

VHA 206B/L Main Rotor Blade

Balance Procedures and Best Practices

September 2021

The following is a compilation of the recommended procedure for balancing Van Horn Aviation (VHA) main rotor blades on the Bell 206B JetRanger and Bell 206L LongRanger helicopters. The procedure integrates maintenance manual procedures as well as tips gathered from operators and track & balance experts across the industry.

When followed carefully, this procedure provides the operator with the **best chance** of a smooth and painless track & balance experience.

Before Spin-up

1. Center Main Rotor Hub using the trunnion center tooling.
 - a. 206B: BHT-206B3-CR&O Section 62-17 Assembly - Step 4. Center trunnion on pitch change axis
 - b. 206L: BHT-206L-CR&O-3 Section 62-35 Assembly - Step 4. Center main rotor trunnion
 - c. Trunnion centering tools for 206 hubs are commercially available from numerous aviation vendors. Operators have expressed that these options simplify the process.



2. Remove weights from MR Bolts.
3. Check rig cyclic and collective and reset to nominal.
 - a. Pitch change links per
 - i. 206B: BHT-206A/B-SERIES-MM-6 Chap 62 – Figures 62-10 thru 62-13
 - ii. 206L: BHT-206L4-MM-6 Chap 62 – Figure 62-11
 - b. Collective rigging per
 - i. 206B: BHT-206A/B-SERIES-MM-6 Section 67-8 Collective pitch control rigging
 - ii. 206L: BHT-206L4-MM-8 Section 67-8 Collective pitch control rigging
 - c. Cyclic rigging per
 - i. 206B: BHT-206A/B-SERIES-MM-6 Section 67-37 Cyclic control rigging
 - ii. 206L: BHT-206L4-MM-8 Section 67-38 Cyclic control rigging

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4. Read the Read Me First instructions provided with the VHA blades. These are also downloadable from the VHA website:
 - a. 206L <https://vanhornaviation.com/wp-content/uploads/206L-MRB-READ-ME-FIRST-2021.pdf>
 - b. 206B Version 1 https://vanhornaviation.com/wp-content/uploads/206BV2_MRB_READ_ME-2021.pdf
 - c. 206B Version 2 <https://vanhornaviation.com/wp-content/uploads/206B-MRB-READ-ME-FIRST-NewFinal.pdf>
5. Zero trim tabs using zero tab indicator provided with VHA blades.
6. Pay special attention to the blade alignment. Spending the extra time to align the blades as close as possible saves time during the dynamic balance.
 - a. String method (VHA recommended):
 - i. 206B: BHT-206A/B-SERIES-MM-6 Section 62-42 Alignment (string method)
 - ii. 206L: BHT-206L4-MM-6 Section 62-43 Alignment (string method)
 - b. Scope Method
 - i. 206B: BHT-206A/B-SERIES-MM-6 Section 62-43 Alignment (scope method)
 - ii. 206L: BHT-206L4-MM-6 Section 62-42 Alignment (scope method)
7. Perform a static balance in a sterile environment (i.e., no air movement).
 - a. 206B: BHT-206A/B-SERIES-MM-6 Section 62-44 Balancing – Static method
 - b. 206L: BHT-206L4-MM-6 Section 62-44 Main Rotor Hub and Blade – Static Balancing

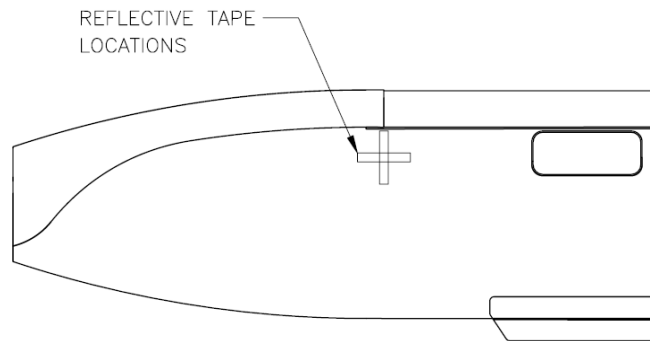
Dynamic Balance

Notes

- Any dynamic balance equipment that outputs vibration values with a magnitude in IPS (inch/sec) and a clock angle (12:00 scale or in degrees) can be used.
- VHA recommends using polar charts developed with move lines specific to the VHA main blades
 - 206B (Version 1 and Version 2)
 - For lateral balance, use [VHA 206B Hover lateral balance polar chart](#)
 - For vertical balance, use [VHA 206B 60 KIAS vertical balance polar chart](#) and [VHA 206B 100 KIAS vertical balance polar chart](#)
 - 206L
 - For lateral balance, use [VHA 206L Hover lateral balance polar chart](#)
 - For vertical balance, use [VHA 206L 55 KIAS vertical balance polar chart](#) and [VHA 206B 105 KIAS vertical balance polar chart](#)
- Diagnostic Solutions International, LLC (DSI) has developed algorithms using the Honeywell Chadwick Helmuth Vibrex EV2K+ and Carry-on VXP balancers/analyzers. These are available for purchase from DSI. They incorporate the algorithms for the move lines from the VHA polar charts. The standard OEM blade algorithms available on these systems and other learning system balancers may be used, but it is likely the systems will require a few more flights to correct the coefficients for the new blades.

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- For strobe-type tracking devices, place reflective tape on the lower blade surface just aft of the abrasion strip over the black paint, at the radial station where the blade sweep starts.



- For optical tracking devices, early generation blades with glossy paint may be difficult to pick up. Spraying flat black paint in the target area can resolve this issue.

Dynamic Balance Procedure

1. Ground run
 - a. Adjust pitch links for track at around 90% N2.
 - b. Observe track at 100% N2
 - c. After first run, perform main rotor head torque check. When new components are installed, the head often requires a retorque after spin up. **Omitting this step may cause your balancer to register vibrations that get progressively worse.**
2. Hover
 - a. Span Weight or chord/sweep adjustment for lateral 1P vibration
3. Forward flight
 - a. If there is a question whether to make a pitch link adjustment or a tab adjustment, make the pitch link adjustment first.
 - b. As a general rule (as described by BHT-206A/B-SERIES-MM-3 Chapter 18)
 - i. If vertical 1P increases with speed – Adjust tabs. Excessive tab can affect high speed 2P; in this case, find tolerable medium
 - ii. If vertical 1P does not increase with speed and/or is harder in autorotative letdown – Adjust pitch links
 - c. Check flight vibrations at no less than 60 and 100 kts (mph for 206B). Check at VH (continuous level flight at 85% Tq). Make adjustments to ensure all regimes are within acceptable criteria of .2 IPS and below
 - d. Make minor adjustments to get the lowest vibration level in the range that is flown the most.
4. Perform OGE Hover lateral check (while at 50% Torque or above)
5. Autorotation RPM - Adjust pitch links equally
 - a. 206B: BHT-206A/B-SERIES-MM-3 Section 18-30 Final acceptance or rejection
 - b. 206L: BHT-206L4-MM-2 Section 18-25 Main rotor autorotation RPM – Adjustment

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6. Flap Restraint engagement RPM – Remove weight if below 25%; Add weight if above 31%
 - a. 206B: BHT-206A/B-SERIES-MM-6 Section 62-12 Adjustment of engagement RPM
 - b. 206L: BHT-206L4-MM-6 Section 62-3 Main rotor operation check – Flap restraint engagement RPM
7. Perform another main rotor torque check.

Troubleshooting

- If moves during track and balance appear to be having an opposite affect from what the polar charts predict, check that the balancer equipment is installed correctly. This may be the result of a velocimeter or accelerometer installed upside down, or a photocell or magnetic interrupt placed at an incorrect location. Check the balancer manufacturer-provided information for proper installation instructions.
- Use vibration troubleshooting charts located in Tables 18-3 & 18-5 in BHT-206A/B-SERIES-MM-3 Chapter 18
- Check for trunnion end play in excess of .004" (BHT-206A/B-Series-CR&O)
- 2P vibration (from MM Chap 18)
 - a. Check insufficient friction on swashplate ball.
 - b. Check for loose control linkage or swashplate parts.
 - i. Friction the cyclic, place the collective in normal cruise position and rotate the blades 90 degrees.
 - ii. Have someone stand on the end of a ladder and twist the blade end while you check the flight controls for any looseness. This will help you identify loose rod ends, uniball bearing play, tilt friction, etc., which can manifest a 2P rev vibration.
 - c. Check tail boom attach bolts torque (MM Ch 62).
 - d. Check latch bolt torque (MM Ch 62).
 - e. Check for deteriorated/separated Transmission mount (MM Ch 63).
 - f. Check for bolt/bearing wear on the control rod ends.
- 2P vibration (additional)
 - a. Is there excessive differential tab?
 - b. Check for loose flight steps, cargo hook bungy, battery, ballast weight, high skid or pop-out floats.
 - c. Check for excessive breakaway friction of isolation mount bearing or drag link bearing.
 - d. Check for excessive breakaway of hub trunnion.
 - e. Check for low swashplate friction.
 - f. Check for improper assembly of spike striker plate.
 - g. Are any kits attached to aft or forward crosstube (speakers)?
- Spike knocking
 - Check if isolation mount is deteriorated (MM Ch 63).

Questions? Still having issues?

Please contact VHA at 1.480.483.4202 or info@vanhornaviation.com.