

Product: TRACK LOADER

Model: 943 TRACK LOADER 31Y

Configuration: 943 TRACK LOADER / HIGH DRIVE / 31Y00001-01333 (MACHINE) POWERED BY 3204 ENGINE

## Disassembly and Assembly 3204 VEHICULAR ENGINE FOR 943 & 953 TRACK-TYPE LOADERS

Media Number -SEN4214-00

Publication Date -01/04/1985

Date Updated -11/10/2001

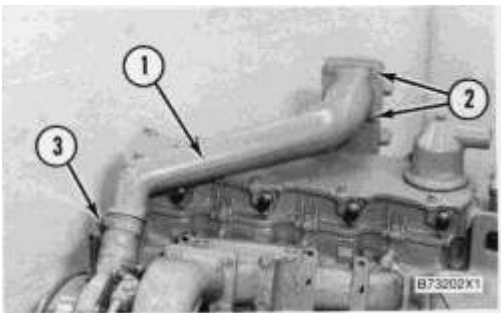
### Valve Cover (Later)

SMCS - 1107-012; 1107-011

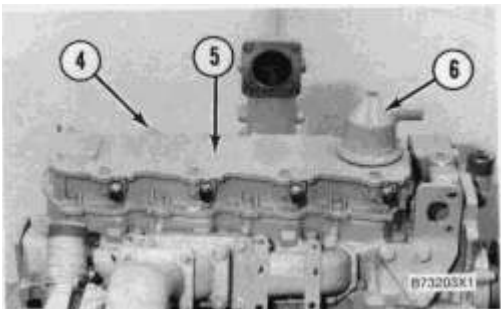
### Remove Valve Cover (Later)

START BY:

a. remove fuel injection lines

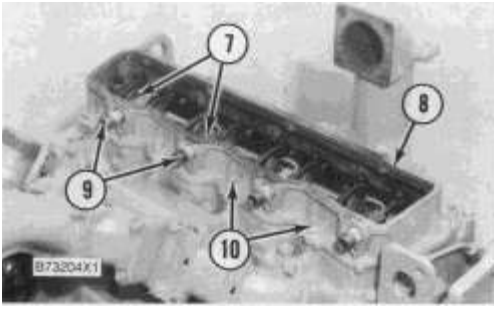


1. Loosen hose clamp (3), and remove four bolts (2) and pipe assembly (1).



2. Remove bolts (4) and valve cover (5).

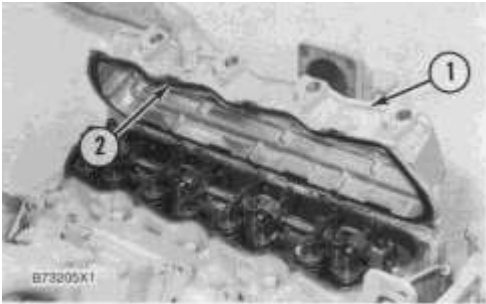
3. Remove bolt and breather assembly (6).



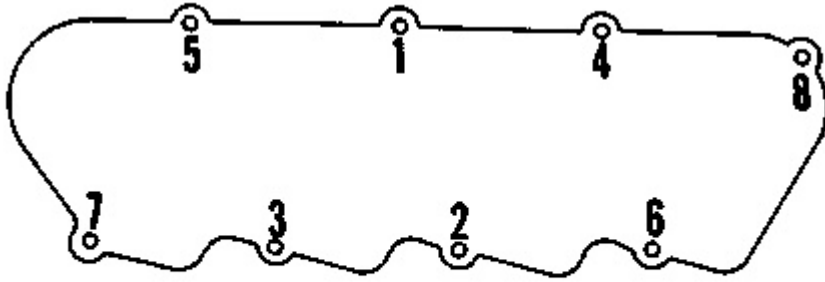
4. Disconnect nuts (7) from the fuel line adapter assemblies.
5. Remove fuel line adapter (9). Remove bolts (10) and valve cover base (8).

## Install Valve Cover (Later)

1. Inspect gaskets and seals. Make a replacement if needed.

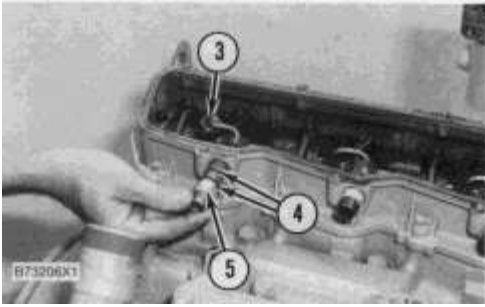


2. Install gasket (2) and valve cover base (1) on the cylinder head.

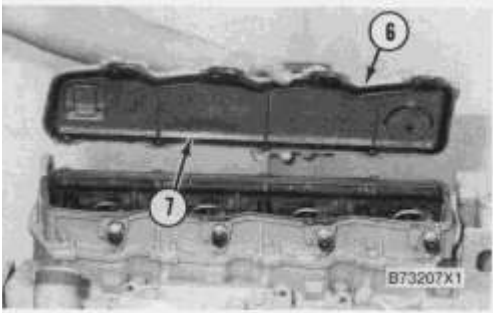


**B86585X1**

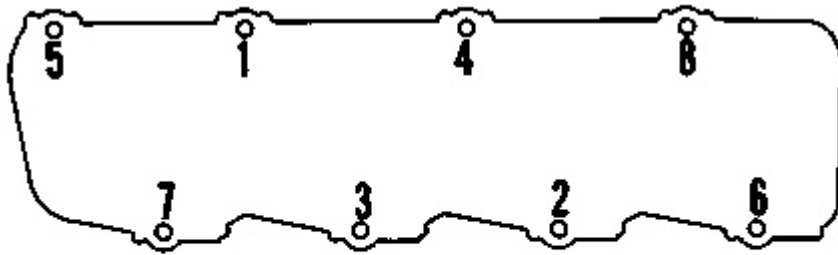
3. Tighten the bolts in the valve cover base in number sequence to a torque of  $14 \pm 3$  N·m ( $10 \pm 2$  lb.ft.).



4. Put engine oil in the base adapter bores and on the seals (4). Install adapters (5). Connect fuel injection line nuts (3). Tighten fuel line nuts to a torque of  $41 \pm 7 \text{ N}\cdot\text{m}$  ( $30 \pm 5 \text{ lb}\cdot\text{ft}$ ).

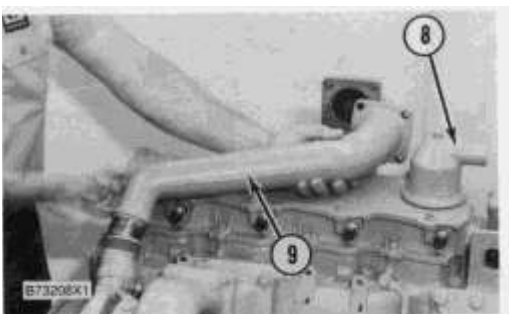


5. Install gasket (7) and valve cover (6).



**B86584X1**

6. Tighten the bolts in the valve cover in number sequence to a torque of  $14 \pm 3 \text{ N}\cdot\text{m}$  ( $10 \pm 2 \text{ lb}\cdot\text{ft}$ ).



7. Install breather (8), and tighten bolt to a torque of  $14 \pm 3 \text{ N}\cdot\text{m}$  ( $10 \pm 2 \text{ lb}\cdot\text{ft}$ ).

8. Install pipe assembly (9).

END BY:

**a.** install fuel injection lines

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Product: TRACK LOADER

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## Disassembly and Assembly

### 3204 VEHICULAR ENGINE FOR 943 & 953 TRACK-TYPE LOADERS

Media Number -SEN4214-00

Publication Date -01/04/1985

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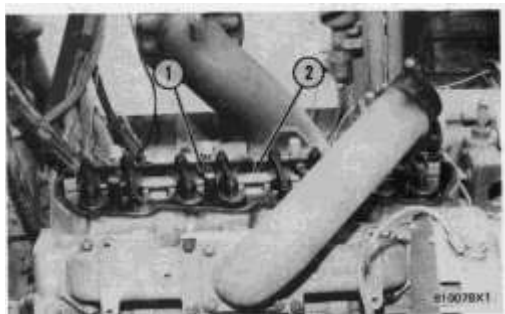
## Rocker Shaft Assembly And Push Rods

SMCS - 1102; 1208-011; 1208-012

### Remove Rocker Shaft Assembly And Push Rods

START BY:

- a. remove valve cover (earlier or later)



1. Remove bolts (1) from rocker shaft assembly (2), and remove the rocker shaft assembly from the head.



2. Remove push rods (3).

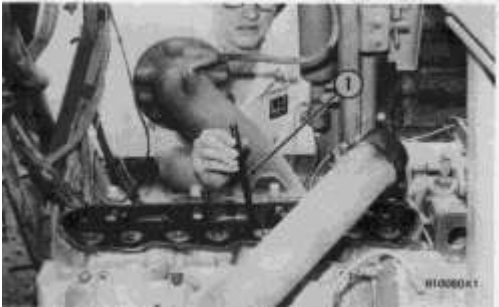
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### NOTICE

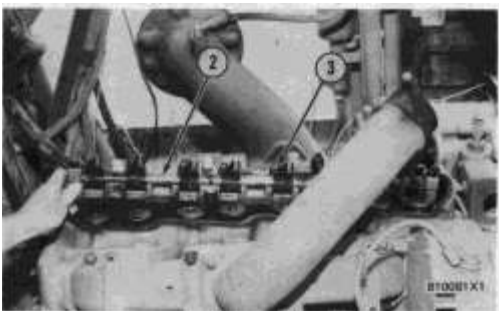
**Put identification marks on the push rods as to their location in the engine.**

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## Install Rocker Shaft Assembly And Push Rods



1. Install push rods (1) in their original location in the engine. New push rods can be mixed.



2. Put rocker shaft assembly (2) in position on the head. Install the bolts that hold the rocker shaft assembly in position.

3. Make an adjustment until the intake valve clearance is 0.38 mm (.015 in.) and the exhaust valve clearance is 0.64 mm (.025 in.). Tighten nuts (3) to a torque of  $32.5 \pm 6.8 \text{ N}\cdot\text{m}$  ( $24 \pm 5 \text{ lb}\cdot\text{ft}$ ).

END BY:

a. install valve cover (earlier or later)

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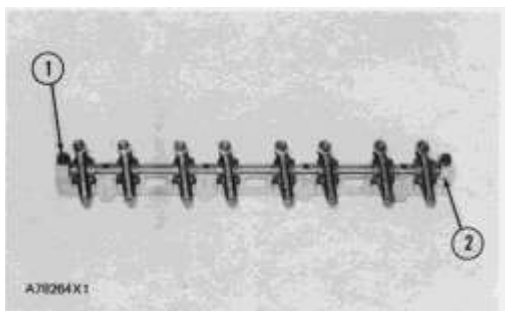
## Rocker Shaft Assembly

SMCS - 1102-016; 1102-015

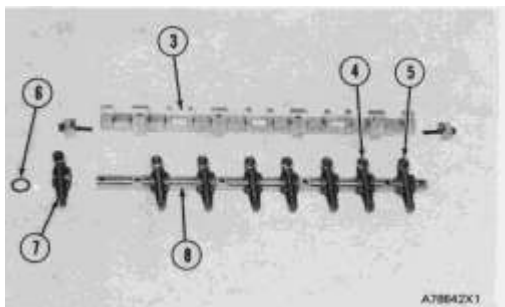
### Disassemble Rocker Shaft Assembly

START BY:

- a. remove rocker shaft assembly and push rods



1. Remove bolts (1) and washers (2) from the bracket.



2. Remove shaft (8) from bracket (3).
3. Remove washers (6) and rocker arm assemblies (7) from shaft (8).
4. Remove adjustment screws (4) and nuts (5) from the rocker arm assemblies.
5. Inspect the ball end of the adjusting screw and valve contact surface of the rocker arm for wear, and make a replacement if needed.

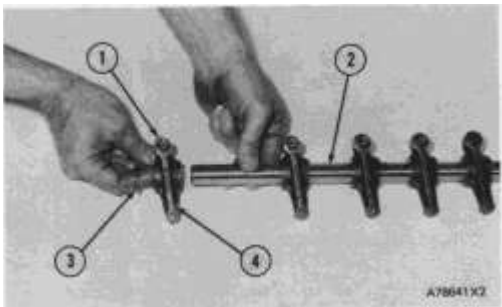
## Assemble Rocker Shaft Assembly

1. Make sure the oil holes in the rocker arm assemblies, rocker shaft and bracket are clean and free of all dirt and foreign material. Be sure the plugs are installed in both ends of the rocker shaft.

2. Measure the bore of the bushing in each of the rocker arms. The bore must be  $21.852 \pm 0.020$  mm (.8603  $\pm$  .0008 in.). The maximum permissible bore is 21.920 mm (.8630 in.).

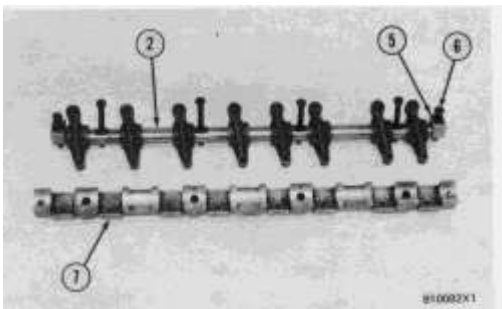
**NOTE:** Make a replacement of the arm and bushing as a unit if the bore is not correct. The arms and bushings cannot be ordered separately.

3. Measure the diameter of the shaft at each of the rocker arm locations. The diameter must be 21.793 to 21.814 mm (.8580 to .8588 in.). The minimum permissible diameter is 21.768 mm (.8570 in.).



4. Install the screws and nuts (1) into rocker arm assemblies (4). Turn the screws until they are 11.2 mm (.44 in.) below the bottom of the rocker arm assemblies.

5. Install the rocker arm assemblies and eight washers (3) on shaft (2) as shown.



6. Put shaft (2) and the rocker arm assemblies in position on bracket (7) with the adjustment screws on the opposite side as the oil hole on the bottom of the bracket.

7. Make sure the flat surfaces on shaft (2) are turned up. Install washers (5), the washers and bolts (6). Tighten the bolts to a torque of  $24 \pm 7$  N·m ( $18 \pm 5$  lb.ft.).

END BY:

a. install rocker shaft assembly and push rods

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## Cylinder Head Assembly

SMCS - 1100-012; 1100-015; 1100-016; 1100-011

### Remove Cylinder Head Assembly

Tools Needed		A
5P9736	Link Bracket	1

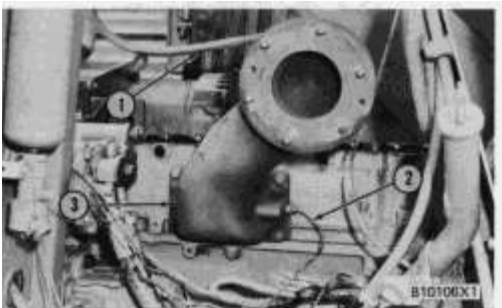
START BY:

- a. tilt cab (24° position) \*
- b. remove air cleaner housing
- c. remove muffler
- d. remove fuel injection nozzles
- e. remove exhaust manifold

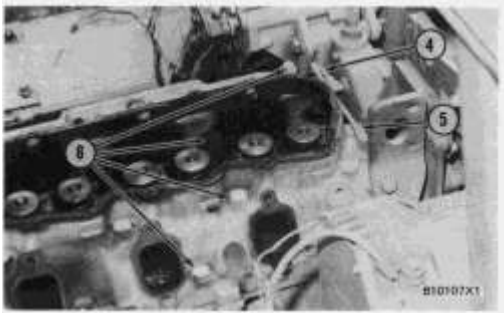
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\*This operation is in the Vehicle Systems Disassembly And Assembly section.

1. Fasten a hoist to the hood. Remove four bolts and the clip on the top coolant tube; then remove the hood. Weight is 25 kg (55 lb.).



2. Disconnect hose (1) for the air cleaner indicator and from air inlet elbow (3). Disconnect line (2) for the ether starting aid from air inlet elbow (3).
3. Remove air inlet elbow (3) from the cylinder head assembly.

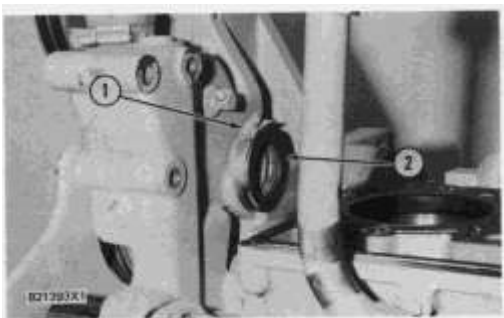


4. Remove tube assembly (4). Loosen hose clamp (5) between the cylinder head assembly and timing gear cover.
5. Remove 22 bolts (6) that hold the cylinder head assembly to the cylinder block. Fasten tool (A) and a hoist to the cylinder head assembly. Remove the cylinder head assembly. Weight is 54 kg (120 lb.).

## Install Cylinder Head Assembly

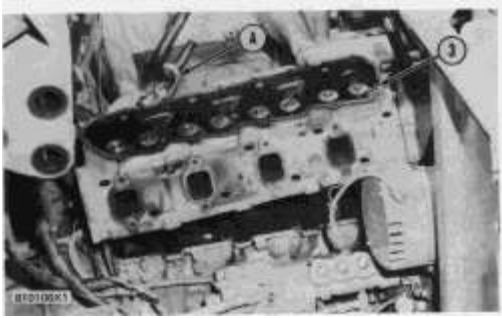
Tools Needed		A
5P9736	Link Bracket	1

1. Clean the surfaces of the cylinder head assembly and the cylinder block that make contact with each other. Check the cylinder head and cylinder block deck for flatness. The overall flatness for both the cylinder block and cylinder head should be 0.15 mm (.006 in.) or less. The maximum allowable for any 152.4 mm (6.00 in.) span is 0.08 mm (.003 in.). Make sure the surfaces are clean and dry. Install a new dry gasket on the cylinder block.

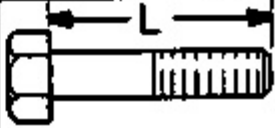


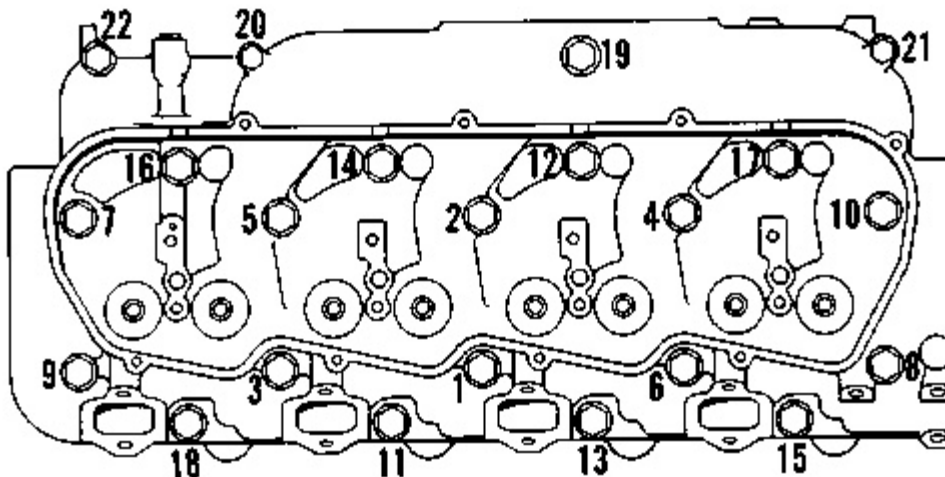
2. Inspect the condition of water ferrule and seal (2). Make a replacement if needed. Put water ferrule and seal (2) in position with the adjusting screw of hose clamp (1) toward the top and approximately 45° to the right of vertical as seen from the front of the engine.
3. Make sure the seal is installed all the way in the counterbore.

**NOTE:** If the plugs in the oil passages in the cylinder head were removed, put 5P3413 Pipe Sealant with Teflon on the threads, and install the plugs in the head.



4. Fasten tool (A) and a hoist to the cylinder head assembly. Put cylinder head assembly (3) in position on the cylinder block.
5. Put 5P3931 Anti-Seize Compound on all the threads of the head bolts.

A77829X2 HEAD BOLT LOCATION CHART				
Dia.	Part No.	Location (Bolt No.)	Bolt Length "L"	
			in.	mm
1/2"	1D4572	5, 2, 4, 10	5.50	139.7
	2H6488	7, 9, 3, 1, 6, 8	5.00	127.0
	L1329	16, 14, 12, 17	3.00	76.2
	2B947	18, 11, 13, 15	2.25	57.2
3/8"	5B9603	20, 21	5.00	127.0
	1A5964	19	4.50	114.3
	S1571	22	1.75	44.5

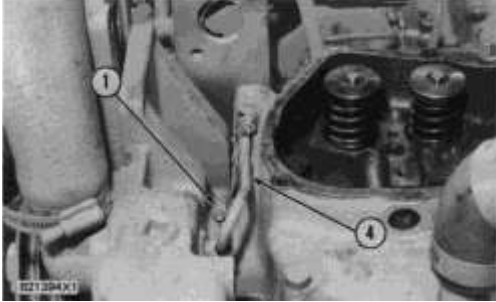


A50900X4

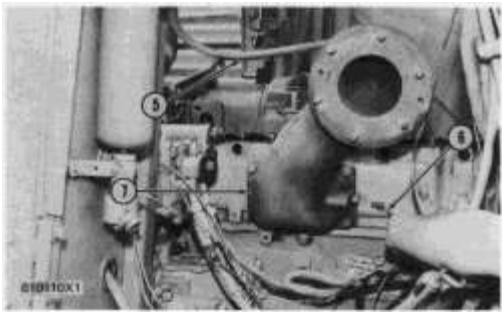
Head Bolt Location And Tightening Sequence

6. Install the head bolts, and tighten as follows:

- a. Tighten bolts (1) to (18) by number sequence to a torque of  $80 \pm 14 \text{ N}\cdot\text{m}$  ( $60 \pm 10 \text{ lb}\cdot\text{ft.}$ ).
- b. Tighten bolts (1) to (18) by number sequence to a torque of  $150 \pm 7 \text{ N}\cdot\text{m}$  ( $110 \pm 5 \text{ lb}\cdot\text{ft.}$ ).
- c. Tighten bolts (1) to (18) again by number sequence to a torque of  $150 \pm 7 \text{ N}\cdot\text{m}$  ( $110 \pm 5 \text{ lb}\cdot\text{ft.}$ ).
- d. Tighten bolts (19) to (22) by number sequence to a torque of  $43 \pm 7 \text{ N}\cdot\text{m}$  ( $32 \pm \text{lb}\cdot\text{ft.}$ ).



- 7. Tighten hose clamp (1).
- 8. Install tube assembly (4).



- 9. Install the gasket and air inlet elbow (7) on the cylinder head assembly.
- 10. Connect hose (5) for the air cleaner indicator to air inlet elbow (7). Connect line (6) for the ether starting aid to the air inlet elbow.
- 11. Fasten a hoist to the hood, and put the hood in position on the machine. Weight of the hood is 25 kg (55 lb.). Install the four bolts that hold the hood in place. Install the clip on the top coolant tube.

END BY:

- a. install muffler
- b. install exhaust manifold
- c. install air cleaner housing
- d. install fuel injection nozzles
- e. lower cab \*

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\*This operation is in the Vehicle Systems Disassembly And Assembly section.

# Disassemble Cylinder Head Assembly

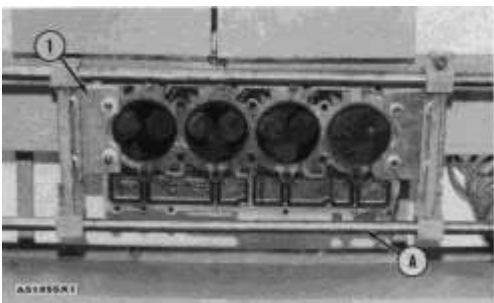
Tools Needed		A	B	C	D	E	F	G
FT806	Cylinder Head Repair Bench	1						
	Adapter Plate*	2						
8S2263	Valve Spring Tester		1					
5S1330	Pneumatic Valve Spring Compressor			1				
8S7170	Valve Seat Insert Puller Group				1			
5P3536	Valve Guide Gauge Group					1		
6T7058	Valve Guide Gauge Group						1	
6V7097	Exhaust Valve Seat Gauge							1
6V7098	Valve Seat Gauge							1

\*Part of FT1670 Cylinder Head Bench.

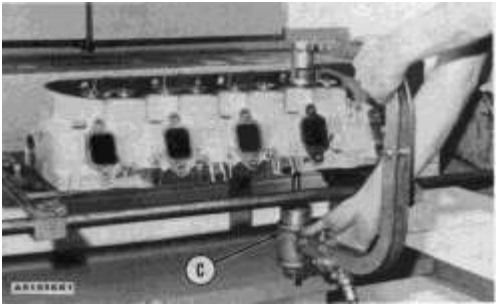
START BY:

a. remove cylinder head assembly

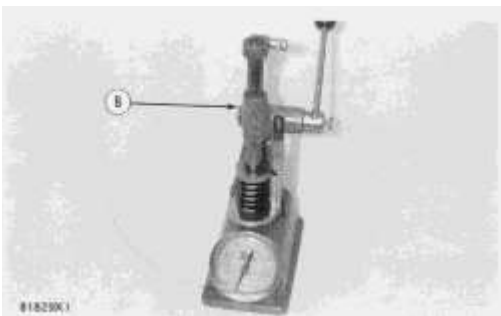
**NOTE:** New cylinder head components are effective with the 943 and 953 Loaders with engine serial numbers 10X2188-2205, 10X2210 and 45V32874. New valve springs, retainers, washers and fuel nozzle clamp assemblies are available as a direct replacement for the former components. All new parts must be used together when a replacement is made of the former parts. It is recommended to change all the retainers, valve springs, fuel nozzle clamp assemblies, washers and spacers on a cylinder head or engine at the same time. Do not mix new and used components on the same cylinder head or engine.



1. Fasten a hoist, and put the cylinder head assembly in position on tool (A). Use adapter plates (1) from tooling (A) to hold the head in place.

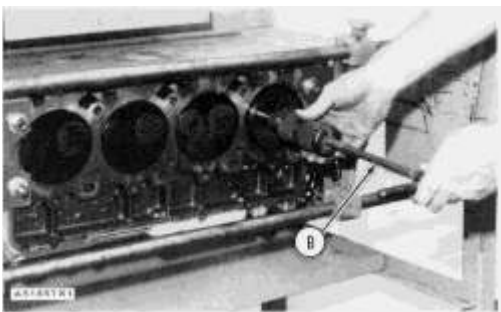


2. Put the valves under compression with tool (C).
3. Remove the locks from the valves.
4. Remove tool (C), retainer, spring, washer and valve from the cylinder head. Put identification marks on the valve as to its location in the cylinder head.



5. There is an earlier and later valve spring used. The earlier spring, a 9N3617, has a 4.877 mm (.1920 in.) wire diameter and an outside coil diameter of 36.6 mm (1.44 in.). The later spring, a 1W4259, has a 5.232 mm (.2059 in.) wire diameter and an outside coil diameter of 39.6 mm (1.56 in.). Check the valve spring force with tool (B). The minimum spring force of a 9N3617 Spring (used) is 191 N (43 lb.) at a length (height) of 42.04 mm (1.655 in.). The spring force of a new 9N3617 Spring is  $222 \pm 22$  N ( $50 \pm 5$  lb.). The length (height) is the same as the used spring. The minimum spring force of a used 1W4259 Spring is 187 N (42 lb.) at a length height of 45.8 mm (1.80 in.). The spring force of a new 1W4259 Spring is  $216 \pm 22$  N ( $49 \pm 5$  lb.) when the height is the same as above. For additional information, see Guidelines For Reusable Parts - Valve And Valve Springs Specifications, Form No. 8034-03. Also see Guideline For Reusable Parts And Salvage Operation, Form No. SEBF8002.

6. Do Steps 2 through 5 for the remainder of the valves.



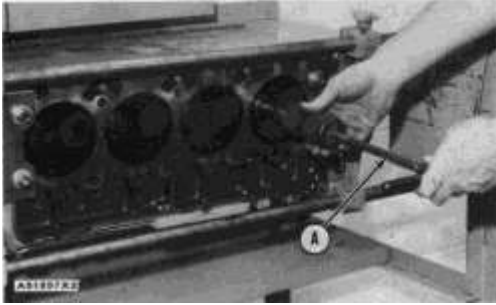
7. Remove the valve seat inserts with tooling (D).
8. Inspect valve guides for wear with tooling (E) or (F). Measure both ends of the valve guide. The diameter of a new valve guide bore is  $9.512 \pm .013$  mm ( $.3745 \pm .0005$  in.). The maximum

permissible diameter is 9.550 mm (.3760 in.). Any valve guide worn beyond the maximum permissible tolerance must be replaced or knurled.

## Assemble Cylinder Head Assembly

Tools Needed		A	B	C	D
8S7170	Valve Seat Insert Puller Group	1			
5S1322	Valve Keeper Inserter		1		
5P1330	Valve Spring Compressor			1	
6V7097	Exhaust Valve Seat Gauge				1
6V7098	Valve Seat Gauge				1

1. Clean and remove burrs and all foreign material from the valve seat bores.



2. Lower the temperature of the valve seat inserts, and install them with tooling (A).

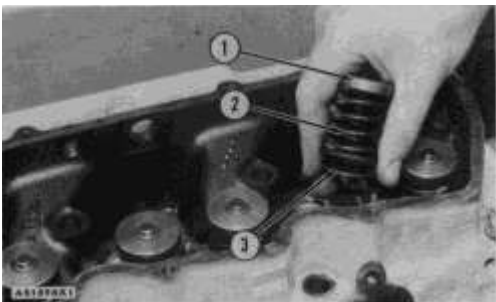
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### NOTICE

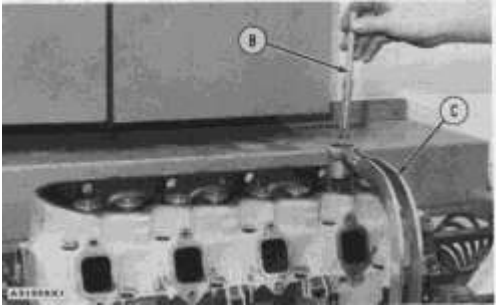
**Do not make the diameter of the extractor [part of tooling (A)] in valve seat insert larger when the insert is installed in the cylinder head.**

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3. Grind the valve inserts according to specifications given in Engine Specifications. Use tooling (D) and Special Instructions, Form No. SMHS8319 to measure the valve seat height.

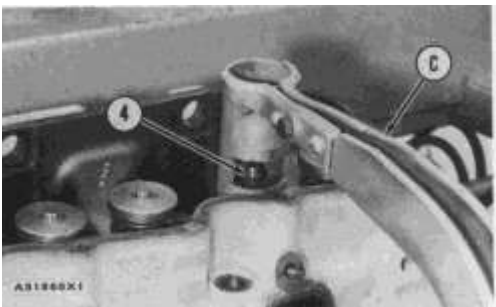


4. Put clean engine oil on the valve stem. Install the valve, washer (3), spring (2) and retainer (1) in the cylinder head.



5. Put the valve spring under compression with tool (C).

6. Install the locks on the valve stem with tool (B).



**WARNING**

**Make sure locks (4) are in their correct position on the valve. The locks can be thrown from the valve when tool (C) is released if the locks are not in their correct position on the valve.**

7. Remove tool (C) and hit the valve with a rubber hammer to be sure the locks are in their correct position.

8. Do Steps 4 through 7 for the remainder of the valves.

END BY:

a. install cylinder head assembly

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### 3204 VEHICULAR ENGINE FOR 943 & 953 TRACK-TYPE LOADERS

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## Valve Lifters

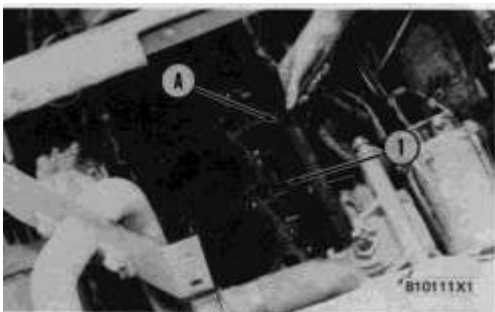
SMCS - 1209-010

### Remove And Install Valve Lifters

Tools Needed		A
8S2293	Magnet	1

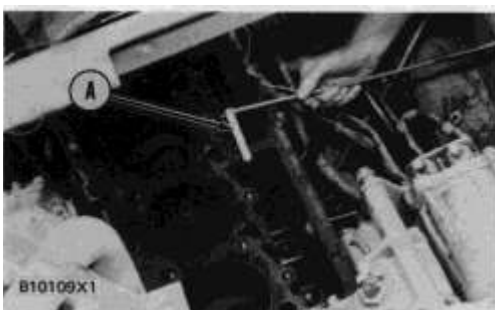
START BY:

a. remove cylinder head assembly



1. Remove valve lifters (1) from the cylinder block with tool (A). Put identification marks on the lifters as to their location in the cylinder block.

2. Put 8T2998 Lubricant on the lifter face that makes contact with the camshaft.



**3.** Install the valve lifters in the cylinder block with tool (A). Install the lifters in their original locations. New valve lifters can be mixed.

END BY:

**a.** install cylinder head assembly

---

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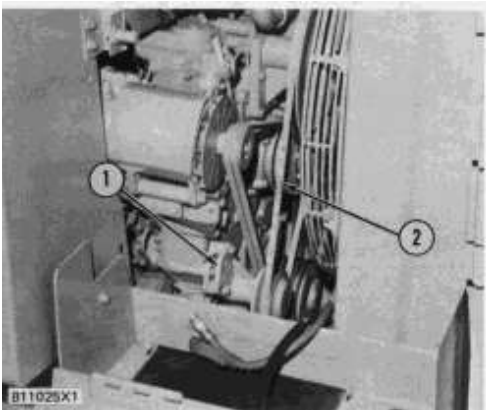
Date Updated -11/10/2001

### Fan

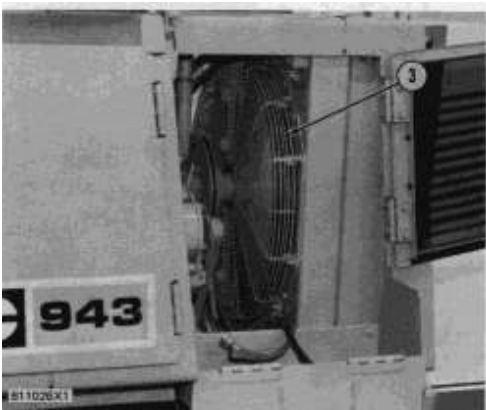
SMCS - 1356-011; 1356-012

### Remove Fan

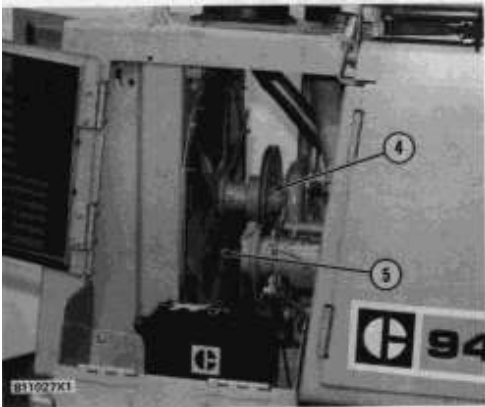
**NOTE:** The battery was removed for better photo illustration only.



1. Loosen fan belt tightener (1), and move fan belt (2) off the pulley.



2. Remove both halves of fan guard (3) from the radiator guard.



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## NOTICE

**Use extra care not to damage the radiator or oil cooler core when the fan is removed.**

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**3. Remove six bolts, nuts and washers (4). Pull the fan and adapter off the bearing and O-ring seal on the fan drive. Remove fan (5) out of the right side of the machine. Weight is 20 kg (45 lb.).**

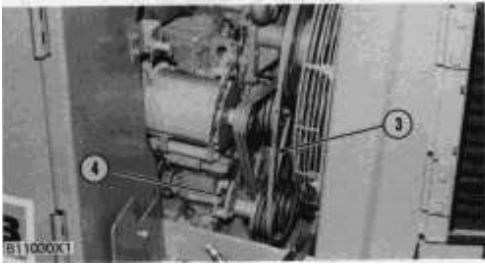
## Install Fan



**1. Put fan (1) in position on the fan drive through the opening on the right side of the machine as shown. Install the six bolts, nuts and washers that hold the fan in position on the fan drive.**



**2. Install both halves of fan guard (2) on the radiator guard.**



3. Put fan belt (3) in position on the pulleys on the crankshaft, fan drive and fan belt tightener (4).
4. Adjust the fan belt. See the V-Belt Tension Chart that follows. When the fan belt tension is correct, tighten the bolt in fan belt tightener (4).

V-BELT TENSION CHART										
BELT SIZE	WIDTH BELT TOP		WIDTH TOP OF PULLEY GROOVE		BELT TENSION "INITIAL"*		BELT TENSION "USED"***		BORROUGHS GAUGE NUMBERS	
					GAUGE READING		GAUGE READING			
	mm	In.	mm	In.	N	lb.	N	lb.	OLD GAUGE NO.	NEW GAUGE NO.
3/8	10.72	.422	9.65	.380	445 ± 22	100 ± 5	400 ± 22	90 ± 5	BT-33-73F	BT-33-95
1/2	13.89	.547	12.70	.500	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-96-4-16	BT-33-95
5V	15.88	.625	15.24	.600	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-72-4-15	BT-33-72C
11/16	17.48	.688	15.88	.625	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-72-4-15	BT-33-72C
3/4	19.05	.750	17.53	.690	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-72-4-15	BT-33-72C
15/16	23.83	.938	22.30	.878	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-72-4-15	BT-33-72C
MEASURE TENSION OF BELT FARTHEST FROM THE ENGINE										
**"INITIAL" BELT TENSION is for a new belt.										
***"USED" BELT TENSION is for a belt which has more than 30 minutes of operation at rated speed of engine.										
										A10232-1X1

Product: TRACK LOADER

Model: 943 TRACK LOADER 31Y

Configuration: 943 TRACK LOADER / HIGH DRIVE / 31Y00001-01333 (MACHINE) POWERED BY 3204 ENGINE

## Disassembly and Assembly

### 3204 VEHICULAR ENGINE FOR 943 & 953 TRACK-TYPE LOADERS

Media Number -SEN4214-00

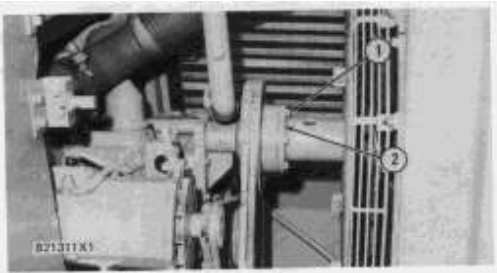
Publication Date -01/04/1985

Date Updated -11/10/2001

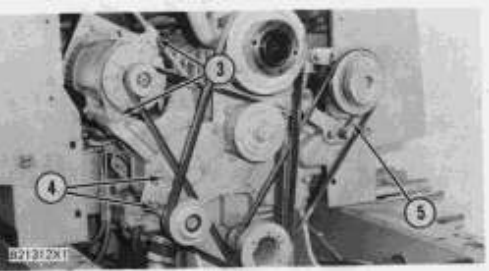
## Fan Belts

SMCS - 1357-010

### Remove And Install Fan Belts



1. Remove bolts (1), and move fan adapter (2) and the fan clear of the fan drive.



**NOTE:** The radiator and guard were removed for better photo illustration.

2. Loosen bolts and nut (3) on the alternator, bolts (4) on the belt tightener, and the nuts on belt tightener (5) for the air conditioner compressor. Remove the fan belts.

**NOTE:** When a replacement of one belt in a V-belt set is necessary, a replacement of the complete set should be made.

3. Install the fan belts on the engine. Adjust the fan belts. See the V-Belt Tension Chart at the bottom of the page. Tighten bolts (3) and (4) and the locknut on belt tightener (5) after the belts are adjusted.

**NOTE:** When the tension on a V-belt set is measured, measure the belt farthest from the engine block.



4. Put fan adapter (2) and the fan in position on the fan drive, and install the bolts that hold it in place.

V-BELT TENSION CHART										
BELT SIZE	WIDTH BELT TOP		WIDTH TOP OF PULLEY GROOVE		BELT TENSION "INITIAL"***		BELT TENSION "USED"***		BORROUGHS GAUGE NUMBERS	
	mm	in.	mm	in.	GAUGE READING		GAUGE READING		OLD GAUGE NO.	NEW GAUGE NO.
					N	lb.	N	lb.		
3/8	10.72	.422	9.65	.380	445 ± 22	100 ± 5	400 ± 22	90 ± 5	BT-33-73F	BT-33-96
1/2	13.89	.547	12.70	.500	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-96-4-16	BT-33-96
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11/16	17.48	.688	15.88	.625	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-72-4-15	BT-33-72C
3/4	19.05	.750	17.53	.690	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-72-4-15	BT-33-72C
15/16	23.83	.938	22.30	.878	534 ± 22	120 ± 5	400 ± 44	90 ± 10	BT-33-72-4-15	BT-33-72C
MEASURE TENSION OF BELT FARTHEST FROM THE ENGINE										
***"INITIAL" BELT TENSION is for a new belt.										
***"USED" BELT TENSION is for a belt which has more than 30 minutes of operation at rated speed of engine.										
										A10232-1X1

Product: TRACK LOADER

Model: 943 TRACK LOADER 31Y

Configuration: 943 TRACK LOADER / HIGH DRIVE / 31Y00001-01333 (MACHINE) POWERED BY 3204 ENGINE

## Disassembly and Assembly 3204 VEHICULAR ENGINE FOR 943 & 953 TRACK-TYPE LOADERS

Media Number -SEN4214-00

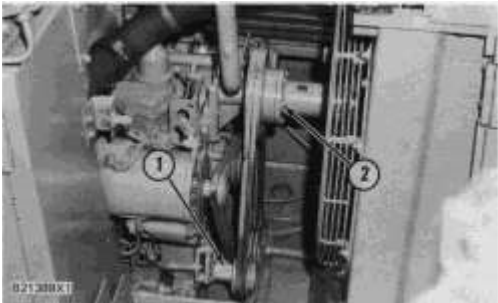
Publication Date -01/04/1985

Date Updated -11/10/2001

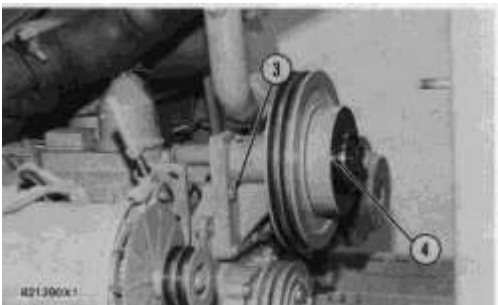
### Fan Drive

SMCS - 1359-011; 1359-012; 1359-015; 1359-016

### Remove Fan Drive



1. Loosen the bolts in belt tightener (1) so the fan belts can be removed from the fan drive.
2. Remove bolts (2) that hold the adapter to the fan drive. Move the adapter and fan clear of the fan drive.
3. Remove the belts from the fan drive.

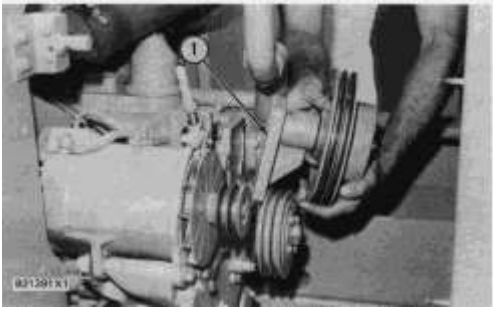


**NOTE:** The radiator guard was removed for better photo illustration only.

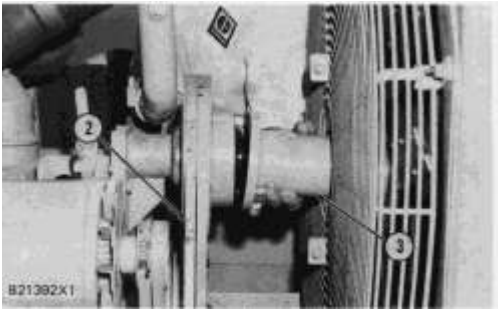
4. Remove bolts (3), and remove fan drive (4).

### Install Fan Drive





1. Put fan drive (1) in position on the timing gear cover, and install the bolts that hold it in place.



2. Put fan belts (2) in position on the fan drive pulley.

3. Put adapter (3) for the fan in position on the fan drive, and install the bolts that hold it in place.

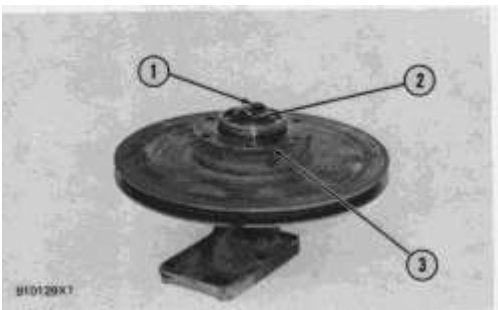
4. Adjust the fan belt tension. See Fan Belt Removal And Installation for the correct belt tension.

## Disassemble Fan Drive

Tools Needed		A
1P510	Driver Group	1

START BY:

a. remove fan drive



1. Remove bolts (1), the lock and washer (2) from the bracket assembly.

2. Remove hub (3) and the pulley from the bracket assembly.

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