

Intro To Tools, Equipment, And Attachment Methods - Part 2

Self-study Narrations



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***Intro To Tools,
Equipment, And
Attachment Methods
- Part 2***

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Learning Objectives

Welcome to Intro to Tools, Equipment, and Attachment Methods – Part 2: Measuring and Straightening. This module discusses equipment used for measuring and straightening collision damaged vehicles.

Learning objectives for this module include:

- describing different types of three-dimensional measuring equipment.
- describing different types of frame straightening equipment.
- describing different types of pulling hardware.

Portable Hydraulic Rams

Portable hydraulic rams are used in areas on a vehicle where traditional pulling equipment may not be able to access. Another term for this type of equipment is porta power.

Module Summary

In this module, you learned about some of the different equipment used to measure and straighten a collision damaged vehicle.

Topics discussed in this module included:

- different types of three-dimensional measuring equipment.
- different types of frame straightening equipment.
- different types of pulling hardware.

Learning Objectives

Welcome to Intro to Tools, Equipment, and Attachment Methods – Part 2: Welding. This module discusses different tools and equipment used when doing different types of welding.

Learning objectives for this module include:

- identifying parts that make up a welding machine.
- explaining the difference between a MIG torch and a spool gun.
- explaining parts of a spot welding machine.
- explaining why dye penetrant is used.

Fume Extractor

Fume extractors are typically used for capturing the fumes given off from MIG welding.

Module Summary

In this module, you learned the different welding equipment parts and tools.

Topics discussed in this module included:

- different parts that make up a welding machine.
- differences between a MIG torch and a spool gun.
- parts of a spot welding machine.
- why dye penetrant is used.

Learning Objectives

Welcome to Intro to Tools, Equipment, and Attachment Methods – Part 2: Welding Methods. This module presents information about using spot welding, and GMA (MIG) welding for attaching certain vehicle parts. Additionally, this module provides a basic explanation of the MIG brazing process. Information is also presented about laser welding used during vehicle construction.

Learning objectives for this module include:

- explaining the spot welding process.
- identifying considerations when using spot welding.
- explaining the GMA (MIG) welding process.
- identifying considerations when using GMA (MIG) welding.
- explaining the MIG brazing process.
- explaining laser welding used in vehicle construction.

Spot Welding

Spot welding is a pressure-welding process that is used extensively when steel vehicles are built. Spot welding can also be done during collision repairs and may be called squeeze-type resistance spot welding, or STRSW.

Advantages of spot welding include that it results in a weld similar to the original factory weld in appearance and strength, the spot weld process is easy to learn and use, no

drilling is required to make a spot weld, and no filler metal is required. Spot welding results in minimal heat-affect in the weld zone. This reduces the concern when welding on steels that are sensitive to heat. Also, it is not necessary to grind or sand the weld in most applications.

Spot Weld Process

The spot welding process includes the squeeze time, current-on time, and hold time.

The squeeze time part of the process occurs when the electrode tips close against the panels to be welded and equal force is applied to both sides of the metal.

Current-on time is the time that current passes through the metal to be joined, lasting only for a fraction of a second. The current tries to flow from one electrode tip to the other, but meets resistance in the steel. Resistance to current flow causes enough heat to melt the sheet metal and fuse the pieces together.

Hold time occurs after the current is turned off, allowing the weld to solidify and the sheet metal workpieces to cool. Force is held in place for about 1 - 2 seconds.

Spot Welding Considerations

Considerations when using spot welding include flange preparation. For current to flow, there must be a metal-to-metal path between the electrode tips.

Additionally, with the spot welding process, there is a magnetic field where there is current flowing through the arms, electrode tips, and connecting cables. This magnetic field can affect sensitive electronic parts on the vehicle, such as control modules. The magnetic field can also affect pacemakers, key fobs, and cell phones.

Spot Welding Limitations

Limitations for using spot welding include that using a spot welder requires access to both sides of the panel, and the possibility of a maximum combined thickness recommendation from the vehicle maker.

Another limitation is power requirements. Adequate power in the facility is required to fuse the metal in the short period of time it takes to make a spot weld.

GMA (MIG) Welding

Gas metal arc welding with an inert gas, or GMA (MIG) welding, is used in many collision repair facilities. Another similar, but lesser used operation is metal active gas, or MAG welding. The difference between these welding operations is the type of gas

used. GMA (MIG) welding uses a mixture that is mostly inert gas, which does not react with other elements, and produces a smooth and stable welding arc. The most common mixture is 75% argon, which is inert, and 25% carbon dioxide, which is active.

GMA (MIG) welding is a fusion welding process. During welding, the base metal melts and fuses with a melted electrode wire, which is the filler metal. The electrode wire is on a spool that is continuously fed. The molten electrode wire is deposited into the molten weld puddle, producing a raised weld bead.

GMA (MIG) welding produces heat using a short electric arc between the base metal and the electrode wire. The electrical arc melts both the base metal and the electrode wire to fuse them together.

A shielding gas protects the molten weld pool from atmospheric contamination, which can cause defects in the weld.

GMA (MIG) welding is typically recommended where the weld site cannot be accessed using spot welding equipment, or where seam welds are required.

GMA (MIG) Weld Types

GMA (MIG) weld types include plug welds and continuous welds.

A plug weld joins two or more lapped pieces together. The top piece has punched or drilled holes at the weld location. The completed weld fills, or plugs the holes.

Continuous welds include fillet welds, butt joint with backing welds, and open butt joint welds. A fillet weld is a bead deposited along the joint formed by the fit-up of two lapped pieces. Butt joint welds are seam welds along the seam of panels that are nearly butted together.

GMA (MIG) Welding Aluminum

When GMA (MIG) welding aluminum the same machine used for steel welding may be used with modifications, or dedicated machines may be used. Different electrode drive rolls may be used to allow easy passage of the soft wire.

A spool gun may also be used. Spool guns have a small spool of electrode wire and wire feeder in one hand-held unit.

Also, the shielding gas used is pure argon.

MIG Brazing

MIG brazing is also called silicon-bronze welding. The brazing process is done with a GMA (MIG) welder. The welding process and joint types are similar to those used with steel GMA (MIG) welding, however, MIG brazing is done with lower heat input into the base metal. Lower temperatures help minimize the loss of strength in the metal when welding heat-sensitive steels.

With MIG brazing only the filler metal melts, the base metal does not melt. A strong joint is formed as the molten filler metal bonds with the base metal. MIG brazing is considered a non-fusion welding process, unlike GMA (MIG) welding, where the base metal melts and fuses with a melted filler metal.

Also, the filler metal, which is the electrode wire, is a different material than the base metal. The molten filler metal is drawn into the joint by capillary action. Capillary action is the force that distributes and holds the molten filler metal between the surfaces to be joined.

Laser Welding

Laser welding is becoming more common during vehicle construction. Laser welding uses a high-energy light beam to fuse metal. During this process, the beam is aimed at the edge of the top panel, with the top panel melting and fusing to the bottom panel. It may be used with or without a filler metal.

Laser welding results in a long, continuous weld, or a series of separated welds. Examples of use include roof panel, and outer bodyside panel flanges.

Laser welding is a factory joining process that currently cannot be duplicated during repair.

Replacement for a laser-welded joint may include rivet bonding, GMA (MIG) welding, or adhesive bonding.

Module Summary

In this module, you learned about using spot welding and GMA (MIG) welding for attaching certain vehicle parts. Additionally, this module provided a basic explanation of the MIG brazing process. Information was also presented about laser welding used during vehicle construction.

Topics discussed in this module included:

- the spot welding process.
- considerations when using spot welding.
- the GMA (MIG) welding process.
- considerations when using GMA (MIG) welding.
- the MIG brazing process.
- laser welding used in vehicle construction.

Learning Objectives

Welcome to Intro to Tools, Equipment, and Attachment Methods – Part 2: Panel Bonding. This module will present basic information about using adhesive bonding, weld bonding, and rivet bonding for attaching vehicle parts.

Learning objectives for this module include:

- explaining the adhesive bonding process for attaching vehicle parts.
- identifying considerations when adhesive bonding.
- explaining the weld bonding process for attaching vehicle parts.
- explaining the rivet bonding process for attaching vehicle parts.

Adhesive Bonding

Some vehicle panels are attached with adhesive, which is called bonding. Adhesive bonding attachments may be done using adhesive only, or adhesive and welds, rivets, or threaded fasteners. Some parts that may be attached using adhesive bonding include roof panels, door skins, rear body panels, and floor pans.

Some of the reasons for using adhesives to attach panels are that dissimilar materials can be joined, and the adhesive may help protect against corrosion.

There are different types of adhesives. Adhesives are one- or two-part.

Materials And Equipment

One-part adhesives are packaged as a single cartridge. Two-part adhesives are packaged as two cartridges that are dispensed together through a single mixing tip.

Mixing tips are product- and material-specific. There are various application guns for dispensing adhesive. Depending on the material being used, an adhesive maker may have a specific applicator gun designed for their product.

Applying Adhesive

Adhesive is applied to a part using a continuous non-breaking bead. To ensure proper bond-line thickness, some adhesives contain glass beads to prevent a bond line that is too thin. The bond-line thickness is the thickness of the cured adhesive in the joint, and may be controlled by the size of glass beads used in the adhesive.

Work, Clamp, And Cure Times

There are various time requirement stages to follow when attaching parts with adhesive. These include the wet or work time, the clamp or handling time, and the cure time.

Wet or work time is the required time from when the adhesive is applied to when the parts must be attached and clamped in place. When adhesively bonded parts are being attached, any necessary repositioning is done by sliding. If a part is lifted, air bubbles can become trapped inside the adhesive and could weaken the bond. If the parts are lifted, the adhesive must be removed and reapplied.

Clamp or handling time is the required time that parts must remain joined with pressure applied.

Cure time is the specific time required for an adhesive to set at a specific temperature and humidity. One-part adhesives cure using moisture or heat. Two-part adhesives cure from being mixed together.

Welding Bonding

Vehicle maker recommendations for some bonding repairs may require using welds and adhesive together in the same joint. Using welds and adhesive is called weld bonding. Depending on the vehicle maker recommendations, the weld bonding process may be a combination of adhesive and spot welds, or a combination of adhesive and GMA (MIG) plug welds.

Rivet Bonding

Using rivets and adhesive together in the same joint is called rivet bonding. Though typically used on aluminum-intensive vehicles, rivet bonding is increasingly being used on steel vehicles for collision repair. Rivet bonding is used for both structural and non-structural repairs.

Some of the advantages of using adhesives along with rivets include increased stiffness of the joined panel, distribution of the load evenly along the joint, and the adhesive may help seal against corrosion. Some adhesive applications are specifically designed for this purpose.

Examples of vehicles that use rivet bonding include Audi on the A8, Jaguar on the XK, which has extensive rivet bonding throughout the vehicle, and Mitsubishi Lancer Evolution and Outlander, on models equipped with an aluminum roof panel. On these models, the roof panel is rivet-bonded along the front, sides, and rear.

Module Summary

In this module, you learned basic information about using adhesive bonding, weld bonding, and rivet bonding for attaching vehicle parts.

Topics discussed in this module included:

- the adhesive bonding process for attaching vehicle parts.
- considerations when adhesive bonding.
- the weld bonding process for attaching vehicle parts.
- the rivet bonding process for attaching vehicle parts.

Learning Objectives

Welcome to Intro to Tools, Equipment, and Attachment Methods – Part 2: Capital Equipment. This module discusses some of the items found in a collision repair facility that may be considered capital equipment.

Learning objectives for this module include:

- explaining what an air compressor is used for.
- explaining how mobility jacks are used.
- explaining the different types of battery chargers.
- describing different types of recovery equipment.
- explaining the function of a wheel balancer.
- describing the different types of headlamp aiming tools.

Vehicle Hoist And Lifts

Vehicle hoists and lifts can be either the above ground, in-ground, or scissors type. Above-ground lifts use extendable arms to raise the vehicle, while in-ground and scissors-types are driven over and then raised.

Engine Hoist And Engine Support

An engine hoist is used to lift engine or transmissions out of a vehicle. An engine hoist can also be used to transport an engine or transmission around the repair facility.

An engine support may be used to support the engine when replacing an engine cradle or engine mounts.

Air Conditioning (A/C) Recover, Recycling, And Recharging

Because of state and federal laws, equipment that captures air conditioning (A/C) refrigerant is required when working on A/C systems. This equipment is designed to evacuate refrigerant from the A/C system on a vehicle before the system can be repaired. It also recycles the refrigerant. This allows the machine to capture and hold the refrigerant to recharge the system at a later time or use the it in another vehicle.

Coolant Recovery

Engine coolant recovery machines are used to recover and recycle engine coolant for reuse.

Wheel Alignment Equipment

Though there are different types and brands of wheel alignment equipment, all of the systems are designed to align all four wheels of the vehicle. Typical wheel alignment equipment uses a computer, alignment heads that mount on each wheel, and an alignment vehicle rack.

Aligning the wheels allows the vehicle to travel down the road straight.

Wheel Balancer

Wheel balancers spin the wheel of a vehicle to detect any irregularities in balance. If an out-of-balance condition is detected, weights are added to the wheel for balance. The equipment will show where and how much weight should be added to the wheel.

Module Summary

In this module, you learned about some of the larger and more specialized items that may be considered capitol equipment. Topics discussed in this module included:

- what an air compressor is used for.
- how mobility jacks are used.
- why different types of battery chargers are used.
- the different types of recovery equipment.
- the function of a wheel balancer.
- types of headlamp aiming tools.

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