

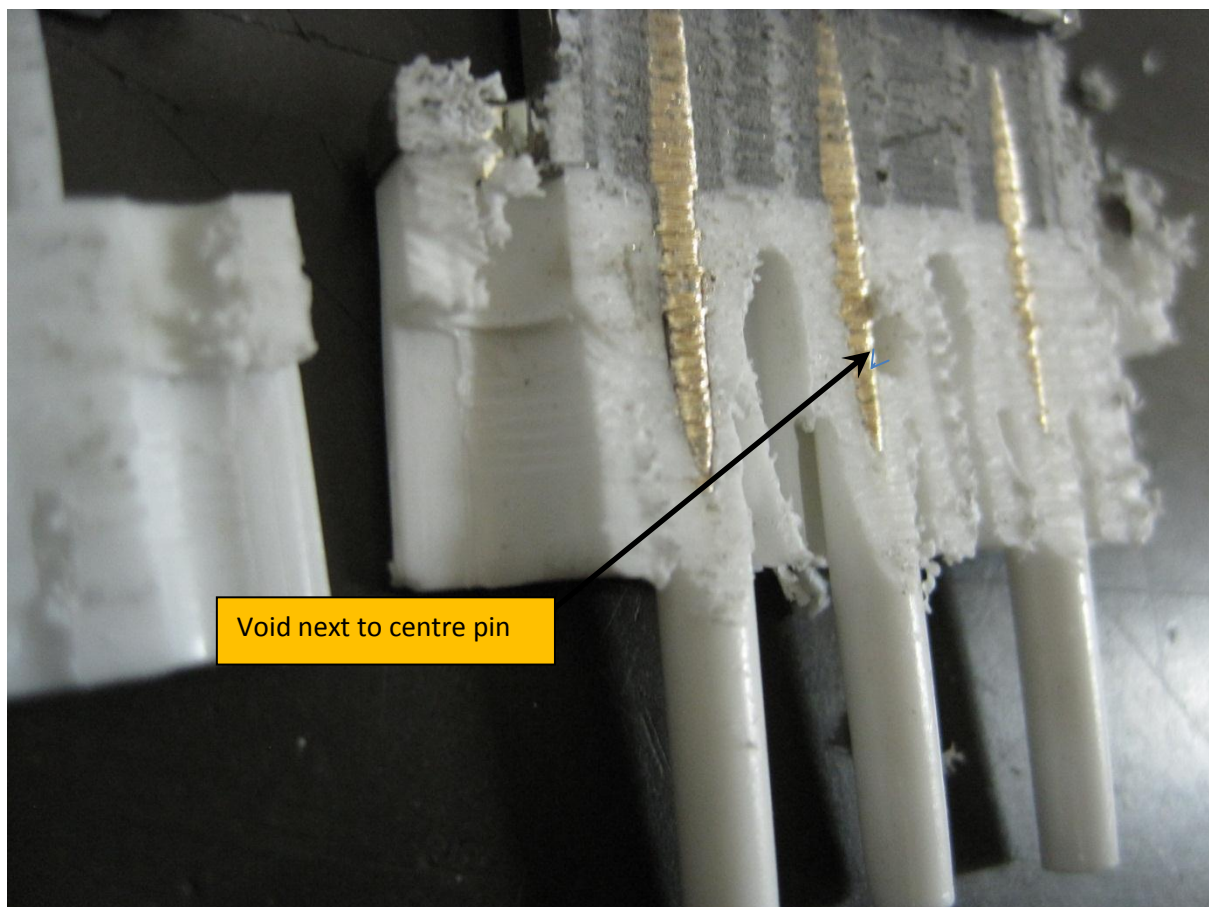
# Inspection of 3 pole connectors following 2 failures of July 2012 delivery

Failures of the first production made by Mrs Wang for RE1, 2 & 3.

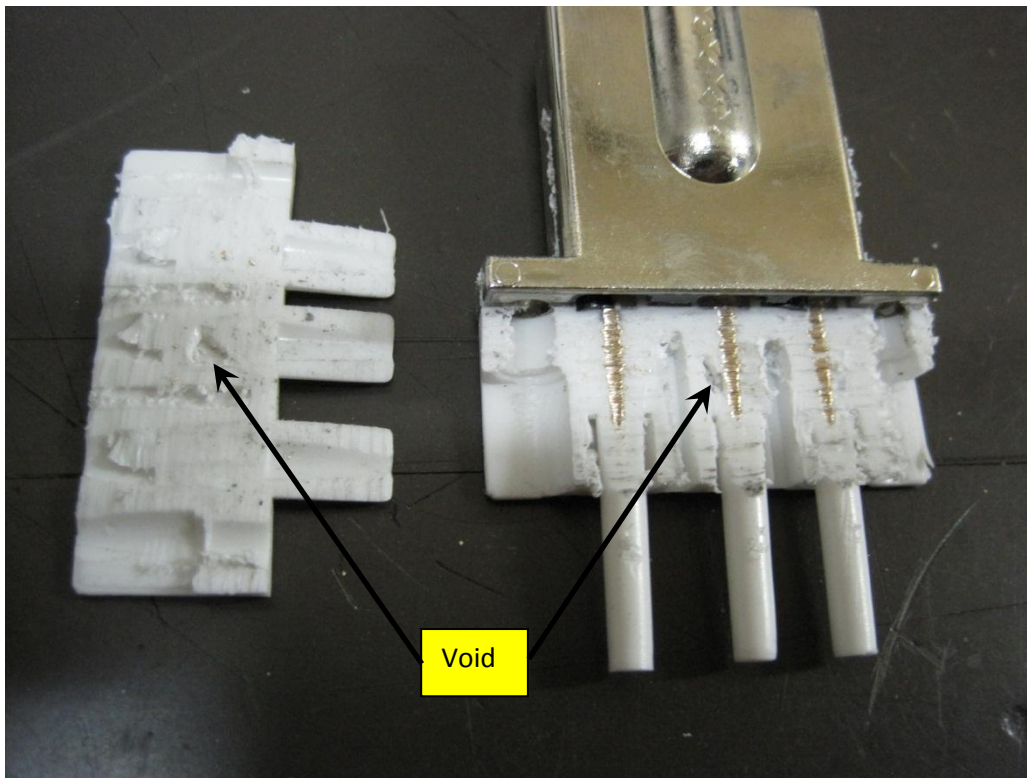
4 Connectors were opened in a rough manner with a hand held saw.

These connectors were removed from completed cables following a failed static test at 15kV. Unfortunately no details of where the failure occurred were noted

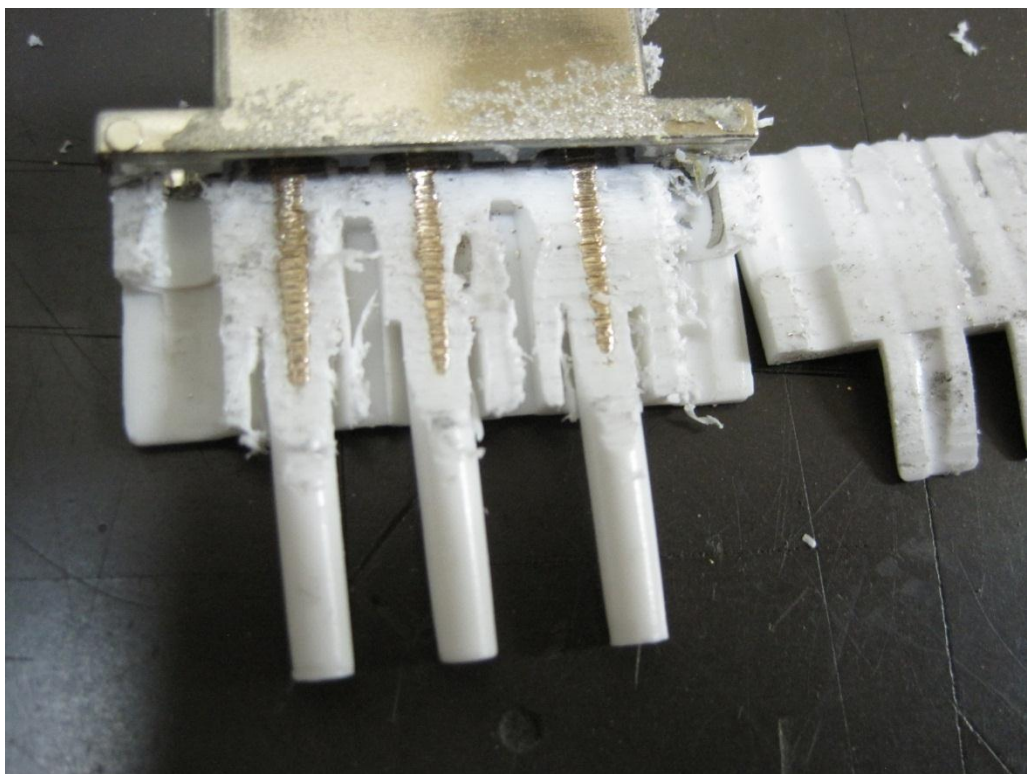
Below is an example of poor quality moulding showing a void. This will compromise the insulation although in this case the 0Volt pin is far away.



Another void next to centre pin

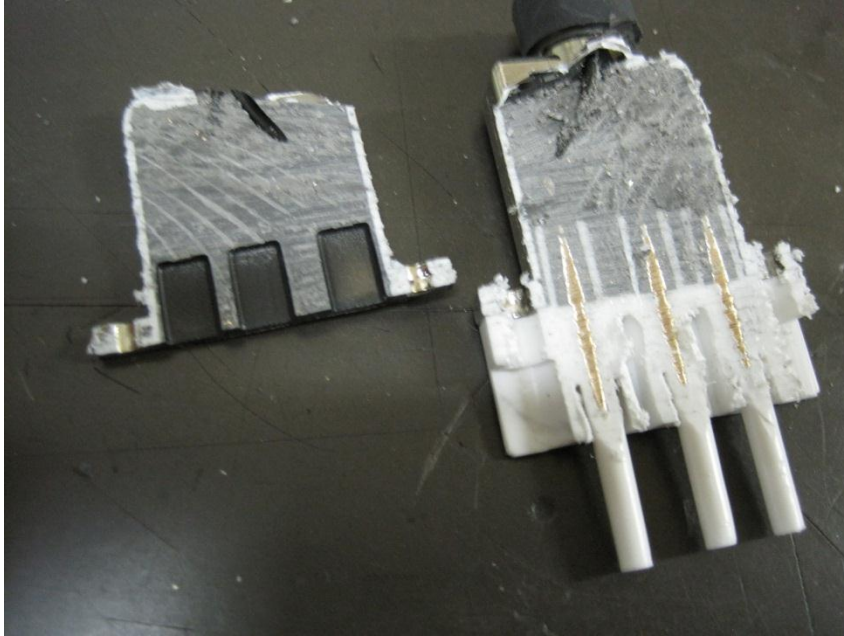


And another

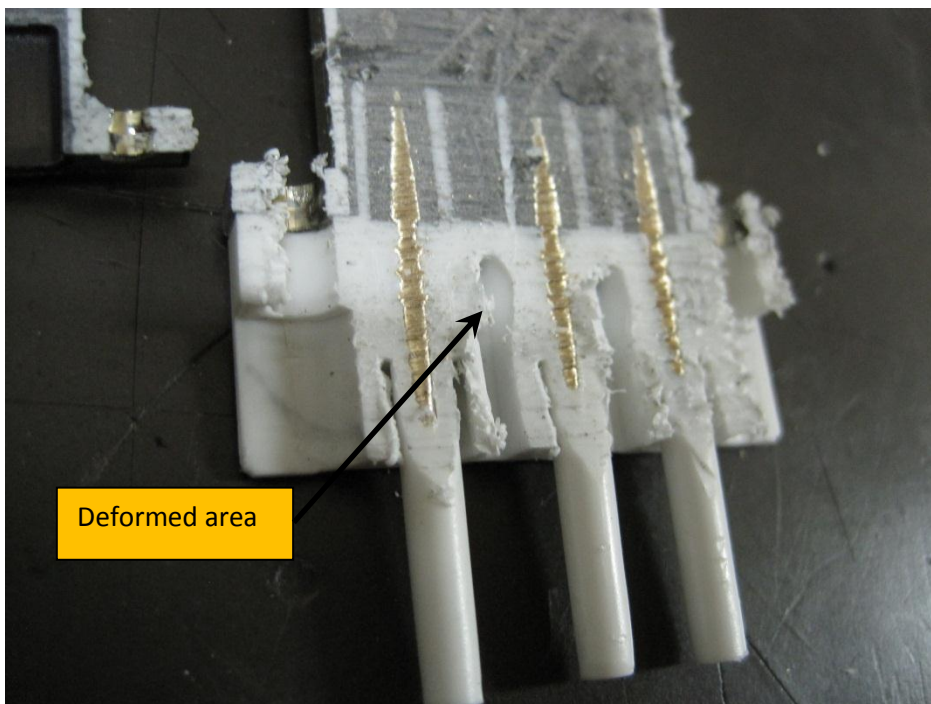


Examples of in correct moulding of the intentional gaps between individual pins.

General view showing good filling of Stycast.



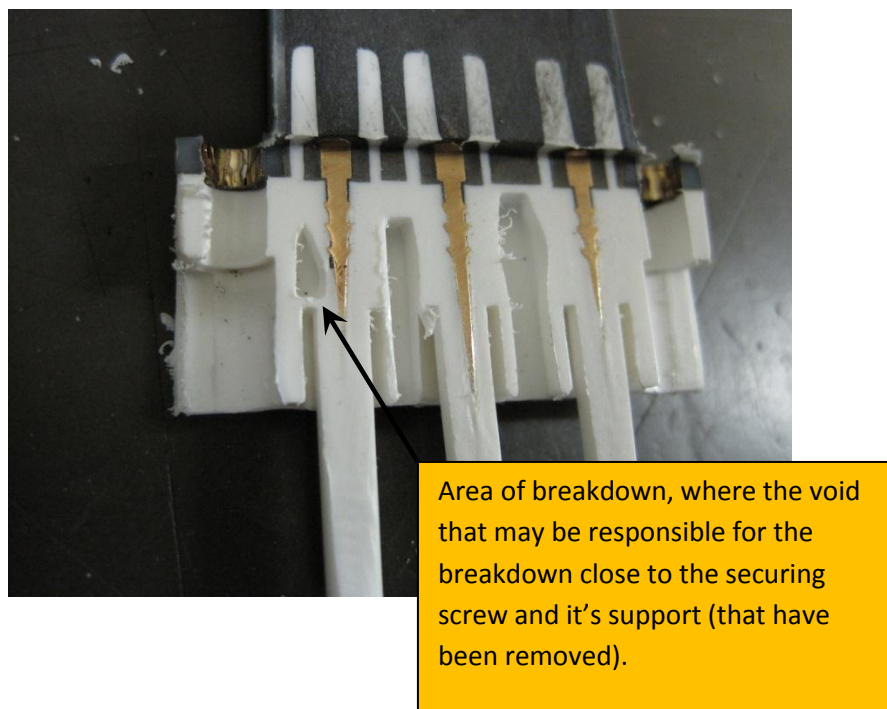
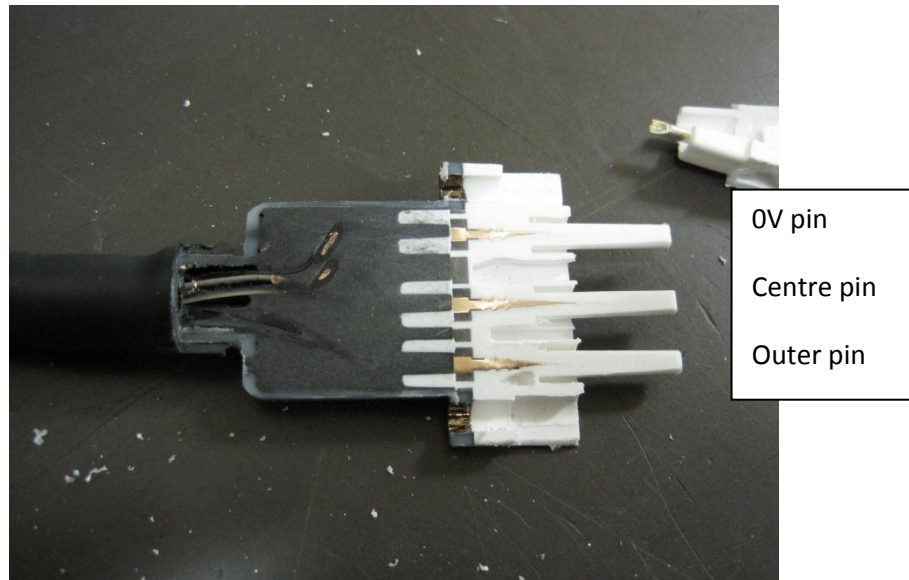
Close up showing poor deformed inter-pin spacings



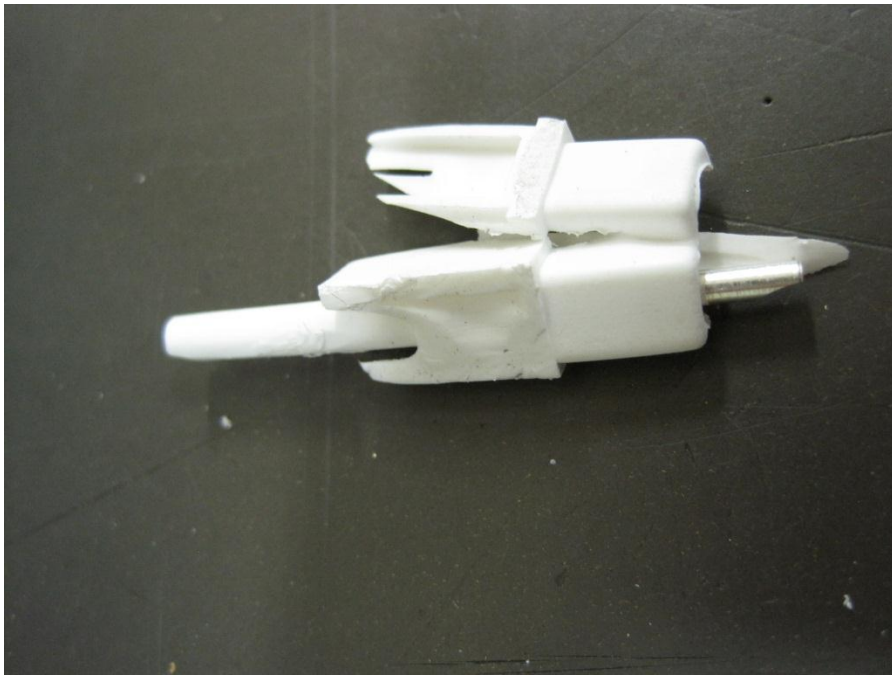
The first failure, 2 of 12, of the delivery this July 2012.

The connector failed before reaching 15kV, at approx. 13kV, on the outer of the 2 "live" pins. Loud cracking and light was visible through the white area of the connector close to the securing screw.

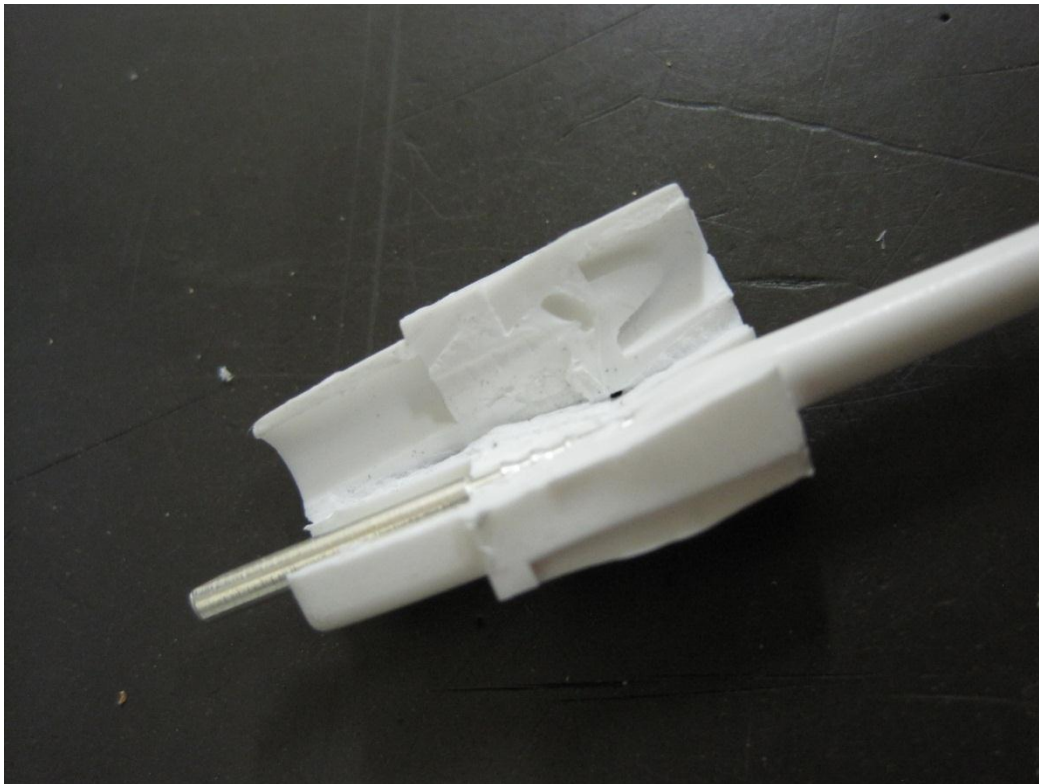
The connector was milled through, 0.5mm for each pass, by Jean Francois looking for the origin of the breakdown.



Examples of voids in similar locations

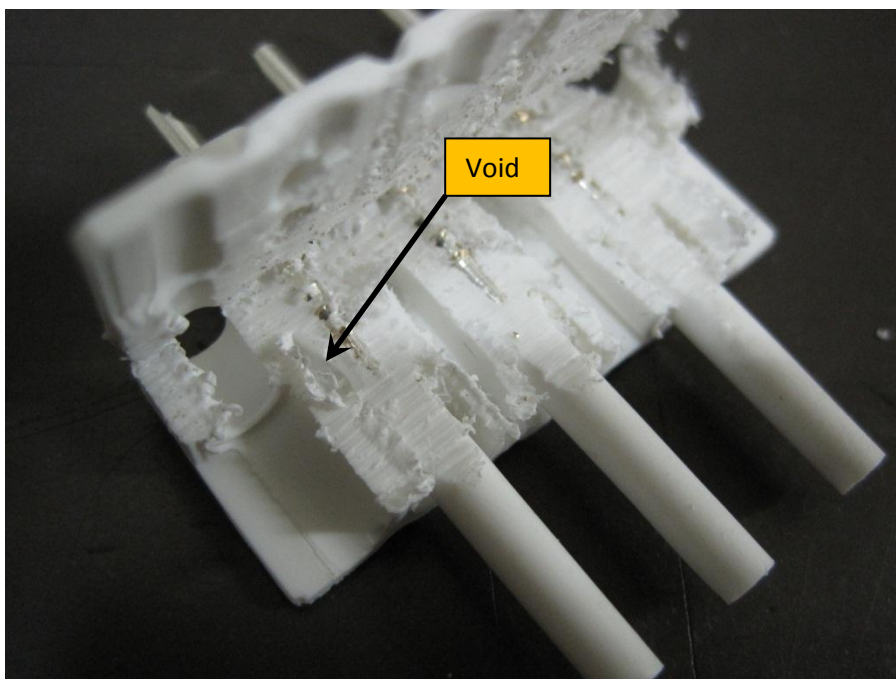
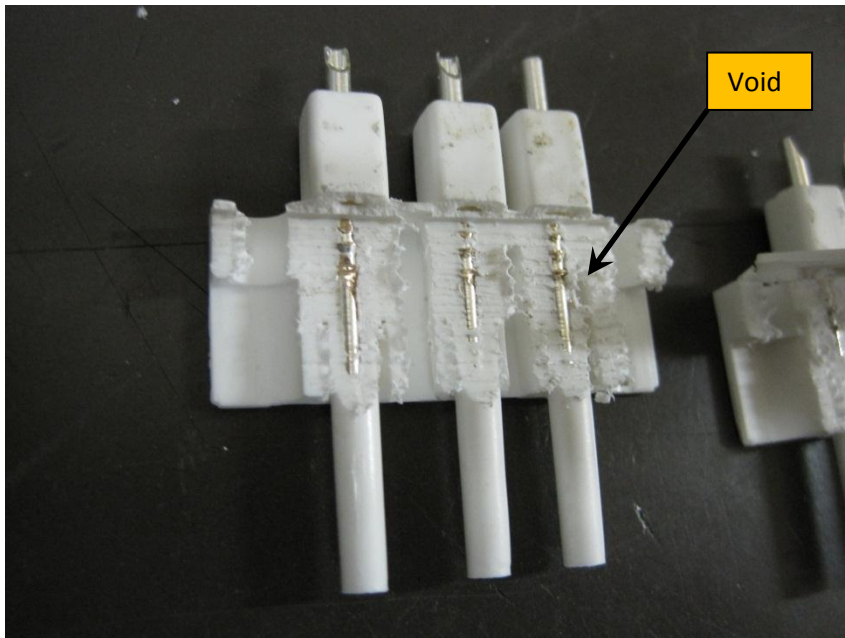


Another example. If these are outer pins or centre is not clear.



Stock items chosen at random from our stock with Jean Francois. 10 pieces were selected, 5 to be opened in the rough manner and 5 to be milled down to approx. ½ way.

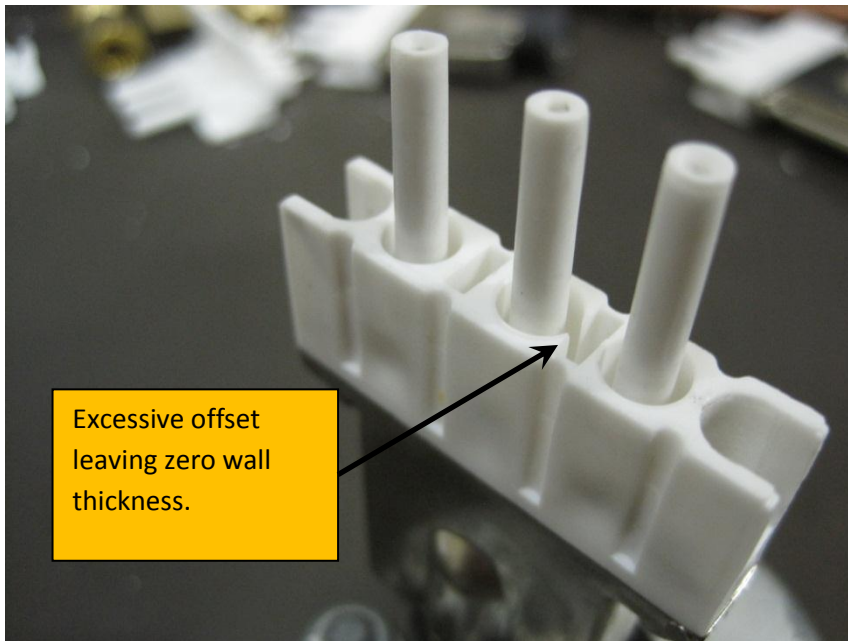
Two of the 5 opened by hand show voids between the outer pin and the securing screw emplacement. They are shown below.



The 5 opened by milling are shown below.....

Other faults;

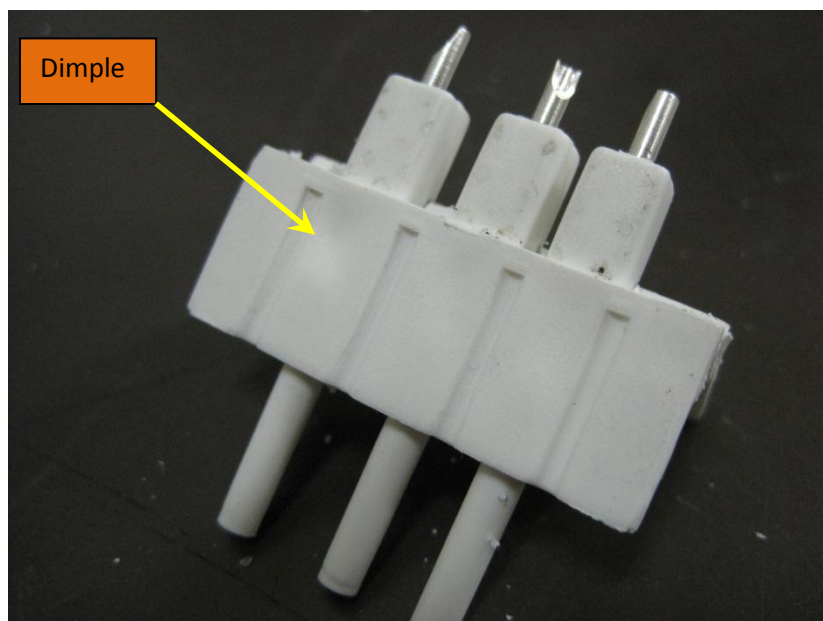
This bad mould geometry is inherent to all connectors of whatever age.



Means of identifying the defective parts ????

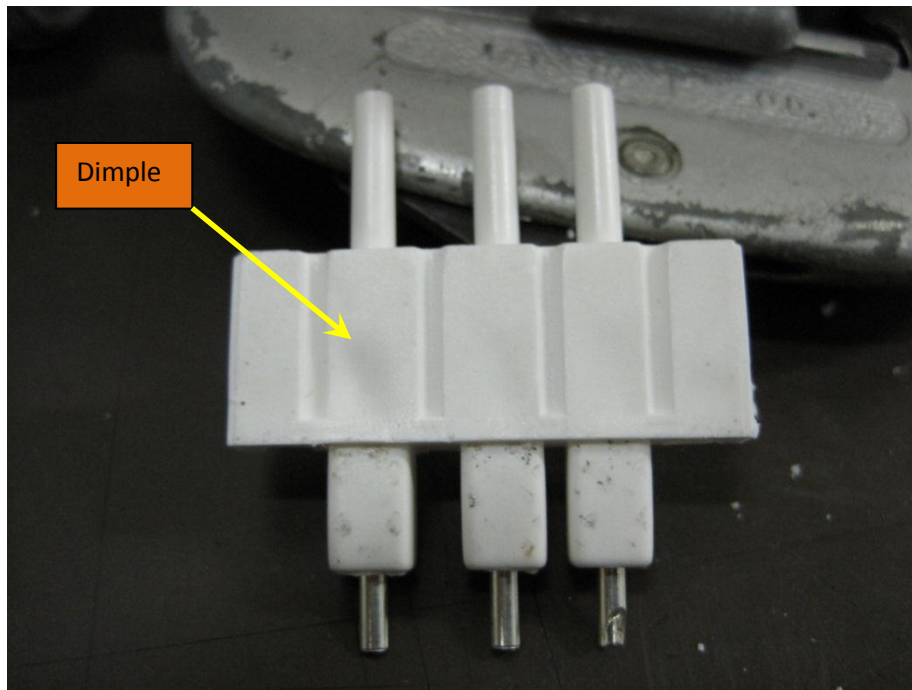
Dimples (sinkage) are present in many cases. They seem to coincide with the internal voids, as logically a lack of dimple implies that the material has not shrunk into the low density area but has remained in its initial condition so producing the voids.

Dimple is on the left and the void is on the RHS



The second of 5 samples. The dimple is on the left and the void is on the RHS





## Conclusions

There have been, throughout the production, voids introduced during the manufacture of the connector. The voids, meaning a reduction in the insulation thickness, around the outer pin could give problems with breakdown to the outer securing screw if this is grounded. This is not intentionally the case in the YE1 Patch panel, however the leakage of charge could lead to charging up of the area and subsequent breakdown as perhaps witnessed by Anna and myself many years ago in UXC. It is of course the case at the chamber patch panel as the securing pins of the female cable connector are screwed into the male chamber connector that is secured to the aluminium chamber patch panel that is itself intentionally grounded to the chamber and finally to the YE3 yoke.

It would appear reasonable to suppose that some or many of the HV failures in the HV 3 pole cable connector may be due to the presence of voids near the outer pin or close to others pins. This should be substantiated by further tests (breakdowns) and, if confirmed, then a selection procedure worked out to eliminate the bad cases in this year's delivery.

Ian Crotty

24 Oct 2012