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TECHNICAL BULLETIN #5

TO: ALL VCNZ CERTIFIERS, VCNZ APPROVED ENGINEERS, AND NZHRA MEMBER CLUBS

REVISION 00

1587/25E

BUILDERS WELDING GUIDE

This Bulletin takes effect as at the 1st of September 1996

INTRODUCTION:

This Bulletin provides some basic information to assist those builders who wish to carry out their own structural welding. This information has been compiled by the Technical Advisory Committee after consultation with experts in the aviation industry, professional engineers, and welding tutors.

RULES AMENDMENTS:

1. Rules affected by this Technical Bulletin are (New Code):

   2.13, Page 64;
   2.17 Page 64;
   2.36 Page 66;
   2.46, Page 67;
   3.2, Page 73;
   3.9 Page 74

   The Rules are is to be changed from:

   "..... must be carried out by an NZHRA Approved Engineer with written verification provided", to:

   "..... must be carried out by an NZHRA Approved Engineer ***or holder of an NZHRA Welding Approval,*** *with written verification provided".*

2. No rules are affected by this Technical Bulletin in the Retrospective Vehicle Code.

Authorised by land transport safety authority for low volume vehicle certification

BACKGROUND:

During the development of the NZHRA Code of Construction Manual, welding was seen as a very important part of a vehicle's construction and a lot of areas were required to be welded by an NZHRA-Approved Engineer. Due to many requests for owner/builders to carry out their own welding, a Welding Approval Procedure was introduced to facilitate this. To assist this process, this Bulletin has been developed to provide prospective builders with some basic information seen as being necessary to understand prior to applying for Welding Approval.

Note that critical areas such as steering and front suspension components will still need to be welded by an NZHRA-Approved Engineer or a formally qualified welder experienced in the strength requirements and types of steel used in steering, braking, and front suspension components.

The following information is only a guide and not intended as a replacement for a welding course.

REQUIREMENTS:

Equipment

The most common types of welders commonly used in home workshops are stick electrode (arc) and MIG. It is important in either case to use a machine capable (sufficient amperage) of welding the types of material normally associated with chassis construction. Usually this involves from 2mm to 6mm maximum thickness, but can in some cases be up to 12mm.

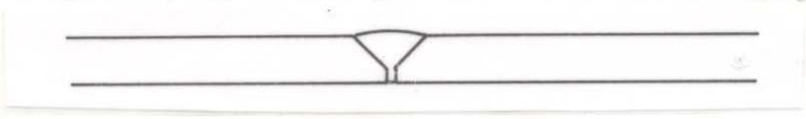
Note that for typical fabrication materials (eg: 3-5mm mild steel) a minimum of 140 amp capability with a 50% duty cycle should be used. Many of the problems associated with MIG welding stem from people using machines far too light for the application, such as chassis work using panel-steel welders.

Preparation

Correct preparation is very important as insufficient penetration or fusions often results when preparation is not carried out properly. Ensure that the steel being welded is clean and free of paint, rust and grease.

Where possible joints should always be "veed" to ensure that proper penetration takes place, such as that shown in Figure 1. (See Figure 1)

Figure 1



For butt-welds the joint should be prepared for possible full penetration. The amount of preparation will depend upon the material thickness. Some guidelines are below: (See Figures 2)

Figure 2(a)

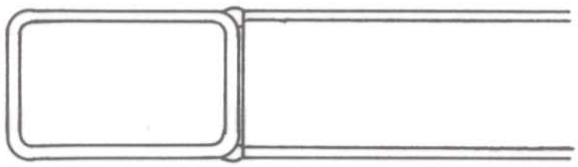
Thin material up to 2 mm. No preparation required.

Figure 2(b)

3 mm upwards.

Where t-joints are formed in RHS, joint preparation is usually not necessary due to the radii on the corners of the RHS, as shown in Figure 3. (See Figure 3)

Figure 3



In all of the above cases, the weld metal should be slightly proud of the parent materials being joined.

Pre-Welding Set-Up

A thorough knowledge of the type of steels being welded is essential as is ensuring that the type of welding electrodes or MIG wire is compatible with the parent materials being welded. Various types of MIG-welding gas are also available. A lack of compatibility in any of these areas can cause premature cracking and failure.

When welding dissimilar thicknesses it is advisable to pre-heat the thicker component prior to welding, especially if the welding machine being used is small and multi-passes (runs) are required to obtain correct weld size.

Pre-heating should be to about 100 degrees C and an oxy-acetylene torch is sufficient for this.

Shrinkage is a problem with most types of welding, so care should be taken to ensure that sections are held securely and all tacked first to eliminate distortion and sections being pulled out of square. Full chassis may need to be held in a jig if full boxing is to be done or all new cross-members are being fitted, as chassis distortion is a known problem if not held securely when fully boxing.

Keep fit-up gaps to a minimum to avoid linear shrinkage.

WELDING TEST PROCEDURE:

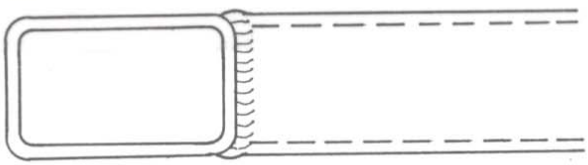
When applying for Welding Approval (effective as at release date of this Technical Bulletin), a requirement now is that the Applicant carries out a physical welding test in the presence of an NZHRA Certifier, to satisfy the Certifier of the Applicant's competency.

This is to be carried out by practical weld tests of the same types of section and material as those to be primarily used throughout the Applicant's vehicle's construction.

- The test material sizes should relate to the sizes of materials to be used for the actual vehicles construction. This is to ensure that the Applicant will be proficient in welding the size of materials being used in the actual vehicle being built or modified.
- The welding equipment being used should be appropriate for the work being carried out. A large amperage welder would not be required for a light space frame, but would be required for a chassis with heavy section brackets.
- The test pieces are to be welded together on one side only, after which the Certifier using a hammer and a vice, is to force one piece against the other in the direction of the welded side of the sample.
- The specific tests are to approximate those shown in the following diagrams {Figures 4(a), (b), and (c)}, which the Applicant is to have prepared for the test prior to the arrival of the Certifier overseeing the welding test.

The Certifier will be looking primarily to ensure that after the bend-test, the material and the weld do not separate due to lack of fusion. It is acceptable for the weld itself to fracture, or for the weld to tear away with some of the parent material attached. It is not acceptable for the weld to separate from the parent material.

Figure 4(a)



3mm RHS, 50mm × 50mm or larger

Figure 4(b)

25mm to 50mm
1.6mm to 3 mm wall pipe

OR

25mm to 50mm
1.6 mm to 3mm wall pipe and 6mm to 12 mm base plate

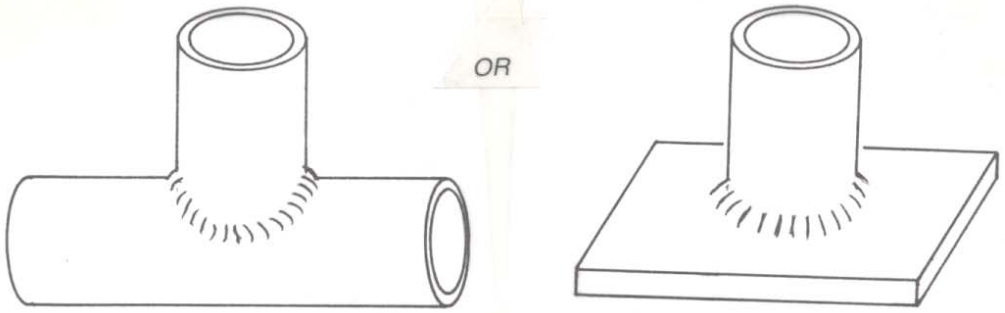
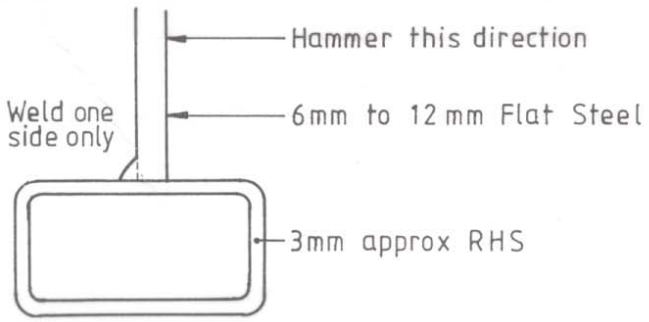


Figure 4(c)



COST:

The costs for the Certifier to carry out the test inspection are to be met directly by the applicant on the basis of a market hourly rate. It is expected that a maximum recommended charge for this service is one hour at $40.00 per hour, plus any travelling costs. This is to be arranged between the Applicant and the Certifier.

GENERAL INFORMATION:

This Technical Bulletin is not intended to tell the builder how to weld, but offers in this section a few points to take into consideration.

Porosity

Porosity in a MIG weld is caused by insufficient gas shielding. To be sure of avoiding this, ensure that correct gas flow settings are used, and the correct gas type is used. Avoid welding in the wind, as even light breezes can blow away the shielding gas, which is vital for a good weld.

Vertical Welding

Vertical (downhand) welding is difficult and can often look good without necessarily having any fusion. A test piece should always be tried and tested prior to doing the welding to ensure the capability of the builder.

Weld Cooling

Welds should be left to "air cool" - ie: don't put them under the hose. This has the effect of "locking in" the changes present in the heat affected zone, as the chemical processes are basically stopped when the metal is "frozen" by sudden cooling (quenching). Generally this change is detrimental to the materials' properties.

Power Supply

In some areas the voltage supply to the welding machine may be low at peak load times, so there is a need to be aware of this when setting up the welder.

Lighting

Ensure that there is sufficient lighting in the area that the welding is being carried out in.

Safety

Always ensure that adequate safety equipment is on hand, including gloves and a proper welding helmet in good condition.

Signed: ..... Date: 24th April 1997.
Tony Johnson
General Manager
New Zealand Hot Rod Association (Inc)

For any queries in relation to this Technical Bulletin please contact either the Project Manager, Chris Litherland, or the NZHRA Office.