IHLP Manufacturing Standards

INTRODUCTION

Scope

This document was written for the purpose of helping customers better understand the IHLP product they are purchasing. It will give the customer an idea as to the type of cosmetic irregularities that may occur from time to time during the manufacturing of the component itself, or during their use of the component.

This document also discusses the criteria that have been developed for the rejection of irregularities that are determined to be excessive.

While it is desirable to have cosmetically perfect IHLP inductors, the powdered iron manufacturing technique has cosmetic limitations.

Certified test labs have performed extensive environmental testing on IHLP inductors with and without cosmetic imperfections according to AEC-Q200 standards for thermal shock, mechanical shock, vibration, humidity, and others. This testing has shown that the cosmetic imperfections listed in this document do not affect the performance or reliability of the IHLP inductor. Test results are available upon request.

Product

The IHLP inductor is different from most inductors. The inductor body is a soft magnetic composite (SMC), not a ferrite. It is made from an iron powder mixture and cemented together using a resin binder. This powder mixture, when pressed around the inductor coil, greatly enhances the electrical properties of the inductor and gives protection from environmental forces. After pressing, the component is cured in an oven to increase the bonding strength of the resin binders with the iron powder, yielding excellent electrical and physical properties.

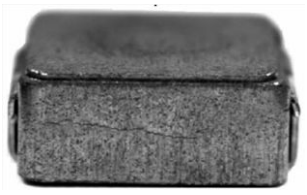
The IHLP inductor provides the best combination of:

- Inductance
- Low core loss
- Saturation
- Temperature stability
- Smallest footprint
- Lowest profile

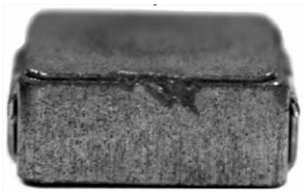
Surface irregularities

The following pages include descriptions of the most common irregularities seen on IHLP inductors. Common causes are described along with variations in their magnitude. Customers may at some time see one or all of these irregularities.

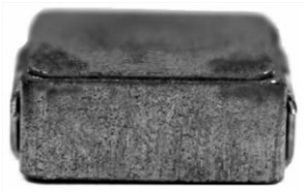
Those that are determined to adversely affect the customer's use of the component are rejected, but minor (acceptable) irregularities will occasionally be present. With the use of this guide, a customer will better understand the effect of each irregularity.



Cracks



Chips



Oxidation

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CRACKS

Cracks within the inductor body are unavoidable during the manufacturing process. Small cracks are caused by die wall friction when the parts are ejected during the pressing process, and by expansion of the coil during the process of curing the resin binder in the powdered iron body. Unlike ferrite material, cracks on the IHLP body do not affect the electrical performance of the component.

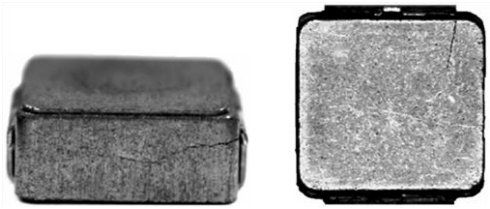
Reliability testing has shown that even cracks in excess of 0.005 inch will not cause the component to fail electrically or physically in field applications. Acceptance widths are adopted based on the ability to detect cracks both at the component and circuit level.

Terminal area crack, acceptable

Cracks coming from the top corner of the terminal are a normal occurrence and are caused by terminal expansion during curing operations.

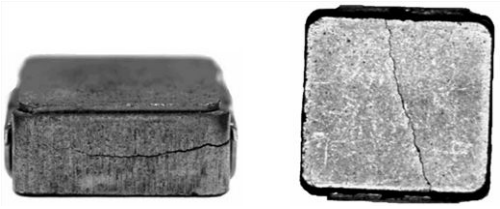
Negligible crack, acceptable

Negligible cracks are those that are nearly invisible without magnification.



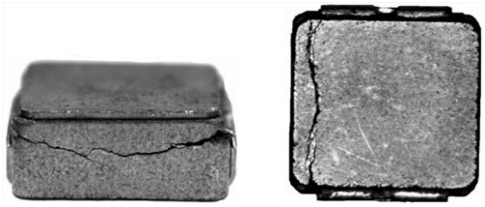
Minor crack, acceptable

Minor cracks are those that are visible without magnification but are not apparent without close inspection.



Moderate crack, rejectable

Moderate cracks are those that are obvious upon examination and continue across most of the component.



Major crack, rejectable

Major cracks are those that are obvious to a customer and would possibly result in large chip-outs that would expose the coil and lead frame.

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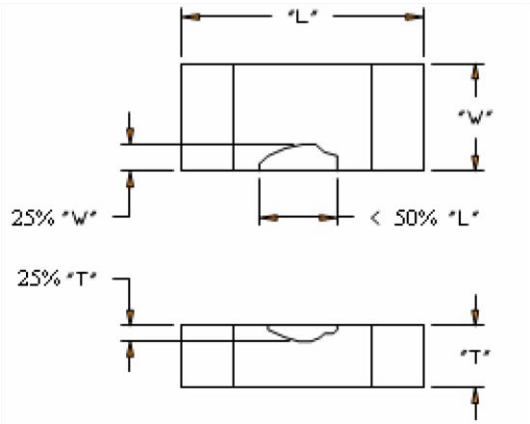
CHIPS

Chipping of the inductor body can occur during normal processing and testing of the inductor. The acceptance criteria for chipping vary with the size of the component, but current acceptance standards are based on IPCA-610. The effect of chipping is negligible as long as the inductor coil is not showing. See IPC standard for class 1 and 2 components below.

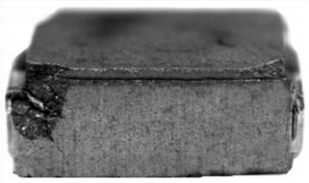


T	25 % of the thickness
W	25 % of the width
L	50 % of the length

Chips typically occur on the edges and corners of the inductor body. They are slightly darker in color and rougher in appearance than the surrounding material.

Minor chipping, acceptable

Minor chips in the inductor body are those that are typically shallow imperfections that occur on the corners and edge of components. No coil wire or lead frame is showing and the chip does not affect the performance or reliability of the component.



Major chipping, rejectable

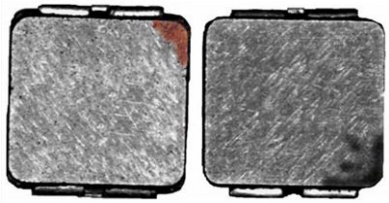
Major chips in the inductor body are those that are very obvious to the customer and may expose the wire coil or lead frame.

OXIDATION

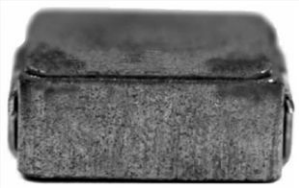
The IHLP inductor is predominately iron, and oxidation may occur in a small percentage of inductors. Resin binders give moderate protection, but some slight oxidation may occur. All components should be stored away from heat, humidity, and ionized atmospheres as much as possible before mounting.

Basic steps should be taken in order to limit surface oxidation, including keeping the IHLP inductors sealed in their packaging until PCB mounting.

In the event that oxidation does occur, the effects are contained to the surface of the component and do not penetrate into the core material. No electrical effects have ever been documented due to oxidation of the IHLP product. Oxidation should never be considered a reliability risk.



Top view



Side view

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OTHER

A very small number of other irregularities have been reported. These occur at an exceedingly low rates and typically do not affect the components electrically. These include:

Foreign material may be seen pressed into the upper terminals. This material is of the same material as the inductor body and should not be a reason for rejection unless solderability is affected.

Foreign material: acceptable

Scratches may be seen on the surface of the inductor body. Scratches are an acceptable surface irregularity.

Scratch: acceptable

SUMMARY

The IHLP inductor is comprised of an iron powder body compressed around a coil. Due to the fact that this iron powder body is not solid like ferrite material, irregularities such as cracks and chips do not affect the electrical properties or the reliability of the component. Criteria have been determined for the acceptability of the components that allow for a robust manufacturing process as well as an acceptable degree of cosmetic irregularity.

Reliability testing has been done on the effects of cracking of the iron powder body and on the oxidation of the iron particles that are present on the surface. Testing has shown no reliability issues from either of these cosmetic differences.