RUBEN GARIAZZO CLASS OF 2030

ENGINEERING SCHOOL

ENGINEERING SCHOOL - CACHAN CAMPUS

EXECUTION INTERNSHIP REPORT 1A

Quality control and metrology on a diesel cylinder block machining line

AMPERE

RENAULT GROUP - CLEON PLANT

Cleon (Seine-Maritime, France) - 22 June to 17 July 2026

EXECUTION INTERNSHIP 1A - P2030

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I would finally like to thank the whole workshop staff, operators, maintenance technicians, the quality team, and the team in charge of tooling performance, for their patience and willingness to teach.

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1. Introduction

As part of the first-year engineering curriculum at EPF (Cachan campus), students are required to complete an execution internship, giving a first, hands-on experience of professional life at operator level. This report presents the four-week internship I completed at Ampere, the Renault Group subsidiary, at the Cléon plant in Normandy (Seine-Maritime, France), from 22 June to 17 July 2026, within the machining workshop for diesel cylinder blocks.

I obtained this internship through personal networking. A friend of my sister had previously completed an internship at this same plant, and put me in touch with the person who had supervised him there. I contacted this person directly, sending a cover letter together with my CV, which led to my being accepted for this internship.

Beyond these practical circumstances, choosing to spend it in an automotive machining workshop was also a deliberate decision on my part. I have long been passionate about the automotive world, and I would like to build my future engineering career within it, ideally in motorsport, or more broadly in a demanding, cutting-edge industry such as aerospace. Discovering, from the inside, how a major manufacturer like Renault designs, controls and industrialises a mechanical part felt like a natural first step towards that ambition.

This internship had three main aims. It was meant to give me a sense of the workload involved in an operator-level position, to expose me to the human and social realities of shop-floor work (schedules, rules, hierarchical and human relationships), and to help me discover the structure and functioning of a large industrial company.

During my time at Cléon, working under the supervision of the workshop's team leader, [redacted], I was assigned to the quality control and metrology activities of the diesel cylinder-block machining line, which included dimensional inspection of machined parts, visual quality control, leak-tightness testing, and maintenance of cutting tools.

This report begins by presenting Ampere and the Cléon plant, as the context needed to make sense of everything that follows. It then turns to the tasks I actually carried out there, illustrated through detailed examples and a typical working day, before stepping back to look at the working conditions and social environment in which that work took place. Drawing on this whole experience, I finally summarise the engineering skills it helped me develop and close with a broader reflection on what this internship meant to me.

2. Company Presentation

2.1 The Renault Group and its Ampere subsidiary

Ampere is the Renault Group entity dedicated to electric vehicles and software. Announced on 8 November 2022 under the working name "Renault Electricity," it took the name Ampere in 2023 and aims to become the European leader in electric vehicles. It is headed by Luca de Meo and employs around 10 000 people, a third of them engineers, mostly spread across sites in France (Douai, Cléon, Ruitz, Maubeuge) and other locations in Europe.

Financially, Ampere was targeting revenue above 10 billion euros in 2025, with an annual growth target of around 30 % to exceed 25 billion euros by 2031. After abandoning a plan for a separate stock market listing, the Renault Group began, from 1 July 2026, a simplification of the legal structure it had put in place in November 2023, under which around 2 500 employees changed their employing entity. I was able to observe this shift from the inside: when I arrived, my whole team still belonged to Ampere, but after two weeks of my internship, the department I was part of was transferred to Renault.

2.2 The Cléon Plant

The Cléon plant, in Seine-Maritime, is one of the oldest factories in the Renault Group. Historically focused on producing combustion engines and gearboxes, the plant is now undergoing a deep transformation toward electric motor manufacturing: it notably produces the electric motor for the Alpine A390, and is set to start production of the E7A motor, jointly developed by Renault and Valeo, from 2028. The Group has announced an investment of 133 million euros at the site by 2028, along with around 50 hires over 2025-2026, bringing headcount above 3 200 employees.

Its first part was machined there on 2 September 1958. Its history is then marked by several key milestones: the C engine, the first engine built at the site, in 1962; the creation of the aluminium foundry in 1964; then the launch of the F8M engine, the site's first diesel engine, in 1981. Next came the creation, in 1991, of the Elementary Work Units (UET), the basic organisational level of the workshop still in use today, before the 2005 launch of the M9 engine, the first engine to come out of the Renault-Nissan Alliance and the family to which the M9R engine I worked on belongs. The site then began its shift toward electric power, producing its first electric motor (5AX) in 2015, up to the creation of Ampere in 2023, the same year it passed the milestone of 100 million parts produced over 66 years of history.

> **Notebook excerpt (25 June)**
>
> *"There used to be 11 000 of them back then, now we're down to 2 500 people because of robotisation."*

This account gathered in the field contrasts with the site's official figures, which showed more than 3 200 employees in 2025, including over 150 apprentices. The gap likely reflects a change measured over a narrower scope than the whole plant, probably the workshop or production department of the person I spoke with, but it clearly illustrates how staff perceive a growing automation of jobs.

Now Ampere's leading mechanical plant, the Cléon site is organised into four production departments (aluminium foundry and machining, gearboxes, combustion engines, electric powertrains), along with support departments (logistics, quality, maintenance, engineering) and corporate services (human resources, communications, administration). It has 129 production lines, 6 assembly lines, around 6 000 machines and over 600 robots, works with 39 customer sites and 355 supplier sites worldwide, and receives or ships around 240 trucks a day. More than 100 million euros have been invested there since 2018 to meet new challenges, particularly around electrification. The plant also supplies the Renault-Nissan Alliance; around 46 % of its output goes to Renault and 54 % to other Group and Alliance brands (notably Dacia, Nissan, and Infiniti).

This transformation of the site is noticeable on a day-to-day basis. During my internship, for instance, the workshop's water network had to be modified following the closure of a neighbouring workshop, a concrete sign of the industrial reorganisation under way at the site.

2.3 Company Values

I noticed these values from the very first days, on the operators' work clothes: a t-shirt reading "The best equip themselves here, Cléon Plant, Proud, High-performing, Bold" ("Les meilleurs s'équipent chez nous, Usine de Cléon, Fiers, Performants, Audacieux"). This pride in belonging to the site is not just a slogan printed on a garment. I found it again day to day in the quality rigour applied to every inspected cylinder block, and even more so in the mutual support between operators when facing production hiccups, for instance during the cooling-unit breakdown in the middle of the heatwave.

I found this same message, in more detail, in the welcome address that the plant director, Christophe Clément, gives to new arrivals. It emphasises “solidarity, mutual support and mutual respect,” and presents health and safety as “absolute priorities.” The site’s quality policy is built around a “Customer Satisfaction Plan” with seven pillars: compliance, responsiveness, perceived quality, reliability and durability, service quality, meeting expectations, and communication. During my internship I was also able to see a concrete example of the site’s individual recognition policy, with “HD” gift vouchers awarded for exemplary behaviour or for an action that benefited safety, quality, deadlines or the environment.

2.4 Competition and Positioning

As a mass-market manufacturer, Renault, and its Ampere subsidiary for the electric segment, operates in a highly competitive European car market, facing manufacturers such as Stellantis, Volkswagen, and Asian carmakers increasingly present in the electric segment. At the Cléon site, this competitive logic translates concretely into a search for productivity gains (automation, robotisation) and into maintaining a high level of quality demanded by the Group’s and the Alliance’s internal customers: the site works with 39 customer sites and 355 supplier sites worldwide, which requires flawless reliability and traceability on every part delivered.

The site also highlights its two ISO certifications (ISO 14001 for the environment, ISO 50001 for energy, detailed in section 4.3), which have become a competitive argument in their own right with international manufacturers increasingly attentive to the environmental footprint of their suppliers. Competitive pressure is thus pushing the site to cut costs while demonstrating a credible path toward decarbonisation.

2.5 Position within the Org Chart

I was hosted within the diesel cylinder block machining workshop, which falls under the site’s Combustion Engines department, led by Sébastien Ricca, himself reporting to the plant’s management (Christophe Clément, Plant Director, assisted by Jonathan Larcher, Deputy Director). At the workshop level, the basic organisational unit is the Elementary Work Unit (UET), a level created in 1991 and still in use today: my direct point of contact, [redacted], is its team leader (“chef d’UET”). He supervises, on a daily basis, two to three head mechanics depending on the period (including [redacted]), a maintenance technician team, and two people in charge of quality and tooling upkeep, one of whom herself supervises a dedicated mechanic.

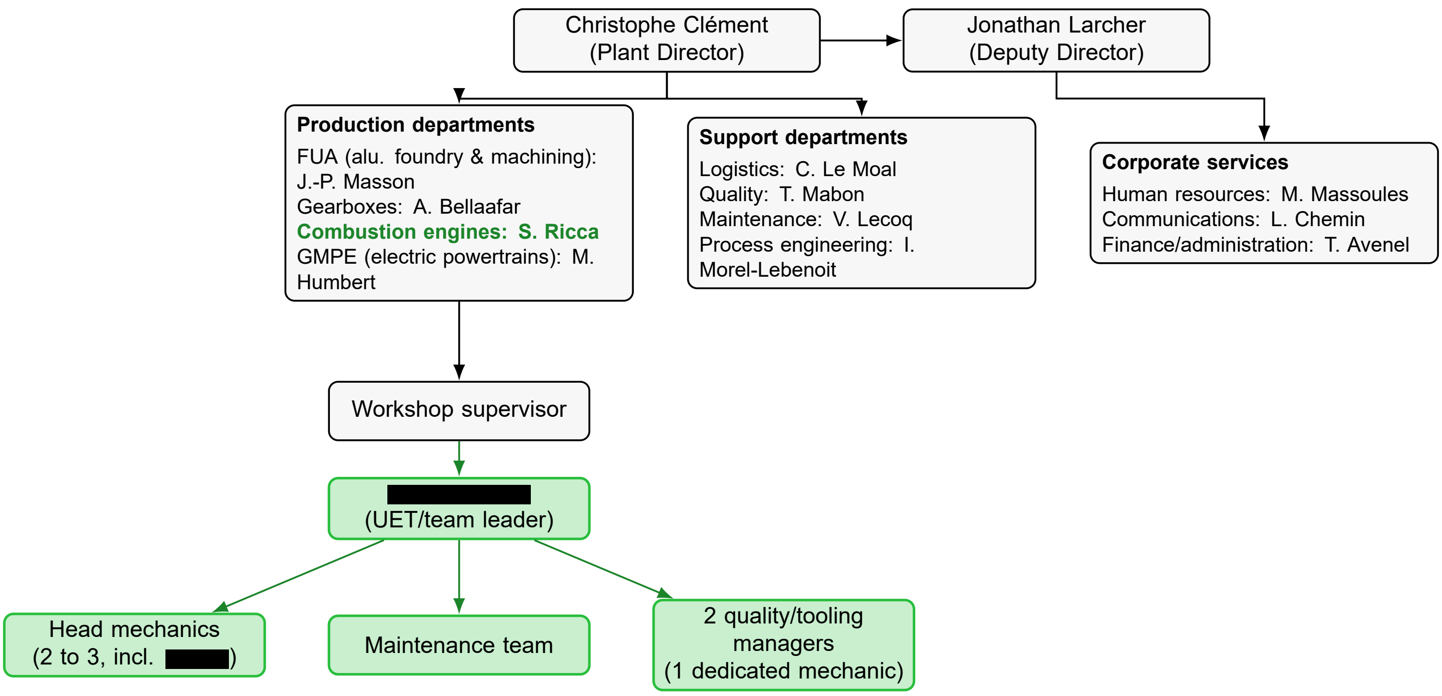


Figure 1. Site org chart and position of the host workshop (in green), from plant management down to the head mechanics (source: the management committee’s org chart, from the Ampere 2025 onboarding booklet sent to me before the internship began).

3. Work Carried Out

3.1 Overview of Tasks

During my internship, I was integrated into all the quality control and metrology activities of the diesel cylinder block machining workshop (M9R engine), rotating through several stations over the weeks (the technical vocabulary used in this section is defined in Appendix 1, p. 23). One technician summed up the workshop's logic to me like this: "every machine does something specific, and every machine has a matching measuring station," a principle I was able to see for myself, station by station:

- dimensional probing of the cylinder blocks on metrology machines (Mahr) after machining, with a periodic check carried out among others by [redacted], the machine stopping regularly to verify a reference part before resuming production.
- visual inspection of the cylinder blocks (chipping, oxidation, missing material, impacts), which I often carried out alongside [redacted].
- the 3D coordinate metrology station, where I stood in for the regular technician, [redacted], one Friday. This involved taking surface finish readings, choosing the right measurement program according to each part's label, and entering the results into a shared Excel file; whenever a result was out of tolerance, I printed a "modification protocol" for the attention of the head mechanic in charge, [redacted].
- leak-tightness testing of the cylinder blocks on a dedicated bench (ATEQ device).
- preparation and adjustment of cutting tools (inserts, milling cutters, honing heads), detailed in section 3.2.
- quality sorting of cylinder blocks with non-conformities, ahead of their return to Nissan for a decision (use as-is, rework, or scrap).

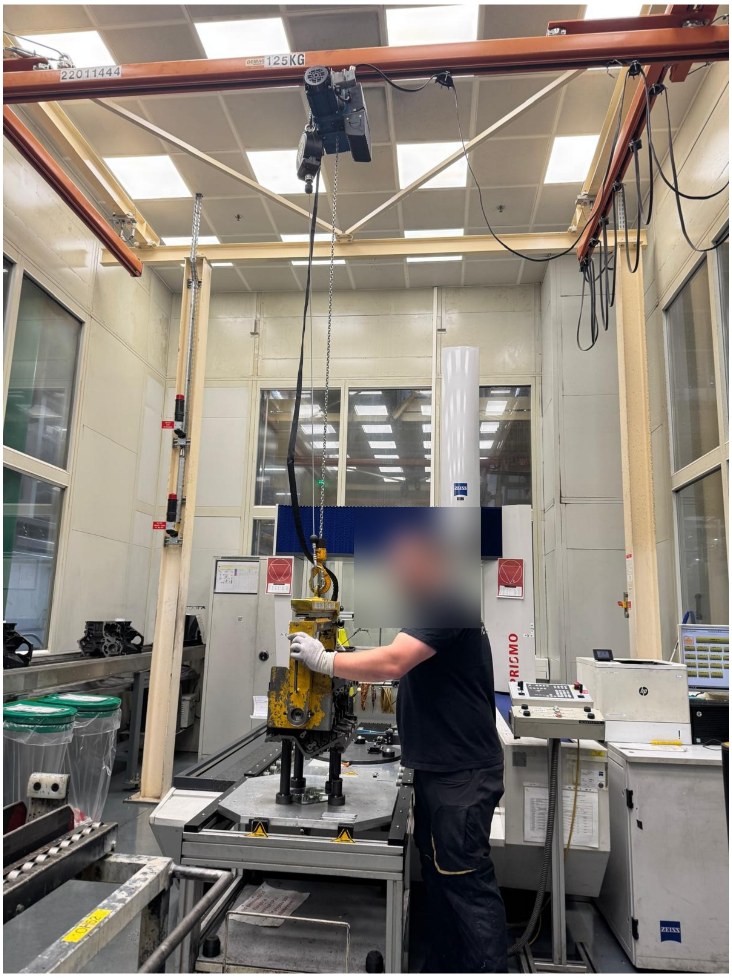


Image 2. Positioning a cylinder block on the fixture of the Zeiss Prismo 3D coordinate measuring machine, using a chain hoist (125 kg capacity).

3.2 Maintenance and Adjustment of Cutting Tools

Part of my time was spent maintaining the workshop's stock of cutting tools (milling cutters, drill bits, honing heads). The day starts with cleaning and drying the tools used during the week, before storing them in a centralised automatic cabinet, where we sort them ourselves to distinguish tools that are already sharpened from those still needing it. Some tools are mounted by shrink-fitting: a magnetic heating system slightly expands the tool holder cone, which allows a drill bit or milling cutter to be removed or fitted, and it then locks in place by shrinking as it cools.

Changing a carbide insert follows a precise procedure: unscrewing, a visual check of wear, then either scrapping it or turning it onto an unused face, cleaning, refitting and tightening to the specified torque. Once adjusted, the milling cutters and drill bits are gathered on a trolley before being brought back to their station on the line.

Image 3. Changing a carbide insert on a finishing milling cutter (HSK cone), using a torque screwdriver.

On more complex tools, the height of each insert then has to be checked on a dedicated optical presetting machine (Zoller bench), which automatically measures the tool's diameter and position by camera. Only inserts sitting too low need to be raised, using adjustment screws: I would loosen slightly, measure, adjust, then re-tighten to torque, working in small increments so as not to put too much strain on the tool.

Honing heads follow a fairly similar logic: their position depends on several pneumatic nozzles, whose pressure and flow rate must be perfectly matched to guarantee an even result (an imbalance between them is enough to throw off the adjustment, as I found out later in the internship, see section 3.7). Over several days, I also took part in changing several honing stones, which are screwed into their metal holder.

Image 4. Trolley loaded with adjusted milling cutters and drill bits, ready to be refitted at the workshop's stations.

Image 5. Adjusting a milling cutter on the metrology surface plate, using a Mahr Millimess dial gauge.

Image 6. Changing a honing stone, mounted in its holder.

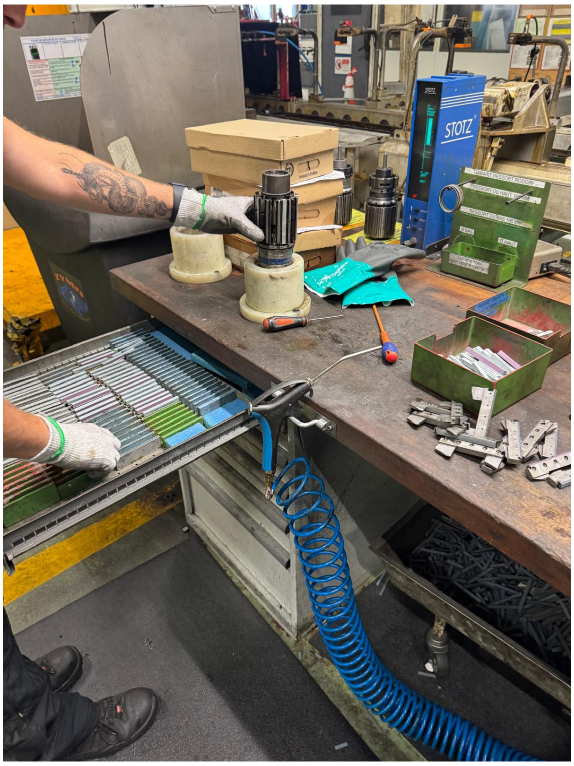


Image 7. Honing stone preparation station: honing tool spring gauge (top spring, 165 mm; bottom spring, 185 mm), a box of finishing stones sorted by shade, and a compressed-air blower.

3.3 Detailed Task: Diagnosing and Repairing the Leak-Tightness Test Bench

The most representative episode of the work I carried out involves a major breakdown of the cylinder block leak-tightness test bench. A “high” or “low” cylinder block is a block variant defined by the different positioning of certain components; for about a month, the workshop had only been making high blocks, so low blocks had not gone through the leak-tightness bench in all that time. When production of low blocks resumed, the ambient heat revealed that the seals on that unused part of the bench had degraded: the problem then spread, to the point that no block, high or low, could pass the test any more. This quickly brought the whole line to a halt, since no part could move from the rinsing station to the next visual inspection step without prior validation.

Notebook excerpt (late June)
“No block (high/low) is passing the leak-tightness test because the test machine hadn’t run for a month, and the heat destroyed the seals. [...] The workshop is stuck, no part is moving from rinsing to visual inspection any more.”

Image 8. The leak-tightness test bench (ATEQ F510/01 unit, on the left) at the time of the incident.

Faced with this blockage, the diagnostic approach was to proceed by elimination: an attempted repair with oil, without success, then grease was applied to each of the bench’s “air pipettes,” one by one, to isolate the source of the leak. After several hours of investigation, and despite the problem initially persisting on the high side of the block while the low side worked normally, the cause was finally identified: a worn seal combined with a localised lack of grease. Replacing it allowed production to restart.

This intervention let me see, first-hand and in an industrial setting, a problem-solving method built on formulating hypotheses and testing them systematically by elimination, with several technicians involved and production constraints constantly weighed when deciding what to prioritise.

3.4 *Another Example: Quality Sorting of Defective Blocks and Customer Return*

One Tuesday, after a period of sick leave, I took part in sorting the blocks set aside for non-conformity. The first step was to clear away the packing boxes meant to be thrown away, before numbering and marking each defective block ahead of a photographic check for the quality database. This meant lifting each block with a hoist from its original TM and moving it to another TM, an operation repeated on around 200 blocks.

> **Notebook excerpt (Tuesday)**
>
> *"The job is to spot the defect, mark it with a felt-tip pen, number the block, then take a photo of both together [the defect and the number]. [...] They're going to be sent back to Nissan, who will decide whether the parts get used, reworked, or returned."*

This sorting task let me discover how the quality agreement works between the Cléon site and one of its Alliance customers, Nissan: blocks judged defective are not systematically scrapped on site, but photographed, referenced and sent back to the customer, who decides their fate. A telling incident happened during this sorting, when several blocks were wrongly classified as defective because of a duplicate in the referencing system (the last digit of two production years, 2016 and 2026, matching), which made the system think a part already sold was back in stock. The actual defects observed (impacts on the face, missing casting numbers on the piston bores) were, moreover, judged not to be a problem for engine operation, unlike cylinder head gasket defects. Once the photos were taken, I had to sort and file them on the Teams collaborative tool according to defect type (internal codes such as "MM," "ACM," oxidation, chipping).

This same sorting task was also the occasion for a maintenance intervention on a machine without programmable recentring, for which the machine had to be opened up and a shim unscrewed and changed by hand. This first required fitting a lockout padlock, in line with the safety procedure required for any work inside a piece of equipment.

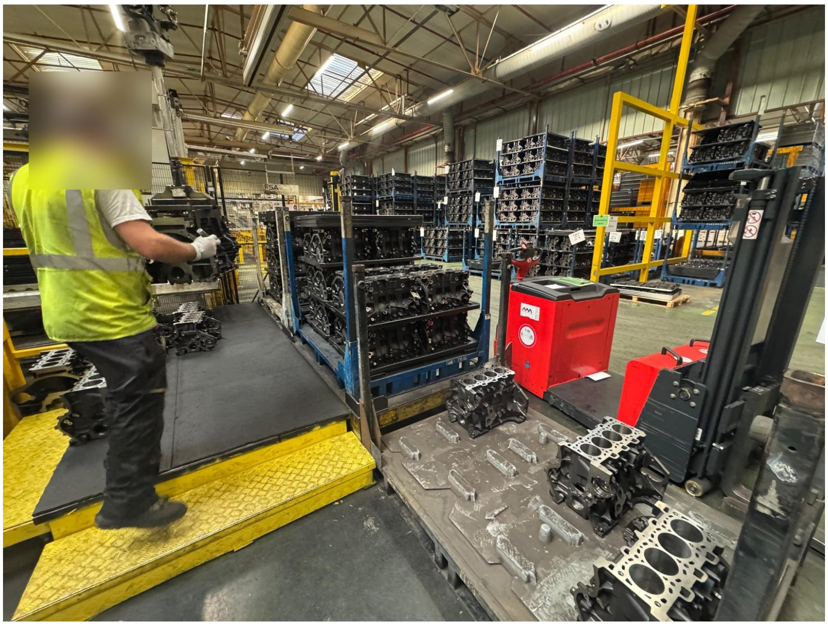


Image 9. Handling and sorting blocks with [redacted], in front of the storage racks.

A little later in the internship, a visual inspection carried out with [redacted] let me gauge just how rigorous this quality process is, with every face of every block examined for missing material, chipping, defects or oxidation before being validated. Once 24 parts have been checked and validated, a robot automatically stores them ready for assembly, and a shipping label (bearing the reference and the time) is printed and attached to the transport carrier ("TM," a metal pallet with plastic dividers) that groups them together. That same day, the inspection was interrupted by a recurring fault: as soon as a new block arrived, the inspection machine would fault itself, requiring another intervention.

Finally, a Wednesday spent checking parts flagged during visual inspection let me hear an interesting remark from a technician about how different manufacturers' requirements compare:

Image 10. A “TM”: a pallet with plastic dividers grouping a batch of inspected blocks, used for storing and moving them around the workshop.

Notebook excerpt (Wednesday)
"Luckily Renault's standards aren't as strict as Nissan's, so a lot of minor defects are negligible, and get overlooked."

This remark is a concrete illustration of how quality requirements vary depending on the end customer, with the very same block, machined on the very same line, being accepted or rejected depending on whether it is destined for Renault or for Nissan.

3.5 Another Example: Precision Adjustment of the Bearing Caps

One day was spent, in the workshop's tooling section, adjusting a fixture on the bearing caps, requiring "micron-level" precision: the reference part is positioned on a master gauge, and each adjustment screw has to be fine-tuned very precisely (marks drawn in white marker keep track of their original position), with a deviation of 24 microns measured, for example, during my time there. Adjusting a single screw from scratch takes around four hours of work, with the fixture having to be unlocked on six sides at each iteration, which makes the operation particularly time-consuming.

Image 11. The workshop's broach adjustment station: adjusting a precision tool suspended from a hoist, on its reference fixture.

Once the adjustment is finished, the "broach" (nicknamed "brocheton" in the workshop) is put back in place; since this part is very heavy, moving it requires a hoist. It was also at this station that I saw [redacted], the team leader, work directly on a broach: using a high-pressure air blower, he cleared out metal chips and coolant residue before it was re-measured, a simple but essential maintenance step to avoid throwing off a micron-level adjustment. This is not normally his role, particularly when it involves working inside the machines themselves: seeing him do it mostly reflects a shortage of staff and resources for this kind of station.

Image 12. [redacted], the team leader, adjusting a broach with a high-pressure air blower to remove metal chips and coolant.

A second intervention, the same day, dealt with a sensor that had shifted: it had moved by three tenths of a millimetre because of the ambient heat, throwing off the measurement. The procedure involved stopping the machine cycle, opening the door and then the access hatch, unlocking the fixture, and readjusting it. I took part in this by holding the screws and the access hatch, while a technician, watching a control screen some distance from the work area, indicated whether the sensor was moving the right way. The first adjustment of the brocheton turned out to be insufficient (two parts measured afterward still showed a deviation), so a further correction was needed. I then helped clean and dry the parts (washed in the machine, then dried with a compressed-air gun) ahead of their re-measurement.

For this kind of correction, the workshop has a set of metal shims of various thicknesses (on the order of a tenth to a hundredth of a millimetre), which are used to pack out certain tools directly, without having to fully disassemble them, providing the few microns of correction needed whenever a deviation is picked up during 3D inspection.

Image 13. Working on the sensor mentioned above, inside the machine.

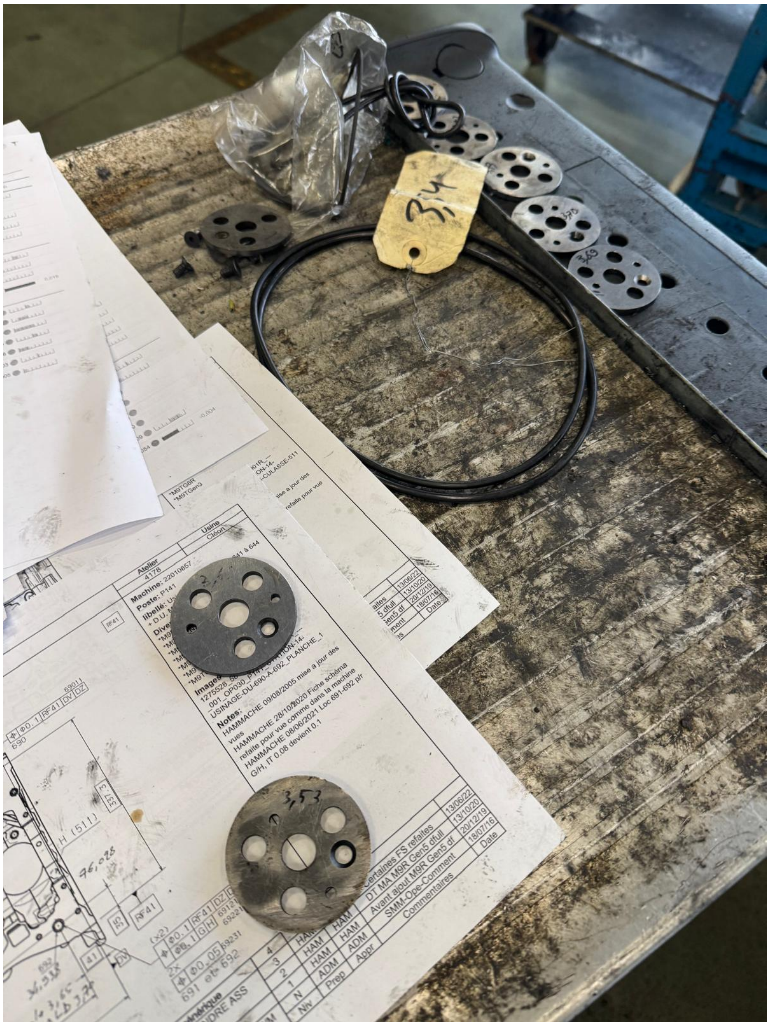


Image 14. Set of metal shims of various thicknesses, used to correct a tool's adjustment by a few microns without disassembling it.

3.6 Tapping and Roughness Non-Conformities Linked to Temperature

On several occasions during probing, the team detected tapping defects on blocks that had nonetheless been corrected earlier in the week, as well as surface roughness anomalies. The explanation settled on was the swings in ambient temperature the workshop was subjected to during the heatwave. Adjustment corrections validated on a given day were no longer valid the next, with thermal expansion of the parts and tools throwing off the dimensions obtained.

Notebook excerpt (tapping/roughness diagnosis)

"It could be down to the temperature of the metal, the amount of coolant, the torque, the speed, vibration, and so on. You have to be careful with the coolant flow [...] or risk burning the tool and the material, or breaking the tool. Very tricky."

This diagnosis required weighing several competing causes before acting, showing how hard it is to isolate a single factor in a precision machining process exposed to unstable ambient conditions. The surfaces involved were then cleaned with a vacuum and then glass cleaner, and the guide balls were cleaned with a chamois. A closing issue with the telescopic bellows guards (“accordions”) on the machine axes was also noted during this period.

3.7 Other Examples of Routine Interventions

Beyond the interventions detailed above, the workshop exposed me to many small incidents typical of daily life on a machining line: a milling machine producing inaccurate dimensions combined with a leak on a washing machine, fixed with a simple hose change; a honing machine with a part “knocking” at the bottom of the machine, requiring a height adjustment followed by a full pneumatic adjustment; or an imbalance in pressure and flow rate between the three pneumatic nozzles that set the honing heads’ position, corrected after measuring each of them individually. Taken on their own, these interventions can seem trivial, but they are not: each one demands a precise diagnosis, a technically demanding intervention, and a good understanding of the mechanical and pneumatic workings of the machine in question. It is really their sheer number and variety that define daily life in the workshop: in a single day you have to deal with a multitude of small, specific and very varied problems, which ultimately takes up a significant share of a production line’s actual working time.

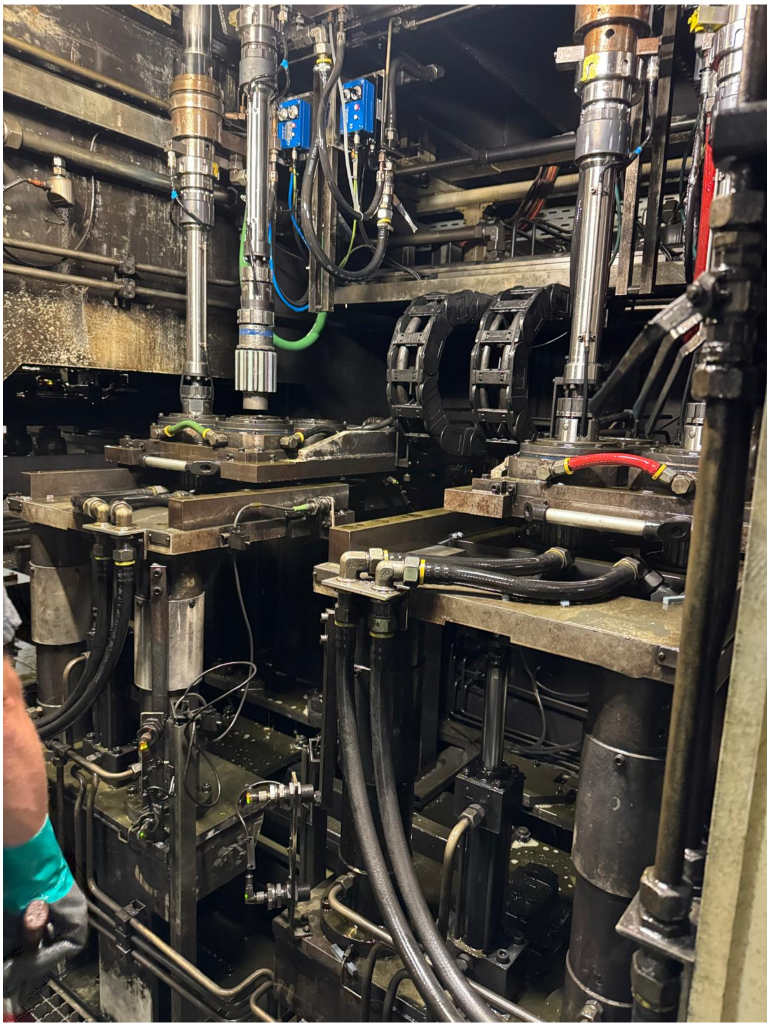


Image 15. The honing machine open for changing the stones (as in Image 6), with one of the honing heads (Image 7) removed, visible on the left.

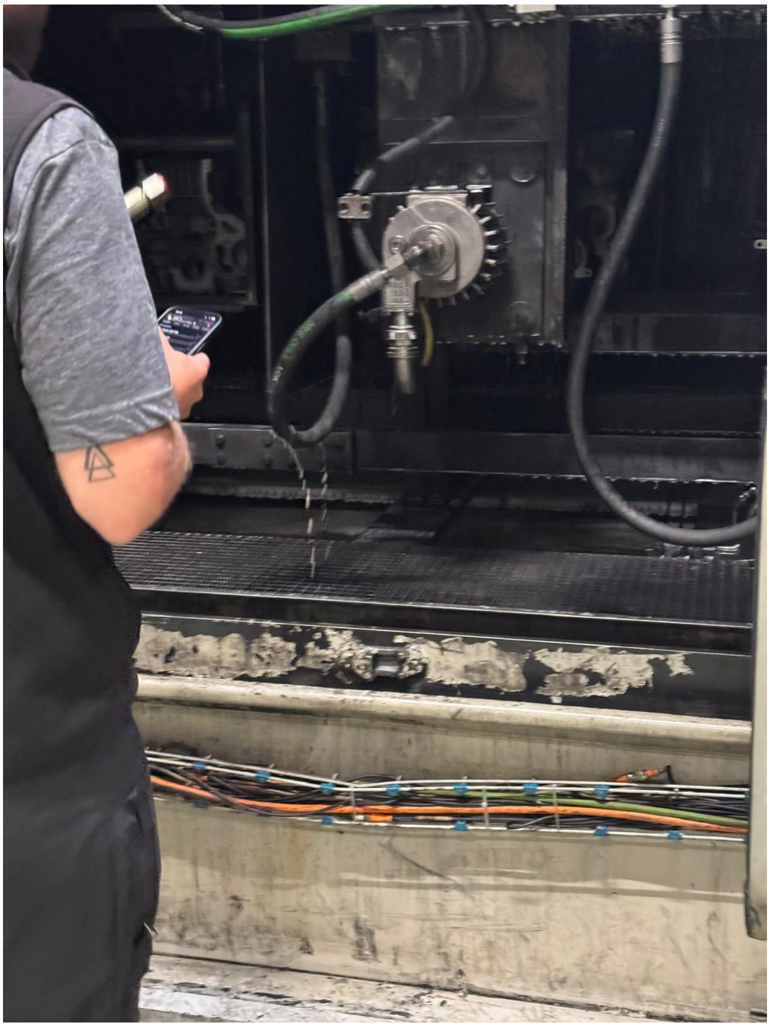


Image 16. The leak on the washing machine hose mentioned above, located at a fitting.

3.8 Description of a Typical Day

I cycled between my accommodation and the plant every day, both morning and evening. Once at the site, the day always starts with a stop at the locker room to change into work clothes; the same happens in reverse at the end of the shift, before cycling back.

Once in work clothes, each operator heads to their station for the actual start of shift. This begins with checking the tablet linked to the station, accessed with a password matching the last four digits of the machine number: a colour code shows whether everything is in order or whether action is needed before starting up. The machine must actually start up within an hour of the shift beginning, or an alert is triggered. On 29 June, the day of my first shift run on my own, I got to see this start-up responsiveness requirement first-hand, along with the mutual support between operators: a more experienced colleague can be asked to validate the start-up check ("OK démarrage") of a neighbouring station before even starting their own shift. The "OK démarrage" is a quality and safety checklist each operator fills in on a tablet before starting their machine (out-of-flow parts identified, measuring equipment calibrated, personal protective equipment available), illustrated in Appendix 2 (Image 32, p. 32).

About two and a half hours after the start of the shift, the team gathers for a standing meeting in the middle of the workshop. It is a chance to review any problems encountered, as well as the previous day's and previous week's production figures, before going back to work with all that in mind.

My team worked on a 2x8 shift pattern (morning shift then afternoon shift), with no night shift of its own. We were part of production, a field that is now largely automated: the machining of the parts themselves is done by the machines, and human work mainly consists of monitoring, diagnosing and maintaining them. That still demands a great deal of expertise and know-how from every team member, especially given how many machines there are to cover for what is, in the end, a fairly small team.

Work then continues according to whatever station is being run that day, whether that is launching probing programs and tracking measurements, systematic part-by-part visual inspection, or preparing and adjusting cutting tools. The machines get a sequential clean at the start and end of the shift. A night team normally keeps production running on other units of the workshop; however, it was not in place on Monday mornings, nor for the whole of the last week of my internship, which then meant restarting the machines one by one before the day could begin. Parts of the plant actually run continuously: even when our unit is not producing, on weekends for instance, several machines stay switched on, since the energy cost of a full shutdown and restart is higher than that of just leaving them running. The day ends with logging the checks carried out (timestamp, machine, operator, tools used) and, where needed, dealing with any non-conformities found.

This growing autonomy was especially clear toward the end of the internship. One day, with [redacted] at a medical appointment, I found myself alone in charge of the workshop's quality control. On my very last day, I also single-handedly ran, without direct supervision, the entire 3D coordinate metrology station usually held by [redacted], from taking surface finish readings through to entering the results, a sign of the trust the team gradually placed in me over the four weeks.

Other stations and operations observed during the internship are illustrated in Appendix 2 (p. 23).

4. Working Conditions and Social Environment

4.1 Human Aspects

My internship began with two days of onboarding training at the site's training school (the Global Training Center, building X3), before joining the workshop itself. The heat there was such, right from the first days, that another intern fainted. I then saw first-hand how quickly the site's fire service responded, arriving within just a few minutes.

Image 17. The site's training school (Global Training Center, building X3), where I spent two days of onboarding training before joining the workshop; engines and cylinder blocks on display for training purposes.

Settling into the team happened quickly, under the direct responsibility of the team leader [redacted], who welcomed me as soon as that training ended and introduced me to the rest of the workshop. I was also able to attend, on that very first day, a meeting held with the plant director. [redacted] came to get me earlier than planned specifically for that, which made me the only intern to attend. Day-to-day working relationships, in particular with [redacted] (technician on the Zeiss 3D station), [redacted] (quality technician) and [redacted] (periodic quality control at the end of the line), were built on direct communication and an "on-the-job" training approach: after an observation phase, I was gradually brought in to carry out the tasks myself, first under supervision and then with growing independence. One Friday, for example, I was put in charge of standing in for [redacted] at the 3D metrology station.

Notebook excerpt (heatwave)
"Cooling unit breakdown. Mechanics are busy trying to restart it [...] we used a truck to get some shade."

Mutual support between colleagues came through clearly during this breakdown of the cooling unit that keeps the machines cool, right in the middle of the heatwave, a concrete illustration of the solidarity and resourcefulness the workshop staff show when facing the unexpected.

4.2 Work Environment: Safety, Hygiene and Labour Relations

Wearing personal protective equipment (cut-resistant gloves, handling gloves, safety shoes, safety glasses) is mandatory throughout the workshop, as are earplugs, probably the most important item in such a noisy environment. Safety glasses in particular are essential whenever there is a risk of liquid or solid splashing, for example when cleaning parts or using a compressed-air gun. Any work inside a machine also requires a hard hat and compliance with a lockout procedure, to prevent any accidental restart during the intervention. Moving the heaviest parts must always be done with an overhead crane, a hoist, or a lifting beam. Hazardous areas (pressurised components, cutting fluid spills) are marked with dedicated signage and barriers.

On the hygiene side, every operator goes through the locker room at the start and end of their shift to change, and hands are systematically washed after handling oily parts (at the washing stations) before entering the inspection room. The site also has a medical service open continuously from Sunday 9:30pm to Friday 9:30pm, with an occupational physician responsible for monitoring employees. Outside those hours, emergencies are handled around the clock by a fire station located directly on site, able to respond within five minutes at most.

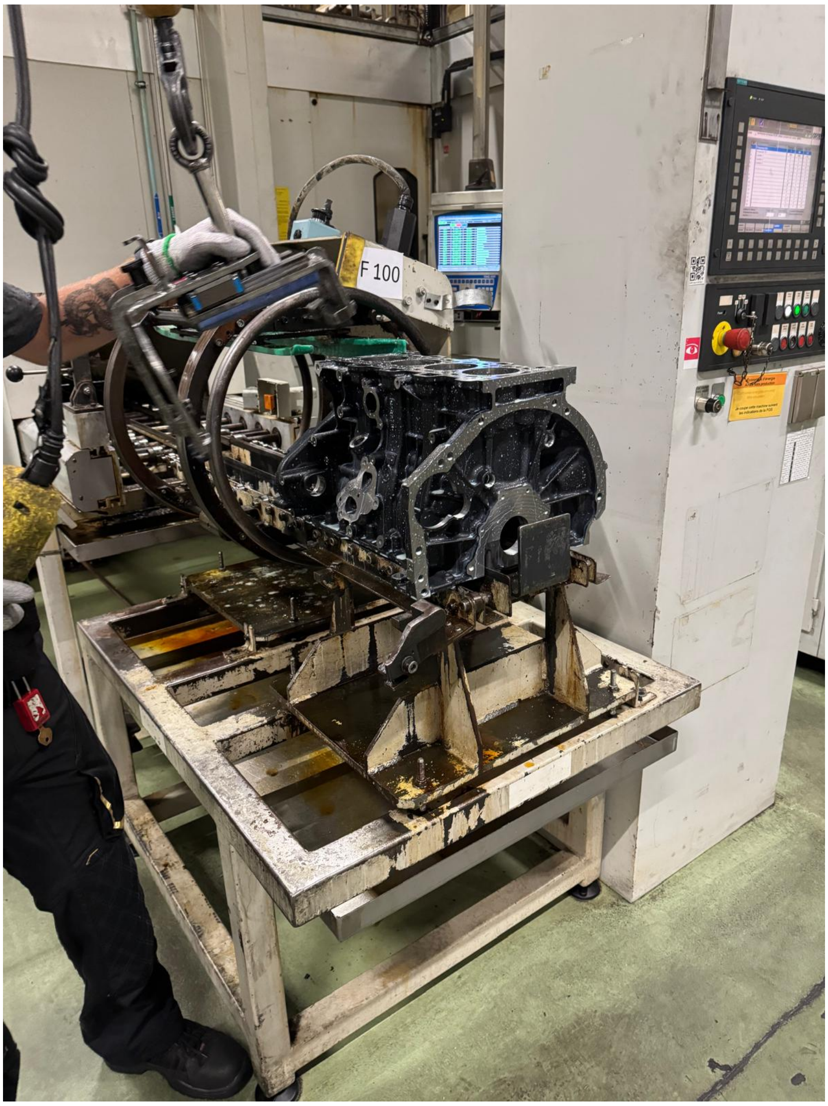


Image 18. Handling a cylinder block with a lifting beam; the "F100" label marks face 100 of the block, used to position it correctly before sending it back onto the conveyor that returns it to the machine cycle.

The internship took place during a heatwave that strongly affected working conditions: use of aerial platforms was suspended, since the heat became excessive at height; fumes from the machines were worse than usual; the cooling of the electrical cabinets was no longer enough, to the point of overheating the equipment; and there was the cooling-unit breakdown mentioned above. The production monitoring dashboard, normally dominated by green, would then be covered in red (machine stoppages), a visible sign of how much the heat affected production during that period. Fatigue was noticeable among the teams from early in the day, especially during the weeks when I worked the 1:30pm-9:30pm shift.

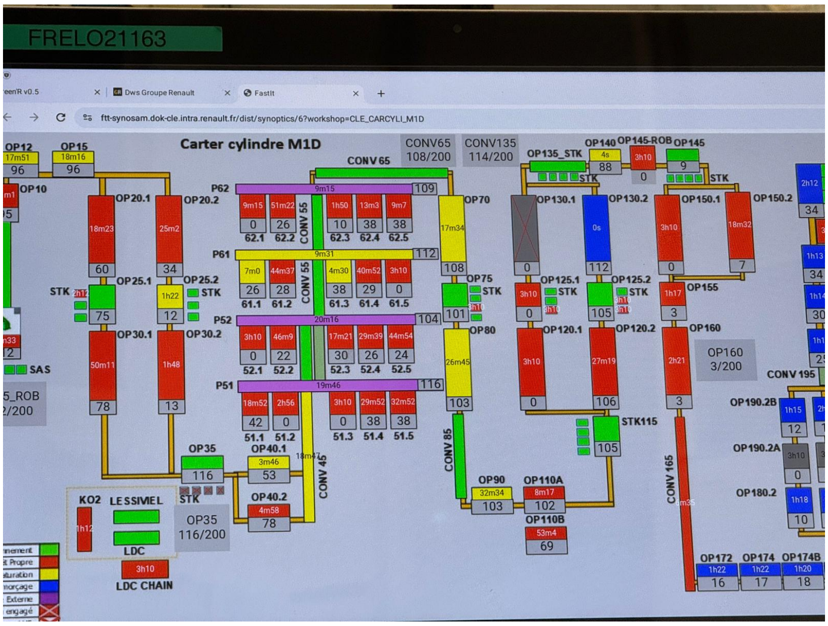


Image 19. Production monitoring dashboard during the heatwave: the red boxes, a large majority, indicate far more machine stoppages than on a cooler day (compare with Image 23, Appendix 2, p. 25).

This period also stood out in terms of labour relations. The production and assembly buildings, very hot and without air conditioning, put workers under an oppressive, even dangerous, atmosphere. It was in this context that the CGT union called a strike that ran through the whole month of my internship, and, in response to the heat-degraded working conditions, won employees an extra RTE day (a paid day off that workers accrue throughout the year). This let me see first-hand the role a trade union plays in defending working conditions at a large industrial site. Beyond this action, the site has a works council (CSE) accessible to all staff, with drop-in sessions several days a week, covering activities and support related to culture, sport, holidays or health, a sign of structured, day-to-day labour relations.

4.3 Environmental Policy and Corporate Social Responsibility

At Group level, Ampere puts forward an ambitious environmental strategy, since its whole purpose is developing electric vehicles. The Cléon site itself illustrates this shift, gradually redirecting its production, historically focused on combustion engines, toward electric motor manufacturing. The site is certified ISO 14001 (environmental management, since 1999) and ISO 50001 (energy management, since 2019), and is aiming for carbon neutrality across the whole plant by 2030.

On resources, the results are concrete: annual consumption of borehole and drinking water fell from 1 836 467 m^3 in 2006 to 604 770 m^3 in 2024, a drop of 67 %, equivalent to going from the water use of a city of 34 000 people down to that of a city of 12 000. COD (chemical oxygen demand) discharges, meanwhile, fell by 88 % over the same period. On waste, managed by a specialised contractor, 100 % of the site's non-hazardous waste is now recovered (either resold as material or turned into energy), against around 70 % of hazardous industrial waste; in 2024, 11 882 tonnes of metal chips were recovered this way, out of a total of 8 529 tonnes of waste excluding construction sites, foundry and metal waste.

This policy translates concretely, in the workshop, into strict waste sorting, which I was able to observe and practise daily: separate bins collect clean, folded paper and cardboard; clean rigid industrial plastics; clean flexible industrial plastics; uncontaminated general industrial waste (food scraps, uncontaminated rags); and contaminated general industrial waste (gloves, glasses, vests and rags that have been in contact with grease, oil or chemicals). Any liquid waste or chemical product, on the other hand, is strictly forbidden in these bins and must be taken to dedicated collection points.

Used cutting oils and coolants, for their part, are never thrown away. They go through a dedicated piping network that carries the liquids to a treatment centre, upstream of the town's own water treatment, which is consistent with the site's commitment to controlling discharges into the aquatic environment.

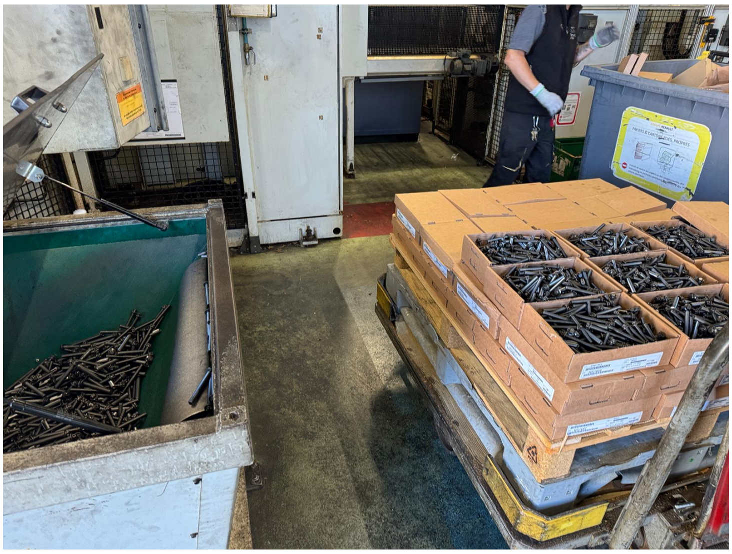


Image 20. Renault Group waste-sorting bin (clean, folded paper and cardboard), located near the station where screws are transferred from their box into the hopper of the machine that fastens the bearing caps onto the block, a spot that makes it easy to sort the emptied boxes straight away.

Finally, the site relies on a network of Health, Safety and Environment (HSE) officers, one per department, tasked with answering employees' questions and making sure these rules are followed, as well as on spill-containment equipment available at marked points in case of an accidental leak or overflow.

5. Skills Development

This internship let me develop several skills in line with EPF's engineering competency framework. On the technical side, I got hands-on with industrial metrology tools I had not used before the internship (Mahr probes, 3D coordinate measuring machine, leak-tightness test bench), and above all I discovered what it really means to work to the micron on real-world adjustments, with concrete consequences as soon as a dimension is out of tolerance.

Diagnosing the leak-tightness bench breakdown, just like the tapping and roughness non-conformities linked to temperature swings, above all taught me to form hypotheses, test them one by one by elimination, and talk them through with others rather than working things out alone in a corner. In a workshop supplying parts to a customer like Nissan, an undetected error has a direct impact on the conformity of what gets delivered, which changes the way you approach every single check.

My autonomy grew throughout the four weeks. I started out by observing, then I was called on directly by the maintenance team in the event of a breakdown, I stood in for a regular technician on a metrology station, and I ended up single-handedly running quality control or the 3D station, without supervision, whenever a colleague was away. Rotating through stations as different as probing, visual inspection, 3D metrology, leak-tightness testing, tool preparation and quality sorting forced me to adapt quickly every time, while keeping the same safety reflexes everywhere: systematic lockout-tagout (LOTO) before any work on a machine, and moving heavy loads with a hoist, lifting beam or overhead crane.

Day to day, I also got to grips with several work-specific digital tools (Simap, shared spreadsheets, Teams) to record measurements, track quality and file non-conformities. And beyond technical skills, I discovered from the inside how a workshop organised around UETs is run hierarchically, as well as the mechanisms of labour relations specific to a large unionised industrial site, particularly during the strike that marked my internship.

6. Conclusion

This four-week execution internship at the Ampere Cléon plant gave me a first, concrete experience of professional life at operator level, in line with the objectives set by EPF for this first-year internship. Looking back at the four weeks, what stands out most is how much responsibility I was gradually given, from simply observing during my first days to single-handedly diagnosing a taraudage and roughness non-conformity, assisting on the micron-precision adjustment of the bearing caps, being trusted alone on quality control while [redacted] was at a medical appointment, and finally, on my very last day, running the entire 3D metrology station on my own.

Beyond the technical dimension of my missions (dimensional and visual quality control, leak-tightness testing, precision adjustment work, and cutting-tool maintenance on a diesel cylinder-block machining line), this experience made me aware of the workload and the level of precision required from shop-floor operators. It also gave me a first look at the human and social realities of industrial work, such as team solidarity in the face of equipment failures like the cooling-unit breakdown, strict safety procedures, and the concrete role played by a trade union (the CGT) in obtaining better working conditions during a heatwave that lasted the whole month of my internship.

I was also able to observe how a large industrial group such as Renault, through its Ampere subsidiary, organizes a traditional production site and gradually steers it towards new activities linked to electric mobility, while maintaining, on a daily basis, an uncompromising level of quality control on parts still built around combustion-engine technology, technology whose history at Cléon goes back to 1981.

Beyond the technical skills gained, this internship confirmed my interest in the industrial and quality engineering side of the automotive sector. The rigour demanded by precision metrology, the teamwork required to diagnose and solve production incidents such as the leak-tightness bench failure, and the human dimension of a large production site are all aspects I would like to keep exploring during the rest of my engineering studies at EPF.

Appendices

Appendix 1: Technical Glossary

- **Cylinder block**: the mechanical part in which the engine's cylinders are machined.
- **Probing**: dimensional measurement of a part using a contact sensor (probe).
- **Honing**: a surface-finishing operation using controlled abrasion.
- **Tapping**: a machining operation that creates an internal thread in a hole.
- **Insert**: a removable carbide cutting tip, fitted onto a tool or milling cutter.
- **Calibration**: periodic verification of a measuring instrument against a master gauge.
- **Lockout-tagout (LOTO)**: a safety procedure (padlocking) preventing a machine from restarting during an intervention.
- **ATEQ**: a pneumatic leak-tightness testing device.
- **Coolant flow**: the supply of cutting fluid/lubricant during machining.
- **TM**: a metal transport pallet fitted with plastic dividers, on which a batch of 24 inspected and validated cylinder blocks is grouped, before a shipping label is attached.
- **CSR**: a non-conformity form associated with a part set aside from the normal flow, filled in during warehouse storage checks.
- **Broach ("brocheton")**: a heavy, high-precision tool/part whose adjustment requires unlocking at multiple points and whose handling requires a hoist.
- **Bellows guard ("accordion")**: a telescopic protective bellows shielding a machine tool's moving axes.
- **MM**: a defect code meaning "Manque Matière" (missing material).
- **Chipping**: a defect where a piece of material is torn away from an edge of the block, caused by a damaged milling cutter or a misaligned broach.

Appendix 2: Additional Illustrations

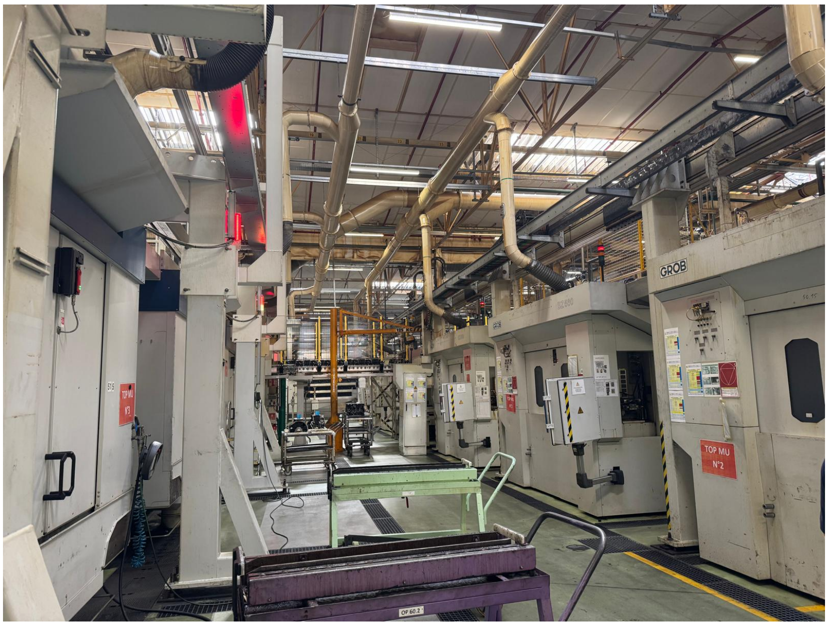


Image 21. An aisle of the cylinder block machining workshop, fitted with GROB machines (the workshop has several aisles like this one).

Image 22. Another aisle of the workshop, with its control panels and overhead cranes.

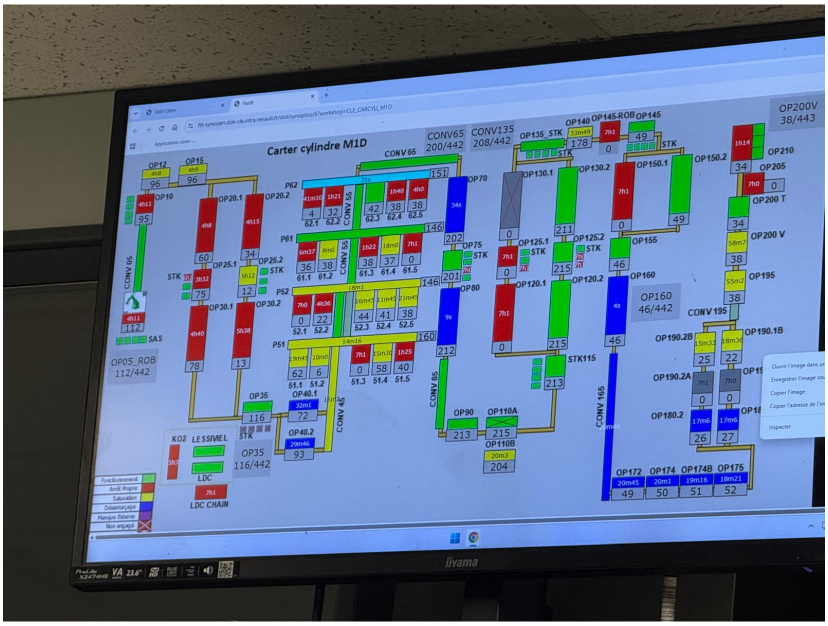


Image 23. Real-time production monitoring dashboard for the “Carter cylindre M1D” line, taken on a day when the workshop stayed a little cooler: operation is still imperfect, but production continues despite a few breakdowns, unlike the heatwave episode shown earlier.

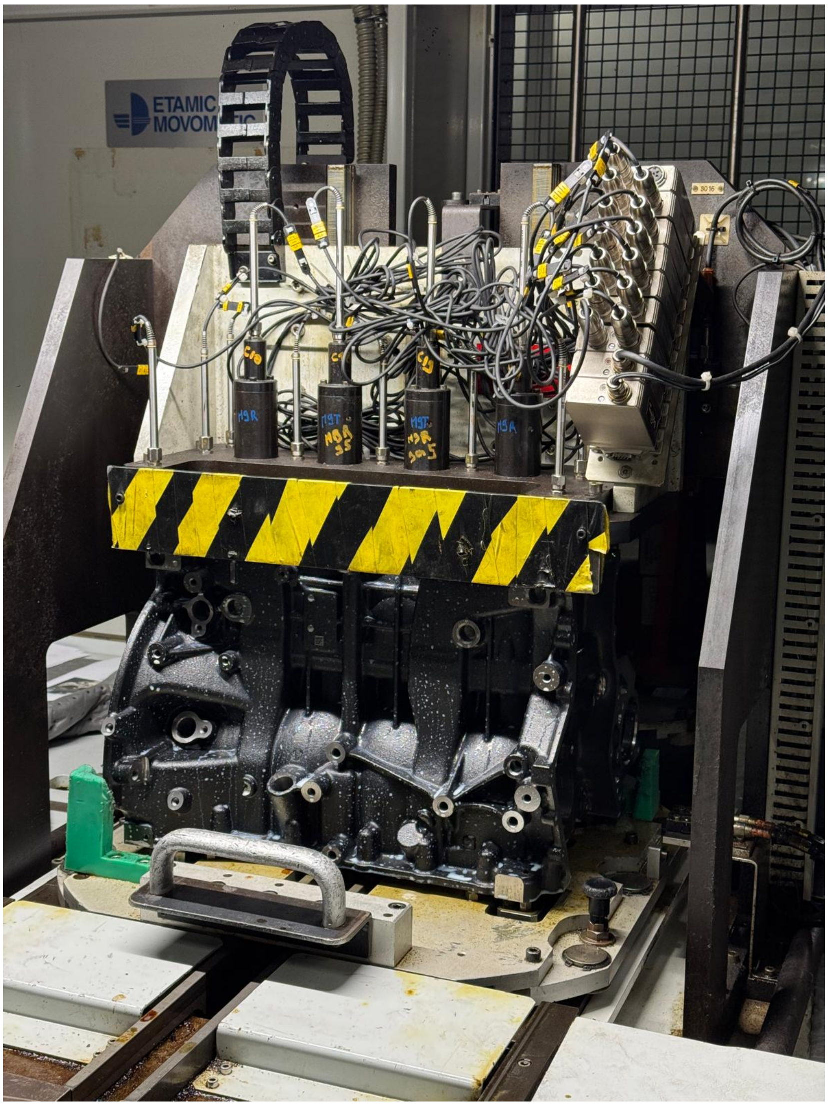
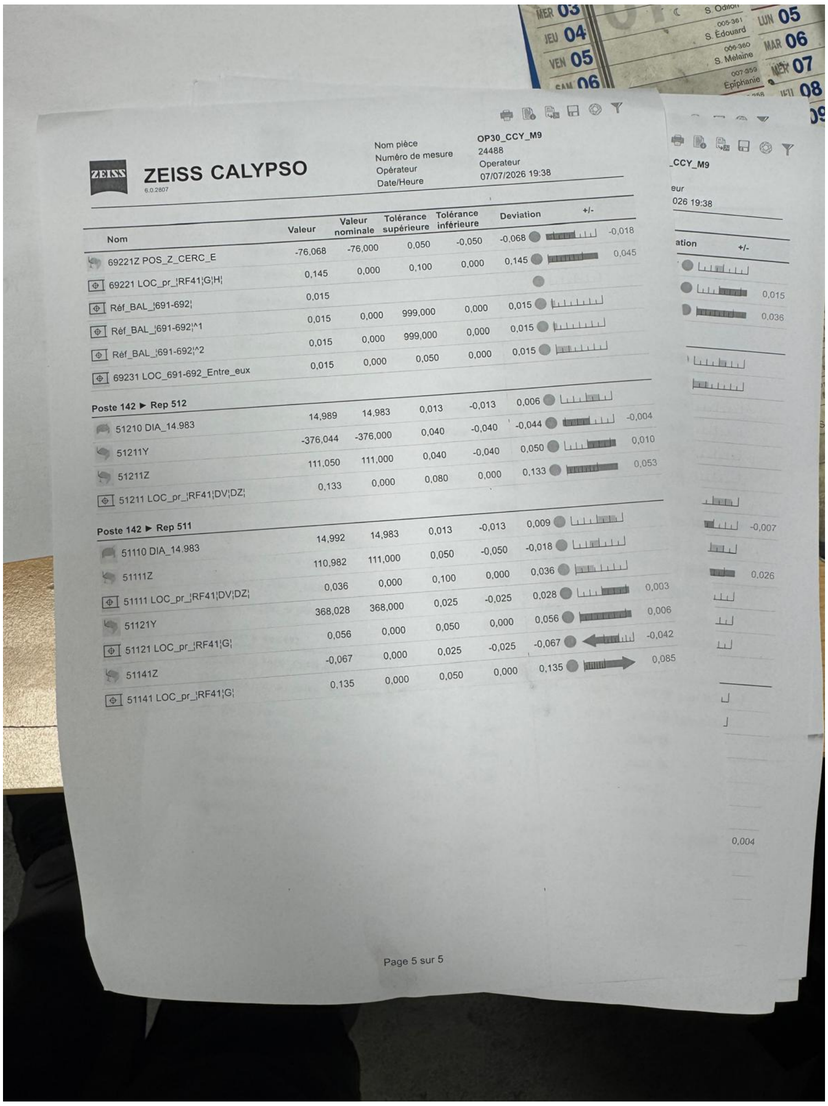


Image 24. M9R diesel cylinder block positioned on the ETAMIC MOVOMATIC dimensional inspection machine.

Image 25. 3D coordinate metrology room fitted with the Zeiss Prismo Navigator machine.



ZEISS CALYPSO
6.0.2807

Nom pièce: OP30_CCY_M9
Numéro de mesure: 24488
Opérateur: Operateur
Date/Heure: 07/07/2026 19:38

Nom	Valeur	Valeur nominale	Tolérance supérieure	Tolérance inférieure	Deviation	+/-
69221Z POS_Z_CERC_E	-76,068	-76,000	0,050	-0,050	-0,068	-0,018
69221 LOC_pr_¦RF41¦G¦H¦	0,145	0,000	0,100	0,000	0,145	0,045
Réf_BAL_¦691-692¦	0,015					
Réf_BAL_¦691-692¦^1	0,015	0,000	999,000	0,000	0,015	
Réf_BAL_¦691-692¦^2	0,015	0,000	999,000	0,000	0,015	
69231 LOC_691-692_Entre_eux	0,015	0,000	0,050	0,000	0,015	
Poste 142 ► Rep 512						
51210 DIA_14.983	14,989	14,983	0,013	-0,013	0,006	
51211Y	-376,044	-376,000	0,040	-0,040	-0,044	-0,004
51211Z	111,050	111,000	0,040	-0,040	0,050	0,010
51211 LOC_pr_¦RF41¦DV¦DZ¦	0,133	0,000	0,080	0,000	0,133	0,053
Poste 142 ► Rep 511						
51110 DIA_14.983	14,992	14,983	0,013	-0,013	0,009	
51111Z	110,982	111,000	0,050	-0,050	-0,018	
51111 LOC_pr_¦RF41¦DV¦DZ¦	0,036	0,000	0,100	0,000	0,036	
51121Y	368,028	368,000	0,025	-0,025	0,028	0,003
51121 LOC_pr_¦RF41¦G¦	0,056	0,000	0,050	0,000	0,056	0,006
51141Z	-0,067	0,000	0,025	-0,025	-0,067	-0,042
51141 LOC_pr_¦RF41¦G¦	0,135	0,000	0,050	0,000	0,135	0,085

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Image 26. Excerpt from a 3D measurement report (Zeiss Calypso software, part OP30_CCY_M9).

Image 27. Laser scanner inspection station, with two Enhanced Monitoring Plan (PSR) sheets displayed. The first concerns “missing or shifted bearing cap number”: a block’s five bearing caps are numbered 1 to 5 and must be fitted in that order, but on some blocks the order is occasionally reversed, or the number is not visible at all; while this has no effect on engine operation, it still has to be reported to Nissan, who requires it contractually. This defect echoes the bearing cap adjustment described in section 3.5.

Image 28. Screen of the tool presetting bench (Zoller, pilot 4.0 software): measuring the diameter and position of a finishing milling cutter before refitting.

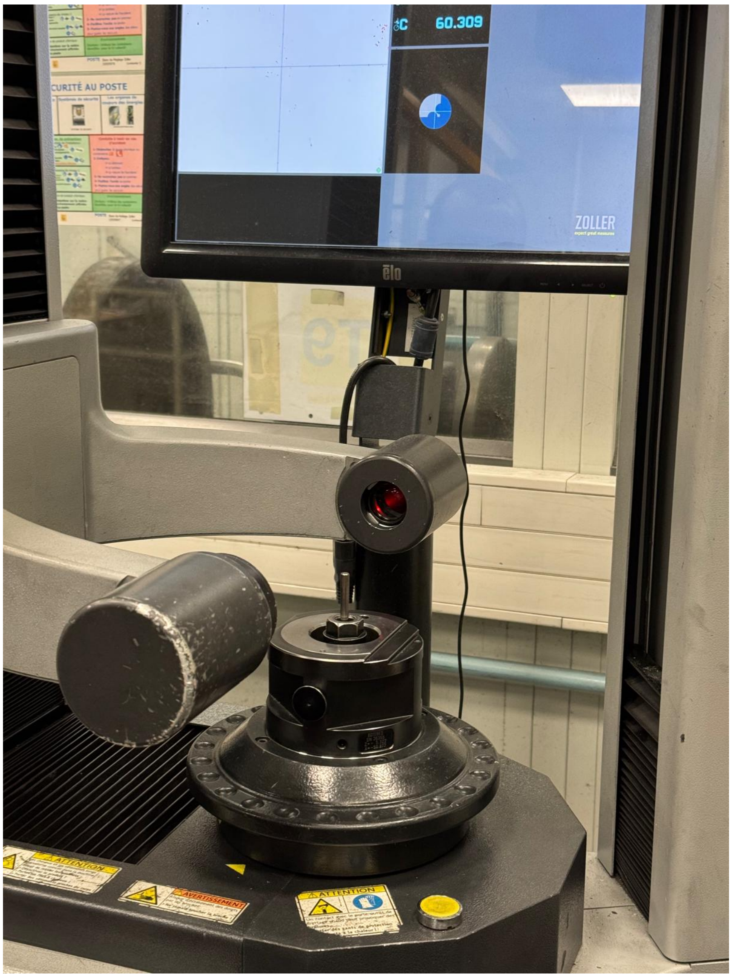

Image 29. The Zoller optical presetting machine itself, whose screen is shown in the previous image: the measuring head (camera) rotates around the tool, mounted on the turntable at the base.

Image 30. Inside one of the workshop's machine tools (cylinders, hydraulic and pneumatic hoses, cable chains), with the lifting arm used to fit and remove the milling cutter: this kind of access requires a lockout padlock to be fitted beforehand.

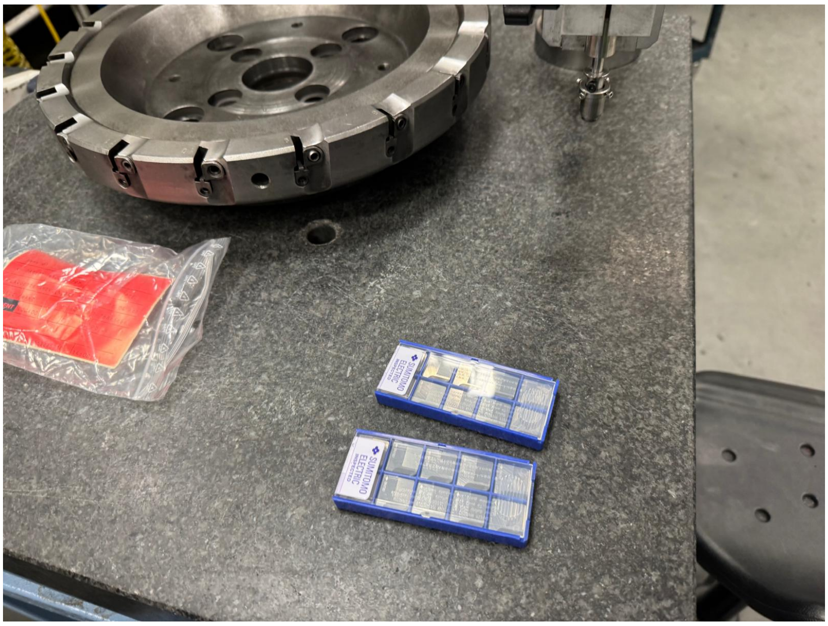

Image 31. Checking and sorting carbide inserts while changing a milling tool, on the metrology surface plate.

Image 32. Station quality and safety checklist filled in on an industrial tablet during the “OK Démarrage” start-up check at the beginning of a shift (operator’s name blurred out).

Image 33. Insert-tipped circular milling cutters from the machining line, placed on a workshop trolley before inspection and refitting.

Image 34. Checking the inner diameter of a blind hole in the block with a pneumatic gauging tool, wearing a cut-resistant glove.

Image 35. Cylinder block coming out of the washing machine: the compressed-air gun's hose (in the foreground) is used to blow off the water before sliding the part onto the conveyor leading directly to the 3D inspection room.