8.0 Engine Cleaning Methods

Automobile engines attract and accumulate particles during its operation and these deposits could come in these forms: - water soluble deposits, organic soil, rust or scale. Effectively cleaning these deposits require the use of the most appropriate cleaning method, bearing in mind that cleaning takes a very significant part of the running budget of an automobile workshop.

The three widely applied cleaning methods are:

- Wet cleaning
- Abrasive blast cleaning
- Thermal cleaning

In most small automotive workshops, the wet cleaning method is mostly used.

8.1 Wet Cleaning

Water/chemical solution cleaning: this cleaning method involves the application of water only, water and chemicals (acid or base) or chemicals (acid or base) only. The choice of wet cleaning method is dependent on the dirt in or on the engine.

In automobile engines, to clean soil, a chemical must wet the material and suspend the dirt so that it can be washed off. Dirt is a water soluble particle or material found on the part of an engine.

On the other hand, organic soils which includes petroleum by-products, carbon, gasket sealers and paint and other products of combustion, cannot be effectively washed off with water, as a result of this introduction of a chemical is required. The introduced chemical makes the dirt soluble before they are washed off.

8.1.1 Chemical Cleaning of the Outer Part of an Engine

8.1.1.1 Cleaning with Alkaline

Alkaline materials are good cleaning materials for greasy surfaces and they work best when heated up. It should be noted that most automobile soaps are alkaline based and using soap and hot water effectively cleans greasy surfaces.

- Cleaning with bases: used on greasy parts

8.1.1.2 Cleaning with Acid

Acid materials are good for only cleaning rusts and scales. It does not clean grease; therefore, if rust is to be removed from a greasy surface, an alkaline agent is first used for the cleaning to remove the grease before acid is applied. It is to be noted that alkaline materials do not remove rust and scale.

Scales are removed from the cooling system of an automotive using acid.

8.1.1.3 Cleaning with solvents

Solvents employed in engine cleaning come in three different types: (i) Water Based (ii) Mineral Spirits and (iii) Chlorinated Hydrocarbon

8.2 Cleaning of the Inside Part of an Engine

Some of the cleaning methods employed in washing off unwanted materials inside an engine are: (i) Chemical Cleaning (ii) Abrasive Cleaning and (iii) Thermal Cleaning

8.2.1 Chemical Cleaning: they involve the following:-

- Solvent cleaning
- Alkaline cleaning:-
  - Cleaning aluminium
  - Hot Soak Tanks
- Spray Washer: the use of hot spray jet

8.2.2 Abrasive blast cleaning

For engine parts to be cleaned with this method, they must be grease free. Two types of abrasive blasting are employed for cleaning various engine parts. They are:-

- **Shot:** Which is round in shape and
- **Grit:** Which is sharp and angular

Different types of blast materials, which choice is subjected to the parts cleaning requirement, are used by engine rebuilders for cleaning engine parts. For cleaning in which the wear of the parts surface is a concern, **steel shots** and **glass beads** are used for cleaning such automotive parts. These shots and beads also come in sizes, and their applications vary. While smaller beads and shots are used for cleaning tight concerns and crevices (such as the threads or gear teeth), the large beads are used for loosening heavy deposits or cleaning flat surfaces.

In situations where the engine parts are plastics or soft metals or when there is a chance of the shot getting trapped in the engine part or destroying an engine part or transmission, **plastic chips** are used. Shots and grits are shown in Figure 8.1.

Figure 8.1: Blasting Media (a) Shot and (b) Grit

For heavy-duty cleaning, **grit** is used and it makes use of blasting materials called **media**. They are mostly made of steel (steel grit) and aluminium oxide. As opposed to other blasting materials which have spherical shapes, the blasting material, "media", has an angular shape and this makes it remove materials from the engine part surface during cleaning. It gives a good part surface for preparation for painting. It is not widely used choice for cleaning.

8.2.2.1 BLASTERS

These are machines used for cleaning engine parts in an automotive machine shop. They include the following:-

8.2.2.2 Glass Bead Blasters

This is a very effective method of removing carbon from an engine part and this machine is found in most automotive shops.

Figure 8.2: Glass bead blasters

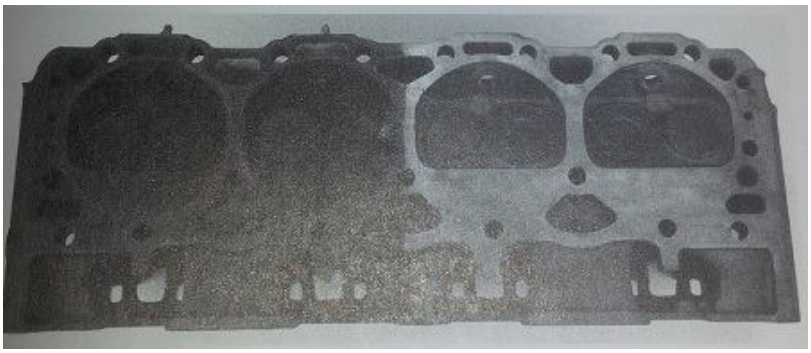

Figure 8.3: Part of a cylinder head cleaned with a glass bead blaster

The disadvantage of the use of this machine is that it requires an operator and is labour intensive.

Some of the time, glass bead blaster is used improperly. This could be the case in the following instances:-

- When used to clean parts that have oil galleries. This cleaning could leave blind spots in oil channels/passages where beads could be lodged and are pulled out later by flowing engine oil when the engine is in operation
- Where it could get trapped in spot-welded locations in oil pans or valve covers.
- Where it could cause abrasive wear to engine parts especially those made of aluminium.

8.2.2.3 Soda Blaster

This is a blast-cleaning method that involves the use of a baking powder as a cleaning medium. The soda material can only be used once (it cannot be reused).

Figure 8.4: Soda Blaster

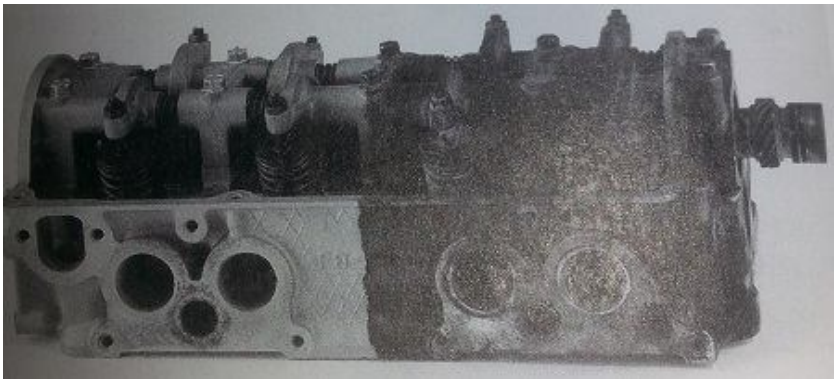

Figure 8.5: Half of the cylinder head was cleaned with a soda blaster

The advantages of this method over the beads are:-

- That it can be used to clean greasy engine part surfaces.
- The removal of the residue on the engine surface is not as important and tasking as the beads, since when the part is soaked in water, it is easily washed off.

The disadvantage is that is not effective in rust removal but it is very effective in removing carbon deposits and safe for aluminium parts.

8.2.2.4 Airless Blaster

This is a centrifugal blasting machine that uses an impeller to scatter steel shots in a sealed cabinet on the engine part. Shot blasting is widely used to clean ferrous parts like the engine top cylinder head, block and sometimes the connecting rod and crankshaft. This is the common used cleaning method amongst the three methods, because it is more environmentally friendly.

The cleaning process involves two stages:-

(i) the pre-cleaning of oil and grease on the engine part to be cleaned and

(ii) the removal of trapped shots before assembling the engine

Note: it is not as labour intensive as the glass bead blaster. The shots come in different sizes and hardness.

The most widely used steel shot has a Rockwell C hardness of between 40 and 50 Rc.

8.2.3 Thermal cleaning: this type of cleaning is employed in automotive workshops. It is a cleaning procedure in which a pyrolytic (high-temperature) oven heats oil and greasy, turning them into ash. Hard and dry deposits are left on the surface of the engine part and are removed by jet washing or shot blasting.

Two types of thermal ovens exist: (i) the convention and (ii) Open flame.

8.2.3.1 Convention Oven:- this type of oven is referred to as a flameless and insulated oven from the bottom. The parts in this system are not exposed to flame but they are gradually heated as the oven heats up. An advantage in the gradual heating of the parts is that there is a lesser chance of "Warpage". The cleaning cycle usually last between 1 to 4 hours.

Aluminium is cleaned at about 450 F (232 C) while ferrous metals are cleaned at about 700 F (371 C).

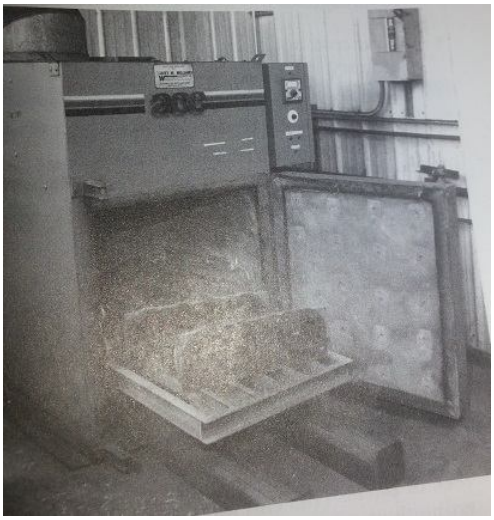

Figure 8.6: Cleaning furnace

8.2.3.2 Open Flame Oven:- in this setup, parts are mounted in a cage that avoids hot spots by slowly rotating the part directly over the flame. This set up makes cleaning of aluminium and ferrous metals together possible, because the temperature of air inside the oven is about 500 F (260) while the temperature of the flame is an average of about 1100 F (593 C).

After about 10 minutes of exposing the part or parts to the flame, the flame is turned off and a 20 minutes baking is allowed. Within 30 minutes, the total cleaning cycle is completed.

Note: For thermal cleaning, the three processes are observed:- (i) Pre-cleaning, (ii) Baking and (iii) Post-cleaning

Shot blasting is mainly employed in post-cleaning because the cooling down of the baked parts is not required as opposed to **jet washing** which requires the parts to be cold before the process starts. One possible problem with jet washing during post-cleaning is that ash might find its way into the jet's nozzles.

Advantages of thermal cleaning are:-

- It is cheaper

- There are lesser hazardous wastes to dispose
- The inside of oil galleries are thoroughly cleaned
- Rust and scales are turned by the heating to powder
- Carbon deposits in the manifolds and combustion chambers are loosed.
- Warped cylinder head can be straightened
- Aluminium wielding is easier after open flame because the contaminants are thoroughly cleaned
- Stress raisers are removed from the part's surfaces by shot blasting

8.2.4 Other Cleaning Methods:-

- Vibratory parts cleaner
- Salt bath cleaning
- Ultrasonic cleaning

8.2.4.1 Vibratory parts cleaner: this machine cleans the engine part by causing the beads covering the engine to vibrate thereby knocking off the deposits.

Figure 8.7: Vibratory parts cleaner

8.2.4.2 Salt bath cleaning methods are used in large and nonautomotive applications. This method is mostly used by large production engine rebuilders.

8.2.4.3 Ultrasonic cleaning is used commonly by jewellers and dentists. It is used for small parts cleaning by some rebuilders.

8.3 Manual Cleaning Methods

Hand-held brushes are employed in cleaning engine parts like the top cylinder head, crankshaft, valve guides, oil galleries in engine blocks, etc. sandpaper or scotchbrite can also be employed in cleaning engine parts manually or with the aid of power tools.

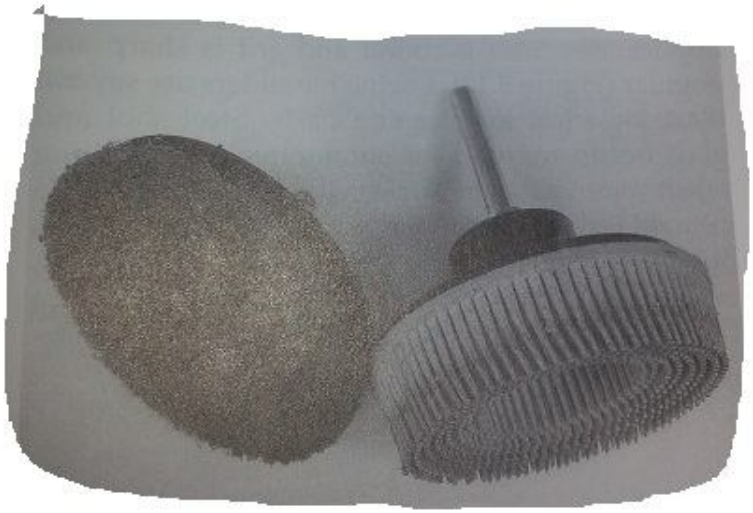

Figure 8.8: Scotch-brite pads and Roloc discs for cleaning gasket

Small wire brush can be used to remove dirt and deposits from some engine parts surfaces by fixing/fitting them to electric or air drills. Other cleaning tools are:- the plastic abrasive disc, hand-held gasket scraper, special wire wheel, etc.

Figure 8.9: A wire brush mounted on a drill