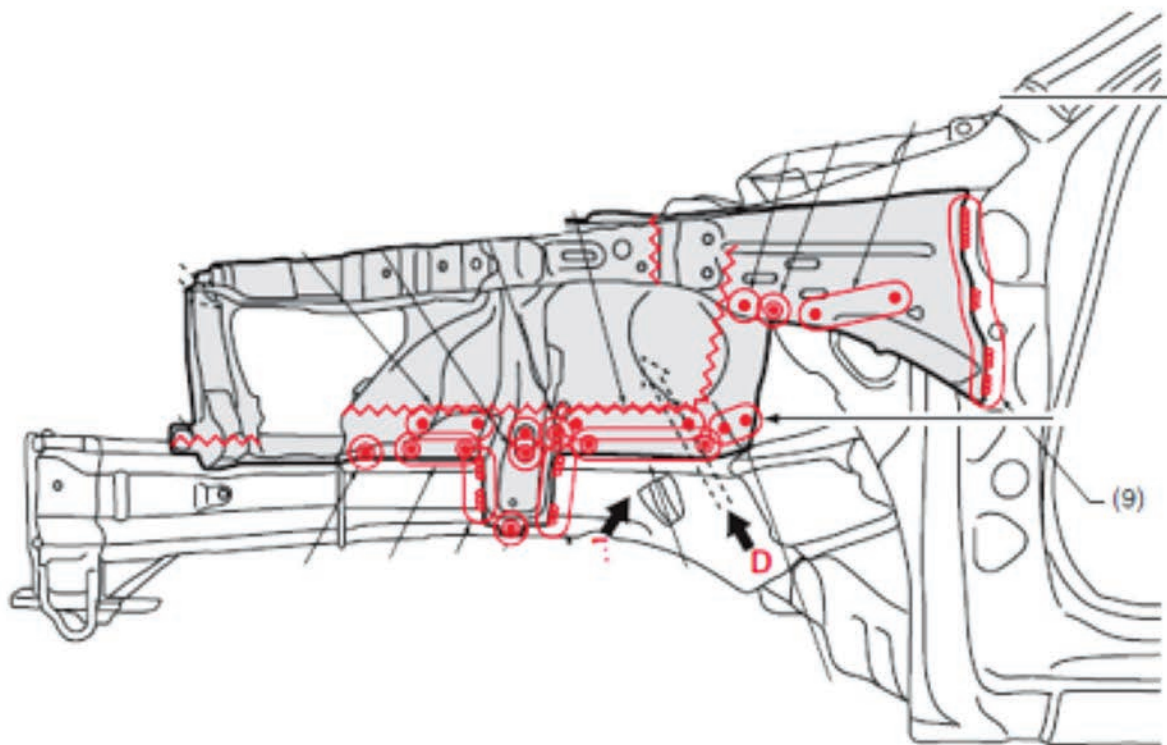


# TECHNICAL REPORT



## REPAIR PROCEDURES –

### UNDERSTANDING AND INTERPRETING THE INFORMATION



Like it or not, Body Repair Manual (BRM) information is an absolute REQUIREMENT to enable autobody technicians to develop correct repair strategies (structural or otherwise), on newer-generation vehicles.

At I-CAR, we receive many requests from the industry for repair procedure information on Suzuki, Holden and Toyota, as well as being regularly asked for an “expert opinion” on a variety of other repair scenarios that have been or are looking to be, carried out on other vehicle makes, particularly where there may be a dispute about the methodology.

It is a shame that many of those repairs that have already been completed prior to our involvement, are not done in accordance with the manufacturer’s specifications, requiring extensive re-work to comply – often simply because the technician(s) do not have all the information available, or that they simply do not understand the symbols, and/or other details contained in the procedure documents.

**Resene**

Automotive & Light Industrial

Coatings Experts at your door

0800 108 008 | [reseneauto.co.nz](http://reseneauto.co.nz)







# TECHNICAL REPORT






## SYMBOLS AND COLOURS :-

While there is some commonality across vehicle-maker BRM's, there are just as many (or more) differences !!! – It's a fallacy to think that symbols identify the same operation across vehicle-makers. Having stated that, it is also fair to say that a holistic overview would identify, in general terms that :-

- Dots  or circles  refer to Spotwelds (STRSW).
- Squares (Filled)  or Squares (Outlined)  refer to MIG plug welds.

Confusion and misunderstanding creeps in when we observe variations to even these common symbols – e.g.

- Dots with a letter in the middle   or a “circle within a circle” 

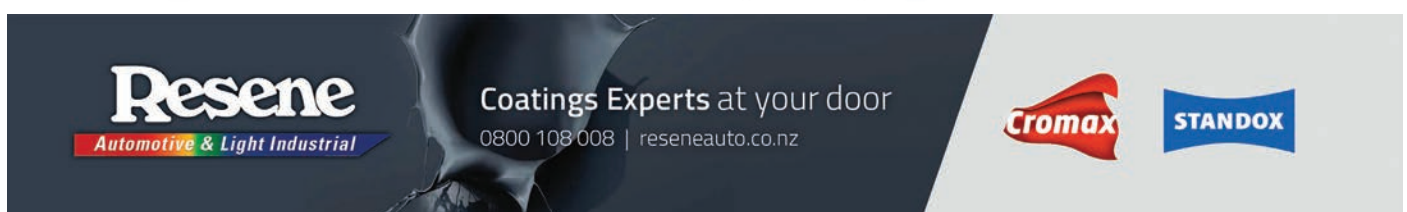
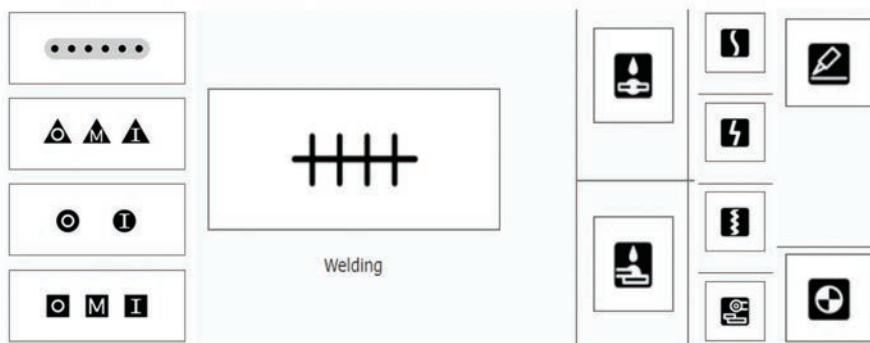
- Squares with a letter in the middle   or a “square within a square” 

While the vehicle-makers in the above examples are still identifying spot welds and MIG plug weld symbols respectively, the inclusion of **LETTERS / MULTIPLE SYMBOLS / COLOURS**, determines other operations or requirements, such as :-

- Plate or panel stack thickness and plate count (number).
- Orientation of the weld site (over lapping panels).
- Removal or replacement operations.
- Sealers, adhesives & NVH materials.

## A CLOSER LOOK AT SOME OF THE VARIETY OF SYMBOLS USED BY VEHICLE-MAKERS :-











### TOYOTA



# TECHNICAL REPORT



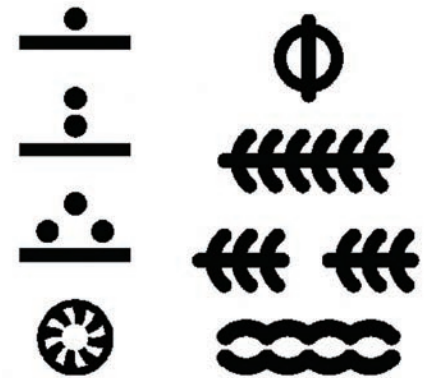
## KIA

REMOVAL	 : Outside	 : Middle	 : Inside	 : Cut	 : Hidden weld point
INSTALLATION	 : Spot welding	 : Plug welding	 : Lap welding	 : Epoxy adhesive	 : Butt welding

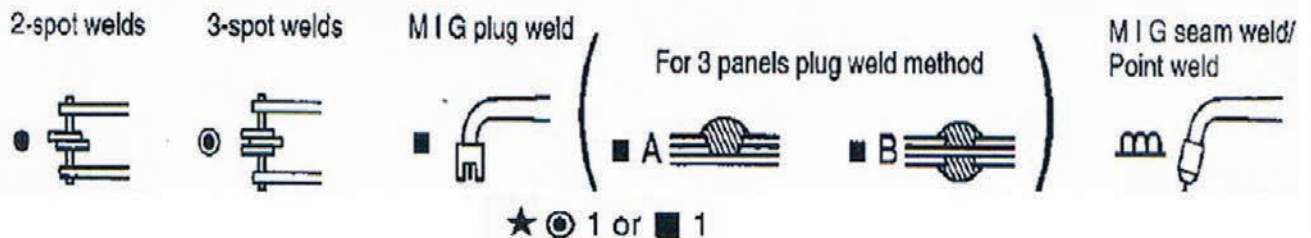
## HONDA

- \* : Spot weld
- ▽ : MIG weld
- × : 2-plate welding
- ⊗ : 3-plate welding
- ⊠ : 4-plate welding
- ( ) : The number of welding

## VOLKSWAGEN



## NISSAN



**Resene**  
Automotive & Light Industrial

Coatings Experts at your door  
0800 108 008 | [reseneauto.co.nz](http://reseneauto.co.nz)





# TECHNICAL REPORT



## HYUNDAI

Symbol	Used for	Figure
	MIG butt weld	
	MIG lap weld	
	Sealer	
	Adhesive	

Symbol	Used for	Figure
●	Spot weld	
O	Outside	
M	Middle	
I	Inside	
—	Cut	
	MIG plug weld	

## MITSUBISHI

Symbol	Operation description
● ● ● ●	Spot welding
■ ■ ▲ ▲	MIG plug welding (■: indicates two panels to be welded ▲: indicates three panels to be welded)
++++	MIG spot welding
	MIG arc welding (continuous)
ooooooo	Braze welding
	Anti-corrosion agent application locations (Use access holes to apply liberally to butt-welded joints.)

## MAZDA

SYMBOL	MEANING
●	Spot welding
■	CO <sup>2</sup> arc welding (plug welding)
+	CO <sup>2</sup> spot welding

SYMBOL	MEANING
	Continuous MIG welding (Cut-and-join location)
○○	Braze welding
~~~~~	Rough cut location

**Resene**  
Automotive & Light Industrial





Coatings Experts at your door  
0800 108 008 | [reseneauto.co.nz](http://reseneauto.co.nz)



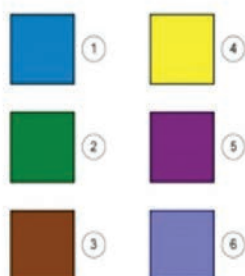
# TECHNICAL REPORT



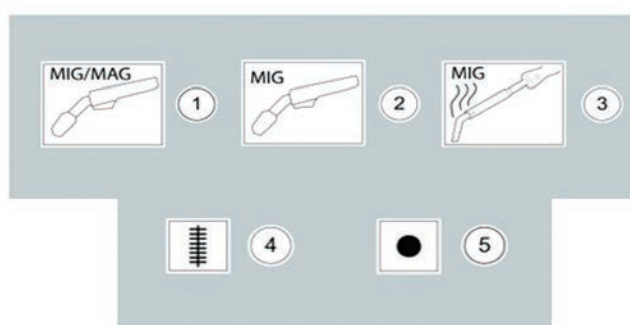
## FORD (AUSTRALIA)


TYPE OF WELD	
	SPOT WELD Through 3 thicknesses of metal
	SPOT WELD Through 2 thicknesses of metal
	HOLE PUDDLE WELD
	FUSION WELD

## FORD (USA and EUROPE)





Item	Part Number	Description
1	—	Blue - Target or primary component to be removed/installed (or disassembled/assembled).
2	—	Green - Components that need to be removed prior to or installed after the target/primary.
3	—	Brown - Components that need to be removed prior to or installed after the target/primary.
4	—	Yellow - Components to be set aside for access, but not removed. Also highlighted areas to inspect or adjust.
5	—	Magenta - Electrical connectors and fasteners such as nuts, bolts, clamps, or clips to be: detached, attached, loosened, moved, removed or installed.
6	—	Pale Blue - Special tool(s), general equipment, or common tools used in an uncommon way.





**Resene**  
Automotive & Light Industrial

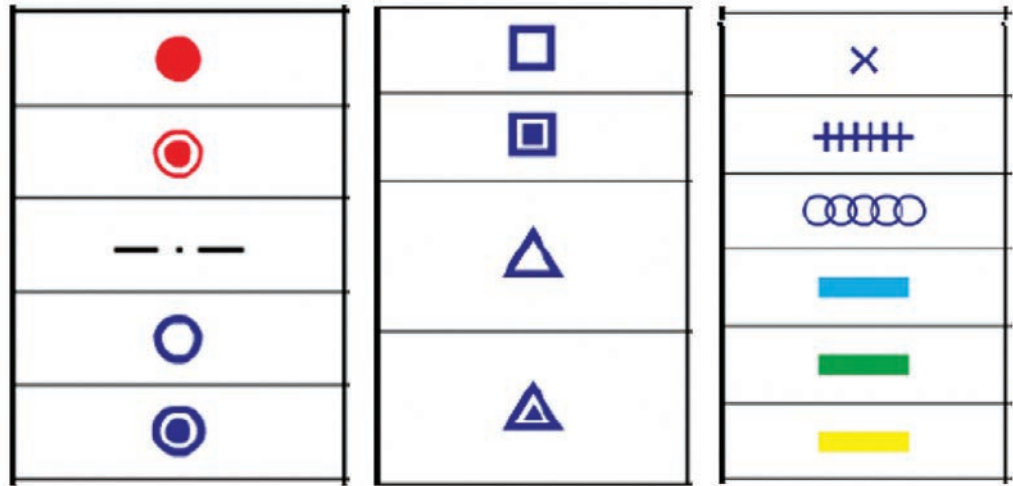
Coatings Experts at your door  
0800 108 008 | [reseneauto.co.nz](http://reseneauto.co.nz)

# TECHNICAL REPORT



## SUZUKI




## THE BIGGER PICTURE –

### LOOKING BEYOND “JUST THE PROCEDURE” ---



The challenges that the modern-day repair technician faces when reading through the multiple pages of a typical repair procedure will include :-

- Are all of the symbols and call-outs specified in the procedure identified and understood?
- Does the particular procedure include the various symbols identification and specifications ?  
– (often this information is found elsewhere in the BRM).
- The printout of the procedure will be normally be done via the office printer – as **COLOURS** are often used to identify different products / materials, how will the technician know what products are used where, if the print-out is in **Black and White** ?
- Is the procedure actually for the model that is being worked on ? We have to remember that many OEM parts salespeople who we use to source the information from, simply have no knowledge or comprehension of the information contained in a BRM.
- Are there updates or bulletins from the OEM available that restrict or, conversely, allow some flexibility in perhaps, welding methods/cut locations, joint types etc?

It's a well-known fact that **no** Body Repair Manual (BRM), irrespective of the manufacturer, will cover all of the damage scenarios that we see in our workshops – additionally, a substantial number of “Domestic Market”, imported models may not necessarily have any BRM info available at all.

  
Automotive & Light Industrial

Coatings Experts at your door  
0800 108 008 | [reseneauto.co.nz](http://reseneauto.co.nz)





# TECHNICAL REPORT



In the absence of a specific procedure, we need to take a more pragmatic approach to develop a repair blueprint that still meets all OEM requirements.

This is where the “**GENERAL INFORMATION**” section of the appropriate body repair manual should be read and understood, as this will contain a great deal of generic information, which typically includes :-

- Structural outlines.
- Crash management systems diagnosis.
- Symbols and icons overview and descriptions.
- Steel strengths of different structures and panels.
- Cross sections of structural sub – assemblies (e.g. pillars and sills).
- NVH locations and material types.
- Welding methods, preparations and machine set up for certain steel types, thicknesses and locations.
- Corrosion protection requirements.
- Cautions and Precautions.
- Statements and requirements / prohibitions.

With this information obtained and researched, the technician has a much better understanding of how the vehicle can be repaired and returned to its pre-accident condition without compromising the safety and quality of the repair. Effectively, the general information section of the selected BRM could be described as being “**BEST TRADE PRACTICE**” for that particular vehicle.

## EXAMPLES OF “GENERAL INFORMATION”

- a. For areas where a spot welder cannot be used, use a puncher or drill to make holes for plug welding.

Thickness of Welded Portion	Diameter of Plug Hole
Under 1.0 mm (0.04 in.)	Over 5.0 mm (0.20 in.)
1.0 to 1.6 mm (0.04 to 0.06 in.)	Over 6.5 mm (0.26 in.)
1.7 to 2.3 mm (0.07 to 0.09 in.)	Over 8.0 mm (0.31 in.)
Over 2.4 mm (0.09 in.)	Over 10 mm (0.39 in.)

**When welding more than 3 panels together including 1500 MPa or 1180 MPa ultra high strength steel. (When plug welding a third panel to 2 panels which are welded under the conditions described above.)**

Plug weld	Plug diameter	Same as the standard method (See the introduction)
	Wire type	AWS A5.18 ER70S-3
	Shield gas	Metal active gas

**Resene**  
Automotive & Light Industrial

Coatings Experts at your door  
0800 108 008 | [reseneauto.co.nz](http://reseneauto.co.nz)

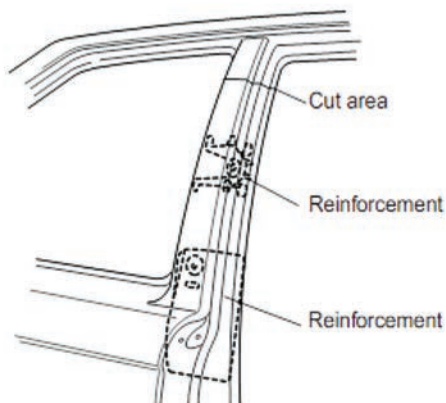


# TECHNICAL REPORT



## 2. Cut and welding point selection

Cutting, if necessary, should not be done in a reinforcement area. Select an area which will result in the least amount of deformation after welding.



## POSITION STATEMENT EXAMPLES :-



Ford is pleased to advise the inclusion of three overarching statements that may be used by repairers in the event that a procedure does not exist. They can be found in more recent model years 501-25 section of the body repair manual. FCSD believes this will be a welcomed addition from the repairer group.

### Statement 1 : Sectioning non-structural components

#### Exterior skin repairs – Non – structural

Exterior skins may be sectioned according to REPAIR NEEDS and TECHNICIAN JUDGEMENT.

There may be suggested cut lines or repair scenarios dictated in the workshop manual, or common industry guidelines may be applied. All joints should use MIG welded butt joints with a typical 50mm backer, and must be at least 50mm away from hinge and striker mounting points. Consideration should be made as to final finishing of the repair area, and restoration of corrosion protection after repair must be restored per the workshop manual procedures and guidelines.

**Resene**

Automotive & Light Industrial

Coatings Experts at your door

0800 108 008 | [reseneauto.co.nz](http://reseneauto.co.nz)





# TECHNICAL REPORT



## Structural components

If a factory procedure for sectioning a component is published, it may be followed using the workshop manual. If there is no published procedure for sectioning the NEW part, the new part must be installed as received, and using the same number of spot welds and/or other factory joining methods. Restoration of corrosion protection and proper sealing of the repair (as required) must be done following the workshop manual procedures.



## General Welding Recommendations :-

1. Spot welding (STRSW) is the preferred method for attaching of panels and should be used wherever possible.
2. Where the spot welding equipment will not access the required weld position, a GMA (MIG) plug weld should be performed.
3. The same number and similar position of spot welds (or plug welds) should be used when replacing the panel, as was used during the manufacture, in order to maintain the original structural strength of the vehicle.
4. If the location of the original weld holes cannot be determined, space the replacement weld sites every 40mm (1½ in) apart.
5. Prepare all mating surfaces, as necessary, with the application of 3M Weld – thru coating (Part # 05916), or an equivalent weld-through compound.

**Resene**  
Automotive & Light Industrial

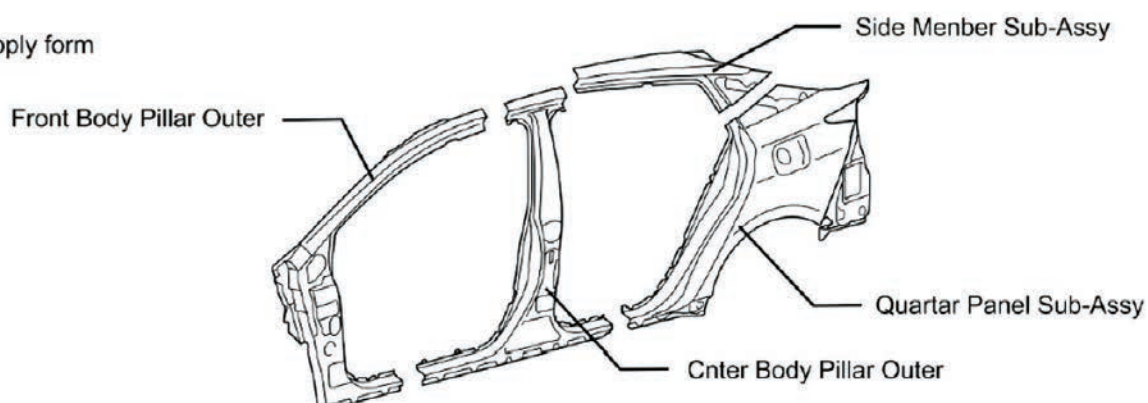
Coatings Experts at your door  
0800 108 008 | [reseneauto.co.nz](http://reseneauto.co.nz)



# TECHNICAL REPORT

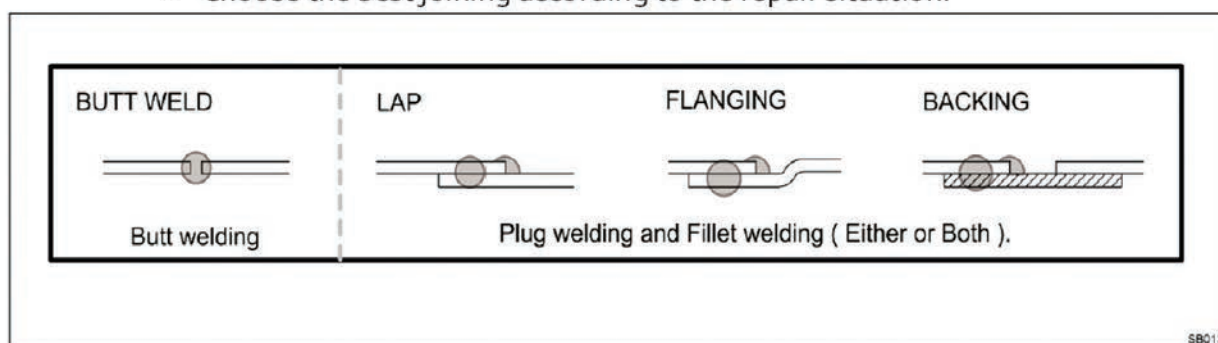


Supply form



## 2. JOINING OF CUT PANELS

- Butt welding, lap welding, flanging and backing are also effective.
- Choose the best joining according to the repair situation.



*These articles have been written by Martyn Lane : I-CAR Instructor, Weld Test Administrator and Technical Specialist to the auto body industry*

**Resene**  
Automotive & Light Industrial

Coatings Experts at your door  
0800 108 008 | [reseneauto.co.nz](http://reseneauto.co.nz)

