VISVESVARAYA TECHNOLOGICAL UNIVERSITY
JNANA SANGAMA, BELAGAVI-590018

Report on Internship

At

"SANSERA ENGINEERING LIMITED"

Submitted in partial fulfillment for the award of the degree

BACHELOR OF ENGINEERING

IN

"MECHANICAL ENGINEERING"

Submitted By

PAVAN KUMAR N

USN:1JS16ME417

Under the guidance of

Internal Supervisor	External Supervisor
Mr. NAGARAJA T K	**Mr. SIDDALINGAPPA**
Assistant professor	Training Head

DEPARTMENT OF MECHANICAL ENGINEERING

JSS ACADEMY OF TECHNICAL EDUCATION

JSS Campus, Dr. Vishnuvardan Road, Srinivaspura, Bengaluru, Karnataka 560060

2019-2020

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JSS Campus, Dr. Vishnuvardan Road, Srinivaspura, Bengaluru, Karnataka 560060

DEPARTMENT OF MECHANICAL ENGINEERING

CERTIFICATE

This is to certify that the Internship entitled carried out at **"Sansera Engineering Limited"** by **Mr. Pavan Kumar N (*USN- 1JS16ME417*),** bonafied students of JSS Academy of Technical Education, in partial fulfilment for the degree of Bachelor of Engineering in Mechanical Engineering course of **Visvesvaraya Technological University, Belgaum** during the academic year 2019-2020. The Internship work has been approved as it satisfies the academic requirements for the award of Bachelor of Engineering degree.

Nagaraja T K
Signature of Supervisor

Mr. Nagaraja T K
Assistant professor

10.03.2020
Signature of HOD

Dr. Bhimasen Soragaon
Professor, HOD

EXAMINERS:

1. G·M·SWAMY

2. NAGARAJA T.K.

SIGNATURE WITH DATE:

6/3/20

Nagu
6/3/20

SANSERA
ideas@work

05.08.2019

CERTIFICATE

This is to certify that **Mr. Pavan Kumar N** (Reg No-1JS16ME417), **Bachelor of Engineering (M.E)** student from J.S.S Academy of Technical Education, Bangalore(JSSATEB) completed his internship project on '**Types of Heat Treatment Process and Methods of Heat Treatment followed for GSF, Connecting Rod and Rocker Arm'** in our establishment from **08.07.2019 to 03.08.2019.**

During the period of his project, his performance was found satisfactory.

We wish him all success in future endeavors.

for Sansera Engineering Ltd.,

(Subash. A)
Dy. Manager - HR

SANSERA ENGINEERING LIMITED
(Formerly Sansera Engineering Pvt Ltd)
No. 261/C, Bommasandra Indl. Area, Bangalore - 560 099. INDIA Ph : +91 80 27833056, 27833442
E-mail id : info@sansera.in Website : www.sansera.in CIN : U34103KA1981PLC004542

ACKNOWLEDGEMENT

I consider myself proud to be a part of the JSSATEB family, the institution that stood by my way in all my endeavors.

I am thankful to **Dr. Bhimasen Soragaon,** Head of Department of Mechanical Engineering for providing permission to attend and complete this Internship.

Firstly, I would like to express my sincere gratitude to my advisor Professor and Guide **Mr. Nagaraja T K** Department of Mechanical Engineering for his patience, motivation, immense knowledge, guidance, helped me writing this Report

I would like to express our special thanks of gratitude to **Mr. SIDDALINGAPPA** who gave an opportunity to do this internship program, which also helps to do a lot of research and we come to know about so many new things.

I would like to thank the Senior Manager of the Heat Treatment Department **Mr. KIRAN KUMAR G** for his constructive criticism throughout my internship.

I would like to thank the Manager of the Heat Treatment Department **Mr. D G REVANNA GOWDA**.

I would like to thank the Senior Engineer of the Heat Treatment Department **Mr. JAMES PAUL**.

I would like to thank the Assistant Manager of the Heat Treatment Department **Mr. PRABU R**.

I would like to thank the Senior Engineer of the Heat Treatment Department **Mr. PRASATH S**

I also would like all the people that worked along with me at SANSERA Engineering Limited, with their patience and openness they created an enjoyable working environment.

It is indeed with a great sense of pleasure and an immense sense of gratitude that I acknowledge the help of these individuals. I am extremely great full to my department staff members and friends who helped me in the successful completion of this internship.

We hereby also declare that the content in this report is true to the best of our knowledge.

INTRODUCTION

SANSERA Engineering limited is a company that manufactures Connecting rods, crankshafts, rocker arms of top-quality and other sophisticated components for the aerospace and automotive sector, primarily supplying to original equipment manufacturers (OEMs) in India and internationally. They manufacture and provide a good range of precision forged and machined components that's for the engine, transmission, and other systems for the two-wheeler, passenger vehicle, and light and heavy commercial vehicles in the automotive sector. They supply components to the aerospace sector and off-road vehicles and other non-automotive applications.

SANSERA is a leading supplier of the two-wheeler and passenger vehicle in India. Specifically, they're one among the leading Indian manufacturers of Connecting rods, crankshafts, rocker arms and kit shifter forks for 2-wheelers and connecting rods, rocker arms and kit shifter forks for passenger vehicles. They are among the top 2 and top 3 manufacturers of 2-wheeler and passenger vehicle connecting rods in India, respectively among the top two manufacturers and the largest manufacturer of 2-wheeler and passenger vehicle rocker arms in India, respectively and the top 3 manufacturers of 2-wheeler gear shifter forks in India, they supply most of the products directly to OEMs and in forged and machined conditions, resulting in higher value addition.

As of May 31, 2018, they have 15 manufacturing facilities in the production facilities of certain of our OEM customers, enabling faster supply times. Fourteen of their facilities are situated in India at various locations like Bengaluru, Manesar, Pune, Pantnagar, and Tumkur, and one facility is situated at Trollhattan, Sweden, in Europe.

VISION, MISSION & SHARED VALUES

VISION

"World-Class Engineering Corporation that Maximizes the Stakeholders Values"

- INVESTORS
- EMPLOYES
- CUSTOMERS

- SUPPLIERS
- GOVERNMENT
- SOCIETY

MISSION

"Building an Employee driven and socially responsible Global Engineering Corporation using Innovative Methods and Efficient Management for lasting Customer Loyalty."

- Employee driven
- Socially responsible
- Global Engineering Corporation
- Innovative Method
- Efficient Management
- Customer Loyalty

Shared Values

- Customer-Centric
- Respect for Individuals & Trust in Relationship
- Accountability to Stakeholders
- Teamwork & Integrity
- Excellence & Innovation
- Corporate Social Responsibility
- Value for Time.

HISTORY

This Company was established on 15 December 1981, with the Registered Office and Corporate Office located in Bengaluru. They are promoted by S. Sekhar Vasan, F.R. Singhvi, Unni Rajagopal K, and D. Devaraj. They commenced commercial production of passenger vehicle components in 1986 for Maruti Suzuki. They then grew in precision components manufacturing in India by commencing supplies to the two-wheeler in 1996, for off-road vehicles in 2009 and

to the sunshine commercial vehicle in 2011. They established a producing facility dedicated to high precision aluminum and titanium machined aerospace components manufacturing in 2013 and In April 2017, they acquired a 100% stake in SANSERA Sweden (SANSERA Sweden), which has facilitated their entry into the heavy commercial vehicle vertical in automotive sector and expanded their customer base and improved geographical access to original equipment manufacturers (OEMs) outside India.

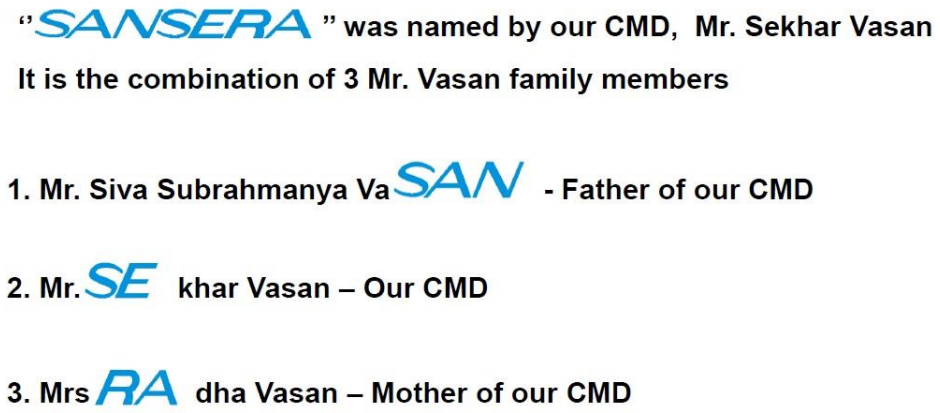


Figure 1 – This figure shows how the company name was derived

LIST OF PLANTS IN INDIA AND LOCATION

Figure 2 – Sansera Plants Photos

DOMESTIC CUSTOMERS

Two-wheelers

1. Bajaj
2. Honda
3. Suzuki
4. Yamaha
5. Royal Enfield
6. Hero
7. Piaggio
8. Harley-Davidson
9. Ducati
10. Aprilia

Automotive

1. Toyota
2. Honda
3. Daimler
4. Volkswagen
5. Maruti Suzuki
6. Fiat Chrysler Automobiles

LCV/HCV

1. Ashok Leyland
2. Nissan
3. BharatBenz
4. Tata
5. UD Trucks
6. Volvo
7. Fuso

Aerospace

1. Boeing
2. Wipro
3. Tata
4. United Technologies
5. Sikorsky
6. GKN Aerospace
7. Magellan Aerospace

RAW MATERIALS SUPPLIERS

1. (SAIL) Steel Authority of iron-limited, Bhadravathi.
2. Mukund Steels Ltd, Mumbai.
3. ISMT Ltd, Pune.
4. Sunflag Steel Ltd, Maharashtra.
5. Vardhaman Special Steels, Lundhiana.

SANSERA ENGINEERING QUALITY POLICY

Sansera is committed to continuous improvement through the application of tools and methods designed to enhance quality, productivity, and reliability. Internal monitoring or quality performance is a key element of quality assurance.

Some of the Other highlights of Sansera Quality are:

- NABL certified Metallurgy & Metrology laboratory.
- KAIZENs concept is implemented to stimulate productivity improvement as an ongoing process.
- Poke-yoke system in our machines for inspection.
- Received Best Quality award from Honda Motor & Scooters India.
- Received Best Quality Award from Ducati Motor

SANSERA ENGINEERING QUALITY POLICY TABLE

SL.NO	SYSTEM	STANDARD	PLANT- 1	PLANT- 2	PLANT- 3	PLANT- 4	PLANT- 5	PLANT- 6	PLANT- 7	PLANT- 9
1	QMS	ISO 9001	1999	2000						
2		IATF 16949:2016	2003	2003	2006	2008	2007	2009	2009	
3		ISO/AS: 9100C								2015
4	EMS	ISO 14001:2015		2007	2007	2010	2011	2010	2010	2013
5	OHSAS	ISO 45001:2018		2007	2007	2010	2011	2010	2010	2013
6	EnMS	EN ISO 50001:2011		2016	2016	2016	2016	2016	2016	2016
7	NABL	ISO/IEC 17025:2005	For Mechanical & Chemical tastings							
Abbreviations: 1. QMS : Quality Management System										
2. ISO : International Organization for Standardization										
3. IATF : International Automotive Task Force										
4. AS : Aerospace Standard										
5. EMS : Environmental Management System										
6. OHSAS : Occupational Health & Safety Assessment Series										
7. EnMS : Energy Management System										
8. NABL : National Accreditation Board for Testing & Calibration Laboratories										

Table 1 – Sansera Quality Policy Table

OBJECTIVES OF THE STUDY

The objectives of the internship are as follows

(i) To improve my skillset in my profession.

(ii) To develop my attitude and behavior with the professionals

(iii) To obtain good work habits and responsibilities.

SCOPE OF THE STUDY

The major scope of this work is to have hands-on experience in Heat Treatment and methods of heat treatment done for several automotive Parts, as this work is limited to one month I am not able to collect entire information from all departments of this industry this work is mainly

concentrated on to study the Heat treatment process done for automobile parts like Gear shifter fork, connecting rod & rocker arm.

WEEKLY OVERVIEW OF INTERNSHIP ACTIVITIES -

Week 1

- **Monday** – Introduction Program at Plant 8
- **Tuesday** – Dojo Training room at Plant 2
- **Wednesday** -Training & Importance of Safety and rules of Company
- **Thursday** - Introduction of staff and faculty of Plant 2
- **Friday** – Allotment of the department (Allotted to Heat Treatment Department)

Week 2

- **Monday**- Walkthrough of Plant 2
- **Tuesday-**Introduction to Sealed Quenching Furnace & working
- **Wednesday-**Introduction to Induction Hardening and Softening
- **Thursday**- Introduction to Brazing
- **Friday-** SQF process for Gear Shifter Fork and taking a reading in a log sheet

Week 3

- **Monday-**SQF process for Rocker Arm and taking a reading in a log sheet
- **Tuesday**- SQF process for Connecting Rod and taking a reading in a log sheet
- **Wednesday-**Induction Hardening of pads and endpin of the Gear Shifter Fork
- **Thursday-** Induction Softening of the Connecting Rod
- **Friday-** Grinding and Brazing Rockers Arm end by using MAHLER – I (Machine used for Brazing)

Week 4

- **Monday-**Tempering Process (loading and unloading process) and visual inspection
- **Tuesday-** Types of inspection & Magnetic particle testing & Ultrasonic cleaning & drying
- **Wednesday-**Introduction to Gas Carburizing Furnace (Connecting Rod)
- **Thursday-**Visit to Metallurgy Department and Introduction Types of inspection in metallurgy Field
- **Friday-**Final day preparing Internship report and submitting

DOJO TRAINING

A **Dojo** is a Japanese term that means "place of the way". The concept of a Dojo as a martial arts training place is a Western concept in Japan, any physical training facility, including professional wrestling schools, may be called Dojo because of its close martial arts roots.

OBJECTIVES OF DOJO

- Insight of SANSERA Plants
- Safety Training, usage of PPEs in shop floor
- Rules of shop floor
- Understanding the roles and responsibilities
- Daily logbook, and documents to be maintained as per cp
- Understanding Quality requirement training concerning the product
- Maintenance space and usage
- Standard view by model
- Products knowledge(basic)

Figure 4 – Sansera Plant 2 Dojo Room

Figure 5 – Sansera Plant 2 Dojo Room

BENEFITS OF DOJO TRAINING

- It is helpful to increase the performance of the operator
- To reduce reduction

- To reduce accident and increase safety awareness
- Action plan for the fallen down part
- 5s improvement
- Knowledge about line documents like a poll, check sheet, etc.
- Standardization the work process
- Beneficial to achieve company targets like productivity, PPM, Cost, and delivery.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

It is anything used or worn by a person to minimize risk to the person's health or safety at the workplace. They are:

- Goggles (Eve protection)
- Earplug (Ear Protection)
- Mask (Respiratory protection)
- Hand Gloves
- Helmet (Head Protection)

Figure 6 – Components Process Display

Figure 7 – Sansera Uniform

Figure 8 – Engine Cut section Display

MANUFACTURING PROCESS FLOW OF CONNECTING ROD

1. Raw Material
2. Forging
3. Inward Inspection
4. Big End Rough Boring & Chamfer
5. Small End Drilling
6. Vibro Finishing
7. Pre-Heating
8. Case Hardening
9. Tempering
10. Shot Blasting
11. Induction Softening
12. Finish Grinding
13. Hard Boring
14. Deburring
15. Honing
16. Cleaning
17. Bend and Twist Inspection and Correction
18. Marking
19. Final Inspection
20. Packing
21. Dispatch

In the above manufacturing process of the connecting rod only Vibro finish, preheating, case hardening, tempering, shot blasting, induction softening is done in the heat treatment department rest of the process is carried in other plants located in other parts of Bangalore.

Figure 9 – Connecting Rod

MANUFACTURING PROCESS FLOW OF GEAR SHIFTER FORK

1. Raw material
2. Inward Inspection
3. Forging operation
4. Finish horning
5. Radius milling
6. Pin Machining
7. Induction Hardening (pad)
8. Tempering
9. Bend Correction & inspection
10. Pad grinding
11. Radius chamfering
12. Crack Checking
13. Vibro finish
14. Stage inspection
15. Chrome plating &inward inspection
16. Final inspection
17. Oiling
18. Packing

In the above manufacturing process of the gear shifter fork only Induction Hardening (pad), Vibro finish, tempering, is done in the heat treatment department rest of the process is carried in other plants located in other parts of Bangalore.

Figure 10 – Gear Shifter Fork

MANUFACTURING PROCESS FLOW OF ROCKER ARM

1. Raw Material
2. Forging
3. Inward Inspection
4. Machining and Chamfering
5. Face Milling
6. Profile Milling
7. Slot Milling
8. OD Radius & Angle Milling
9. Pad Milling Chamfering
10. Vibro Finishing
11. Case Hardening
12. Tempering
13. Shot Blasting
14. Rough Honing
15. Pre Chrome-Pad Grinding
16. Pre Chrome-Buffing
17. Chrome Plating
18. Pad Brazing
19. Final Inspection
20. Packing
21. Dispatch

In the above manufacturing process of the connecting rod only Vibro finish, case hardening, tempering, shot blasting, Pad Brazing is done in the heat treatment department rest of the process is carried in other plants located in other parts of Bangalore.

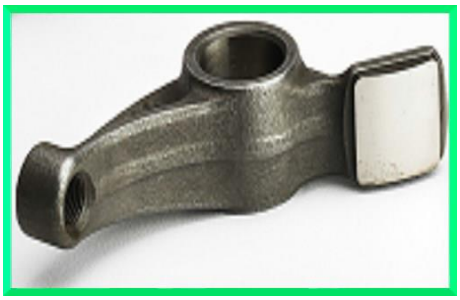


Figure 11 – Rocker Arm

INTRODUCTION TO SEALED QUENCHING FURNACE & WORKING

The sealed quench furnace is a type of heat treatment furnace. Sealed quench furnaces are of 'straight through' type with integral oil and gas quenching features. Suitable for carburizing and carbo-nitriding under protective atmospheres, sealed quench furnaces are fully automatic and PLC controlled.

Figure 12 – SQF front view

Figure 13 – Sealed quenching furnace

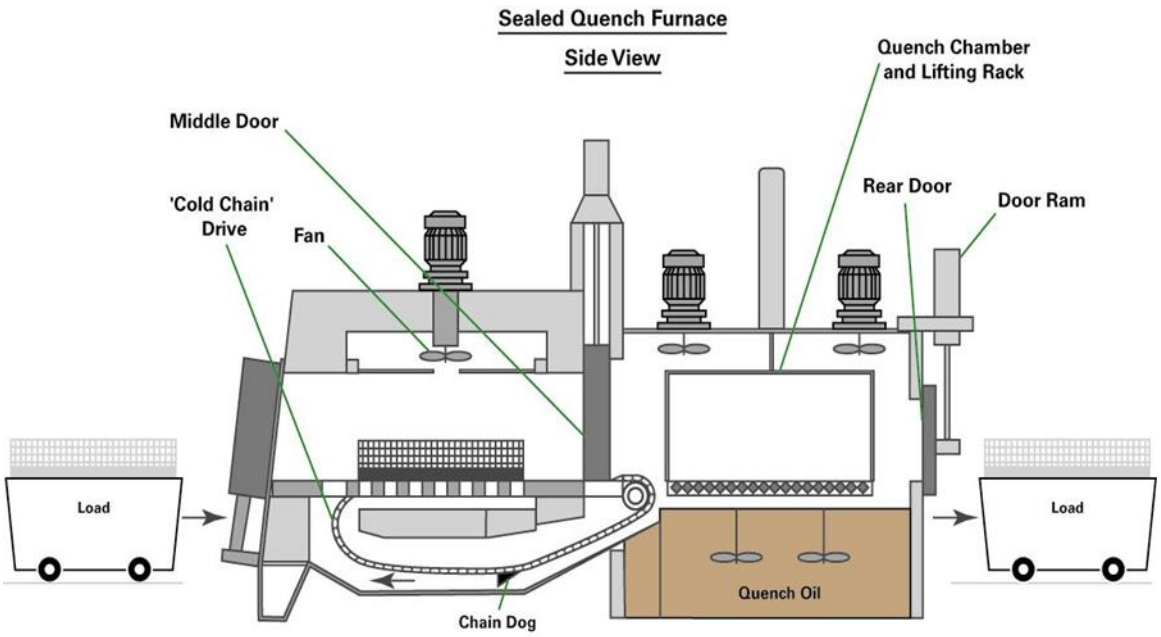


Figure 14 – SQF Side View Diagram

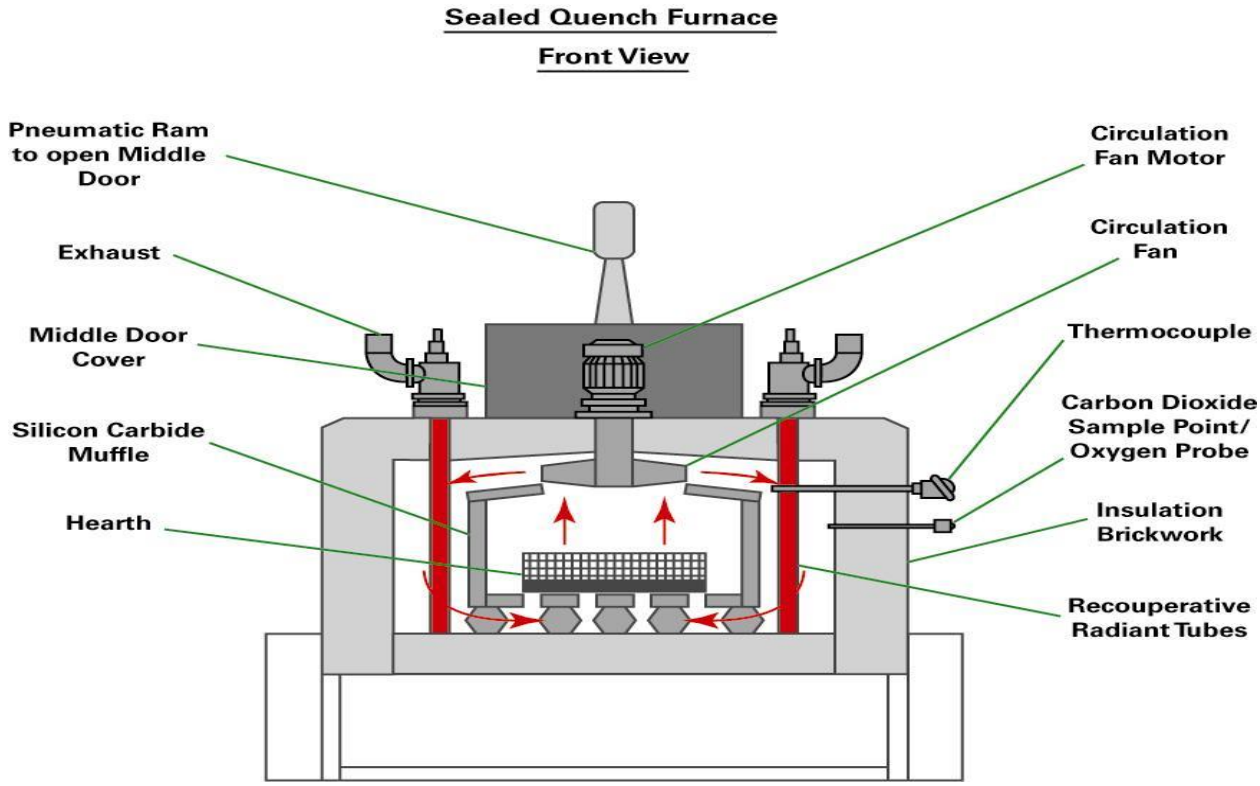


Figure 15 – SQF Front View Diagram

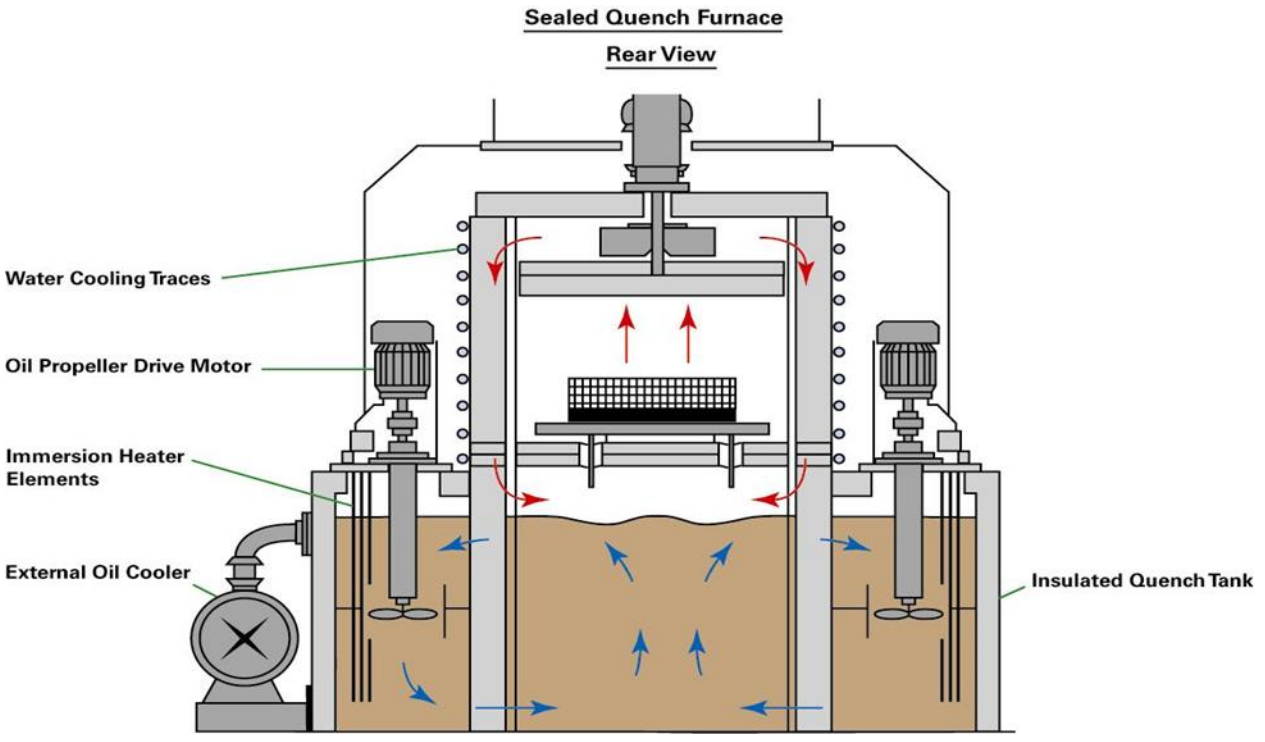


Figure 16– SQF Rear View Diagram

THREE DIFFERENT PROCESSES TAKING PLACE ARE

First stage Carburizing second stage Diffusion And finally Hardening

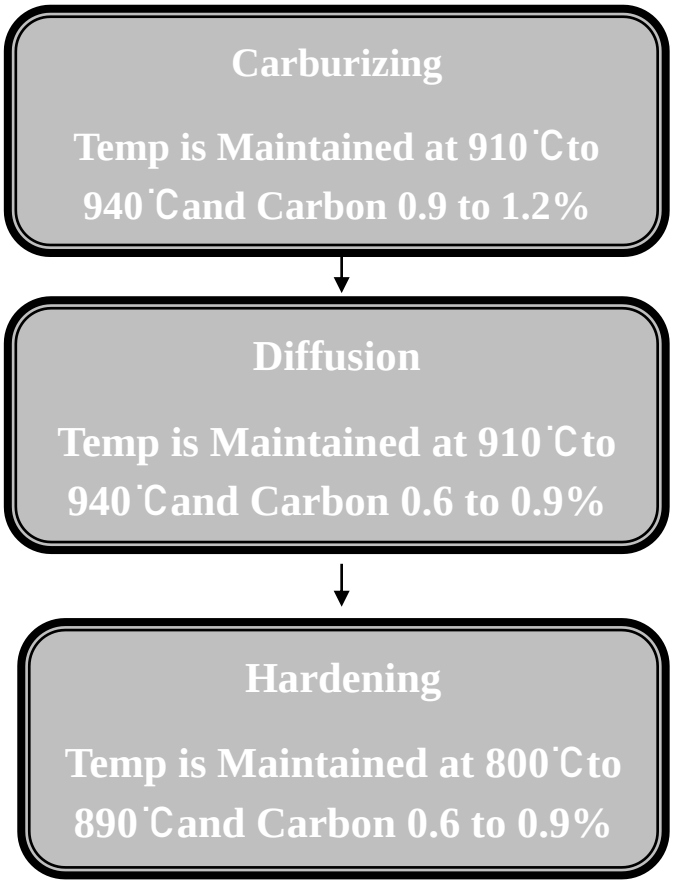


Figure 17 – SQF Loading

ENDO GAS GENERATOR

LPG and AIR mixed at 1000˚C, this is called Endo Gas

Figure 18– Endo gas generator

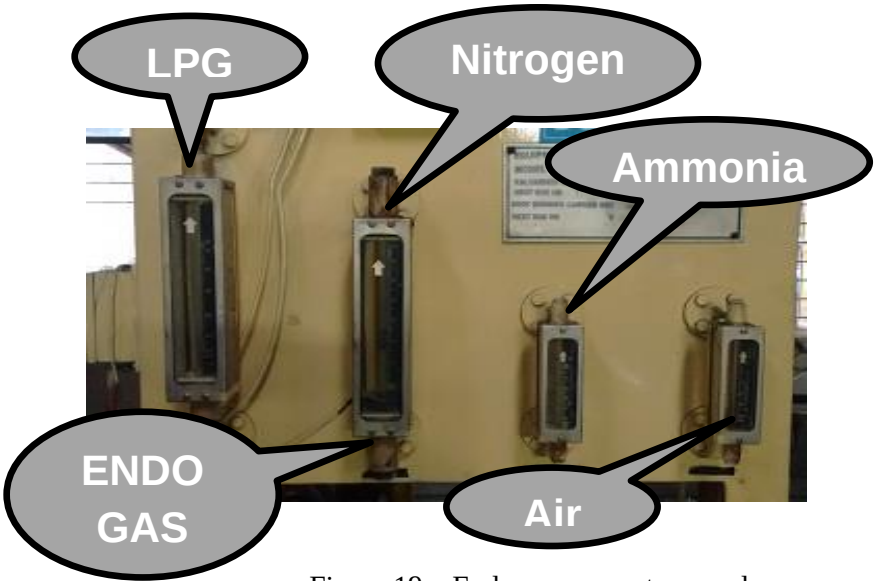


Figure 19 – Endo gas generator supply

GENERAL PROCESS INSTRUCTION SHEET

HTD/F/01 R : 01
ISSUE : 01
DATE : 01.09.2015

HT PROCESS INSTRUCTION SHEET

SANSERA ENGINEERING PLANT 2

FURNACE: SQF - 201

INSTRUCTION NO :HPS/01/071

IN PROCESS CONTROL PLAN REF. NO. : PIRA1034, PIRA1035

PART NUMBER : PIRA1034, PIRA1035

PART NAME : ROCKER ARM

1218

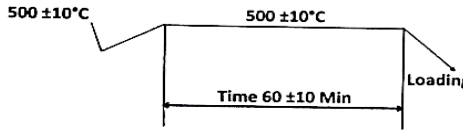
SPECIFICATION

MATERIAL :	16CrNi4
PROCESS :	Case Hardening & Tempering
SURFACE HARDNESS :	60 ~63 HRC
CASE DEPTH :	MCD 0.50 ~ 0.65 MM, Cut off at 685 Hv 1 Kg. ECD 1.10 ~ 1.43 MM, Cut off at 514 Hv 1 Kg.
CORE HARDNESS :	35 ~45 HRC
As per Norma:	STD.2602/L.T(CMT-50)
BATCH QTY :	PIRA1034 / PIRA1035
WEIGHT / COMPONENT :	1218

Pre wash :

Process	Water temp.	Chemical	Plunging	Resting	Spraying	Drying	Blower on	Skimming
Temp. & Time	60 ± 5°c	Hi Clean L44	10±2 Mins	NA	5±2 Mins	5±2 Mins	NA	Auto Through out cycle

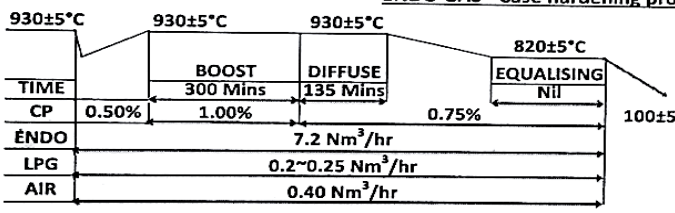
Pre heating :



Note :

1. 30 to 50 Minutes will take to reach set temperature after charge loading to pre heating
2. Temperature drop up to 380°c when charge loaded to furnace.
3. Excess temperature controller set temperature 20°c more pre heating process set temperature
4. 10 Minutes (Max.) will take from pre heating unloading to SQF loading.

ENDO GAS - Case hardening process



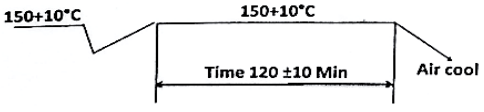
QUENCH TIME - 9 to 12 Min
OIL DRIPING - 10 to 15 Min
AGITATION SPEED (QUENCHING) -1480± 25 RPM

NOTE :
1. Temperature drop up to 760°c when charge loaded to furnace.
2. Boost timer start when less than 0.1% Set CP value.
3. When Boost period start first 10 to 15 Minutes CP sooted up to 0.1% against set CP value.
4. The Percentage of carbon potentiol variation against set point during HT process ±0.05.
5. When Diffusion timer start first 15 min CP will drop from Boost CP.
6. Every 1°c temperature drop taken 1 Minute after diffusion end to hardening timer start.(Total 10 to 15 min. extra depends.)
7. Hardening timer start when 1°c less than hardening temperature set value.
8. Impeller fan speed 1500±25 RPM.
9. Agitation speed idle and during process(Slow sped) 750±25 RPM.

Post wash :

Process	Water temp.	Chemical	Plunging	Resting	Spraying	Drying	Blower on	Skimming
Temp. & Time	65 ± 5°c	Cleansol LDS	20±2 Mins	NA	10±2 Mins	10±2 Mins	NA	Auto Through out cycle

Tempering :



Note :

1. Temperature drop up to 120°c when charge loaded to furnace.
2. Excess temperature controller set temperature 20°c more tempering process set temperature
3. 10 to 20 Minutes will take to reach set temperature after charge loading to tempering

Additional Information :

1. Incase of mixing of two part number of the same case depth please make sure the weight shall be with in 200 to 240Kgs.
2. Total batch weight with fixture 350 Kgs Max.

Alteration :

Sl. No.	Rev No.	Rev Date	Amendments
1	00	19.05.2016	NEW FORMET
2	01	30.07.2018	Diffustion & Hardening CP reduced from 0.75 to 0.70% due to CO factor changed from 23.0 to 19.5 in CP controller due to actual CO 19.5% observed in 3IR gas analyser, Boost time reduced from 300 to 285 Mins and Diffusion time reduced from 135 to 120 Mins to maintain case depth mean range.
3	02	01.10.2018	Diffusion & Hardening CP increased from 0.70 to 0.75%, Boost time increased from 285 to 300 Mins and Diffusion time increased from 120 to 135 Mins (set previous cycle) due to actual CO 23.0% observed after 3IR gas analyser calibration so that CO factor changed from 19.5 to 23.0% in CP controller.

	Prepared by	Approved by
Name	Kiran Kumar G	Kanchivaradaiah.K
Sign		
Date	01.10.2018	01.10.2018

MASTER COPY
Sign:
Date: 01/10
Valid Only in Red Colour

CONTROLLED COPY
Copy No: 01 PLANT 2
Sign: Date: 01.10

HEAT TREATMENT PROCESS USING SQF

Types of heat treatment that can be done using sealed quench furnace are

1.CASE HARDENING

2.THROUGH HARDENING

3.CASE CARBURISING

Figure 20 – Heat Treatment Process Flow chart



LOADING → **PRE-WASHING** → **PRE-HEATING**


Sealed Quench Furnace → **POST-WASHING**


TEMPERING → **INSPECTION**

GENERAL PROCEDURE OF SQF

Fixture Loading -Soft components received from the centralized store after that soft component is moved to the loading area with verifying identification tag.

Figure 20– Components Loading for Pre wash

Pre-washing – Dust, oil and coolant removal from the component so doing pre-washing in the washing machine, two operations are done here that is Plunging and Spraying, water at 55-65 ℃ mixed with chemical L44(alkaline), plunging time 10min and spraying time 10 min.

Figure 21– Pre washing process

Preheating – During the forging and machining process internal stress will be generated in the components. To relief the stress the preheating is done

Figure 22– Pre heating process

Case Carburising – After Preheating, the material is loaded into sealed quench furnace Carburizing, also referred to as Case Hardening, is a heat treatment process that produces a surface that is resistant to wear, while maintaining toughness and strength of the core. This treatment is applied to low carbon steel parts after machining, as well as high alloy steel bearings, gears, and other components.

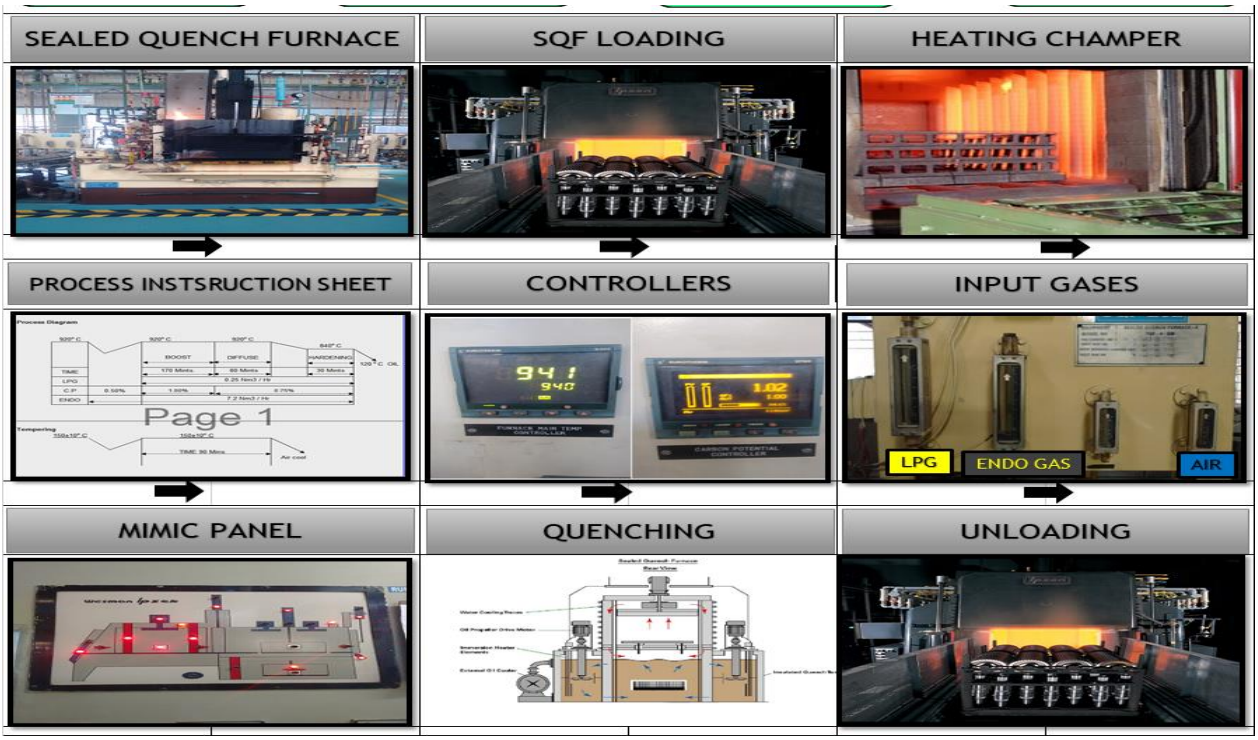


Figure 23– Case Carburizing process

Post washing – After Quenching in oil the surface of the component will be oily to remove oil from components washing is done in three stages they are dipping, spraying, drying

Figure 24– Post washing process

Tempering – After heat treatment components will get brittle while tempering brittleness has to be removed and mechanical strength, ductility, and toughness will be improved.

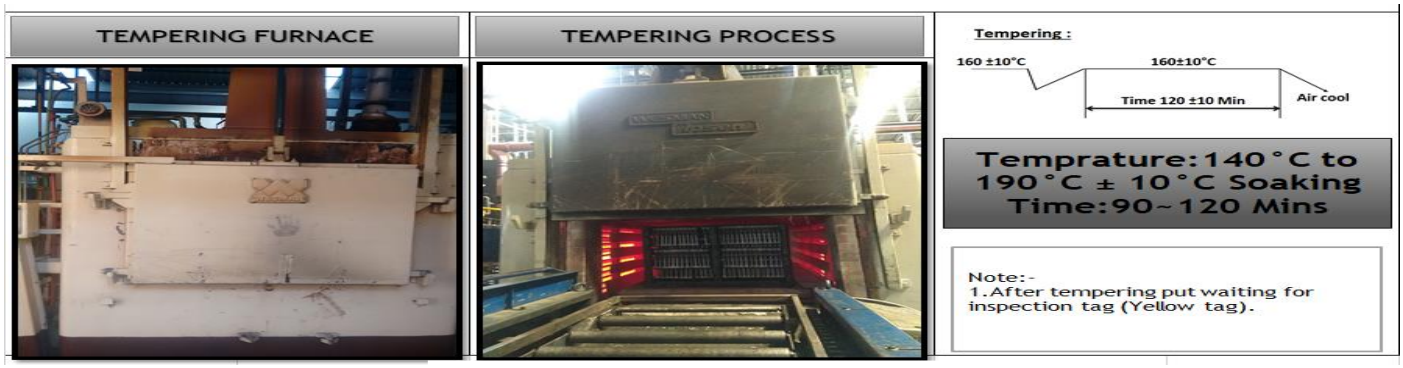


Figure 25 – Tempering process

Figure 26– SQF Controller

Figure 27– SQF Display unit

SQF PROCESS PARAMETER SHEET BASE ON REQUIREMENTS OF CUSTOMER FOR CONNECTING ROD, GEAR SHIFTER FORK &ROCKER ARM

SCM 420H steel is an alloy containing chromium and molybdenum. Its symbol is SCM and its specifications comply with Japanese Industrial Standards (JIS) that govern all industrial activities in Japan. **HRC** - Rock Well Hardness Number C Table

16MnCr5 is an alloy special steel composition Carbon, Chromium, and Magnesium.

IS10343 – Carbon and Low Alloy Steel Investment Casted for Industrial Purpose.

		COMPONENTS		
SL. NO	**SPECIFICATIONS**	**ROGS1005**	**YMRA0013**	**BACR1070**
1	MATERIAL	IS10343	16MnCr5	SCM 420H
2	SURFACE HARDNESS	79-81HRC	78-83 HRC	59-63HRC
3	CASE DEPTH	0.65-0.80MM	0.45-0.65 MM	0.95-1.20MM
4	CORE HARDNESS	25-45HRC	30-45 HRC	26-45 HRC
5	QUENCH TIME	9-12 MIN	9-12 MIN	9-12 MIN
6	OIL DRIPPING	10-15 MIN	10-15 MIN	10-15 MIN
7	AGITATION SPEED	1480 RPM	1481 RPM	1482 RPM

Table 2 – Customer Requirement Table

COMPONENT

ROGS1005 – Royal Enfield Gear Shifter Fork 1005 Part No.

YMRA0013 -Yamaha Rocker Arm 0013 Part No.

BACR1070 -Bajaj Connecting Rod 1070 Part No.

TIME	TEMPERATURE		Carbon %		MV	GAS FLOW RATE			QUENCH OIL TEMP		HEATING CHAMBER FAN SPEED IN RPM	OIL AGITATOR SPEED IN RPM	PRODUCT ROGS1005	
	SET	ACTUAL	SET	ACTUAL		PNG IN Nm^3/Hr	PNG IN Nm^3/Hr	AIR IN Nm^3/Hr	SET	ACTUAL		RIGHT	LEFT	REMARKS
10:10 AM	920	900	0.5	0	900	72	0.25	0.5	120	119	1496	749	748	
10:40 AM	920	865	0.5	0.5	1077	72	0.25	0.5	120	120	1497	748	749	
10:55 AM	920	920	1.1	1.1	1151	72	0.25	0.5	120	120	1496	749	749	CARBURISING START AT 10:55 AM
11:25 AM	920	920	1.1	1.1	1152	72	0.25	0.5	120	120	1497	748	748	
11:55 AM	920	920	1.1	1.1	1151	72	0.25	0.5	120	120	1496	749	749	
12:15 PM	920	920	0.9	1.1	1150	72	0.25	0.5	120	120	1497	748	748	DIFFUSION START AT 12:15 PM
12:30 PM	800	920	0.75	0.9	1127	72	0.25	0.5	120	120	1496	749	749	DIFFUSION END AT 12:30 PM
1:10 PM	800	880	0.75	0.75	1117	72	0.25	0.5	120	120	1497	748	748	
1:30 PM	800	840	0.75	0.75	1107	72	0.25	0.5	120	120	1496	748	749	
														QUENHING STOP AT 2:15PM
														UNLOADING AT 2:35PM

Table 3 - Heat Treatment Process sheet of Gear Shifter Fork ROGS1005

TIME	TEMPERATURE		Carbon %		MV	MAIN BURNER		QUENCH OIL TEMP IN C		HEATING CHAMBER FAN SPEED IN RPM	OIL AGITATOR SPEED IN RPM		BACR 1070 REMARKS
	SET	ACTUAL	SET	ACTUAL		PNG IN Nm^3/Hr	AIR IN Nm^3/Hr	SET	ACTUAL		RIGHT	LEFT	
9:30 AM	930	928	0.5	0.03	870	13	10	120	120	1496	749	748	
10:30 AM	930	866	0.5	0.5	1076	13	10	120	120	1497	748	749	
11:00 AM	930	930	1	0.6	1110	13	10	120	120	1496	749	748	CARBURISING START AT 2:10PM
11:30 AM	930	930	1	1	1132	13	15	120	120	1497	748	748	
12:00 PM	930	930	1	1	1132	13	10	120	120	1496	749	749	
12:25 PM	850	930	0.7	1	1132	13	15	120	120	1497	749	748	
1:15 PM	850	896	0.7	0.7	1108	13	10	120	120	1496	748	748	CARBURISING END AT 4:20PM
											1482	1481	QUENCHING START AT 5:25PM
													UNLOADING AT 5:50PM

Table 4 - Heat Treatment Process sheet of Connecting Rod BACR1070

TIME	TEMPERATURE		Carbon %		MV	GAS FLOW RATE			AIR IN	QUENCH OIL TEMP IN C		HEATING CHAMBER FAN SPEED IN RPM	OIL AGITATOR SPEED IN RPM		YMRA 0013 REMARKS
	SET	ACTUAL	SET	ACTUAL		PNG IN Nm^3/Hr	PNG IN Nm^3/Hr	AIR IN Nm^3/Hr		SET	ACTUAL		RIGHT	LEFT	
1:00 PM	910	900	0	0.01	921	72	0.25		0.5	120	120	1496	749	748	
1:30 PM	910	870	0.5	0.5	1077	72	0.25		0.5	120	120	1497	748	749	
2:10 PM	910	910	1	1	1140	72	0.25		0.5	120	120	1496	749	748	CARBURISING START AT 2:10PM
2:40 PM	910	910	1	1	1141	72	0.25	0.4	0.5	120	120	1497	748	748	
3:10 PM	910	910	1	1	1140	72	0.25	0.4	0.5	120	120	1496	749	749	
3:40 PM	910	910	1	1	1141	72	0.25	0.4	0.5	120	120	1497	749	748	
4:20 PM	840	910	0.7	1	1140	72	0.25	0.4	0.5	120	120	1496	748	748	CARBURISING END AT 4:20PM
4:50 PM	840	870	0.7	0.7	1106	72	0.25	0.4	0.5	120	120	1497	479	749	
													1482	1481	QUENCHING START AT 5:25PM
															UNLOADING AT 5:50PM

Table 5- Heat Treatment Process sheet of Rocker Arm YMRA0013

GAS CARBURIZING FURNACE PROCESS

Figure 28 – Gas Carburizing furnace

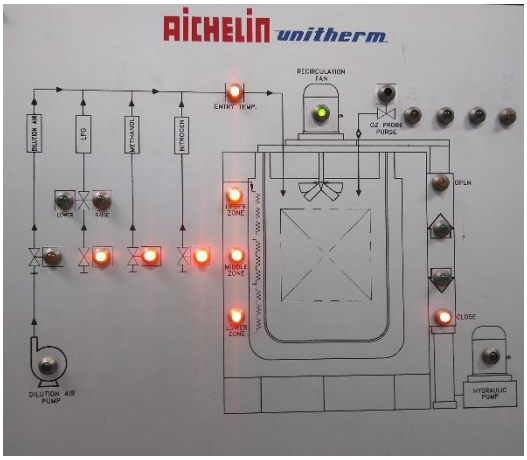


Figure 29– furnace control system

1. Material Received from centralized storage and loaded to fixture
2. Pre-washing
3. Pre-Heating - 500°C
4. GCF Loading for Casehardening after loading 30min Equalizing Carbon -0.40%
5. 350min bosting at Carbon – 1.00% and 170 min diffusion at Carbon-0.75%
6. Loading to Cooling pit and cooling for 120min
7. LPG, Air, Methanol & Nitrogen is used for carburizing
8. GCF is used to Case Carburizing Connecting Rod

Figure 30 – Connecting rod loading to fixture to place in furnace

Figure 31 – Before and after heat treatment

CONTINUOUS BRAZING FURNACE

1. Material Received from Vibro Process
2. Ultra-sonic cleaning is done
3. Coper Past is applied on Rocker Arm pad surface and place
4. Rocker arm with a pad is placed in the fixture
5. Loading to Inlet of Brazing Furnace (MAHLER 1)
6. Brazing Process takes place and unloading is done at outlet
7. Finishing using pneumatic Grinder
8. Visual Inspection
9. Shear load Test conducted in Metallurgy lab
10. Moved to Heat treatment for case hardening and tempering
11. Brazing temp - 1075℃ at zone 1 & 1098.0℃ at zone 2
12. Belt speed 190.28mm/min
13. Ammonia cracked temp – 906.4℃ main and 869.7℃ excess

Figure 32 – Brazing Furnace

Fig 33-Loading and Applying Copper Paste

Figure 34 - Loading to furnace

Figure 35- Brazed rocker arm

Figure 36- Unloading from furnace

INDUCTION HARDENING

1. Material Received from Centralized storage
2. Plc Program selection in M/c
3. Induction Hardening
4. Tempering in Oven for 150℃ for 90-120min
5. Metallurgical inspection is done
6. Visual inspection
7. Dispatched to Hard operations (Production)
8. Induction hardening is done to ends of gear shifter fork at the pin end
9. Heating to 250-625℃ and cooling with coolant
10. Dispatched to storeroom

Figure 37 – Induction Hardening

INDUCTION SOFTENING

1. Connecting Rod received form Storage
2. Plc Program should be selected in M/c
3. Induction softening is done for the stem of Connecting Rod and Small end at 650℃
4. Air Cooling after Induction softening
5. Sent to Metallurgical inspection
6. Visual inspection is done
7. Dispatched to Hard operations (Production)

Figure 38– Induction Softening

Figure 39– Induction Softening done to Connecting Rod

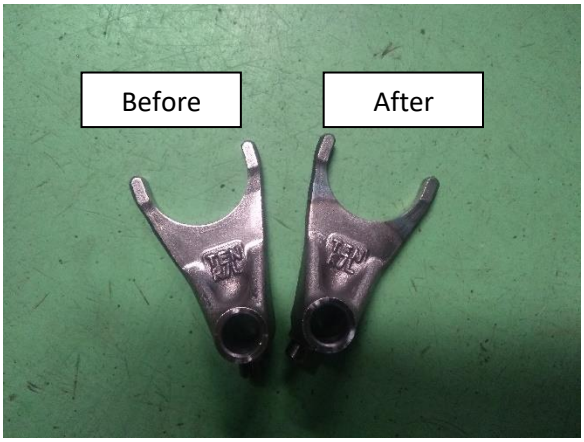


Figure 40– Induction Hardening done to GSF pad

SHOT BLASTING MACHINE

Shot blasting is a method used to clean, strengthen or polish metal. Shot blasting is used in almost every industry that uses metal, including aerospace, automotive, construction, foundry, shipbuilding, rail, and many others.

Process

Loading components and adding Lead shots (Small circular balls of Diameter 1mm) and the machine is switched on and short blasting takes 20 min and then the machine is switched off and components are removed.

Figure 41– Loading to Shot blasting machine

Figure 42 – Unloading after shot blasting

Figure 43 – Shot blasting machine

INSPECTIONS AT METALLURGY LAB

Metallurgical lab identifies material defects & structure metallurgical analysis, also called metallurgical examination, testing or evaluation, which can be a valuable source of information to any industry working with metals.

Figure 44 – Metallurgy lab

Equipment List

1. Micro Vickers hardness tester
2. Image analysis system.
3. Universal testing machine.
4. The digital surficial hardness tester.
5. Grinding machine and cutting machine
6. Auto polishing machine.

The Hardness test will be conducted to a random sample from a batch and the sample will be cut in half and tested for hardness and other Properties using equipment in this lab.

The Surface Finish and Dimensional accuracy of the component will also be tested here using Digital Vernier caliper, Digital Screw Gauge.

Figure 47 – Rockwell Hardness Test Rig

Figure 47 – Grinding machine and cutting M/c

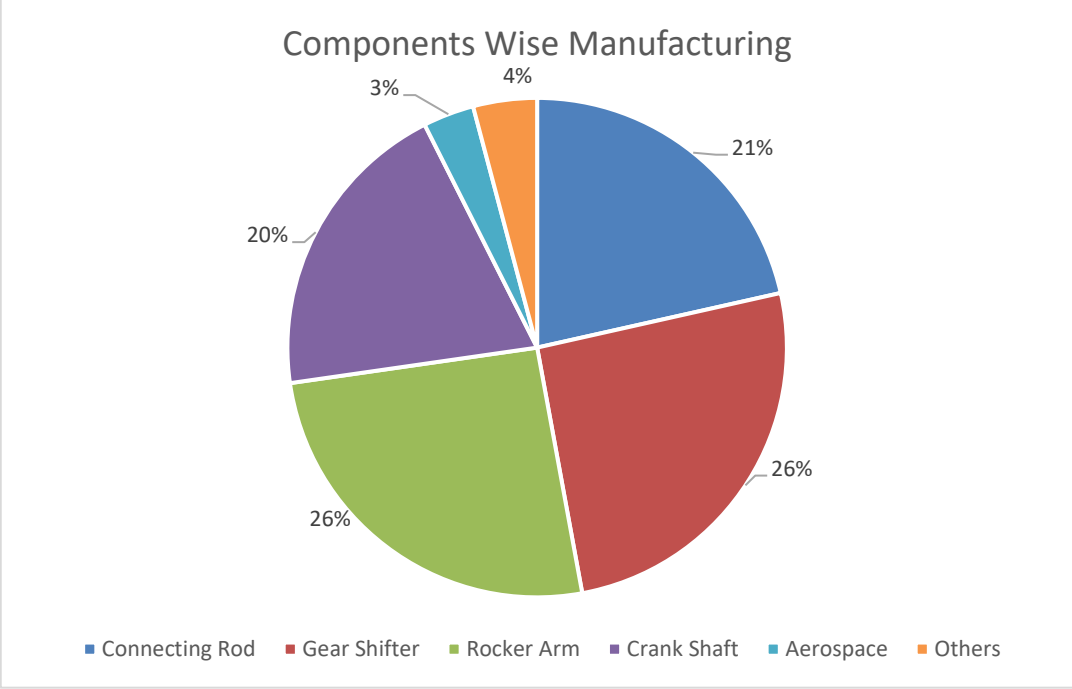


Figure 47 – Components Manufacturing percentage pie chart

CONCLUSION

From this internship, we learned about how a Heat Treatment Department runs in an organization. We got to see and study different types of Heat treatment and Types of Machines used for Heat treatment and method of heat treatment as per customer requirements of a product related to an automobile (Engine Parts). By this internship Program, we became more aware of heat treatment and its purpose and importance and use of Heat Treatment. We also learned about New Types of Inspection Machine tools and the purpose of inspection. Also, this training provided me to implement the theories of our syllabus to apply practically. This was the best opportunity I did not have in our academic year. To do some practice with experienced workers in a live workshop and to see the internal parts of engines and other parts. So, this training program was very helpful for me in studying. By this platform, I gained some knowledge and I hope that it will impact a lot in our future.

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