Introduction

Electrostatic powder enamel application has been developed in the mid 70's and was initially mainly used for a relative simple products, like "flat" cooker panels.

In the 80's the continuous quality improvement of both powder enamels and powder coating equipment allowed the application of more complex products, like washing machine drums, barbecues, boilers and baking ovens.

Nowadays the powder enameling technology has become a mature process, which has been globally accepted by more then 300 enameling shops, thanks to its lower operational cost, reduction of environmental emissions and improve quality.

More information about the benefits of powder enameling versus liquid enameling may be found at our website (http://www.ditmer.nl)

Boiler enameling

The inside enameling of hot water tanks pioneered by Atlantic (France) and adopted by many South European companies in the early '90s.

Originally boilers have been powder enameled by means of a so-called online system at which the products have been suspended to a monorail or Powder+Free conveyor.

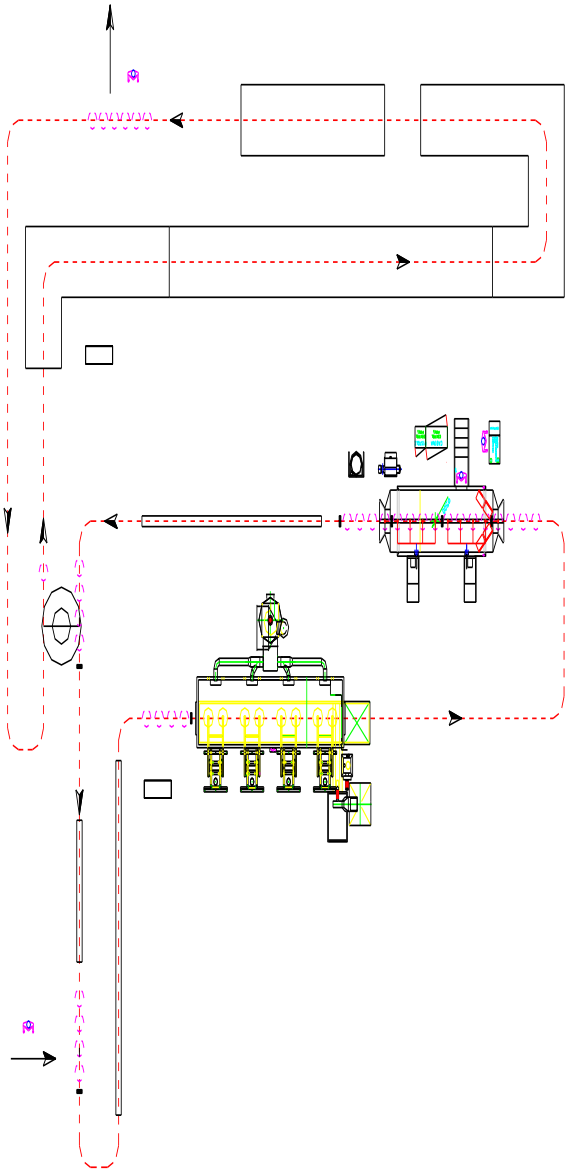
The picture below shows a powder enamel system at Kwikot (South Africa), which has a production capacity of 120 boiler of 150 liter per hour.

At this point we could discuss in much details the pro's and con's of the various material handling concepts, like integrated monorail conveyor, two simple monorail conveyors, a

combination of simple monorail plus P+F with automatic product transfer or a full P+F system with furnace integration.

Each of the above mentioned concepts has already been used in practice, but they all have in common that the introduction of the lance into small boilers with ditto openings requires the very precise positioning and centering of the conveyor, products & lances.

Furthermore the total solution, complete with online shotblaster, ditto powder enamel system, advanced material handling system and continuous enameling furnace, require a relatively large capital investment and much factory space.



Offline solutions

In response to market requests Nordson & its Dutch partners (Straaltechniek & Railtechniek) developed a patent applied off-line solution, which has been successfully installed and put in operation at Leov Company in Macedonia earlier this year.[1]

Orders for two similar enameling plants have already been received and these equipments will both be installed in Greece within 2003.

As you may see on the enclosed plant layout, the total enameling plant including storage area requires only 25 x 15 meters, which is only 50 % of the typical space for an online solution with comparable production capacity.

[1] This project was sponsored by Senter International under the PSO program of the Dutch government.

The boilers are first placed on the indexing table of the offline shotblasting system, which consists of two consecutive processes stages; blasting with a rotating multi-outlet nozzle and ditto blow-off.

Once the products have been clamped to the table, the operator has to select the appropriate program and push one button to initiate the blasting process, which is done fully automatically in accordance with the data stored in a Siemens S7 PLC.

Upon completion of the pretreatment cycle, the boilers are transferred manually (eventually with the support of a weight balancer) to the powder enameling system.

Also the off-line enameling system is characterized by the use of a large indexing table, on which the products are clamped.

Thanks to this rigid indexing table the product positioning is much more accurate then with online system and therefore allowing much smaller product openings.

The system, which has two application stations and may be operated by one person, has a typical production of 30 to 40 boilers of 80 liters per hour, depending upon the product complexity & application requirements.

The system is equipped with robust single axe robot and an advanced microprocessor based control panel with a large touch screen and closed-loop digital flow controls for both powder flow & atomizing air to ensure a very homogeneous film built inside the hot water tanks.

These closed-loop controlled flow controls are especially useful, when regular fluctuations in the plant's compressed air supply are expected.

Powder feeding, sieving & recovery is done automatically, likewise the online systems.

Thanks to a user-friendly interface the operator can easily select and edit the available recipes per product family or monitor the other system parameters.

This allows even a relative inexperienced enamellist to produce a good & constant quality once the right process parameters have been entered into the controls system.

A set of beam array is furthermore protecting the system against human errors during program selection.

Since the touch screen runs under windows operating system all technical information concerning the system & its components are under the finger tips of the operator.

After completion of the application cycle the boilers are transferred to the furnace conveyor and cured in a low thermal mass enameling furnace at 830 degrees Celsius.

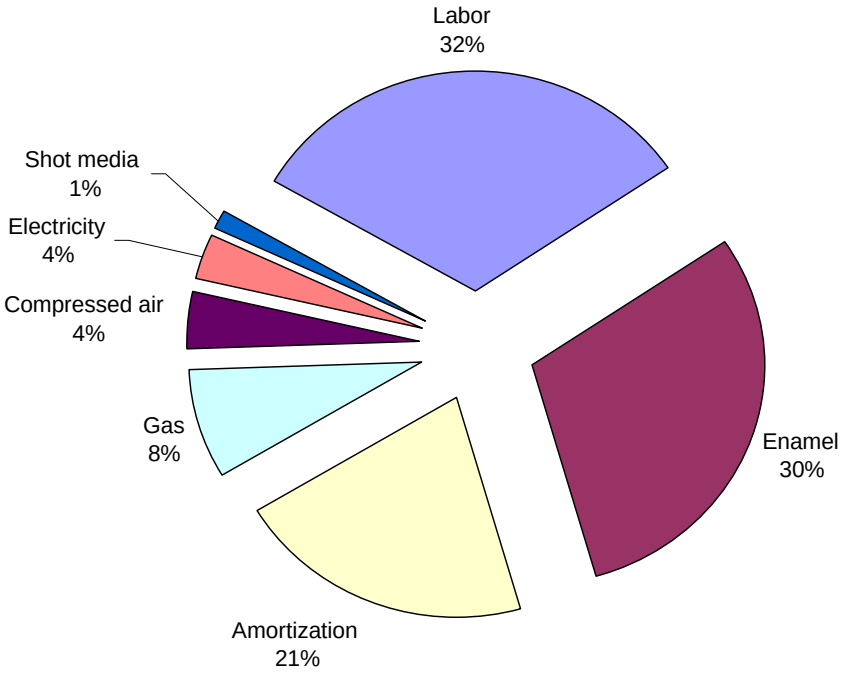
Enameling cost

It is always hard to present detailed information about the expected enameling cost, since the various cost components might vary from country to country and from customer to customer.

However, in general terms we may state that :

- The variable material costs with an offline solution are identical to those with an online plant.
- One extra labor position is required due to the manual product transfer from the shot blaster to the powder enameling system, which is otherwise done by means of the conveyor system
- The capital investment for the offline solution is at least 100 k Euro lower.

The share below show the typical cost distribution for an 80 liter boiler at an European customer, which operates his plant in two shifts, utilizes a gas fired U-type furnace and amortizes the equipment in 5 years.



We trust that thanks to the moderate capital investment required and the excellent coating quality achieved with this compact enameling plant, many small & medium-sized boiler manufacturers, which currently use other metal substrates and/or protective coatings, will consider to start powder enameling too.

For further information we kindly refer to our website (http://www.ditmer.nl/) and for assistance contact

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