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SAFETY RULES SERVICE MANUAL INTRODUCTION AND TORQUE SPECIFICATIONS

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SERVICE MANUAL INTRODUCTION

This service manual has been prepared with the latest service information available. Troubleshooting, removal, disassembly, inspection and installation procedures, and complete specifications and tightening references can be found in most sections. Some sections have drawings but no written procedure because the job is so easily done.

Right, Left, Front, and Rear

The terms right-hand and left-hand and front and rear as used in this manual indicate the right and left sides, and front and rear of the machine as seen from the operator's seat for correct operation of the machine or attachment.

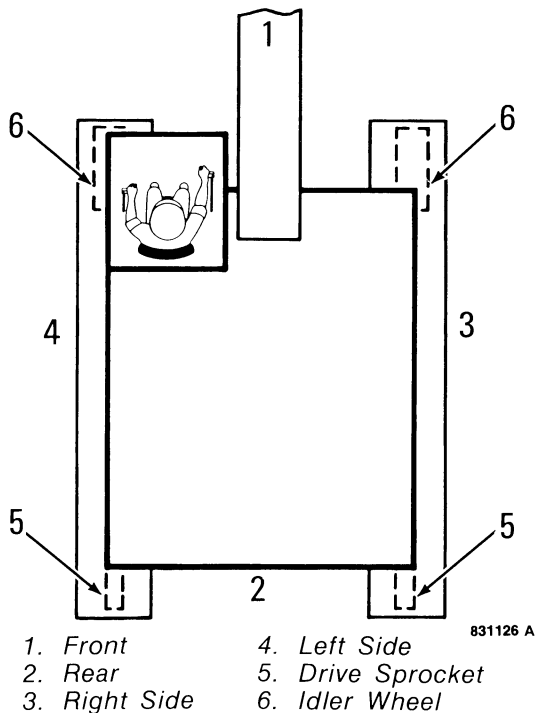


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A Table of Contents is in the front of this manual. The Table of Contents shows the main divisions and the sections that are in each division. The individual sections also have a Table of Contents.

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Illustrations

Illustrations are put as near as possible to the text and are to be used as part of the text.

Clear and Simple English

This manual is written in C.A.S.E. (Clear and Simple English). C.A.S.E. is easier to read and understand than "regular" English because C.A.S.E. uses a small number of common words and has special rules for writing.

All sections written in C.A.S.E. are indicated by the symbol below.

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And
Simple
English*

Special Tools

Special tools are needed to remove and install, disassemble and assemble, check and adjust some component parts of this machine. Some special tools can be easily made locally and the necessary information to make the tool is in this service manual. Other special tools are more difficult to make locally and are available from Service Tools in the U.S. and from Jobborn Manufacturing in Canada. Use these tools according to the instructions in this service manual for your personal safety and to do the job correctly.


Order special tools from either of the following companies.


Service Tools
P.O. Box 314
Owatonna, Minnesota 55060

Jobborn Manufacturing Co.
97 Frid Street
Hamilton, Ontario L8P 4M3
Canada

TORQUE SPECIFICATIONS - U.S. HARDWARE

Use the torques in this chart when special torques are not given. These torques apply to fasteners with both UNC and UNF threads as received from suppliers, dry, or when lubricated with engine oil. Not applicable if special graphites, moly-disulfide greases, or other extreme pressure lubricants are used.

| Grade 5 Bolts, Nuts, and Studs | | | |
|---|------------|---------------|-----------------|
|  | | | |
| Size | Pound-Feet | Newton metres | Kilogram metres |
| 1/4 in 6.4 mm | 9-11 | 12-15 | 1.2-1.5 |
| 5/16 in 7.9 mm | 17-21 | 23-28 | 2.4-2.9 |
| 3/8 in 9.5 mm | 35-42 | 48-57 | 4.8-5.8 |
| 7/16 in 11.1 mm | 54-64 | 73-87 | 7.5-8.8 |
| 1/2 in 12.7 mm | 80-96 | 109-130 | 11.1-13.3 |
| 9/16 in 14.3 mm | 110-132 | 149-179 | 15.2-18.2 |
| 5/8 in 15.9 mm | 150-180 | 203-244 | 20.8-24.9 |
| 3/4 in 19.0 mm | 270-324 | 366-439 | 37.3-44.8 |
| 7/8 in 22.2 mm | 400-480 | 542-651 | 55.3-66.4 |
| 1.0 in 25.4 mm | 580-696 | 787-944 | 80.2-96.2 |
| 1-1/8 in 28.6 mm | 800-880 | 1085-1193 | 111-122 |
| 1-1/4 in 31.8 mm | 1120-1240 | 1519-1681 | 155-171 |
| 1-3/8 in 34.9 mm | 1460-1680 | 1980-2278 | 202-232 |
| 1-1/2 in 38.1 mm | 1940-2200 | 2631-2983 | 268-304 |

| Grade 8 Bolts, Nuts, and Studs | | | |
|---|------------|---------------|-----------------|
|  | | | |
| Size | Pound-Feet | Newton metres | Kilogram metres |
| 1/4 in 6.4 mm | 12-15 | 16-20 | 1.7-2.1 |
| 5/16 in 7.9 mm | 24-29 | 33-39 | 3.3-4.0 |
| 3/8 in 9.5 mm | 45-54 | 61-73 | 6.2-7.5 |
| 7/16 in 11.1 mm | 70-84 | 95-114 | 9.7-11.6 |
| 1/2 in 12.7 mm | 110-132 | 149-179 | 15.2-18.2 |
| 9/16 in 14.3 mm | 160-192 | 217-260 | 22.1-26.5 |
| 5/8 in 15.9 mm | 220-264 | 298-358 | 30.4-36.5 |
| 3/4 in 19.0 mm | 380-456 | 515-618 | 52.5-63.0 |
| 7/8 in 22.2 mm | 600-720 | 814-976 | 83.0-99.5 |
| 1.0 in 25.4 mm | 900-1080 | 1220-1465 | 124-149 |
| 1-1/8 in 28.6 mm | 1280-1440 | 1736-1953 | 177-199 |
| 1-1/4 in 31.8 mm | 1820-2000 | 2468-2712 | 252-277 |
| 1-3/8 in 34.9 mm | 2380-2720 | 3227-3688 | 329-376 |
| 1-1/2 in 38.1 mm | 3160-3560 | 4285-4827 | 437-492 |

TORQUE SPECIFICATIONS - STEEL HYDRAULIC FITTINGS

| Tube OD Hose ID | Thread Size | Pound- Feet | Newton metres | Kilogram metres |
|---------------------------------|----------------|----------------|------------------|--------------------|
| 37 Degree Flare Fittings | | | | |
| 1/4 in 6.4 mm | 7/16-20 | 6-12 | 8-16 | 0.8-1.7 |
| 5/16 in 7.9 mm | 1/2-20 | 8-16 | 11-21 | 1.1-2.2 |
| 3/8 in 9.5 mm | 9/16-18 | 10-25 | 14-33 | 1.4-3.5 |
| 1/2 in 12.7 mm | 3/4-16 | 15-42 | 20-56 | 2.1-5.8 |
| 5/8 in 15.9 mm | 7/8-14 | 25-58 | 34-78 | 3.5-8.0 |
| 3/4 in 19.0 mm | 1-1/16-12 | 40-80 | 54-108 | 5.5-11.1 |
| 7/8 in 22.2 mm | 1-3/16-12 | 60-100 | 81-135 | 8.3-13.9 |
| 1.0 in 25.4 mm | 1-5/16-12 | 75-117 | 102-158 | 10.4-16.2 |
| 1-1/4 in 31.8 mm | 1-5/8-12 | 125-165 | 169-223 | 17.3-22.8 |
| 1-1/2 in 38.1 mm | 1-7/8-12 | 210-250 | 285-338 | 29.0-34.6 |

| Tube OD Hose ID | Thread Size | Pound- Feet | Newton metres | Kilogram metres |
|-------------------------------------|----------------|----------------|------------------|--------------------|
| Straight Threads with O-ring | | | | |
| 1/4 in 6.4 mm | 7/16-20 | 12-19 | 16-25 | 1.7-2.6 |
| 5/16 in 7.9 mm | 1/2-20 | 16-25 | 22-33 | 2.2-3.5 |
| 3/8 in 9.5 mm | 9/16-18 | 25-40 | 34-54 | 3.5-5.5 |
| 1/2 in 12.7 mm | 3/4-16 | 42-67 | 57-90 | 5.8-9.3 |
| 5/8 in 15.9 mm | 7/8-14 | 58-92 | 79-124 | 8.0-12.7 |
| 3/4 in 19.0 mm | 1-1/16-12 | 80-128 | 108-174 | 11.1-17.8 |
| 7/8 in 22.2 mm | 1-3/16-12 | 100-160 | 136-216 | 13.8-22.1 |
| 1.0 in 25.4 mm | 1-5/16-12 | 117-187 | 159-253 | 16.2-25.9 |
| 1-1/4 in 31.8 mm | 1-5/8-12 | 165-264 | 224-357 | 22.8-36.5 |
| 1-1/2 in 38.1 mm | 1-7/8-12 | 250-400 | 339-542 | 34.6-55.3 |

| Split Flange Mounting Bolts | | | |
|------------------------------------|----------------|------------------|--------------------|
| Size | Pound- Feet | Newton metres | Kilogram metres |
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| 3/8-16 | 20-25 | 26-33 | 2.8-3.5 |
| 7/16-14 | 35-45 | 47-61 | 4.7-6.2 |
| 1/2-13 | 55-65 | 74-88 | 7.6-9.0 |
| 5/8-11 | 140-150 | 190-203 | 19.4-20.7 |

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ENGINE ACCESSORIES

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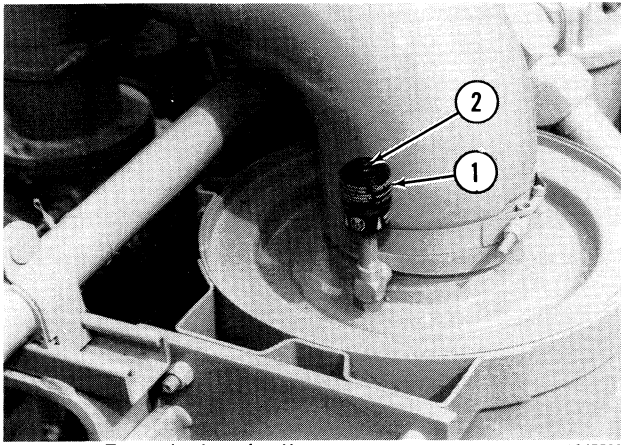
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| Dust Valve | 2001-2 | Illustration of Ether Injection System .. | 2001-8 |
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AIR CLEANER

Restriction Indicator

Check the restriction indicator every 10 hours of operation or each day, whichever occurs first.



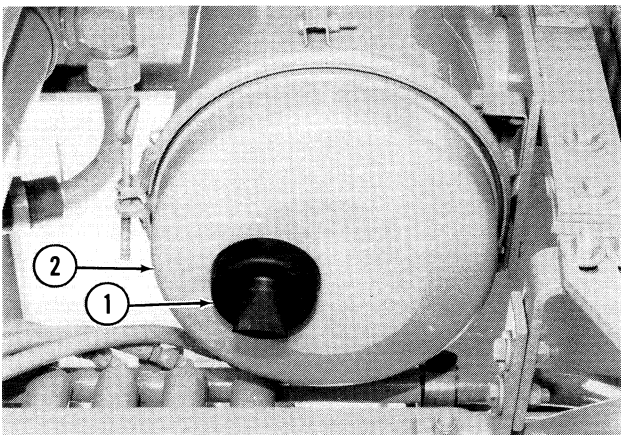
1. Restriction Indicator
2. Button

A845539

If the red band in the restriction indicator is in full view, clean or replace the air cleaner elements. Do not run the engine when the red band is in full view.

Dust Valve

Remove and clean the dust valve after every 50 hours of operation.



1. Dust Valve
2. Cover

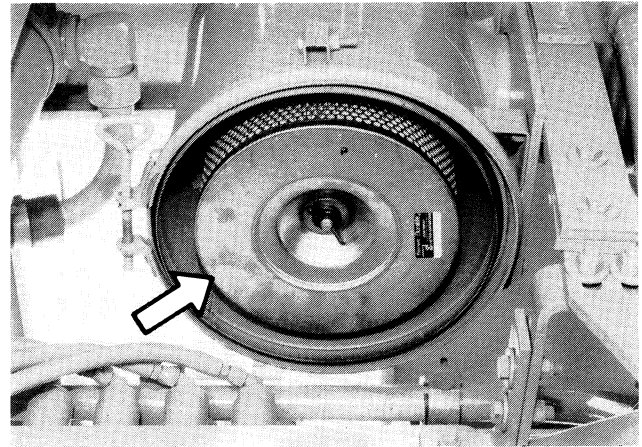
835281

Replacing Elements

1. Remove the air cleaner cover.

2. Remove and clean the primary element. See Cleaning Primary Element on page 2001-3. Replace the primary element after cleaning six times.

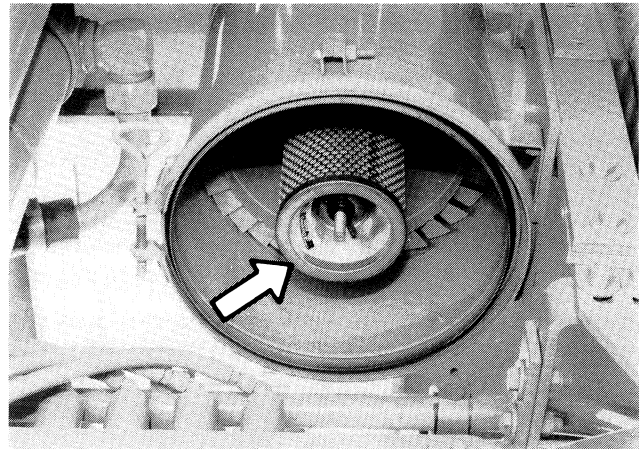
NOTE: The date of manufacture is on the end cap of the primary element. Do not install a primary element that is more than two years old.



Primary Element

835282

3. Replace the secondary element if you are servicing the primary element for the third time, if the date of manufacture on the end cap shows the secondary element is two years old, or if the secondary element is damaged.



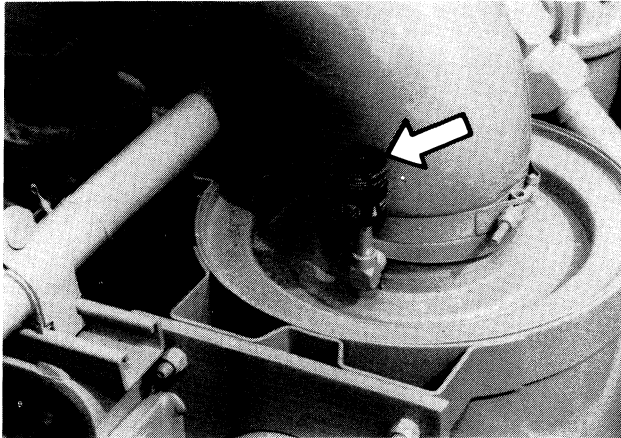
Secondary Element

835283

4. After the primary element is clean and dry, use a lamp to inspect the primary element for damage. Look for holes, wear, bent end covers, etc. Discard the primary element if damaged.

5. Install the primary element.
6. Install the air cleaner cover.

7. Push the button on the top of the restriction indicator to remove the red band from view.



1. Button

A845539

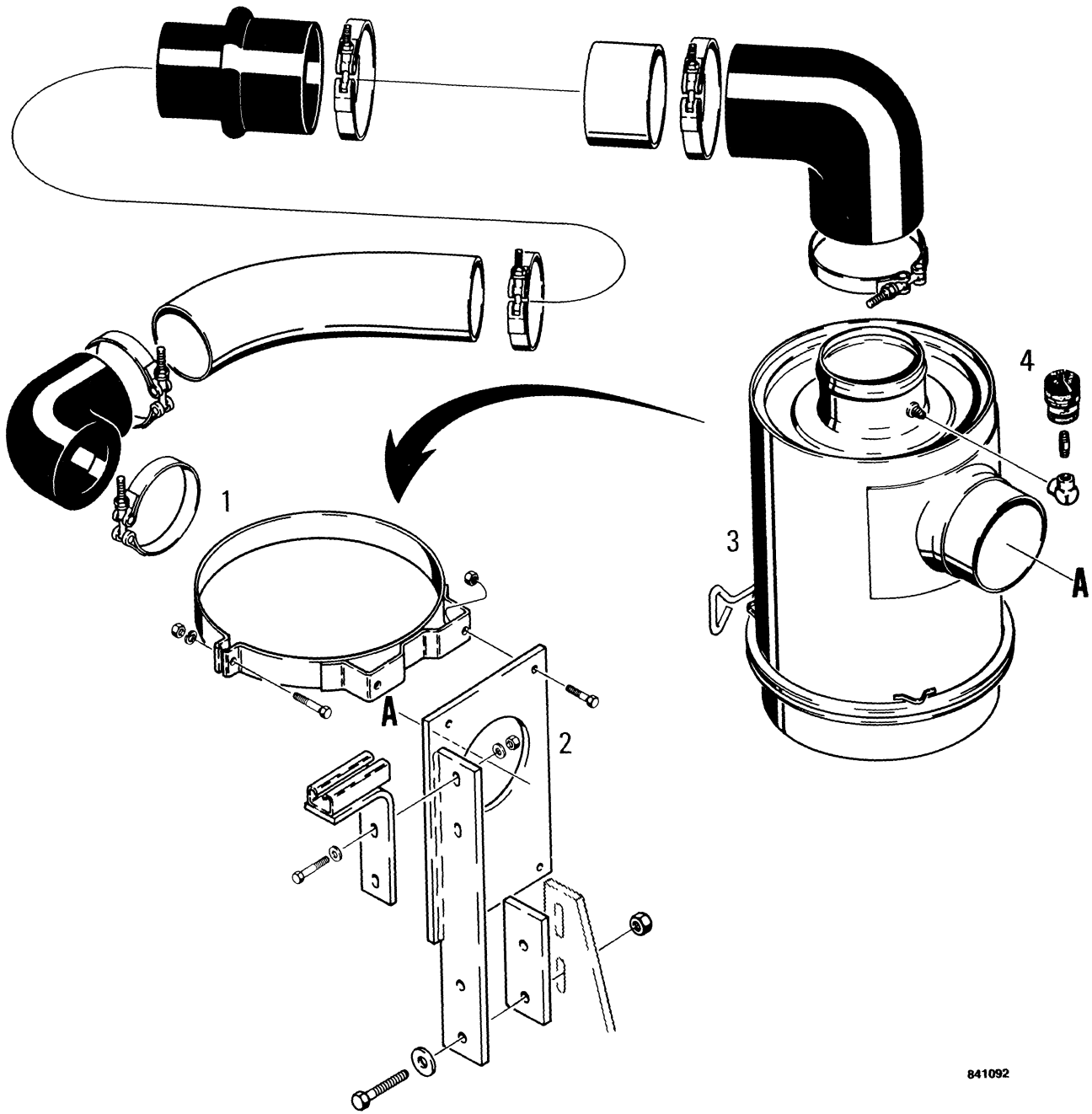
8. Start the engine. If the red band shows in the restriction indicator, replace the secondary element.

NOTE: *Do not clean the secondary element.*

Cleaning Primary Element

WASHING: Washing is the best method for cleaning the primary element. Wash the primary element with D-1400 detergent (Case part number A40910). The primary element must be dry before installation in the air cleaner. Do not use compressed air to dry the primary element.

COMPRESSED AIR: Use compressed air that is not more than 30 psi (206 kPa, 2.1 kg/cm³) at the nozzle. Use the compressed air inside the primary element and 1 inch (25 mm) or more in distance from the primary element. Cleaning the primary element with compressed air will not remove carbon or soot.

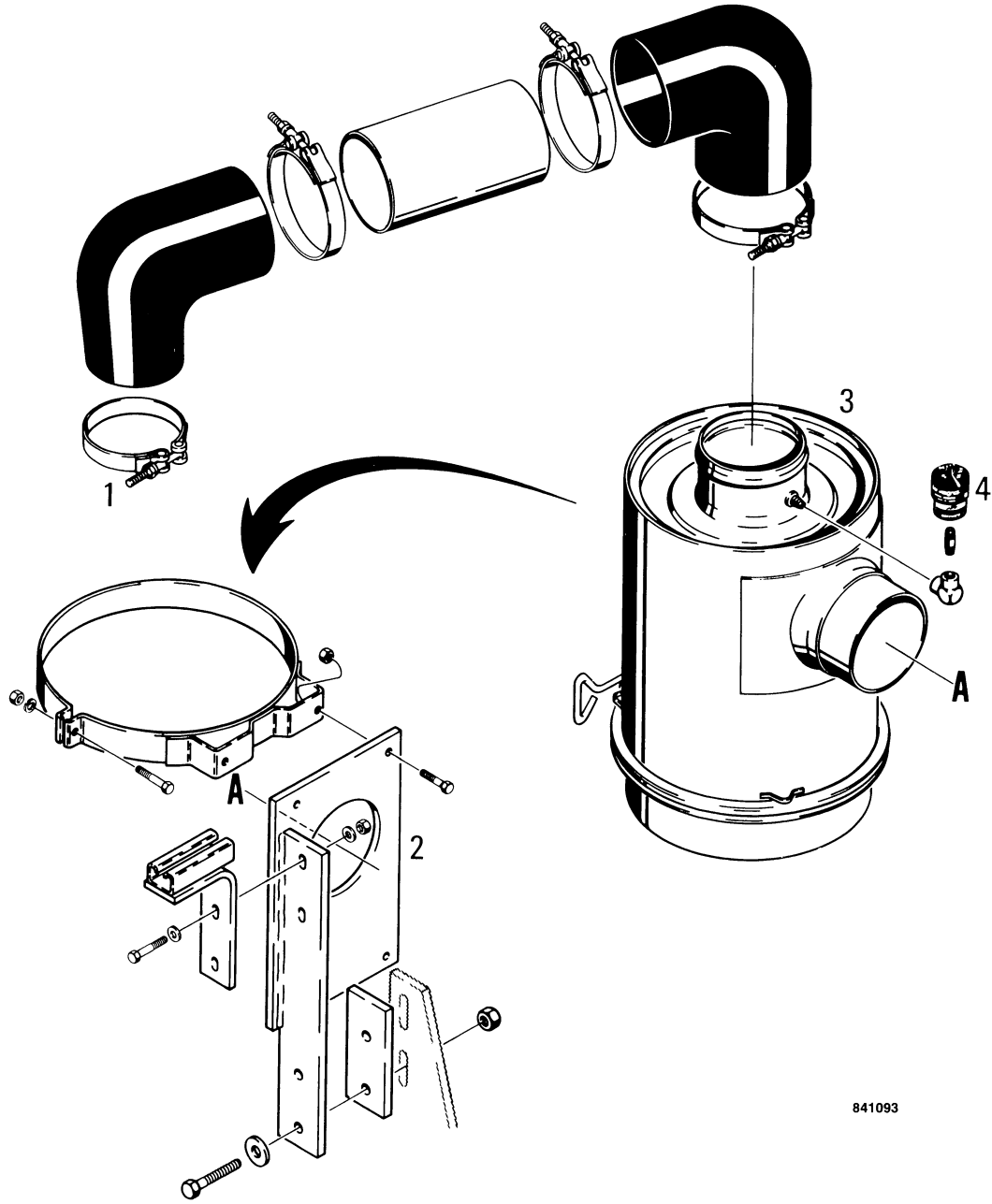


841092

- 1. Connects to Turbocharger
- 2. Bracket

- 3. Air Cleaner
- 4. Restriction Indicator

Air Cleaner Installation on Case Engines

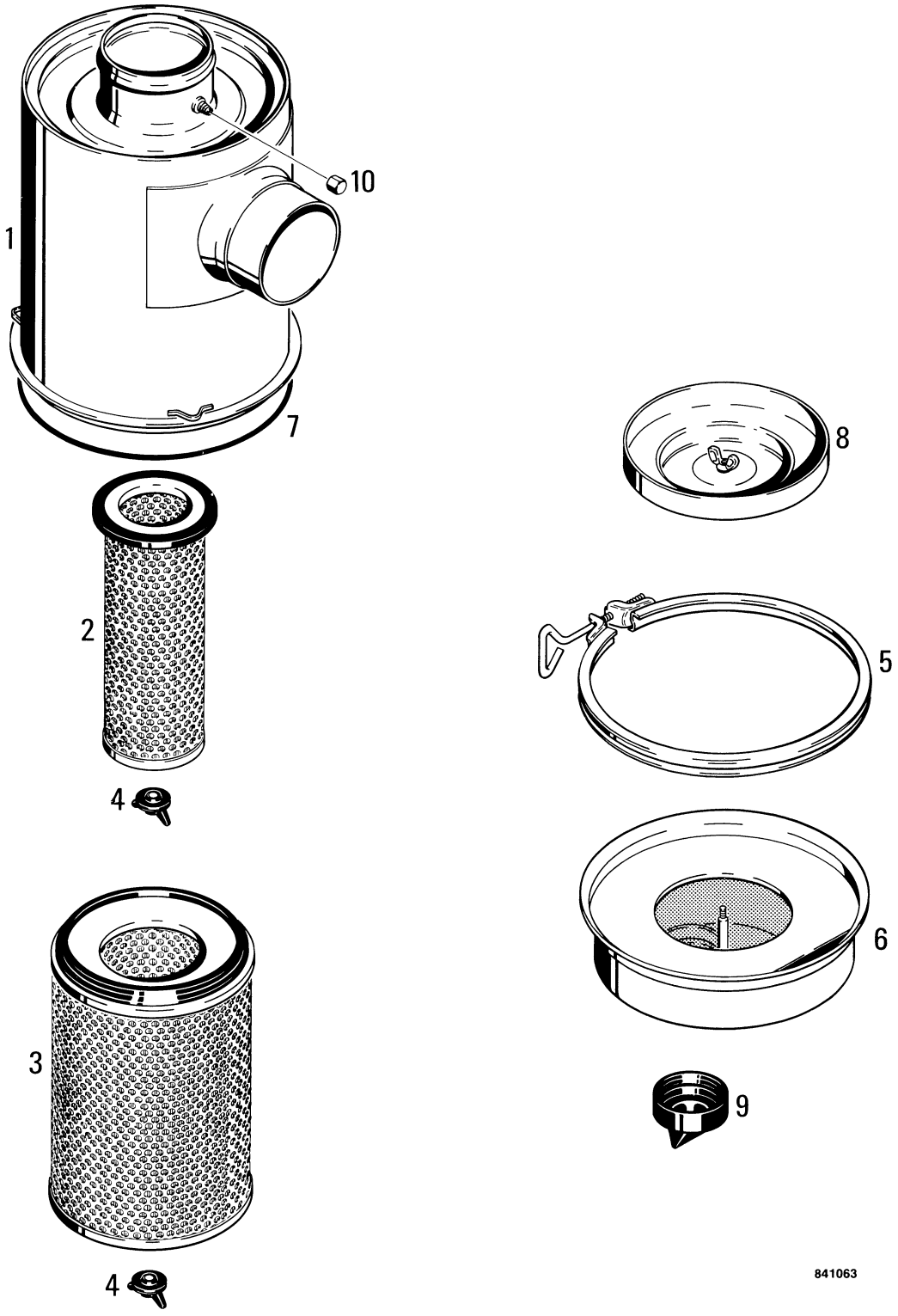


841093

- 1. Connects to Intake
- 2. Bracket

- 3. Air Cleaner
- 4. Restriction Indicator

Air Cleaner Installation on GMC Engines



- 1. Body
- 2. Inner Element
- 3. Outer Element
- 4. Wing Nut

- 5. Clamp
- 6. Dust Cup
- 7. O-ring

- 8. Baffle
- 9. Dust Valve
- 10. Cap

841063

Air Cleaner

ETHER INJECTION SYSTEM

WARNING: An explosion can occur if sparks or flame make contact with the starting fluid in the starting fluid container or if you keep the starting fluid container in an area with a temperature above 120° F (49° C). Read the following information.

1. Know the correct method for operating the ether injection system.
2. Always remove the starting fluid container from the machine before you weld, grind, or use a cutting torch on the machine. Use compressed air to remove any starting fluid fumes from the area.
3. Do not breathe the starting fluid fumes or let the starting fluid make contact with your skin.
4. Keep the starting fluid container out of the reach of children.
5. Never make a hole in the starting fluid container.
6. Do not put the starting fluid container in a fire.

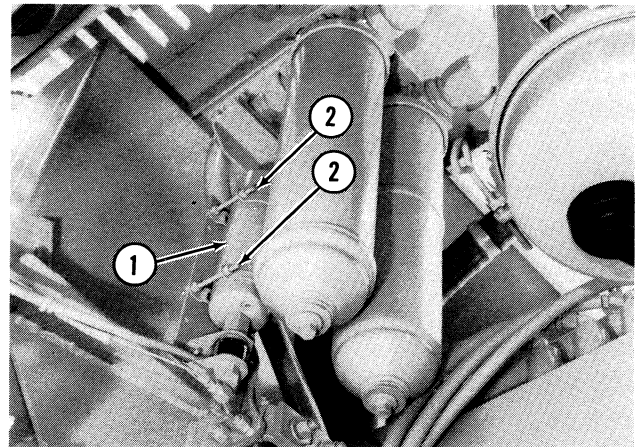


Failure to follow the above instructions can cause a severe injury. 48-20

1. See Starting the Engine in the operators manual to learn the correct steps in starting the engine.
2. Turn the key to the START position and push the cold start button two times. Release the key as soon as the engine starts to run.

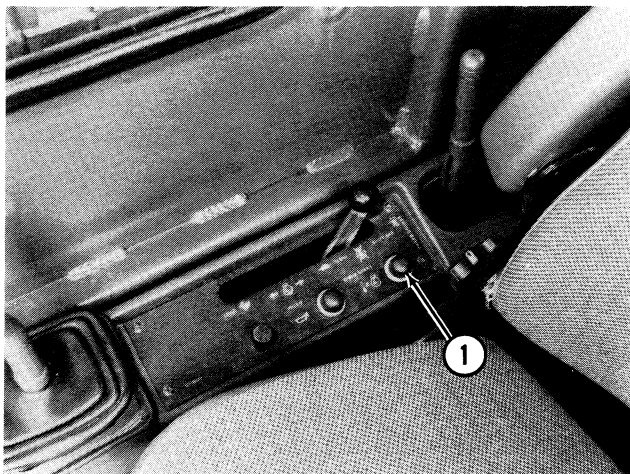
NOTE: If the engine runs for a short time and then stops, repeat step 2. If the engine will not start, see Starting Fluid Can on this page and check to make sure the starting fluid can is not empty.

Starting Fluid Can



1. Starting Fluid Can
2. Mounting Clamp

835284



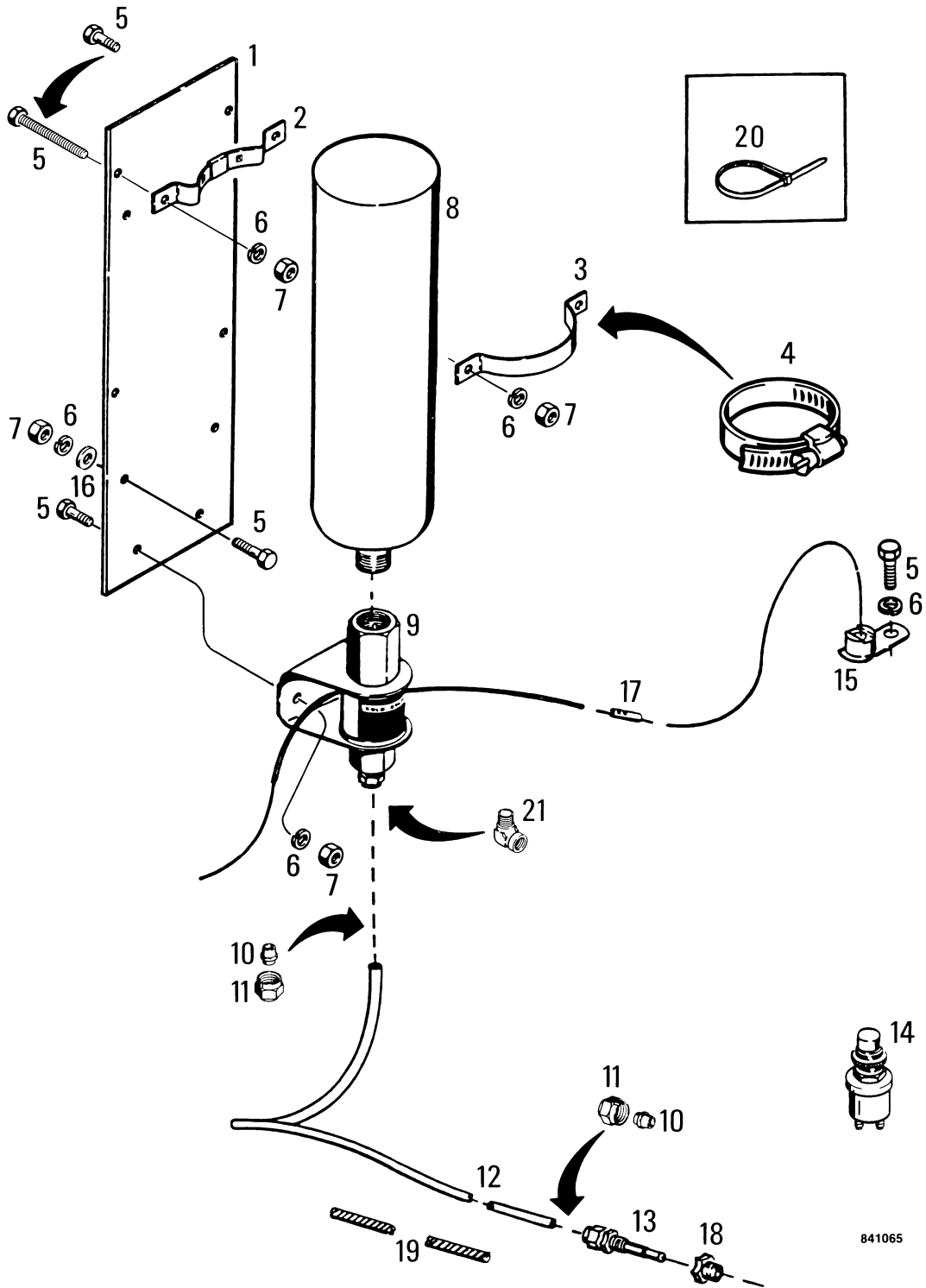
1. Cold Start Button

A845584

The optional cold start system is an aid to help start the engine in cold weather. The cold start system operates only when the engine is cold. The cold start system injects a measured amount of ether into the intake manifold each time you push the cold start button.

IMPORTANT: Read the information and warnings on the starting fluid can.

1. Loosen the bottom mounting clamp.
2. Remove the top mounting clamp.
3. Turn the starting fluid can counterclockwise and remove the starting fluid can from the solenoid valve.
4. Install a new starting fluid can. Tighten the starting fluid can hand tight.
5. Tighten the lower mounting clamp.
6. Install the upper mounting clamp.



- | | | | |
|----------------|-------------|-----------------|------------------|
| 1. Plate | 7. Nut | 12. Tube | 17. Connector |
| 2. Bracket | 8. Cylinder | 13. Nozzle | 18. Reducer |
| 3. Clamp | 9. Valve | 14. Switch | 19. Loom |
| 4. Hose Clamp | 10. Sleeve | 15. Thermostat | 20. Tie Strap |
| 5. Bolt | 11. Nut | 16. Flat Washer | 21. Street Elbow |
| 6. Lock Washer | | | |

841065

Ether Injection System

TURBOCHARGER - CASE ENGINE

Removal

1. Park the machine on a level surface.
2. Lower the boom until the bucket is on the floor.
3. Decrease the engine speed to idle. Stop the engine.
4. Remove the muffler.
5. Remove the hood top.
6. Disconnect the air cleaner hose from the inlet of the turbocharger.
7. Disconnect the hose on the intake elbow from the turbocharger.
8. Loosen and remove the cap screws, lock washers, and flat washers that fasten the brace to the exhaust elbow.
9. Loosen and remove the cap screws and lock washers that fasten the exhaust elbow to the engine. Remove the exhaust elbow and connector.
10. Disconnect the oil supply tube from the fitting at the top of the turbocharger.
11. Loosen and remove the cap screws and lock washers that fasten the oil drain tube to the bottom of the turbocharger.
12. Loosen and remove the nuts and lock washers that fasten the turbocharger to the engine.
13. Remove the turbocharger.
14. Use tape to close the end of the intake elbow and the holes in the exhaust manifold.
15. Check the condition of the rubber sleeve on the oil supply tube. Use a new rubber sleeve as necessary.
16. Remove the gasket from the oil drain tube and the exhaust manifold.
17. Check the condition of the hoses for the intake elbow and the air cleaner tube. Use new hoses as necessary.

Installation

1. Install a new gasket on the exhaust manifold.
2. Install a new gasket on the oil drain tube. Use gasket sealer to hold the gasket in place.
3. Install the turbocharger.
4. Install the lock washers and nuts to fasten the turbocharger to the exhaust manifold.
5. Install the cap screws and lock washers to fasten the oil drain tube to the turbocharger.
6. Install the connector and exhaust elbow. Install the cap screws and lock washers to fasten the exhaust elbow to the engine.
7. Install the cap screws, lock washes, and flat washers to fasten the brace to the exhaust elbow.
8. Connect the oil supply tube to the fitting at the top of the turbocharger.
9. Connect the hose on the intake elbow to the turbocharger. Tighten the clamps.
10. Connect the hose to the inlet of the turbocharger. Tighten the clamps.
11. Prime the turbocharger according to the instructions on this page.
12. Stop the engine and check for oil leakage.
13. Install the hood top.
14. Install the muffler.

Priming the Turbocharger

If the weather is very cold, if the engine oil filters have been changed, if the turbocharger has been removed, or if the engine has not been run for more than two weeks, the turbocharger must be filled with oil before the engine is started.

1. Pull out the fuel shutoff control.
2. Hold the key switch to the START position for 30 seconds. During this time, the oil pump in the engine will fill the turbocharger with oil.



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2001-10

3. Push in the fuel shutoff control and start the engine. Run the engine at idle for two minutes.

IMPORTANT: *If the engine stops running while the engine has been running at a fast speed, start the engine immediately. If the engine is not started immediately, the turbocharger can be damaged.*

Stopping the Engine

1. Park the machine on a level surface.
2. Run the engine at idle for two minutes.
3. Pull out the fuel shutoff control until the engine stops.
4. Turn the key switch to the OFF position.

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