REPAIRCERTNZ
SPECIALIST CERTIFICATION MANAGEMENT (REPAIR) LTD

TECHNICAL BULLETIN

 # 01 - 2024 (April 2024)

The Correct Use of Weld-through Primers

Which Weld-through Primers to Use, and When to Use Them

Supporting New Zealand's Repair Certification Industry

About RepairCert NZ Technical Bulletins

These Technical Bulletins have been developed to provide 'Best-practice' guidance for Repair Certifiers, to assist them in ensuring that autobody repairs are carried out safely and correctly. It is also intended that these Technical Bulletins can be used by the wider autobody repair industry.

Purpose of this Technical Bulletin

This Technical Bulletin contains information about weld-through primers, and highlights changing positions in more recent times amongst the vehicle manufacturing industry, and industry experts, about the relevance and value of weld-through primers.

The information provides guidance to Repair Certifiers (and autobody repairers) on the correct use of weld-through primers in (predominately) collision repairs, including identification and descriptions of how they work, their limitations, basic compositions, welding considerations, vehicle manufacturer (OEM) recommendations, and corrosion protection performance.

This Technical Bulletin significantly expands upon the information relating to weld-through primers contained in the NZTA Light vehicle repair certification Vehicle Inspection Requirements Manual (Repair VIRM).

Background

For many years it has been an expected practice in the collision repair industry (and a Repair VIRM requirement) to apply weld-through primers to all bare metal joints (especially mating flanges) on weld-on panels and other steel autobody components prior to their installation. This expectation has been applied irrespective of the vehicle make, model, year of manufacture, or the selected welding method.

However, expert opinion about this has changed in recent times. Some OEM recommendations and requirements (as provided in Body Repair Manual [BRM] publications, update bulletins, and position statements) don't support the

'blanket use' of weld-through primers when replacing weld-on components. Several OEMs describe the types of weld-through primers that should be used, one OEM limits the type of welding that can be performed, and there are other OEMs that recommend weld-through primers should not be used at all.

Likewise, some autobody industry experts have raised concerns that some copper-based weld-through primer formulations provide little in the way of corrosion protection to bare steel, and under certain conditions and concentrations, may even promote the formation of corrosion *(see Image 1)*.

Because learnings over recent times now show that long-held beliefs about weld-through primers are not in fact correct, this Technical Bulletin has been developed to provide clarification.

Image 1: *In this photograph, the copper-based primer chosen and applied during a previous repair is inappropriate, and as a result, its presence has not only failed to provide the corrosion prevention expected of it by the repairer, but has in fact promoted further corrosion on the vehicle's structure.*

About Weld-through Primers

How Weld-through Primers Work

An electrically conductive and sacrificial zinc-rich (may also be referred to as 'zinc-enriched' or 'zinc-based') coating is either brushed or sprayed onto bare metal (steel) joints - predominately sheet-metal flange joints - that will subsequently be welded together, using either Squeeze Type Resistance Spot Welding (STRSW), or Gas Metal Arc (GMA)-MIG/MAG welding. The heat generated during the welding process melts the zinc, producing zinc oxide vapour that forms a protective barrier around completed welds as they cool.

Copper-based Weld-through Primers

There are many copper-based weld-through primers (of varying compositions) available from a wide variety of manufacturers. Many autobody repairers prefer to use copper-based weld-through primers rather than zinc-rich weld-through primers (particularly for GMA-MIG/MAG welding), as there is a noticeable reduction in the amount of splatter and porosity in completed welds, along with better conductivity and stability of the welding arc during the welding process.

However, as mentioned in the Background section on Page 1, it is now thought that some copper-based weld-through primers provide minimal corrosion protection, and may even promote corrosion as seen in *Image 1*. This is brought about by the galvanic corrosion process as described in *Appendix A* where (under certain conditions and concentrations) the more 'anodic' bare steel reacts or oxidises to protect the more 'cathodic' copper coating.

Preferred Zinc-rich Weld-through Primer

What has been discovered by the industry in recent times is that when copper-based weld-through primer formulations that are zinc-rich (such as those shown in *Images 2 and 3*) are applied to bare steel welded joints, they are more likely to provide an appropriate level of corrosion protection.

Image 2 and 3: *Different terminology exists for 'zinc-rich' weld-through primers, including 'zinc-enriched', and 'zinc-based'. Note also that if using a 'copper-spray' can or a 'zinc-spray' can for this purpose, ensure that these cans are in fact weld-through primers.*

OEMs and industry experts repeatedly identify zinc as the primary corrosion protection component in weld-through primer. This is because, in addition to being electrically conductive with a relatively low melting point (which creates the protective vapour barrier described earlier), it is also a 'sacrificial coating' - in that it sacrifices itself by the process of galvanic corrosion *(see Appendix A)* to protect the correctly prepared bare steel surfaces it's applied to.

How Welding Methods Influence Weld-through Primer Performance

The general understanding is that corrosion protection performance of weld-through primer coatings is reduced to some degree by the welding process.

The type of welding method used to attach welded components together will have a substantial influence on the level of corrosion protection provided by weld-through primers:

- Squeeze Type Resistance Spot Welding (STRSW)

  Weld-through primers retain more of their corrosion protection properties when the welding method is STRSW, as the heat affected zone (HAZ) created during the welding process is very small and localised. The short, but extremely hot, weld cycle time generated in STRSW (especially when using inverter spot welding equipment), rapidly melts the zinc (at around 420°C), creating the zinc oxide vapour that, as it rapidly cools, forms a corrosion protection barrier around the weld site. It is for this reason that most OEMs recommend the use of weld-through primer when flange joints are to be spot welded.

- Gas Metal Arc (GMA)-MIG/MAG Welding

  Conversely (and by necessity) the GMA-MIG/MAG welding process has a substantially longer weld cycle time, creating a much larger HAZ. This prolonged welding time introduces additional heat into the weld site which boils away much of the zinc coating (at around 900°C), substantially reducing the amount of zinc oxide vapour available to create the corrosion barrier, thereby reducing the level of corrosion protection.

Other Considerations for GMA-MIG/MAG Welding

Although the zinc in weld-through primers is electrically conductive, GMA-MIG/MAG welding directly onto weld-through primers (especially when the coating is heavier) can be problematical for welding technicians, with common complaints being excessive weld splatter or difficulties in maintaining the welding arc during the welding process, as the zinc melts and boils off. Completed welds often display excessive porosity and impurities (raising concerns that weld strength may also be compromised). Just ask any welding technician that has tried to

weld galvanised sheet metal without first removing the galvanised coating (a heavy coating of zinc), and they'll tell you how difficult or almost impossible it is to produce successful, fault and porosity-free welds.

Generally, these problems can be overcome by reducing the thickness of weld-through primer applied to bare metal flange joints, and ensuring there is no weld-through coating present at the targeted weld site.

What the OEMs and Industry Experts Say About Weld-through Primers

Limitations of Weld-through Primers

Weld-through primers are considered by some industry experts to be 'better than nothing' corrosion protection for welded joints. Many OEMs who specify the use of weld-through primers in their BRMs also recommend that additional corrosion protection coatings or inhibitors (e.g. cavity wax) are applied to the completed welded joints to provide an appropriate level of corrosion protection.

None, or Only for Certain Weld Types

While many OEMs recommend (or require), the use of weld-through primers (sometimes described in the General Information section of their BRMs as 'spot sealer'), there are some with very different requirements or recommendations:

- FCA/Stellantis

  15 vehicle brands including Jeep, Chrysler, Citroen, Maserati, Alfa Romeo, Dodge, Peugeot, Lancia, Ram, Abarth, Opel and Mopar, do not recommend the use of any type of weld-through primer. The current editions of all FCA/Stellantis manuals state, *'FCA US LLC does not recommend the use of any type of "weld-thru" primer during repairs. Weld-bonding with corrosion protecting adhesives or sealers, along with final application of inner panel corrosion protection is the proper method.'*

- Honda

  Recommends weld-through primer for STRSW only, stating in their Honda BRM Welding and Sectioning Guideline Revisions publication *'When doing squeeze-type resistance spot welding (STRSW), apply a zinc-rich weld-through primer, or spot sealer, to bare steel areas being welded and wipe off any excess'; and 'Weld-through primer should never be used when doing MAG plug, MAG butt, or MIG brazing. Studies have shown that weld-through primers can negatively affect weld or joint quality.'*

- Mitsubishi

  Recommends the use of weld-through primer for STRSW but does not specify the use of it when GMA-MIG/MAG welding.

- Subaru

  Does not specify whether to use, or not to use, weld-through primer.

Preference for Zinc-rich

For the most part, vehicle manufacturers that recommend or require the use of weld-through primers don't provide information on its composition, nor do they specify any particular weld-through primer brand(s). However, Thatcham Research and at least two major vehicle manufacturers have provided information that specifies or recommends the use of zinc-rich weld-through primers:

- Thatcham Research states:

  'After the joint has been prepared, apply a dust coat of zinc-rich weld-through primer to the inner faces of the weld joint, before welding'.

- Toyota states:

  'Weld-thru primer is usually made with zinc; however, some are copper based. For collision repairs on Toyota and Lexus vehicles, zinc-based primer must be used (consult the repair manual) during welding procedures because these vehicles are manufactured using an e-coat process. Zinc is also more resistant to corrosion than other types of primers, such as those made with copper'.

- Honda states:

  'Only zinc-rich weld-through primer should be used on Honda vehicles and should only be applied to mating surfaces of panels where squeeze-type resistance spot welding will be used as the attachment method'.

When Using Weld-through Primers

When using weld-through primers, the following 'Best-practice' rules must be followed.

Weld-through primers must:

- only be applied on the inside of flange joints - adhesion performance of zinc-rich weld-through primers is relatively low, so any overspray on exterior surfaces must be removed prior to the application of subsequent surface primers, fillers, and topcoats to ensure they adhere properly. Note however that zinc does have good adhesion when applied to sandblasted steel, being absorbed into the sandblasted (profiled) surface; and
- only be applied to correctly prepared bare steel - weld-through primers must not be applied to aluminium or other metals; and
- not be applied to flange joints that are to be MIG brazed; and
- importantly, correct personal protective equipment (PPE) must be worn to prevent the inhalation of harmful zinc oxide fumes (produced when welding zinc coated steels). Exposure to welding fumes can present an immediate health risk to welding technicians from an illness called 'Fume Fever', with the potential for serious long-term health problems including lung disease and neurological complications.

Also, the general recommendation for GMA-MIG/MAG plug welding is to remove any weld-through primer from the pre-punched or pre-drilled holes prior to performing plug welding.

In Summary

The following points summarise the subject of the correct use of weld-through primers:

- Repair Certifiers and autobody repairers should understand that whilst the majority of OEMs recommend the use of weld-through primers when replacing welded body panels and structural components, it's not a universal requirement; and
- in the first instance, the vehicle manufacturer's BRMs, position statements, and general recommendations (if available) should be referenced to confirm where and under what circumstances weld-through primers should or shouldn't be used; and
- autobody repairers should be mindful of the amount and placement of weld-through primer applied to welded flange joints, especially when GMA-MIG/MAG welding; thin coats over bare metal flanges with the immediate weld site cleaned of primer will minimise porosity and welding defects (that can compromise weld strength); and
- there are very few OEMs that identify, recommend, or endorse any particular brand or type of weld-through primer, however, the general consensus among industry experts (and at least two vehicle manufacturers), is that weld-through primers with a zinc-rich composition provide the best corrosion protection performance for welded flange joints; and
- if copper weld-through primers are to be used, those that are zinc-rich are more likely to provide the appropriate level of corrosion protection. This is particularly relevant when selecting copper-based weld-through primers.

By following this Technical Bulletin, a Repair Certifier's decisions will be aligned with OEM requirements, guidelines, and/or recommendations.

FOR FURTHER INFORMATION PLEASE CONTACT REPAIRCERT NZ.

Appendix A: Galvanic Corrosion Explained

When dissimilar metals come into contact with each other, and in the presence of an electrolyte (including ordinary moisture such as water, rain, dew, snow, high humidity, and sea spray), the more 'active' (anodic) metal sacrifices itself to protect the more 'inert' (cathodic) metal.

Zinc is the second most active (anodic) metal in the galvanic series, positioned well below iron and steel *(see Image A1)*, and will therefore actively 'corrode' to protect any iron or steel that it comes in direct contact with.

This is primarily the reason that 'hot dip' zinc galvanising is recognised globally as one of the most effective, durable, and long-lasting coatings for protecting steel from corrosion, in a wide variety of environments.

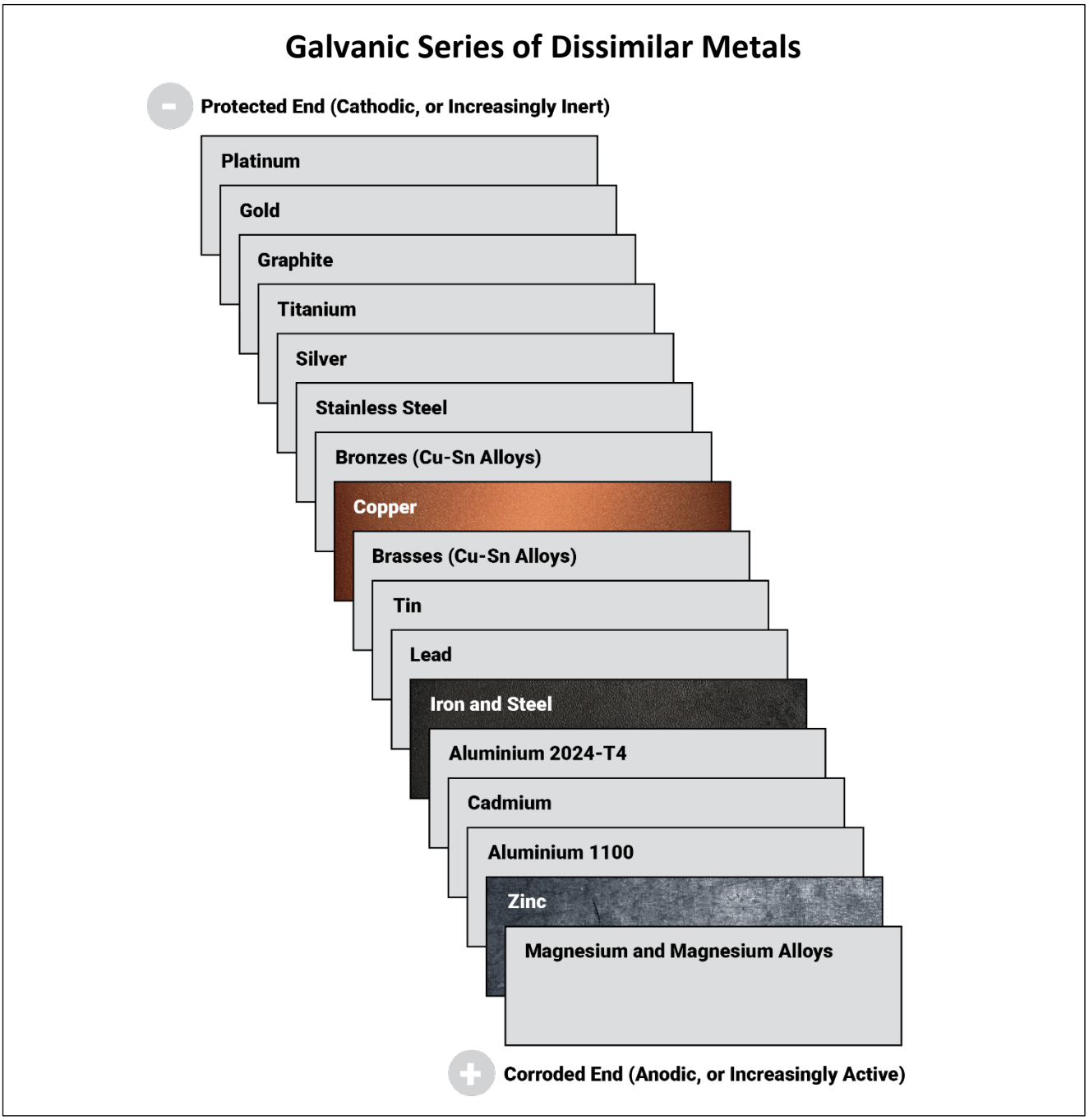

Image A1: *Galvanic Series of Dissimilar Metals - 'Anodic' Zinc actively protects the more 'Cathodic' Steel.*