NAZARETH COLLEGE OF TECHNICAL TEACHER EDUCATION
Department of Automotive Technology

CHAPTER-4

4. Repairing sheet metal panels

Metal has elastic properties that allow it to be shaped and reshaped with out breaking. In repairing sheet metals, the auto body technician; takes advantage of the properties of metal to restore damage areas to their pre-collision shape and state. To do this technician needs to know:

1. The type of steel used in vehicles
2. How steel panels are strengthened, and
3. The typical damage patterns resulting from collision

With this as background the procedures used to repair metal may include straightening metal, relieving stress, and expanding and shrinking metals.

4.1.1 Manufacture of steel for the automobile industry

The raw material iron ore is fed into a blast furnace, together with limestone and coke; the coke is used as a source of heat. While the limestone acts as a flux and separates impurities from the ore. The ore is quickly reduced to molten iron, known as pig iron which contains approximately 3-4% carbon. The iron is changed into steel by reheating it in a steel making furnace and blowing oxygen their in the surface of the iron or through the liquid iron, which causes oxidation of the molten metal. This process burns out the impurities and reduces the carbon content from 4% to between 0.08 and 0.20%.

Types of steels used in vehicles.

Steel is produced from iron, carbon and certain additional alloy, including chromium, manganese, nickel and others each mixed according to specific formula, giving the steel certain properties. One of this properties is yield strength.

Steel processing a yield strength of up to 35,000 psi is called mild steel, which until 1980 was used extensively in manufacturing automobiles of conventional as well as unitised body construction.

- Soft and easy to work
- Can be safely welded, heat shrunk and cold worked without
- Seriously affecting is strength

But easily deformed and relatively heavy

- However new factor such as a world-wide requirement for fuel conservation for lighter-weight body structures, and safety

legislation requiring greater protection of occupants through improved impact resistance, are bringing about a change in materials and production technology. This has resulted in the use of steel known as high strength steels (HSSs) (Steel with a yield strength of 40,000 to 150,000 psi)

- Mild steel is composed of a large grains that are widely spaced; high-strength steel has far smaller grains that are more densely packed together, It is the interlocking of the grains and the forces of attraction of the grains to each other that gives high-strength steel its superb strength.

- There are several different types of high strength steels different is strengthening process. Three types are often used in automotive structure.

    1. High-strength, low-1lloy (HSLA) steel, or rephosphorised steel. Has a yield strength of 40,000 psi
    2. High-tensile strength steel or Si-Min solid solution hardened steel
    3. Ultra-high strength steel (UMSS)-which has a yield strength of 85,000 psi 140,000 psi

Treated steels- manufacturers also use HSS in treated forms such as galvanized steel, galvanized steel, electro galvanized steel and zincrometal. All of those metal contains provide maximum protection from corrosion.

Note:-

- Use extreme care when using heat on HSS panels. After exposure of to a temperature of 1200of or higher for several minutes, the special hardening elements are absorbed by larger, softer elements in the heated area, resulting in lower strength.
- MIG welding is an acceptable practice for MSS. Most automobile manufacturers do not recommended using oxyacetylene to weld either type.
- Check the appropriate collision or parts manual for vehicle being repaired to learn exactly what parts are made with, HSLA, UHSS, HTSS, and so on.

4.1.2 How sheet metal (steel) is formed to provide strength?

Physical structure of steel:- Steel just like all matter, is composed of atoms. This minute particles of matter are combined to form *grains*. Grains are large enough to be seen with the aid of a microscope. Grains are formed into patterns called the grain structure.

The atomic structure and grain pattern of a metal will determine how it reacts to force.

Effect of impact forces:- The sheet metals resistance to change has three properties

- Elastic deformation
- Plastic deformation

- Work hardening

Elastic deformation:- Is the ability of metal to stretch and return to its original shape.

Plastic deformation:- is the ability of the metal to be bent to formed into different shapes. This is b/c the grain structure has taken on a new set.

When a car is damaged in a collision, the stress unstained from the impact will remain unless it is taken out. This is a condition in which there is an area with permanent stress surrounded by a neighbouring area with elastic stress that can not be removed unless the permanent stress is removed that is restricting the elastic stress.

Work hardening :- Work hardening is the upper limit of plastic deformation causing the metal to become very hard in the area where it has been bent. For example, if a welding rod is bent back and forth several times, a fold or buckle will appear at the point of the bend. The plastic deformation has been so great at this point the grain structure has been radically forced out of alignment causing the metal to become very hard and stiff. This increased hardness is called work hardening.

Some work hardness will be found in any undamaged body panel. It is as the result of the original forming process. The bending caused by collision adds still more work hardening in the areas affected.

Some times much more will be added by the body technician as he or she straightens the damaged area making the job more difficult.

- Crowned surfaces.
  The most common features of the body are the curved surfaces; these are called crowns. The crowned surface is stronger than a flat panel.
  e.g. door panels, fenders, quarter panels, hoods etc.
- Angles and flanges:- another method of giving strength to metal is to form angles of flanges along the edges of sheets. A right-angled bend greatly increases the strength of a sheet. The method is used on inner door panels and where ever stiffness is required at unsupported edges.
- U-channels and box sections

A u-channel comprises two right-angled bends. The U-channel is the most common type of section used in the construction of car frames. Under bodies, sub frames cross members, and any construction where greet strength is required.

4.1.3 **Types of collision damage**

4.1.4 **Methods of sheet metal repairs**

There are various methods of sheet metal repair which repair method or methods are used on a particular job depends on several things:

1. Quality of job required
2. Repair equipment in the shop
3. Type of damage
4. Type of vehicle construction (Body over frame/unitised)
5. Type of sheet metal- HSLA, UHST, etc.

On some jobs you will use only method, other type of damage might require you to use two or more of the basic methods.

1. Pulling out with a vacuum (suction) caps- on a panel which has been pushed in but has suffered little or no bending beyond its elastic limit.
2. pulling out crease or dent with pull rods
3. Using dent pullers and welded studs.
4. Pulling out a panel from two sides to straighten the sheet metal the pull can be done by attaching appropriate clamps and a power ram
5. Using a pry bar (spoons and picks) to get behind a dent and put it out
6. Using a spread ram
7. Using a hammer and dolly where both sides of a damaged panel are accessible
8. Using body files
9. Using a bumping spoon:- the bumping spoon is held b/n the damaged metal and the hammer. The hammer blows fall on the bumping spoon. This distributes the force of the blows over a large area. Effective in working down long ridges or buckles.
10. Heat shrinking a panel which has been stretched by the impact and by the work of straightening the panel.
11. Filling low areas with plastic body filler
12. When a panel is severely damaged, the repair probably would be to install a new or salvaged panel in its place. Whether to repair or replace is a matter of materials and labor cost.

4.2 **Using Body Hammers and Dollies**

Body Hammer:- They come in different designs, some have flat square heads, some have rounded head and some called picking hammers have pointed heads.

∗ Bumping hammer ∗ Dinging hammer ∗ Shrinking

hammer ✶ Finishing hammer ✶ Pick hammer

Carefully select the hammer
The face of the hammer must fit the contour of the panel

- Use a flat hammer on flat or low-crown panel.
- Use a convex-shaped or high-crown hammer face when bumping inside curves
- Heavy bumping hammers should be used for roughing out the damage
- Finishing, or dinging hammers should be used for final shaping.

Dollies:- universal dolly, toe dolly, heal dolly, comma dolly, fender dolly
The Dolly block is also used in the rough out phase as an impact tool. The underside of the metal can be hit with the dolly to raise low areas.

- The dolly block is also used as an anvil for the hammer. When it is used this way there are two techniques:
  - Hammer on dolly (Direct hammering)
  - Hammer-off-dolly (Indirect hammering)

Hammer- on-dolly method:- is used to small, shallow dents and bulges and to stretch metal so that it can return to its original shape.

Hammer-off dolly method:- is used straighten metal just before the finishing stage. In it the hammer does not actually strike the dolly.

- Pick hammer and the edge of dolly can be used to pick small dents. After an area has been picked up, a file or grinder can be used to level the damages area.
- The contour of the dolly must fit the contour of the underside of the damages area.

4.3 **Using Spoons**.

Body spoons have flattened ends which are curved or straight depending on the purpose of the spoon.

- To pry out dents in places inaccessible to a hammer or dolly
- Can be struck with a hammer to drive out dents
- Used as a dolly in hard-to-reach area
- To spread the blows of the hammer a large area (on large ridges)

4.4 **Using Pull rods and dent pullers**.

Pull rods are another type of tool that can be used to pull small dents out on sealed body panels or panel sections that can not be reached from the back side even with the longest spoon.
To use a pull rod:

- A hole is drilled in the center of the dent

- The hook end of the pull rod is then pushed through the hole and hooked on the backside of the sheet metal.
  This enables you to pull the dent out. Often you can use a body hammer to tap lightly around the dent to help the metal spring back to its original contour:

A dent puller usually comes with a threaded tip (sheet metal screw) and hook tip. Either tip is inserted in the drilled hole and a hammer is slide on steel shaft and struck against the handle.