CHT™ - Unique Process for Aluminum Radiator Repair . . .

What does CHT™ stand for?

CHT™ is an acronym for Continuous Heat Transfer. Johnson's CHT™ process solves a big problem facing radiator mechanics when attempting to repair aluminum radiators using a torch brazing method, i.e., Heat Control.

Aluminum radiators are very efficient, which makes it difficult to build up enough heat using a torch to make brazing repairs, without running the risk of a meltdown of the tubes or fins. Few radiator mechanics have mastered the skill necessary when using an oxy-acetylene torch, to build-up heat in the general area, and then direct the flame on the repair, while simultaneously bringing the filler rod up to its melting temp., just a few degrees below aluminum. Sometimes this works, sometimes it doesn't.

More often than not, the only way to accomplish this task is to remove adjoining fins so heat can be isolated to a single tube, rather than be carried away by the fins. Other techniques have included the use of heat dams (putty), or asbestos shields; rotating your torch is also quite important, as is holding the filler rod just right, so you don't block heat to the tube.

Typically, when heating the core of an aluminum radiator with a single torch, the heat travels fastest through the fins, to the under side of the core, where it is given off by the slightest movement of air across the fins. Heat also gradually radiates sideways to the adjoining fins and tubes but this too is given up (lost) to the air currents.

How does the CHT™ Process work?

When the radiator is placed on a Hot Plate, the primary source of heat for the CHT™ process, it provides a continuous volume of heat to the under side of the radiator. The heat rises through the core until it reaches the top surface, right at the point of repair. Then, a secondary heat source is added to finish the repair. This provides much better control of the heat so that melt-downs are rare. We recommend a Sure-Fire self-lighting, L-P Gas torch equipped with a pencil tip with adjustable flame. Then, it is no longer necessary, nor desirable to remove fins because they deliver heat to the repair. Also, think how much nicer the finished job will look without big holes in the core created by pulling out fins .

Continuous Heat Transfer is only part of the process...

Aluminum oxides are extremely tenacious; they form very quickly and are difficult to remove, even when using strong chemical fluxes made for this purpose.

There's an alternative process called swaging that has been used successfully in other industries for many years. Swaging is done by abrading (scratching) solders that contain zinc into the surface of aluminum as it is being heated. This form of mechanical cleaning enables filler metals to form metallurgical bonds with the aluminum underneath.

This abrading action utilizes the sharp-edged crystals in zinc-based alloys to scrub the aluminum surface, fracturing, dislodging the oxide layer so the filler metal can form an intimate bond with the freshly exposed aluminum. Using this swaging method, excellent bonds are possible on all aluminum alloys except for those containing magnesium.

The Abrader™ Tool provides a Key Link

Johnson has adapted what has been done in other industries, to what was needed for today's aluminum radiator repair. introduce the *Abrader*™, a small electric tool, used to scrub our special zinc-based solder into a hole, split or seam while the repair is heated using the new Johnson CHT™ method. This unique combination of heat, abrading action and alloy together form strong, long lasting, intermetallic bonds without the use of a flux whatsoever.

Expect to be amazed at how easily repairs are done, the very first time you do it!

Johnson Mfg. Co. introduces Penny Solder™

We call it Penny Solder™ because like pennies, it contains mostly zinc (not copper as most people think) and because you can complete most radiator repairs using less than a penny's worth of solder. Indeed, 1/4 lb. (approx. 18 sticks of Penny Solder™ 11 3/4" long) is enough to complete hundreds of typical aluminum radiator repairs.

What else is so unique about Penny Solder™?

First of all, let's define the difference between soldering and brazing. Soldering, as described in the AMS Welding, Brazing & Soldering Handbook is a metal joining process occurring at less than 840 degrees F compared to brazing which is above 840 F. Most aluminum solders typically have melting ranges between 350 and 800 degrees F. Aluminum brazing alloys melt between 1050 and 1150 degrees F. (Fahrenheit). Aluminum melts at 1220 degrees F. Another measurement C, which stands for Centigrade or Celsius as it is now called, should not be confused with Fahrenheit. Here's how to convert one measurement to the other:

Convert C to F:
Degrees C multiplied by 9, then divided by 5, then add 32, equals Degrees F.

Convert F to C:
Degrees F minus 32, multiplied by 5, then divided by 9, equals Degrees C.

Aluminum brazing alloys are made up largely of aluminum (85% or more) with additions of Silicon, Magnesium, Manganese, Titanium and/or other trace elements. Johnson's Aluminum Brazing Rod falls under this category of brazing alloys.

Johnson's Penny Solder™ melts and bonds at approx. 750 degrees F. which classifies it as a "hard solder", not brazing alloy. Some other aluminum solders contain either tin, or cadmium, or both. Tin is quite dissimilar to aluminum (ref. periodic table of elements) which means that it may corrode away from the aluminum within a short period of time due to a "galvanic corrosion." For this reason we do not recommend using aluminum solders that contain tin for radiator repair.

Cadmium, which is also found in some low temperature solders for aluminum is highly toxic and should be completely avoided. We do not recommend using a torch to melt cadmium-bearing solders for any sort of aluminum radiator repair, especially without the use of an OSHA approved, full face respirator.

Johnson's Penny Solder™ contains no tin or cadmium. Our zinc-based solder has a very high affinity for aluminum and its alloys and therefore, it is a logical choice for aluminum heat exchanger repairs.

Penny Solder™ is not toxic, but even so, using good ventilation is recommended, as with any other soldering method. Penny Solder™ will not corrode away from the aluminum, even in the presence of moisture because of its similarity to aluminum on the periodic table. Penny Solder™ also has excellent bridging (gap-filling) capabilities and you can add to it, build it up.

Let's recap the important benefits when using the CHT™ process

CHT™ Technology
- *No Holes in core*
- *No melt-downs*
- *No Oxy-Torches*
- *No Face Masks*
- *No Colored Goggles*

Abrading Action
- *No Flux*
- *No Smoke*
- *No Residues*
- *No Clean-up,*
- *No Waste Disposal*

Penny Solder™
- *No Cadmium Fumes*
- *No Galvanic Corrosion*
- *No Special Training*
- *No Tricky Techniques*
- *No Lost Time*

OK! So how do you get started? Buy the full CHT™ Aluminum Radiator Repair Kit!

As we've already pointed out, it takes

all three factors to make the CHT™ process work. Don't try to shortcut the system by buying only the torch and some Penny Solder™ and don't think any ordinary hot plate is going to do the trick either. Johnson's model CHT™ 2000 Ceramic Hot Plate has an 1100 watt capacity which produces up to 1000 degrees F. Its ceramic top is one of the keys. It heats-up more quickly and more uniformly than any other hot plate of its type on the market.

The SureFire® T-655 self-lighting torch head is another key factor. It is the most reliable torch of its type that we've found. It offers push-button ignition, good for up to 30,000 lights; it has a built-in regulator to provide a steady flame, even when used upside-down. It also features an adjustable flame for precise temperature control, and it has a pencil flame tip that allows you to focus the heat precisely where it is needed. All of these factors combine to make this the easiest-to-use and best all-around torch for this job.

The Abrader™ electric tool offers a whole new dimension for soldering with zinc-based alloys. It provides pin-point placement of Penny Solder™ with just the right amount of abrasive action to scrub away tough aluminum oxides.

The Burnisher™ is a unique tool; one that we've never seen used for any type of soldering before. It has a flattened, slightly curved blade that comes in handy for scraping away excess solder, while it is in a molten state, and for scrubbing through aluminum oxides to expand the wetted area.

The RadStand™ is useful for positioning radiators on the Hot Plate. It can be used to support the other end of the core, or to hold the radiator in an upright position for header repairs.

A Bonus Tip!

Using the RadStand™ and the CHT™ 2000 Ceramic Hot Plate together provides a convenient way to remove the epoxy found in many Ford headers. Set the temperature control on the Hot Plate just high enough to enable you to break the epoxy bond, without producing any charring, fuming or smoking. Then, simply pick out chunks of old epoxy and clean up the area before completing the repair.

Johnson's Aluminum Brazing Rod and Flux, are also supplied with the CHT™ Kit. These are economical alter-natives for making certain types of repairs and for where the highest possible strength is required. Remember, aluminum brazing requires a higher temperature process, it may require the use of an oxy-fuel gas torch along with the CHT™ 2000 Hot Plate, to deliver sufficient heat to the repair area. Always use caution when working at the higher brazing temperatures, to avoid damage to the Hot Plate.

Surface Preparation, Spot Cleaning

As this pamphlet suggests, today's aluminum repair techniques are quite different from those used several years ago on copper/brass radiators. Primarily due to environmental and safety concerns, preparing the surface before repair consists mostly of spot cleaning around the repair; not as much general cleaning as before.

Spot cleaning is done quickly in a bead blast cabinet, using a medium abrasive with short blasts about 110 PSI. Another cleaning method is using a stainless steel toothbrush to remove dirt and oxidation, to shine up the area before proceding with a CHT™ repair.

Restoration of Tubes and/or Fins may be necessary

Certain repairs require a few additional minutes of preparation so that the CHT™ process works its best. For example, tubes that are nearly severed should probably be closed off at each header. Fins that are smashed and or tubes that have been bent should be straightened to their original upright position. If a tube is cut down one side, further than the other, the tall side should be routed down to the height of the short side using Dremel's® MotoTool with a 1/8" carbide bit. The idea is to create a crescent in both walls of the tube as deep as the cut. Next, pinch the exposed edge of tube nearly closed using a pair of bent needle nose pliers. This provides a clean surface for abrading Johnson's Penny Solder™ into both edges of the tube.

Another TIP!

The Burnisher™ Tool supplied with this Kit is also a great little "fin- pick". Use it to remove fins on either side of a damaged tube if repair is necessary before soldering. Try not to take out fin material deeper than the repair itself.

Steps to follow when making CHT™ aluminum radiator repairs.

1. Place radiator on the Hot Plate, making full contact with it; center it, repair side up.

2. Set temperature control on Hot Plate to 7 and allow 5 minutes to preheat a typical radiator. Thicker radiators (more mass) may require a setting of 8 or 9.

3. Begin to apply supplemental heat using the SureFire® T-655 LP Gas torch directly to the tube being repaired.

4. Alternating with the heat, abrade the repair with Johnson's Penny Solder™ using the Abrader™ tool with the control set on 1, the least amount of vibration.

5. Alternate between heating and abrading until enough heat builds up in the tube to melt the Penny Solder.™

6. Never apply the flame directly to the solder to speed-up the process.

7. The abrasive action of the sharp-edged crystals in the Penny Solder™ are needed to scrub through the oxide layer so that a true intermetallic bond can be formed.

8. If the finished repair looks dull or porous it is probably because Johnson's Penny Solder™ flowed underneath the oxide layer, lifting it to the surface. Reheating the repair until it is molten, and then gently scraping the oxides off the surface with a Burnishing Tool will produce a bright and shiny looking joint. Do not disturb the alloy until it has fully solidified!

9. Remove the radiator from the Hot Plate. Never quench the repair; allow it to air-cool naturally. It takes only a couple of seconds for the molten Penny Solder™ to solidify. Any movement during this time can cause porosity in the joint.

10. To avoid discoloration of the radiator, air test it in a test tank that contains Johnson Aluma Test™ Tank Fluid with water. Typical test tank solutions are too alkaline and may cause aluminum to blacken.

Limited Liability Statement:

Johnson Manufacturing Company believes that all that stated herein is true to the best of our present knowledge and it is based on months of development. Under no circumstances shall Johnson Mfg. Co. be held responsible for any loss or damage that may be incurred, either directly or indirectly, as a result of the using of the above described products or methods.

Johnson Mfg. Co. believes that many other repair procedures such as tube-to-header repairs, sealing off tubes, repairing return bends, tinning and joining other components may be possible using this process. As we learn more from our customers about uses for this technology, we will be sharing it with the industry. Please stay in contact with your local Johnson distributor.