2.1 **AUTOMOTIVE REFRESHING MATERIALS**

Function of Automobile paint materials

Function nomenclature	Primary Objective	Use and Feature
Primer	Adhesion and anticorrosion	Apply directly to panel surface
Primer surface	Adhesion anticorrosion and smoothness	Intermediate b/n primer and surface. Applied to metal surface or over primer
Putty	Filler	To smooth out rough spots
Sealer	Prevent absorption of topcoat	Intermediate b/n surface and topcoat
Top coat	Upgrades external appearance	Gives color, gloss, and body to help upgrade merchandizing valve

Use of three major types of putties and body fillers.

	Body filler	*Polyester putty*	*Lacquer putty*
Primary use	Used to smooth out large depression and fill in scratches	Used to fill holes in body filler and sand paper scratches in the metal	Used to cover pinholes and small scratches after application of primer surface, and to fill in small scratches in the old paint film
Maximum film thickness per application	Below ¼"	Below 1/8"	Below 1/6"

In summery, the selection of one or more undercoats will be determined by the following characteristics of a job

- Type of surface bare metal or previously finished
- Condition of that surface repaired area or sanded aged finish

2.2 REFINISHING EQUIPMENT AND ITS USE

Spray painting equipment for the auto refinishing shop consists of :

- Spray guns and cups (either suction or pressure feed)
- Air compressor of adequate size
- Oil and water extractor and air regulator combination to filer air and regulate pressure
- Air hose of sufficient size(inside diameter) to convey air from the regulator to the spray gun without causing an excessive drop in pressure

- Spray both or enclosure to ensure a healthy, safe, dust free working area.

SPRAY GUNS

ATOMIZASTION AND THE SPRAY GUN

An air spray gun can be defined as a tool that turns a liquid in to tiny droplets by means of air pressure. This process is called atomisation. A through understanding of atomisation is the key to using a spray gun correctly. Atomisation breaks pain into a spray of tiny, uniform droplets. When properly applied to the auto's surface, this tiny drop less will flow together to create an even film thickness with a mirror-like gloss

Atomisation takes place in three basic stages

- In the first stage, the paint siphoned from the find tip is immediately surrounded by air streaming from the annular ring. This turbulence begins the break up of the paint
- The second stage of atomisation occurs when the paint stream is hit with jets of air from the containment holes. These air jets keep the paint stream from getting out control and aid the break up of the paint
- In the third of atomisation, the paint is struck by jets of air from the air cap horns. These are streams hit the paint from opposite sides, causing the paint to form in to a fan-shaped spray

PRINCIPAL PARTS OF SPRAY GUN

The principal parts or components of a typical air spray gun are illustrated in Figure 17-4. Some guns are equipped with a removal spray head unit containing the air cap, fluid tip, and fluid needle.

- Air cap or nozzle
- Fluid tip or nozzle
- Fluid needle valve
- Trigger
- Fluid control (or spreader) knob
- Air valve
- Pattern (or fan adjustment)control knob
- Gun body (or handle

The air cap directs the compressed air into the material stream to atomize it and form the spray pattern. There are three types of orifices (holes). The center orifices, the side orifices or ports, and the auxiliary orifices. Each of the orifices has a different function. The center orifice located at the nozzle tip creates a vacuum for the discharge of the paint, The side orifices determine the spray pattern by means the ability to atomize more material for painting large objects with great speed. Fewer or smaller orifices usually required less air, produce smaller spray patterns, and deliver less material to conveniently paint smaller objects or apply coatings at lower speeds.

Air also flows through the two side orifices in horns of the air cap. This flow forms the shape of the spray pattern. When the pattern control valve is closed, the spray pattern is round. As the valve is opened, the spray becomes more oblong in shape.

The fluid needle valve and the fluid tip meter direct the flow of material from the gun into the air stream. The fluid tip forms an internal seat for the fluid needle that shuts off the flow of material. The amount of material that actually leaves the front of the gun depends on the size of the fluid tip opening provided when the needle is unseated from the tip. Fluid tips are available in a barite of sizes to properly handle materials of various types and viscosities and pass the required volume of material to the cap for different away from its seat in the nozzle when the trigger is pulled.

The air valve, like the fluid valve is opened by moving the tigger. When the trigger is pulled partway, the air valve opens. When its pulled a little farther, the fluid valve opens.

TYPES OF AIR SPRAY GUNS

As pointed out in table 17-1, there are three basic methods of paint supply or feed to the air spray gun (Figure 17-7)

- Suction (or siphon) feed type (Figure 17-8A)
- Compression feed type (Figure 17-8B)
- Gravity feed type (Figure 17-8C)

The suction feed type air spray gun is by far the most used type in auto paint shops. The paint material

Table 17-1 YPES OF AIR SPRAY GUNS

TYPE	PAINT FEED METHOD	ADVANTAGES	DISADVANTAGES
Suction feed type	Paint container is installed below the spray nozzle and paint is supplied by suction force alone	Stable gun operation, Easy to refill container or make color changes	Difficult to spray on horizontal surfaces and some variations occur in discharge volume due to variations in viscosity. Has a larger paint container than gravity feed type but this causes quicker painter fatigue.
Pressure type	Paint is pressurized by a compressed air taken or pump	Large surface can be paint without stopping to refill container or make color changes	Not suitable for small area painting. Color changes and gun cleaning take time
Gravity feed type	As the paint cup is installed above the spray nozzle, paint is supplied by gravity and a suction force at the nozzle yip.	Because there is no change in paint viscosity, there is no variation in the injection volume.	Because the cup is installed above the injection nozzle, it adversely affects gun stability. Cup capacity is small so not useful for painting larger surface

		The position of the cut can be changed according to the configuration of the painted item	

Is held a quart cup attached to the gun. When the spray gun trigger is partially depressed, the air valve opens and air rushes through the gun. As the air passes through the openings in the air cap, a partial vacuum is created at the fluid tip (Figure 17-9A). Further squeezing of the trigger withdraws the fluid needle from the fluid tip. The vacuum sucks paint from the cup, up the fluid inlet, and out through the open fluid tip. Air enters through the air hole and replaces the siphoned paint (Figure 17-9B). The inlet air vent holes in the cup lid must be open.

The suction feed equipment (Figure 17-10) is hooked up for operation as follow:

- Connect air line from the compressor outlet to the air control device inlet.
- Connect air hose leading from the air outlet on the air control device to the air inlet on the spray gun
- After the material has been reduced to proper consistency, thoroughly mixed, and strained into the cup, attach the gun to the cup

In the gravity feed system, the paint is supplied by gravity and the material is suction forced at the nozzle tip. This system is ideal for heavier material such as lightweight body filler. The handling of the gun is the same as a suction feed type gun.

The suction feed gun is by far the most popular type of gun is by far the most popular type of gun in auto refinishing shapes for all types of work (spot, panel and overall). The pressure feed gun is mainly used for overall painting of vehicles (including trucks and vans), for spraying some heavier refinishing material that are too heavy to be siphoned from a container, or where volume painting is required. Although gravity feed guns can be used for base coat/clear coat work, they are employed to spray undercoat refinishing material such as primers and sealers, as well as some lighter body putties and fillers. Gravity feed guns are specially good for those European and Japanese finishes that are formulated for these types of guns.

SPRAYING TECHNIQUES

There are several variables contributing to the quality of the spray finish including spraying material viscosity, spray booth temperature, film thickness, and spray practice.

SPRAYING MATERIAL VISCOSITY

When preparing material for spraying, thin to the proper viscosity according to the directories on the can, using the thinner or reducer best suited.

Table:
SPRAYING VISCOSITY

Material	***Reduction***	***Viscosity***
Acrylic enamel	30 (1/3)%	19 seconds (19")
Acrylic enamel	50%	18 seconds (18")
Acrylic lacquer	150%	15 seconds

REDUCTION RATIO GUIDE

Reduction percentage	*Mixing Ratio*	*Paint material*	*Solvent materials*
25	4:1	4 parts	1 part
33	3:1	3 parts	1 part
50	2:1	2 parts	1 part
75	4:3	4 parts	3 parts
100	1:1	1 parts	1 part
125	4:5	4 parts	4 parts
150	2:3	2 parts	2 parts

FILM THICKNESS

The amount of material sprayed on a surface with one stroke of the gun will depend on:

Width of far,
Distance from gun,
Air pressure at the gun
Amount of reduction.
Speed of stroke

ADJUSTING THE SPRAY (For suction feed spray gun)

A good spray pattern depends on the proper mixture of air and paint droplets much like a fine tuned engine depends on the proper mixture of air and gasoline. There are three basic adjustments, which under normal conditions will give the proper spray pattern, degree of wetness, and air pressure for suction feed guns.

1. Adjust the air pressure to the specification indicated on the paint can
2. Set the size of the spray pattern using the fan adjustment or pattern control knob
3. Set the fluid control knob to regulate the amount of paint according to the selected pattern size: backing the knob out increases the paint flow turning the knob decreases paint flow.

TESTINBG THE SPRAY PATTERN

After setting the air pressure, the fan size, and the fluid flow, test the spray pattern on a piece of masking paper or newspaper.

Hold the gun 6 to 8 inches away from the paper if spraying lacquer and 8 to 10 inches for enamel. Pull the trigger all the way back and release it immediately. This burst of paint should leave a long, slender pattern on the last paper.

Turn the pattern control knob in until the spray pattern is 6 to 8 inches high

For spot repair, the pattern should be about 5 to 6 inches from top to bottom. For paper or overall repair the length of the pattern should be 9 inches from top to bottom.

The Application Stroke

The proper stroke is most important is obtaining a good refinishing job. To obtain a good stroke, proceed as follow:

1. Hold the spray gun at the proper distance from the surface
   Short- the high velocity air tends to ripple wet film
   Long- A greater percent of thinner evaporated (dry film result), loss of material
2. Hold the gun level and perpendicular to the surface, otherwise uneven paint film will result
3. Do not fan the sun and do not use wrist motions if a uniform film is desired. The only time it is permissible to fan the gun is on a small spot spray where the paint film at the edges of the spot should be thinner than the center portion
4. move the gun with a steady deliberate pass, about 1 foot per second. Moving the gun too fast will produce a thin film, while moving it too slowly will result in the paint running.
5. Release the tiger at the end of each pass
6. Difficult areas such as corners and edges should be sprayed first
7. Generally, start at the top un upright surface such as a door panel. The spray gun nozzle should be level with the top of the surface, this means that the upper half of the spray pattern will hit the masking
8. The second pass is made in the opposite direction with the nozzle level at the lower edge of the previous pass and the other half is sprayed on the unpainted area.
9. The last pass should be made with the lower half of the spray pattern below the surface being painted
10. The procedure just followed is called a ***Single Coat***. For a double coat, repeat the single coat procedure immediately. Generally, two or more double coats are required to properly a lacquer top coat.

Allow for flash time (the time required for the solvents to evaporate and the finish to dull slightly.) or several minutes between coats.

Two or three single coats are normally required for enamel top coats

GUN HANDLING PROBLEMS

The inexperienced painter is prone to several spraying errors including:

- ***Heeling***:- This occurs when the painter allows the gun to tilt because the gun is no longer
  Perpendicular to the surface, the spray produces an uneven layer of paint, excessive over spray, dry spray

- ***Arcing:-*** This occurs when the gun is not moved parallel with the Surface the result is uneven film build up
- ***Speed of stroke***: If the stoke is made too quickly, the paint will not cover the surface evenly. If it is made slowly, sags and runs will develop
  The proper stroking speed comes with experience

Improper over lap:Improper overlapping results in uneven film thickness, sags and runs

Improper Leverage:- Triggering at the wrong time (on the near by panel) is another common error

4.8 USE OF BODY FILLERS

4.8.1. BODY SOLDERING

- Body soldering is a general practice to fill dents where the use of normal panel beating methods of repair using hand stools is not possible
- It is used to hide a lapped joint in the construction of a body shell
- It is used to hide welded joints

Composition

Body solder consists of 68.5% lead, 1.5% antimony and 30% tin.

Characteristics

- It must remain plastic over a large temperature range, so that is stays workable
- It must wipe with the solder stick and not crumble, this providing a clean surface finish
- It must be capable of being reheated and reworked without forming hard spots.

Process of body soldering

Materials

- Soldering blocks- which are usually hardwood blocks shaped to suit the panel being soldered
- A suitable grease or light oil which is rubbed on to the surface of the blocks to stop them sticking to the solder, resulting in a smoother surface finish;
- A sanding machine files and sand paper for cleaning purposes prior to tinning the metal for soldering.
- A welding torch or similar heating appliance which produces a low temperature flame (carbonised flame if it is a welding torch)
- 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 timing paste
- Safety clothing for the operator

1. The first step in body soldering is to clean the surface to be soldered to a bright metallic finish

   Use –sanding machine (air sander), file and/ or emery paper (sand paper) and with a metal conditioner

   This pre-cleaning is very important, as the tinning paste will not tin the surface unless it is perfectly clean and free from paint

2. Apply the timing flux compound by brushing it over the cleaned section so that an area slightly larger than that to be soldiered is covered with tinning paste
3. Using the torch, (a medium size welding tip) heat the tinning CPD until it becomes fluid. Then with a clean rag wipe the tinned area to spread the tinning over the cleaned surface. This helps the solder to adhere well to the surface
4. Hold the welding torch in one hand and a stick of body solder in the other and play the flame over the thinned 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 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 a quantity of body solder to adhere to the thinned section, thus causing a quantity of body solder has been deposited on the 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 greases or dipped in oil, 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 movable 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 with out sticking
   - It is very important to make sure that the thinned surface is heated to the melting point as the solder is smeared(spread 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 fallout.

5. After the required shape has been formed and the solder built up to the level slightly above the existing panel, the final finish is gained by filing the body solder with a flexible panel file
6. After filing the solder can then be rubbed down with sand paper (of grit no # 80 or # 100) to give a finer surface finish for painting.
7. When the final shaping and smoothing of the loaded are is complete it is essential to remove all traces of soldering flux, oils, and grease which may have been used during the loading operation.

Warning:- High strength steels used in modern uni-body vehicles are heat sensitive. Do not attempt to fill high strength sheet metal with lead.

→ Tinning fluxes are used to clean microscopic rust particles from bare metal, prevent rust from forming, and promote adhesion of the solder to the sheet metal.

A variety of fluxes is available. Some are acidic; others are non acidic. Muriatic acid is an example of a flux often used in lead repair. The acid is cut or diluted with a zinc bar and applied to the repair area with an acid brush.

4.8.2 Chemically hardening fillers (Plastic Fillers)

These fillers are used in the body repair trade as an alternative method to body soldering.

They are based on the polyester group of thermosetting resins, and require a catalyst or activator to cure them.

- 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 advantage.
  - Its use eliminates fire risk , especially filling its application it tanks or any inflammable materials.
  - It also eliminated the problem of heat distortion which occurs when solder filling
  - It is cheaper than body solder and much easier to apply

Composition:- Plastic body filler is very similar to paint in composition. Both are made of resins, pigments, and solvents Most plastic body fillers have a polyester resin that acts as a binder. When the filler is applied and the solvent evaporates, the binders hold the pigments together in a tough, durable film. The basic pigment or filler in conventional fillers is talc.

Plastic fillers harden by chemical action. The chemical rxn is set off by oxygen. To speed up the process, a chemical catalyst is provided by the manufacturer. The catalyst, in liquid or cream form, is called hardener. Hardener is basically a chemical cpd called peroxide.

As Table below shows, the filler will soon become too stiff to work in just a few minutes after adding hardener, depending on the ambient air temper

Temperature	Working times
100^0F	3 to 4 minutes
85^0F	4 to 5 minutes
77^0F	6 to 7 minutes
70^0F	8 to 9 minutes

Table . Effect of Temperature on working time

Applying Plastic Body Filler

1. Preparing the surface for filling:- wash the repair area to remove dirt. Then clean the area with wax and grease remover.
   Use # 24 or # 36 girt grinding disc to remove the paint and rust

2. Mixing the filler:- Mix the can of filler to a uniform and smooth consistency before use, the filler in the upper portion of the can will be too him. This results in runs and sags in application, slow and poor curing, a summery condition when sanded…

3. Kneading the hardener :- Loosen the cap of the cream hardener tube to prevent the hardener from being or bound.
   - Knead the tube thoroughly to assure a smooth paste like consistency. Like tooth paste when squeezed out.
   - If the cream hardener is not kneaded thoroughly to produce a smooth, paste like consistency or ribbon-effect when squeezed out,
   - The hardener can cause slow and in effective curing
   - Poor adhesion
   - Blistering and peeling after recoating
   - Poor feather edge

4. Mixing filler and hardener
   - Using a clean putty or squeeze, place the filler on a smooth clean, nonporous surface such as sheet metal or glass
   - Add the hardener in the proportion indicated on the can instructions
   - With a clean putty knife or squeeze and using a scraping motion (back and forth). Mix the filler and the hardener together the thoroughly to achieve a uniform color

NOTE:-
   - Too little hardener will result in a soft, gummy filler that will not adhere properly to the metal and will not sand cleanly
   - Too much hardener will produce excessive gases, resulting in rempant pin holding
   - Do not stir while mixing filler and hardener. Stirring whips air into the filler producing air pockets and pinholes in the application
   - Do not return the knife or squeeze or mixed filler to the can

5. Applying Filler
   Apply the mixed filler promptly a thoroughly clean and well- sanded surface. A first tight. Thin application is recommended. Press firmly to force filler into sand scratches to minimize the bond. When cured, apply additional thicker application as needed to build up the repaired area to proper contour.

6. Shaping the filler:- Allow the filler to cure to a semi hard consistency this usually takes 15 to 20 minutes

Filling is perhaps the most important factor in achieve a quality surface and controlling material cost and labor.

The body file (surform file) is used to cut the excess filler to size quickly. Its long length produces an even, level surface. The teeth in the file are open enough to prevent the tool from clogging

- Grinders and sanders do not level well, they become loaded quickly, create too much dust, and waste a lot of sand paper.
- Stop filing when the filer is slightly above the desired level. This will leave sufficient filler for sanding out the file marks and for feathering the edges.
- Sand block with # 40, or 50 or 60 #80-final smoothing should be done using # 180 girt paper until all #80 girt scratches are removed.
- After the final sanding, below off the area with a high pressure air gun and wipe with a take cloth. This removes any fine sanding dust that might be hiding surface pinholes and exposes holes lying just below the surface.

These holes and remaining sand scratches must be filled with PUTTY.

- Run a hand over the surface often the check for evenness
- Do not trust eyeing for accuracy

7. **Applying glazing putty**

Fibreglass fillers :- use fiber glass strands rather than talk
Aluminium fillers:- talk- with aluminium powder

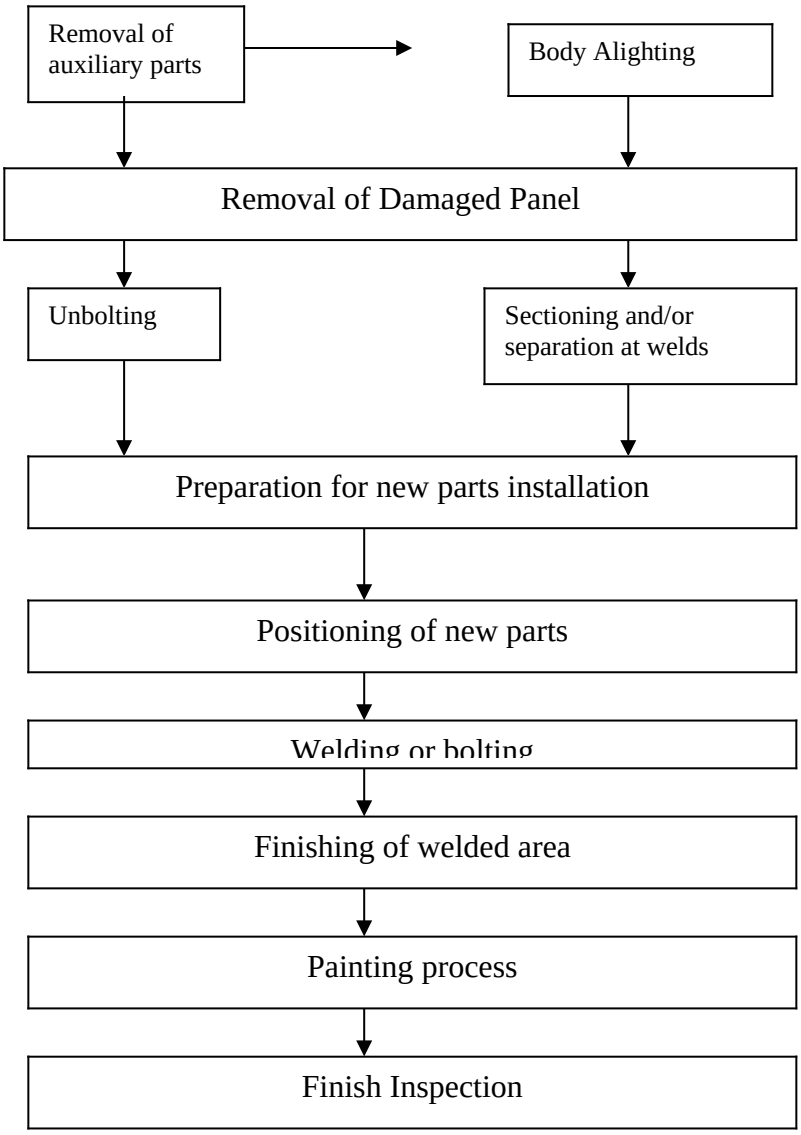
4.9 Replacing body panels

A vehicle that sustains extensive damage in a collision will require a variety of repair operations.

- Bent structural panels will have to be pulled and realigned by power straightening (Anchored and portable)
- Bulges, dents, and creases must be eliminated using the metal; working techniques
- Some panels, however, might be so badly damaged that replacing the panel is the only practical and effective procedure.
- Panel replacement is often the only permanent remedy for corrosion damage.
  The repair is made by coating the rusty metal away and welding new partial panels in place

Table below shows the general procedure for replacing both bolted and welded panels.

Table:- Typical Panel Replacement Procedure



Replacing Mechanically Fastened Panels

Non structural panels such as fenders, hoods, or quarter panels can be attached with bolts, rivets, and screws, among others. Bumpers and selected hard were are also usually bolted to the frame.

- Replacing these panels requires removing the fasteners. It is simple and fast. It is a matter of bolting the new panel in place and adjusting the fit.

Replacing welded panels

Structural body panels are joined together in the factory by spot welding There for removing panels mainly involves the separation of spot welds.

* Spot welds can be:
- Drilled Out
- Blown out with a polasma torch

- Chiseled out or
- Ground out with a high speed-grinding wheel

The best method for removing a spot welded panel is determined by the number and arrangement of mating panels and the accessibility of the weld.

Procedures:

1. Determining spot weld position
   Remove the paint film, under coast, or other coatings covering the joint area to find the location of spot welds
2. Sparating spot welds
   After the spot welds have been located, the welds can be removed with the apporpiate cutting tools.
   - Drilling
   - Chiselling
3. Separating continuous welds
   In some vehicles, panels are joined by continuous MIG welding. Since the welding bead is long, use a grinding wheen (high speed gtrinder) to separate the panels. After grinding trough the weld, use a hammer and chisel to separate the panels.
4. Prepare the vehicle for installation of the new panel
   - Grind off the welding marks from the spot welding areas and clean
   - Smooth the dents and bumps in the mathing flanges with a hammer and dolly
   - Apply antirust to joining surfaces and exposed bare metals
5. Replacement panel preparation
   - The primer must be removed from the mathing langes of new replacement panels to allow the welding current to flow properly doing spot welding
   - Drill holes for plug welds where spot welding is not possible
6. Positioning new panels

Allign new panel with the exisiting body

   - Dimensional measurement method
   - Visual by looking the surrounding panel

7. Fitting the panel (with clamps temporarily)
8. Cutting the over lapping panel
9. Welding.

REPLACEMNT PANELS