



QUALITY PROGRAM

Q50 WORKMANSHIP STANDARDS

TITLE: Q50 Workmanship Standards

APPROVAL AUTHORITY:

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FORMS: N/A

REFERENCE DOCUMENT: **IPC-A-610** Acceptability of Electronic Assemblies
IPC-A-610DC Telecom Addendum
IPC/WHMA-A-620 Acceptability of Electronic Wire Harnesses and Cables
IPC-7711/7721 Rework, Repair and Modifications of Electronic Assemblies

REVISION HISTORY:

Revision	Date Revised	Author	Change History
A	06/26/92	Unknown	New
B	03/24/02	Unknown	Adopted IPC-A-610 and created HTML document format.
C	11/30/04	W. Powell	General update. Adopted IPC/WHMA-A-620 for Cable and Wire Harness requirements. Converted document to pdf format.
D	05/16/12	J. Berry	General update. Deleted Rework, Repair and Modification Section 4.0 and re-numbered. Added IPC-A-610DC Telecom Addendum and IPC-7711/7721 to "Reference Documents" and "Document Hierarchy" sections for Rework, Repair and Modification industry methods and acceptability.
D	1/23/18	G Giles	Review as required, no changes

1.0 PURPOSE

The purpose of this document is to achieve uniformity in the quality and appearance of each product produced by ADTRAN and ADTRAN suppliers and subcontractors. This is accomplished by providing general requirements of quality acceptance for those who design, manufacture, and inspect the products. It is the intent of ADTRAN that all work be done to meet the preferred criteria in this manual. Work that is judged minimally acceptable indicates that process improvements are required.

2.0 SCOPE (Document Hierarchy)

ADTRAN has adopted IPC-A-610 Class 2 as the primary workmanship standard for all electronic assemblies. The purpose of this ADTRAN specific workmanship standards manual is to clarify or modify the requirements that ADTRAN has deemed unique or more critical than that which is stated in IPC 610. Therefore, the requirements listed in the ADTRAN Q50 Workmanship Standard supersedes the like requirement described in IPC 610. For the purpose of judging adequacy of workmanship, the following documents will be used in the order below:

1. ADTRAN Engineering documentation (drawings, bills of materials, specifications, RWI's and Engineering Change Orders).
2. ADTRAN Q50 Workmanship Standards
3. IPC- A- 610 Acceptability of Electronic Assemblies
4. IPC- A- 610DC Telecom Addendum
5. IPC-7711/7721 Rework, Repair and Modifications of Electronic Assemblies
6. IPC/WHMA-A-620 Acceptability for Wire Harnesses and Cables

3.0 RESPONSIBILITY

Recommended additions, corrections and deletions should be forwarded to the Quality Assurance Department. The Quality Assurance Department will conduct periodic review of this document.

This document is provided as an aid for quality workmanship verification and is to be used by trained personnel. Dimensions given are not absolute, but provided as guidelines.

4.0 HARDWARE

4.1 *Torque Requirements*

Torque values specified in Table 4.1 represent the best balance between torque and tension unless otherwise stated on the Engineering drawing.

TABLE 4.1 BOLT TIGHTENING TORQUE SPECIFICATIONS

Thread Size	Aluminum Nominal (in-lb)	Low Carbon Steel Nominal (in-lb)	Stainless Steel Nominal (in-lb)	Nylon Nominal (in-lb)	Brass Nominal (in-lb)
2-56	1.5	1.7	2.0	0.1	1.3
4-40	3.1	3.6	4.3	0.3	2.8
6-32	5.8	6.6	8.1	0.5	5.1
8-32	10.7	12.1	14.8	0.9	9.3
10-24	15.4	17.6	21.4	1.3	13.5
10-32	17.6	20.1	24.4	1.5	15.5
¼-20	36.9	42.0	51.1	3.1	32.4
¼-28	42.2	48.1	58.5	3.6	37.0
5/16-18	76.0	86.5	105.3	6.4	66.7
5/16-24	84.1	95.8	116.5	7.1	73.8
3/8-16	134.9	153.6	186.8	11.4	118.3
3/8-24	152.9	174.0	211.6	12.9	134.0
7/16-14	215.9	245.8	298.9	18.3	189.3
7/16-20	241.1	274.5	333.8	20.4	211.4
½-13	329.4	375.0	456.1	27.9	288.8
½-20	371.2	422.6	513.9	31.4	325.5

Definition of Tight

Because of the many variables affecting tightening, tight is defined as meaning the fastener cannot be appreciably tightened further without damage to the threads or material.

Faceplate Fastening

All 4-40 self-tapping hardware used to fasten PCBs to faceplates shall be installed with a hex driver to a torque of up to 10 in-lb unless otherwise specified. 4-5 in-lb is recommended for plastic faceplates. 10 in-lb is recommended for metal faceplates. Phillips or slot drivers are prohibited to eliminate any potential burring during installation.

5.0 COSMETIC REQUIREMENTS

5.1 *Surface Classification*

Three classes of cosmetic grading will be used to identify the level of cosmetic characteristics of a part. These classes distinguish between the requirements for surfaces normally viewed by a product's end user and those of lesser importance that are seldom viewed.

Class A: External surface which is in plain view of the customer during normal use, (panel fronts, faceplates, chassis fronts, etc.).

Class B: External surface which is not in plain view of the customer during normal use, but may be visible to the customer during installation or maintenance, (chassis sides, top, or bottom, faceplate edges, etc.).

Class C: Surfaces seldom, if ever, seen by the customer, (inside of chassis, inside battery boxes, back of faceplates, back of chassis etc.).

5.2 *Inspection Criteria*

5.2.1 **Class A:**

Distance from Eye: 18 to 24 inches away using unaided eyes.

Viewing Time: 10 seconds maximum.

Type of Light: 85 minimum Foot Candles Cool White Florescent.

Viewing Angle: 45-90degrees. With part manipulation allowed.

5.2.2 **Class B:**

Distance from Eye: 24 to 36 inches away using unaided eyes.

Viewing Time: 5 maximum seconds.

Type of Light: 85 minimum Foot Candles Cool White Florescent.

Viewing Angle: 45-90 degrees. No part manipulation allowed.

Viewing must be done at a constant viewing angle.

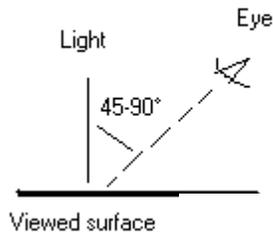
5.2.3 **Class C:**

Distance from Eye: 48 to 60 inches away using unaided eyes.

Viewing Time: 5 maximum seconds.

Type of Light: 85 Foot Candles Cool White Florescent.

**Viewing Angle: 90 degrees. No part manipulation allowed.
Viewing must be done at a constant viewing angle.**



5.3 Fabricated Metal

5.3.1 Class A :

Preferred:

No nicks, dents, scratches or any other surface blemish.

Acceptable (Minimum): Plating may have minimal discoloration.

Scratch - Qty 1 @ 0.015" Wide x 0.10" Long per 50 Square Inches (example: 5" x 10" area),

Scratch - Qty 2 @ 0.015" Wide x 0.10" Long or combination of up to 0.20" long per 100 Square Inches,

Scratch - Qty 3 @ 0.015" Wide x 0.10" Long or combination of up to 0.030" long per 300 Square Inches or greater

Unacceptable: Smears, runs, non-uniform glossiness and coverage, fingerprints, corrosion, scratches through the plating, excessive grease/oils, grit, dust or other foreign matter that may affect the decorative, adhesion and protective surface finish.

5.3.2 Class B:

Acceptable (Minimum):

Scratch - Qty 1 @ 0.015" Wide x 0.25" Long per 50 Square Inches.

Scratch - Qty 2 @ 0.015" Wide x 0.250" Long or combination of up to 0.50" per 100 Square Inches.

Scratch - Qty 3 @ 0.015" Wide x 0.25" Long or combination of up to 0.75" per 300 Square Inches or greater.

Runs or Smears 1x per 50 square inches and multiple increments thereof, i.e. 2x @100 sq. in, 3x @150 etc.

Minimal non-uniform glossiness, and discoloration.

Unacceptable: Fingerprints, corrosion, scratches through the plating, excessive grease/oils, grit, dust or other foreign matter that may affect the decorative, adhesion and protective surface finish.

5.3.3 Class C:

Acceptable (Minimum):

Scratch - Qty 3 @ 0.015" Wide x 0.50" Long or combination of up to 1.50" per 50 Square Inches.

Scratch - Qty 4 @ 0.015" Wide x 0.50" Long or combination of up to 2.00" per 100 Square Inches.

Scratch - Qty 5 @ 0.015" Wide x 0.50" Long or combination of up to 2.50" per 300 Square Inches or greater.

Minimal non-uniform glossiness, coverage, and discoloration.

Unacceptable: Scratches through plating, corrosion, excessive grease/oils, grit, dust or other foreign matter that may affect adhesion and protective surface finish.

5.4 Painted Fabricated Material/Parts

Note: ADTRAN Mechanical Engineering dept. approves paint color and gloss (see paint specifications). Texture will be measured using paint chips (min and max).

Note: All material/parts shall pass tape test using 3M Scotch Tape # C-4210 invisible tape.

5.4.1 Class A:

Preferred: No nicks, dents, scratches or any other surface blemish. Shall be wrinkle and bubble free.

Acceptable (Minimum):

No scratches allowed on areas less than 100 Square Inches.

Scratch - Qty 1 @ 0.015" Wide x 0.10" Long per area greater than 100 Square Inches.

Unacceptable: Smears, runs, non-uniform glossiness, texture and coverage, finger-prints, corrosion, orange peel, excessive grease/oils, wrinkles, grit, dust or other foreign matter that may affect the decorative, adhesion and protective surface finish.

5.4.2 Class B:

Preferred: Shall be wrinkle and bubble free.

Acceptable (Minimum):

Scratch - Qty 1 @ 0.015" Wide x 0.30" Long per 50 Square Inches.

Scratch - Qty 2 @ 0.015" Wide x 0.30" Long or combination of up to 0.60" per 100 Square Inches.

Scratch - Qty 3 @ 0.015" Wide x 0.30" Long or combination of up to 0.90" per 300 Square Inches and greater.

Unacceptable: Smears, runs, non-uniform glossiness, texture and coverage, finger-prints, corrosion, orange peel, excessive grease/oils, wrinkles, grit, dust or other foreign matter that may affect the decorative, adhesion and protective surface finish.

5.4.3 Class C:

Acceptable (Minimum):

Scratch - Qty 2 @ 0.015" Wide x 0.50" Long or combination of up to 1.00" per 100 Square Inches.

Scratch - Qty 4 @ 0.015" Wide x 0.50" Long or combination of up to 2.00 "per 100 Square Inches and greater.

Runs or Smears 1x per 50 square inches and multiple increments thereof, i.e. 2x @100 sq. in, 3x @150 etc.

Minimal non-uniform glossiness, coverage, and discoloration.

Unacceptable: Corrosion, excessive grease/oils, grit, dust or other foreign matter that may affect the adhesion and protective surface finish.

5.5 Silkscreen, Pad Print, and Labels

Characters on stamped, engraved, silkscreened, printed or typed labels, nameplates, faceplates, or any other customer-visible surfaces shall be legible in all cases.

5.5.1 APPEARANCE

Preferred

1. Characters are clean, legible, aligned, and evenly spaced.
2. Labels and decals are not torn, scratched, bent, or chipped.

Acceptable (minimum)

Lines of a number or letter may be broken (or the ink thin over a portion of the character) providing the character is legible and cannot be confused with another number or character.

Unacceptable

Characters are smeared, broken, or missing causing text to be illegible.

5.5.2 POSITIONING

Preferred

Customer-visible labels, decals, or nameplates orientated to read from left to right or bottom to top with reference to normal operating position of the equipment.

Acceptable (minimum)

1. Labels, decals, nameplates or stamps should be applied in a consistent location and orientation.
2. Customer-visible labels, decals, or nameplates shall be mounted squarely and shall not have a skew of more than 1/32 (0.020) inch per linear inch relative to the edge of the surface being applied.

Unacceptable

Skew greater than 1/32 (0.020) inch per linear inch relative to the edge of the surface being applied.

5.5.3 FASTENING

Preferred

Adhesive labels, nameplates or logos shall be flush with the mounting surface. Nameplates or logos mounted with hardware shall be properly secured to avoid the possibility of rattling or movement.

Unacceptable

Lifting (poor adhesion), Wrinkling, Turned-up edges, Voids (caused by contamination or trapped air between decal and the surface of panel or chassis, or my improper mounting), Skewed

5.6 Plastic Parts (both surface and entire part)

Note: First Articles may be used as go/no go examples.

Preferred:

No nicks, dents, scratches or any other surface blemish.

Acceptable (minimum):

Scratches: 1x @ 0.10" long max

Sinks: 0.003" max

Pits: 2 per total surface area

Discoloration: use limit sample

Gate Blush: use limit sample

Flow/Knit/Weld lines: 2 @ 0.25" each

Flash: 0.02"

Cracking: None

Warping: See part drawing

Short shot: None

Haze: None

Drag/pull marks: use limit sample

Texture Variation: None. see part drawing for texture type. Texture to be consistent and uniform coverage

Unacceptable:

Nicks, dents, scratches, or any other surface blemish that exceeds minimum acceptable requirements under appropriate viewing conditions.

5.7 Cosmetic Definitions

Bleed out: Substance that runs out of seams. Color can vary from dark brown to gray white.

Blister: Enclosed raised spot on a surface.

Burn Deposits: Rough discolored plating on edges or, in/on

Burr: Thin slivers of base material at the junction of a cut edge.

Chips or Voids: Areas of a surface that have been broken or chipped, or are missing coating.

Corrosion: Surface impurities or oxidation (Rust).

Drag/pull marks: Scratches or wiping mark from part dragging against mold when part is ejected from mold.

Discoloration: Unintended inconsistency or change in color from the approved standard color chip.

Fisheye: Cratering caused by organic contamination.

Flash: Thin protrusion of material at the parting line or junction of mold.

Flow mark: Visible mark resulting from solidification of two material flow fronts. Also known as Knit or weld lines.

Foreign Material: Dirt, lint, or other particles trapped in the finish.

Gate blush: Discolored area near mold gate.

Haze: Cloudiness on a transparent part.

Machine Marks: Visible lines caused during the punching and forming of sheet metal. Lines are straight and uniform.

Non adhesion: Plated, painted, pad print, silkscreen or label material is separating from base material.

Non uniform coverage: Area that has insufficient or excessive coating.

Orange Peel: Rippled appearance of material surface. Looks like orange peel in texture.

Oxidation: Rust.

Runs: Excessive coating forming drips or stains.

Pit: Small crater or void on surface.

Sink: Shallow depression on surface resulting from internal shrinkage during molding.

Short shot: Insufficient fill of material during molding.

Spot Welds: Indentations or rough areas from spot welding that exceeds the drawing or specification requirements.

Tape test: Apply a typical 3M Scotch Tape # C-4210 invisible tape over lettering or paint to be tested, and with normal pressure press the tape in place. Then tear off the tape in a continuous motion at a 90 degree angle to surface being tested. There shall be no evidence of ink or paint on tape.

Tool Marks: Creases or other indentations from tooling during the manufacturing process.

Void: Unfilled space where paint, plating or lettering should have been.

Warpage: Dimensional distortion of a part.

Water marks: Stains caused by excessive water not being blown off the part before drying sets in.

Weld Porosity: Pinholes in welds.