CRAFCO

MODEL 200
JOINT and CRACK CLEANER

MODEL 200
JOINT AND CRACK CLEANER

This manual is furnished with each new Crafco Joint and Crack Cleaner. The manual will help your machine operators learn to run the machine properly and understand its mechanical functions for trouble free operation.

Your Crafco Model 200 is designed to give excellent service and save maintenance expense. However, as with all specially engineered equipment you can get best results at minimum cost if you operate and maintain your machine as instructed in this manual. Manufactured under U.S. Patent Numbers 4,175,788, and 4,204,714, and Canadian Patent Number 1,098,355.

Other Patents Pending.

20 hp Onan - 32013
20 HP Muffler Spec. # 541-0280

Onan Oil Filter #
122-0323
our pn - 32122

Onan Air Filter #
140-1911 01
our pn - 32177

24 ~~hp~~ Onan engine # - T260-G
~~3501F~~ Model # GA-024-4451F
24 hp Onan muffler - 22017

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LIMITED WARRANTY

CRAFCO, Inc. warrants to the original purchaser only, that each new CRAFCO machine *excluding* the electrical system, will be free from defects in material and workmanship for a period of one year from the date of delivery. Integral units such as gasoline engines, electric motors, transmissions, etc., are subject to the warranties issued by the manufacturers of such units.

The responsibility of CRAFCO under this warranty is *limited* to replacement or repair of defective parts at CRAFCO's Chandler, Arizona factory, or at a point *designated by it*, of such parts as shall appear to CRAFCO, upon inspection at such point, to have been defective in material or workmanship, *with expense for transportation to be borne by the original purchaser.* The labor covered by this warranty includes only that labor which is required to repair the defective part itself, and *not* that labor required to gain access to the part.

CRAFCO, Inc. shall only be liable when the equipment is used in compliance with those directions specified in the manufacturer's instructions.

The warranty provided herein extends only to the repair and/or replacement of those components of the equipment covered above, and does not extend to incidental or consequential damages incurred as a consequence of any defects covered by this warranty.

This warranty shall not apply to any machine or parts altered and modified without CRAFCO's written consent, nor shall it apply to normal wear and tear or when misuse, negligence or accident are evident, or when machines have been operated at speeds or loads beyond factory rated capacities or specifications.

CRAFCO, Inc. specifically disavows any other representation, warranty, or liability related to the condition or use of the product.

WARRANTY CLAIM INSTRUCTIONS

Please follow the instructions stated below when calling in a Warranty Claim. Failure to follow these procedures will cause the Warranty Claim to be voided.

(1) Indicate to CRAFCO's Customer Service Representative by telephone or letter that the order being placed is a *Warranty Claim.*

(2) Indicate to the CRAFCO Customer Service Representative the type of equipment under warranty, serial number and a brief description of the warranty defect. A replacement part will be shipped immediately F.O.B. Chandler, Arizona, and invoiced.

(3) Return the defective part to CRAFCO within fifteen (15) days of the date the claim was called in. Indicate on shipper, packing slip or by letter the model number and serial number of the machine from which the defect is being claimed, along with the part being returned. If the defective part is not returned to CRAFCO within the fifteen (15) day period or if the defect is determined by CRAFCO, Inc. to be due to normal wear and tear or misuse, the claim will be voided. The customer will be notified within thirty (30) days of disposition of the claim. If the failure was caused by a defect in material or workmanship, a credit will be issued.

If you have any additional questions regarding warranty repairs and parts, please do not hesitate to call toll free 1-800-528-8242.

Operating Instructions

INTRODUCTION

The CRAFCO Model 200 Joint and Crack Cleaning Machine was designed specifically to widen and clean joints and cracks in asphalt and concrete surfaces. When working with a concrete surface, it is recommended that the optional wheel weights be used to provide extra stability and performance if your machine is powered by Onan (wheel weights are unnecessary on machines powered by Wisconsin). The CRAFCO Model 200 is not intended to be used to clean old sealant from joints or cracks. CRAFCO, Inc. recommends the use of the CRAFCO Model 100 joint cleaning attachment for removing old sealant from joints.

CRAFCO, Inc. and its Distributors assume no liability for accident or injury incurred through improper use of this machine.

SAFETY PRECAUTIONS

1. Eye and ear protective devices are required when operating the CRAFCO Joint and Crack Cleaner. A respirator should also be worn if the surface being worked with is dry.

2. Care should be taken when operating machine on grades. It is usually best to operate machine going up hill.

3. To stop or slow machine, push down on handle. (See page 10 for further details).

4. When cleaning joints near moving traffic, always move in a direction away from traffic to protect the operator.

5. Tires should be inflated to 45 psi to allow machine to roll easily.

PREPARING MACHINE FOR OPERATION

DO NOT operate machine without following these instructions:

1. Check engine crankcase oil. Refer to engine section on pages 31 or 50 for instructions.

2. Fill engine gas tank with regular grade gasoline. For new engines, nonleaded gasoline gives the most satisfactory results. For older engines that have previously used leaded gasoline, take off heads and remove all lead deposits from engine before switching to nonleaded gasoline.

3. Check tire inflation. Proper tire inflation is 45 psi. Machine will be difficult to roll with under inflated tires.

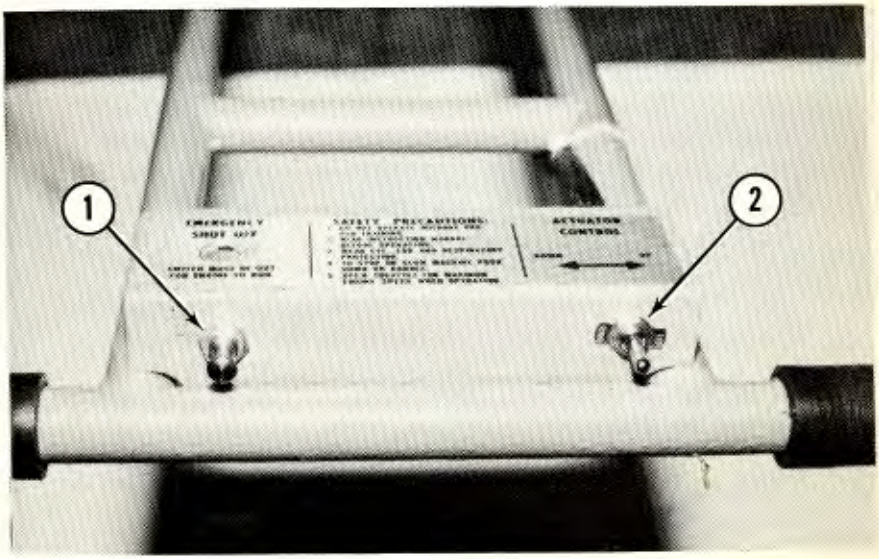


FIGURE 1

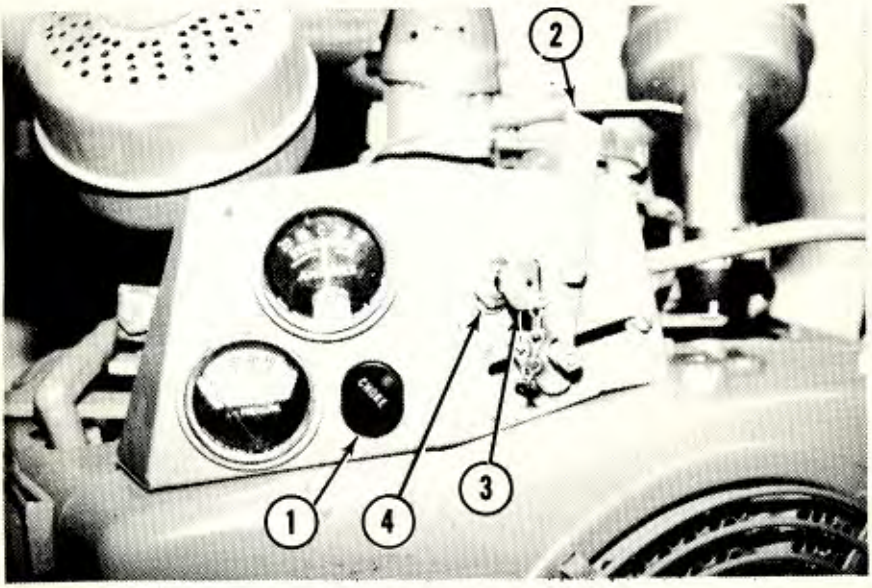


FIGURE 2

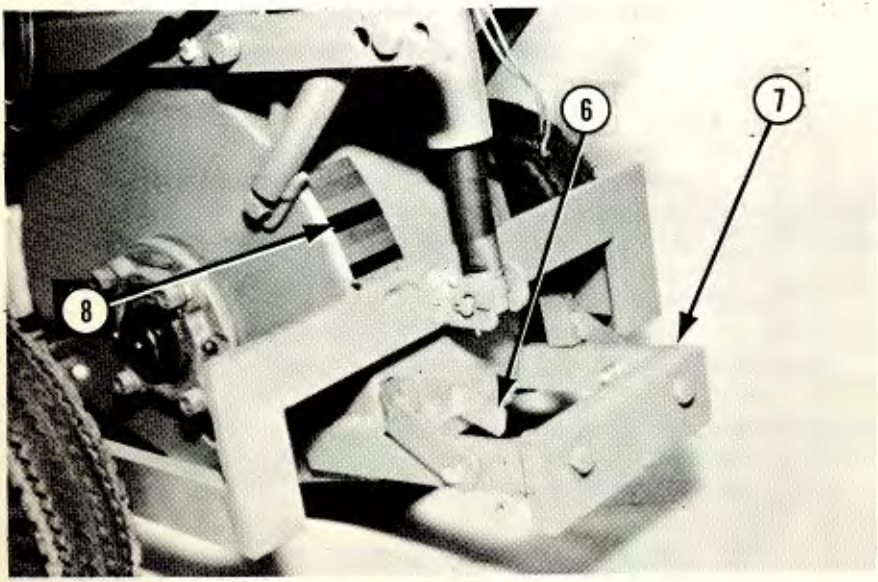


FIGURE 3

OPERATING PROCEDURE

TO START ONAN ENGINE:

NOTE It is recommended that you read the Onan Engine Section before you start the engine.

(Refer to Figure 1, Page 6)

1. Pull out emergency stop button **1** to energize system.

2. Raise cutter mechanism by moving switch lever **2** with thumb to right.

(Refer to Figure 2, Page 8)

1. Pull choke **1** out.

2. Open throttle **2** about half way.

3. Insert key **3** into Ignition/Starter Switch **4** and turn to extreme right to engage starter.

4. Push choke in after engine starts.

TO START WISCONSIN ENGINE:

NOTE: It is recommended that you read the Wisconsin Engine section before you start the engine.

(Refer to Figure 1, Page 7)

1. Pull out emergency stop button **1** to energize system. This button also acts as ignition switch.

2. Raise cutter mechanism by moving switch lever **2** with thumb to the right.

(Refer to Figure 3, Page 8)

1. Pull choke **1** out.

2. Open throttle **2** about half way.

3. Press starter button **3** to engage starter.

4. Push choke in after engine starts.

TO CLEAN JOINTS AND CRACKS

1. Open throttle for maximum engine speed. Position machine over joint and line up pointer **6** (Figure 3, Page 7) with joint. **NOTE:** Machine is designed to travel in a direction towards the operator. The stabilizer mechanism **7** is designed to stabilize the machine and to act as a brake. The Model 200 has a tendency to self-propel itself when cutting. To slow or stop machine push down on the handle. Refer to Page 10 for a more detailed explanation.

2. Lower cutter head until cutters slightly touch the surface. Notice color on the depth indicator **8** (Figure 3). To cut ¾ inch depth, lower cutter until same color appears on depth indicator. **NOTE:** Each color represents ¼ inch depth variation.

3. Do not try to go too fast. Do not overload the engine. Optional wheel weights should be used on Onan equipped machines when cutting concrete. Overloading the engine will slow cutting action and cause damage to engine and drive components. A bouncing or hammering action usually indicates the machine is moving too fast or the cutters have worn out of round (refer to Troubleshooting Section). Let machine thoroughly clean joint. For deep cuts (deeper than ¾ inch) it may be necessary to make two passes. Tightly compacted surfaces will cause machine to push toward operator. Use brake as required to keep machine under complete operator control. For emergency stop push down firmly on handle.

4. As cutters wear depth of cut will change, to compensate for cutter wear, repeat step #2 as often as necessary to reset depth.

5. When cutters will no longer cut to desired depth, they must be replaced. Refer to cutter changing section on Page 12.

6. Throttle and governor are factory set for the most efficient cutting action. Increasing engine speed may hinder cutter action and also void warranty. Proper engine speed is 3250 rpm.

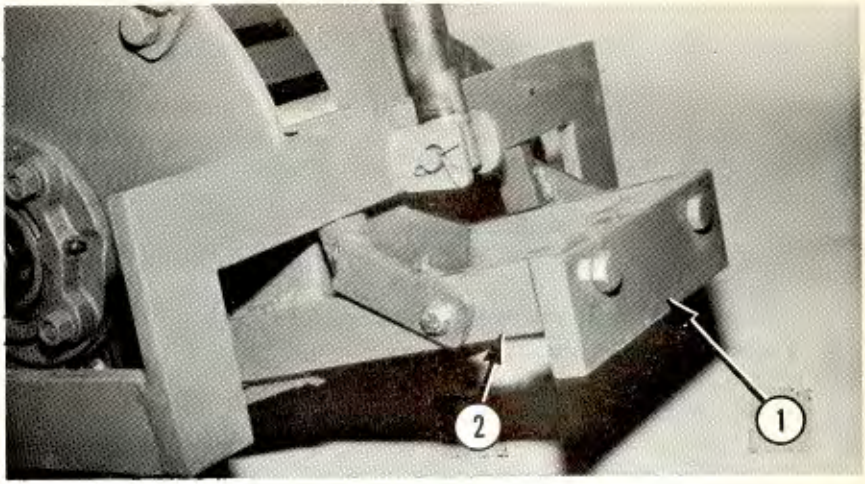


FIGURE 4

STABILIZER MECHANISM AND ACTUATOR STOPS

A stabilizer mechanism is used on the CRAFCO Joint and Crack Cleaner to improve the stability of the machine and to act as a brake. *To slow or stop the machine, simply push down on the handle.* For normal operation, let wear plate **1** drag on paved surface while machine is in operation. (Figure 4).

Wear plate **1** (Part No. 31065) should be replaced before wear reaches the attaching bar **2**.

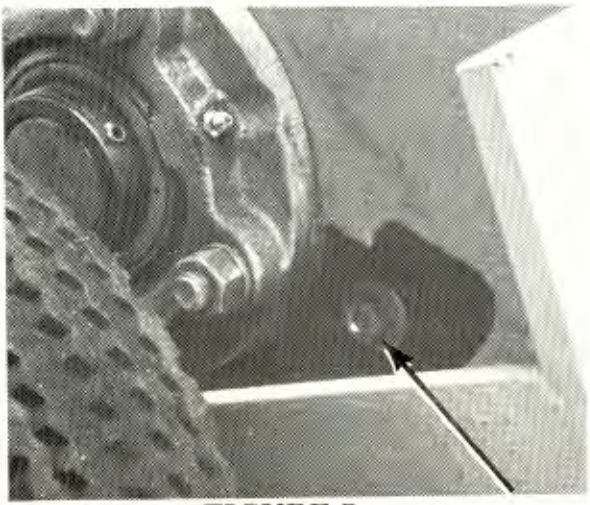


FIGURE 5

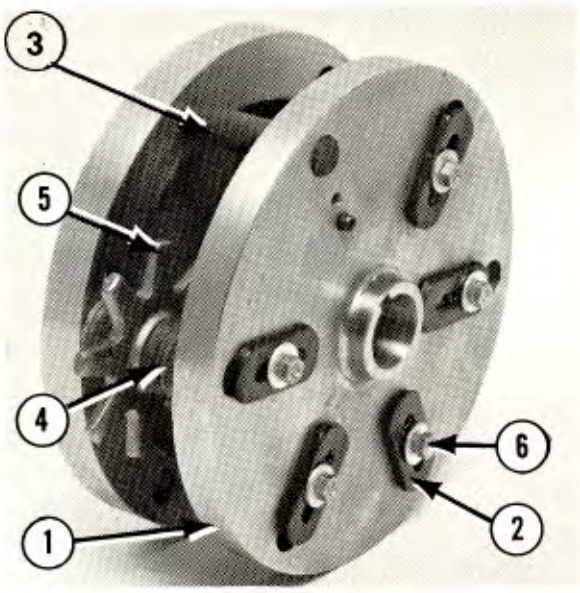


FIGURE 6

ITEM	PART NO.	DESCRIPTION	QUANTITY
1	31032	Cutter Head	1
2	31120	Retainer	6
3	31114	Pin	6
4	32093	Spacer	60 (10 per shaft)
5	31134	Cutter 4.75 dia.	6
6	32039	Bolt L09	6

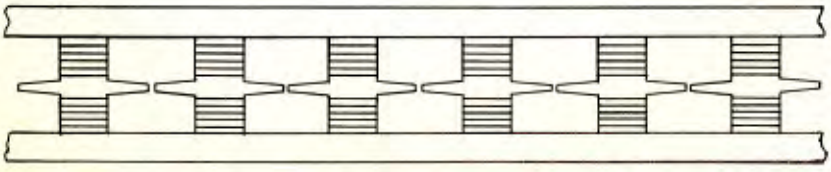


FIGURE 7

CHANGING CUTTERS

To clean joints of up to ¾ inches wide, assemble cutters and other components as shown in Figure 7. For cleaning greater widths, refer to Page 13. The procedure outlined below will greatly simplify cutter changing.

1. Raise cutter mechanism to maximum height. Push machine forward while holding handle up. This will allow rock deflector to fold up and machine to tilt forward exposing cutters for easy accessibility.

2. Place wrench supplied with machine on exposed bolt in cutter window. See Figure 5. Turn clockwise to rotate cutter head to end of cutter window. This will rotate cutter head for proper indexing. Do not attempt to turn cutter head with hands.

3. Remove wrench and place on bolt just exposed. Loosen bolt at least one full turn. Slide retainer back exposing pin. Refer to Figure 6.

4. Using pin removal tool (also supplied with machine) push pin through from opposite side. Note - It is not necessary to push pin all the way out, except when changing pins. Remove worn cutters and/or worn pins. Pins should be replaced when worn in any area to a diameter less than ¾ inch. Use pin as a pilot to mount spacers and cutters.

5. Slide retainer back into position and tighten bolt. Caution: It is most important that retainer is always put back in locking position. As bolt is tightened, flywheel will rotate clockwise exposing next cutter.

6. Repeat steps 3, 4 and 5 for other five cutter positions.

ALTERNATE CUTTER POSITIONING

For wider cracks it may be necessary to rearrange or to stagger the cutters for best results. Several different patterns are possible. The patterns shown below (Figure 8) will clean out cracks up to 2 inches wide. The main consideration in cutter arrangement is placing equal number of cutters and spacers on opposite pins to maintain balance. Failure to do so could result in permanent damage to the machine and possible injury to the operator.

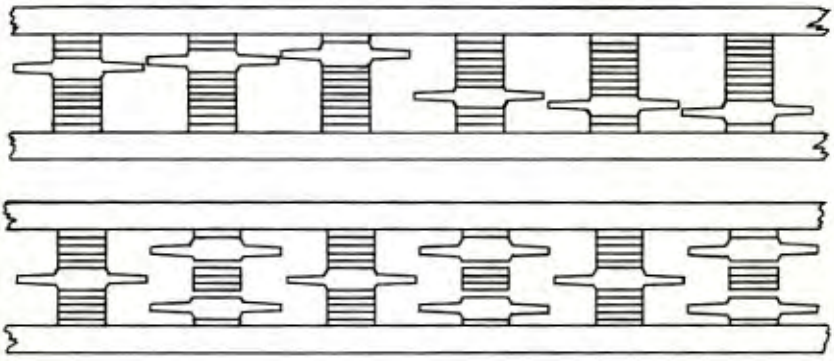
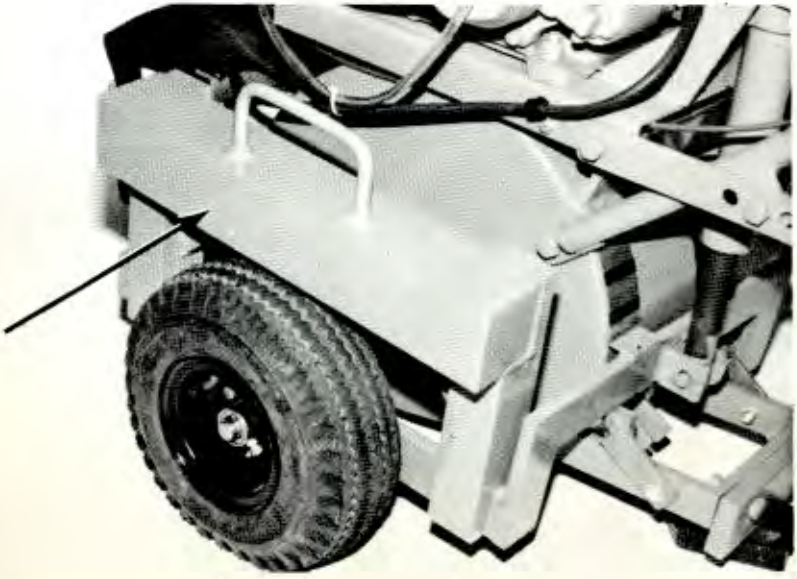


FIGURE 8



Wheel Weights

WHEEL WEIGHTS

Special wheel weights (P/N 31113) are available to facilitate in the cutting of concrete surfaces. The wheel weight rests on the frame over each wheel of the machine. These weights are easily removed by simply lifting each weight off.

SETTING DEPTH STOP

Depth stop **1** should be set so cutter housing **2** just clears the pavement at maximum cutter depth. An improper setting may cause damage to cutter housing and rotating cutter head. Refer to Figure 10.

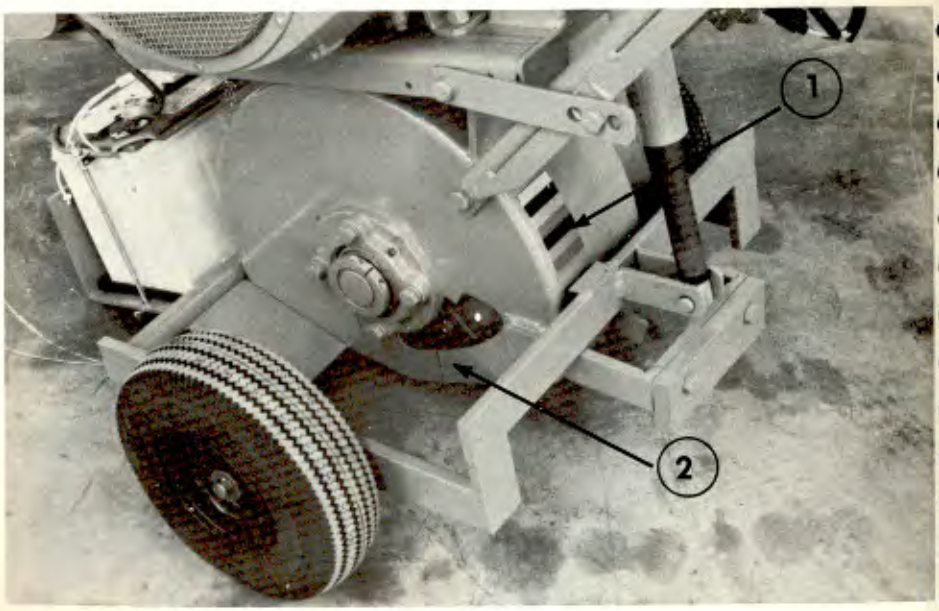
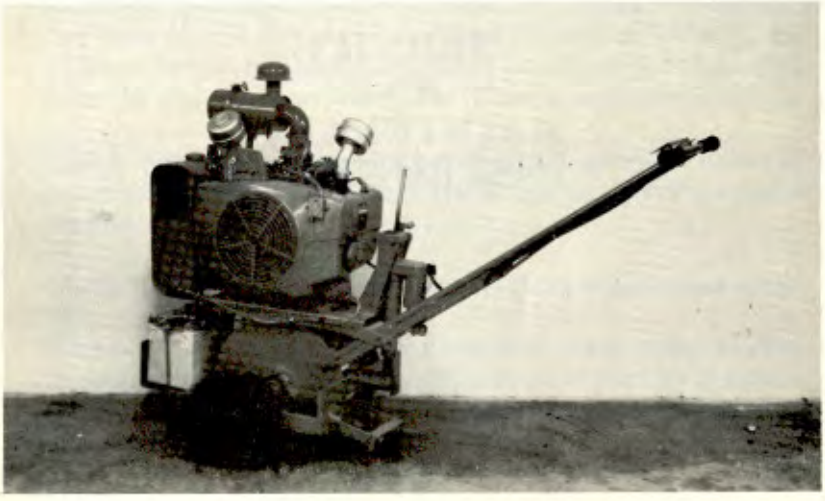


FIGURE 10

STORING MACHINE

DO NOT rest weight of machine on rubber rock deflector when changing cutters or rubber will become deformed making deflector unfunctional. Store with engine in a near level position. See Figure 9.



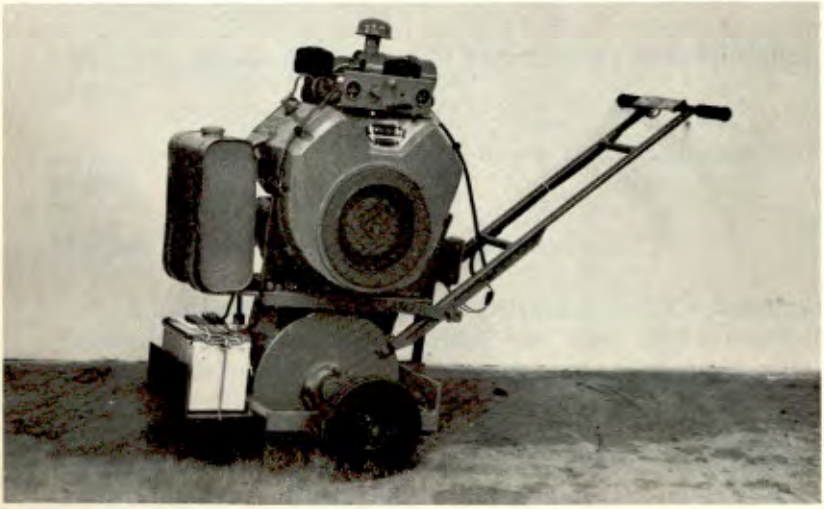


FIGURE 9

SERVICE AND MAINTENANCE INSTRUCTIONS

SERVICE AND MAINTENANCE

1. For longer engine life the Model 200 has been fitted with an industrial type air cleaner. Air cleaner should be serviced every 40 hours or sooner in extremely dusty conditions, such as when cutting concrete. Thorough cleaning of element with air or water is recommended. But be careful, too much pressure can break the filter paper and destroy the element. Rapping, tapping or pounding dust from element is dangerous and should be avoided. Carefully check element for damage before reinstallation. Dust should also be removed from the dust cap and from filter housing at service interval.

2. Check engine oil daily. Change oil after every 25 hours of operation. Change oil filter every 50 hours. (Refer to engine section.)

3. Check fluid level in battery regularly if not maintenance free.

4. Every 100 hours of operation remove sheet metal shroud from engine and clean out cooling fins on engine. If dust is allowed to accumulate overheating may occur, causing damage to the engine.

5. Lubricate cutter bearings **1** every 100 hours using multi-purpose grease. See Figure 11.

6. Lubricate wheels **2** every 100 hours using multi-purpose grease.

7. Lubricate frame pivot **3** every 50 hours using multi-purpose grease.

8. Tighten all bolts on machine frequently.

9. After 2 hours of operation check and tighten the V-belts as required. To tighten belts adjust jam nuts under engine mount. Refer to Figure 12. Caution: Do not overtighten belts as damage will occur to belts and bearings. Belts that are too loose will shorten the life of the belts and sheaves. Recheck belt tension after eight hours and every 40 hours thereafter. When installing new belts do not attempt to stretch over sheaves. When replacing V-belts always use a "matched set."

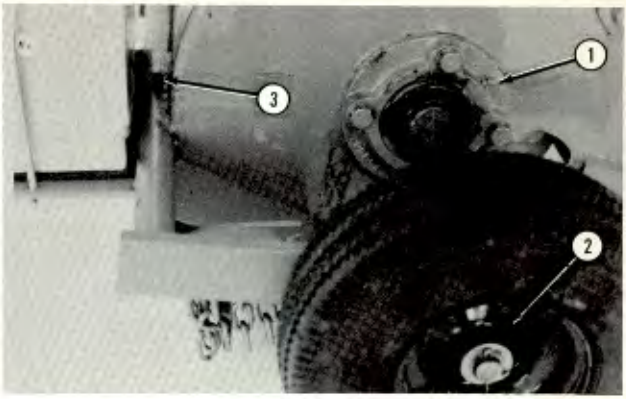


FIGURE 11

FIGURE 12

10. Clean machine after each days use using compressed air or by wiping with rags, especially in area of engine cooling fins.

11. Always use genuine Crafco cutters and replacement parts.

CHANGING CUTTER HEADS

It is recommended that the cutter head be changed when holes for pins are worn to 1.000 diameter or larger.

REMOVING OLD CUTTER HEAD AND MAIN SHAFT

1. Remove belt guard.

2. Back off belt tension adjusting bolt jam nuts all the way and remove the V-belts.

3. Tip machine back lowering handle all the way to ground. (See Figure 13.)

4. Remove wheels **1**.

5. Remove lower sheave. (See Figure 14.) The sheave **2** has a built in puller. Loosen and remove the three mounting cap screws. **3** insert these same cap screws in the threaded jack-screw holes. Starting with the screw farthest from the bushing saw slot; tighten all screws alternately and progressively to separate sheave from bushing.

6. Drive a wedge into slot **4** of bushing, barely enough to free the bushing and slide bushing off shaft.

7. Lift handle to set machine flat on ground, (see Figure 15) then remove top three cap screws **5** in each of the two main shaft bearings. It is not necessary to remove bottom cap screw **6** in each bearing but leave it intact.

8. Push handle down all the way to the ground again (See Figure 16). This will lift front of machine free of cutter head assembly and complete assembly can be rolled out to clear machine.

INSTALLING NEW CUTTER HEAD AND MAIN SHAFT

The cutter head and main shaft are sold in matched sets and must be installed together.

1. Slip the bearings on to the main shaft in the new cutter head.

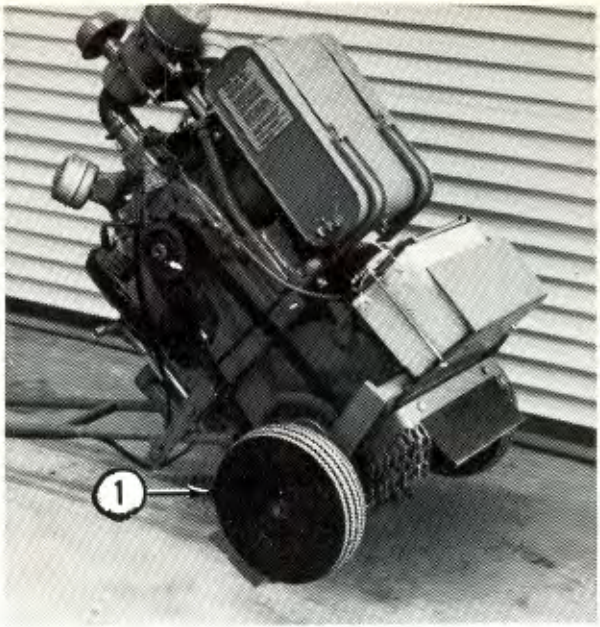


FIGURE 13

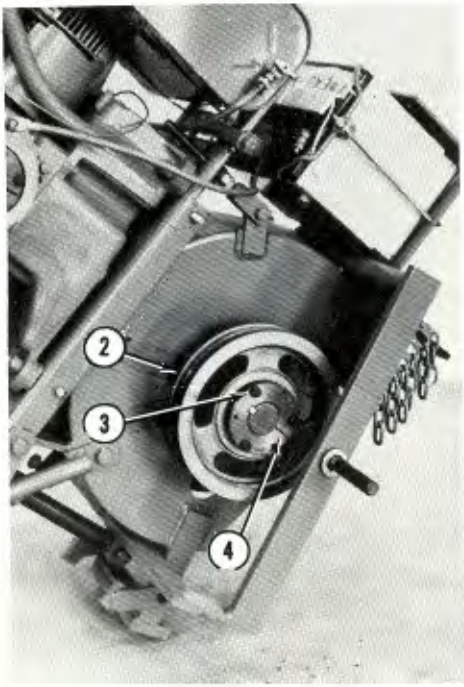


FIGURE 14

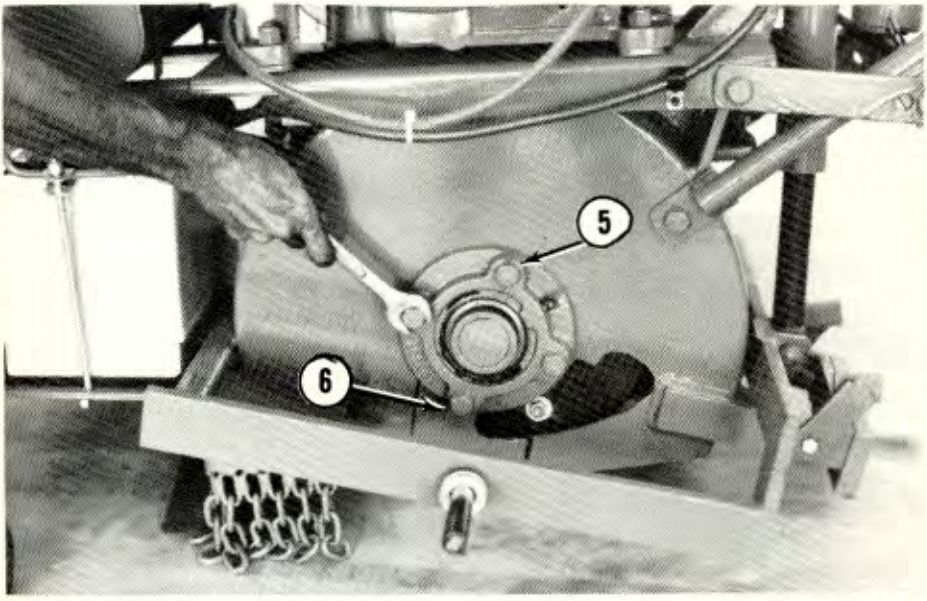


FIGURE 15

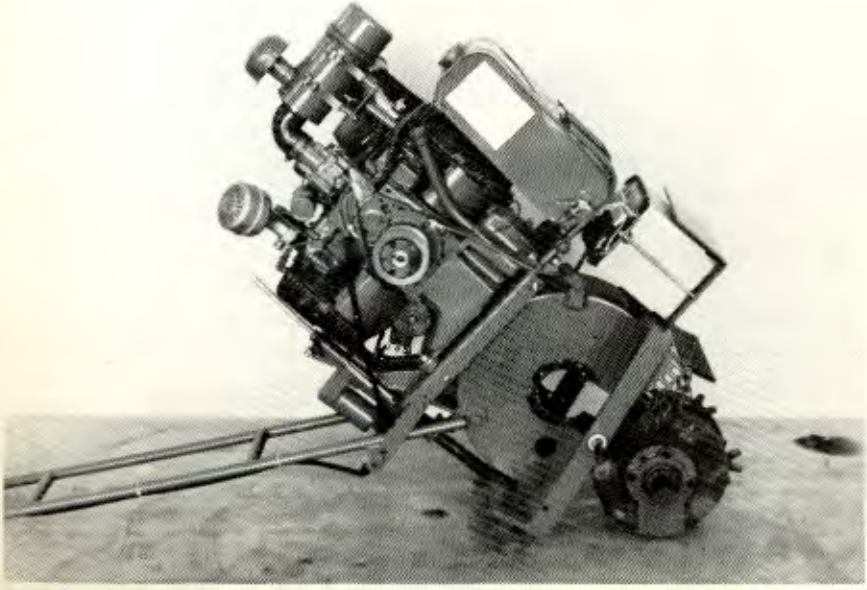


FIGURE 16

2. Push the handle down all the way to the ground to raise the front of machine.

3. Roll new cutter head assembly under machine and into position.

4. Line up bearings with cutout sections in the flywheel housing, fitting each into its slot as machine is lowered over flywheel.

5. Reinstall three cap screws that attach bearings to flywheel housing.

6. Center cutter head in housing and move main shaft so that it is flush with bearing on side opposite sheaves.

7. Replace locking ring mechanism on each bearing. (or 7A.)

7A. If bearings do not use a locking ring, follow this procedure: Using ¼" electric drill and 13/64" drill bit, make dimple in shaft under one or more set screws. Remove two set screws on each bearing and coat with a thread adhesive such as locktite. Replace set screws and tighten until snug.

8. Reinstall hub and lower sheave. Be sure the sheaves are in alignment using straight edge. Reset the key.

9. Tighten cap screws that pull the sheave onto bushing alternately and progressively until tapers are seated. Check alignment and sheave runout or wobble and correct as necessary before tightening cap screws to recommended torque value of 9 ft.-lbs. each.

10. Reinstall wheel and tire assemblies.

11. Install V-belts and tighten tension using the jam nuts underneath motor mount. Correct belt tension is ¼" deflection per belt when 10 lbs. pressure is applied.

12. Install belt guard.

13. Install cutters, shafts and spacers as outlined in cutter installation section, Page 12.

PROBLEM	CAUSE	REMEDY
Cutters wear out of round.	Cutters not spinning on pins thereby creating uneven wear	Take deeper cut. Work machine harder causing cutters to spin on pins.
Engine stalls	No spark.	Clean or replace points;
		Check electric system for defective wires, switches, etc.
	Inadequate supply of fuel to carburetor.	Check fuel pump, fuel valve and lines.
Machine fails to raise or lower.	Damaged switch, wiring, or fuse.	Replace defective components.
	Defective or worn linear actuator.	Replace linear actuator.
Engine doesn't spin properly when cranking.	Starter problems.	Repair or replace starter.
Engine missing, loss of power.	Dirty points.	Clean or replace points.
	Dirty carburetor.	Clean carburetor.
	Defective fuel pump.	Replace fuel pump.

FIGURE 17

CHANGING V-BELTS

1. Remove belt guard by removing 4 bolts.
2. Loosen belt tensioner until bottomed out. See Figure 16.
3. Remove old belts. Install new belts.
4. Tighten belt tensioner as instructed on Page 22 (step #11).

PARTS LIST

Ordering Parts

Parts may be ordered directly from Crafco, Inc. or from your nearest Crafco Distributor. When ordering parts give model number and serial number from name plate.

Write or phone:

Crafco, Inc.
P.O. Box 20133
Phoenix, AZ 85036
(602) 276-0406

changing small tires to the large ones
2 - 32057 wheel & tire assy
2 - 31099 - axle assy

WISCONSIN ENGINE PARTS LIST 1986

Model # W2-1230-421607

ITEM NO.	DESCRIPTION	QTY. PER UNIT	PART NO.
1	Toggle Switch, Actuator	1	32513
2	Master Switch	1	32533
3	Starter Switch	1	31315
4	Safety Precaution Decal	1	31106
5	Hand Grip	2	32081
6	Ammeter	1	32542
7	Gauge Oil Pressure	1	32132
8	Pin Removal Tool	1	31100
9	Wrench	1	31101
10	In-line Fuse Modified	1	31511
11	Fuse 30 Amp	1	32509
12	Wiring Harness Complete	1	31502
13	Actuator	1	32001
14	7/16 14 Unc. Lock Nut	1	28527
15	Bolt 7/16 — 14 Unc. x 4-1/4" Long	1	28756
16	Clevis Pin 1/4 x 2	1	29345
17			
18	Handle Assembly	1	31060
19	Handle Bracket	1	31132
20	Sheave 2G-5V 4.65 Diameter	1	32068
21	Sheave 2G-5V 8.00 Diameter	1	32074
22	5V-560 Belts, Matched Set of 2	1	32078
23	Belt Guard Assembly	1	31059
24	Decal, Nameplate	1	26160

ITEM NO.	DESCRIPTION	QTY. PER UNIT	PART NO.
	Cutter Head Assembly — Items 25-33	1	31230
25	Key 3/8 x 1-5/8	1	31071
26	Main Shaft	1	31073
27	Key 3/8 x 4	1	31072
28	Cutter Head	1	31032
29	1/2 — 13 x 1 Set Screw	2	28847
30	Roll Pin 3/8 x 3/4	6	32061
31	Retainer	6	31120
32	3/8 Flat Washer	6	28634
33	3/8 — 16 Bolt 1-9	6	32039
34	Pin	6	31114
35	Cutter 4/75 Diameter	6	31134
35A	Cutter 4/75 Diameter, Carbide Tipped	6	31136
36	Spacer	60	32093
37	Cotter Pin, 1/8 x 1	2	29638
38	Wheel & Tire Assembly 16.6 x 4.80/4.00 - RIB	2	32057
39	3/4" SAE Hardened Steel Washer	A/R	32093
40	Bushing, SDS x 17/16		32067
41	Bushing, #2517		32076
42	1/2" SAE Hardened Steel Washer	3	32091
43	Bolt 1/2-13 Unc. x 1-3/4 Long	1	28763
44	1/2-13 Locking Jam Nut		28516
45	Rubber Bushing, Modified	2	32110
46	Shock Absorber	1	31068
47	Wear Plate	1	31065
48	Rock Deflector	1	31102
49	Battery Bolt	1	32031
50	Deflector, Chain Assembly	1	31104
51	Battery Cushion	1	31045
52	Battery — 12 Volt	1	32547
53	Battery Cable — 38"	1	24015
54	Battery Cable — 20"	1	32602
55	Battery Hold Down	1	24005
56	Tank Bracket — Left	1	31095
57	Tank Bracket — Right	1	31096
58	Clevis Assembly	1	31052
59	Frame and Housing Assembly	1	31201
60	Depth Decal	1	31110
61	Tank Strap — MOD	2	32086
62	Tank Pad	2	31057
63	Fuel Tank Kit	1	32087
65	Upper Tank Support	1	31015

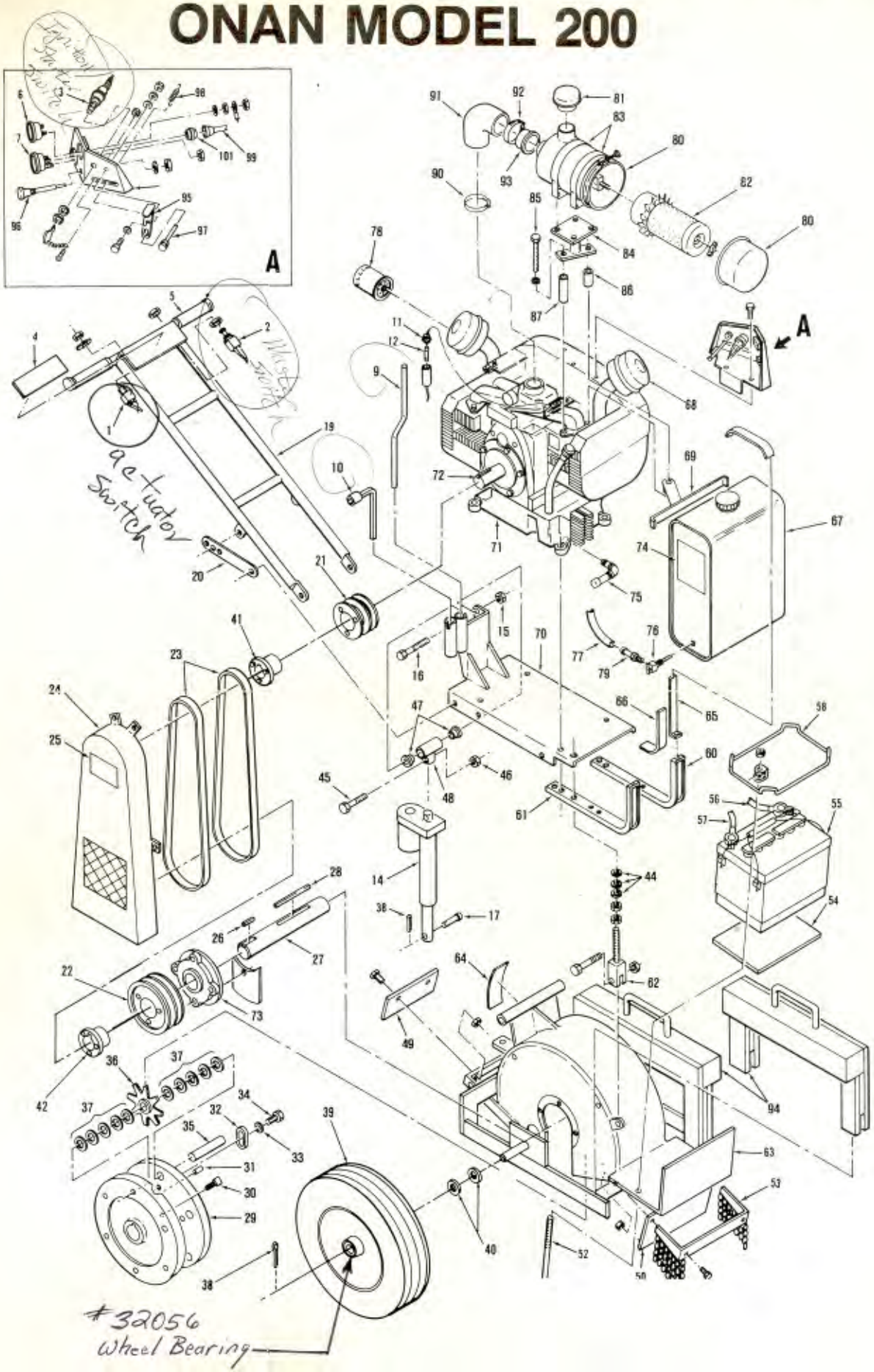
ITEM NO.	DESCRIPTION	QTY. PER UNIT	PART NO.
66	Engine Mount Assembly	1	31151
67	Engine Wisconsin W2-1230	1	32050
68	Key ' 3/8" x 1'5/8"	1	31071
69	Bearing — 1-3/4"	2	32043
70	Decal, General Instruction	1	31108
71	Oil Drain Assembly	1	32016
72	Fuel Valve	1	32118
73	Fuel Line	1	32120
74	Oil Filter * engine	1	31311
75	1/8" Straight Inverted Flare Push-on	1	26790
76	Air Cleaner Assembly	1	32100
77	Breather Cap	1	32101
78	Air Cleaner Element *	1	32103
79	Band	2	32102
80	Air Cleaner Bracket	1	31153
81	Breather Hose Assembly only available thru Wisconsin Eng.	1	~~31168~~
82	Muffler	2	32025
83	Gear Clamp — Size 56	1	26091
84	Rubber Elbow	1	32116
85	Hose Clamp — 2"	1	32112
86	Bushing (Rubber)	2	32117
87	Choke Cable	1	32007
88	Throttle Control	1	32010
89	Governor Spring	1	32035

No fuel Filter

"Turbo" optional pre-cleaner - 32104

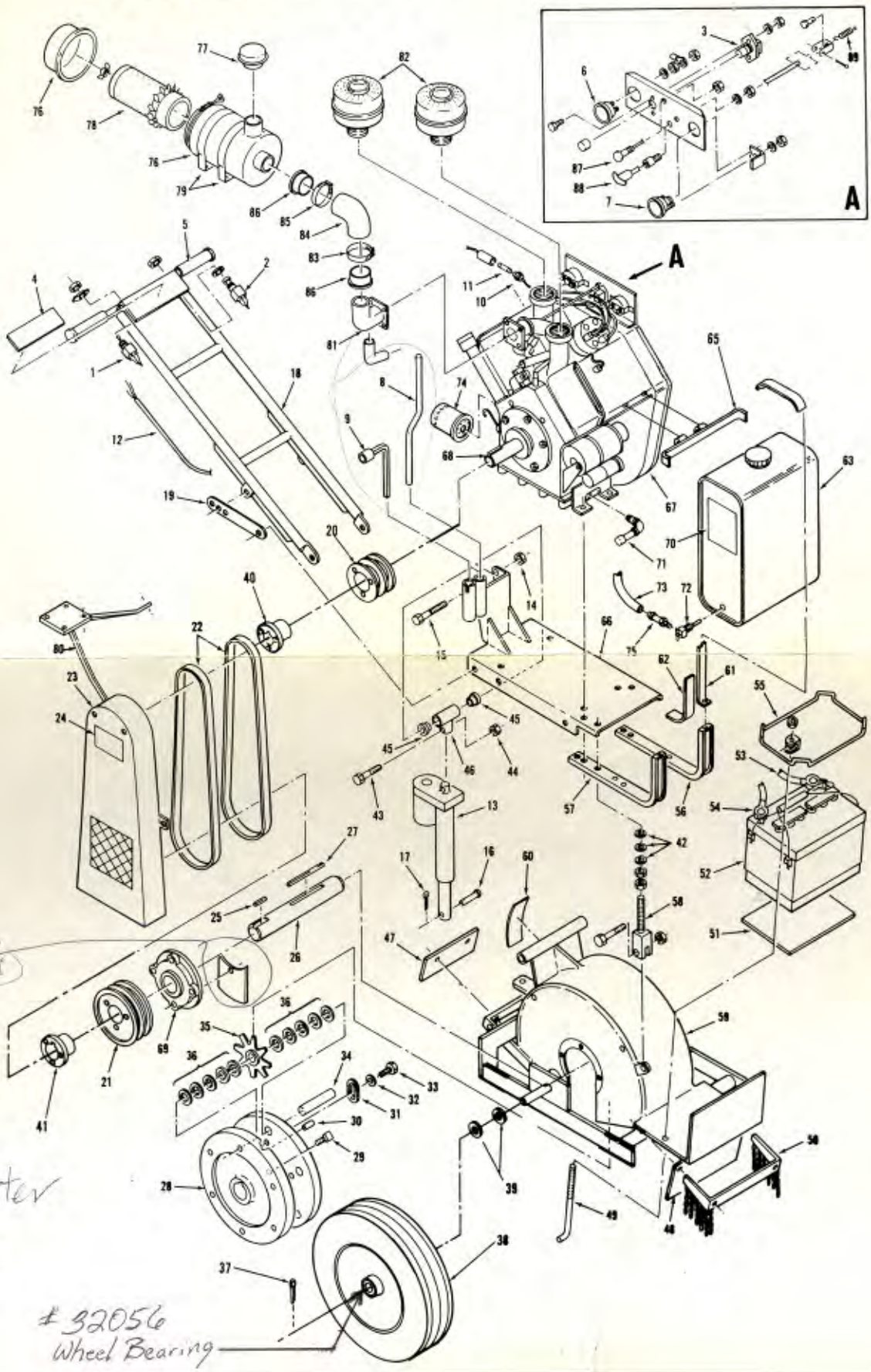
WIRE END ACTUATOR - ~~32517~~ 32517
ON WIRE HARNESS

ONAN MODEL 200

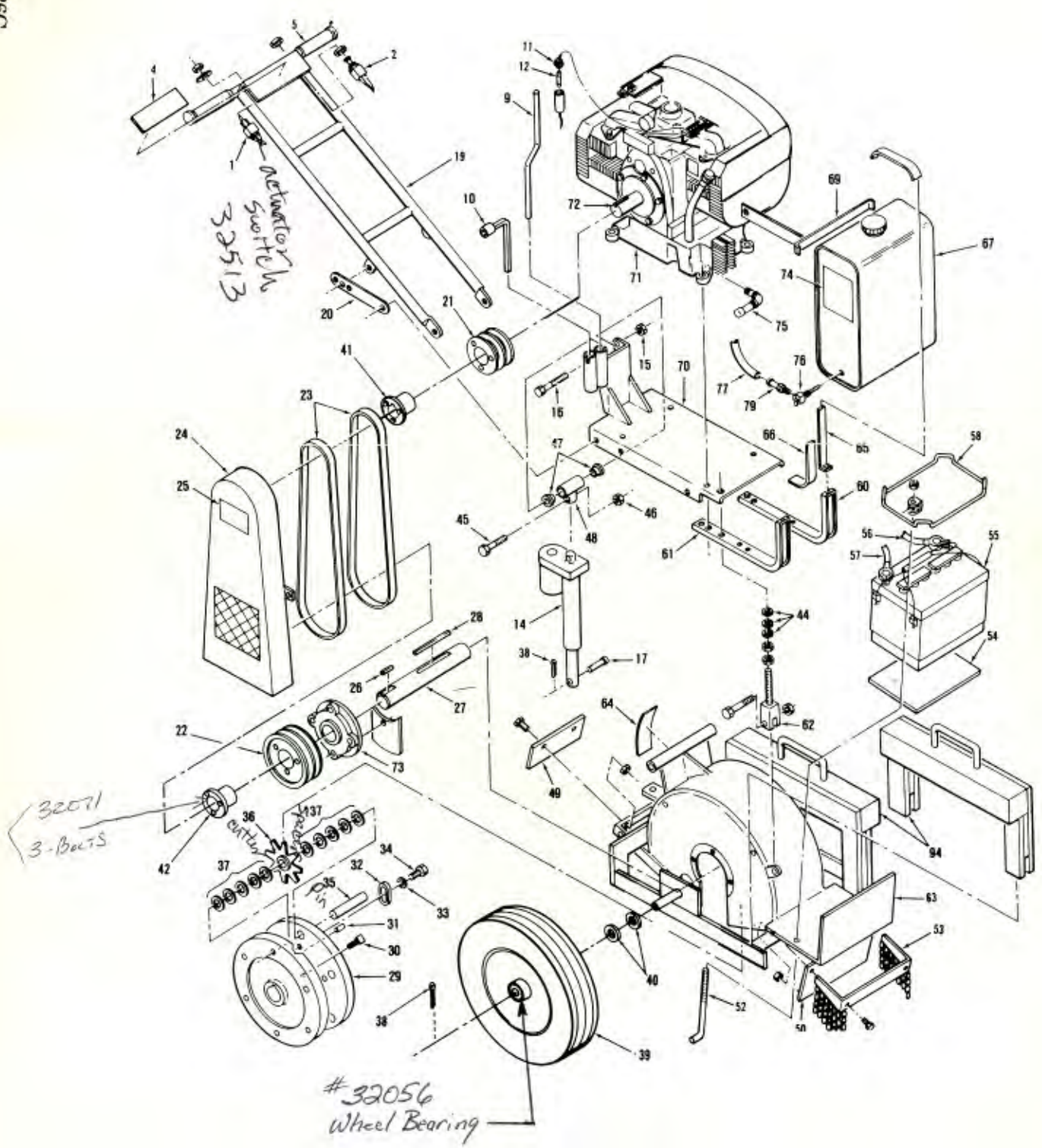


WISCONSIN MODEL 200

24 HP only



MODEL 200
BRIGGS & STRATTON



Model # [redacted]
422437

BRIGGS & STRATTON ENGINE PARTS LIST

ITEM NO.	DESCRIPTION	QTY. PER UNIT	PART NO.
1	Toggle Switch, Actuator	1	32513
2	Master Switch	1	32534
4	Safety Percaution Decal	1	31106
5	Hand Grip	2	32081
8			
9	Pin Removal Tool	1	31100
10	Wrench	1	31101
11	In-line Fuse Modified	1	31511
12	Fuse — 30 Amp	1	32059
13	Wiring Harness Complete	1	31502
14	Actuator	1	32001
15	7/16 14 Unc. Lock Nut	1	28527
16	Bolt 7/16 — 14 Unc. x 4-1/4" Long	1	28756
17	Clevis Pin 1/4 x 2	1	29345
18			
19	Handle Assembly	1	31060
20	Handle Bracket	1	31132
21	Sheave 2G-5V 4.65 Diameter	1	32068
22	Sheave 2G-5V 9.25 Diameter	1	32072
23	5V-560 Belts, Matched Set of 2	1	32078
24	Belt Buard Assembly	1	31086
25	Decal, Nameplate	1	26160
	Cutter Head Assembly — Items 26-34	1	31232
26	Key, 3/8 x 1-5/8	1	31071
27	Main Shaft/Wisc.	1	31073
28	Key 3/8 x 4	1	31072
29	Cutter Head	1	31032
30	1/2 — 13 x 1 Set Screw	2	28847
31	Roll Pin 3/8 x 3/4	6	32061
32	Retainer	6	31120
33	3/8 Flat Washer	6	28634
34	3/8 — 16 Bolt 1-9	6	32039
35	Pin	6	31114
36	Cutter 4.75 Diameter (Standard)	6	31134
36A	Cutter 4.75 Diameter, Carbide Tipped	6	31136
37	Spacer	60	32093
38	Cotter Pin, 1/8 x 1	2	29638
39	Wheel and Tire Assembly 16.6 x 4.80/4.00-8 RIB	2	32057
40	3/4" SAE Hardened Steel Washer	A/R	32093
41	Bushing, SDS x 1	1	32070
42	Bushing, SKX x 1-3/4	1	32071

ITEM NO.	DESCRIPTION	QTY. PER UNIT	PART NO.
43	5/16 — 18 Lock Nut	2	28525
44	1/2" SAE Hardened Steel Washer	3	32091
45	Bolt 1/2 — 13 Unc. x 1-3/4 Long	1	28763
46	1/2 — 13 Locking Jam Nut		28516
47	Rubber Bushing, Modified	2	32110
48	Shock Absorber	1	31068
49	Wear Plate	1	31065
50	Rock Deflector	1	31102
51			
52	Battery Bolt	2	32031
53	Deflector, Chain Assembly	1	31104
54	Battery Cushion	1	31045
55	Battery — 12 Volt	1	32547
56	Battery Cable, 38"	1	24015
57	Battery Cable 20"	1	32602
58	Battery Hold Down	1	24005
59			
60	Tank Bracket — Left	1	31095
61	Tank Bracket — Right	1	31096
62	Clevis Assembly	1	31052
63	Frame and Housing Assembly	1	31201
64	Depth Decal	1	31110
65	Tank Strap (Modified)	2	32086
66	Tank Pad	2	31057
67	Gasoline Tank Kit	1	32087
69	Upper Brack Ass'y.	1	31085
70	Engine Mount Assembly	1	31151
71	B/S Engine	1	32051
72	Key, 1/4" x 1-1/8" Diameter	1	37032
73	Bearing 1-3/4"	2	32043
74	Decal, General Instruction	1	31108
75	Oil Drain Assembly	1	32016
76	Fuel Value	1	32118
77	Fuel Line	1	32120
79	1/8" Straight Inverted Flare	1	26790
88			
89			32107
	Air - Cleaner *	1	~~32007~~
	Pre - Cleaner (foam) *	1	32108

Model # NHC MS 3898D
3600 RPMS

ONAN ENGINE PARTS LIST

ITEM NO.	DESCRIPTION	QTY. PER UNIT	PART NO.
1	Toggle Switch, Actuator	1	32513
2	Master Switch	1	32533
3	Ingition/Starter Switch	1	32538
4	Safety Percaution Decal	1	31106
5	Hand Grip	2	32081
6	Ammeter	1	32542
7	Gauge Oil Pressure	1	32132
8			
9	Pin Removal Tool	1	31100
10	Wrench	1	31101
11	In-line Fuse Modified	1	31511
12	Fuse — 30 Amp	1	32059
13	Wiring Harness Complete	1	31502
14	Actuator	1	32001
15	7/16 14 Unc. Lock Nut	1	28527
16	Bolt 7/16 — 14 Unc. x 4-1/4" Long	1	28756
17	Clevis Pin 1/4 x 2	1	29345
18			
19	Handle Assembly	1	31060
20	Handle Bracket	1	31132
21	Sheave 2G-5V 4.65 Diameter	1	32068
22	Sheave 2G-5V 9.25 Diameter	1	32072
23	5vx-600 Belts, Matched Set of 2	1	32077
24	Belt Buard Assembly	1	31055
25	Decal, Nameplate	1	26160
	Cutter Head Assembly — Items 26-34	1	31232
26	Key, 3/8 x 1-5/8	1	31071
27	Main Shaft	1	31070
28	Key 3/8 x 4	1	31072
29	Cutter Head	1	31032
30	1/2 — 13 x 1 Set Screw	2	28847
31	Roll Pin 3/8 x 3/4	6	32061
32	Retainer	6	31120
33	3/8 Flat Washer	6	28634
34	3/8 — 16 Bolt 1-9	6	32039
35	Pin	6	31114
36	Cutter 4.75 Diameter (Standard)	6	31134
36A	Cutter 4.75 Diameter, Carbide Tipped	6	31136
37	Spacer	60	32093
38	Cotter Pin, 1/8 x 1	2	29638
39	Wheel and Tire Assembly 16.6 x 4.80/4.00-8 RIB	2	32057

ITEM NO.	DESCRIPTION	QTY. PER UNIT	PART NO.
40	3/4" SAE Hardened Steel Washer	A/R	32093
41	Bushing, SDS x 1-7/16	1	32067
42	Bushing, SK x 1-3/4	1	32071
43	5/16 — 18 Lock Nut	2	28525
44	1/2" SAE Hardened Steel Washer	3	32091
45	Bolt 1/2 — 13 Unc. x 1-3/4 Long	1	28763
46	1/2 — 13 Locking Jam Nut		28516
47	Rubber Bushing, Modified	2	32110
48	Shock Absorber	1	31068
49	Wear Plate	1	31065
50	Rock Deflector	1	31102
51			
52	Battery Bolt	2	32031
53	Deflector, Chain Assembly	1	31104
54	Battery Cushion	1	31045
55	Battery — 12 Volt	1	32547
56	Battery Cable, 38"	1	24015
57	Battery Cable 20"	1	32602
58	Battery Hold Down	1	24005
59			
60	Tank Bracket — Left	1	31095
61	Tank Bracket — Right	1	31096
62	Clevis Assembly	1	31052
63	Frame and Housing Assembly	1	31201
64	Depth Decal	1	31110
65	Tank Strap (Modified)	2	32086
66	Tank Pad	2	31057
67	Gasoline Tank Kit	1	32087
68	Muffler Kit	2	32088
69	Upper Tank Mount	1	31013
70	Engine Mount Assembly	1	31151
71	Engine Onan NHC-MS/3806C	1	32066
72	Key, 3/8 x 1-5/825 Diameter	1	31071
73	Bearing 1-3/4"	2	32043
74	Decal, General Instruction	1	31108
75	Oil Drain Assembly	1	32016
76	Fuel Value	1	32118
77	Fuel Line	1	32120
78	Oil Filter	1	32122
79	1/8" Straight Inverted Flare	1	26790
80	Air Cleaner Assembly	1	32100
81	Breather Cap	1	32101
82	Air Cleaner Element	2	32103

No Fuel Filter

ITEM NO.	DESCRIPTION	QTY. PER UNIT	PART NO.
83	Band	2	32102
84	Air Cleaner Bracker	1	31155
85	Bolt 3/8 — 16 Unc. x 3" Long	2	28737
86	Air Cleaner Spacer, Short	1	31157
87	Air Cleaner Spacer, Long	1	31156
88			
89			
90	Gear Clamp — Size 56	1	26091
91	Rubber Elbow 2"	1	32116
92	Gear Clamp 2"	1	32112
93	Bushing (Rubber)	1	32117
94	Wheel Weight (Optional)	2	31112
95	Throttle Control Lever	1	32004
96	Choke Cable	1	32006
97	Speed Adjusting Stud	1	32033
98	Governor Spring	1	32035
99	Oil Line Flexible — (36" LG)	1	32134
101	Pipe Coupler 1/2"	1	28178

OUT-OF-SERVICE PROTECTION

Protect an engine that will be out-of-service for more than 30 days as follows:

1. Run the engine until it reaches normal operating temperature.
2. Turn off the fuel supply and run the engine until it stops.
3. Drain oil from oil base while the engine is still warm. Refill with fresh crankcase oil and attach a tag stating viscosity used.
4. Remove spark plugs. Pour 1 ounce (2 tablespoons or 28 grams) of rust inhibitor or SAE #50 oil into the cylinders. Crank the engine over a few times. Reinstall spark plugs.
5. Service air cleaner as outlined in MAINTENANCE section.
6. Clean governor linkage and protect by wrapping with a clean cloth.
7. Plug exhaust outlet to prevent entrance of moisture, dirt, bugs, etc.
8. Wipe entire unit. Coat rustable parts with a light film of grease or oil.
9. Provide a suitable cover for the entire unit.
10. If battery equipped, disconnect and follow standard battery storage procedure.

RETURNING UNIT TO SERVICE

1. Remove cover and all protective wrapping. Remove plug from exhaust outlet.
2. Check tag on oil base and verify that oil viscosity is still correct for existing ambient temperatures.
3. Clean and check battery. Measure specific gravity (1.260 at 77°F [25°C]) and verify level to be at split ring. If specific gravity is low, charge until correct value is obtained. If the level is low, add distilled water and charge until specific gravity is correct. DO NOT OVERCHARGE.

4. Check that fuel filter and fuel lines are secure, with no leaks.

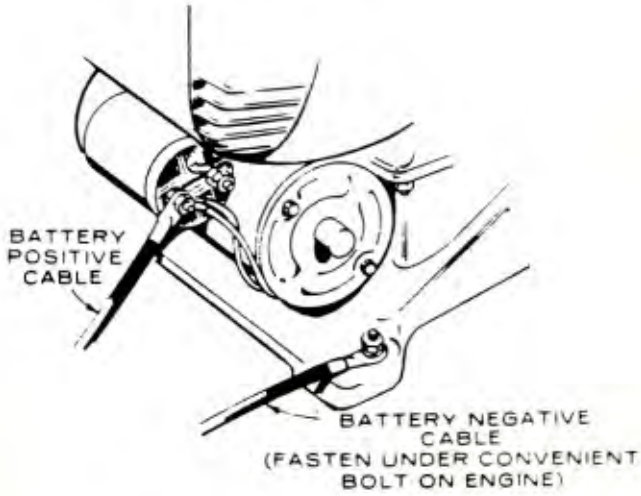
5. Check carburetor, adjust if necessary.

6. Connect battery.

7. Refer to *STARTING* section for starting procedures.

BATTERY CONNECTIONS (Engines with Automotive Type Separate Starter.

Connect the 12 volt battery positive cable to the engine start switch terminal. Connect the battery negative cable to the ground point on the engine oil base (see Figure).



BATTERY CONNECTIONS

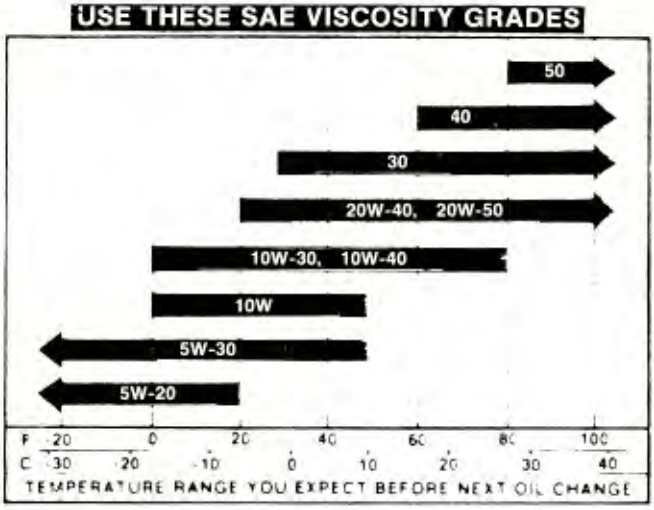
PRE-START INSTRUCTIONS

BEFORE STARTING

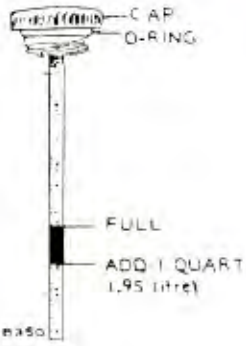
Inspection: Inspect the engine visually before starting. Check for loose or missing parts and any damage which may have occurred in shipment.

Crankcase Oil: Be sure the crankcase has been filled with oil to the "FULL" mark on the oil level indicator. Use oil with the API (American Petroleum Institute) designation SE or SE/CC. Do not mix brands or grades of motor oil. Recommended oil numbers for expected temperatures are listed in the oil chart.

WARNING: Do not remove the dipstick while the engine is running. Oil may blow out the oil fill tube causing injury.



CAUTION: Do not overfill crankcase. Overfilling causes the oil to foam and enter the breather system. Do not use service DS oil or damage to the engine could occur.



OIL LEVEL INDICATOR

Recommended Fuel: Use regular gasoline for the first 25 hours to allow the rings to seat well for best performance. Then use unleaded or regular gasoline thereafter. Use only clean, fresh, unleaded or regular grade gasoline. DO NOT USE HIGHLY LEADED PREMIUM FUELS.

Using unleaded gasoline results in less maintenance. If regular gasoline is used continuously carbon and lead deposits must be periodically removed from the cylinder head to avoid loss of engine power.

If an engine is switched to unleaded gasoline after an extended period of operation with regular gasoline, all carbon and lead deposits must be removed from the cylinder heads. Failure to remove deposits could lead to pre-ignition and result in damage to the engine if operated with unleaded gasoline.

WARNING: Never fill the tank when the engine is running. Overflowing gasoline fumes may ignite causing a fire or explosion. Leave some space in the tank for fuel expansion.

STARTING

STARTING (Electric Start)

1. Turn the ignition switch on, pull the choke lever way out (for a cold engine) and push the start switch.

2. When the engine starts, gradually push the choke lever in until the engine runs smoothly.

3. Black smoke from the exhaust and a rough running engine usually indicates over-choking.

4. To stop the engine, turn the ignition switch to the "Off" position.

If the engine fails to start at first attempt, rust inhibitor oil used at the factory may have fouled the plugs. Remove the plugs, clean in a suitable solvent, dry thoroughly and reinstall. Heavy exhaust smoke when the engine is initially started is normal and usually caused by rust inhibitor oil.

STARTING (Manual Start)

1. Hold choke about three quarters way closed or as necessary according to temperature conditions.

2. Pull start rope with a fast steady pull to crank engine. Do not jerk.

3. Open choke as engine warms up.

STOPPING THE ENGINE

Disconnect all load before stopping the engine. Engines equipped with battery ignition are stopped by positioning the ignition switch to the OFF position.

OPERATION

BREAK-IN PROCEDURE

Controlled break-in is the ideal fitting of all internal moving metal parts. Using the proper oil and applying a conscientious maintenance program during this period helps assure satisfactory service from your Onan engine.

Maintain the proper cooling and lubrication during break-in. Run the engine at half load for the first three hours with intermittent periods of full load to control engine break-in.

CAUTION:

Using the wrong grade and weight of oil and high engine operating temperature during break-in can cause engine damage.

Check the oil level at least every five operating hours. Add oil to keep it at the proper level, but never overfill, as overfilling may cause the oil to foam and enter the breather system.

HOT WEATHER OPERATION

When operating the engine in temperatures above 75°F (24°C), pay particular attention to the following items to prevent damage:

1. Keep the engine cooling fins clean and free of obstruction.

CAUTION: Plugged or clogged cooling fins can cause overheating and engine damage.

2. See that nothing obstructs air flow to and from the engine.

3. Ensure that you are using the proper grade and weight of oil for ambient temperatures. Check the oil level each time you fill the fuel tank.

4. Check the battery water more frequently than every 50 hours which is recommended under normal conditions. High temperatures cause faster evaporation.

COLD WEATHER OPERATION

When the engine is being used in temperatures below 32°F (-0°C), check the following items closely:

1. Use the correct grade and weight of oil for the temperature conditions. Change the oil only when the engine is warm. If an unexpected temperature drop occurs when the engine is filled with summer oil, before starting the engine, move it to a warm location until the oil will flow freely.

2. Use fresh fuel. Fill the fuel tank after each day's use to protect against moisture condensation.

3. Keep the battery in a well-charged condition.

DUST AND DIRT

1. Keep unit clean. Keep cooling system clean.

2. Service air cleaner as frequently as required.

3. Change crankcase oil and filter more often than recommended under normal conditions.

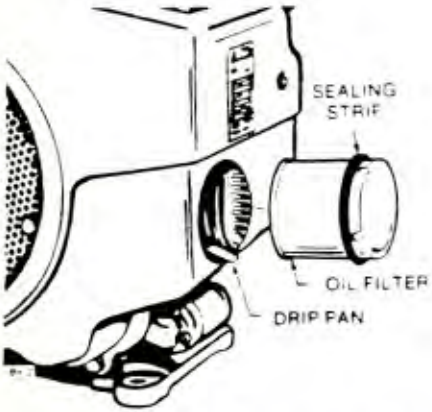
MAINTENANCE

CRANKCASE OIL

Oil Level: Check oil level at least every 8 hours of operation. Check more frequently on a new or reconditioned engine as oil consumption is higher until the piston rings seat properly.

Oil Change: Change crankcase oil after the first 25 hours of operation, change every 50 hours after that. If operating in extremely dusty conditions, change oil more frequently.

Oil Filter: Change the oil filter every 100 hours. Remove the filter (see Figure) by turning counterclockwise using a filter wrench. Add the strip provided with the filter to prevent air loss in the area indicated. It is advisable to wipe dry the drip pan located below the filter. Coat rubber gasket on filter with a film of oil before installing. Install the filter finger-tight plus ¼ to ½ turn. If oil becomes so dirty that the markings on the oil level indicator cannot be seen change the filter and shorten the filter service period.



BATTERY

Check charge condition. Check electrolyte level. Add distilled water to keep electrolyte at its proper level. In freezing weather, run engine immediately after adding water. Keep battery connections tight and clean.

Onan recommends that all major service be performed by qualified service personnel. An engine service manual and complete parts catalog is available at additional cost. Contact your nearest authorized dealer or Onan Parts and Service Center.

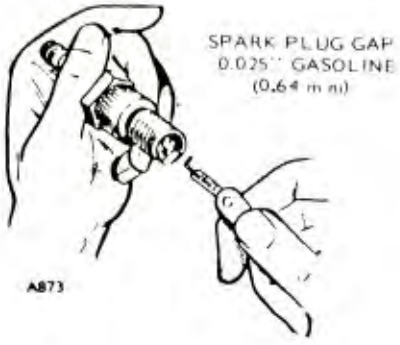
COOLING SYSTEM

Check and clean cooling fins at least every 50 hours. Remove any dust, dirt or oil which may have accumulated.

CAUTION: Plugged or clogged cooling fins can cause overheating and engine damage.

SPARK PLUGS

Check, clean and reset spark plugs every 200 operating hours. Replace spark plugs that show signs of fouling or electrode erosion.

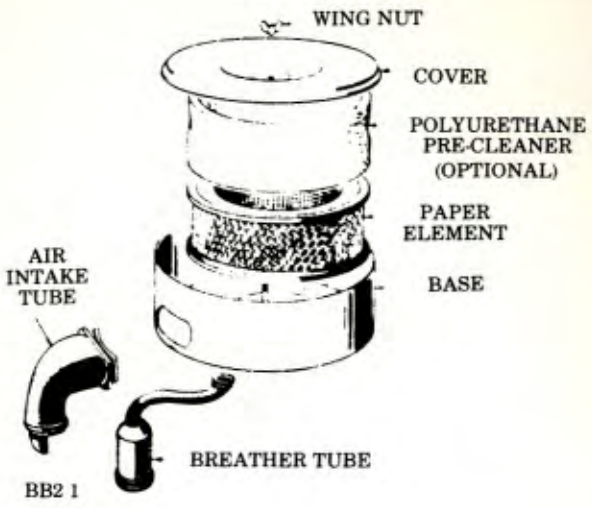


AIR CLEANER

Cartridge Air Cleaner: Check and clean air cleaner element every 25 hours. Clean by gently tapping element on a flat surface. Replace the element every 200 hours. Clean or replace more frequently in dust operating conditions.

Air Cleaner Wrapper (Pre-Cleaner [If used]): Wash in water and detergent and squeeze dry like a sponge. Allow to dry, then coat evenly with three tablespoons (42.5 grams) of SAE 30 engine oil. Knead into and wring excess oil from pre-cleaner. Reinstall over cartridge.

Failure to adequately wring out excess oil from the wrapper may cause a drop in engine horsepower due to an increased restriction of inlet air.

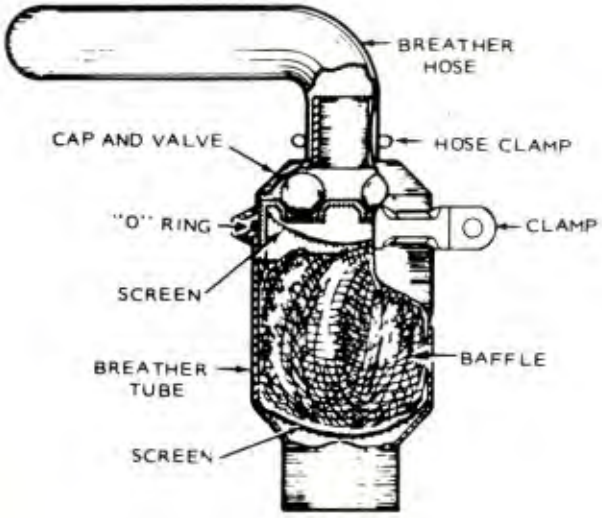


1. WASH
2. SQUEEZE DRY
3. COAT WITH OIL
4. INSTALL OVER PAPER ELEMENT

CAUTION: Do not run engine with air cleaner removed. Intake of dirty air or solid materials could cause severe damage to engine parts.

CRANKCASE BREATHER

This engine uses a crankcase breather valve for maintaining crankcase vacuum. No maintenance is generally required. If the crankcase becomes pressurized as evidenced by oil leaks at the seals, clean baffle and valve in a suitable solvent.



EXHAUST SYSTEM

Make regular inspections of the exhaust system throughout the entire life of the engine. Locate leaks in muffler and piping while the engine is operating. Repair all leaks immediately after they are detected for personnel safety.

WARNING: Leaky exhaust systems emit noxious carbon monoxide fumes which are a potential safety hazard in enclosed areas.

ADJUSTMENTS

CARBURETOR

The carburetor idle and main mixture screws were set for maximum efficiency at the factory and should normally not be disturbed. If adjustments seem necessary, first be sure the ignition system is working properly and is not the source of the problem.

If adjustment is needed, proceed as follows:

1. Turn both the main fuel and idle fuel mixture screws in until lightly seated, then back them out 1⅛ to 1⅜ turns.

CAUTION: Forcing the mixture adjustment screws tight will damage the needle and seat. Turn in only until light tension can be felt.

2. Start the engine and allow it to warm up thoroughly (at least 10 minutes).

3. Move the engine speed control to the slow position.

4. Determine if the engine has a GOVERNOR low speed adjustment screw (see illustration).

5. Pull the governor back (see illustration) so the THROTTLE stop screw is against its stop. Continue to hold the governor arm in this position while completing the adjustments described in steps 6 through 8.

6. If the governor DOES NOT have a low speed adjustment screw, adjust the THROTTLE stop screw to obtain 1200 RPM. If the governor DOES have a low speed adjustment screw, adjust the THROTTLE stop screw to obtain 1100 RPM.

7. Turn the IDLE adjustment screw IN until engine speed drops and then OUT until engine speed drops again. Over a narrow range between these two settings, engine speed will be at its maximum. Set the idle adjustment screw about ⅛ turn outward from the midpoint of this range.

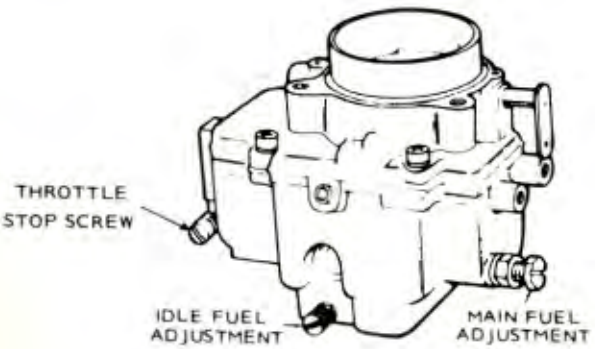
8. Re-adjust the THROTTLE stop screw to obtain the RPM specified in step #6 and release the governor arm.

9. Engines WITHOUT a governor low speed adjustment screw require no further low speed adjustments. Engines WITH a governor low speed adjustment screw require the following low speed adjustment:

   a. Check to see that the governor linkage moves freely and is not binding

   b. Adjust the GOVERNOR low speed adjustment screw to obtain 1200 RPM

10. Check the main mixture adjustment by rapidly accelerating the engine from idle to full speed. The engine should accelerate evenly and without hesitation. If it does not, turn the main adjustment screw out in ⅛ turn increments until the engine accelerates smoothly, but do not turn it out more than ½ turn beyond the original setting.



BREAKER POINTS (Cold Setting)
IGNITION TIMING

To maintain maximum engine efficiency, change the breaker points every 200 hours of operation. Proceed as follows:

1. Remove spark plugs and rotate flywheel TC mark clockwise to 20°BTC (points open).

2. Remove breaker box cover.

3. Remove two Allen screws (C) and lift breaker assembly from engine.

4. Replace condenser and point assembly with new parts and reinstall using above procedure in reverse order of removal.

5. Connect an ohmmeter or a continuity test lamp set across the ignition breaker points. Touch one test probe to the breaker box terminal to which the coil lead is connected and touch the other test probe to a good ground on the engine.

6. Turn crankshaft against rotation (counterclockwise) until the points close. Then slowly turn the crankshaft with rotation (clockwise).

7. The lamp should go out just as the points break which is the time at which ignition occurs (20°BTC). If timing is early (large point gap) or late (small point gap), adjust point gap using Allen screw (D) so that lamp goes out at 20°BTC with crankshaft rotation clockwise.

8. An alternate method may be used for setting breaker point gap/ignition timing if a continuity lamp or ohmmeter is not available or timing marks cannot be seen. Rotate crankshaft clockwise (facing flywheel) by hand until the points are fully open. Set the point gap (using flat feeler gauge) at .016 inch (0.41 mm) by adjusting the Allen screw (D) inward or outward.

NOTE: Make sure feeler gauge is clean and free of any grease, oil, or dirt.

The timing is adjusted during initial engine assembly at the factory and is fixed by the point gap adjustment. A .016 point gap is equivalent to 20°BTC.

9. Replace breaker box cover, coil wire, spark plugs, and spark plug cables.

PERIODIC MAINTENANCE SCHEDULE

SERVICE THESE ITEMS	AFTER EACH CYCLE OF INDICATED HOURS				
	8	25	50	100	200
Inspect Engine Generally	x1				
Check Oil Level	x				
Service Air Cleaner		x2			
Change Crankcase Oil			x2		
Check Battery Electrolyte Level			x		
Clean Cooling Fins			x		
Replace Oil Filter (if used)				x2	
Replace Spark Plugs					x
Check Breaker Points				x	
Clean Breather Valve					x2
Replace Air Cleaner Element					x2
Check Valve Clearance			x3		x4
Compression Check					x

x1 – Check for fuel leaks, exhaust leaks, etc.

x2 – Perform more often in extremely dusty conditions.

x3 – Initial break-in check only.

x4 – For detailed maintenance, contact an Onan Service Center.

ROUTER POWERED BY ONAN

SPECIFICATIONS

ENGINE:	2 Cylinder opposed, 23 HP
WEIGHT:	425 #
FUEL:	Regular Gasoline
FUEL TANK CAPACITY:	3-3/4 Gallons
MAXIMUM DEPTH OF CUT:	1-5/8"
DEPTH:	Depth gauge for precise depth control.
SAFETY FEATURES:	Braking system and safety guards for increased safety.
DEPTH CONTROL:	Electric actuator for fingertip depth control.
CUTTER DESIGN:	6 radially located sprocket shaped cutters on 12" diameter cutter head.
CUTTERS:	Hardened alloy steel for long cutter life.
CRACK CLEANING RATE:	Up to 1500 L.F. per hour.

OPERATION GUIDE

WISCONSIN ENGINE
Model
W2-1230

INTRODUCTION

The Model W2-1230 is a two cylinder, four cycle, Vee type, air cooled gasoline engine of the most advanced design, and is readily and efficiently adaptable to a great variety of customer requirements. This typical **Wisconsin** heavy-duty engine has full pressure lubrication with a full-flow oil filter, and is capable of operating at a 30° angle in any direction.

COOLING is accomplished by a flow of air circulated around the cylinders and heads of the engine from a combination fan-flywheel encased in a metal shroud. The air is divided and directed by ducts and baffle plates to insure uniform cooling of all parts.

IMPORTANT:

Never operate an engine with any part of the shrouding removed - this will retard air cooling.

Keep the air intake screen, and the cylinder and hand fins free from dirt and chaff. Improper circulation of cooling air will cause engine to overheat.

BATTERY IGNITION (12 volt) distributor with automatic advance is furnished as standard equipment, and can be supported by an efficient **30 amp Flywheel Alternator** and unified Rectifier-Regulator module, or a lower output 10 amp Flywheel Alternator.

ROTATION of the crankshaft is clockwise when viewing the flywheel or starting end of the engine. This gives counterclockwise rotation when viewing the power take-off end of the crankshaft. With a **Take-off Shaft** optionally available at flywheel end, full engine power can be taken from either end of crankshaft.

SPECIFICATIONS

Bore	3.75 inch
Stroke	3.40 inch
Piston Displacement - cu. in.	75.0
Cu. cm.	1230.0

Horsepower

1600 R.P.M.	15.0
1800 R.P.M.	17.5
2000 R.P.M.	19.5
2200 R.P.M.	21.0
2400 R.P.M.	22.0
2600 R.P.M.	23.0
2800 R.P.M.	23.6
3000 R.P.M.	24.0
3200 R.P.M.	24.5
3400 R.P.M.	24.8
3600 R.P.M.	25.0

Engine rated performance is documented to Engine Test Code — SAE J-245. Continuous duty operation is recommended at 85% of horsepower shown.

The friction in new engines cannot be reduced to the ultimate minimum during the regular block test, but engines are guaranteed to develop at least 85% of maximum power when shipped from the factory. Power will increase, as friction is reduced, after a few days of operation. The engine will develop at least 95% of power when friction is reduced to a minimum.

BATTERY IGNITION (12 volt) .. Distributor with automatic advance

BEARINGS, crankshaft main ..... Sleeve Type
1000 lb. thrust capacity - 1000 lb. belt load

COMPRESSION RATIO 6.81

CONNECTING ROD Forged Steel Automotive Shell Bearings

CRANKSHAFT ..... Ductile Iron

CYLINDER DESIGN ..... L-head

GEAR TRAIN ..... Helical Gears

ROTATION ..... Counterclockwise at T.O. end

STARTING MOTOR ..... with Folo-Thru Bendix

TORQUE, maximum ..... 51 ft. lbs. at 2000 r.p.m.

VALVE GUIDES ..... Replaceable

VALVES and SEAT INSERTS ..... Hardened exhaust
Exhaust Valve Rotators - Replaceable Inserts

SAFETY PRECAUTIONS

Careless use of the engine causes a high percentage of accidents. Avoid serious injury by being alert, use common sense and be safety minded. Observe the following precautions and carefully enforce them when operating your ***Wisconsin Engine.*** Read operating instructions thoroughly — Know how to stop the engine in case of emergency.

(•) This symbol indicates important safety messages throughout this operators guide — ***Read Them Carefully.***

- Engine should be operated only by qualified persons.
- Do not operate engine in a closed building unless the exhaust is piped outside. This exhaust contains carbon monoxide, a poisonous, odorless and invisible gas, which if breathed can cause serious illness and possible death.
- Keep exhaust connection tight and components in good condition, noise from a faulty exhaust system can also be harmful.
- Exhaust system parts get very hot — avoid touching these parts until engine has stopped and has sufficiently cooled.
- Never refuel a hot or running engine. DO NOT smoke while filling fuel tank or servicing fuel system.
- Always refuel slowly to avoid spillage.
- Make sure all fuel lines and connections are tight and in good condition.

- Handle batteries carefully, battery acid will burn skin and can cause blindness if it contacts the eyes.
- Avoid sparks near battery. Gas given off by battery is explosive.
- Keep engine and surrounding area clean and clear of trash.
- When starting engine, maintain a safe distance from moving parts of equipment. Be sure all rotating parts are secure and in good condition.
- Do not start engine with clutch engaged.
- Never run engine with governor linkage disconnected, or operate at speeds in excess of 3600 R.P.M. load.
- Never make adjustments on machinery while it is connected to the engine, without first disconnecting the ignition cables from the spark plugs. Turning the machinery over by hand during adjusting or cleaning might start the engine and machinery with it, causing serious injury to the operator.
- Never run engine while safety switches are disconnected, or protective screening is removed from unit.
- Do not leave engine running while lubricating, making adjustments or repairs unless specifically recommended.
- Never leave engine unattended while it is running.
- Keep hands, feet and clothing away from all moving parts.
- Mount a fire extinguisher close to the engine. Maintain extinguisher properly and be familiar with its use.
- Precaution is the best insurance against accidents.

Model W2-1230

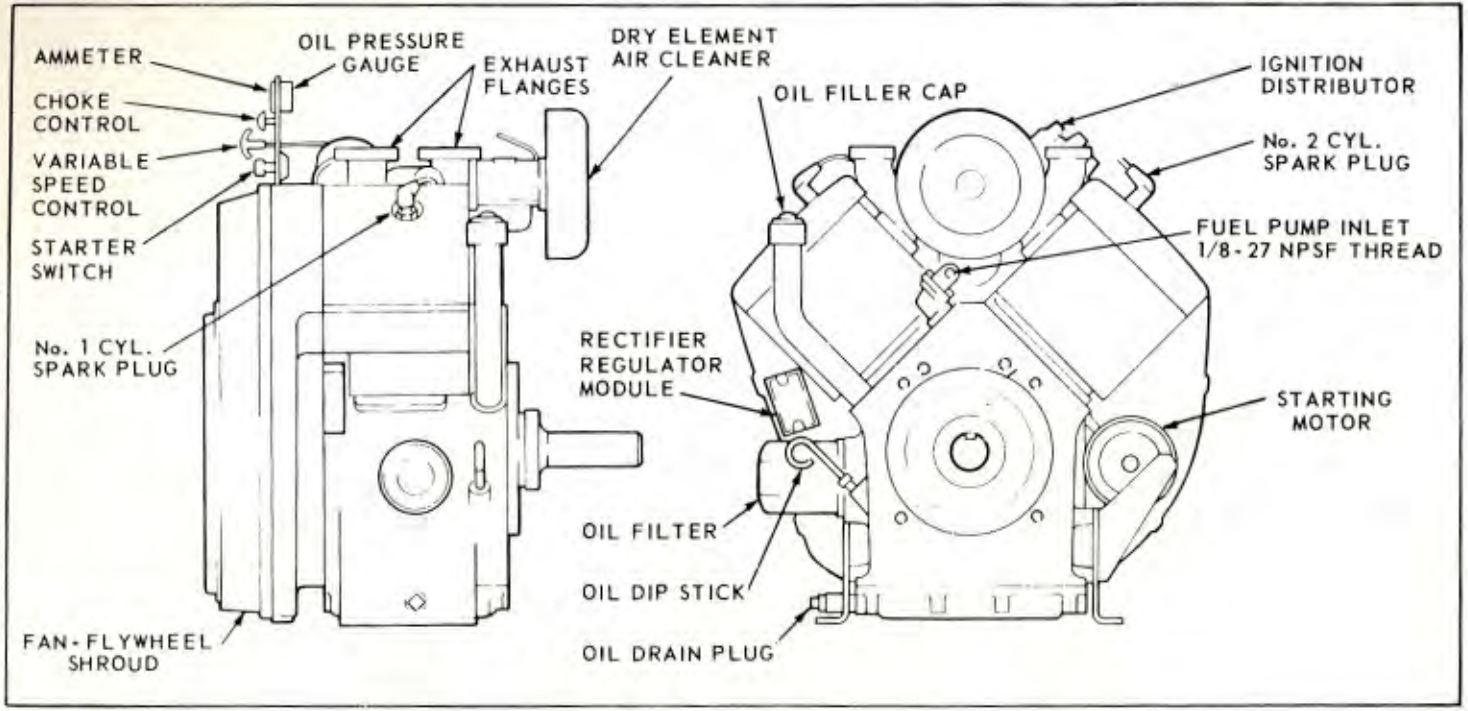


FIGURE 1, REFERENCE VIEWS

STARTING and OPERATING INSTRUCTIONS

Model W2-1230

IMPORTANT:

Engine is shipped without oil. Fill crankcase to proper level, and add oil to Clutch or Reduction gear units and Oil Bath Air Cleaner if furnished. Refer to Lubrication paragraphs, Oil Chart, and Air Cleaner Maintenance.

NEW ENGINE BREAK-IN

Proper Break-in will lead to trouble-free operation and increased engine life. The factory test given to a new engine is not sufficient to establish the polished bearing surfaces which are so necessary for good performance and long engine life. There is no quickway to force the establishment of good bearing surfaces, and these can only be obtained by running a new engine carefully and under reduced speeds and loads for a short period of time as follows:

½ hour	1000-1200 rpm	No load
1 hour	50% rated rpm	25% load
1 hour	75% rated rpm	50% load
1 hour	100% rated rpm	75% load
5 minutes	Low idle	No load

For **break-in** of new engines, use same oil as recommended in oil chart.

BEFORE STARTING ENGINE

1. **FUEL**

Fill fuel tank with a reputable well known brand of **Regular Grade** gasoline. **Leaded** gasoline is preferred with an *Anti-knock Index of **87 minimum.** Unleaded regular gasoline may be used, although shorter valve life may be experienced.

Note: *minimum Motor octane number must be 82.

CAUTION: Refuel slowly to avoid spillage. DO NOT smoke when filling tank.

Be sure that vent hole in fuel tank cap is clean and free of any obstruction.

2. **LUBRICATION**

Fill crankcase base with the proper grade of engine oil as specified in **"Grade Of Oil"** chart. Fill through the oil filter tube opening to the level indicated by the **Full Mark** on **Dipstick.** Approximately 3½ quarts are required in a new engine — 4 quarts with oil and filter change.

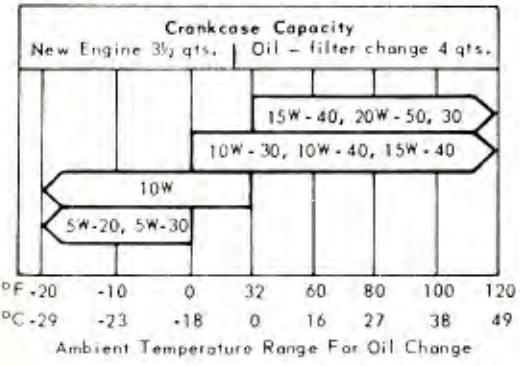
IMPORTANT

DO NOT overfill crankcase. DO NOT allow oil level to go below **Add** mark on dip stick.

Check oil level every 8 hours. One quart of oil is required to raise the oil level from **Add** to **Full** mark on dip stick.

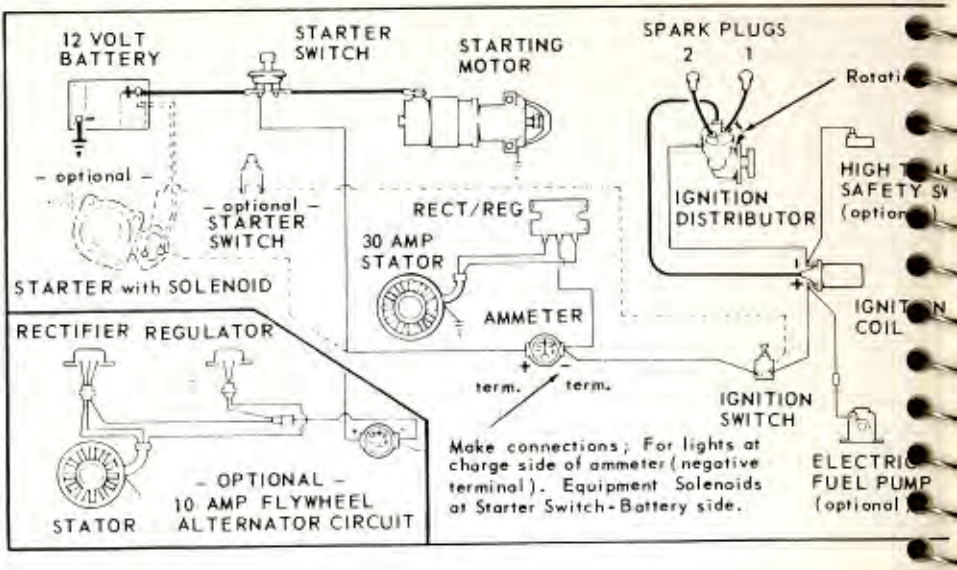
Change oil every **100 hours** under normal operating conditions. In extreme dusty and extensive idling conditions, change oil at 50 hour intervals.

RECOMMENDED SAE VISCOSITY GRADES
Use Oil Designation as Service SE or SF



If engine is used at near maximum performance, it is recommended that a single-viscosity oil of SE Quality be used either grade SAE 30 or SAE 10W.

Proven synthetic oils give superior service in air cooled gasoline engines and can be used, but the recommended oil change interval remains at 100 hours.



ELECTRICAL SYSTEM

12 Volt Battery Ignition Distributor, Coil and heavy duty Starting Motor are standard equipment. Options include: 10 amp or 30 amp Flywheel Alternator, Instrument Panel, Solenoid Starting, High-Temperature Safety Switch and electric Fuel Pump.

Battery is not furnished by Teledyne Wisconsin Motor.

ALTERNATOR

The 12 volt - 30 amp Flywheel Alternator system consists of a Magnetic Rotor, Starter and Rectifier-Regulator module. No adjustments are required. The alternator is wired into the electrical circuit as illustrated in Fig. 4.

IMPORTANT

This is a **Negative Ground** system. Charging components will be damaged if grounded wrong in connecting or jumping batteries.

CAUTION: Handle battery carefully to prevent acid burns. Avoid sparks near battery — gas given off by battery is explosive.

PRECAUTIONS to be exercised in the use of Alternators:

1. DO NOT reverse battery connections. Negative battery terminal must be grounded. Reverse polarity will damage rectifier-regulator.

2. Connect booster batteries — positive to positive and negative to negative.

3. DO NOT ground any wires from stator or module which terminate at connectors.

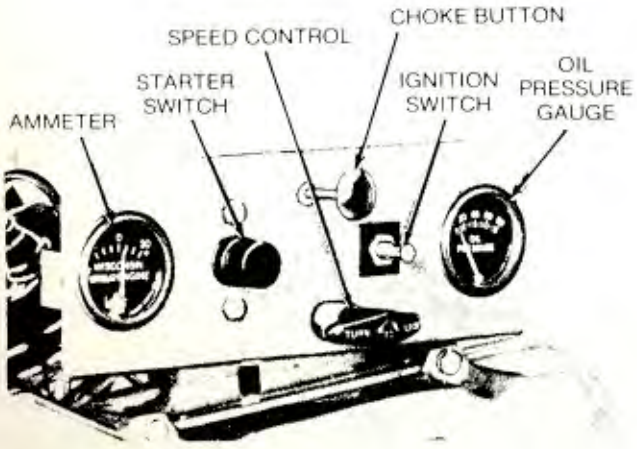
4. DO NOT operate engine with battery disconnected from system.

5. Disconnect at least one battery lead if a battery charger is used.

STARTING

CAUTION: Maintain a safe distance from moving parts of equipment. Know how to stop the engine quickly in case of emergency.

CAUTION: DO NOT operate engine in a closed building unless it is properly ventilated.



STARTING PROCEDURE, Fig. 5

1. Check crankcase oil level and gasoline supply. Open fuel shut-off valve in fuel strainer or tank.

2. Disengage clutch, if furnished.

3. Pull variable speed control "T" handle out about half-way and lock in place. With a two speed (idle control) start in full load position — idle after engine starts.

4. Close choke by pulling choke button to extreme out position.

5. Pull out ignition switch.

6. Depress starter switch to start engine.

IMPORTANT:

DO NOT crank engine for more than 30 seconds at a time. If engine fails to start, wait about 2 minutes between cranking periods to prevent starter from over-heating.

7. After engine starts, push choke button in as required for smooth running.

   Less choking is necessary in warm weather or when engine is warm, than when cold. Should flooding occur, open choke fully and continue cranking.

WARM-UP

After engine starts, allow it to warm up a few minutes before applying load **DO NOT race or gun engine** to hurry WARM-UP. The proper oil film on various surfaces of the pistons, cylinders, bearings, etc., cannot be established until the oil has warmed up and becomes sufficiently fluid.

TO STOP ENGINE

Depress ignition switch button, tag reads **"To Stop Push In."**

If engine has been running hard and is hot, do not stop it abruptly from full load. Cool the engine by removing the load and allowing the engine to run idle (1000 to 1200 R.P.M.), for 3 to 5 minutes.

OIL PRESSURE

Oil pressure is controlled by a non-adjustable relief valve mounted in the crankcase below the oil pump. With engine oil hot, gauge pressure will be from 30 to 50 P.S.I. at engine speeds of 1600 to 3600 r.p.m. If pressure fails below 15 P.S.I., refer to **"Trouble Shooting"** for possible causes.

MAINTENANCE

AIR CLEANERS

The air cleaner is an essential accessory, filtering the air entering the carburetor and preventing abrasive dirt from entering the engine and wearing out valves and piston rings in a very short time.

The air cleaner must be serviced frequently, depending on the dust conditions in which the engine is operated. Check connections for leaks or breaks and replace all broken or damaged hose clamps on remote or side mounted air cleaners.

Excessive smoke or loss of power are good indications that the air cleaner requires attention.

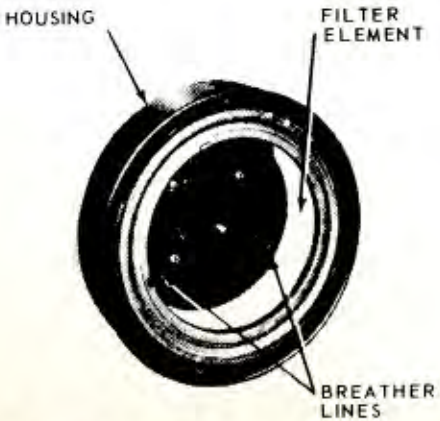


FIGURE 6 - DRY ELEMENT AIR CLEANER

The dry element air cleaner mounted directly to the carburetor is standard equipment on this model engine. DO NOT oil element, and DO NOT use gasoline or kerosene for cleaning.

Service Daily; or twice a day if engine is operating in very dusty conditions. Remove element and shake out the accumulated dust and dirt. Wipe out dirt from inside cover and from housing.

Once Each Week; The filtering cartridge should be taken out and rinsed under a faucet with cold water, then wash by repeated dippings for several minutes in a solution of lukewarm water and a mild, **Non-sudsing** detergent. Rinse in cold water from the inside out, and allow to dry overnight before installing in air cleaner. In cold weather, protect element from freezing until dry.

After five washings or one year of service, which ever comes first, replace the cartridge element. New filter elements are available from all Teledyne Wisconsin Motor Distributors and Service Centers.

HEAVY DUTY AIR CLEANERS, Fig. 7

Dry Element or Oil Bath heavy duty type air cleaners are optionally used, and are mounted either to the side of the engine or to the equipment structure.

DRY TYPE HEAVY DUTY AIR CLEANER

Service Daily; squeeze rubber dust unloader once or twice a day to check for possible obstruction. If engine is operating in very dusty conditions, remove cartridge and shake out the accumulated dust and dirt.

Wipe out dirt from inside housing and bowl, after removing baffle and dumping out dust.

Once Each Week; The filtering cartridge should be taken out and rinsed under a faucet with cold water, then wash by repeated dippings for several minutes in a solution of lukewarm water and a mild, **Non-sudsing** detergent. Rinse in cold water from the inside out, and allow to dry overnight before re-installing. In cold weather, protect element from freezing until dry.

DO NOT use Gasoline, Kerosene or Solvent for cleaning — DO NOT oil Element.

After ten washings or one year of service, which ever comes first, replace cartridge element — available from your nearest Teledyne Wisconsin Motor Distributor or Service Center.

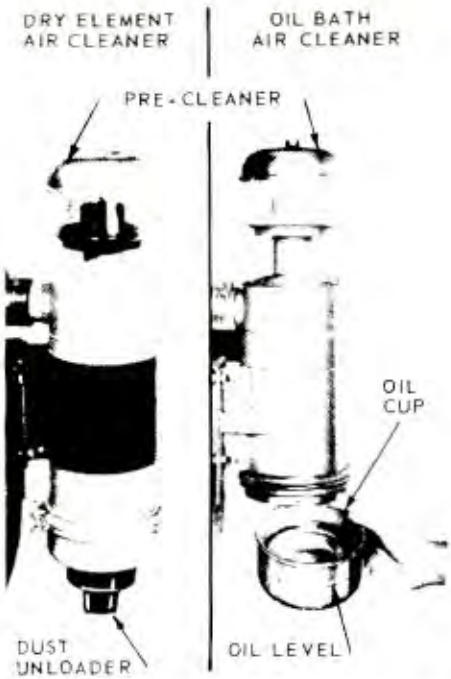


FIGURE 7 - HEAVY DUTY AIR CLEANERS

OIL BATH HEAVY DUTY AIR CLEANER

Service Daily; or twice a day if engine is operating in very dusty conditions. **Once each week;** in comparatively clean conditions.

Remove oil cup from bottom of air cleaner and clean thoroughly. Add the same grade of oil, as used in the engine crankcase, to the **Level Line** indicated on the oil cup.

IMPORTANT:

Operating the engine under dusty conditions without oil in the air cleaner or with dirty oil, may wear out cylinders, pistons, rings and bearings in just a few days time.

Once a Year; or oftener if conditions are severe, the air cleaner should be removed from the engine and the element, which is not removable, should be washed in a solvent to clean out accumulated dust and dirt.

PRE-CLEANER

The optionally furnished collector type precleaner, mounted to the top of the air cleaner as illustrated in Fig. 7, removes the larger dirt and dust particles before the air reaches the main air cleaner.

Clean bowl regularly of accumulated dust and dirt. **DO NOT put oil or water in pre-cleaner, this must be kept dry.**

CRANKCASE BREATHER, Fig. 8

The crankcase is ventilated by means of a closed breather system, controlled by **Reed type breather valves.** The breather valve is an integral part of each of the two valve chamber inspection covers.

Oil and fuel vapors **(blow-by)** in the crankcase are released through the breather valves to the air cleaner, carburetor and intake manifold, where it is mixed with fresh fuel vapor and burned in the combustion chamber.

IMPORTANT:

It is necessary that the breather valves be kept clean and operable, and the breather lines free of obstruction.

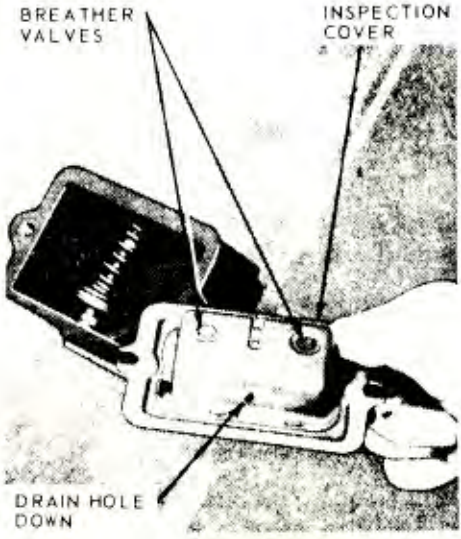


FIGURE 8 - CRANKCASE BREATHER

The operation of the breather valves is also important in maintaining a partial vacuum in the crankcase to prevent oil leaks at seal and gasket surfaces.

Every 100 Hours; Inspect breather lines.

Every 250 Hours; Remove inspection covers and clean breather valves with a solvent.

CAUTION: Do not use gasoline, naptha, or benzine. They are highly flammable.

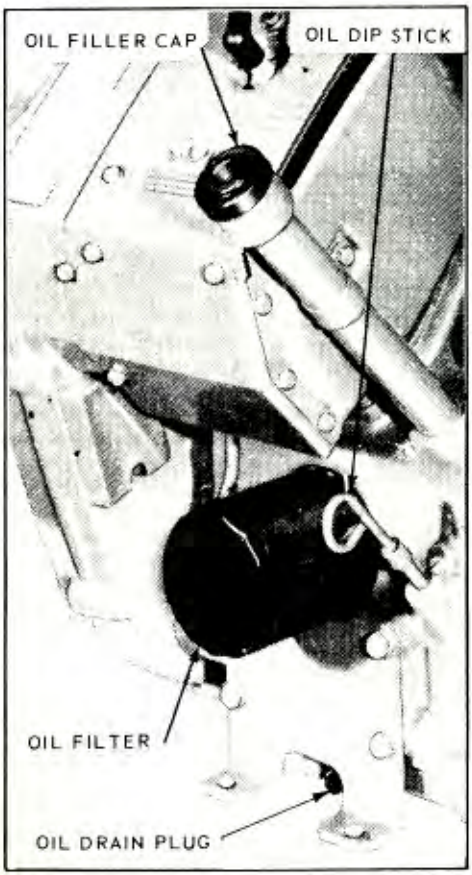


FIGURE 9 - LUBRICATION

CRANKCASE OIL, Fig. 9

Check Oil Level Every 8 Hours. One quart of oil is required to raise the oil level from **Add** to **Full** mark on dipstick.

Change Oil Every 100 Hours under normal operating conditions. In extreme dusty and extensive idling conditions, change oil at 50 hour intervals. Remove drain plug and allow oil to drain into a suitable container. Drain oil while engine is hot — it will flow more freely.

CAUTION: Wear gloves when removing drain plug from a hot engine.

Crankcase capacity	3-1/2	Quarts
With Oil Filter Change	4	Quarts

IMPORTANT:

DO NOT overfill crankcase. **DO NOT** allow oil level to go below **Add** mark on dipstick.

Refer to **Recommended Grades of Oil** chart, page 1, for classification and grade of oil to be used.

OIL FILTER Fig. 9

Under ordinary conditions all of the engine oil is circulated through a **full-flow Micro-Fine** oil filter. But, when the filter element becomes extremely dirty, the oil by-passes the filter material through a relief valve within the oil filter. As a result, there is no variation in oil pressure to indicate that the oil filter is clogged and requires replacement. Because clean oil is so essential for the friction free operation of all bearing surfaces, it is very important that the oil filter be changed at the recommended interval.

Every 100 hours of operation, or at every oil change, replace oil filter.

For replacement, use only a Wisconsin **Micro-Fine** oil filter, specifically designed for this model engine.

When reassembling new filter, add a film of oil to the face of the base gasket. Turn filter to a snug fit, then ½ turn more — **DO NOT over-tighten.**

FUEL FILTER, Fig. 10

It is very important that the fuel be filtered to prevent sediment, dirt and water from entering the carburetor and causing trouble

or even complete stoppage of the engine. A glass bowl fuel filter should be connected into the fuel system between the tank and fuel pump, see Fig. 10.

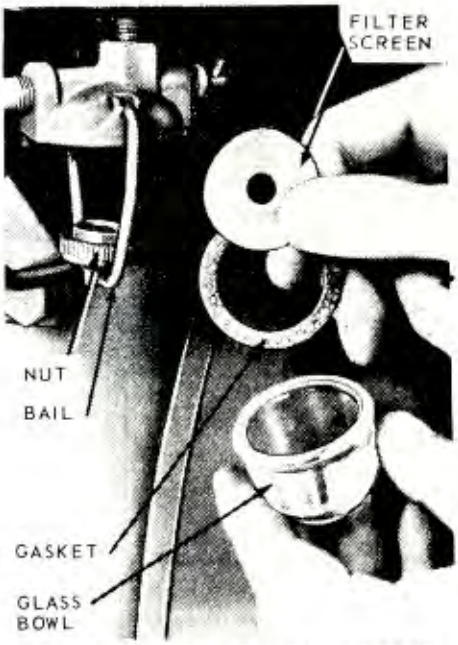


FIGURE 10 - FUEL FILTER

Inspect glass filter bowl daily, and clean if dirt or water are visible. To remove sediment bowl, loosen nut below glass bowl and swing bail to one side. Twist bowl as it is being removed to prevent gasket from sticking to bowl and breaking. Clean screen and bowl thoroughly — replace gasket if it is damaged or hardened.

IGNITION DISTRIBUTOR, Fig. 13

Check for faulty and loose fitting wires, and for cracks in distributor cover.

Every 250 Hours; apply 1 or 2 drops of light engine oil (10W), to the felt in the top of the cam sleeve, and 1 drop to breaker arm pivot.

Every 250 Hours; add a small amount of high melting point grease to the breaker arm rubbing block.

Avoid Excessive Lubrication. Oil on the contact points will cause them to burn.

SPARK PLUGS, Fig. 11

Incorrect gap, fouled or worn spark plug electrodes, will have an adverse affect on engine operation.

Every 250 Hours; remove spark plugs — clean, regap or replace if necessary.

Spark plug gap - 0.030 inch

Replacement plugs must be of the correct heat range, like Champion No. D-16J, AC No. C86 Commercial (Wisconsin YD-6). Thread size is 18 mm. In reassembly tighten spark plugs, **28 to 34 foot pounds torque (dry).**

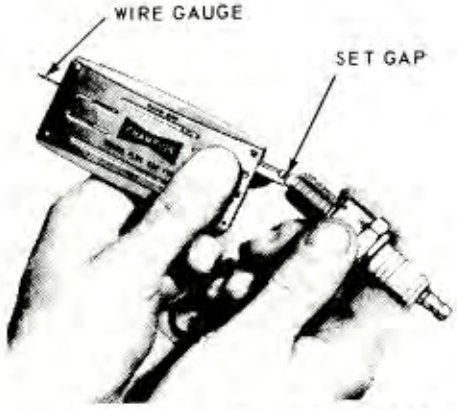
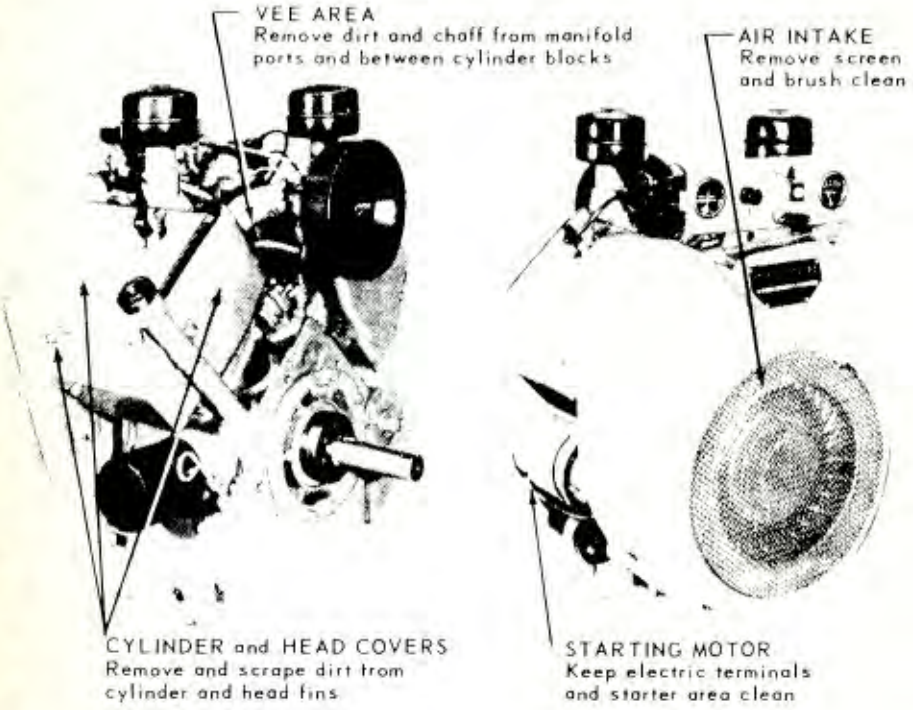


FIGURE 11 - SPARK PLUG

STARTING MOTOR, Fig. 12

No maintenance is required other than keeping the outside of the starting motor clean, and periodic inspection for insecure mounting and loose or corroded cable connections.

In extreme dust and dirt conditions it may be necessary to occasionally remove the starter from the engine and clean the Bendix by brushing with Kerosene. **DO NOT oil Bendix drive** — if necessary lubricate with powdered graphite.



KEEP ENGINE CLEAN, Fig. 12

This engine is cooled by blasts of air which must be allowed to circulate all around the cylinders and cylinder heads to properly cool the engine and thereby keep it in good running condition. If dust, dirt or chaff is allowed to collect in the cylinder shrouding or in the V between the cylinders, it will retard the flow of air and cause the engine to overheat. Keep flywheel screen clean, so as not to restrict the intake of cooling air.

IMPORTANT:

DO NOT operate engine with damaged or badly dented shrouding.

DO NOT operate engine with any part of the shrouding removed.

DO NOT allow warm air to recirculate back through the cooling system.

ADJUSTMENTS

CARBURETOR, Fig. 16

The carburetor **Main Metering Jet** is of the fixed type and therefore no adjustment is necessary.

The correct amount of throttle plate opening for the proper low idle speed is obtained by means of the **Throttle Stop Screw.** However, this is set at the factory so that no immediate adjustment is necessary. The **Idle Adjustment** is for smooth low speed operation and this adjustment, if necessary, must be made with the engine running at idle speed (throttle valve closed). Initial setting is approximate **1 turn open.**

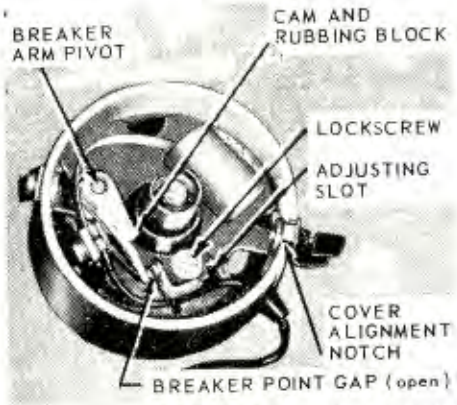


FIGURE 13 - DISTRIBUTOR BREAKER POINTS

DISTRIBUTOR BREAKER POINTS, Fig. 13

The breaker point gap should be:

.020 inch at full separation

To readjust point gap, turn engine over slowly until the distributor breaker arm **Rubbing Block** is on a high point of the **Cam.** Loosen the stationary contact **Lockscrew** slightly and place a feeler gauge between the points. Insert the end of a screwdriver into the **Adjusting Slot** on the breaker plate. Open or close the points by moving the point bracket until a slight drag is felt when sliding the feeler gauge from between the points. Tighten lockscrew and recheck point gap.

Points that are badly pitted or worn should be replaced and properly adjusted.

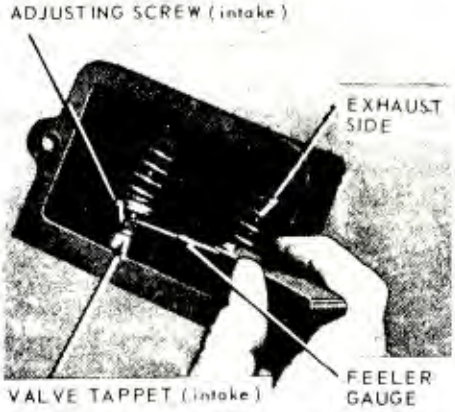


FIGURE 14 - VALVE TAPPET ADJUSTMENT

VALVE TAPPET ADJUSTMENT, Fig. 14

With the tappets in their **lowest position** (valves completely closed) and **engine cold,** the clearance between valve stem and tappet adjusting screw should be.

Intake - .007 inch Exhaust - .020 inch

The **intake valve** is to the left in the cylinder block, facing the valve chamber opening. The **exhaust valve** is to the **right.** Place a feeler gauge of proper clearance thickness between valve stem and tappet screw. Adjust clearance by means of two 1/2 - 7/16 inch tappet wrenches.

TIMING

FIRING ORDER

The firing interval (crankshaft degrees), between No. 1 cylinder and No. 2 is 270° — from No. 2 cylinder to No. 1, 450°.

The **No. 2 cylinder** is on the **Right Hand Side,** when viewed from flywheel end of engine No. 2 cylinder is on the left hand side, nearest to the flywheel.

DISTRIBUTOR

The distributor is of the mechanical advance type and it is driven off an engine speed governor shaft through a pair of 2:1 ratio gears. Thus, the distributor operates at **one-half** engine speed in a **clockwise direction,** when viewed from above.

SPARK ADVANCE

The running spark advance is 6° before Top Dead Center (T.D.C.) at 1800 r.p.m., with the distributor **fully advanced** to **22°** before T.D.C. at **3400 r.p.m.** Engines are properly adjusted at the factory for accurate timing and peak dependable performance for the complete operating range of speeds from 1600 through 3600 r.p.m. Future timing can be checked and adjusted in the following manner:

TIMING MARKS

Two timing slots are provided on the right hand side of the front face of flywheel shroud:

1. **For timing variable high speed engines to 22° at 3400** r.p.m., refer to Fig. 15 which illustrates 25°, 22°, 19° and T.D.C. timing marks. A **cast arrow** identifies the **"I"** marked flywheel vane that is visible through the opening at the 22° mark.

2. **For fixed speed engines,** particularly those operating at **1800 r.p.m.,** refer to Fig. 16 which illustrates 9°, 6°, 3° and T.D.C. timing marks. The **cast arrow** identifies the **"I"** marked flywheel vane that is visible through the opening at the 6° **mark.**

NOTE: Read **Important Note** with reference to Fig. 18 on page 6, for adjusting engine speed to 1800 r.p.m. for 6° advance timing.

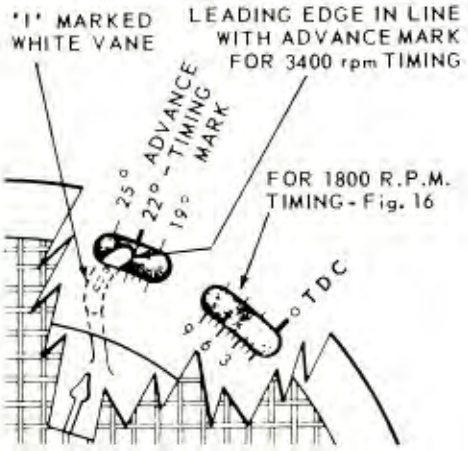


FIGURE 15 - SPARK ADVANCE VARIABLE HIGH SPEED

FIGURE 16 - SPARK ADVANCE FIXED LOW SPEED

TIMING CHECK AND ADJUSTMENT

IMPORTANT:

It is necessary that the distributor breaker point gap be **.020 inch,** because any change in gap opening will affect the ignition advance. Check and adjust if necessary, per Distributor Breaker Point Adjustment paragraphs, before timing.

A **slotted opening** is provided on the rim of the flywheel screen so that timing can be checked without removing the screen.

CAUTION:

DO NOT operate engine with screen removed from front face of shroud.

NOTE:

Paint the **"I" marked** flywheel vane **white,** so that it will be clearly visible for checking with a **Timing Light.**

1. With reference to Fig. 17, insert a small screwdriver into the No. 1 terminal tower on the distributor cap, making contact with the spark plug wire terminal. Connect the red terminal clip, from a conventional automotive type **Timing Light,** to the metal portion of the screwdriver. One of the other two

timing light wires is connected to the battery, and the other to the ground.

2. With reference to Fig. 15 and the engine operating at **3400 r.p.m.,** allow the flash from the timing light to illuminate the **"I" whitened** flywheel vane. At the time of the flash the **leading edge** of the vane should line up with the **22° Timing Mark** on the flywheel shroud.

2a. For fixed **low speed** applications, operate the engine at **1800 r.p.m.** and allow the flash from the timing light to illuminate the **"I" whitened** flywheel vane. At the time of the flash the leading edge of the vane should line up with the **6° Timing Mark** on flywheel shroud, as illustrated in Fig. 16.

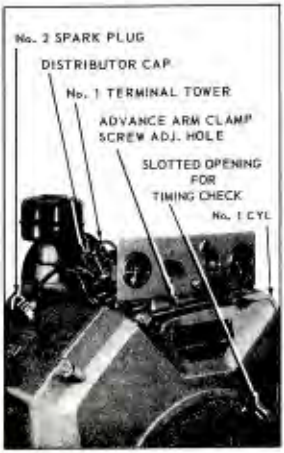


FIGURE 17

3. If timing is incorrect, loosen the advance arm **clamp screw** at the base of the distributor. A screwdriver clearance hole is provided in the flywheel shroud as shown in Fig. 17.

With the engine again running at timing speed turn the distributor body **very slightly** clockwise or counterclockwise as required, until **white vane** and **Timing Mark** do match up. Securely tighten clamp screw when satisfactory timing is accomplished.

IMPORTANT:

On fixed low speed applications timing should be adjusted to 6° before T.D.C. at 1800r.p.m.

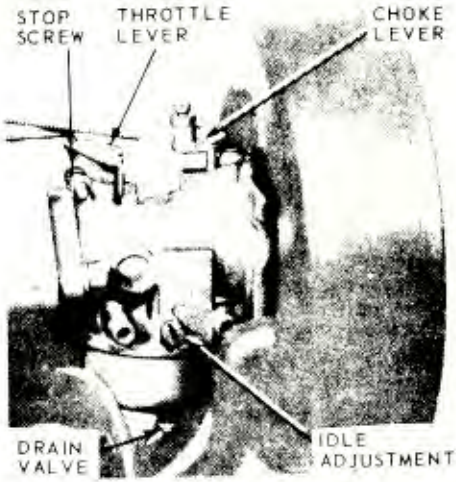


FIGURE 18, CARBURETOR ADJUSTMENT

For engines where the governor is set to operate at speeds other than 1800 R.P.M., a tachometer will have to be used, and the speed adjusted to 1800 r.p.m. in the following manner, and with reference to **Fig. 18.**

1. Run engine at idle speed, **1000 r.p.m.**

2. Turn **Stop Screw** on carburetor throttle lever clockwise until engine speed reaches **1800 r.p.m.**

3. Proceed to check and adjust timing.

4. After timing is accomplished, turn stop screw on carburetor throttle lever counterclockwise until original idle speed of **1000 r.p.m.** is obtained.

CLUTCH ADJUSTMENT

The clutch is an optional accessory furnished either as a power take-off unit, or a clutch reduction assembly.

If the clutch begins to slip, it should be readjusted to prevent it from becoming overheated and damaged. First, remove inspection plate to expose the **adjusting ring.** Release clutch by pushing **shifter lever forward** (toward engine).

OPERATION GUIDE
BRIGGS & STRATTON ENGINE

MODEL SERIES 402400 — 422400

IN THE INTEREST OF SAFETY

DANGER: DO NOT RUN THE ENGINE IN AN ENCLOSED AREA. Exhaust gases contain carbon monoxide, an odorless and deadly poison. A FIRE OR EXPLOSION CAN OCCUR RESULTING IN PERSONAL INJURY IF THE FOLLOWING INSTRUCTIONS ARE NOT FOLLOWED:

1. DO NOT FILL GASOLINE TANK WHILE engine is running. Allow engine to cool two minutes before refueling.
2. Do not operate the engine when an odor of gasoline is present or other explosive conditions exist.
3. If gasoline is spilled, move machine away from the area of the spill and avoid creating *any* source of ignition until the gasoline has evaporated.
4. DO NOT STORE, SPILL OR USE GASOLINE NEAR AN OPEN FLAME, or devices such as a stove, furnace or water heater which utilize a pilot light, or devices which can create a spark.
5. Refuel outdoors preferably, or only in well ventilated areas.
6. DO NOT OPERATE ENGINE WITHOUT A MUFFLER. Inspect muffler periodically and replace, if necessary.
7. Periodically clean the muffler area to prevent grass, dirt and combustible material from accumulating.
8. DO NOT use this engine on any forest covered, brush covered or grass covered unimproved land unless a spark arrester is attached to the muffler.

9. DO NOT operate the engine if air cleaner or covered directly over the carburetor air intake is removed.

10. When transporting equipment which is powered by an engine using a float feed carburetor and gravity fuel source, the fuel shut off valve must be closed to prevent fuel leaking from carburetor.

11. DO NOT choke carburetor to stop engine.

WARNING: DO NOT RUN ENGINE AT EXCESSIVE SPEEDS. Operating an engine at excessive speeds increases the danger of personal injury.

DO NOT TAMPER WITH GOVERNOR SPRINGS, GOVERNOR LINKS OR OTHER PARTS WHICH MAY INCREASE THE GOVERNED ENGINE SPEED.

Do not tamper with the engine speed selected by the original equipment manufacturer.

DO NOT TOUCH hot mufflers, cylinders or fins as contact may cause burns.

Dirt and grass clippings or other debris, in cooling fins or governor parts can affect engine speed. See cleaning instructions in MAINTENANCE section.

ALWAYS KEEP HANDS AND FEET CLEAR OF MOVING OR ROTATING PARTS.

TO PREVENT ACCIDENTAL STARTING when servicing the engine or equipment, always remove the spark plugs or wire from the spark plugs, shown on page . Disconnect negative wire from battery terminal if equipped with a 12 volt starting system.

WHEN WORKING ON EQUIPMENT

DO NOT STRIKE FLYWHEEL with a hard object or metal tool as this may cause flywheel to shatter in operation, causing personal injury or property damage. To remove flywheel, use Briggs & Stratton approved tools only.

IN THE INTEREST OF ENVIRONMENT

A muffler which leaks because of rust or damage can permit an increased exhaust noise level. Therefore, examine the muffler periodically to be sure it is functioning effectively. To purchase a new muffler, see SERVICE AND REPAIR INFORMATION.

WARNING: If this engine is not equipped with a spark arrester and is to be used on any forest covered, brush covered, or grass covered unimproved land, before using on such land a spark arrester must be added to the muffler. The arrester must be maintained in effective working order by the operator. In the State of California the above is required by law (Section 4442 of the California Public Resources Code). Other states may have similar laws. Federal laws apply on federal lands. See your Authorized Briggs & Stratton Service Center for spark arrester muffler options.

SERVICE & REPAIR INFORMATION

If service or repair is needed, contact an Authorized Briggs & Stratton Service Center. To serve you promptly and efficiently, the Service Center will need the model, type and code number on your engine.

Each Authorized Service Center carries a stock or original Briggs & Stratton repair parts and is equipped with special service tools. Trained mechanics assure expert repair service on all Briggs & Stratton engines.

Major engine repairs should not be attempted unless you have the proper tools and a thorough knowledge of internal combustion engine repair procedure.

Your nearest service center is listed in the "Yellow Pages" under "Engines, Gasoline" or "Gasoline Engines".

This illustrated book includes common specifications, and detailed information covering the adjustment, tune-up and repair procedures for Twin Cylinder, 4 cycle models. It is available from any Authorized Briggs & Stratton Service Center. Order as Part Number 271172.

BEFORE STARTING

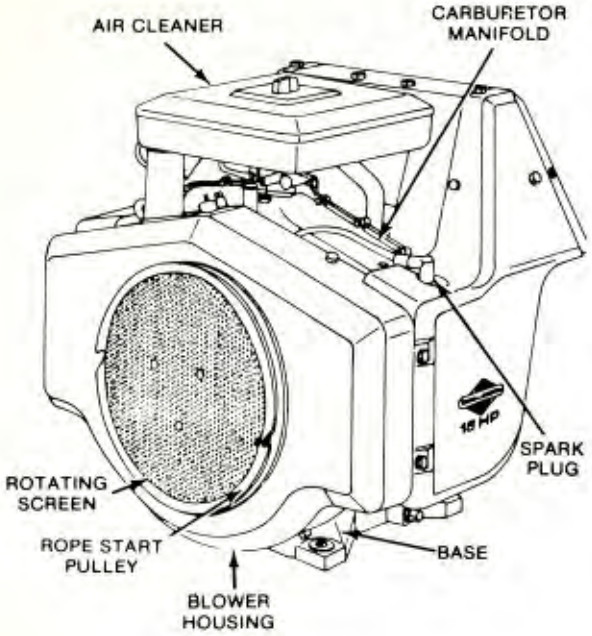
READ THE OPERATING INSTRUCTIONS OF THE EQUIPMENT THIS ENGINE POWERS

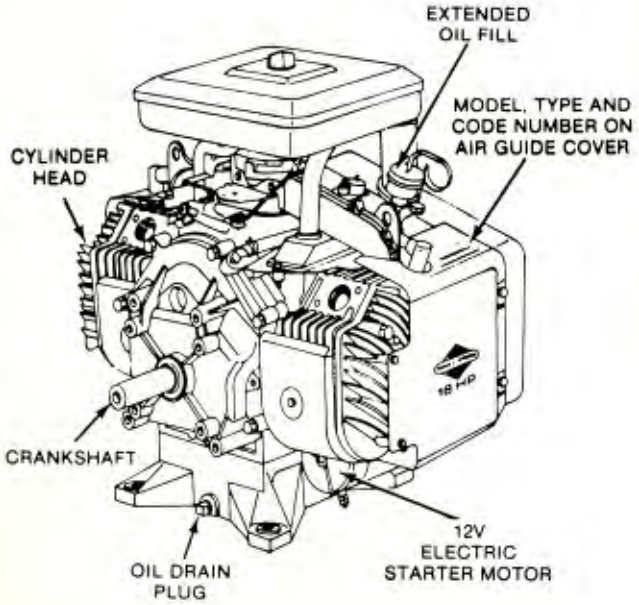
Use a high quality detergent oil classified "For Service SF, SE, SD or SC." Detergent oils keep the engine cleaner and retard the information of gum and varnish deposits. Nothing should be added to the recommended oil.

*If not available, a synthetic oil may be used having 5W-20, 5W-30 or 5W-40 viscosity.

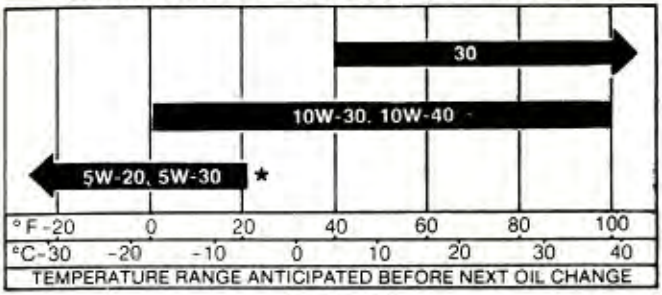
FILL CRANKCASE WITH OIL

Place engine level. Clean area around oil fill before removing dipstick.


AIR CLEANER
CARBURETOR MANIFOLD
SPARK PLUG
ROTATING SCREEN
ROPE START PULLEY
BLOWER HOUSING
BASE

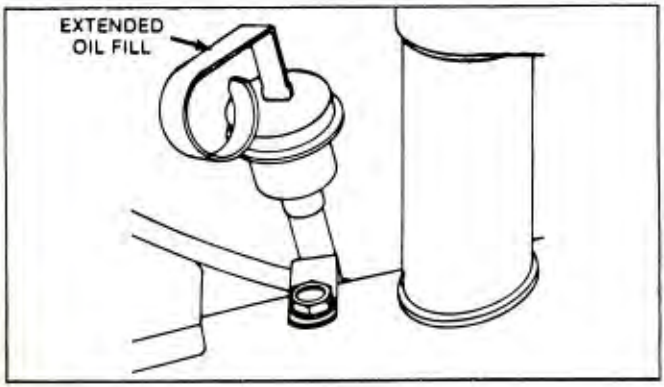

EXTENDED OIL FILL
MODEL, TYPE AND CODE NUMBER ON AIR GUIDE COVER
CYLINDER HEAD
CRANKSHAFT
OIL DRAIN PLUG
12V ELECTRIC STARTER MOTOR

RECOMMENDED SAE VISCOSITY GRADES



*If not available, a synthetic oil may be used having 5W-20, 5W-30 or 5W-40 viscosity.

EXTENDED OIL FILL. Remove cap and dipstock. **FILL TO FULL MARK** on dipstick, POUR SLOWLY. Capacity approximately 3 pints (1.4 liters). When checking oil level, screw dipstick assembly firmly but slowly until cap bottoms on tube. **DO NOT OVERFILL.** Dipstick assembly must be securely assembled into tube at all times when engine is operating.



CHARGE BATTERY

Charge battery before use on engines equipped with 12 volt electric starter motor. See manufacturers' recommendations.

FUEL RECOMMENDATIONS

Our engines will operate satisfactorily on any gasoline intended for automotive use. DO NOT MIX OIL WITH GASOLINE.

We recommend the use of clean, fresh, *lead-free* gasoline. Leaded gasoline may be used if lead-free is not available. A minimum of

77 octane is recommended. The use of lead-free gasoline results in fewer combustion deposits and longer valve life.

STARTING

OPEN FUEL VALVE on engines so equipped.

CHOKE ENGINE: Move equipment control lever to "CHOKE" position.

NOTE: This should fully close choke on carburetor. If it does not, remote control must be re-adjusted. See ADJUSTMENT section.

NOTE: A warm engine requires less choking than a cold engine.

TO START ENGINE

DANGER: ALWAYS KEEP HANDS AND FEET CLEAR OF ROTATING MACHINERY.

Turn key to "START" position and/or press starter button on powered equipment. The best starter life is provided by using short starting cycles of several seconds. Prolonged cranking can damage the starter motor if cranked more than 15 seconds per minute. When engine starts, open choke gradually.

When equipment is not in operation, provide protection from direct exposure to weather.

COLD WEATHER STARTING HINTS

1. Be sure to use the proper oil for the temperature expected.
2. Declutch all possible external loads.
3. Set speed control at part-throttle position.
4. A warm battery has much more starting capacity than a cold battery.
5. Use fresh winter grade fuel.

NOTE: Winter grade gasoline has higher volatility to improve starting. Do not use gasoline left over from summer.

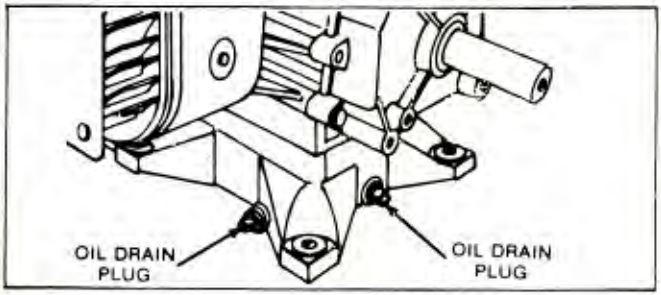
TO STOP ENGINE

Turn key to "OFF" position. Do not choke carburetor to stop the engine.

CAUTION: TO PREVENT ACCIDENTAL STARTING when servicing the engine or equipment, always remove the spark plugs or wire from the spark plugs shown on page Disconnect negative wire from battery terminal if equipped with a 12 volt starter system.

CHECK OIL LEVEL regularly — after each five hours of operation. BE SURE OIL LEVEL IS MAINTAINED.

CHANGE OIL after first five hours of operation. Thereafter change oil every 25 hours of operation. Remove oil drain plug and drain oil while engine is warm. Replace drain plug. Remove dipstick and refill with new oil of proper grade. Replace dipstick.

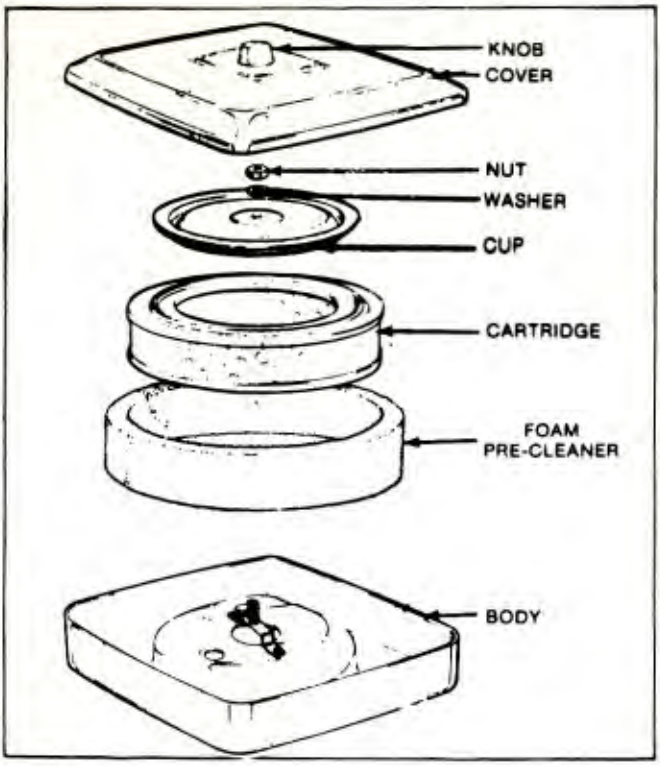


TO SERVICE DUAL ELEMENT AIR CLEANER

Clean and re-oil foam pre-cleaner at three month intervals or every 25 hours, whichever occurs first.

NOTE: Service air cleaner more often under dusty conditions.

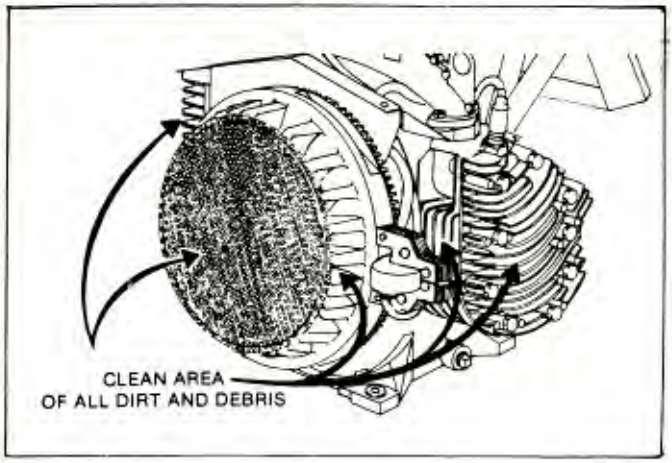
1. Remove knob and cover.
2. Remove foam pre-cleaner by sliding it off the paper cartridge.
3. a. Wash foam pre-cleaner in kerosene or liquid detergent and water.
   b. Wrap foam pre-cleaner in cloth and squeeze dry.
   c. *Saturate foam pre-cleaner in engine oil.* Squeeze to remove excess oil.
4. Install foam pre-cleaner over paper cartridge. Reassemble cover and screw down tight.



Yearly or every 100 hours, whichever occurs first, remove paper cartridge. Clean by tapping gently on flat surface. If very dirty, replace cartridge, or wash in a low or non-sudsing detergent and warm water solution. Rinse thoroughly with flowing water from inside out, until water is clear. Cartridge must be allowed to stand and air dry *thoroughly* before using. Service more often if necessary.

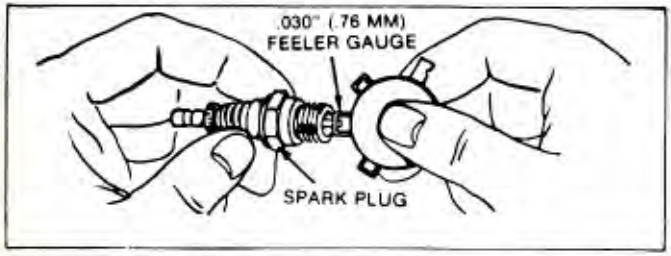
CAUTION: Petroleum solvents, such as kerosene, are not to be used to clean cartridge. They may cause deterioration of the cartridge. DO NOT OIL CARTRIDGE. DO NOT USE PRESSURIZED AIR TO CLEAN OR DRY CARTRIDGE.

CLEAN COOLING SYSTEM — Grass, chaff or dirt may clog the rotating screen and the air cooling system, especially after prolonged service in cutting tall dry grasses. Yearly or every 100 hours, whichever occurs first, remove the blower housing and clean the areas shown to avoid overspeeding, overheating and engine damage. Clean more often if necessary.



DANGER: Periodically clean muffler area to remove all grass, dirt and combustible debris.

SPARK PLUGS — Clean and reset gap at .030" every 100 hours of operation.



CAUTION: Do not blast clean spark plugs. Spark plugs should be cleaned by scraping or sire brushing and washing with a commercial solvent.

Sparking can occur if wire terminals do not fit firmly on spark plugs. Reform terminals if necessary.

REMOVE COMBUSTION DEPOSITS every 100-300 hours of operation. Remove cylinder heads and cylinder head shields. Scrape and wire brush the combustion deposits from cylinder, cylinder heads, top of pistons and around valves. Use a soft brush to remove deposits. Re-assemble gaskets, cylinder heads and cylinder head shields. Turn screws down finger tight, with the three longer screws around the exhaust valve, if so equipped. Torque cylinder head screws in a staggered sequence to 165 inch pounds (18.65 Nm).

SPARK ARRESTER EQUIPPED MUFFLER — If engine muffler is equipped with spark arrester screen assembly, remove every 50 hours for cleaning and inspection. Replace if damaged.

CLEAN ENGINE — Remove dirt and debris with a cloth or brush. Cleaning with a forceful spray of water is not recommended as water could contaminate the fuel system.

FUEL FILTER — Replace IN-LINE filter every season.

ADJUSTMENTS

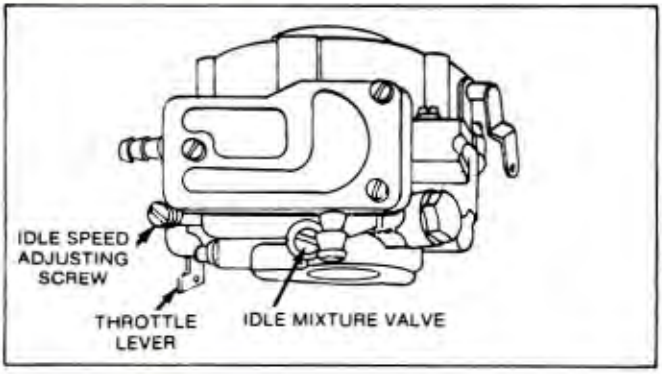
CARBURETOR ADJUSTMENTS

Minor carburetor adjustment may be required to compensate for differences in fuel, temperature, altitude or load.

NOTE: The air cleaner must be assembled to carburetor when running engine.

Gently turn the idle mixture valve clockwise until it just closes. Valve may be damaged by turning it in too far. Open idle valve 1½ turns counterclockwise.

This initial adjustment will permit the engine to be started and warmed up prior to final adjustment.



Start engine and place equipment speed control lever in idle position. Hold carburetor throttle lever against idle stop, and adjust idle speed screw to obtain: 1200 to 1400 RPM. Turn idle mixture valve *slowly* clockwise (lean mixture) until speed *just* starts to slow. Then turn idle mixture valve ½ turn

counterclockwise. Now adjust idle speed screw to obtain: 900 to 1200 RPM. Release throttle lever.

NOTE: Engines operated at altitudes of approximately 5000 feet, may require the installation of a high altitude carburetor main jet to achieve best engine performance. If erratic performance or lack of power is observed, select the fixed main jet part number 231333. It may be ordered through your nearest Briggs & Stratton Service Center.

CONTROL ADJUSTMENTS

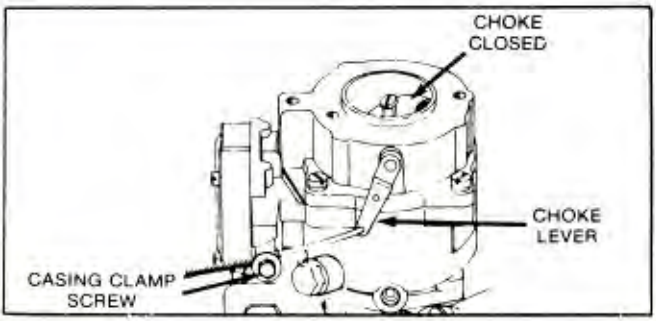
Proper choke and speed control operation is dependent upon correct adjustment of controls on the powered equipment.

TO CHECK OPERATION OF CHOKE CONTROLS

Move control lever to "CHOKE" position. The carburetor choke should be closed.

TO ADJUST CHOKE:

Place control lever on equipment in "CHOKE" position. Loosen casing clamp screw. Move casing and wire until choke is completely closed. Tighten casing clamp screw.



SPEED CONTROL ADJUSTMENT

The acceptable operating speed range is 1800 to 3600 RPM. Idle speed is 1400 RPM. The manufacturer of the equipment on which the engine is used, specifies the top governed no load speed at which the engine may be operated. DO NOT EXCEED this speed.

Engine speed is controlled by movement of the control lever. Move control lever on equipment, "A," to slowest engine speed

possible. Throttle lever on carburetor should touch idle speed adjusting screw. To adjust, loosen control casing clamp screw "B." Move control casing and wire in direction shown by arrow until throttle lever touches idle speed adjusting screw on carburetor. Retighten casing clamp screw "B."

CAUTION: Throttle lever on carburetor MUST touch idle speed adjusting screw when equipment control lever is in slowest position.

GENERAL INFORMATION

These engines are two-cylinder L-head, air-cooled type.

MODEL SERIES 402400

Bore	3-7/16" (87.31 mm)
Stroke	2-5/32" (54.77 mm)
Displacement	40.00 cu. in. (656.0 cc)
Horsepower Max.	16 @ 3600 RPM
Torque (Ft. Lbs.) Max.	25.8 @ 2700 RPM

MODEL SERIES 422400

Bore	3-7/16" (87.31 mm)
Stroke	2-9/32" (57.94 mm)
Displacement	42.33 cu. in. (694.0 cc)
Horsepower Max.	18 @ 3600 RPM
Torque (Ft. Lbs.) Max.	28.6 @ 2600 RPM

The horsepower ratings listed are established in accordance with the Society of Automotive Engineers Test Code - J607. For practical operation, the horsepower loading should not exceed 85% of this rating. Engine power will decrease 3½% for each 1,000 feet (304.8 m) above sea level and 1% for each 10° above 60° F (16° C).

TUNE-UP SPECIFICATIONS

Spark Plug Type	Champion	Autolite
Resistor Long Plug	RJ-12	308

Spark Plug Gap	030" (.76 mm)
Intake Valve Clearance**	.004" - .006" (.10 - .15 mm)
Exhaust Valve Clearance**	007" - 009" (.18 - .23 mm)

**with valve spring installed.

WARNING: For electrical safety, always remove cable from negative (-) side of the battery before attempting any repairs or maintenance.

STORAGE INSTRUCTIONS

Engines to be stored over 30 days should be completely drained of fuel to prevent gum deposits from forming on essential carburetor parts, fuel filter and tank.

NOTE: The use of a fuel additive, such as STA-BIL, or an equivalent, will minimize the formation of fuel gum deposits during storage. Such an additive may be added to the gasoline in the fuel tank of the engine, or to the gasoline in a storage container.

a. All fuel should be removed from the tank. Run the engine until it stops from lack of fuel. The small amount of fuel that remains in the sump of the tank should be removed by absorbing it with a clean, dry cloth.

b. While engine is still warm, drain oil from crankcase. Refill with fresh oil.

c. Remove spark plugs, pour approximately one ounce (30 cc) of engine oil into cylinder and crank slowly to distribute oil. Replace spark plugs.

d. Clean dirt and chaff from cylinders, cylinder head fins, blower housing, rotating screen and muffler areas.

e. Store in a clean and dry area.

f. Charge battery and store as recommended by the manufacturer.

TROUBLE SHOOTING

The three prime requisites essential to starting and maintaining satisfactory operation of internal combustion engines are:

1. A **Proper Fuel Mixture** in the cylinder.

2. **Good compression** in the cylinder.

3. **Good Spark, Properly Timed,** to ignite the mixture.

If all three of these conditions do not exist the engine cannot be started.

As a guide to locating some of the difficulties in starting, **causes** are listed under the three main headings of:

Fuel Mixture, Compression and **Ignition.**

FUEL MIXTURE

No fuel in tank or fuel valve closed.

Plugged vent hole in fuel tank cap.

Fuel line clogged.

Fuel pump diaphragm worn or punctured.

Carburetor not choked sufficiently, especially if engine is cold.

Water, dirt, or gum in gasoline interfering with free flow of fuel to carburetor.

Poor grade, stale or out-of-season gasoline.

Carburetor flooded, caused by too much choking especially if engine is hot.

Dirt or gum holding float needle valve in carburetor open. This condition would be indicated if fuel continues to drip from carburetor with engine standing idle.

Carburetor out of adjustment. Restricted (dirty) air cleaner.

COMPRESSION

Cylinders dry due to engine having been out of use. Pour one fluid ounce of crankcase oil through spark plug holes.

Loosen or broken spark plug. A hissing noise will be heard in cranking due to escaping gas mixture on compression stroke.

Damaged cylinder head gasket or loose cylinder head. This will likewise cause hissing noise on compressions stroke.

Valve stuck open. Piston rings stuck or worn.

Valves adjusted with insufficient clearance.

IGNITION

Test for spark by removing spark plugs and observe spark at plug gap while turning engine over. No spark or weak spark may be attributed to the following:

Ignition wires loose or disconnected at spark plug, distributor or coil.

Broken or frayed ignition wires.

Spark plug insulator broken.

Spark plugs wet or dirty.

Spark plug gap incorrect.

Condensation on spark plug electrodes.

Breaker point gap incorrect.

Breaker points pitted or fused.

Breaker arm sticking.

Condenser leaking or grounded.

Spark timing wrong.

Weak battery, Faulty ignition coil.

ENGINE MISSES

Spark plug gap incorrect.

Worn, leaking or loose ignition cables.

Weak spark. See "Ignition" test for spark.

Loose connections at ignition cables.

Breaker points pitted or worn.

Water in gasoline. Sticky valves.

Poor compression. See "Compression."

ENGINE STOPS

Fuel tank empty.

Water, dirt or gum in gasoline.

Gasoline vaporized in fuel lines, due to excessive heat around engine (Vapor Lock).

Vapor lock in fuel lines due to using winter gas (too volatile) in hot weather.

Air vent hole in fuel tank cap plugged.

Ignition troubles. See "Ignition."

OVERHEATING

Crankcase oil supply low.

Ignition timing wrong.

Low grade of gasoline.

Engine overloaded.

Restricted cooling air circulation.

Part of air shroud removed from engine.

Dirt between cooling fins.

Intake screen clogged with dirt.

Restricted exhaust.

ENGINE SURGES OR GALLOPS

Carburetor flooded.

Governor spring hooked into wrong hole.

Governor rod incorrectly adjusted.

ENGINE KNOCKS

Poor grade gasoline or of low octane rating.

Operating under heavy load at low speed.

Loose or burnt out rod bearings.

Spark advanced too far.

Worn or loose piston pin.

Carbon or lead deposits in cylinder head.

Backfires thru carburetor.

High oil pressure.

Low or no oil pressure.

ENGINE MAINTENANCE SCHEDULE	Daily	Weekly or 50 Hrs.	100 Hrs.	250 Hrs.
CHECK OIL LEVEL. Add to level of filler hole opening.	•			
CHECK AIR CLEANER. Shake out accumulated dirt from dry element.	•			
CLEAN AIR INTAKE SCREEN. Clean cooling fins if necessary.	•			
CLEAN AIR FILTER ELEMENT. Replacement Element LO 194 A		•		
CHANGE CRANKCASE OIL. Use grade and classification of oil recommended. In adverse conditions change oil every 50 hours of operation.			•	
REPLACE OIL FILTER every oil change. Replacement Filter RV 51.			•	
INSPECT CRANKCASE BREATHER SYSTEM. Clean if necessary.			•	
DISTRIBUTOR CAM. Apply 1 or 2 drops of light oil (10W) to felt in cam sleeve and 1 drop to breaker arm pivot.				•
INSPECT SPARK PLUGS and BREAKER POINTS. Replace if necessary and regap. (Spark Plugs .030 inch) (Breaker gap .020 inch). Replacement Spark Plugs YD6.				•
INSPECT FUEL FILTER. Clean filter screen or strainer in fuel tank.				•
INSPECT COOLING SYSTEM. Remove shrouding and scrape off dirt from between fins, around cylinder head and from shrouding.				•
INSPECT STARTING MOTOR. Check for loose mounting and cable connections.				•

DC 24
12 V MARINE
AND RV
10 H DEEP CYCLE
11 1/4 L 6 13/16 W

ROUTER - ONAN NHC.

No Fuel Filter

Air cleaner Element - 32103

Eng. oil Filter - 32122

MS - 3898 D

ROUTER - WISC #220

No Fuel Filter

Air Cleaner Element - 32103

Eng. oil Filter - 31311

"Turbo" optional Pre-Cleaner 32104

BRIGGS - ROUTER - 18 HP.

Air Cleaner Element - 32107

Foam. Pre-cleaner - 32108