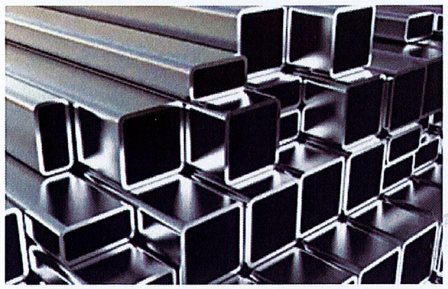
Criteria 5

VCE Number: 17120139G

Research For Canopy Frame Material

Stainless Steel Tube

Reference: (Stalatube 2008)



Advantages

- Corrosion resistant
- High strength
- Attractive appearance

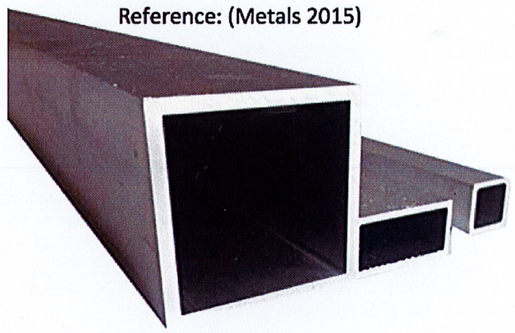
Disadvantages

- High costs
- Hard to weld

Stainless Steel: would not be a suitable product because of its high costs and the fact that it's very hard to weld.

Aluminium Tube

Reference: (Metals 2015)



Advantages

- Very light which will help keep the weight effects minimal on the ute.
- High corrosion resistance.
- Fairly strong.

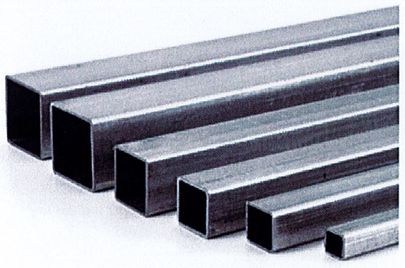
Disadvantages

- Very expensive.
- Easily dented/marked/damaged.

Aluminium Tube: could be a suitable metal to use while constructing the frame of the canopy however the high costs could be a factor in the decision because the user has set a budget. This material would suit my product because its very light weight which means that its minimalizing the effect on the ute.

Mild Steel Tube

Reference: (Sciencing 2019)



Advantages

- Very strong, help ensure maximum strength of the canopy.
- Very good weldability and machinability.
- Easily welded to other metals.
- Reasonable price.

Disadvantages

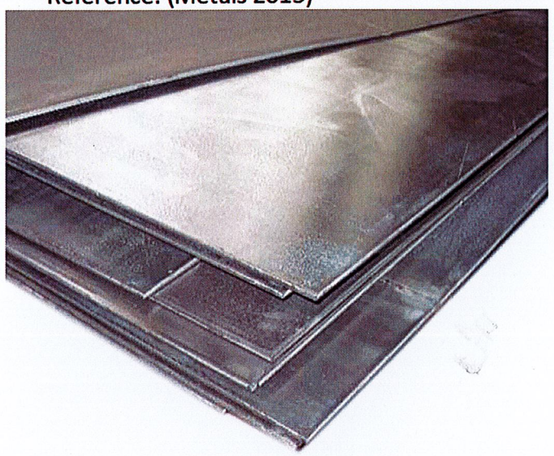
- Will rust if left untreated.

Mild Steel: would be a good option for my product for the framing of the canopy because it's very strong and it has good weldability to itself and also other types of metals. This will suit my product because it needs to be strong to last a long time and I also need to weld another metal to the outside to enclose it.

Research For Canopy Sheet Material

Flat Sheet Aluminium

Reference: (Metals 2015)



Advantages

- Corrosion resistance.
- Good overall machinability.
- Strong.
- Lightweight.

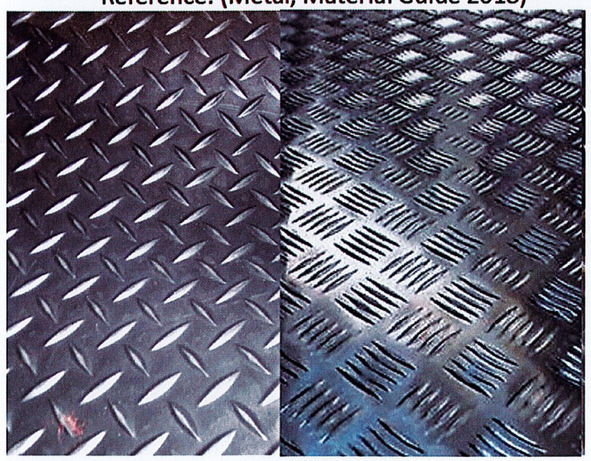
Disadvantages

- Dents and scratches become easily visible.
- Slightly Expensive.

Flat Sheet Aluminium: would be a good material to use for my product because of its good overall machinability meaning its easy on the tools. The material is also corrosion resistant which will suit the product as it's an outside use product. It is also a fairly cost effective material.

Checker Plate Aluminium

Reference: (Metal, Material Guide 2018)



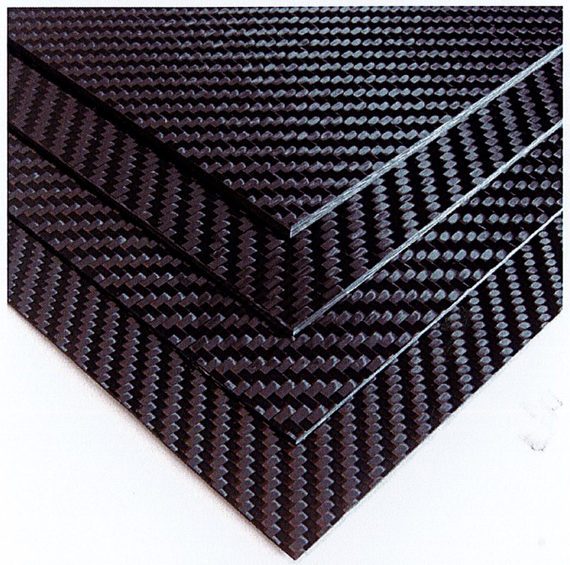
- **Advantages**
- Lightweight.
- Good forming, drilling, and welding ability.
- Corrosion resistance.
- The checker plate patterns will disguise scratches and dents, hence lengthening product life and reducing maintenance costs and cleaning.
- **Disadvantages**
- Slightly Expensive.

Checker Plate Aluminium: would be a very good option for a material for my product. It has good forming drilling and welding ability meaning it's easy to work with in the workshop and its easier on the tools. It is also corrosion resistant which is good because the product is an outside use product. It also has a fairly good cost price.

Research For Canopy Sheet Material

Carbon Fibre

Reference: (Research 2017)



Advantages

- It has a high strength to weight ratio.
- It's corrosion resistant.
- It's fire resistant.

Disadvantages

- On the other side its quite expensive.

Carbon Fibre: would not be a good option for my product because it is expensive and would exceed the users budget, it also isn't a very good material to have as an outside use one as it wouldn't last years of being outside. It also would get damaged very easily.

Marine Ply

Reference: (Plywoods, Austral marine plywood 2019)

Advantages

- It offers all the attributes of the woods it contains plus it has additional strength and stability because of its laminated structure.
- Durable and long lasting.
- It has high impact resistance.
- Made with high quality woods that are selected based on density, bending strength, impact resistance and surface finishing characteristics.

Disadvantages

- Not very strong compared to metal

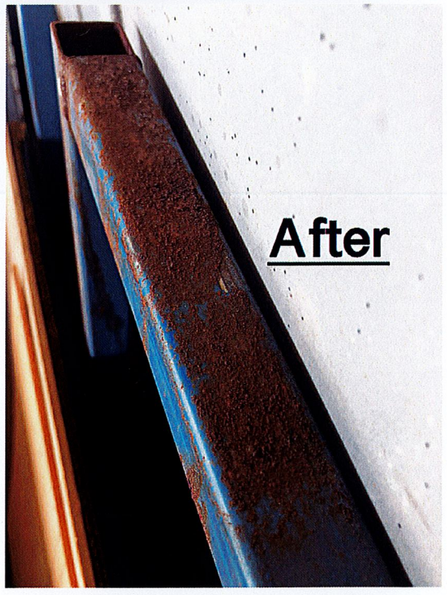
Marine Ply: could be a good option because of its characteristics, its Durable and long lasting but because it's a wood it's not really suited to the user's needs of keeping items in a storage location in a safe manner. People can break the wood and so can tree branches whilst in use. The user also wanted it to me a fully metal product.

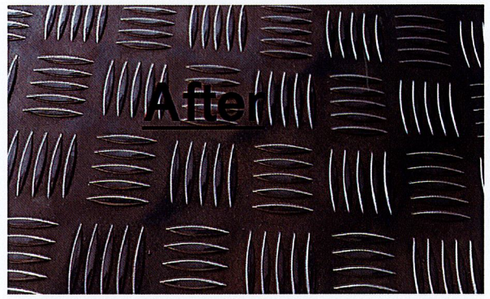
Material Testing

Corrosion Resistance

Mild Steel

The mild steel had rust forming on it after the 2nd day. It was fairly obvious and I could see that it was starting to spread over more of the metal.



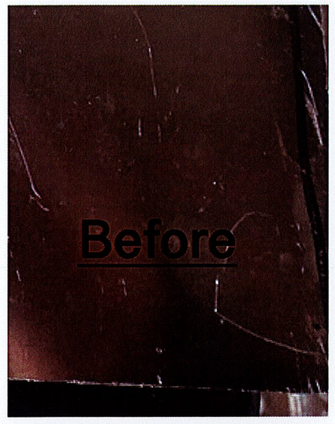


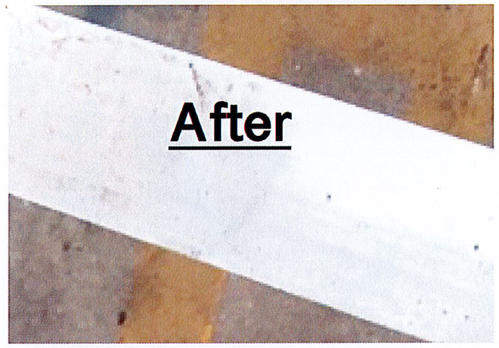
Checker Plate Aluminium

The checker plate also had no signs of rust and I couldn't see any forming in the near future. The ball dent wasn't very obvious and the checker bits hide the dent mark.

Flat Sheet Aluminium

Flat sheet as expected had no rust marks and no signs of rust that was forming any time soon, the ball dent was slightly obvious but wasn't too bad.





Aluminium Tube

The aluminium tube had no signs of rust. However, there were a few dent marks and it is easily dented but doesn't matter because it's not on the outside.

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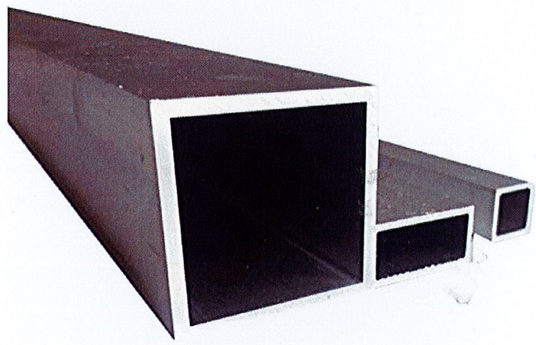
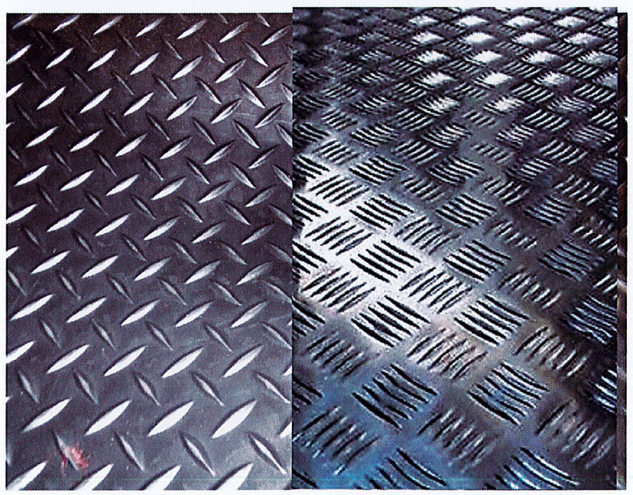
Final Material Decision

Aluminium Tube



Why: I have chosen to use this material because it is light weight which will help minimalize the effect on the ute. It is also a corrosion resistant and the user wants maximum life out of the canopy.

Checker Plate Aluminium



Why: I have chosen to use this material because its lightweight, and corrosion resistant. The canopy needs to be lightweight to minimalize the effect on the ute and it also needs to be corrosion resistant so it last ages. I also chose aluminium sheet because I can Tig weld it to the aluminium tube and don't need to pop rivet or anything

Process Research

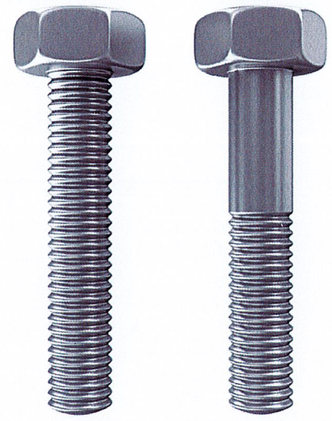
MIG Welding

Advantages:
- Quick
- Easy

Disadvantages:
- Can only weld aluminium with certain settings and lots of knowledge and practice.
- Messy welds

Mig welding would be a good process to use while building my canopy because I will need to weld the frame together. However, they mig welder may not be the best depending on if I make the canopy from aluminium or mild steel.

Bolts

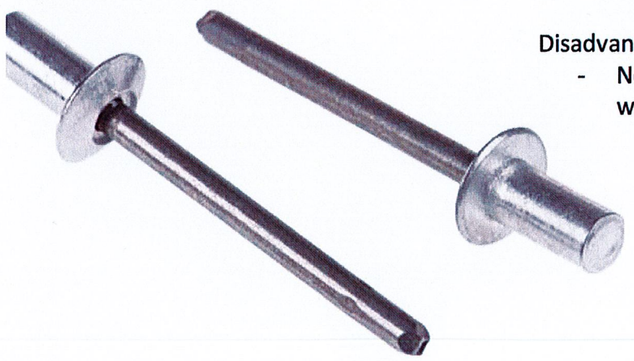


Advantages:
- Cheap
- Easy

Disadvantages:
- Not won't make the canopy water and dust proof

Bolts would be a good option to connect the canopy together however I wouldn't be able to get it to fully seal and be 100% water and dustproof.

Pop Rivets



Advantages:
- Cheap
- Easy

Disadvantages:
- Not won't make the canopy water and dust proof

Pop Rivets would be a good option to connect the sheeting to the frame, however it would be impractical because it would be too hard to make the seals waterproof and dustproof if it is pop riveted on.

TIG Welding

Tig welding would be a good option to use because I will need to weld the canopy together. However, I do not know how to tig weld but I can learn if need be. This welding would depend on what material I use.

Advantages:
- Can weld all metals, Mild steel, stainless steel, aluminium
- Welds are visually appealing and clean

Disadvantages:
- Hard to learn from scratch
- Slow

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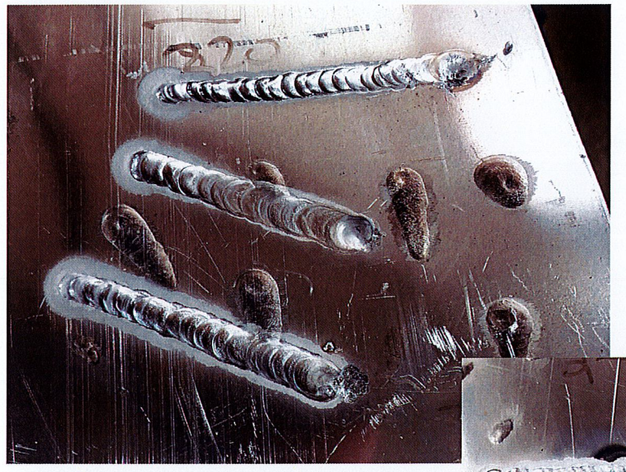
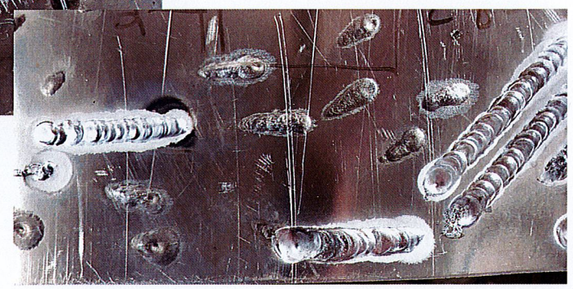
Tig Welding

Process testing



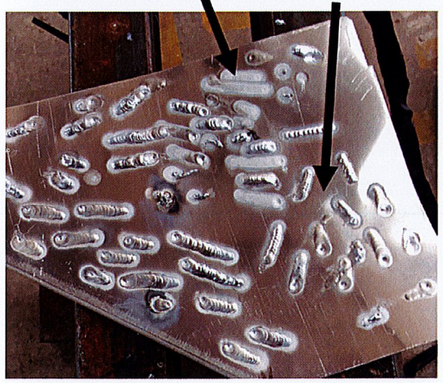
As expected/ hoped for the welds slowly got better and as time progressed I got more confident and it because easier to get and even pool of metal



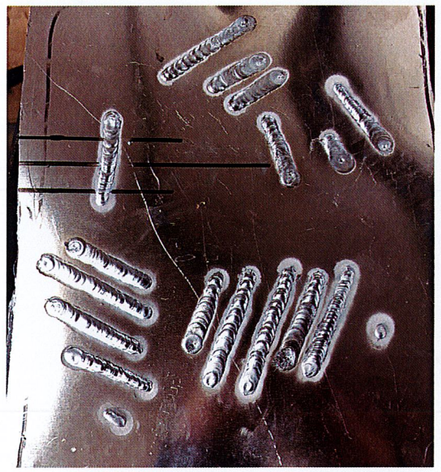
Whilst learning I firstly started practicing with just the torch trying to get an even weld pool and move it at a constant speed. Once I got the hang of that I started adding filler rod to create more of a pool and a lump on the metal. I practiced moving the torch slowly whilst maintaining an even weld pool and slowly adding the filler rod as I went and moved along. I found whilst practicing that your torch had to be pointing as vertical as possible to ensure that the filler rod flows out both sides of the weld pool evenly.

Practicing an even pool with just the torch and no filler rod.

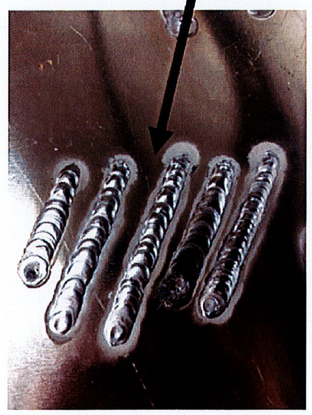
Using filler rod to try and create an even pool and a free flowing weld

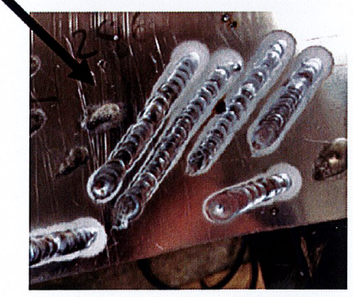


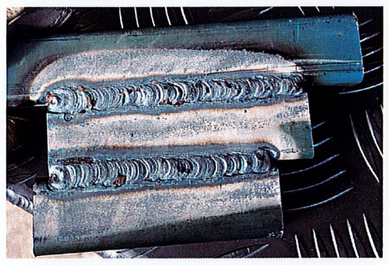
The good thing about Tig welding that I found is that when you get good at it the welds can look amazing and very visually appealing. It doesn't spit stuff everywhere like Mig welding does and it can also be used on aluminium Stainless steel and mild steel. It can be used on all sought of thicknesses on metals because all you need to change is the welder settings and the tungsten's and a few things in the torch.
It's a very skill required type of welding but it produces some great welds and can be used on practically anything.



As you can see I started to get the hang of it fairly quickly and managed to get some pretty good welds within a couple of hours.



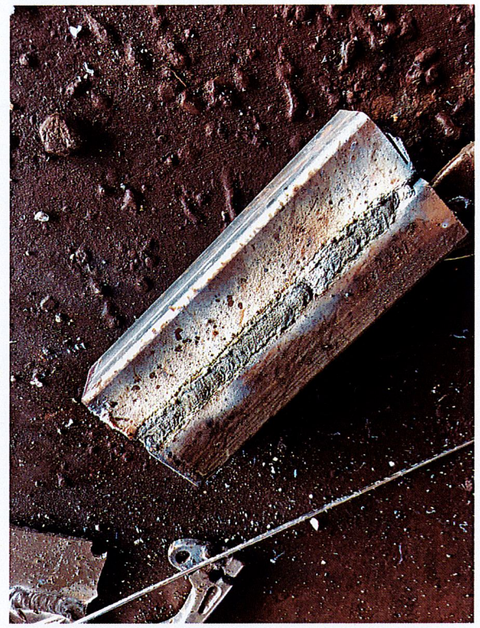




On mild steel the Tig welder produced some good strong welds. I threw this piece of metal on the ground multiple times as hard as I could and there were no signs of cracking or anything wrong with the weld.

Mig welding Process Testing

The weld here was a nice strong weld, I threw it at the ground multiple times as hard as I could and there were no signs of anything wrong with the weld and there were no cracks.

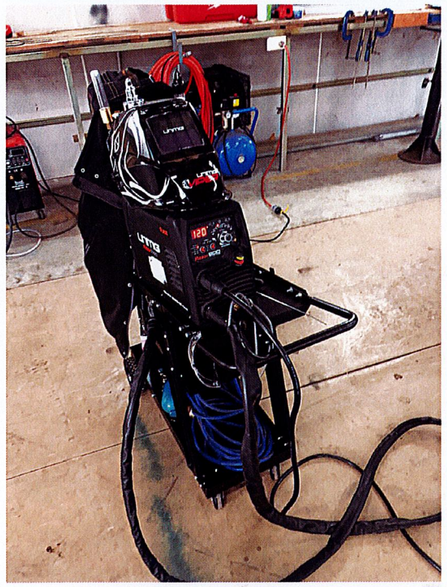


Mig Welding is the easiest form of welding. To mig weld all you need to do is pull the trigger and watch your pool of metal and move it accordingly. These are 2 examples of mig welders and one of them is using gas and one of them is gasless. The positives of gasless is that you don't have gas to move around and don't need to worry about blowing the place up because of a gas leak. Gas however can produce cleaner welds and can make it look a bit nicer.

Here you can see an example of Mig welding, it looks a bit messy because the steel was galvanised so the galvanising was messing with it but but overall the quality of the weld wasn't effected.

Although easy to do Mig welding isn't suitable for welding Aluminium and requires different gas and wire. It's also would make the project look messy with all the crap that flies all over the place and sticks to the material.

Process Decision



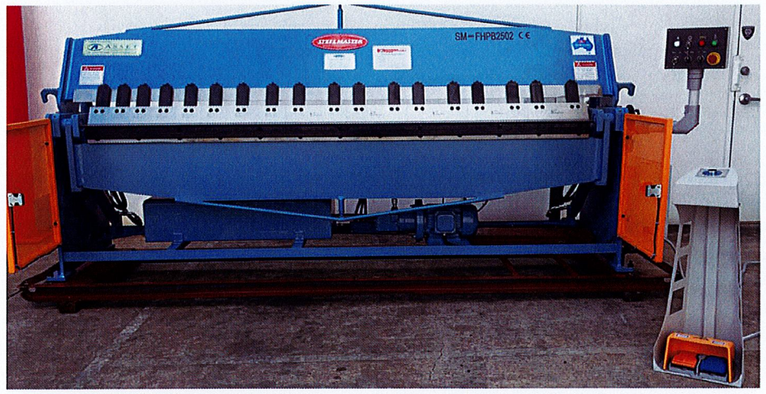
TIG Welding

For the canopy I will mainly be using the Tig welder. The main reasons for choosing the Tig is because I have chosen to use aluminium for the canopy. Tig welding is the most suited to welding aluminium so that's why I've chosen the Tig. I also have found someone who is willing to teach me so I well be hopefully able to learn off him quickly.

MIG Welding

I will also be using a Mig welder for the making of the canopy to connect the sheet to the frame. It's better to use a mig welder because there will be less distortion and warping of the sheeting and it is a lot quicker.

Processes



Folder

I will need to fold the sheeting I use to be able to create the door jams to make it seal and also to create the doors with the angles on it. I found while using the folder with the checker plate aluminium that when I was folding into the checkers is would have a little bit of spring back and wouldn't be perfect so I had to add another 2 degrees onto the folding angle when I was folding that way, folding into the flat side however was fine and the angles were perfect.

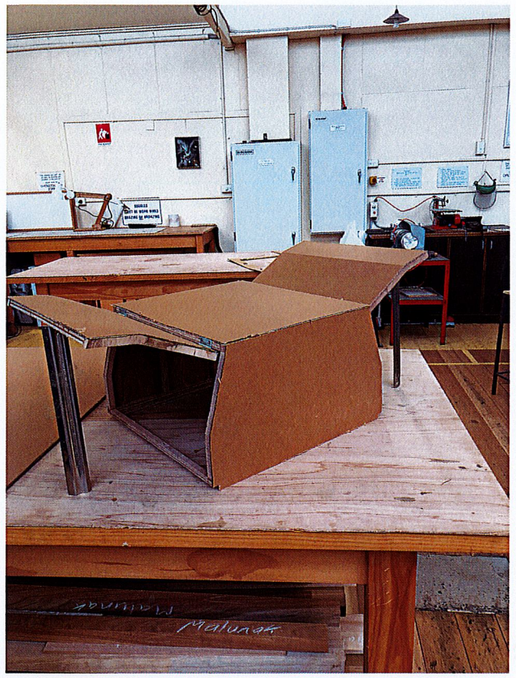
The folder is the most appropriate way to fold my sheeting because it is a hydraulic one and there is no chance of folding 3mm aluminium with a hand bender. I also have easy access to one.

Guillotine

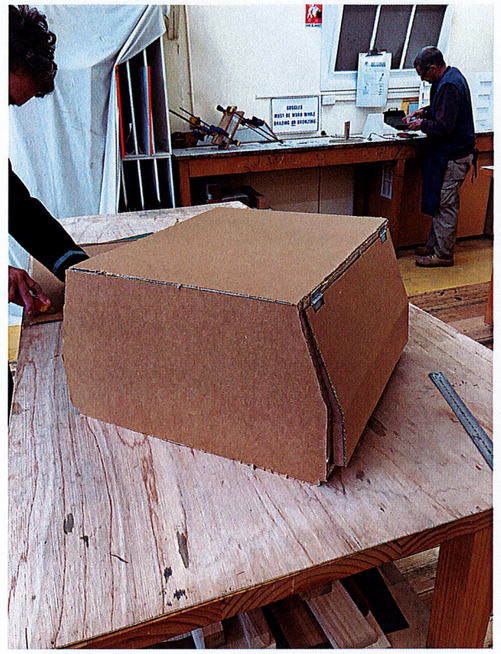
A guillotine would be the most appropriate and easiest way to cut my sheet aluminium. The guillotine was very easy to use once lined up and press the foot peddle and down the blade comes and cuts it. This type of guillotine can cut up to 8mm aluminium so it will be more than able to cut my 3mm stuff.

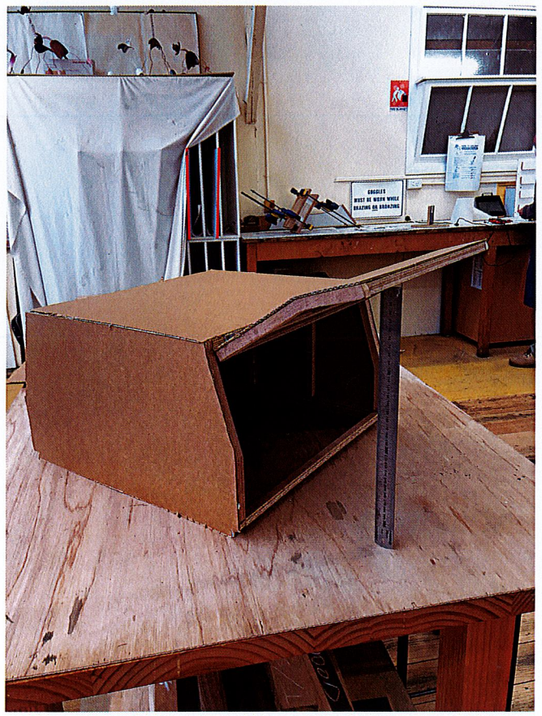
This guillotine would be the most appropriate one to use because I have access to one easily. Also it would be very hard to cut the sheeting with a hand guillotine.

Model



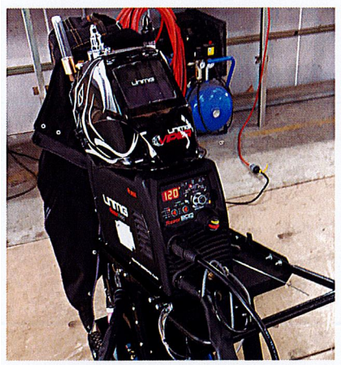
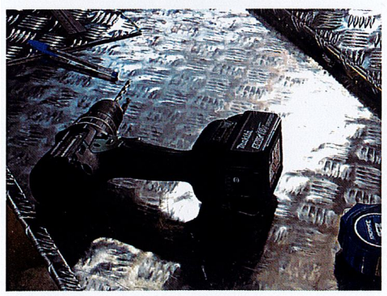
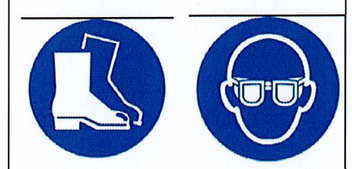
I made a 1-5 scale model of my canopy. After making the model I realised how big the canopy was actually going to be because he model was fairly big and was only 1-5 scale.



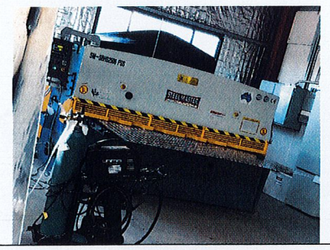
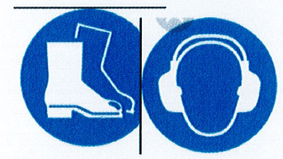
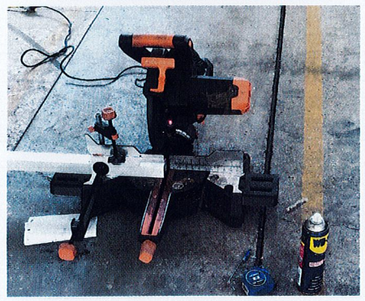
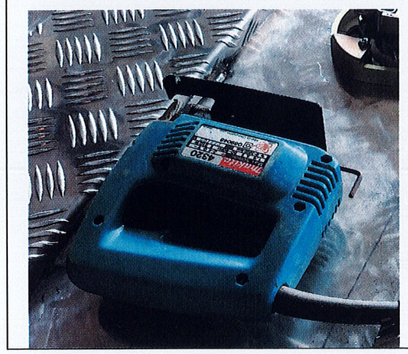
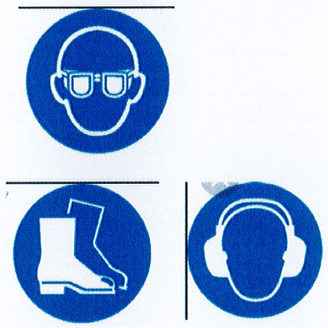


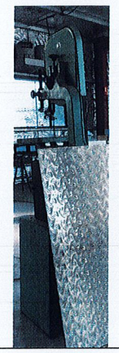
I don't think I'm going to need as much frame work because of the strength the sheeting will also give me. That's the main thing I'm going to change is the amount of frame there is in the design because it will also make it lighter with less frame.

Risk Management

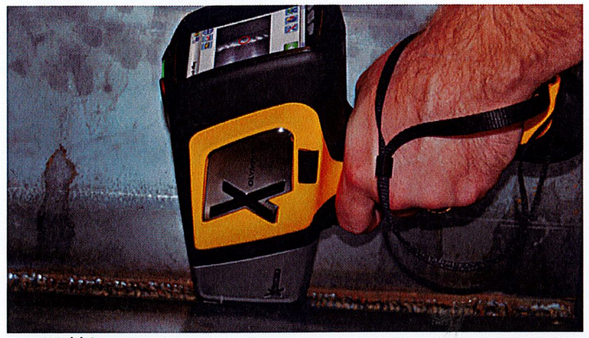
Equipment/ Tools	Stage of Production	Hazards	Possible Injuries	Risk Control	PPE
Welder (MIG)  	• Welding the sheet aluminium to the tube	• Temperature/ Molten Metal • Electricity • Gas • Eye damage • Sparks • Wire feeding out of the nozzle	• Gas Inhalation • Arc eye • Weld burn from radiation • Burn from hot metal	• Ensure that Fume extraction is turned on and working • Wear welding helmet to protect the operators eyes from the bright ark • Don't touch recently welded surfaces with bare hands to avoide burns • Long clothing to prevent radiation issues with skin • Use a well ventilated area to weld	
Welder (TIG)  	• Welding the frame and the seams of the aluminium tube	• Temperature/ Molten Metal • Electricity • Eye damage	• Slag and molten metal burning clothing and skin • Arc eye •	• Don't touch recently welded surfaces with bare hands to avoide burns • Wear welding helmet to protect the operators eyes from the bright ark • Long clothing to prevent radiation issues with skin	
Cordless Drill 	• Attaching hinges for doors and gas struts	• Metal Splinters • Metal shards flying • Drill Piece Spinning • Loud sounds	• Lacerations • Eye scratches and damage • Punctures to skin • Hearing damage	• Hold the drill firmly with two hands to maintain control • Clamp the object that will be drilled to prevent slipage. • Wear Correct PPE Pictured in the next column	

Mallet 	• Connecting the aluminium sheets	•	• Crushing of hands	• Keep hands away from the strike zone	
Angle Grinder 	• Cutting the aluminium sheet	• Rotating disk • Heat from friction • High decibel sound	• Lacerations • Deep cuts • Burns • Hearing loss or damage	• Hold the grinder firmly with two hands to maintain safe level of control • Clamp the object that will be cut to prevent slipage • Wear Correct PPE Pictured in the next column	
Folder 	• Folding the sheet aluminium	• Clamp	• Crushing	• Keep away from the moving parts when switched on • Wear Correct PPE Pictured in the next column	

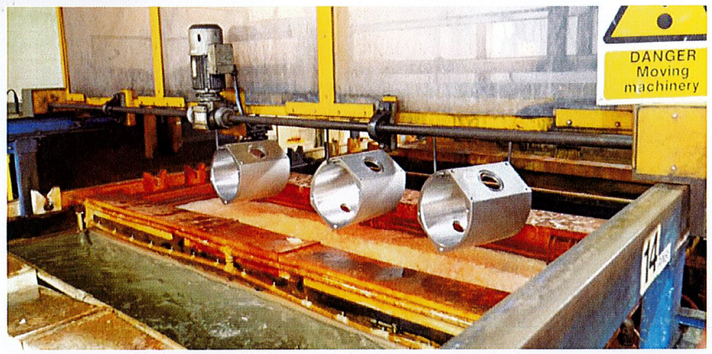
Guillotine 	• Cutting the sheet aluminium	• Blade • Loud sounds	• Loss of body parts • Hearing damage	• Ensure safety guards are in place before operating • Wear Correct PPE Pictured in the next column	
Drop Saw 	• Cutting the aluminium tube	• Rotating saw blade • High decibel sound • Fling chunks of metal	• Lacerations • Hearing damage • Eye damage	• Keep hand clear of the saw blade to prevent lacerations • Clamp materials in the intended vice to prevent injury • Wear Correct PPE Pictured in the next column	
Jig Saw 	• Cutting the lock holes	• Blade • Loud noise • Jolting materials	• Lacerations/ cuts • Hearing damage	• Clamp object • Hold saw firmly with both hands • Wear Correct PPE Pictured in the next column	

Band Saw 	• Cutting Sheet aluminium	• Circulating blade • Loud noises • Jolting materials	• Loss of body parts • Hearing damage	• Hold object firmly • Wear Correct PPE Pictured in the next column • Keep body parts away from the blade	

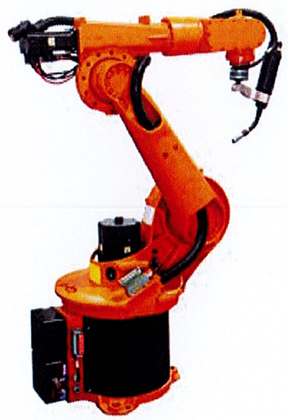
Mass Volume Production



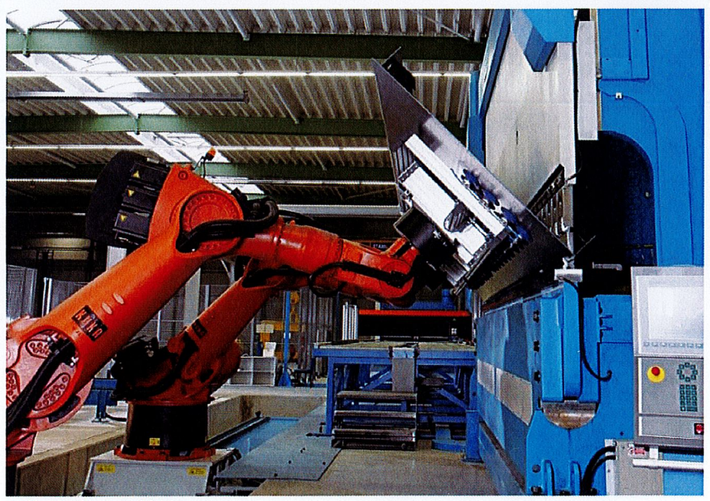
Ray Weld Scanner



Anodize Dip



CNC Welder



Robotic Sheet Folder

To change my product from a one off production to a mass production product I would have to do a few things. Firstly, I would change around the building process to be more time efficient and having multiple pieces built at once by using an automated production line. I would also have to change around the tools I use.

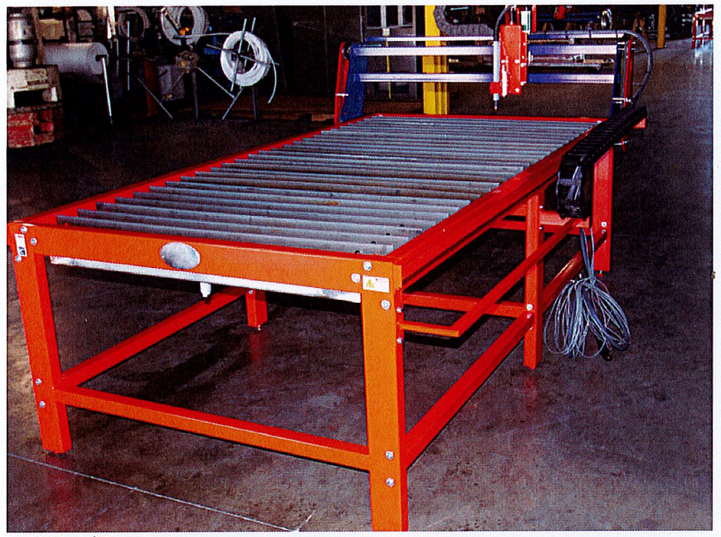
I would be using a CNC Welder which is programmed to weld all the tubing in the correct locations. The tubing would be cut with a CNC water cutter which will give me precision accuracy. I would be using radiographic testing (X-ray technology) to check the soundness and quality of the welds before moving on to the next stage.

I would be using a CNC Drill to drill all the required holes. The holes are coordinates on the computer program. The drills are all controlled by a computer program and this would make holes exact and precise.

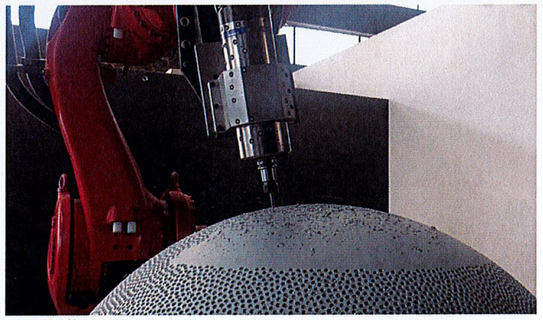
I would be using a robotic sheet folder that's all pre-programed to get the exact folds.

Then I would have an automated anodizing line to anodize all the canopy's parts in whatever colour the user wants. The anodizing adds another little protection layer on the aluminium and will also give it more visual appeal to the user.

At the end of the process line I would have workers putting the doors onto the canopy and adding the gas struts, locks and the rubber seal.



CNC Metal Cutter



CNC Drill

Workers

VCE Number: 17120139G

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