



Tannery of the Year: Couro Azul, Alcanena, Portugal

Family-owned and -run, Couro Azul is part of the Carvalhos Group of tanneries, based in Alcanena, Portugal's main leather industry hub. Its main focus is automotive leather, with steering-wheel leather its specialism, but it aims to expand more and more into upholstery leather for cars, aircraft and for other forms of transport seating.

The Carvalho family, established as leather manufacturers in Alcanena, Portugal's principal leather production centre since 1939, took over and began running the Couro Azul tannery at the time of company's fiftieth anniversary. The name (which means blue hide or blue leather) does not lack irony because the acquisition came at a time when a new generation of Carvalhos Group directors wanted to diversify and move into automotive leather, for which it has no bluing operation. "The name stuck," explains chief executive, Pedro Carvalho, "and people like it, so we haven't changed it."

It took until 1993 for the company to achieve its first big breakthrough in the automotive sector, with a contract to supply steering-wheel leather to Opel, but Couro Azul has grown steadily since then and automotive now contributes more than 70% of group turnover. It is in the middle of an ambitious expansion plan, with an

extension to the beamhouse due to open in February or March 2014 and a new cutting plant planned for 2015. The total group workforce is 420 people at the moment, having increased by 100 in the last 12 months. Almost 75% of these employees work in Couro Azul. Originally, the plan was to install the new cutting plant first, Mr Carvalho explains, but the increase in demand for automotive leather that the whole leather industry has noticed in recent years means bigger beamhouse capacity has become more urgent.

Export focus

Since the economic downturn that began in 2008, these have been difficult years for the Portuguese economy. For an export-focused company such as Couro Azul, things have been better, but lower spending around the world initially meant fewer car sales, and this hurt tanners for the first few years. Couro Azul noticed things



The land around the site of the tannery is naturally contoured and lends itself to landscaping as shown in this image of the entrance to the tannery.

picking up in 2011, as new product launches, such as the introduction of new models of cars, that had been put on hold began to reach the market. In 2012, the company's sales increased by a further 8%. For 2013, however, the company has calculated that the increase will be of the order of 40%. "A lot of factors have come together at the right time," says Mr Carvalho. "In steering-wheels and gear-sticks, there is increasing use of leather because leather adds value, much more value than the automotive companies have to pay tanners. It's a small investment for them and they get a lot in return. The point is that if you go to the dealer and ask to add a leather-covered steering-wheel to the model you have decided to buy, they are likely to ask the consumer to pay ten times the cost of the leather. As a result, leather is becoming more and more popular, even in medium-range cars. An important volume of these cars now have some leather in their interiors, even if it's split." Reflecting this, there are new Couro Azul projects to supply leather to Porsche, Mercedes, Volvo, Volkswagen, PSA (Peugeot Citroën) and others in 2014 and beyond.

This progress is welcome, and important. Creating employment matters immensely. "Everything changed when the financial crisis hit," the chief executive continues. "Running a country is like running a

company; if there is no growth, you cannot pay back financial support you received when you needed it." Nationally, unemployment was around 7% seven years ago and it's now around 16%, and has been higher. More worryingly, youth unemployment is above 35% and young doctors, architects and engineers are leaving Portugal in search of better opportunities elsewhere. "What will happen in Portugal in, say, the next ten years without these highly qualified young people?" Mr Carvalho wonders. "We used our taxes to educate them, but now won't have access to their skills and knowledge in our economy. In the last three or four months of 2013, the figures appeared to be more positive, but there is a lot still to do. So, for us at Couro Azul, we are happy to have the opportunity to grow our business and to create jobs. We are giving opportunities to young people. We insist they have to have completed 12 years of education, while the national requirement is only nine years. We want more than the minimum. We have an internal training programme, in which more than 100 individuals took part in 2012. Many have also attended training courses at the locally based Leather Industry Technology Centre (CTIC) and some have gone on to university courses at the Polytechnic Institute of Tomar, 40 kilometres from the tannery. We believe

that we will gain an advantage in the years ahead from having well educated people work here."

A family affair

Pedro Carvalho, and technical director, António Carvalho, are cousins; they and three other cousins represent the third generation of the family to run the tanning group, begun by their grandfather. Their nephew, Bernardo, has recently joined the company and represents a fourth generation; he spent three years working for a consultancy company in Lisbon before following his forefathers into the leather industry. It's a company rule that family members need to gain at least three years' experience of working outside the Carvalhos Group before taking up a role there.

António Nunes de Carvalho, founder of the group, began by tanning sheep and goat skins for garment and footwear applications; he was a tanner all his working life and had many years' experience of making leather when he branched out on his own. A photograph in the Couro Azul offices marks the moment in 1939 when he brought his first batch of raw skins to Alcanena to start production. "He had to go to Porto to buy the raw material from a dealer there," the grandson who bears his name explains. "No one had a car then and he had to go by taxi; the taxi driver is in the photograph."

All three plants the group runs (the cutting plant, Couro Azul and the footwear tannery) are close to one another and are all part of the Alcanena leather cluster that now comprises 95% of the Portuguese tanning industry, with around 50 tanneries operating there. Footwear leather is still hugely important in the Alcanena cluster as a whole. Official figures from CTIC suggest 70% of turnover, by value, from these tanners collectively comes from sales to Portuguese footwear manufacturers. However, CTIC managing director, Alcino Martinho, confirms that 90% of the shoes these manufacturers make are then exported, so the focus on external markets continues. At the end of 2012, Couro Azul won an important export award, organised by one of Portugal's main business newspapers and Banco Espírito Santo.

Raw material from Spain and beyond

Seventy-five years on, the Carvalho group is still making shoe leather in the original (though much modernised) António Nunes



From a technical point of view

(1) Overview of operations

Couro Azul bovine leather tannery has been operating on the same site in Alcanena since the 1980s. The tannery mainly produces steering-wheel leathers, although other leathers are manufactured for other parts of the automotive sector, aircraft and railway carriages. The company cutting plant for supply of cut components from the tannery is situated nearby, and also a second tannery (António Nunes de Carvalho) for the manufacture of footwear leathers from chrome-free leather manufactured at the Couro Azul tannery. The company has manufactured leather for almost 75 years, employs around 330 people at Couro Azul plant out of a total of 420 at the three locations.

(2) Manufacture and processing

Bovine hides are mainly received following collection in Spain, mostly as fresh hides using refrigerated transport. Salted hides are also used from other sources in Europe, and all goods received are assessed on receipt for quality.

The average input is 1,100 hides per day, but the process used at Couro Azul is unusual. The whole technology is based around leathers that are chrome free, and follow a single process through soaking, unhairing or liming, tanning and retannage (with the exception of different dye requirements), with the majority of the leathers being black. In addition, all of the leathers are shaved at the same substance, for the final thickness as required for steering-wheel leathers.

This has enabled rationalisation and process development that would be difficult to achieve with multi-product manufacture. Chemical stocks are simplified and reduced in volume, the volume of goods in work and stock is minimised, and throughput is rationalised. Other advantages are found within machine and operations management, and production control.

The soaking, liming and tanning processes operate using two, five and five wooden drums respectively. These are all 4.5 x 4.0 metres in size, set in line and serviced by a rear mezzanine. These vessels are loaded using a grab, and the goods are all discharged after processing into stainless steel trucks. The process starts with a two-hour soak, followed by manipulator feed from a loading station to an elevated through-feed fleshing machine. Considerable care is taken at this stage as this is the only fleshing operation that is performed.

After discharge from liming, the hides are hooked onto a feed-conveyor track for delivery to a trimming-preparation table. They are then automatically delivered in batches to loading stations for optimum presentation for the lime splitting operation. After splitting the flesh splits are delivered flat onto a semi-transparent trimming table which is illuminated from below to reveal defects. The trimmed splits are processed in-house for steering-wheel leathers using the same chemical process as grain split hides. The trimmings are sold for gelatine production.

The tannage produces a cream-white leather, and together with an over-night lay before samming takes two days from hide input. There is emphasis within the samming operation for the operatives to extend the leathers to avoid any creasing. The operation is slow and set to the feed-rate required by the shaving operation. Unusually, the hides are offered flesh side up to samming, so that after conveyor delivery the hides



There is considerable focus on the fleshing operation before unhairing/liming as none of the hides that are processed are lime split. The photo shows out-feed from the through-feed fleshing operation.



After lime splitting, the flesh splits are trimmed on a static table lit from below to expose any faults and gouges in the croupions. These are then further processed in-house.



After a chrome-free tannage the hides are dumped into stainless steel trucks, then stacked flat onto two stillages in preparation for samming the following day.



remain flat and extended, thus enabling the operatives to slide the hides directly into the shaving machine. On out-feed from the shaving machine, the hides are loaded flat onto an over-machine conveyor, which delivers the hides to a grading area, followed by stacking into six selections. The lower grades are removed from site and processed as chrome free leathers with anti-bacterial properties within the company footwear tannery to produce footwear leathers such as Oak Leather, which is ultimately compostable over 21 days and 100% biodegradable.

After dyeing and a retannage that provides a firm and tight structure, the hides are samm-set, with automatic delivery onto a low-temperature vacuum drier. On off-take the hides are slid flat onto a conveyor feed into a drying unit where they are dried for 20 minutes, then trimmed on off-take. The hides are then dry split and de-dusted. This is to remove approximately 0.1 mm from the flesh side to ensure the stringent thickness requirements for steering-wheel leathers.

The hides are tumbled to soften with continuous dust removal by filtration, and are then extended by toggling and then dried. If any leather is to be buffed this follows together with de-dusting. The sorting arrangement has been rationalised. Two operatives trim the leather on a movable loading table, and at the same time they are graded. The grading team stamp the grade onto a flank on the flesh side, then slide the hide into the through-feed vibration staking machine. The hides are stacked to grade on out-feed, followed by de-dusting, then spray-sealed on the flesh side to avoid the release of any residual fibres or dust.

The finishing operation is in an adjacent building, where a single roller coater and drying tunnel is used for first coat and top coat applications. Two spraying units comprising one spray head and one drying line are used for intermediate finish applications and a fine top spray. Two of the drying units are electrically heated, and the third is being converted from steam; there is also a rolling-embossing machine with seven replacement rollers for various surface textures. Leathers are also staked and tumbled within the finishing sequence.

Great care is taken to eliminate dust throughout the plant. Filters are fitted to the fan-operated cooling unit at the end of each drying unit, and the normally open area between the roller coater-spraying units is enclosed to protect the wet finish from any residual particles.

Cutting operations take place in a separate unit near the tannery, but first each hide is inspected at the tannery for defects, which are then identified by marking the grain surface. After delivery to the cutting plant the hides are placed on a conveyor belt within a scanning cabinet using one of four identical cutting lines. The hides are scanned to achieve the optimum cutting coefficients, where both the defects as previously identified, and the direction of the pattern according to the direction of minimum elongation under load, are taken into account.

Once scanned, the conveyor moves the hide into the cutting zone, where each pattern is cut using an oscillating knife blade mounted in a cutting head. This is under computer control, with the whole operation managed from an elevated control room overlooking the whole department.

Each component is then inspected for shape and size against standard templates and for defects, then manually assessed for elongation. Once non-conforming components have been rejected, each remaining component is



After samming, the fully opened hides are delivered flesh side up for direct feed to the shaving operation. After shaving, the hides exit over the top of the shaving machine by conveyor, grain side up for inspection and grading.



Dyeing, retanning/lubrication is performed in Dose tri-compartment drums of equal size. The feed mezzanine is constructed of steel lattice and extends over the top of these vessels. Additions are by chute through feed hoppers or through the floor into the open drum.



Within a team of four, hides are simultaneously trimmed by two people and graded by the other two team members. Once graded the hides are slid into the feed for through-feed vibration staking.



The humidity and temperature is controlled within the finishing department to avoid variation and help control the absorbency of the grain of the leather within finishing.



There is emphasis on dust elimination, and the space between both roller coating and spray units and the drying tunnels are enclosed to avoid contamination from any dust that might be in the air.



Within the cutting plant, the leather is scanned, and the cutting arrangements for the steering-wheel components optimised by computer. This takes into account both the pre-marked defects identified in the tannery, and the direction of minimum stretch as required the final component.

mechanically stretched using equipment developed by the company, then graded according to the percentage elongation under load. This is to ensure that when the steering-wheel kits are brought together, each component will have the same elongation grading, and provide uniform behaviour when the steering-wheels are assembled. Other operations include manual press cutting to create punch holes within cut components, and a dry splitting if required to ensure uniformity of thickness. Other components also cut at this plant include coverings for grab handles for trucks, auto upholstery and interior components.

(3) Solids management

- All of the fleshings following the soaking process are sold for grease extraction
- All of the cuttings before limed splitting, and the trimmings from the limed flesh splits are sold for gelatine production
- The wet-white shavings are compressed and sold for fertiliser manufacture
- Waste from press cutting perforated components and from dry splitting are designated for leather board manufacture
- All containers are washed before reuse, return or sale.

(4) Water and environmental management

[a] WATER

All water used is from the tannery's own supply. Discharge is after pre-treatment to a common effluent treatment plant (CETP) that serves the Alcanena cluster of tanneries.

[b] EFFLUENT TREATMENT

The tannery discharges are separated into sulfide-containing discharges and washings, and the remaining wastewaters from processing. The sulfide-containing wastewaters are held in a sump during the daytime, with the sulfide removed at night time using catalysed aeration, before discharge from the site through a self-cleaning screen. During daytime all of the other discharges are screened using the same screen and discharged. No chromium-based tannages or retannages are used, so no further separation or pre-treatment is required. All of these wastewaters are delivered directly to the CETP, the volume being metered for charging purposes.

The treatment by the CETP is comprehensive. Between 4,000 and 5,000 cubic-metres of effluent is received from the tanneries in the area through a total of 40 km of pipelines. Pre-treatment is required by the CETP, including the segregation and collection of chrome-containing discharges. These are delivered to a dedicated treatment plant for precipitation and regeneration. The effluents are blended, coarse screened then lightly aerated for flotation purposes within extended gullies with automatic surface scraping to remove surface scum or solids, before mixing and balancing in a single high-volume holding tank. With uniform discharge, the effluent is adjusted to pH 9.0 to precipitate any residual chromium compounds, then with ferrous sulfate to precipitate protein and retanning agents, followed by poly-electrolytes to assist primary settling. After primary settling the effluent is subjected to an activated sludge treatment, then



settled in two secondary clarifying units that operate in parallel before discharge to the adjacent river, the Alviela.

All of the solids are dewatered using two conventional filter presses. On discharge the dry cake drops onto conveyor belts to deliver to trucks for landfill, being located on the same site as the CETP. The solids from effluent treatment are deposited in one excavation, and other solid wastes from the tanneries, including chrome shavings and municipal waste, are deposited in a second. These areas are of considerable capacity, lined with PVC membrane to avoid water percolation, and are expected to last for 20 years. The surrounding area is being heavily planted with trees.

[c] ENERGY

When the steam-operated drying unit in the finishing department is replaced by electrical heating there will be no need for steam in the tannery. The hottest water used will be 45°C, and it is planned to supplement the (then) oil-fired hot water system using solar panels. ☺



The components are cut by an oscillating cutting blade set in the cutting head. This cutting is under computer control as determined by the scanning operation.



Solids from the effluent treatment plant and general solid waste from the tanneries are stored in separate encapsulated landfill sites adjacent the CETP. The surrounding area is being planted with trees.



The common effluent treatment plant (CETP) receives pre-treated wastewaters from around 50 tanneries in the Alcanena cluster. The image shows one of the pair of secondary clarifying units.

de Carvalho tannery, but its main business these days is the automotive leather produced by Couro Azul. It processes 1,100 bovine hides a day, from which it makes the leather for all its operations. From early 2014, when the beamhouse extension is complete, this figure will increase to 1,600 hides and there are plans to acquire more tanning drums and push production up to 2,000 hides per day by the end of 2014. Between 90% and 95% of the hides Couro Azul sources are from Europe, with some from Portugal (which has only a small cattle population and slaughter rate), some from south Germany, France, the Netherlands and the UK. Spain, however, is the main source. With the number of tanneries

decreasing across the border, Couro Azul believes it is in a good position to find good volumes of high-quality hides in Spain, where it has a dozen or more regular suppliers. With good transportation links between the Iberian neighbours now, 75% of the material coming into Couro Azul is made up of fresh rather than salted hides. Group chief executive, Pedro Carvalho, would like the leather industry to do more to encourage cattle farmers to look after the hides of their animals better to make it easier for tanners to produce high-quality leather, from which everyone in the supply chain would benefit. "Tanners can almost perform miracles by transforming by-products into luxury material," he says, "but

there are limits." He feels the leather industry should have formal, global guides for farmers, abattoirs and hide traders to help them look after animals well and produce hides of the best possible quality.

Steering-wheel leather still accounts for between 65% and 70% of all Couro Azul's automotive output, most of it going to customers as complete cut kits. Of all its steering-wheel leather, 57% leaves Couro Azul as cut sets in top grain leather, and 23% as top grain that customers will cut themselves, so product quality is of the utmost importance. Six years ago, it began to seek seat cover business too; work on initial projects for Mitsubishi, Toyota and MG Rover has paid off with more recent contract wins



The tannery is being expanded into a new wet end facility adjoining the existing buildings. The trench is part of the construction of the drainage arrangements for separation and recycling of wastewaters from wet processing and machine operations. The building will be prefabricated with a construction deadline of early 2014.



The engineering department, workshop, maintenance stores, boiler plant and water delivery systems are all very accessible as they are located directly behind the row of soaking, liming and tanning drums.



All of the shaving dust is blown from the shaving operation to an elevated cyclone set outside the building for compression before deposit into a hopper.

from Porsche. It's attractive business, Pedro Carvalho says, because the quality of the leather has to be high and the volume is good. If the gross amount of leather required to cover a steering-wheel is around 0.5 square-metres, a fuller car interior project could easily consume between six and 12 square-metres. "Steering-wheels are still our core business, though," the chief executive continues. "We believe we are in the top four or five worldwide for steering-wheel leather."

Something that helps is an agreement with a taxi company in the national capital, Lisbon, to test Couro Azul's steering-wheel leathers. Representatives of the company go to look carefully at the taxis and to talk to the drivers about wear and tear on the steering-wheel cover. "We want to see how the leather works in real conditions," says sales manager Mateus Couto. "Sometimes the taxis are on the road for three shifts, which can mean 100,000 kilometres per year. We have learned a lot from this."

Since 2006, Couro Azul has also had a keen interest in leather for aviation interiors. It is still working hard to make inroads into this segment, and has had recent discussions with Brazilian manufacturer Embraer. The tannery has been part of an all-Portuguese project (apart from Embraer) to design a new, sustainable aircraft interior. The project, called Life, won an award at the Aircraft Interiors Expo in Hamburg a few years ago. There are also projects for trains in Spain and for buses in the UK. "These companies do not invest in leather upholstery for status or comfort reasons," Pedro Carvalho says. "It's simply that, even if the initial investment is higher, the payback is better than with fabrics. The life of leather upholstery can be four times longer."

Final cut

Couro Azul runs its cutting department in a separate building, which it rents. It has experimented here for some time on the best lay-out of the cutting machinery and the best work-flow and will put all its findings and experience into the new cutting plant it will open in 2015. This new cutting plant will be on the same site as the Couro Azul tannery and will link to it by tunnel to make it easy and quick to transfer finished hides from one to the other.

One innovation in the current cutting plant that Couro Azul believes has made a big difference is a machine that allows it to group cut-pieces together based on their elasticity. This, the company says, helps it meet its customers' demands on elongation. Technical director António Carvalho explains that matching pieces used to go together based only on the visual quality of the grain and lack of obvious defects. However, an extra machine, developed in-house, has allowed the company to take another factor into account, the elasticity of a particular cut piece. All pieces meet customers' technical specifications, but this extra step in the sorting process, using an extra machine, allows sets to match up in elongation too. There are three categories, A, B and C, based on how much force the piece of leather will tolerate on elongation. Pieces in the same category will combine more easily when workers at a tier-one supplier's steering-wheel factory come to attach the leather to their product.

"This is based on our knowledge of our leather and of how each steering-wheel works," says António Carvalho, "knowledge we have built up from previous projects. It benefits us because we want to have fewer rejections. Some rejections may not be necessary; it's just that if the different pieces in one kit have different elongations,



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it can be harder for the tier-one worker to make the kit fit." He explains that the differences between categories A, B and C are quite small, and hard to detect by stretching the strips by hand. "We have to think also of the workers in the tier-one factory," he continues. "They are often women, often from poor communities, often paid by the piece. If all the leather fits together better, at the end of a shift, a woman may have completed one more piece and will take home more money to her family." Around 47% of all Couro Azul's steering-wheel leather shipments go to Romania at the moment; part of the European Union (EU) since 2007, Romania has become an important centre for automotive production in Europe. It is close to the geographical centre of the continent but has the second-lowest per capita gross domestic product in the EU (only Bulgaria's is lower) and consequently has proved attractive in terms of labour costs to many of the big names in the automotive industry. This development work carried out in a tannery almost at the other extreme of Europe, close to the Atlantic Ocean, (the grouping of leather strips into categories A, B and C for elasticity), has helped make the lives of workers there easier and more prosperous.

António Carvalho says he is always on the look-out for new ideas. "What I like," he says, "is finding different ways of doing things, ways I think no one else is using." Another example from the cutting-room is putting perforations into leather pieces, which some automotive brands, usually called original equipment manufacturers (OEMs) demand, after initial cutting. The pieces are deliberately cut a little larger, with a final cut, including the perforations, taking place at a second stage. This produces a second lot of scrap, but Mr Carvalho insists it's better and faster than having the cutters work with dies to make the perforations on large pieces of finished leather. In fact, he insists this change has led to a four-fold increase in the number of sets that a cutting team can complete in a shift. He has also developed a complex-looking costing software tool that takes all costs, not just hide prices, into consideration and allows the management team at Couro Azul and in the rest of the Carvalhos Group to calculate the prices they need to ask customers for to avoid producing leather at a loss.

Good relationships

For Couro Azul, as for other tanners serving the automotive industry, customer relations can be complex. In some instances, the tannery talks directly to car brands, the OEMs, even if they now rely on external suppliers to make most of their equipment and materials. In other cases, the dialogue has to take place with tier-one suppliers, the companies that specialise in making steering-wheels or seats. Purchasing professionals in these organisations often stay in their jobs for only a few years, which can lead to mistakes being repeated. An example of an old mistake that they can make again is to put price above all other reasons for choosing a supplier of steering-wheel leather. For example, not every tanner can secure access to raw material of sufficiently high quality to make this leather, on which the amount of finishing is always restricted, Couro Azul says.

Its discussions with suppliers of leather chemicals and tanning machinery seem more straightforward. The new beamhouse will have a new handling system from Italian automation specialist Feltre, of whom António Carvalho speaks very highly. He also likes recent innovations in drying from Cartigliano and in spray-coating from Gemata. "You can see in the systems they produce that they are open-minded and creative," he says. With regard to chemicals, he has also sought to build up partnerships. "We need each other," he says. "We, the tanners, cannot do what we have to do without the chemical companies and their technicians because they have new products. But they also need us because they don't have our knowledge of production. They have ideas about new chemicals, new chemical processes and so on, but we feel leather every day." Total investment in new buildings and machinery for the months ahead has a value of at least €2.5 million.

Seat covers will, Couro Azul, hopes, become an important part of its offering in the years ahead. An increased focus on seat covers has led group chief executive, Pedro Carvalho, to see labelling as a big issue. "We have worked in the shoe business for a long time," he says, "and for a long time shoes have had labels showing which parts are leather and which parts are synthetic. We should use the same principles in car seats." He explains that most of the time, only the part of seat upholstery that will come into

contact with the body is likely to be leather, with polyurethane (PU) covering the rest. Mr Carvalho is among those who believe that if OEMs are going to claim their cars have a leather interior, and charge consumers accordingly, at least 70% of the upholstery should be real leather. "It should really be 100%," he says, "but the minimum should be 70%." He wonders how synthetic substitute materials such as Alcantara can have come to be presented in catalogues as a desirable optional extra for which consumers can expect to pay more, sometimes more than leather. He asks why the chemical industry seems reluctant to want to promote leather upholstery, too, either on its own or in conjunction with tanners. "There are still lots of opportunities to improve leather," he says. "I mean improvements supported by the chemicals industry, such as natural, soft-touch leathers that can meet all the technical requirements of automotive OEMs. There are still important opportunities to improve leather as an exclusive, natural material." ☺

Control and Accreditations



LABORATORY SERVICES

Comprehensive physical testing is performed within the tannery. All of the chemical testing is carried out by CTIC, which is located nearby, and serves all of the Portuguese tanning industry.

ACCREDITATION AND AWARDS

- ISO 9001
- ISO TS 16949
- Oeko Tex Product Certification
- OEM's certifications according to their own referencial: VW group (Supplier A)