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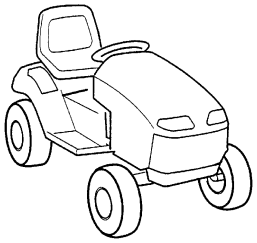
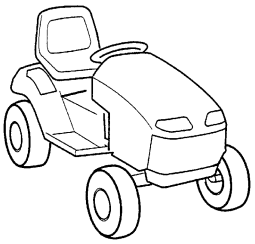


GARDEN TRACTOR REPAIR

GT18, GT20, GT22

Vol. 1

86620471



GARDEN TRACTOR REPAIR

GT18, GT20, GT22

Vol. 1

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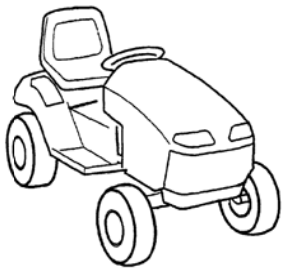


NEW HOLLAND

REPAIR MANUAL

GT18
GT20
GT22

Section 1 - Engine Systems

NEW HOLLAND

SERVICE

86705718 10/01

GT18, GT20, GT22 REPAIR MANUAL CONTENTS

SECTION 1 - ENGINE SYSTEMS

CONTENTS

GT18 AND GT22 KOHLER ENGINES

GT20 KAWASAKI ENGINES

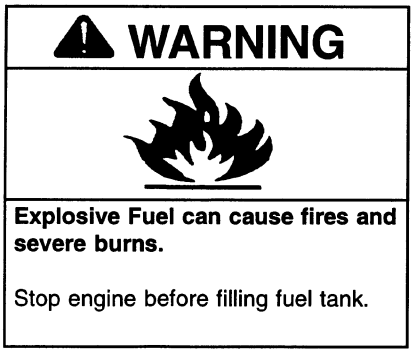
GT18 AND GT22 KOHLER ENGINES

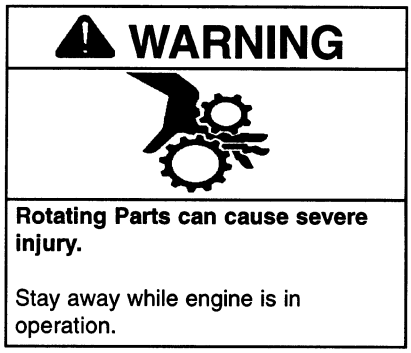
SAFETY AND GENERAL INFORMATION

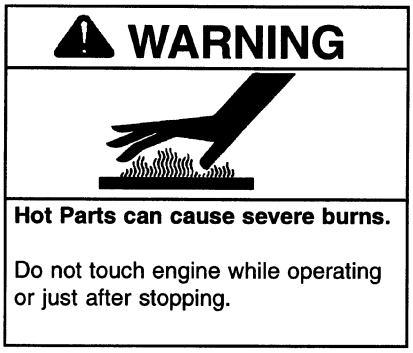
Safety Information

For Your Safety!

These precautions should be followed at all times. Failure to follow these precautions could result in injury to yourself and others.







Explosive Fuel!

Gasoline is extremely flammable and its vapors can explode if ignited. Store gasoline only in approved containers, in well ventilated, unoccupied buildings, away from sparks or flames. Do not fill the fuel tank while the engine is hot or running, since spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Do not start the engine near spilled fuel. Never use gasoline as a cleaning agent.

Rotating Parts!

Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate the engine with covers, shrouds, or guards removed.

Hot Parts!

Engine components can get extremely hot from operation. To prevent severe burns, do not touch these areas while the engine is running—or immediately after it is turned off. Never operate the engine with heat shields or guards removed.

⚠ WARNING

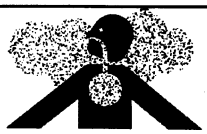
Accidental Starts can cause severe injury or death.

Disconnect and ground spark plug lead before servicing.

Accidental Starts!

Before servicing the engine or equipment, always disconnect the spark plug leads to prevent the engine from starting accidentally. Ground the leads to prevent sparks that could cause fires. Make sure the equipment is in neutral.

⚠ WARNING



Carbon Monoxide can cause severe nausea, fainting or death.

Do not operate engine in closed or confined area.

Lethal Exhaust Gases!

Engine exhaust gases contain poisonous carbon monoxide. Carbon monoxide is odorless, colorless, and can cause death if inhaled. Avoid inhaling exhaust fumes, and never run the engine in a closed building or confined area.

⚠ WARNING

Explosive Gas can cause fires and severe acid burns.

Charge battery only in a well ventilated area. Keep sources of ignition away.

Explosive Gas!

Batteries produce explosive hydrogen gas while being charged. To prevent a fire or explosion, charge batteries only in well ventilated areas. Keep sparks, open flames, and other sources of ignition away from the battery at all times. Keep batteries out of the reach of children. Remove all jewelry when servicing batteries.

Before disconnecting the negative (-) ground cable, make sure all switches are OFF If ON, a spark will occur at the ground cable terminal which could cause an explosion if hydrogen gas or gasoline vapors are present.

⚠ WARNING

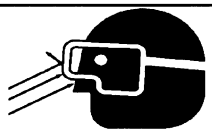
Cleaning Solvents can cause severe injury or death.

Use only in well ventilated areas away from ignition sources.

Flammable Solvents!

Carburetor cleaners and solvents are extremely flammable. Keep sparks, flames, and other sources of ignition away from the area. Follow the cleaner manufacturer's warnings instructions on its proper and safe use. Never use gasoline as a cleaning agent.

⚠ WARNING



Uncoiling Spring can cause severe injury.

Wear safety goggles or face protection when servicing retractable starter.

Spring Under Tension!

Retractable starters contain a powerful, recoil spring that is under tension. Always wear safety goggles when servicing retractable starters and carefully follow instructions in the "Retractable Starters Section 7 for relieving spring tension.

⚠ CAUTION

Electrical Shock can cause injury.

Do not touch wires while engine is running.

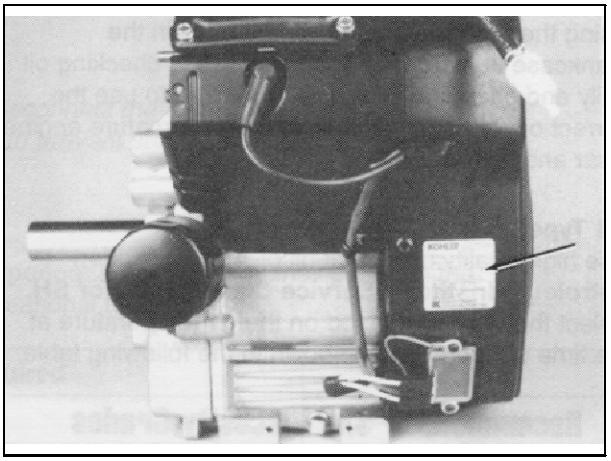
Electrical Shock!

Never touch electrical wires or components while the engine is running. They can be sources of electrical shock.

Engine Identification Numbers

When ordering parts, or in any communication involving an engine, always give the Model, Specification and Serial Numbers, including letter suffixes if there are any.

The engine identification numbers appear on a decal, or decals, affixed to the engine shrouding. See Figure 1-1. An explanation of these numbers is shown in Figure 1-2.



1

Engine Identification Plate Location

A. Model No. **C H 18 S**

- **Command Engine**
- **Horizontal Crankshaft**
- **Horsepower**
  - 18 = 18 HP
  - 20 = 20 HP
  - 22 = 22 HP
  - 25 = 25 HP
- **Version Code**
  - S = Electric Start

B. Spec. No. **62500**

Engine Model Code — **Variation of Basic Engine**

Code	Model
62	CH18
64	CH20
66	CH22
68	CH25

C. Serial No. **2105810334**

Manufactured — **Factory Code**

Year	Manufactured
21	1991
22	1992
23	1993
24	1994
25	1995
26	1996
27	1997

2

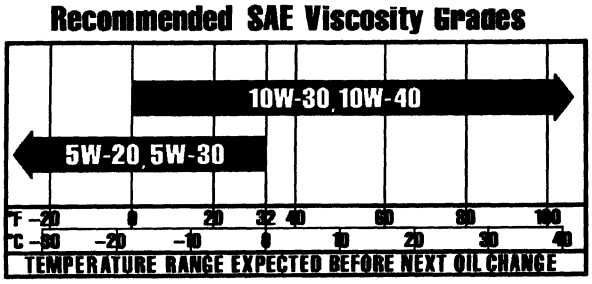
Explanation of Engine Identification Numbers

Oil Recommendations

Using the proper type and weight of oil in the crankcase is extremely important. So is checking oil daily and changing oil regularly. Failure to use the correct oil, or using dirty oil, causes premature engine wear and failure.

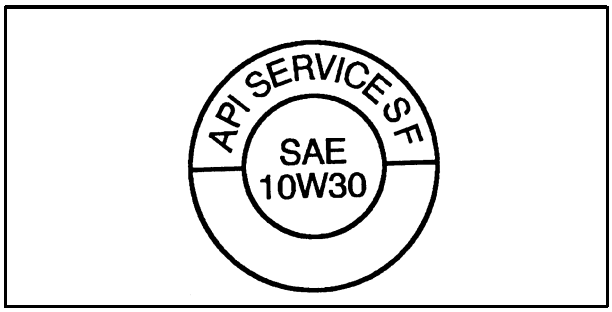
Oil Type

Use high quality detergent oil of API (American Petroleum Institute) Service Class SF, SG or SH. Select the viscosity based on the air temperature at the time of operation as shown in the following table.



NOTE: *Using other than service class SF, SO or SH oil or extending oil change intervals longer than recommended can cause engine damage.*

A logo or symbol on oil containers identifies the API service class and SAE viscosity grade.



3

Oil Coolant Logo

Refer to Section 6—"Lubrication System" for detailed procedures on checking the oil, changing the oil and changing the oil filter.

Fuel Recommendations

⚠ WARNING ⚠

Explosive Fuel!

Gasoline is extremely flammable and its vapors can explode if ignited. Store gasoline only in approved containers, in well ventilated, unoccupied buildings, away from sparks or flames. Do not fill the fuel tank while the engine is hot or running, since spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Do not start the engine near spilled fuel. Never use gasoline as a cleaning agent.

General Recommendations

Purchase gasoline in small quantities and store in clean, approved containers. A container with a capacity of 2 gallons or less with a pouring spout is recommended. Such a container is easier to handle and helps eliminate spillage during refueling.

Do not use gasoline left over from the previous season, to minimize gum deposits in your fuel system and to ensure easy starting.

Do not add oil to the gasoline.

Do not overfill the fuel tank. Leave room for the fuel to expand.

Fuel Type

For best results, use only clean, fresh, unleaded gasoline with a pump sticker octane rating of 87 or higher. In countries using the Research method, it should be 90 octane minimum.

Unleaded gasoline is recommended, as it leaves fewer combustion chamber deposits. Leaded gasoline may be used in areas where unleaded is not available and exhaust emissions are not regulated. Be aware, however, that the cylinder head will require more frequent service.

Gasoline/Alcohol blends

Gasohol (up to 10% ethyl alcohol, 90% unleaded gasoline by volume) is approved as a fuel for Kohler engines. Other gasoline/alcohol blends are not approved.

Gasoline/Ether blends

Methyl Tertiary Butyl Ether (MTBE) and unleaded gasoline blends (up to a maximum of 15% MTBE by volume) are approved as a fuel for Kohler engines. rather Nether blends are not approved.

Periodic Maintenance

⚠ WARNING ⚠

Accidental Starts!

Before servicing the engine or equipment, always disconnect the spark plug leads to prevent the engine from starting accidentally. Ground the leads to prevent sparks that could cause fires. Make sure the equipment *is* in neutral.

Maintenance Schedule

These required maintenance procedures should be performed at the frequency stated in the table. They should also be included as part of any seasonal tune up.

Frequency	Maintenance Required	Refer to:
Daily or Before Starting Engine	Fill fuel tank. Check oil level. Check air cleaner for dirty[1], loose, or damaged parts. Check air intake and cooling areas, clean as necessary[1].	Section 5 Section 6 Section 4 Section 4
Every 25 Hours	Service precleaner element[1].	Section 4
Every 100 Hours	Service air cleaner element[1]. Change oil. Remove cooling shrouds and clean cooling areas[1].	Section 4 Section 6 Section 4
Every 200 Hours	Change oil filter. Check spark plug condition and gap.	Section 6 Section 8

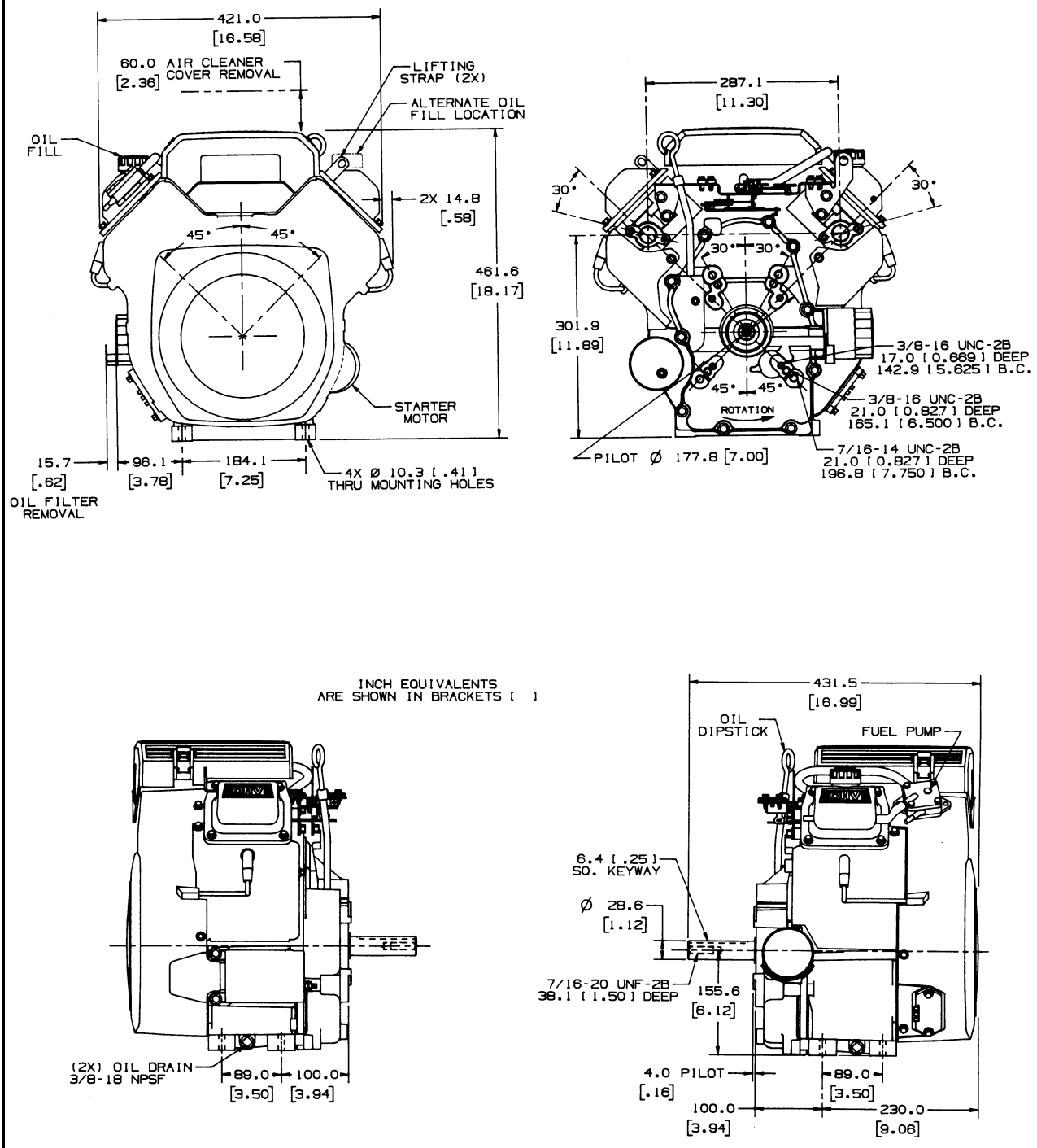
[1] *Perform these maintenance procedures more frequently under extremely dusty, dirty conditions.*

Storage

If the engine will be out of service for two months or more, use the following storage procedure:

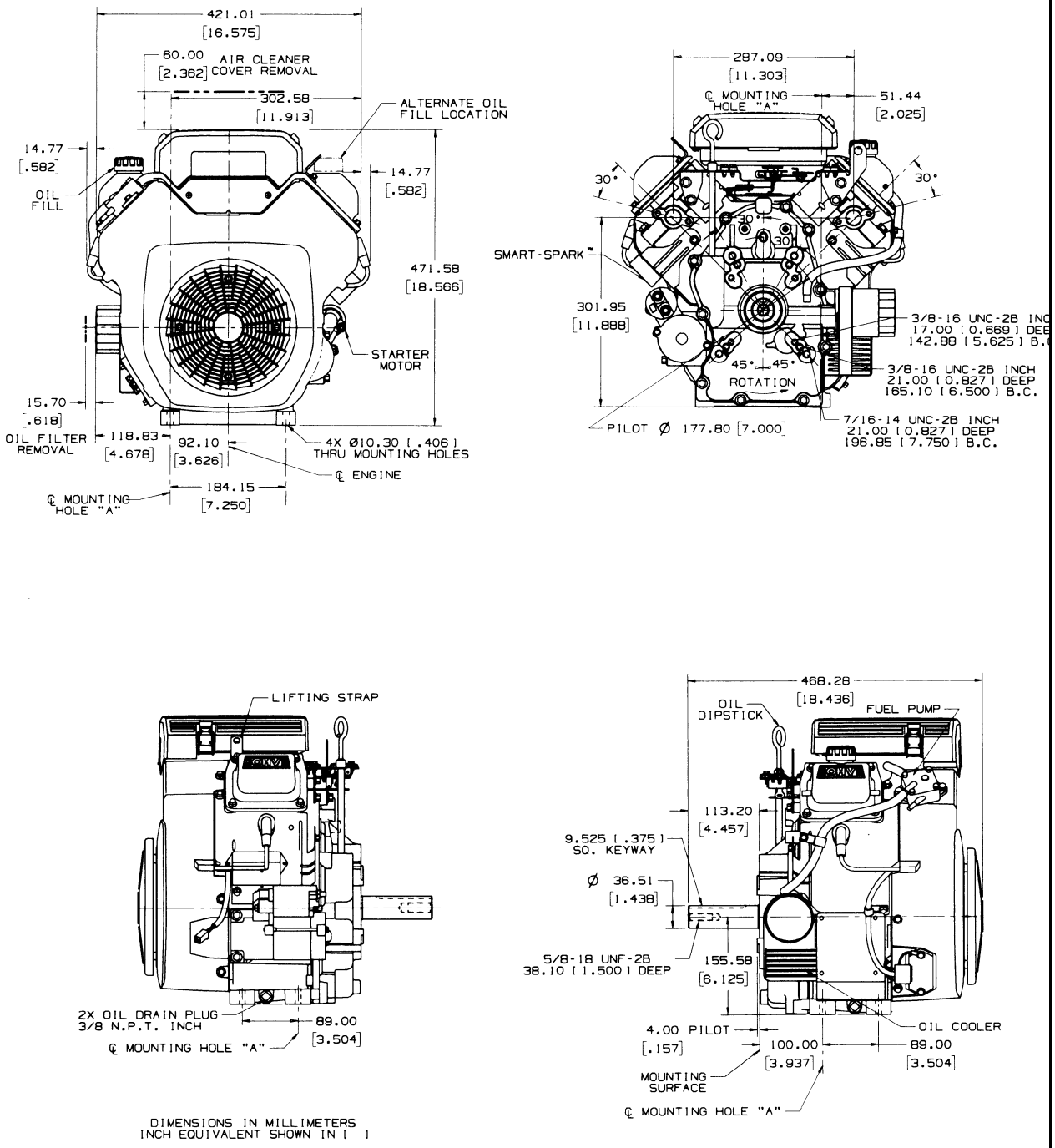
1. Clean the exterior surfaces of the engine.
2. Change the oil and oil filter while the engine is still warm from operation. See “Change Oil and Oil Filter” in Section 6.
3. The fuel system must be completely emptied, or the gasoline must be treated with a stabilizer to prevent deterioration. If you choose to use a stabilizer, follow the manufacturer’s recommendations, and add the correct amount for the capacity of the fuel system. Fill the fuel tank with clean, fresh gasoline. Run the engine for 2 to 3 minutes to get stabilized fuel into the carburetor.

   To empty the system, drain the fuel tank and carburetor, or run the engine until the tank and system are empty.
4. Remove the spark plugs and add one tablespoon of engine oil into each spark plug hole. Install plugs and **ground** spark plug leads do not connect the leads to the plug. Crank the engine two or three revolutions.
5. Store the engine in a clean, dry place.



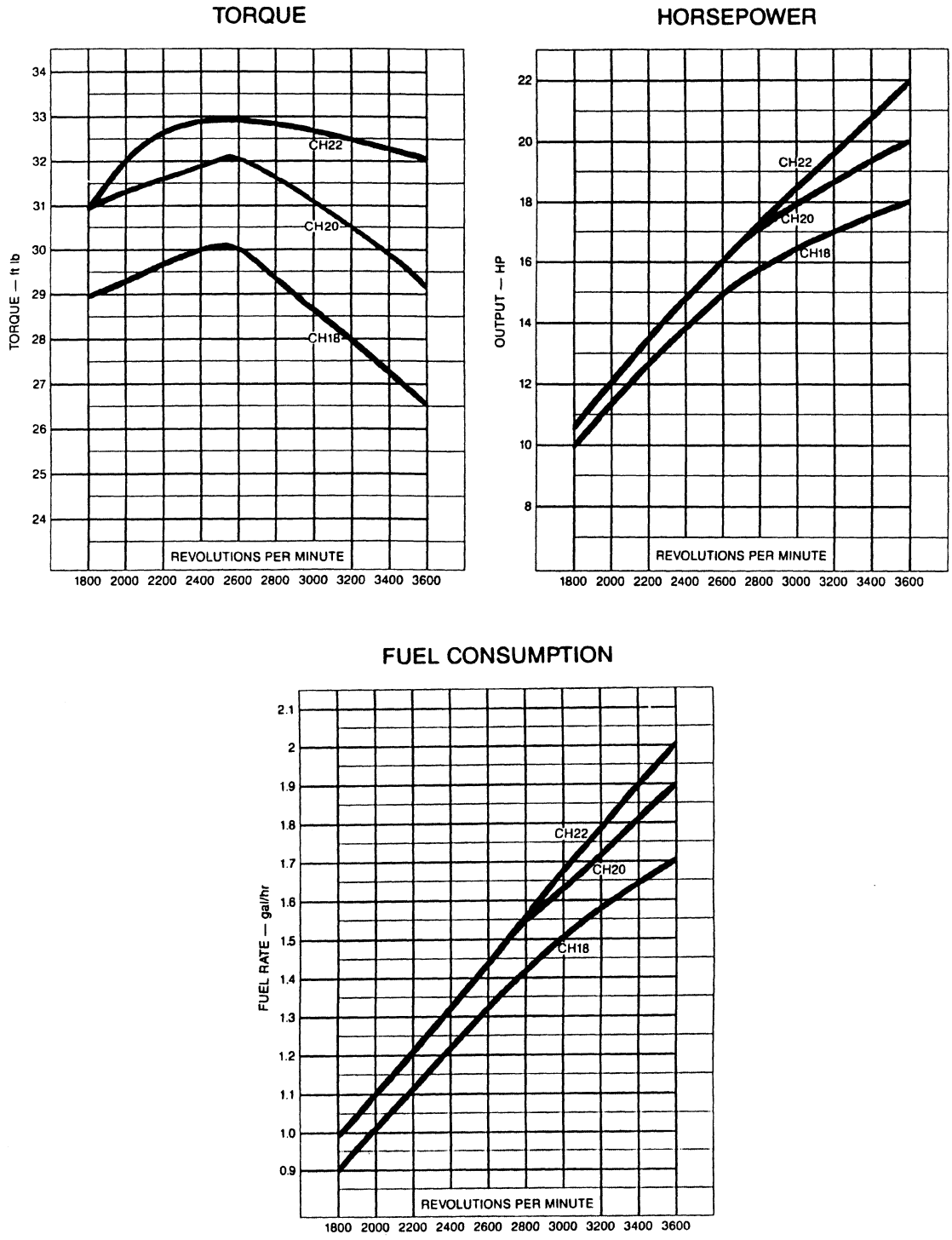
4

Typical Engine Dimensions CH18-22



5

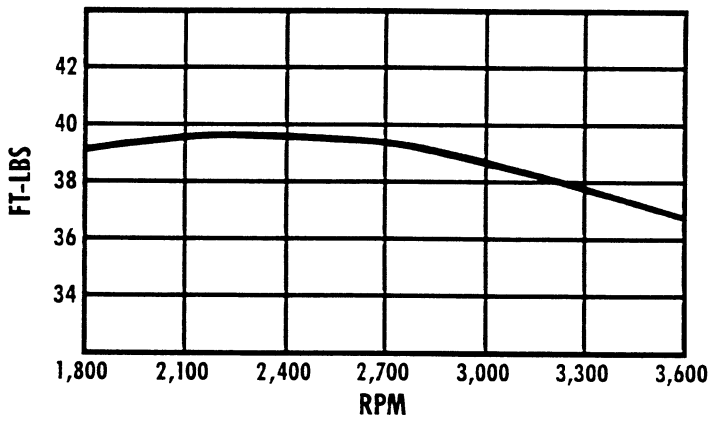
Typical Engine Dimensions CH25



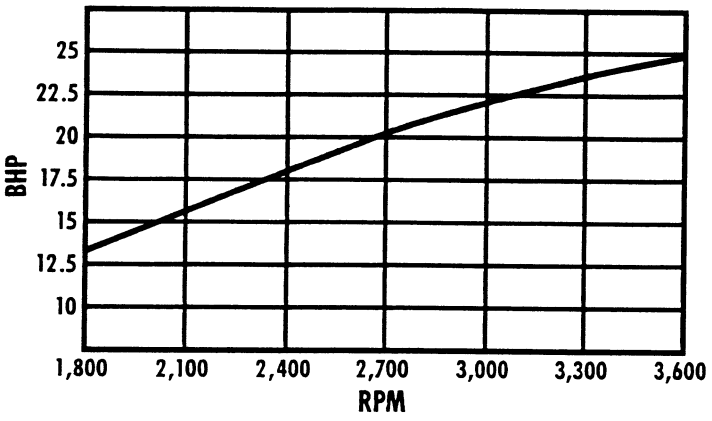
6

Torque, Horsepower and Fuel Curves CH18-22

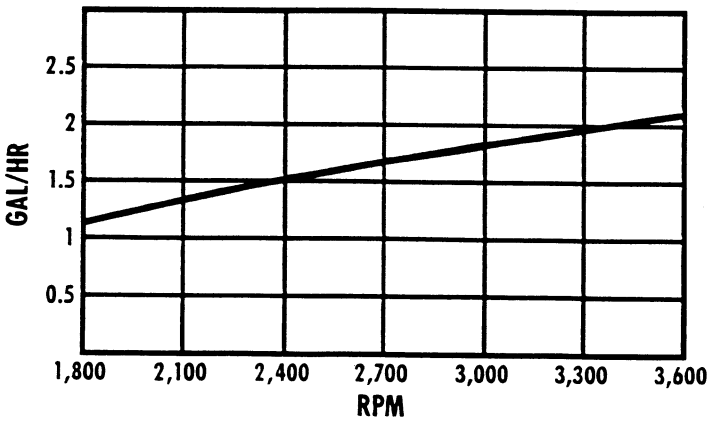
CH25 TORQUE CURVE



CH25 POWER CURVE



CH25 FUEL RATE (at WOT)



7

Torque, Horsepower and Fuel Curves CH25

Specifications, Tolerances, and Special Torque Values

Description

General Specifications

Power (@ 3600 RPM, corrected to SAE J1349)

CH18	13.4kW(18HP)
CH20	14.9 kW (20HP)
CH22	16.4 kW (22 HP)
CH25	18.6 kW (25 HP)

Peak Torque (See Torque Curves)

CH18 @ 2500 RPM	41 N·m (30 ft. lb.)
CH20 @ 2500 RPM	44 N·m (32 ft. lb.)
CH22 @ 2500 RPM	45 N·m (33 ft. lb.)
CH25 @ 2500 RPM	53 N·m (39.5 ft. lb.)

Bore

CH18, CH20, CH22	77 mm (3.03 in.)
CH25	83 mm (3.27 in.)

Stroke	67 mm (2.64 in.)

Displacement

CH18, CH20, CH22	624 cc (38 cu. in.)
CH25	725 cc (44 cu. in.)

Compression Ratio

CH18, CH20, CH22	8.5:1
CH25	9.0:1

Dry Weight

CH18, CH20, CH22	41 kg (90 lb.)
CH25	43 kg (94 lb.)

Oil Capacity (with filter)

CH18, CH20, CH22	2.0 U.S. qt. (1.9 L)
CH25	2.1 U.S. qt. (2.0 L)

Angle of Operation Maximum (At Full Oil Level) All Directions	25°

Blower Housing and Sheet Metal

M5 Fasteners Torque	4.7 N·m (35 in. lb.)
M6 Fasteners Torque	8.6 N·m (65 in. lb.)
Rectifier Fastener Torque	4.7 N·m (35 in. lb.)

Camshaft

End Play (With Shim) . . . . . 0.076/0.127 mm (0.0030/0.0050 in.)

Running Clearance . . . . . 0.025/0.063 mm (0.0010/0.0025 in.)

Bore I.D.

New . . . . . 20.00/20.25 mm (0.7874/0.7884 in.)
Max. Wear Limit . . . . . 20.038 mm (0.7889 in.)

Camshaft Bearing Surface O.D.

New . . . . . 19.962119.975 mm (0.7859/0.7864 in.)
Max. Wear Limit . . . . . 19.959 mm (0.7858 in.)

Carburetor and Intake Manifold

Intake Manifold Mounting Fasteners Torque . . . . . 9.9 N·m (88 in. lb.)

Carburetor Mounting Fasteners Torque . . . . . 9.9 N·m (88 in. lb.)

Connecting Rod

Cap Fastener Torque . . . . . 17.3 N·m (130 in. lb.)

Connecting Rod to Crankpin Running Clearance

.New . . . . . 0.030/0.055 mm (0.0012/0.0022 in.)
Max. Wear Limit . . . . . 0.07 mm (0.0028 in.)

Connecting Rod to Crankpin Side Clearance . . . . . 0.26/0.63 mm (0.0102/0.0248 in.)

Connecting Rod to Piston Pin Running Clearance . . . . . 0.015/0.028 mm (0.0006/0.0011 in.)

Piston Pin End I.D.

New . . . . . 17.015/17.023 mm (0.6699/0.6702 in.)
Max. Wear Limit . . . . . 17.036 mm (0.6707 in.)

Crankcase

Governor Cross Shaft Bore I.D.

New . . . . . 6.025/6.050 mm (0.2372/0.2382 in.)
Max. Wear Limit . . . . . 6.063 mm (0.2387 in.)

Breather Cover Mounting Fasteners . . . . . 8.6 N·m (65 in. lb.)

Oil Drain Plugs . . . . . 13.6 N·m (10 ft. lb.)

Crankshaft

End Play (Free) . . . . . 0.070/0.480 mm (0.0028/0.0189 in.)

End Play (With Thrust Bearing Components) . . . . . 0.050t0.5 mm (0.0020/0.0197 in.)
Except CH25 Engines Below Serial No. 2403500008 . . . . . 0.050/0.75 mm (0.0020/0.0295 in.)

Crankshaft Sleeve Bearing I.D. (Crankcase)

New . . . . . 40.965/41.003 mm (1.6128/1.6143 in.)

Max. Wear Limit . . . . . 41.016 mm (1.6148 in.)

Crankshaft (Cont'd)

Crankshaft to Sleeve Bearing (Crankcase)

Running Clearance - New ..... 0.03/0.09 mm (0.0012/0.0035 in.)

Crankshaft Bore (In Closure Plate) - New ..... 40.987/40.974 mm (1.6128/1.6143 in.)

Crankshaft Bore (In Closure Plate)-to-Crankshaft

Running Clearance - New ..... 0.039/0.074 mm (0.0015/0.0029 in.)

Flywheel End Main Bearing Journal

O.D; New ..... 40.913/40.935 mm (1.6107/1.6116 in.)
O.D. Max. Wear Limit ..... 40.84 mm (1.608 in.)
Max. Taper ..... 0.022 mm (0.0009 in.)
Max. Out of Round ..... 0.025 mm (0.0010 in.)

Closure Plate End Main Bearing Journal

O.D. New ..... 40.913/40.935 mm (1.6107/1.6116 in.)
O.D. Max. Wear Limit ..... 40.84 mm (1.608 in.)
Max. Taper ..... 0.022 mm (0.0009 in.)
Max. Out of Round ..... 0.025 mm (0.0010 in.)

Connecting Rod Journal

O.D. - New ..... 35.955/35.973 mm (1.4156/1.4163 in.)
O.D. Max. Wear Limit ..... 35.94 mm (1.415 in.)
Max. Taper ..... 0.018 mm (0.0007 in.)
Max. Out of Round ..... 0.025 mm (0.0010 in.)

Crankshaft T.I.R.

PTO End, Crank in Engine ..... 0.15 mm (0.0059 in.)
Entire Crank, in V Blocks ..... 0.10 mm (0.0039 in.)

Cylinder Bore

Cylinder Bore I.D.

New - CH18, CH20, CH22 ..... 77.000/77.025 mm (3.0315/3.0325 in.)
New - CH25 ..... 82.988/83.013 mm (3.3195/3.3205 in.)
Max. Wear Limit CH18, CH20, CH22 ..... 77.063 mm (3.0340 in.)
Max. Wear Limit CH25 ..... 83.051 mm (3.3220 in.)
Max. Out of Round ..... 0.12 mm (0.0047 in.)
Max. Taper ..... 0.05 mm (0.0020 in.)

Cylinder Head

Cylinder Head Fastener Torque ..... 40.7 N·m (30 ft. lb.)
Max. Out of Flatness ..... 0.076 mm (0.003 in.)
Rocker Pivot Fastener Torque ..... 14 N·m (124 in.)

Electric Starter

Starter Mounting Fastener Torque ..... 15.3 N·m (135 in. lb.)

Fan/Flywheel

Fan Fastener Torque . . . . . 9.9 N·m (88 in. lb.)
Flywheel Retaining Screw Torque . . . . . 66.4 N·m (49 ft. lb.)

Governor

Governor Cross Shaft to Crankcase
Running Clearance . . . . . 0.013/0.075 mm (0.0005/0.0030 in.)

Governor Cross Shaft O.D.
New . . . . . 5.975/6.012 mm (0.2352/0.2367 in.)
Max. Wear Limit . . . . . 5.962 mm (0.2347 in.)

Governor Gear Shaft to Governor
Gear Running Clearance . . . . . 0.015/0.140 mm (0.0006/0.0055 in.)

Governor Gear Shaft O.D.
New . . . . . 5.990/6.000 mm (0.2358/0.2362 in.)
Max. Wear Limit . . . . . 5.977 mm (0.2353 in.)

Ignition

Spark Plug Type (Champion or Equivalent) RC12YC

Spark Plug Gap . . . . . 1.02 mm (0.040 in.)

Spark Plug Torque . . . . . 24.4/29.8 N·m (18/22 ft. lb.)

Ignition Module Air Gap . . . . . 0.2/0.3 mm (0.008/0.012 in.)

Ignition Module Fastener Torque . . . . . 4.0/6.2 N·m (35/55 in. lb.)

Muffler

Muffler Retaining Nuts Torque . . . . . 24.4 N·m (216 in. lb.)

Oil Filter/Closure Plate/Oil Cooler

Oil Filter Torque . . . . . 5.7/9.0 N·m (50/80 in. lb.)

Oil Cooler Torque (Std. CH25 Option on Others) . . . . . 40.6 N·m (30 ft. lb.)

Closure Plate Fastener Torque . . . . . 24.4 N·m (216 in. lb.)

Piston, Piston Rings, and Piston Pin

Piston to Piston Pin (Selective Pin) . . . . . 0.006/0.017 mm (0.0002/0.0007 in.)

Piston Pin Bore I.D.
New . . . . . 17.006/17.012 mm (0.6695/0.6698 in.)
Max. Wear Limit . . . . . 17.025 mm (0.6703 in.)

Piston Pin O.D.

New . . . . . 16.995/17.000 mm (0.6691/0.6693 in.)
Max. Wear Limit . . . . . 16.994 mm (0.6691 in.)

Piston, Piston Rings, and Piston Pin (Cont'd)

Top Compression Ring to Groove
- Side Clearance - CH18, CH20, CH22 . . . . . 0.040/0.080 mm (0.0016/0.0031 in.)
- Side Clearance CH25 . . . . . 0.025/0.048 mm (0.0010/0.0019 in.)

Middle Compression Ring to Groove
- Side Clearance - CH18, CH20, CH22 . . . . . 0.040/0.072 mm (0.0016/0.0028 in.)
- Side Clearance – CH25 . . . . . 0.015/0.037 mm (0.0006/0.0015 in.)

Oil Control Ring to Groove
- Side Clearance - CH18, CH20, CH22 . . . . . 0.060/0.202 mm (0.0024/0.0080 in.)
- Side Clearance CH25 . . . . . 0.026/0.176 mm (0.0010/0.0070 in.)

Top and Center Compression Ring End Gap
- New Bore CH18, CH20, CH22 . . . . . 0.25/0.45 mm (0.0098/0.0177 in.)
- New Bore CH25 . . . . . 0.25/0.56 mm (0.0100/0.0224 in.)
- Used Bore (Max.) CH18, CH20, CH22 . . . . . 0.77 mm (0.030 in.)
- Used Bore (Max.) CH25 . . . . . 0.94 mm (0.037 in.)

Piston Thrust Face O.D.2
- New CH18, CH20, CH22 . . . . . 76.967/76.985 mm (3.0302/3.0309 in.)
- New CH25 . . . . . 82.986 mm (3.3194 in.)
- Max. Wear Limit CH18, CH20, CH22 . . . . . 76.840 mm (3.0252 in.)
- Max. Wear Limit CH25 . . . . . 82.841 mm (3.3136 in.)

Piston Thrust Face to Cylinder Bore Running Clearance
- New - CH18, CH20, CH25 . . . . . 0.015/0.058 mm (0.0006/0.0023 in.)
- New - CH25 . . . . . 0.002/0.045 mm (0.001/0.0018 in.)

Speed Control

Speed Control Bracket Assembly
- Fastener Torque . . . . . 7.3/10.7 N·m (65/95 in. lb.)

Stator

Mounting Screw Torque . . . . . 4.0 N·m (35 in. lb.)

Throttle/Choke Controls

Governor Control Lever Fastener Torque . . . . . 9.9 N·m (88 in. lb.)

Valve Cover/Rocker Arms

Valve Cover Fastener Torque . . . . . 3.4 N·m (30 in. lb.)

Valves and Valve Lifters

Hydraulic Valve Lifter to Crankcase Running Clearance . . . . . 0.0124/0.0501 mm (0.0005/0.0020 in.)
Intake Valve Stem to Valve Guide Running Clearance . . . . . 0.038/0.076 mm (0.0015/0.0030 in.)
Exhaust Valve Stem to Valve Guide Running Clearance . . . . . 0.050/0.088 mm (0.0020/0.0035 in.)

Valve and Valve Lifters (Cont'd)

Intake Valve Guide I.D.
- New ..... 7.038/7.058 mm (0.2771/0.2779 in.)
- Max. Wear Limit ..... 7.134 mm (0.2809 in.)

Exhaust Valve Guide I.D.
- New ..... 7.038/7.058 mm (0.2771/0.2779 in.)
- Max. Wear ..... 7.159 mm (0.2819 in.)

Valve Guide Reamer Size
- Standard ..... 7.048 mm (0.2775 in.)
- 0.25 mm O.S ..... 7.298 mm (0.2873 in.)

Intake Valve Minimum ..... 8.07 mm (0.3177 in.)

Exhaust Valve Minimum Lift ..... 8.07 mm (0.3177 in.)

Nominal Valve Seat Angle ..... 45°

General Torque Values

Metric Fastener Torque Recommendations for Standard Applications

Tightening Torque: N•m (in. lb.) + or - 10%

	Property Class					
Size	4.8	5.8	8.8	10.9	12.9	Noncritical Fasteners Into Aluminum
M4	1.2 (11)	1.7 (15)	2.9 (26)	4.1 (36)	5.0 (44)	2.0 (18)
M5	2.5 (22)	3.2 (28)	5.8 (51)	8.1 (72)	9.7 (86)	4.0 (35)
M6	4.3 (38)	5.7 (50)	9.9 (88)	14.0 (124)	16.5 (146)	6.8 (60)
M8	10.5 (93)	13.6 (120)	24.4 (216)	33.9 (300)	40.7 (360)	17.0 (150)

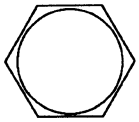
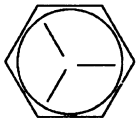
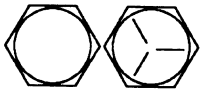
Tightening Torque: N•m (ft. lb.) + or - 10%

	Property Class					
	4.8	5.8	8.8	10.9	12.9	Noncritical Fasteners Into Aluminum
M10	21.7 (16)	27.1 (20)	47.5 (35)	66.4 (49)	81.4 (60)	33.9 (25)
M12	36.6 (27)	47.5 (35)	82.7 (61)	116.6 (86)	139.7 (103)	61.0 (45)
M14	58.3 (43)	76.4 (55)	131.5 (97)	184.4 (136)	219.7 (162)	94.9 (70)

Torque Conversions

N•m = in. lb. x 0.113
N•m = ft. lb. x 1.356
in. lb. = N•m x 8.85
ft. lb. = N•m x 0.737

English Fastener Torque Recommendations for Standard Applications

Tightening Torque: N•m (in. lb.) + or - 20%				
Bolts, Screws, Nuts and Fasteners Assembled Into Cast Iron or Steel				**Grade 2 or 5 Fasteners Into Aluminum**
	 **Grade 2**	 **Grade 5**	 **Grade 8**	
Size				
8-32	2.3 (20)	2.8 (25)	---------	2.3 (20)
10-24	3.6 (32)	4.5 (40)	---------	3.6 (32)
10-32	3.6 (32)	4.5 (40)	---------	---------
1/4-20	7.9 (70)	13.0 (115)	18.7 (165)	7.9 (70)
1/4-28	9.6 (85)	15.8 (140)	22.6 (200)	---------
5/16-18	17.0 (150)	28.3 (250)	39.6 (350)	17.0 (150)
5/16-24	18.7 (165)	30.5 (270)	---------	---------
3/8-16	29.4 (260)	---------	---------	---------
3/8-24	33.9 (300)	---------	---------	---------
Tightening Torque: N•m (ft. lb.) + or - 20%				
Size				
5/16-24	---------	----------	40.7 (30)	---------
3/8-16	---------	47.5 (35)	67.8 (50)	---------
3/8-24	---------	54.2 (40)	81.4 (60)	---------
7/16-14	47.5 (35)	74.6 (55)	108.5 (80)	---------
7/16-20	61.0 (45)	101.7 (75)	142.4 (105)	---------
1/2-13	67.8 (50)	108.5 (80)	155.9 (115)	---------
1/2-20	94.9 (70)	142.4 (105)	223.7 (165)	---------
9/16-12	101.7 (75)	169.5 (125)	237.3 (175)	---------
9/16-18	135.6 (100)	223.7 (165)	311.9 (230)	---------
5/8-11	149.2 (110)	244.1 (180)	352.6 (260)	---------
5/8-18	189.8 (140)	311.9 (230)	447.5 (330)	---------
3/4-10	199.3 (150)	332.2 (245)	474.6 (350)	---------
3/4-16	271.2 (200)	440.7 (325)	637.3 (470)	---------

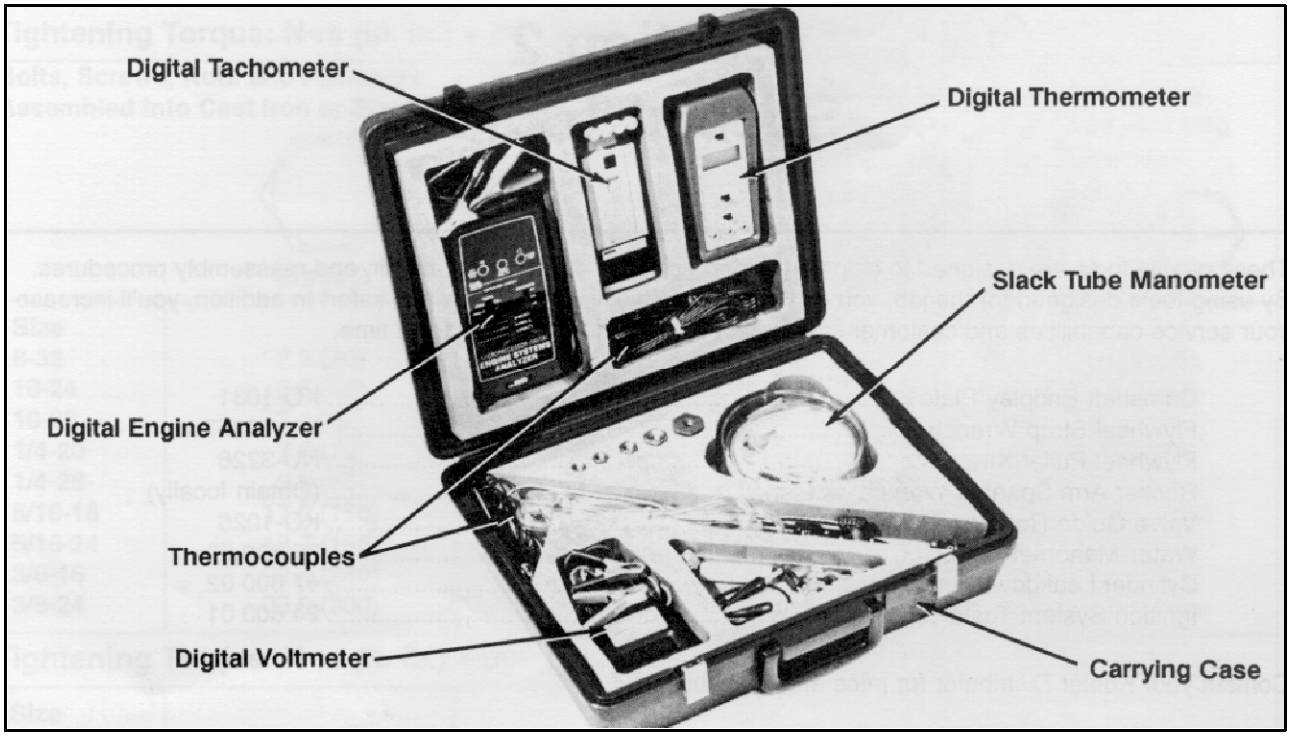
SPECIAL TOOLS

These quality tools are designed to help you perform specific disassembly, repair, and reassembly procedures. By using tools designed for the job, you can service engines easier, faster, and safer! In addition, you'll increase your service capabilities and customer satisfaction by decreasing engine down time.

Camshaft Endplay Plate KO 1031
Flywheel Strap Wrench NU 10357
Flywheel Puller Kit . . . . . NU 3226
Rocker Arm Spanner Wrench . . . . . (Obtain locally)
Valve Guide Reamer . . . . . KO 1026
Water Manometer 25 800 50
Cylinder Leakdown Tester 47 800 02
Ignition System Tester . 24 800 01

Contact your Kohler Distributor for price and availability.

Engine Analysis Kit No. KO-1000



8

Engine Analysis Kit - KO-1000

The Kohler Engine Analysis Kit contains a selection of instruments that will enable you to measure critical items that relate to engine performance. You will find many uses for these instruments—from basic crankcase vacuum checks to sophisticated application tests.

The Engine Analysis Kit Includes:

Qty.	Description	Part No.
1	Digital Voltmeter	KO 1001
1	Digital Tachometer	KO 1002
1	Digital Thermometer	KO 1004
1	Digital Engine Analyzer	KO 1003
1	Slack Tube Manometer	KO 1005
1	8 ft. Lead with Plug	KO 1006
3	14 mm Spark Plug Thermocouple	KO 1007
2	Head Bolt Thermocouple	KO 1008
1	Oil Sump Thermocouple	KO 1009
1	1/4″ x 1/8″ Bushing	KO 1010-B
1	3/8″ x 1/8″ Bushing	KO 1010 A
1	1/2″ x 1/8″ Bushing	KO 1010 C
1	3/4″ x 1/8″ Bushing	KO 1010 D
1	Tube with Fittings	KO 1011 B
1	Carrying Case	KO 1013
3	Plain Thermocouple	KO 1015

The voltmeter, tachometer, and engine analyzer feature electronic circuitry and digital readouts. Guidelines for using the instruments and testing are included.

Using the instruments in the Engine Analysis Kit you will be able to:

1. Measure the temperatures of the: a. spark plug base gasket/cylinder head bolt, b. oil sump, and c. air into flywheel and carburetor.
2. Measure engine speed (RPM).
3. Measure crankcase vacuum and exhaust system back pressure.
4. Measure voltage.
5. Measure charging system current.
6. Measure electric starter current (amp) draw.

The Engine Analysis Kit can be ordered complete as shown, or the instruments can be ordered individually. Contact your Kohler Distributor for price and availability.

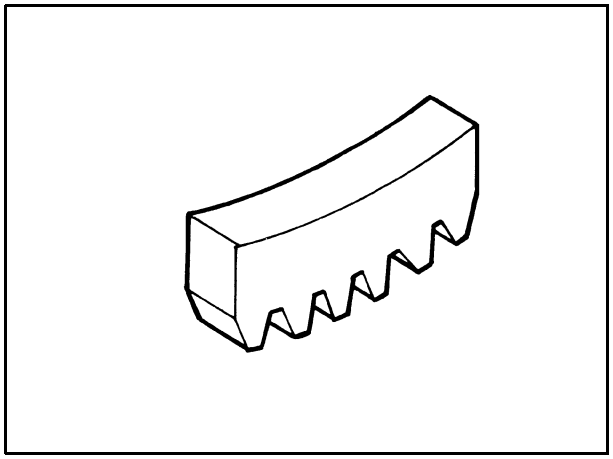
Ignition System Tester

The new Kohler Part No. 24 800 01 can be used to test all ignition systems including the new CD systems.

Special Tools You Can Make

Flywheel Holding Tool

Flywheel removal and reinstallation becomes a “snap” using a handy holding tool you can make out of a piece of an old “junk” flywheel ring gear as shown. Using an abrasive cut off wheel, cut out a six tooth segment of the ring gear as shown. Grind off any burrs or sharp edges. The segment can be used in place of a strap wrench. Invert the segment and place it between the ignition bosses on crankcase so that the tool teeth engage the ring gear teeth on the flywheel. The bosses will “lock” the tool and flywheel in position for loosening, tightening or removing with a puller.



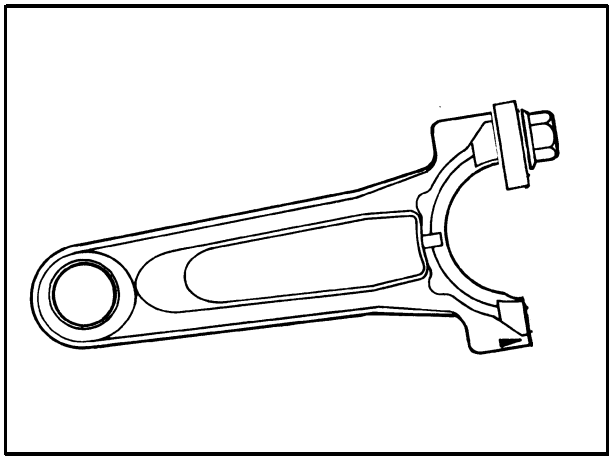
9

Flywheel Holding Tool

Rocker Arm/Crankshaft Tool

If you don’t have a spanner wrench to lift the rocker arms or to turn the crankshaft, you can make a tool for doing this out of an old junk connecting rod.

Find a used connecting rod from a 10 HP or larger engine. Remove and discard the rod cap. If it is a Posi Lock rod, you will also need to remove the studs. If it is a Command rod, you will need to grind off the aligning steps, so the joint surface is flat. Find a 1″ long capscrew with the correct thread size to match the threads in the connecting rod. Obtain a flat washer with the correct I.D. to slip on the capscrew and an O.D. of approximately 1″. Kohler Part No. 12 468 05 can be used if you don’t have the right size on hand. Assemble the capscrew and washer to the joint surface of the rod, as shown.



10

Rocker Arm/Crankshaft Tool

Cylinder Leakdown Tester

Kohler Part No. 47 800 02 Cylinder Leakdown Tester is a valuable alternate to a compression test on these ACR equipped engines. By pressurizing the combustion chamber from an external air source, this tool can determine if valves or rings are leaking. Instructions for using this tester are found on page 3.4 of this manual.

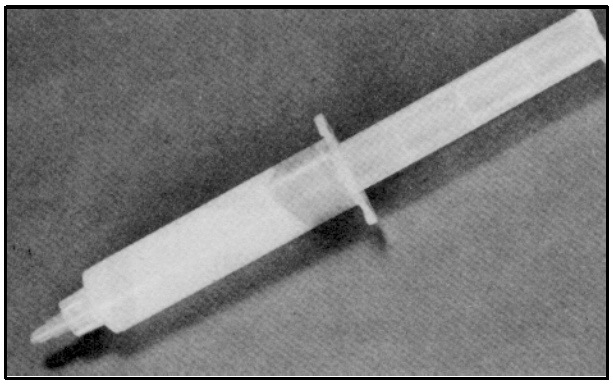
RTV Silicone Sealant

RTV silicone sealant is used as a gasket between the crankcase and closure plate, breather cover and cra nkcase, and valve cover and heads on some models. The chart below lists some of the approved sealants.

RTV Sealants

Vendor	Vendor No. and Description	
G.E.	RTV-102 White RTV-103 Black RTV-106 Red RTV-108 Clear	RTV-109 Gray RTV-154 Gray RTV-156 Red RTV-1473 Black
Loctite®*	593 Black 594 White 595 Clear	598 Black* 5900 Black
Permatex	6 Blue 6B Blue 6C Blue	6M Blue 66B Clear 66C Clear

*NOTE: Loctite® No. 598 is available in a handy 10 cc size syringe type dispenser (with 2 disposable tips) under Kohler Part No. 25 597 04.



11

Loctite No. 598 Syringe Dispenser

NOTE: *Always use Fresh sealant. Using outdated sealant can result in leakage. Generally, the shelf life of an unopened dispenser is about 1 year while that of a used one is not more than 6 months.*

TROUBLESHOOTING

Troubleshooting Guide

When troubles occur, be sure to check the simple causes which, at first, may seem too obvious to be considered. For example, a starting problem could caused by an empty fuel tank.

Some common causes of engine troubles are listed below. Use these to locate the causing factors.

Engine Cranks but will not Start

1. Empty fuel tank.
2. Fuel shutoff valve closed.
3. Dirt or water in the fuel system.
4. Clogged fuel line.
5. Spark plug lead disconnected.
6. Key switch or kill switch in “off” position.
7. Faulty spark plugs.
8. Faulty ignition module.
9. Smart Spark™ malfunction (CH22 & CH25).
10. Carburetor solenoid malfunction.

Engine Starts but does not Keep Running

1. Restricted fuel tank cap vent.
2. Dirt or water in the fuel system.
3. Faulty choke or throttle controls.
4. Loose wires or connections that short the kill terminal of ignition module to ground.
5. Faulty cylinder head gasket.
6. Faulty carburetor.

Engines Starts Hard

1. PTO drive is engaged.
2. Dirt or water in the fuel system.
3. Clogged fuel line.
4. Loose or faulty wires or connections.
5. Faulty choke or throttle controls.
6. Faulty spark plugs.
7. Low compression.
8. Weak spark.

Engine will not Crank

1. PTO drive is engaged.
2. Battery is discharged.
3. Safety interlock switch is engaged.
4. Loose or faulty wires or connections.
5. Faulty key switch or ignition switch.
6. Faulty electric starter or solenoid.
7. Seized internal engine components.

Engine Runs but Misses

1. Dirt or water in the fuel system.
2. Spark plug lead disconnected.
3. Loose wires or connections.
4. Engine overheated.
5. Faulty ignition module.
6. Faulty spark plugs.
7. Carburetor adjusted incorrectly.
8. Smart Spark™ malfunction (CH22 & CH25).

Engine will not Idle

1. Restricted fuel tank cap vent.
2. Dirt or water in the fuel system.
3. Faulty spark plugs.
4. Idle fuel adjusting needle improperly set.
5. Idle speed adjusting screw improperly set.
6. Low compression.
7. Stale fuel and/or gum in carburetor.

Engine Overheats

1. Air intake/grass screen, cooling fins, or cooling shrouds clogged.
2. Excessive engine load.
3. Low crankcase oil level.
4. High crankcase oil level.
5. Faulty carburetor.
6. Lean fuel mixture.
7. Smart Spark™ malfunction (CH22 & CH25).

Engine Knocks

1. Excessive engine load.
2. Low crankcase oil level.
3. Old/improper fuel.
4. Internal wear or damage.
5. Hydraulic lifter malfunction.

Engine Loses Power

1. Low crankcase oil level.
2. High crankcase oil level.
3. Dirty air cleaner element.
4. Dirt or water in the fuel system.
5. Excessive engine load.
6. Engine overheated.
7. Faulty spark plugs.
8. Low compression
9. Exhaust restriction.
10. Smart Spark™ malfunction (CH22 & CH25).
11. Low battery.

Engine Uses Excessive Amount of Oil

1. Incorrect oil viscosity/type.
2. Clogged or improperly assembled breather.
3. Worn or broken piston rings.
4. Worn cylinder bore.
5. Worn valve stems halve guides.
6. Crankcase being overfilled.

Oil Leaks from Oil Seals, Gaskets

1. Crankcase breather is clogged or inoperative.
2. Loose or improperly torqued fasteners.
3. Piston blowby or leaky valves.
4. Restricted exhaust.

External Engine Inspection

Before cleaning or disassembling the engine, make a thorough inspection of its external appearance and condition. This inspection can give clues to what might be found inside the engine (and the cause) when it is disassembled.

Check for buildup of dirt and debris on the crankcase, cooling fins, grass screen and other external surfaces. Dirt or debris on these areas are causes of overheating.

Check for obvious fuel and oil leaks, and damaged components. Excessive oil leakage can indicate a clogged or improperly assembled breather, worn or damaged seals and gaskets, or loose or improperly torqued fasteners.

Check the air cleaner cover and base for damage or indications of improper fit and seal.

Check the air cleaner element. Look for holes, tears, cracked or damaged sealing surfaces, or other damage that could allow unfiltered air into the engine. Also note if the element is dirty or clogged. These could indicate that the engine has been underserviced.

Check the carburetor throat for dirt. Dirt in the throat is further indication that the air cleaner is not functioning properly.

Check the oil level. Note if the oil level is within the operating range on the dipstick, or if it is low or overfilled.

Check the condition of the oil. Drain the oil into a container the oil should flow freely. Check for metal chips and other foreign particles.

Sludge is a natural by product of combustion; a small accumulation is normal. Excessive sludge formation could indicate overrich carburetion, weak ignition, overextended oil change interval or wrong weight or type of oil was used, to name a few.

NOTE: *It is good practice to drain oil at a location away from the workbench. Be sure to allow ample time for complete drainage.*

Cleaning the Engine

After inspecting the external condition of the engine, clean the engine thoroughly before disassembling it. Also clean individual components as the engine is disassembled. Only clean parts can be accurately inspected and gauged for wear or damage. There are many commercially available cleaners that will quickly remove grease, oil, and grime from engine parts. When such a cleaner is used, *follow the manufacturer's instructions and safety precautions carefully.*

Make sure all traces of the cleaner are removed before the engine is reassembled and placed into operation. Even small amounts of these cleaners can quickly break down the lubricating properties of engine oil.

Basic Engine Tests

Crankcase Vacuum Test

A partial vacuum should be present in the crankcase when the engine is operating at normal temperatures. Pressure in the crankcase (normally caused by a clogged or improperly assembled breather) can cause oil to be forced out at oil seals, gaskets, or other available spots.

Crankcase vacuum is best measured with a water manometer. Kohler Part No. 25 800 50 is recommended. Complete instructions are provided in kit.

Test the crankcase vacuum with the manometer as follows:

1. Insert the stopper/hose into the oil fill hole. Leave the other tube of manometer open to atmosphere.

   Make sure the shut off clamp is closed.

2. Start the engine and run at no load high idle speed 13200 to 3750 RPM1.
3. Open the clamp and note the water level in the tube.

   The level in the engine side should be a minimum of 10.2 cm (4 in.) above the level in the open side.

   If the level in the engine side is the same as the open side (no vacuum), or the level in the engine side is lower than the level in the open side (pressure), check for the conditions in the table below.

4. Close the shut off clamp before stopping the engine.

Compression Test

Some of these engines are equipped with an automatic compression release (ACR) mechanism. Because of the ACR mechanism, it is difficult to obtain an accurate compression reading. As an alternate, use the leakdown test described in the following:

No Crankcase Vacuum/Pressure in Crankcase

Possible Cause	Solution
1. Crankcase breather clogged or inoperative.	1. Disassemble breather, clean parts thoroughly, reassemble, and recheck pressure.
2. Seals and/or gaskets leaking. Loose or improperly torqued fasteners.	2. Replace all worn or damaged seals and gaskets. Make sure all fasteners are tightened securely. Use appropriate torque values and sequences when necessary.
3. Piston blowby or leaky valves. (Confirm by inspecting components.)	3. Recondition piston, rings, cylinder bore, valves, and valve guides.
4. Restricted exhaust.	4. Repair/replace restricted muffler/exhaust system.

Cylinder Leakdown Test

A cylinder leakdown test can be a valuable alternative to a compression test. By pressurizing the combustion chamber from an external air source you can determine if the valves or rings are leaking, and how badly.

Kohler Part No. 47-800-02 is a relatively simple, inexpensive leakdown tester for small engines. The tester includes a quick disconnect for attaching the adapter hose, and a holding tool.

Leakdown Test Instructions

1. Run engine for 3 - 5 minutes to warm it up.
2. Remove spark plug(s) and air filter from engine.
3. Rotate crankshaft until piston (of cylinder being tested) is at top dead center of compression stroke. You will need to hold the engine in this position while testing. The holding tool supplied with the tester can be used if the PTO end of the crankshaft is accessible. Slide the holding tool onto the crankshaft and adjust the set screw to fit in the key slot. Install a 3/8″ breaker bar into the square hole of the holding tool, so it is perpendicular to both the holding tool and crankshaft PTO. If the flywheel end is more accessible, you can use a breaker bar and socket on the flywheel nut/screw to hold it in position. You may need an assistant to hold the breaker bar during testing. If the engine is mounted in a piece of equipment, you may be able to hold it by clamping or wedging a driven component. Just be certain that the engine cannot rotate off of TDC in either direction.
4. Install the adapter into the spark plug hole, but do not attach it to the tester at this time.
5. Connect an air source of at least 50 psi to the tester.
6. Turn the regulator knob in the increase (clockwise) direction until the gauge needle is in the yellow “set” area at the low end of the scale.
7. Connect tester quick disconnect to the adapter hose while firmly holding the engine at TDC. Note the gauge reading and listen for escaping air at the carburetor intake, exhaust outlet, and crankcase breather.
8. Check your test results against the table below:

Leakdown Test Results

Air escaping from crankcase breather	Defective rings or worn cylinder walls.
Air escaping from exhaust system	Defective exhaust valve.
Air escaping from carburetor	Defective intake valve.
Gauge reading in “low” (green) zone	Piston rings and cylinder in good condition.
Gauge reading in “moderate” (yellow) zone	Engine is still usable, but there is some wear present. Customer should start planning for overhaul or replacement.
Gauge reading in “high” (red) zone	Rings and/or cylinder have considerable wear. Engine should be reconditioned or replaced.

AIR CLEANER AND AIR INTAKE SYSTEM

Air Cleaners

General These engines are equipped with a replaceable, high-density paper air cleaner element. Most are also equipped with an oiled foam precleaner which surrounds the paper element.

Service

Check the air cleaner daily or before starting the engine. Check for and correct heavy buildup of dirt and debris along with loose or damaged components.

NOTE: *Operating the engine with loose or damaged air cleaner components could allow unfiltered air into the engine causing premature wear and failure.*

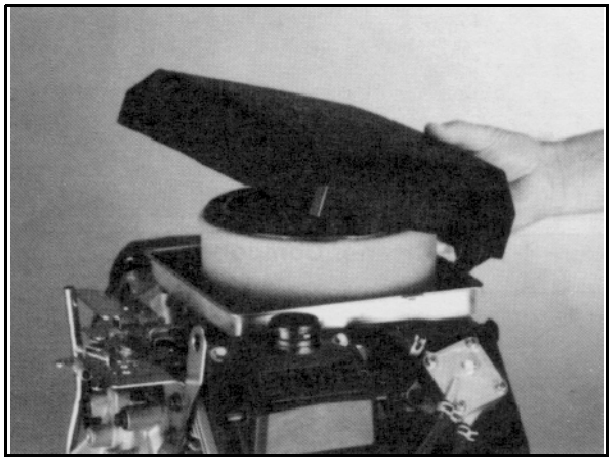
Precleaner Service If so equipped, wash and reoil the precleaner every 25 hours of operation (more often under extremely dusty or dirty conditions).

To service the precleaner perform the following steps:

1. Unhook the latches located on either side of the air cleaner cover then slide cover upward and lift off.
2. Remove the foam precleaner from the paper air cleaner element.
3. Wash the precleaner in warm water with detergent. Rinse the precleaner thoroughly until all traces of detergent are eliminated. Squeeze out excess water (do not wring). Allow the precleaner to air dry.
4. Saturate the precleaner with new engine oil. squeeze out all excess oil.
5. Reinstall the precleaner over the paper air cleaner element.
6. Reinstall the air cleaner cover and secure the two latches.

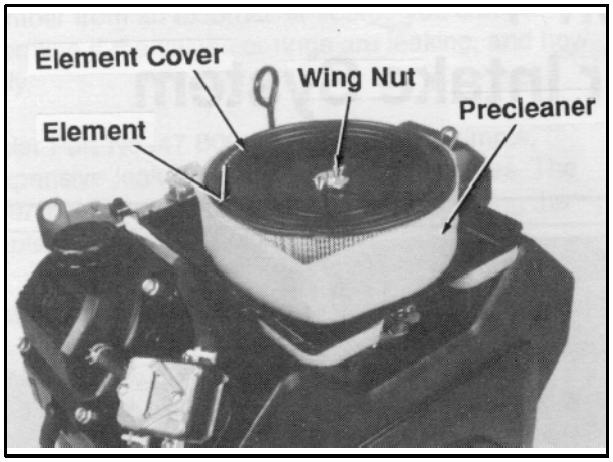
12

Unhooking Latches on Air Cleaner Cover



13

Removing Air Cleaner Cover



14

Air Cleaner Components