

# Ten Million Kilometres without a Hitch

## Low emissions zones for trains too

In 1996, Environmental Zones (E-Zones) were established in three Swedish cities: Stockholm, Gothenburg and Malmo. Their aim was to improve air quality by reducing transport pollution, especially the harmful particulate matter from vehicles with large diesel engines such as buses and trucks, but also trains and later off-highway vehicles.

Trains, while a small contributor to the total pollution, are a very heavy polluter in a few localised places where pollution is a real issue— such as train stations which are located close to where people live and work and where many people pass-through each day.

The three main elements of the programme were:

- The introduction of clean fuel.
- Encouraging the take-up of newer vehicles (clean engines).
- Encouraging or enforcing the use of exhaust aftertreatment.

Environmental Class 1 (MK1) diesel was introduced, effectively sulphur-free (S <10ppm) and with a reduced aromatics content. The E-Zones put limits on the age of vehicles to encourage the use of newer, cleaner engines. And many vehicles, including trains, were fitted with Eminox CRT® systems.

## New trains fitted with Eminox CRT® systems

The Swedish rail company, SJ Rail, purchased eight new IC3 Flexliner DMU's, manufactured by ADtranz (now Bombardier Transportation) in Rungby, Denmark. The IC3's, which subsequently became known as Y2 trains in Sweden, are three-car sets with 2 Cummins NTAA855 R7 (310kW/416bhp) or Deutz BF8L513C (265kW/355bhp) engines in each of the end cars.

Working with Cummins and ABB, Eminox designed and supplied CRT® systems for the trains. The CRT® systems for each pair of engines were packaged into a single compact assembly that was easy to fit and service.

## No Smoke, no trouble

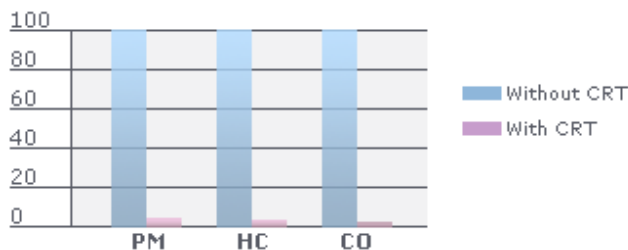
The eight Y2 trains were put into service between 1996 and 1997 on routes entering the E-zones. Their service is very typical of a DMU with frequent stops, starts and high speed operation between stations.

Since their introduction, the trains have travelled nearly 10,000,000 kilometres in total without a CRT® system failure. The only maintenance that the CRT® units have required has been routine cleaning, amounting to 10 hours work per train, every 300,000km. The catalysts and filters were replaced every 1,200,000 kilometres as planned maintenance.

Running costs per train have therefore been extremely low, amounting to less than €12 per 1000 km.

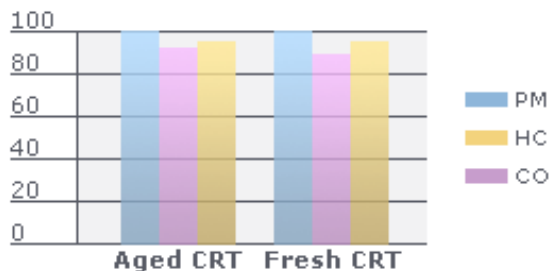


A rigorous evaluation of the CRT® system performance was performed by DTI Energy "Measurement of fuel consumption and emissions from a Cummins engine for IC3 Flexliner", 8th April, 1997. Emissions reduction was excellent with in excess of 95% of particulate matter, carbon monoxide and hydrocarbons being removed from the exhaust gas. There was no noticeable change in fuel consumption.



"The smell from the diesel exhaust has all but disappeared. As a result the maintenance crew often forget to turn the fume extraction equipment on when engines are operating indoors". *Kenneth Parsfelt, SJ Rail/ Euro Maintrain AB.*

One CRT® system performance was evaluated after 600,000km (approximately 3 years) and its performance measured on an engine bench. This test showed that there had been no deterioration in its operating performance over this time and it was still removing over 90% of the particulate matter, hydrocarbons and carbon monoxide from the exhaust.



Comparison of the CRT system performance after 600,000 kilometres in service.

"There has been no effect on fuel consumption or engine power. We have been very pleased with the performance of the CRT systems installed on the trains". *Kenneth Parsfelt, SJ Rail/ Euro Maintrain AB*

### Truly eco-friendly transport

For many years particulate emissions reduction was limited to road-going vehicles, with trains being deemed too demanding and operating in an environment where nothing but flawless performance is expected.

With today's modern engines and low sulphur fuel it has now been proved that the Eminox CRT® system can meet these exacting requirements.

10,000,000 kilometres of service without a single failure proves that. The Y2 trains in Sweden demonstrate that it is possible to combine the energy efficiency and low CO2 emissions offered by rail transport with very low emissions of regulated pollutants.



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