



# Blue Ribbon Service

GSS-1398

**INTERNATIONAL<sup>®</sup>**  
**CUB CADET<sup>®</sup> TRACTOR**

**Models 72, 104, 105, 124 and 125**  
**and**  
**IH Equipment**

**INTERNATIONAL HARVESTER COMPANY**  
401 NORTH MICHIGAN AVE. CHICAGO, ILLINOIS 60611, U.S.A.

## FOREWORD

The instructions and special tools shown in this Blue Ribbon Service Manual are for use by International Harvester Dealers and their factory trained servicemen.

The specifications as listed in this manual are current as of the printing date. Due to changes and improvements in our products, dealers are periodically issued Service Bulletins to keep this manual up-to-date. We suggest you refer to the most recent information when performing service work on this equipment.

International Harvester Factory Trained servicemen are best qualified to service IH equipment.

Service on other Cub Cadet equipment is available at your International Cub Cadet dealer.

### LIBRARY FILING INFORMATION

1. File this Manual in Book 17 after Divider Tab GSS-1398.
2. Enter the following information in the Service Manual Index.

In the following Sections, print, or preferably type in, the Manual Description, Form Number, and the Book Filed in.

General  
Tractor Specifications  
Tractor Engine  
Tractor Fuel System  
Tractor Electrical System  
Tractor Transmission  
Tractor Differential and Final Drive  
Tractor Clutch  
Tractor Brakes  
Tractor PTO and Belt Pulley  
Tractor Chassis  
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# IH EQUIPMENT

## SPECIAL SERVICE TOOLS REQUIRED

FES 54-4	Seal Protector - Rear
FES 54-5	Seal Protector - Front
FES 54-6	Seal Driver

Order from: Service Tools, Inc.  
1901 S. Indiana Avenue  
Chicago, Illinois 60616

# STANDARD TORQUE DATA FOR NUTS AND BOLTS

Recommended torque, in foot pounds, for all Standard Application Nuts and Bolts, provided:

- A. All thread surfaces are clean and lubricated with SAE-30 engine oil. (See NOTE.)
- B. Joints are rigid, that is, no gaskets or compressible materials are used.
- C. When reusing nuts or bolts use minimum torque values.

NOTE: Multiply the standard torque by:

- .65 when finished jam nuts are used.
- .70 when Molykote, white lead or similar mixtures are used as lubricants.
- .75 when parkerized bolts or nuts are used.
- .85 when cadmium plated bolts or nuts are used.
- .90 when hardened surfaces are used under the nut or bolt head.

Bolt or Stud Diameter	Type 1 Studs Only		Type 1 Bolts 6" length or less		Type 1 Bolts longer than 6"		Type 2 (all lengths)		Type 3 (all lengths)		Type 4 (all lengths)			
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Only when used in cast (gray) iron		All other applications	
											Min.	Max.	Min.	Max.
1/4	5	6	5	6	3	3	9	10	11	13	11	13	12	14
5/16	12	13	12	13	6	7	19	21	24	27	24	27	27	30
3/8	21	24	21	24	11	13	33	37	43	47	43	47	45	50
7/16	35	38	35	38	19	21	53	60	69	76	69	76	75	85
1/2	52	58	52	58	29	32	80	90	104	117	104	117	115	130
9/16	70	80	70	80	41	46	115	130	150	170	150	170	165	185
5/8	98	110	98	110	57	63	160	180	210	230	210	230	220	250
3/4	174	195	174	195	100	112	290	320	350	390	350	390	400	450
7/8	300	330	162	181	162	181	420	470	570	630	570	630	650	730
1	420	470	250	270	250	270	630	710	850	950	850	950	970	1090
1-1/8	600	660	350	380	350	380	850	950	1200	1350	1200	1350	1380	1550
1-1/4	840	940	490	540	490	540	1200	1350	1700	1900	1700	1900	1940	2180
1-3/8	1100	1230	640	710	640	710	1570	1760	2300	2500	2300	2500	2600	2800
1-1/2	1470	1640	850	940	850	940	2000	2300	3000	3300	3000	3300	3300	3700
1-3/4	2350	2450	1330	1490	1330	1490	3300	3700	4700	5200	4700	5200	5300	6000
2	3500	3900	2000	2200	2000	2200	5000	5500	7000	7800	7000	7800	8000	9000

## BOLT TYPE IDENTIFICATION CHART

IH TYPE	S.A.E. GRADE	DESCRIPTION	BOLT HEAD MARKING *
1	Equivalent 1 or 2	WILL HAVE IH STANDARD MONOGRAM IN THE CENTER OF THE HEAD Low or Medium Carbon Steel Not Heat Treated	
2	5	WILL HAVE AN IH AND 3 RADIAL LINES Quenched and Tempered Medium Carbon Steel	
3	6	WILL HAVE AN IH AND 4 RADIAL LINES No longer used in production. For replacement, use Type 4 if Type 3 is not available.	
4	8	WILL HAVE AN IH AND 6 RADIAL LINES Quenched and Tempered Special Carbon or Alloy Steel	

\* The center marking identifies the bolt manufacturer. The IH monogram is currently used. Some bolts may still have a raised dot which previously identified IH bolts.

# Section 1

## ENGINE

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## SPECIFICATIONS

	Model 72	Models 104 & 105	Models 124 & 125
<b>General</b>			
Make and model (with electric starting) . . . . .	Kohler K-161S	Kohler K-241AS	Kohler K-301AS
(with retractable starter) . . . . .	Kohler K-161T		
Cylinders . . . . .	1	1	1
Bore - inches . . . . .	2-7/8	3-1/4	3-3/8
Stroke - inches . . . . .	2-1/2	2-7/8	3-1/4
Displacement - cu. inches . . . . .	16.23	23.9	29.1
Compression pressure (Refer to page 1-7 and 1-16) . . . . .	110 to 120 psi	110 to 120 psi	110 to 120 psi
Rated horsepower (at 60 deg. F and 29.92 inch Hg barometric pressure) - rpm . . . . .	7.0 at 3600	10 at 3600	12.0 at 3600
Engine speed (governed)			
Minimum speed - rpm . . . . .	1000	1000	1000
Maximum idle speed (no load) - rpm . . . . .	3780	3800	3800
Maximum (full load) - rpm . . . . .	3600	3600	3600
Valve clearance (engine cold)			
Intake - inch . . . . .	.006 to .008	.008 to .010	.008 to .010
Exhaust - inch . . . . .	.015 to .017	.017 to .019	.017 to .019
Ignition			
(with electric starting) . . . . .	Battery	Battery	Battery
(with retractable starter) . . . . .	Magneto		
Spark plug gap (14 mm plug) - inch . . . . .	.025	.025	.025
Breaker point gap - inch . . . . .	.018 to .022	.018 to .022	.018 to .022
Timing (before TDC) - degrees . . . . .	20	20	20
<b>Engine</b>			
Cylinder bore			
New - inches . . . . .	2.8745 to 2.8755	3.2505 to 3.2515	3.3745 to 3.3755
Maximum out-of-round (before re boring) - inch . . . . .	.005	.005	.005
Crankshaft			
End clearance - inch . . . . .	.002 to .023	.003 to .020	.003 to .020
Crankpin diameter (new) - inches . . . . .	1.1855 to 1.1860	1.4995 to 1.5000	1.4995 to 1.5000
Crankpin, maximum out-of-round before reconditioning - inch . . . . .	.0015	.0015	.0015

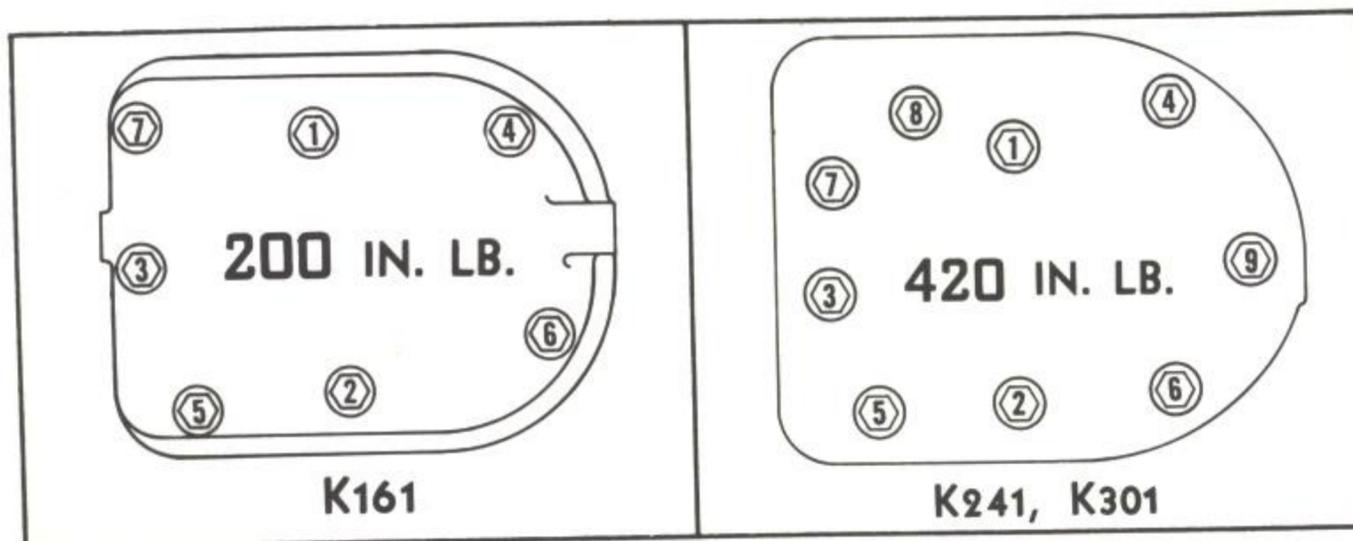
	Model 72	Models 104 & 105	Models 124 & 125
<b>Connecting rod</b>			
Bore (new) - inches . . . . .	1.1870 to 1.1875	1.5010 to 1.5015	1.5010 to 1.5015
Crankpin running clearance (new) - inch . . . . .	.0010 to .0020	.001 to .002	.001 to .002
Maximum crankpin running clearance (before reconditioning) - inch . . . . .	.003	.003	.003
Side clearance - inch . . . . .	.005 to .016	.007 to .016	.007 to .016
To wrist pin clearance - inch . . . .	.0006 to .0011	.0003 to .0008	.0003 to .0008
Wrist pin to piston boss - inch . . . .	.0001 Int. to .0003 loose	.0000 to .0003 loose select fit	One thumb push fit
<b>Piston</b>			
New (measured just below oil ring 90 deg. from piston pin) - inches . . . . .	2.8660 to 2.8675	3.2415 to 3.2445	3.3655 to 3.3685
Maximum allowable undersize (for wear) - inch . . . . .	2.8645	3.2400	3.3640
Piston ring end gap - inch . . . . .	.007 to .017	.010 to .020	.010 to .020
<b>Piston to cylinder bore clearance</b>			
Top of skirt (measured just below oil ring) - inch . . . . .	.006 to .0075	.0075 to .0085	.0065 to .0095
Bottom of skirt - inch . . . . .	.0045 to .0065	.003 to .004	.003 to .004
Piston pin bore - inch . . . . .	.62565	.85975	.85975
Piston pin diameter - inch . . . . .	.625	.860	.860
<b>Valves</b>			
<b>Valve stem clearance in guide</b>			
Intake - inch . . . . .	.001 to .0025	.001 to .0025	.001 to .0025
Exhaust - inch . . . . .	.0025 to .004	.0025 to .004	.0025 to .004
<b>Valve stem (diameter)</b>			
Intake (new) - inch . . . . .	.3105 to .3110	.3105 to .3110	.3105 to .3110
Maximum allowable undersize (for wear) - inch . . . . .	.3090	.3090	.3090
Exhaust (new) - inch . . . . .	.3090 to .3095	.3090 to .3095	.3090 to .3095
Maximum allowable undersize (for wear) - inch . . . . .	.308	.308	.308
Intake and exhaust maximum (allowable oversize for wear) - inch . . . . .	.315	.315	.315
Valve guide depth from top of block - inches . . . . .	1-5/16	1-15/32	1-15/32
Tappet clearance in block - inch . . . .	.0005 to .002	.0008 to .0023	.0008 to .0023
Camshaft running clearance - inch . . . . .	.001 to .0035	.001 to .0035	.001 to .0035
Camshaft end clearance - inch . . . .	.005 to .025	.005 to .010	.005 to .010

	Model 72	Models 104 & 105	Models 124 & 125
Valve clearance			
Intake (cold) - inch . . . . .	.006 to .008	.008 to .010	.008 to .010
Exhaust (cold) - inch . . . . .	.015 to .017	.017 to .019	.017 to .019
Valve face angle - degrees . . . . .	45	45	45
Valve seat inserts (service only)			
Intake - inches . . . . .	Bore 1.4995 to 1.5005	1.4995 to 1.5005	1.4995 to 1.5005
	Depth .224 to .229	.224 to .229	.224 to .229
Exhaust - inches . . . . .	Bore 1.2495 to 1.2505	1.2495 to 1.2505	1.2495 to 1.2505
	Depth .224 to .229	.224 to .229	.224 to .229
Seat angle - degrees . . . . .	44-1/2	44-1/2	44-1/2
Valve seat width - inch . . . . .	.037 to .045	.037 to .045	.037 to .045
Current-voltage regulator			
Make and model (Delco-Remy) . . .	1118987	1118987	1118987
Ground . . . . .	Negative	Negative	Negative
Voltage regulator			
Air gap - inch . . . . .	.075	.075	.075
Setting range (volts) . . . . .	13.6 to 14.5	13.6 to 14.5	13.6 to 14.5
Adjust to . . . . .	14 volts	14 volts	14 volts
Cut-out relay			
Air gap - inch . . . . .	.020	.020	.020
Point opening - inch . . . . .	.020	.020	.020
Closing voltage (volts) . . . . .	11.8 to 14	11.8 to 14	11.8 to 14
Adjust to . . . . .	12.8 volts	12.8 volts	12.8 volts
Motor-generator			
Make and model (Delco-Remy) . . .	1101996	1101996	1101996
Rotation (viewing drive end) . . . . .	CC	CC	CC
Brush spring tension - oz. . . . .	24 to 32	24 to 32	24 to 32
Field current (at 80 deg. F)			
Amps . . . . .	1.5 to 1.6	1.5 to 1.6	1.5 to 1.6
Volts . . . . .	12	12	12
Cold output			
Amps . . . . .	14	14	14
Volts . . . . .	15	15	15
Approximate rpm . . . . .	High idle	High idle	High idle
No load test:			
Volts . . . . .	11	11	11
Amps . . . . .	10 to 14	10 to 14	10 to 14
RPM . . . . .	1650 to 1950	1650 to 1950	1650 to 1950

	Model 72	Models 104 & 105	Models 124 & 125
Carburetor			
*Float setting - inch . . . . .	11/64 ± 1/32	11/64 ± 1/32	11/64 ± 1/32
Idle mixture screw setting . . . . .	3/4 to 1-1/2 turns open	3/4 to 1-1/2 turns open	3/4 to 1-1/2 turns open
High speed mixture screw setting . . . . .	1-1/4 to 2 turns open	1-1/4 to 2 turns open	1-1/4 to 2 turns open
*Measure between top of float (free end) and casting body.			
Recoil starter			
Preload on rewind spring . . . . .	4 turns		

### Special Torques

Engine		
Head bolts - tighten evenly in steps to K-161 . . . . .	200 in. lbs.	
		K-241 and K-301 . . . . . 420 in. lbs.
Rod bolts - K-161 tighten to 200 in. lbs. loosen then tighten to . . . . .	180 in. lbs.	
		K-241 and K-301 tighten to 300 in. lbs. loosen then tighten to . . . . . 280 in. lbs.
Crankshaft nut . . . . .	60 ft. lbs.	
Spark Plug . . . . .	27 ft. lbs.	



FESM-2784

Illust. 1-1. Head bolt torque and torquing sequence.

## Compression Check

Engines equipped with Automatic Compression Release require a different procedure for checking compression than ordinary engines. Since the A. C. R. relieves compression pressure during lower cranking speeds, a compression check is not possible in the normal manner.

Engines should be checked using the following procedures and should show a compression of 110 to 120 p. s. i. if in top mechanical condition. If reading is below 100 p. s. i., engine should be reconditioned.

Method No. 1 - Checking by "feel" of compression. Rotate flywheel backward against power stroke. Resistance should be felt. If little or no resistance is felt, check with gauge.

Method No. 2 - Checking with gauge on manual start engine.

a. Wind rope on flywheel pulley so that engine may be cranked in reverse direction.

b. Hold throttle in wide open position.

c. Crank engine. Reading should be normal since engine will develop full compression when power stroke is reversed.

NOTE: Engine should be cycled more than once to obtain accurate reading.

Method No. 3 - Checking with gauge on electric start engine. Crank engine electrically in normal manner. Engine will reach a high enough r. p. m. range to disengage A. C. R. and will then slow down slightly. Normal reading should then be obtained. If reading is below 100 p. s. i., recheck manually using Method No. 2.

## GENERAL INFORMATION



FESM-2785

Illust. 1-2. Cub Cadet 124 tractor.

The model 72 is powered by a 7 horsepower, four cycle, air cooled, gasoline engine and is available with retractable hand starting or electric starting.

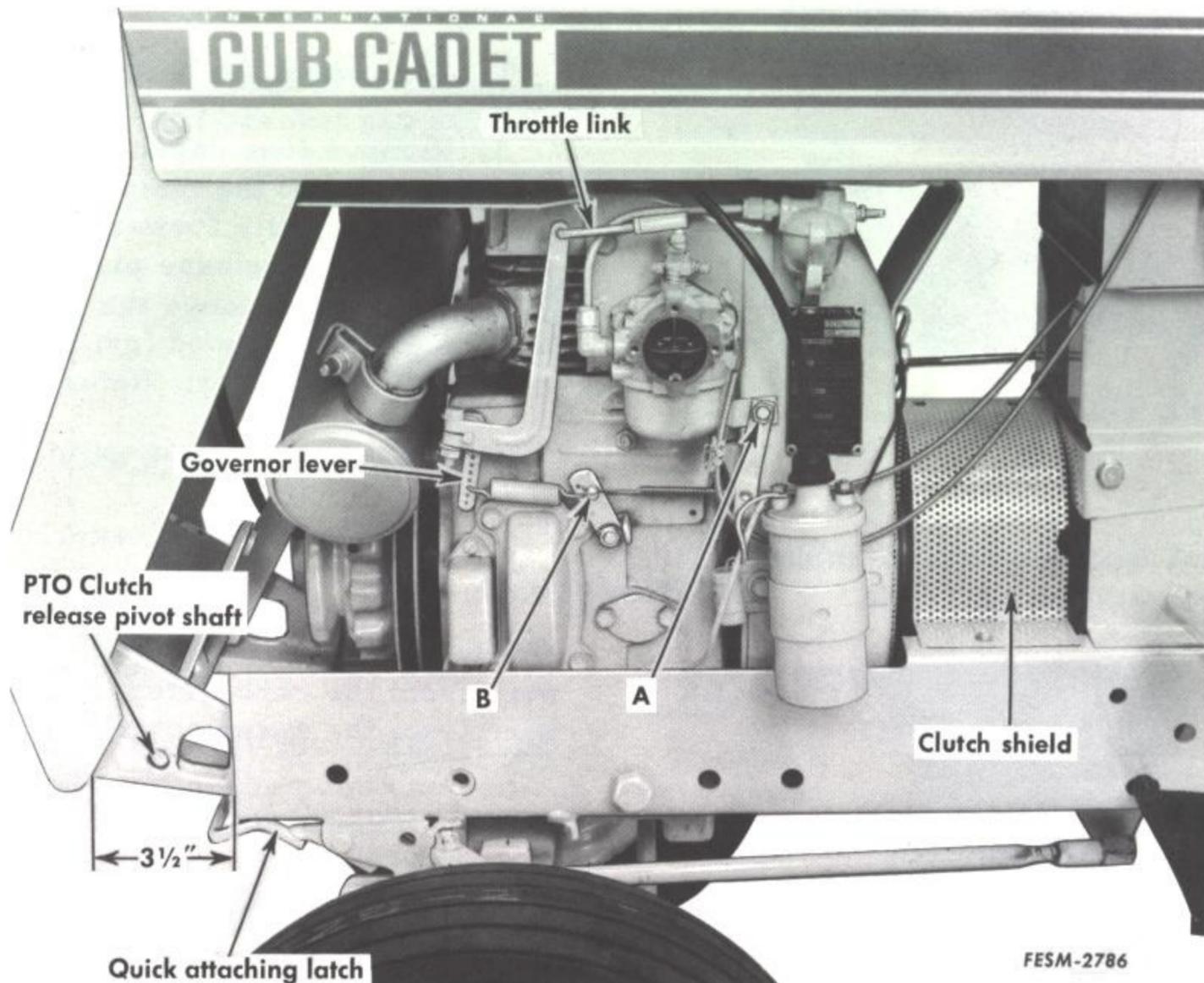
The model 104 and 105 are powered by a 10 horsepower, four cycle, air cooled,

gasoline engine and are available with electric starting only.

The model 124 and 125 are powered by a 12 horsepower, four cycle, air cooled gasoline engine and are available with electric starting only.

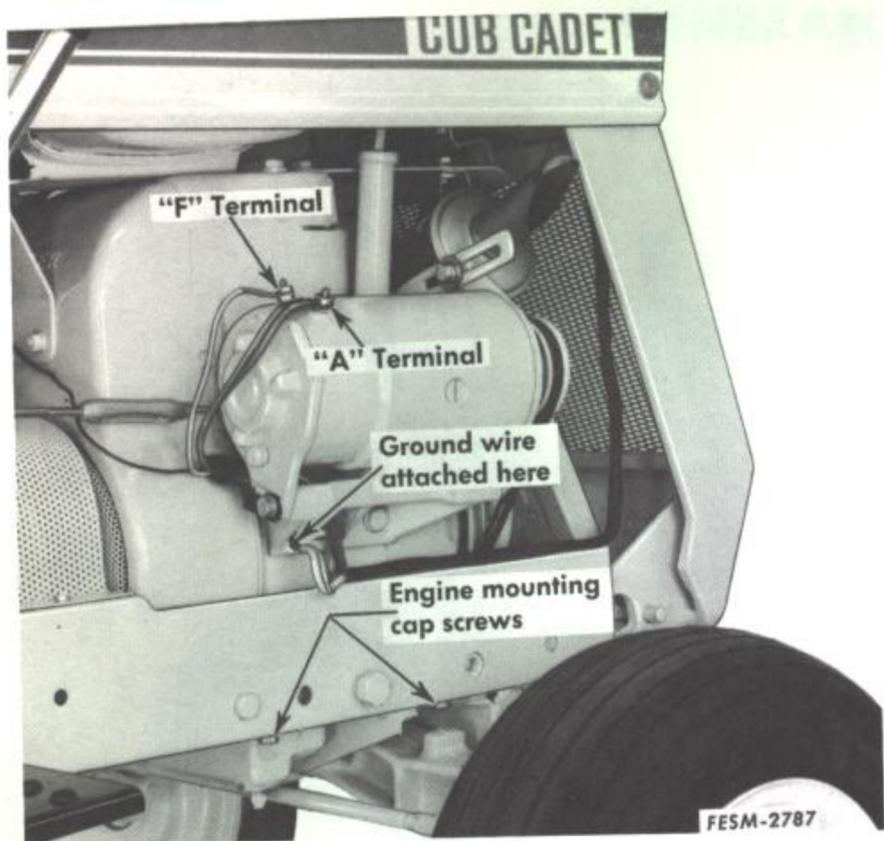
# ENGINE Removal

## Manual Starting



Illust. 1-3.

1. Remove grille and hood:
  - a. Remove four capscrews and nuts that hold the grille to the tractor main frame.
  - b. Slide bottom of grille forward 3-1/2" and remove clutch release pivot shaft from grille casting.
  - c. Remove the grille and hood. Lay the grille and hood (grille face down) in front of the tractor (Illust. 1-5).
2. Remove clutch shield (Illust. 1-3).
3. Remove air cleaner.
4. Disconnect throttle wire. (Illust. 1-3 Item B.)
5. Disconnect choke wire from the carburetor.
6. Disconnect switch wire (not shown).



Illust. 1-4. Right side view Model 124.

9. Slide engine forward to disengage the drive pins from the clutch driven disc.

10. The engine can now be lifted from the tractor.

### Electric Starting

1. Disconnect the battery cables.

2. Remove four capscrews and nuts that hold the grille to the main frame. Slide the bottom of the grille forward 3-1/2" and remove the clutch release pivot shaft from the grille casting. Remove the grille and hood. Lay the grille and hood (grille face down) in front of the tractor. Refer to Illust. 1-5.

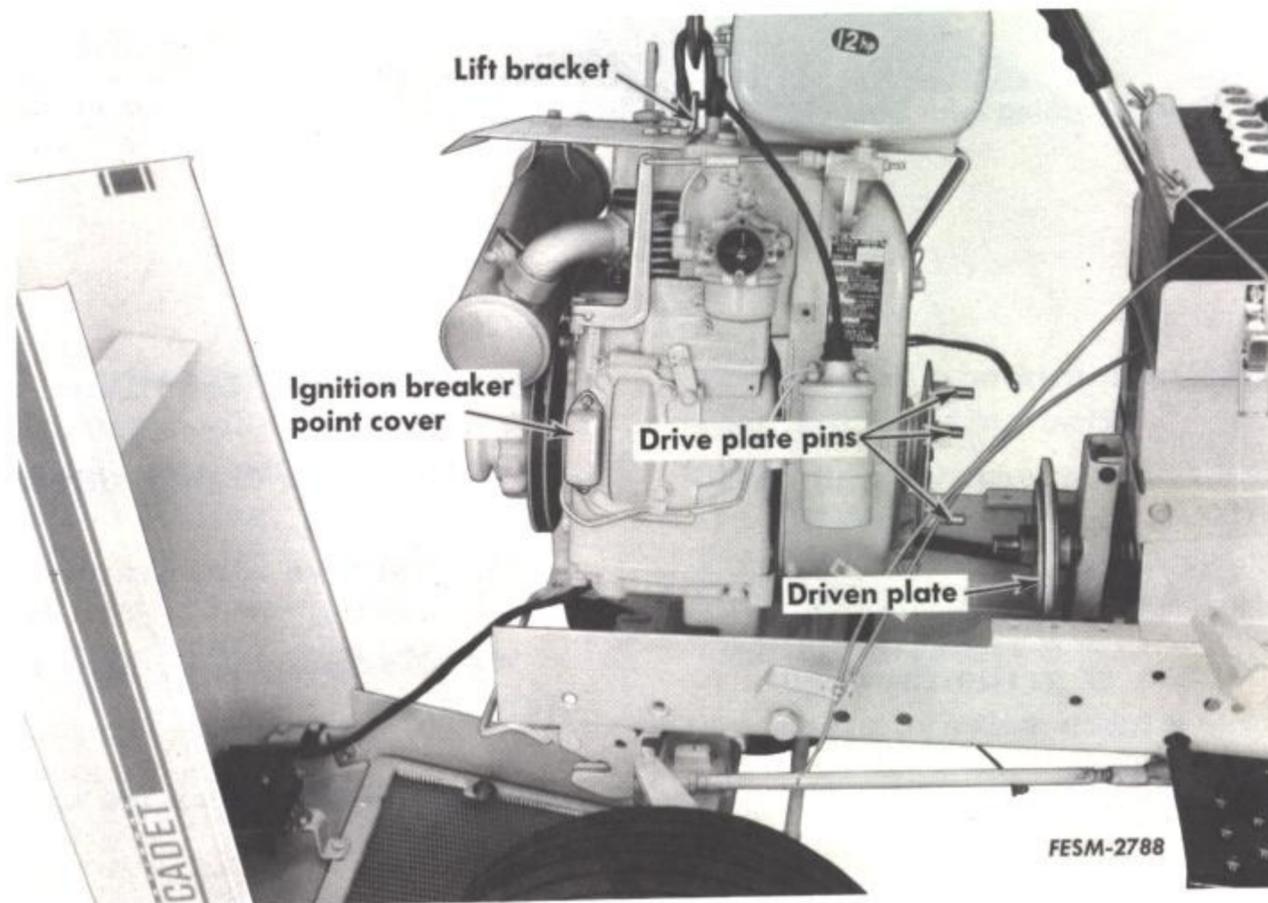
3. Remove the clutch shield (Illust. 1-3).

4. Remove the air cleaner.

5. Remove cap screw "A" and loosen screw "B" (Illust 1-3). Remove the choke wire from the carburetor, and the throttle wire from the speed control lever.

7. Remove four cap screws holding engine to the frame (Illust. 1-4).

8. Attach lifting equipment to motor lift bracket on head bolt (Illust. 1-5).



Illust. 1-5. Lifting the engine from the frame.

6. Disconnect the positive (+) coil wire from the coil.

7. Disconnect the wires from the Generator "A" terminal and from the "F" terminal.

NOTE: Large wire to "A" terminal. Small wire to "F" terminal.

8. Disconnect the ground cable connected to a starter-generator bracket cap screw

and remove starter-generator and coil wires from the generator bracket (Illust. 1-4).

9. Remove four cap screws holding the engine to frame. Two on each side (Illust. 1-4).

10. Slide the engine forward to disengage the drive pins from the clutch driven disc.

11. The engine can now be lifted from the frame using the engine lift bracket on a head bolt. Refer to Illust. 1-5.

## Disassembly

1. Drain engine oil.

2. Disconnect the coil-to-breaker point wire (if so equipped) at the points and remove coil and bracket from engine.

3. Remove breaker point assembly and breaker point push rod.

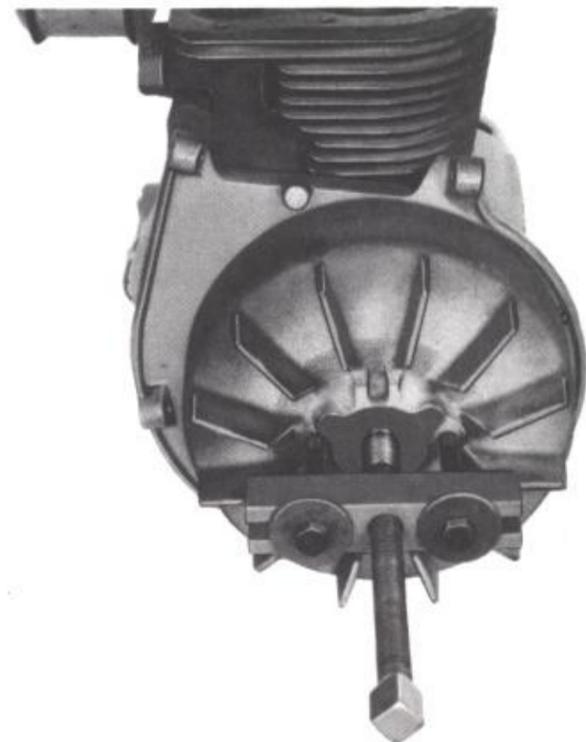
4. Remove rotating screen and drive pulley assembly.

5. Remove fuel tank, blower housing, cylinder baffle, head baffle, muffler and baffle.

6. Remove breather plate assembly. See Illust. 1-24.

7. Remove the flywheel and (magneto, if so equipped).

NOTE: The flywheel is mounted on a tapered shaft and must be removed with the use of a puller (Illust. 1-6). Do not Hammer on puller or nut. If necessary tap lightly.

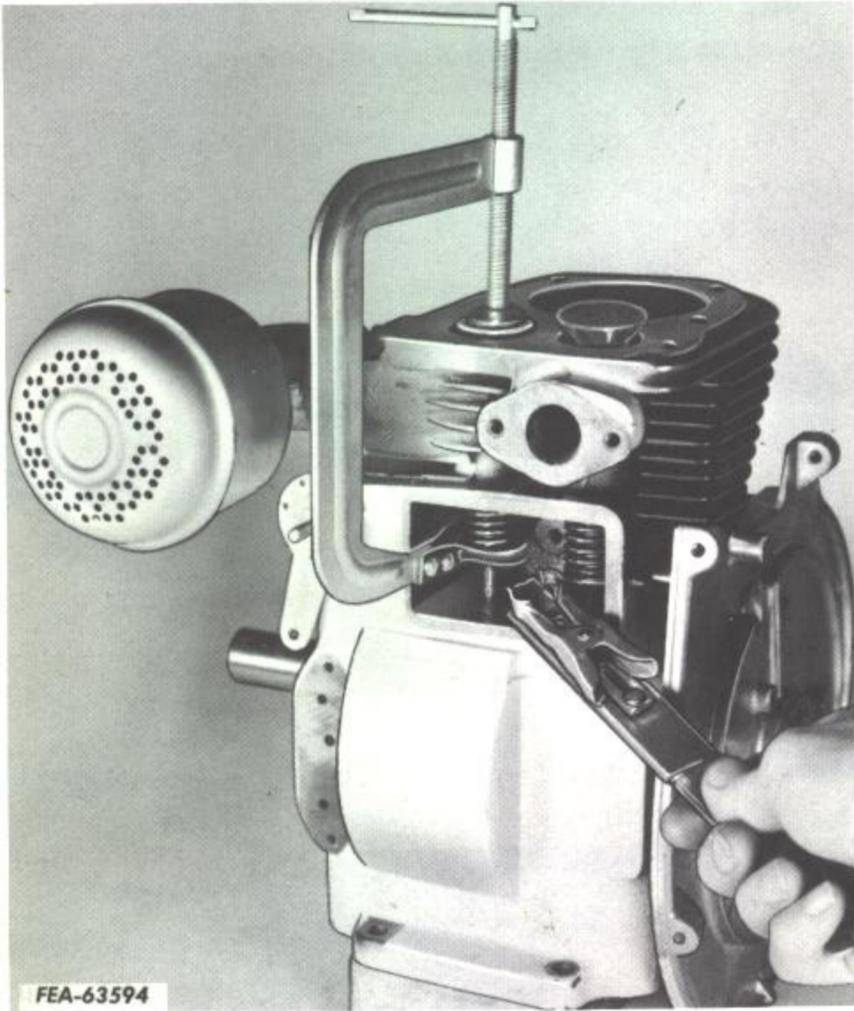


Illust. 1-6. Removing flywheel.

8. Remove the two Allen set screws in the front pulley hub. Remove the pulley with two long screwdrivers. Place the screwdrivers between the pulley and the crankcase, 180 degrees apart. Pry against the pulley near the crankshaft to prevent bending the pulley.

9. On manual starting engines, remove the retractable starter assembly and its mounting plate.

10. Remove the cylinder head.



Illust. 1-7. Valve spring compressed to remove or install keepers.

11. Compress the valve springs and remove the valve keepers, springs, retainers and valves (Illust. 1-7).

12. Remove the oil base.

13. Remove connecting rod cap. Remove ridge at top of cylinder wall, if present, and slide piston and rod out the top of the cylinder block.

14. Remove crankshaft, oil seals and if necessary press out the crankshaft main ball bearings.

**NOTE:** It may be necessary to press the crankshaft out of the cylinder block. The bearing plate should be removed first if this is done. The bearing plate can be removed with a bridge type puller, using the two tapped holes in the bearing plate.

15. Turn the cylinder block upside down and using a small punch, drive out camshaft pin from the gear end of the camshaft. The pin will slide out easily after it is driven free of front side of cylinder block.

16. Remove the camshaft and valve tappets. Save the washer type shim or shims if any located between the end of the camshaft (Opposite camshaft gear), and the cylinder block. These shims will be reused in reassembly.

17. Unscrew the governor bushing nut and remove the throttle bracket and speed control disc. The governor cross-shaft can now be removed by sliding the pilot end from its bearing, then inward and downward from inside the crankcase.

18. Remove the holding screw located to the right of the governor bushing nut to allow governor gear and weight assembly to be removed from the shaft inside the crankcase.

## Inspection and Repair

Clean all parts and inspect them to determine which parts are reusable.

### Reboring Cylinder Block

1. The cylinder should be rebored if badly scored, or worn in excess of taper or out-of-round limits.
2. Always rebore and hone to use a .010, .020, or .030 inch over standard size piston.
3. Use an inside micrometer or cylinder taper gauge to determine cylinder size and condition before and during honing.
4. Oversize piston and ring assemblies must be used in crankcases which have been rebored.
5. A cylinder hone can be used with either a drill press or a portable electric drill. The drill press is preferred, for it is important to keep bore in alignment with crankshaft cross-bore.
6. Finish by washing cylinder walls with SAE-10 oil and a clean cloth.

### Crankshaft

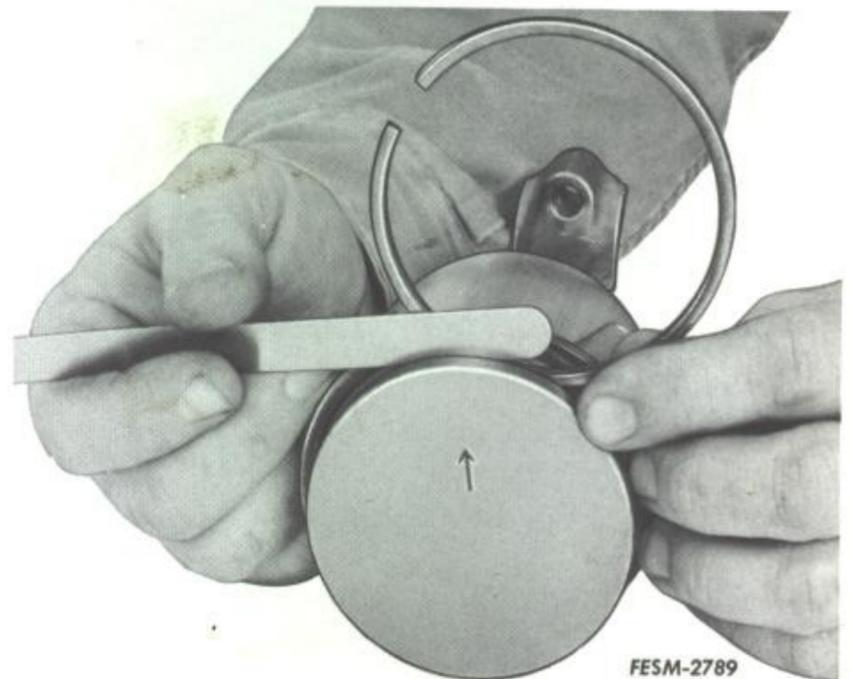
1. Check for score marks and metallic pick-up. Superficial score marks can be polished out with crocus cloth soaked in oil.
2. With a micrometer, check crankpin diameter for out-of-round specified as follows:  
K-161 (new) - - - - - 1.1855 to 1.1860  
K-241 and K-301 (new) - 1.4995 to 1.5000  
If out-of round, replace shaft or regrind to .010 undersize.
3. Check gear, keyway and tapered part of shaft for wear. If worn, replace shaft.

### Connecting Rod

1. Check rod for wear, score marks, running clearances, and side clearance. Replace rod if worn beyond high limit of clearances shown in specifications.
2. Connecting rod bearings are an integral part of the rod and not separately replaceable.
3. Connecting rods .010 undersize are available for reground crankshafts.

### Piston and Rings

1. If cylinder block does not require reboring and old piston is free of score and scuff marks, check piston ring grooves and lands.



Illust. 1-8. Checking ring groove.

2. Clean ring grooves and check width with a new ring and thickness gauge. Replace piston if .005 or more gauge can be inserted between ring and land (Illust. 1-8).
3. NEVER RE-USE OLD RINGS.
4. When inserted in cylinder, piston ring end clearance should be as follows:  
K-161 - - - - - .007 to .017 inch  
K-241 and K-301 - .010 to .020 inch

## Piston Pin

1. Very little wear takes place on piston pin or in piston bosses.
2. If it is necessary to replace connecting rod because of wear at crank end of rod, it is advisable to install a new piston pin.
3. Assemble pin to rod. Use a rod aligner to check rod for proper alignment. Straighten as necessary.

## Valves, Seats and Guides

1. Check clearance of valve stems in guides. Refer to Specifications.
2. If necessary, remove valve guides as follows:

Tap the valve guide its full length using a  $3/8$  inch N. C. tap.

Thread a  $3/8$  N. C. x 6 inch cap screw its full length.

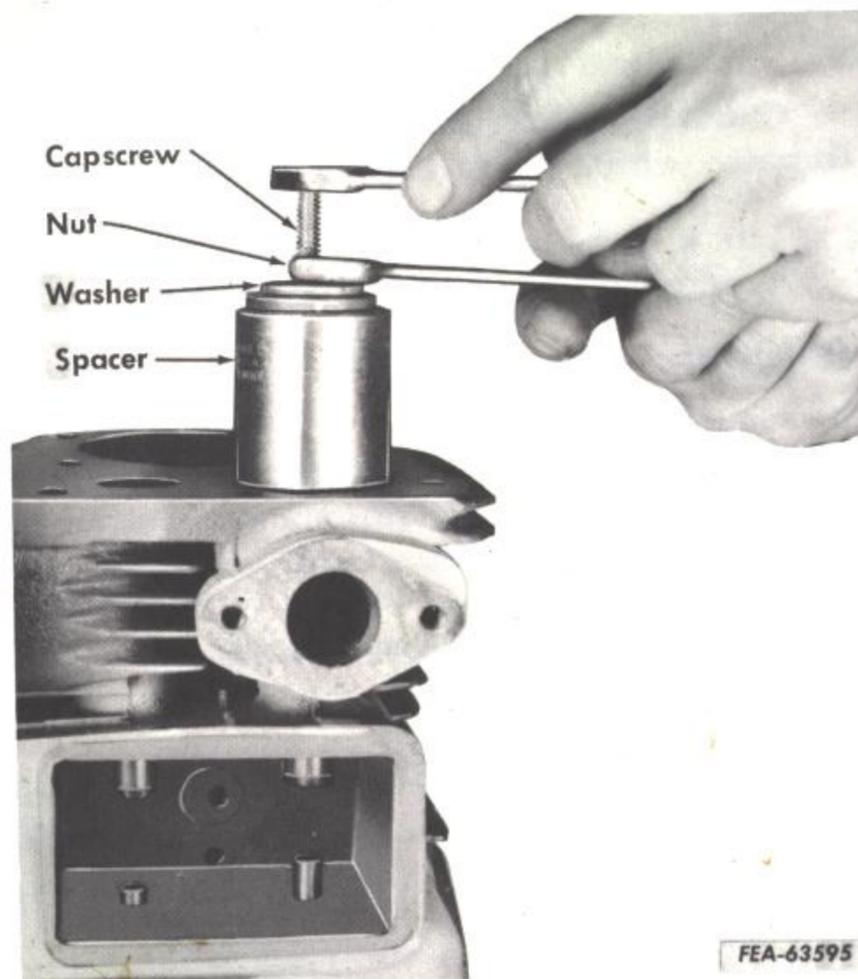
Install a nut, washer and spacer on the cap screw, then screw the cap screw into the valve guide, the full length of the valve guide.

Hold the cap screw and turn the nut, as shown in Illust. 1-9.

3. Press new guide into the crankcase a depth below top surface of cylinder block as specified:

K-161 - - - - - 1-5/16 inches  
K-241 and K-301 - 1-15/32 inches

It will be necessary to ream guides to gain correct fit. Refer to Specifications for proper clearance.



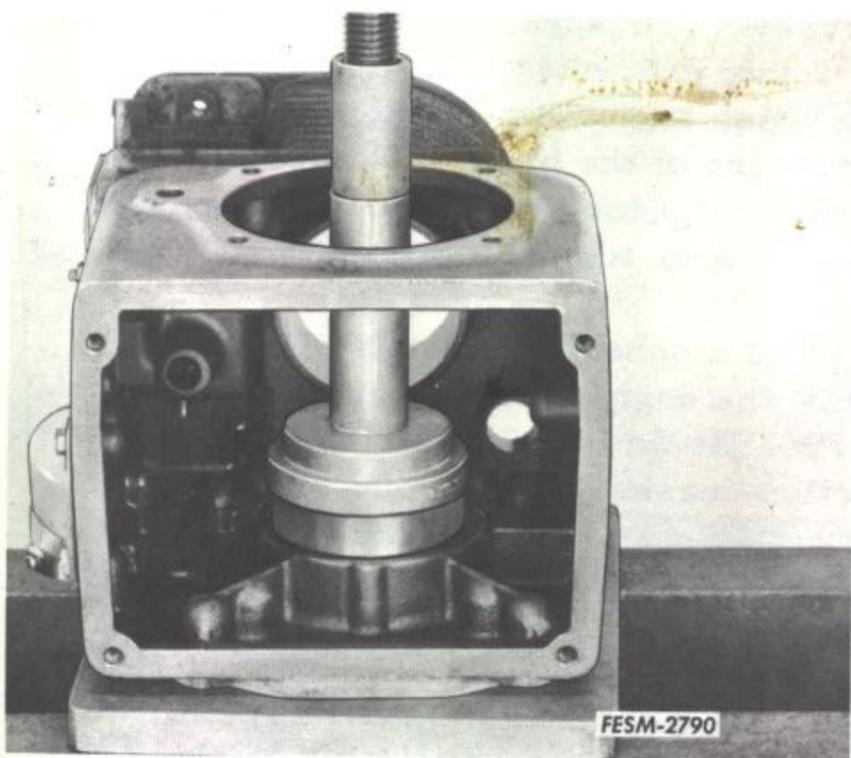
Illust. 1-9. Removing valve guides.

4. The valve seat should be held as nearly as possible to .037 inch in width. Seats with more than .045 inch width should be reconditioned.

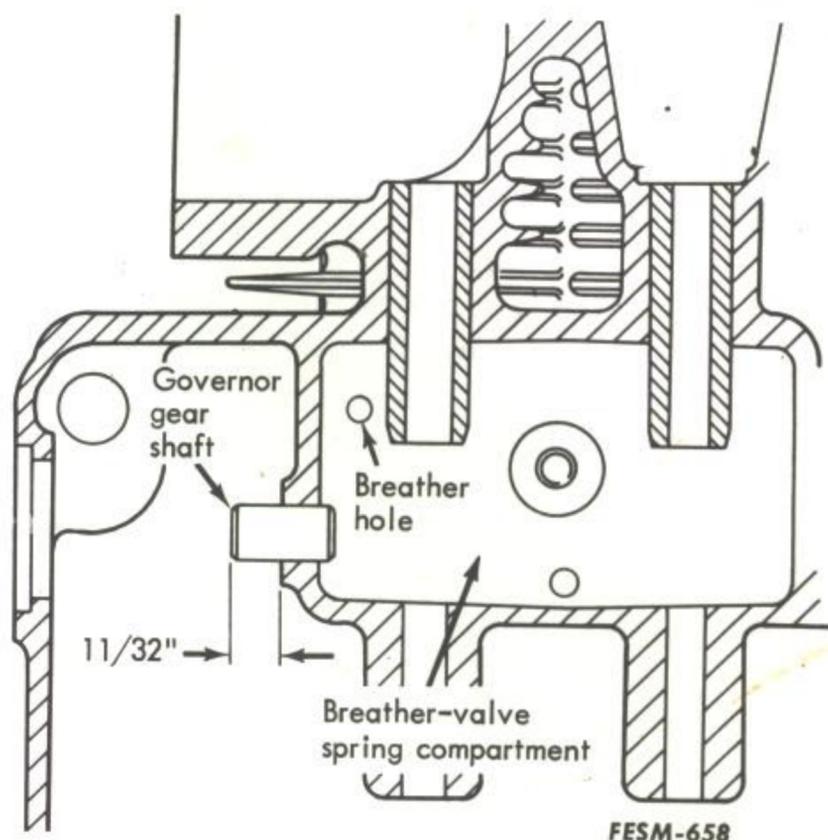
5. Intake valve seat is machined into block. If seat is ground too deep an insert is available for service. Refer to Specifications for bore and depth for machining block before installing the insert.

6. The exhaust valve seat is a Moly Nickel Chrome or Stellite insert. An over-size insert is available for service. Refer to Specifications for bore and depth for machining block before installing the insert.

## Reassembly



Illust. 1-10. Installing front main bearing.



Illust. 1-11. Height of governor gear shaft.

### Governor

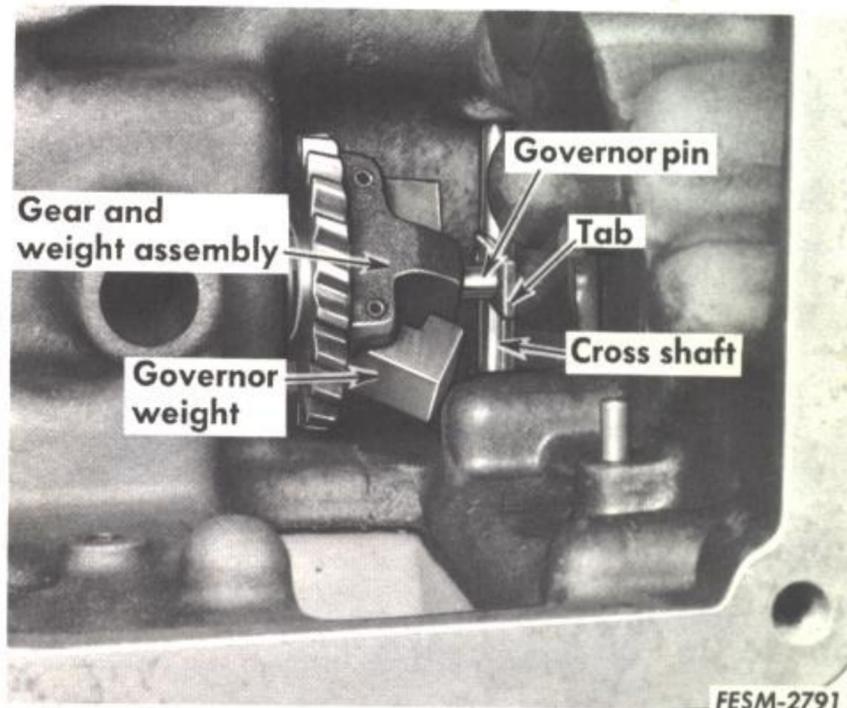
Install front main bearing by pressing into cylinder block (shielded side on 7 H. P. to inside of block). See Illust. 1-10.

1. Check the governor gear shaft for wear. Do not remove the shaft unless it needs to be replaced. To remove the shaft, remove the expansion plug and drive the shaft into the inside of breather valve spring compartment.

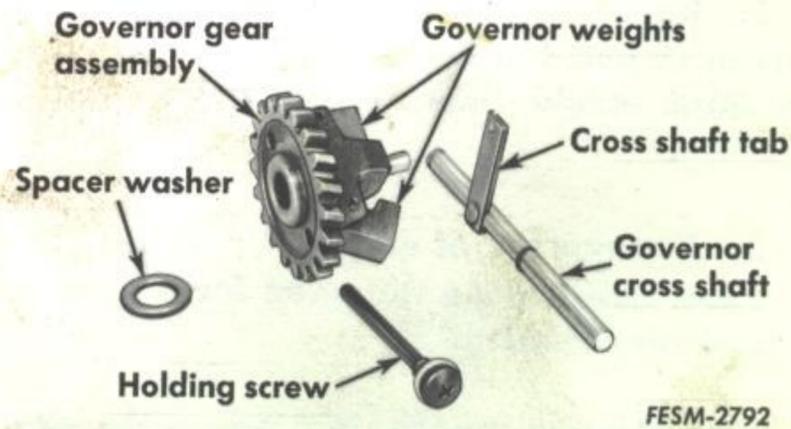
Install the governor gear shaft and expansion plug, if they were removed. See Illust. 1-11 for proper positioning.

2. Place spacer washer on gear shaft and slide governor gear assembly into place and secure with holding screw (Illust. 1-13). This screw prevents governor gear from sliding off gear shaft.

3. Place cylinder block upside down. Slide governor cross-shaft (Illust. 1-12) into place from inside of block. Make sure tab on governor shaft is against pin in end of governor gear.



Illust. 1-12. Governor gear and cross shaft installed.



Illust. 1-13. View of governor parts.

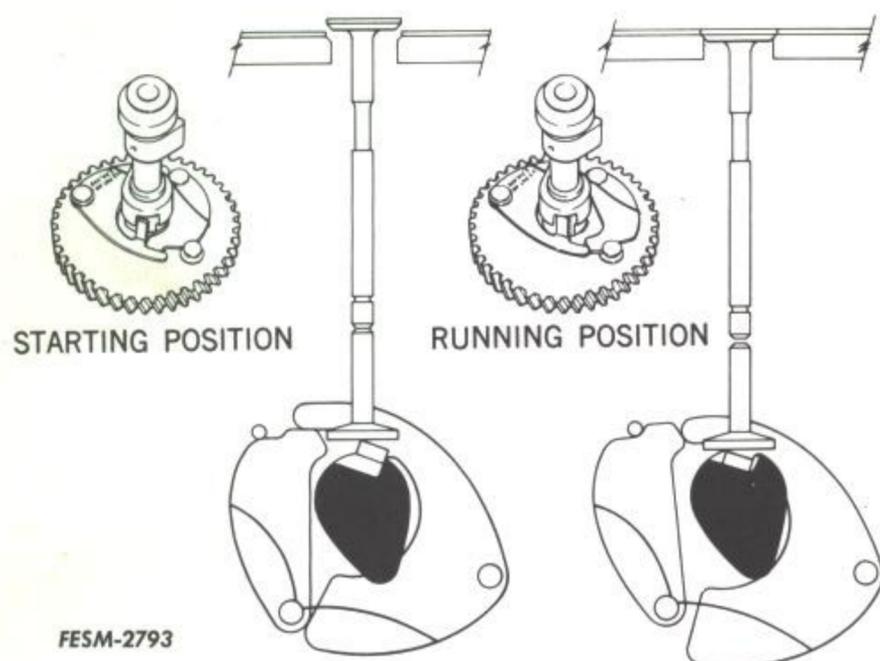
On the K-161 place speed control disc on governor bushing nut and thread bushing nut into block, clamping throttle bracket into place (Illust. 1-29).

On the K-241 and K-301 the bushing nut is installed without any additional parts.

4. Governor shaft can be adjusted for end clearance by moving needle bearing in block. Set bearing to allow a slight back-and-forth movement of the shaft.

5. Rotate governor gear assembly to be sure the holding screw does not contact the weight section of the gear.

### Automatic Compression Release



Illust. 1-14. ACR operation.

The Kohler Automatic Compression Release provides:

1. Reduction of the cranking effort required to pull the engine through the compression stroke thus making the engine easy to start.

2. Prevention of engine "kick back" thereby eliminating the need for a spark retard mechanism.

The release mechanism opens the exhaust valve slightly during the first part of

the compression stroke allowing part of the mixture to escape and lowering the compression pressure.

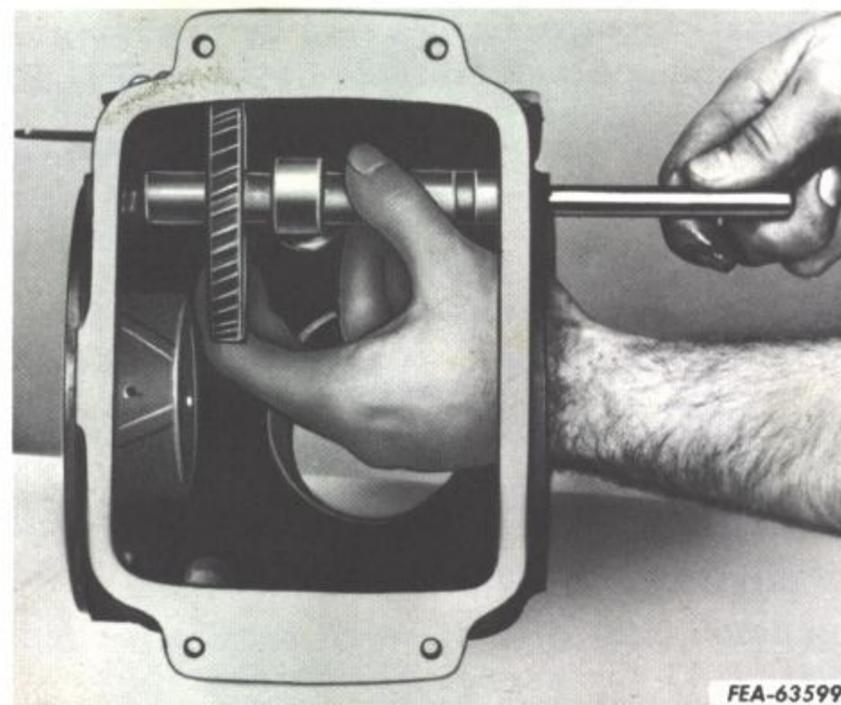
"Kick back" is prevented because the pressure of the burning mixture is reduced sufficiently for the flywheel to carry the engine over top dead center.

The mechanism remains in operation until the engine reaches approximately 650 RPM. At this speed all decompression action ceases. The engine operates in the standard manner at all higher speeds with no loss of power.

Compression release weights are not serviced separately. Weight spring is available for service.

### Valve Tappets and Camshaft

1. Turn the cylinder block upside down and place valve tappets in tappet guides.



Illust. 1-15. Installing camshaft.

2. Position the camshaft in the block with washer type shims (that were removed during disassembly) between the end of the camshaft and the bearing plate side of the block. Slide the camshaft pin through the shims and camshaft from the bearing plate side (Illust. 1-15), and press into the front side of the block.

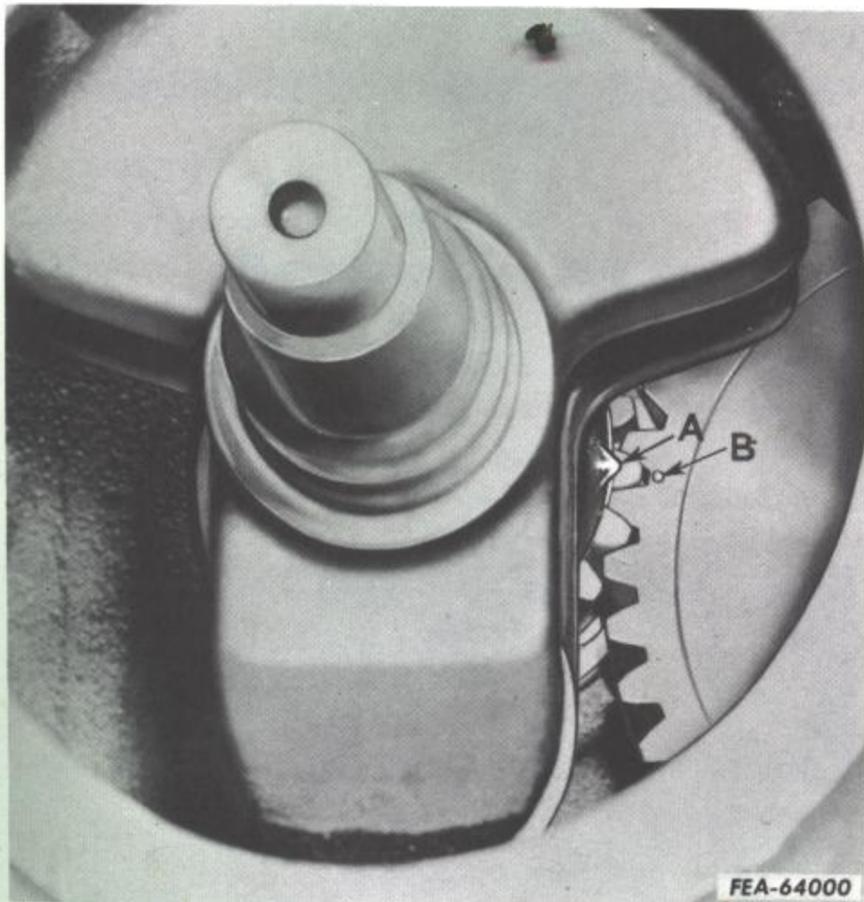
3. Check camshaft end clearance specified as follows:

- K-161 - - - - - .005 to .025 inch
- K-241 and K-301 - .005 to .010 inch

Clearance can be changed by adding or removing shims as required.

2. Timing marks are provided on the crankshaft and camshaft gear for correct timing of engine. When in place, the mark "B" between teeth of camshaft gear (Illust. 1-16) must line up with the mark on shoulder of crankshaft "A" (Illust. 1-16). Chalk timing mark positions for ease of viewing during assembly.

### Installation of Crankshaft



Illust. 1-16. Crankshaft installation, A and B are timing marks.

1. The installation of the crankshaft in the cylinder block is shown in Illust. 1-16.

### Bearing Plate

1. Press the rear main bearing into the bearing plate (shielded side to the inside of 7 H. P. only).

2. Crankshaft end play is determined by the bearing plate gasket thickness. Use of about .030 of gaskets should bring end play within limits. Clearance must be checked after assembly between front main bearing inner race and shoulder on crankshaft as follows:

- K-161 - - - - - .002 - .023
- K-241 and K-301 - .003 - .020

3. Carefully press the bearing plate assembly onto the crankshaft and into the block.

4. Install four cap screws with copper washers. Draw cap screws up evenly and check end play.

## Piston and Rod Assembly

1. Assemble the piston to the rod so the arrow on the piston (when so marked) faces away from the valves and the connecting rod marking "A" (Illust. 1-18) is toward the camshaft side of the engine. Secure piston pin with retainer rings. Always use new retainer rings. Be sure the retainer rings are fully engaged in the grooves in piston bosses.



Illust. 1-17. Installing piston assembly.

2. Coat the cylinder bore and each piston ring with clean engine oil. Insert one ring into the bore. Use the piston to force the ring squarely down inside the bore below normal ring travel. Position a feeler gauge between the ends of the ring and compare the existent gap against the specified gap for a new ring. Specified gap as follows:

K-161 - - - - - .007 to .017 inch  
 K-241 and K-301 - .010 to .020 inch

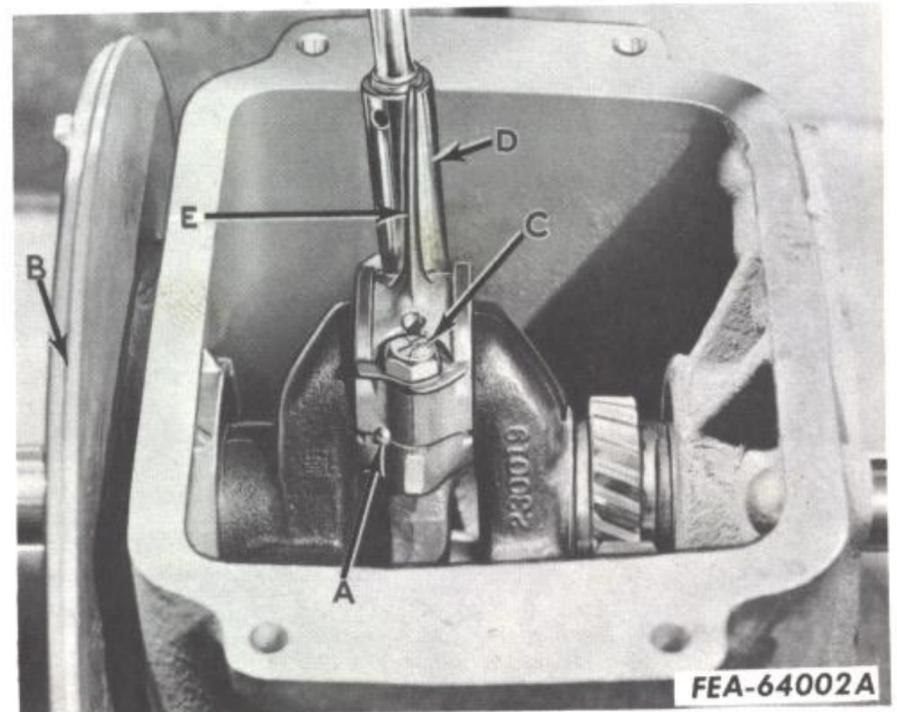
Remove the first ring and install the other rings and repeat the foregoing procedure.

3. Piston rings must be installed according to their markings. Install compression ring with groove or bevel up when it is located on the inside of the ring. The groove or bevel goes down when located on the outside of ring.

4. After rings are in proper position and in the correct grooves, oil the complete assembly, stagger ring gaps so they are not in line and insert complete assembly into cylinder bore. Be sure connecting rod marking "A" (Illust. 18) is toward camshaft side of engine. Use a ring compressor to prevent ring breakage during installation (Illust. 1-17).

## Attaching Rod to Crankshaft

1. After piston assembly is installed, place the block on end and oil connecting rod and crankpin.



Illust. 1-18. Tightening connecting rod cap screws.

A - Connecting Rod Marks	C - Cap Screw
B - Bearing Plate	D - Socket Wrench
	E - Oil Slinger

2. Install connecting rod cap, lock and cap screws to connecting rod (Illust. 1-18). K-241 and K-301 use flat washer for lock. The oil hole in the cap is on the camshaft side of the engine when properly installed.

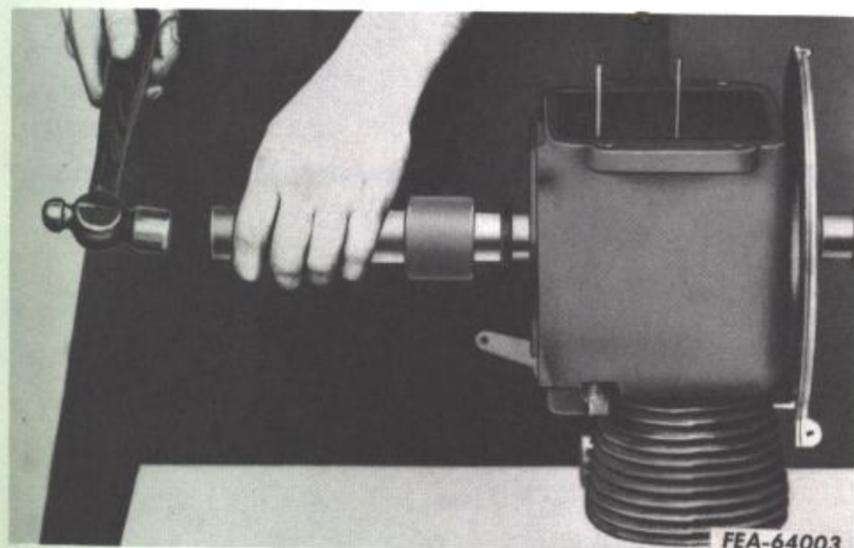
3. Use the torque wrench to tighten cap screws to 200 inch pounds on the K-161, and 300 inch pounds on the K-241 and K-301. Back off the screws and retighten cap screws to 180 inch pounds on the K-161, and 280 inch pounds on the K-241 and K-301. This two-step procedure will assure a tight fit of cap to rod and avoids the possibility of screws tightening in threads while the cap remains loose.

**NOTE:** Be careful not to bend the oil slinger "E" (Illust. 1-18).

### Installation of Oil Seals on Crankshaft

**IMPORTANT:** The oil seal at the front of the engine is countersunk 1/8 inch in factory production. This is not necessary for service. The service oil seal is to be installed flush with the crankcase. Since the seal will be seating on a new portion of the crankshaft, it is extremely important that all paint and any foreign material be removed from the sealing surface before the new seal is installed.

1. Model K-161 Only: Place the seal protector tool FES 54-5 over the crankshaft at the front of the engine and protector tool FES 54-4 over the crankshaft at the flywheel end of the engine.



Illust. 1-19. Installing oil seal on front side of engine.

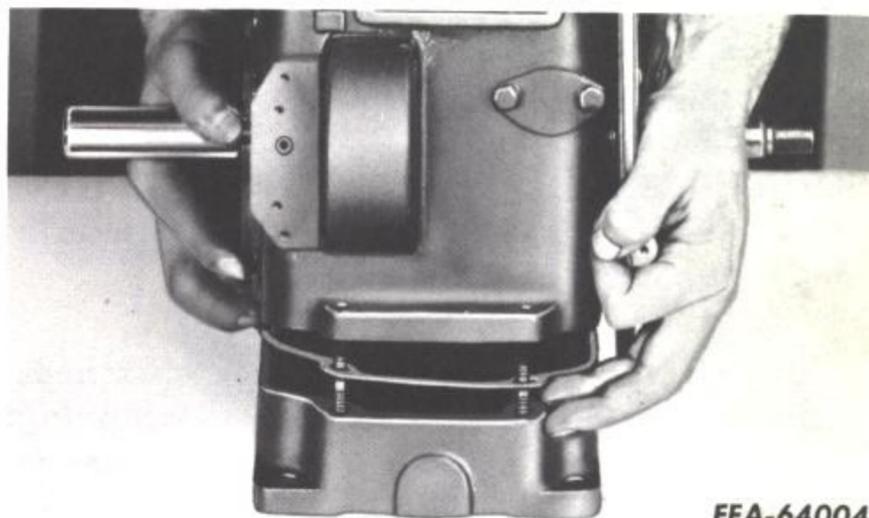
2. Lubricate the seals and slide them onto the protector tools. Drive the front seal in flush with the cylinder block and the rear seal flush with the bearing plate, with seal driver FES 54-6 (Illust. 1-19).

**NOTE:** The two seal protector tools and the driver can be ordered from:

Service Tools Inc.,  
1901 S. Indiana Ave.  
Chicago, Illinois 60616

3. K-241 and K-301: Remove any burrs or sharp edges from the crankshaft keyway. Lubricate and install the seals flush with the bearing plate.

### Oil Base



Illust. 1-20. Installing oil base.

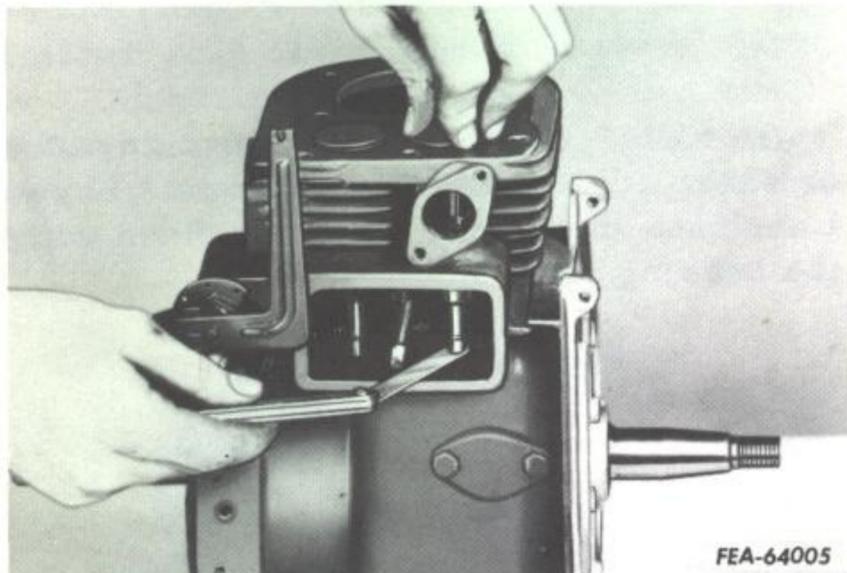
1. Assemble oil base to the block with four screws (Illust. 1-20).

2. It is important that a new gasket be used to prevent oil leakage.

3. Use 5/16 inch pilot studs to align the cylinder block, gasket and oil base.

## Installing and Setting Valves

1. Valves, valve seats and ports should be thoroughly cleaned.



FEA-64005

Illust. 1-21. Checking valve clearance.

2. Turn crankshaft to top dead center at end of compression stroke. On K-161 install valves less springs and keepers and check clearance (Illust. 1-21).

Valves that do not have sufficient clearance on K-161 engine must be removed and stem ends ground until desired clearance is obtained. ENDS MUST BE GROUND SQUARE AND ALL BURRS MUST BE REMOVED. If clearance is excessive install new valves.

3. After correct clearance is obtained, remove the valves and install valve springs and retainers. Replace the valves, compress the springs (using a spring compressor) and place locking key in grooves of the valve stems.

4. On K-241 and K-301 tappets are adjustable and grinding of valve stems is not necessary. Assemble valves, springs, retainers and keepers and then adjust tappets to proper clearance.

K-161	-	.006 to .008 cold (Intake)
		.015 to .017 cold (Exhaust)
K-241	}	.008 to .010 cold (Intake)
and		.017 to .019 cold (Exhaust)
K-301		

## Cylinder Head



FEA-64006

Illust. 1-22. Cylinder head assembly.

1. Always use a new gasket when the head has been removed for service work. It is recommended that head gaskets be soaked in water before assembly.

2. Check the cylinder head on a face plate to be sure the gasket surfaces make good contact at all points.

3. It is important that cylinder head cap screws be tightened evenly and in steps until inch pounds torque specified is reached (Illust. 1-23).

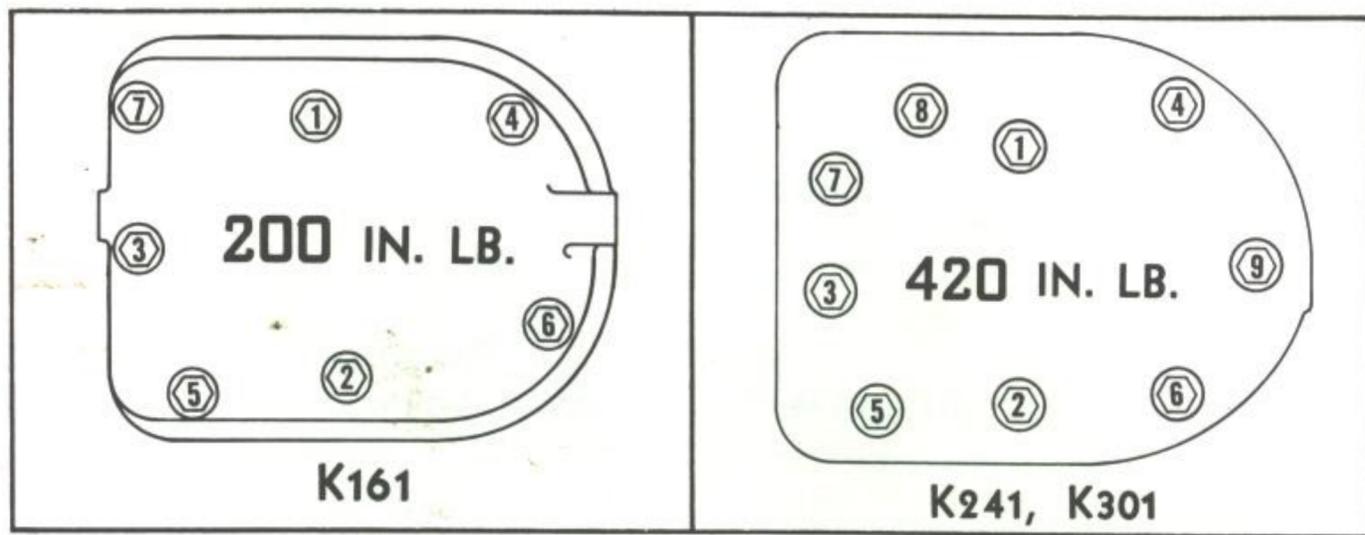
K-161 - - - - - 200 inch pounds  
K-241 and K-301 - 420 inch pounds

**NOTE:** Do not torque head until steps 1 and 2 of Flywheel, Blower Housing Section page 1-22 have been completed.

4. Spark plug gap should be .025. Install spark plug and tighten to 27 foot pounds torque.

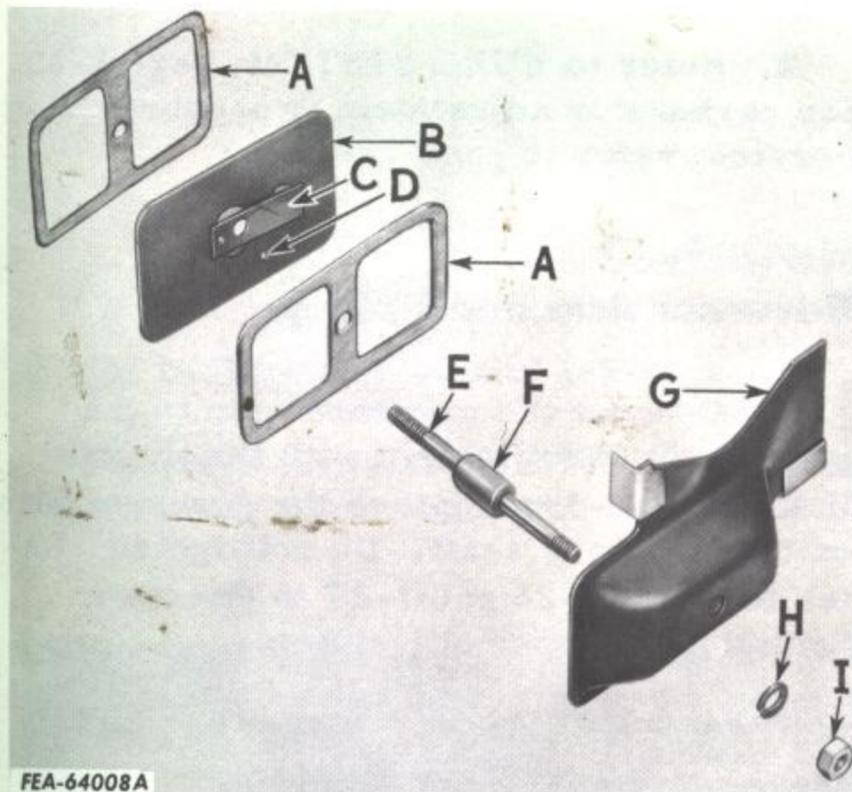
## Breather Assembly

1. The reed type breather valve maintains a slight vacuum in engine crankcase. All parts must be clean and in good condition. Parts can be replaced as necessary.



FESM-2784

Illust. 1-23. Head torquing sequence.



FEA-64008A

Illust. 1-24. Exploded view of breather and vent assembly.

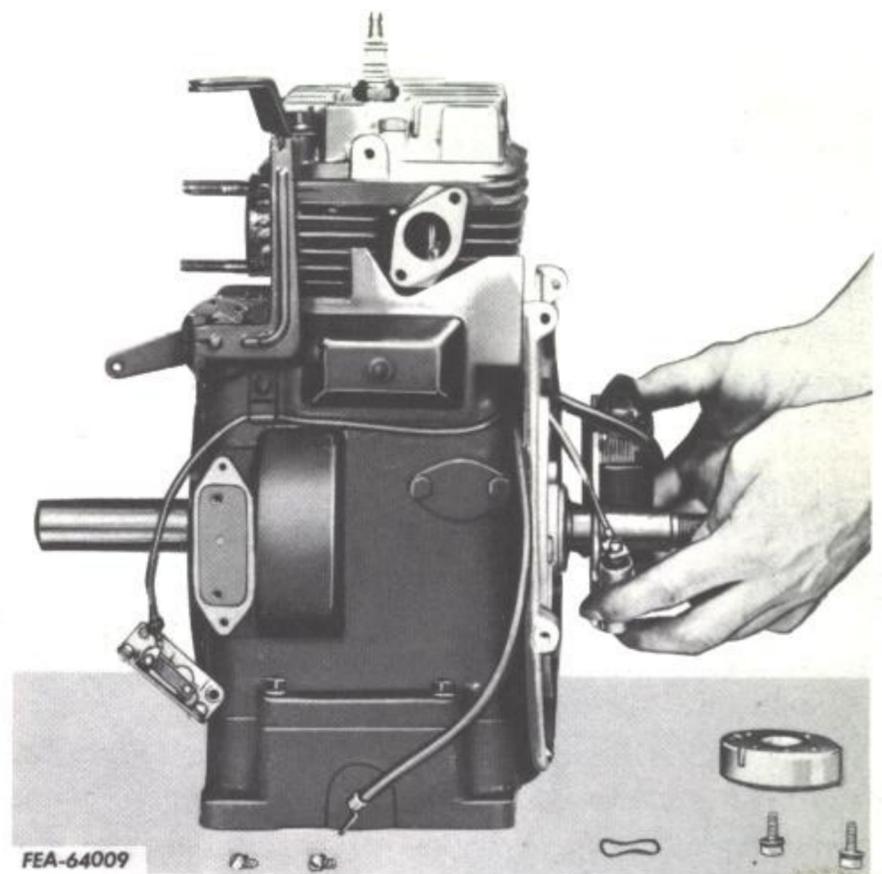
- |             |            |            |
|-------------|------------|------------|
| A - Gaskets | D - Hole   | G - Cover  |
| B - Plate   | E - Stud   | H - Washer |
| C - Reed    | F - Spacer | I - Nut    |

2. The correct order for assembly of the breather is as follows (Illust. 1-24): A-Gasket, B-Plate and C-Reed, D-small drilled hole must be at bottom of plate and reed to the outside. Improper assembly will result in oil leakage.

3. Cover must be tight to prevent oil leaks.

### Magneto (If equipped)

1. Install square key in slot of crankshaft.



FEA-64009

Illust. 1-25. Assembly of magneto.

2. Illust. 1-25 shows the magneto in position. Note how breaker lead and high tension spark plug cables are pulled through plate opening.

3. After the magneto assembly has been fastened to the bearing plate, the rotating magnet is pressed onto the crankshaft. Magnet is marked "ENGINE SIDE" for correct assembly.

## **Flywheel, Blower Housing, Tank Brackets and Fuel Tank**

NOTE: At this time it is desirable to clean the area around the timing mark "S" on the flywheel so it will be readily visible for engine timing.

1. Place flywheel in position (the square key aligns flywheel on shaft).
2. Remove enough head bolts to locate blower housing, head baffle, tank bracket and install. Torque head as instructed in Cylinder Head Section (Illust. 1-23).
3. Install screen, "V" pulley, lock washer, and flywheel nut. Torque nut to 60 ft. lbs.
4. Install the main clutch drive plate on the "V" pulley.
5. Install fuel tank, sediment bowl and connect to carburetor.
6. Install cylinder baffle, muffler and muffler baffle.

## **Starting Pulley**

Install the starting pulley. The dimension from the front face of the starter-generator pulley hub to the end of the crankshaft must be 1-1/2 inches for the K-161 Engine and 1-1/4 inches for the K-241 and K-301. Be sure the pulley set screws are torqued to 12 to 14 foot pounds. The set screw that contacts the engine shaft must be tightened first; then tighten the set screw that contacts the key.

If equipped with front PTO refer to Chassis Section for service or installation.

## **Breaker Points**

1. Install push rod.
2. Fasten breaker in place with two screws.
3. Place the cover gasket in position and attach the magneto lead or coil lead. For precision ignition setting, refer to Ignition Timing, page 1-33.

## **Carburetor**

1. Using a new gasket attach the carburetor.
2. Refer to FUEL SYSTEM, page 1-23 for carburetor adjustment procedure. For Service, refer to page 1-24.

## **Governor Arm and Linkage**

1. Connect the governor arm to the carburetor throttle arm with the throttle link (Illust 1-3) and place the governor arm on the governor shaft. Do not tighten. Refer to pages 1-26 and 1-27 in Governor Section for proper adjustments.

## **Motor-Generator (If equipped)**

Install the motor generator and adjust the drive belt to give approximately 1/4 inch of slack midway between the driven pulley and the drive pulley. Refer to wiring diagrams (pages 1-28 and 1-29) under Electrical System of this manual for the proper electrical connections.

# FUEL SYSTEM

## General Information

The fuel system consists of a gasoline storage tank, shut-off valve, sediment bowl, fuel line with connections, and carburetor.

Service difficulties with fuel systems usually originate from improper carburetor adjustments, dirt or gum. If gum forms in the components it will be necessary to disassemble and thoroughly clean the carburetor.

Any carburetor having loose worn shafts

or a damaged fuel nozzle must be replaced by a new carburetor assembly. Wear in the throttle (or choke) shaft area is extremely critical for this not only upsets mixture control but allows entrance of unfiltered air which will quickly ruin the engine.

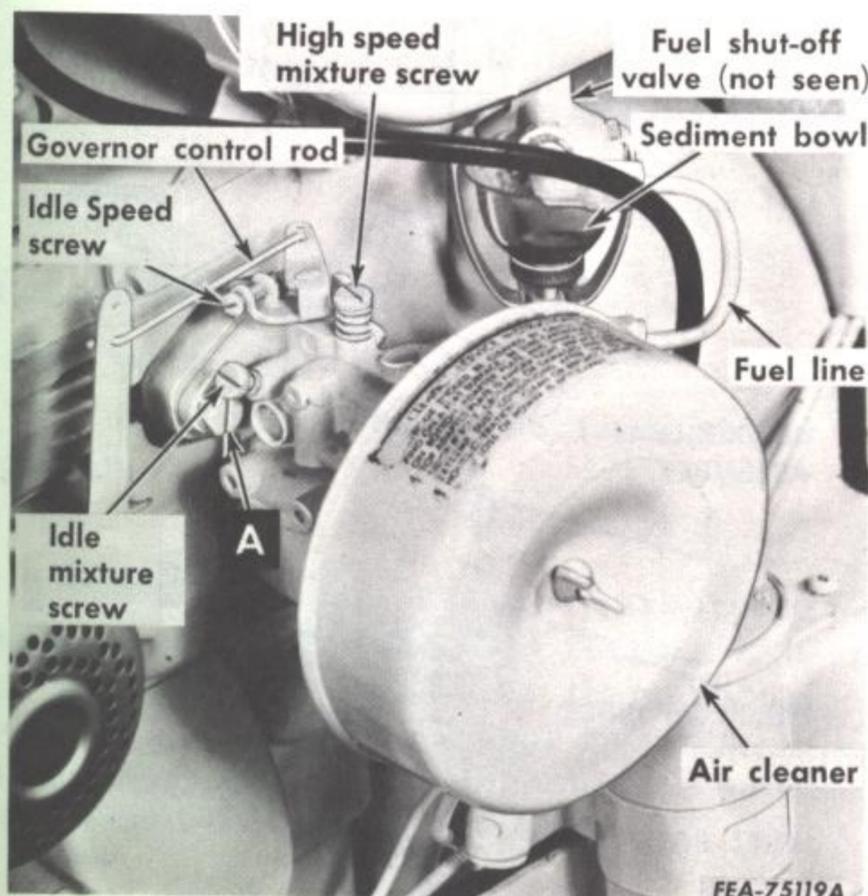
Throttle shafts, choke shafts, main fuel nozzles and other parts are not serviced separately.

## Carburetor Adjustments

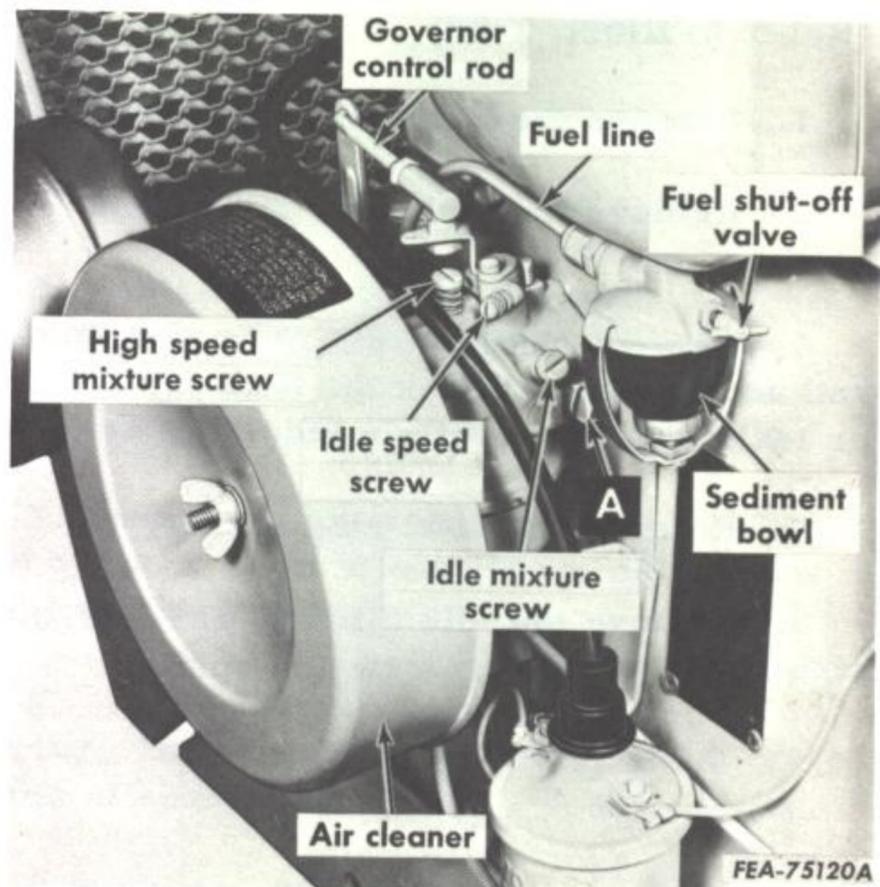
(Refer to Illusts. 1-26 and 1-27)

If adjustment is necessary, the following procedure is recommended.

Idle mixture screw adjustment should be made at the same time as high speed mixture screw adjustments, as each effects the other.



Illust. 1-26. Carburetor for Model 72.



Illust. 1-27. Carburetor for Model 104, 105, 124 and 125.

1. Turn the high speed mixture screw counter-clockwise two turns from closed position, turn the idle mixture screw 1-1/2 turns from the closed position and start the engine.

2. After the engine has reached normal operating temperature, accelerate and check the response. Place the engine under full load and adjust as follows:

a. If the engine misses and backfires under full load, the high speed mixture is too lean. The high speed mixture screw must be turned counter-clockwise 1/4 turn at a time until the condition is corrected.

b. If engine shows sooty exhaust and is sluggish under full load, the high speed mixture is too rich. The high speed mixture screw must be turned clockwise 1/4 turn at a time until the condition is corrected. Final check of high speed mixture; operate the engine under full load and make any corrections necessary for smooth operation.

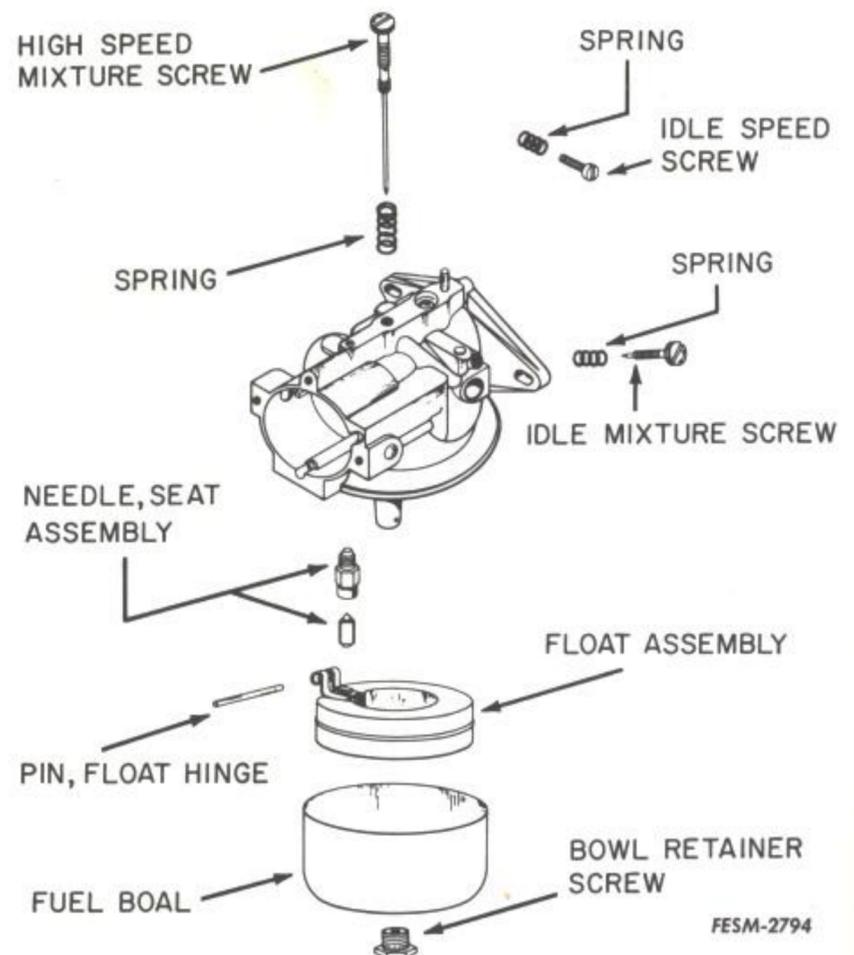
3. The final idle adjustment should be made at an engine speed of not less than 1000 rpm. Adjust until smoothest idle is obtained.

**CAUTION:** Do not use force on high speed mixture screw or idle speed mixture screw - - they will be damaged.

## Disassembly of Carburetor

(Refer to Illust. 1-28)

1. Remove the carburetor from engine.
2. Remove the bowl nut, gasket, and bowl.
3. Remove the float pin, float, needle and needle seat. Check the float for dents or leaks. Check float pin holes for wear.
4. Remove the bowl ring gasket.
5. Remove the idle mixture screw and high speed mixture screw and spring.



Illust. 1-28. Exploded view of carburetor.

## Cleaning Carburetor Parts

1. Clean all parts in solvent. Gum is easily removed with an alcohol or acetone solvent.

2. Be sure all carbon deposits are removed from bore, especially where the throttle valve seats in the casting.

3. Blow out all passages with compressed air.

4. Replace all worn and damaged parts that are serviced separately. **ALWAYS USE NEW GASKETS.**

## Reassembly of Carburetor

(Refer to Illust. 1-28)

1. Install needle seat, needle, float and float pin.

2. Set float level. With the carburetor casting inverted and the float resting lightly against the needle in its seat, there should be  $11/64 \pm 1/32$  inch clearance between machined surface of casting and free end of float (side opposite needle seat).

3. Adjust by bending lip of float with a small screwdriver.

4. Install new bowl ring gasket, new bowl gasket, new bowl nut gasket and bowl nut. Tighten securely after making sure bowl is centered on gasket.

5. Install high speed mixture screw and spring. Turn in until the needle seats and back out two turns.

6. Install idle mixture screw and spring. Back out approximately 1-1/2 turns after seating lightly.

**CAUTION:** Do not jam the mixture screws into their seats as this will damage them.