DEPARTMENT OF DEFENSE
STANDARDIZATION PROGRAM REPORT

FEDERAL SUPPLY CLASSES
5905, 5910, 5915, AND 5950

RESISTORS, CAPACITORS,
ELECTRICAL FILTERS AND NETWORKS,
COILS AND TRANSFORMERS

FISCAL YEARS: 1999-2001

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LEAD STANDARDIZATION ACTIVITY: DLA-CC

FSCs 5905, 5910, 5915 and 5950 PROGRAM REPORT

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AUTHENTICATION PAGE

The Federal Supply Class (FSC) 5905, 5910, 5915, and 5950 Standardization Program Report is approved for implementation at all levels within the Department of Defense (DoD). A primary goal of this Report is to establish overall DoD objectives in these FSCs and provide a management tool for decision making at all levels within the DoD.

Responsibility and authority for the development and coordination of this Report are assigned to the Defense Logistics Agency (DLA) as the Lead Standardization Activity (LSA). This activity is responsible for implementation and continued management of FSCs 5905, 5910, 5915, and 5950. It is the responsibility of each identified DoD activity to support the implementation of this Report and provide the resources to complete these standardization actions under the auspices of the Defense Standardization Program (DSP).

JUL 31 2000
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/ Signed /
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I. SCOPE AND EXECUTIVE SUMMARY.

A. *Scope.*

This document presents the coordinated DoD Standardization Program Report for four of the passive electronic device groups or FSCs. The FSCs represent the following:

1) FSC 5905 covers various types of resistors, including fixed and variable along with thermistors, varistors, and rheostats. Resistor networks and resistor mounting hardware are also in FSC 5905. Resistance wire is not included.

2) FSC 5910 covers various types of capacitors, which includes fixed, variable, and feed-through. Capacitor networks, trimmers, and capacitor mounting hardware are also in FSC 5910. Semi-conductive devices and associated hardware are not included.

3) FSC 5915 covers various types of electrical filters. These types include Electromagnetic Interference (EMI), Radio Frequency Interference (RFI), electromagnetic pulse, microwave, crystal, and active, along with networks. Networks consist of a combination of resistors, capacitors and/or inductors; but not resistors, capacitors, or inductors only. Hereafter in this Program Report, these devices will be referred to as Filters.

4) FSC 5950 covers coils and transformers. Coils can be fixed, variable, degaussing, power, or Radio Frequency (RF), along with leaded ferrite beads. Transformer types include fixed, variable, single and multi-phase, audio, isolation, power, high power, and pulse.

In support of Acquisition Reform, this Program Report has been extensively revised to reflect the current protocol or standardization direction for component level documentation. It will serve as a source of information for ongoing and planned standardization activities and provide contact points within DoD and Industry for standardization issues. Document statistics, including the types of existing procurement tools used by the military services, will be highlighted along with a general discussion on Challenges and Opportunities within the subject FSCs.

B. *Executive Summary.*

Since Acquisition Reform became the way of doing business for the DoD in 1994, the DSP has changed dramatically. The goal of focusing on all levels and types of procurement documents is now the mindset of every standardization activity. No longer are detailed “how-to” requirements an acceptable approach for documenting components. Stating requirements in “performance terms” has always been the preferred method but, unfortunately, was not the norm. However, after the report entitled “Blue Print for Change, Report of the DoD Process Action Team on Specifications and Standards” was published in April 1994, the world of standardization has found that the new way of doing business.

This Program Report will highlight the types of documents used to procure passive electronic components, the impact those documents have in terms of National Stock Numbers (NSNs), and some of the challenges and opportunities the services will be faced with in the near future.

Commercial type items are making their way into military systems, and configuration control is still needed for these devices. This is where the efforts on Commercial Item Descriptions (CIDs) and the partnering with Non-Government Standards (NGS) bodies will play a vital role. Performance specifications will continue to drive the military specification system with detail documents being utilized where specific requirements are required to ensure an item will function as intended.

Major Challenges and Opportunities.

Major challenges and opportunities face the DoD in the near future. It is our obligation to the men and women in the field to maintain quality and reliable components to support our military systems. This Report is not intended as an all inclusive approach on the four commodity areas addressed, but it will serve as a guideline for future actions and current accomplishments to assist in achieving that obligation to our fighting forces.

Major Accomplishments.

The DSP has been at the forefront of Acquisition Reform. The Preparing Activities (PAs) have worked diligently to achieve the Acquisition Reform Goals through the transition of military specifications to performance specifications, CIDs and NGSs. They have also reviewed the existing military specifications and canceled or inactivated obsolete documents. Their efforts to state requirements in terms of performance and embrace "Best Commercial Practices" will enable DLA to pass costs savings to DoD customers and improve the way standard parts are procured. Products acquired using standardization documents with Qualified Products Lists/Qualified Manufacturers Lists (QPLs/QMLs) have proven to be prime candidates for many of the new ICP business practices, including long term contracting and eliminating origin inspection. Standardization documents, coupled with QPLs/QMLs, always result in superior performance, quality, and reliability while improving logistics support timeliness, availability, and reduced backorders. The Parts Support Management Team is working with the Parts Standardization and Management Committee to develop a new handbook on the application of Parts Management and a new Standardization Directory (SD-7) addressing contractor implementation of Parts Management.

In answer to Acquisition Reform, 58 percent of the documents contained in these four FSCs have been converted into Performance Specifications, 34 percent remain Detail Specifications, 6.5 percent are CIDs, 1.5 percent are NGSs.

DoD DOCUMENTS					
FSC	**Percent Performance Specifications**	**Percent Detail Specifications**	**Percent Standards Handbooks**	**Percent CIDs**	**Percent NGSs Adopted**
5905	**66.2**	**21.7**	**0.4**	**11.4**	**0.4**
5910	**55.6**	**41.1**	**0.6**	**1.5**	**1.2**
5915	**60.0**	**26.3**	**0.0**	**11.3**	**2.5**
5950	**50.0**	**46.4**	**0.3**	**2.1**	**1.2**

II. LOGISTICS IMPACT

The DSP provides benefits to both the Inventory Control Point (ICP) and DoD customers. Use of standard parts minimizes acquisition and life cycle costs, while providing parts of known high quality and reliability for critical weapons systems. Cost avoidance is achieved for DoD customers by reducing the proliferation of nonstandard parts in systems. ICP benefits include sales of standard parts as spares to DoD customers, reduced Administrative Lead-time (ALT) and/or Production Lead-time (PLT) for specifications with Qualified Products List (QPL) or Qualified Manufacturers List (QML) sources, as well as minimizing the proliferation of nonstandard parts in the DSCC inventory system.

The data in the following table reports NSN information. It is grouped by FSC and categorized by manager and the type of procurement documentation.

NATIONAL STOCK NUMBERS				
FSC	**5905**	**5910**	**5915**	**5950**
Total NSN Count	**243,239**	**127,029**	**31,670**	**120,743**
DSCC Managed	**184,845**	**93,611**	**24,178**	**100,277**
Non-DSCC Managed	**58,394**	**33,418**	**7,492**	**20,466**
Military Specifications	**84,872**	**23,640**	**460**	**2,427**
Commercial Item Descriptions	**3**	**0**	**1**	**3**
DSCC Drawings	**106**	**164**	**22**	**35**
Total Military	**84,981**	**23,804**	**483**	**2,465**
Total Non-Military	**158,258**	**103,225**	**31,187**	**118,278**

Standardization documents have substantial impact on the DSCC ICP business in particular. Since the majority of these standardization documents are “procurement documents," there are specific NSNs in the inventory system assigned to these standard parts. These standard parts generate sales for the ICP. Due to the nature of these standard parts, it is usually far easier to manage, buy, and minimize technical problems in the ICP business.

III. DOCUMENT STATISTICS

The following table lists the different types of DoD documents and the number of each type in the respective FSCs. Performance Specifications, Detail Specification, and CIDs may have a main body specification (Basic) and ancillary specifications (Specification Sheets denoted here as S/S). There are currently four types of Military Standards, Interface, Test Method, Manufacturing Process, and Standard Practice. Handbooks are used to provide guidance and do not contain mandatory requirements. Column six contains the total of all these types in each FSC. The types of DoD documents will be elaborated on later in this Program Report.

DoD DOCUMENTS									
FSC	Performance Specifications		Detail Specifications		Standards and Handbooks	CIDs		DSCC Drawings	NGSs Adopted
	Basic	S/S	Basic	S/S		Basic	S/S		
5905	28	158	7	54	1	11	21	116	1
5910	22	166	13	126	2	4	1	54	4
5915	2	46	9	12	0	9	0	19	2
5950	5	164	12	145	1	6	1	13	4
Total	57	534	41	337	4	30	23	202	11

The next table reports the number of new DoD documents that were developed and the number of NGSs adopted in each of the respective FSCs. These projects have been accomplished by the Preparing Activity or by their Standardization Agent.

NEW DOCUMENTS IN FY 99							
FSC	Performance Specifications		Standards Handbooks	CIDs		DSCC Drawings	NGSs Adopted
	Basic	S/S		Basic	S/S		
5905	0	2	1	0	1	4	0
5910	0	1	1	0	0	2	0
5915	0	0	0	0	1	3	0
5950	0	0	0	0	0	2	0
Total	0	3	2	0	2	11	0

The following table lists the number and type of Standardization Project completed in FY 1999 for each FSC.

DoD STANDARDIZATION PROJECTS FY 99					
FSC	**New**	**Revisions**	**Amendments**	**Change Notices**	**Cancellations**
5905	**2**	**46**	**11**	**0**	**1**
5910	**6**	**39**	**8**	**0**	**39**
5915	**0**	**0**	**0**	**0**	**3**
5950	**0**	**0**	**1**	**0**	**9**
Total	**8**	**85**	**20**	**0**	**52**

This table reports the number of QPL documents in each respective FSC. It also shows a small part of the required workload insofar as the generation of new or additional sources and the number of quality audits that were performed in FY 1999.

QPL INFORMATION				
FSC	**QPLs**	**Zero Source Basics**	**Single Source Basics 1/**	**Audits**
5905	**34**	**0**	**11**	**8**
5910	**31**	**0**	**8**	**8**
5915	**2**	**0**	**0**	**2**
5950	**5**	**0**	**0**	**4**
Total	**72**	**0**	**19**	**22**

1/ All the single source QPLs have been justified. Most are older technology and used to procure parts in support of our older military systems. The others are either new products that have yet to have additional sources qualified or the result of the many company mergers common in industry today.

IV. STANDARDIZATION PROGRAM DIRECTION

A. *Acquisition Reform.*

For many years, the DSP has supported the military services by writing and coordinating military specifications and standards for use in the acquisition of electrical, electrical-mechanical and electronic components. The military service standardization offices have been downsized over the years and the Preparing Activity (PA) responsibilities for many of the military specifications and standards have been transferred to DSCC. This new direction has drastically changed the workload for the PAs. Significant actions were undertaken to review and convert the majority of electronic components military specifications to the new "Performance Specification" category. As part of this effort, these specifications were streamlined to reduce cost, testing and administrative oversight while not compromising the quality and reliability of the parts. As part of this new effort, military specifications that are no longer needed were cancelled or converted to CIDs or NGSs. Also, there is greater effort to cover existing commercial products under an expanded CID program. Similarly, our efforts with NGS bodies will continue; however, the major payoff here has been methodology type documents (for example, solderability, Statistical Process Controls (SPC) and Parts Per Million (PPM)) versus actual product procurement specifications. Military standards were reviewed for cancellation or conversion to handbooks or guidelines. Currently, there are a limited number of NGSs available for the government to adopt.

B. *Non-Government Standards (NGSs).*

There are numerous industry organizations that are partnering with DoD on all aspects of the documentation process. Through the NGS organizations, DoD is tapping into the commercial aspects of the subject commodities as well as receive feedback on the military unique items that are required to support the military services. One of the primary industry organizations is the EIA. This and other committees include the following:

- EIA Committee on soldering technology
- EIA P-1 on resistors
- Various EIA P-2 committees on different capacitor types
- EIA P-3 on inductors
- EIA P-9 on electronic test methods
- EIA P-10 on integrated passive components
- EIA G-11, the government/industry liaison committee on component parts
- ECA Groups – Electronic Components, Assemblies, Equipment and Supplies Association

C. *Commercial Item Descriptions (CIDs).*

CIDs are one type of federal specification used to describe commercial items that the Government procures for non-critical applications. CIDs are not to be used to modify or upgrade "standard commercial items" for critical military applications. CIDs are used to describe a commercially available item of supply and to freeze the configuration for that particular CID revision. The manufacturers may vary their design, but the CID number and revision letter will require the components to meet the performance parameters in effect at the time of the CID. CIDs have unique

specification numbers and part numbers; however, the items are generally marked with manufacturer's part numbers. CIDs have no qualification requirements and, therefore, items may be procured from any supplier that will meet the specified requirements.

Several new CIDs have been or are currently being written by DSCC. A-A-59496 covers commercial grade, rectangular plastic cased, surface mount variable resistors. These resistors should be used in non-critical applications only. A-A-59497/1 covers commercial grade, rounded plastic cased, through hole printed circuit board mount resistors. Again, these resistors should be used in non-critical applications. A-A-59497/2 covers precision linear motion sensors. A-A-55089 covers a series of small, low voltage, ceramic dielectric, chip capacitors. These capacitors have a large capacitance to volume (CV) ratio. It may be a challenge to coordinate these new ceramic chip capacitors among the capacitor manufacturers because we are pushing the state-of-the art in this type of dielectric formulation and production. The current active projects are as follows:

CID NUMBER	PROJECT NUMBER	TITLE
A-A-55089/1	5910-1996-01	Capacitor, Fixed, Ceramic Dielectric
A-A-55089/2	5910-1996-02	Capacitor, Fixed, Ceramic Dielectric
A-A-55089/3	5910-1996-03	Capacitor, Fixed, Ceramic Dielectric
A-A-55089/4	5910-1996-04	Capacitor, Fixed, Ceramic Dielectric
A-A-55089/5	5910-1996-05	Capacitor, Fixed, Ceramic Dielectric
A-A-55089/6	5910-1996-06	Capacitor, Fixed, Ceramic Dielectric
A-A-55089/7	5910-1996-07	Capacitor, Fixed, Ceramic Dielectric
A-A-55089/8	5910-1996-08	Capacitor, Fixed, Ceramic Dielectric
A-A-55089/9	5910-1996-09	Capacitor, Fixed, Ceramic Dielectric

D. Performance Specifications.

A performance specification is a document that specifies general requirements, such as physical dimensions, temperature characteristics, or interface requirements, not how an item is to be fabricated. It is preferred that items be described in terms of performance to allow the supplier maximum flexibility. At the present time, 58 percent of the documents in these four FSCs are performance documents.

There were two new performance specification sheets written in FY 99. These sheets cover small, fixed film chip resistors.

MIL-PRF-55342/11	5905-1575	Resistor, Fxd, Film, Chip, ER & Non-ER, 0402
MIL-PRF-55342/12	5905-1576	Resistor, Fxd, Film, Chip, ER & Non-ER, 0603

E. Detail Specifications.

A detail specification is a document that specifies design requirements, such as materials to be used, how a requirement is to be achieved, or how an item is to be fabricated. It is preferred that items be described in terms of performance; however, some items are inherently military unique and

critical to weapon system operations. These items will continue to be described by detail specifications. In the four FSCs covered by this Program Report, detail specifications range from 22 to 46 percent or an average of 34 percent.

F. Qualification Systems for Passive Components (QPL and QML).

There are two approved qualification systems in Defense Standardization Manual 4120.24-M for military standardization documents, Qualified Products Lists (QPLs) and Qualified Manufacturers Lists (QMLs). Traditionally, QPLs have been used for standard type parts while QMLs are applied to complex or custom type products where manufacturing processes were qualified (e.g., complex microcircuits).

For passive type components covered by this Program Report, a mix of these qualification systems will be applied in the future. For conventional type specifications, covering standard type parts that rely almost exclusively on testing of the product, the traditional type QPL system will continue to be used. For established reliability and high reliability type specifications covering standard type parts that invoke the revised MIL-STD-790F "Standard Practices for Established Reliability and High Reliability Qualified Products List (QPL) Systems for Electrical, Electronic and Fiber Optic Parts Specification," a QPL system with some of the QML type concepts will be applied (e.g., use of a Technology Review Board (TRB) to administer the QPL system). These flexible based QPL type specifications, although still focusing on qualifying large generic families of standard parts/products, will allow more flexibility for the best manufacturers to administer the QPL system. This flexibility also allows the qualifying activity to be less prescriptive in how a manufacturer meets the quality system elements of MIL-STD-790. Instead, evaluation and approval of the manufacturer's existing system are encouraged, allowing a single quality system to be used for both commercial and military needs to the greatest extent possible. QML type concepts will be applied where there are complex type designs or where more custom type parts are the norm, e.g., MIL-PRF-31033, a new specification covering discodial ceramic capacitors. Another general area for application of QML type concepts is on magnetics where qualification of manufacturing processes and design rules would be appropriate and standard parts and products are not the norm.

V. CHALLENGES / OPPORTUNITIES

Surface Mount Technology.

The EIA and the IPC associations have a joint surface mount council to coordinate the publication of standards and provide guidance to government activities. The Military Advisory Panel, which exists in association with the joint council, deals with such issues as body and contact materials, pad size, lead configuration, retention methods, and assembly and test methods. Two solder processes are being evaluated, vapor phase and infrared.

Documentation activities in this area include the completion of two new specification sheets under MIL-PRF-55342 covering fixed film resistor chips and the dating of two CIDs under A-A-59496 covering non-wire wound trimmer resistors. The majority of future surface mount documentation will focus on smaller devices as well as commercial items. To date, the resistor area has documents on devices as small as 0603 and 0402. A possible future specification will be to cover an 0102 size resistor device. The capacitor area currently has a published document (MIL-PRF-55681) covering an 0805 size capacitor with drafts circulating on 0504 and 0603 size capacitors.

Lead-free Solders.

Definite trends are underway in Japan and Europe to go "lead-free" during the manufacture of electronic components as well as Printed Wiring Board (PWB) assemblies. In the case of both areas, the focus is on consumer and industrial electronics. In Europe, there is the Waste from Electrical and Electronic Equipment (WEEE) proposed directive; however, it was noted that aerospace, defense, and automotive electronics will have an exception to use lead-based solders. In Japan, the push is more of a marketing effort to tout consumer electronics as "green" and "earth friendly." All major consumer electronic companies have road maps to move to lead-free soldering systems. There is no directive similar to WEEE forcing this; however, a collaborative effort between Government and industry is the way to go.

NEMI has developed a road map (a subset of which is moving to lead-free soldering) that is apparently the most well known national effort. The automotive sector seems to be a primary area of attention, with tin-silver (SnAg) solders under consideration. The remaining U.S. effort is somewhat fragmented. NEMI has surveys out to the various trade organizations and requested information on company plans to move to lead-free soldering systems. The NEMI goal is for North America to be able to go lead-free on solders by 2001 and to have recommended alloys and supporting performance data for North American companies. IPC is currently developing a roadmap to lead-free soldering.

For the component level, only a handful of alloys all based on tin, are getting consideration. Unfortunately, none seem to be the "drop-in replacement" for tin-lead (SnPb) that everyone is seeking (i.e., the silver bullet). Since many of these solders will require higher processing temperatures, the ability of the components to withstand new thermal profiles becomes a major question. Pure tin has not been considered due to the well-documented "tin whisker" problem. Promising alloys are tin-silver-copper (SnAgCu), tin-silver (SnAg), and tin-copper (SnCu).

There is some discussion on doping these alloys with bismuth (Bi), which lowers the reflow

temperature. Some Japanese manufacturers are pursuing this option; however, bismuth presents other problems such as material availability, fillet strength and lifting, and rework that raises questions about its long-term use.

There does not appear to be any imminent push to go lead-free for military electronics. One would expect that, as the commercial marketplace moves to lead-free, there will be military customers and military component suppliers that will want to provide lead-free components for military applications.

The move to lead-free soldering is expected to offer some challenges to the military electronics market including:

(1) The reliability of lead-free soldering in military type applications.
(2) Availability of lead-free solders for military grade components.
(3) Impact of drop-in replacement component leads that are lead-free on spares in military equipment.

The following areas should be pursued in the DoD role of component standardization:

(1) Monitor the development and availability of lead-free component lead finishes.
(2) Plan for the introduction of new lead-free component lead finishes and associated testing.
(3) Survey existing component specifications to determine the following:
    (a) Coding in part numbers to facilitate lead-free options for component lead finishes.
    (b) Survey major military component manufacturers and users for the need and plans to introduce new lead-free options and testing.
    (c) Look at lead finish standards (MIL-STD-1276, etc.) and test method standards (e.g., MIL-STD-202/750/883) for needed changes to solderability and resistance to soldering heat.
    (d) Compare various industry road maps (e.g., NEMI, IPC).
    (e) Look at J-STD-006 for available industry standards.
(4) Contact the military services to determine trends.

Integrated Passive Components.

Integrated passive components contain a combination of two or more passive parts in a single device package. There are currently three documents covering integrated passive components. Two DSCC drawings, 89004 and 89023, covering 16-pin resistor/capacitor devices and CID A-A-55088, have been developed on a resistor/fuse device. These devices appear to have potential for standardization documentation.

Smaller Chip Sizes.

This area has been very challenging for documenting capacitors. Drafts of new specification sheets were prepared with very little interest from suppliers. The market may still be too small for the suppliers to justify the costs of qualification. Drafts of several CIDs were also prepared and the response on these was limited. The suppliers appear to see no advantage in using CIDs and are hesitating to make parts to the CID requirements. Efforts will continue in FY 2000 to attempt to offer smaller size chip capacitors for military users and to explore CIDs where applicable.

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