

# Investigation of Fuel Saving in Annealing Lehr through Magnetic Material Fuel Saver

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**Abstract:** “Annealing is a process of slowly cooling glass to relieve internal stresses. The process may be carried out in a temperature-controlled kiln known as a Lehr”. When in case of glass manufacturing if raw glass suddenly removed from a cabinet of 1500°C to room temperature then it break due to the reason that the temperature inside the glass bottle and outside is different this will produce strain which cause breaking of glass. Annealing is the process which decreases the sudden cooling & minimizes the possibility of strains occurring. To analysis the cooling process, it is necessary to get correct information on why stain occurs in glass. This paper helps to understand the process of annealing and how to minimise the cost of the process.

**Keywords:** Glass, Stress, Annealing, Magnet, Magnetic Material Fuel Saver.

## 1. Introduction

“Annealing is a process of slowly cooling glass to relieve internal stresses. The process may be carried out in a temperature-controlled kiln known as a Lehr.” Lehr is high technology process & is designed to be used by the glass Industries for processing their products. The Lehr is manufactured for carrying out the annealing of glassware. The well designed & efficient air guiding & distribution system incorporate in this Lehr helps in excellent heat treatment & annealing of products. The automatic temperature control & draft system included further add to its advantage. Burner used for burning fuel that provide heat energy thus ensuring a very neat & clean of glassware. The annealing process starts with the entry of products into the 1<sup>st</sup> heating zone. As the products move through 2<sup>nd</sup>, 3<sup>rd</sup> heating zones the product temperature reaches approximately to 500°C – 700°C. The product cooling cycle follow the soaking through 4<sup>th</sup> zone and throw fast cooling zone No 5. Once the lower annealing point (LAP) of the glass is attained, the fast cooling of glass will commence. Finally the product leaves the zone no. 6 with a temperature of approximately ≤100°C (20°C to 30°C from ambient temperature.) The automatic draft system principal in Lehr function & elaborately disused in the later chapters not only ensures a perfect annealing by utilizing the bottle heat but also transfer the heat energy back in the Lehr interior. This use of internal heat energy minimizes the Lehr operation, energy consumption thus resulting in a higher thermal efficiency of the system.

Lehr is available in two types; a direct fired type where the combustion gas directly contacts with the product and a muffle type where gas and Products are separated from each other by the partition. The muffle type permits the use of less expensive heavy oil but the heat efficiency is low.

## 2. Construction Detail

The simplified design & construction of plant layout will help the plant personnel to operate the unit safely &

economically because of its simplified maintenance procedure. Proper attention is given at design stage in selection of materials & choosing quality component to ensure trouble free & smooth working, coupled with long life & low maintenance costs. The Lehr is made of with heavy gauge steel frame using 304 stainless steel in the hot zones, in order to increase Lehr life & reduce maintenance costs.

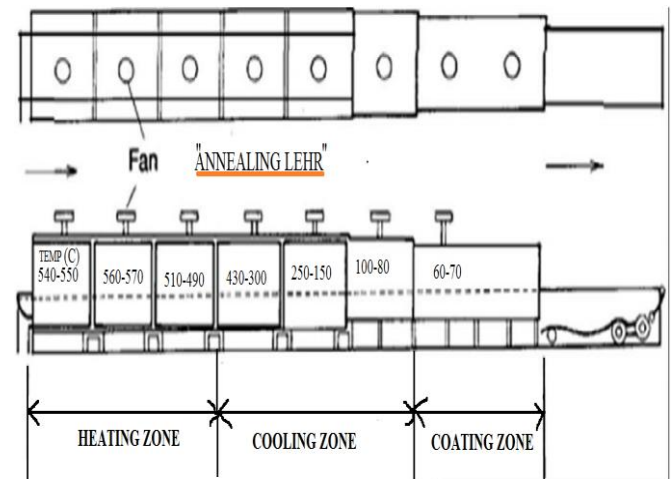
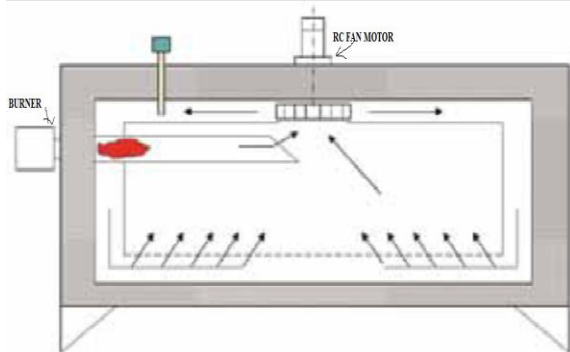


Figure 1: (Annealing Lehr)

The force air convection system provided on these Lehr’s uses stainless steel radial blowers, built of ss304 material, (dynamically balanced to 2 gm) & employs the most efficient system of air circulation. It forces hot air through the belt across the container & then drive back to the enclosed re-circulating chamber. Each heating & cooling zone has the provision for automatic temperature control. The system provides plant personnel with an easy method of controlling the extract desired temperature in each zone. Thus maintain a desired temperature profile across the Lehr. The belt support is constructed of heavy gauge stainless steel for all zones. The reason behind using SS is to prevent formation of corrosion. The longitudinal skids are constructed using heavy steel flats of 8mm thick to enhance the skid life. The smooth finish, obtained from the aforesaid steel to facilitate a longer belt life. Further high strength skid contains angles &

channels also to prevent sagging. High speed convection blower distributes a large volume of hot air flow through the Lehr chambers to bring about the desired temperature in hot zones efficiently & economically.



**Figure 2:** (Location of burner & RC Fan Motor)

### 3. Magnetic Material Fuel Saver (MMFS)

A magnetic material fuel saver is a device which is used to alter atomic construction and organize fuel molecules (fuel quality) so that proper combustion happens in "Annealing Lehr". As magnetic field is applied to ionizing fuel feed to combustion chamber(BURNER) which enhance combustion process and gives out lower emission and improved the fuel gas efficiency. Magnetic field applied to fuel line atomizes fuel gas properties which get adheres to more oxygen molecules and enhances fuel air mixture. This provides peak magnetic pipe performance while extending burner maintenance and filters change intervals thus reducing harmful emissions and carbon deposits & also we can ensure more complete combustion.

Basic concept of magnetize fuel gas: In 1989, Hans Dehmelt of university of Washington awarded noble prize in physics for his great contribution in fundamental properties of electrons. According to that electrons having ability to store up energy within itself similar to flywheel called spin. When it provides small amount of magnetic field, it absorb the energy and properties will change which is based on the below theories i.e.

1. Chemistry theory – Covalent bond,
2. Physics theory – Barnett effect,
3. Math's theory – Quantum mechanics.

#### Chemistry Theory

Particles are made up of number of atoms. An atom having equals number of Proton & electron in neutral charge, if greater number of electrons is there then -ve charge is obtained & if reversed then +ve charge is obtained. We are familiar with construction of fuel molecule (C--H bond). Each electron has two movements 1) Spin & 2) orbital movement which results in mixing of fuels. shows molecules of fuel has nucleus at it center around which electrons are orbiting, which having tendency to attract towards nucleus, due to which intermolecular force of attraction increases & thus fuel particle are not actively interlocked with oxygen during combustion & some un-burn fuel goes into exhaust & thereby causing incomplete combustion .

When we apply magnetic field around fuel inlet lines, due to magnetization we reduces intermolecular attraction of fuel molecule, which results in better combustion of fuel.

#### Physics theory:

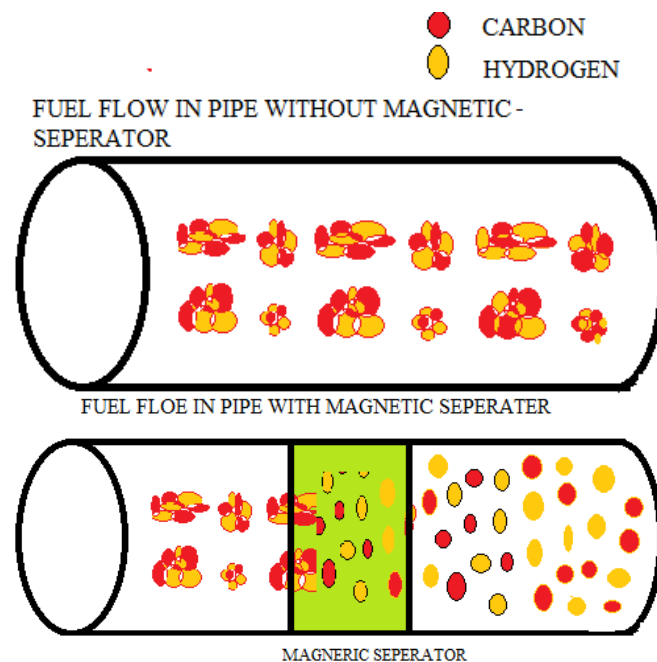
Due to Magnetic effect on molecules, spinning electrons will absorb the energy and finally flip into alignment. Because of that cluster structure of fuel breaks i.e. bonds will break into fine particles. Now, this fine particles (C and H) having magnetic influence, which tend to adhere more oxygen electrons i.e. extra oxidation is done and ultimately complete combustion at its optimum value is obtained , hence pollution will be reduced.

#### Math's theory:

Quantum (Math's) theory is used for analyzing the above effects which are occurred in covalent bond & Barnett theory. Experimental Investigation of Magnetic Fuel Separator (MFS)

#### Test Location

Properties of MMSF Device: The ferrite magnets (Magnetic flux density is from 1000-1800) are most cost effective & withstand with the temperature of burner inlet line for treating the fuel. Annealing Lehr burner, horizontal Lehr, R.c Fan motor for heat circulation and other parameter shown in figure.



**Figure 3:** (Without and with used of Magnetic fuel separator)

### 4. Calculation

Ultimately the fuel saving is 450-391 = 59 m3 per day  
 That means (59\*30\*12) = 21240 m3 fuel save per year  
 So per year saving fuel gas is 54375 kg.  
 Means total cost saving is (43200\*156.2) = 84.82 lakh/ year saving

**Table 1:** (Observation table for the consumption of fuel in different zone without Magnet)

Date	Time	Job Weight (Gms)	M/CSpeed (BPM)	LehrSpeed (Hz) 490 mm/min	Zone-1 (550)	Zone-2 (555)	Zone-3 (505)	FlowMeter Reading for fuel consumption
28-02-15	7:30 AM	58	393.5	483	546	559	507	692
28-Feb-15	8:30 AM	58	393.2	516				712
Difference in fuel consumption								20
28-Feb-15	9:30 AM	58	281.8	483	556	560	502	731
28-Feb-15	10:30 AM	58	281.8	493				750
Difference in fuel consumption								19
28-Feb-15	12:30 PM	58	281.8	533	552	554	506	789
28-Feb-15	1:30 PM	58	282	523				809
Difference in fuel consumption								20
Total consumption of fuel per day								450

Here the shown table gives the temperature of different zone of glass chamber and the last column shows the fuel consumption of a burner.

**Table 2:** (Observation table for the consumption of fuel in different zone with Magnet)

Date	Time	Job Weight(Gms)	M/C Speed (BPM)	Lehr Speed (Hz) 490 mm/min	Zone-1 (550)	Zone-2 (555)	Zone-3 (505)	Flow Meter Reading for fuel consumption
10-Mar-15	9:30 AM	58	393.7	381	550	558	504	136
10-Mar-15	10:30 AM	58	393.2	381	545	556	507	152
Difference in fuel consumption								16
10-Mar-15	11:30 AM	58	393.7	381	553	551	508	170
10-Mar-15	12:30 PM	58	393.7	365	555	551	502	186
Difference in fuel consumption								16
10-Mar-15	1:30 PM	58	393.3	344	550	550	503	203.00
10-Mar-15	2:30 PM	58	393.2	371	550	551	505	220
Difference in fuel consumption								17
<b>Total consumption of fuel per day</b>								<b>391</b>

## 5. Conclusion

By establishing correct fuel burning parameters through proper magnetic means MMFS increases the internal energy of a fuel gas to cause specific changes at a molecular level which obtained easier combustion. The resultant fuel burn more completely, producing higher engine output, better fuel economy, more power & most importantly reduces the amount of HC, CO, NO<sub>x</sub> in the exhaust. & therefore control the emission at low cost. In short the summary of the conclusion includes: MFS increases 3-4% efficiency of fuel gas, Reduction in HC emission & other pollutants, Avoid clogging problems in fuel gas burner, Cost saving, Eco friendly, Reduce maintenance of Through magnetic fuel saver there are huge saving of fossil fuel in terms of Natural gas and also decrease investment cost and ultimately increase the profit of the company. Annealing burner most importantly does not require any design modification & finally COST SAVING.

## 6. Acknowledgment

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