

ANDHRA PRADESH STATE ROAD TRANSPORT CORPORATION

O/o the VC & MD,
MSRD, Hyderabad

No.OP1/517(10)/2006-MED

CIRCULAR NO. 11/2006-MED, dt.11.10.2006

Sub : MAINTENANCE – Maintenance of Power Steering system of vehicles –
Reiteration of instructions – Reg.

Ref : 1. Circular No.13/1995-MED, dt.20.07.1995.
2. Circular No.13/2001-MED, dt.18.05.2001.
3. Circular No.13/2005-MED, dt.07.11.2005.

Recently, one vehicle of Alipiri Depot met with an accident on Tirumala-Tirupathi ghat road by hitting a parapet wall; because the driver could not negotiate a steep curve due to “steering hard problem”.

Though, there were no injuries and casualties, the incident has to be viewed seriously in view of the ghat road.

Steering is one of the vital systems from the point of view of safety. The system requires greater and special attention during the preventive maintenance schedules. In order to ensure effective maintenance, several training programmes have been conducted to the Mechanics & Supervisors ever since the power steering system was introduced on vehicles.

During the recent inspections conducted by the Service Engineers of M/s Rane & M/s ZF India Ltd., (the original equipment manufacturers), several deficiencies have been observed in the maintenance of Power Steering system at the Depots. **The common lapses observed are as follows.**

- Heavy leakage of ATF oil from the pipe joints resulting in operation of vehicles with low oil levels, leading to premature failure of Vane pump & steering box components.
- Delay in changing the Power Steering Oil & Filter
- Operating the Engine without filling the ATF oil in the Reservoir at the time of Engine change leading to seizure of the vane pump.
- Mis-matching of Vane pump & Steering Box of different makes.
- Missing of ATF oil reservoir filling caps & dip sticks resulting in entry of dust & moisture into the oil.
- Wrong practices in changing the ATF oil & Filter
- Contamination of ATF oil

- Improper clamping of ATF oil pipe lines leading to rubbing with other parts due to vibrations and resulting in leakages
- Heavy leakage of oil from the Steering Box input shaft seal and side cover/ Trunnion cover seals (in the case of Rane)
- Blocking the side cover plug with bolt (in the case of Rane) without replacing the Side cover seal kit
- Heavy vibrations in Vane Pump due to improper mounting of Vane pump owing to oblonged mounting bracket/ mounting bolts (in the case of TATA).
- Loose mounting of Steering box foundation
- Excessive steering play due to improper adjustment of Sector shaft end play (backlash)
- Excess play in steering column bush
- Severely worn out Pitman arm splines, steering linkages, loose Pitman arm check nuts
- Tampering of Poppet screw (Limiters) adjustment
- Missing wheel lock bolts
- Tampering of preload adjustment for steering box input shaft (in case of Rane)
- Worn out Steering column UJ crosses/ sticky UJ crosses
- Improper adjustment of drive belt tension (In Tata)
- Dry king pin bushes & steering linkages
- Broken/ sticky King pin thrust bearing (Tata)

Further, the problems related to steering system are not being diagnosed properly at Depots and the vehicles are being operated without rectifying the complaint thoroughly.

In the light of the above, it is felt necessary to reiterate the instructions on maintenance of Power Steering system of the vehicles once again.

The following “**Troubleshooting guide**” helps the Mechanics to identify and rectify the defects in the Power Steering system.

1) **PROBLEM : STEERING HARD ON BOTH SIDES**

CAUSE	REMEDY
(For Tata 697/ CMVR) 1. Vane Pump V'belt tension less 2. Fan belts tension less	Adjust the belt tension
Tyre pressures low	Check the tyre pressures and inflate to recommended level
Low oil level in the system	1) Check for external leakages in the pipe lines, arrest the leakages and fill the oil to the correct level 2) Check for Leakage from the Steering box seals and replace the seals if necessary.
Steering box relief valve (Valve insert sticky or defective)	3) Replace the relief valve in the steering box
Air in the system (clearly visible in the form of foam in Oil reservoir)	1. Check Suction pipe adaptor at oil reservoir and tighten with two spanners. (Never use single spanner as this may lead to damage at the O'ring seating of the reservoir) 2. Check all the hose connectors in the suction line between Reservoir and vane pump. 3. Check the adaptor at Vane pump suction port 4. Check for the condition of Vane pump shaft seal and replace if necessary 5. Check the condition of suction hose and replace if necessary.
Restriction in return line (Pipes get overheated)	Check for kinking of return lines due to hitting with other objects. (Provide proper clamping to the pipe lines to avoid pipe damages)
Pressure relief valve in vane pump leaking/ sticky	Remove the Pump pressure regulating valve, clean thoroughly and ensure free movement of valve in the port.
Steering linkages sticky or ball joints worn out	Replace the defective ball joints, tighten the loose linkages.
Steering column binding	Check for free movement in steering column bushes and replace bushes if necessary.
UJ cross in the steering column stuck up	Check for free movement of the UJ cross and replace if necessary.
King pins dry	Lubricate the king pins
Thrust ball bearing in (TATA) stub axle broken or jammed	Replace the thrust bearing

2) **PROBLEM : DIFFICULT TO STEER IN ONE DIRECTION**

CAUSE	REMEDY
Thrust ball bearing in (TATA) stub axle broken or jammed	Replace the thrust bearing
Front Spring center bolt broken	Replace the spring center bolt
Poppet valve sticky	Clean the poppet valve and refit
UJ cross in the steering column stuck up	Check for free movement of the UJ cross and replace if necessary.
Excessive internal leakage in one direction in the Steering box	Replace the Steering box

3) **PROBLEM : NO SELF CENTERING**

CAUSE	REMEDY
Steering linkages binding	Check for free movement in steering linkages replace if defective
UJ cross in Steering column binding	Replace the UJ cross
Steering column binding	Check for free movement in the steering column. Replace the bushes if necessary.
Binding in King pin thrust bearings	Check and replace the defective king pin bearings
Defective Steering Assy	Replace the Steering assembly

4) **PROBLEM : STEERING WOBBLING**

CAUSE	REMEDY
Excess play in King pin bushes	Replace the worn out king pin bushes (& thrust bearing in Tata)
Loose King pin cotter bolts	Check & tighten King pin cotter bolts
Loose spring bed bolts	Check & tighten spring bolts, replace if necessary
Loose spring U'clamps/ I bolts	Tighten spring U'bolts/ I bolts
Loose steering linkages	Check for tightness of steering arm bolts and tighten if necessary
Misalignment of front wheels	Check and adjust wheel alignment
Imbalance in front wheels	Check for defective Wheel disc and replace the tyres if necessary
Loose steering foundation bolts	Check & tighten steering assy foundation bolts
Low oil level	Top-up power steering oil to the correct level
Air in the hydraulic system	Arrest air entry into the system (as recommended above)

5) PROBLEM : STEERING PLAY

CAUSE	REMEDY
Excess play in Sector shaft	Adjust sector shaft play (backlash)
Worn out splines on pitman arm	Replace the pitman arm
Loose Pitman arm check nut	Tighten the Check nut for Pitman arm and lock with lock washer
Loose spring U'clamps/ I bolts	Tighten spring U'bolts/ I bolts
Loose steering linkages	Check for tightness of steering arm bolts and tighten if necessary. Replace the ball joints in Drag link/ Tierod ends

6) PROBLEM : ONE SIDE PULLING

CAUSE	REMEDY
Low Oil level	Arrest leakages and maintain correct oil level
Worn out Ball joints & steering linkages	Check & tighten the steering arm bolts, replace the worn out ball joints.
Wheel alignment wrong	Check and adjust wheel alignment
Defective UJ Crosses	Replace the defective UJ crosses
Loose steering foundation bolts	Check & tighten steering foundation bolts
Air in the hydraulic system or Steering box internal leakage.	Bleed the system to vent out the air. Replace the Steering box if found defective
Defective Front Wheel Bearings	Check the Wheel Bearings and adjust the Bearing play correctly
Unequal braking force	Adjust the Brakes correctly

7) PROBLEM : LESS CUTTING IN ONE SIDE

CAUSE	REMEDY
Mis-alignment of Drop arm & Sector shaft	Check and adjust the Drop arm position so that the marking on Drop-arm correctly coincides with that of Sector shaft.
Mis-adjustment of Poppets	Check and adjust the poppet valves as per the procedure.
Mis-adjustment of Stopper bolts.	Check and adjust the stopper bolts correctly as per the procedure.

7) PROBLEM : NOISE

The following noises can be treated as normal which do not indicate any defect in the system.

- Hissing noise when control valve is actuated
- Noise when fluid bypasses poppets
- Noise from actuated system relief
- Pump growl from some Vane pumps

The following noises are treated as abnormal noises, which indicate defects in the system

- Noise due to air in the oil
- Noise due to low oil level
- Noise due to restricted pipe lines, restrictions at pump inlet
- Squealing noise due to Worn out/ loose drive belt
- Clicking noise due to loose components

PREVENTIVE MAINTNENACE FOR STEERING SYSTEM :

Schedule – I Maintenance :

- 1) Check the oil level, check for any leakages, attend and top-up the oil to correct level
- 2) Check the tightness of Steering foundation, Universal Joints, Steering linkages, Ball joints and attend if necessary.

Schedule – II Maintenance :

- 1) The above items of Sch.I maintenance &
- 2) Check the Drive belt tension (Tata) and attend if necessary
- 3) Check Vane pump foundation bolts and attend if necessary
- 4) Check the drop arm (Pitman arm) check nut and tighten if necessary
- 5) Lubricate all the steering linkages and king pin bushes
- 6) Check the wheel alignment & adjust if necessary
- 7) Carry out steering test and attend the defects

Schedule – III Maintenance :

- 1) The above items of Sch.I & II maintenance &
- 2) Check for kinking of pipe lines and attend if necessary. Provide clamping to all pipe lines.
- 3) Check the steering column bush and replace if necessary
- 4) Check the stopper bolts (Wheel lock bolts) and adjust if necessary
- 5) Check the condition of Steering box seals and replace if necessary

Schedule – IV Maintenance

- 1) The above items of Sch.I, II & III maintenance
- 2) Check for sector shaft play (Backlash) and adjust if necessary
- 3) Remove the Metal pipe lines clean thoroughly and refit.
- 4) Check the condition of Rubber hoses and replace if necessary
- 5) Check for excess play in king pins and replace the bushes if necessary
- 6) Check the condition of Steering Arms & Pit man arm and replace if necessary

In addition to the above, the following maintenance has to be carried out at the prescribed intervals.

- Change the oil and filter at 80,000 kms. Ensure fitment of rubber sleeve on the filter element (for ZF) without fail
- Replace the Steering Box Assy. at 5,00,000 kms for OE and at 3,00,000 kms for CO
- Replace the Drag link ends & Tie-rod ends during the FC attention
- Replace the Universal Joints in the Steering column during FC attention.

DON'TS IN STEERING SYSTEM :

The following precautions shall be ensured while maintaining the power Steering system on vehicles.

- Do not attempt to hammer the Steering wheel while pulling out/ fixing the UJ crosses in the steering column, as this will damage the input shaft seal and other steering gear components.
- Do not remove the filter from the Reservoir without draining the oil completely from the steering system at the time of oil change, as this will allow the dirt (accumulated in the filter) to enter into the Vane pump.
- Clean the Steering box exterior thoroughly while changing the seal kits, otherwise the dirt may enter into the steering box causing damage to the precision parts.
- Do not tamper the input shaft preload on Rane Steering Boxes at Depot level
- Do not block the pipe lines with cotton waste at the time of changing pipes, connectors and steering box as there is scope for pieces of cotton waste entering into the system causing damage to the internal parts.
- Always use recommended pinch bolt for UJ crosses with proper locking. Fitment of ordinary bolts may lead to loosening of UJ crosses while the vehicle is in running condition.
- Ensure fitment of dust cap to Input shaft on steering box & UJ crosses to avoid entry of water causing rust formation.
- Do not mis-match the Steering box and Vane pumps of different makes
- Ensure filling of clean oil in the reservoir as the oil filled initially in the tank will directly goes to the Vane pump without filtration since the filter is provided in the return line.
- Do not hammer the drop arm while removing the drag link end/ drop arm from the sector shaft. Hammering the drop arm may cause damage to the seals and bearings.
- Do not attempt to run the Vane pump without ensuring sufficient oil in the reservoir
- Do not use contaminated or wrong grade of oils for power steering as this may lead to failure of Pump and steering box components
- Do not attempt to steer the vehicle when the vehicle is not in motion.
- Ensure proper cleaning of Metal pipelines with compressed air after attending brazing/ welding works.

Stocking of the following essential spares for Power Steering System shall be ensured at Depots for effective maintenance.

FOR RANE POWER STEERING (COMMON FOR AL & TATA) :

1). St. Box input Shaft Seal Kit	42 10 01 03
2). St. Box Trunnion Cover Seal Kit	42 10 01 04
3). Side Cover Seal Kit	42 10 01 05
4). O' Ring (Valve Housing)	69 03 23 01
5). Filter Assembly	41 20 00 06
6). Cover Seal	69 14 14 01
7). Oil filler Cap with Chain	41 23 00 01
8). Dipstick	41 22 00 03

FOR ZF (COMMON FOR TATA & LEYLAND)

1). Filter with rubber sleeve	7632 440 800
2). Strainer	7632 340 801
3). Rubber gasket	7632 033 104
4). Dipstick assy.	7632 319 802
5). Steering box shaft seal	0770 198 103
6). Vane pump shaft seal	0770 198 070

OTHER SPARES IN TATA 1510 / 1510 CMVR

1). V' Belt, 980mm	2600 2015 6302
2). Vane Pump Clamping lever Assy	2525 2340 01 05
3). Clamping Piece	314 155 02 28
4). Pivot Pin (to Vane pump bracket on filter bed)	2525 2311 6705
6). Pulley (Vane pump)	2525 2340 70 05
7). Assy. U.J (Steering) 7026 410 102 (ZF)	2573 4620 01 06
8). Assy. U.J. (Steering) 30310002 (Rane)	2573 4620 01 08
9). Hex Screw for UJ (Pinch bolt)	321 990 04 01
10). Pitman Arm	2063 4630 51 04
11). Suction line Hose 3/4" (400 mm long) (from Tank to pump)	2576 4680 5802
12). 3/8" HP hose with wire guard (from pump to St.Box)	2574 4680 0104
13). 3/8" HP hose with wire guard (from St.Box to tank)	2651 4680 0101
14). Check nut for Pitman arm (ZF)	2573 4621 6501
15). Check nut for Pitman arm (Rane)	2573 4620 6504
16). Tab Washer for Checknut (ZF)	2573 4621 9201
17). Tab Washer for Checknut (Rane)	2573 4620 9203

OTHER SPARES IN ASHOK LEYLAND

1). Pitman Arm 59280108 (Rane)	F 3243511
2). Pitman Arm 7373 012 800 (ZF)	F 3241511
3). Check Nut for Pitman Arm (Rane)	P2404835
4). Check Nut for Pitman Arm(ZF)	P 4200235
5). Washer for Pitman Arm (Rane)	F 4947910
6). Tab Washer for Pitman Arm (ZF)	P 4200249
7). Key	F 0953315
8). Gear	F 1657211
9). Washer	H 4111400
10) Special Bolt for Pump gear mounting	F 3594015
11) Hose Pipe (Tank to Pump) ZF/Rane	F 7884700
12). Pressure Hose (Pump to St.Box) Rane	F 7886500
13). Pressure Hose (Pump to St.Box) ZF	F 7887100
14). Return Hose (St.Box to Tank) Rane	F 8001800
15). Return Hose (St.Box to Tank)	F 7884200
16). UJ Assy. (3/4" x 48) Rane	F 7832100
17). UJ Assy. 1" x 48 (Rane)	F 3981700
18). UJ Bolt (Pinch bolt) M10	F 3581515
19). UJ Bolt (Pinch bolt) M8	F 3593615
20). UJ Assy with pinch Bolt (ZF)	F 7454300

The Controller of Stores' are advised to ensure supply of the above spares adequately to Depots.

The DMs and Maintenance incharges are advised to ensure proper maintenance of power steering system at their Depots and educate the maintenance staff on "troubleshooting" related to steering complaints as explained above and see that the defects are rectified promptly.

The Dy.CMEs are advised to pay special attention to the maintenance of steering system on vehicles during their inspection of Depots, and take necessary action if the systems are not followed properly.

VICE CHAIRMAN & MANAGING DIRECTOR

To
All Depot Managers .

Copy to : VC & MD for favour of information

Copy to : All Executive Directors (Zones) for necessary action

Copy to : Director (V&S), ED(E), ED(A), ED(O), ED(IT&MS), ED(HRD), FA & CAO
for information.

Copy to : All RMs for necessary action

Copy to : All HODs for information

Copy to : All DVMS for necessary action

Copy to : All Dy.CMEs for necessary action

Copy to : All WMs & COS's for necessary action

Copy to : All Dy.CAOs for information

Copy to : All Principals ZSTCs & TA/HPT for information

Copy to : All Maintenance incharges for necessary action

Copy to : Manual section for record.

IMPORTANT SPECIFICATIONS OF POWER STEERING SYSTEM :

	RANE	ZF
Steering Box	HFB64	8043
Steering Box valve Mechanism	Rotary Valve	Valve Spool
Vane Pump	AVP type	7373 type
Steering box operating pressure	105 bar	80 bar
Oil specification	ATF oil Type A/F	ATF oil Type A/F
Oil with filter change Periodicity	80,000 kms	80,000 kms

IMPORTANT SPARES TO BE STOCKED AT DEPOTS

ZF

1). Filter with rubber sleeve	7632 440 800
2). Strainer	7632 340 801
3). Rubber gasket	7632 033 104
4). Dipstick assy.	7632 319 802
5). Steering box shaft seal	0770 198 103
6). Steering box valve insert	7752 242 174
7). Vane pump shaft seal	0770 198 070

TATA 1510 / 1510 CMVR

1). V'Belt, 980mm	E.1	2600 2015 6302
2). Vane Pump Clamping lever Assy		2525 2340 01 05
3). Clamping Piece		314 155 02 28
4). Assy. U.J (Steering)	E.2	2651 4660 01 02 (ZF, Tata Part No)
		7026 410 102 (ZF part No)
5). Assy. U.J. (Steering)	E.2	2573 4620 01 06 (Rane)
6). Pitman Arm	E.1	2063 4630 51 04 (Tata Pt.No)
7). Suction line Hose Assy		
8). Pressure line Hose Assy.		
9).		

ASHOK LEYLAND

Pitman Arm	7673 012 801 (ZF)
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