



ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES

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Test Plan For GenCAM Certification and Registration

WORKING DRAFT

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A standard developed by IPC

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IPC-2511-2 Test Plan For GenCAM Certification and Registration

1 Scope

This document defines a program which will be used to verify the implementation of the IPC GenCAM format, and to certify and register automation tools used in the design and fabrication of printed boards and printed board assemblies. The program applies to Computer Aided Design (CAD) platforms, and Computer Aided Manufacturing (CAM) tools.

Included in the program are checks for syntax and semantics through the use of a Compliance Test Module that verifies proper order and grammar of the output provided to the program from the tool or software intended to be registered.

The certification is not intended to demonstrate the automation tool's capability regarding the speed or completeness in which the tool and software system performs the intended function. The certification is intended to demonstrate that the output from the CAD or CAM tools are usable GenCAM data, structured in accordance with the latest released version of GenCAM identified in IPC-2511 Revision A, i.e. GenCAM 1.5.

A series of test GenCAM data, known as *golden boards*, have been developed for the program to be used to evaluate the capability of the tools to read and write GenCAM data. The golden board descriptions are used to certify the ability to interpret, maintain, and output GenCAM data. The evaluation of automation tool equipment performance capability is outside the scope of testing.

2 Compliance

There are several types of GenCAM compliance. Compliance may be either *Self-Declaration* or *Official Certification*.

Self-Declaration is the simplest form of certification. It allows the applicant to specify their tool capability with regard to a certification category. For a Self-Declaration to be compliant, the tool must support the read and/or write capabilities for each of the keyword statements required for each of the twenty GenCAM sections. Tools that only normally read are not required to demonstrate a write capability. Support of read/write capabilities is established by utilization or manipulation of the data within the tool.

There are two types of Self-Declaration. A fully compliant application supports all the keyword statements for a specific certification category. A partially compliant application supports a subset of the keyword statements for a specific certification category.

The verification of a Self-Declaration is accomplished by the IPC certification agency and determines the degree of compliance (tool support) for a particular certification category. This information, in addition to the Self-Declaration form, will be posted on the GenCAM.org web-site.

Applicants wishing to establish Self-Declaration must submit the GenCAM Certification form to indicate the degree of coverage by their tool. The GenCAM Certification form must be submitted online through the GenCAM website at <http://www.gencam.org/certification/application>.

For a tool to receive Official Certification it must meet the fully compliant Self-Declaration requirements, and be capable of processing of one or more of the golden boards through the desired certification categories.

The IPC Certification Agency will determine compliance of the delivered golden-board that is returned from the applicant. Each of these techniques involve the use of the Compliance Test Module (CTM) and/or a golden board provided by the IPC. The CTM will be used to check syntax, semantics and completeness and to determine that all instructions have been accomplished. The certification of the tools related to the golden boards will be posted on the GenCAM web-site. (see Section 10)

The tool provider may have several listings of their capability on the section of the GenCAM web-site. These include:

- Self-Declaration – Partial Compliance
 - Type <*
 - reads GenCAM input for specific certification categories not verified
 - Type <**
 - reads GenCAM input for specific certification categories verified by the IPC certification agency
 - Type *>
 - writes GenCAM output for specific certification categories not verified
 - Type **>
 - writes GenCAM output for specific certification categories verified by the Conformance Test Module (CTM)
- Self-Declaration – Full Compliance
 - Type <***
 - Reads an IPC test file of GenCAM input for specific certification categories verified by the IPC certification agency
 - Type ***>
 - writes GenCAM output for specific certification categories verified by the Conformance Test Module (CTM)
- Official Certification
 - Type <****
 - reads GenCAM input for specific certification categories verified by the IPC certification agency related to specific golden-board(s)
 - Type ****>
 - writes GenCAM output for specific certification categories verified by the IPC certification agency
 - Type <****>
 - reads GenCAM input for specific function(s)
writes GenCAM output for specific certification categories verified by the IPC certification agency related to specific golden-board(s)

The following steps are recommended for achieving any of the certifications listed:

- Review the test plan instructions to determine certification requirements.
- Using the GenCAM Certification form, declare the certification category and compliance level(s) being sought.
- Complete the generated GenCAM Keyword Requirement forms.
- Submit the form to IPC Certification Agency.
- The IPC Certification Agency will evaluate the supplier request and prepare the following:
 - For partial Self-Declaration, the IPC Certification Agency will prepare a read/write file in accordance with the applicant's Self-Declaration statement. Prepare schedule for verification if requested.
 - For fully compliant Self-Declaration, the IPC Certification Agency will prepare a read/write file in accordance with the applicant's Self-Declaration statement. Prepare schedule for verification if requested.

- For Official Certification, the IPC Certification Agency will prepare a read/write file in accordance with the applicant's fully compliant Self-Declaration statement. Prepare schedule for verification if requested. Execute the following:
 - a) Select appropriate instructions based on task assessment
 - b) CAD Design Tool = Net list, component list, board size, layer types
 - Output = Good design file
 - c) CAM for FAB = Read in appropriate single image GenCAM file
 - Output = Good board fabrication and sub-panel file
 - d) CAM for Assembly = Read in appropriate single image GenCAM file
 - Output = Good board assembly and sub-panel file description
 - e) CAM for Board Test = Read in appropriate single image GenCAM file
 - Output = Good probe point position and sub-panel test node file, fixture
 - f) CAM for InCircuit Test = Read in appropriate single image GenCAM file
 - Output = Good probe point position and sub-panel test node file, fixture
 - g) Tool to convert Legacy data = Initial input from representative legacy file
 - Output = Good and complete design description file

3 Golden Board Descriptions

The input to the certification process consists of partially populated GenCAM files. This data is supplemented by a set of instructions intended to have the applicant reach the highest level of certification based on the automation tools' "Self Declaration" statements. As an example if the automation tool is a CAD station the GenCAM input file would describe the net list, the component description and reference designators, the board outline and layer count, as well as the material and thickness properties. The input would essentially be the same as what an engineer might provide to a designer before positioning any components or routing any conductors.

The instructions that accompany the CAD file input would require that the CAD system with an experienced operator convert the GenCAM engineering input into a completed design and provide a GenCAM design output file ready to be sent to a fabricator for panelization. If the CAD tool supports sub-panels, an additional requirement might be to populate the PANELS section of the GenCAM file.

Each automation tool will receive an input that matches the tools' capability. The initial package provided to each applicant will contain instructions on how to select the best project to show off the tools' capability, and make the most impressive characterisation of the certification data posted on <gencam.org>, the home page on the World Wide Web.

The Golden Board general descriptions are:

1. Single sided board, all through hole components, no SMT.
2. 20 Dips, 6 RC07 resistors, 12 Tantalum Capacitors, 4 diodes, 1 choke, 1 two-piece connector. Board has solder mask on solder side and legend on both sides
3. Double sided board, mixed components SMT and through hole all on one side.
4. Four layer Multilayer Board mixed components one side

5. Four Layer Multilayer board, blind and buried vias SMT components both sides
6. Four Layer Multilayer with embedded passive and mixed components both sides
7. Three four layer boards on a sub-panel, each with its own description interconnected by flat cable.
8. High density type II (HDI) board (2[C]2) all SMT, where [C] is four layers

Each of the Golden Board descriptions includes several tasks depending on whether the automation tool does design, board fabrication, bare board test, assembly, in-circuit test, or photo plotting/drawing. As such the requirements for the GenCAM output file will be very different for each application. The judgement on successful completion of the certification process will be based on the fully described requirements as detailed in the application package.

4 Fee Structure for Certification

A nominal fee will be charged for all certification services. For Self-Declaration the fee for administration and posting is \$100. Updating of the web-site will incur a fee of \$50 for each time the Tool Suppliers information is changed. Verification of Self-Declaration fee shall be dependent on the effort required for off-site or on-site verification.

The fee for Official Certification is commensurate with the services provided. Assembling a golden board package incurs a nominal fee for the instructions and mailing. Providing certification review to establish compliance is dependent on the number of certification categories, and the number of golden boards for which the applicant wishes to be certified. Completing the request for certification will start the process. Upon receipt of the desired effort IPC will develop a quote to show where cost to certify are applied and where they can be reduced by bundling the efforts.

All quotes have a time limit during which time the effort must be completed. The start time is indicated on the quote and provides a liberal time in which to prepare. Applicants should not request certification services until they are ready to begin the testing process. The purpose of the time limits is to ensure availability of personnel to provide feedback to the applicant.

5 Updating Certification Status

Once the Tool Supplier has been listed on the GenCAM home page, minor changes can be made with out charge. New requirements are charged a fee commensurate with the effort required as indicated in Section 3 of the test plan.

6 Arbitration and re-calibration of GenCAM performance

Applicants may apply for re-evaluation of their status at any time. The Compliance Test Module will be used as the metric to establish GenCAM compliance. Any arbitration shall be in accordance with the IPC Appeals review procedure, IPC-AP-81 (See Appendix C).

7 System Diversity

To accommodate the diverse set of systems (CAD, CAM, Conversion, Plug and Play, etc.), more than one type of certification is defined. Systems will only be evaluated for their ability to use GenCAM data in performing the functions for which the system was intended.

Companies that wish to be certified (see Appendix A) will be asked, at the time of their request, to provide information regarding the capabilities of their tool. Using the "Self-Declaration" process, the applicant must submit a form indicating the list of GenCAM parameters their tool supports.

There are twenty sections in a GenCAM file. Section 9 of this document contains a table corresponding to each certification category. The table identifies the keyword statements required for each category. In order to be certified as *fully* compliant with the standard, the tool must be able to read and/or write all keyword statements identified in the table. Compliance is confirmed using the Compliance Test Module (CTM) provided by the National Institute of Standards and Technologies. Partial compliance can be achieved through the Self-Declaration method if some keyword statements or some keyword statement parameters are not supported.

Table 1 provides an example subset of the information provided by the applicant during the "Self Declaration" process. The information in the table provides identification of the automation tool's present capability. Applicants will be provided with a form that contains all of the keyword statements and parameters of a fully compliant GenCAM file. Since each tool provider has a different focus the certification validation will be measured against the "Self Declaration" information provided by the applicant.

An indication in the table that the tool supports the keyword statement (o) is evidence that all parameters of that keyword statement are available. The letter (x) signifies non-compliance. Variations in full compliance are noted in the "Remarks" column.

Table 1 Example of Self Declaration Automation Tool Assessment

Sections and Parameters	Tool Supports	Remarks
\$PRIMITIVES	O	
CIRCLE:	O	
RECTCENTER:	O	
RECTCORNER:	O	
RECTCHAM:	O	
RECTROUND:	O	
OVAL:	O	
DSHAPE:	X	
DIAMOND:	X	
HEXAGON:	X	
OCTAGON:	O	
THERMAL:	O	Round thermals 4spokes
POLYLINE:	O	
POLYGON:	O	
LINEDESC:	O	
PAINTDESC:	O	

BARRELDISC: BARREL:<barrel_type>,<material>, <min_thickness>,<max_thickness>;	O O, O, O, O;	
\$BOARDS	O	
OUTLINE	O	
THICKNESS:	O	
CUTOUT:	O	
WELL:<well_name>, <nominal_angle>, <surface>, <cutmode>, <rem_value>, [<barreldesc_ref>], [<profiledesc_ref>;	O, O, O, O, X, X, X;	
SLOT:	O	
GROOVE:	X	
HOLE: <hole_name>, <hole_type>, <primitive_ref>, <barreldesc_ref>, [<profiledesc_ref>], [<layer_ref>], <xform>;	O, O, O, O, X, X, O;	

8 Registration and Certification Status Reporting

All companies who have successfully completed the Official Certification process will be permitted to display the GenCAM compliant logo. This does not apply to Self-Declaration processes. The processes for handling the golden boards are tailored to each tools' maximum capability as described by the applicant in the Self-Declaration statements. Each golden board requires that a different capability exists, thus it would be improper to evaluate the capabilities of a tools based on features that the tool itself does not profess to support. For example, a moderately priced tool may not support blind or buried vias and high density interconnect (HDI) products.

Status of Certification success therefore will be based on the accomplishments of executing one or more of the eight golden board projects. Outputting a GenCAM file that contains the characteristics is necessary to fully describe the product within the capability of the Self-Declaration statements. A summary of the Self-Declaration statements for each golden board completeness will be identified through the amount of parameters that were correctly defined in each of the GenCAM sections.

9 Certification Potential

There are twenty-two different certification categories. The categories are identified in the sectional standards of the GenCAM series, specifically IPC-2512 through IPC-2518. The different potentials are related to tool capabilities and the purpose that they serve within the industry. There is no limit as to the number of functions that a tool can perform. However, in order to be certified the capabilities of a tool must demonstrate compliance to the specified certification category related to the GenCAM structure.

The twenty-two certification categories are:

- | | |
|-------------------------------------|--|
| a) Board Assembly | l) Panel Fabrication |
| b) Panel Assembly | m) Bare Board Test Fixture Generation |
| c) Assembly Preparation | n) Bare Board Test Program Generation |
| d) Glue Dot | o) Fabrication Drawings |
| e) Solder Stencil | p) Assembly Drawings |
| f) Mechanical Hardware | q) Schematic/Logic Drawings |
| g) Assembly Fixtures | r) Detail Drawings |
| h) Assembly Test Program Generation | s) Specification/Source Control Drawings |
| i) Assembly Test Fixture Generation | t) Parts List Drawings |
| j) Phototools | u) Parts List |
| k) Board Fabrication | |

Appendix B shows the requirements for each of the GenCAM sections as to which keyword statements are required in the within a section related to a specific certification category. The data shown in Appendix B has been reorganised according to each of the twenty-two categories in the following paragraphs.

9.1 Board Assembly (a)

The Board Assembly certification category defines information requirements for the manufacture of a printed board assembly. The requirements are for both manual and automated assembly. The board assembly information only contains assembly information. Information required for manufacturing the bare board is not required.

The parameter requirements shown in Table 3 are necessary to be compliant with the GenCAM standard and this Board Assembly certification category:

Table 3 Board Assembly (a)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	FIXTURE (0 to n)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	TRANSACTION (1 to 1)	BARRELDISC (0 to n)
HISTORY (1 to 1)	PERSON (1 to n)	BARREL (0 to n)
LANGUAGE (0 to 1)	SENT (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	OWNER (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	RECEIVED (1 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	ACCEPT (0 to 1)	RECTCORNERDEF (0 to n)
FIXTURE (0 to n)	BILLTO (0 to 1)	POLYGONDEF (0 to n)
	SCHEDULE (0 to n)	STARTAT (1 to 1)
	COMMENT (0 to n)	LINETO (1 to n)
	ENTERPRISE (0 to n)	CIRCARC (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to 1)
		ENDCIRCARC (1 to 1)
		ENDELLIPARC (1 to 1)
ARTWORKS	LAYERS	PADSTACKS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	LAYERSINGLE (1 to n)	HOLEDEF (0 to n)
TARGETDEF (0 to n)	LAYERSET (1 to n)	PADDEF (0 to n)
FONT (0 to n)	LAYER (1 to n)	PADSTACK (1 to n)
UFONT (0 to n)	LAYERSWAP (0 to n)	PAD (0 to n)
GLYPH (1 to n)		PADREF (0 to n)
LOGODEF (0 to n)		ARTWORKREF (0 to n)
TEXT (1 to n)		HOLEREF (0 to n)
ARTWORKDEF (0 to n)		
TEXT (1 to n)		

LOGOREF (1 to n)		
ARTWORKREF (1 to n)		
TARGET (0 to n)		
PATTERNS	PACKAGES	DEVICES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
PATTERNDEF (0 to n)	PACKAGE (1 to n)	DEVICE (1 to n)
PADSTACKREF (0 to n)	BODY (0 to n)	PART (0 to 1)
TARGETREF (0 to n)	TARGETREF (0 to 1)	ALIAS (0 to n)
FEATUREREF (0 to n)	PIN (1 to n)	ALTERNATE (0 to n)
ARTWORKREF (0 to n)	PINONE (0 to 1)	PINDESC (0 to n)
ARTWORK (0 to n)		VALUE (0 to n)
MECHANICALS	COMPONENTS	BOARDS
GROUP (0 to n)	GROUP (0 to n)	BOARD (1 to n)
MECHANICAL (1 to n)	COMPONENT (1 to n)	USING (1 to n)
PART (0 to 1)	DEVICEREF (0 to 1)	OUTLINE (1 to n)
ALIAS (0 to n)	MECHANICALREF (0 - 1)	THICKNESS (0 to 1)
ALTERNATE (0 to n)	PATTERNREF (0 to 1)	HOLE (0 to n)
ARTWORKREF (0 to n)	ARTWORKREF (0 to n)	HOLEREF (0 to n)
ARTWORK (0 to n)	ARTWORK (0 to n)	CUTOUT (0 to n)
HOLEREF (0 to n)	TEXT (0 to n)	WELL (0 to n)
	PROGRAM (0 to 1)	SLOT (0 to n)
	PREPARATION (0 to n)	KEEPOUT (0 to n)
	PRESENTATION (0 to 1)	GROOVE (0 to n)
	KEEPOUT (0 to n)	CONSISTENCY (1 to 1)
		TARGETREF (0 to n)
		LOGOREF (0 to n)
		TEXT (0 to n)
		IMAGE (0 to n)
		ASSEMBLY (1 to n)
		USING (1 to n)
FIXTURES	DRAWINGS	CHANGES
FIXTURE (1 to n)	DRAWING (1 to n)	RENAME (1 to n)
USING (1 to n)	SHEET (1 to n)	DELETE (1 to n)
OUTLINE (1 to n)	FRAME (1 to 1)	ADD (1 to n)
THICKNESS (0 to 1)	INSERTLAYER (0 to n)	RENAMEPRODUCT (1 to n)
HOLEREF (0 to n)	ANNOTATION (0 to n)	DELETEPRODUCT (1 to n)
CUTOUT (0 to n)	ARTWORKREF (0 to n)	ADDPRODUCT (1 to n)
WELL (0 to n)	LOGOREF (0 to n)	
SLOT (0 to n)	TEXT (0 to n)	
KEEPOUT (0 to n)	DWGREF (1 to 1)	
PLACEMENT (1 to n)		
Global Requirements		
ATTRIBUTE (1 to 1)		
MODIFIED (1 to 1)		
AUDIT (1 to 1)		

9.2 Assembly Panel (b)

The Assembly Panel certification category defines information requirements for the manufacture of a printed board panel assembly. The requirements are for both manual and automated assembly. The assembly information does include the information required to manufacture a panel or board.

The parameter requirements shown in Table 4 are necessary for someone to be compliant with the GenCAM standard and the Assembly Panel certification category:

Table 4 Assembly Panel (b)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	TRANSACTION (1 to 1)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	PERSON (1 to n)	BARRELDISC (0 to n)
HISTORY (1 to 1)	SENT (1 to 1)	BARREL (0 to n)
LANGUAGE (0 to 1)	OWNER (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	RECEIVED (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	ACCEPT (0 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	BILLTO (0 to 1)	RECTCORNERDEF (0 to n)
	SCHEDULE (0 to n)	RECTCHAMDEF (0 to n)
	COMMENT (0 to n)	RECTROUNDDEF (0 to n)
		OVALDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		POLYLINEDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to 1)
		ENDCIRCARC (1 to 1)
		ENDELLIPARC (1 to 1)
ARTWORKS	LAYERS	PADSTACKS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	LAYERSINGLE (1 to n)	HOLEDEF (0 to n)
TARGETDEF (0 to n)	LAYERSET (1 to n)	PADDEF (0 to n)
FONT (0 to n)	LAYER (1 to n)	PADSTACK (1 to n)
UFONT (0 to n)	LAYERSWAP (0 to n)	PAD (0 to n)
GLYPH (1 to n)		PADREF (0 to n)
LOGODEF (0 to n)		ARTWORKREF (0 to n)
TEXT (1 to n)		HOLEREF (0 to n)
ARTWORKDEF (0 to n)		
TEXT (1 to n)		
LOGOREF (1 to n)		
ARTWORKKREF (1 to n)		
TARGET (0 to n)		
PATTERNS	PACKAGES	DEVICES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
PATTERNDEF (0 to n)	PACKAGE (1 to n)	DEVICE (1 to n)
PADSTACKREF (0 to n)	BODY (0 to n)	PART (0 to 1)
TARGETREF (0 to n)	TARGETREF (0 to 1)	ALIAS (0 to n)
FEATUREREF (0 to n)	PIN (1 to n)	ALTERNATE (0 to n)
ARTWORKKREF (0 to n)	PINONE (0 to 1)	PINDESC (0 to n)
ARTWORK (0 to n)		VALUE (0 to n)
MECHANICALS	COMPONENTS	BOARDS
GROUP (0 to n)	GROUP (0 to n)	BOARD (1 to n)
MECHANICAL (1 to n)	COMPONENT (1 to n)	USING (1 to n)
PART (0 to 1)	DEVICEREF (0 to 1)	OUTLINE (1 to n)
ALIAS (0 to n)	MECHANICALREF (0 - n)	THICKNESS (0 to 1)
ALTERNATE (0 to n)	PATTERNREF (0 to 1)	HOLEREF (0 to n)
ARTWORKKREF (0 to n)	ARTWORKREF (0 to n)	CUTOUT (0 to n)
ARTWORK (0 to n)	ARTWORK (0 to n)	WELL (0 to n)
HOLEREF (0 to n)	TEXT (0 to n)	SLOT (0 to n)
	PROGRAM (0 to 1)	KEEPOUT (0 to n)
	PREPARATION (0 to n)	GROOVE (0 to n)
	PRESENTATION (0 to 1)	TARGETREF (0 to n)

	KEEPOUT (0 to n)	LOGOREF (0 to n)
		TEXT (0 to n)
		IMAGE (0 to n)
		ASSEMBLY (1 to n)
		USING (1 to n)
PANELS	FIXTURES	DRAWINGS
PANEL (1 to n)	FIXTURE (1 to n)	DRAWING (1 to n)
USING (1 to n)	USING (1 to n)	SHEET (1 to n)
OUTLINE (1 to n)	OUTLINE (1 to n)	FRAME (1 to 1)
THICKNESS (0 to 1)	THICKNESS (0 to 1)	INSERTLAYER (0 to n)
HOLEREF (0 to n)	HOLEREF (0 to n)	ANNOTATION (0 to n)
CUTOOUT (0 to n)	KEEPOUT (0 to n)	ARTWORKREF (0 to n)
WELL (0 to n)	PLACEMENT (1 to n)	LOGOREF (0 to n)
SLOT (0 to n)		TEXT (0 to n)
KEEPOUT (0 to n)		DWGREF (1 to 1)
GROOVE (0 to n)		
PLACEMENT (1 to n)		
TARGETREF (0 to n)		
LOGOREF (0 to n)		
TEXT (0 to n)		
IMAGE (0 to n)		
CHANGES	Global Requirements	
RENAME (1 to n)	ATTRIBUTE (1 to 1)	
DELETE (1 to n)	MODIFIED (1 to 1)	
ADD (1 to n)	AUDIT (1 to 1)	
RENAMEPRODUCT (1 to n)		
DELETEPRODUCT (1 to n)		
ADDPRODUCT (1 to n)		

9.3 Assembly Preparation (c)

The Assembly Preparation certification category defines the information requirements to support the preparation of devices or mechanicals for placement on a board.

The parameter requirements shown in Table 5 are necessary for someone to be completely compliant with the GenCAM standard and the Assembly Preparation certification category:

Table 5 Assembly Preparation (c)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	TRANSACTION (1 to 1)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	PERSON (1 to n)	BARRELDISC (0 to n)
HISTORY (1 to 1)	SENT (1 to 1)	BARREL (0 to n)
LANGUAGE (0 to 1)	OWNER (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	RECEIVED (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	ACCEPT (0 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	BILLTO (0 to 1)	RECTCORNERDEF (0 to n)
	SCHEDULE (0 to n)	POLYLINEDEF (0 to n)
	COMMENT (0 to n)	STARTAT (1 to 1)
	ENTERPRISE (0 to n)	LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to 1)
		ENDCIRCARC (1 to 1)
		ENDELLIPARC (1 to 1)

ARTWORKS	PACKAGES	DEVICES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	PACKAGE (1 to n)	DEVICE (1 to n)
TARGETDEF (0 to n)	BODY (0 to n)	PART (0 to 1)
FONT (0 to n)	TARGETREF (0 to 1)	ALIAS (0 to n)
UFONT (0 to n)	PIN (1 to n)	ALTERNATE (0 to n)
GLYPH (1 to n)	PINONE (0 to 1)	PINDESC (0 to n)
LOGODEF (0 to n)		
TEXT (1 to n)		
ARTWORKDEF (0 to n)		
TEXT (1 to n)		
LOGOREF (1 to n)		
ARTWORKREF (1 to n)		
TARGET (0 to n)		
MECHANICALS	COMPONENTS	CHANGES
GROUP (0 to n)	GROUP (0 to n)	RENAME (1 to n)
MECHANICAL (1 to n)	COMPONENT (1 to n)	DELETE (1 to n)
PART (0 to 1)	DEVICEREF (0 to 1)	ADD (1 to n)
ALIAS (0 to n)	PROGRAM (0 to 1)	RENAMEPRODUCT (1 to n)
ALTERNATE (0 to n)	PREPARATION (0 to n)	DELETEPRODUCT (1 to n)
ARTWORKREF (0 to n)	PRESENTATION (0 to 1)	ADDPRODUCT (1 to n)
ARTWORK (0 to n)		
HOLEREF (0 to n)		
Global Requirements		
ATTRIBUTE (1 to 1)		
MODIFIED (1 to 1)		
AUDIT (1 to 1)		

9.4 Glue Dot (d)

The Glue Dot certification category defines minimum information requirements to support depositing glue dots on a board or a panel.

The parameter requirements shown in Table 6 are necessary for someone to be completely compliant with the GenCAM standard and the Glue Dot certification category:

Table 6 Glue Dot (d)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	TRANSACTION (1 to 1)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	PERSON (1 to n)	BARRELDISC (0 to n)
HISTORY (1 to 1)	SENT (1 to 1)	BARREL (0 to n)
LANGUAGE (0 to 1)	OWNER (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	RECEIVED (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	ACCEPT (0 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	BILLTO (0 to 1)	RECTCORNERDEF (0 to n)
FIXTURE (0 to n)	SCHEDULE (0 to n)	POLYLINEDEF (0 to n)
	COMMENT (0 to n)	STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to 1)
		ENDCIRCARC (1 to 1)
		ENDELLIPARC (1 to 1)

ARTWORKS	LAYERS	PACKAGES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	LAYERSINGLE (1 to n)	PACKAGE (1 to n)
	LAYERSET (1 to n)	BODY (0 to n)
	LAYER (1 to n)	TARGETREF (0 to 1)
	LAYERSWAP (0 to n)	PIN (1 to n)
		PINONE (0 to 1)
DEVICES	COMPONENTS	BOARDS
GROUP (0 to n)	GROUP (0 to n)	BOARD (1 to n)
DEVICE (1 to n)	COMPONENT (1 to n)	USING (1 to n)
PART (0 to 1)	PATTERNREF (0 to 1)	OUTLINE (1 to n)
ALIAS (0 to n)		THICKNESS (0 to 1)
ALTERNATE (0 to n)		WELL (0 to n)
PINDESC (0 to n)		KEEPOUT (0 to n)
		TARGETREF (0 to n)
		ASSEMBLY (1 to n)
		USING (1 to n)
PANELS	FIXTURES	CHANGES
PANEL (1 to n)	FIXTURE (1 to n)	RENAME (1 to n)
USING (1 to n)	USING (1 to n)	DELETE (1 to n)
OUTLINE (1 to n)	OUTLINE (1 to n)	ADD (1 to n)
THICKNESS (0 to 1)	THICKNESS (0 to 1)	RENAMEPRODUCT (1 to n)
WELL (0 to n)	HOLEREF (0 to n)	DELETEPRODUCT (1 to n)
KEEPOUT (0 to n)	KEEPOUT (0 to n)	ADDPRODUCT (1 to n)
PLACEMENT (1 to n)	PLACEMENT (1 to n)	
TARGETREF (0 to n)		
Global Requirements		
ATTRIBUTE (1 to 1)		
MODIFIED (1 to 1)		
AUDIT (1 to 1)		

9.5 Solder Stencil (e)

The Solder Stencil certification category defines minimum information requirements to support depositing solder paste on a board or a panel.

The parameter requirements shown in Table 7 are necessary for someone to be completely compliant with the GenCAM standard and the Solder Stencil certification category:

Table 7 Solder Stencil (e)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	FIXTURE (0 to n)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	TRANSACTION (1 to 1)	BARRELDDESC (0 to n)
HISTORY (1 to 1)	PERSON (1 to n)	BARREL (0 to n)
LANGUAGE (0 to 1)	SENT (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	OWNER (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	RECEIVED (1 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	ACCEPT (0 to 1)	RECTCORNERDEF (0 to n)
FIXTURE (0 to n)	BILLTO (0 to 1)	RECTCHAMDEF (0 to n)
	SCHEDULE (0 to n)	RECTROUNDDEF (0 to n)
	COMMENT (0 to n)	OVALDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		POLYLINEDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)

		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to 1)
		ENDCIRCARC (1 to 1)
		ENDELLIPARC (1 to 1)
ARTWORKS	LAYERS	PADSTACKS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	LAYERSINGLE (1 to n)	HOLEDEF (0 to n)
TARGETDEF (0 to n)	LAYERSET (1 to n)	PADDEF (0 to n)
FONT (0 to n)	LAYER (1 to n)	PADSTACK (1 to n)
UFONT (0 to n)	LAYERSWAP (0 to n)	PAD (0 to n)
GLYPH (1 to n)		PADREF (0 to n)
LOGODEF (0 to n)		HOLEREF (0 to n)
TEXT (1 to n)		
ARTWORKDEF (0 to n)		
TEXT (1 to n)		
LOGOREF (1 to n)		
ARTWORKREF (1 to n)		
TARGET (0 to n)		
PATTERNS	PACKAGES	DEVICES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
PATTERNDEF (0 to n)	PACKAGE (1 to n)	DEVICE (1 to n)
PADSTACKREF (0 to n)	BODY (0 to n)	PART (0 to 1)
TARGETREF (0 to n)	TARGETREF (0 to 1)	ALIAS (0 to n)
FEATUREREF (0 to n)	PIN (1 to n)	ALTERNATE (0 to n)
ARTWORKREF (0 to n)	PINONE (0 to 1)	PINDESC (0 to n)
ARTWORK (0 to n)		
COMPONENTS	BOARDS	PANELS
GROUP (0 to n)	BOARD (1 to n)	PANEL (1 to n)
COMPONENT (1 to n)	USING (1 to n)	USING (1 to n)
PATTERNREF (0 to 1)	OUTLINE (1 to n)	OUTLINE (1 to n)
	THICKNESS (0 to 1)	THICKNESS (0 to 1)
	HOLEREF (0 to n)	HOLEREF (0 to n)
	KEEPOUT (0 to n)	KEEPOUT (0 to n)
	TARGETREF (0 to n)	PLACEMENT (1 to n)
	IMAGE (0 to n)	TARGETREF (0 to n)
	ASSEMBLY (1 to n)	IMAGE (0 to n)
	USING (1 to n)	
FIXTURES	DRAWINGS	CHANGES
FIXTURE (1 to n)	DRAWING (1 to n)	RENAME (1 to n)
USING (1 to n)	SHEET (1 to n)	DELETE (1 to n)
OUTLINE (1 to n)	FRAME (1 to 1)	ADD (1 to n)
THICKNESS (0 to 1)	INSERTLAYER (0 to n)	RENAMEPRODUCT (1 to n)
HOLE (0 to n)	ANNOTATION (0 to n)	DELETEPRODUCT (1 to n)
HOLEREF (0 to n)	ARTWORKREF (0 to n)	ADDPRODUCT (1 to n)
KEEPOUT (0 to n)	LOGOREF (0 to n)	
PLACEMENT (1 to n)	TEXT (0 to n)	
	DWGREF (1 to 1)	
Global Requirements		
ATTRIBUTE (1 to 1)		
MODIFIED (1 to 1)		
AUDIT (1 to 1)		

9.6 Mechanical Hardware (f)

The Mechanical Hardware certification category defines minimum information requirements to support the placement of non-electrical components on a board or a panel.

The parameter requirements shown in Table 8 are necessary for someone to be completely compliant with the GenCAM standard and the Mechanical Hardware certification category:

Table 8 Mechanical Hardware (f)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	FIXTURE (0 to n)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	TRANSACTION (1 to 1)	BARRELDDESC (0 to n)
HISTORY (1 to 1)	PERSON (1 to n)	BARREL (0 to n)
LANGUAGE (0 to 1)	SENT (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	OWNER (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	RECEIVED (1 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	COMMENT (0 to n)	RECTCORNERDEF (0 to n)
FIXTURE (0 to n)	ENTERPRISE (0 to n)	RECTCHAMDEF (0 to n)
		RECTROUNDEF (0 to n)
		OVALDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to 1)
		ENDCIRCARC (1 to 1)
		ENDELLIPARC (1 to 1)
ARTWORKS	LAYERS	MECHANICALS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
ARTWORKDEF (0 to n)	LAYERSINGLE (1 to n)	MECHANICAL (1 to n)
ARTWORKREF (1 to n)	LAYERSET (1 to n)	PART (0 to 1)
	LAYER (1 to n)	ALIAS (0 to n)
		ALTERNATE (0 to n)
		ARTWORKREF (0 to n)
		ARTWORK (0 to n)
		HOLEREF (0 to n)
COMPONENTS	DRAWINGS	CHANGES
GROUP (0 to n)	DRAWING (1 to n)	RENAME (1 to n)
COMPONENT (1 to n)	SHEET (1 to n)	DELETE (1 to n)
PATTERNREF (0 to 1)	FRAME (1 to 1)	ADD (1 to n)
	INSERTLAYER (0 to n)	RENAMEPRODUCT (1 to n)
	ANNOTATION (0 to n)	DELETEPRODUCT (1 to n)
	ARTWORKREF (0 to n)	ADDPRODUCT (1 to n)
	LOGOREF (0 to n)	
	TEXT (0 to n)	
	DWGREF (1 to 1)	
Global Requirements		
ATTRIBUTE (1 to 1)		
MODIFIED (1 to 1)		
AUDIT (1 to 1)		

9.7 Assembly Fixtures (g)

The Assembly Fixtures certification category defines minimum information requirements to support the construction of assembly fixtures. Examples includes fixtures used to hold boards during conveyor transport, used to act as barriers to prevent reflow of/ or soldering of components, and used to mask assembly areas during conformal coating.

The parameter requirements shown in Table 9 are necessary for someone to be completely compliant with the GenCAM standard and the Assembly Fixtures certification category:

Table 9 Assembly Fixtures (g)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	FIXTURE (0 to n)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	TRANSACTION (1 to 1)	BARRELDISC (0 to n)
HISTORY (1 to 1)	PERSON (1 to n)	BARREL (0 to n)
LANGUAGE (0 to 1)	SENT (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	OWNER (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	RECEIVED (1 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	ACCEPT (0 to 1)	RECTCORNERDEF (0 to n)
FIXTURE (0 to n)	BILLTO (0 to 1)	RECTCHAMDEF (0 to n)
	SCHEDULE (0 to n)	RECTROUNDEF (0 to n)
	COMMENT (0 to n)	OVALDEF (0 to n)
	ENTERPRISE (0 to n)	DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		POLYLINEDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to 1)
		ENDCIRCARC (1 to 1)
		ENDELLIPARC (1 to 1)
ARTWORKS	LAYERS	PACKAGES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
TARGETDEF (0 to n)	LAYERSINGLE (1 to n)	PACKAGE (1 to n)
ARTWORKDEF (0 to n)	LAYERSET (1 to n)	BODY (0 to n)
ARTWORKKREF (1 to n)	LAYER (1 to n)	TARGETREF (0 to 1)
TARGET (0 to n)	LAYERSWAP (0 to n)	PIN (1 to n)
		PINONE (0 to 1)
DEVICES	COMPONENTS	BOARDS
GROUP (0 to n)	GROUP (0 to n)	BOARD (1 to n)
DEVICE (1 to n)	COMPONENT (1 to n)	USING (1 to n)
PART (0 to 1)	DEVICEREF (0 to 1)	OUTLINE (1 to n)
ALIAS (0 to n)	MECHANICALREF (0 - n)	THICKNESS (0 to 1)
ALTERNATE (0 to n)	KEEPOUT (0 to n)	HOLEREF (0 to n)
PINDESC (0 to n)		CUTOUT (0 to n)
VALUE (0 to n)		WELL (0 to n)
		SLOT (0 to n)
		KEEPOUT (0 to n)
		TARGETREF (0 to n)
		ASSEMBLY (1 to n)
		USING (1 to n)
PANELS	FIXTURES	DRAWINGS
PANEL (1 to n)	FIXTURE (1 to n)	DRAWING (1 to n)
USING (1 to n)	USING (1 to n)	SHEET (1 to n)
OUTLINE (1 to n)	OUTLINE (1 to n)	FRAME (1 to 1)
THICKNESS (0 to 1)	THICKNESS (0 to 1)	INSERTLAYER (0 to n)
HOLEREF (0 to n)	HOLE (0 to n)	ANNOTATION (0 to n)
CUTOUT (0 to n)	HOLEREF (0 to n)	ARTWORKKREF (0 to n)
WELL (0 to n)	CUTOUT (0 to n)	LOGOREF (0 to n)

SLOT (0 to n)	WELL (0 to n)	TEXT (0 to n)
KEEPOUT (0 to n)	SLOT (0 to n)	DWGREF (1 to 1)
PLACEMENT (1 to n)	KEEPOUT (0 to n)	
TARGETREF (0 to n)	PLACEMENT (1 to n)	
CHANGES	Global Requirements	
RENAME (1 to n)	ATTRIBUTE (1 to 1)	
DELETE (1 to n)	MODIFIED (1 to 1)	
ADD (1 to n)	AUDIT (1 to 1)	
RENAMEPRODUCT (1 to n)		
DELETEPRODUCT (1 to n)		
ADDPRODUCT (1 to n)		

9.8 Assembly Test Program Generation (h)

The Assembly Test Program Generation certification category defines minimum information requirements to support the generation of test programs for the testing of an assembly.

The parameter requirements shown in Table 10 are necessary for someone to be completely compliant with the GenCAM standard and the Assembly Test Program Generation certification category:

Table 10 Assembly Test Program Generation (h)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	TRANSACTION (1 to 1)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	PERSON (1 to n)	BARRELDISC (0 to n)
HISTORY (1 to 1)	SENT (1 to 1)	BARREL (0 to n)
LANGUAGE (0 to 1)	OWNER (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	RECEIVED (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	ACCEPT (0 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	BILLTO (0 to 1)	RECTCORNERDEF (0 to n)
	SCHEDULE (0 to n)	RECTCHAMDEF (0 to n)
	COMMENT (0 to n)	RECTROUNDDEF (0 to n)
	ENTERPRISE (0 to n)	OVALDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to 1)
		ENDCIRCARC (1 to 1)
		ENDELLIPARC (1 to 1)
ARTWORKS	LAYERS	PADSTACKS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
TARGETDEF (0 to n)	LAYERSINGLE (1 to n)	HOLEDEF (0 to n)
ARTWORKDEF (0 to n)	LAYERSET (1 to n)	PADDEF (0 to n)
ARTWORKREF (1 to n)	LAYER (1 to n)	PADSTACK (1 to n)
TARGET (0 to n)	LAYERSWAP (0 to n)	PAD (0 to n)
		PADREF (0 to n)
		HOLEREF (0 to n)
PATTERNS	PACKAGES	FAMILIES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
PATTERNDEF (0 to n)	PACKAGE (1 to n)	FAMILY (1 to n)
PADSTACKREF (0 to n)	BODY (0 to n)	
TARGETREF (0 to n)	TARGETREF (0 to 1)	
FEATUREREF (0 to n)	PIN (1 to n)	

ARTWORKREF (0 to n)	PINONE (0 to 1)	
ARTWORK (0 to n)		
TEXT (0 to n)		
HOLEREF (0 to n)		
DEVICES	MECHANICALS	COMPONENTS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
DEVICE (1 to n)	MECHANICAL (1 to n)	COMPONENT (1 to n)
PART (0 to 1)	PART (0 to 1)	DEVICEREF (0 to 1)
ALIAS (0 to n)	ALIAS (0 to n)	MECHANICALREF (0 - n)
ALTERNATE (0 to n)	ALTERNATE (0 to n)	PATTERNREF (0 to 1)
PINDESC (0 to n)		PROGRAM (0 to 1)
VALUE (0 to n)		KEEPOUT (0 to n)
		ONFAIL (0 to 1)
ROUTES	POWER	TESTCONNECTS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
ROUTE (1 to n)	SUPPLY (1 to n)	TESTPIN (0 to n)
PATH (0 to n)		LOCATION (0 to n)
PLANE (0 to n)		TESTPROBE (0 to n)
VIA (0 to n)		VIAREF (0 to n)
TESTPAD (0 to n)		TESTPADREF (0 to n)
COMPPIN (0 to n)		COMPPINREF (0 to n)
CONNPIN (0 to n)		CONNPINREF (0 to n)
		FIXELEC (0 to n)
		TESTCONNECT (0 to 1)
		TESTPINREF (0 to 2)
		FIXELECTREF (0 to 2)
		TESTPROBEREF (0 to 2)
BOARDS	PANELS	DRAWINGS
BOARD (1 to n)	PANEL (1 to n)	DRAWING (1 to n)
USING (1 to n)	USING (1 to n)	SHEET (1 to n)
OUTLINE (1 to n)	OUTLINE (1 to n)	FRAME (1 to 1)
THICKNESS (0 to 1)	THICKNESS (0 to 1)	INSERTLAYER (0 to n)
KEEPOUT (0 to n)	PLACEMENT (1 to n)	ANNOTATION (0 to n)
TARGETREF (0 to n)	TARGETREF (0 to n)	ARTWORKREF (0 to n)
ASSEMBLY (1 to n)		LOGOREF (0 to n)
USING (1 to n)		TEXT (0 to n)
		DWGREF (1 to 1)
CHANGES	Global Requirements	
RENAME (1 to n)	ATTRIBUTE (1 to 1)	
DELETE (1 to n)	MODIFIED (1 to 1)	
ADD (1 to n)	AUDIT (1 to 1)	
RENAMEPRODUCT (1 to n)		
DELETEPRODUCT (1 to n)		
ADDPRODUCT (1 to n)		

9.9 Assembly Test Fixture Generation (i)

The Assembly Test Fixture Generation certification category defines minimum information requirements to support the construction of test fixtures for assemblies.

The parameter requirements shown in Table 11 are necessary for someone to be completely compliant with the GenCAM standard and the Assembly Test Fixture Generation certification category:

Table 11 Assembly Test Fixture Generation(i)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	FIXTURE (0 to n)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	TRANSACTION (1 to 1)	BARRELDISC (0 to n)
HISTORY (1 to 1)	PERSON (1 to n)	BARREL (0 to n)
LANGUAGE (0 to 1)	SENT (1 to 1)	PROFILEDESC (0 to n)

BOARD (0 to n)	OWNER (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	RECEIVED (1 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	ACCEPT (0 to 1)	RECTCORNERDEF (0 to n)
FIXTURE (0 to n)	BILLTO (0 to 1)	RECTCHAMDEF (0 to n)
	SCHEDULE (0 to n)	RECTROUNDEF (0 to n)
	COMMENT (0 to n)	OVALDEF (0 to n)
		DIAMONDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		POLYLINEDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARC (1 to n)
		ELLIPARC (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARC (1 to n)
		ELLIPARC (1 to n)
		ENDLINE (1 to 1)
		ENDCIRCARC (1 to 1)
		ENDELLIPARC (1 to 1)
ARTWORKS	LAYERS	PADSTACKS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
TARGETDEF (0 to n)	LAYERSINGLE (1 to n)	HOLEDEF (0 to n)
ARTWORKDEF (0 to n)	LAYERSET (1 to n)	PADDEF (0 to n)
ARTWORKREF (1 to n)	LAYER (1 to n)	PADSTACK (1 to n)
TARGET (0 to n)	LAYERSWAP (0 to n)	PAD (0 to n)
		PADREF (0 to n)
		HOLEREF (0 to n)
PATTERNS	PACKAGES	DEVICES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
PATTERNDEF (0 to n)	PACKAGE (1 to n)	DEVICE (1 to n)
PADSTACKREF (0 to n)	BODY (0 to n)	PINDESC (0 to n)
TARGETREF (0 to n)	TARGETREF (0 to 1)	
FEATUREREF (0 to n)	PIN (1 to n)	
ARTWORKREF (0 to n)	PINONE (0 to 1)	
ARTWORK (0 to n)		
TEXT (0 to n)		
HOLEREF (0 to n)		
MECHANICALS	COMPONENTS	ROUTES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
MECHANICAL (1 to n)	COMPONENT (1 to n)	ROUTE (1 to n)
	DEVICEREF (0 to 1)	VIA (0 to n)
	MECHANICALREF (0 - N)	TESTPAD (0 to n)
	PATTERNREF (0 to 1)	COMPPIN (0 to n)
	ARTWORKREF (0 to n)	CONNPIN (0 to n)
	ARTWORK m (0 to n)	
	TEXT (0 to n)	
	KEEPOUT (0 to n)	
POWER	TESTCONNECTS	BOARDS
GROUP (0 to n)	GROUP (0 to n)	BOARD (1 to n)
SUPPLY (1 to n)	TESTPIN (0 to n)	USING (1 to n)
	LOCATION (0 to n)	OUTLINE (1 to n)
	TESTPROBE (0 to n)	THICKNESS (0 to 1)
	VIAREF (0 to n)	HOLEREF (0 to n)
	TESTPADREF (0 to n)	CUTOUT (0 to n)
	COMPPINREF (0 to n)	WELL (0 to n)
	CONNPINREF (0 to n)	SLOT (0 to n)
	FIXELEC (0 to n)	KEEPOUT (0 to n)
	TESTCONNECT (0 to 1)	TARGETREF (0 to n)
	TESTPINREF (0 to 2)	ASSEMBLY (1 to n)
	FIXELECTREF (0 to 2)	USING (1 to n)
	TESTPROBEREF (0 to 2)	
PANELS	FIXTURES	CHANGES
PANEL (1 to n)	FIXTURE (1 to n)	RENAME (1 to n)
USING (1 to n)	USING (1 to n)	DELETE (1 to n)

OUTLINE (1 to n)	OUTLINE (1 to n)	ADD (1 to n)
THICKNESS (0 to 1)	THICKNESS (0 to 1)	RENAMEPRODUCT (1 to n)
HOLEREF (0 to n)	HOLEREF (0 to n)	DELETEPRODUCT (1 to n)
CUTOUT (0 to n)	CUTOUT (0 to n)	ADDPRODUCT (1 to n)
WELL (0 to n)	WELL (0 to n)	
SLOT (0 to n)	SLOT (0 to n)	
KEEPOUT (0 to n)	KEEPOUT (0 to n)	
PLACEMENT (1 to n)	PLACEMENT (1 to n)	
TARGETREF (0 to n)		
Global Requirements		
ATTRIBUTE (1 to 1)		
MODIFIED (1 to 1)		
AUDIT (1 to 1)		

9.10 Phototools (j)

The Phototool certification category defines minimum information requirements to support the generation of photo masks used to manufacture the layers of a board or a panel.

The parameter requirements shown in Table 12 are necessary for someone to be completely compliant with the GenCAM standard and the Phototool certification category:

Table 13 Phototools (j)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	TRANSACTION (1 to 1)	LINEDESC (0 to n)
UNITS (1 to 1)	PERSON (1 to n)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	SENT (1 to 1)	BARRELDISC (0 to n)
HISTORY (1 to 1)	OWNER (1 to 1)	BARREL (0 to n)
LANGUAGE (0 to 1)	RECEIVED (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	ACCEPT (0 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	BILLO (0 to 1)	RECTCENTERDEF (0 to n)
	SCHEDULE (0 to n)	RECTCORNERDEF (0 to n)
	COMMENT (0 to n)	RECTCHAMDEF (0 to n)
		RECTROUNDDEF (0 to n)
		OVALDEF (0 to n)
		DSHAPEDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		DONUTDEF (0 to n)
		THERMALDEF (0 to n)
		POLYLINEDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to 1)
		ENDCIRCARC (1 to 1)
		ENDELLIPARC (1 to 1)
ARTWORKS	LAYERS	PADSTACKS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	LAYERSINGLE (1 to n)	HOLEDEF (0 to n)
TARGETDEF (0 to n)	LAYERSET (1 to n)	PADDEF (0 to n)
FONT (0 to n)	LAYER (1 to n)	PADSTACK (1 to n)
UFONT (0 to n)	LAYERSWAP (0 to n)	PAD (0 to n)
GLYPH (1 to n)		PADREF (0 to n)
LOGODEF (0 to n)		HOLEREF (0 to n)
TEXT (1 to n)		

ARTWORKDEF (0 to n)		
TEXT (1 to n)		
LOGOREF (1 to n)		
ARTWORKKREF (1 to n)		
TARGET (0 to n)		
PATTERNS	COMPONENTS	ROUTES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
PATTERNDEF (0 to n)	COMPONENT (1 to n)	ROUTE (1 to n)
PADSTACKREF (0 to n)	PATTERNREF (0 to 1)	PATH (0 to n)
TARGETREF (0 to n)	ARTWORKREF (0 to n)	PLANE (0 to n)
FEATUREREF (0 to n)	ARTWORK (0 to n)	VIA (0 to n)
ARTWORKKREF (0 to n)	TEXT (0 to n)	TESTPAD (0 to n)
ARTWORK (0 to n)		
TEXT (0 to n)		COMPPIN (0 to n)
HOLEREF (0 to n)		CONNPIN (0 to n)
BOARDS	PANELS	DRAWINGS
BOARD (1 to n)	PANEL (1 to n)	DRAWING (1 to n)
USING (1 to n)	USING (1 to n)	SHEET (1 to n)
OUTLINE (1 to n)	OUTLINE (1 to n)	FRAME (1 to 1)
HOLEREF (0 to n)	HOLEREF (0 to n)	INSERTLAYER (0 to n)
TARGETREF (0 to n)	PLACEMENT (1 to n)	ANNOTATION (0 to n)
LOGOREF (0 to n)	TARGETREF (0 to n)	ARTWORKKREF (0 to n)
TEXT (0 to n)	LOGOREF (0 to n)	LOGOREF (0 to n)
IMAGE (0 to n)	TEXT (0 to n)	TEXT (0 to n)
ASSEMBLY (1 to n)	IMAGE (0 to n)	DWGREF (1 to 1)
USING (1 to n)		
CHANGES	Global Requirements	
RENAME (1 to n)	ATTRIBUTE (1 to 1)	
DELETE (1 to n)	MODIFIED (1 to 1)	
ADD (1 to n)	AUDIT (1 to 1)	
RENAMEPRODUCT (1 to n)		
DELETEPRODUCT (1 to n)		
ADDPRODUCT (1 to n)		

9.11 Board Fabrication (k)

The Board Fabrication certification category defines minimum information requirements to support the manufacture of a board. This includes the physical dimensions, the conductive patterns, hole locations and tolerances, layers, and surface finishes.

The parameter requirements shown in Table 13 are necessary for someone to be completely compliant with the GenCAM standard and the Board Fabrication certification category:

Table 13 Board Fabrication (k)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	TRANSACTION (1 to 1)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	PERSON (1 to n)	BARRELDDESC (0 to n)
HISTORY (1 to 1)	SENT (1 to 1)	BARREL (0 to n)
LANGUAGE (0 to 1)	OWNER (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	RECEIVED (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	ACCEPT (0 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	BILLTO (0 to 1)	RECTCORNERDEF (0 to n)
	SCHEDULE (0 to n)	RECTCHAMDEF (0 to n)
	COMMENT (0 to n)	RECTROUNDDEF (0 to n)
		OVALDEF (0 to n)
		DSHAPEDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		DONUTDEF (0 to n)
		THERMALDEF (0 to n)

		POLYLINEDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to 1)
		ENDCIRCARC (1 to 1)
		ENDELLIPARC (1 to 1)
ARTWORKS	LAYERS	PADSTACKS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	LAYERSINGLE (1 to n)	HOLEDEF (0 to n)
TARGETDEF (0 to n)	LAYERSET (1 to n)	PADDEF (0 to n)
FONT (0 to n)	LAYER (1 to n)	PADSTACK (1 to n)
UFONT (0 to n)	LAYERSWAP (0 to n)	PAD (0 to n)
GLYPH (1 to n)		HOLE (0 to n)
LOGODEF (0 to n)		PADREF (0 to n)
TEXT (1 to n)		HOLEREF (0 to n)
ARTWORKDEF (0 to n)		
TEXT (1 to n)		
LOGOREF (1 to n)		
ARTWORKKREF (1 to n)		
TARGET (0 to n)		
PATTERNS	COMPONENTS	ROUTES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
PATTERNDEF (0 to n)	COMPONENT (1 to n)	ROUTE (1 to n)
PADSTACKREF (0 to n)	PATTERNREF (0 to 1)	PATH (0 to n)
TARGETREF (0 to n)	ARTWORKREF (0 to n)	PLANE (0 to n)
FEATUREREF (0 to n)	ARTWORK (0 to n)	VIA (0 to n)
ARTWORKREF (0 to n)	TEXT (0 to n)	TESTPAD (0 to n)
ARTWORK (0 to n)		COMPIN (0 to n)
TEXT (0 to n)		CONNPIN (0 to n)
HOLEREF (0 to n)		REFERENCE (0 to n)
		IMPEDANCE (0 to 1)
		INDUCTANCE (0 to 1)
		CAPACITANCE (0 - 1)
BOARDS	PANELS	FIXTURES
BOARD (1 to n)	PANEL (1 to n)	FIXTURE (1 to n)
USING (1 to n)	USING (1 to n)	USING (1 to n)
OUTLINE (1 to n)	OUTLINE (1 to n)	OUTLINE (1 to n)
THICKNESS (0 to 1)	THICKNESS (0 to 1)	THICKNESS (0 to 1)
HOLEREF (0 to n)	HOLEREF (0 to n)	HOLEREF (0 to n)
CUTOUT (0 to n)	CUTOUT (0 to n)	KEEPOUT (0 to n)
WELL (0 to n)	WELL (0 to n)	PLACEMENT (1 to n)
SLOT (0 to n)	SLOT (0 to n)	
KEEPOUT (0 to n)	KEEPOUT (0 to n)	
GROOVE (0 to n)	GROOVE (0 to n)	
TARGETREF (0 to n)	PLACEMENT (1 to n)	
LOGOREF (0 to n)	TARGETREF (0 to n)	
TEXT (0 to n)	LOGOREF (0 to n)	
IMAGE (0 to n)	TEXT (0 to n)	
ASSEMBLY (1 to n)	IMAGE (0 to n)	
USING (1 to n)		
DRAWINGS	CHANGES	Global Requirements
DRAWING (1 to n)	RENAME (1 to n)	ATTRIBUTE (1 to 1)
SHEET (1 to n)	DELETE (1 to n)	MODIFIED (1 to 1)
FRAME (1 to 1)	ADD (1 to n)	AUDIT (1 to 1)
INSERTLAYER (0 to n)	RENAMEPRODUCT (1 to n)	
ANNOTATION (0 to n)	DELETEPRODUCT (1 to n)	
ARTWORKKREF (0 to n)	ADDPRODUCT (1 to n)	
LOGOREF (0 to n)		
TEXT (0 to n)		
DWGREF (1 to 1)		

9.12 Panel Fabrication(I)

The Panel Fabrication certification category defines minimum information requirements to support the manufacture of a board panel. This includes the number of boards per panel, their arrangement, and appropriate tooling features for electrical evaluation of the board for assembly.

The parameter requirements shown in Table 14 are necessary for someone to be completely compliant with the GenCAM standard and the Panel Fabrication certification category:

Table 14 Panel Fabrication (I)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	TRANSACTION (1 to 1)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	PERSON (1 to n)	BARRELDISC (0 to n)
HISTORY (1 to 1)	SENT (1 to 1)	BARREL (0 to n)
LANGUAGE (0 to 1)	OWNER (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	RECEIVED (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	ACCEPT (0 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	BILLO (0 to 1)	RECTCORNERDEF (0 to n)
	SCHEDULE (0 to n)	RECTCHAMDEF (0 to n)
	COMMENT (0 to n)	RECTROUNDDEF (0 to n)
		OVALDEF (0 to n)
		DSHAPEDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		DONUTDEF (0 to n)
		THERMALDEF (0 to n)
		POLYLINEDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to 1)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to 1)
		ENDCIRCARC (1 to 1)
		ENDELLIPARC (1 to 1)
ARTWORKS	LAYERS	PADSTACKS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	LAYERSINGLE (1 to n)	HOLEDEF (0 to n)
TARGETDEF (0 to n)	LAYERSET (1 to n)	PADDEF (0 to n)
FONT (0 to n)	LAYER (1 to n)	PADSTACK (1 to n)
UFONT (0 to n)	LAYERSWAP (0 to n)	PAD (0 to n)
GLYPH (1 to n)		HOLE (0 to n)
LOGODEF (0 to n)		PADREF (0 to n)
TEXT (1 to n)		HOLEREF (0 to n)
ARTWORKDEF (0 to n)		
TEXT (1 to n)		
LOGOREF (1 to n)		
ARTWORKKREF (1 to n)		
TARGET (0 to n)		
PATTERNS	COMPONENTS	ROUTES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
PATTERNDEF (0 to n)	COMPONENT (1 to n)	ROUTE (1 to n)
PADSTACKREF (0 to n)	PATTERNREF (0 to 1)	PATH (0 to n)
TARGETREF (0 to n)	ARTWORKREF (0 to n)	PLANE (0 to n)
FEATUREREF (0 to n)	ARTWORK (0 to n)	VIA (0 to n)
ARTWORKKREF (0 to n)	TEXT (0 to n)	TESTPAD (0 to n)
ARTWORK (0 to n)		COMPIN (0 to n)

TEXT (0 to n)		CONNPIN (0 to n)
HOLEREF (0 to n)		REFERENCE (0 to n)
		IMPEDANCE (0 to 1)
		INDUCTANCE (0 to 1)
		CAPACITANCE (0 - 1)
BOARDS	PANELS	FIXTURES
BOARD (1 to n)	PANEL (1 to n)	FIXTURE (1 to n)
USING (1 to n)	USING (1 to n)	USING (1 to n)
OUTLINE (1 to n)	OUTLINE (1 to n)	OUTLINE (1 to n)
THICKNESS (0 to 1)	THICKNESS (0 to 1)	THICKNESS (0 to 1)
HOLEREF (0 to n)	HOLEREF (0 to n)	HOLEREF (0 to n)
CUTOUT (0 to n)	CUTOUT (0 to n)	KEEPOUT (0 to n)
WELL (0 to n)	WELL (0 to n)	PLACEMENT (1 to n)
SLOT (0 to n)	SLOT (0 to n)	
KEEPOUT (0 to n)	KEEPOUT (0 to n)	
GROOVE (0 to n)	GROOVE (0 to n)	
TARGETREF (0 to n)	PLACEMENT (1 to n)	
LOGOREF (0 to n)	TARGETREF (0 to n)	
TEXT (0 to n)	LOGOREF (0 to n)	
IMAGE (0 to n)	TEXT (0 to n)	
ASSEMBLY (1 to n)	IMAGE (0 to n)	
USING (1 to n)		
DRAWINGS	CHANGES	Global Requirements
DRAWING (1 to n)	RENAME (1 to n)	ATTRIBUTE (1 to 1)
SHEET (1 to n)	DELETE (1 to n)	MODIFIED (1 to 1)
FRAME (1 to 1)	ADD (1 to n)	AUDIT (1 to 1)
INSERTLAYER (0 to n)	RENAMEPRODUCT (1 to n)	
ANNOTATION (0 to n)	DELETEPRODUCT (1 to n)	
ARTWORKREF (0 to n)	ADDPRODUCT (1 to n)	
LOGOREF (0 to n)		
TEXT (0 to n)		
DWGREF (1 to 1)		

9.13 Bare Board Test Fixture Generation (m)

The Bare Board Test Fixture Generation certification category defines minimum information requirements to support the generation of board manufacture and test fixtures. Examples include, translation plates, board support fixtures, and carriers for environmental stress testing.

The parameter requirements shown in Table 15 are necessary for someone to be completely compliant with the GenCAM standard and the Bare Board Test Fixture Generation certification category:

Table 15 Bare Board Test Fixture Generation (m)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	FIXTURE (0 to n)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	TRANSACTION (1 to 1)	BARRELDDESC (0 to n)
HISTORY (1 to 1)	PERSON (1 to n)	BARREL (0 to n)
LANGUAGE (0 to 1)	SENT (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	OWNER (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	RECEIVED (1 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	ACCEPT (0 to 1)	RECTCORNERDEF (0 to n)
FIXTURE (0 to n)	BILLTO (0 to 1)	RECTCHAMDEF (0 to n)
	SCHEDULE (0 to n)	RECTROUNDDEF (0 to n)
	COMMENT (0 to n)	OVALDEF (0 to n)
	ENTERPRISE (0 to n)	DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		POLYLINEDDEF (0 to n)
		STARTAT (1 to n)

		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to n)
		ENDCIRCARC (1 to n)
		ENDELLIPARC (1 to n)
ARTWORKS	LAYERS	PADSTACKS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
TARGETDEF (0 to n)	LAYERSINGLE (1 to n)	HOLEDEF (0 to n)
ARTWORKDEF (0 to n)	LAYERSET (1 to n)	PADDEF (0 to n)
ARTWORKREF (1 to n)	LAYER (1 to n)	PADSTACK (1 to n)
TARGET (0 to n)	LAYERSWAP (0 to n)	PAD (0 to n)
		HOLE (0 to n)
		PADREF (0 to n)
		HOLEREF (0 to n)
PATTERNS	COMPONENTS	ROUTES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
PATTERNDEF (0 to n)	COMPONENT (1 to n)	ROUTE (1 to n)
PADSTACKREF (0 to n)	DEVICEREF (0 to 1)	PATH (0 to n)
TARGETREF (0 to n)	MECHANICALREF (0 - n)	PLANE (0 to n)
FEATUREREF (0 to n)	PATTERNREF (0 to 1)	VIA (0 to n)
ARTWORKREF (0 to n)		TESTPAD (0 to n)
ARTWORK (0 to n)		COMPIN (0 to n)
		CONNPIN (0 to n)
		REFERENCE (0 to n)
		IMPEDANCE (0 to 1)
		INDUCTANCE (0 to 1)
		CAPACITANCE (0 - 1)
TESTCONNECTS	BOARDS	PANELS
GROUP (0 to n)	BOARD (1 to n)	PANEL (1 to n)
TESTPIN (0 to n)	USING (1 to n)	USING (1 to n)
LOCATION (0 to n)	OUTLINE (1 to n)	OUTLINE (1 to n)
TESTPROBE (0 to n)	THICKNESS (0 to 1)	THICKNESS (0 to 1)
VIAREF (0 to n)	HOLEREF (0 to n)	HOLEREF (0 to n)
TESTPADREF (0 to n)	CUTOUT (0 to n)	CUTOUT (0 to n)
COMPINREF (0 to n)	WELL (0 to n)	WELL (0 to n)
CONNPINREF (0 to n)	SLOT (0 to n)	SLOT (0 to n)
FIXELEC (0 to n)	KEEPOUT (0 to n)	KEEPOUT (0 to n)
TESTCONNECT (0 to 1)	TARGETREF (0 to n)	PLACEMENT (1 to n)
TESTPINREF (0 to 2)	ASSEMBLY (1 to n)	TARGETREF (0 to n)
FIXELECTREF (0 to 2)	USING (1 to n)	
TESTPROBEREF (0 to 2)		
FIXTURES	CHANGES	Global Requirements
FIXTURE (1 to n)	RENAME (1 to n)	ATTRIBUTE (1 to 1)
USING (1 to n)	DELETE (1 to n)	MODIFIED (1 to 1)
OUTLINE (1 to n)	ADD (1 to n)	AUDIT (1 to 1)
THICKNESS (0 to 1)	RENAMEPRODUCT (1 to n)	
HOLEREF (0 to n)	DELETEPRODUCT (1 to n)	
CUTOUT (0 to n)	ADDPRODUCT (1 to n)	
WELL (0 to n)		
SLOT (0 to n)		
KEEPOUT (0 to n)		
PLACEMENT (1 to n)		

9.14 Bare Board Test Program Generation (n)

The Bare Board Test Program Generation certification category defines minimum information requirements to support the generation of test programs for the testing of a bare board. Examples include isolation testing, continuity testing, hi-potential stress testing, dielectric withstanding voltage testing, and controlled impedance value testing.

The parameter requirements shown in Table 16 are necessary for someone to be completely compliant with the GenCAM standard and the Bare Board Test Program Generation certification category:

Table 16 Bare Board Test Program Generation (n)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	TRANSACTION (1 to 1)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	PERSON (1 to n)	BARRELDDESC (0 to n)
HISTORY (1 to 1)	SENT (1 to 1)	BARREL (0 to n)
LANGUAGE (0 to 1)	OWNER (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	RECEIVED (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	ACCEPT (0 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	BILLTO (0 to 1)	RECTCORNERDEF (0 to n)
	SCHEDULE (0 to n)	RECTCHAMDEF (0 to n)
	COMMENT (0 to n)	RECTROUNDEF (0 to n)
		OVALDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to n)
		ENDCIRCARC (1 to n)
		ENDELLIPARC (1 to n)
ARTWORKS	PATTERNS	ROUTES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
TARGETDEF (0 to n)	PATTERNDEF (0 to n)	ROUTE (1 to n)
ARTWORKDEF (0 to n)	PADSTACKREF (0 to n)	PATH (0 to n)
ARTWORKREF (1 to n)	TARGETREF (0 to n)	PLANE (0 to n)
TARGET (0 to n)	FEATUREREF (0 to n)	VIA (0 to n)
	ARTWORKREF (0 to n)	TESTPAD (0 to n)
	ARTWORK (0 to n)	COMPPIN (0 to n)
		CONNPIN (0 to n)
		REFERENCE (0 to n)
		IMPEDANCE (0 to 1)
		INDUCTANCE (0 to 1)
		CAPACITANCE (0 - 1)
POWER	TESTCONNECTS	BOARDS
GROUP (0 to n)	GROUP (0 to n)	BOARD (1 to n)
SUPPLY (1 to n)	TESTPIN (0 to n)	USING (1 to n)
	LOCATION (0 to n)	OUTLINE (1 to n)
	TESTPROBE (0 to n)	CUTOUT (0 to n)
	VIAREF (0 to n)	WELL (0 to n)
	TESTPADREF (0 to n)	SLOT (0 to n)
	COMPPINREF (0 to n)	KEEPOUT (0 to n)
	CONNPINREF (0 to n)	GROOVE (0 to n)
	FIXELEC (0 to n)	TARGETREF (0 to n)
	TESTCONNECT (0 to 1)	BAREBOARDTEST (1 to 1)
	TESTPINREF (0 to 2)	ASSEMBLY (1 to n)
	FIXELECTREF (0 to 2)	USING (1 to n)
	TESTPROBEREF (0 to 2)	
PANELS	FIXTURES	DRAWINGS
PANEL (1 to n)	FIXTURE (1 to n)	DRAWING (1 to n)
USING (1 to n)	USING (1 to n)	SHEET (1 to n)
OUTLINE (1 to n)	OUTLINE (1 to n)	FRAME (1 to 1)
CUTOUT (0 to n)	THICKNESS (0 to 1)	INSERTLAYER (0 to n)
WELL (0 to n)	HOLEREF (0 to n)	ANNOTATION (0 to n)
SLOT (0 to n)	CUTOUT (0 to n)	ARTWORKREF (0 to n)

KEEPOUT (0 to n)	WELL (0 to n)	LOGOREF (0 to n)
GROOVE (0 to n)	SLOT (0 to n)	TEXT (0 to n)
TARGETREF (0 to n)	KEEPOUT (0 to n)	DWGREF (1 to 1)
	PLACEMENT (1 to n)	
Global Requirements	CHANGES	
ATTRIBUTE (1 to 1)	RENAME (1 to n)	
MODIFIED (1 to 1)	DELETE (1 to n)	
AUDIT (1 to 1)	ADD (1 to n)	
	RENAMEPRODUCT (1 to n)	
	DELETEPRODUCT (1 to n)	
	ADDPRODUCT (1 to n)	

9.15 Fabrication Drawings (o)

The Fabrication Drawings certification category defines minimum information requirements to support the generation of fabrication drawings. This includes, single image master drawing requirements, panelization for subpanel arrays, and manufacturing panels.

The parameter requirements shown in Table 17 are necessary for someone to be completely compliant with the GenCAM standard and the Fabrication Drawings certification category:

Table 17 Fabrication Drawings (o)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	TRANSACTION (1 to 1)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	PERSON (1 to n)	BARRELDISC (0 to n)
HISTORY (1 to 1)	SENT (1 to 1)	BARREL (0 to n)
LANGUAGE (0 to 1)	OWNER (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	RECEIVED (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	ACCEPT (0 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	BILLTO (0 to 1)	RECTCORNERDEF (0 to n)
	SCHEDULE (0 to n)	RECTCHAMDEF (0 to n)
	COMMENT (0 to n)	RECTROUNDEF (0 to n)
		OVALDEF (0 to n)
		DSHAPEDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		DONUTDEF (0 to n)
		THERMALDEF (0 to n)
		POLYLINEDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to n)
		ENDCIRCARC (1 to n)
		ENDELLIPARC (1 to n)
ARTWORKS	LAYERS	PADSTACKS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	LAYERSINGLE (1 to n)	HOLEDEF (0 to n)
TARGETDEF (0 to n)	LAYERSET (1 to n)	PADEF (0 to n)
FONT (0 to n)	LAYER (1 to n)	PADSTACK (1 to n)
UFONT (0 to n)	LAYERSWAP (0 to n)	PAD (0 to n)
GLYPH (1 to n)		HOLE (0 to n)
LOGODEF (0 to n)		PADREF (0 to n)

TEXT (1 to n)		HOLEREF (0 to n)
ARTWORKDEF (0 to n)		
TEXT (1 to n)		
LOGOREF (1 to n)		
ARTWORKREF (1 to n)		
TARGET (0 to n)		
MECHANICALS	PATTERNS	PACKAGES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
MECHANICAL (1 to n)	PATTERNDEF (0 to n)	PACKAGE (1 to n)
PART (0 to 1)	PADSTACKREF (0 to n)	BODY (0 to n)
ALIAS (0 to n)	TARGETREF (0 to n)	TARGETREF (0 to 1)
ALTERNATE (0 to n)	FEATUREREF (0 to n)	PIN (1 to n)
ARTWORKREF (0 to n)	ARTWORKREF (0 to n)	PINONE (0 to 1)
ARTWORK (0 to n)	ARTWORK (0 to n)	
HOLEREF (0 to n)	TEXT (0 to n)	
	HOLEREF (0 to n)	
COMPONENTS	ROUTES	BOARDS
GROUP (0 to n)	GROUP (0 to n)	BOARD (1 to n)
COMPONENT (1 to n)	ROUTE (1 to n)	USING (1 to n)
DEVICEREF (0 to 1)	PATH (0 to n)	OUTLINE (1 to n)
MECHANICALREF (0 - n)	PLANE (0 to n)	THICKNESS (0 to 1)
PATTERNREF (0 to 1)	VIA (0 to n)	HOLEREF (0 to n)
ARTWORKREF (0 to n)	TESTPAD (0 to n)	CUTOUT (0 to n)
ARTWORK (0 to n)	COMPIN (0 to n)	WELL (0 to n)
TEXT (0 to n)	CONNPIN (0 to n)	SLOT (0 to n)
		KEEPOUT (0 to n)
		GROOVE (0 to n)
		TARGETREF (0 to n)
		LOGOREF (0 to n)
		TEXT (0 to n)
		IMAGE (0 to n)
		ASSEMBLY (1 to n)
		USING (1 to n)
PANELS	FIXTURES	DRAWINGS
PANEL (1 to n)	FIXTURE (1 to n)	DRAWING (1 to n)
USING (1 to n)	USING (1 to n)	SHEET (1 to n)
OUTLINE (1 to n)	OUTLINE (1 to n)	FRAME (1 to 1)
THICKNESS (0 to 1)	THICKNESS (0 to 1)	INSERTLAYER (0 to n)
HOLEREF (0 to n)	HOLEREF (0 to n)	ANNOTATION (0 to n)
CUTOUT (0 to n)	CUTOUT (0 to n)	ARTWORKREF (0 to n)
WELL (0 to n)	WELL (0 to n)	LOGOREF (0 to n)
SLOT (0 to n)	SLOT (0 to n)	TEXT (0 to n)
KEEPOUT (0 to n)	KEEPOUT (0 to n)	DWGREF (1 to 1)
GROOVE (0 to n)	PLACEMENT (1 to n)	
PLACEMENT (1 to n)		
TARGETREF (0 to n)		
LOGOREF (0 to n)		
TEXT (0 to n)		
IMAGE (0 to n)		
CHANGES	Global Requirements	
RENAME (1 to n)	ATTRIBUTE (1 to 1)	
DELETE (1 to n)	MODIFIED (1 to 1)	
ADD (1 to n)	AUDIT (1 to 1)	
RENAMEPRODUCT (1 to n)		
DELETEDPRODUCT (1 to n)		
ADDPRODUCT (1 to n)		

9.16 Assembly Drawings (p)

The Assembly Drawings certification category defines minimum information requirements to support the generation of assembly drawings.

The parameter requirements shown in Table 18 are necessary for someone to be completely compliant with the GenCAM standard and the Assembly Drawings certification category:

Table 18 Assembly Drawings (p)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	TRANSACTION (1 to 1)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	PERSON (1 to n)	BARRELDISC (0 to n)
HISTORY (1 to 1)	SENT (1 to 1)	BARREL (0 to n)
LANGUAGE (0 to 1)	OWNER (1 to 1)	PROFILEDESC (0 to n)
BOARD (0 to n)	RECEIVED (1 to 1)	CIRCLEDEF (0 to n)
PANEL (0 to n)	ACCEPT (0 to 1)	RECTCENTERDEF (0 to n)
ASSEMBLY (0 to n)	BILLTO (0 to 1)	RECTCORNERDEF (0 to n)
	SCHEDULE (0 to n)	RECTCHAMDEF (0 to n)
	COMMENT (0 to n)	RECTROUNDDEF (0 to n)
		OVALDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		DONUTDEF (0 to n)
		POLYLINEDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to n)
		ENDCIRCARC (1 to n)
		ENDELLIPARC (1 to n)
ARTWORKS	LAYERS	PATTERNS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	LAYERSINGLE (1 to n)	PATTERNDEF (0 to n)
TARGETDEF (0 to n)	LAYERSET (1 to n)	PADSTACKREF (0 to n)
FONT (0 to n)	LAYER (1 to n)	TARGETREF (0 to n)
UFONT (0 to n)	LAYERSWAP (0 to n)	FEATUREREF (0 to n)
GLYPH (1 to n)		ARTWORKREF (0 to n)
LOGODEF (0 to n)		ARTWORK (0 to n)
TEXT (1 to n)		TEXT (0 to n)
ARTWORKDEF (0 to n)		HOLEREF (0 to n)
TEXT (1 to n)		
LOGOREF (1 to n)		
ARTWORKREF (1 to n)		
TARGET (0 to n)		
PACKAGES	DEVICES	MECHANICALS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
PACKAGE (1 to n)	DEVICE (1 to n)	MECHANICAL (1 to n)
BODY (0 to n)	PART (0 to 1)	PART (0 to 1)
TARGETREF (0 to 1)	ALIAS (0 to n)	ALIAS (0 to n)
PIN (1 to n)	ALTERNATE (0 to n)	ALTERNATE (0 to n)
PINONE (0 to 1)	PINDESC (0 to n)	ARTWORKREF (0 to n)
	VALUE (0 to n)	ARTWORK (0 to n)
		HOLEREF (0 to n)
COMPONENTS	BOARDS	PANELS
GROUP (0 to n)	BOARD (1 to n)	PANEL (1 to n)
COMPONENT (1 to n)	USING (1 to n)	USING (1 to n)
DEVICEREF (0 to 1)	OUTLINE (1 to n)	OUTLINE (1 to n)
MECHANICALREF (0 - n)	THICKNESS (0 to 1)	THICKNESS (0 to 1)
PATTERNREF (0 to 1)	HOLEREF (0 to n)	HOLEREF (0 to n)
ARTWORKREF (0 to n)	CUTOUT (0 to n)	CUTOUT (0 to n)
ARTWORK (0 to n)	WELL (0 to n)	WELL (0 to n)
TEXT (0 to n)	SLOT (0 to n)	SLOT (0 to n)
KEEPOUT (0 to n)	KEEPOUT (0 to n)	KEEPOUT (0 to n)

	GROOVE (0 to n)	GROOVE (0 to n)
	TARGETREF (0 to n)	PLACEMENT (1 to n)
	LOGOREF (0 to n)	TARGETREF (0 to n)
	TEXT (0 to n)	LOGOREF (0 to n)
	ASSEMBLY (1 to n)	TEXT (0 to n)
	USING (1 to n)	
FIXTURES	DRAWINGS	CHANGES
FIXTURE (1 to n)	DRAWING (1 to n)	RENAME (1 to n)
USING (1 to n)	SHEET (1 to n)	DELETE (1 to n)
OUTLINE (1 to n)	FRAME (1 to 1)	ADD (1 to n)
THICKNESS (0 to 1)	INSERTLAYER (0 to n)	RENAMEPRODUCT (1 to n)
HOLEREF (0 to n)	ANNOTATION (0 to n)	DELETEPRODUCT (1 to n)
CUTOUT (0 to n)	ARTWORKREF (0 to n)	ADDPRODUCT (1 to n)
WELL (0 to n)	LOGOREF (0 to n)	
SLOT (0 to n)	TEXT (0 to n)	
KEEPOUT (0 to n)	DWGREF (1 to 1)	
PLACEMENT (1 to n)		
Global Requirements		
ATTRIBUTE (1 to 1)		
MODIFIED (1 to 1)		
AUDIT (1 to 1)		

9.17 Schematic/Logic Drawings (q)

The Schematic/Logic Drawings certification category defines minimum information requirements to support the generation of schematic drawings and logic drawings.

The parameter requirements shown in Table 19 are necessary for someone to be completely compliant with the GenCAM standard and the Schematic/Logic Drawing certification category:

Table 19 Schematic/Logic Drawing (q)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	TRANSACTION (1 to 1)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PERSON (1 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	SENT (1 to 1)	LINEDESC (0 to n)
UNITS (1 to 1)	OWNER (1 to 1)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	RECEIVED (1 to 1)	BARRELDISC (0 to n)
HISTORY (1 to 1)	ACCEPT (0 to 1)	BARREL (0 to n)
LANGUAGE (0 to 1)	BILTO (0 to 1)	PROFILEDESC (0 to n)
	SCHEDULE (0 to n)	CIRCLEDEF (0 to n)
	COMMENT (0 to n)	RECTCENTERDEF (0 to n)
		RECTCORNERDEF (0 to n)
		RECTCHAMDEF (0 to n)
		RECTROUNDDEF (0 to n)
		OVALDEF (0 to n)
		DSHAPEDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		DONUTDEF (0 to n)
		POLYLINEDDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to n)
		ENDCIRCARC (1 to n)
		ENDELLIPARC (1 to n)

ARTWORKS	PATTERNS	PACKAGES
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	PATTERNDEF (0 to n)	PACKAGE (1 to n)
TARGETDEF (0 to n)	PADSTACKREF (0 to n)	BODY (0 to n)
FONT (0 to n)	TARGETREF (0 to n)	TARGETREF (0 to 1)
UFONT (0 to n)	FEATUREREF (0 to n)	PIN (1 to n)
GLYPH (1 to n)	ARTWORKREF (0 to n)	PINONE (0 to 1)
LOGODEF (0 to n)	ARTWORK (0 to n)	
TEXT (1 to n)	TEXT (0 to n)	
ARTWORKDEF (0 to n)	HOLEREF (0 to n)	
TEXT (1 to n)	SYMBOLDEF (0 to n)	
LOGOREF (1 to n)	ARTWORKREF (0 to n)	
ARTWORKREF (1 to n)	ARTWORK (0 to n)	
TARGET (0 to n)	TEXT (0 to n)	
	SYMPINDEF (0 to n)	
DEVICES	COMPONENTS	POWER
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
DEVICE (1 to n)	COMPONENT (1 to n)	SUPPLY (1 to n)
PART (0 to 1)	DEVICEREF (0 to 1)	
ALIAS (0 to n)	PATTERNREF (0 to 1)	
ALTERNATE (0 to n)		
PINDESC (0 to n)		
VALUE (0 to n)		
DRAWINGS	CHANGES	Global Requirements
DRAWING (1 to n)	RENAME (1 to n)	ATTRIBUTE (1 to 1)
SHEET (1 to n)	DELETE (1 to n)	MODIFIED (1 to 1)
FRAME (1 to 1)	ADD (1 to n)	AUDIT (1 to 1)
INSERTLAYER (0 to n)	RENAMEPRODUCT (1 to n)	
SYMBOLREF (0 to n)	DELETEPRODUCT (1 to n)	
SYMPINREF (1 to n)	ADDPRODUCT (1 to n)	
TEXT (0 to n)		
NET (0 to n)		
TEXT (0 to n)		
ANNOTATION (0 to n)		
ARTWORKREF (0 to n)		
LOGOREF (0 to n)		
TEXT (0 to n)		
DWGREF (1 to 1)		

9.18 Detail Drawings (r)

The Detail Drawings certification category defines minimum information requirements to support the generation of detail drawings.

The parameter requirements shown in Table 20 are necessary for someone to be completely compliant with the GenCAM standard and the Detail Drawings certification category:

Table 20 Detail Drawings (r)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	ASSEMBLY (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	FIXTURE (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	TRANSACTION (1 to 1)	LINEDESC (0 to n)
UNITS (1 to 1)	PERSON (1 to n)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	SENT (1 to 1)	BARRELDDESC (0 to n)
HISTORY (1 to 1)	OWNER (1 to 1)	BARREL (0 to n)
LANGUAGE (0 to 1)	RECEIVED (1 to 1)	PROFILEDESC (0 to n)
ASSEMBLY (0 to n)	ACCEPT (0 to 1)	CIRCLEDEF (0 to n)
FIXTURE (0 to n)	BILLTO (0 to 1)	RECTCENTERDEF (0 to n)
	SCHEDULE (0 to n)	RECTCORNERDEF (0 to n)
	COMMENT (0 to n)	RECTCHAMDEF (0 to n)
		RECTROUNDDDEF (0 to n)
		OVALDEF (0 to n)
		DSHAPEDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)

		OCTAGONDEF (0 to n)
		DONUTDEF (0 to n)
		POLYLINEDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to n)
		ENDCIRCARC (1 to n)
		ENDELLIPARC (1 to n)
ARTWORKS	LAYERS	PATTERNS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	LAYERSINGLE (1 to n)	PATTERNDEF (0 to n)
TARGETDEF (0 to n)	LAYERSET (1 to n)	PADSTACKREF (0 to n)
FONT (0 to n)	LAYER (1 to n)	TARGETREF (0 to n)
UFONT (0 to n)	LAYERSWAP (0 to n)	FEATUREREF (0 to n)
GLYPH (1 to n)		ARTWORKREF (0 to n)
LOGODEF (0 to n)		ARTWORK (0 to n)
TEXT (1 to n)		TEXT (0 to n)
ARTWORKDEF (0 to n)		HOLEREF (0 to n)
TEXT (1 to n)		
LOGOREF (1 to n)		
ARTWORKREF (1 to n)		
TARGET (0 to n)		
PACKAGES	MECHANICALS	BOARDS
GROUP (0 to n)	GROUP (0 to n)	BOARD (1 to n)
PACKAGE (1 to n)	MECHANICAL (1 to n)	USING (1 to n)
BODY (0 to n)	PART (0 to 1)	OUTLINE (1 to n)
TARGETREF (0 to 1)	ALIAS (0 to n)	THICKNESS (0 to 1)
PIN (1 to n)	ALTERNATE (0 to n)	HOLEREF (0 to n)
PINONE (0 to 1)	ARTWORKREF (0 to n)	CUTOUT (0 to n)
	ARTWORK (0 to n)	WELL (0 to n)
	HOLEREF (0 to n)	SLOT (0 to n)
		KEEPOUT (0 to n)
		GROOVE (0 to n)
		TARGETREF (0 to n)
		LOGOREF (0 to n)
		TEXT (0 to n)
		ASSEMBLY (1 to n)
		USING (1 to n)
PANELS	FIXTURES	DRAWINGS
PANEL (1 to n)	FIXTURE (1 to n)	DRAWING (1 to n)
USING (1 to n)	USING (1 to n)	SHEET (1 to n)
OUTLINE (1 to n)	OUTLINE (1 to n)	FRAME (1 to 1)
THICKNESS (0 to 1)	THICKNESS (0 to 1)	INSERTLAYER (0 to n)
HOLEREF (0 to n)	HOLEREF (0 to n)	ANNOTATION (0 to n)
CUTOUT (0 to n)	CUTOUT (0 to n)	ARTWORKREF (0 to n)
WELL (0 to n)	WELL (0 to n)	LOGOREF (0 to n)
SLOT (0 to n)	SLOT (0 to n)	TEXT (0 to n)
KEEPOUT (0 to n)	KEEPOUT (0 to n)	DWGREF (1 to 1)
GROOVE (0 to n)	PLACEMENT (1 to n)	
PLACEMENT (1 to n)		
TARGETREF (0 to n)		
LOGOREF (0 to n)		
TEXT (0 to n)		
CHANGES	Global Requirements	
RENAME (1 to n)	ATTRIBUTE (1 to 1)	
DELETE (1 to n)	MODIFIED (1 to 1)	
ADD (1 to n)	AUDIT (1 to 1)	
RENAMEPRODUCT (1 to n)		
DELETEPRODUCT (1 to n)		
ADDPRODUCT (1 to n)		

9.19 Specification/Source Control Drawings (s)

The Specification/Source Drawings certification category defines minimum information requirements to support the generation of specification drawings and source control drawings.

The parameter requirements shown in Table 21 are necessary for someone to be completely compliant with the GenCAM standard and the Specification/Source Control Drawings certification category:

Table 21 Specificaiton/Source Control Drawings (s)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	ASSEMBLY (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	TRANSACTION (1 to 1)	COLOR (0 to n)
CERTIFICATION (1 to n)	PERSON (1 to n)	LINEDESC (0 to n)
UNITS (1 to 1)	SENT (1 to 1)	PAINTDESC (0 to n)
ANGLEUNITS (1 to 1)	OWNER (1 to 1)	BARRELDISC (0 to n)
HISTORY (1 to 1)	RECEIVED (1 to 1)	BARREL (0 to n)
LANGUAGE (0 to 1)	ACCEPT (0 to 1)	PROFILEDESC (0 to n)
ASSEMBLY (0 to n)	BILLTO (0 to 1)	CIRCLEDEF (0 to n)
	SCHEDULE (0 to n)	RECTCENTERDEF (0 to n)
	COMMENT (0 to n)	RECTCORNERDEF (0 to n)
	ENTERPRISE (0 to n)	RECTCHAMDEF (0 to n)
		RECTROUNDDEF (0 to n)
		OVALDEF (0 to n)
		DSHAPEDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		DONUTDEF (0 to n)
		POLYLINEDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to n)
		ENDCIRCARC (1 to n)
		ENDELLIPARC (1 to n)
ARTWORKS	PACKAGES	MECHANICALS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	PACKAGE (1 to n)	MECHANICAL (1 to n)
TARGETDEF (0 to n)	BODY (0 to n)	PART (0 to 1)
FONT (0 to n)	TARGETREF (0 to 1)	ALIAS (0 to n)
UFONT (0 to n)	PIN (1 to n)	ALTERNATE (0 to n)
GLYPH (1 to n)	PINONE (0 to 1)	ARTWORKREF (0 to n)
LOGODEF (0 to n)		ARTWORK (0 to n)
TEXT (1 to n)		HOLEREF (0 to n)
ARTWORKDEF (0 to n)		
TEXT (1 to n)		
LOGOREF (1 to n)		
ARTWORKREF (1 to n)		
TARGET (0 to n)		
COMPONENTS	TESTCONNECTS	DRAWINGS
GROUP (0 to n)	GROUP (0 to n)	DRAWING (1 to n)
COMPONENT (1 to n)	TESTPIN (0 to n)	SHEET (1 to n)
DEVICEREF (0 to 1)	LOCATION (0 to n)	FRAME (1 to 1)
MECHANICALREF (0 - n)	TESTPROBE (0 to n)	INSERTLAYER (0 to n)
	VIAREF (0 to n)	ANNOTATION (0 to n)
	TESTPADREF (0 to n)	ARTWORKREF (0 to n)
	COMPPINREF (0 to n)	LOGOREF (0 to n)
	CONNPINREF (0 to n)	TEXT (0 to n)

	FIXELEC (0 to n)	DWGREF (1 to 1)
	TESTCONNECT (0 to 1)	
	TESTPINREF (0 to 2)	
	FIXELECTREF (0 to 2)	
	TESTPROBEREF (0 to 2)	
CHANGES	Global Requirements	
RENAME (1 to n)	ATTRIBUTE (1 to 1)	
DELETE (1 to n)	MODIFIED (1 to 1)	
ADD (1 to n)	AUDIT (1 to 1)	
RENAMEPRODUCT (1 to n)		
DELETEPRODUCT (1 to n)		
ADDPRODUCT (1 to n)		

9.20 Parts List Drawings (t)

The Parts List Drawings certification category defines minimum information requirements to support the generation of an assembled board part list.

The parameter requirements shown in Table 22 are necessary for someone to be completely compliant with the GenCAM standard and the Parts List Drawing certification category:

Table 22 Parts List Drawing (t)

HEADER	ADMINISTRATION	PRIMITIVES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	COLOR (0 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	LINEDESC (0 to n)
HISTORY (1 to 1)	FIXTURE (0 to n)	PAINTDESC (0 to n)
LANGUAGE (0 to 1)	TRANSACTION (1 to 1)	BARRELDISC (0 to n)
BOARD (0 to n)	PERSON (1 to n)	BARREL (0 to n)
PANEL (0 to n)	SENT (1 to 1)	PROFILEDESC (0 to n)
ASSEMBLY (0 to n)	OWNER (1 to 1)	CIRCLEDEF (0 to n)
FIXTURE (0 to n)	RECEIVED (1 to 1)	RECTCENTERDEF (0 to n)
	ACCEPT (0 to 1)	RECTCORNERDEF (0 to n)
	BILLTO (0 to 1)	RECTCHAMDEF (0 to n)
	SCHEDULE (0 to n)	RECTROUNDDEF (0 to n)
	COMMENT (0 to n)	OVALDEF (0 to n)
	ENTERPRISE (0 to n)	DSHAPEDEF (0 to n)
		DIAMONDDEF (0 to n)
		HEXAGONDEF (0 to n)
		OCTAGONDEF (0 to n)
		DONUTDEF (0 to n)
		POLYLINEDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		POLYGONDEF (0 to n)
		STARTAT (1 to n)
		LINETO (1 to n)
		CIRCARCTO (1 to n)
		ELLIPARCTO (1 to n)
		ENDLINE (1 to n)
		ENDCIRCARC (1 to n)
		ENDELLIPARC (1 to n)
ARTWORKS	DEVICES	MECHANICALS
GROUP (0 to n)	GROUP (0 to n)	GROUP (0 to n)
FEATUREDEF (0 to n)	DEVICE (1 to n)	MECHANICAL (1 to n)
TARGETDEF (0 to n)	PART (0 to 1)	PART (0 to 1)
FONT (0 to n)	ALIAS (0 to n)	ALIAS (0 to n)
UFONT (0 to n)	ALTERNATE (0 to n)	ALTERNATE (0 to n)
GLYPH (1 to n)	VALUE (0 to n)	HOLEREF (0 to n)
LOGODEF (0 to n)		
TEXT (1 to n)		
ARTWORKDEF (0 to n)		
TEXT (1 to n)		

LOGOREF (1 to n)		
ARTWORKREF (1 to n)		
TARGET (0 to n)		
COMPONENTS	BOARDS	PANELS
GROUP (0 to n)	BOARD (1 to n)	PANEL (1 to n)
COMPONENT (1 to n)	USING (1 to n)	USING (1 to n)
DEVICEREF (0 to 1)	OUTLINE (1 to n)	OUTLINE (1 to n)
MECHANICALREF (0 - 1)	THICKNESS (0 to 1)	THICKNESS (0 to 1)
	HOLEREF (0 to n)	HOLEREF (0 to n)
	CUTOUT (0 to n)	CUTOUT (0 to n)
	WELL (0 to n)	WELL (0 to n)
	SLOT (0 to n)	SLOT (0 to n)
	KEEPOUT (0 to n)	KEEPOUT (0 to n)
	GROOVE (0 to n)	GROOVE (0 to n)
	TARGETREF (0 to n)	PLACEMENT (1 to n)
	LOGOREF (0 to n)	TARGETREF (0 to n)
	TEXT (0 to n)	LOGOREF (0 to n)
	ASSEMBLY (1 to n)	TEXT (0 to n)
	USING (1 to n)	
FIXTURES	DRAWINGS	CHANGES
FIXTURE (1 to n)	DRAWING (1 to n)	RENAME (1 to n)
USING (1 to n)	SHEET (1 to n)	DELETE (1 to n)
OUTLINE (1 to n)	FRAME (1 to 1)	ADD (1 to n)
THICKNESS (0 to 1)	INSERTLAYER (0 to n)	RENAMEPRODUCT (1 to n)
HOLEREF (0 to n)	ANNOTATION (0 to n)	DELETEPRODUCT (1 to n)
CUTOUT (0 to n)	ARTWORKREF (0 to n)	ADDPRODUCT (1 to n)
WELL (0 to n)	LOGOREF (0 to n)	
SLOT (0 to n)	TEXT (0 to n)	
KEEPOUT (0 to n)	DWGREF (1 to 1)	
PLACEMENT (1 to n)		
Global Requirements		
ATTRIBUTE (1 to 1)		
MODIFIED (1 to 1)		
AUDIT (1 to 1)		

9.21 Parts List (u)

The multiple assembled board parts list certification category defines minimum information requirements to support the generation of multiple assembled board part lists.

The parameter requirements shown in Table 23 are necessary for someone to be completely compliant with the GenCAM standard and the Parts List certification category:

Table 23 Parts List (u)

HEADER	ADMINISTRATION	DEVICES
GENCAM (1 to 1)	BOARD (0 to n)	GROUP (0 to n)
GENERATEDBY (1 to 1)	PANEL (0 to n)	DEVICE (1 to n)
CERTIFICATION (1 to n)	ASSEMBLY (0 to n)	PART (0 to 1)
HISTORY (1 to 1)	FIXTURE (0 to n)	ALIAS (0 to n)
LANGUAGE (0 to 1)	TRANSACTION (1 to 1)	ALTERNATE (0 to n)
BOARD (0 to n)	PERSON (1 to n)	VALUE (0 to n)
PANEL (0 to n)	SENT (1 to 1)	
ASSEMBLY (0 to n)	OWNER (1 to 1)	
FIXTURE (0 to n)	RECEIVED (1 to 1)	
	ACCEPT (0 to 1)	
	BILLTO (0 to 1)	
	SCHEDULE (0 to n)	
	COMMENT (0 to n)	
	ENTERPRISE (0 to n)	
MECHANICALS	COMPONENTS	BOARDS
GROUP (0 to n)	GROUP (0 to n)	BOARD (1 to n)
MECHANICAL (1 to n)	COMPONENT (1 to n)	USING (1 to n)
PART (0 to 1)	DEVICEREF (0 to 1)	OUTLINE (1 to n)
ALIAS (0 to n)	MECHANICALREF (0 - 1)	THICKNESS (0 to 1)

ALTERNATE (0 to n)		HOLEREF (0 to n)
HOLEREF (0 to n)		CUTOUT (0 to n)
		WELL (0 to n)
		SLOT (0 to n)
		KEEPOUT (0 to n)
		GROOVE (0 to n)
		TARGETREF (0 to n)
		LOGOREF (0 to n)
		TEXT (0 to n)
		ASSEMBLY (1 to n)
		USING (1 to n)
PANELS	FIXTURES	DRAWINGS
PANEL (1 to n)	FIXTURE (1 to n)	DRAWING (1 to n)
USING (1 to n)	USING (1 to n)	SHEET (1 to n)
OUTLINE (1 to n)	OUTLINE (1 to n)	FRAME (1 to 1)
THICKNESS (0 to 1)	THICKNESS (0 to 1)	INSERTLAYER (0 to n)
HOLEREF (0 to n)	HOLEREF (0 to n)	ANNOTATION (0 to n)
CUTOUT (0 to n)	CUTOUT (0 to n)	ARTWORKREF (0 to n)
WELL (0 to n)	WELL (0 to n)	LOGOREF (0 to n)
SLOT (0 to n)	SLOT (0 to n)	TEXT (0 to n)
KEEPOUT (0 to n)	KEEPOUT (0 to n)	DWGREF (1 to 1)
GROOVE (0 to n)	PLACEMENT (1 to n)	
PLACEMENT (1 to n)		
TARGETREF (0 to n)		
LOGOREF (0 to n)		
TEXT (0 to n)		
CHANGES	Global Requirements	
RENAME (1 to n)	ATTRIBUTE (1 to 1)	
DELETE (1 to n)	MODIFIED (1 to 1)	
ADD (1 to n)	AUDIT (1 to 1)	
RENAMEPRODUCT (1 to n)		
DELETEPRODUCT (1 to n)		
ADDPRODUCT (1 to n)		

10 Posting on WWW.gencam.org

When information is posted on the WEB it shall be according to the following format. The tool provider will have an opportunity to explain on one screen page the capability of his tools or offering to the industry. The second page will show the status of his certification. If the tool supplier has not tried any of the Golden Boards he may post the "GenCAM Lite" status by providing information in accordance with Table 1 showing which characteristics of GenCAM his tool supports.

After having tried some of the Golden Boards pasting will be in accordance with Table 25. The example shows some characteristics where the applicant is only "Self Certified"; other certification categories shown indicate that they have been through the official certification process and are fully compliant. The (O) indicates the fully compliant condition.

Table 25 GenCAM posting example

Golden Bds	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	U	v
1 sided, Thru hole, no SMT																						
2 sided thru hole, Soldermask		O	O			O			O			S			S			S			S	
2 sided THT, SMT, 1Side																						
4 layer mixed, Comp. 1 side																						
4 layer B&B vias SMT 2 Sides	O	S	S			O			S			S			S			S	S	S	O	
4 layer Mix, 2S, embedded R																						
3-4layer Bds on Sub Panel																						
8 Lay HDI-type II 2[C]2, C=4																						

Appendix A

This appendix contains the names of some applications that are within one of the GenCAM certification domains. Although not intended to be a complete or stagnant list this appendix identifies those companies that might have an interest in the certification process.

Computer Aided Design Tool providers:

Mentor Graphics

PADS

Cadence

Züken-Redac

Veribest

OrCad

Accel (pcad/Tango)

Xynetics

AutoCAD

ProEngineer

IDEF

Intercept Technologies

Uniographics

Computer Aided Manufacturing Tool providers:

ACT - CAM 350

RSI - CAD/CAM

Global IGI - ParCAM

GenRAD - Producability Analyser

Orbotech -

Wise Software - GerbTools

Tibor Darvis -

Appendix B

[The TABLES in Appendix B have not been updated to match the tables in section 9]

Test Requirement Structure

The following tables identify the requirements to be demonstrated by the applicant seeking GenCAM compliancy. The tables have been organized according to the sections of the GenCAM structure and the twenty-two potential certification possibilities. The letter "x" in any of the tables signifies a mandatory requirement. In evaluating a returned "Golden Board" GenCAM file the applicants data will be analyzed for compliancy to all mandatory features.

The letter "-" in the table signifies that the indicated parameter is optional. A dash "-" indicates that the parameter is not necessary and will be ignored. A tool should use caution in using parameters that have been designated "optional" or "not required" to describe features within the GenCAM file in that CAD or CAM tools required to read the file may ignore those parameters.

HEADER Section

Table B-1 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-1 HEADER Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
HEADER	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
GENCAM (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
GENERATEDBY (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
CERTIFICATION (1 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
UNITS (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
ANGLEUNITS (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
HISTORY (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
LANGUAGE (0 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	x
BOARD (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	x
PANEL (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	x
ASSEMBLY (0 to n)	x	x	x	x	x	x	x	x	x	-	x	x	x	x	x	x	-	x	x	x	x
FIXTURE (0 to n)	x	-	-	-	x	x	x	-	x	-	-	-	x	-	-	-	-	x	-	x	x

ADMINISTRATION Section

Table B-2 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-2 ADMINISTRATION Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
ADMINISTRATION	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BOARD (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	x	x
PANEL (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	x	x
ASSEMBLY (0 to n)	x	x	x	x	x	x	x	x	x	-	x	x	x	x	x	x	-	x	x	x	x
FIXTURE (0 to n)	x	-	-	-	x	x	x	-	x	-	-	-	x	-	-	-	-	x	-	x	x
TRANSACTION (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
PERSON (1 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
SENT (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
OWNER (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
RECEIVED (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
DESIGNER (0 to 1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ENGINEER (0 to 1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUYER (0 to 1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
CUSTOMERSERVICE (0-1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ACCEPT (0 to 1)	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
BILLTO (0 to 1)	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
SCHEDULE (0 to n)	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
COMMENT (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
ENTERPRISE (0 to n)	x	-	x	-	-	x	x	x	-	-	-	-	x	-	-	-	-	-	x	x	x

PRIMITIVES Section

Table B-3 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-3 PRIMITIVES Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
PRIMITIVES	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
GROUP (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
COLOR (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
LINEDESC (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
PAINTDESC (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
BARRELDISC (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
BARREL (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
PROFILEDESC (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
CIRCLEDEF (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
RECTCENTERDEF (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
RECTCORNERDEF (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
RECTCHAMDEF (0 to n)	-	x	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
RECTROUNDEF (0 to n)	-	x	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
OVALDEF (0 to n)	-	x	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
DSHAPEDEF (0 to n)	-	-	-	-	-	-	-	-	-	x	x	x	-	-	x	-	x	x	x	-	-
DIAMONDDEF (0 to n)	-	x	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
HEXAGONDEF (0 to n)	-	x	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
OCTAGONDEF (0 to n)	-	x	-	-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
DONUTDEF (0 to n)	-	-	-	-	-	-	-	-	-	x	x	x	-	-	x	x	x	x	x	-	-
THERMALDEF (0 to n)	-	-	-	-	-	-	-	-	-	x	x	x	-	-	x	-	-	-	-	-	-
POLYLINEDEF (0 to n)	-	x	x	x	x	-	x	-	x	x	x	x	x	-	x	x	x	x	x	-	-
STARTAT (1 to 1)	-	x	x	x	x	-	x	-	x	x	x	x	x	-	x	x	x	x	x	-	-
LINETO (1 to n)	-	x	x	x	x	-	x	-	x	x	x	x	x	-	x	x	x	x	x	-	-
CIRCARTO (1 to n)	-	x	x	x	x	-	x	-	x	x	x	x	x	-	x	x	x	x	x	-	-
ELLIPARTO (1 to n)	-	x	x	x	x	-	x	-	x	x	x	x	x	-	x	x	x	x	x	-	-
POLYGONDEF (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
STARTAT (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
LINETO (1 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
CIRCARTO (1 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
ELLIPARTO (1 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
ENDLINE (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
ENDCIRCARC (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
ENDELLIPARC (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-

ARTWORKS Section

Table B-4 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-4 ARTWORKS Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
ARTWORKS	x	x	-	x	-	x	x	-	x	x	x	x	x	-	x	x	x	x	x	-	-
GROUP (0 to n)	x	x	-	x	-	x	x	-	x	x	x	x	x	-	x	x	x	x	x	-	-
FEATUREDEF (0 to n)	x	x	-	x	-	-	-	-	-	x	x	x	-	-	x	x	x	x	x	-	-
TARGETDEF (0 to n)	x	x	-	-	-	-	x	-	x	x	x	x	x	-	x	x	x	x	x	-	-
FONT (0 to n)	x	x	-	-	-	-	-	-	-	x	x	x	-	-	x	x	x	x	x	-	-
UFONT (0 to n)	x	x	-	-	-	-	-	-	-	x	x	x	-	-	x	x	x	x	x	-	-
GLYPH (1 to n)	x	x	-	-	-	-	-	-	-	x	x	x	-	-	x	x	x	x	x	-	-
LOGODEF (1 to n)	x	x	-	-	-	-	-	-	-	x	x	x	-	-	x	x	x	x	x	-	-
TEXT (1 to n)	x	x	-	-	-	-	-	-	-	x	x	x	-	-	x	x	x	x	x	-	-
ARTWORKDEF (0 to n)	x	x	-	-	-	x	x	-	x	x	x	x	x	-	x	x	x	x	x	-	-
TEXT (1 to n)	x	x	-	-	-	-	-	-	-	x	x	x	-	-	x	x	x	x	x	-	-
LOGOREF (1 to n)	x	x	-	-	-	-	-	-	-	x	x	x	-	-	x	x	x	x	x	-	-
ARTWORKREF (1 to n)	x	x	-	-	-	x	x	-	x	x	x	x	x	-	x	x	x	x	x	-	-
TARGET (0 to n)	x	x	-	-	-	-	x	-	x	x	x	x	x	-	x	x	x	x	x	-	-

LAYERS Section

Table B-5 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-5 LAYERS Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
LAYERS	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
GROUP (0 to n)	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
LAYER SINGLE (1 to n)	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
LAYERSET (1 to n)	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
LAYER (1 to n)	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
LAYERSWAP (0 to n)	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-

PADSTACKS Section

Table B-6 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-6 PADSTACKS Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
PADSTACKS	-	-	-	-	x	-	-	x	-	x	x	x	x	x	x	-	-	-	-	-	-
GROUP (0 to n)	-	-	-	-	x	-	-	x	-	x	x	x	x	x	x	-	-	-	-	-	-
HOLEDEF (0 to n)	-	-	-	-	x	-	-	x	-	x	x	x	x	x	x	-	-	-	-	-	-
PADDEF (0 to n)	-	-	-	-	x	-	-	x	-	x	x	x	x	x	x	-	-	-	-	-	-
PADSTACK (1 to n)	-	-	-	-	x	-	-	x	-	x	x	x	x	x	x	-	-	-	-	-	-
PAD (1 to n)	-	-	-	-	x	-	-	x	-	x	x	x	x	x	x	-	-	-	-	-	-
PADREF (1 to n)	-	-	-	-	x	-	-	x	-	x	x	x	x	x	x	-	-	-	-	-	-
HOLEREF (1 to n)	-	-	-	-	x	-	-	x	-	x	x	x	x	x	x	-	-	-	-	-	-

PATTERNS Section

Table B-7 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-7 PATTERNS Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	
PATTERNS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
GROUP (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
PATTERNDEF (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
PADSTACKREF (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
TARGETREF (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
FEATUREREF (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
ARTWORKREF (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
ARTWORK (0 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	-	-
TEXT (0 to n)	-	-	-	-	-	-	x	x	x	x	x	x	-	-	x	x	x	x	x	x	-	-
HOLEREF (0 to n)	-	-	-	-	-	-	x	x	x	x	x	x	-	-	x	x	x	x	x	x	-	-
SYMBOLDEF (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-
ARTWORKREF (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-
ARTWORK (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-
TEXT (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-
SYMPINDEF (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-

PACKAGES Section

Table B-8 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-8 PACKAGES Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	
PACKAGES	x	x	x	x	-	-	x	x	x	-	-	-	-	x	x	x	x	x	x	x	-	-
GROUP (0 to n)	x	x	x	x	-	-	x	x	x	-	-	-	-	x	x	x	x	x	x	x	-	-
PACKAGE (1 to n)	x	x	x	x	-	-	x	x	x	-	-	-	-	x	x	x	x	x	x	x	-	-
BODY (0 to n)	x	x	x	x	-	-	x	x	x	-	-	-	-	x	x	x	x	x	x	x	-	-
TARGETREF (0 to 1)	x	x	x	x	-	-	x	x	x	-	-	-	-	x	x	x	x	x	x	x	-	-
PIN (1 to n)	x	x	x	x	-	-	x	x	x	-	-	-	-	x	x	x	x	x	x	x	-	-
PINONE (0 to 1)	x	x	x	x	-	-	x	x	x	-	-	-	-	x	x	x	x	x	x	x	-	-

FAMILIES Section

Table B-9 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-9 FAMILIES Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	
FAMILIES	-	-	-	-	-	-	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-
GROUP (0 to n)	-	-	-	-	-	-	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-
FAMILY (1 to n)	-	-	-	-	-	-	-	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-

DEVICES Section

Table B-10 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-10 DEVICES Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
DEVICES	x	x	x	-	-	-	x	x	x	-	x	x	x	x	-	x	x	-	-	x	x
GROUP (0 to n)	x	x	x	-	-	-	x	x	x	-	x	x	x	x	-	x	x	-	-	x	x
DEVICE (1 to n)	x	x	x	-	-	-	x	x	x	-	x	x	x	x	-	x	x	-	-	x	x
PART (0 to 1)	x	x	x	-	-	-	x	x	-	-	-	-	-	-	-	x	x	-	-	x	x
ALIAS (0 to n)	x	x	x	-	-	-	x	x	-	-	-	-	-	-	-	x	x	-	-	x	x
ALTERNATE (0 to n)	x	x	x	-	-	-	x	x	-	-	-	-	-	-	-	x	x	-	-	x	x
PINDESC (0 to n)	x	x	x	-	-	-	x	x	x	-	x	x	x	x	-	x	x	-	-	-	-
VALUE (0 to n)	x	x	-	-	-	-	x	x	-	-	x	x	x	x	-	x	x	-	-	x	x

MECHANICALS Section

Table B-11 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-11 MECHANICALS Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	I	j	k	l	m	n	o	p	q	r	s	t	u
MECHANICALS	x	x	-	-	-	-	x	X	x	-	-	-	x	x	-	x	x	-	-	x	x
GROUP (0 to n)	x	x	-	-	-	-	x	X	x	-	-	-	x	x	-	x	x	-	-	x	x
MECHANICAL (1 to n)	x	x	-	-	-	-	x	X	x	-	-	-	x	x	-	x	x	-	-	x	x
PART (0 to 1)	x	x	-	-	-	-	x	X	-	-	-	-	-	-	-	x	x	-	-	x	x
ALIAS (0 to n)	x	x	-	-	-	-	x	X	-	-	-	-	-	-	-	x	x	-	-	x	x
ALTERNATE (0 to n)	x	x	-	-	-	-	x	X	-	-	-	-	-	-	-	x	x	-	-	x	x
ARTWORKREF (0 to n)	x	x	-	-	-	-	-	-	-	-	-	-	x	x	-	x	x	-	-	-	-
ARTWORK (0 to n)	x	x	-	-	-	-	-	-	-	-	-	-	x	x	-	x	x	-	-	-	-
HOLEREF (0 to n)	x	x	-	-	-	-	-	-	-	-	-	-	x	x	-	x	x	-	-	x	x

COMPONENTS Section

Table B-12 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-12 COMPONENTS Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
COMPONENTS	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x
GROUP (0 to n)	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x
COMPONENT (1 to n)	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x	-	x	x	x
DEVICEREF (0 to 1)	x	x	x	-	-	-	x	x	x	-	-	-	x	-	x	x	x	-	x	x	x
MECHANICALREF (0 - n)	x	x	-	-	-	-	x	x	x	-	-	-	x	-	x	x	-	-	x	x	x
PATTERNREF (0 to 1)	x	x	-	x	x	-	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-
ARTWORKREF (0 to n)	x	x	-	-	-	-	-	-	x	x	x	x	-	x	x	x	-	-	-	-	-
ARTWORK (0 to n)	x	x	-	-	-	-	-	-	x	x	x	x	-	x	x	x	-	-	-	-	-
TEXT (0 to n)	x	x	-	-	-	-	-	-	x	x	x	x	-	x	x	x	-	-	-	-	-
PROGRAM (0 to 1)	x	x	x	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
PREPARATION (0 to n)	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PRESENTATION (0 to 1)	x	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KEEPOUT (0 to n)	x	x	-	-	-	-	x	x	x	-	-	-	-	-	-	x	-	-	-	-	-
ONFAIL (0 to 1)	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-

ROUTES Section

Table B-13 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-13 ROUTES Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
ROUTES	x	x	-	-	x	-	-	x	x	x	x	x	x	x	x	-	-	-	-	-	-
GROUP (0 to n)	x	x	-	-	x	-	-	x	x	x	x	x	x	x	x	-	-	-	-	-	-
ROUTE (1 to n)	x	x	-	-	x	-	-	x	x	x	x	x	x	x	x	-	-	-	-	-	-
PATH (0 to n)	x	x	-	-	-	-	-	x	-	x	x	x	x	x	x	-	-	-	-	-	-
PLANE (0 to n)	x	x	-	-	-	-	-	x	-	x	x	x	x	x	x	-	-	-	-	-	-
VIA (0 to n)	x	x	-	-	x	-	-	x	x	x	x	x	x	x	x	-	-	-	-	-	-
TESTPAD (0 to n)	x	x	-	-	x	-	-	x	x	x	x	x	x	x	x	-	-	-	-	-	-
COMPPIN (0 to n)	x	x	-	-	-	-	-	x	x	x	x	x	x	x	x	-	-	-	-	-	-
CONNPIN (0 to n)	x	x	-	-	-	-	-	x	x	x	x	x	x	x	x	-	-	-	-	-	-
HIGHPOTTEST (0 to 1)	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	-	-	-	-	-	-
REFERENCE (0 to n)	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	-	-	-	-	-	-
IMPEDANCE (0 to 1)	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	-	-	-	-	-	-
INDUCTANCE (0 to 1)	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	-	-	-	-	-	-
CAPACITANCE (0 - 1)	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	-	-	-	-	-	-

POWER Section

Table B-14 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-14 POWER Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
POWER	-	-	-	-	-	-	-	x	x	-	x	x	x	x	-	-	-	-	-	-	-
GROUP (0 to n)	-	-	-	-	-	-	-	x	x	-	x	x	x	x	-	-	-	-	-	-	-
SUPPLY (1 to n)	-	-	-	-	-	-	-	x	x	-	x	x	x	x	-	-	-	-	-	-	-

TESTCONNECTS Section

Table B-15 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-15 TESTCONNECTS Requirements

Parameter Requirements	a	b	c	D	e	f	G	h	i	j	k	l	M	n	o	p	q	r	s	t	u
TESTCONNECTS	-	-	-	-	-	-	x	-	x	-	-	-	-	-	[i3]	-	-	-	-	-	-
GROUP (0 to n)	-	-	-	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-
TESTPIN (0 to n)	-	-	-	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-
LOCATION (0 to n)	-	-	-	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-
TESTPROBE (0 to n)	-	-	-	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-
VIAREF (0 to n)	-	-	-	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-
TESTPADREF (0 to n)	-	-	-	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-
COMPPINREF (0 to n)	-	-	-	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-
CONNPINREF (0 to n)	-	-	-	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-
FIXELEC (0 to n)	-	-	-	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-
TESTCONNECT (1 to n)	-	-	-	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-
TESTPINREF (0 to 2)	-	-	-	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-
FIXELECTREF (0 to 2)	-	-	-	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-
TESTPROBEREF (0 to 2)	-	-	-	-	-	-	x	-	x	-	-	-	-	-	-	-	-	-	-	-	-

BOARDS Section

Table B-16 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-16 BOARDS Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
BOARDS	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
BOARD (1 to n)	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
USING (1 to n)	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
OUTLINE (1 to n)	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
THICKNESS (0 to 1)	x	x	-	x	x	-	x	x	x	-	x	x	x	x	x	x	-	-	-	-	-
HOLEREF (0 to n)	x	x	-	-	x	-	x	-	x	x	x	x	x	-	x	x	-	-	-	-	-
CUTOUT (0 to n)	x	x	-	-	-	-	x	-	x	-	x	x	x	x	x	x	-	-	-	-	-
WELL (0 to n)	x	x	-	x	-	-	x	-	x	-	x	x	x	x	x	x	-	-	-	-	-
SLOT (0 to n)	x	x	-	-	-	-	x	-	x	-	x	x	x	x	x	x	-	-	-	-	-
KEEPOUT (0 to n)	x	x	-	x	x	-	x	x	x	-	x	x	x	x	x	x	-	-	-	-	-
GROOVE (0 to n)	x	x	-	-	-	-	-	-	-	-	x	x	-	x	x	x	-	-	-	-	-
TARGETREF (0 to n)	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
LOGOREF (0 to n)	x	x	-	-	-	-	-	-	-	x	x	x	-	-	x	x	-	-	-	-	-
TEXT (0 to n)	x	x	-	-	-	-	-	-	-	x	x	x	-	-	x	x	-	-	-	-	-
IMAGE (0 to n)	x	x	-	-	x	-	-	-	-	x	x	x	-	-	x	-	-	-	-	-	-
BAREBOARDTEST (1-1)	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-
ASSEMBLY (1 to n)	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
USING (1 to n)	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-

PANELS Section

Table B-17 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-17 PANELS Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
PANELS	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
PANEL (1 to n)	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
USING (1 to n)	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
OUTLINE (1 to n)	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
THICKNESS (0 to 1)	x	x	-	x	x	-	x	x	x	-	x	x	x	-	x	x	-	-	-	-	-
HOLEREF (0 to n)	x	x	-	-	x	-	x	-	x	x	x	x	x	-	x	x	-	-	-	-	-
CUTOUT (0 to n)	x	x	-	-	-	-	x	-	x	-	x	x	x	x	x	x	-	-	-	-	-
WELL (0 to n)	x	x	-	x	-	-	x	-	x	-	x	x	x	x	x	x	-	-	-	-	-
SLOT (0 to n)	x	x	-	-	-	-	x	-	x	-	x	x	x	x	x	x	-	-	-	-	-
KEEPOUT (0 to n)	x	x	-	x	x	-	x	-	x	-	x	x	x	x	x	x	-	-	-	-	-
GROOVE (0 to n)	x	x	-	-	-	-	-	-	-	-	x	x	-	x	x	x	-	-	-	-	-
PLACEMENT (1 to n)	x	x	-	x	x	-	x	x	x	x	x	x	x	-	x	x	-	-	-	-	-
TARGETREF (0 to n)	x	x	-	x	x	-	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-
LOGOREF (0 to n)	x	x	-	-	-	-	-	-	-	x	x	x	-	-	x	x	-	-	-	-	-
TEXT (0 to n)	x	x	-	-	-	-	-	-	-	x	x	x	-	-	x	x	-	-	-	-	-
IMAGE (0 to n)	x	x	-	-	x	-	-	-	-	x	x	x	-	-	x	-	-	-	-	-	-

FIXTURES Section

Table B-18 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-18 FIXTURES Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
FIXTURES	x	x	-	x	x	-	x	-	x	x	x	x	x	-	x	x	-	-	-	-	-
FIXTURE (1 to n)	x	x	-	x	x	-	x	-	x	x	x	x	x	-	x	x	-	-	-	-	-
USING (1 to n)	x	x	-	x	x	-	x	-	x	x	x	x	x	-	x	x	-	-	-	-	-
OUTLINE (1 to n)	x	x	-	x	x	-	x	-	x	x	x	x	x	-	x	x	-	-	-	-	-
THICKNESS (0 to 1)	x	x	-	x	x	-	x	-	x	x	x	x	x	-	x	x	-	-	-	-	-
HOLEREF (0 to n)	x	x	-	x	x	-	x	-	x	x	x	x	x	-	x	x	-	-	-	-	-
CUTOUT (0 to n)	x	-	-	-	-	-	x	-	x	-	-	-	x	-	x	x	-	-	-	-	-
WELL (0 to n)	x	-	-	-	-	-	x	-	x	-	-	-	x	-	x	x	-	-	-	-	-
SLOT (0 to n)	x	-	-	-	-	-	x	-	x	-	-	-	x	-	x	x	-	-	-	-	-
KEEPOUT (0 to n)	x	x	-	x	x	-	x	-	x	x	x	x	x	-	x	x	-	-	-	-	-
PLACEMENT (1 to n)	x	x	-	x	x	-	x	-	x	x	x	x	x	-	x	x	-	-	-	-	-

DRAWINGS Section

Table B-19 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-19 DRAWINGS Requirements

Parameter Requirements	a	b	c	d	E	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
DRAWINGS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	x	-	-
DRAWING (1 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	x	-	-
SHEET (1 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	x	-	-
FRAME (1 to 1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	x	-	-
INSERTLAYER (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	x	-	-
SYMBOLREF (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-
SYMPINREF (1 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-
TEXT (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-
NET (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-
TEXT (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-
ANNOTATION (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	x	-	-
ARTWORKREF (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	x	-	-
LOGOREF (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	x	-	-
TEXT (0 to n)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	x	-	-
DWGREF (1 to 1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x	x	-	-

CHANGES Section

Table B-20 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-20 CHANGES Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
CHANGES	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
RENAME (1 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
DELETE (1 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
ADD (1 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
RENAMEPRODUCT (1 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
DELETEPRODUCT (1 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
ADDPRODUCT (1 to n)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Global Requirements

Table B-21 provides the detail requirements related to the parameter availability for each of the potential twenty-two certification category capabilities.

Table B-21 Global Requirements

Parameter Requirements	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
ATTRIBUTE (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
MODIFIED (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
AUDIT (1 to 1)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

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