Vancouver Community College

Auto Collision & Refinishing Programs

Unit 6000- Automobile Body Repair Techniques

6006 Shrinking Sheet Metal

Student Manual

About This Publication

This manual was designed with the materials contained and presented in the Auto Collision Repair & Refinishing Programs of Vancouver Community College. VCC cannot accept responsibility for any individual repair or quality of repairs. Any person(s) who so chooses to deviate from the instructions in this manual must ensure that neither personal safety nor the integrity of the repair will be compromised by their choice of methods, tools, or supplies.

This manual was last revised 09/2005

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Introduction

Sheet metal shrinking is one of the most important operations in collision repair. Correct shrinking not only save hours of labor but also is the main factor in a good job. Most metal jobs require some shrinking, and improper shrinking can make the job almost impossible to repair. It is rather difficult to determine the correct amount of shrinking since the metal is expanded when hot and will be stable only when cooled.

The main sources of heat are:

- MIG welding
- The oxy-acetylene torch
- Friction from power driven abrasives (grinders, disc sanders)

Heat has three separate effects on sheet metal:

- Scaling
- Change in grain structure
- Expansion and contraction

Heat Effects on Steel

The Relationship of Heat Temperatures and Scaling

The scale found on the surface of heated sheet metal is iron-dioxide and is the first progressive change when heat is applied to sheet metal.

Prior to performing a shrink on sheet metal it is important to ensure that the panels structure and bodylines are properly aligned. Even a slight indent of a bodyline can cause a great distortion in the panel which can be misdiagnosed as stretched metal. View the interactive lesson below for a deeper look at this.

Media

Interactive Lesson:
Body Lines

Notes:

Key Points in Detecting Colors When Heat Treating Sheet Metal

Remember that colors below red heat are not affected by light conditions because they are simply film coats that cover the surface. They can of course, be used as an indication of the approximate temperature of the surface, an essential piece of information in many straightening and shrinking operations in bodywork.

The colors in the red range can be seriously affected by the light conditions in the shop itself. Be careful not to work in bright sunlight, for a bright red will not appear bright at all. Therefore be careful to make allowances for shop lighting conditions when heating metal to specific heat temperatures in the red range.

Metal heated to the higher temperature range will accumulate a heavy film of scale on the red area unless it is protected from the air. When heated by a torch, the scale forms immediately on the underside of the hot spot, but is protected from the air by the flame on the upper side (the outer blue envelope) and does not scale until the torch has been removed from the spot. Although scaling is actually burning of the metal, nothing much can be done about it during a heating operation. There are however, some precautions:

- Do not heat sheet metal repeatedly in the same spot.
- Do not go over a pass more than once in welding if possible.
- Do not overheat beyond the critical temperature of 871°C (1600°F) for the normal straightening operations. (Beyond annealing temperature, the metal is being damaged rather than helped, as further heating serves no particular benefit).

Effects of heat on Grain Structure of Sheet Metal

A progressive change in grain structure takes place from room temperature up to its melting point. The structures that result have a direct effect on the hardness of the metal. Hardness and strength are so closely related, the structure also affects the strength of the metal.

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Effects of Heat on Sheet Metal (mild steel)

More limited than for higher carbon steels, therefore, there is no measurable hardness achieved after heating mild steel, and no tempering occurs. The only appreciable effect is that of softening or annealing of the metal

Remember: Distortions from heat are not areas of annealed or "relieved" metal. Heat distorted areas and annealed areas show no particular difference in effect therefore, the restricting pressure of the surrounding cooler metal causes distortion. *Distorted metal is not stretched metal*. This is a fallacy that some metal men have said about distorted bumps left behind in heating operations. This is due to the fact that metal, after it cools under its compression strain, tends to shorten. This in turn has a pulling or "draw string" effect on the surrounding areas, with buckling, valleys and "oil-canning" of the panel being produced. This is especially so in the flat, low-crowned panels. Take a look at the interactive lesson below for a closer look at restricted expansion.

Media

Interactive Lesson:
Restricted Expansion Demo

Advantages of Using Heat

- Where inner construction does not allow easy access to the damage.
- Saving in cost of removing parts to gain access to the damage.
- Once a skill is accomplished, is a fast method of repair.
- Can be used to shrink stretched metal.

Disadvantages of Using Heat

- Not generally applicable to severely damaged metal.
- Rather limited on low crowned panels. Dent has tendency to go down further.
- Not practical on reverse crowns. Dent goes inwards.
- Requires a good amount of skills and understanding of heat distortion control and where and when to apply the method.

Quiz #1
(F6006-1)

Quiz

Shrinking Proceedure

Now let's learn the basic method for shrinking sheet metal...
This operation is used to remove small dents in which the direct damage is not too severely stretched or torn, and which the work-hardness of the buckles is not too severe. Hail damage and other similar small dents are examples.This operation is used:

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Interactive Lesson: Shrinking Hail Damage

Video: Hail Damage Repair

- When it is determined that the use of heat is necessary.
- When dents are located behind inner construction that hinders
- When it is necessary to reduce the size of the dent.
- When it is necessary to avoid removal of certain parts.

Shrink Preparation

- If you are using an oxy/acetylene outfit the size of tip used is the same as the one you would use to weld the panel (neutral flame).
- Some MIG welders come with carbon heat tips to heat the metal for shrinking. They are set to a shrink mode on the selector dial and adjust automatically.
- Spoons or dollies selected should have a crown or shape slightly less than that of the panel being shrunk.Note: If the spoon or dolly is greater than the crown or shape you will stretch the metal.
- Hammer face should be flat and have the edges rounded so that crescent shaped marks are not left by the hammer face edge (see image below).

Note:Be sure both hammer and dolly surfaces are clean.

A slighty rounded hammer face edge and proper technique ensure cresent-shaped damage is not left by hammer blows.

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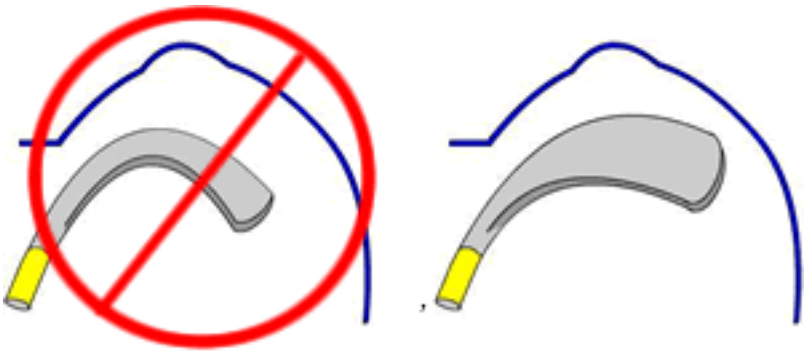

A spoon or dolly with a lower crown than the stretched area must be used when shrinking.

General Shrinking Procedure

Arrange your tools - Arrange tools so time is not wasted leaning or bending down to grab them after heat has been applied.

Concentrate stretched metal - Hammer stretched section up and outward, into one or more concentrated areas. The number of areas will be determined by the amount of shrinking required.

Locate the highest spot - locate the highest point as this will be the location of the first shrink.

Select the appropriate torch tip - Select a torch tip as you would to weld the metal (as per metal thickness).

Setup a neutral flame - Light the torch and adjust to a neutral frame

Apply heat - Hold the torch perpendicular to the panel approximately 3 mm (1/8") from the surface until the desired temperature is reached.

Holding the torch perpendicular to the panel will ensure the spot is heated evenly. This will give you greater control of the restricted expansion and contraction. The size and colour of the heated spot will be governed by the shape of the panel and how much stretching has occurred.

Heating the metal softens a small spot in the centre of a larger stretched area. This allows the technician to compress the metal towards the centre. As the heated spot cools, it contracts and draws the stretched metal with it, firming up the panel. Heating can be accomplished using an oxy-acetylene torch setup or electrically with panel repair equipment. Most GMA (MIG) welders can be setup for shrinking by installing a carbon shrinking tip. For better control on a flat or low-crowned panel it may be beneficial to

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perform 2 or 3 smaller blue shrinks than one large cherry red shrink. Overshrinking causes the metal to be held under tension and may be mistaken for stretched metal.

Level the damage - Choose a dolly with a slightly lessor crown than the panel being shrunk. Hammer blows should be directed around the outside of the heated spot pulling the metal towards the centre. Hold the dolly loosely against the backside of the panel and level it with a body hammer

Quench the area- The shrink may now be quenched (if desired) with a wet rag or cooled with air. Additional shrinks must not be attempted until previous shrinks have cooled. Wait times can be shortened by quenching. Quenching increases the amount of contraction and allows you to continue working without having to wait for the metal to cool.

Media

Video: General Shrinking Procedure
Duration: 00:07:34

Skrinking and Oblong Area

This type of stretched metal condition is the one perhaps most common in repair operations. It can result from damage and also from faulty workmanship on the part of the technician. It takes the shape of an oblong rectangular shape, and because of this shape, calls for a somewhat different method and approach than does the spot type of stretch.

1. ***Plan your repair -*** Study your metal and determine where the stretch is and how great an area it covers. A good plan is to mark out the boundaries of the area with chalk or similar material.
2. ***Heat an area -*** Starting at a point roughly 13mm (½") from the end of the stretch and following a line down the center of the stretched area, heat up an oblong spot about 38 mm (1.5") long. You will have to judge the length of this oblong heat spot in accordance with the size of the area you are shrinking. Heat as quickly as possible to prevent the heat from expanding a large area.
3. ***Level the area -*** Strike open blows on the heated spot, then using a dolly as a backing tool and a dinging hammer to level the metal. Remember to keep the metal in proper contour at all times.
4. ***Proceed to next area -*** Shrink successive spots from the first one, overlapping each new one partially on the old and keeping on the centerline of the stretched area. The reason for heating oblong spots is to draw the excess metal from the sides, and not form the ends.
5. ***End shrinks -*** Finally, heat two round spots about the size of a dime at each end of the shrink area and flatten down. This is to stop the strain extending beyond the shrink area. If any metal collapses during the shrinking operation, use a dolly and hammer to stretch the spot last shrunk until the metal returns to the original contour.

Media

Video: General Shrinking Oblong Areas
Duration: 00:06:24

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Skrinking a Flange

Wheel Openings & Hood Edges

When the flanged edge of a panel such as a hood edge or wheel opening have been stretched, straightening will usually produce wrinkles along the edge. These areas must be shrunk as they are usually visible. This is accomplished by heating the stretched metal, moving the torch in a semicircle away from the edge (see image at right). Be sure not to heat beyond the bodyline. Use light on-dolly blows to dolly the wrinkles smooth.

Drip Rails & Trunk Gutters

This operation could be applicable when repairing trunk gutters and lipped flanges. Here you heat the stretched side of the angled sheet metal and straighten at this point. Shrink these to return the metal to its former shape.

Video: Shrinking a Flange
Duration: 00:04:30

Quiz #2
(F6006-2)

Quenching

When higher carbon steels are heated to high temperatures and then immersed in water or “quenched”, they become quite hard and brittle. In order for them to be any use as tools, they have to be tempered or drawn. This is done by heating to a cherry red, and, when the right temperature colour is reached, the item is quenched and retains the temper that the temperature gave the metal. The more the carbon in steel, the lower the critical temperature.

Except in unusual circumstances, quenching should not be performed when shrinking. This could result in over shrinking causing warpage and oil canning.

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