TRADE OF
VEHICLE BODY REPAIR

PHASE 2

Module 2

UNIT: 4

Lead Loading
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Introduction

Lead Loading

Body soldering, or lead loading as it is sometimes termed, has become a general practice where, due to the structured design of the all-steel body, the use of normal panel beating methods of repair using hand tools is not possible. It is ideally used to hide a lapped joint in the construction of a body shell and is very useful to the panel beater repairing a windscreen, door pillars or when a dent or crease is backed by a bracket or is double skinned, which prevents the placing of a dolly behind the panel and beating the section out. Body solder was first used in the motor trade in the mid-thirties and was introduced into the repair industry by the car manufacturers who were using it on the mass production of car bodies. It was during this period that the all-steel body was developed, along with rapid advances in streamlining. To finish a panel in the area of the production welds, which in most cases where lapped joints, body solder was used and found most useful. This method has been continued and today solder filling plays a major part in the finish and repair of the modern car body.
Unit Objective:

Lead Loading

By the end of this unit each apprentice will be able to:

- Select the correct tools and material needed to solder a surface imperfection on a vehicle body section
- Use suitable techniques to prepare the surface for the application of solder
- Apply the solder with the correct amount of overfill
- Restore the panel curvature using filing and sanding techniques
- Prepare surface prior to painting process

Key Learning Points

- Hazards created by the application and sanding of solder
- Solder composition
- Cleaning and tinning techniques
- Solder application techniques
- Filing of solder
- Finishing
- Application of body solder to a motor vehicle
1.0 Lead Loading Health and Safety

1.1 Hazards created by the Application and Sanding of Solder

It is now your statutory obligation to ensure the Health and Safety Regulations are adhered to.

- Health and Safety Regulations require the use of an airline breathing apparatus. A fume extractor must also be used. Gloves must be worn when using or handling lead solder.

- Use applicators of some form when necessary. Do not inhale fumes from heat/flux application.

- Always use Personal Protection Equipment.

- Avoid skin contact at all times with fluxes and lead.

- If skin contact is made wash immediately.

- Wash hands before you eat when lead loading.

- See control of Substances Hazardous to Health.

- Never use a sander to dress and shape solder.

- The use of sanding machine in finishing produces injurious lead dust.

- A fume extractor reduces the risk of adjacent working areas being contaminated and protects the operator.

- It is a requirement of the Health and Safety Regulations that all residual swarf and metal filings must be removed from the work area following body solder dressing operations. In addition, operators must wash their hands.

- Brush, clean and vacuum as necessary around work area and vehicle.
2.0 Selecting the Correct Tools and Material

Selecting the correct tools and materials needed to solder imperfection on a vehicle body section.

*Soldering Tools*

**Figure 1:** Body File

**Figure 2:** Paddle (Hardwood)
3.0 Application of Body Solder to a Motor Vehicle

During the repairs of body damage, some means of reproducing the normal contour of the damaged area is necessary when it cannot be restored by normal panel beating methods. This is a case where body solder can be used to advantage so the area can be filled and then dressed down to a smooth and perfect finish.

Body soldering requirements are soldering blocks, which are usually hardwood blocks shaped to suit the panel being soldered; a suitable grease or light oil which is rubbed on the surface of the blocks to stop them sticking to the solder, resulting in a smoother surface finish (tallow is the optimum substance for this purpose); a sanding machine, files and emery cloth for cleaning purposes prior to tinning the metal for soldering; a welding torch or similar heating appliance which produces a low-temperature flame (if a welding torch is used the flame should be feathered, which means slightly carbonizing, resulting in a soft flame); a quantity of body solder and a suitable tinning paste complete with a tinning brush for ease of application; and a clean rag for rubbing off the tinning paste. The operator must also use a self-contained air-fed mask together with a fume extractor for his own protection and to conform to Health and Safety Regulations. Before commencing work make sure that the appropriate tools and other materials are close to the job and within easy reach, thus avoiding a delay during working operations.
4.0 Techniques to Prepare the Surface for the Application of Solder

Do not overheat the panel as this will damage the plating layer and render it useless. Heat the panel uniformly over the repaired area but take care to avoid heat distortion.

The base metal and solder must not be allowed to cool whilst applying the solder to the panel. This will help to maintain the solder in the correct semi-molten state.

Avoid the tendency to build up an excess of solder material on the repaired area, as this will mean more time spent over shaping and dressing. On the other hand, if too little solder is applied this may result in low spots which will require additional soldering and/or stopping at a later stage. Try to build up the solder until it stands slightly proud of the surface contour and no more than that.

4.1 Filing of Solder

Never use a sander to dress and shape body solder. The correct tool to use is a spring-type body file which should be adjusted to produce a slight clearance at either end when it is laid against the panel.

![Figure 3: Filing of Solder](image)

The file should be worked obliquely across the panel, to prevent the teeth and edges from cutting into the solder and leaving scratches:

![Figure 4: Filing](image)
The step in body soldering is to clean the surface to be soldered to a bright metallic finish. This can be done by using a sanding machine with the right type of sanding disc until the area to be soldered is cleaned to the bare metal. Any small particles of paint which the sander will not remove can be cleaned off by using emery paper and a file; this pre-cleaning is very important, as the tinning paste will not tin the surface unless it is perfectly clean and free from paint. Apply the tinning compound by brushing it over the cleaned section so that an area slightly larger than that to be soldered is covered with tinning paste. Using the welding torch with the flame set in the carbonizing condition, which is slightly feathered and gives a very soft flame, heat the tinning compound until it becomes fluid. Then with a clean rag wipe the tinned area to spread the tinning over the cleaned surface, making sure that every part to be soldered is perfectly clean and completely tinned. An important point at this stage is not to overheat the tinning paste when tinning or the surface will discolor usually blue and the tinning will be burnt; solder will not then adhere to this surface unless it is re-cleaned and tinned again.

Hold the welding torch in one hand and a stick of body solder in the other and play the flame over the tinned section, heating it just sufficiently to cause the tinning to begin to flow. Whilst doing this, hold the stick of body solder near the work and apply the flame over both the tinned area and solder stick so that the melting stage of each coincides. When the end of the solder stick begins to melt, press it against the tinned section, thus causing the quantity of body solder to adhere to the tinned surface of the work. After sufficient solder has been deposited on the surface of the work, select a suitably shaped solder block, which should have previously been greased or dipped in oil or tallow and commence to push the body solder over the damaged section of the panel. From time to time the flame should be played over the solder to keep it in a plastic or moveable state; then, using the solder block, the solder should be moulded to the general contour of the panel. The solder blocks must be kept continually coated with oil or grease to allow them to slide over the surface of the solder whilst it is in a plastic state. This coating also produces a very smooth surface on the face of the area being soldered. It is very important to make sure that the tinned surface is heated to the melting point as the solder is smeared across the area being built up; unless this is done a poor bonding between the solder and the panel will be the result and the solder may fall out.
After the required shape has been formed and the solder built up to a level slightly above the existing panel, the final finish is gained by filing the body solder with a flexible panel file, being careful to ensure that the level does not fall below that of the surrounding area. After filing, the solder can then be rubbed down with emery paper to give a finer surface finish for painting. The sander should never be used for dressing down the solder except as a last resort, because it is too severe and tends to cut deeply and unevenly into the solder. The dust given off from the sander when using body solder is also injurious. When the final shaping and smoothing of the loaded area is complete it is essential to remove all traces of soldering flux, oils and grease which may have been used during the loading operation. If these were not removed they would have a harmful effect when the section is finally spray painted.

4.2 Cleaning and Tinning Techniques

1. Apply solder flux to a clean metal surface and give good adhesion.

![Figure 5: Applying Solder Flux](image)
2. Heat the area treated with flux, melt the flux over the surface and wipe clean with a soft cloth.

![Figure 6: Applying Solder Flux](image)

3. Apply body solder to tinned area, heating the panel and solder uniformly. Apply solder to the panel until it stands slightly proud of the desired contour.

![Figure 7: Solder Application](image)
4. Heat the solder to the point where it will flow easily on the panel surface without any tendency to run off, then press it down firmly and shape it using a hardwood block lubricated with tallow. The solder should be spread carefully and evenly over the entire area to achieve as smooth a finish as possible.

![Figure 8: Solder Application](image)

5. Allow the soldered area to cool down and wipe off all traces of tallow. Shape and dress the soldered area using a flexible body file to match the contour with that of the adjacent panel areas.

![Figure 9: Restore a Panel Curvature using a Flexible File](image)
Commence operation

1. Apply solder flux

2. Heat the area treated with flux, melt the flux over the surface and wipe clean with a soft cloth.

3. Apply body solder to tinned area leaving slightly proud of desired contour.

4. Shape lead load with a body file to match the surrounding body panel contour.
When applying lead solder, use **Grade ‘G’ (BS219:1977)** where possible. This allows a heat range sufficient to make the material plastic enough to be worked while ensuring that the flux is burnt off.

### 4.3 Solder Composition

Body solder consists of 68.5% lead, 1.5 % antimony and 30% tin. The solder has the following characteristics:

- It must remain plastic over a large temperature range, so that it stays workable from 183°C to 226°C.
- It must wipe with the solder stick and not crumble, thus providing a clean surface finish.
- The lead and tin must not separate, as it is worked in vertical or overhead positions.
- Melting point of tin is 232°C.
- It must be capable of being reheated and reworked without forming hard spots.
5.0 Prepare Surface Prior to Painting

5.1 Finishing

The soldered area must now be wiped with a suitable solvent in order to neutralise the flux residue and prevent surface oxidation on the bare steel.

To prevent the formation of surface oxidation on thin sheet steel, use a semi-corrosive flux. Disperse the corrosive residues formed after burning off the flux using a solution of sodium dichromate, allowing the work surface to cool to ambient temperature first. Sodium dichromate has excellent wetting properties and may also be used for weld cleaning and the removal of oxides. Do not use organic solvents for the removal of flux residues, as they will not purge the residues sufficiently to prevent corrosion. Should it be necessary to use an alternative to sodium dichromate a suitable proprietary flux neutraliser may be applied – see Thatcham Newsletter No.TL348 ‘The Selection of Fluxes and Lead’ (February 1987)

Wipe soldered area thoroughly and carry out visual check on its shape and surface appearance.
Summary

Body soldering is still the most widely used method of achieving a professional surface finish on motor vehicle bodywork today and is perfectly satisfactory provided that the Health and Safety Regulations governing its use are followed. It should be borne in mind, however, that the use of lead soldering nowadays tends to be limited by the construction of modern motor vehicles as some panels can be easily distorted by heat. Where such doubts exist it is advisable to use cold polyester filler as an alternative.

- Health and Safety Regulations require the use of an airline breathing apparatus.
- A fume extractor must also be used.
- Gloves must be worn when using or handling lead solder.
Self Assessment

Questions – Module 2. Unit 4

1. What is the composition of body solder?

2. What is the composition of the solder paste?

3. Why must all traces of soldering flux, oil and grease used during the lead loading operation be removed?

4. What is the most important pieces of PPE to be worn?

5. What is the melting point of tin?
6. Why is flux required in the soldering operations?

7. What is the paddle for body soldering made of?

8. What is the plastic temperature range of body solder?

9. What type of flame is required for soldering?

10. What P.P.E is required?
**Answers to Questions 1-10. Module 2. Unit 4**

1.  
   - 68.5% Lead  
   - 1.5% Antimony  
   - 30% Tin

2.  
   Zinc in hydrochloric acid.

3.  
   To ensure good paint adhesion.

4.  
   - Air fed mask  
   - Fume extraction  
   - Gloves

5.  
   232 °C
6. To clean the metal surface to allow good adhesion.

7. Hardwood (e.g. Teak)

8. 183°C - 226°C

9. Soft white flame

10. • Fume extraction
    • Air fed mask
    • Gloves
    • P.P.E
Suggested Exercise

Exercise – Lead Loading

Instructions:

- Prepare and thin the surface
- Apply the solder
- Solder the dent and allow to cool
- File to correct profile
- Finish using hand sanding process

Tools and Materials:

- Safety Equipment
- Grinder and discs
- Vacuum sander
- Body file
- Various grades of sandpaper
- Hardwood stick
- Body solder paint brush
- Lubricating material and wiping cloth
- Heat source

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Standards: Large enough area cleaned for tinning. Area tinned correctly. Area filled correctly. Contour correct. No file or scratch marks.

Training Resources

- Classroom/workshop
- Safety equipment
- Grinder and discs
- Various grades of sandpaper
- Hardwood stick
- Body solder
- Solder paint
- Brush
- Wiping cloth
- Lubricating material
- Heating source
27-33 Upper Baggot Street
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