IPC-A-610HC

2023 - April
Telecom Addendum to
IPC-A-610 Revision H Acceptability of Electronic Assemblies

Supersedes IPC-A-610GC

October 2019

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Telecom Addendum to IPC-A-610 Revision H Acceptability of Electronic Assemblies

Developed by the IPC-A-610 Telecom Addendum Task Group (7-31bc) of the Product Assurance Subcommittee (7-30) of IPC

Users of this publication are encouraged to participate in the development of future revisions.

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Supersedes:
IPC-A-610GC - October 2019
IPC-A-610FC - January 2017
IPC-A-610DC - August 2009

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Acknowledgment

Any document involving a complex technology draws material from a vast number of sources across many continents. While the principal members of the IPC-A-610 Telecom Addendum Task Group comprised of IPC Task Group (7-31bc) of the Product Assurance Subcommittee (7-30) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of IPC extend their gratitude.

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IPC-A-610 Revision H Telecom Addendum

0.1 Scope This Addendum provides requirements to be used in addition to, and in some cases, in place of, those published in IPC-A-610 Revision H to ensure that electrical and electronic assemblies meet requirements for customers requiring Telcordia GR-78-CORE compliance.

Where content criteria are not supplemented, the Class 2 requirements of IPC-A-610 Revision H apply.

This addendum contains criteria for process control.

0.1.1 Purpose When required by procurement documentation/drawings, this Addendum supplements or replaces specifically identified requirements of IPC-A-610 Revision H.

0.1.2 Precedence Customer contractual requirements take precedence over this Addendum, referenced standards and User-approved drawings. In the event of a conflict between this Addendum and the applicable documents cited herein, this Addendum takes precedence. Where referenced criteria of this Addendum differ from the published IPC-A-610 Revision H, this Addendum takes precedence.

0.1.3 Existing or Previously Approved Designs This Addendum **shall not** constitute the sole cause for the redesign of previously approved designs. When drawings for existing or previously approved designs undergo revision they should be reviewed and changes made that allow for compliance with the requirements of this Addendum.

0.1.4 Use This Addendum is applicable for rigid single-sided, double-sided, and multilayer boards. This Addendum **shall not** be used as a standalone document.

Where criteria are not supplemented, the Class 2 requirements of IPC-A-610 Revision H apply. Criteria defined in IPC-A-610 Revision H as ''process defects'' for Class 2 **shall** be treated as defective, unless otherwise stated in this Addendum.

If an IPC-A-610 Revision H requirement is changed or added by this Addendum, the clause is identified and that entire IPC-A-610 Revision H clause or subordinate clause is replaced by the criteria in this Addendum.

The clauses modified by this Addendum do not include subordinate clauses unless specifically stated, e.g., 1.4 dœs not include 1.4.1. Clauses, Tables, Figures, etc., in IPC-A-610 Revision H that are not listed in this Addendum are to be used as-published.

In this Addendum, as in the published IPC-A-610 Revision H, in case of conflict or discrepancy, the description or written criteria always take precedence over the illustrations.

The surface insulation resistance and the electromigration resistance of the finished PWB **shall** be in accordance with GR-78-CORE. This is relevant for no-clean assembly processes, which should be used preferably, as well as for fluxes which are intended to be cleaned, and for SMC adhesives.

Solder alloy **shall** comply with J-STD-006 or equivalent.

0.1.5 Additional Referenced Standards Telcordia GR-78-CORE Generic Requirements for the Physical Design and Manufacture of Telecommunications Products and Equipment (http://telecom-info.telcordia.com).

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1.8.5 Electrical Clearance

These criteria replace all of 1.8.5 Electrical Clearance in published IPC-A-610 Revision H.

Minimum electrical clearance for products built to this document is specified as 0.13 mm [0.005 in].

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4.1.4.3 Hardware Installation – Heatsinks – Phase Change Material

This is added criteria in this Addendum.

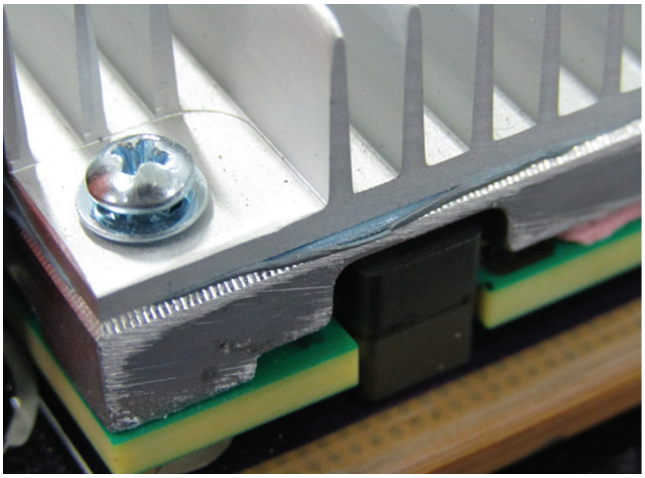


Figure 4-1HC

Acceptable

- The phase change material to not squeeze out between the heat sink and component, provided it is present and in the correct position.
- The phase change material to squeeze out, provided it dœs not touch the printed board or other components.

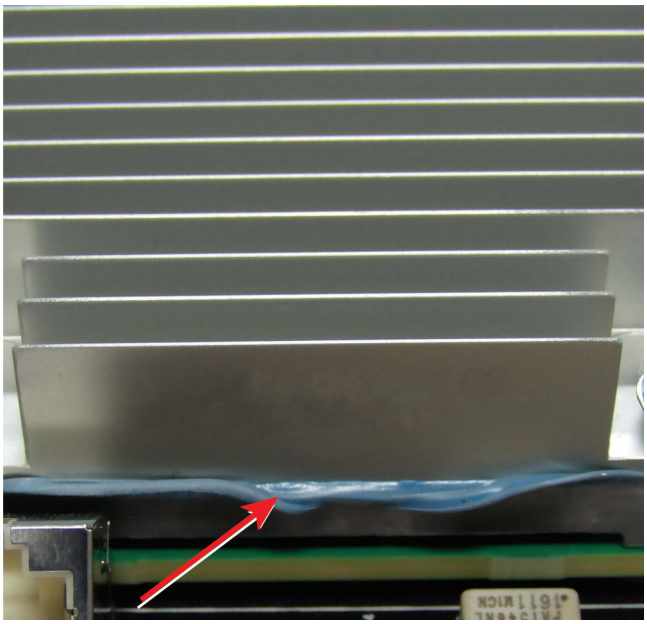


Figure 4-2HC

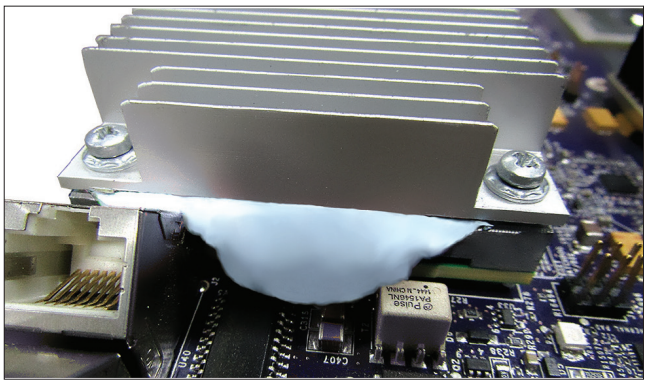


Figure 4-3HC

Defect

- Phase change material is missing.
- Excess phase change material touches the printed board or other components.

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4.1.4.4 Hardware Installation – Heatsinks – Horizontal Rotation

This is added criteria in this Addendum.

This section applies to heatsink attachments where alignment mechanism is not part of design.

The image below represents a misaligned heatsink, where σ represents the angle of rotation.

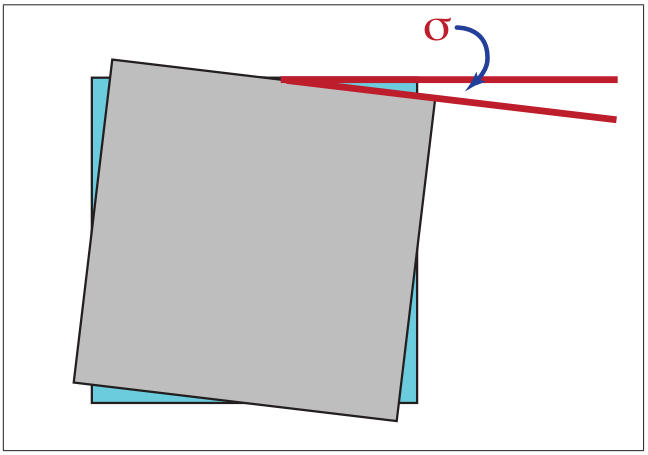


Figure 4-4HC

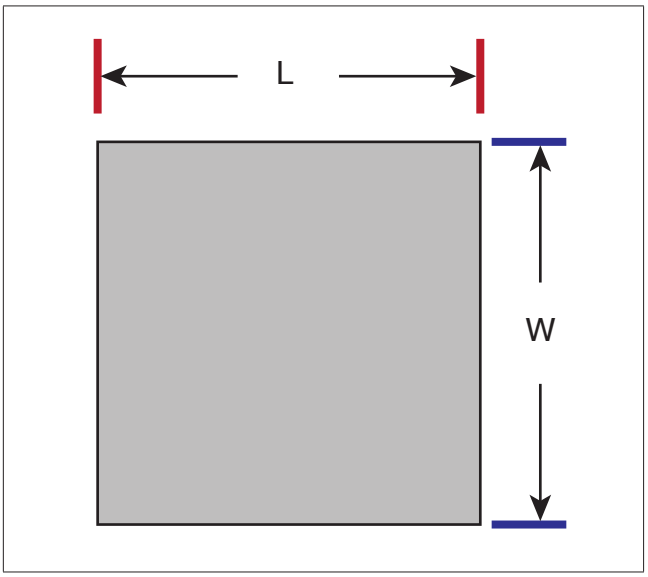


Figure 4-5HC

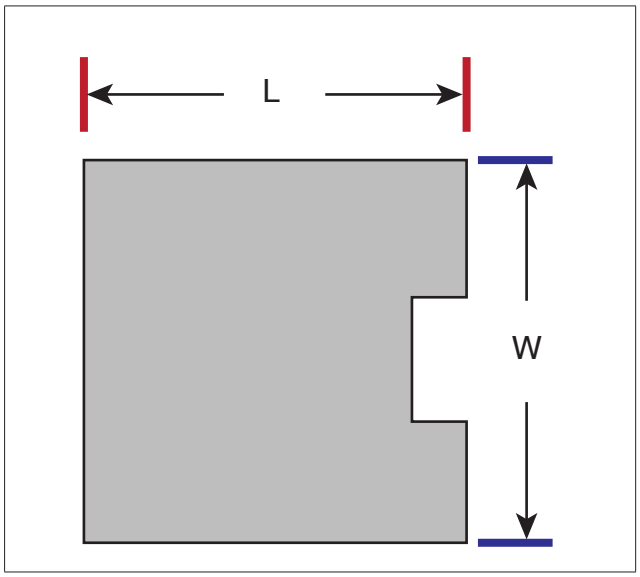


Figure 4-6HC

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4.1.4.4 Hardware Installation – Heatsinks – Horizontal Rotation (cont.)

Table 4-1HC below represents small, medium and large heat sinks, based on the heatsink footprint as described above and the maximum angle of rotation by heatsink size.

Table 4-1HC Heat Sink Size, Longest Heat Sink Measurement and Maximum Angle of Rotation, σ

Heat Sink Size	Longest Heat Sink Measurement L or W		Maximum Angle of Rotation, σ
	Min L or W	Max L or W	
Small	0 mm [0 in]	25 mm [0.98 in]	7°
Medium	> 25 mm [0.98 in]	50 mm [1.97 in]	5°
Large	> 50 mm [1.97 in]	Not Specified	3°

Acceptable

- The maximum allowable rotation dœs not exceed criteria established in Table 4-1HC.

Defect

- Rotation of a heat sink exceeds the maximum angle of rotation as defined in Table 4-1HC.

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4.1.4.5 Hardware Installation – Heatsinks –Tilt/Gap

This is added criteria in this Addendum.

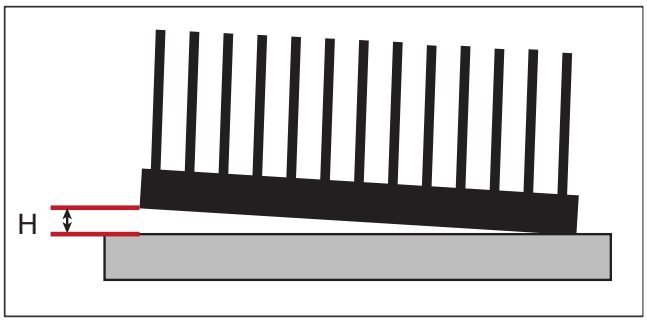


Figure 4-7HC

Acceptable

- The maximum allowable heat sink tilt/gap (H) is 0.4 mm [0.015 in] with the component surface as a datum.

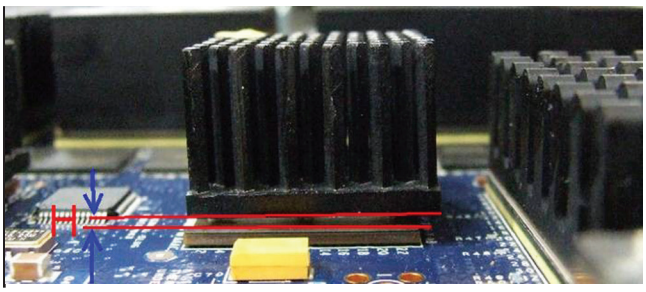


Figure 4-8HC

Defect

- Heatsink tilt/gap that exceeds 0.4 mm [0.015 in] with the component surface as a datum.

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4.1.4.6 Hardware Installation – Heatsinks – Excessive Adhesive

This is added criteria in this Addendum.

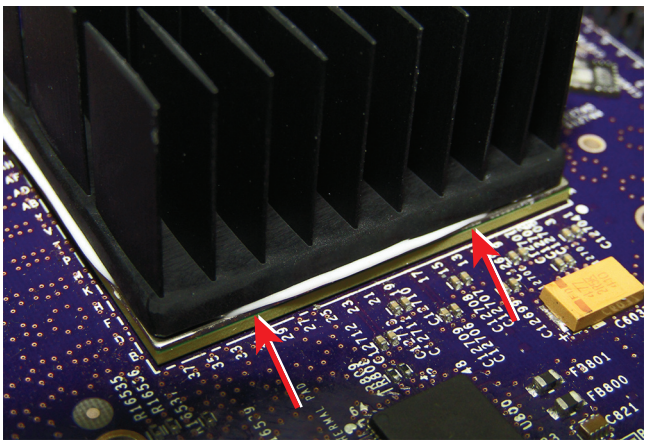


Figure 4-9HC

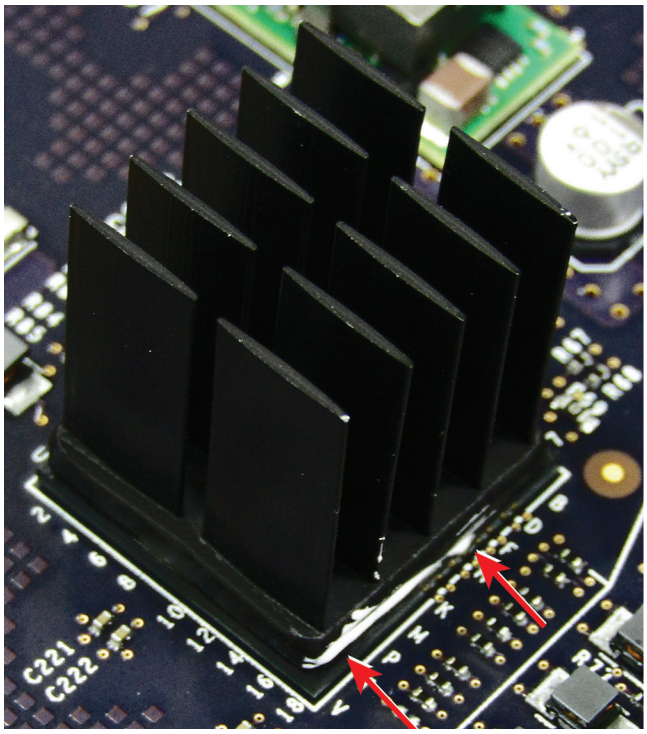


Figure 4-10HC

Acceptable

- The heatsink adhesive to squeeze out from under the heatsink, provided the following conditions are met:
  - Does not come in contact with the printed board or another component.
  - Does not extend more than 3 mm [0.120 in] above the surface of the component.
  - Remaining adhesive is dry to the touch.

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4.1.4.6 Hardware Installation – Heatsinks – Excessive Adhesive (cont.)

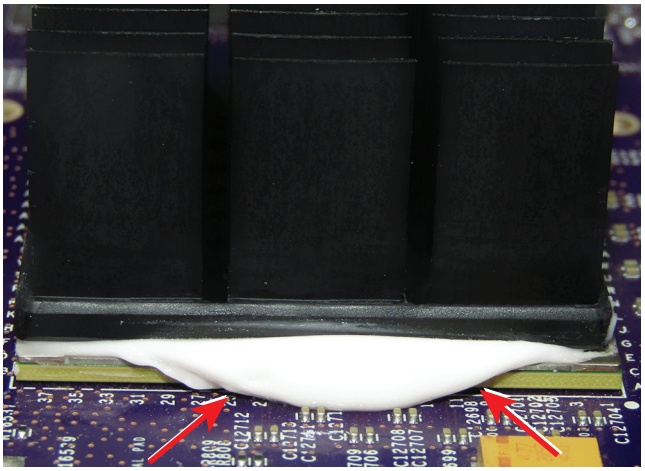


Figure 4-11HC

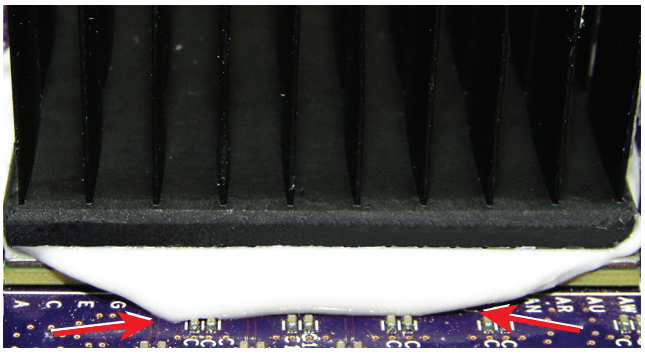


Figure 4-12HC

Defect

- Adhesive comes in contact with the printed board or another component.
- Adhesive extends more than 3 mm [0.120 in] above the surface of the component.
- Remaining adhesive is not dry to the touch.

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4.1.4.7 Hardware Installation – Heatsinks – Insufficient Adhesive

This is added criteria in this Addendum.

This section applies to heatsink attachments where an alignment mechanism is not part of the design. This applies to both pin and blade heatsinks. It defines the visual criteria for insufficient heatsink adhesive. This dœs not apply to heatsinks attached with tape.

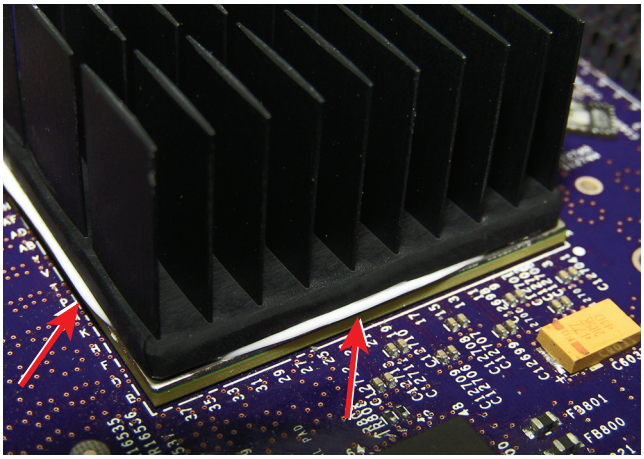


Figure 4-13HC

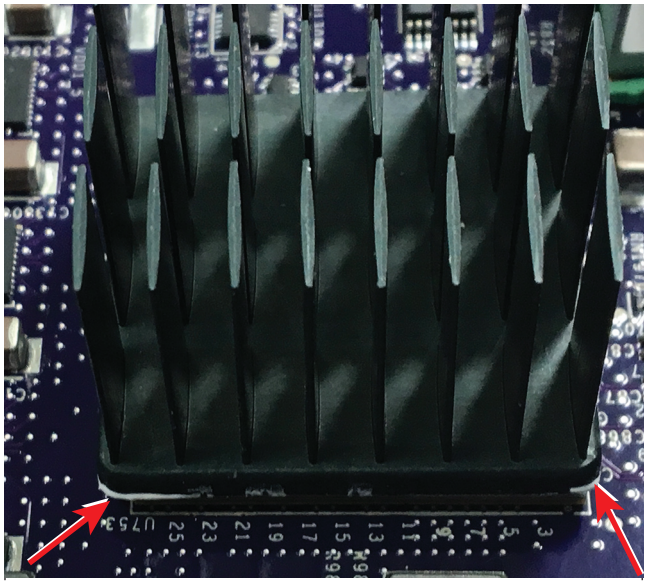


Figure 4-14HC

Acceptable

- The heatsink adhesive dœs not squeeze out from under the heatsink, provided the following conditions are met:
  - There are signs of adhesive at one or more locations around the heatsink.
  - If necessary, a feeler gauge can be used to slide between the heat sink and the component. If the feeler gauge stops, the presence of adhesive is indicated and is acceptable. A maximum of 10% of the mating surface of the component and heat sink is allowed to be accessed by the feeler gauge.

Defect

- Ability to slide the feeler gauge between the heatsink and component for more than 10% of the mating surface.

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4.1.4.8 Hardware Installation – Heatsinks – Adhesive on Pins and Blades

This is added criteria in this Addendum.

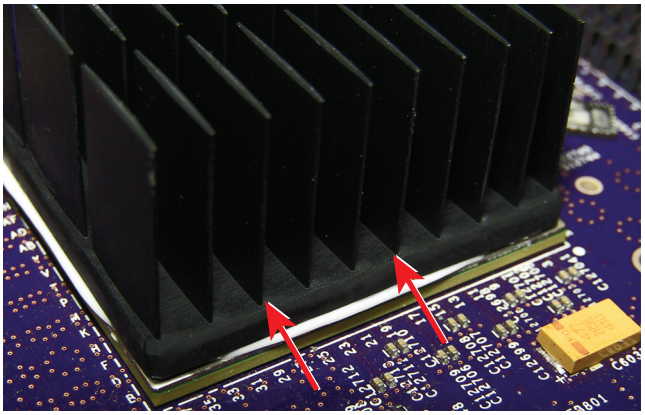


Figure 4-15HC

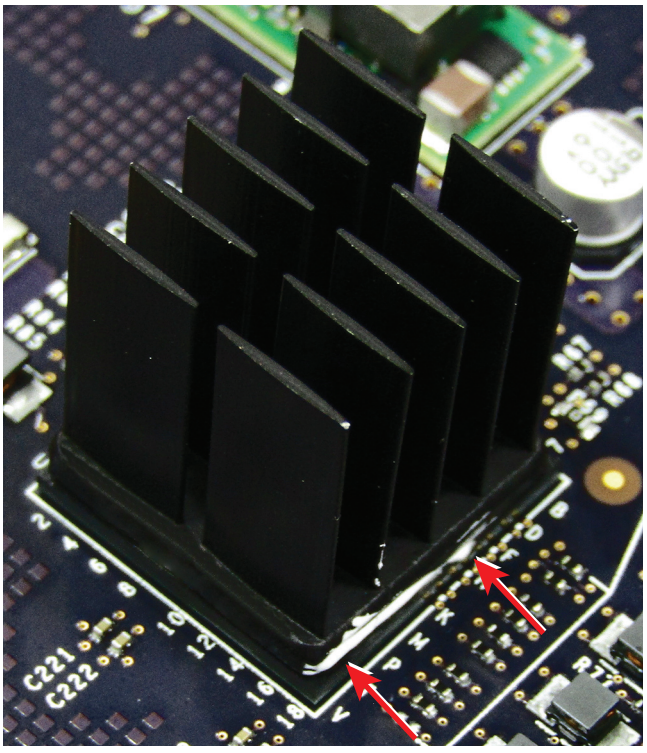


Figure 4-16HC

Acceptable

- Small amounts of heatsink adhesive on the heatsink pins or blades, provided the following conditions are met:
  - Maximum length in any direction of a single point is 5 mm [0.2 in].
  - Maximum area of a single location is 15 mm^2 [0.023 in^2].
  - The adhesive is dry to the touch.
  - Dœs not extend more than 3 mm [0.120 in] above the surface of the component.
  - Loose adhesive is removed.

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4.1.4.8 Hardware Installation – Heatsinks – Adhesive on Pins and Blades (cont.)

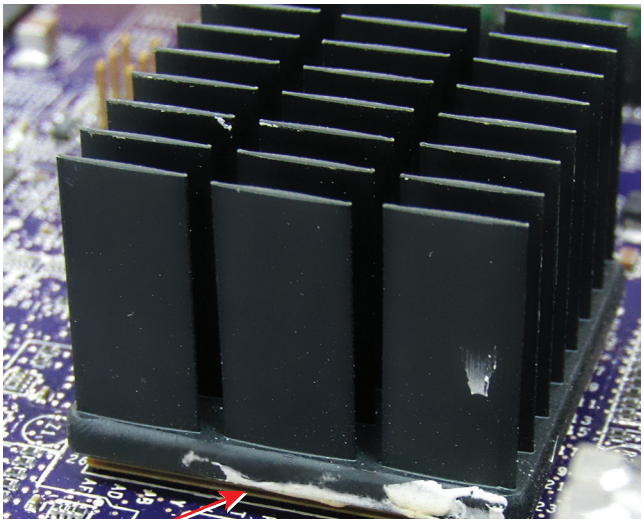


Figure 4-17HC

Defect

- Heatsinks with excessive adhesive on the pins or blades that do not meet the above criteria.

4.1.5.1.2 Countersinks

This is added criteria in this Addendum

Table 4-2HC Maximum Flat Head Screw Depression

Maximum Flat Head Screw Depression					
Inches	0.015	0.020	0.025	0.030	0.040
mm	0.38	0.51	0.64	0.76	1.02
Screw Thread Size	4	6	8	10	0.250

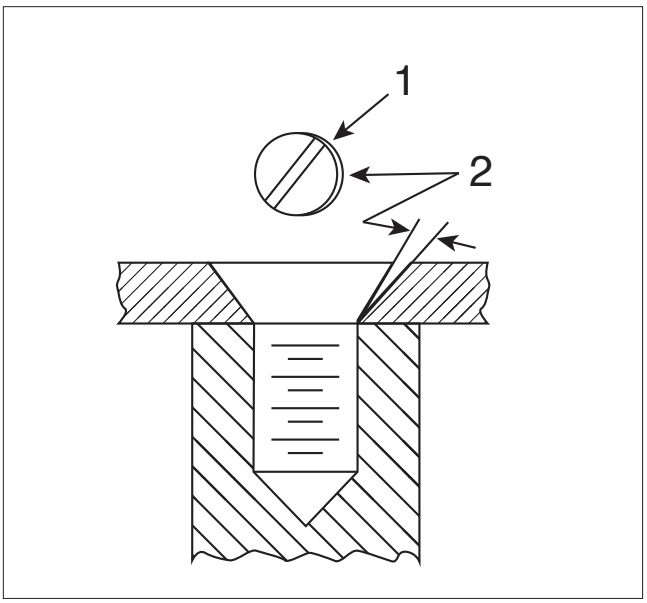


Figure 4-18HC
1. Gap extends less than ⅓ screw diameter.
2. Gap width less than 0.01 cm [0.005 in] maximum.

Acceptable

- Gap between the flat head and the countersink surface is less than 0.13 mm [0.005 in] and less than ⅓ the distance around the screw head (not shown).
- Height 'H' (Figure 4-19HC) is less than 0.64 mm [0.025 in], does not interfere with other parts or assemblies or create a safety hazard.
- Depression depth 'D' (Figure 4-20HC) is within the values shown in Table 4-2HC.
- The lower portion of flush screws that pass completely through a panel or part **shall not** interfere with the next part in sequence.

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4.1.5.1.2 Countersinks (cont.)

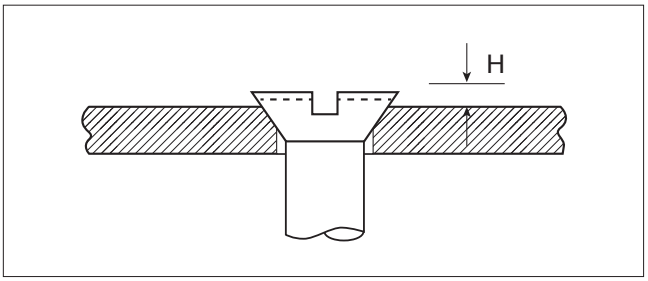


Figure 4-19HC

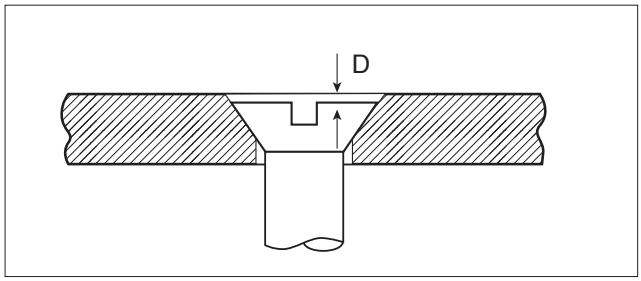


Figure 4-20HC

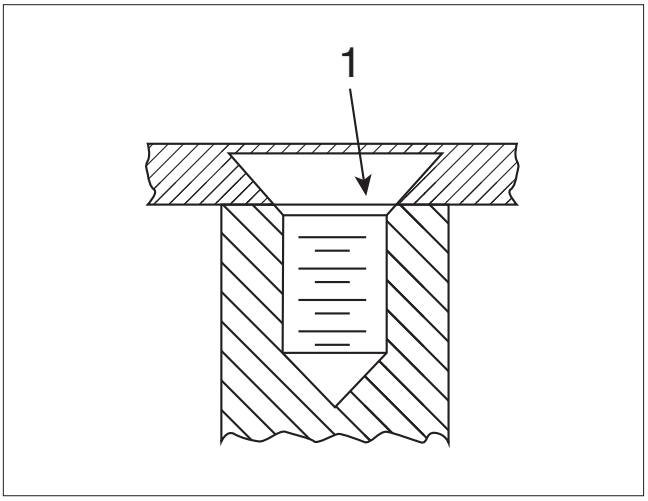


Figure 4-21HC

1. Parts recessed to receive screw head.

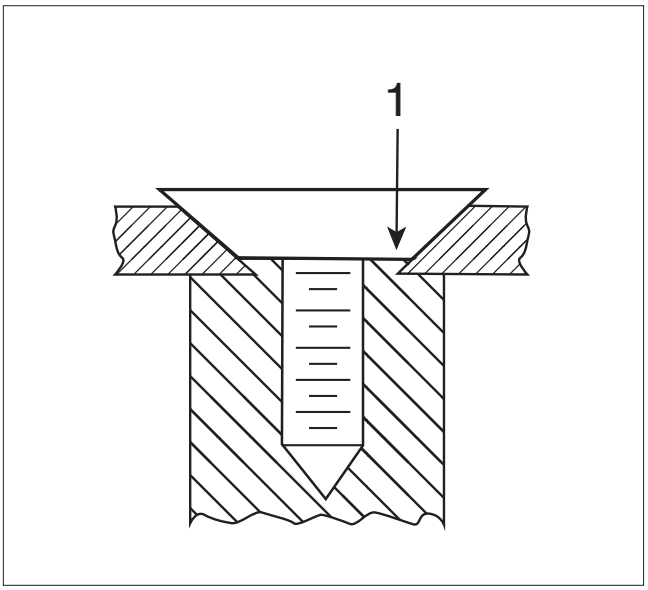


Figure 4-22HC

1. Screw head modified.

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4.1.5.1.2 Countersinks (cont.)

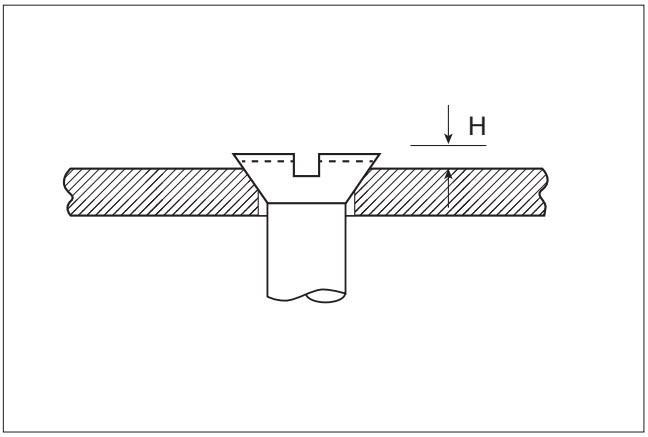


Figure 4-23HC

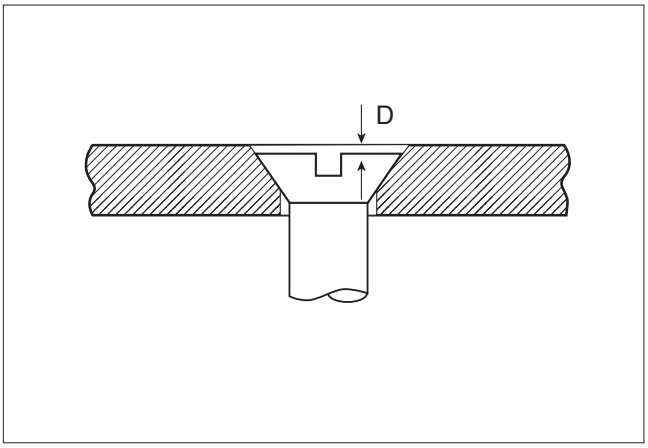


Figure 4-24HC

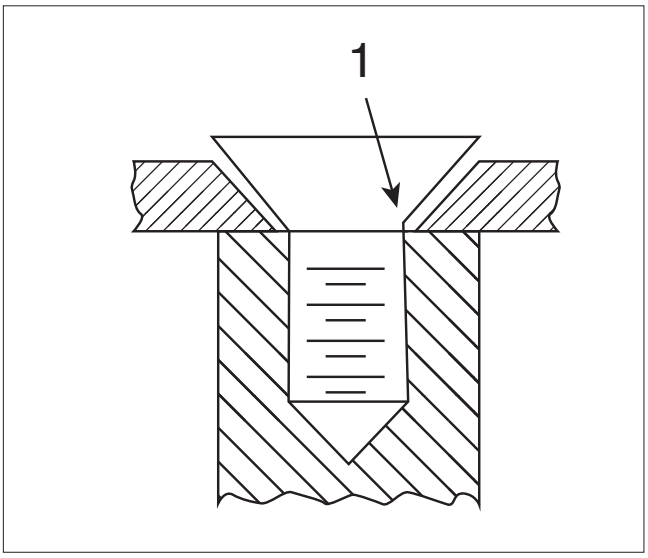


Figure 4-25HC
1. Screw head bottomed.

Defect

- Gap between screw head and material is greater than
- 0.13 mm [0.005 in] or gap extends more than 1/3 the distance around the screw head.
- Height 'H' exceeds 0.64 mm [0.025 in], interferes with another part or assembly process or creates a safety hazard.
- Depression depth 'D' is greater than the values shown in Table 4-2HC.
- Screw head bottomed on adjacent part.
- Parts not secure and tight.

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4.1.5.1.3 Rivets

This is added criteria in this Addendum.

4.1.5.1.3.1 Rivet Installation

This is added criteria in this Addendum.

Rivets **shall** be installed with well-formed driven heads seated tightly against their bearing surface (any evidence of loose parts or loose rivets that can be moved or turned with finger tip pressure **shall not** be acceptable). Joined parts **shall** fit firmly showing no significant distortion or other physical damage (such as tool marks as a result of the riveting operation). There **shall** be no foreign material captured between the mating materials or under the heads of the rivet.

Hollow shank rivets, such as tubular rivets, **shall** be installed tight against their mounting surface with no portion of the hole visible. The driven head **shall** be formed with a rollover line having complete contact with the mounting surface. The internal portion of tubular rivets **shall** be free of any visible cracks or distortion.

Pop rivets **shall** meet all of the criteria for tubular rivets except that the rollover on the backside of the rivet is not present.

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4.1.5.1.3.1 Rivet Installation (cont.)

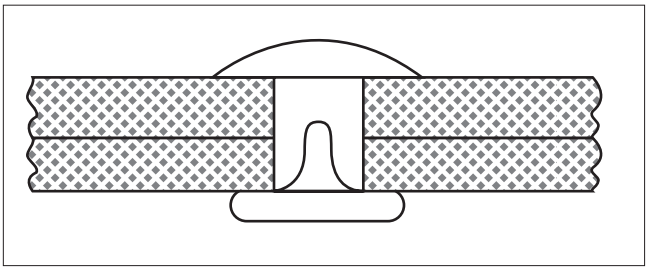


Figure 4-26HC

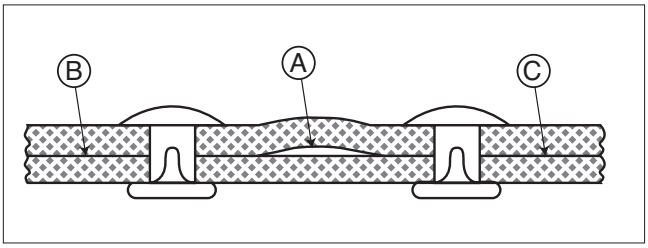


Figure 4-27HC

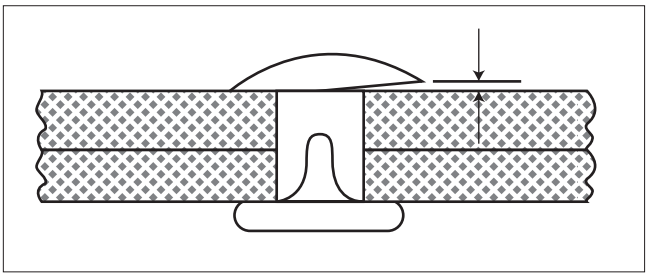


Figure 4-28HC

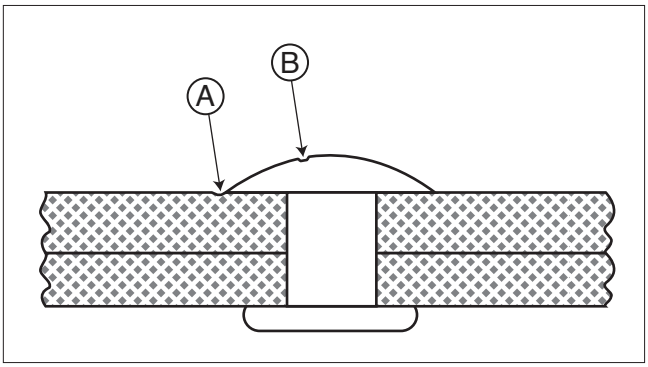


Figure 4-29HC

Acceptable

- Rivets used to install handles must not exceed a height of 0.38 mm [0.015 in] as measured from the handle surface to the top of the rivet and cannot exceed the allowable maximum or minimum component height for that assembly (refer to Section 4.5).
- Internal gap equal to or less than 0.15 mm [0.006 in], see Figure 4-27HC (A), and gap dœs not extend to rivet shank, see Figure 4-27HC (B).
- Mating surfaces free of foreign material or burrs, see Figure 4-27HC (C).
- The heads of flat countersunk head rivets **shall** be between 0.64 mm [0.025 in] above flush and 0.13 mm [0.005 in] below flush (not shown). The heads **shall not** protrude to the extent that mechanical interference will result.
- Slight gap under rivet head where 50% of the head is in contact with the mating surface and the gap dœs not exceed 0.38 mm [0.015 in], see Figure 4-28HC.
- Cut or tool mark in material less than 25% of the material thickness, see Figure 4-29HC (A), or cut in rivet head less than 0.64 mm [0.025 in], see Figure 4-29HC (B).

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4.1.5.1.3.1 Rivet Installation (cont.)

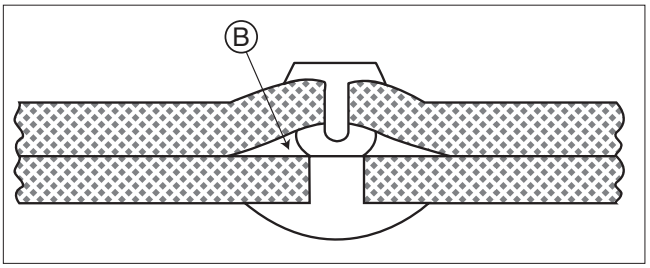


Figure 4-30HC

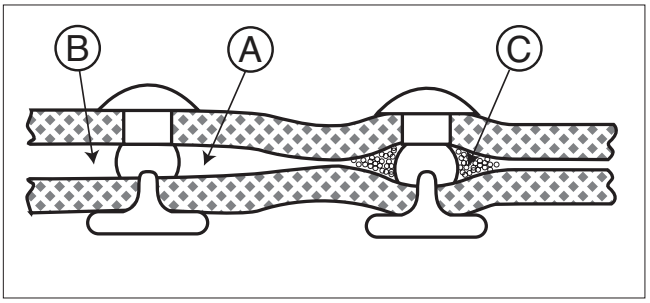


Figure 4-31HC

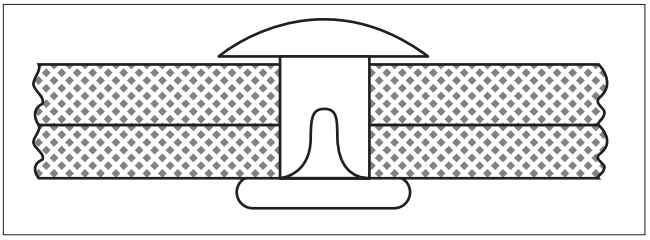


Figure 4-32HC

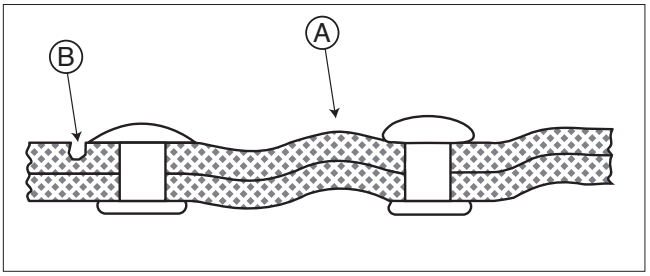


Figure 4-33HC

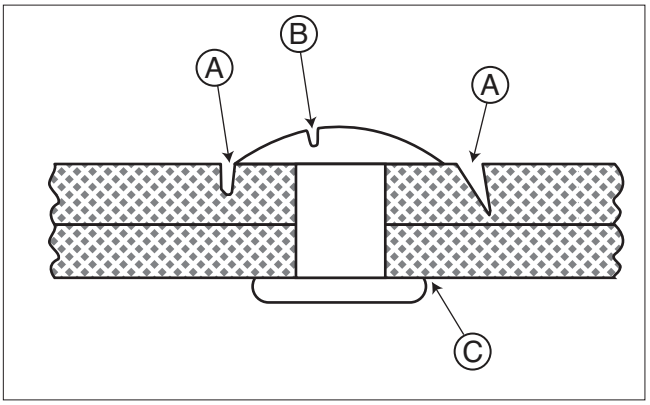


Figure 4-34HC

Defect

- Internal gap between joined materials exceeds 0.15 mm [0.006 in], see Figure 4-31HC (A).
- Gap extends to rivet shank, see Figure 4-31HC (B).
- Burrs, foreign material between mating surfaces, see Figure 4-31HC (C).
- Rivet swelled between joined materials, see Figure 4-30HC (B).
- Rivet is not seated firmly.
- Joined material visibly distorted, see Figure 4-33HC (A), or tool marks evident, see Figure 4-33 (B).
- Cut or tool mark in material surface more than 25% of material thickness or 0.38 mm [0.015 in] deep, see Figure 4-34HC (A), whichever is less.
- Cut in rivet head more than 0.25 mm [0.010 in] deep, see Figure 4-34HC (B).

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4.1.5.1.3.2 Rivet Head Deformation

This is added criteria in this Addendum.

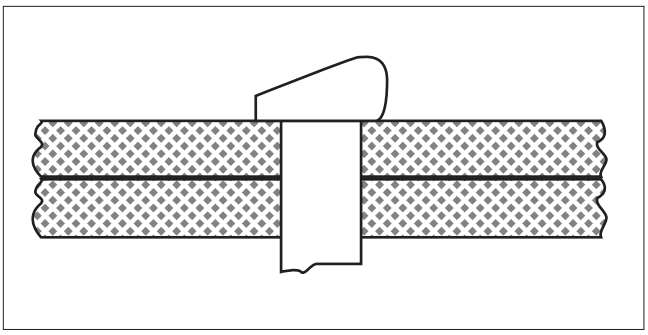


Figure 4-35HC

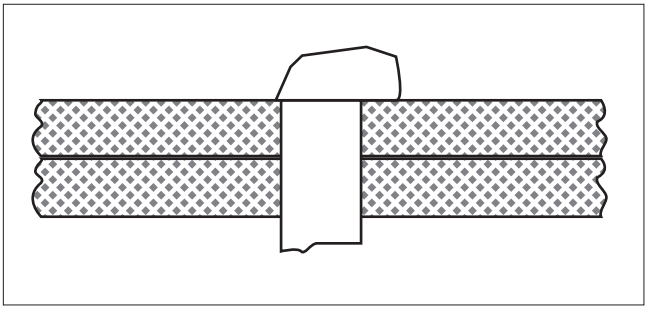


Figure 4-36HC

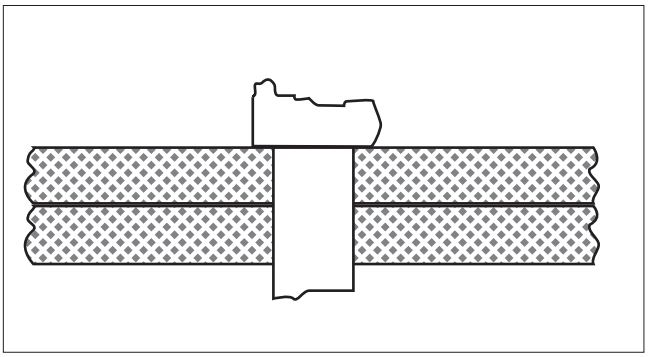


Figure 4-37HC

Acceptable

- Bevel driven head: The formed head **shall** be between 25-75% of the original head height.
- Offset driven head: The head can be off center with the shank but the shank **shall** not be exposed.
- Step driven head: The minimum thickness **shall** be 25% of the original head height.

Defect

- Bevel driven head: The formed head is not between 25-75% of the original head height.
- Offset driven head: The head is off center with the shank and the shank is exposed.
- Step driven head: The minimum thickness is more than 25% of the original head height.

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4.1.5.1.3.3 Tubular and Pop Rivets

This is added criteria in this Addendum.

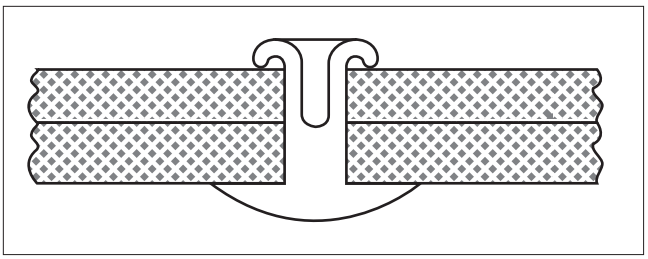


Figure 4-38HC

Acceptable

- Rivet tight against mounting surface.
- Rollover complete.
- Edge of hole not visible.
- Gap equal to or less than 0.051 mm [0.002 in].
- Splits in the head of the rivet are acceptable providing there are no more than three, all spaced greater than 90° apart, and they do not extend into the rivet shank.
- Pop rivets do not need to have a captive mandrel present as long as the secondary head is fully formed.

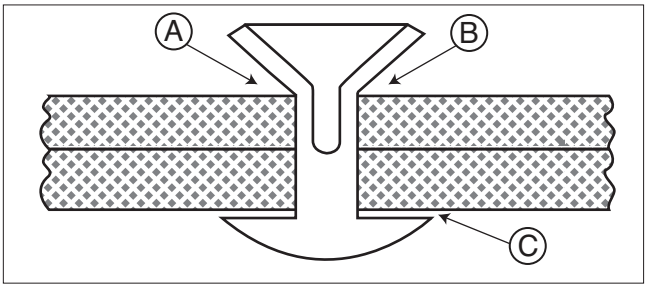


Figure 4-39HC

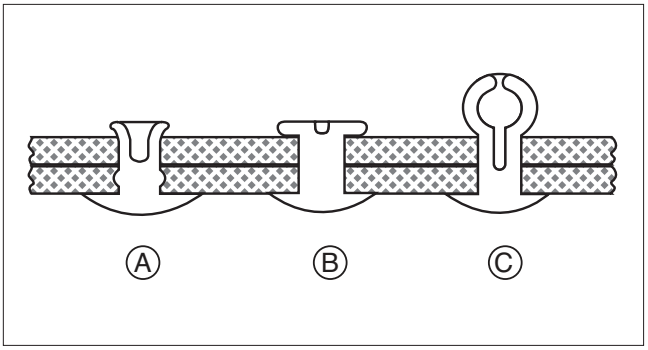


Figure 4-40HC

Defect

- Rivet not tight against mounting surface, see Figure 4-39HC.
- Rollover incomplete, see Figure 4-39HC (A).
- Edge of hole visible, see Figure 4-39HC (B).
- Gap greater than 0.051 mm [0.002 in], see Figure 4-39HC (C).
- More than three splits in the head of the rivet or excessive bulges that may weaken the rivet.
- Secondary head on pop rivet is not fully formed and rivet is loose.
- Rivet too short and dœs not form proper rollover, see Figure 4-40HC (A).
- Driven head flattened, formed with improper tool, see Figure 4-40HC (B).
- Insufficient forming, bulged ends not curled, see Figure 4-40HC (C).

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4.1.5.1.3.4 Countersunk Rivets

This is added criteria in this Addendum.

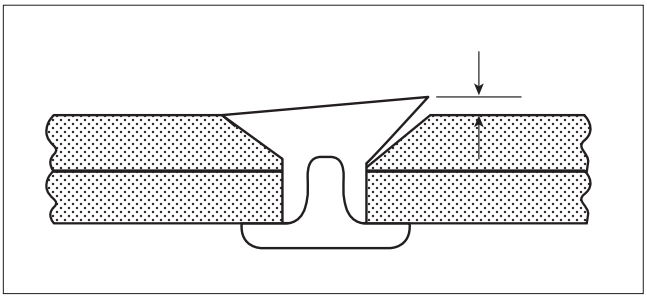


Figure 4-41HC

Acceptable

- The heads of flat countersunk head rivets **shall** be between 0.64 mm [0.025 in] above flush and 0.13 mm [0.005 in] below flush.
- The heads **shall not** protrude to the extent that mechanical interference will result.

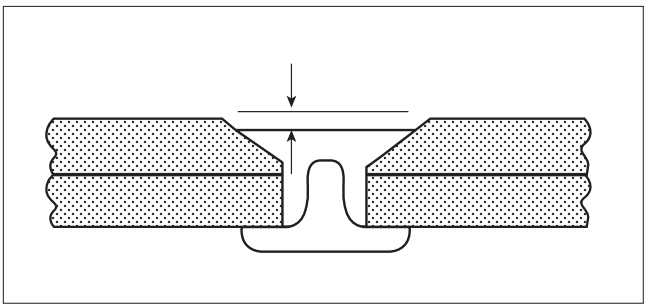


Figure 4-42HC

Defect

- The heads of flat countersunk head rivets are more than 0.64 mm [0.025 in] above flush or less than 0.13 mm [0.005 in] below flush.
- The heads protrude to the extent that mechanical interference will result.

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4.3.2.1 Connector Pins – Press Fit Pins – Land/Annular Ring

These criteria replace all of IPC-A-610H 4.3.2.1 Connector Pins – Press Fit Pins – Land/Annular Ring.

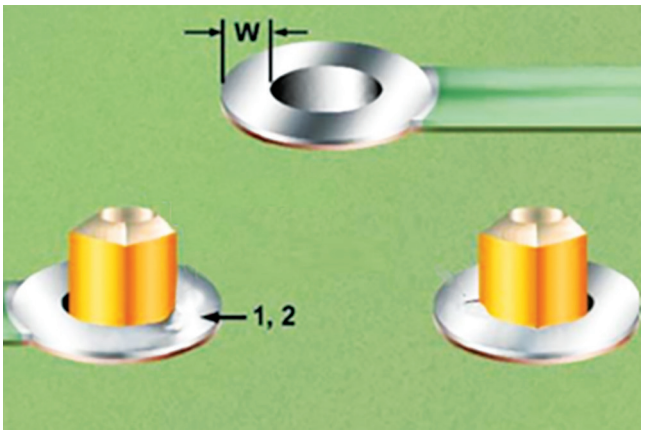


Figure 4-43HC
1. Annular ring with conductor
2. Annular ring not fractured

Acceptable

- No lifted or fractured annular rings.

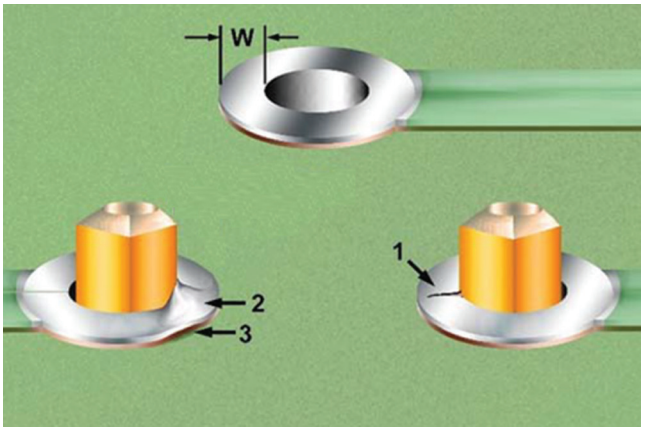


Figure 4-44HC
1. Annular ring fractured
2. Annular ring lifted
3. Annular ring lifted

Defect

- Any functional annular ring which is lifted or fractured, see Figure 4-44HC.

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4.4 Wire Bundle Securing – General

Class 2 requirements of IPC/WHMA-A-620 14 Securing **shall** be used except:

– Metal cable clamps **shall not** be used unless they are insulated.
– Cable ties **shall** be cut flush with the locking head.
– Tie wraps / straps **shall** not cause deformation of coaxial cables.

5.2.1 Soldering Anomalies – Exposed Base Metal

These criteria replace all of IPC-A-610H 5.2.1 Soldering Anomalies – Exposed Basis Metal. There are no illustrations for these criteria.

Acceptable

- Exposed basis metal on:
  – Vertical conductor edges.
  – Cut ends of component leads or wires.
  – Organic Solderability Preservative (OSP) coated lands.
- Exposed surface finishes that are not part of the required solder fillet area.
- Exposed basis metal on component leads, conductors or land surfaces from nicks or scratches provided conditions do not exceed the requirements of 7.1.2.4 Through-Hole Technology – Component Mounting – Lead Forming – Damage for leads and 10.3.1 Printed Boards and Assemblies – Conductors/ Lands – Reduction for conductors and lands.

AVA Documents
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Full document details: IPC A-610HC-2023