DEPARTMENT OF MECHANICAL & MECHATRONIC ENGINEERING
STELLENBOSCH UNIVERSITY
VACATION TRAINING CERTIFICATE

TO BE COMPLETED BY THE STUDENT

STUDENT'S NAME: Athenkosi Hlonyane

STUDENT NUMBER: 21879168

FIELD OF STUDY: Mechatronic Engineering

PERIOD OF TRAINING: First, 341 ☐ Second, 441 ☑

EMPLOYER'S NAME AND ADDRESS: Volkswagen of South Africa (Pty) Ltd

103 Algoa Rd, Alexander Park, Kariega, 6229, South Africa

EMPLOYER'S EMAIL ADDRESS: thulani.ntshanyana@vwsa.co.za

DATE STARTED SERVICE: 26/06/2023 DATE LEFT SERVICE: 21/07/2023

DATES OF INTERRUPTIONS (DATES NOT AT WORK): 26/06/2023 (A3 exam)

Official use:

☐ Accepted

☐ Redo the vacation training

☐ Redo the report

Date ___/___/___

Signature _____

TO BE COMPLETED BY THE STUDENT'S VACATION TRAINING SUPERVISOR

TYPE OF WORK DONE: Attending Maintenance Breakdowns, Understanding Vehicle Manufacturing, Optimising maintenance Work Instructions, Introducing Inventory Control Maintenance Store

GENERAL CONDUCT (please indicate whether acceptable or not[1]): Acceptable

Treated all individuals with respect

Was on time and completed all tasks that he had to do.

OTHER REMARKS: Exceptional Student

21/07/2023 — DATE

SUPERVISOR'S SIGNATURE

Thukani Ntshanyana 0605135165

SUPERVISOR'S NAME AND CONTACT NUMBER

Ntshanyana Thulani VWPKI B157772686A7D6BE

Digitally signed by Ntshanyana Thulani VWPKI
B157772686A7D6BE
Date: 2023.07.21 15:10:29 +02'00'

VOLKSWAGEN OF SA (PTY) LTD.
P.O. BOX 80
UITENHAGE 6230

OFFICIAL STAMP OF EMPLOYER[2]

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1 *If a student's conduct was unacceptable, the vacation training period will have to be repeated.*

2 *Also accepted:*

- *A letter on an official company letterhead, that states the dates worked*
- *A payslip*

Stellenbosch
UNIVERSITY
IYUNIVESITHI
UNIVERSITEIT

MR A Hlonyane
14 Ngesi Street
Kwanobuhle
Uitenhage
6229

4 August 2023

Student number : 21879168-2018

Dear MR Hlonyane

PROOF OF REGISTRATION FOR 2023

You have been registered for the following programme and modules:

Programme : 2023/02 BEng (Mechatronics) F (FULL TIME)

Year/Mth	Code		Name	Module Type
2023/06	12491-315	(15)	Electronics	H
2023/06	51993-412	(12)	Project management	H
2023/06	33928-414	(15)	Heat transfer A	H
2023/06	11949-324	(15)	Electrical drive systems	H
2023/11	50431-442	(8)	Environmental engineering	H
2023/11	40150-441	(1)	Vacation training	H
2023/11	23477-354	(12)	Vibration and noise	H

If you wish to have any of the above particulars altered, you have to come and see me before the relevant closing date, which will be strictly enforced. Please, too, be sure to bring this letter with you.

Yours sincerely

Ms N Hartzenburg
Faculty Administrator
for THE REGISTRAR

Technical Summary

Volkswagen Group South Africa, Kariega

During my four week vacation work stint at Volkswagen Group South Africa (VWSA) in Kariega, Eastern Cape I spent my time at the Production and Maintenance Department in the Final Assembly Plant within the main plant (A-Plant). The main plant, which has been building Volkswagens since 1951, stretches over 518 378m^2 and produces 710 vehicles per day. Apart from manufacturing engines, the Kariega plant currently builds the Polo Vivo and Polo, and is the sole manufacturer of the Polo GTI. Here I was appointed to work as a Assembly Maintenance Engineer. The technical work I participated in will be detailed below in no particular order.

A KUKA 6-degree-of-freedom (6-dof) robot, equipped with a custom end-effector featuring pneumatic plungers, was employed to apply sealer to panoramic car roof glass (PAD). The robot's task involved picking up glass using the plungers, aligning it on a rig, and then moving it beneath a nozzle. Compressed air was used to eject sealant, applying it along the glass perimeter. Cameras strategically positioned for computer vision identified gaps in the sealer path, triggering an alarm. This alarm activated a safety circuit, halting the automation process temporarily. To resolve issues, collaboration between an engineer and technician was pivotal. The solution included switching to a backup pneumatic pump due to insufficient pressure on the main and replacing the sealer nozzle. Apparatus: KUKA Robot, pneumatic cylinder, and a Compressor/Pump supplying air.

The Assembly Production and Maintenance team are undergoing a process of renewing Work Instructions and Introducing Work Instructions for processes where they were previously not documented. This is to ensure consistency of various processes throughout production and upholding a certain standard and quality. I was tasked with Documenting a Work Instruction which includes a Process flow, for the manual quality checks of the sealer application onto PAD's. This included me observing how a technician performed the checks taking images, and then compiling a labelled and detailed process flow chart. And also documenting the entire Work Instruction according to an existing template. The Work Instruction was edited and approved by the company's Assembly Maintenance Engineer and sent to the Assembly Production Manager for necessary signature. Apparatus: Vernier Caliper, Microsoft Office Word.

Orders were received from the Assembly Maintenance Engineer to move the Maintenance Storage to a new location within the Plant. This also meant sorting existing materials, discarding, and proper categorisation and organisation of the new storage area, with proper labelling to ensure easier inventory control. I was asked to assist in the Project Management aspect (developing a Gannt Chart, and Assigning resources), additionally I was provided with a Spreadsheet containing over 2000 materials uncategorised, unorganised, with empty data entries and I developed an Excel program that cleans the data, presents it properly with labelled columns, highlights all the rows with corrupt data entries, sorts and assigns tags of "Electrical", "Mechanical", and "Pneumatic&Hydrilic" based on the part name and description. And colour codes the rows to assist the personnel physically sorting the materials into the new storage area where the shelves were marked with the corresponding colours. Apparatus: Microsoft Excel (VBA)

Management tasked the Assembly Maintenance team with tracking a device called 'SIDIS Smart Plug -W'. This device connects to a vehicle's OBD-II port located under the dashboard near the driver's seat. It retrieves and interprets information from the vehicle's onboard computer system used in checking the status of a car on the line. Management wanted better historical data to backup budget requests for when they order new batches. I created a SmartPlug Tracking dashboard that accesses more than 500 relevant databases, updating a real-time table and dashboard with the retrieved information. The functionality of this dashboard includes Real-time Monitoring, and various visualizations including Failure Rate Over Time, Time Series Visualization, Failure Distribution, Top Failure Reasons to mention a few. Apparatus: Microsoft Power BI, Oracle Database (SQL).

Additional Maintenance Work worth mentioning include: Replacing a Hydraulic cylinder at the decking facility the cylinder failed to fully retract. Hence automatic sequencing could not continue, causing a line-stop. Investigating into repetitive alarm latching due to car carrying platform not progressing through rollers fast enough in section 3, issue was concluded to be worn out rubber on rollers causing platform not to slide due to insufficient friction. Plan of action was to replace rubbers. Investigated repetitive safety alarm randomly activating when no one opened the gate to a demarcated area. Troubleshooted the PLC wiring and logic for a fault. Hypothesised a potential memory variable addressing issue causing unwanted behaviour in PLC logic.

Non-technical summary

Volkswagen Group
South Africa, Kariega

In this section I will discuss the non-technical aspect of my vacation work experience focusing on the departments I directly or indirectly exposed to. The first department, Pilot Hall, is responsible for testing, validating, and implementing new facilities, systems or products (new vehicle models) or updated versions before they are introduced into full-scale operation or production. This department works closely with engineering and design teams to understand requirements and processes for the new facilities, systems or products. Most design work is performed by the team at the headquarters in Germany. And once signed-off and verified it can be implemented in the South African division.

Planning department is responsible for developing and implementing the production plan. This includes determining the production schedule, allocating resources, and coordinating with various departments to meet the production target. This department works closely with Pilot Hall's findings and feedback to ensure a smooth transition to full-scale production. Consider the example where a new facility has to be introduced to automate the process of attaching windows to the car. The planning group will optimise the stakeholder requirements and specifications, and project plan in order to constrain contractors into producing what is required and limit their creative freedom in implementing the contract work. This ensures a higher success in meeting the initial requirements. Once a new facility has been introduced into the plant for full-scale production Planning does not just hand over to Production and Maintenance, they are still involved in monitoring and sometimes resolving more major issues to ensure smooth operation, since they understand the problem or solution in a bit more detail. However the more active role is taken by Production and Maintenance team.

The Production department is responsible for the actual assembly of vehicles on the production line. Using the production plan which was finalized from Planning department, they are able to execute it by coordinating the flow of materials, components and manpower. For new facilities Production will work with Pilot Hall which will provide insight into optimising and potential challenges in the initial production stages. The Maintenance department is responsible for upkeep of the plant facilities, including machinery and all equipment. Ensuring they are in good working conditions, and that there are always spares to replace machinery or equipment that cannot be quickly repaired. Regular maintenance is conducted by this team to address breakdowns or reduce the risk of having one. The main daily object is to minimize downtime and ensure the production line's continuous objectives to meet, in the bigger scheme, yearly targets.

The structure within the Production and Maintenance department starts at the top with the Assembly Production Manager which reports to the Plant Production Manager. The Assembly Production Manager receives a brief from the Plant Production Manager, and allocates the task to three Maintenance Supervisors, one Automation Specialist, and one Maintenance Engineer. The supervisors are in-charge of different sections of production in the factory and along with the engineer they have communication lines with two technicians at each section. Finally there are line-operators which perform hands-on assembling of vehicles throughout the factory and have direct communication to the technicians. The cars arrives from Press Shop, Body shop, Paint Shop various facilities located at A-Plant and B-Plant where individual components such as metal panels and structural parts are welded, riveted, or otherwise joined together to create the car's body shell. And surface preparation is done, which involves cleaning, sanding, and applying a primer coat to ensure proper paint adhesion.

The factory comprises five sections, aligned along the production line. Section 1 encompasses a Tyre Store sub-section for assembling, inflating, and rotationally balancing rims and tires. Another sub-section within this area conducts VIN number scribing on the frame, installs a Panoramic Sunroof (PAD), and carries out preparations like stud drilling on the car frame for side skirts. In Section 2, cockpit assembly takes place, involving attachment of the dashboard, front, rear, and quarter glass, insertion of the car's interior carpet and center console, and execution of engine control unit (ECU) Flashing. Section 3 focuses on separate assembly of the door frame and the engine, which arrives from the Engine Plant, a distinct facility at A-Plant. This engine is combined with the gearbox, and subsequent oil filling occurs. The drive-train, comprising front struts, sub-frame, and rear axle, is then assembled with the engine-gearbox unit. An added heat shield enhances this sub-assembly, referred to as the under-body or rahmen. In Section 4, decking operations involve attaching the rahmen to the car frame from Section 2. This step includes seat installation, battery addition, charging, and attachment of doors, wheels, and remaining sub-assemblies. Finally, Section 5 (End-Of-Line) conducts comprehensive tests on the fully assembled car, employing both automated and manual procedures to ensure compliance with handling, stability, and performance standards. These tests encompass a pre-roller test, roller test, and road test.