



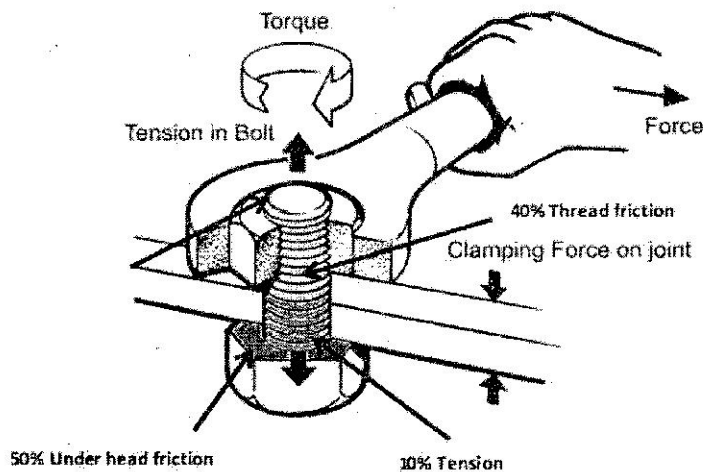
ANDHRA PRADESH STATE ROAD TRANSPORT CORPORATION  
Office of the VC & MD, Bus Bhavan, Hyderabad - 500 624

No.OP5/ 462(03)/2013-MED

**CIRCULAR No.16/2013 - MED, Dated 25.07.2013.**

Sub: **Angular Torque Tightening:** Usage of Rotation angle gauge in combination with Manual Torque wrench for AL BS-II/BS-III 'H' series engines for achieving precise Angular torque in critical areas- Reg.

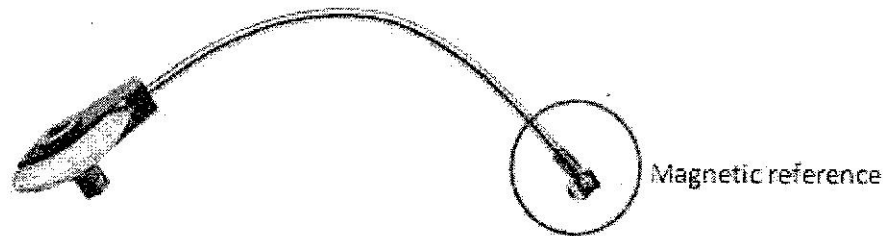
- 1.00 Angular torque system has been introduced in Ashok Leyland BS-II/BS-III 'H' series engines to get consistent stretch in the bolts of cylinder head & connecting rod bolts etc. This method of tightening fasteners in engines is relatively new. Since a torque wrench senses friction, there are a lot of variables that can affect proper tightening, especially as the torque specification increases.
- 2.00 In a fastener, the torque applied is absorbed in '3' main areas.
  - Under head friction (usually absorbs 50% or more of total torque).
  - Thread friction (usually absorbs as much as 40% of total torque).
  - Clamping force required to hold components together (usually 10% of total torque).



- 3.00 In conventional torque tightening, final torque values that are in Foot-pounds (Lb-ft) Or Newton-meter (N-m) alone is usually provided. This does not take into account the torque Lost in friction.

- 4.00 **Angular Torque Tightening** on the other hand reduces the inaccuracies because initial snug Torque is often low and angular stretch will ensure frictional variations will have very less effect on the end clamping load.
- 5.00 In order to obtain the correct clamping load, it is essential to use precise angular torque tightening method. By only using the Conventional torque wrench for a small initial torque to seat the bolt, and then turning the bolt to a certain number of degrees of rotation as specified by the OEM, the correct stretch will apply to the bolt.
- 6.00 Rotation angle gauge in combination with manual torque wrench enables precise control on angular torque tightening.

**Rotation Angle Gauge:**

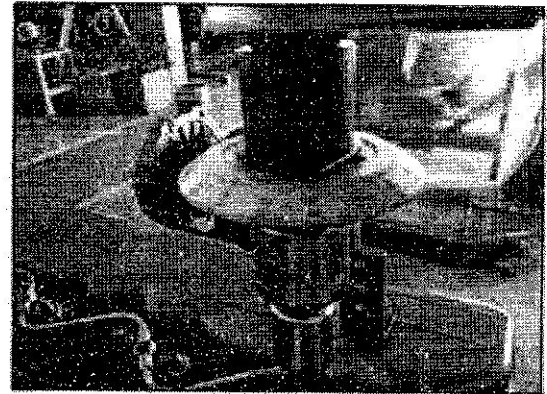
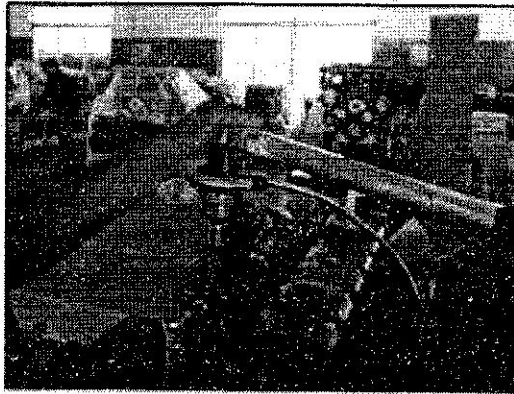


7.00 It is offered as an add-on fitment to the existing manual torque wrench.

➤ **Method of usage:**

1. Mount the rotation gauge along with manual torque wrench on the required Fastener.
2. Mount the magnetic reference on the nearest stable reference.
3. Note down the values of angular torque to be applied. For example, on H-series A And B Platform engines, the angular torque tightening values for cylinder head Bolts is  $70 \pm 5 \text{ Nm}$  and  $90^\circ \pm 5^\circ$ . Where,
  - $70 \pm 5 \text{ Nm}$  is the pre-torque
  - $90^\circ \pm 5^\circ$  is the angular torque
4. Torque the fastener to required pre-torque using manual torque wrench. (e.g.  $70 \pm 5 \text{ Nm}$  in Case of cylinder head bolt).
5. After the pre-torque is achieved using the manual torque wrench, ensure the Pointer of the rotational angle gauge is set to "Zero" (mark) on the dial.
6. Start tightening until the required angle (e.g.  $90^\circ \pm 5^\circ$  angle in case of cylinder Head bolt), is achieved (at the pointer) on the rotation angle gauge.
7. Make sure that the magnetic reference is not disturbed during the tightening, as it Would result in the pointer direction getting altered.
8. Also, make sure not to obstruct/interfere in the movement of the dial gauge during Tightening.

## 8.00 Rotation angle gauge in combination with the Manual torque wrench:



- Note: Since the rotation angle gauge is available on a 3/4" square drive, it might be required to use a 3/4" to 1/2" square adaptor based on the socket size used for the particular fastener.

9.00 The recommended Angular torque tightening of critical areas of BS-II & BS-III 'H' series engines which should be ensured during overhauling of aggregates at ZWSs & Depots are as follows.

Description	Kgm	Lb.Ft.	Nm
Connecting Rod Cap Bolts	4+ 68 Degrees	29+ 68 Degrees	39+ 68 Degrees
Cylinder Head Bolts(M12)	7.1+/- 0.5 & 90+/- 5 Degrees	52+/- 4 & 90+/- 5 Degrees	70+/- 5 & 90+/- 5 Degrees
Idler gear fitting bolt	4+ 60 Degrees	30+ 60 Degrees	40+ 60 Degrees

10.00 The tool is available with M/s Bhatia tools and Technology, at the below mentioned address:

- M/s Bhatia tools and Technology, Bhatia Aerospace, #60, 2nd floor, G block, 60 feet main road, Sahakar nagar, Bangalore - 560 092.
- Tool part number - 7385N & Tool code number - 54010002
- Cost of tool - Rs. 12155/- (Discount- Rs.2145/-)
- After discount tool cost is - Rs. 10010/-
- Additional - CST 14.50%, Packing and forwarding charges (2% extra).
- Terms and conditions - Payment immediate (Cheque/ Demand Draft payable at Bangalore)

- 11.00 Hence all the WMs and Dy.CMEs of Leyland area advised to educate the staff on importance of Precise Angular Torque at Zonal Work Shops and Depots. They should also ensure the usage of **Rotation Angle Gauge** while carrying out engine Overhauls/TOs to tighten the fasteners in critical areas to the prescribed torque plus angle given by the OEMs, to achieve the targeted engine mileages and also to reduce premature failures.
- 12.00 All the Depot Managers and Maintenance Incharges are advised to ensure usage of **Rotation Angle Gauge** while carrying out TOs at Depots.

  
EXECUTIVE DIRECTOR (E&IT) 29/9/13

To

All Depot Managers of Leyland Area

Copy to: Dir (V&S), ED(E&IT), ED (O&MIS), ED (A&P), FA, CAO, ED (HRD&Med) for infn.

Copt to: ED (GHZ&HZ), ED (HYD), ED (KRMR), ED (VJA), ED (VZM), ED(NLR), ED(KDP) for information.

Copy to: All RMs for information.

Copy to: CME (O), CCOS, CA, CFM, CME(C&B), CE (IT), CPM, CM (HRD) for information & n/action.

Copy to: DyCME (O), DyCME (P), DyCME(C&B), DyCME (IED), DyCAO (SP&A), CSTO, COS(C) I & II for information.

Copy to: DyCMEs, WMs, COS & DyCAOs for necessary action.

Copy to: All AOs for information & n/action.

Copy to: All Principals of ZSTCs, BTC, HPT & TA/HPT for information.

Copy to: Resident Audit Officer, Bus Bhavan, Hyd for information.

Copy to: In-charge, Manual Section for record.