

Special Maintenance Tools - Rear Axle

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ABSTRACT

Rear Axle SMT- Special Maintenance Tools are the highlight and focus of this journal. The SMT used in service of Rear axle during overhauling and breakdown are being discussed. Trouble shooting methods and identification of problem is discussed as part of SMT utilization. Pre-requisite for understanding the details on usage of SMT is knowledge on the rear axle parts and function to the core. This paper gives an insight on different types of problems arising in the rear axle and SMT used for particular part to ease the difficulty in assembling and disassembly the rear axle aggregate parts. This paper is an initiative for New-development of SMTs for various functions and dimensions in rear axle. Many new SMT being designed are under development stage and is expected to be patented. The Special tool prevents any injury to work man as the usage is very simple and easy. Effort and Ergonomics variation will avoid fatigue to the workman and even unskilled technician can easily use the tool.

KEY WORDS: Special Maintenance Tools, Rear axle Service.

1. INTRODUCTION

Any Aggregate in the vehicle/ Automobile, need service as part of regular maintenance schedule, due to Break down, overhauling due to long periods of operation. This paper focuses on Special Maintenance Tools for Rear Axle

Rear Axle has various parts, bearings, bearing cups, nuts etc., if removal is done manually without proper tools, it is time consuming and cannot be done accurately, damage to the parts being removed/disassembled. Cost of Service becomes higher, wages to manpower goes up, resulting in longer duration of service and unsatisfied customers.

Solution for all the above problem is achieved by using of proper Maintenance tools, developed especially for particular part and operation. The tools are designed based on our requirements to solve the problem. Special materials are used for strength and rigidity of the tools. The tool is hardened/blackened for strength, under goes salt spray test to withstand corrosion.

In case vehicle is off road / at workshops for service, it is most arduous task to disassemble the aggregate parts. Even in workshops it is not easy task, increasing the Repair Operation Time. Keeping note on key points of field issue, development of a Special Tool is planned. Special tool is developed, machined as per requirements. SMT ensures safe practice, easy methodology and certain SMTs can be directly used on the vehicle in the field without any workshop facility.

This paper is based on field survey and finding the difficulty faced by the technician and engineers in removing rear axle components due to various reasons. Development of tool may support the technicians in completing the specified repair on time. Current manpower, methodology, time consumed will totally change after the development is completed. The damage of aggregate is prevented due to safe practice.

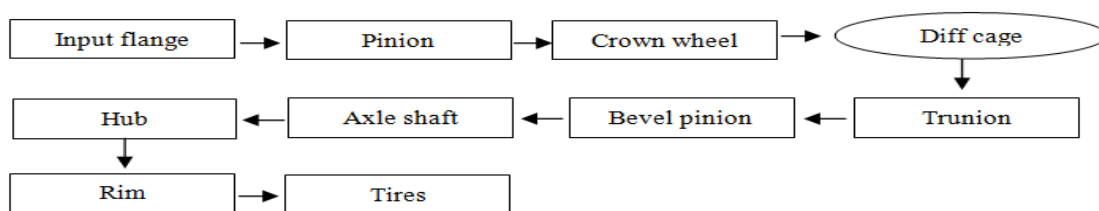


Figure.1. Power flow in Rear Axle

SMT has to be developed for all the sub assembly and assembly in rear axle for service. The following is the procedure to start a SMT development process.

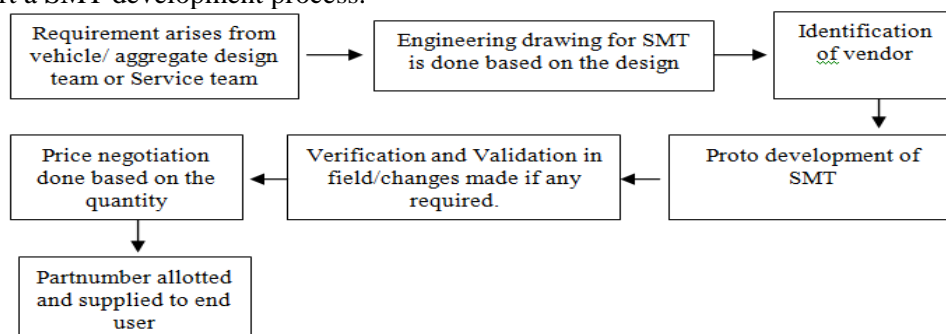


Figure.2. SMT Development Process

Settings and Adjustments in Rear Axle: SMTs are required even for some Settings and Adjustments. The following are settings and adjustments required in rear axle.

- a. Drive Pinion Preload,
 - b. Main Differential Bearing Preload
 - c. Ring Gear Run out
 - d. Ring Gear Back lash
 - e. Thrust screw clearance
 - f. Oil seal flange and bearing case clearance
 - g. Input shaft and Output shaft end play
 - h. Bearing Preload on Output Shaft
- Back Lash is given for Lubrication between crown and pinion. A Special Tool is used for adjustment. It is done by adjusting the crown wheel towards or away from the pinion. Back lash is measured by suitable dial gauge and magnetic stands.
 - Pinion is preloaded to take the load without deflection from Propeller and transfer without any delay to crown wheel. This load tends to deflect crown wheel. Preload is measured with help of advanced machine or by spring balance by addition of different size spacer and torque tightening the nut.
 - Thrust screw is provided to prevent crown from deflecting. The adjustments are done with spanner and screw driver in such a way that thrust screw does not touch the crown wheel.

Shim Thickness Calculation

- Any Number on the crown; Example (+/- Y), The same number is Added or Subtracted to the standard pack
- New Number of New set of Crown is noted. It may be (+/- X). It is added or subtracted to the standard pack.

Trouble Shooting of Rear axle: Noise from Differential

- Prolonged Operation: Worn out gears, Worn out Bearings, Worn out Thrust washer, Worn out diff gear
- Material: Crown Pinion Mismatch, Non- Genuine parts
- Method: Poor Backlash humming noise, Over Backlash grinding noise, Less preload crown bearing
- Maintenance: Insufficient lubrication (quality, quantity, contamination), foreign material inside, Propeller shaft flange bolts loose.

Loss of Preload Pinion Bearing:

- Others: Not using Proper tools to check preload, Technician not trained
- Material: Poor quality bearing, Non Genuine Parts, Wear on bearing
- Method: Distance piece parallelism not maintained, Insufficient torque tightening Correct amount of preload not set
- Maintenance: Pinion Nut not tightened periodically, Lack of Lubrication

Crown Wheel and Pinon Tooth Breakage

- Bearing Seizure
- Material
- Crown wheel pinion unmatched set, Foreign material inside, Stuck up ring nut, Nose bearing not fitted
- Method: Shim selection wrong, improper preload, Improper Back lash, Improper tooth contact.
- Maintenance: Insufficient lubrication, Pinion nut not tightened periodically

Inspected failure mode Analysis

- ✓ Fracture of Ring gear teeth at tooth heel or toe,
- ✓ Scored or scuffed ring and pinion gear teeth,
- ✓ Overheated ring and Pinion gear teeth,
- ✓ Look for discoloration of the gear teeth,
- ✓ Pitted drive pinion teeth, Bent axle housing,
- ✓ Leaking oil seal,
- ✓ Excessive end yoke spline looseness,
- ✓ Fatigue fracture of the pinion gear teeth, Look for clear cut wavy fracture lines,
- ✓ Fracture of differential side gears and Pinion mates
- ✓ Scoring / seizure of cross shaft arms and pinion mate gears
- ✓ Worn side gear splines
- ✓ Twisted or broken axle shaft
- ✓ Fractured axle shaft at the flange.

When all these failure occur, there are certain cases the correction and rectification can be done by settings or without any disassembly. In case of Major Failures the rear axle components need to be disassembled, in such cases the Special Maintenance tools – SMT comes into the picture.

Special Tools for Rear Axle Service & Its Importance

Use of SMT

- Avoid damage to disassembling parts – Cost Reduction
- Quick Completion of Disassembly/ Assembly – Time Saved
- Safe Working Method – Avoid worker Fatigue
- Easy to Operate with any component/ parts
- Better Ergonomics
- There are many Special tools used for RA some of them are

SMT used for Rear Axle Assembly:



Rear Axle Hub Nut Spanner



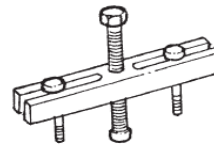
Rear Axle Hub Nut Spanner



Install Inner Oil Seal



Drift Oil Seal Inner Hub



To be used with respective drifts or extractors for installing/extracting oil seals and bearing cones

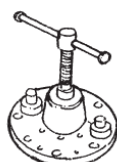
To extract companion flange



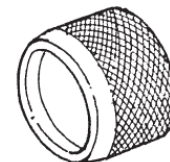
To be used with handle, to extract hub outer bearing outer cone



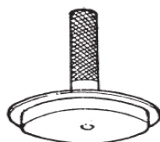
To tighten or loosen hub nut



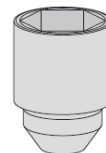
To extract hub rear axle



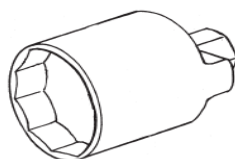
To install deflector



To install oil seal on rear hub



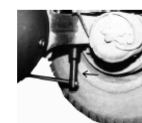
To loosen & tighten the flange nut

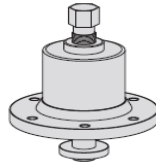


To tighten or loosen hub nut



To loosen or Tighten Spring 'U' Bolt





To remove hub from axle



Drift Pinion Oil Seal



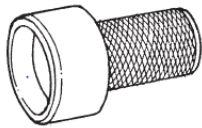
Bearing Adjuster



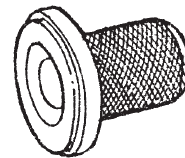
Flange holder



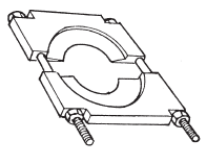
Drift Pinion inner bearing



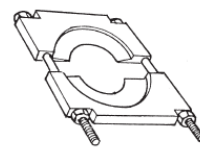
To install diff. side bearings



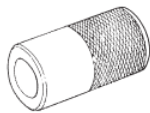
Drift oil seal pinion hsg.



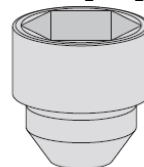
Puller spigot brg.



Split puller pinion bearing



Drift inner outer brg.pinion



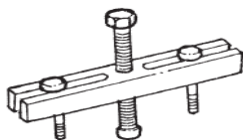
To loosen & tighten the flange nut(C100)



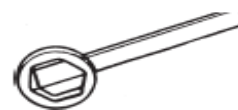
To install pinion shaft bearing (8T & 10T)



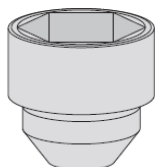
To instal inner oil seal in rear hub(8T & 10T)



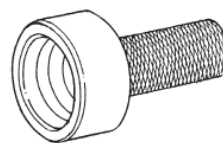
To extract companion flange (Rear Axle)



To tighten or loosen hub nut (8T & 10T)

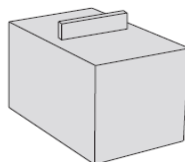


To loosen & tighten the flange



To install spigot brg





Restainer crown wheel bolt

Table.1. Time measured for disassembly with use of SMT

Failures/ Problems in Rear Axle	SMT used	Time consumed (mins)
Rear Hub Failure/jam	Hub Puller	3
Crown Wheel Pinion breakage	Pinion nut spanner	8
Diff carrier Bearing	Bearing Puller	4
Rear Wheel Inner Bearing	Bearing Puller	4
Axle Shaft splines chipping	Special bolts	2
Pinion Oil Seal	Oil Seal Drift	1
Pinion Tapper Roller bearing	Hydraulic Puller	3
Twin Speed differential cage	Cage Puller (man/hyd)	3

Table.2. Time measured for disassembly without SMT

Failures/ Problems in Rear Axle	Without SMT	Time consumed (mins)
Rear Hub Failure/jam	Rod, Hammer and chisel	10
Crown Wheel Pinion breakage	Rod, Hammer and chisel	15
Diff carrier Bearing	Rod, Hammer and chisel	9
Rear Wheel Inner Bearing	Rod, Hammer and chisel	8
Rear Hub Failure/jam	Rod, Hammer and chisel	15
Axle Shaft splines chipping	Rod, Hammer and chisel	10
Pinion Oil Seal	Rod, Hammer and chisel	5
Pinion Tapper Roller bearing	Rod, Hammer and chisel	7
Twin Speed differential cage	Rod, Hammer and chisel	9

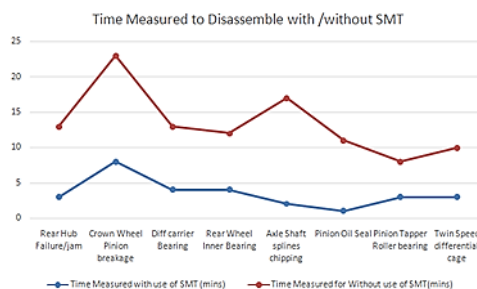


Figure.3. Time measured to disassemble with/without SMT

2. CONCLUSION AND FUTURE ENHANCEMENT

SMT for rear axle parts are given in the table for reference, Field survey confirms the need of SMT and the advantages of using the SMT and completion of service in stipulated period of time, Enhancing the repair operation time and finally the delivery of vehicle is quicker and customer satisfaction is achieved.

Un Explored Area and Future Scope: There are many components where Special tools are yet to be developed. With field survey, a mapping has been done on necessary tools, where it is very difficult to operate in field without SMTs in workshop. Some tools are under development awaiting to be patented on completion. SMT a friend in deed and need. Any new development/changes – New Scope for SMT development. Wide area is open for Research and Development of SMT. Design, Tool Strength, Material change, weight reduction, process simplification have scope for continuous improvement.

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