

STAINLESS INDIA

A MAGAZINE PUBLISHED BY

**Indian Stainless Steel
Development Association**

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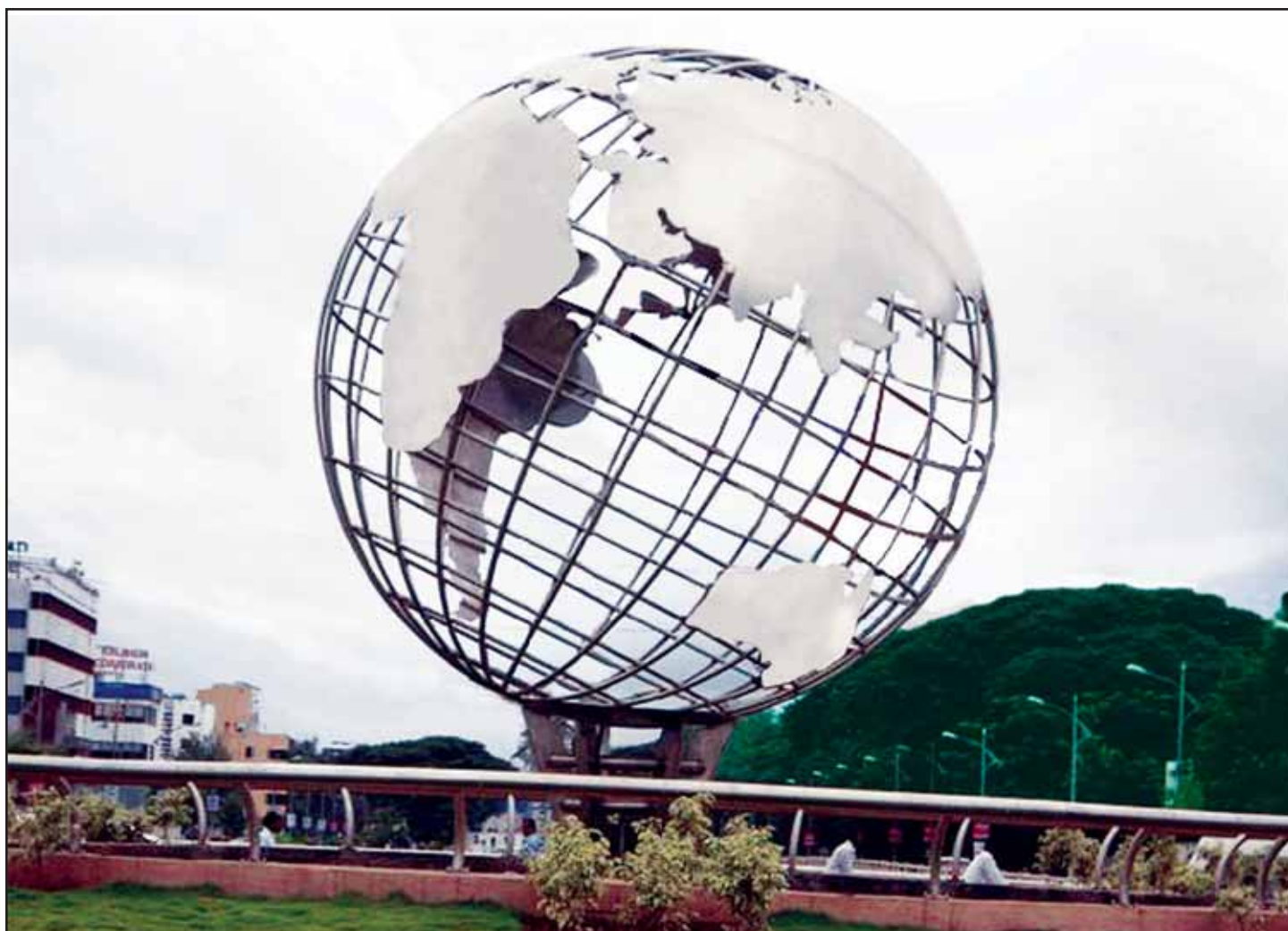
Web: www.stainlessindia.org

VOL.16 NO. 3

A Magazine Devoted to Stainless Steel Applications
Published four times a year

SEPTEMBER 2011

STAINLESS STEEL GOES GLOBAL



The next time you pass by the Mumbai-Pune Road (NH4), you will not miss the huge ball that rivets your eyeballs at the Akurdi Chowk in PIMPRI CHINCHWAD, Pune. Instead of spraining your neck, get off the vehicle to have a good look and take a couple of shots to show it to your family and friends.

This is a huge 15-foot diameter globe made by M/s. Sharp Engineers, Pune,

out of stainless steel tubular structure with laser-cut continents depicted on it. You may go around the globe, try to locate your city or locate where your near and dear ones are living around the globe.

The entire Globe made of stainless steel grade 304 was manufactured using CNC bending machine and specially designed tooling to form and press the continents out of 3mm thick SS304 sheets. The type

304 stainless steel tubes forming the globe are of 40mm diameter. This stainless work of art is mounted on a suitable pedestal for passersby to have a good look.

Although the globe looks lovely and serves as a landmark, fabricating it was a huge challenge. Making this huge globe was easy (WAS IT REALLY EASY?) compared to the challenge of

Continued on page 2

Continued from page 1

pressing the continents to the same curvature as the globe and surface finishing after installing on the tubular globe.

The 'Globe' has been adorned by illuminated display signs and has been drawing attention of everyone passing by. The 'Globe' is also protected by a sturdy railing system in stainless steel type 304 to protect it in case of traffic accidents.

Fabricated and Installed By:

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OUTOKUMPU Receives ISSF sustainability award

The International Stainless Steel Forum (ISSF) has granted the first ISSF Sustainability Award for Outokumpu. The acknowledgement was received in ISSF Annual General Meeting in Madrid, Spain on 22 May 2011. The recognition was based on Outokumpu's determined actions and great achievements in reducing waste to landfill and increasing material efficiency in Sheffield.

David Martin, chairman of the ISSF Health & Environment Committee comments: "Outokumpu's Sheffield melting shop case is an excellent example of sustainable development. Minimising waste is in everyone's interest and this case demonstrates significant improvements with clear figures."

Outokumpu established a sustainable recovery and re-use route for different stainless steel waste in Sheffield. Slag was re-used in the production of asphalt and waste refractory material was used as a substitute for limestone in the stainless steel making process. These actions have led to dramatic reduction in waste to landfill. Since 2007 over 80% of all slag has been recovered and re-used as road stone in the asphalt production. During 2010 half of all refractory waste generated on site was re-used as a lime substitute.

[Extract: Outokumpu press release dated 26th May, 2011]

All-India ABC Workshops by Ms Catherine Houska, the world's leading expert on stainless steel – New dates

ISSDA is organizing a series of five workshops this year on the applications of stainless steel for the architecture, building & construction (ABC) sector.

Workshops will be held during December 2011 in the following metro cities:

Delhi : 5th Dec, Monday
Mumbai : 7th Dec, Wednesday
Bangalore : 8th Dec, Thursday
Chennai : 9th Dec, Friday
Kolkata : 10th Dec, Saturday

Timings : 5:30 to 9.30 pm
followed by Dinner

Ms Catherine Houska, consultant to Nickel Institute will be making presentations in these workshops. The



Catherine Houska

workshops are open to architects, builders, interior designers, engineers, civil authorities, urban planners, infrastructure personnel from airports, highways, sea ports, railways and other facilities and stainless steel industry personnel.

There is no participation fee.

For details, please contact ISSDA, nissda@gmail.com

Workshop on 'Sustainable Stainless Steel for Building & Construction' held in Pune



Mr Ramesh Gopal (seated)

Mr N C Mathur (speaking)



A section of the participants

On 17th June 2011, ISSDA organized a half-day workshop titled '**Sustainable Stainless Steel for Building & Construction**' in Pune. About 70 invited delegates and 20 industry participants from member companies participated in this workshop.

A good number of academics including staff and students of schools of

architecture in the city, Public Works Department, Municipalities of Pune, Pimpri & Chinchwad, Cantonment Board and other government agencies, a couple of ABC fabricators and builders also attended.

This event can definitely be described as a very successful initial foray into Pune.

RAILWAYS TO ENHANCE STAINLESS STEEL COACH PRODUCTION

Kalka mail going from Howrah to Delhi, derailed on July 10, 2011 and caused 69 passengers dead and around 250 injured. The impact was such that 13 coaches were thrown off the track, many on top of others, which left them badly mangled. Fire and sparks were seen in the AC compartments of the train. The train was travelling at a speed of 110 km/hr at the time of the accident.

While loss of life and limb in accidents is most regrettable, rail accidents are played up by the media to sell the story. It must however be admitted that rail transport is a relatively safe mode of travel compared to road, where the annual number of victims in the country are easily 100 times more, but do not come up in the national news, or hardly a mention. This article is about what the Indian Railways are doing to enhance safety of passengers travelling by train.

The news item that “the casualties in the recent Kalka derailment could have been much less if the train was running on LHB (Linke Hoffmann Bush) coaches” speaks volumes on the advantages of stainless steel including safety aspects. The modern coaches made of stainless steel have more in-built safety features, and can absorb shock and impact of accidents more effectively. The sturdy and robust design obviates capsizing of coaches in case of accidents.

The importance of stainless steel coaches has been well recognized by the Indian Railways. The railways plan to switch over from indigenous ICF-design coaches to German Technology based LHB coaches in all mail and express trains in a phased manner within the next five years i.e. by 2016-17. LHB coaches are designed to minimize fire accidents as they are equipped with fire retardant quality material and advanced couplers.

This move is aimed at infusing more safety in train operations.

COACH PRODUCTION – SIGNIFICANT INCREASE IN STAINLESS COACHES PLANNED

The Indian Railways is the largest single railway system in the world under a single owner – the Government of India. It has a fleet of 60,000 coaches, 64,000 route kilometers and 220,000 wagons. It carries 8 billion people a year, more than the total population of the world which is over 6 billion. Metro rail systems are separate and not included in the above numbers.

Out of the 60,000 coaches presently only 1,600 coaches are in stainless steel (LHB design). Current and next year plan of the railways to enhance the share of stainless steel coaches is given in the table below:

	2011-12	2012-13
Total Coach Production	3,650	3,800
Stainless Coach Production	320	800

A traditional ICF-design air conditioned coach made of corten steel costs Rs. 1.5 crore each against stainless steel LHB coach costing Rs. 2.5 – 3.0 crores.

The modern coaches are more comfortable; have a longer life span of 35 years because of their high level of corrosion resistance against ICF's 25 years. LHB require much less maintenance, and also have a 12% - 15% higher passenger capacity that can increase revenue. Railways are expecting to enhance production capacity of its coach factories to greatly

increase LHB coach production in subsequent years.

It is planned to enhance stainless steel coach production through the following investments:

1. Rail Coach Factory, Raibareli, UP – Outlay Rs. 2,000 Crores (1,000 LHB coaches per annum)
2. Rail Coach Factory, Palghat, Kerala – Outlay Rs. 1,000 Crores (600 LHB coaches per annum)
3. Expansion of Integral Coach Factory, Chennai – Outlay Rs. 240 Crores (300 LHB coaches per annum)

In addition, significant investments will be made for new factories for manufacture of wagons (both stainless and carbon steel varieties) at five factories – Halida, Guwahati, Bardhaman, Bhubneswar & Secunderabad; Electrical Multiple Units at Kacharapara, West Bengal; Diesel Multiple Units at Sankrail, near Kolkata; locomotives at Marhoura, and Madhepura in Bihar and rail axle at New Jalpaiguri.

This is part of an overall plan of the Government of India to enhance infrastructure facilities. Severe constraints in infrastructure such as road, rail, water, electricity etc., are seen as the bottleneck pulling down the growth of the economy.

Unlike indigenous ICF coaches, which are prone to capsize or climb on each other during collision, the LHB coaches do not get toppled. Apart from restricting the speed limit to 105 and 110 kmph on main line and Rajdhani tracks respectively, ICF coaches raise safety concerns due to a large number of hanging under-gear parts.



Corten Steel Coach after accident

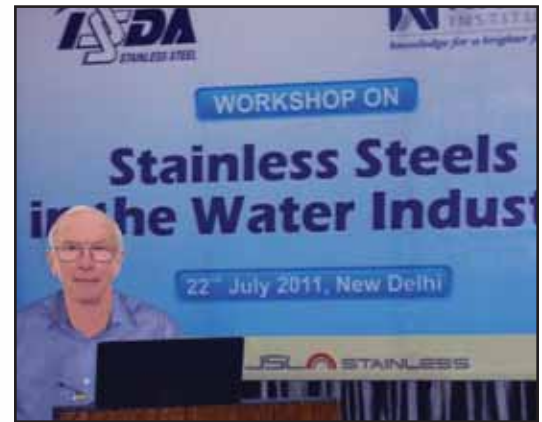


Safer Stainless Steel LHB Coach

Workshop on Stainless Steels in the Water Industry



A section of the participants



David Jordan, Consultant, Nickel Institute

ISSDA organized a workshop on 'Stainless Steels in the Water Industry' on Friday, July 22, 2011 at India International Centre, New Delhi. The workshop was attended by 50 participants from a cross section of organizations related to water industry. The participants included officials from MCD, NDMC, DDA, Ministry of Coal, Ministry of Water Resources (WAPCOS), Architects, Builders,

Water Treatment Plant Specialists and Consultants etc. The lecture of Mr. David Jordan, consultant to Nickel Institute, consisted of three sessions on the topics of i) Stainless Steels in the Water Industry, ii) Fabricating Stainless Steel and iii) Water Treatment Plant. Participants were very much appreciative of the contents of these lectures. The concept of stainless steel plumbing evinced keen interest among

the participants. The display of stainless steel plumbing items by JSL was befitting to the occasion of the workshop.

Many of the participants requested for having a soft copy of the lectures delivered by Mr. David Jordan and we have sent them a CD of the PPT of all the three presentations.



World leaders in handrail and balustrade, the Denmark – based Carl F International has bagged the Chennai International Airport project and also identified tremendous growth opportunities in the handrail industry of India.

Ms. Renu Kathuria – Managing Director of Carl F International Pvt Ltd said "We are proud to be associated with the development of the Chennai International Airport. This clearly endorses our expertise in the field of handrails and balustrade.

The Company has already done the Delhi International Airport order for creating and installing handrails running about 30 to 35 km length. We are poised at an interesting point on the growth curve and see this as an opportunity to further enhance our association with the aviation infrastructure industry. Carl F

Bags Chennai International Airport Project

International is bullish in working across industry segments in the near future."

Carl F International introduced the concept of handrails in combination with stainless steel and glass. Apart from its products being associated with the elite landmarks and buildings for blue – chip clients like the TCS, Cisco, Royal Sundaram, HP, Crisil, Syntel, Turbo

N . R . N a r a y a n a Murthy, Nandan Nilekani, besides celebrities like Chiranjeevi, Sachin Tendulkar and Shah Rukh Khan among others.



*Ms Renu Kathuria
Managing Director*



Stainless steel handrails at T3, I.G.I Airport, Delhi

Energy, Techpro Systems and offices of Reliance Group, Carl F International has also supplied and installed its handrail & balustrade systems in known Hotels like Le-Meridien, Radisson, ITC Group of Hotels. The company has worked on the residences of iconic business people like

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Metro Rail Systems Sprout in Cities Across India

Transportation Sector to claim a Significant Share of Stainless Steel Usage in India

Rapid urbanization is taking place in India due to migration of populations in search of a living and other requirements. This is naturally leading to congestion in urban centres, both large and small. In an attempt to decongest the roads which are choking, many cities across India are opting for Mass Rapid Transit Systems (MRTS) similar to the one in Delhi – The famous Delhi Metro. These include Bengaluru, Chennai, Hyderabad and Mumbai which are on the fast track to complete their projects.

The Delhi Metro Rail Corporation has completed Phase I & II with 189.63 KMs of rail tracks with 142 stations. Another 103.50 KMs are planned in phase III to be completed by 2016. By 2021, Delhi Metro will have covered more than 400 KMs.

Delhi Metro using stainless steel for the coaches and in stations etc. is very much appreciated by the people of this city. Due to increasing passenger traffic, DMRC has made most of the lines 6-coach trains, instead of the 4-coach trains in the beginning. These will be made 8-coach trains within two years.

Metro coaches are in 301L grade of stainless steel because of its strength resulting in light weight coaches, aesthetics, durability, minimum maintenance, and above all the safety of passengers in case of crash or fire. In metro stations stainless steel is extensively used in escalators, handrails, benches, advertising panels, ticketing counters, turn styles etc..

Stainless steel requirement is slated for further boost as the following cities have



made their plans to have metro rail systems:

- Bangalore Mass Rapid Transit Limited – 42.3 KMs
- Mumbai Metro One Private Limited – 145.67 KMs
- Jaipur Metro Rail Corporation Limited – 35.15 KMs
- Hyderabad Metro Rail Limited – 71.16 KMs
- Chennai Metro Rail Project – 43 KMs
- Ludhiana Metro Rail Corporation – 28.82 KMs
- Lucknow Metro – DPR prepared by DMRC
- Ahmedabad Metro – DPR prepared by DMRC

There are other cities such as Kochi in Kerala, Patna in Bihar, Meerut & Kanpur in Uttar Pradesh which have set their sights on Metro Rail Systems. To our knowledge, most of the cities listed

herein have decided to follow Delhi Metro as their role model.

Expecting a rush of cities going in for stainless steel rolling stock and passenger facilities in stainless steel, apart from Bharat Earth Movers Ltd. (BEML in Bangalore), two overseas stainless steel metro coach makers such as Alstom and Bombardier have moved in to the country. While Bombardier has a plant running near Baroda in Gujarat, Alstom is expected to set up shop in the south, along the border areas of Andhra Pradesh & Tamil Nadu.

The Metro Rail System boost along with the Indian Railways' own plan (*see an article on page 3*) for expanding production capacity of stainless steel wagons and coaches, and the burgeoning requirement of automotive exhaust system, the transportation sector in India will become a significant share of the use of stainless steel in India within a few years.

Rail Wagons Presentation Available on ISSDA Website

A presentation made by Mr. Ramesh Gopal, Executive Director, ISSDA at Jadavpur University, Kolkata, is now available at www.stainlessindia.org. The title of the presentation is 'Sustainable Stainless Steel for Wagons'. Click on the icon "What's New" on the home page.

Attention Readers!

It has been observed that some of the Stainless India magazines are not getting delivered and being redirected back to us. Readers are requested to provide their changed mailing address and contact particulars so that they are assured to get 'Stainless India' magazine regularly.

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SIGNIFICANT POTENTIAL FOR STAINLESS STEEL IN BIO ENERGY

Biogas typically refers to a gas produced by the biological breakdown of organic matter in the absence of oxygen. Organic waste such as dead plant (straws of crops like wheat, rice, jowar, bajra, husk of rice etc.), animal material, animal dung, kitchen and human waste etc., can be converted into a gaseous fuel called biogas.

The gases-methane, hydrogen and carbon monoxide (CO) can be combusted or oxidized with oxygen. This energy release allows biogas to be used as a fuel. Raw biomass can be used as a fuel in any country for any heating purpose, such as cooking.

Nearly 700 million Indians still burn biomass as the primary source of energy for cooking in inefficient cookstoves *which burn wood and other agricultural matter and add to air pollution. In addition, it is a source of health problem in kitchens with insufficient ventilation.*

India is the world's fifth-largest and second-fastest-growing producer of greenhouse gas emissions. Generating electrical power by burning biogas (a mixture of methane and carbon dioxide produced by the bacterial degradation of organic matter) harnesses these greenhouse gases and reduces demand for fossil fuel-fired generating plants.

The Government is exploring the development of community-driven biomass based resources programs to meet the basic energy needs of the population in areas where electrification is not possible, such as remote villages. As a climate change co-benefit, a large scale conversion to biomass-energy can decrease India's greenhouse gas emissions.

BIOGAS ENERGY POTENTIAL

The Government of India's Ministry of New and Renewable Energy Sources is preparing a national bio-energy mission to boost power generation from biomass, a renewable energy source abundantly available in India. Surplus biomass in India is estimated to be 150 million tonnes. This could potentially be used to generate 16 giga watts (16000 MW) of power.

During the 12th Five-Year Plan (2012-2017), the Indian Government is envisaging to facilitate large-scale capital

investments in biomass-fired power stations. It will provide power for day-to-day requirements of the population, encourage development of rural enterprises and provide employment to a large number of people in the countryside. This could also help in the stabilization of electricity grid.

Nearly 70% of the country's population lives in villages with marginal access to electricity. Currently, India has a total installed capacity of 3,000 MW of biomass-based power generation. The ministry of new and renewable energy is targeting to double this capacity during the 12th Plan (2012-17).

According to some estimates, biomass from agro and agro-industrial residue could potentially generate 25,000 MW of power in India. This can be further raised with wasteland-based integrated energy plantation and power generation systems.

Each MW generated from biomass plants would be able to cover about 6,000 rural households. The ministry has earmarked 3,400 crore for the various incentive schemes under the biomass mission.

POWER GENERATION EQUIPMENT

We present a case study (from 'Nickel Magazine', volume 23, number 3, June 2008) where M/s Capstone Turbine Corporation of Chatsworth, California, U.S.A. installed their first micro turbine to produce biogas energy in Purulia, West Bengal in 2006. Based on this experience, they installed few more micro-turbines at different locations in India for generating more biogas energy. The Purulia installation is at a dairy farm and consists of two 30-kilowatt micro-turbine systems, one of which is for backup. These can run either linked or independently of the power grid. "When the grid is down, it is connected to the dairy to keep it running".

The micro-turbines use nickel alloys and stainless steel in components such as the combustion chamber, spinning turbine, main rotor shaft, recuperator housing etc., all of which run continuously with minimal maintenance. Austenitic stainless steels are the most cost-effective material for the systems that clean and compress the corrosive biogas prior to combustion in micro-turbines.

Biogas is mostly methane with hydrogen sulphide present as a contaminant. When hydrogen sulphide is mixed with water (with which biogas is always 100% saturated), it becomes a weak acid (hydrosulphuric acid). Carbon dioxide forms a mild carbonic acid in the presence of water. "Biogas is very corrosive, which is why we use a lot of stainless steel".

"Stainless steel has good corrosion resistance to those acids. Predominantly we use S30400 and S30403, though sometimes customers request S31600 and S31603, as these are more resistant to corrosion. The S30403 might last 40-50 years whereas the S31603 can last 100 years."

A typical compression and cleaning system takes the gas drawn off the top of the sludge in a digester, where manure has decayed for 20-30 days, and compresses and cleans it before it is burned. In a simplified description of this process, the gas first passes through filters that remove the hydrogen sulphide. These tanks will typically be constructed of stainless steel plate 4.8 or 6.4mm thick and are made to withstand negative pressure. The gas then passes through a compression system, where it is raised to pressures as high as 8.4 kilograms per square cm (kg/cm²). The piping used in this process is typically stainless steel. Next it passes through heat exchangers to reduce the temperature to about 4 °C, forcing more water out of the gas. The gas is then re-heated to 27 °C, reducing the relative humidity to 25%. Subsequently, the gas passes into stainless steel vessels where siloxane, a chemical used in lubricants and personal care products, is filtered out. Since siloxane turns into a glass-like substance at high temperatures it must be removed before the gas is burned. After this step, the biogas is delivered to an end-use device, such as a turbine, internal combustion engine, or fuel cell.

CONCLUSION:

Given the big plans the Government has for use of bio-gas for energy production in India, austenitic stainless steels have a significant market potential in this sector because they have proved to be the most cost-effective material for the systems that clean and compress the corrosive biogas prior to combustion.

STAINLESS STEEL IS IDEAL FOR MITIGATING AIR POLLUTION IN COMMERCIAL VEHICLES

Commercial vehicles constitute 1.1% of total vehicular population in Delhi, but account for 90% of total vehicular pollution.

THE GOVERNMENT MUST TAKE STRINGENT MEASURES TO CONTROL POLLUTION BY DIESEL COMMERCIAL VEHICLES

Fossil fuel-based vehicles using petrol and diesel emit various air pollutants like CO (carbon monoxide), HC (unburned hydrocarbons), NOx (nitrogen oxides), SOx (Sulphates) and PM (particulate matter). These pollutants in auto exhaust are responsible for major diseases and are extremely harmful for humans. In Delhi, for instance, one out of every third child is currently suffering from Asthma and related respiratory diseases.

A study conducted by IIT Delhi in 2007 established that even though CNG operated buses are present in Delhi since the year 2000, pollution due to diesel commercial vehicles is a major source of air pollution in the city. Although commercial vehicles constitute only 1.1% of the total vehicular population in Delhi, they account for 90% of the total vehicular pollution in the city. People of Delhi will distinctly remember the day when all diesel based buses were sent off the road and CNG buses were introduced, one could start seeing the blue sky over Delhi. This highlights the effect of diesel vehicles on the air pollution in cities.

This is not only the case with developing country like India; a similar situation prevails in developed countries like USA, Japan, Europe and our close neighbour China. Pollution is the cause of concern especially for urban areas in India.

Hence, tight control over the emission of diesel commercial vehicles is absolutely essential all over the country to protect the health of humans, especially in urban areas where there is heavy traffic. Through strict emission norms and effective implementation all across the country, we can achieve growth of both health and wealth of India. Stainless steels play a very useful role in the mitigation of pollution from diesel/petrol powered vehicles.

Impact of pollution

Diseases caused due to vehicular pollution include Asthma, Alzheimer, Strokes, Pulmonary diseases and irritation in eyes etc., depending upon the exposure to air pollution. This effectively shortens the life span of living beings. The effect is much greater in urban areas because of higher vehicular population.

A survey has revealed that over 900 million people in India are affected by air pollution. The number of premature deaths through harmful emission keeps on increasing. Deterioration of health is the major and visible result of air pollutants which has been released by vehicular exhaust.

Given below are the health impacts of air pollution caused by vehicles:

Oxides of nitrogen (NOx): This gas can make children susceptible to respiratory diseases in winters.

Moreover, increased nitrogen loading in water bodies, particularly coastal estuaries, upsets the chemical balance of nutrients used by aquatic plants and animals. Additional nitrogen accelerates "eutrophication," which leads to oxygen depletion and reduces fish and shellfish populations. NOx emission in the air is one of the largest sources of nitrogen pollution in water bodies.

Carbon monoxide (CO): It combines with haemoglobin to lessen the amount of oxygen that enters our blood through the lungs. The binding with other haemoglobin in proteins causes changes in the function of the affected organs such as the brain and the cardiovascular system, and also the developing foetus. It can impair our concentration, slow our reflexes, and make us confused and sleepy.

Sulphur dioxide (SO₂): SO₂ in the air is caused due to combustion of fossil

fuels. It can oxidize and form sulphuric acid mist. SO₂ in the air leads to diseases of the lungs and other lung disorders such as wheezing and shortness of breath. Long-term effects are more difficult to ascertain as SO₂ is often combined with that of SPM.

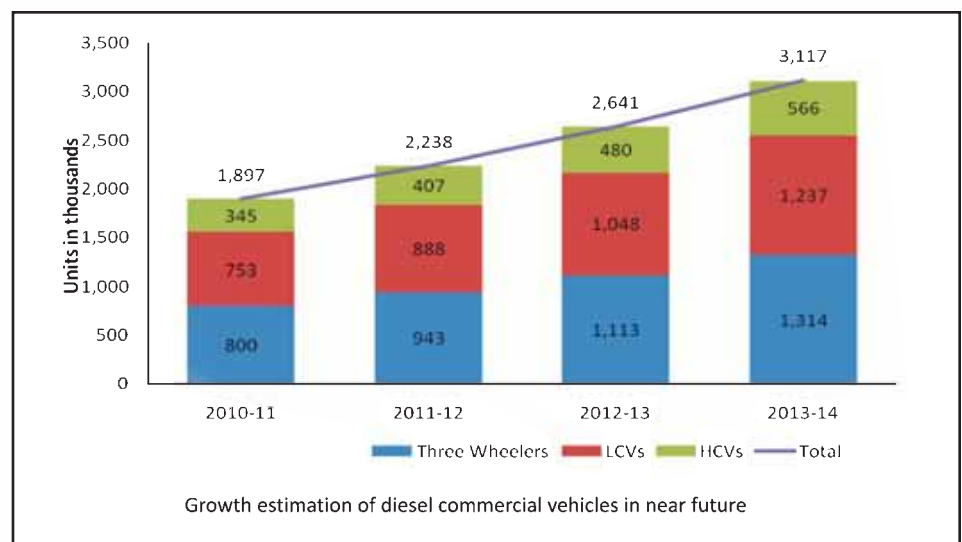
Suspended Particulate Matter (SPM):

Suspended matter consists of dust, fumes, mist and smoke. The main chemical component of SPM that is of major concern is lead, others being nickel, arsenic, and those present in diesel exhaust. These particles when breathed in, lodge in our lung tissues and cause lung damage and respiratory problems

It is important to understand that the above pollutants are not only affecting the health of human beings, but all forms of life on the planet earth.

Key Factor for Air Pollution – Diesel Commercial Vehicles

Boom in industrial and agricultural output in India, alongwith the favourable policies of government towards farmers and factors such as migration of population towards urban centres for education, jobs, medical facilities and entrepreneurial opportunities contribute to high density of population in urban centres. To supply food, vegetables, dairy products, clothing and other day-to-day needs of urban centres with high population, we need more and more diesel commercial vehicles. This is a necessary evil, which is necessary to feed India.



Continued on page 9

FEIN power tools
FEIN Elektrowerkzeuge



Make Stainless Steel Shine with FEIN Tools

From the inventors of World's First Power Tools from Germany



FEIN: 143 Years of experience and specialist for solutions in Stainless Steel Application.

FEIN Presents new Stainless Steel range for machining surfaces, pipes, profiles, corners and edges which requires highest standards in precision, surface quality and finish. The products range in Stainless Steel includes Compact Angle Grinder for Stainless Steel Application, Polishers, Straight Grinders, Pipe Polishers and Belt Grinder to suit the toughest Stainless Steel Application.

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- Deburring
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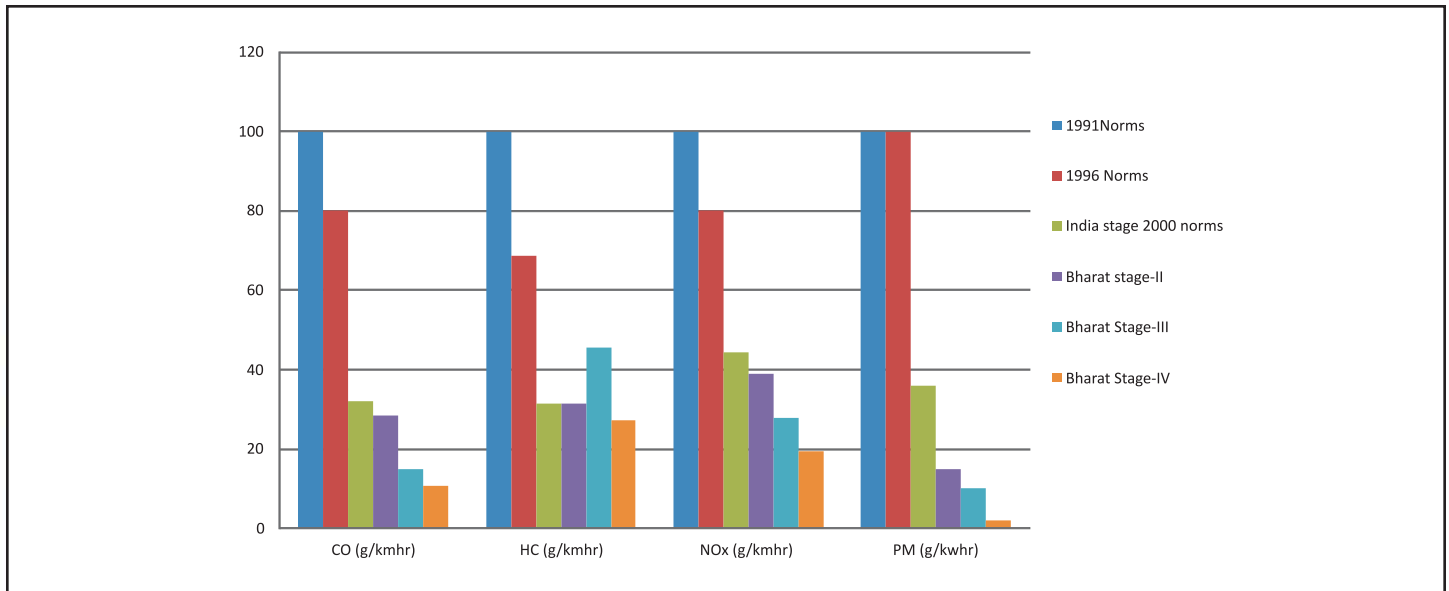
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Emission standards for new heavy-duty diesel engines—applicable to vehicles of GVW > 3,500 kg



Harmful Particulate Matter will be reduced drastically by over 98% if BS-IV norms are implemented throughout the country.

EMISSION NORMS - INDIA

Source : Wikipedia

In order to reduce harmful emission of gases from vehicles, including carbon dioxide, the governments all over the world have been taking steps for cleaning the environment. India has also issued the Clean Air Act which is popularly known as **Bharat Stage** in line with **EURO** norms.

In India, it was in 1991, that the first set of emission norms came into picture for

petrol vehicles and the same was imposed on diesel vehicles in 1992. In 1995, the next regulation was extended to four metro cities (Delhi, Calcutta, Mumbai and Chennai). According to this, it was mandatory to fit catalytic converters in new petrol passenger cars sold. This step was so needed at that time as “Lead” the highly toxic pollutant, was required to be taken out of petrol. Unleaded fuel was introduced first in

metro cities and then in other 42 major cities.

One part of the emission is Particulate Matter (PM) emitted by diesel vehicles only, which causes serious damage to human beings. PM is considered as main source of pollution. In 1996, regulation was made that there should be cold start emission test for diesel vehicles below 3.5 ton GVW (Gross Vehicle Weight).

Comparison of materials for exhaust systems

As customers, we are concerned about the quality of the vehicle while purchasing a personal vehicle or diesel commercial vehicle. In case of personal vehicles, we look into the aesthetic value, the mileage, the ergonomics, brand value and cost. In diesel commercial vehicles, the customer looks for products which have lower maintenance cost, higher load carrying capacity and best mileage. In the market, exhaust systems with pipes of mild steel, mild steel coated with aluminium and stainless steel are the choices.

Since the service life of the exhaust system has not been defined in the Bharat Emission norms, in order to reduce their selling price, manufacturers use lowest cost materials like mild steel or aluminised steel for their exhaust system and provide only one year warranty. Their perception is that

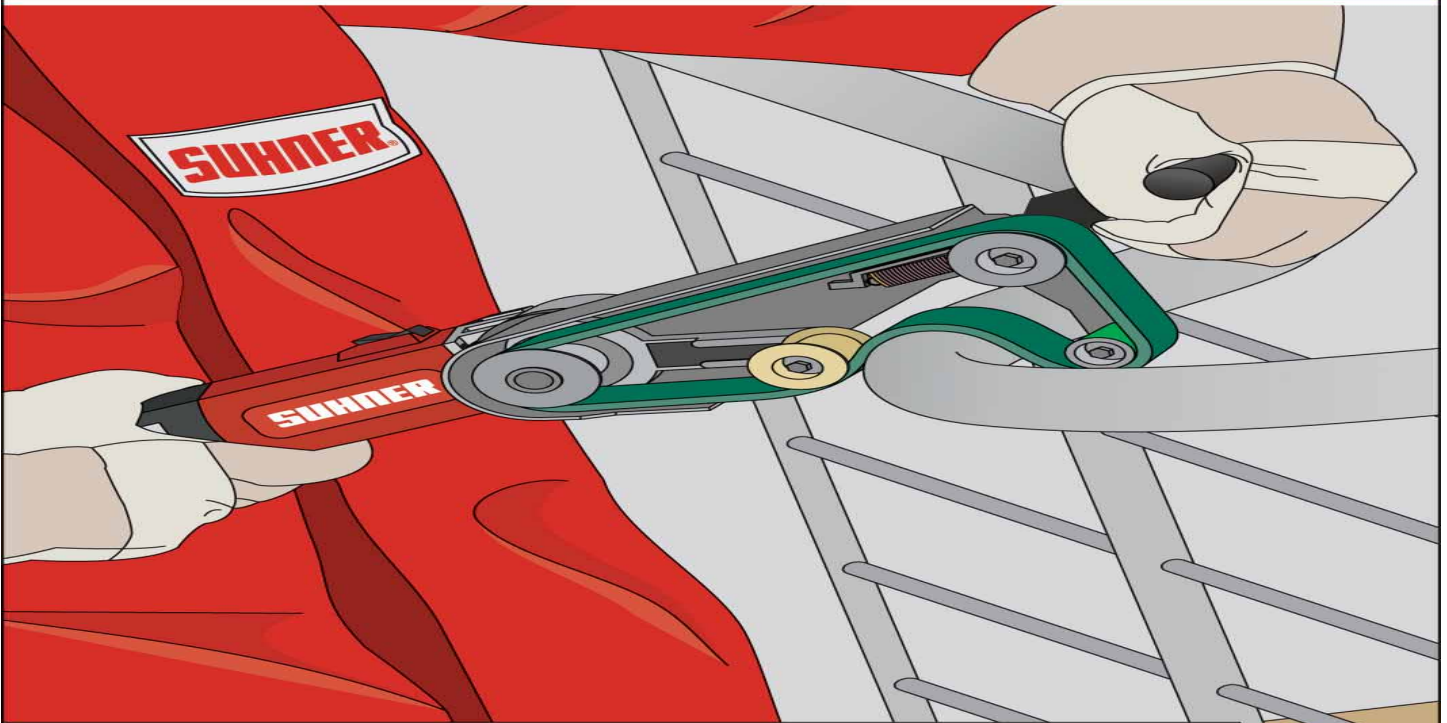
In 2010, Bharat Stage IV (BS-IV) was adopted only in 13 major cities in India, but the implementation is still not proper.

In India, all on-road vehicles are required to have a valid Pollution under Control (PUC) certificate. However, a significant number of vehicles were already on-road. Poor road conditions and inappropriate maintenance of these vehicles were the main reason of pollution. As of now, each commercial vehicle should undergo an Inspection and Certification Programme (I&C) through authorized RTO agencies. However, inadequate training given to independent centres for providing this certificate, outdated equipment, and inept tracking system of vehicles are major flaws in this PUC system till date. This is making the emission norms not capable of controlling the today’s pollution levels.

Anyone can purchase the commercial vehicle from outside these 13 cities and drive the vehicle in these cities without any check and control on diesel commercial vehicles. The whole purpose of cleaning the air in these cities is being defeated as the pollution norms are not uniformly applied throughout the country.

As per published data, the sale of diesel commercial vehicle in domestic market has grown by more than seven times in last 10 years, but emission norms have changed only twice. This is not enough for the country which is on high growth path and emission norms needs to be matched along with the changing profile of diesel commercial vehicle exhaust volume.

Abrasive expert.
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Table

FACTORS \ MATERIAL	Mild Steel	Aluminised Steel	Stainless Steel
Initial Cost	1 Unit	2 Units	5 Units
High Temperature Resistance	Low	Can perform till 500 deg.C	Can perform at higher temperatures
Maintenance Cost	High	High	Low
Service Life	1 year	1 year	8 - 10 years
Replacements over 8 years	7	7	None
Resistance to corrosion working temperature	Starts at immediately	Can resist till the layer is intact but layer starts depleting at working temperature	8 - 10 year of service
Life cycle cost	High	High	Low
Mileage	Low	Low	High

stainless steel exhaust system is too "costly". However, when the operational, maintenance and replacement costs to the customer over the service life of the vehicle, say 8 years, stainless steel systems prove to be the least cost option to the user (See Table above).

First and foremost, stainless steels can withstand high operating temperatures of the exhaust system without corrosion over the life of the vehicle. This means (a) the high operating temperatures of the exhausts will maximize the burning of the fuel and will lead to lesser emission of PM and other harmful gases; (b) There will be increased fuel efficiency (read: mileage) (c) There will be no need to change the exhaust system during the life of the vehicle; (d) Maintenance costs will be minimal and NO replacements; (e) Because of high corrosion resistance,

thin gauges are used, reducing the weight of the vehicle and further enhancing fuel efficiency. In other words, higher initial outlay on stainless steel systems gives life-long benefits and helps keep our environment clean. (f) At the end of service life all the stainless steel in the exhaust train is 100% recycled whereas in the case of mild steel and aluminised steel there is a significant loss of material due to corrosion in service.

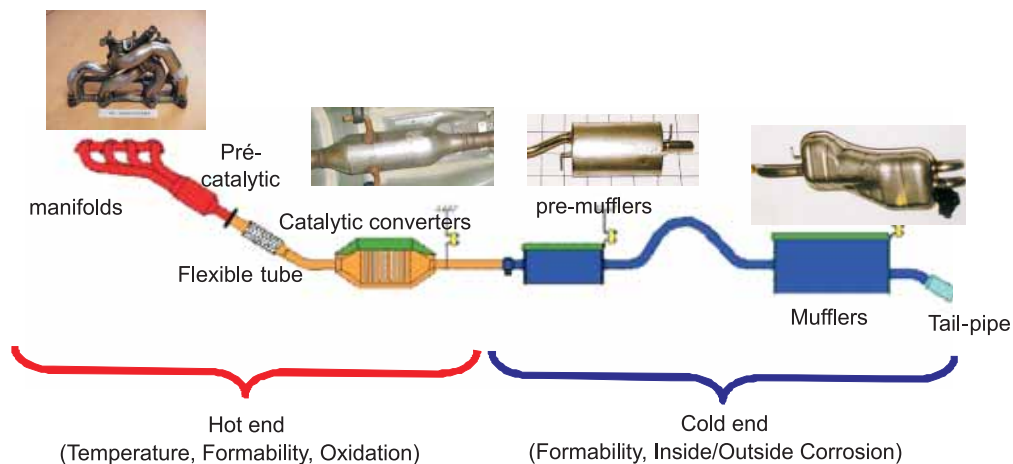
The other two options i.e. mild steel and aluminised steel, though appear to be "costing less" initially, are life-long trouble, probably seven replacements and a constant threat to the environment through leakage of exhaust when in a state of repair (both air and noise pollution), and a big source of pollution when not replaced. When you choose stainless steel, you are minimizing the

cost and saving the environment. The choice is yours!

An exhaust system comprises of following components: an exhaust manifold, front pipe, flexible pipe, catalytical convertor, centre pipe, main muffler, and tail end pipe.

Exhaust system has differential temperature at its two ends. At the head end it has the highest temperature (900 degree centigrade) but at the tail end it has relatively low temperature (100 – 400 degree centigrade). The material for these parts should be chosen carefully so that it possesses these temperature characteristics to meet the aim. Different grades of stainless steel have the necessary properties to make a successful exhaust system with better fuel efficiency, excellent oxidation

EXHAUST TRAIN COMPONENTS



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resistance, good formability and weldability with a better aesthetic feel.

Exhaust Train Components:

Manifolds: should have the property to bear high temperature near 900 degree centigrade, good oxidation resistance, thermal fatigue life and good workability because of its structure. So the best supporting material in the case of Manifolds is 304, 316 or 321 stainless steel.

Front Pipe and Flexible Tube: should be able to withstand a temperature of 600 – 800 degree centigrade. Good oxidation resistance is must in this part also. Grades of stainless steel that are best fit in these parts of Exhaust system are: 409L, 436L.

Catalytic Converter: this includes shell and catalyst carriers. This part of exhaust system should have the highest temperature strength, approximately 1000 - 1200 degrees centigrade. Also, it should have the high thermal shock resistance as this is the part which is very near to engine. Workability and resistance to chloride attack in coastal areas is a must for this part because of

its working. Smart Catalytic convertor can be made up of these grades of stainless steel: 409L, 439, and 441.

Center Pipe: this has relatively low temperature (600 degree centigrade) but the material used to make this should have more corrosion resistance. 409L, 439 grades Stainless Steel are the best fit as a countermeasure against the corrosion of the inner and outer surfaces.

Main Muffler and Tail End Pipe: this part has to face the exhaust gas condensation which forms a very high moist atmosphere inside the muffler. The Tail End Pipe should have its own feature other than oxidation resistance. This should have good exterior as this part is visible. Thus, ferritic stainless steel like 409, 436, and 430 are used for this part.

Conclusion

In view of what has been clarified in the body of this article, we request the authorities to consider the following suggestions: (a) Strictly implement BS-IV norms for diesel commercial vehicles across the country without exception; (b) Make use of stainless steel exhaust systems mandatory both

from the point of view of mitigating pollution and to minimize the cost to the nation in doing so.

Finally, it may be noted that various grades of stainless steel for use in different sections of the exhaust system are available indigenously.

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Editor's Note : This article explains the harmful effects of diesel as a fuel for IC engines. While a lot of effort is on to mitigate pollution by commercial diesel vehicles, we see that the number of privately owned diesel passenger cars are drastically increasing. Why? Because diesel is highly subsidised. Private diesel cars do the same damage as commercial vehicles. It would therefore, make a lot of sense if the government discourages use of diesel vehicles for private use.

WORKSHOP ON STAINLESS STEEL ROLLING STOCK AT JADAVPUR UNIVERSITY

On 8th & 9th September, 2011, the Welding Technology Centre of the Metallurgical & Materials Engineering Department of Jadavpur University, Kolkata, in association with ISSDA, held a two-day workshop on 'Stainless Steel Coach & Wagon Manufacture'. The workshop was attended by about 70 persons from various units engaged in the manufacture of stainless steel coaches and wagons, raw material suppliers and vendors of formed parts and sub-assemblies from across India. Welding equipment and consumables suppliers were also present in significant numbers and a few students of the department.

The attendance was full even on the second day, right till the end of workshop sessions. This is an indication of how valuable the presentations and discussions were to the participants.

Professor T K Pal, coordinator of the Welding Technology Centre did a wonderful job of creating this forum for industry-academia interface where both matters of fundamental knowledge of stainless steel and its joining, as well as industrial manufacturing matters were discussed in great detail during the



Participants at the workshop on stainless steel rolling stock

course of two days. Practical demonstration of joining methods with advanced equipment was also on display.

The undersigned made a presentation on the material properties of 409M and its eminent suitability for manufacture of wagons. An important recommendation made to railway personnel was that the specification of IRSM 44/97 (wagons) and CK 201 (for LHB coaches) should be aligned (minimum 0.3% Ni) so that the weldability of IRSM 44/97 is enhanced. Such alignment would enhance the chances of continued use of this grade not only for open wagons, but also to other categories of wagons. This matter would be further pursued by ISSDA with

the appropriate organizations of Indian Railway.

On its part, ISSDA also proposed two important things at this workshop which were accepted in principle by the management of Jadavpur University: (1) Helping with the development of a curriculum for teaching stainless steel as an elective subject for undergraduate students in various engineering disciplines in the University. (2) Conduct joint workshops with the University in locations close to the wagon and coach manufacturing units in Bengal and elsewhere in India to resolve outstanding fabrication problems with the help of the Professor and other experts.

Edited & Published by **Ramesh R. Gopal**, for and on behalf of the **Indian Stainless Steel Development Association**.

Printed by : **Vee Kay Graphics**, D-14/8, 1st Floor, Okhla Indl. Area, Phase-I, New Delhi - 110 020 Phone : 011-26814083/84 E-mail : veekay.graphics@gmail.com