

# TRADE OF VEHICLE BODY REPAIR

PHASE 2

---

**Module 2**

---

UNIT: 5

## Body Fillers



*Produced by*

**SOLAS**

An tSeirbhís Oideachais Leanúnaigh agus Scileanna  
Further Education and Training Authority

*In cooperation with subject matter expert:*

**Maurice Stack**

*Some material courtesy of CDX Global and  
FENC – Further Education National Consortium.*

**© SOLAS 2014**

# Table of Contents

<b>Introduction</b>	
Body Fillers.....	
<b>Unit Objective</b> .....	1
Body Fillers.....	1
<b>1.0 Health and Safety</b> .....	2
1.1 Hazards created by the Application and Sanding Processes.....	2
<b>2.0 Points of Interest</b> .....	3
<b>3.0 Selecting Suitable Tools and Materials</b> .....	5
3.1 Filler Dispensers.....	5
3.2 Hand Sanding Blocks .....	6
3.3 Random Orbital Sanders (Air/Electric).....	7
3.4 Body Fillers .....	7
<b>4.0 Body Filler Techniques</b> .....	8
<b>5.0 Preparing a Damaged Body Panel for the Application of Plastic Filler</b> ..	9
5.1 Panel Substrate Treatment.....	9
5.2 Mixing .....	11
5.3 Application .....	13
5.4 Pinholes.....	16
<b>6.0 Sanding the Filler to the Correct Contour</b> .....	18
6.1 Sanding and Filing Techniques .....	18
6.2 Orbital Action Sander .....	19
6.3 Hand Block .....	21
<b>7.0 Preparing Surface Prior to Painting Process</b> .....	24
7.1 Surface Contour Assessment Technique .....	24

7.2 Thermo Plastic Panels .....	25
7.3 Fibreglass Repairs.....	25
7.4 Repairs to Composite Panels .....	25
<b>Summary</b> .....	26
<b>Self Assessment</b> .....	27
<b>Suggested Exercise - Exercise – Body Filler</b> .....	
<b>Training Resources</b>	

# Table of Figures

Figure 1: Body File.....	6
Figure 2: Dressing Body Filler.....	6
Figure 3: Panel Substrate Treatment .....	9
Figure 4: Panel Substrate Treatment .....	9
Figure 5: Filler Preparation.....	10
Figure 6: Degreasing the surface .....	10
Figure 7: Mixing .....	11
Figure 8: Mixing .....	12
Figure 9: Spatula Movement .....	12
Figure 10: Best Holding Methods .....	13
Figure 11: Correct Application of Filler.....	16
Figure 12: Pinholes .....	16
Figure 13: Filing Technique .....	18
Figure 14: Orbital Action Sander .....	19
Figure 15: Sanding with an Orbital Action Sander .....	20
Figure 16: Sanding Block.....	21
Figure 17: Sanding Direction .....	21
Figure 18: Sanding with a Hand Block.....	21
Figure 19: Using a Sanding Block .....	22
Figure 20: Unblocking Clogged Sandpaper.....	22
Figure 21: Low Spots .....	23
Figure 22, 23: High Spots .....	23
Figure 24: Use of a 'Guide Coat'.....	24

# Introduction

## *Body Fillers*

Although body soldering still provides the best quality of filling for a repair, there are cases where an alternative method is required. Much research on this matter has led to the development of plastic fillers which would come up to the standard of body solder. They are based on the polyester group of thermosetting resins and require catalyst or activator to cure them. The fillers obtainable are of a duo-pack type containing paste and hardener. When they are mixed together a catalytic action takes place, resulting in the filler hardening very quickly. As this plastic filler does not require heat during its application it has certain clear advantages, its use eliminates fire risk, especially when filling next to petrol tanks or any inflammable material. It also eliminates the problem of heat distortion which can occur when solder filling flat body panels. It is cheaper than body solder and much easier to apply. The first of these fillers developed, were released some years ago and many disappointments were associated with their use; problems encountered were poor bonding to panels, too much delay in hardening and too hard to file when dry. Several fillers now available have been vastly improved; they will harden in as short a period as twelve minutes provided the quantities are correct and the two chemicals thoroughly mixed. These fillers have excellent bonding qualities and will feather out to a fine smooth edge. They are also lightweight; this is a good property as it does not add extra weight to the vehicle.

### **Note:**

The application of polyester fillers (or stoppers) is an essential step in most body repair jobs, as without these materials it would be almost impossible to attain the blemish-free surface essential for modern refinishing paints.

## Unit Objective:

### *Body Fillers*

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

- Select suitable tools and materials
- Prepare damaged body panel for the application of plastic filler
- Apply filler correctly
- Sand filler to the correct contour
- Preparing surface prior to the painting process

#### ***Key Learning Points:***

- Hazards created by the application and sanding processes
- Plastic filler and its properties
- Application
- Sanding and filing techniques
- Surface contour assessment techniques
- Fibreglass repairs
- Thermo plastic panels
- Repairs to composite panels

# 1.0 Health and Safety

## *1.1 Hazards created by the Application and Sanding Processes*



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

- The inhalation of filler dust is dangerous to your health, so always wear a particle (dust) mask approved to British Standards or equivalent, and use a sander with a dust collection attachment.
- Face mask and goggles must be worn.
- Never use a sander to dress and shape solder.
- A preparation bay is a very handy way of controlling the spread of filler dust.



## 2.0 Points of Interest

The purpose of body fillers is to restore the body contour and provide a smooth surface ready for priming. Careful dressing is therefore critical at this stage.

It is important to assess the situation before using fillers and stoppers. As a rule of thumb, it is necessary to fill dents of more than 3mm they should be filled first using a suitable two-component filler and then covered with a coat of poly-stopper (cellulose stopper) for the best finish. Before the application of filler, the panel should be planished and filed to remove any minor distortion or surface blemishes.

Do not apply a thick layer of filler all at once. It is better to spread several thinner layers one top of the other until the desired thickness is reached. An over-thick layer will tend to create air pockets and pores.

### Curing

Body fillers harden rapidly, but it should be noted that curing (hardening) times will be affected by ambient temperature, as shown in the following table:

Temperature	Curing Time
Approx. 20 deg. C air temperature	20-30 mins. approx
Heating by infra-red lamps	3-10 mins. approx

Polyester filler cures by an exothermic reaction and will become increasingly hot during the curing time. When fully cured, the filler will be cool and will no longer feel sticky to the touch.

**Note:** Caution must be exercised when force drying filler to accelerate curing time. Sudden increases in temperature or the use of a very high temperature can cause the filler to crack or peel.

Do not place heater closer than 18" to surface. Once the filler has started to become warm the curing no longer requires further external heat.

Where the humidity reading is high (such as on a cold, damp day) heat the panel surface with an infra-red lamp or heater to evaporate any moisture, as this could cause rust to develop between the filler and base metal. In low ambient temperatures the panel should be warmed to approximately 20°C or 68°F to improve adhesion and accelerate the curing time.



**Always use a particle mask and use dust extractors when using power tools**

## 3.0 Selecting Suitable Tools and Materials

### *3.1 Filler Dispensers*

Filler materials can be dispensed either from wall mounted, air operated filler dispensers or from portable dispensers. These dispensers take a 10kg tin of polyester filler together with a matching cartridge of benzoyl peroxide hardener.

Portable dispensers offer the user the advantage of being able to take the filler from repair to repair or from workshop to paint shop. Unless the body shop is very large it would be cost effective to have many large wall mounted dispensers and the portable dispenser offers a viable alternative.

The portable dispenser is operated by pushing the handle down; the filler is then extruded together with the correct amount of hardener for quantity of filler. With most filler this is normally 2 per cent by weight. Using a dispenser ensures that the correct proportion is added, making it impossible to over-catalyse the filler and thus eliminating or very much reducing the possibility of spoilt paintwork. With over catalysed filler there is the risk, particularly with metallic paints, of the repaired area showing through owing to the action of the peroxide in the hardener bleaching the paint. Another major advantage of using filler dispensers is that the filler is kept clean and uncontaminated from the beginning to the end of the tin because there is no need to replace the lid every time the filler is used. This is a feat which is commonly accepted impossible in most body shops owing to the rim of the tin becoming off, or simply owing to forgetfulness even with the lid being replaced every time the filler is used, there is exposure to air and therefore a tendency for the filler to lose its styrene content and thus to become stiffer and less spreadable.

### 3.2 Hand Sanding Blocks

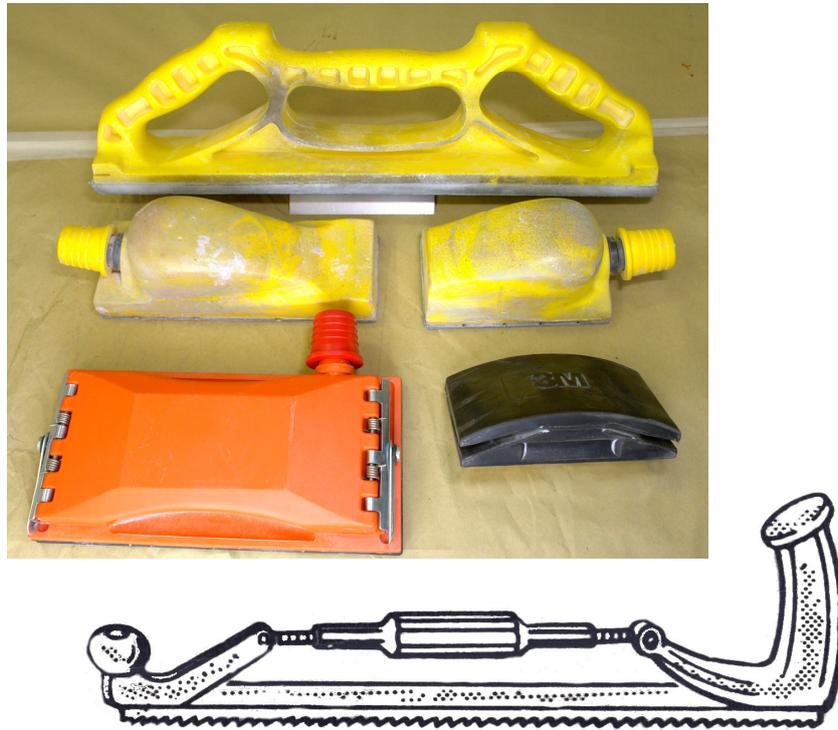


Figure 1: Body File

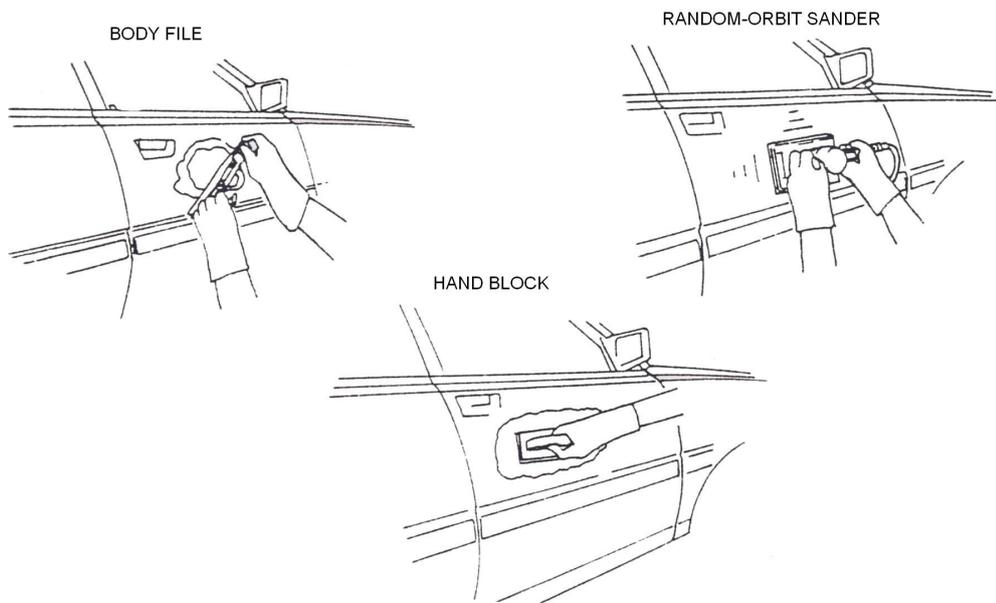


Figure 2: Dressing Body Filler

### 3.3 Random Orbital Sanders (Air/Electric)



#### Round sanders



#### Rectangular sanders

### 3.4 Body Fillers





To mix and apply: Filler is mixed with approximately 1-2% of benzoyl peroxide hardener depending on manufacturer.



## 4.0 Body Filler Techniques

The technique of repair using this plastic filler is carried out by first roughing out the damaged area to as near the original shape as possible, or, if the area has been patched, by hammering the patch down below the original level of the panel. The area is then ground using a sander to remove all rust and paint present. A coarse-grained sanding disc should be used for this operation as this will provide better adhesion for the plastic filler. Next mix the paste with its hardener on a flat surface using a stopping knife or flexible spatula, making sure that the materials are mixed in accordance with the maker's instructions. The filler can then be applied to the damaged area after making sure that the surface is absolutely clean and free from any trace of oil. If the area to be filled up is deep, make several applications, allowing each layer to dry before adding more filler. After the filler is applied and allowed to set, it can be shaped to the contour of the panel using a plastic filler file with an abrasive paper backing, or sanded using a sander. Plastic filler should never be used over rusted areas without patching the area with new metal so that the filler is applied to a solid base. It should not be used in areas on a panel or body surface which are continually in direct contact with water. Never drill holes in a panel to give the filler a better grip, as the holes will allow water or dampness to work in between the filler and the metal surface, leading eventually to the separation of the filler from the metal surface. The filler should not be applied in any great thickness, especially where excessive vibration occurs, or the surface will crack and fall out. A good standard of finish can be achieved using these plastic fillers if the correct working procedure is adopted.

## 5.0 Preparing a Damaged Body Panel for the Application of Plastic Filler

Before applying cold fillers or stoppers the affected panel area on the vehicle must be prepared. Loose paint, rust, welding flux, oil and dust should be removed before applying the material.

See Manufacturer’s Body Manual if cold filler is to be applied to galvanised steel panels.

### 5.1 Panel Substrate Treatment

1. Remove existing paint film and rust using 80 grit paper exposing an area 5-10cm wider than the area to be repaired, failure to remove paint film or rust may cause filler adhesion failure.

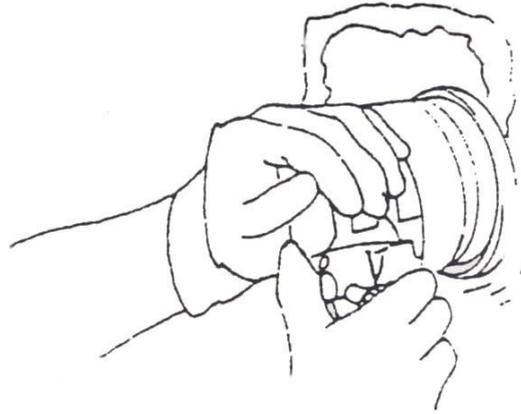


**Figure 3:** Panel Substrate Treatment

2. Feather edge remaining paint film edge with 120 grit paper to create a gentle slope to which filler are merged to avoid ‘mapping’ lines showing under final paint film.



**Figure 4:** Panel Substrate Treatment



Feathering off edge of paint layer during filler preparation

### Figure 5: Filler Preparation

3. Clean and degrease sanded area to remove sanded particles, oil or silicones which may contaminate surface, (Wipe off degreaser before it dries). Dry with clean cloth. Heat the panel to remove any moisture this gives excellent adhesion.

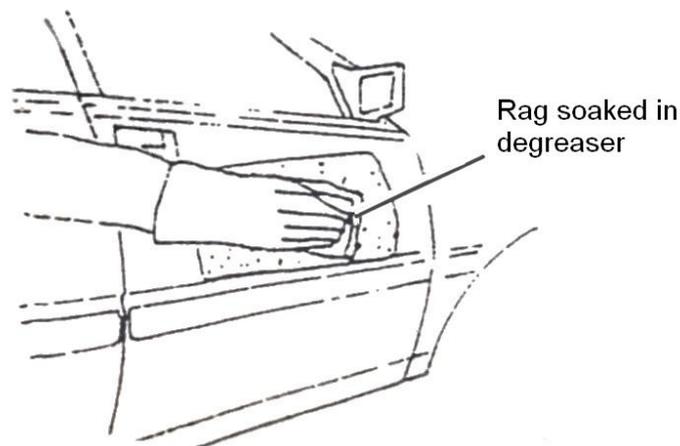


Figure 6: Degreasing the surface



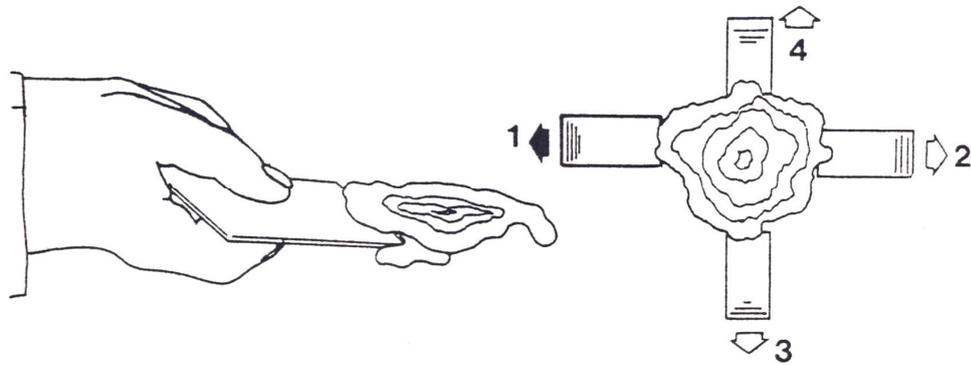
**Always use a Face Mask, Goggles and Dust Extractor**

## 5.2 Mixing

Masking of surrounding areas and trim to avoid accidental scratching and contamination is recommended after the area is prepared for repair.

When mixing polyester filler, always follow the directions on the container, do not add extra hardener to accelerate the curing time or the mixture may harden unevenly. Irregular hardening will also be caused if the two components are not mixed thoroughly.

The mixture should be kneaded with a spatula, working at a steady rate and moving the spatula lengthways and in alternate directions to avoid the build-up of air bubbles.



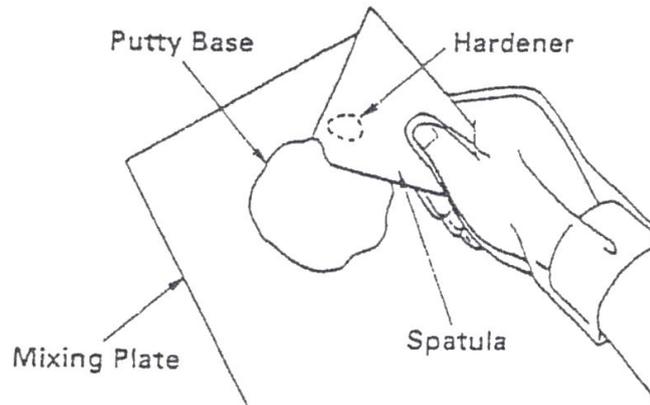
**Figure 7:** Mixing

Mix the hardener and filler/stopper together thoroughly until a uniform colour with no streaks of hardener has been achieved. Apply the mixture with a spatula to the entirety of the panel area to be treated. Always clean filler application tools immediately using cellulose thinners. Use a clean mixing board, preferably made of glass, hard plastic, metal, hard wood etc, (do not use corrugated cardboard) and a clean applicator/spreader blade to mix filler paste at a ratio of 50 parts of paste to 2 parts hardener.



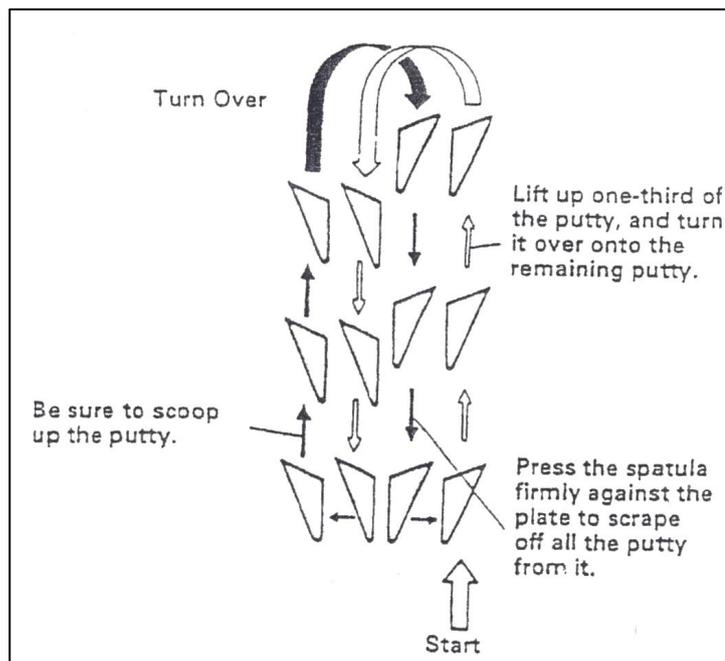
Mix thoroughly until all traces of the yellow hardener are fully blended into the paste. Do not mix more than can be used and applied in four minutes. (Initial curing may start more quickly in hot climates). Larger quantities are hard to mix and take more time. Replace the lid of the body filler to avoid the paste drying out and accidental contamination which may spoil future applications.

- Approximately a golf ball size of filler (from tins) to a pea size of hardener.

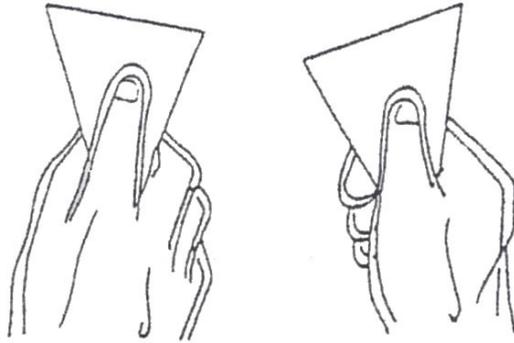


**Figure 8: Mixing**

When using tubes of filler, measure equal lengths of filler paste and hardener paste. Do not mix using a stirring action instead use a folding/blending method as described below, this will avoid excess air being introduced to the paste.



**Figure 9: Spatula Movement**



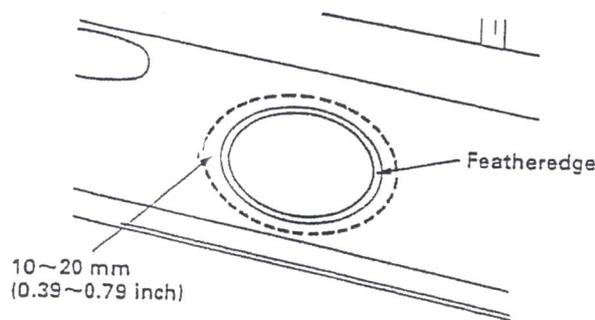
**Figure 10:** Best Holding Methods

**Important:** the mixture starts to react at the moment both components are mixed together. Therefore they must be mixed and applied quickly.

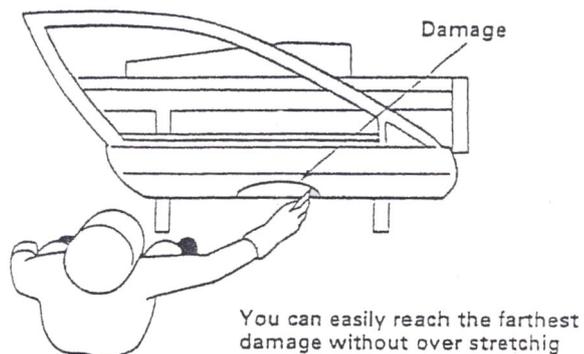
### 5.3 Application

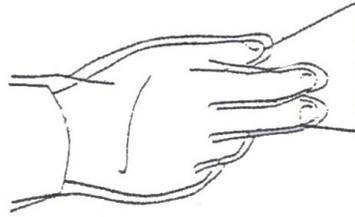
Using a clean metal, plastic or rubber spreader blade, apply a thin layer of mixed filler to the metal surface using a ‘scraping action’, pressing the filler paste into the grooves caused by the initial sanding. Then fill immediately to the required level. The recommended fill level per layer is 3-5mm. if multiple layers are required, sanding between layers is essential.

1. Assess the range of the application area.



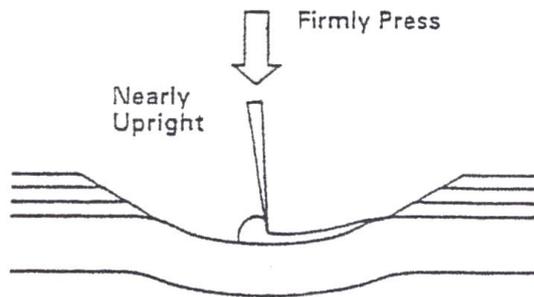
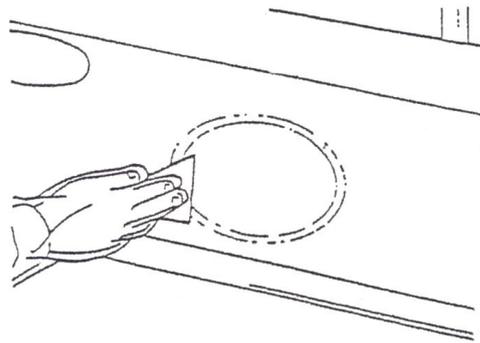
2. Decide your standing position.



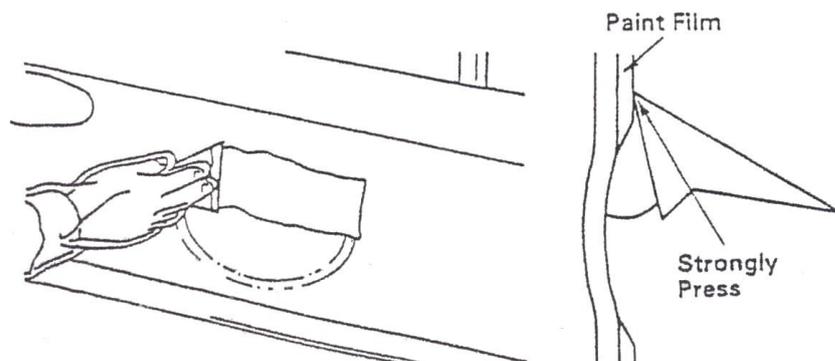


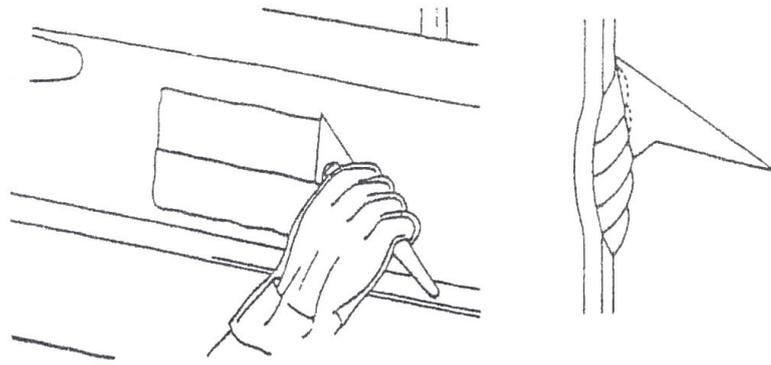
The best holding method is the one shown opposite.

3. Blade coating: this allows the putty to come into firm contact with in the metal surface to prevent air bubbles. Take a small amount of putty on the spatula. Apply the putty to the metal surface and make a thin coat to the entire surface.

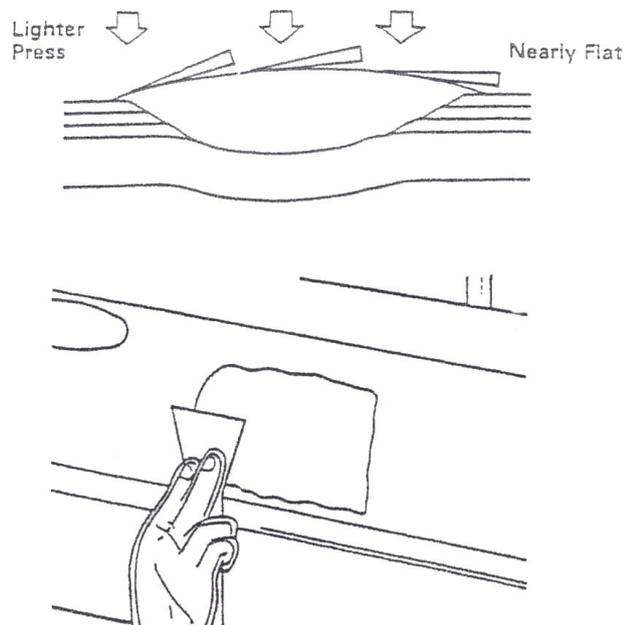


4. Build-up: without trapping any air bubbles putty is built up so that it is eventually higher than the original surface. On the first application, apply putty by scraping the paint along the featheredge.

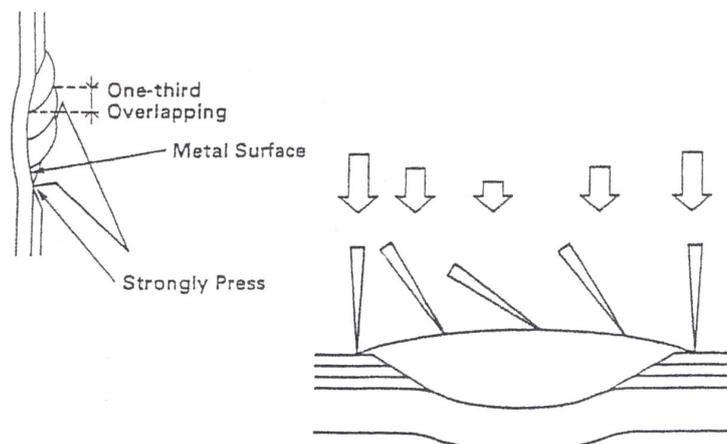




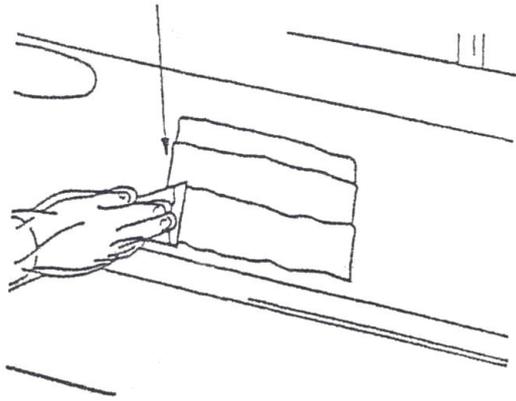
5. Move the spatula in the opposite direction.



6. From the next application, scrape the metal surface while overlapping at least one-third of the previously applied putty.



7. Avoid leaving excess ridges of filler.

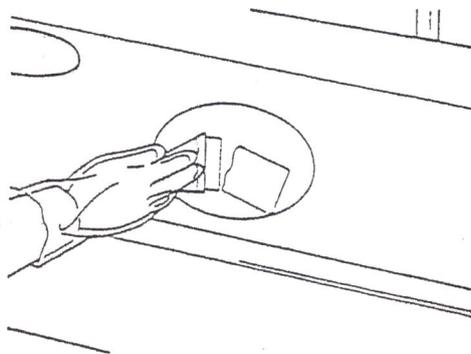
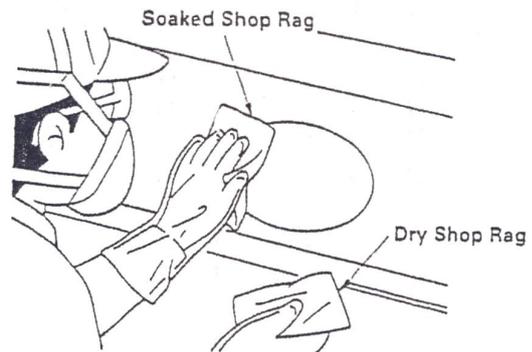


**Figure 11:** Correct Application of Filler

### **5.4 Pinholes**

Small holes in the filler are usually caused by poor mixing and application techniques or poor quality filler paste. These must be removed by a further 'skim coat' application of filler.

If pinholes exist, follow the procedure; degrease the surface and then scrape the putty into the holes.



**Figure 12:** Pinholes

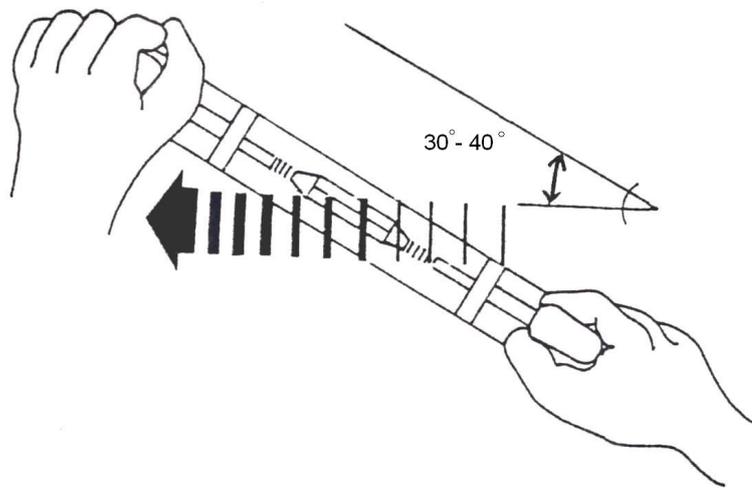
After initial sanding a guide coat film of black aerosol paint applied to the filler will show up imperfections as high or low spots.



## 6.0 Sanding the Filler to the Correct Contour

### 6.1 Sanding and Filing Techniques

After completed curing, initial sanding should be made using a cheese grater - type body file working it outwards and changing direction every few sweeps; that is to say, up-down, left-right, diagonally, etc. the tool should also be held at between 30 and 40 degrees to the direction of movement. This method will help to ensure that the contour matches the body panel as closely as possible.



**Figure 13:** Filing Technique

Progress to 80 grit abrasive on a random orbital, flatbed power sander or by hand, using a rubber based sanding block. Dry sanding is recommended to avoid humidity absorption of the filler, which may cause problems during painting.

Use progressively finer abrasives (120 grit, 180 grit, 240 grit and finally 360 grit) to achieve the perfect finish ready for spraying.

Vacuum extraction sanding equipment is ideal to use in conjunction with body fillers.



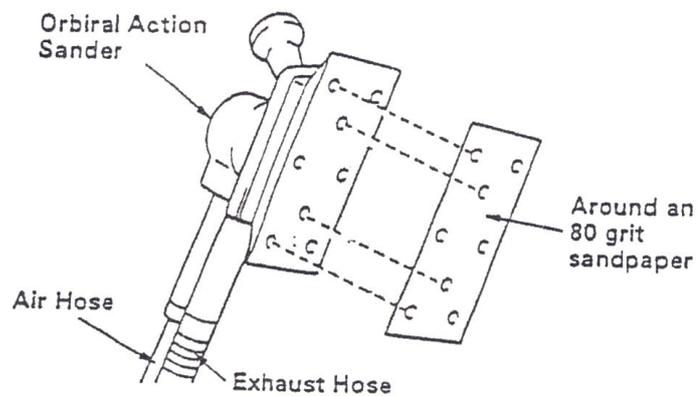


Vacuum sander in use.

## *6.2 Orbital Action Sander*

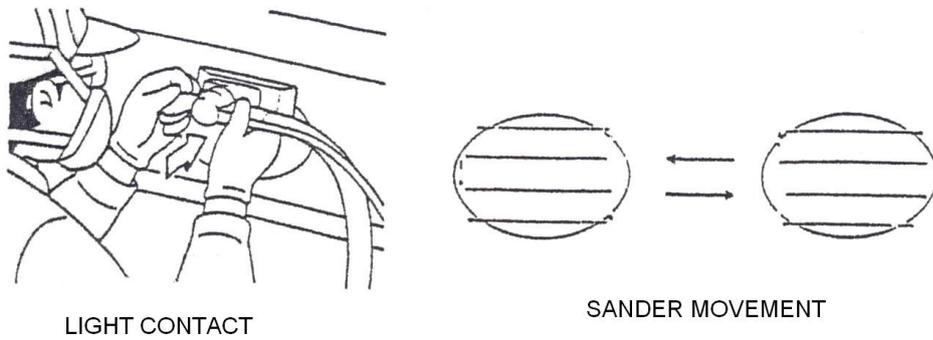
Sanding with an orbital sander:

1. Attach sandpaper to the sander and match the sandpaper onto the holes of the disc.
2. Connect the holes.
3. Adjust the speed of the sander.



**Figure 14:** Orbital Action Sander

4. Sand the putty surface until the entire surface resembles the original surface.



**Figure 15:** Sanding with an Orbital Action Sander

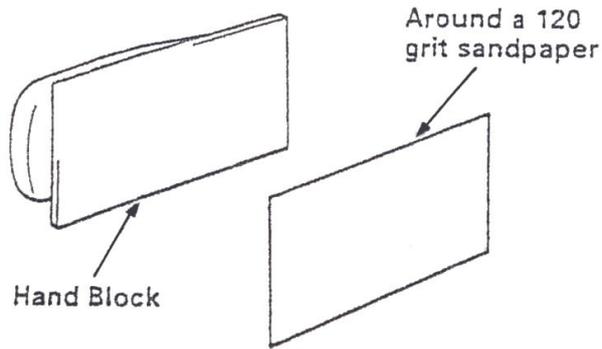
5. Sanding is finished when a thin featheredge can be seen.



### 6.3 Hand Block

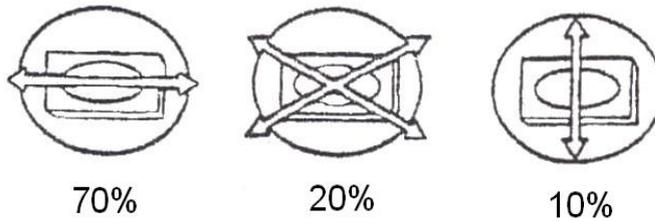
Sanding with a hand block:

1. Attach sandpaper to a hand block.
2. Decide your standing position.



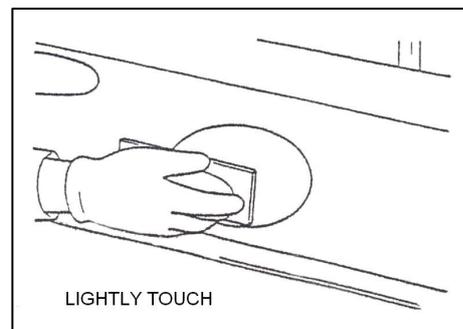
**Figure 16:** Sanding Block

3. Place the hand block on the panel.
4. Sand the putty surface, after some repeat sanding, change sanding direction.



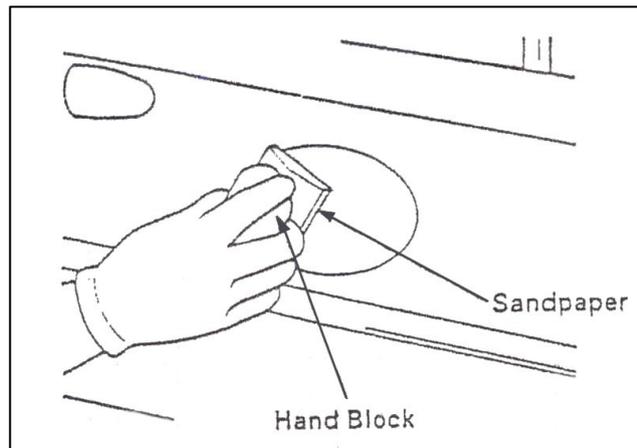
Example of door outer panel

**Figure 17:** Sanding Direction



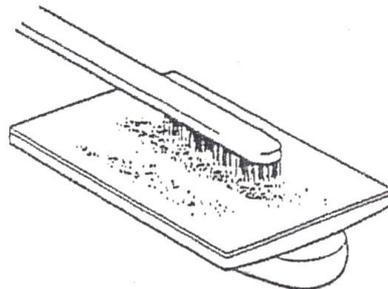
**Figure 18:** Sanding with a Hand Block

5. Clean sand paper regularly to avoid clogging and maintain good sanding conditions.



**Figure 19:** Using a Sanding Block

6. Check whether or not the sanded particles fall down easily. If they still cling to the sandpaper, sanding is impossible.



**Figure 20:** Unblocking Clogged Sandpaper

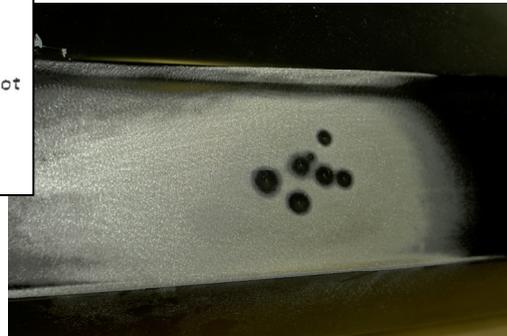
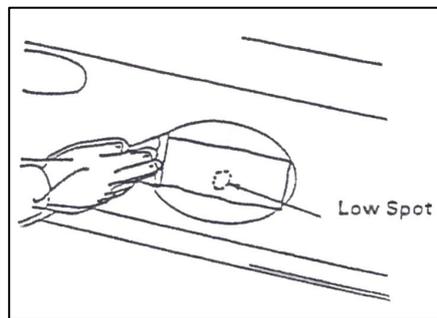


Check the shape and smoothness of the sanded filler. Low spots in the final finish should be cleaned to remove sanded particles and refilled.

### Low Spots

If a low spot is found in the putty surface, follow the procedure below:

- Blow off the sanded particles.
- Degrease the area.
- Fill the low spots with putty.

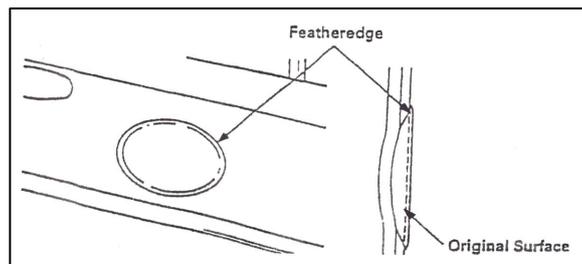
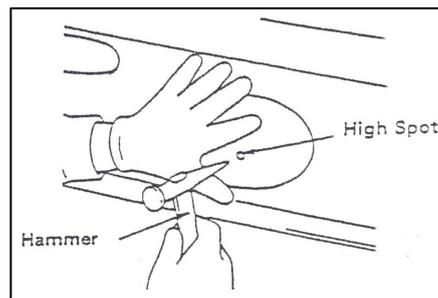


**Figure 21:** Low Spots

### High Spots

If bare metal is found in the applied area, follow the procedure below:

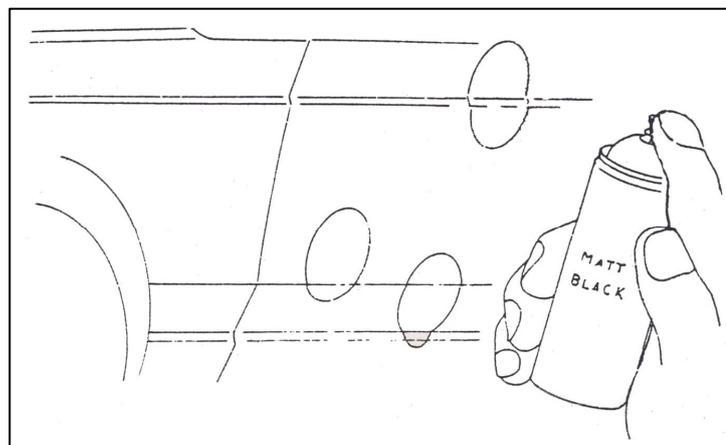
- Hammer the high spot down.
- Remove the putty from around the bare metal.
- Blow off the sanded particles.
- Degrease the area.
- Apply a primer to the area.
- Refill the area with putty.



**Figure 22, 23:** High Spots

## 7.0 Preparing Surface Prior to Painting Process

Once the filler has been roughly shaped with hand tools a final inspection of the filled area should be made before passing the vehicle onto the paint shop, as any pinholes or other minor blemishes will become visible beneath the top paint coats. The inspection should be carried out by application of the 'guide coat' of matt black aerosol spray over the repaired area. This is then rubbed down by hand using a very fine grit paper and block to highlight any blemishes, which should be treated with stopper.



**Figure 24:** Use of a 'Guide Coat'

### 7.1 Surface Contour Assessment Technique

- Touch
- Vision
- By straight edge



This picture demonstrates the effect of a pinhole in the filler and the finish coat.

Apply primer according to manufacturer's recommendations.

## 7.2 Thermo Plastic Panels

These are panels that may be welded and repaired with plastic fillers or fibreglass.

## 7.3 Fibreglass Repairs

Fibreglass repairs are very popular when repairing body kits and fibreglass panels such as rally car panels.

## 7.4 Repairs to Composite Panels

Some sport cars are made from composite panels, for example Ferrari and Lotus. This means that large sections are made of fibreglass or glass reinforced plastic.



Dust extraction



**Wear a particle mask and use dust extractors on power tools.**

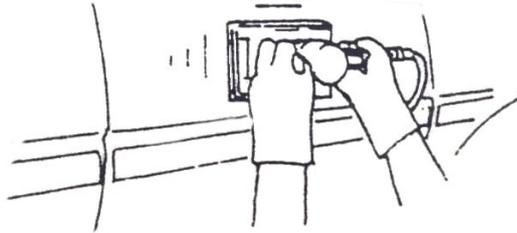
## Summary

Plastic filler should never be used over rusted areas without patching the area with new metal so that the filler is applied to a solid base. It should not be used in areas on a panel or body surface which are continually in direct contact with water. Never drill holes in a panel to give the filler a better grip, as the holes will allow water or dampness to work in between the filler and the metal surface, leading eventually to the separation of filler from the metal surface. The filler should not be applied in any great thickness, especially where excessive vibration occurs, or the surface will crack and fall out. A good standard of finish can be achieved using these plastic fillers if the correct working procedure is adopted.

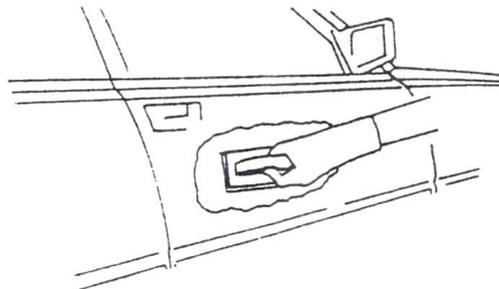
## Self Assessment

### *Questions – Module 2. unit 5*

1. What type of sander is being used in the diagram below?



2. What type of sander is being used in the diagram below?



3. What is the best quality of filling for a repair?

4. What reaction takes place during filler curing?

5. Can filler be applied over rust?

6. What must be removed before applying filler?

7. What percentage of hardener goes into filler?

8. Why is it important to apply filler in stages?

9. What can be used to highlight pin holes?

**10.** What safety equipment is required for the filler operation?

*Answers to Questions 1-10. Module 2. Unit 5*

1.

Electric random orbital sander

2.

Hand block

3.

Body solder

4.

Exothermic reaction

5.

No, replace rust with a metal patch.

6.

Paint and loose material

7.

50 parts filler to 2 parts hardener.

e.g. Golf ball to a pea

8.

Because to avoid air pockets and pores

9.

Guide coat

10.

Dust particle mask and P.P.E

# Suggested Exercise

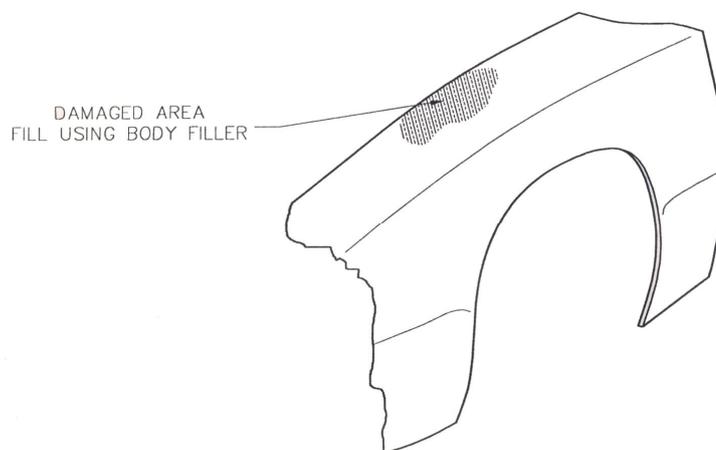
## *Exercise – Body Filler*

### Instructions:

- Select and name tools and materials
- Prepare damaged area of body panel
- Mix and apply body filler, file and sand to correct contour of panel

### Tools and Materials:

- Safety Equipment
- Grinder
- Vacuum sander
- Tool kit
- Various grades of sandpaper
- Body fillers
- Spatula
- Damaged body panel



Dimensions	Gen. tol.	Scale	Material
mm		nts	
<b>BODY FILLER</b>			
SOLAS	Phase 2. Mod 2. Practice		

**Standards:** Correct tool and material selected. Safety standards applied. Damaged area cleaned correctly. Components of body filler mixed correctly. Correct application. Correct contour achieved. No file or scratch marks or pin holes.

# Training Resources

- Classroom/workshop
- Safety equipment
- Grinder
- Tool kit
- Vacuum sander
- Various grades of sandpaper
- Damaged panel
- Polyester filler mixing tray
- spatula

SOLAS

An tSeirbhís Oideachais Leanúnaigh agus Scileanna  
Further Education and Training Authority

*27-33 Upper Baggot Street  
Dublin 4*