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Production and quality control of GM pinion 17/77 T of traction motor

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Abstract: - The pinion is only thing by the help of which power is transferred from engine to wheel. It is situated inside the traction motor of the engine. The material of the pinion is cast iron. The gear of pinion is mounted on the gear of axle of the wheel. When power comes from engine to the traction motor, this rotates the pinion on its axis which rotates the axle gear. This in turn rotates the wheel. Hence engine moves forward.

The project is all about production and quality control of the pinion. The production is always done on the basis of the design provided by the organization. According to the design of the pinion, its tolerance must be ±0.38mm. Tapper of pinion is 1:20.

In this project, we have done tapper grinding, radius grinding, quality control and center holding of the pinion. The tapper grinding is done according to the ring gauge provided by organization (BHEL). The ring gauge must properly fit into the pinion with completely visible blue contact and after check the crakes on the pinion by MPI test and Dye penetrant test.

Key Words: -pinion, traction motor, cast iron, tapper, grinding, Ring gauge, MPI Test, Dye penetrant test

1. INTRODUCTION

Live project on **"Production process and Quality control of Railway Engine Pinion".**The aim of this project is to manufacture object (pinion) as per design by following various mechanical process and control its quality according to design and also from various parameters. The pinion is only thing by the help of which power is transferred from engine to wheel. It is situated inside the traction motor of the engine. The material of the pinion is cast iron. The gear of pinion is mounted on the gear of axle of the wheel. When power comes from engine to the traction motor, this rotates the pinion on its axis which rotates the axle gear. This in turn rotates the wheel. Hence engine moves forward.

In this project, we have done tapper grinding, radius grinding, quality control and center holding of the pinion.

1.1 Traction Motor: -

Since the diesel-electric locomotive uses electric transmission, traction motors are provided on the axles to give the final drive. These motors were traditionally DC but the development of modern power and control electronics has led to the introduction of 3-phase AC motors. For a description of how this technology works. There are between four and six motors on most diesel-electric locomotives. A modern AC motor with air blowing can provide up to 1,000 hp.

1.2 Pinion/Gear: -

The traction motor drives the axle through a reduction gear of a range between 3 to 1 (freight) and 4 to 1 (passenger).

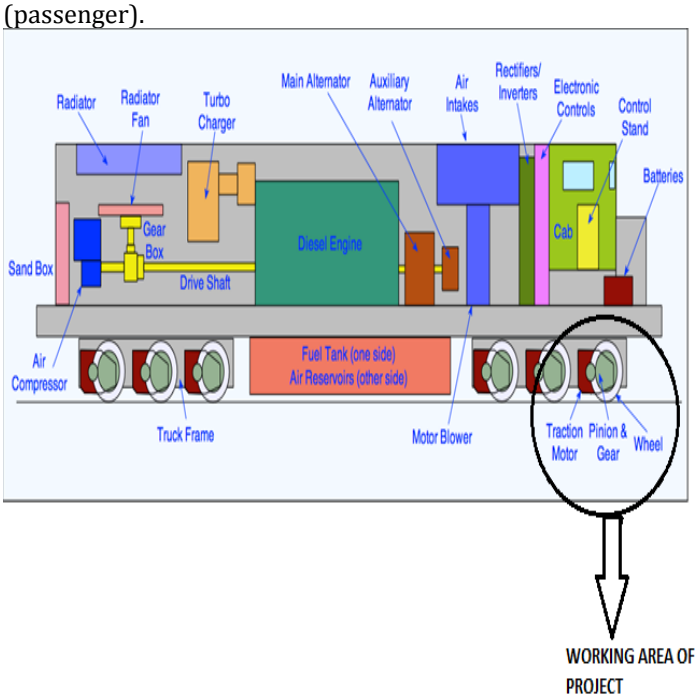

Fig. No.: -01

Fig. No.: -2

Pinion of traction motor

2. Design of pinion gear:-

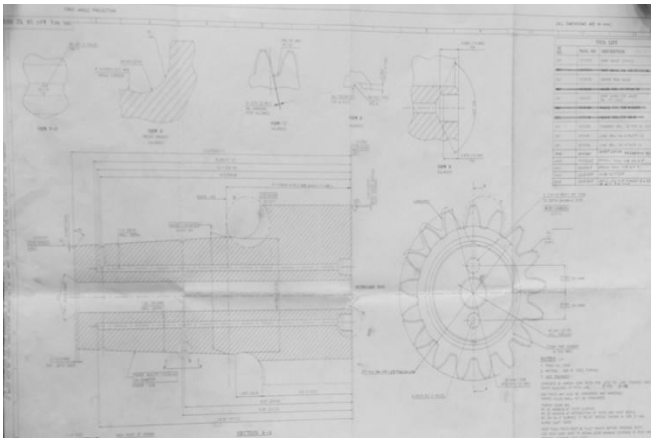

Fig. No.: -03
Design of pinion gear

Length of Pinion: 337.1mm; Radius of Pinion: 23.4mm
Length of Gear Teeth: 114.3mm; Tapper required: 1:20
Length of Pinion Shaft: 181.885mm; No. of gear Teeth: 17
Diameter pitch: 2.5668mm ; Pressure Angle: 25°
Angle of TYP- both end: 60° ;Length of TYP- both end: 3.048mm
Gauge diameter: 124.993mm

Fig. No.: -04

3. Description about process: -

TOOL AND GAUGE DIVISION

DATE 18/05/2015

PART PROSSEES OF GM 17/77 T PINION TO DRG. NO. 14451692003 REV.03

ANNEXTURE WITH PI NO. 233457309

OPN NO.	MACHINE	DISCRIPTION
001	GRINDING	HOLD BETWEEN CENTRE GRIND SHANK DIA 124.99 GRIND RADIUS R-23.4 MM X 32.8 AND MAINT. FLANK LENGTH 114.30/114.20 AS PER DRG.
002	GRINDING	HOLD BETWEEN CENTRE FINISH GROUND TAPER 1:20 AND MAINT. GAUGE LENGTH 155.245 (+0.38/-0.38 MM) AS PER RING GAUGE NO. 1573155 MAINT. TOTAL LG. 337.10/337.20
003	HAND	INDENTIFICATION DETAILS OF VENDOR(E.G. SL. NO.) MARK WITH WHITE PAINT CLEAN ALL OVER JOB AND APPLY RUST PREVENTIVE PAINT.

SUBHASH CHAND
PE. TGM PLG.

DIKSONI
TGM PLG.

Table No.: -01

4. Objective: -

The project is all about production and quality control of the pinion. The production is always done on the basis of the design provided by the organization. According to the design of the pinion, its tolerance must be ±0.38mm. Tapper of pinion is 1:20.
In this project, we have done tapper grinding, radius grinding, quality control and center holding of the pinion. The tapper grinding is done according to the ring gauge provided by organization (**BHEL)**. The ring gauge must properly fit into the pinion with completely visible blue contact.

Fig. No.: -05
Past Status of pinion

Fig. No.: -06
Present Status of pinion

5. Working principle of pinion: -

This pinion is part of traction motor of the WDG4 railway engine. This pinion is present in between traction motor of engine and gear, present at axle of the wheel. Power of the engine coming to traction motor from the generator is transferred to wheel by this pinion. This pinion is installed in the traction motor. When power comes to the traction motor, the traction motor starts and the pinion rotates. When pinion starts rotating, due to this wheels also rotate because teeth of the pinion are connected with the helical gear which is mounted at axle of wheel.

Fig No.:- 07
WDG 4 Engine

6. Application: -

The only use of the pinion is to help rotate the helical gear mounted on axle of wheel, because of this engine will move or run. It transmits the power from traction motor to wheel.

7. Problem formulation: -

Table No.: -02

Note: -
P = P1, P2, P3, P4, P5, P6 = PROBLEMS
S = S1, S2, S3, S4, S5, S6 = SOLUTIONS

8. Steps to resolve Problems: -

8.1. Step 1: -

1. This is the initial level or we can say that it is a first step to start our production or solve our first problem.
2. We check our job after it enters into our work place, we check in following ways: -
   - Check the cracks in the pinion.
   - Check any manufacturing defect.
3. If there occurs any defect as above then informed and send that job for the replacement to the organization.

Fig. No.: -08
Pinion of traction motor

8.2. Step 2: -

1. The imaginary center point or center axis of the pinion is completely damaged.
2. The solution of this problem is to polish its center. The imaginary center point or center line of the pinion is not present in proper way in pinion.
3. Make the center line or center polishing of the pinion.
4. We fit the pinion on lathe machine for center polishing of the pinion.

S. No.	Problem	Solution
1.	P1. Observe the pinion for present any crack or any other manufacturing defect.	S1. Check the pinion in proper way, if any crack or any other manufacturing defect is present.
2.	P2. Center is damaged	S2. Center holding of the pinion.
3.	P3.Extra material present at face of the pinion.	S3. Face grinding of the pinion.
4.	P4. Extra material present at radius of the pinion.	S4. Radius grinding of the pinion.
5.	P5. Extra material present at axle of the pinion.	S5. Tapper grinding of the pinion.
6.	P6. Quality control	S6. Installation of ring gauge and complete blue contact come on pinion.

Fig. No.: -09
Center polish of pinion

8.3. Step 3: -

1. The material present on radius of pinion is comparatively more than the design. This radius does not fulfill our requirement.
2. The solution of this problem is to grind the radius of the pinion.
3. The radius grinding of pinion is very difficult as per the design of the job.
4. After the grinding process, we work on quality control.
5. Check the pinion in all way and also from the design.
6. If any possibility of mistake in process then it again goes for the machining.

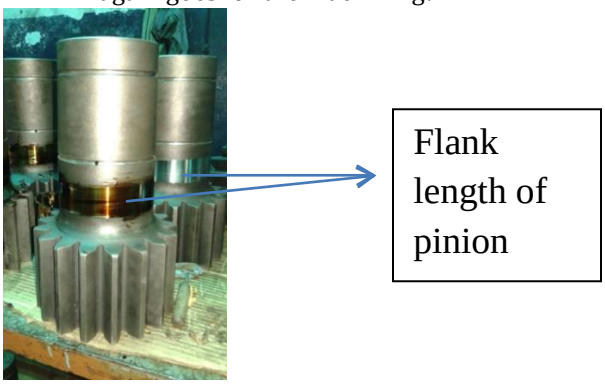

Fig. No.: -10

Flank grinding of pinion

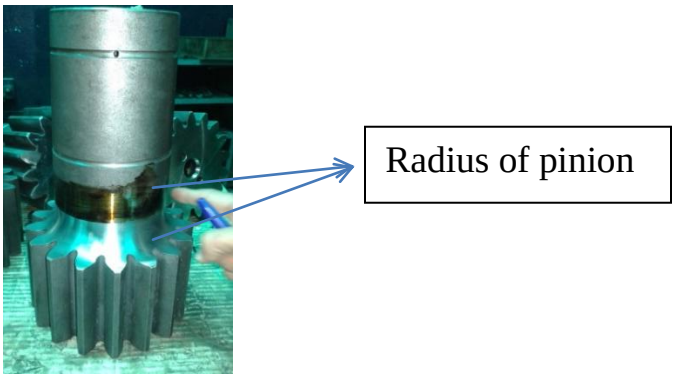

Fig. No.: -11

Radius Grinding of pinion

8.4. Step 4: -

1. In pinion, it is observed that the surface is very rough.
2. The solution of this is to make the surface of the pinion smooth.
3. This process occurs on grinding machine.

Fig. No.: -12
Surface Finish of Pinion

8.5. Step 5

1. As per design of the job or pinion, we give the tapper of 1:20 on it axle.
2. To provide tapper grinding we adjust the bed of machine at some angle (angle depends upon the job).After adjusting the bed, mount the pinion on the machine and start grinding the pinion.
3. After completing the tapper grinding of the job, we come on the quality control.
4. In this step we check the pinion on various ways and also from the design of the pinion.
5. We also check that there is no any rough surface present on the pinion.

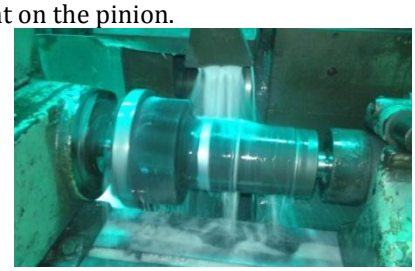

Fig. No.: -13
Tapper grinding of pinion

Fig. No.: -14
Tapper grinding of Pinion

Fig. No.: -15
Final pinion

✓ **Time duration for Grinding Process of one piece:-**

The following table shows the how much time would we taken by any machine to complete its operation, and it also show there gauges for check its dimensions.

Step No.	Grinding Process	Process Time	Check Gauges
Step 3	Radius grinding G1	1/4th of day	Vernier Calliper, Vernier Height Gauge, Screw Gauge
Step 4	Face grinding	1/4th of day	Vernier Calliper
Step 5	Tapper Grinding	½ of day	Ring Gauge, Vernier Calliper

Table No.: -03

9. TOTAL QUALITY CONTROL: -

9.1. Quality Control using Ring Gauge: -

1. After tapper grinding, the pinion goes for its quality control.
2. In this process we check that the ring gauge is completely fitted on pinion as well as also check whether the blue contact is coming completely on pinion or not.
3. If the gauge is not completely fitted on the pinion then pinion again goes for the tapper grinding.
4. If at some position the blue contact is not coming properly then it goes for the tapper grinding.

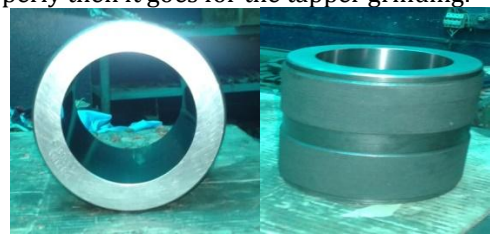

Fig. No.: -16 Fig. No.: -17
Ring Gauge

Note: -

1. Fig. No. 19 and Fig. No. 20 is Ring Gauge of pinion for check the tapper of pinion.
2. The blue solution is paste inside the Ring Gauge of pinion.
3. Now put the pinion inside the Ring Gauge and rotate the ring gauge at the pinion.
4. After follow these such process we check the blue solution is completely come on the pinion or not.
5. If blue solution completely come on the pinion then the pinion will be ok or tapper of the pinion is according to the design, if these such thing is not come properly then it will again send to the tapper grinding
6. Fig. No. 16 and Fig. No. 17 shows the complete blue contact on the pinion.

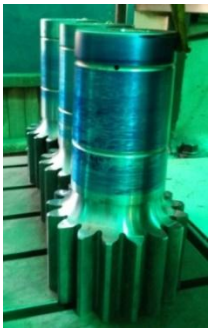

Fig. No.: -18
Complete Blue contact coming on pinion

9.2. Quality control by dye penetrant test: -

Dye penetrant inspection (DPI), also called liquid penetrant inspection(LPI) or penetrant testing (PT), is a widely applied and low-cost inspection method used to locate surface-breaking defects in all non-porous materials (metals, plastics, or ceramics). The penetrant may be applied to all non-ferrous materials and ferrous materials, although for ferrous components magnetic-particle inspection is often used instead for its subsurface detection capability. LPI is used to detect casting, forging and welding surface defects such as hairline cracks, surface porosity, leaks in new products, and fatigue cracks on in-service components.

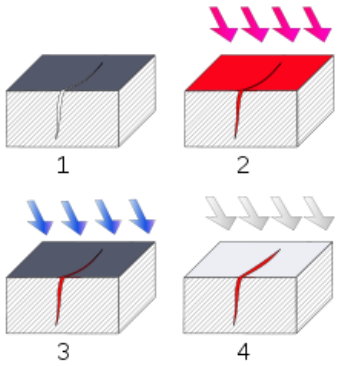

Fig. No.: -19
Dye penetrant test

1. Section of material with a surface-breaking crack that is not visible to the naked eye.
2. Penetrant is applied to the surface.
3. Excess penetrant is removed.
4. Developer is applied, rendering the crack visible.

9.3.MPI test (Magnetic power inspection): -

Magnetic particle Inspection (MPI) is a non-destructive testing (NDT) process for detecting surface and slightly subsurface discontinuities in ferromagnetic materials such as iron, nickel, cobalt, and some of their alloys. The process puts a magnetic field into the part. The piece can be magnetized by direct or indirect magnetization. Direct magnetization occurs when the electric current is passed through the test object and a magnetic field is formed in the material. Indirect magnetization occurs when no electric current is passed through the test object, but a magnetic field is applied from an outside source. The magnetic lines of force are perpendicular to the direction of the electric current, which may be either alternating current (AC) or some form of direct current (DC) (rectified AC).

The presence of a surface or subsurface discontinuity in the material allows the magnetic flux to leak, since air cannot support as much magnetic field per unit volume as metals. Ferrous particles are then applied to the part. The particles may be dry or in a wet suspension. If an area of flux leakage is present, the particles will be attracted to this area. The particles will build up at the area of leakage and form what is known as an indication. The indication can then be evaluated to determine what it is, what may have caused it, and what action should be taken, if any.

10. Present Status of the Project: -

The present status of project is **"Complete"**. There is no any defected or any sort of rejected pinion by the organization (BHEL).

Fig No.:-20

Final Pinion

11. CONCLUSION: -

1. The project status is completed.
2. It is given technically "OK" by the organization (BHEL) to all pinions after checking according to their norms.
3. The pinion is ready to be installed in the engine.

Fig. No.: -21
Technically "OK' pinion

12. Reference

1. P. C. Sharma
S. Chand, 01-Jan-2007 - Production engineering.

2. Narayana**,** K L
K. International Pvt Ltd, 01-Aug-2010.

3. R. K. Rajput
A *Textbook* of *Manufacturing Technology*: Manufacturing Processes. Firewall Media, 2007 - Manufacturing processes.

4. Dr. R. Kesavan
Laxmi Publications, Ltd., 01-Sep-2010 - Machine-tools.

5. B. L. Juneja
New Age International, 2003 - Machine-tools.

6. Author : - A.B. Chattopadhyay
Machining and Machine Tools, w/cd

7. Fundamentals of Metal Machining and Machine Tools, Third Edition (Mechanical Engineering) Hardcover – Import, 1 Nov 2005
by Winston A. Knight **(Author),** Geoffrey Boothroyd **(Author)**

8. Fundamentals of Metal Cutting and Machine Tools Paperback – 1 Dec 2008
by B.L. Juneja **(Author),** Nitin Seth **(Author),** G.S. Sekhon **(Author)**

9. Fundamentals of Metal Machining and Machine Tools, Third Edition (Mechanical Engineering)
Winston A. Knight

10. Amitabh Bhattacharya
Metal Cutting

11. Manufacturing Engineering and Technology Paperback
SeropeKalpakjian