Group 20

KEC-440/21 CCW REED VALVE ENGINE OVERHAUL

GENERAL INFORMATION

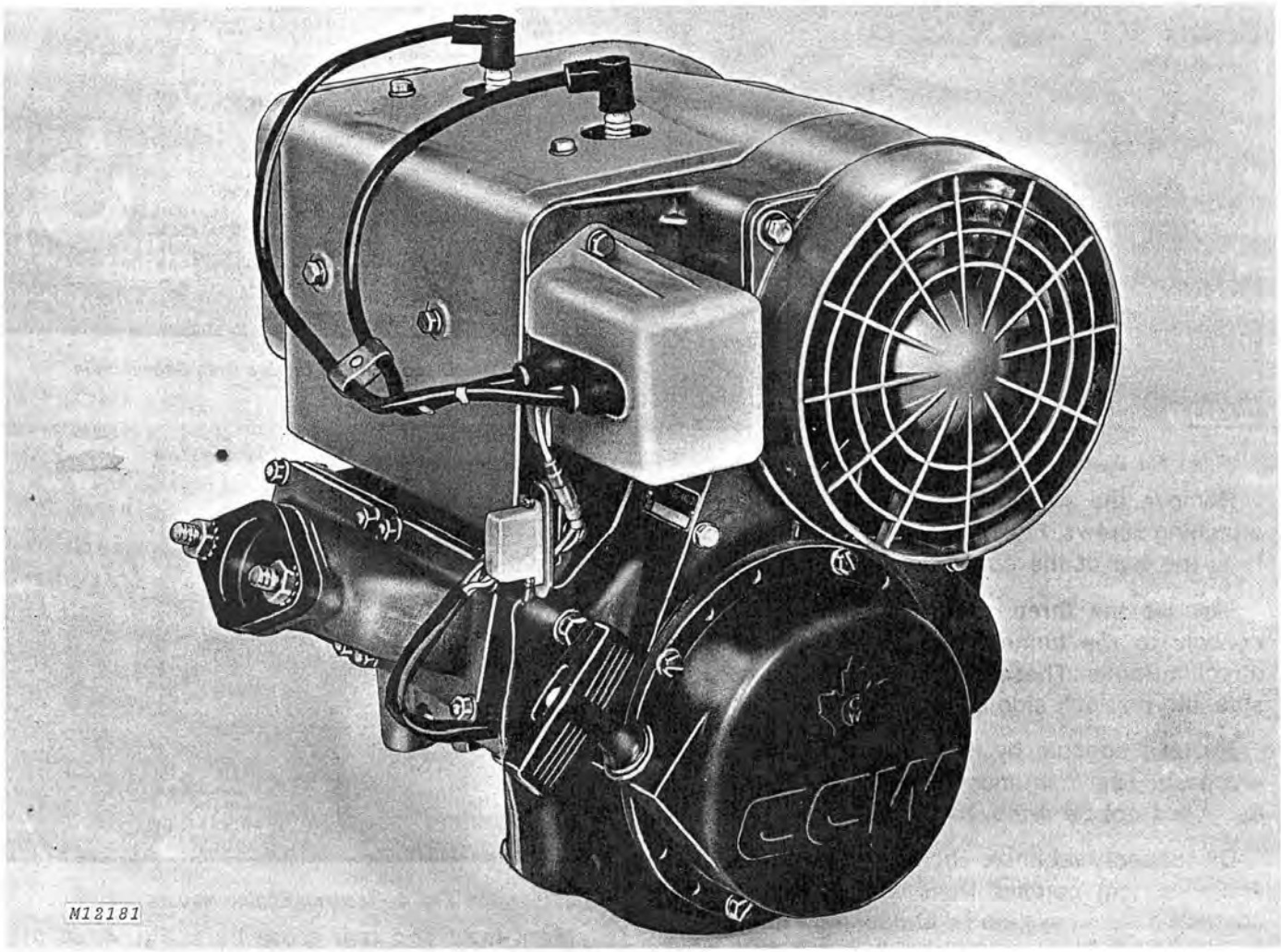


Fig. 1—KEC-440/21 CCW Reed Valve Engine

The KEC-440/21 Canadian Curtiss-Wright engine used on the JDX8 Snowmobile, Fig. 1, is a 2-cylinder, 2-cycle, air-cooled, reed valve engine. The engine has five ball bearings; two between crankthrows, one on the flywheel end, and two on the PTO end of the crankshaft. Needle bearings are used at both crankpin and piston pin locations.

The crankshaft, inner ball bearings and seals, connecting rods and crankpin bearings are available only as a complete assembly. If any of these parts are worn or damaged an entire crankshaft assembly must be installed. The complete assembly also includes outer seals and bearings which may, however, be purchased separately. The crankcase upper and lower halves are available only as a matched set.

Oversize pistons are not available for service.

The reed valve engine has metric handware. Always use proper tools when servicing the engine.

See Group 5 for "Principle of Operation".

REMOVING ENGINE

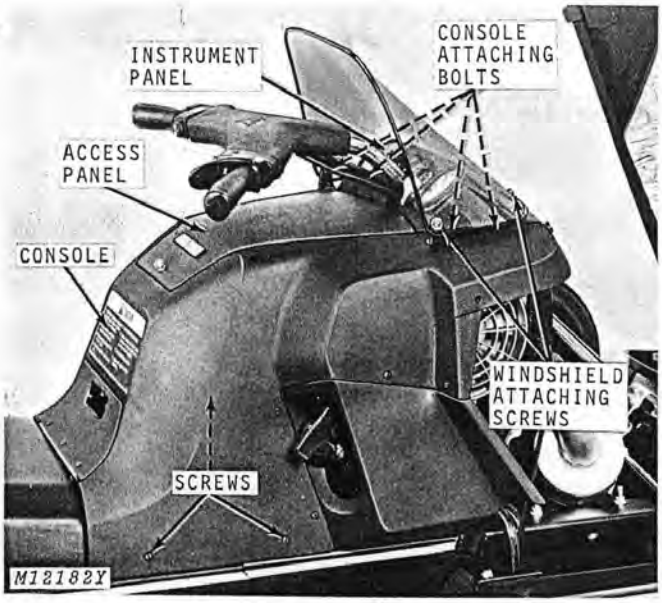


Fig. 2—Removing Console and Windshield

Remove the windshield by removing the four attaching screws, Fig. 2. Remove the access panel from the top of the console.

Remove the three screws securing the lower console to the tunnel. Loosen the four console attaching bolts. These are located under the console and on each side of the instrument panel.

Remove console by lifting it up and sliding it rearward. The instrument panel remains in place and need not be removed.

Disconnect fuel lines, choke and throttle cables, and electrical coupler from engine, Fig. 3. Disconnect exhaust system by unhooking four springs by ball joint. Remove drive belt guard and drive belt.

If snowmobile is equipped with electric starter, remove lead from starter terminal. Disconnect ground strap from engine.

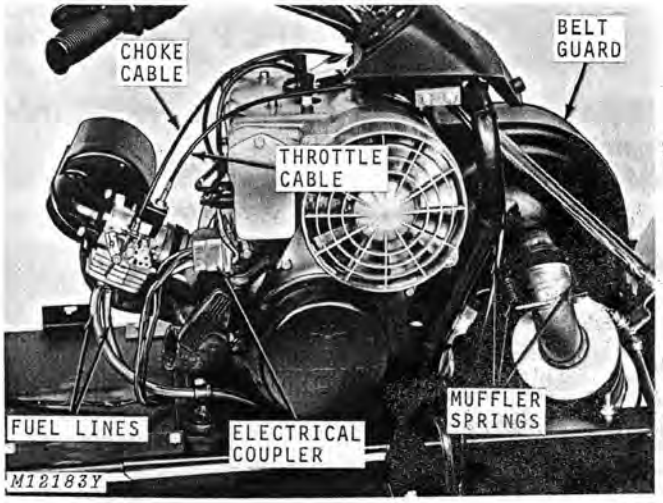


Fig. 3—Disconnecting Engine from Snowmobile

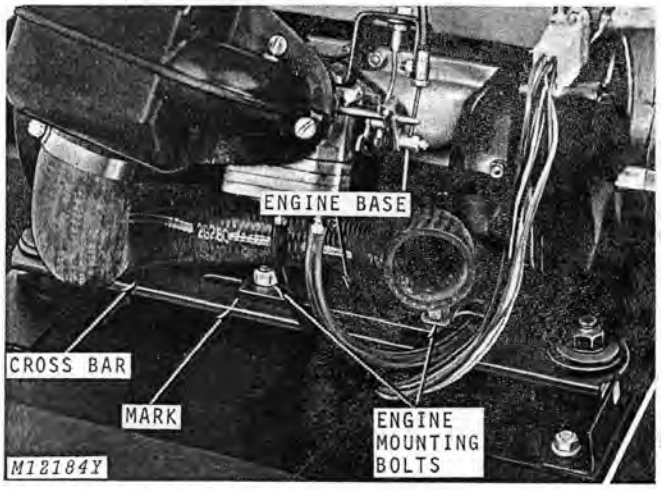


Fig. 4—Marking Engine Mounts

Mark front and rear cross bars, Fig. 4, so that sheaves will be in correct alignment when engine is reinstalled.

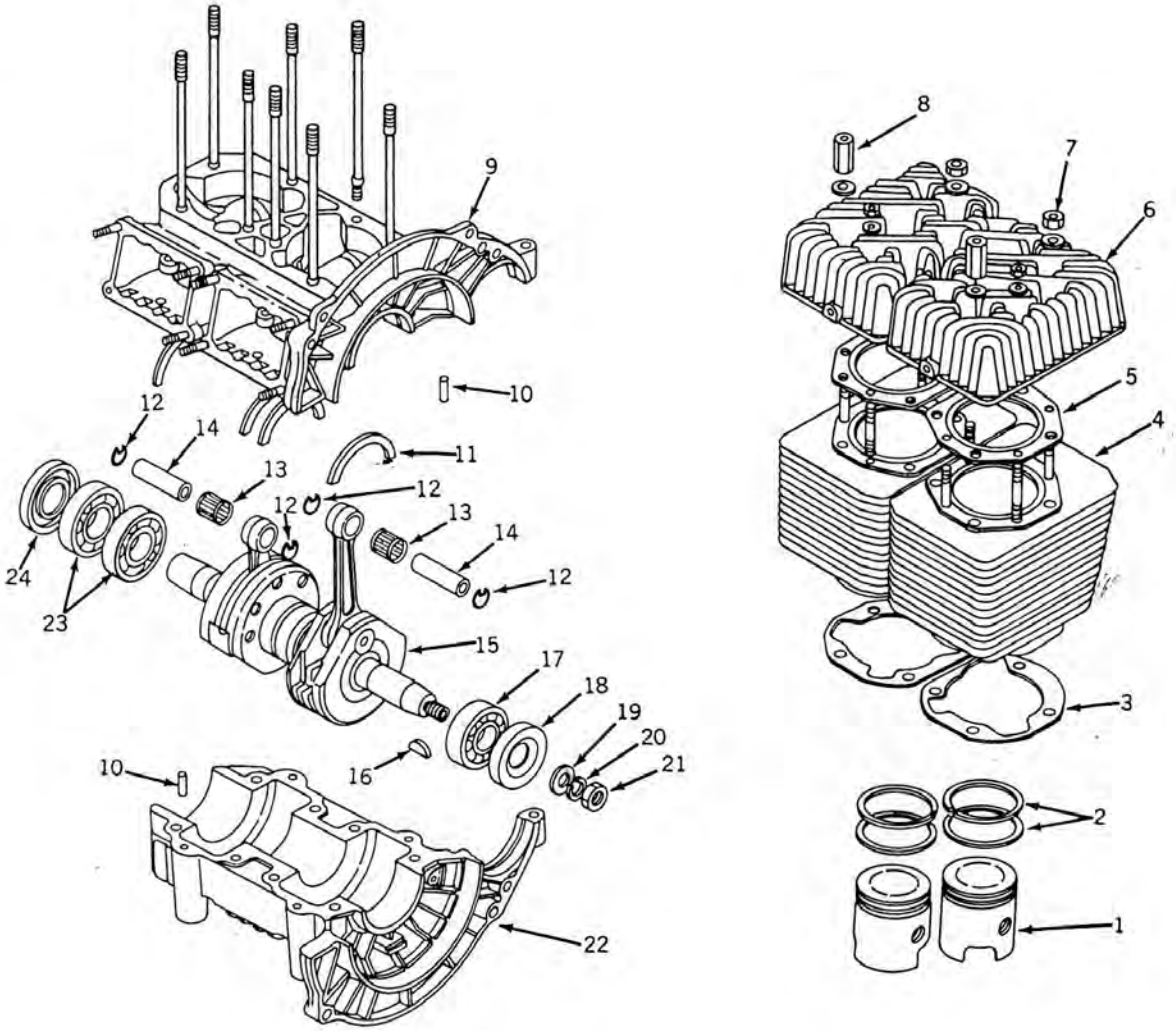
Remove four bolts securing engine base to cross bars. Lift engine from snowmobile. Remove engine base from engine.

Place engine on a workbench and thoroughly clean exterior surface with cleaning solvent. Use JDM-16 bench mounted service fixture, shown in Figs. 6 and 7, for servicing snowmobile engines.

Remove carburetor.

Remove drive sheave. Refer to Section 50, Group 15 for proper procedure and tools.

DISASSEMBLY



M11935

1—Piston
2—Rings
3—Cylinder Base Gasket
4—Cylinder
5—Head Gasket
6—Cylinder Head
7—Nut
8—Special Long Nut
9—Upper Crankcase Half
10—Dowel
11—Oil Seal Retaining Ring
12—Circlip
13—Connecting Rod Needle Bearings
14—Piston Pin
15—Crankshaft Assembly
16—Woodruff Key
17—Crankshaft Bearing (fan end)
18—Oil Seal (fan end)
19—Washer
20—Lock Washer
21—Nut
22—Lower Crankcase Half
23—Crankshaft Bearing (PTO end)
24—Oil Seal (PTO end)

Fig. 5—Exploded View of KEC-440/21 CCW Reed Valve Engine

Removing Exterior Components

NOTE: To prevent loss and to aid in assembly, keep attaching hardware with each part as it is removed.

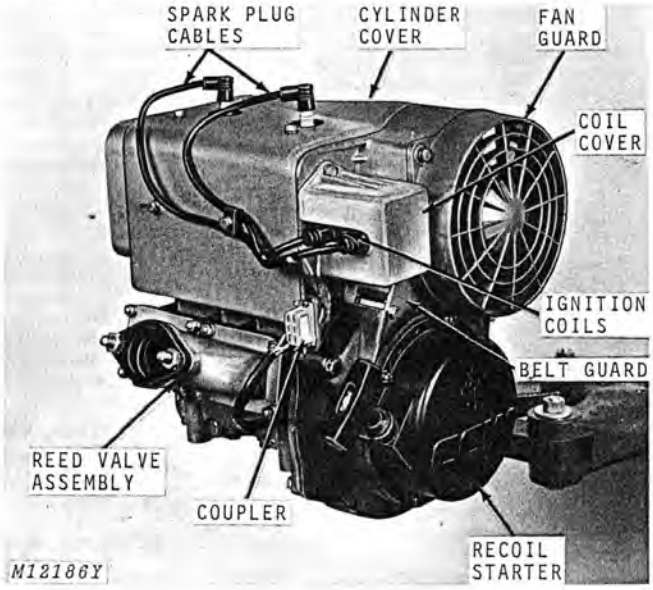


Fig. 6—Removing Exterior Components

Disconnect spark plug cables and remove plugs, Fig. 6. Disconnect the two ignition leads between the ignition coil and coupler. Remove coil cover and high tension coils with spark plug cables.

Remove the bolts securing cylinder cover to engine and remove cover, Fig. 6. Remove exhaust manifolds. Remove starter motor, if so equipped.

Remove recoil starter assembly, starter cup, belt sheave and window plate from flywheel.

Removing Flywheel

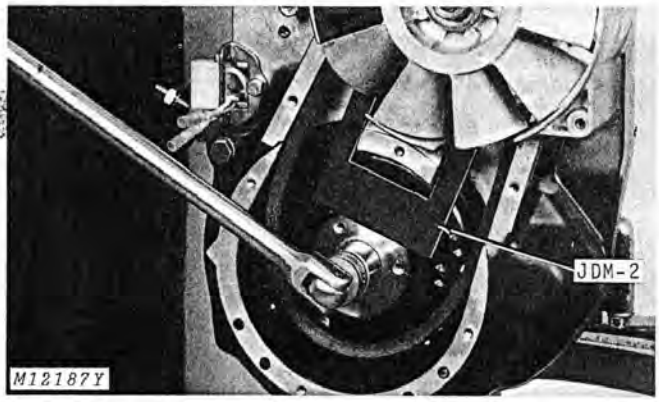


Fig. 7—JDM-2 Flywheel Holding Tool

Install JDM-2 flywheel holding tool, Fig. 7. Remove retaining nut, lock washer and flat washer securing flywheel to crankshaft.

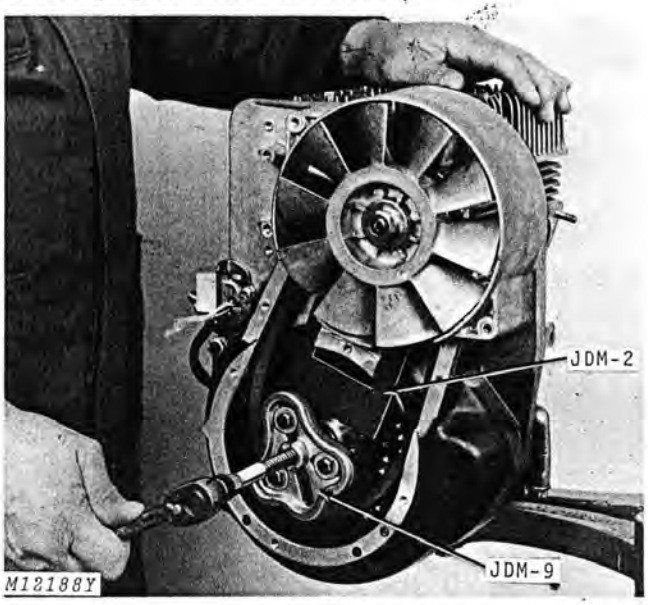


Fig. 8—Removing Flywheel

Install JDM-9, flywheel puller, Fig. 8, using the three tapped holes in the flywheel. Hold flywheel with JDM-2 tool and tighten puller center bolt to 35 to 40 ft-lbs.

NOTE: Do not overtorque center bolt of flywheel puller. Do not hammer on end of puller bolt because damage to crankshaft or bearings may result.

If flywheel does not break loose, leave puller in place and remove fan cover assembly.

NOTE: Fan cover must be removed before flywheel can be removed.

With tension on the puller and fan cover removed, strike flywheel with a plastic or wood mallet in line with flywheel keyway.

Removing Cylinder Heads

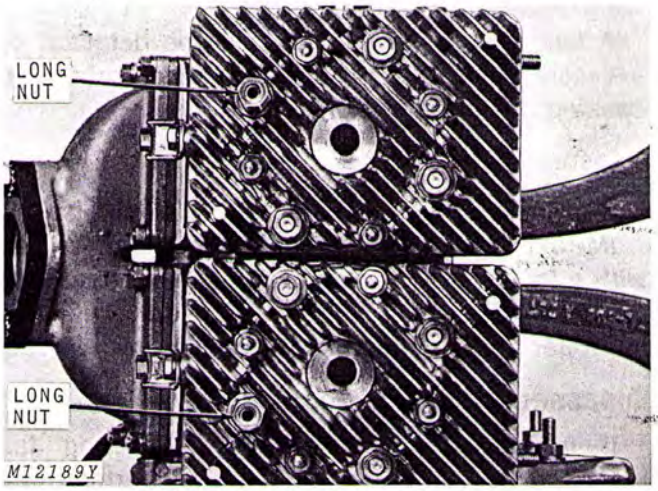


Fig. 9—Removing Cylinder Heads

Remove eight cylinder head retaining nuts, Fig. 9. Remove cylinder heads and discard gaskets.

Checking Crankshaft Runout

Before proceeding further with engine disassembly, check crankshaft runout.

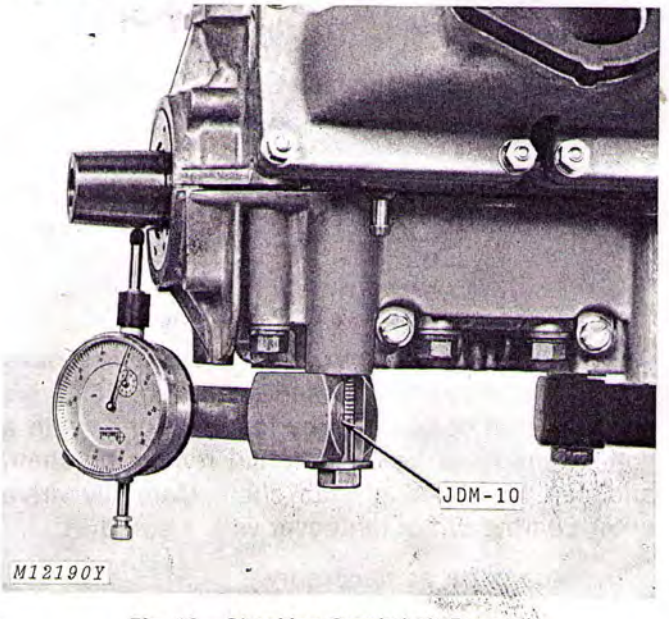


Fig. 10—Checking Crankshaft Runout

Install a dial indicator against the crankshaft at the junction of the tapered and parallel sections of the shaft, Fig. 10. Rotate crankshaft and check runout. Maximum permissable runout is 0.0035-inch. If not within limits, replace crankshaft assembly.

Lift cylinders off studs and discard cylinder base gaskets.

Removing Pistons

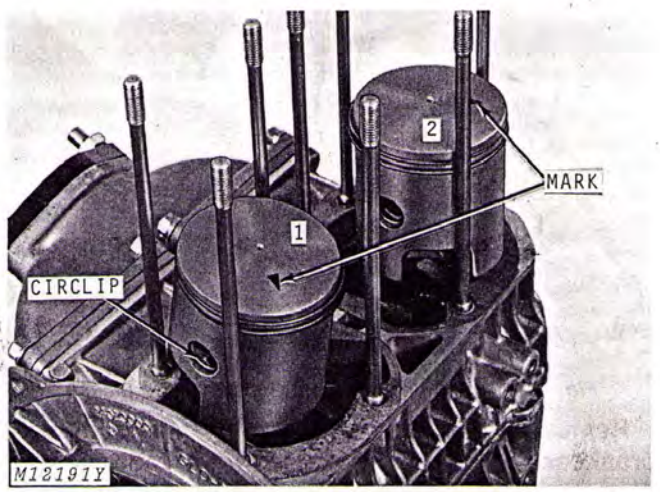


Fig. 11—Mark on Piston Crown Exhaust Port Side

Before removing pistons, be sure piston crowns are marked on the exhaust port side, Fig. 11. If no mark is legible, inscribe pistons accordingly. Mark pistons "1" and "2" and scribe mark on piston toward the exhaust port side.

NOTE: Pistons "1" and "2" are not interchangeable and must be installed correctly during reassembly.

Remove circlips from each end of piston pin.

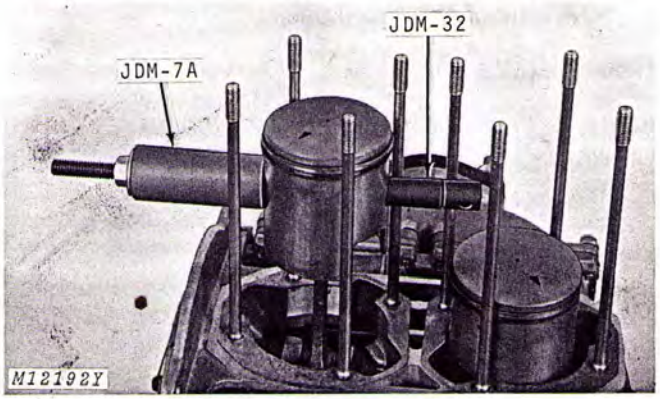


Fig. 12—Removing Pistons

Use JDM-7A piston pin removal tool and JDM-32 piston pin guide to remove piston pins, Fig. 12.

IMPORTANT: Be careful when removing piston pins to prevent damage to connecting rod needle bearings.

Remove needle bearings from connecting rods.

Removing Crankshaft

Remove reed valve assembly.

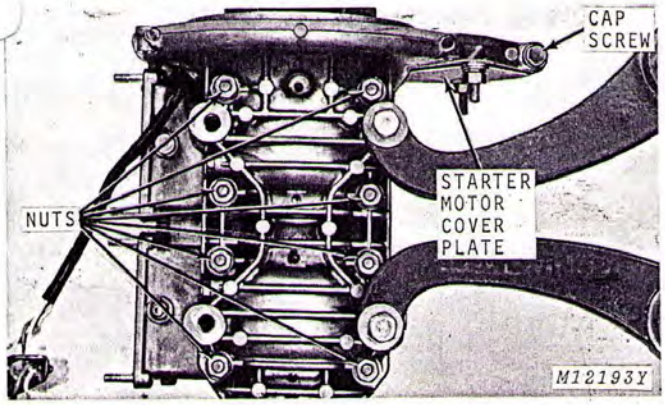


Fig. 13—Removing Nuts from Bottom of Crankcase

Remove eight nuts and washers from bottom of crankcase, Fig. 13. Remove starter motor cover plate, cap screw by cover plate, and two screws securing stator plate, before separating crankcase halves. Use a soft hammer and lightly tap the halves to separate.

IMPORTANT: Do not pry crankcase halves apart with a screwdriver. This will damage crankcase sealing surfaces.

Remove stator assembly and store in flywheel until ready for reassembly.

Remove crankshaft by lifting upward. Note the four seal retaining circlips located in the UPPER or TOP half of the crankcase.

Reed Valve Service

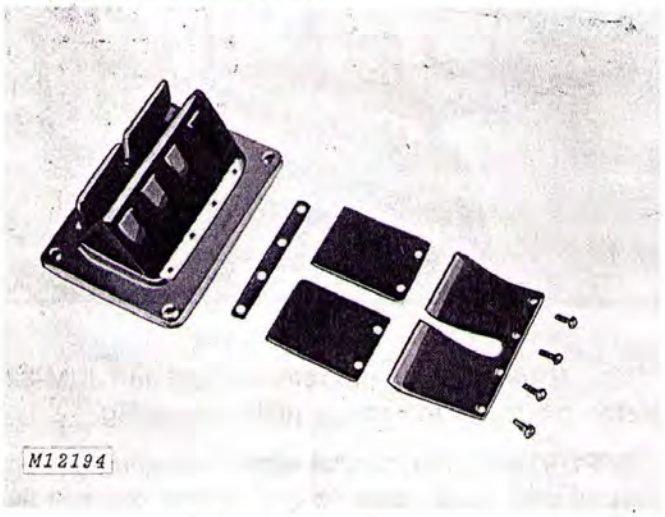


Fig. 14—Reed Valve Assembly

Disassemble and clean reed valve assembly, Fig. 14.

A faulty reed valve can usually be detected by excessive fuel "spit-back" through the carburetor, causing a "popping" noise.

Inspect reeds for cracking or warpage. Inspect reed seating surfaces for damage or wear.

IMPORTANT: Prolonged running of an engine with a faulty reed valve could cause a seized piston. This is due to the lean fuel mixture caused by improper fuel transfer on the pistons down-stroke.

Disassembling Fan Cover

If inspection reveals damaged cooling fan blades or worn fan shaft bearings, further disassembly is necessary to replace parts.

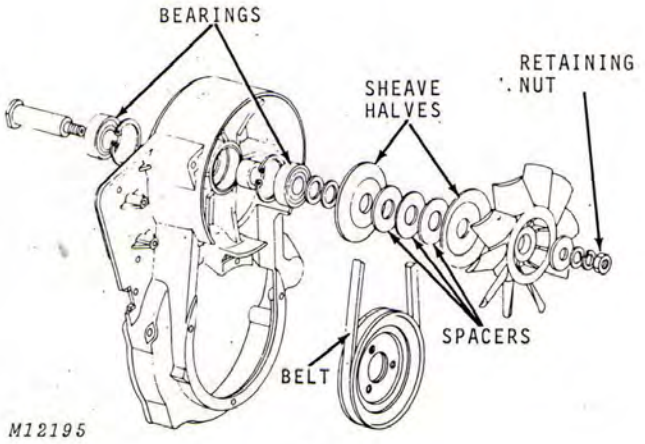


Fig. 15—Fan Assembly

Remove retaining nut, washers, fan, sheave halves and spacers from fan shaft, Fig. 15. Drive assembly out of bearings by tapping lightly with a soft mallet. Inner bearing should remain on shaft, and can be pulled off fan shaft. Carefully drive outer bearing out of fan cover with a soft drift.

Replace parts as necessary.

INSPECTION

Prior to inspection, clean all parts except crankshaft assembly and ignition parts in a suitable cleaning solvent.

For analysis and inspection of parts refer to Group 10 of this section.

ASSEMBLY

Assembling Fan Cover

Assemble fan as shown in Fig. 15, if previously disassembled to replace worn parts.

Torque retaining nut to 28 to 31 ft-lbs.

Replacing Crankshaft Bearings

Removing Crankshaft Outer Bearings

NOTE: Refer to Group 10, page 20-10-11 for proper procedure for removing outer bearings.

Installing Outer Crankshaft Bearings and Seals

Apply a light film of 2-cycle engine oil to crankshaft and inner race of ball bearing.

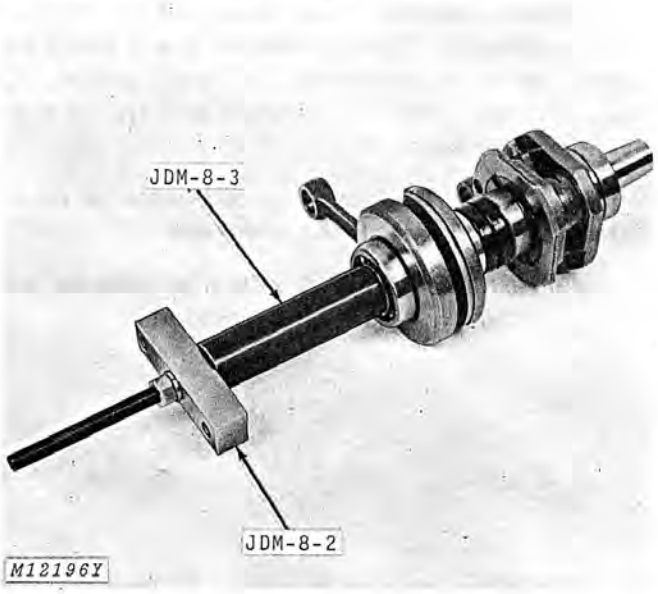


Fig. 16—Installing Outer Crankshaft Bearing

Assemble JDM-8-2 and JDM-8-3 as shown in Fig. 16 to install outer bearings. Press bearings onto crankshaft until bearing is firmly seated against counterweight. Be sure bearing is started true and is not cocked on shaft.

Thread other end of crankshaft bearing tool into PTO end of crankshaft for installing PTO end bearings.

NOTE: KEC-440/21 reed valve engines use two ball bearings on PTO end of crankshaft.

Lubricate and install seals, lip inward, on each end of crankshaft.

IMPORTANT: Cover keyway on flywheel end of crankshaft with tape to prevent damage to new seal.

Installing Crankshaft

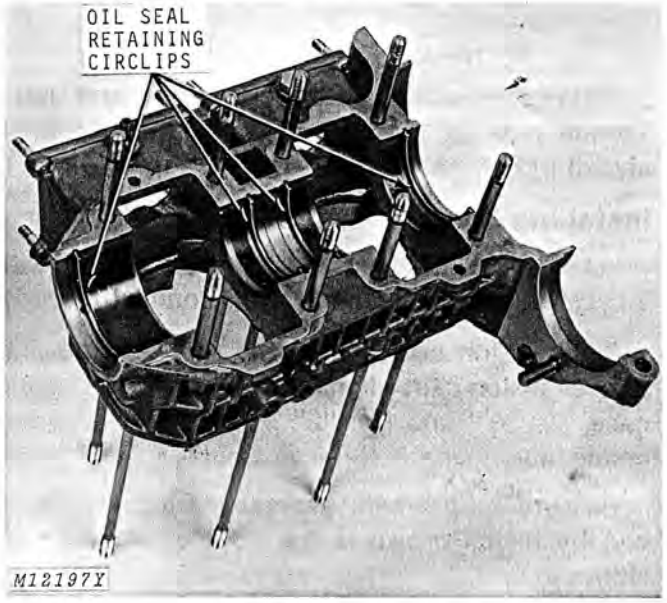


Fig. 17—Installing Crankshaft

Stand upper crankcase half on studs and install oil seal retaining circlips, Fig. 17. Liberally coat crankshaft and bearings with 2-cycle oil and install in upper crankcase half. Check to be sure oil seal retaining circlips do not become dislodged.

IMPORTANT: Apply an even coat of good quality latex base, non-hardening, gasoline-resistant, sealing compound to sealing surfaces of both crankcase halves.

NOTE: DO NOT permit sealer to run into interior of crankcase halves.

Install stator assembly over crankshaft. Be sure rubber grommet on stator assembly wiring leads is positioned in the recess between upper and lower crankcase halves. Install the lower crankcase half to the upper half. Be sure the two dowel pins are properly engaged with mating holes in opposite half of crankcase.

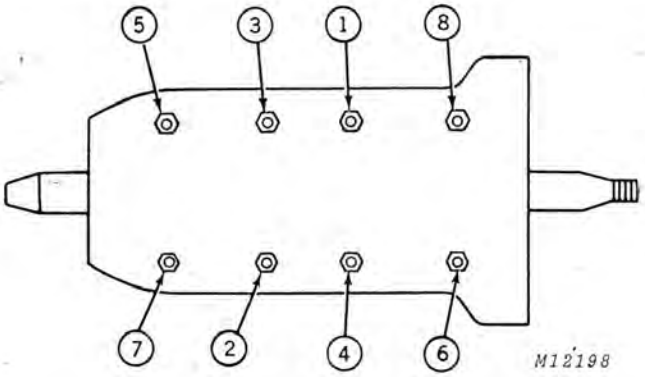


Fig. 18—Nuts on Lower Crankcase Half

Install flat washers, lock washers and nuts. Torque nuts to 15 to 18 ft-lbs in the sequence shown in Fig. 18.

Installing Pistons and Piston Rings

Lubricate connecting rod needle bearings with 2-cycle engine oil and install in connecting rods.

Place piston over connecting rod. Be sure port area of piston skirt aligns with port area of crankcase. No. "1" and No. "2" pistons are not interchangeable.

Be sure scribe mark (marked during disassembly) on piston crown is toward the exhaust port side.

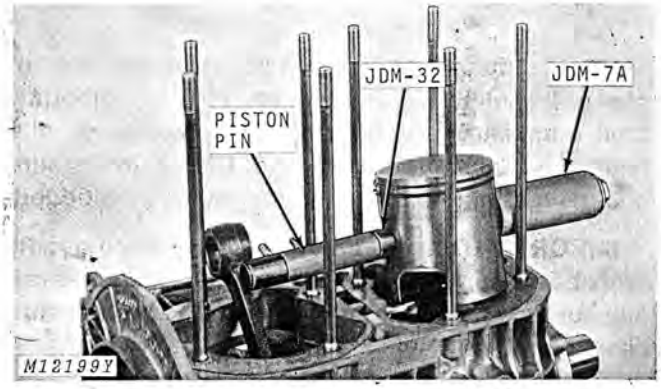


Fig. 19—Installing Piston Pin

Use tool JDM-7A with JDM-32 piston pin guide and pull piston pin into position, Fig. 19. Install four new piston pin circlips. Be sure clips have adequate tension to remain in place during engine operation.

NOTE: If new rings are to be installed, do so at this step of reassembly. Leaving the old rings on pistons until this step provides piston ring groove protection. Rings should be installed with hands only. Spread rings with thumbs for removal and installation. Install CHROME ring in top groove.

Installing Cylinders and Cylinder Heads

Install new base gaskets over cylinder studs.

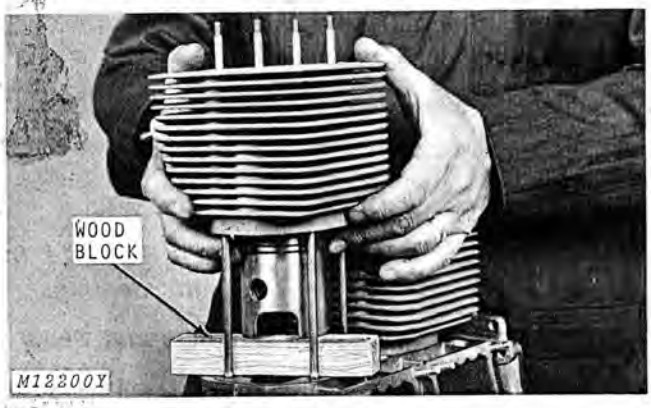


Fig. 20—Installing Cylinders

Lubricate pistons, rings and cylinders with 2-cycle engine oil. Place a suitable wood block between piston and crankcase to steady piston, Fig. 20. Compress rings with fingers and gently slide cylinder over each ring.

IMPORTANT: Be sure rings are centered on locating pins to prevent ring breakage.

Install exhaust manifold with new gaskets and tighten securely. This aligns cylinders.

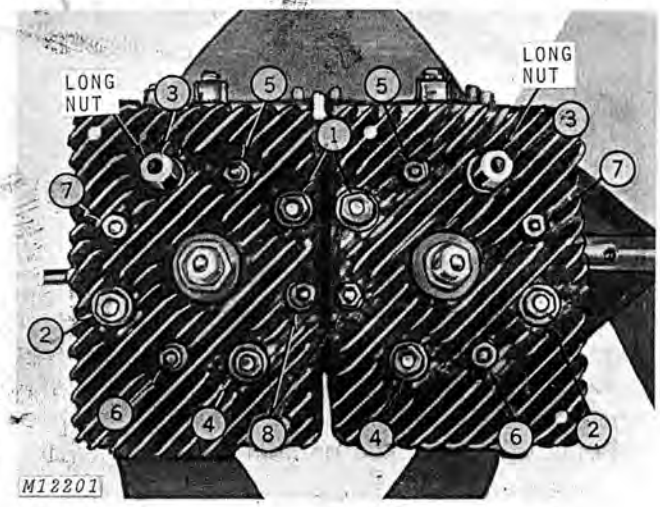


Fig. 21—Cylinder Head Torquing Sequence

Install NEW cylinder head gaskets and cylinder heads. Use flat washers under nuts and install nuts. Use special long nuts in locations shown in Fig. 21.

Torque cylinder stud nuts 1, 2, 3 and 4 in sequence to 11.5 to 14.5 ft-lbs. Complete torquing sequence by tightening cylinder head stud nuts 5, 6, 7 and 8 in sequence shown, to 5.0 to 6.5 ft-lbs.

Installing Reed Valve Assembly

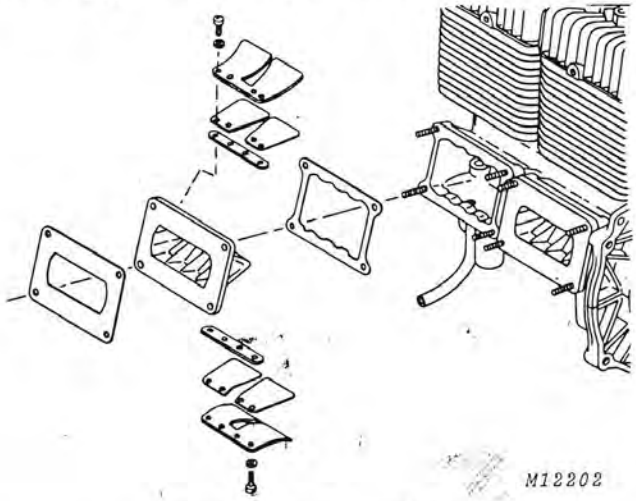


Fig. 22—Installing Reed Valves

Assemble carefully, Fig. 22, being sure reeds form a light, tight seal. If reeds are warped or cracked they must be replaced.

Use new gaskets and install reed valve assembly to crankcase. Tighten nuts securely.

Installing Flywheel

NOTE: Be sure stator plate is securely in place before installing flywheel.

Wipe crankshaft clean and install Woodruff key. Position flywheel and install flat washer, lock washer and nut. Install fan cover and secure with four cap screws, lock washers and flat washers.

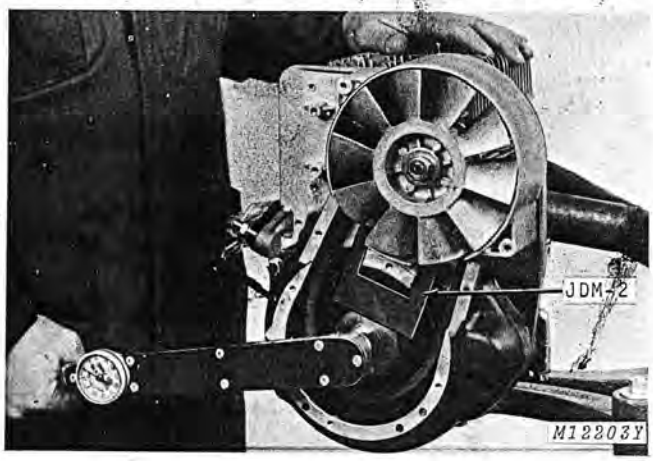


Fig. 23—Installing Flywheel

Use JDM-2 holding tool and a torque wrench, tighten flywheel nut, Fig. 23, to 45 to 50 ft-lbs.

Timing Ignition

Install electrical coupler and coils, Fig. 24.

Adjust breaker points and time ignition. Refer to Section 40, Group 10.

Adjusting Fan Belt Tension

Install fan belt, window plate, belt sheave and starter cup. Secure to flywheel with three 6 x 15MM cap screws and lock washers.

IMPORTANT: DO NOT use 6 x 22MM cap screws from recoil starter in this location. Longer cap screws will make centrifugal advance mechanism inoperative.

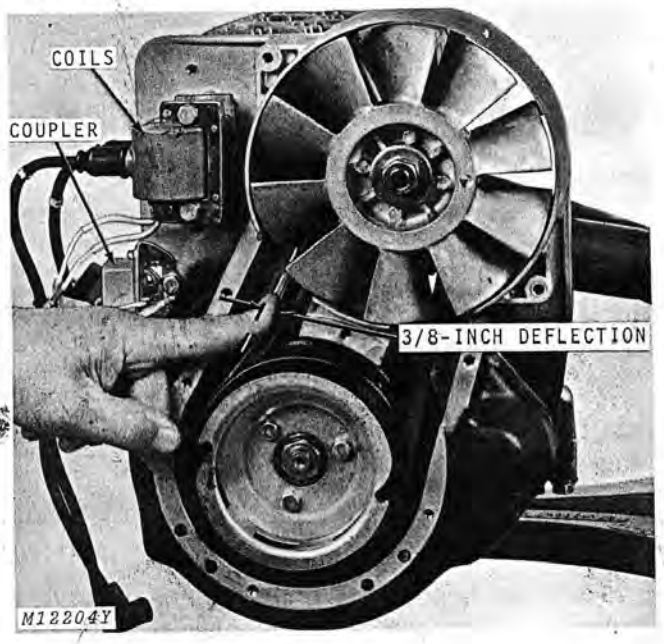


Fig. 24—Checking Fan Belt Tension

Check fan belt for proper tension, Fig. 24. A properly adjusted fan belt should deflect approximately 3/8-inch when flexed by hand at a point near center of belt span.

To adjust belt, remove fan retaining nut, using JDM-30 spanner wrench to keep fan from turning.

Remove fan, belt, and outer sheave half to expose spacing washers. Remove one or more spacing washers to increase tension to 3/8-inch deflection.

Installing Exterior Components

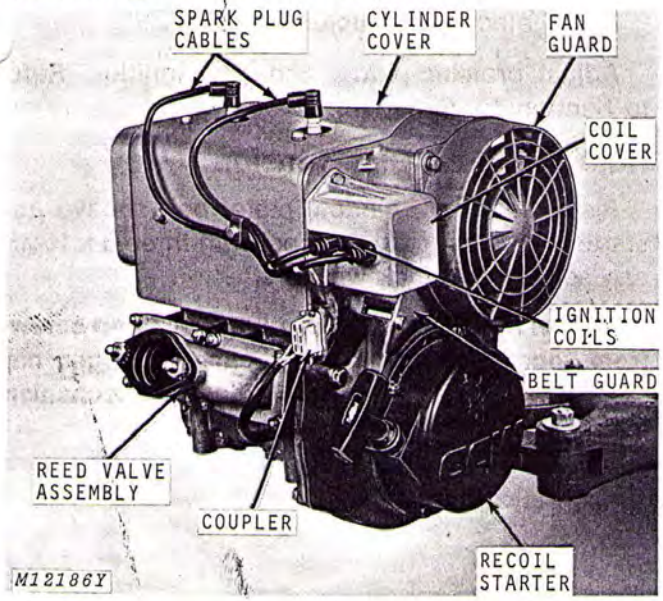


Fig. 25—Installing Exterior Components

Install starter motor, if so equipped and starter mounting plate.

Install fan guard, recoil starter and cylinder cover on engine, Fig. 25.

Install coil cover.

Connect the two ignition leads between the ignition coils and coupler.

Install spark plugs of proper heat range and connect spark plug cables.

Install drive sheave. Torque retaining nut to 50 ft-lbs.

INSTALLING ENGINE

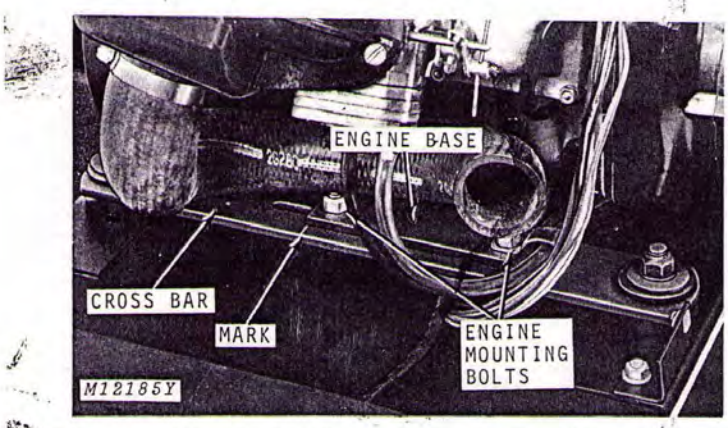


Fig. 26—Installing Engine in Snowmobile

Install and bolt engine in place using marks made prior to engine removal as a guide, Fig. 26. Refer to Section 50, Group 15, for sheave alignment specifications and procedure.

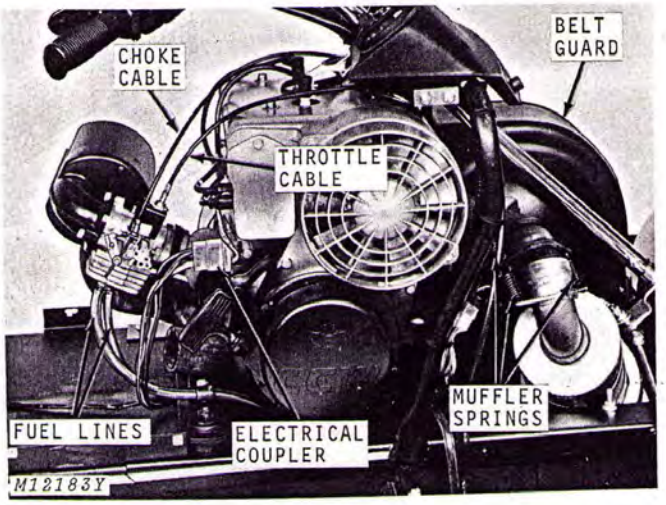


Fig. 27—Making Connections to Snowmobile

Connect fuel lines, choke and throttle cables and electrical coupler to engine, Fig. 27. Connect exhaust pipe, install drive belt and belt guard.

If snowmobile is equipped with electric start, connect cable to starter terminal and ground strap to engine.

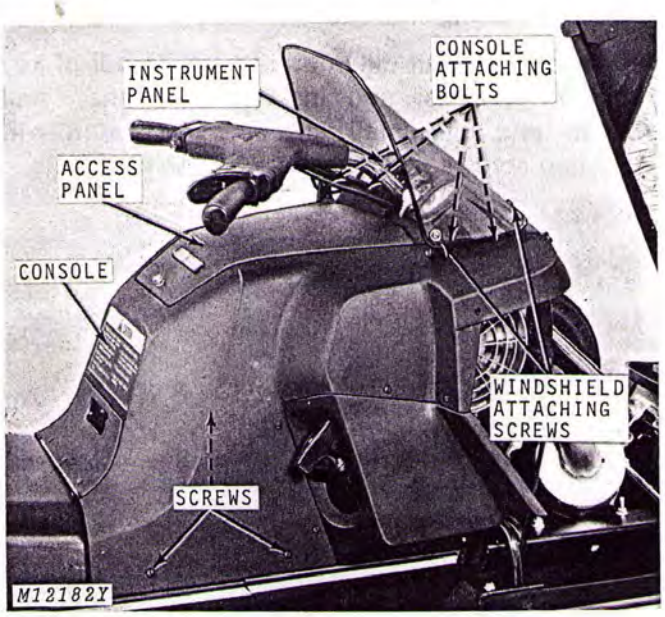


Fig. 28—Installing Console and Windshield

Slide console down and forward into position, Fig. 28. Install three screws at lower side positions and tighten the two console attaching bolts on each side of the instrument panel. Install top access panel.

Attach windshield with four screws.

IMPORTANT: After engine overhaul, carefully run the engine at varying speeds for the first 2 hours, or 25 miles of operation.

Group 35
SPECIFICATIONS

SPECIFICATIONS

Item	New Part Dimension				Wear Tolerance
	KEC-340/4 CCW (400)	KEC-440/4 CCW (500 and 600)	KEC-440/21 CCW (JDX8)	K295-2AX Kohler (JDX4)	
Cylinder Bore	2.3622 in. to 2.3629 in.	2.6772 in. to 2.6779 in.	2.6000 in. to 2.6007 in.	2.2631 in. to 2.2651 in.	0.005 in.
Connecting Rod Small End	0.8664 in. to 0.8669 in.	0.8664 in. to 0.8669 in.	0.7870 in. to 0.7878 in.	0.7872 in. to 0.7876 in.	0.0005 in.
Connecting Rod Side Clearance	0.014 in. to 0.016 in.	0.014 in. to 0.016 in.	0.014 in. to 0.016 in.	0.008 in. to 0.016 in.	+0.004 in.
Crankshaft Runout	0.0035 in.	0.0035 in.	0.0035 in.	0.0012 in.	———
Crankshaft Twist	———	———	———	———	0.003 in. off TDC
Piston at Top Land	2.3500 in. to 2.3510 in.	2.6650 in. to 2.6660 in.	2.5880 in. to 2.6000 in.	2.2504 in. to 2.2516 in.	———
Piston at Skirt	2.3570 in. to 2.3580 in.	2.6720 in. to 2.6730 in.	2.5953 in. to 2.6000 in.	2.2600 in. to 2.2608 in.	0.005 in.
Piston Pin Bore	0.7083 in. to 0.7087 in.	0.7083 in. to 0.7087 in.	0.6296 in. to 0.6300 in.	0.6300 in. to 0.6302 in.	No Clearance Permissable
Piston Pin	0.7084 in. to 0.7087 in.	0.7084 in. to 0.7087 in.	0.6297 in. to 0.6300 in.	0.6297 in. to 0.6299 in.	———
Ring Groove Clearance (top)	0.004 in.	0.004 in.	0.004 in.	0.0022 in. to 0.0037 in.	+0.002 in.
Ring Groove Clearance (bottom)	0.003 in.	0.003 in.	0.003 in.	0.0012 in. to 0.0024 in.	+0.002 in.
Crankshaft O.D. (PTO End)	30 MM	30 MM	30 MM	30 MM	———
Crankshaft End Play	0.003 in.	0.003 in.	0.003 in.	0.006 to 0.012 in.	———

SPARK PLUG SPECIFICATIONS

ENGINE MODEL	BRAND	COLD**	NORMAL	HOT**
400-500-600	AC	S-41F - AM52272	S-42F - AM52301	.....
KEC 340/4-440/4	Champion	L-78 - AM52266	L-81 - AM52303	L-86 - AM52646
Piston-Ported	Champion*	L-4G - AM52613	L-6G - AM52304	L-9G - AM52647
JDX4	AC	S41XL - AM52639	S42XL - AM52561	S43XL - AM52643
K295-2AX	Champion	N-2 - AM52640	N-3 - AM52432	N-4 - AM52644
Piston-Ported	Champion*	N-59G - AM52641	N-3G - AM52614	N-4G - AM52645
JDX8	AC	.....	S40F - AM52271	S41F - AM52272
KEC440/21	Champion	L-77J - AM52642	L78 - AM52266	L-81 - AM52303
Reed Valve	Champion*	L-3G - AM52302	L-4G - AM52613	L-6G - AM52304

*Gold-Palladium plugs.

**Use "hot" or "cold" plugs only under circumstances explained in operator's manual. The "normal" heat range plug is proper for most snowmobiling.

NOTE: Kohler (JDX4) engine requires "long-reach" spark plugs. Never use these plugs in CCW engines.

Torque for Hardware

Location	Torque	
	CCW	KOHLER
Crankcase	15 to 18 ft-lbs	———
Cylinder-to-Crankcase	15 to 18 ft-lbs	15 to 18 ft-lbs
Cylinder Head	15 to 18 ft-lbs	15 to 18 ft-lbs
Intake and Exhaust Manifold	10 to 12 ft-lbs	15 to 18 ft-lbs
Flywheel-to-Crankshaft	45 to 50 ft-lbs	85 to 90 ft-lbs
Fan Pulley Retaining Nut	28 to 31 ft-lbs	30 to 40 ft-lbs
PTO End Bearing Plate	———	8 to 10 ft-lbs
Spark Plug	14 ft-lbs	14 ft-lbs