


**Automotive Engines Theory and Servicing**  
Ninth Edition

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Theory and Servicing

Ninth Edition  
James D. Halderman



## Chapter 25

### Engine Cleaning and Crack Detection

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## OBJECTIVES

**25.1** Explain the mechanical cleaning procedure of engines.

**25.2** Discuss chemical cleaners.

**25.3** Compare spray and steam washing, thermal cleaning, tank and vapor cleaning, and ultrasonic and vibratory cleaning.

**25.4** Explain crack detection and crack repair.

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## MECHANICAL CLEANING (1 OF 3)

- Heavy deposits should be removed by mechanical cleaning before using other cleaning methods.
- Mechanical cleaning involves:
  - Scraping
  - Abrasive brushing
  - Abrasive blasting
- Scraping

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## MECHANICAL CLEANING (2 OF 3)

- Abrasive Pads or Discs
  - White
  - Yellow
  - Green

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## MECHANICAL CLEANING (3 OF 3)

- Media Blasting
  - Nontoxic
  - Nonflammable
  - Nonhazardous
  - Environmentally Safe

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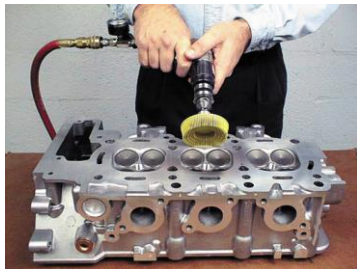
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**FIGURE 25-1** An air-powered grinder attached to a bristle pad being used to clean the gasket surface of a cylinder head. This type of cleaning pad should not be used on the engine block where the grit could get into the engine oil and cause harm when the engine is started and run after the repair.



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## CHEMICAL CLEANERS

- pH
- Solvent-based Cleaning
- Water-based Chemical Cleaning

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## SPRAY AND STEAM WASHING

- Spray Washing
  - Spray washing is faster than soaking
- Steam Cleaning
  - Steam vapor is mixed with high-pressure water and sprayed on the parts



**FIGURE 25-5** A pressure jet washer is similar to a large industrial-sized dishwasher. Each part is then rinsed with water to remove chemicals or debris that may remain there while it is still in the tank.

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## THERMAL CLEANING

- Temperatures Involved
- Advantages
- Microbial Cleaning
- Pyrolytic Oven



**FIGURE 25-6** A microbial cleaning tank uses microbes to clean grease and oil from parts.

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## TANK AND VAPOR CLEANING

- Cold Tank Cleaning
- Hot Tank Cleaning
- Vapor Cleaning

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## ULTRASONIC AND VIBRATORY CLEANING

- Ultrasonic Cleaning
  - To clean small parts that must be absolutely clean
- Vibratory Cleaning
  - Best on small parts
  - The movement of the vibrating solution and the scrubbing action of the media do an excellent job of cleaning metal.

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**FIGURE 25-8** An ultrasonic cleaner is used to clean fuel injectors.



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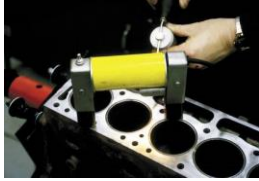
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## CRACK DETECTION

- Visual Inspection
- Magnetic Crack Detection
- Dye-penetrant Testing
- Fluorescent-penetrant Testing
- Pressure Testing



**FIGURE 25-9** The top deck surface of a block is being tested using magnetic crack inspection equipment.

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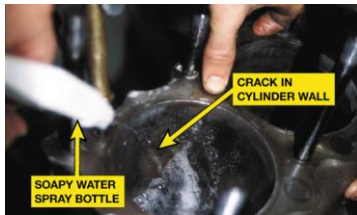
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**FIGURE 25-12** To make sure that the mark observed in the cylinder wall was a crack, compressed air was forced into the water jacket while soapy water was sprayed on the cylinder wall. Bubbles confirmed that the mark was indeed a crack.



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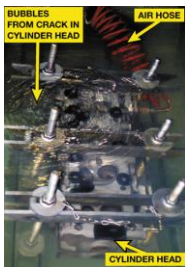
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**FIGURE 25-13** A cylinder head is under water and being pressure tested using compressed air. Note that the air bubbles indicate a crack.



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## CRACK REPAIR

- Crack Concerns
- Stop Drilling
- Crack-welding Cast Iron
- Crack-welding Aluminum
- Crack Plugging

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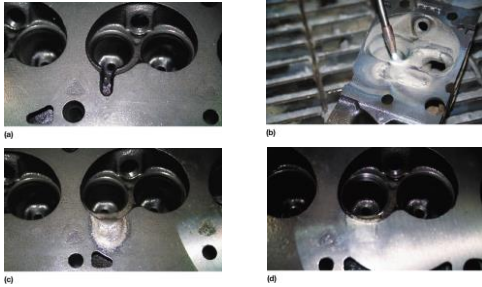
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**FIGURE 25-14** (a) Before welding, the crack is ground out using a carbide grinder. (b) Here the technician is practicing using the special cast-iron welding torch before welding the cracked cylinder head. (c) This is the finished welded crack before final machining. (d) Note the finished cylinder head after the crack has been repaired using welding.



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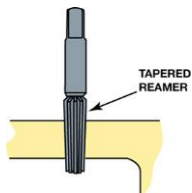
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**FIGURE 25-15** Reaming a hole for a tapered plug.



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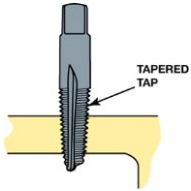
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FIGURE 25-16 Tapping a tapered hole for a plug.



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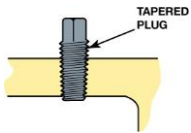
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FIGURE 25-17 Screwing a tapered plug in the hole.



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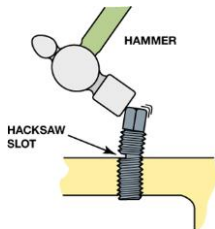
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FIGURE 25-18 Cutting the plug with a hacksaw.



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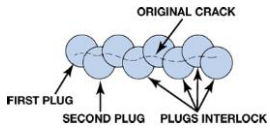
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FIGURE 25-19 Interlocking plugs.



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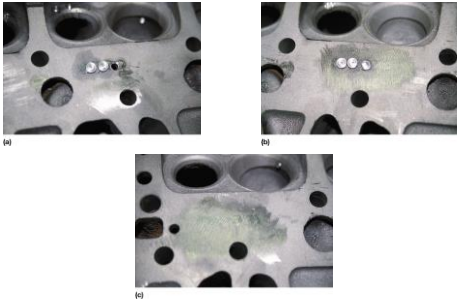
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FIGURE 25-20 (a) A hole is drilled and tapped for the plugs. (b) The plugs are installed. (c) After final machining, the cylinder head can be returned to useful service.



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### SUMMARY (1 OF 3)

- Mechanical cleaning with scrapers or wire brushes is used to remove deposits.
- Steel wire brushes should never be used to clean aluminum parts.
- Most chemical cleaners are strong soaps called caustic materials.

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### SUMMARY (2 OF 3)

- Always use aluminum-safe chemicals when cleaning aluminum parts or components.
- Thermal cleaning is done in a pyrolytic oven in temperatures as high as 800°F (425°C) to turn grease and dirt into harmless ash deposits.

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### SUMMARY (3 OF 3)

- Blasters use metal shot or glass beads to clean parts.
- All parts should be checked for cracks using magnetic, dye-penetrant, fluorescent-penetrant, or pressure testing methods.
- Cracks can be repaired by welding or by plugging.

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