to promote energy efficient & cleaner production for sustainable industrial growth" held from 8th to 9th March, 2018, at India Habitat center, New Delhi, where presented a Technical Paper on "SIGNIFICANT SAVINGS IN ENERGY THROUGH FALSE AIR REDUCTION" & received an award for "UPCOMING ENTREPRENEUR IN THE FIELD OF ENERGY EFFICIENCY".
- 14th & 15th Green Cementech 2018 & 2019 at Hyderabad International Convention Center, Hyderabad where presented Technical Paper on "Enhancing Energy efficiency in Captive Power Plants by reduction of False Air".
- Some of our articles also published in prestigious CMA's Technical Journal "Cement Energy & Environment", Vol. 17 No. 1 (Jan – Jun 2018) & Vol. 18 No. 1 (Jan – Jun 2019).

Summary

An integral approach to optimize energy usage in a compressed air system has a range of benefits for the operator of compressed air systems, such as:

- Reduction in energy costs and, as a result, in operating costs
- Reduction in costs for maintenance and servicing
- Increase in process security
- Reduction in unplanned production downtime and associated costs

Conclusion

Substantial potential for energy efficiency improvement/cost cutting by adopting innovative ways exist in the Cement industry. Persistent efforts are also being made by Cement industry to continue to improve energy efficiency and reduce the energy cost for survival and growth. Our baby step towards saving "Compressed Air" can contribute immensely towards cost cutting of Cement Industry. It is needless to mention that our efforts to improve energy efficiency will also minimize greenhouse gas and mitigate the environmental problems associated with cement production.