AIR BUBBLES

GET INVOLVED!

Air bubbles of one kind or another are inevitable if you deal with materials which start out life as a liquid and then later solidify such as plaster, latex, silicone and resin. Let's take a look at what can happen, why, and what to do about it.

Air bubbles can be small, almost insignificant cosmetic issues or more substantial structural weaknesses if large or inconveniently placed.

Most liquid materials usually require some kind of preparation involving stirring or agitation to blend catalysts, pigments or to simply shaken to recombine components in a container which may have separated over time.

This is usually where air is added into a mixture, and is difficult to avoid. If the material is low viscosity (runny), then usually the air introduced in mixing can rise and leave the material quicker than if the material is higher viscosity (thicker).

The other consideration is 'pot life', as many materials may set quickly, and this means a more fluid material which could allow added air bubbles to rise and escape will not do so for long before it starts to thicken and set – essentially trapping the air.

To avoid lots of air bubbles therefore, the ideal combination is a runny material which doesn't set too quickly.

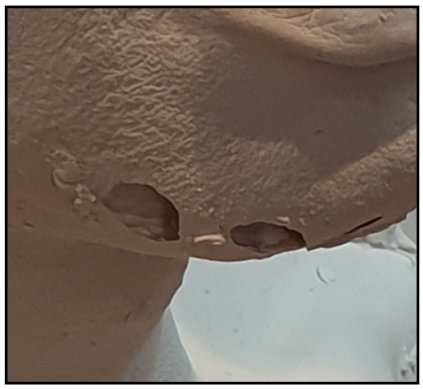
This may mean modifying it...most silicones can be slowed down by adding a chemical retarder, or by refrigerating them beforehand. Perhaps in worse case scenarios when it is really toasty, you need to do both!

Note: Materials will have an accompanying data sheet which will list its properties, and for liquid materials, one of them is to quantify the viscosity usually measured in 'centipoise' (cP).

The lower the number, the more fluid it is. For example, water is 1-5cP, honey is approx. 3000cP, Ketchup is about 60,000cP and peanut butter is about 200,000cP.

Air bubbles in the mould (as in the lifecasting process) mean raised areas in the cast.

Eyebrows and lashes often trap air and create these little artefacts in the cast which need to be cleaned away. Using a softer plaster will make this step easier.



As this head was cast with the mould upside-down, I managed to accidentally trap some air causing these bubbles which will need filling.

Dampening the plaster will enable a small mix to be used to fill these. Not ideal but with care, a good result can be achieved.

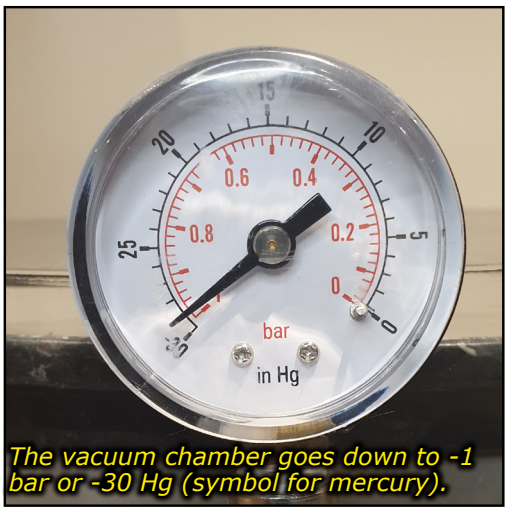
Degassing the mixture in a vacuum chamber (assuming there is time to do this process) is great if you have one, as this will remove the most amount of air by literally sucking it out.

The more fluid the mixture, the quicker and more easily it will degas. A good degasser will usually do its job in a few minutes, and the more powerful the pump, the better.

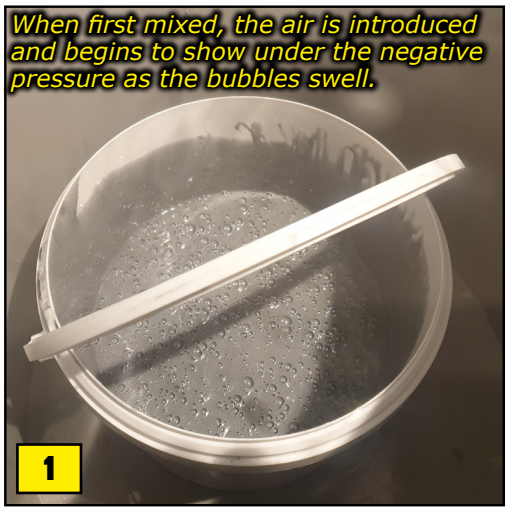
Take care to ensure your container is large enough to accommodate the rising mixture, as degassing will cause a temporary 'expansion' and again, the more viscous the material is, the more it will expand (2 to 4 times it's original volume sometimes) and the longer it will take.

If you don't have access to a vacuum chamber, pouring the material from a height in a thin stream is best. A thin stream prevents large air bubbles from remaining in the mix and the long stream created in pouring will help them break.

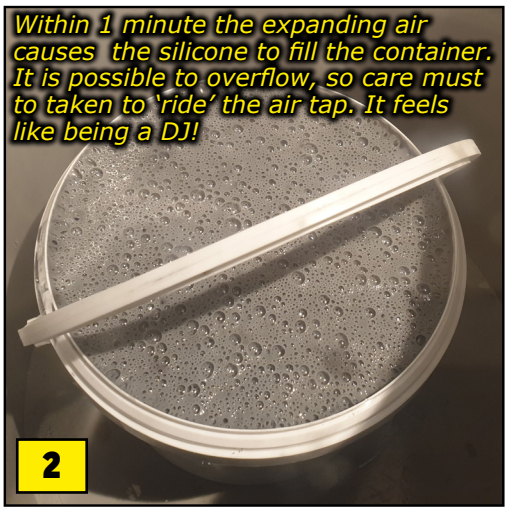
Slow pours give air time to rise through the material rather than dumping it in quickly. Swill or gently rock the mould to allow the silicone to travel over the surface if there is time.



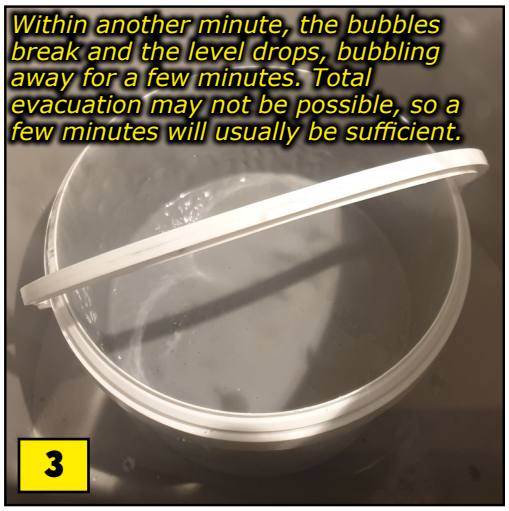
The vacuum chamber goes down to -1 bar or -30 Hg (symbol for mercury).


When first mixed, the air is introduced and begins to show under the negative pressure as the bubbles swell.

1


Within 1 minute the expanding air causes the silicone to fill the container. It is possible to overflow, so care must to taken to 'ride' the air tap. It feels like being a DJ!

2


Within another minute, the bubbles break and the level drops, bubbling away for a few minutes. Total evacuation may not be possible, so a few minutes will usually be sufficient.

3

Taking the air out before pouring into the mould is the best thing you can do to prevent air bubbles in the first instance, but you're not out of the jungle yet. You can still trap air in the mould with completely air-free silicone!

The other kind of air bubble is the 'void' usually created by air trapped in a high point in the mould, as the material gradually fills the space inside.

Most of the air will usually get out, especially if the mould can be rotated carefully during the fill.

However sometimes in high points, like finer or ear tips, there will be a bubble of air which cannot escape or compress any further, preventing the casting material from making it in there.

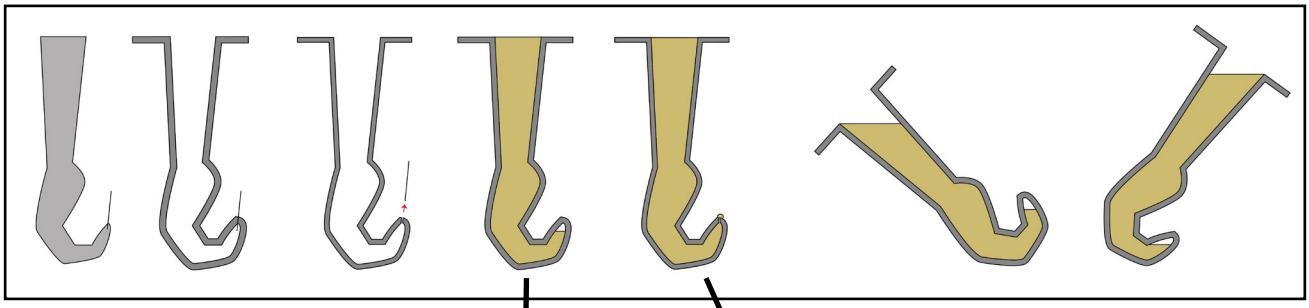
You won't know until the mould is opened, and then you can either repair the bubble or decide to pour another one.

If you do, then you need to make a few changes to ensure it doesn't happen again such as drilling/cutting small bleed holes or risers to allow the air to escape out from the high points.

This is best done during the moulding process by fitting thin wire into the points of the sculpt which will be the 'high points' for trapping air.

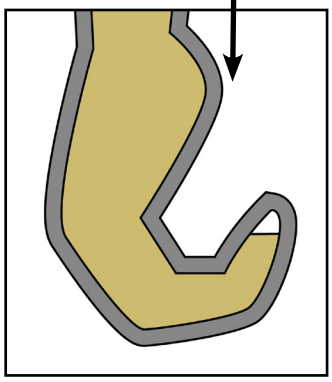
Moulding with these in place, and then removing them afterwards will ensure a clean hole in the right place which is preferable to drilling then in afterwards.

Materials like silicone are hard to drill clean, and rigid materials can break drill bits (assuming there is a convenient place to position the drill which often there is not – in this instance length of piano wire may be a handy alternative.)

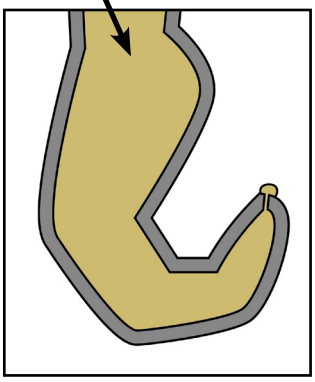


These image show an inverted sculpt (The position the mould will be filled in) with removeable pins in the fingertips.

Without a hole to escape, air can trap in fingertips. Tilting the mould may also help, but not always as seen in the images top right.



Trapped air in tip.



Air escapes through hole, silicone can then 'bleed' before being plugged shut.

An example of a mould with cut lengths of piano wire inserted into the sculpt prior to moulding.

The manner in which the material is applied can make a difference. The previous examples were looking at pouring a solid mass, so swilling a layer first can help, agitating the mould if possible, forcing material to slosh into deeper areas.

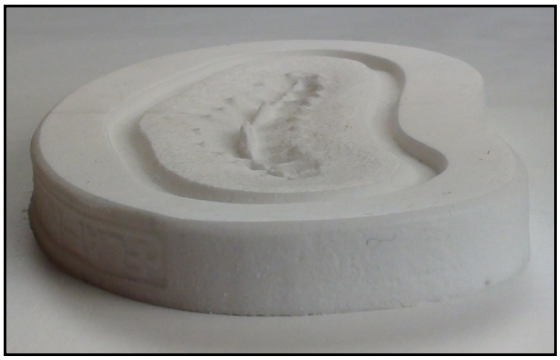
Touching the surface of a mould during application by using a brush or roller for example can also help reduce the likelihood of trapping air bubbles, as can using compressed air to blow the surface when a thin layer of material is applied.

Breaking the mould's surface tension is possible on some materials by applying a proprietary 'surface tension breaker' or even talc. In combination with brushes/roller, the outcomes are usually pretty good.

Tiny air bubbles can sit on the surface, and touching as much of the surface as possible is the best way to push them around and get them away from the surface.

There are two categories of moulds to consider – open and closed moulds. Open moulds include simple flat moulds or a simple bowl-like mould of a face for example. which allows bubble to easily escape.

These core moulds are 'open moulds', in that there is access for casting material can be brushed in, swilled or poured - the air bubbles which accumulate may break the surface and be shaken out - or at least seen. Being open, the air has somewhere to go.



A typical flat mould is similarly easy to avoid trapping air. Usually the piece isn't that thick so the air doesn't have too far to travel before breaking the surface.

Despite being a closed mould, a bowl-like mould like this is relatively easy to fill.

This mould is closed - the core and mould assembled before filling and has the highest chance of trapping air bubbles.

Closed moulds are those consisting of an inner core and outer mould, which is assembled before the mould is filled.

Closed kinds of moulds offer the greatest likelihood of air bubbles, so some thought should go into mould design to minimise the chances of doing so.

This includes:

- Large enough or multiple points to introduce the casting material into the mould.

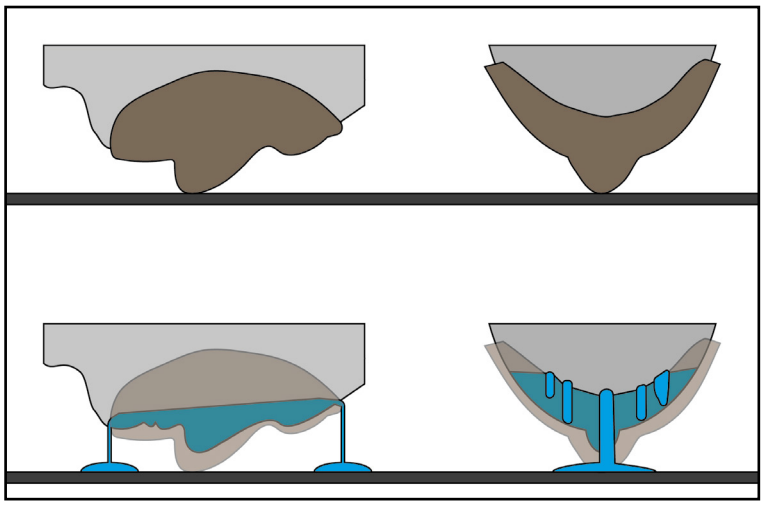
- Bleeders or risers to allow air to escape.

- Rotating the mould to move trapped air to points where risers can carry the air out

- Using plungers/syringes to increase the pressure during filling.

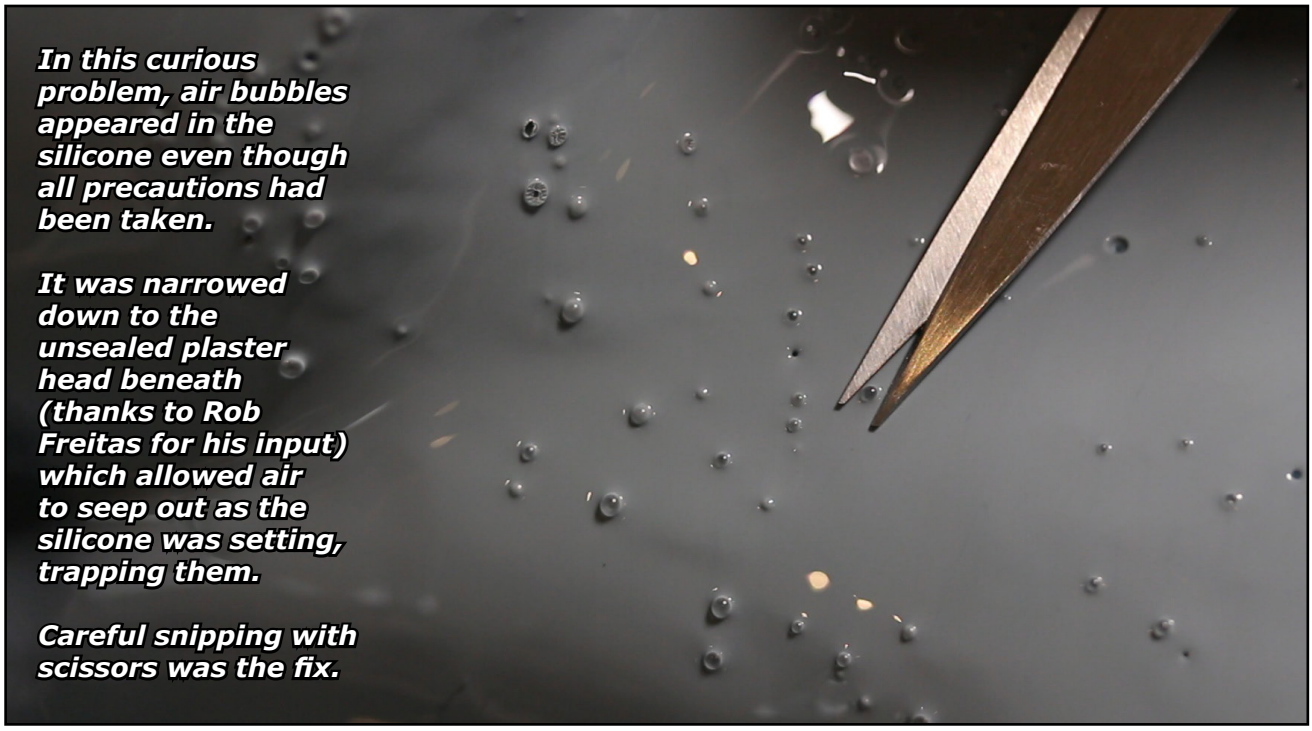
- A system for blocking the bleed holes once they have let the air out lest the material continue to leak out, causing it to under-fill.

- Spray back of flat mould with air.



In this example of a mould (left), you can see how a fluid such as silicone will seek to be level, thus moulds which have a low point like the chin and forehead here could leak creating cavities after filling.

Using air (in this case, an empty air-gun) to blast and pop surface bubbles.



In this curious problem, air bubbles appeared in the silicone even though all precautions had been taken.

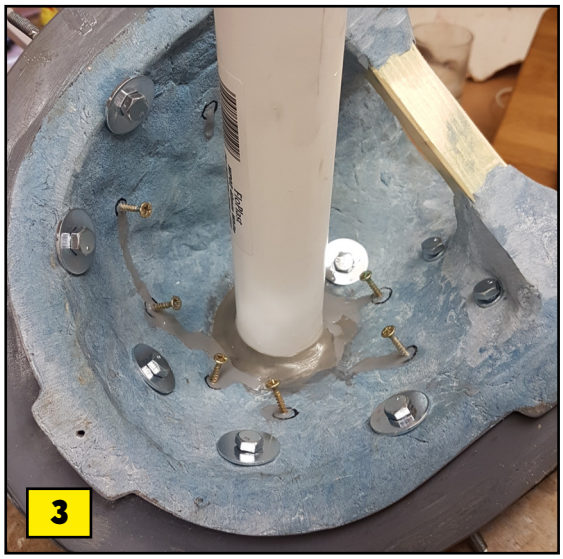
It was narrowed down to the unsealed plaster head beneath (thanks to Rob Freitas for his input) which allowed air to seep out as the silicone was setting, trapping them.

Careful snipping with scissors was the fix.

1. This appliance seen from the back with trapped air near the edge (you can see the cutting edge). I drilled extra holes to remove this issue.

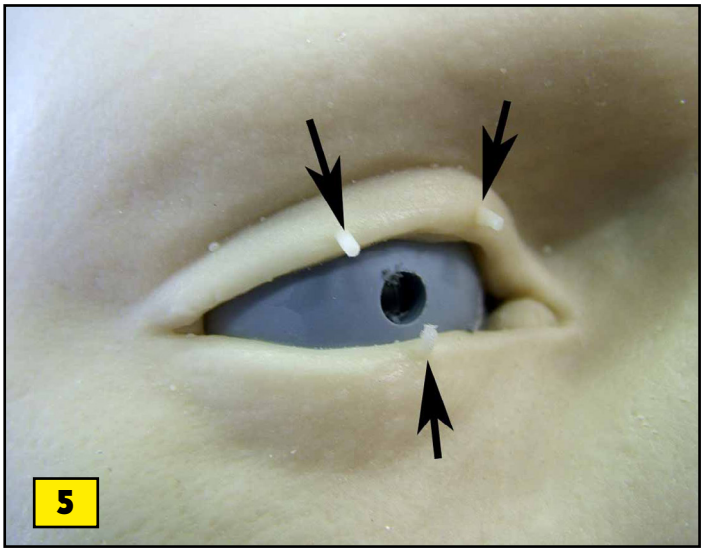
2. Injection/pour tubes with custom made plungers. This is just waste water pipe and wood with fast-cast resin plungers.

3. An epoxy mould assembled with pour tube in place. You can also see the screws used to close up the bleed holes once the air has escaped and silicone flows out clear of any air bubbles.

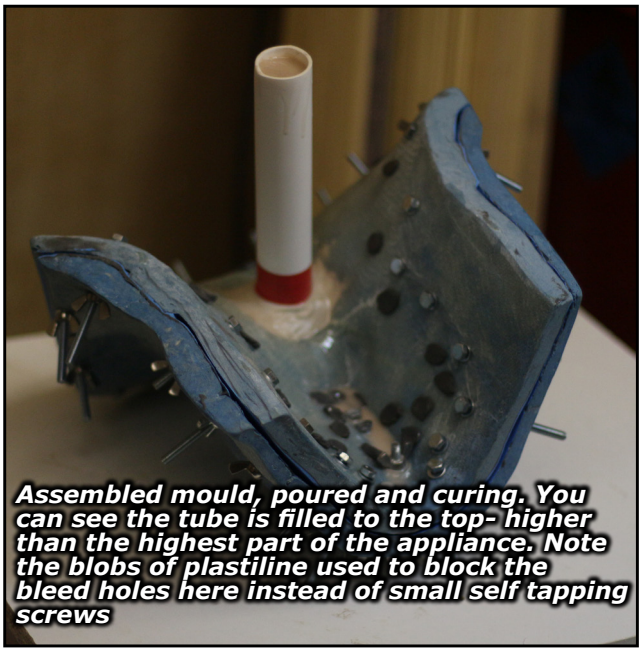


4. When the pour tube is removed, you can see the multiple drill holes which allow the silicone to fill the mould.

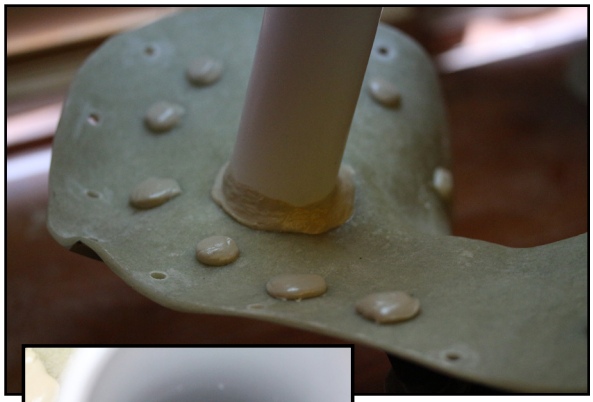
5. Here you can see the little 'nipple' which is the result of the bleed holes. These can be snipped off easily and are less of a difficulty to fix than air bubbles which may result from not having them.

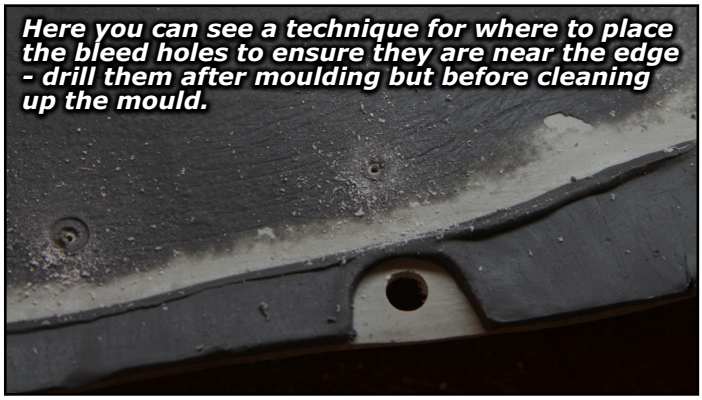


Although this kind of mould is closed because it is clamped shut, it is filled when open, the silicone being poured into the mould as if it were like a bowl. The air is less likely to get trapped before the core is inserted and clamped.



Assembled mould, poured and curing. You can see the tube is filled to the top- higher than the highest part of the appliance. Note the blobs of plastiline used to block the bleed holes here instead of small self tapping screws

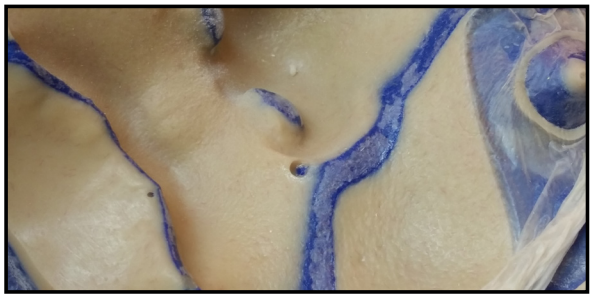




Here you can see a technique for where to place the bleed holes to ensure they are near the edge - drill them after moulding but before cleaning up the mould.

Left & left/above: *The pour tube in place (inset pic shows the multiple holes in the core surface to allow silicone to flow through better). Note the blobs of car body filler used to thicken the bleed holes, slowing the flow of silicone whilst allowing air to escape.*

Below right: *An assembled mould with blobs/bleed holes in place.*



Left: *Here you can see an air bubble was trapped in the casting of a nose/upper lip appliance, seen from the back of the piece. It was a simple matter to snip out the back and refill with a little silicone to fx it (**lower left**).*