



Mounting of Meritec Through Hole Products Using Lead-Free Solder

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Scope

To determine acceptable methods and materials for mounting Meritec's Through Hole products using lead-free wave processes. The findings will form the basis by which Meritec can assist its customers in making the changeover.

After reviewing the current product line, it was decided that Meritec's PCI Connector Product represented the biggest challenge. Of these, we chose the 184 pin right angle version for our tests.

1...To mount Pb-free Meritec PCI Connectors using a Pb-free printed circuit board and wave process. Establish a target time/temperature profile from which a recommendation can be made to Meritec's customers.

- Target time/temperature will be the profile that confirms good solder characteristics and causes no damage to the plastic of the connector.

2...Mounting of Pb-free Meritec PCI Connectors will also be done using a 63/37 solder alloy. This will be done to establish a backwards compatibility of the new plating with a 63/37 lead bearing solder.

Test Samples/Preparation

- Connector...

<u>Meritec P/N</u>	<u>Size/Type</u>
981159-184-2MPF	184 pin right angle PCI

- Printed Circuit Board...A test board (Meritec P/N 600440-02) was manufactured with a pad pattern for each of the PCI connectors in the product line. Immersion silver was chosen as a pcb finish for the Pb-free tests and Sn63/Pb37 HASL for the backwards compatibility tests.

- Solder Alloy...Nihon Superior Solder Product Number SN100C was used for Pb-free testing and has an alloy composition of Sn/Cu/Ni. Backwards compatibility testing was done using a Nihon Superior Product Number H63A (Sn63/Pb37).

- Flux...Superior Flux and Mfg Co. Product Number 420-S flux was used for Pb-free testing. This is a VOC (Volatile Organic Compound) free, water based flux. Backwards compatibility testing was done using a Superior Flux and Mfg Co. Product Number 325, an alcohol based product. Both products are "No Clean" fluxes.

Facilities

The facilities used for this testing were located at:

APSCO International
3700 Lane Road
Perry, Ohio 44081

APSCO International was chosen for its well qualified lead-free SMT and Wave production lines and knowledgeable personnel. APSCO has been addressing RoHS compliance since 2003.

Equipment

Equipment used for the Pb free tests was:

Wave Solder Line...Electrovert Econopak Plus
Inspection...Ersa scope
Xray...Nicolet NXR 1510 System

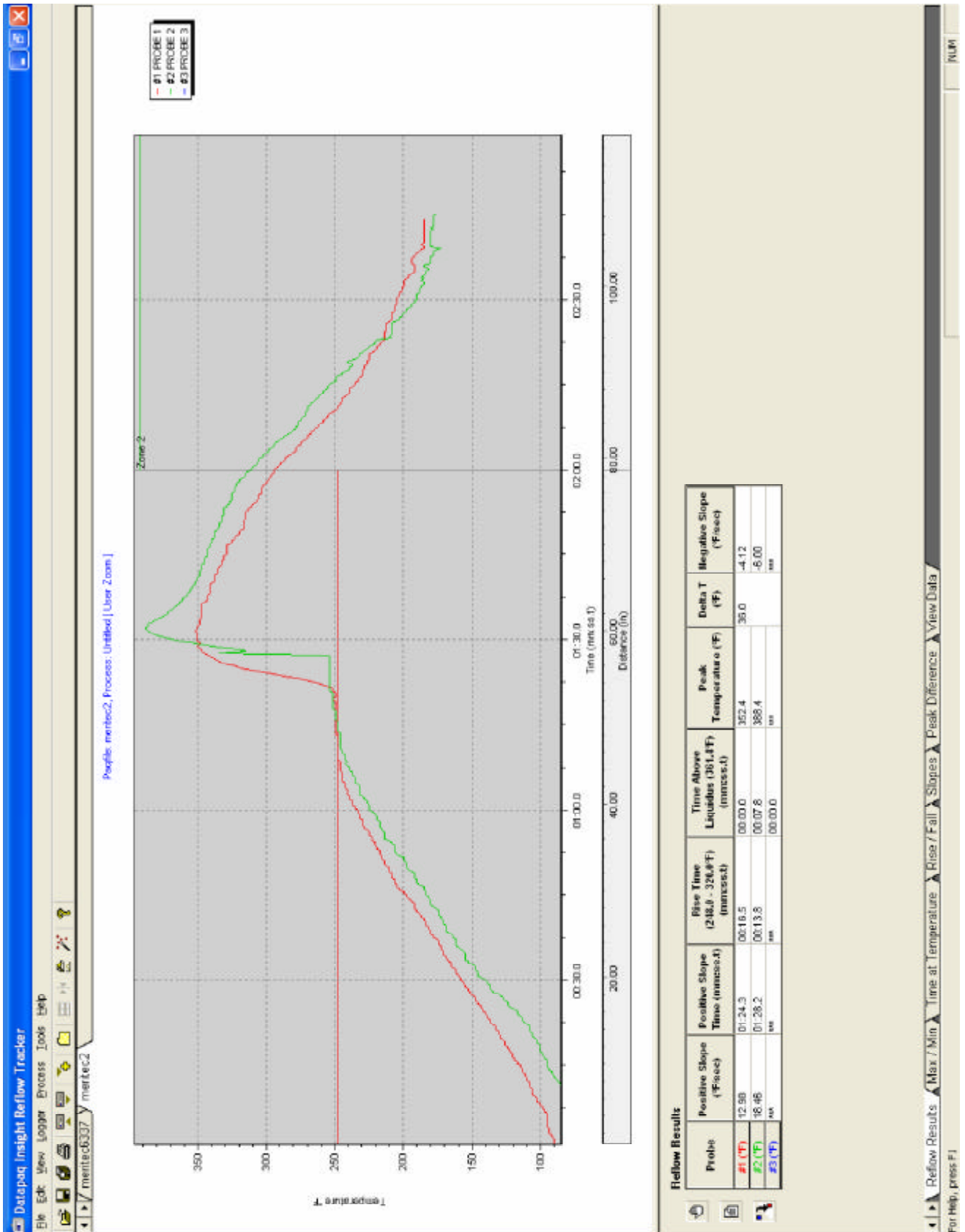
The collection of the time/temperature data was done with a Datapaq Data Logger and processed using the Datapaq Insight Reflow Tracker v1.40 software.

Additional visual inspection was made using Leica StereoZoom SZ-4 microscopes with 10X eyepieces mounted.

Equipment used for the backwards compatibility (Sn63/Pb37) tests was the same as the above except:

Wave Solder Line...Electrovert /Vectra Type 400F

Pb Free "Target" Wave Soldering Profile



Pb Free Solder Joint Photos



Fig 1...Contact, PCB Bottom



Fig 2...Contact, PCB Top



Fig 3...Retention Clip, PCB Bottom

Pb Free Solder Joint X-Ray

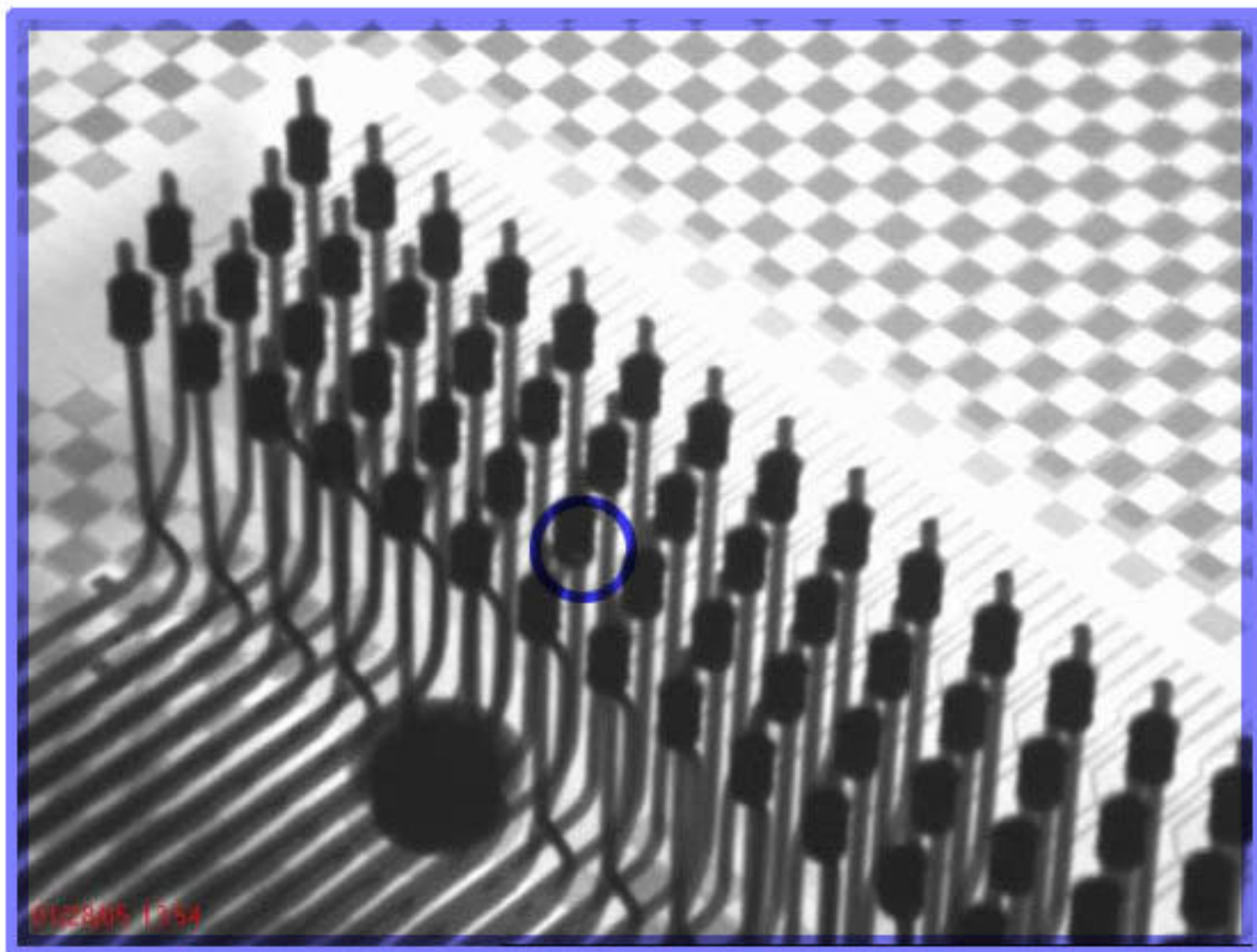


Fig 4...XRay, PCB Bottom

Conclusions

Good results were achieved with the profile on page 5 using the materials defined on page 3. Though the new lead-free solder alloys do not flow and wet as well as lead-bearing alloys, the solder joints were quite acceptable based on the new proposed standards.

Fig. 1 on page 6 is typical of the results to be expected with the new lead-free alloys.

Fig 2 illustrates how the new alloys and plating materials result in a smaller fillet on the top side of the board.

Though Fig 3 is quite acceptable to the new standards, the entire pad did not wet. This could have easily been improved with the use of a thieving pad located adjacent to the one in the photo.

The photo on page 7 is an X-ray. A solder void has been circled there for reference. During these tests, 3 or 4 of these appeared on both the Pb-free and Pb tests, and are very acceptable.

The recommended wave profile for all Meritec through hole products is the one shown on page 5. This, when combined with a good solder alloy and flux chemistry should result in a good starting point.

Commentary

Other platings, board finishes and solder alloys were considered for inclusion in our tests. The following is a brief discussion regarding these other materials:

- PCB Finish...Two popular finishes were considered for use in these tests, ENIG (Electroless Nickel/Immersion Gold) and Immersion Silver. Each has unique benefits and liabilities that warrant further discussion.

ENIG exhibits better surface wetting of the solder than Immersion Silver, but can suffer from “black pad” if it’s not cleaned and handled properly during the PCB manufacturing process. It is felt that as PCB manufacturers modernize their production lines this will become less of an issue because cleaning equipment is continuously being improved.

Immersion Silver is not prone to “black pad” and is more easily implemented on older PCB manufacturing lines, because cleaning requirements are not as stringent. This provides some economic advantage. A liability of Immersion Silver is long term formation of silver oxides. Though electrically harmless, they are nevertheless esthetically undesirable.

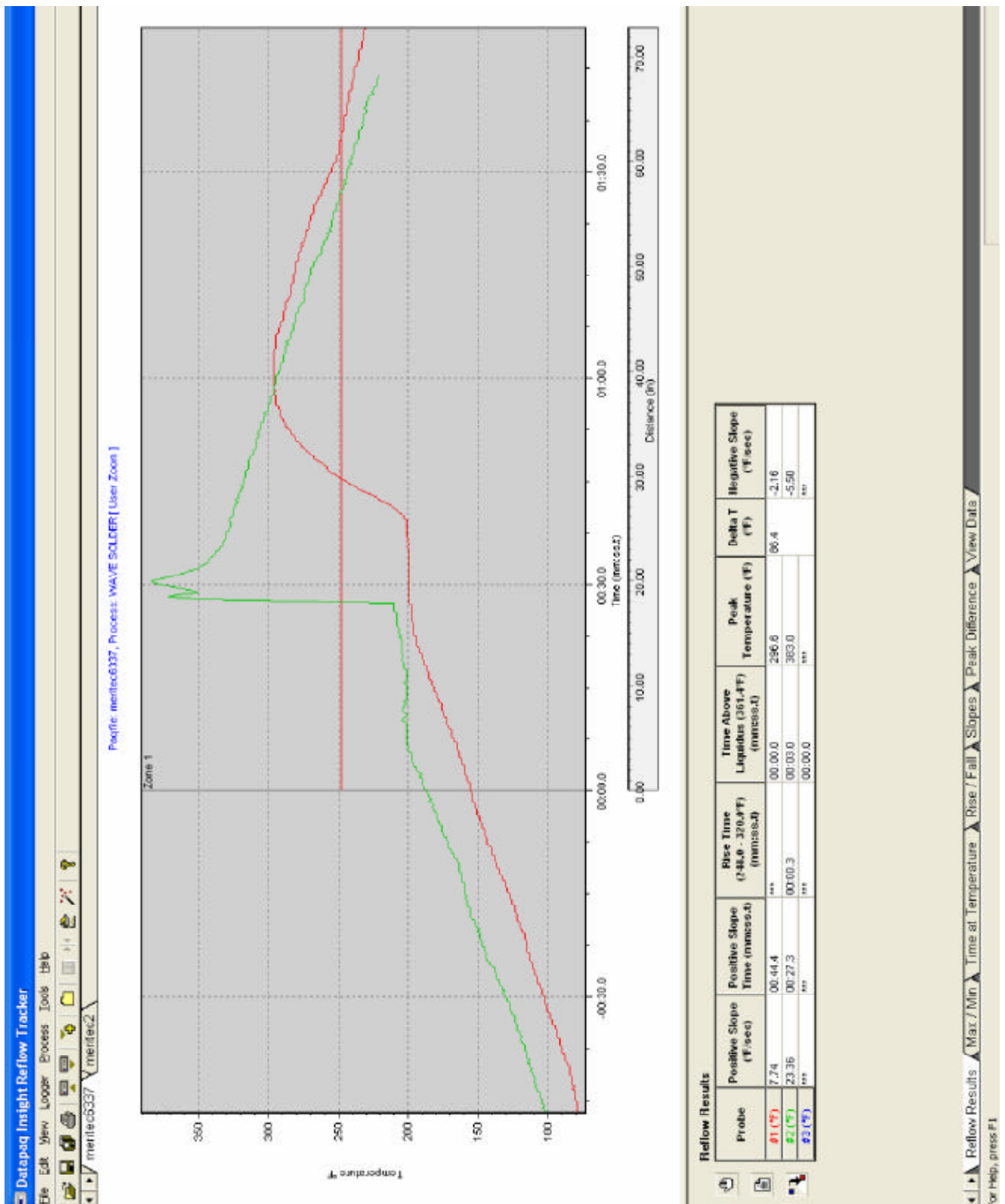
Because we would be exposing samples mounted on these boards to extreme environmental conditions in preparation for electrical testing of the “interface” end of the contact, we needed to eliminate the possibility that no unknown variables would surface. For this reason, we chose the Immersion Silver board finish over ENIG. It was thought by many that, by the time of this writing, a lead-free HASL finish may have been developed and accepted, but it has not.

- Contact Plating...Pure Sn plating of the connector contacts was considered and discarded. Meritec has taken a conservative approach to pure tin on connector designs with pitches less than 1mm. Though the PCI connector tested here is a .100” pitch product, there are areas of the design where the gap between contacts is similar to that of a 1mm pitch product. There persist, after decades of debate within the industry, uncertainties regarding tin whisker growth. Our position is that a slight increase in the cost is worth avoiding the risk of field failures in the future. For this reason, we chose pure Pd as a contact finish.

- Solder Alloy...There are many solder alloys currently on the market, most of which are patented. We chose to use the most popular public domain alloy because of it’s wide availability.

Backwards Compatibility Wave Profile (Sn63/Pb37)

Realizing that many users will still be soldering with lead-bearing alloys for the foreseeable future, we've included this profile here. The results were very good, demonstrating that the Pd plating is very compatible with with the older alloys.



If you require further assistance, please contact Meritec at:

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