

Saving energy and costs in automotive painting

Painting is the most energy-intensive process in automotive production. In one year a large paint shop uses as much energy as a city with 50,000 inhabitants and associated commercial zone. For this reason Dürr has been working on energy efficient plant concepts for many years which can be measured in actual costs per unit reductions. Under the name “Green Paint Shop” experts from Dürr have developed a model paint shop system to optimize the energy balance. This serves the customer in two ways: substantially smaller costs per unit and better environmental compatibility.

With this green paint shop Dürr has reduced automobile painting energy consumption by 60% and consumption of fresh water by 44%. The CO₂ emissions of such a plant are also cut by around 33% compared to conventional paint shops. In this model more than 20 different measures are brought together in a package, decisively contributing to an improvement in the energy balance and ecobalance of automobile painting.

New methods for pretreatment: rotational dipping or heavy metal free

Energy savings start with pretreatment. The rotational dipping process RoDip is used here and in cathophoretic painting. The process of dipping, flooding and dripping off is optimized due to the rotation of the entire car body in the tank. RoDip means significant costs per unit (CPU) savings owing to reduced expenditure on building investments, material, personnel, maintenance and energy.

A sample calculation for a European model plant with a capacity of 300,000 bodies per year reveals CPU savings of nearly 16% per body. The first contributing factor is the opportunity to save space: Due to the 360° rotation in

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the dip tank, the slopes at entrance and exit are not required and the tank can be significantly shortened. Further factors are reduced material costs based on a smaller dip tank as well as energy conservation of over 35% due to better circulation and heat efficiency resulting from smaller bath volumes and less waste water. This technology also minimizes contamination, paint runs and sags, which improves not only the quality, but reduces repair, touch-up work and polishing and as a result personnel costs as well.

An alternative type of pre-treatment is the Aquence™ chemical “autodeposition” process developed in collaboration with Henkel. In just a few process stages this innovative technology facilitates high-quality corrosion protection without the use of heavy metals. The coating film forms an organically aqueous solution wherever the chemicals meet ferrous metals. A deciding cost factor is that the whole process is chemically induced and no electricity is required. Fewer process stages and streamlining of the process result in a significant reduction in painting costs.

Overspray separation has just been changed to a dry process

The EcoDryScrubber is a further step nearer to “the green paint process”. In terms of the whole paint process this new overspray separation technology for wet painting saves 30% of the energy needed for automobile painting. If we consider just the booth area, energy savings can be as high as 60%.

Crucial here is the re-circulation of booth air and dry removal of excess paint particles during the paint application process. By air recirculation the energy requirements for air treatment are clearly reduced compared to conventional paint booths. In addition, the replacement of conventional wet scrubbers means that fresh water is no longer needed for paint separation. Besides this large energy saving rate the EcoDryScrubber sets itself apart because it protects resources due to reduced CO₂ and paint particle emissions.

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Another point relating to the environment also needs to be mentioned: The limestone powder used as the bonding agent in dry separation can be reused untreated in its saturated condition in other production processes such as in the cement industry or flue gas desulphurization – in contrast to wet separation paint sludge, which has to be disposed of as hazardous waste.

In real terms this means that a standard plant using heat recovery saves 7.20 Euros per painted vehicle. Depending on the location and the complexity of the plant this CPU saving can add up to as much as 14 Euros per vehicle. The recirculation of process air is a key to making this process stable enough for use all over the world as it is largely independent of outside temperatures and air humidity, and also results in an increase in paint coating quality which is more than just an agreeable side effect.

Paint coating becomes more efficient

Promising approaches to reducing costs per unit are also being made in application technology. The largest cost factors, apart from personnel, are material costs (paint, sealing materials). These can be largely reduced by increased effectiveness. In this way the innovative EcoPurge LCC color change system leads to smaller paint losses and shorter process times during color change. With EcoLCC each color is activated as soon as it is docked on to the appropriate color valve. For this reason a common paint channel is no longer required. This color changer can be variably designed for up to 36 colors. The color change times can be shortened to under 10 seconds depending on the version and procedure, while paint loss per change procedure can be reduced to less than 10 ml.

The EcoBell2 ICC high rotation atomizer possesses an integrated color change-over switch for high runner colors which reduces color change loss for 6 colors to approx. 4 ml instead of the usual 40 - 50 ml per color change and atomizer. Due

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to this short color change time of approx. 6 seconds productivity can be increased and up to 5% more car bodies produced.

The introduction of the rotation atomizer for interior painting, when compared to a pneumatic atomizer, clearly brings a higher application efficiency. The development of a new bell disk in conjunction with a new shaping air ring allows a new mode of operation of the EcoBell2 HD atomizer, and provides a very accurately focused spray jet. In this way the interior paint finish efficiency improves on average by around 25%, and in individual cases by up to 50%.

In addition, energy costs can be considerably reduced by intelligently designed application equipment: Robots arranged on raised travel rails improve accessibility during external finishing of the surfaces to be coated and this allows the use of narrower booths, which in turn, results in lower operating costs.

Robots in the fast lane

Travel rails in the interior painting booth can be fitted one above the other. The handling robots for opening engine hoods on the upper travel rail can “overtake” the paint robot on the lower rail. Shorter booth lengths of 1 to 2 m are thereby possible and this reduces capital expenditure as well as operating costs.

Extensive automation in the sealing processes such as seam sealing, underbody protection and cavity wax rust proofing leads to savings in personnel and material costs. The reduction in material costs is a consequence of precise and reproducible automated process management, in particular by accurate dosing and movement synchronization.

Everything under control at a glance

Under the aspect of energy and cost saving Dürr has also extended its globally deployed *EcoEMOS* supervisory control technology by adding an interesting component - the *EcoEMOS* Energy software module. This tool facilitates targeted

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evaluation of consumption data. In this way redundant points of consumption can be identified and eliminated when compared with customized reference curves.

In addition, a focused and automated reduction of consumers during non-production times can be achieved by *EcoEMOS* in combination with the working schedule module. This new module developed by Dürr on the basis of longstanding experience offers very practical possibilities to reduce costs in an energy-intensive environment.

Expert check for the paint shop

Of course there is vast potential for optimization, when existing plants are given a closer look. Dürr has therefore already conducted successful assessments of paint shops for customers in Europe, Asia and the USA. As the world's leading paint shop supplier Dürr possesses total process know-how in industrial painting. The assessments already carried out have shown that plant checks hold great potential for optimization and cost savings.

The surveys can be conducted under a wide variety of aspects. Depending on the needs and priorities of the customer, focus can be placed on energy and material efficiency, on capacity adjustments or on the optimal implementation of statutory provisions. Another process that benefits from such an assessment is of course benchmarking.

New form of co-operation

The ABF framework agreement is a special kind of co-operation which has been finalized with Ford. Dürr has thus been awarded worldwide status as Aligned Business Framework (ABF) partner. This means that Dürr is the first point of contact for Ford in the contract awarding process for paint finishing equipment, and both companies develop technical solutions together. In this way Ford cars are built on fewer platforms worldwide, with higher quality, lower costs and a larger proportion of standard parts and systems.

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The Dürr Group is a supplier of plant and equipment that commands leading global market positions in its areas of activity. Business with the automotive industry accounts for about 85% of its sales. Dürr also supplies innovative manufacturing and environmental technologies for the aircraft, mechanical engineering, chemical and pharmaceutical industries. The Dürr Group operates in the market through two divisions. The Paint and Assembly Systems division supplies production and painting technologies, mainly for automotive body & chassis manufacturing. The equipment and systems supplied by the Measuring and Process Systems division are used, among other things, for engine and transmission production and for final vehicle assembly. Dürr is present in 45 locations in 20 countries around the world. The group achieved sales of € 1.6 billion with approximately 6,100 employees in 2008.

Photo 1: Increase in quality and reduction of costs: RoDip rotational dip coating

Photo 2: 60% less energy consumption in the painting booth through dry overspray separation

Photo 3: Higher capacity thanks to shorter color change times using the EcoBell2 ICC high rotation atomizer

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