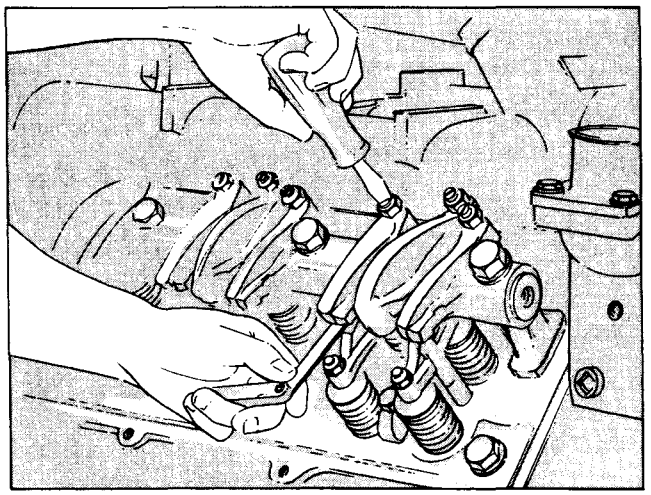


Fig. 2-34, (OM1040L). Adjusting valves

locknut. A check can be made of the adjustment without disturbing the locknut or screw setting. The valves can also be checked or set while adjusting the injectors by this method. See Table 2-11 for specifications.

Table 2-11: Adjustment Limits Using Dial Indicator Method Inch [mm] V-903 Engines

Injector Plunger Travel	Valve Clearance Intake	Exhaust
1 to 1 Rocker Lever Ratio — Injector Lever Casting P/N 211319		
0.187 ± 0.001 [4.75 ± 0.03]	0.012 [0.30]	0.025 [0.64]

Before adjustment, tighten the injector hold-down capscrew to 30 to 35 ft-lbs [41 to 47 N•m] torque.

Note: Remove the clip, and using either a 3/8 inch hex drive for female type barring device or a 5/8 inch sixpoint socket for the male type barring device, press inward until the barring gear engages the drive gear; then advance. Fig. 2-35. After completion of adjustment, be sure the drive retracts and install the key into the safety lock groove.

Using the regular engine barring device, Fig. 2-35, rotate the engine in the direction of rotation with the "VS" mark for cylinder 2-8 is aligned with the pointer. In this position both the intake and exhaust valve rocker levers for No. 2 cylinder should be free and can be moved up and down. If not, bar the engine

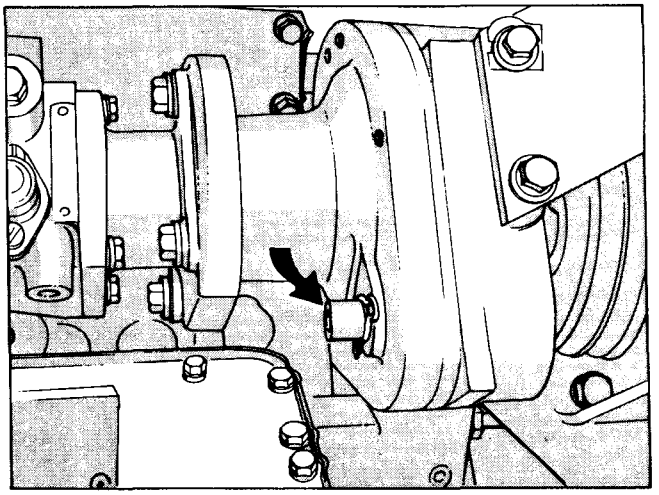


Fig. 2-35, (OM1041L). Barring V-903 Engine

another 360 degrees in the direction of rotation and realign the 2-8 "VS" mark.

The timing mark locations (Fig's. 2-36 and 2-37) are used with the dial indicator method of setting the injectors and valves. Alignment, in either location, should be held to within one-half inch [12.7 mm] of the pointer.

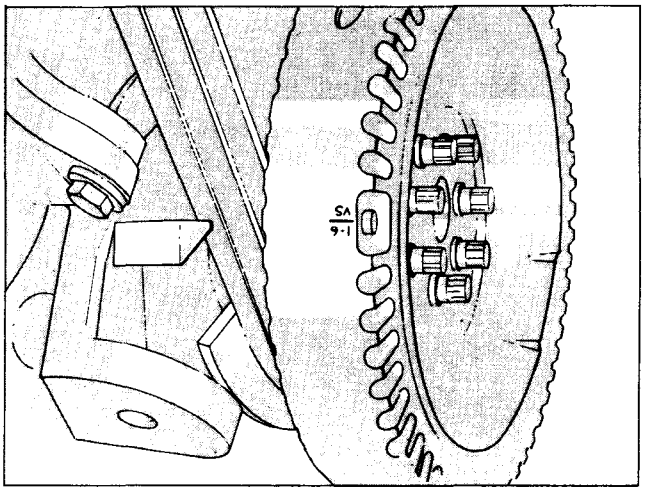


Fig. 2-36, (OM1042L). Location of timing marks on front cover and vibration damper

Note: No. 1 cylinder is selected for the purpose of illustration only. Any other cylinder could be used, if so desired.

1. Set up the ST-1170 Indicator Support with the indicator extension atop the injector plunger flange at the cylinder to be set. Fig. 2-38.
2. Screw the injector lever adjusting screw down

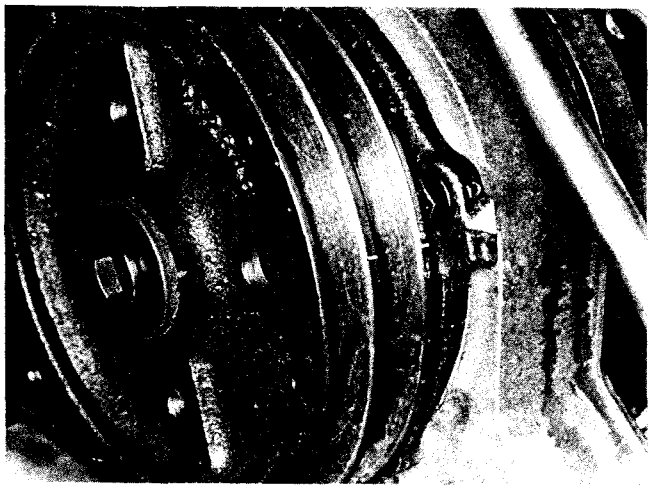


Fig. 2-37, (V514127). Valve set mark on acessory drive — V-903

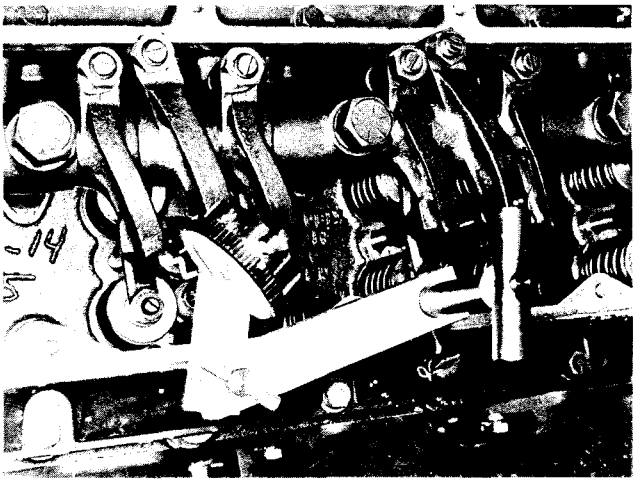


Fig. 2-38, (V514114). Dial indicator in place — V-903

until the plunger is bottomed in the cup, back off approximately 1/2 turn then bottom again, set the dial indicator at zero (0).

Note: Care must be taken to assure the injector plunger is correctly bottomed in the cup, without overtightening the adjusting screw, before setting the dial indicator.

3. Back the adjusting screw out until a reading of 0.187 inch [4.75 mm], reference Table 2-11, is obtained on the dial indicator. Snug tighten the locknut.
4. Using 3375790 Rocker Lever Actuator, bottom the injector plunger, check the zero (0) setting. Fig. 2-39. Allow the plunger to rise slowly, the indicator must show the plunger travel to be within the range specified in Table 2-11.

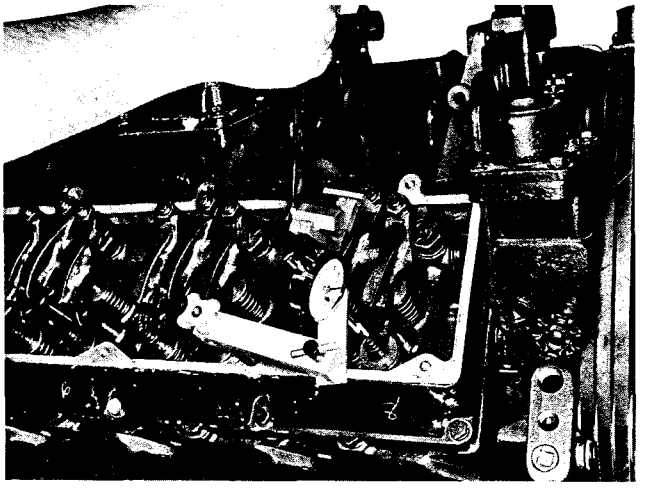


Fig. 2-39, (V514128). Bottoming injector plunger in cup — V-903

5. Using ST-669 Torque Wrench Adapter to hold the adjusting screw in position, torque the locknut 30 to 35 ft-lbs [41 to 47 N•m]. If the torque wrench adapter is not used, hold the adjusting screw with a screwdriver, torque the locknuts 40 to 45 ft-lbs [54 to 61 N•m].
6. Actuate the injector plunger several times as a check of the adjustment. Remove the dial indicator assembly.
7. Adjust the valves on the appropriate cylinder as determined in Step 1 and Table 2-11. Tighten the locknuts the same as the injector locknut.

Crosshead Adjustment

Crossheads are used to operate two valves with one rocker lever. The crosshead adjustment is provided to assure equal operation of each pair of valves and prevent strain from misalignment.

1. Loosen the valve crosshead adjusting screw locknut and back off the screw one turn.
2. Use light finger pressure at the rocker lever contact surface to hold the crosshead in contact with the valve stem (without adjusting screw). Fig. 2-40.
3. Turn down the crosshead adjusting screw until it touches the valve stem.
4. Hold the adjusting screw in position and torque the locknut to the values listed in Table 2-9.

Note: Be sure that the crosshead retainer on the exhaust valves, if used, are positioned equally on both sides of the spring over the crossheads and valve springs properly.

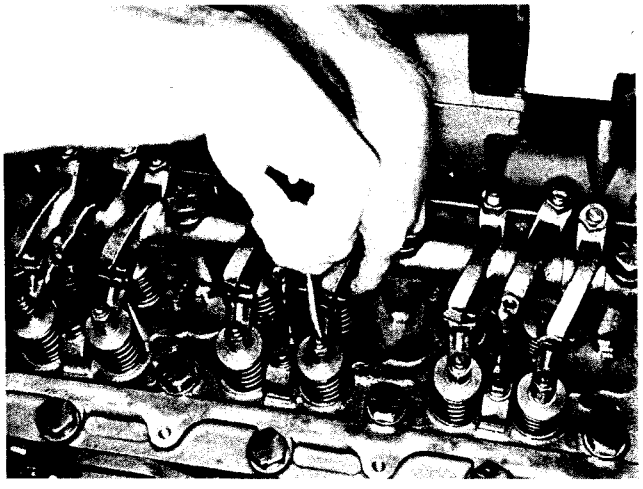


Fig. 2-40, (V51490). Adjusting crossheads — V-903

5. Check the clearance between the crosshead and the valve spring retainer with a wire gauge. There must be a minimum of 0.025 inch [0.64 mm] clearance at this point.

Valve Adjustment

The same crankshaft position used in adjusting injectors is used for setting intake and exhaust valves.

1. Loosen the locknut and back off the adjusting screw. Insert a feeler gauge between the rocker lever and the top of the crosshead. Fig. 2-41. Valve clearances are shown in Table 2-11. Turn the screw down until the lever just touches the gauge, and lock the adjusting screw in position with the locknut. Torque the adjusting screw locknuts to 40 to 45 ft-lb [54 to 61 N•m] or 30 to 35 ft-lb [41 to 47 N•m] when using an ST-669 Adapter.
2. Always make the final valve adjustment after the injectors are adjusted.

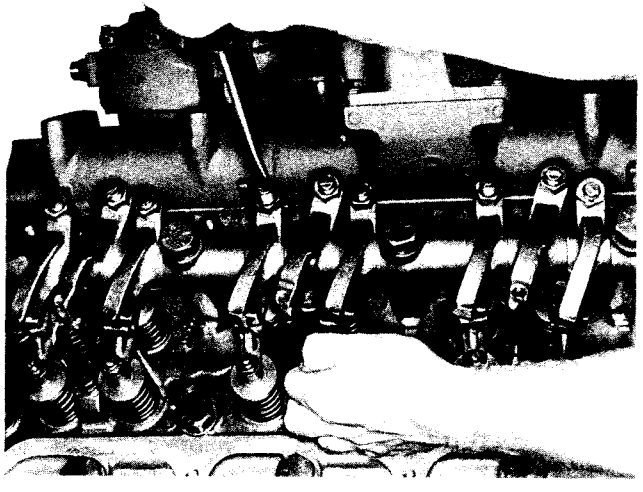


Fig. 2-41, (V51492). Adjusting valves — V-903

NH-743, N-855, C.I.D. Engines, Injector and Valve Adjustment (Dial Indicator Method)

Note: Before adjusting the injectors and valves be sure to determine if the rocker housings are cast iron or aluminum and use the appropriate setting.

Before adjusting the injectors, torque the cylindrical injector, hold-down capscrews in alternate steps to 10 to 12 ft-lbs [14 to 16 N•m]. With flange injectors torque the hold-down capscrews in alternate steps to 12 to 14 ft-lbs [16 to 18 N•m]. Tighten the fuel inlet and drain connections to 20 to 25 ft-lbs [27 to 34 N•m] in the flange injectors.

Maintenance Adjustment

1. Bar the engine until "A" or 1-6 "VS" mark on the pulley, Fig. 2-42, is aligned with the pointer on the gear case cover. In this position, both valve rocker levers for cylinder No. 5 must be free (valves closed). The injector plunger for cylinder No. 3 must be at top of its travel; if not, bar the engine 360 degrees, realign the mark with the pointer.

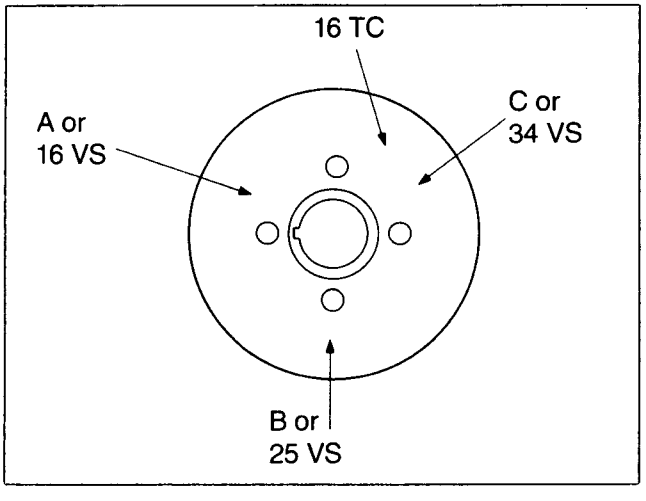


Fig. 2-42, (N114230). Accessory drive pulley marking — N-855

2. Set up ST-1170 Indicator Support with the indicator extension on the injector plunger top at No. 3 cylinder, Fig. 2-43. Make sure the indicator

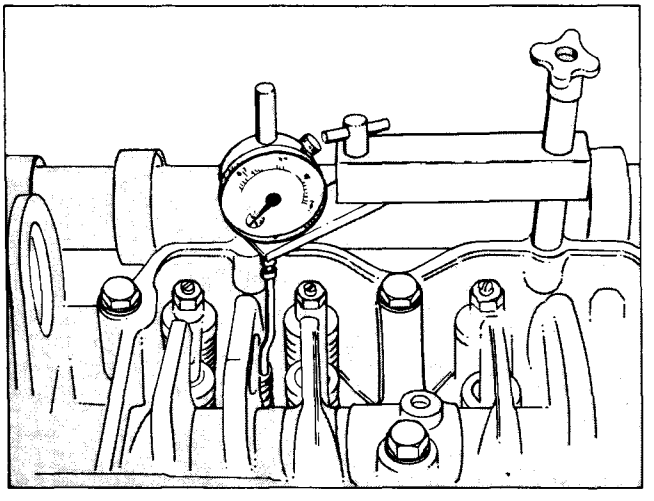


Fig. 2-43, (OM1051L). Extension in contact with plunger

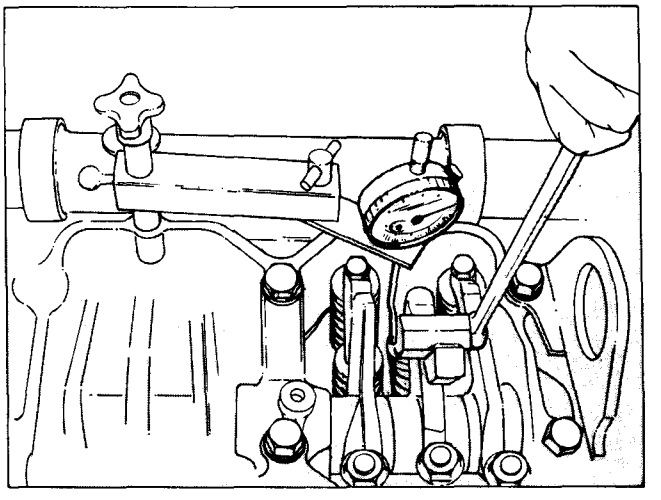


Fig. 2-44, (OM1052L). Actuating rocker lever

extension is secure in the indicator stem and not against the rocker lever.

Note: Cylinder No. 3 for injector setting and cylinder No. 5 for valve setting are selected for illustration purposes only. Any cylinder combination may be used as a starting point. See Table 2-12.

Table 2-12: Injector and Valve Set Position N-855 Engines

Bar in Direction	Pulley Position	Set Cylinder Injector	Valve
Start	A or 1-6VS	3	5
Adv. To	B or 2-5VS	6	3
Adv. To	C or 3-4VS	2	6
Adv. To	A or 1-6VS	4	2
Adv. To	B or 2-5VS	1	4
Adv. To	C or 3-4VS	5	1

3. Using ST-1193 Rocker Lever Actuator, Fig. 2-44, or equivalent, bar the lever toward the injector until the plunger is bottomed to squeeze the oil film from the cup. Allow the injector plunger to rise, then bottom again. Set the indicator at zero (0). Check the extension contact with the plunger top.
4. Bottom the plunger again, release the lever; the indicator must show travel as indicated in Table 2-12. Adjust as necessary.
5. If loosened, tighten the locknut to 40 to 45 ft-lbs [54 to 61 N•m] and actuate the injector plunger several times as a check of the adjustment. Tighten to 30 to 35 ft-lbs [41 to 47 N•m] when using ST-669 Adapter.

Table 2-13: Adjustment Limits Using Dial Indicator Method Inch [mm] N-855 Engines

Oil Temp.	Injector Plunger Travel Inch [mm]	Valve Clearance Inch [mm]	
	Adj. Value	Intake	Exhaust
Aluminum Rocker Housing			
Cold	0.170 [4.32]	0.011 [0.28]	0.023 [0.58]
Hot	0.170 [4.32]	0.011 [0.28]	0.023 [0.58]
Cast Iron Rocker Housing			
Cold	0.175 [4.45]	0.013 [0.32]	0.025 [0.63]
Hot	0.170 [4.32]	0.011 [0.28]	0.023 [0.58]
NT-855 (Big Cam only — Non Top-Stop)			
	0.228 [5.79]	0.011 [0.28]	0.023 [0.58]

Note: Check engine dataplate for injector and valve setting.

Adjust Injectors and Valves (Torque Method) V-1710, NH-743, N-855 C.I.D. Engines

Timing Mark Alignment

1. If used, pull the compression release lever back and block in the open position only while barring the engine.

2. Loosen the injector rocker lever adjusting nut on all cylinders. This will aid in distinguishing between cylinders adjusted and not adjusted.

Note: Before adjusting the injectors and valves be sure to determine if the rocker housings are cast iron or aluminum and use the appropriate setting.

3. Bar the engine in the direction of rotation until a valve set mark (Fig's. 2-45, 2-46 and 2-47) aligns with the mark or pointer on the gear case cover. Example: A or 1-6 "VS" on Inline Engines or 1-6R "VS" on V-1710 Engines.

4. Check the valve rocker levers on the two cylinders aligned as indicated on the pulley. On one cylinder of the pair, both rocker levers will be free and the valves closed; this is the cylinder to be adjusted.

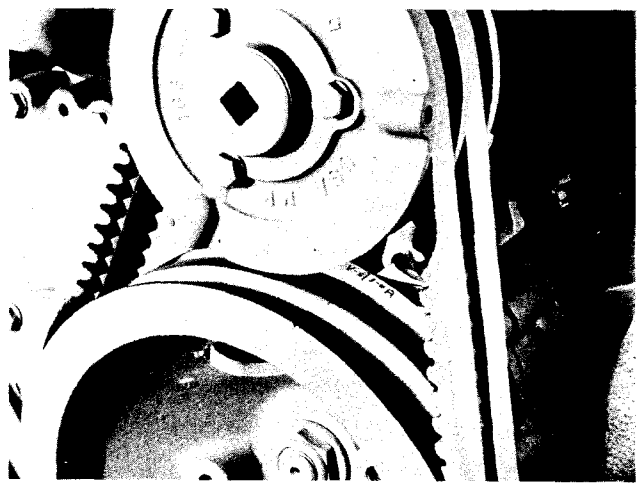


Fig. 2-45, (V41484). Valve set mark — V-1710

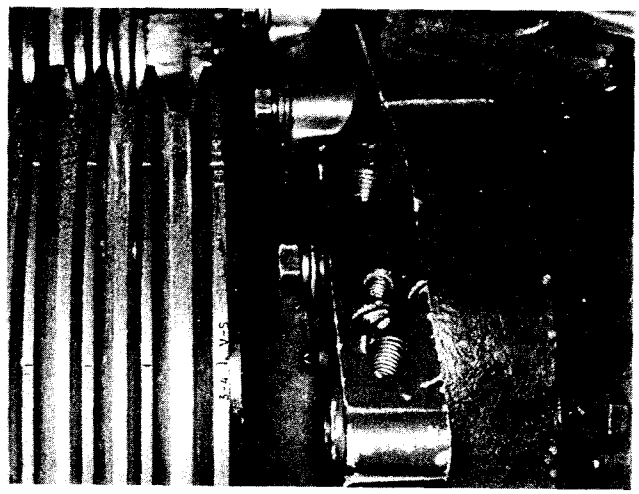


Fig. 2-46, (N114220-A). Valve set mark — N-855

5. Adjust the injector plunger first, then the crossheads and valves to the clearances indicated in the following paragraphs.

6. For the firing order see Table 2-14 for Inline Engines and Table 2-15 and Fig. 2-47 for V-1710 Engines.

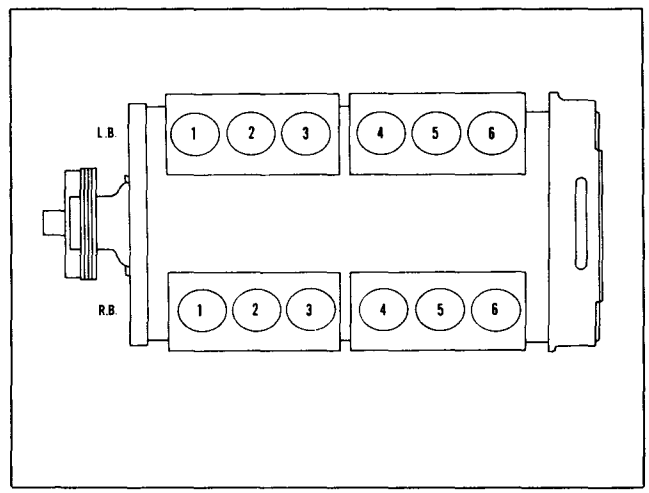


Fig. 2-47, (V414231). V-1710 piston position

Table 2-14: Engine Firing Order N-855 Engines

Right Hand Rotation	Left Hand Rotation
1-5-3-6-2-4	1-4-2-6-3-5

Table 2-15: Firing Order V-1710 Engines

Right Hand —

1L-6R-2L-5R-4L-3R-6L-1R-5L-2R-3L-4R

Left Hand —

1L-4R-3L-2R-5L-1R-6L-3R-4L-5R-2L-6R

7. Continue to bar the engine to the next "VS" mark and adjust each cylinder in the firing order.

Note: Only one cylinder is aligned at each mark. Two complete revolutions of the crankshaft are required to adjust all cylinders.

Injector Plunger Adjustment

The injector plungers must be adjusted with an inch-pound torque wrench to a definite torque set-

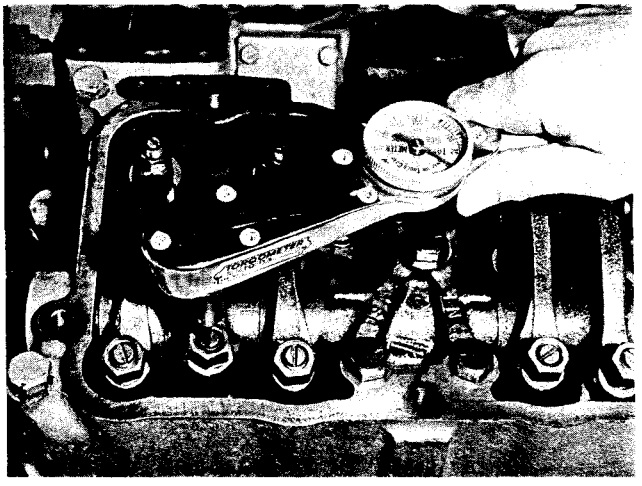


Fig. 2-48, (V414190). Adjusting injector plunger — V-1710

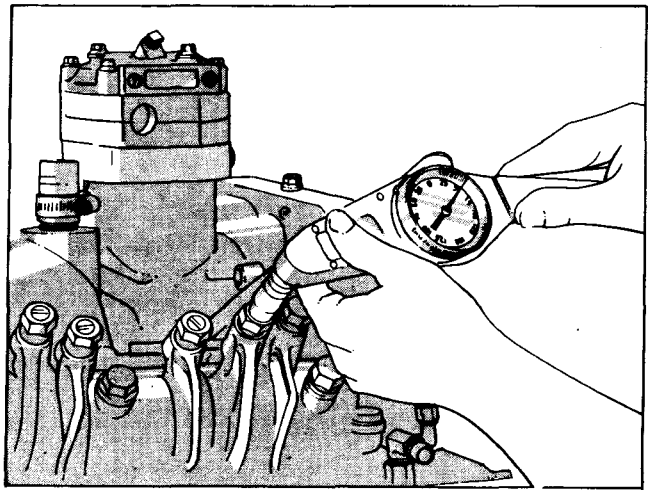


Fig. 2-49, (OM1037L). Adjusting injector plunger — V-903

ting. Snap-On Model TE-12 or torque wrench and a screwdriver adapter can be used for this adjustment. See Fig's. 2-48 and 2-49.

1. Turn the adjusting screw down until the plunger contacts the cup and advance an additional 15 degrees to squeeze the oil from the cup.

Note: Number one L and one R cylinders on V-1710 Engines are at the gear case of the engine.

2. Loosen the adjusting screw one turn; then using a torque wrench calibrated in inch-pounds and a screwdriver adapter tighten the adjusting screw to the value shown in Table 2-16 and tighten the locknut to 40 to 45 ft-lbs [54 to 61 N•m] torque. If ST-669 Torque Wrench Adapter is used, torque to 30 to 35 ft-lbs [41 to 47 N•m].

Crosshead Adjustment

Crossheads are used to operate two valves with one rocker lever. The crosshead adjustment is provided to assure equal operation of each pair of valves and prevent strain from misalignment.

1. Loosen the valve crosshead adjusting screw locknut and back off the screw (4, Fig. 2-50) one turn.

Table 2-16: Injector Plunger Adjustment — Inch-lbs [N•m]

Cold Set	Hot Set
V-1710 Engines	
50 [0.6]	
NH-NT-743 and 855 Engines Cast Iron Rocker Housing	
48 [5.4]	72 [8.1]
Aluminum Rocker Housing	
71 [8.1]	72 [8.1]

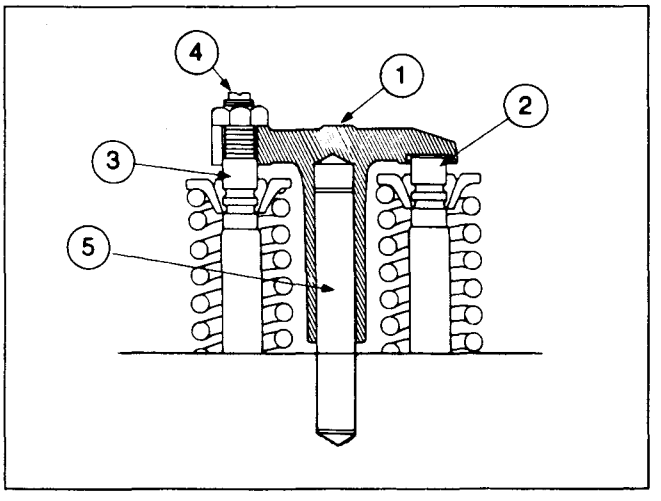


Fig. 2-50, (N21461). Valve crosshead

2. Use light finger pressure at the rocker lever contact surface (1) to hold the crosshead in contact with the valve stem (2).
3. Turn down the crosshead adjusting screw until it touches the valve stem (3).
4. Using ST-669 Torque Wrench Adapter, tighten the locknut to 22 to 26 ft-lbs [30 to 35 N•m]. If ST-669 is not available, hold the screws with a screwdriver and tighten the locknuts to 25 to 30 ft-lbs [34 to 41 N•m].

5. Check the clearance between the crosshead and the valve spring retainer with a wire gauge. There must be a minimum of 0.020 inch [0.51 mm] clearance at this point.

Valve Adjustment

The same engine position used in adjusting the injectors is used for setting the intake and exhaust valves.

1. While adjusting the valves, make sure that the compression release, on those engines so equipped, is in the running position.
2. Loosen the locknut and back off the adjusting screw. Insert a feeler gauge between the rocker lever and crosshead. Turn the screw down until the lever just touches the gauge and lock the adjusting screw in this position with the locknut. Tighten the locknut to 40 to 45 ft-lbs [54 to 61 N•m] torque. When using ST-669 torque to 30 to 35 ft-lbs [41 to 47 N•m].
3. Always make final valve adjustment at stabilized engine lubricating oil temperature. See Table 2-17 for the appropriate valve clearances.

Table 2-17: Valve Clearances — Inch [mm]

Intake Valves Cold Set	Exhaust Valves Cold Set
V-1710 Engines	
0.014 [0.36]	0.027 [0.69]
NH-NT-743 and 855 Engines	
Cast Iron Rocker Housing	
0.016 [0.41]	0.029 [0.74]
Aluminum Rocker Housing	
0.014 [0.36]	0.027 [0.69]

Injector and Valve Adjustment Using 3375004 Dial Indicator Kit KT/KTA19 Engines

This method involves adjusting the injector plunger travel with an accurate dial indicator. A check can be made of the adjustment without disturbing the locknut or screw setting. The valves can also be checked or set while adjusting the injectors by this method. See Table 2-18.

3375004 Injector Adjustment Kit is used to adjust the injectors with or without Jacobs Brake units installed.

It is essential that the injectors and valves be in correct adjustment at all times for the engine to operate properly.

Table 2-18: Injector and Valve Set Position KT/KTA19

Bar in Direction	Pulley Position	Set Cylinder Injector	Valve
Start	A	3	5
Adv. To	B	6	3
Adv. To	C	2	6
Adv. To	A	4	2
Adv. To	B	1	4
Adv. To	C	5	1

Firing Order 1-5-3-6-2-4

One controls engine breathing; the other controls fuel delivery to the cylinders.

Operating adjustments must be made using the correct values as stated.

Injector and Valve Adjustment

Note: Do not use the fan to rotate the engine. Remove the shaft retainer clip. Fig. 2-51, and press the shaft inward until the barring gear engages the drive gear; then advance. After the adjustments are complete retract the shaft and install the retainer clip into the safety lock groove.

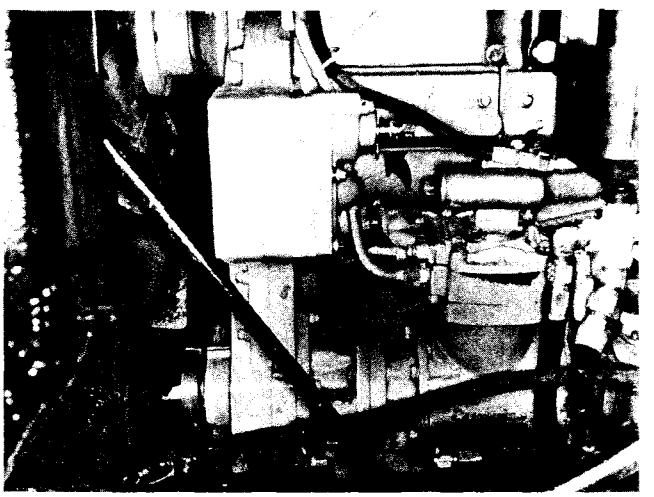


Fig. 2-51, (K11919). Engine barring arrangement — KT/KTA19

Caution: The barring mechanism gear must be completely engaged when barring the engine to avoid damage to the teeth of the gear.

1. Bar the engine in the direction of rotation until "B" mark on the pulley, Fig. 2-52, is aligned with pointer on the gear case cover. In this position, both valve rocker levers for cylinder No. 3 must be free (valves closed). The injector plunger for cylinder No. 6 must be at top of travel; if not, bar the engine 360 degrees, realign the marks with the pointer.

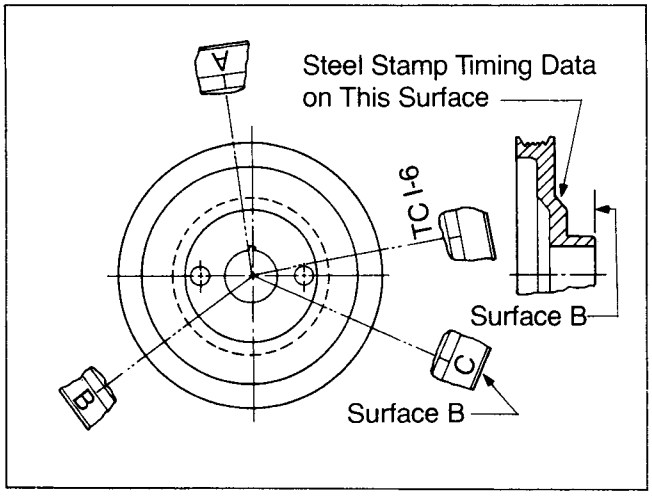


Fig. 2-52, (K11920). Accessory drive pulley marking — KT/KTA19

Note: The injector and valves on any one (1) cylinder can not be set at the same valve set position. Example: If the rocker levers on No. 3 cylinder are free (valves closed) the injector plunger travel on No. 6 cylinder is a starting point. See Table 2-18.

2. Install 3375004 Dial Indicator Assembly to the rocker housing, (3375005) extension must go through the opening in the Jacobs Brake housing and contact the injector plunger top, Fig. 2-53.

3. Screw the injector lever adjusting screw down until the plunger is bottomed in the cup, back off approximately 1/2 turn then bottom again, set the dial indicator at zero (0).

Note: Care must be taken to assure the injector plunger is correctly bottomed in the cup, without overtightening the adjusting screw, before setting the dial indicator.

4. Back the adjusting screw out until a reading of 0.304 inch [7.72 mm], reference Table 2-19, is obtained on the dial indicator. Snug tighten the locknut.

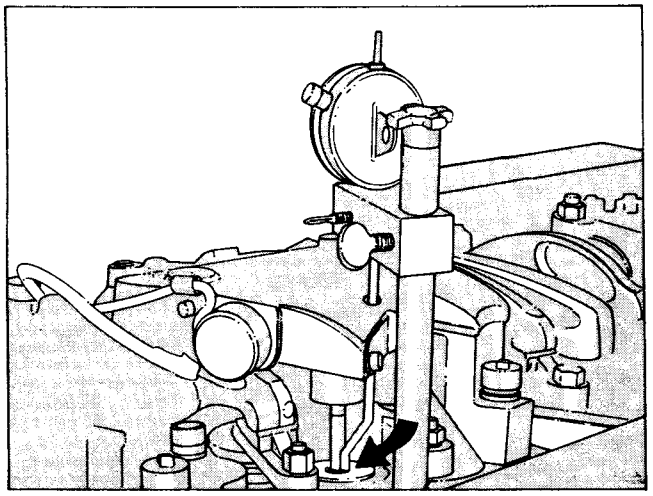


Fig. 2-53, (OM1061L). Dial indicator in place — extension in contact with plunger

5. Using 3375009 Rocker Lever Actuator Assembly and (3375007) Support Plate, bottom the injector plunger, check the zero (0) setting. Fig. 2-54. Allow the plunger to rise slowly; the indicator must show the plunger travel to be within the range indicated in Table 2-19.

Table 2-19: Adjustment Limits Using Dial Indicator Method Inch [mm] KT/KTA19 Engines

Injector Plunger Travel	Valve Clearance Intake	Exhaust
0.304 ± 0.001 [7.72 ± 0.03]	0.014 [0.36]	0.027 [0.69]

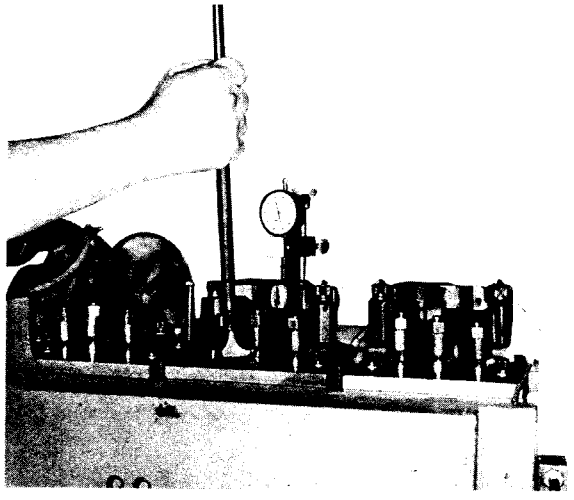


Fig. 2-54, (K114104). Actuating rocker lever

6. Using ST-669 Torque Wrench Adapter to hold the adjusting screw in position, torque the locknut to 30 to 35 ft-lbs [41 to 47 N•m]. If the torque wrench adapter is not used, hold the adjusting screw with a screwdriver, torque the locknuts to 40 to 45 ft-lbs [54 to 61 N•m].
7. Actuate the injector plunger several times as a check of the adjustment. Remove the dial indicator assembly.

Caution: If Jacobs Brake is not used, be sure the crossheads are adjusted before setting the valves. See Crosshead Adjustment following.

8. Adjust the valves on the appropriate cylinder as determined in Step 1 and Table 2-19. Tighten the locknuts the same as the injector locknut.
9. If Jacobs Brake is used, use 3375012 (0.018 inch [0.46 mm] thick) Feeler Gauge and 3375008 Torque Wrench Extension, set the exhaust valve crosshead to Jacobs Brake slave piston clearance, Fig. 2-55.

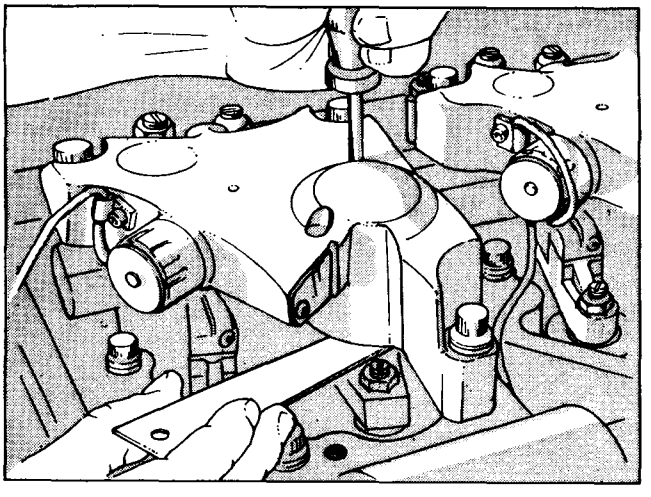


Fig. 2-55, (OM1063L). Adjusting crosshead to slave piston clearance

Note: Turn both adjusting screws alternately and evenly until the crosshead and feeler gauge contact the slave piston and the adjusting screws are bottomed on the valve stem. Back the adjusting screws out one-fourth (1/4) to one-half (1/2) turn. Starting with the outer adjusting screw (next to water manifold), then moving to the screw under the rocker lever, retighten gradually until the crosshead and feeler gauge contact the slave piston. Snug tighten the locknuts.

10. Hold the crosshead adjusting screws with a screwdriver, torque the locknuts 22 to 26 ft-lbs [30 to 35 N•m] using 3375008 Extension and torque wrench.
11. See Table 2-19 for valve clearance values.
12. Repeat the adjustment procedure for each cylinder. See Table 2-18 for firing order and injector and valve set positions.

Crosshead Adjustment

Crossheads are used to operate two valves with one rocker lever. The crosshead adjustment is provided to assure equal operation of each pair of valves and prevent strain from misalignment.

1. Loosen the valve crosshead adjusting screw locknut and back off the screw (4, Fig. 2-56) one turn.

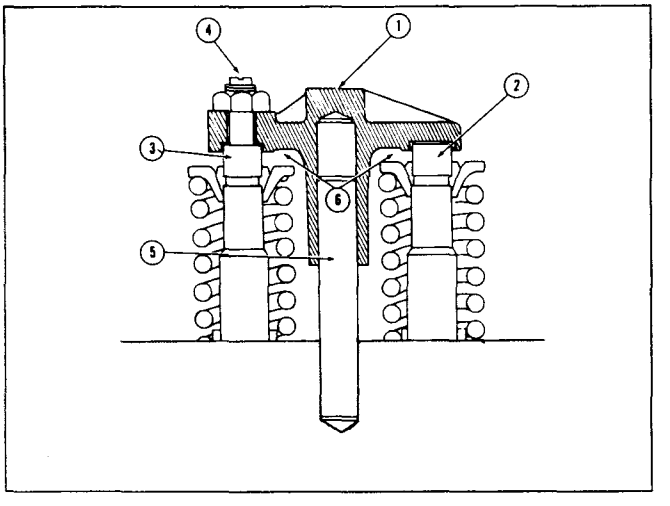


Fig. 2-56, (K21924). Valve crosshead

2. Use light finger pressure at the rocker lever contact surface (1) to hold the crosshead in contact with the valve stem (2) (without adjusting screw).
3. Turn down the crosshead adjusting screw until it touches the valve stem (3).
4. Using ST-669 Torque Wrench Adapter, tighten the locknuts to 22 to 26 ft-lbs [30 to 35 N•m]. If ST-669 is not available, hold the screws with a screwdriver and tighten the locknuts to 25 to 30 ft-lbs [34 to 41 N•m].
5. Check the clearance (6) between the crosshead and valve spring retainer with a wire gauge. There must be a minimum of 0.025 inch [0.64 mm] clearance at this point.

Injector and Valve Adjusting Using 3375004 Dial Indicator Kit (KT/KTA38 and KTA50 Engines)

Valve Set Mark Alignment

Note: KT/KTA38 and KTA50 injectors, crossheads and valves are adjusted to the same values. Refer to Fig's. 2-57 and 2-58 for specific cylinder arrangement and engine firing order.

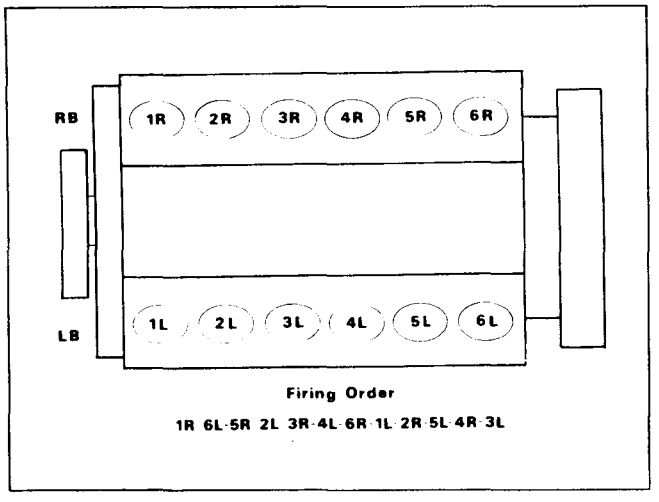


Fig. 2-57, (K21916). Cylinder arrangement and firing order —KT/KTA38

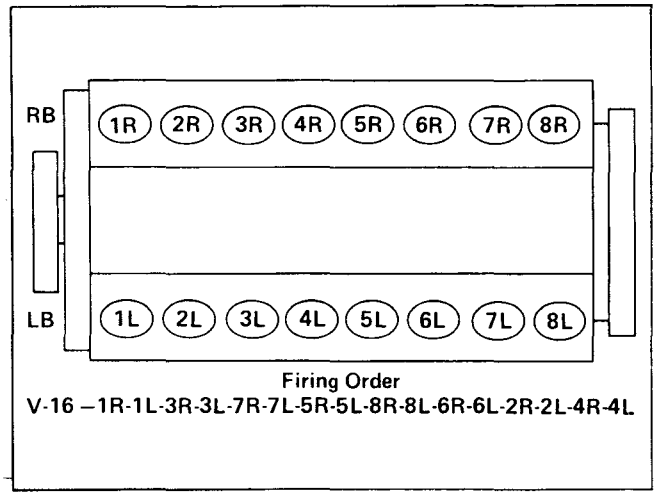


Fig. 2-58, (OM204). Cylinder arrangement and firing order —KTA50

Three locations are provided where valve and injector alignment marks may be viewed. Injector plunger travel and valves both may be set on one cylinder at the same valve set location. The crankshaft must be turned through two (2) complete revolutions to properly set all injector plunger travel and valves.

Note: The barring mechanism may be located on either the left bank or right bank at the flywheel housing. The cover plate on opening "A" or "C" directly above the barring mechanism must be removed when viewing the timing marks at the flywheel housing.

1. When viewing the engine at the vibration damper, Fig. 2-59, align the timing marks on the damper with the pointer on the gear case cover.

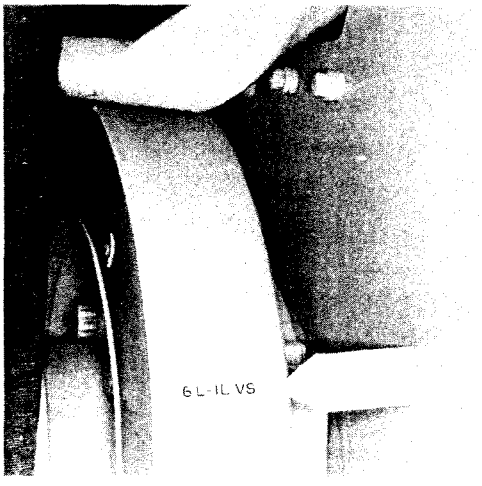


Fig. 2-59, (K21917). Valve set marks on vibration damper —KT/KTA38

2. When barring the engine from the right bank at the flywheel housing "A" VS timing marks on the flywheel (1, Fig. 2-60) must align with the scribe mark (2) when viewed through the opening marked "A" on the flywheel housing.

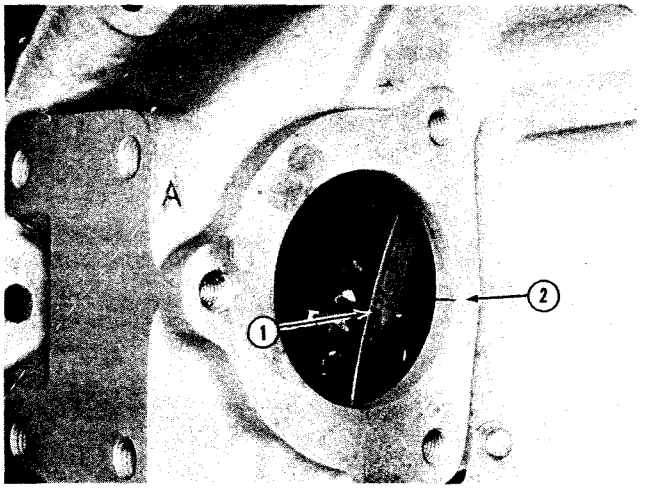


Fig. 2-60, (K21918). Valve set marks on right bank flywheel and housing — KT/KTA38

3. When barring the engine from the left bank at the flywheel housing "C" VS timing marks on the flywheel (1, Fig. 2-61) must align with the scribe

mark (2) when viewed through the opening marked "C" on the flywheel housing.

Caution: When aligning valve set marks at either flywheel housing location, care must be taken to assure that "A" or "C" valve set marks on the flywheel match "A" or "C" marks on the flywheel housing opening.

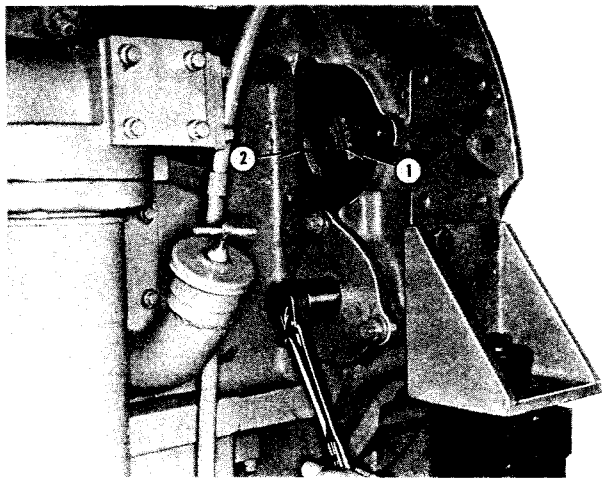


Fig. 2-61, (K21919). Engine barring device

Injector Plunger Adjustment

1. Bar the engine in the direction of rotation until the appropriate valve set mark is aligned with the scribe mark on the flywheel housing or until a valve set mark on the vibration damper is aligned with the pointer on the gear case cover.

Note: Any valve set position may be used as a starting point when adjusting the injectors, crossheads and valves. Determine which of the two (2) cylinder indicated have both valves closed (rocker levers free). This cylinder is in position for injector plunger travel, crosshead and valve adjustment.

2. Set up 3375007 Support Block on the rocker lever housing, of the cylinder selected, with the 3375005 dial indicator extension on the injector plunger top. Fig. 2-62.

Note: Make sure 3375008 Dial Indicator extension is secure in the indicator stem and is not touching the rocker lever.

3. Using the rocker lever actuator, Fig. 2-63, depress the lever toward the injector until the plunger is bottomed in the cup to squeeze the oil film from the cup. Allow the injector plunger to rise, bottom again, hold in the bottom position and set the indicator zero (0). Check the extension contact with the plunger top.

4. Allow the plunger to rise then bottom the plunger again, release the lever, the indicator must show travel as indicated in Table 2-20. Adjust as necessary.

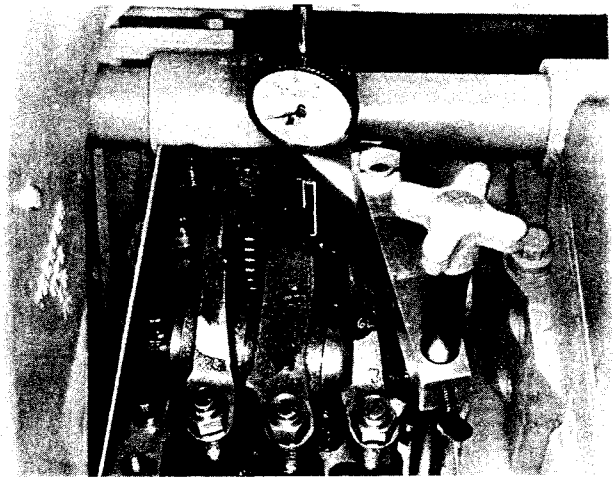


Fig. 2-62, (K21920). Dial indicator in place — extension in contact with plunger

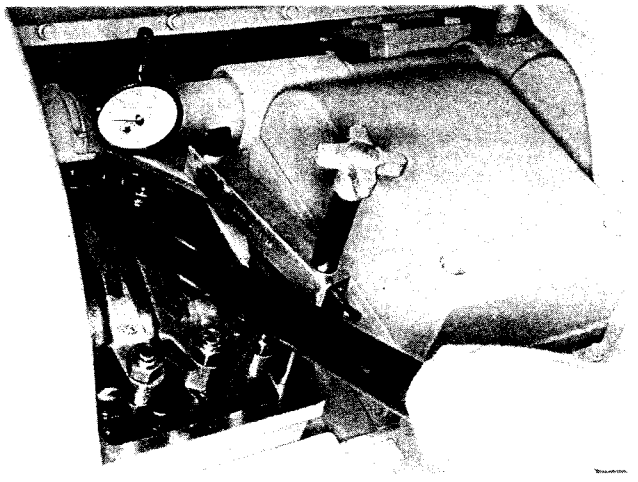


Fig. 2-63, (K21921). Bottoming injector plunger in cup

Table 2-20: Adjustment Limits Using Dial Indicator Method Inch [mm] KT/KTA38 and KTA50 Engines

Injector Plunger Travel	Valve Clearance Intake	Exhaust
0.308 ± 0.001 [7.82 ± 0.03]	0.014 [0.36]	0.027 [0.69]

5. If the adjusting screw locknuts were loosened for adjustment, tighten to 40 to 45 ft-lbs [54 to 61 N•m] torque and actuate the plunger several times as a check of the adjustment. Tighten the locknuts to 30 to 35 ft-lbs [41 to 47 N•m] torque when using ST-669 Torque Wrench Adapter.
6. Remove 3375004 Kit.

Crosshead Adjustment

Crossheads are used to operate two valves with one rocker lever, an adjusting screw is provided to assure equal operation of each pair of valves and prevent strain from misalignment. Crosshead adjustment changes as a result of valve and seat wear during engine operation.

1. Loosen the adjusting screw locknut, back off the screw (4, Fig. 2-56) one turn.
2. Use light finger pressure at the rocker lever contact surface (1) to hold the crosshead in contact with the valve stem (2). The adjusting screw should not touch the valve stem (3) at this point.
3. Turn down the adjusting screw until it touches the valve stem (3).
4. Using 3375008 Torque Wrench Extension to hold the adjusting screw in position, tighten the locknut to 22 to 26 ft-lb [30 to 35 N•m] torque. If the torque wrench adapter is not used, hold the adjusting screw with a screwdriver, tighten the locknut to 25 to 30 ft-lb [34 to 41 N•m] torque.
5. Check the clearance (6) between the crosshead and the valve spring retainer with a gauge. There must be a minimum of 0.025 inch [0.64 mm] clearance at this point.

Valve Adjustment

1. Insert the correct thickness feeler gauge between the rocker lever and the crosshead for the valves being adjusted. See Table 2-20 for valve clearance.

Note: Exhaust valves are toward the front of the engine in each cylinder head on the LB side and are toward the rear of the engine in each cylinder head on the RB side.

2. If adjustment is required, loosen the locknut and turn the adjusting screw down until the rocker lever just touches the feeler gauge; lock the adjusting screw in this position with the locknut.
3. Tighten the locknut to 40 to 45 ft-lb [54 to 61 N•m] torque. When using ST-669 Torque Wrench Adapter tighten the locknuts to 30 to 35 ft-lb [41 to 47 N•m] torque.

After completing the injector plunger travel, crosshead and valve adjustment on this cylinder bar the engine in the direction of rotation until the next valve set mark is aligned with the scribe mark at the flywheel housing or the pointer on the gear case cover; repeat the procedure. See Fig's. 2-57 and 2-58 for cylinder arrangement and engine firing order.

Change Oil

Change Aneroid Oil

1. Remove fill plug (1, Fig. 2-64) from the hole marked "Lub oil".

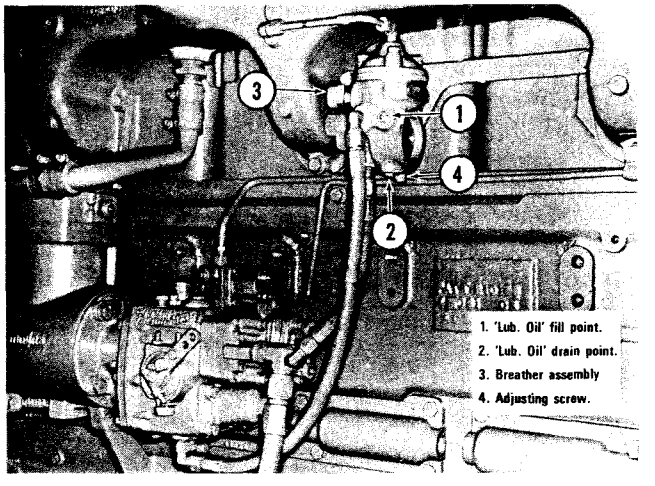


Fig. 2-64, (N10503). Aneroid

2. Remove the drain plug (2) from the bottom of the aneroid.
3. Replace the drain plug (2), fill the aneroid with clean engine lubricating oil. Replace the fill plug (1).

Replace Aneroid Breather

Remove and replace the aneroid breather (3, Fig. 2-64).

Change Hydraulic Governor Oil

Change oil in the hydraulic governor sump at each "C" Check.

Use the same grade of oil as used in the engine. See "Lubricating Oil Specifications".

Note: When temperature is extremely low, it may be necessary to dilute the lubricating oil with enough fuel oil or other special fluid to ensure free flow for

satisfactory governor action.

Backside Idler Fan Drive

Inspect the idler assembly to be sure the pivot arm is not binding. Use the following procedure.

1. Check the idler arm for freedom of movement.
   a. Grasp the pulley and move the pulley and arm away from the fan belt until the arm is nearly vertical.
   b. Release the arm and pulley and allow them to move back to their original position against the belts.
   c. The motion of the arm and pulley assembly should be free with no binding.
2. If the arm appears to be binding or tight, release the spring tension by placing a box end wrench over the square knob on the end of the pivot arm cap and while holding up on the box end wrench, remove the capscrew which holds the cap in place and allow the spring to unwind by allowing the box end wrench to rotate counterclockwise.
   a. With the spring unloaded, rotate the cap until the slots inside the cap align with the roll pins in the pivot arm, and remove the cap by pulling away from the engine.
   b. With the torsion spring unloaded, the pivot arm should rotate freely. If it does not appear free, then the bushings require replacement or repacking with lubricant.
3. To inspect the bushings, loosen and remove the large hex head capscrew in the center of the pivot arm and remove the pivot arm from the pivot arm support.
   a. Inspect the shaft for corrosion and clean it as necessary with fine grade emery cloth.
   b. Inspect the bushings and thrust washers, clean and repack them with a good grade of lubricant such as:
      — lubriplate
      — moly-disulfide grease
   c. Inspect the O-ring on the pivot arm and replace it as necessary. Lubricate the O-ring prior to installation.
   d. Reassemble the pivot arm assembly cap using a new spring.
   e. Retension the new spring and lock the cap in place. Install a new fan belt and test the unit.

Clean Complete Oil Bath Air Cleaner

Steam

Steam clean the oil bath cleaner main body screens. Direct the stream jet from the air outlet side of the cleaner to wash dirt out in the opposite direction of air flow.

Solvent-Air Cleaning

1. Steam clean the exterior of the cleaner.
2. Remove the air cleaner oil cup.
3. Clamp the hose with the air line adapter to the air cleaner outlet.
4. Submerge the air cleaner in solvent.
5. Introduce air into the unit at 3 to 5 psi [21 to 34 kpa] and leave it in the washer 10 to 20 minutes.
6. Remove the cleaner from solvent and steam clean thoroughly to remove all traces of solvent. Dry with compressed air.

Caution: Failure to remove solvent may cause engine to overspeed until all solvent is sucked from the cleaner.

7. If the air cleaner is to be stored, dip it in lubricating oil to prevent rusting of the screens.

Note: If screens cannot be thoroughly cleaned by either method, or if the body is pierced or otherwise damaged, replace with a new air cleaner.

"D" Maintenance Checks

At each "D" Maintenance Check, perform all "A", "B" and "C" checks in addition to those following. Most of these checks should be performed by a Cummins Distributor or Dealer and where Cummins Shop Manuals are available for complete instructions.

Clean and Calibrate Injectors

Clean and calibrate the injectors regularly to prevent restriction of fuel delivery to the combustion chambers. Because of the special tools required for calibration, most owners and fleets find it more economical to let a Cummins Distributor do the cleaning and calibration operations.

To clean and calibrate the injectors, refer to Bulletin No. 3379071 and revisions thereto.

After removing the injectors from KT/KTA19, KT/KTA38 or KTA50 Engines for cleaning the seal seat should be removed from the injector (1, Fig. 2-65) or injector "well" for cleaning, examination and/or replacement as necessary.

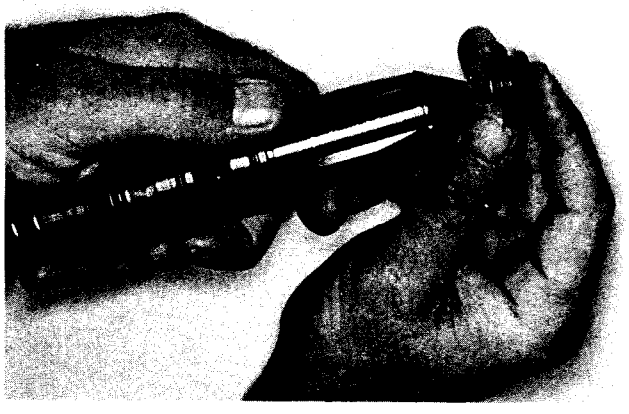


Fig. 2-65, (K11918). Injector seal seat — all KT Engines

Caution: There must be only one (1) seal seat used in each injector "well". Use of more than one seal seat per injector will change the injector protrusion and cause combustion inefficiency.

Clean and Calibrate Fuel Pump

Check the fuel pump calibration on the engine if required. See the nearest Cummins Distributor or Dealer for values.

Clean and Calibrate Aneroid

1. Remove the flexible hose or tube from the aneroid cover to the intake manifold.
2. Remove the lead seal (if used), screws and aneroid cover.
3. Remove the bellows, piston, upper portion of the two piece shaft and the spring from the aneroid body.

Note: Count and record the amount of thread turns required to remove the upper shaft, piston and bellows from the lower shaft.

4. Place the hex portion of the shaft in a vise, snug tighten the vise, remove the self-locking nut, retaining washer and bellows.
5. Clean the parts in an appoved cleaning solvent.
6. Position the new bellows over the shaft to the piston, secure with retaining washer and self-locking nut. Tighten the self-locking nut to 20 to 25 ft-lb [27 to 34 N•m] torque.
7. Install the spring, shaft, piston and bellows assembly into the aneroid body. As the two piece shaft is re-assembled, turn the upper portion of the shaft the same amount of thread turns as recorded during disassembly.

Caution: The amount of thread turns during installation must correspond with turns during removal to avoid changing the aneroid setting.

8. Align the holes in the bellows with the corresponding capscrew holes in the aneroid body.
9. Position the cover to the body; secure with flatwashers, lockwashers and fillister head screws.
10. Install a new seal. Refer to Bulletin No. 3379084 for sealing instructions and calibration procedure. Calibration, if required, must be performed by a Cummins Distributor on a fuel pump test stand.

11. Reinstall the flexible hose or tube from the aneroid cover to the intake manifold.

Clean Cooling System

The cooling system must be clean to do its work properly. Scale in the system slows down heat absorption from water jackets and heat rejection from the radiator. Use clean water that will not clog any of the hundreds of small passages in the radiator or water passages in the block. Clean the radiator cores, heater cores, oil cooler and block passages that have become clogged with scale and sediment by chemical cleaning, neutralizing and flushing.

Chemical Cleaning

If rust and scale have collected, the system must be chemically cleaned. Use a good cooling system cleaner and follow the manufacturer's instructions.

Pressure Flushing

When pressure flushing the radiator, open the upper and lower hose connections and screw the radiator cap on tight. Use the hose connection on both the upper and lower connections to make the operation easier. Attach a flushing gun nozzle to the lower hose connection and let water run until the radiator is full. When full, apply air pressure gradually to avoid damage to the core. Shut off the air and allow the radiator to refill; then apply air pressure. Repeat until the water coming from the radiator is clean.

Caution: Do not use excessive air pressure while starting the water flow. This could split or damage the radiator core.

Sediment and dirt settle into pockets in the block as well as the radiator core. Remove the thermostats from the housing and flush the block with water. Partially restrict the lower opening until the block fills. Apply air pressure and force water from the lower opening. Repeat the process until the stream of water coming from the block is clean.

Inspect Water Pump, Fan Hub and Idler Pulley

Inspect the water pump shaft, fan hub and idler for wobble and evidence of grease leakage. Refer to the engine shop manual for rebuild and lubricating procedure for these assemblies.

Rebuilt prelubricated water pumps, fan hubs and idler assemblies are available from Diesel ReCon, Incorporated.

Inspect Turbocharger

Check Turbocharger Bearing Clearance

Check bearing clearances. This can be done without removing the turbocharger from the engine, by using a dial indicator to indicate the end-play of the rotor shaft and a feeler gauge to indicate the radial clearance. Fig. 2-66.

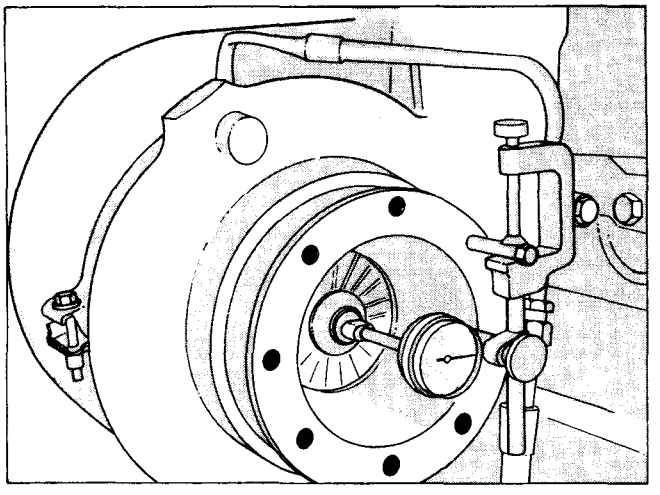


Fig. 2-66, (OM1065L). Check turbocharger bearing end clearance.

Checking Procedure

1. Remove the exhaust and intake piping from the turbocharger to expose the ends of the rotor assembly.
2. Remove one capscrew from the front plate (compressor wheel end) and replace it with a long capscrew. Attach an indicator to the long capscrew and register the indicator point on the end of the rotor shaft. Push the shaft from end-to-end making note of the total indicator reading. Fig. 2-66. On T-50, ST-50 and VT-50 the end clearance should be 0.006 to 0.018 inch [0.15 to 0.46 mm].
3. If end clearances exceed the limits, remove the turbocharger from the engine and replace it with a new or rebuilt unit.
4. Check the radial clearance on the compressor wheel only.
   a. Push the wheel toward the side of the bore.
   b. Using a feeler gauge, check the distance between the tip of the wheel vanes and the bore. On T-50, ST-50 and VT-50 the clearance

should be 0.003 to 0.033 inch [0.08 to 0.84 mm].

Check T-18A turbochargers as follows:

a. For checking procedures refer to Service Manual Bulletin No. 3379091.

b. End clearance should be 0.004 to 0.009 inch [0.10 to 0.23 mm], radial clearance should be 0.003 to 0.007 inch [0.08 to 0.18 mm]. If the clearances exceed these limits, remove the turbocharger(s) from the engine and replace them with new or rebuilt units.

6. Install the exhaust and intake piping to the turbocharger(s).

Inspect Vibration Damper

Rubber Damper

The damper hub (1, Fig. 2-67) and the inertia member (2) are stamped with an index mark (3) to permit the detection of movement between the two components.

There should be no relative rotation between the hub and the inertia member resulting from engine operation.

Check for extrusion or rubber particles between the hub and the inertia member.

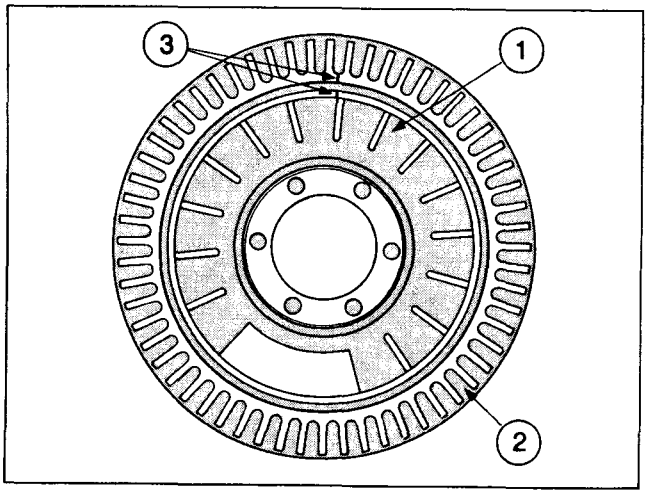


Fig. 2-67, (OM1066L). Vibration damper alignment marks

If there is evidence of inertia member movement and rubber extrusion, replace the damper.

Viscous Dampers

Check the damper for evidence of fluid loss, dents and wobble. Visually inspect the vibration damper's thickness for any deformation or raising of the damper's front cover plate.

1. If a lack of space around the damper will not permit a visual inspection, run a finger around the inside and the outside of the front cover plate. If any variations or deformations are detected, remove the vibration damper and check as follows.
2. Remove paint, dirt and grime from the front and rear surface of the damper in four (4) equal spaced areas. Clean the surface with paint solvent and fine emery cloth.
3. Using a micrometer measure and record the thickness of the dampers at the four (4) areas cleaned in Step 3. Take the reading approximately 0.125 inch [3.18 mm] from the outside edge of the front cover plate.
4. Replace the damper if the variation of the four (4) readings exceed 0.010 inch [0.25 mm].

Viscous vibration dampers should be checked under the following conditions:

1. At any time the damper is removed from the engine.
2. At any time the engine experiences the following problems:
   a. Gear train failure
   b. Accessory drive shaft failure
   c. Crankshaft failure
   d. Damper mounting capscrew failure
   e. Flywheel mounting capscrew failure

Viscous vibration dampers should be replaced at our recommended change interval** regardless of condition. Gellation of the damper's silicon fluid occurs after extended service because of the high shear rates and resulting high temperatures imposed on the fluid during normal damper operation and, if the damper has not failed at this time, its failure is imminent.

Table 2-21: Viscous Vibration Damper Thickness Specifications — Inch [mm]

Damper Part Number	Maximum Allowable Thickness	*Recommended Change Interval — Hours
20633-1	1.981 [50.32]	15000
20634-1	1.644 [41.76]	15000
20835-1	1.142 [29.01]	15000
145789	1.663 [42.24]	15000
190213	1.663 [42.24]	15000
207531	2.574 [65.38]	15000
210758	1.550 [39.37]	15000
211268	1.663 [42.24]	15000
211914	1.981 [50.32]	15000
211915*		
211916	1.663 [42.24]	15000
217321	1.663 [42.24]	15000
217322	1.663 [42.24]	15000
217323	1.663 [42.24]	15000
218755	1.663 [42.24]	15000
3005973	2.574 [65.38]	24000
3015464	2.574 [65.38]	24000
3027315	2.574 [65.38]	24000
3511829	1.732 [44.00]	Major overhaul***

*Due to vendor manufacturing differences 211915 Vibration Damper maximum allowable thickness depends upon the style of damper installed on the engine. Fabricated type 211915 Vibration Dampers, identified by a weld bead on the inside of the damper where the mounting flange joins the housing and vendor Part Number 709555, have a maximum allowable thickness of 1.570 inch [39.88 mm]. Cast and machined type 211915 Vibration Dampers (vendor Part Number 707843) have a maximum allowable thickness of 1.550 inch [39.37 mm].

***If the gear cover is removed and the damper has more than 300,000 miles or 12,000 hours it should be replaced.

Air Compressor

All air compressors have a small amount of oil carryover which lubricates the piston rings and moving parts. When this oil is exposed to normal air compressor operating temperatures over a long period of time, it will form varnish or carbon deposits. Cummins Engine Company recommends air compressor inspections every 180,000 miles or 4500 hours. If the following inspections are ignored, the air compressor piston rings will be affected by high operating temperatures, and will not seal properly.

Note: The following steps can be made with the air compressor on the engine.

Discharge Inspection

1. Inspect the entire system for air leaks. Repair as necessary.
2. Bleed down the air tanks until there is no pressure in the air system.
3. Remove the air in and air out connections from the air compressor.
4. Inspect the air discharge line from the air compressor. If the total carbon deposit thickness (Fig. 2-68) inside the air discharge line exceeds 1/16 inch, remove the head and clean the air passages thoroughly. Also remove and clean or replace the discharge line. Contact the nearest Cummins Distributor or refer to Cummins Bulletin 3379056, "Air Equipment Rebuild Manual" for removing the air compressor head.

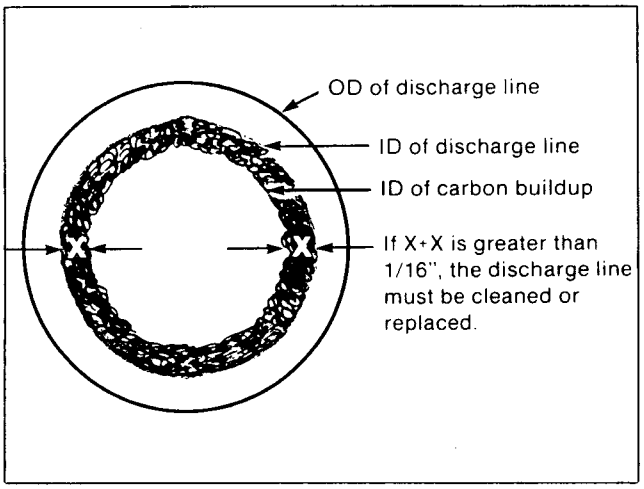


Fig. 2-68, (OM21009). Air discharge line

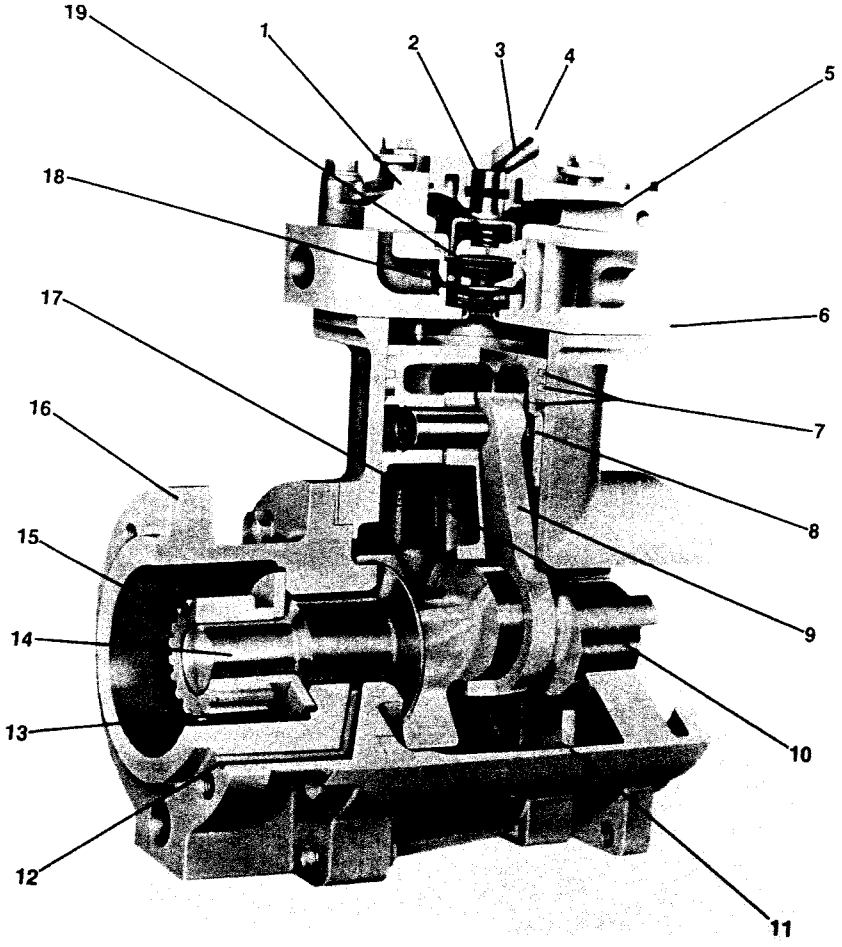
5. Disconnect the discharge line at the first connection after the air compressor. If the total carbon deposit thickness exceeds 1/16 inch, clean or replace the complete line.
6. Continue the procedure until the first (wet) tank or a non-coated connection is reached.
7. Inspect any air driers, spitter valves, or alcohol injectors in the system for carbon deposits or malfunctioning parts. Maintain and repair the

parts according to the manufacturer's specifications.

Intake Inspection

1. Remove the capscrews, flat washers and lockwashers securing the unloader valve assembly to the cylinder head cover. Remove the unloader valve assembly and spring from the cylinder head and cover, Fig. 2-69.
2. Remove the three-prong unloader from the unloader body.
3. Remove the O-ring and packing seal from the unloader body and discard.
4. Remove the intake valve, seat, and spring.
5. Remove the exhaust valve assembly. Remove and discard the O-rings from the exhaust valve seat.
6. Inspect the air inlet in the cylinder head cover. Also inspect the exhaust valve and seat and the intake valve and seat. If the parts have carbon deposits on them, replace the parts. If the parts do not have carbon deposits, reinstall them with new O-rings and unloader seals.

If the air compressor requires major repair or additional troubleshooting, see Cummins Bulletin 3379056, or contact the nearest Cummins Distributor.



1. Cylinder Head Cover
2. Unloader Valve
3. Air Governor Connection
4. Unloader Valve Body
5. Air Inlet
6. Cylinder Head
7. Piston Rings
8. Piston
9. Connecting Rod
10. Fuel Pump Drive
11. Crankcase
12. Lubricating Oil Inlet
13. Thrust Washer
14. Crankshaft
15. Drive Coupling
16. Support
17. Bushings
18. Exhaust Valve
19. Intake Valve

Fig. 2-69 (OM210010). Air Compressor

Backside Idler Fan Drive

Remove the pivot arm assembly, disassemble and clean. Replace the Teflon bushings. Inspect the thrust washers and replace as necessary. Pack Teflon bushings with Aeroshell No. 5 Lubriplate (type 130AA) or Moly-disulfide grease, reassemble and install the idler assembly.

Clean Crankcase Breathers (KT/KTA38 and KTA50 Engines)

Remove the crankcase breathers from the right bank front and left bank rear of the cylinder block. Clean in an approved cleaning solvent, dry with compressed air, install the breather.

Seasonal Maintenance Checks

There are some maintenance checks which may or may not fall exactly into suggested maintenance schedule due to miles or hours operation but are performed once or twice each year.

Replace Hose (As Required)

Inspect the oil filter and cooling system hose and hose connections for leaks and/or deterioration. Particles of deteriorated hose can be carried through the cooling system or lubricating system and restrict or clog small passages, especially radiator core, and lubricating oil cooler, and partially stop circulation. Replace as necessary.

Check Preheater Cold-Starting Aid (Fall)

Remove the 1/8 inch pipe plug from the manifold, near the glow plug, and check the operation of the preheater as described in Section 1.

Check Shutterstats and Thermatic Fans (Fall)

Shutterstats and thermatic fans must be set to operate in the same range as the thermostat with which they are used. Table 2-22 gives the settings for shutterstats and thermatic fans as normally used. The 180 to 195°F [82 to 91°C] thermostats are used only with shutterstats that are set to close at 187°F [86°C] and open at 195°F [91°C].

Check Thermostats and Seals (Fall)

Remove the thermostats from the thermostat housings and check for proper opening and closing temperature.

Most Cummins Engines are equipped with either medium 170 to 185°F [77 to 85°C] or low 160 to 175°F [71 to 79°C] and in a few cases high-range 180 to 195° [82 to 91°C] thermostats, depending on engine application.

Steam Clean Engine (Spring)

Steam is the most satisfactory method of cleaning a dirty engine or piece of equipment. If steam is not available, use an approved solvent to wash the engine.

All electrical components and wiring should be protected from the full force of the cleaner spray nozzle.

Checking Mountings (Spring)

Tighten Mounting Bolts and Nuts (As Required)

Engine mounting bolts will occasionally work loose and cause the engine supports and brackets to wear rapidly. Tighten all mounting bolts or nuts and replace any broken or lost bolts or capscrews.

Torque Turbocharger Mounting Nuts (As Required)

Torque all turbocharger mounting capscrews and nuts to be sure that they are holding securely. Torque the mounting bolts and supports so that vibration will be at a minimum. Fig. 2-70.

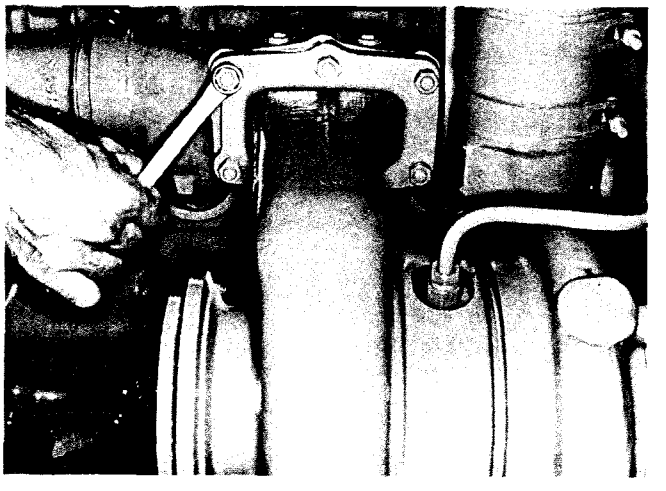


Fig. 2-70, (N11953). Tightening turbocharger mounting nuts

Check Fan and Drive Pulley Mounting (Spring)

Check the fan to be sure it is securely mounted; tighten the capscrews as necessary. Check the fan for wobble or bent blades.

Check the fan hub and crankshaft drive pulley to be sure they are securely mounted. Check the fan hub pulley for looseness or wobble; if necessary, remove

Table 2-22: Thermal Control Settings

Control	Setting With 160 to 175°F [71 to 79°C]		Setting With 170 to 185°F [77 to 85°C]		Setting With 180 to 195°F [82 to 91°C]	
	Open	Close	Open	Close	Open	Close
Thermatic Fan	185°F [85°C]	170°F [77°C]	190°F [88°C]	182° [82°C]		
Shutterstat	180°F [82°C]	172°F [78°C]	185°F [85°C]	177°F [81°C]	195°F [91°C]	187°F [86°C]
Modulating Shutters Open	175°F [79°C]		185°F [85°C]		[91°C]	

the fan pilot hub and tighten the shaft nut. Tighten the fan bracket capscrews.

Check Crankshaft End Clearance (Spring)

The crankshaft of a new or newly rebuilt engine must have end clearance as listed in Table 2-23. A worn engine must not be operated with more than the worn limit end clearance shown in the same table. If the engine is disassembled for repair, install new thrust rings.

Table 2-23: Crankshaft End Clearance — Inch [mm]

Engine Series	New Minimum	New Maximum	Worn Limit
H, NH	0.007	0.017	0.022
NT	[0.18]	[0.43]	[0.56]
V-903	0.005	0.015	0.022
VT-903	[0.13]	[0.38]	[0.56]
V-378, V-504	0.004	0.014	0.022
V-555	[0.10]	[0.36]	[0.56]
V-1710	0.006	0.013	0.018
	[0.15]	[0.33]	[0.46]
KT/KTA19	0.007	0.017	0.022
	[0.18]	[0.43]	[0.56]
KT/KTA38	0.005	0.015	0.022
KTA50	[0.13]	[0.38]	[0.56]

Caution: Do not pry against the outer damper ring.

The check can be made by attaching an indicator to rest against the damper or pulley, while prying against the front cover and inner part of the pulley or damper. End clearance must be present with the engine mounted in the unit and assembled to the transmission or converter.

Check Heat Exchanger Zinc Plugs (Spring)

Check the zinc plugs in the heat exchanger and change if they are badly eroded. Frequency of change depends upon the chemical reaction of raw water circulated through the heat exchanger.

Specifications and Torque

Providing and maintaining an adequate supply of clean, high-quality fuel, lubricating oil, grease and coolant in an engine is one way of ensuring long life and satisfactory performance.

Lubricant, Fuel and Coolant

The Functions of Lubricating Oil

The lubricating oil used in a Cummins engine must be multifunctional. It must perform the primary functions of:

Lubrication by providing a film between the moving parts to reduce wear and friction.

Cooling by serving as a heat transfer media to carry heat away from critical areas.

Sealing by filling in the uneven surfaces in the cylinder wall, valve stems and turbocharger oil seals.

Cleaning by holding contaminants in suspension to prevent a build up of deposits on the engine surfaces.

In addition, it must also provide:

Dampening and cushioning of components that operate under high stress, such as gears and push tubes.

Protection from oxidation and corrosion.

Hydraulic Action for components such as Jacobs Brake and hydraulic controls.

Engine lubricating oil must be changed when it can no longer perform its functions within an engine. Oil does not wear out, but it becomes contaminated to the point that it can no longer satisfactorily protect the engine. Contamination of the oil is a normal result of engine operation. During engine operation a wide variety of contaminants are introduced into the oil. Some of these are:

Byproducts of Engine Combustion — asphaltenes, soot and acids from partially burned fuel.

Acids, varnish and sludge which are formed as a result of the oxidation of the oil as it breaks down or decomposes.

Dirt entering the engine through the combustion air, fuel, while adding or changing lubricating oil.

The oil must have an additive package to combat these contaminates. The package generally consists of:

Detergents/Dispersants which keep insoluble matter in suspension until they are filtered from the oil or are removed with the oil change. This prevents sludge and carbon deposits from forming in the engine.

Inhibitors to maintain the stability of the oil, prevent acids from attacking metal surfaces and prevent rust during the periods the engine is not operating.

Other Additives that enable the oil to lubricate highly loaded areas, prevent scuffing and seizing, control foaming and prevent air retention in the oil.

Oil Performance Classification System

The American Petroleum Institute (API), The American Society for Testing and Materials (ASTM) and the Society of Automotive Engineers (SAE) have jointly developed and maintained a system for classifying lubricating oil by performance categories. The following are brief descriptions of the API categories used in the Cummins oil performance recommendations.

CC (Equivalent to MIL-L-2104B). This category describes oils meeting the requirements of the military specification MIL-L-2104B. These oils provide low temperature protection from sludge and rust and are designed to perform moderately well at high temperature. For moderate-duty service.

CD (Equivalent to Series 3 and MIL-L-45199B). This category described oils meeting the requirements of the Series 3 specification and MIL-L-45199B.

These oils provide protection from deposits and oxidation at high temperature. For severe-duty service.

SC (Equivalent to 1964 MS Oils.) This category describes oils meeting the 1964-1967 requirements of automobile manufacturers. Primarily for use in automobiles, it provides low temperature anti-sludge and anti-rust protection required in a light-duty diesel service such as a stop-and-go operation.

SD (Equivalent to 1968-1971 MS Oils.) This category describes oils meeting the 1964-1967 requirements of automobile manufacturers. Primarily for use in automobiles, it provides low temperature anti-sludge and anti-rust protection required in a light-duty diesel service such as a stop-and-go operation. It may be substituted for SC category.

SE (Equivalent to 1972 MS Oils.) This category describes oils meeting the 1972 requirements of automobile manufacturers. Primarily for use in automobiles, it provides protection from high temperature oxidation and low temperature anti-sludge and anti-rust as required in a light-duty diesel service such as a stop-and-go operation. It may be substituted for SC category.

CB (No equivalent Specification.) These oils were usually referred to as Supplement 1 oils. This category describes oils which met the requirements of the military specification MIL-L-2104A where the diesel engine test was run using fuel with a high sulphur content. For moderate duty service. Oils in this performance category should not be used in Cummins Engines.

The Engine Manufacturers Association (EMA) publishes a book entitled "Lubricating Oils Data Book". Copies may be purchased from the Engine Manufacturers Association, 111 E. Wacker Drive, Chicago, Ill. 60601. This book lists commercially available oils by oil company and brand name with the API performance categories met by each brand.

Oil Performance Recommendations

Cummins Engine Co., Inc., does not recommend the use of any specific brand of engine lubricating oil. Cummins recommends the use of oil designed to meet the following API categories:

CC for use in naturally aspirated engines.

CC/CD for use in turbocharged engines.

CC/SC for use only in engines that operate in a light-duty service including standby and emergency operation.

Dual Categories are used where more protection is required than is provided by a single category. CC/CD and CC/SC categories indicate that the oil is blended to meet the performance level required by each single category.

A **sulfated ash limit** has been placed on lubricating oil for use in Cummins engines. Past experience has shown that oils with a high ash content may produce deposits on valves that can progress to guttering and valve burning. A maximum sulfated ash content of 1.85 mass % is recommended for all oil used in Cummins engines except engines fueled with natural gas. For natural gas engines a sulfated ash range of 0.03 to 0.85 mass % is recommended. Cummins Engine Co., Inc., does not recommend the use of ashless oils for natural gas engines. When the ash content is below .15 mass %, the ash should represent organo-metallic anti-wear additives.

Break-In Oils

Special "break-in" lubricating oils are not recommended for new or rebuilt Cummins engines. Use the same lubricating oils used in normal engine operation.

Viscosity Recommendations

The viscosity of an oil is a measure of its resistance to flow. The Society of Automotive Engineers has classified engine oils in viscosity grades; Table 3-1 shows the viscosity range for these grades. Oils that meet the low temperature (0°F [-18°C] requirement carry a grade designation with a "W" suffix. Oils that meet both the low and high temperature requirements are referred to as multigrade or multiviscosity grade oils.

Multigraded oils are generally produced by adding viscosity index improver additives to retard the thinning effects a low viscosity base oil will experience at engine operating temperatures. Multigraded oils that meet the requirements of the API classifications, are recommended for use in Cummins engines.

Cummins recommends the use of multigraded lubricating oil with the viscosity grades shown in Table 3-2. Table 3-2 shows Cummins viscosity grade recommendations at various ambient temperatures. The only viscosity grades recommended are those shown in this table.

Cummins has found that the use of multigraded lubricating oil improves oil consumption control, improved engine cranking in cold conditions while maintaining lubrication at high operating temperatures and may contribute to improved fuel consumption. Cummins does not recommend the use of single grade lubricating oils. In the event that the recommended multigrade oil is not available, single grade oils may be substituted.

Caution: When single grade oil is used, be sure that the oil will be operating within the temperature ranges shown in Table 3-3.

The primary criterion for selecting an oil viscosity grade is the lowest temperature the oil will experience while in the engine oil sump. Bearing problems can be caused by the lack of lubrication during the cranking and start up of a cold engine when the oil being used is too viscous to flow properly. Change to a lower viscosity grade of oil as the temperature of the oil in the engine oil sump reaches the lower end of the ranges shown in Table 3-2.

Table 3-1: SAE Viscosity Grades for Engines Oils

SAE Viscosity Grade	Viscosity[1] Centipoises at Temperature, °C Maximum	Borderline Pumping Temperature[2] Maximum	Viscosity[3] Centistokes (c5t) at 100°C Min.	Max.
0W	3250 at -30	-35	3.8	
5W	3500 at -25	-30	3.8	
10W	3500 at -20	-25	4.1	
15W	3500 at -15	-20	5.6	
20W	4500 at -15	-15	5.6	
25W	6000 at - 5	-10	9.3	
20	--	--	5.6	9.3
30	--	--	9.3	12.5
40	--	--	12.5	16.3
50	--	--	16.3	21.9

System Effective March 1982, Superceding J300d

1. Cold cranking simulator ASTM D2602
2. Mini-rotary viscometer ASTM D3829
3. ASTM 0445

Table 3-2: Cummins Recommendations for Viscosity Grade vs. Ambient Temperature

SAE Viscosity Grade*	Ambient Temperature*
Recommended	
10W - 30	-13°F to 95°F [-25°C to 35°C]
15W - 40	14°F and above [-10°C and above]
20W - 40	32°F and above [0°C and above]

*SAE-5W mineral oils should not be used.
**For temperatures consistently below -13°F [-25°C] See Table 4.

Table 3-3: Alternate Oil Grades

10W	-13°F to 32°F [-25°C to 0°C]
20W	23°F to 68°F [-5°C to 20°C]
20W-20*	23°F to 68°F [-5°C to 20°C]
20	23°F to 68°F [-5°C to 20°C]
30	39°F and above [4°C and above]
40	50°F and above [10°C and above]

*20W-20 is not considered a multigrade even though it meets two grades.

Synthetic Lubricating Oil

Synthetic oils for use in diesel engines are primarily blended from synthesized hydrocarbons and esters. These base oils are manufactured by chemically reacting lower molecular weight materials to produce a lubricant that has planned predictable properties.

Synthetic oil was developed for use in extreme environment where the ambient temperature may be as low as -50°F [-45°C] and extremely high engine temperatures at up to 400°F [205°C]. Under these extreme conditions petroleum base stock lubricants (mineral oil) do not perform satisfactorily.

Cummins Engine Co., Inc. recommends synthetic lubricating oil for use in Cummins engines operating in areas where the ambient temperature is consistently lower than -13°F [-25°C]. Synthetic lubricating oils may be used at higher ambient temperatures provided they meet the appropriate API Service categories and viscosity grades.

Cummins Engine Co., Inc. recommends the same oil change interval be followed for synthetic lubricating oil as that for petroleum based lubricating oil.

Arctic Operations

For engine operation in areas where the ambient temperature is consistently below -13°F [-25°C] and where there is no provision to keep the engine warm when it is not operating, the lubricating oil should meet the requirements in the following table.

Table 3-4: Arctic Oil Recommendations

Parameter (Test Method)	Specifications
Performance Quality Level	API Classification CC/SC API Classification CC/CD
Viscosity	10,000 mPa•s Max. at -31°F [-35°C] 4.1 mm^2/s Min. at 212°F [100°C]
Pour Point (ASTM D-97)	Min. of 9°F [5°C] Below the Lowest Expected Ambient Temperature
Sulfated Ash Content (ASTM D-874)	1.85% by Weight Maximum

Oil meeting these requirements usually have synthetic base stocks. SAE 5W viscosity grade synthetic oils may be used provided they meet the minimum viscosity requirement at 212°F [100°C].

Grease

Cummins Engine Company, Inc., recommends use of grease meeting the specifications of MIL-G-3545, excluding those of sodium or soda soap thickeners. Contact the lubricant supplier for grease meeting these specifications.

Caution: Do not mix brands of grease. Damage to the bearings may result. Excessive lubrication is as harmful as inadequate lubrication. After lubricating the fan hub, replace both pipe plugs. Use of fittings will allow the lubricant to be thrown out, due to rotative speed.

TEST	TEST PROCEDURE
High-Temperature Performance	
Dropping point, °F.	ASTM D 2265 350 min.
Bearing life, hours at 300°F	*FTM 331
10,000 rpm	600 min.
Low-Temperature Properties	
Torque, GCM	ASTM D 1478
Start at 0°F	15,000 max.
Run at 0°F	5,000 max.
Rust Protection and Water Resistance	
Rust Test	ASTM D 1743 Pass
Water resistance, %	ASTM D 1264 20 max.
Stability	
Oil separation, % 30 hours @ 212°F	*FTM 321 5 max.
Penetration	
Worked	ASTM D 217 250-300
Bomb Test, PSI Drop	ASTM D 942
100 Hours	10 max.
500 Hours	25 max.
Copper, Corrosion	*FTM 5309 Pass
Dirt Count, Particles/cc	*FTM 3005
25 Micron +	5,000 max.
75 Micron +	1,000 max.
125 Micron +	None
Rubber Swell	*FTM 3603 10 max.

* Federal Test Method Standard No. 791a.

Fuel Oil

Cummins diesel engines have been developed to take advantage of the high energy content and generally lower cost of No. 2 Diesel Fuels. Experience has shown that a Cummins diesel engine will also operate satisfactorily on No. 1 fuels or other fuels within the following specifications.

Recommended Fuel Oil Properties:	
Viscosity (ASTM D-445)	1.3 to 5.8 CentiStoke [1.3 to 5.8 mm^2 Per Second] at 104°F [40°C].
Cetane Number (ASTM D-613)	40 minimum except in cold weather or in service with prolonged low loads, a higher cetane number is desirable.
Sulfur Content (ASTM D-129 or 1552)	Not to exceed 1% by weight.
Water and Sediment (ASTM D-1796)	Not to exceed 0.1% by weight.
Carbon Residue (Ransbottom ASTM D-524 or D-189)	Not to exceed 0.25% by weight on 10% residue.
Flash Point (ASTM D-93)	125°F [52°C] minimum. Certain marine registries require higher flash points.
Density (ASTM D-287)	30 to 42°F [-1 to 6°C] A.P.I. at 60°F [16°C] (0.816 to 0.876 Sp. Gr.)
Cloud Point (ASTM D-97)	10°F [-12°C] below lowest temperature expected to operate at.
Active Sulfur-Copper Strip-Corrosion (ASTM D-130)	Not to exceed No. 2 rating after 3 hours at 122°F [50°C].
Ash (ASTM D-482)	Not to exceed 0.02% by weight.
Distillation (ASTM D-86)	The distillation curve should be smooth and continuous. At least 90% of the fuel should evaporate at less than 680°F [360°C]. All of the fuel should evaporate at less than 725°F [385°C].

Coolant

Water should be clean and free of any corrosive chemicals such as chloride, suplhates and acids. It should be kept slightly alkaline with a pH value range of 8.5 to 10.5. Any water which is suitable for drinking can be treated as described in the following paragraphs for use in an engine.

Maintain the Fleetguard DCA Water Filter on the engine. The filter bypasses a small amount of coolant from the system via a filtering and treating element which must be replaced periodically.

1. In summer, with no antifreeze, fill the system with water.
2. In winter, select an antifreeze and use with water as required by temperature.

Note: Some antifreeze also contains anti-leak additives such as inert inorganic fibers, polymer particles or ginger root. These types of antifreeze should not be used in conjunction with the water filter. The filter element will filter out the additives and/or become clogged and ineffective.

3. Install or replace the DCA Water Filter as follows and as recommended in Section 2.

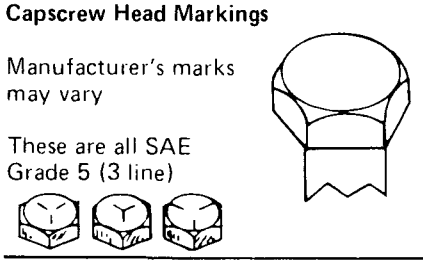
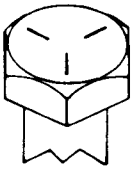
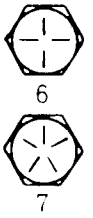
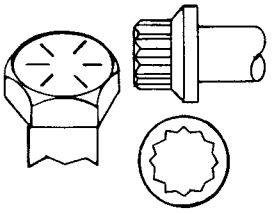
New Engines Going Into Service Equipped With DCA Water Filters

1. New engines shipped from Cummins Engine Company are equipped with water filters containing a DCA precharge element. This element is compatible with plain water or all permanent-type antifreeze except Methoxy Propanol. See Table 3-5 for Methoxy Propanol precharge instructions.
2. At the first "B" Check (oil change period) the DCA precharge element should be changed to DCA Service Element. See Table 3-5.
3. Replace the DCA Service Element at each succeeding "B" Check.
   a. If make-up coolant must be added between element changes, use coolant from a pretreated supply, see "Make-Up Coolant Specifications", Section 2.
   b. Each time the system is drained, precharge per coolant specifications, Table 3-5.
4. The service element may be changed at the "C" Check if 3300858 (DCA-4L) direct chemical additive is added to the cooling system at each "B" Check between service element changes. One bottle of direct additive should be used for every 10 gallons of cooling system capacity. Add one bottle for every 15-gallon capacity if methoxy propanol antifreeze is used in the cooling system.
5. To ensure adequate corrosion protection, have the coolant checked at each third element change or more often. See "Check Engine Coolant". Section 2.

Table 3-5: Spin-on Type DCA Water Filter

Cooling System	Ethylene Glycol Base Antifreeze		Methoxy Propanol Base Antifreeze	
Capacity (U.S. Gallons)	DCA-4L Precharge (P/N 3300858)	Service Element(s)	DCA-4L Precharge (P/N 3300858)	Service Element(s)
0-8	1	WF-2010 (P/N 299080)	1	WF-2011 (P/N 3300721)
9-15	2	WF-2010	2	WF-2011
16-30	5	WF-2010	4	WF-2011
31-60	10	(2) WF-2010	8	(2) WF-2011
35-90 (V-1710)	12	(2) WF-2016 (P/N 299086)	8	(2) WF-2017 (P/N 3300724)
70-90 (KT38)	16	(2) WF-2010	16	(2) WF-2011

Capscrew Markings and Torque Values

Current Usage	Much Used	Much Used	Used at Times	Used at Times
Minimum Tensile Strength PSI MPa	To 1/2–69,000 [476] To 3/4–64,000 [421] To 1–55,000 [379]	To 3/4–120,000 [827] To 1–115,000 [793]	To 5/8–140,000 [965] To 3/4–133,000 [917]	150,000 [1 034]
Quality of Material	**Indeterminate**	**Minimum Commercial**	**Medium Commercial**	**Best Commercial**
SAE Grade Number	**1 or 2**	**5**	**6 or 7**	**8**
Capscrew Head Markings Manufacturer's marks may vary These are all SAE Grade 5 (3 line)				
Capscrew Body Size (Inches) – (Thread)	**Torque Ft-Lbs [N•m]**	**Torque Ft-Lbs [N•m]**	**Torque Ft-Lbs [N•m]**	**Torque Ft-Lbs [N•m]**
1/4 – 20	5 [7]	8 [11]	10 [14]	12 [16]
– 28	6 [8]	10 [14]		14 [19]
5/16 – 18	11 [15]	17 [23]	19 [26]	24 [33]
– 24	13 [18]	19 [26]		27 [37]
3/8 – 16	18 [24]	31 [42]	34 [46]	44 [60]
– 24	20 [27]	35 [47]		49 [66]
7/16 – 14	28 [38]	49 [66]	55 [75]	70 [95]
– 20	30 [41]	55 [75]		78 [106]
1/2 – 13	39 [53]	75 [102]	85 [115]	105 [142]
– 20	41 [56]	85 [115]		120 [163]
9/16 – 12	51 [69]	110 [149]	120 [163]	155 [210]
– 18	55 [75]	120 [163]		170 [231]
5/8 – 11	83 [113]	150 [203]	167 [226]	210 [285]
– 18	95 [129]	170 [231]		240 [325]
3/4 – 10	105 [142]	270 [366]	280 [380]	375 [508]
– 16	115 [156]	295 [400]		420 [569]
7/8 – 9	160 [217]	395 [536]	440 [597]	605 [820]
– 14	175 [237]	435 [590]		675 [915]
1 – 8	235 [319]	590 [800]	660 [895]	910 [1234]
– 14	250 [339]	660 [895]		990 [1342]

Notes:

1. Always use the torque values listed above when specific torque values are not available.
2. Do not use above values in place of those specified in other sections of this manual; special attention should be observed when using SAE Grade 6, 7 and 8 capscrews.
3. The above is based on use of clean, dry threads.
4. Reduce torque by 10% when engine oil is used as a lubricant.
5. Reduce torque by 20% if new plated capscrews are used.
6. Capscrews threaded into aluminum may require reductions in torque of 30% or more of Grade 5 capscrews torque and must attain two capscrew diameters of thread engagement.

Caution: If replacement capscrews are of a higher grade than originally supplied, adhere to torque specifications for that placement.

Troubleshooting

Troubleshooting is an organized study of the problem and a planned method of procedure for investigation and correction of the difficulty. The chart on the following page includes some of the problems that an operator may encounter during the service life of a Cummins diesel engine.

Cummins Diesel Engines

The chart does not give all the answers for correction of the problems listed, but it is meant to stimulate a train of thought and indicate a work procedure directed toward the source of trouble. To use the troubleshooting chart, find the complaint at the top of the chart; then follow down that column until you come to a black dot. Refer to the left of the dot for the possible cause.

Think Before Acting

Study the problem thoroughly. Ask these questions:

1. What were the warning signs preceding the trouble?
2. What previous repair and maintenance work has been done?
3. Has similar trouble occurred before?
4. If the engine still runs, is it safe to continue running it to make further checks?

Do Easiest Things First

Most troubles are simple and easily corrected; examples are "low-power" complaints caused by loose throttle linkage or dirty fuel filters, "excessive lube oil consumption" caused by leaking gaskets or connections, etc.

Always check the easiest and obvious things first. Following this simple rule will save time and trouble.

Double-Check Before Beginning Disassembly Operations

The source of most engine troubles can be traced not to one part alone but to the relationship of one part with another. For instance, excessive fuel consumption may not be due to an incorrectly adjusted fuel pump, but instead to a clogged air cleaner or possibly a restricted exhaust passage, causing excessive back pressure. Too often, engines are completely disassembled in search of the cause of a certain complaint and all evidence is destroyed during diassembly operations. Check again to be sure an easy solution to the problem has not been overlooked.

Find And Correct Basic Cause of Trouble

After a mechanical failure has been corrected, be sure to locate and correct the cause of the trouble so the same failure will not be repeated. A complaint of "sticking injector plungers" is corrected by replacing the faulty injectors, but something caused the plungers to stick. The cause may be improper injector adjustment or more often, water in the fuel.

Tools and Procedures To Correct A Complaint

Tools and procedures to correct the complaints found in this Troubleshooting section are available from Cummins distributors and dealers. A list of publications, by bulletin numbers, is included in the back of this manual in the form of a purchase order. This list includes all engine model shop and engine repair and rebuild manuals.

AFC Fuel Pump Adjustments

All AFC fuel pump adjustments are specified for calibration on a fuel pump test stand and not to be made on the engine. Contact your nearest authorized Cummins distributor to perform maintenance, if required.

Trouble Shooting
Cummins Engines

CAUSES	Hard Starting or Failure to Start	Engine Misses	Excessive Black Smoke at Idle	Excessive White Smoke at Idle	Excessive Smoke Under Load	Excessive-Acceleration Smoke	Low Power or Loss of Power	Cannot Reach Governed RPM	Low Air Output	Sluggish Engine Acceleration	Excessive Fuel Consumption	Poor Deceleration	Erratic Idle Speed	Engine Dies	Surging at Governed RPM	Excessive Oil Consumption	Crankcase Sludge	Dilution	Low Oil Pressure	Coolant Temperature too Low	Coolant Temperature too High	Oil Temperature too High	Piston, Liner and Ring Wear	Wear of Bearings and Journals	Worn Valves and Guides	Fuel Knocks (Combustion Noises)	Mechanical Knocks	Gear Train Whine	Engine Vibration	Excessive Noise	Excessive Crankcase Pressure
Air System																															
Restricted Air Intake				●		●	●		●		●																				
High Exhaust Back Pressure				●		●	●		●		●																				
Thin Air in Hot Weather or High Altitude				●		●	●		●																						
Air Leaks Between Cleaner and Engine						●	●		●														●	●	●						
Dirty Turbocharger Compressor				●		●	●		●		●																				
Improper Use of Starter Aid/Air Temp.	●		●																				●	●		●					
Fuel System																															
Stuck Drain Valve			●	●		●					●	●														●					
Out of Fuel or Fuel Shut Off Closed	●												●																		
Poor Quality Fuel/Grade Fuel	●	●		●	●		●				●		●	●			●									●					
Air Leaks in Suction Lines	●	●					●			●		●	●	●	●											●					
Restricted Fuel Lines	●	●	●	●		●	●			●	●	●																			
External or Internal Fuel Leaks							●				●			●			●														
Plugged Injector Spray Holes			●	●		●	●				●																				
Broken Fuel Pump Drive Shaft	●													●																	
Scored Gear Pump or Worn Gears	●						●																								
Wrong Injector Cups			●	●	●	●	●				●																				
Cracked Injector Body or Cup	●	●	●	●	●	●	●				●						●									●					
Damaged Injector O-Ring		●					●				●	●					●														
Excessive Injector Check Ball Leakage												●																			
Throttle Linkage or Adjustment							●	●				●	●	●	●																
Incorrectly Assembled Idle Springs												●	●	●																	
Incorrectly Assembled Governor Weights													●	●	●																
High-Speed Governor Set Too Low							●	●																							
Water in Fuel and/or Waxing	●	●						●		●			●	●																	
AFC Calibration Incorrect	●					●	●			●																●					
Damaged/Worn AFC Plunger Seal/Barrel										●																					
Fuel Pump Calibration Incorrect					●	●	●	●		●	●	●	●	●												●					
Injector Flow Incorrect			●		●	●	●	●		●	●																				
Plugged ASA							●	●		●																					
ASA/AFC Air Leak, Bellows							●	●		●																					
ASA Reverse Flow Valve Stuck Open						●																				●					
Lubricating System																															
External and Internal Oil Leaks																●		●													
Dirty Oil Filter																●	●						●	●							
Faulty Cylinder Oil Control			●													●	●														
Clogged Oil Drillings																		●					●	●	●						
Oil Suction Line Restriction																		●					●	●	●						
Faulty Oil Pressure Regulator																		●													
Crankcase Low or Out of Oil																		●			●	●	●	●	●						
Wrong Grade Oil for Weather Conditions																●		●					●	●							
Oil Level Too High							●				●					●						●									
Cooling System																															
Insufficient Coolant/Worn Pump																		●			●	●									
Faulty Thermostats																	●				●	●									
Damaged Hose/Loose Belts																		●			●	●									
Radiator Shutters Stuck Open				●													●														
Internal Water Leaks																		●													
Clogged Oil Cooler or Water Passages																			●			●									
Exterior Leaks/Air in System																			●		●	●									
Low Coolant Capacity/Dirty Radiator																			●		●	●									
Coolant Temperature Low				●													●	●								●					
Operation and Maintenance Practices																															
Dirty Filters/Screens/Breather						●	●											●					●	●	●						
Long Idle Periods	●	●	●	●	●	●											●	●		●											
Engine Overloaded						●	●				●												●	●		●					
Oil Needs Changing																	●						●	●	●						
Engine Exterior Dirty																															
Mechanical Adjustments or Repair																															
Gasket Blow-By or Leakage	●	●	●		●	●	●	●		●	●	●	●	●	●	●		●	●								●	●			
Faulty Damper/Flywheel Balance																											●		●		
Valve Leakage/Adjustment Bad	●	●			●	●	●																				●	●			
Broken or Worn Piston Rings	●	●	●		●		●									●			●			●					●			●	
Incorrect Bearing Clearances							●				●							●					●				●				
Excessive Crankshaft End Clearance																							●				●				
Broken Cam Lobes						●																									
Main Bearing Bore Out of Alignment																							●				●				
Engine Due for Overhaul	●		●		●		●				●					●		●				●	●	●			●			●	
Damaged Main or Rod Bearings																		●					●				●				
Geartrain Backlash/Broken Tooth																											●	●	●		
Misalignment-Engine to Driven Unit											●												●								
Loose Mounting Bolts/Head Capscrew																											●		●		
Incorrect Valve and Injection Timing	●			●	●	●	●				●																●			●	
Worn or Scored Liners or Pistons			●			●	●									●						●					●			●	●
Injectors Need Adjustment		●	●	●	●	●	●	●		●	●																●				
Broken/Bent Push Rod or Cam Box						●																					●			●	
Mechanical Variable Timing System																															
Faulty Rail Pressure Switch (Open)			●	●		●																									
Faulty Rail Pressure Switch (Closed)							●																						●		
Faulty Solenoid			●	●		●																									
Damaged Piston and Rack Seals			●	●		●																								●	
Insufficient Torque on Actuator Capscrew			●	●		●																									
Solenoid Orifice Plugged							●																								
System Stick in Retard			●	●		●																									
Broken or Disconnected MVT Wire				●																											
Loose Cam Follower Shaft Eccentric		●		●																											
System Stuck in Advance							●																				●		●		
Maintenance																															
Plugged Airline to MVT Activator			●	●		●																									
Plugged Exhaust From MVT Activator							●																								

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CUMMINS SERVICE PUBLICATIONS

The following Cummins Service Publications related to Operation and Maintenance can be purchased from any Cummins distributor or Cummins dealer.

Many publications have been translated into other languages. Cummins distributors or Cummins dealers have information on which publications are available in languages other than English.

For information about any Cummins publications, contact your local Cummins distributor or dealer.

BULLETIN NUMBER	OPERATION AND MAINTENANCE MANUALS
3379137	Automotive Operation and Maintenance Manual — United States and Canada
3379141	Automotive Operation and Maintenance Manual — International
3379052	Construction/Industrial Operation and Maintenance Manual
3379075	Marine Operation and Maintenance Manual
	ENGINE SHOP MANUALS
3379069	V/VT-378, V/VT-504, V/VT-555 C.I.D. Engine Shop Manual
3379067	H, NH-672, 743 Engine Shop Manual
3379076	NH/NT Engine Shop Manual
3379057	V/VT-903 C.I.D. Engine Shop Manual
3379120	V/VT/VTA-1710 C.I.D. Engine Shop Manual
3379078	KT/KTA19-C Engine Shop Manual
3379053	KT/KTA38-C and KTA50-C Engine Shop Manual
3379539	N/NT/NTA-855 Series GS/GC (Small Cam)
3379558	KT/KTA19 Series GS/GC
3379559	KT/KTA19 Series G
3379566	V/VT/VTA-1710 Series G
3379567	V-1710 Series GS/GC
3379570	KT/KTA38-GS/GC
3379574	NT/NTA-855-G
3379578	KT/KTA38-G
3379592	KTA50
3379593	KTA50-GS/GC
3379597	NTA-855 Series-GS/GC Big Cam
3379598	NTA-855 Series-G Big Cam

BULLETIN	COMPONENT REBUILD MANUALS
3379084	Fuel Pump PT (type G and R) Rebuild and Calibration Instruction
3379071	Injectors PT (all types) Rebuild
3379091	Turbochargers Component Shop Manual (T-18A, T-35, T-46, T-50, VT-50 and ST-50 Models)
3379056	Air Equipment Component Shop Manual
3379117	Water Pump Rebuild Manual
3379092	Crankshaft Inspection and Reconditioning
3379461	Turbocharger Rebuild Manual (H2-B/HC3-1 Models)
	PARTS CATALOGS
3379528	NH-855 (5 1/2 inch bore) Parts Catalog
3379577	V-378 Parts Catalog
3379587	V/VT-378 Big Cam Parts Catalog
3379549	V-504 Parts Catalog
3379586	V/VT-504 Big Cam Parts Catalog
3379535	V/VT-555 Parts Catalog
3379588	V/VT-555 Big Cam Parts Catalog
3379532	V/VT-903 Parts Catalog
3379591	NT-855 Small Cam Parts Catalog
3379599	NT-855 Big Cam Parts Catalog
3379632	KT/KTA19-C Parts Catalog
3379518	KT/KTA38-C Parts Catalog
3379581	KTA50-C Parts Catalog
3379540	V/VT/VTA-1710 Parts Catalog
3379508	N-855-F, NT-855-F1 and F2 Parts Catalog
3379534	V-378, V-504, F1 and F2 Parts Catalog
3379543	VT-1710-IF Parts Catalog
	SERVICE TOOL PUBLICATIONS
3377969	Service Tool Catalog (Pocket Size)
3377971	Service Tool Catalog (Full Size)
	SERVICE BULLETINS
3379348	Troubleshooting Cooling Systems for Cold Engine Operating Temperature
3379000	Air for Your Engine
3379001	Fuel for Cummins Diesel Engines
3379002	Lubricating Oil for Cummins Engines
3379003	Capscrew and Nut Torque Values — In-Line Engines
3379007	Principles of Troubleshooting
3379009	Engine Operation in Cold Weather
3379011	Injector Plunger and Valve Adjustment
3379012	The Cooling System
3379019	Engine Storage
3379022	Governors Used on Cummins Engines
3379023	Capscrew and Nut Torque Values — V-Engines
3379024	Battery and Cable Specifications