SSGC

Sui Southern Gas Company Limited

Intern Report

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Acknowledgment

I am writing this acknowledgment to express my heartfelt gratitude to Sui Southern Gas Company LTD. Over my time with the organization, I have experienced immense personal and professional growth, all made possible by the supportive and dynamic environment fostered by the company and my esteemed colleagues.

I would like to extend my sincere thanks to the leadership and management for the opportunities provided and the trust placed in me. I would also like to give special thanks to all the Quality Control Officers and supervisors for guidance, constant feedback and helpful support throughout this Internship.

These opportunities have not only allowed me to contribute meaningfully to our shared goals but have also helped me refine my skills and expand my horizons.

It is a privilege to be associated with a company that upholds such high values, respect, and esteem. I remain committed to learn the most in my one month training period.

Thank you once again for your unwavering support and encouragement. Please do not hesitate to reach out if there is any way I can be of further assistance.

Abbreviations

Abbreviation	Full form
SSGC	Sui Southern Gas Company
SNGPL	Sui Northren Gas Pipelines Limited
LTD	Limited Company
KT	Karachi Terminal
LDC	Learning & Developmet Centre
SLL	SSGC LPG LTD
AE	Alternate Energy
LNG	Liquified Natural Gas
LPG	Liquified Petroleum Gas
MMP	Meter Manufacturing Plant
MU	Measuring Unit
QC	Quality Control
SOP	Standard Operating Procedure
WIP	Work in progress

Executive Summary

During a one-month internship at Sui Southern Gas Company LTD, I gained practical experience in the manufacturing process of gas meters. The internship provided insights into the plant's operations, from manufacturing plastic parts to final product assembly. I actively participated in understanding production line, quality control testing, and standard operating procedures, enhancing my understanding of industrial workflows and supply chain dynamics.

I worked with engineers and technicians to understand how they troubleshoot manufacturing issues, thereby improving problem-solving and teamwork skills.

Additionally, I attended training sessions on safety protocols in LDC KT and read standards (EN 1359) on which gas meters are tested and materials used for manufacturing, reinforcing the importance of adhering to regulatory requirements in the manufacturing industry.

This internship proved invaluable in bridging theoretical knowledge with practical application. The exposure to advanced manufacturing technologies in Measuring Unit (MU) department and industry practices equipped me with essential skills and a deeper appreciation for the challenges and opportunities within the gas meter industry.

Chapter 1

(Introduction of Area of Interest)

Introduction

I'm Syed Zain Ali, a third year Mechanical engineering student of NED University of Engineering & Technology.

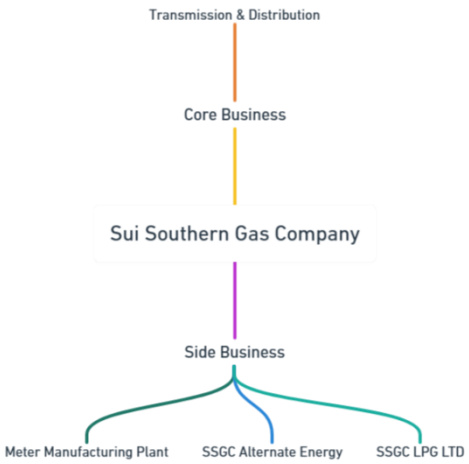
My interest in having understanding of the manufacturing and assembly of a product has always intrigued me into learning about the process, how they are designed and, how they are standardize.

This 1 month internship period in SSGC Meter Manufacturing Plant gave me an understating about production line, quality control testing, and standard operating procedures,

About SSGC

The Sui Southern Gas Company (SSGC) is a downstream gas company in Pakistan. Its primary purpose is the transmission and distribution of natural gas, focusing on the southern regions of the country, including Sindh and Balochistan.

It aims to meet energy needs reliably, sustainably, and ethically.



Transmission & Distribution:

SSGC transmit & distribute natural gas in Sindh & Balochistan, having a network of pipelines up to 4,143 Kilometers. The company also installs high-pressure transmission and low-pressure distribution systems.

Meter Manufacturing Plant:

SSGC operates the only gas meter manufacturing plant in South East Asia, with an annual production capacity of 1 million meters.

SSGC LPG LTD:

SSGC imports LPG at Port Qasim, Karachi, with a storage capacity of 6,500 metric tons. It also owns LPG bottling plants in Karachi, Muridke, and Haripur, ensuring efficient distribution through cylinders and bulk tanks.

SSGC LPG LTD (SLL) focuses on providing clean, portable, and environmentally friendly fuel. It also supports industrial and automotive sectors with LPG solutions, offering an alternative to traditional fuels like CNG and gasoline.

SSGC Alternate Energy:

SSGC Alternate Energy (SSGC-AE) is a subsidiary of Sui Southern Gas Company Limited, established to explore alternative energy solutions and address Pakistan's energy challenges. The program focuses on renewable and eco-friendly energy projects, such as biogas, biomethane, and green hydrogen production. It also includes initiatives like coal-to-gas conversion with carbon capture and storage capabilities.

SSGC-AE aims to reduce reliance on imported LNG by utilizing untapped renewable energy sources, such as animal waste, municipal solid waste, and energy crops. The program promotes sustainable energy ecosystems and supports local industries by providing cost-effective and environmentally friendly fuel options.

Geographical Information System:

SSGC has high resolution GIS system to help planning, development, management, operation & maintenance of it’s gas pipeline system.

Chapter 2

(Overview of the Organization)

The Sui Southern Gas Company (SSGC) is one of the leading integrated gas companies in Pakistan, responsible for the transmission and distribution of natural gas in the southern regions of the country, including Sindh and Balochistan. Established in 1954, the company plays a pivotal role in ensuring energy availability to a wide range of consumers, including residential, commercial, and industrial sectors.

SSGC operates an extensive pipeline network that spans thousands of kilometers, efficiently delivering natural gas to its customers. Its major operations include maintaining the distribution infrastructure, detecting and curbing gas theft, and ensuring compliance with safety and regulatory standards.

The organization is committed to innovation and customer satisfaction, implementing modern technologies to enhance efficiency and service delivery. SSGC also emphasizes corporate social responsibility, engaging in community welfare projects, environmental protection initiatives, and educational programs in the regions it serves.

In recent time, SSGC is completing an order of SNGPL due to which almost 4000 meters are being manufactured while maintaining their quality everyday.

The company is also trying to reduce its dependency on LNG by introducing a new program as SSGC AE where they encourage other businesses to invest in a biogas plant and sell gas to SSGC.

Over the years, SSGC has faced challenges such as the increasing energy demand, gas shortages, and system losses. However, the company continues to strategize and adapt in order to meet these challenges effectively, ensuring a stable and reliable energy supply to its customers.

Chapter 3

(Departments of Meter Plant)

Departments of Meter Plant:

The SSGC Meter Manufacturing Plant (MMP) is a significant component of the Sui Southern Gas Company's operations, designed to ensure the reliable and efficient production of gas meters for distribution. Located in Karachi, Pakistan, the MMP is equipped with state-of-the-art facilities and advanced technology to produce high-quality gas meters that meet both local and international standards.

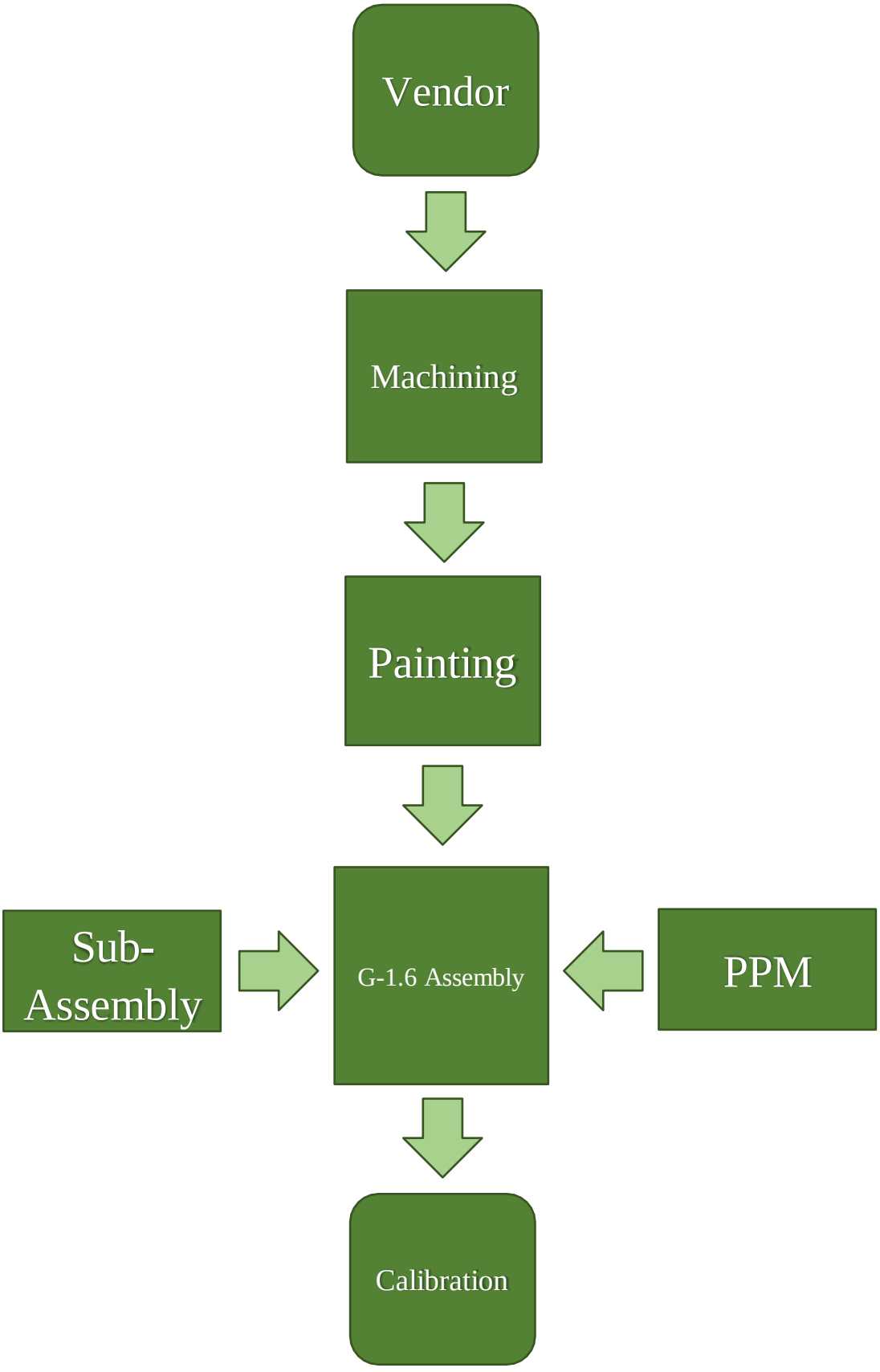
The plant specializes in manufacturing diaphragm gas meters, which are widely used in domestic purposes. These meters are essential for accurately measuring gas consumption and ensuring fair billing. The MMP is not only involved in production but also in the rigorous testing and quality assurance of the meters to maintain consistency and reliability.

In addition to its production capabilities, the MMP places a strong emphasis on research and development. Its operations align with SSGC's broader mission of enhancing energy efficiency and service quality across its distribution network.

There are 8 different departments in Meter Plant:

1. Quality Control
2. Machining
3. Painting
4. Plastic Injection Molding
5. Measuring Unit
6. G-1.6 Assembly
7. V3 Assembly
8. Calibration

Work Flow of Meter Plant



Quality Control

The Quality Assurance (QA) department in a meter manufacturing plant like SSGC (Sui Southern Gas Company) plays a pivotal role in ensuring that the meters produced meet the required standards of accuracy, reliability, and safety. First the unmachined outer covers of G-1.6 and V3 are received from local vendors. The diaphragm are imported from foreign vendors and plastics parts are manufactured by SSGC them selves. There are two types of inspection:

I. Line Inspection
II. Lot Inspection

The quality of all these parts come under the responsibility of Quality Control Department of SSGC. The responsibility of Quality Control Department include:

Inspection and Testing of Lot:

The inspection and testing of a batch (or "lot") of meters at a manufacturing facility like SSGC likely involves several quality control steps to ensure the meters meet performance, reliability, and safety standards. Here's an overview of how such processes typically take place:

Visual Inspection: Each meter in the lot is visually checked for any physical defects, manufacturing flaws, or cosmetic issues. This ensures that the meters are assembled properly and free from visible damage.

Dimensional Verification: Critical dimensions and tolerances are measured using gauge, micrometer & vernier caliper to confirm compliance with design specifications.

Functional Testing: Meters are tested to ensure that they work as intended. This might involve simulating gas flow or its parts working as they are meant to, and measuring its ability to accurately record usage.

Calibration: Meters are calibrated to ensure their readings are accurate with the change of pressure. This involves comparing the meter's readings against reference standards.

Pressure Testing: For gas meters, pressure testing is conducted according to EN 1359 standards to verify the meter's ability to withstand operating conditions without leaks or failures.

Batch Sampling: Random samples from the lot may undergo detailed inspection and testing to validate the overall quality of the batch.

Once testing is complete, a lot inspection report is maintained for the lot, confirming that it has passed inspection and is ready for deployment.

Inspection and Testing of Line:

Quality Assurance oversees the entire manufacturing process and performs rigorous checks on the meters at different stages to identify defects or inconsistencies to make sure the almost finished product is acceptable without any fault.

Quality Assurance of Machining Process:

Dimensional Checks: During machining, operators use tools like calipers, and micrometers to measure critical dimensions of the part.

Visual Inspection: The quality officers visually check if the holes and taping are correct.

Gauges: Go & No Go Gauges are used to ensure that the go gauge fits the screw holes correctly and if no go gauge doesn't fit the screw holes.

Quality Assurance of Painting:

Thickness Measurement: After each coat (primer, base, or top coat), the paint thickness is measured to confirm uniform application.

Visual Inspection: Painted parts are examined for defects like bubbles, drips, sags, or uneven coverage.

Scratch Test: When painting process is completed, the paint of the covers are scratched to test that the paint doesn't come out easily.

Quality Assurance of Plastic Injection Moulding:

Dimensional Measurements: Measure critical dimensions of the molded parts using tools like vernier calipers or gauges to ensure they meet tolerances.

Surface Inspection: Visually check for defects such as flash, voids, or burns on the molded part.

Compliance with Standards:

The Quality Control (QC) department at SSGC's meter manufacturing plant likely adheres to a combination of international, national, and industry standards to ensure the production of high-quality, accurate, and reliable gas meters. SSGC Quality Control department follows MP-SSGC-QC-ORG10, MP-WC-SOP, EN1359 and ISO-9001 standards.

The ISO-9001 Standard sets out the requirements for a quality management system (QMS), helping organization improve efficiency, meet customer requirements and demonstrate a commitment to quality.

In charge QC is responsible to decide the acceptance or rejection of lot on the basis of the lot inspection reports and counter inspection of all the non-conforming parts of the sample and their functional behavior using Acceptance Quality Level (AQL) for each part according with MP-QC-SC.

Normal Inspection:

Normal Inspection is used at the start of inspection. The inspection procedures are changed according to the number of defects. In normal inspection, if there are 1000 parts, then only 200 or more parts are inspected.

Tightened Inspection:

While normal inspection is in effect, if there are 2 or more than 2 consecutive lots have been rejected on original inspection then it is switched to tightened inspection where more parts are being inspected. If 200 parts were being inspected in normal inspection, now 500 parts will be inspected and still rejected parts keep coming then the entire batch can be rejected.

When tightened inspection is in effect, normal inspection shall be instituted when 5 consecutive lots or batches have been considered acceptable on original inspection.

Reduced Inspection:

When 10 or more lots have been accepted in normal inspection then the inspection is switched to reduced inspection.

To keep the production at steady rate, reduced inspection is considered desirable but if a lot is rejected then it will be back to normal inspection

If there were 200 parts inspected in normal inspection then 50 parts will be inspected in reduced inspection

Calibration and Accuracy Verification:

Inspection of index assemblies and calibration of G-1.6 & V3 gas meters on 100% sample.

Final Approval:

Final inspection of G-1.6 & G-4 gas meters on 100% sample.

Machining

In machining, un-machined parts like top cover & body of G-1.6, top case & bottom case of V3 are received from the vendor. These parts come to machining department so drilling and tapping could be performed. The machining section follows MP-MCH-SOP to maintain high standards of SSGC.

Step Drilling in G-1.6 Body for Flag Rod:

The un-machined body of G-1.6 meter is placed on the adjustable jig of the automatic drilling machine where the drilling time preset in the machine. The machine Initiates the step drilling process to create two holes for the flag rod in the body using step drills with a preset stroke.

Drilling & Tapping of 26 Holes in G-1.6 Body:

The G-1.6 body is positioned onto the jig of the drilling and tapping machine, which automates the drilling and tapping processes in two stages. During the first stage, 26 holes are drilled according to a preset time and stroke. In the second stage, the jig is moved from position 2 to position 1 by the shuttle table, completing the tapping of the 26 holes with the same preset timing and stroke.

Tapping of 4 Holes in G-1.6 Top Cover:

The top cover is placed in the adjustable jig of the automatic tapping machine where the machine perform M4 tapping in four designated holes for the index cover on the top cover, utilizing preset M4 tap bits with a predetermined stroke.

7/8 External Tapping in Two Holes of G-1.6:

The G-1.6 top cover is positioned onto the machine's jig. The machine is activated to perform two 7/8" external taps, utilizing preset time and stroke settings.

7/8 External Tapping in Two Holes of V-3:

The V-3 top case is positioned in the machine's jig. The machine was activated to perform 7/8" external tapping on the extruded walls of the two holes in the upper case using preset 7/8" external tap bits, along with the appropriate time and stroke settings.

M3 Tapping in Four Holes of V-3 Top Case:

The upper sections of V-3 gas meters are processed using a threading machine connected to an M3 tapping machine. The top case is positioned onto the machine's jig. The machine is then activated for M3 tapping, utilizing a preset time and stroke.

M13 Tapping in V-3 Top Case:

The upper cases of the G-4 meter are transferred from the M3 tapping machine to the M13 tapping machine for M13 tapping in the hole designated for the index stuffing box. The top case is positioned onto the machine's jig. The M13 tapping process is then initiated with a preset time and stroke.

M5 Tapping in Lower Case:

The lower cases of V-3 are transported to the M5 machine so using a pneumatic pressure tool equipped with an M5 tap, the machine begins the internal tapping process in three holes of the bottom case.

Reworking:

In the production process, the machine operator or section in charge conducts random inspections of the machined components. If any non-conforming parts are identified during these inspections, they are separated for rework and placed in a designated trolley for rework-able items.

Painting

The powder coating process for all metal components measuring G-4 and G 1.6 meters is conducted in an automated painting facility utilizing powder coating technology. Once the painting processes are finalized, the coated parts are unloaded from a closed tunnel via an overhead conveyor that operates at a designated speed of 0.5 to 1.5 meters per minute. The items to be coated are suspended from hangers attached to the conveyor. This conveyor system guides the parts through several stages, including the curing tunnel, drying oven, powder coating booth, curing oven, and the loading and unloading zones. A supervisor conducts periodic visual inspections at the end of the drying zone to verify that the treatment is performed correctly. The painting section follows MP-PNT-SOP of SSGC. The painting of aluminum components is performed to ensure that the paint color aligns with the approved color shade panel located in the quality control and painting department. The paint must adhere properly, passing the cross-hatch test (Peel Test), and the film thickness should be kept between 20 and 70 microns.

Checks Before the Start of Automatic Plant:

Before the start of the plant inspection, the supervisor conducts checks on various sections of the painting facility.

Surface Treatment before Painting:

Before painting, all parts go through surface treatment to remove dust or oil.

Degreasing:

Loaded components are transported to the Degreasing Zone via an automated overhead conveyor system. Here, the parts undergo a cleaning and degreasing process through the application of a degreasing chemical solution, Metacrome-3. The solution's concentration is regularly monitored through testing, while the parts are processed in a sealed tunnel. A supervisor oversees the mixture of low-temperature alkaline cleaner and water, maintaining accurate records of the tests conducted. Over

time, the cleaning solution collects grease and dust, necessitating a replacement of the chemical after every 100 to 150 cycles.

Washing Stage I:

After degreasing, the parts are sent through a rinsing tunnel, where they are washed with a spray of fresh water at room temperature prior to entering the Chromating Zone.

Chromating Zone:

Components are subsequently transferred to the chromatic zone. This procedure is employed for the surface treatment of aluminum or aluminum alloys by applying a mixture of metachrome-9 and water onto the parts through spraying. A pump facilitates the recirculation of the solution. This treatment results in the formation of a thin oxide-chromate layer on the surface, which serves as an excellent foundation for paint adhesion. Additionally, it offers effective corrosion protection for unpainted surfaces

Washing Stage 2:

After the metachrome-9 treatment, the components undergo a water rinse at room temperature, where a spray of fresh water is applied to ensure thorough coverage before they proceed to the drying channel. The water circulation is facilitated by a centrifugal pump.

Drying Zone:

The components are subsequently transferred to the drying area, where they undergo drying through hot air circulation via convection at temperatures ranging from 130 to 170°C. This heated air is generated by natural gas burners located within the kiln, complemented by coiled fans powered by an electric motor. The temperature of the recirculated air is monitored by a pyrometric probe installed in the kiln, which is linked to a controller on the control panel.

Powder Paint:

Once the pre-treatment process is finished, the parts are introduced

into the powder coating stage using a powder gun. Here, Thermosetting power coating paint is used to paint the parts.

Flashoff Zone:

Components are transferred to the Flashoff zone located at the exit of the powder coating booth, where a significant portion of the solvent mixed with the powder evaporates. This process is facilitated by the circulation of ambient temperature air within this area.

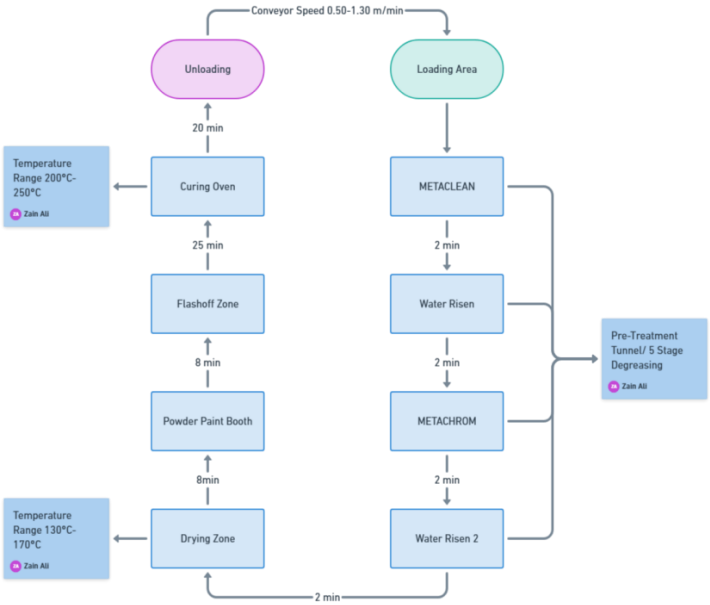
Curing Zone:

Components are transferred to the curing zone, where they undergo the necessary duration for complete polymerization. Heating is achieved through the convection of hot air, with temperatures ranging from 200°C to 250°C. The temperature limits on the control panel are regularly supervised.

Hanger Cleaning:

The hangers having thick paint after burn are cleaned

Painting Work Flow



Plastic Injection Molding

The injection molding department at SSGC serves a unique role by supplying all the plastic components necessary for the production of G.1.6 gas meters, in addition to the V-3 model. Similar to other departments, the injection molding team places a strong emphasis on ensuring the quality of the products delivered.

The PPM department utilizes four types of materials: polycarbonate, Acetal Copolymer, polypropylene, and ABS resin.

The components produced in the PPM department include index covers for all meters, ratchets, flag rods, tangents, tangent links, valve guides, diaphragms, diaphragm pans with guides, calibration gears, and intermediate gears.

Procedure of Injection Molding:

Preparation of Material:

Raw plastic, typically in pellet or granule form, is introduced into the hopper of the injection molding machine.

Material Selection:
Various types of plastics or other materials (including thermoplastics, thermosets, elastomers, etc.) can be chosen based on the required characteristics of the final product.

Melting and Injection:
Melting: The plastic is heated within the barrel of the injection molding machine. As it reaches its melting point, it transforms into a viscous liquid (molten plastic).

Injection: Once in a molten state, the material is injected into the mold cavity at high pressure through a nozzle. This injection system ensures that the plastic fills every section of the mold, accurately forming the desired shape of the final component.
Assembly or Finishing:

Based on the intricacy of the component, further procedures like assembly, painting, or coating may be required.

Inspection:

The components undergo evaluation for defects, dimensional precision, and overall quality. This process may include either manual inspections or the use of automated quality control systems.

Recycling and Material Recovery:

Excess plastic, runners, or sprues generated during the injection of molten plastic are typically recycled and repurposed for future production runs.

PPM Machines

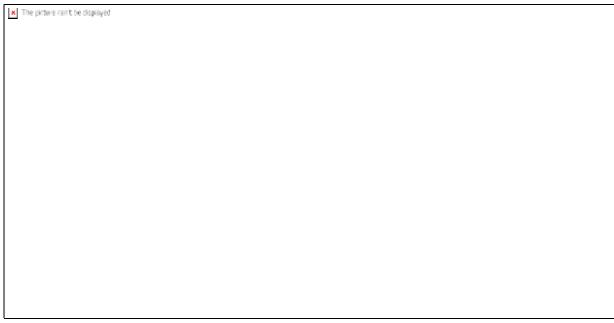
Jon Wat 110:

The JON WAI 110 is an injection molding machine manufactured in Korea. It was brought into the country between 2003 and 2004. Currently, SSGC operates two fully functional units in its PPM department, primarily utilized for producing index cover markalon and flag rod
The machine responsible for producing index cover markalon operates with acetol and has a capacity of two molds. Each production cycle lasts approximately 20 seconds, resulting in the molding of two index cover markalon every 20 seconds.

Victory Engel:

The Victory is a distinct type of injection molding machine utilized in the SSGC PPM department, Imported from Germany in the early 2000s. This machine has demonstrated its value significantly while also enhancing the reputation of its country of origin. Currently, there are two Victory Engels in operation, designed specifically for molding tangent supports and their associated components. Each machine runs approximately 12 hours a day, producing around 2,500 to 3,000 parts independently.

Engel:



This model is an earlier iteration of the Victory Engel, boasting a power output of 110 hp, which makes it significantly faster, more robust, and more dependable than both the Victory 80 and the JW. The ENGEL is utilized for the production of calibration and intermediate gears, with an average cycle time of approximately 20 seconds. The mold contains around 9 cavities, although currently, only 7 are operational. SSGC has a total of 4 Engels in the PPM department, with 2 in working condition while the other 2 are available for auction. These machines were imported during the 1990s.

Margarite:

The Margarite Injection Molding Machine is a piece of equipment designed for the production of plastic parts through injection molding. Although there is no widely recognized machine specifically called "Margarite," it may represent a brand or model of injection molding machinery utilized in certain areas or sectors. This machine was imported in 1976 and remains fully operational to this day.

V3 METERS

The V3 meters are a remodeled version of the G4 gas meters. They are notably larger than the G.1.6 gas meters and are predominantly utilized for industrial applications. The V3 meters are composed of three components:

1. Top cover

2. Bottom cover

3. Measuring Unit

Measuring Unit

The MU is a crucial component of the V3 gas meter. Initially, the body is retrieved from storage, and the diaphragm, counter plate, and diaphragm plate are joined using an ultrasonic welding machine. Following this, the flag rod and gland bush are installed within the body. The flag and lever are then fused together with the ultrasonic welding machine.

The subsequent step involves welding the diaphragm bridle, which is followed by an air leakage test. Shell welding is performed next, immediately followed by another leakage test. In step 8, silica flex is applied to the body for the valve seat, which is then secured in place with glue and allowed to dry for approximately four hours. After this drying period, the flag shaft is pressed, and the crank and valve cover are positioned, followed by another leakage test.

Finally, the kinematic assembly, driving wheel, intermediate gears, and links are attached, completing the unit. The assembly is then forwarded to the assembly section, where all procedures for G.1.6 assembly are executed. A final leakage test is conducted, and the meter is prepared for shipment.

G-1.6 Assembly Line

The G-1.6 assembly line section at the SSGC meter plant is tasked with assembling various components of gas meters and performing final tests to identify any leaks or damage in the meters. The materials required for assembly are sourced from the storage area by the designated supervisor. These materials are temporarily housed in the storeroom and are allocated to assembly workers based on daily needs. The assemblies and sub-assemblies are provided to the assembly personnel, who conduct a leak test after completing their operations. Once all inspections are successfully passed, the meters are forwarded to the calibration section for packing and delivery. The entire assembly process is outlined as follows:

Steps of Assembly

Robotic Gluing of Valve Grid on G.1.6 Body:

A robotic arm, utilizing pneumatic pressure, is employed to glue the valve grid onto the body.

Lapping of Valve Grid:

The valve grid, which is connected to the body, undergoes lapping on the lap master machine for one minute, after which the assembly worker completes the process.

Manufacturing of Diaphragm Assembly:

The diaphragm is combined with the diaphragm pan and guide, then positioned under the ultrasonic welding machine. The guides are riveted together and fused through the welding process.

Assembly of Index Component:

The assembly worker manually constructs the index assembly by attaching the rod, dials, and bushes to the index cover marked as Markalon.

Construction of Valve Guide Assembly:

The valve guide is secured on a pneumatically operated jig, and the valve is positioned above it. By pressing a button, the valve and guide are joined together.

Installation of Top Cover:

The top cover features three pivot holes where the pivots are pushed into position using a pneumatically operated machine by the operator. The Top Case Assembly consists of eight components: a Washer (including a gasket diameter), a Self-Threading Screw, a 10 Teeth Gear Shaft Assembly, an Index Pivot, a Painted Top Case, a Protection Box Assembly, an Index Driving Dog, and a Metallic Deflector with a plastic gird.

Installation of Top Cover on Body:

Grease is applied to both the outlet pipe gasket and the top cover gasket. The outlet pipe gasket is positioned on the outlet port of the valve grid, while the top cover gasket is correctly seated in the groove on the collar of the body. The top cover is then placed onto the body and secured by tightening eight cheese head screws with a pneumatic screwdriver.

Installation of Diaphragm Flag Rod Assembly to the Body:

The assembly personnel manually secure the diaphragm flag rod within the meter body. A greased packing and a flag rod gland are installed at the upper end of the flag rod to ensure a proper seal.

Attachment of Front and Rear Covers to the Body:

The front and rear covers are affixed to the body using screws, which are tightened by a machine operated by an operator.

Assembly of Tangent Support:

The valve grid is thoroughly cleaned, and any excess adhesive I s removed. Flagarms are attached to the upper knurled ends of the

flagrods using hex head screws. The tangent support assembly is positioned on the body and secured with two cheese head screws. A jig is then fixed for timing, and the tangent links are connected to the flag arms. The movement is verified, and timing adjustments are made as necessary. Once the timing is confirmed, the valves are Installed, followed by a check of their movement and lifting capabilities. Securing the Top Cover to the Body:

Installation of security bolt:

To install the Security Bolt, three M5 x 10 Security Bolts are utilized.

Installation of Plastic Seals:

In the Plastic Welding process, four Plastic Seals are employed. This component is assembled to complete the Plastic Welding

Installation of Index Cover Assembly:

The installation of the Index Cover Assembly involves three components: four M3X10 screws, one Index Cover Assembly, and one Index Cover Gasket. These parts are assembled to attach the Index Cover Assembly. Meters are properly placed keeping front side upward. Index cover gasket is placed on the collar provided on the top cover for index assembly. Index assembly is placed over the index cover gasket. The index assembly is then screwed with two cheese head screws and two sealing screws by two types of screw drivers.

External Underwater Leak Testing:

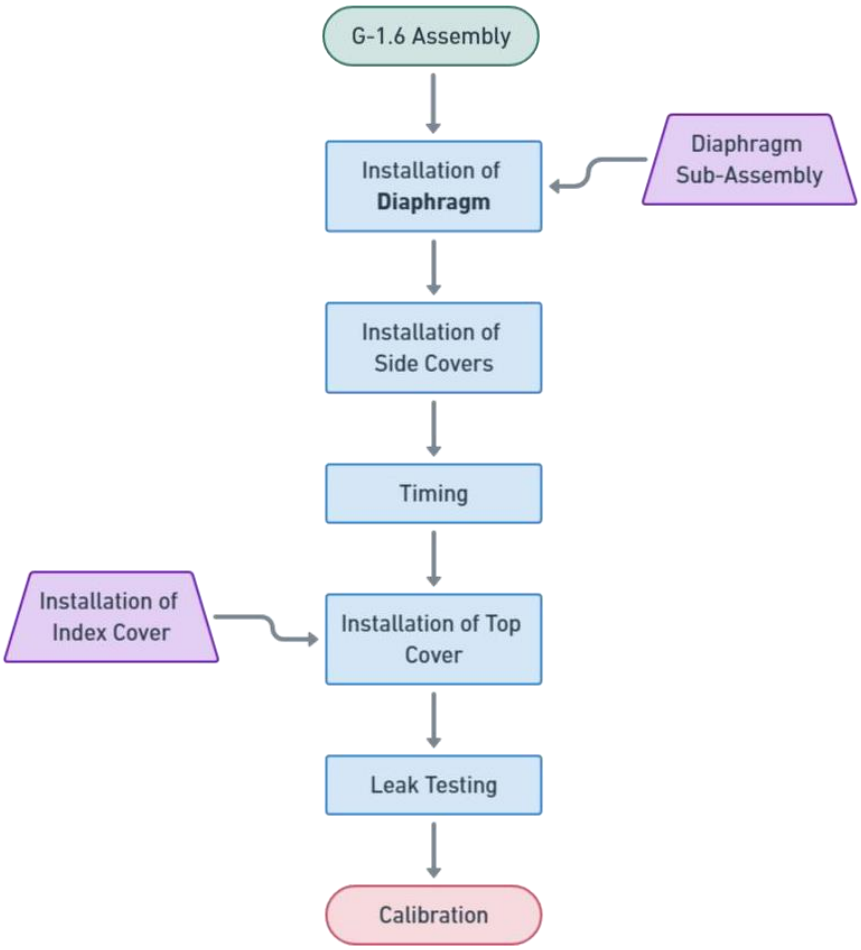
The meter, which has been prepared without the index assembly, undergoes an external leak test. It is positioned on the base of an underwater leak testing machine and secured at both the inlet and outlet ports. The meter is then submerged in a clear glass container filled with water. A pressure of 0.75 bar is applied through the meter to identify any leaks. Visual inspection is conducted to check for the presence of water bubbles, which indicate leakage. If no bubbles are observed, the meter is

deemed satisfactory and forwarded to the calibration section. If bubbles are present, the meters will be reworked to address any issues.

Rework:

The faulty components are disassembled, repaired, and then reassembled again. Any necessary rework on the Index Assembly or other defects caused by missing or loose screws, nuts, or bolts identified during the Final Inspection of the Meter Assembly

G-1.6 Assembly Work Flow



Calibration

Calibration is a critical step in the assembly of the meters. During the calibration process, three gears are positioned in the index cover markalon, which serves as the foundation for the assembly. The gears involved are:

1. Calibration gear
2. Intermediate gear

Prior to the installation of the calibration gears, a leak test is required for each G.1.6. gas meter. This test is conducted using high-quality line machines capable of testing up to 10 meters in a single cycle. The objective of this test is to ensure thorough quality inspection and to prevent any faults during customer usage. The cycle duration is between 5 to 6 minutes, with the pressure maintained at 1 bar, and the test is performed at three distinct flow rates:

i. Q_{max}
ii. Q_{min}
iii. 20%

For Q_{min}, the flow rate is set at 2.5 m^3/hr. At Qmin, the flow rate is maintained at 0.016 m³/hr, while at 20%, it is set at 0.5 m³/hr. Following these evaluations, the computerized results indicate whether the meters are functioning correctly. Meters that successfully pass the test are assigned their corresponding calibrated and intermediate gears, whereas those that do not meet the standards are returned for rework.

Chapter 4
(Recommendation & Conclusion)

As an internee overseeing processes at the SSGC meter plant, I would like to highlight the insights gained during my one month period and recommendations to enhance operations and maintain SSGC's high-quality standards, which serve as a benchmark for the industry.

Observations and Recommendation:

Standard Operating Procedures:

Standard Operating Procedures (SOPs) are essential for maintaining consistency, efficiency, and safety in any operation. During my experience at SSGC MMP, I learned that the company establishes SOPs as a guiding framework for each department to effectively execute tasks, processes, and operations.

Reporting Lines

Clear reporting lines facilitate effective communication between officers and staff regarding the status of operations. In SSGC, engineers from each department prepare reports for their stakeholders to convey both the advancements and setbacks of the project.

Job Description:

Job descriptions play a crucial role in manufacturing facilities by defining the roles and responsibilities of each employee and supervisor, thereby enhancing workforce management and operational efficiency. The SSGC Job description outlines specific responsibilities tailored to the qualifications and expertise of every worker and supervisor.

Comprehensive Process Understanding:

Throughout my time at the plant, I gained an in-depth understanding of the end-to-end process, spanning from the importation of components to the final packaging of gas

meters. It is commendable, SSGC's unwavering commitment to product quality, which reflects in its operational framework.

Quality Discrepancies Between Product Lines:

The rework rate for the G.1.6 meters was observed to be significantly higher compared to the V3 meters. While the V3 meters benefit from machined assembly, the G.1.6 meters rely more on manual assembly, contributing to human errors that exceed the error margin of automated processes.

Plastic Waste Management:

Current practices generate considerable plastic waste, which presents operational & budget concerns.

Dependency on External Vendors:

The reliance on third-party vendors for certain components adds cost implications and poses potential risks related to long-term availability.

Aging Machinery:

While the plastic molding machines are well-maintained, their excessive usage raises concerns about potential breakdowns, particularly given their high cost and dependency on imported replacements.

Control Mechanism:

A control mechanism encompasses the systems, processes, and tools employed to oversee, regulate, and enhance production activities. These mechanisms are essential for ensuring that operations function effectively, efficiently, and in accordance with the objectives of the plant. Within SSGC MMP, the Quality Control department oversees the quality standards of the meters, while Inventory Control manages work in progress (WIP) to prevent both overstocking and shortages, thereby maintaining a balanced supply chain. Additionally, Production Control is responsible for planning, scheduling, and monitoring processes to guarantee the timely delivery of products.

Quality Audit:

I also got a brief understanding about Quality Audit, how SSGC MMP Audits to verify the SOPs or Roadmap of the Manufacturing Process are being followed.

Designing/CAD Department:

I believe that a dedicated Design department is essential for the manufacturing plant. As the only Meter Manufacturing Plant in South Asia, SSGC MMP has the potential to significantly boost its meter exports through effective design and technological upgrades.

Rework Rate Reduction:

Efforts should be directed toward minimizing the rework rate, particularly for the G.1.6 meters. Transitioning to machined assembly for this product line, similar to the V3 meters, will reduce human errors and improve overall quality.

Enhancing Plastic Waste Management:

Consider adopting alternative plastic materials that are more reusable and environmentally friendly to minimize waste and align with sustainable practices.

In-House Production of Key Components:

Transitioning to in-house manufacturing for certain critical components would significantly reduce costs and ensure their uninterrupted availability, thereby fostering operational independence.

Upgrade Plastic Molding Machinery:

To mitigate the risk of production failures, I recommend replacing the current molding machines with advanced injection molding machinery. Investing in newer technology will enhance reliability and efficiency, protecting against potential downtime.

Conclusion:

In conclusion, these recommendations aim to further optimize SSGC's operations, ensuring the company maintains its exemplary quality standards while adopting cost-effective and sustainable practices.

Syed Zain Ali

(Internee)

ATTENDANCE OF INTERNEE MR. SYED ZAIN ALI

METER MANUFACTURING PLANT

FOR THE PERIOD FROM: 03 MARCH TO 31 MARCH 2025

MARCH 2025																										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
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ALI AKBER
DEPUTY CHIEF MANAGER
Meter Manufacturing Plant
Sui Southern Gas Company
Karachi