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Research paper

Design of Fixture for Rotor Post

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Abstract

This paper deals with Design of Fixture for Rotor Post. The existing method is studied regarding the assembly of the rotor post using the normal marking. So, it is to suggest a design for the fixture for rotor post. It includes fixture plate design with leveled bed. The leveled bed is placed on the locator, providing the dimensioned fixture plate fixed on the leveled bed. The fixture plates are designed according to the size of the rotor post. The rotor post is placed on the leveled bed, the verticality of rotor post as in assembly is maintained. The committee has also interacted with shop executives about the work with additional safety also. This paper helps to improve the accuracy and increase the productivity of the rotor post. It also reduces the total time of the fabrication. Due to this work, the fabrication cost of the rotor post reduced.

Keywords: *Rotor post, Fixture plate, Leveled bed.*

1. Introduction

Each time header plate is leveled in different places in the working area with help of wedges. This leveling time varies from place to place depending on floor level. Skilled person is required for leveling. Leveling is done using water level tube; it varies with person to person. The unsafe working like slip of wedges from work piece and slip of hammer during the process was seen. In final fabrication, due to trunnion header is seating on the floor and grooved header with post shell is fitted over stepped header. Due to height and weight unsafe condition (falling down) is noticed.
After interaction with the working team, shop executives and guide, team suggested to make a machine platform (Bed) grouted in the floor and leveled fixture ring plate with side rod of 50mm diameter 5 nos. the fixing rod has the M30 thread and the other end has the hexagonal shape of inner slotted. The fixture ring plate arrangements are designed according to the size of the rotor requirement.

2. Material Requirement of the Suggested Method

- Level bed of diameter 2400mm and thickness of 50mm.
- Fixture rod of diameter 50mm and length of 700mm for 5 no's.
- Fixture ring plate of 2 no's with three connecting rod according to rotor size.

2.1 Arrangement of Fixture Design

- The machined level bed is placed on the locating place.
- The fixture rod of 5 no's are fitted on the level bed using the key.
- The two fixture ring plates are connected to the connecting rod and it is placed near the fixture rod assembly.
- The arrangement diagram of our fixture design is shown.
- The holes are designed for multipurpose usage.

2.2 Fit up Sequence of the Suggested Method

This diagram represents the base plate for the level bed used for design of fixture and assembly. In this diagram, the small holes represent groove used to hold the fixture rod which are connected commonly by fixture ring.

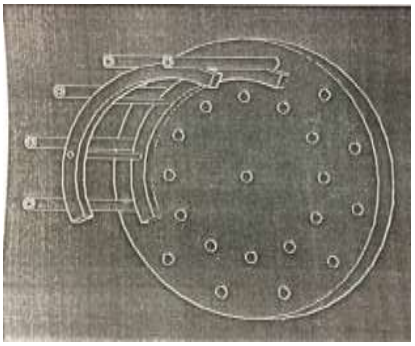

Fig.1: Graphical representation

2.3 Grooved Header and Post Shell Fit Up

- The grooved header is placed on the level bed.
- Fit the fixture rod on the leveled bed.
- Move the grooved header to attach with fixture rod.
- The post shell is placed on the groove header.
- Place the fixture ring plate arrangement.
- Fit the post ring plate arrangement.
- Fit the post shell on the groove header with fixture design.

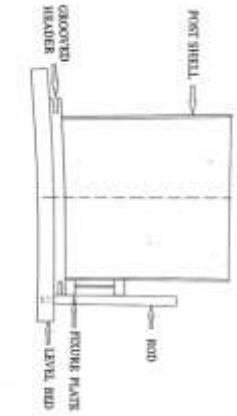

Fig.2: Outline of the fixture

2.4 Trunnion Header and Trunnion Shell Fit Up

- The trunnion header is placed on the level bed.
- Fit the fixture rod on the leveled bed.
- Move the trunnion header to attach with fixture rod.
- Place the fixture ring plate arrangement.
- Fit the trunnion shell on the trunnion header with help of fixture design.

2.5 Stepped Header with Trunnion Header and Shell Fit Up

- The stepped header is placed on the level bed.
- Fit the fixture rod on the leveled bed.
- Move the stepped header to attach with fixture rod.
- The trunnion header and trunnion shell assembly is placed on the stepped header.
- Place the fixture ring plate arrangement.
- Fit the trunnion shell and trunnion header on the stepped header with help of fixture design.

2.6 Final Design

- Place the grooved header and post shell assembly on the leveled bed.
- Fit the fixture rod on the leveled bed.
- Move the grooved header and post shell with assembly to attach with the fixture rod.
- The trunnion header, trunnion shell with stepped header assembly is placed on the grooved header and post shell assembly.
- Place the fixture ring plate arrangement.
- Fix the extension rod on the already fixed rod for required dimension.
- Fit the trunnion shell, trunnion header with stepped header arrangement on the groove header and post shell assembly with help of fixture design.

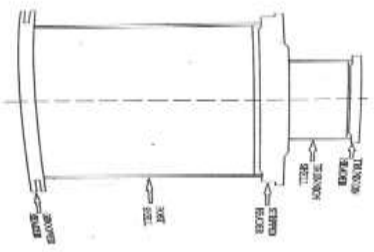

Fig.3: Final figure

3. Design Calculation

3.1 Material Specification

Material = plain carbon steel C35
Young's modulus (E) =2.060×10^5 N/mm^2
Modulus of rigidity (G) =0.790×10^5 N/mm^2
Density =7850 × 10^-9 kg/m^3
(From the design data book)

3.2 Fixture Rod

Diameter (d) =50 mm
Length (I) =700 mm
Density (e) =7850×10^-9 kg/mm^3
Load (N) =1000 N

Calculation
Area =π/4×d^2
=1963.49 mm^2
Volume =π/4×d^2×1
=1.374×10^6mm^3
Mass =volume × density
=10.78kg
Stress = load /area
=0.5 N/mm^2
Young's modulus (E)= stress/strain
Strain =2.427 ×10^-60
Working Stress = P*L/A*E
=1000*700/ 1963.49*2.427*10^-6
=146.89 N/mm^2
Ultimate stress for Mild steel = 440
Factor of Safety =3.01

3.3 Fixture Base Plate

Diameter =2400 mm
Thickness =50 mm
Load =10000 N
Area =π/4×d^2
=452.38×10^3 mm^2
Volume =π/4×d^2×1
=226.195×10^6 mm^3
Mass =volume × density
=1500.63 kg
Stress = load/area
= 0.022 N/mm^2
Working stress = 637.43 N/mm^2
Ultimate stress = 440 N/mm^2
Factor of safety = 1.44

3.4 Fixture Ring & Connecting Rod

Diameter of the rod = 30mm
Length of the rod =450 mm
Thickness of the plate =30 mm
Outer diameter of the ring plate = 1025 mm
Inner diameter of the ring plate = 902 mm

4. Calculation

Area of the rod = π/4×d^2
=706.85 mm^2
Volume = π/4×d^2×L
=318.08×10^3 mm^3
Mass = volume × density
=2.49 kg
Area of the fixture ring = π/8× ((D^2-d^2)/2)
=46.53×10^3mm^2
Volume =π/8× ((D^2-d^2) ×t
=20.9425×10^6 mm^3
Mass of the fixture ring = volume × density
= 10.02 kg
Over all weight of the fixture ring = 17.5 kg

With the help of above calculation of factor of safety between fixture rod and base plate it is identified that factor of safety of the fixture rod is 3.01 which is higher that factor of safety of base plate i.e., 1.44.
Thus the fixture rod can withstand sufficient amount of force greater than the base plate. Hence the design is safe.

5. Result and Discussion

With respect to design calculation regarding the factor of safety and with help of analysis software, it is identified that the proposed method is very much safe. The proposed method is not only greater in safety but also economic.
The total time required for fabrication on rotor post using the existing method is 3840 minutes and the total cost required for fabrication is Rs.17600. But with the help of our suggested method the total fabrication time is reduced to 3740 minutes and the total cost spent on fabrication is also reduced to Rs.15780. As the result of our project, total cost of Rs.131456.60 is saved. Hence, the suggested method is both economic and safe to use.

Fig.4: Photographic view of rotor post

Fig.5: Photographic view of fixture

Fig.6: Rotorpost after welding

6. Conclusion

Thus, the work is entirely different from other works. Since the concepts involved is completely different. In this paper design of the fixture for rotor post is fabricated. It is entirely different that a single unit is used to various size of rotor post fabrication. This is not developed by any of other team members. By doing this work, the knowledge of fixture design is implemented and the rotor post is fabricated. It is concluded that any size of rotor post can be fabricated easily with help of the fixture design. By using of this work, the cost of the rotor post fabrication is reduced. The fabricated time is reduced by using of fixture design arrangement.

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