

**Aerospace
Systems Division**

Schjeldahl Dale Connectors

ATM 1037
PAGE <u>1</u> OF <u>5</u>
DATE

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1.0 SUMMARY

Green corrosion products were observed on wires in the vicinity of A-2 flat cable connectors. Problems were also experienced with an intermittent open circuit contact.

An immediate program of corrective action was adopted for Array D and a study of alternate methods of flat cable termination was started for Array E.

The Schjeldahl Dale connector was found to be best suited to the ALSEP environment and Array E program constraints (Memo 9713-325). More rigorous control of manufacture and assembly operations will ensure a highly reliable connector. This ATM details the steps to be taken to achieve this high reliability.

2.0 CORROSION

The green material observed at KSC was determined to be complex, the main constituent being copper hydroxide.

The reaction was caused by water acting on unplated manganin wire. Manganin is an alloy comprising 84% copper, 12% Manganese and 4% nickel which is cleaned of oxides by flux so that soldering can occur. After soldering the flux is dissolved in isopropyl alcohol and swabbed off. The solvent is highly deliquescent and highly volatile so it evaporates quickly leaving water to react with exposed manganin.

The reaction stops after a few hours when the water evaporates leaving behind the familiar green mark. At this stage no further corrosion or depletion of insulation will occur.

Microscopic examination of affected metal indicated no reduction in section. This defect in assembly chemistry is harmless but undesirable. ALSEP Reliability and Quality have published AQD 63 to eliminate further occurrences.



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ATM 1037

PAGE 3 OF 5

DATE

3.0 THE SOLDER JOINT

The surface of the solder lug on the female Schjeldahl is gold plated. When gold and solder are alloyed with 2.4% gold to solder ratio then a very brittle joint will occur. It is probable that there would be less than the critical percentage of gold in the alloy but it is better to tin the lug in a solder pot before the connector is assembled.

4.0 ENCAPSULATION

A detailed examination of the connector mating pressure indicates that the contact spring arm must be free of redeposited flux or encapsulant. Each contact has its own spring to develop proper contact pressure. The freedom of unencapsulated pins allows them to align with the male at zero pressure and develop almost identical contact force when fully mated. Reducing pin freedom by encapsulation will increase the spread of contact pressures but, with care, will not cause problems. Care in this case refers to the ingress of foreign matter behind the spring contacts. Necessary manufacturing procedures and inspection criteria have been detailed in AQD-59-A.

5.0 CONTACT TOLERANCES (Figure 1)

The printed circuit male part of the connector is subject to two types of defects. Tolerance from the edges of the board to the center of the first pad is critical. The run-out of contact centers from the first to last pad can also be a problem. The receptacle throat to male card clearance is the third element in the build-up problem.

The contact parts are a 19 mil gold plated beryllium copper female and a 29 mil gold plated male circuit board. These contacts are spaced on 50 mil centers allowing clearance of 20 mils between pads. Female contact stamping tools impart a distinct knife edge to the contact with alternate contacts having the edge on left and right sides respectively.

FIGURE 1

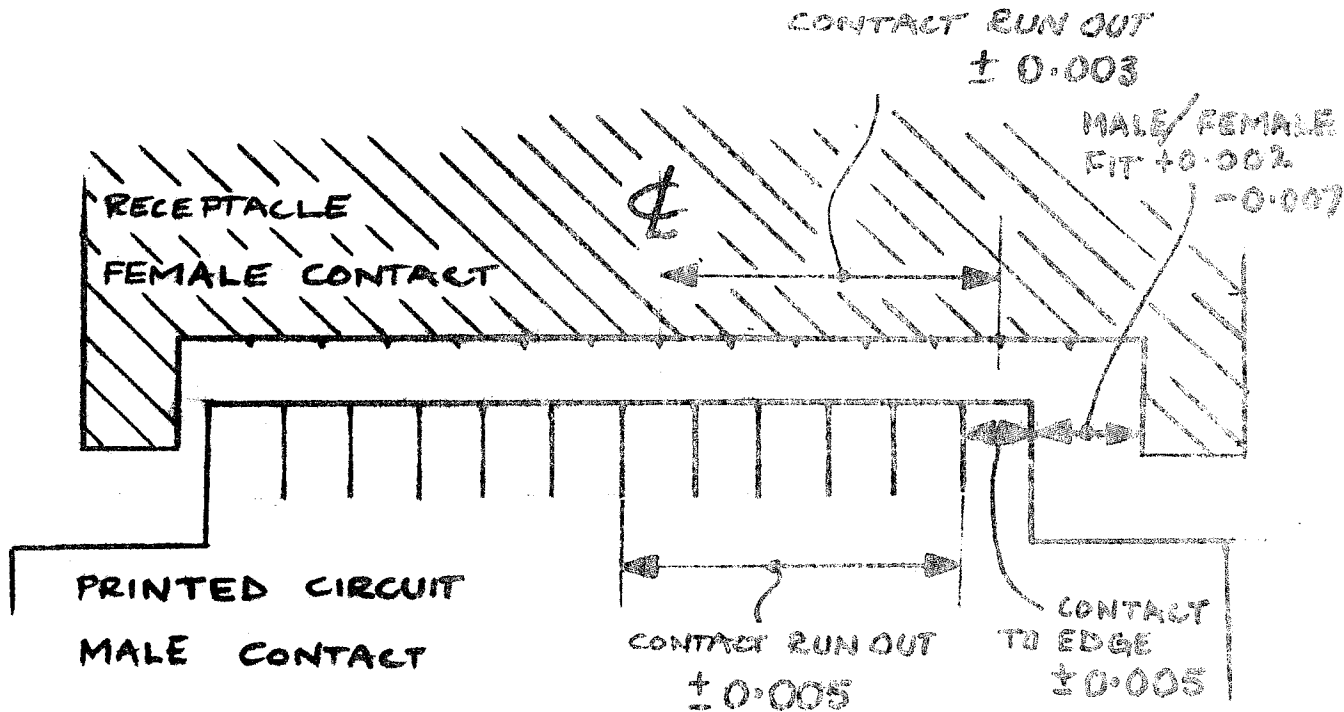
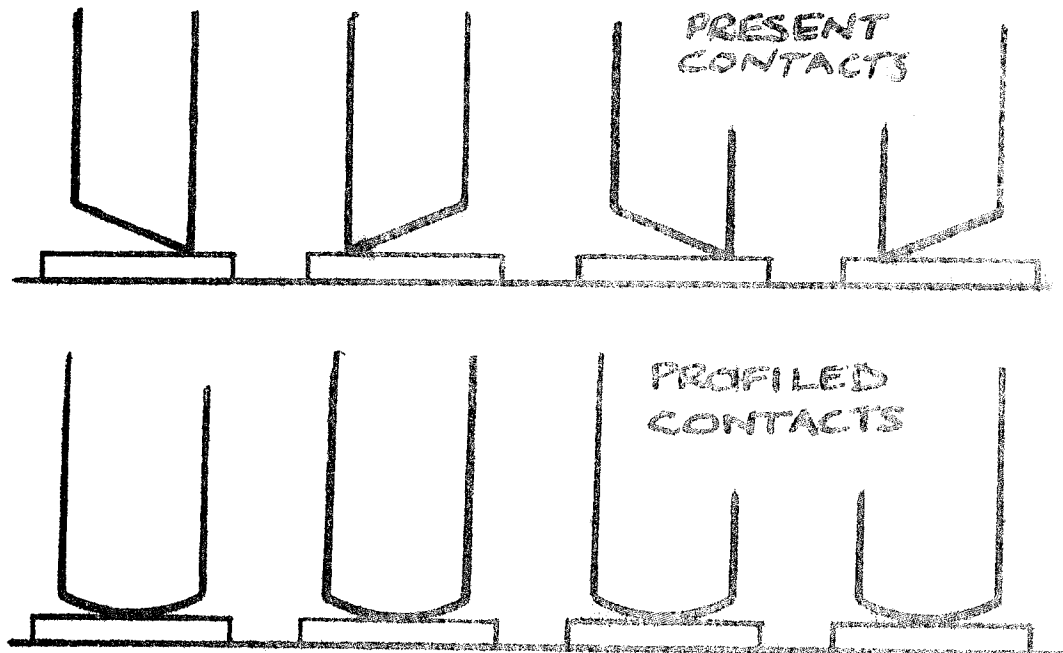


FIGURE 2



This staggering (Figure 2) of the contact point produces a worst case tolerance build-up where either positive or negative shift of $\pm .005$ causes the left or right contact to fail to make. Substantial improvement may be realized by profiling the contact area of the female to give a contact area in the center of the pin allowing $\pm .015$ inch tolerance.

6.0 GOLD SHREDS

A further benefit of profiling the contact with a smoother blunter shape would reduce the incidence of gold shreds being removed from the printed circuit boards during the mating process causing possible short circuits between pads. Such gold shreds were revealed in examination of A-2 connectors.

7.0 CONCLUSIONS

Array D

AQD 59A and AQD 63 were incorporated and connector parts were matched making the improved pin unnecessary.

Array E

AQD 59A and AQD 63 will be used and the improved pin will be available for flight models so that matching of parts will not be required, allowing full interchangeability.