

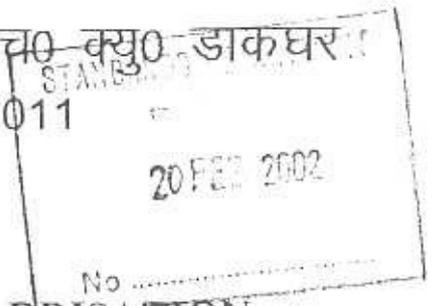
रक्षा मंत्रालय
MINISTRY OF DEFENCE

सयुक्त सेवा गाईड
JOINT SERVICES GUIDE

ON

INTERACTIVE ELECTRONIC TECHNICAL MANUAL (IETM)

मानकीकरण निदेशालय
रक्षा उत्पादन तथा पूर्ति विभाग
रक्षा मंत्रालय, एच-ब्लॉक, डी० एच० क्यू० डाकघर
नई दिल्ली - 110 011



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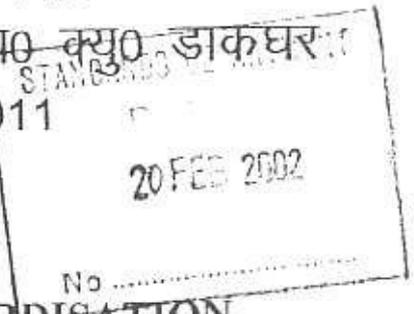
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Amendment		Amendment pertains to: Sl.No. /Para No. / Column No.	Authority	Amended by	Signature & Date
No	Date			Name & Appointment (IN BLOCK LETTERS)	

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0. FOREWORD

0.1 This Joint Services Guide has been prepared by the IT Standardisation Sub Committee on the authority of the Standardisation Committee, Ministry of Defence.

0.2 This guide has been approved by the Ministry of Defence for use by the Defence Services, Defence PSUs and R&D Organizations.

0.3 This guide would be used for the development of Quality Assurance and procurement of the Interactive Electronic Technical Manuals (IETM).

0.4 Guidelines given in the following paragraphs will enable the user in choosing the class of IETM, formulation of specification for IETM, formulation of specification for IETM Data base, formulations of specification for quality assurance besides guidelines for Version Control.

0.5 An attempt has also been made to provide various technical inputs like the:-

- (a) Meaning of IETM,
- (b) Advantages
- (c) Relevance to Maintenance Management
- (d) The approach on using Standard Generalised Markup Language (SGML), Hyper Text Markup Language (HTML) and Extensive Markup Language (XML)
- (e) Main Characteristics of IETM – Display, Functionality, Data Format
- (f) Classification of IETM and Levels of Information in an IETM

0.6 All enquiries related to this document shall be referred to:

The Director,
Directorate of Standardisation,
Ministry of Defence,
'H' Block, DHQ PO,
New Delhi – 110 011

0.7 Copies of this guide can be obtained on payment from:

The Director,
Directorate of Standardisation,
Ministry of Defence,
'H' Block, DHQ PO,
New Delhi – 110 011

1. SCOPE

1.1 This document contains information on the features of IETM, their advantages and classifications. The Standard Generalised Markup Language (SGML) or the Extensible Markup Language (XML) used in creation of IETM is explained. This guideline is based on the basis of the specifications on IETM of Indian Navy and updated with the latest available on SGML, HTML and XML. The referred Naval document was MIL-M-87268, MIL-D-87269 and MIL-Q-87270. This document also includes the following:

- (a) Guidelines to evolve Specification for generation of IETM.
- (b) Guidelines to evolve Specification for generation of IETM Data base.
- (c) Guidelines for formulation of Specification for quality assurance of IETM.

1.2 These guidelines for IETM, though essentially cover maintenance roles, are also applicable to other roles such as operations and planning.

2. RELATED SPECIFICATIONS/DOCUMENTS

EED-P-23	- Indian Naval Specification on IETM
ISO 8879: 1986	- Specification for Standard Generalised Markup Language (SGML) for text and office systems
MIL-D-87269	- Data base Revisable: IETM, for support of
MIL-M-87268	- Manuals, Interactive Electronic Technical: General Style, Format and User Interaction, Requirements
MIL-Q-87270	- Military Specification QA Program: IETM & associated Technical Information. Requirements for
MIL-R-28001	- Data Format: BitMap (raster); Indexing and Headers (Navy MIL-STD-29532)

Web Site - <http://www.oasis-open.org/cover/topics.html> - SGML/XML Specialization
By: Robin Cover

(Last modified: February 23, 2001);

<http://www.google.com> - Search for Study Material on SGML and XML

2.1 Copies of the ISO and MIL specifications are obtainable on payment from: -

Book Supply Bureau,
A-68, South Extension (Part I),
New Delhi - 110 049

2.1 Copies of the Indian Naval specification may be obtained from the Director,
Directorate of Information Technology, Naval Headquarters, Sena Bhavan, DHQ PO,
New Delhi - 110 011

3. ABBREVIATIONS USED

ASCII	- American Standard Code for Information Interchange
BMP	- Bitmap formats (for WINDOWS)
CALS	- Computer Aided Acquisition and Logistic Support
CDM	- Content Data Model
COTS	- Commercially off the Shelf (solutions/hardware/software)
DBMS	- Data base Management System
DOD	- Department of Defence (of United States of America)
DTD	- Document Type Definition
EDD	- Electronic Display Device
GUI	- Graphic User Interface
HTML	- Hyper Text Markup Language
HyTime	- Time based structuring Language
IETM	- Interactive Electronic Technical Manual
IETMDB	- Interactive Electronic Technical Manual Data base
MMS	- Maintenance Management System
MTBF	- Mean Time Between Failures
PEDD	- Portable Electronic Display Device
QA	- Quality Assurance
QAP	- Quality Assurance Program
QAPI	- Quality Assurance Process Inspections
QAPP	- Quality Assurance Program Plan
TI	- Technical Information
XML	- Extensible Markup Language

4. PRESENT DOCUMENTATION SYSTEM

4.1 The present documentation methodology is predominantly based on paper documentation. With the increased complexity of systems, this method consumes enormous amount of paper, which is cumbersome to handle, relatively non-portable, difficult to refer and comprehend and tends to deteriorate easily with frequent use, especially, when used by multiple users.

4.2 This limitation can be overcome by the adoption of Electronically generated technical manuals, commonly known as "Interactive Electronic Technical Manuals" or, in short, IETM.

5. GENERAL FEATURES OF IETM

5.1 **Meaning of IETM:** An Electronic technical manual is not merely a document typed on a word processor and presented on a floppy disk. IETM have been defined by the US DOD as a technical manual prepared in a digital form on a suitable medium, designed for Electronic window display to the user and possessing the following characteristics:

- (a) The format and style of the presented information are optimised for window presentation to assure maximum comprehension, i.e. the presentation format is "Frame-Oriented" and not "Page-Oriented". An IETM can be presented either on a "Desk Top Work Station" or a "Portable Electronic Display Device" (PEDD).
- (b) The elements of technical data constituting the IETM are so interrelated that user's access to the information he requires is facilitated to the greatest extent possible and is achievable by a variety of paths.
- (c) The computer controlled IETM display device can function interactively (as result of user's request and information input) in providing procedural guidance in carrying out logistic support functions supplemental to maintenance.

5.2 **Advantages of IETM:** IETM allow the user to locate required information faster and more easily than is possible with a paper manual. IETM, when designed to clearly defined standard, are easier to comprehend and more specifically matched to the system configuration under diagnosis. Powerful interactive troubleshooting procedures, not possible with paper technical manuals, can be made available using the intelligent features of IETM display device.

5.2.1 It becomes feasible, using IETM, to expand the Electronic classroom technology and introduce the concept of the virtual classroom using remote Video Tele training. These virtual classrooms would use IETM, which would be linked together with a single large Data base augmented with modules of video, sound, animation and interactive courseware.

5.3 Standard Generalised Markup Language (SGML) and Hyper Text Markup Language (HTML)

5.3.1 An SGML document is an information container and not a screen or hard copy output. A document may be thought to consist of three layers, the Structure, Content and Style. SGML separates these three layers and provides ways to directly define the relationship between structure and content. Firstly, there must be declaration - a text file that contains system specific information such as character sets. Secondly, there must be a declaration of the document type and incorporation of the "Document Type Definition" (DTD) that are to be used. The DTD is a set of rules stated in SGML to define the structure of a document and a list of all the permissible elements and entities that can be included in the document. Elements and entities are the units of digital information that are to be included in the document. Thirdly, the document instance consists of the actual text with markups called "SGML Tags", that are defined in the DTD. The document instance is, therefore, directly related to the DTD. There are no text objects in the instance file. All graphics, for example, are extended to the instance and referred to as external entities.

5.3.2 The SGML tags, defined in the DTD and incorporated in the document instance to define the relationship between the structure and content, are the equivalent of pencilled markups that are often used on the printed pages when we want to identify the characteristics of the document such as bolding, position on the page, heading and paragraph types.

However, the SGML markups do much more. When a tag is used to identify a document element such as a unit of text information, it can also have attributes that add intelligence to the document, improve navigation and trigger actions to be taken automatically. This increases the user productivity by decreasing time to access information and providing a smart interface between the user and the document.

5.3.3 SGML fulfils a goal to produce a single set of rules for describing the structure and managing the contents of a digital document. It is an open standard and a shared technology; so it is not owned by anybody and is available to all. It is also free from hardware and software technology.

5.3.4 The SGML rules, in the form of a meta-language, provide a way to extend SGML features and we can expect it to evolve with experience. The Hyper Text Markup Language (HTML), used to define material on the World Wide Web, is an example of how experience will change SGML. HTML has gone through several versions, some of which bend current SGML rules that have been enhanced, to meet project needs. Eventually SGML may be extended to officially meet www type documents.

5.4 Extensive Markup Language (XML): XML has emerged as a draft standard for web application of SGML. XML aims to bridge the gap between SGML and HTML. It is a modernised remake of SGML that removes some of the complex and less-used features of SGML. XML is a simpler form of SGML without the restrictions of DTD. XML also makes it easier to produce documents for many different media such as paper, online and www from a single source. The goal of XML is to enable generic SGML to be served, received and processed on the web by construction of XML documents for SGML documents.

6. CLASSES OF IETM

6.1 The available IETM classes, worldwide, are as under:

- (a) Class 1 : Electronically indexed pages.
- (b) Class 2 : Electronically scrolling Documents
- (c) Class 3 : Linearly structured IETM
- (d) Class 4 : Hierarchically structured IETM
- (e) Class 5 : Integrated Data base.

6.2 Broad features of the above classes of IETM are shown at Appendix 'A'.

6.3 Characteristics of IETM: There are three categories of characteristics used to define IETM – Display, Functionality and Data Format, described as under:

6.3.1 **Display:** The display characteristics cover the presentation of the information to the user, the type of display used and the features provided on the display. The display may be a normal 14" monitor or a lap top LCD display. The information needs to be displayed in the user-friendly way. The display may be customized for full page viewing, scrolling window and page-turner. The hot spot access (Hyper links) to other text or graphics should be provided on the display. The user interaction with dialogue boxes is imperative. The text and graphics should be displayed simultaneously and also through separate windows.

6.3.2 **Functionality:** Functionality is how the end user will access, navigate and interact with the IETM online. For example, we can see increasingly greater use of Hyper Text and hypermedia from Class 1 through to Class 3 (see Appendix - A), and the addition of dialogue driven interactions beginning in Class 3 IETM. Another aspect of functionality is how much intelligence and expertise the system will have that aids the performance of the user. For example, Classes 3-5 IETM provide logical "Next" and "Back" functions for navigation and class 5 is partly defined by an expert system that can aid in implementing next navigation by taking into account the session data such as troubleshooting results. These functionality characteristics potentially have profound impacts on job definition and training requirements because they may very well have major impacts on what the technician has to know and be able to do.

6.3.3 **Data Format:** The data format category of IETM characteristics is of interest not only for defining classes but also for its training development implications. A review across the 5 Classes along this dimension reveals that the Data bases change in various ways, becoming increasingly more useful and integrated for functionality. By virtue of starting out as a legacy hard copy manual, Class 1 IETM is a raster scanned, page turning, Electronic technical manual with only an intelligent index for additional user access. It has only a bitmap Data base with indexing and header file data. Beginning with Class 2 IETM, the text data is all digital with increasingly more useful and effective data structures, use of

SGML/XML tagging to hierarchically structure the text data and associate it to other media and integration with other application data, both at the Data base and the user level.

6.4 **Use of IETM in Maintenance Management System:** The IETM concept can include a Maintenance Management System (MMS) model for continuous improvement of maintenance and spare parts stock, which can facilitate the continuous improvement process by introducing decision support feature. The MMS can generate spares demands continuously, monitor the actual maintenance history and spare parts consumption, indicate pattern and flag deviations from a plan. The MMS itself will direct the user's focus towards the non-conformities and guide them through the decision process.

7. IETM CLASS FOR DEFENCE SERVICES

7.1 The "Linearly Structured" IETM Class 3 (refer Appendix 'A'), is to be followed for use in the Defence Services. The salient features of this class are as under:

(a) Display

- (i) Primary view is scrolling text window interaction through dialogue boxes with user prompts.
- (ii) User selection and navigational aids (Key-word search, on-line indices)
- (iii) Text and graphics displayed simultaneously in separate window when keyed together.

(b) Data Format

Linear ASCII with SGML/XML (or higher version) tags, SGML / XML with content wise format tags.

(c) Outlines

Authored directly to Data base for interactive Electronic output.

(d) Functionality

- (i) **Dialogue Driven Interaction:** Logical display of data in accordance with content.

- (ii) Logical NEXT & BACK Functions: Useful as interactive maintenance & user selectable cross-references and indices content specific help available.

7.2 Levels of Information in an IETM: The IETM will comprise of information at various levels as follows:

- (a) Level 1: Title, Content etc.
- (b) Level 2: Text - The text would be broad outline information on the contents, e.g. if the item in the contents is "Receiver", the text in this level could give information like the names of the submits/modules of the receiver and their broad functions.
- (c) Level 3: Text - This would be detailed information based on hot spots created in Level 2
- (d) Level 4: Text - This could be information about a component part or could be a "Parts List", and could contain ordering information in respect of a spare part.
- (e) Level 5: Drawing.
- (f) Level 6: Drawing/Photograph - This would be a more detailed drawing than available in the previous level.
- (g) Level 7: Spares Order Form

Note: Additional levels could be created depending upon the application.

7.3 Access to each level would be through links created by "Hot Spots" in any level. The user would have the flexibility to go to the next level or directly to a lower level.

7.4 Security features/Access Control

- (a) Only authorised persons should be able to access IETM. Suitable password protection/access control should be incorporated.
- (b) While, the above provisions should permit only authorised person to access the IETM, additional protection may be necessary to authorise only select few to access or add notes to certain portions of the IETM. Suitable provision has to be made for this feature.

7.5 Annotations

7.5.1 IETM, essentially being a technical manual will be accessed by the technicians/engineers for trouble shooting in the concerned equipment. Systems linkage facilities should be provided, to the IETM, so that authorised persons can add notes/annotations to facilitate subsequent reference by concerned personnel.

7.6 Search Feature

7.6.1 Suitable search features should be available for quick reference of the relevant portions by clicking on key words that would be specified by the organisation requiring the development of the IETM.

7.7 Common User Computer Aided Tools

7.7.1 Common user tools like calculator, spell check, drawing tool bar etc, should be included in the IETM as per requirements of the buyer.

8. GUIDE LINES FOR FORMULATION OF SPECIFICATIONS FOR IETM

8.1 **Introduction:** While drafting specifications for IETM the guidelines in the succeeding sub clauses should be followed.

8.2 **Scope:** A specification should define common requirements for the general content, style, format and user interaction features which are required for interactive Electronic technical manuals (IETM). The specification should provide requirements governing the creation of IETM.

8.3 **Basic Requirements:** The following sub clauses present general content requirements, both for technical information, which shall be incorporated as the basic content of the IETM, and for technical information, which shall be incorporated to support use of a particular IETM.

8.3.1 **Help Related to Technical Content:** The user shall have access to additional information relating to the technical content of the IETM, such as information on a weapon system itself, or assistance in using one of the special features of the authored procedures for that particular weapon system. The help function shall also permit the user to access context-sensitive help, which applies to the user's current activity and situation. It shall also permit the user to access descriptive information to further explain some technical point, to define a specific term or to provide further explanation where necessary.

8.3.2 **Administrative Information:** All IETM shall contain the following administrative information for subsequent user selectable display:

- (a) Identification of the "Title of the Technical Manual", assigned "Technical Manual Number", as applicable.
- (b) Classification Level of the IETM (shall also be presented upon initial entry to the IETM by the user)
- (c) Date, baseline date and dates of the latest/all previous changes.
- (d) Verification, change or revision status as applicable.
- (e) Method of obtaining additional copies and the format of such Electronic copies.
- (f) Distribution statement.
- (g) Summary of documents and/or technical manuals that are referred in the IETM but not included in the automatically accessible data (hyperlink) available to the IETM.

8.3.3 **Introductory Information:** All IETM shall contain information, which explains the purpose and scope (e.g., organisational level trouble shooting and corrective maintenance for a particular system), content, and organisation of the IETM. This section shall present the range of tasks covered by the IETM and relate the purpose and scope of the manual.

8.3.4 **List of Contents:** The IETM shall contain a "List of Contents" of the IETM and shall provide instructions for direct user access to each item at the lowest level cited. If the IETM is a "Proceduralised Corrective Maintenance IETM", for instance, the list of contents shall provide a list of maintenance tasks included. The list of contents, while being analogous to the table of contents of a paper manual, shall base sequencing on the logic of the logistics

support function covered and shall contain branching as necessary. The user shall be given the capability to access the listed entries directly from the list of contents menu.

8.3.5 How to Use "Help" Function: In addition to the technical information related "help" function, the user shall be provided with help information involving the use of IETM or the use of the Electronic display system (EDS). This help information shall describe how to use the IETM; e.g., how to reach (access) specific information and how to employ user interaction functions." How to use this IETM" information shall be incorporated as part of the content information of the IETM.

8.3.6 Instructions for Interactions with IETM Utility Functions: Information shall be provided to describe procedures for all utility functions included as supplements to the primary functions of the IETM; e.g., preparation and submission of associated maintenance action reports, accumulation and submission of IETM deficiency reports citing IETM errors/problems in using the IETM, ordering of needed parts, work centre maintenance management, use for on-site training, acquisition of additional IETM discs etc.

8.3.7 Definition of Acronyms, Terms and Abbreviations: A glossary of terms used in the IETM including all acronyms, abbreviations and special terms shall be incorporated in the IETM and shall be directly accessible in all IETM presentations.

8.3.8 Warnings, Cautions and Notes: Technical information shall be supplemented with warnings, cautions and notes in such a way as to:

- (a) Attract the user's attention to correct practices, procedures and conditions which, if not adhered to, could lead to injury or equipment damage.
- (b) Warn the user against performance of certain hazardous actions, and/or,
- (c) Follow specific steps leading to safe performance of the procedures.

8.4 General Style/Presentation: IETM shall be prepared in accordance with the general style requirements contained in this clause. These requirements shall apply both for the language to be used in textual technical information and for the graphics supplementing the textual portions.

8.4.1 **Level of Detail:** The technical content shall be adequate for a user to perform the task for which the IETM has been intended. Unnecessary information above or below this level shall not be included. When a general purpose task, which can be easily performed by an experienced person/technician, is required to be carried out (e.g. "Open Access Panel"), the main equipment need not be specifically listed.

8.4.2 **Multiple Skill Level Tracks:** When required, technical information shall be available in multiple skill level tracks. For example, in the case of novice level and expert level skills, technical information shall be available in each of the two separate and complete tracks representing the two skill levels. The novice level track shall contain all information necessary to carry out a task step by step, while the expert level track may provide only a checklist or a description in broader terms. The expert would have the option of referring to the novice level information also.

8.4.3 **Comprehensibility:** The following guiding principles shall be followed to ensure comprehensibility of data in an IETM:

- (a) Information should be in a descriptive text manner. This text must be consistent in style, terminology and format.
- (b) The functions of the system/component, the inputs, outputs, interfaces and principles of operation are to be described.
- (c) Any special features are to be listed and explained.
- (d) Location of the component/part in the system is to be indicated.
- (e) Each paragraph of the text should be limited to a single idea. Each sentence should be limited to a single thought. Short and familiar words are to be used. Rules of Service writing shall be adhered to.
- (f) Length of a sentence shall not exceed 20 words. The average paragraph shall not exceed 6 sentences.
- (g) Steps and explanations shall be constructed as fully integrated text and graphics modules.
- (h) Text shall be presented in a logical order; e.g., as in an operational sequence or in signal flow sequence.

(j) The IETM shall contain only the information required. Any additional information which could be useful, but not essentially required, shall be provided as HELP

8.4.4 **Quality of Graphics:** Graphics shall be prepared to a scale that ensures that all essential details are legible. Line widths should be chosen so as to be seen clearly on any display. However it should be kept in mind that intensive use of graphics would slow down a system.

8.4.5 **Angle of View:** The graphics should represent the views that are generally used. If necessary, more than one view should be provided.

8.4.6 **Schematic and Wiring Diagrams:** Cable schedules, schematics and wiring diagrams displayed along with an accompanying text should be displayed so as to contain only the information referenced by the text with which they are displayed. However, the user should be able to see the complete diagram or list if it can be displayed on the screen.

8.4.7 **Flow Charts:** These are to be drawn from left to right or from top to bottom. The diagrams should indicate the details referenced by the accompanying text.

8.5 **General Requirements of GUI:** The presentation software of the IETM should provide the display formatting and user interaction functions described in the succeeding sub-clauses. Free form positioning devices such as, a mouse/joystick/track ball/light pen/touch panel or arrows with a selection key may be used to implement cursor movements and selection of functions. Dedicated keys may also be used if required.

8.5.1 **Cursor:** On screen selection, if required and available, shall be by means of a cursor which must be easily distinguishable from other items on the screen. When the cursor is positioned on an item to be selected, that item should be highlighted. The highlighting should be clearly visible. Selecting an item already selected should deselect it. The user should have the facility to select a single item or a range of items, including those that are noncontiguous. Once an item is / items are selected, the OK function will mark the end of selection.

8.5.2 **Cursor Movement:** The cursor should be capable of being positioned either through a free form positioning device or by UP, DOWN, LEFT and RIGHT keys.

8.5.3 **Tab Groups:** Should several sets of objects be displayed, these sets are to be formed into fields called "Tab Groups". The cursor movement is to be constrained within a tab group. The TAB function shall allow a forward sequential movement of the cursor between tab groups. "BACK TAB" shall allow for reverse movement of the cursor between tab groups.

8.5.4 **Pointer:** If the system provides a free form positioning device, a pointer shall also be provided, which will be used in conjunction with the cursor. The pointer shall be used for rapid relocation of the cursor on the display. The pointer should also be capable of selecting items.

8.6 **Presentation of Windows:** Presentation system should be able to display any number of windows on the screen, but only one should be active at any time. Windows should be capable of the following:

- (a) Open/Close
- (b) Overlapping displays
- (c) Adjacent displays
- (d) Positioning anywhere on the screen
- (e) Orderly placement, if overlapped, with only the title bars visible.

8.6.1 **Window Features:** The windows shall comprise of the following features:

- (a) **Minimum Client Area:** The IETM information shall be displayed within this area, which will be contained within the window frame.
- (b) **Title and Menu Bars:** The top area of every window shall display the TITLE BAR and the MENU BAR. The menu bar will be below the title bar. Title shall be displayed in upper case. Title bar shall be highlighted when the window is active.

(c) **Window Controls:** When the information to be displayed requires more space than is available in the client area, the user should have the facility of repositioning the window and stretching/including it.

8.6.2 **Scroll Bar:** Vertical and horizontal scroll bars shall be used to enable the user to scroll UP, DOWN, LEFT and RIGHT to manipulate the displayed information. Scroll bars shall be displayed on the right hand edge, vertically, and on the bottom edge, horizontally, of the data and have arrow marks. A slider box shall be provided to enable the user to scroll incrementally through/across the display. When the scroll bar is used to view information, the information should appear to move in the direction opposite to the movement of the slider box.

8.6.3 **Window Resizing:** Windows that can be resized should have distinctive borders. When a window is resized, information displayed should be reduced/enlarged and not scaled down/up.

8.7 **Menu System:** The menu system shall consist of a menu bar, which shall control a hierarchy of 'pull down' menus and a set of 'pop up' menus. 'Cascading menus' and 'submenus' shall be used to add details to 'pull-down' and 'pop-up' menus. These shall provide a treetop structure for organising information; thus, simplifying the presentation of complex lists. To maintain ease of use, the menu selection tree shall not be more than four levels deep. Menu items shall be displayed using upper and lower case letters.

8.7.1 **Menu Dimensions:** The minimum menu column width shall be no less than 5 times the average length of the longest menu item and shall be wide enough to enclose all menu item labels or options so that none are truncated. When an individual item is too wide for display in the client area, it shall be wrapped out to the next line. If the entire menu cannot be presented within the client area, the existence of the menu data, which is hidden and not displayed, shall be indicated to the user. The minimum height shall be the height of two menu items.

8.7.2 **Highlighting of Menu:** Highlighting shall be used whenever the cursor lands on a selectable item. Reverse sides shall be used to highlight the menu item after the item is selected.

8.7.3 **De-Emphasis:** Those functions that are unavailable shall be de-emphasized by using a gray out or dimming method.

8.7.4 **Cursor Default Location:** In all menus the cursor shall be positioned at the same default location in a menu every time that menu is accessed.

8.7.5 **Dialogue and Dialogue-Controls:** A dialogue box shall be the primary means by which the user converses with the underlying IETM software. It shall be displayed in a separate window, which may overlay the primary window and shall contain a heading and one or more graphical controls (buttons). Dialogues shall be of one of the following kinds:

- (a) Alerts
- (b) Fill the blanks
- (c) Single/Multiple choice
- (d) Selection in list
- (e) Composite

8.7.5.1 All the dialogues shall contain the OK function and with the exception of information only, alerts the CANCEL function. Both terminate the user's interaction with the dialogue box.

8.7.6 **Dialogue Cursor Movement:** During dialogues the cursor shall move only within the dialogue box.

8.7.7 **Dialogue Presentation:** The dialogue boxes shall be distinctive in appearance so that they are not confused with other windows.

8.7.8 **Dialogue Push Buttons:** Dialogue boxes shall contain graphical controls called push buttons. A push button shall be a selectable work or a graphic icon on the screen, which enables the user to make a selection or initiate an action. The push button shall be large enough to enable the user to position the cursor on the same for selection. These will be single action entities. The shape of the push button is to be consistent; e.g., box or circle. Moving the cursor on to the push button and activating SELECT function will activate the push button. After selecting the push button, the user shall have at least two push buttons

located in the bottom of the box. These two push buttons shall have the functions "OK" and "CANCEL", which will be in the last selections made by the user before leaving the dialog box. "HELP" push button shall also be at the bottom of the box.

8.7.9 Alert Dialogues: Alert dialogues shall include warnings, cautions, notes, messages, etc., which require acknowledgement by the user. These would also include messages generated as a result of erroneous user inputs or sequence control actions. They shall also provide information on the status of systems' internal components. Alerts are to be brief, consistent and strictly factual. Alerts regarding calls to erroneous or potentially destructive external systems shall be displayed to the user.

8.8 Graphics: The IETM shall have the capability to display static and interactive type of graphics.

8.8.1 Static Graphics: These shall be displayed in full detail in the graphic area provided with no ability for manipulation, unlike the interactive graphics.

8.8.2 Interactive Graphics: These shall be displayed in an assigned data pane of the displayed window. If a graphic cannot be displayed in its entirety and in full detail, it shall be displayed using interactive graphic display techniques like scrolling, zooming etc.

8.8.3 Selection of Graphics: The user should have the facility to select a point, an area or the entire graphic by positioning the cursor on or near that point and activating SELECT function. The selectable region shall be graphically distinct, but shall not affect the overall appearance of the graphic. Graphical information shall be selected by selecting the following

- (a) A part displayed in a graphic
- (b) A point or a rectangular area in a graphic.

8.8.4 Manipulation of Graphics: If the graphic is designed as scrollable, the user shall have the capability to activate SCROLL, ZOOM or FULL SCREEN functions to manipulate a graphic. These options shall be available whenever the graphic exceeds the size of the data pane.

8.8.5 **Zoom Functions:** The system shall provide the capability to enlarge or reduce the displayed graphical information. The enlargement capability shall be provided to the user by activating a ZOOM IN function. The user shall have the capability to reduce the size of the information being displayed by activating a ZOOM OUT function. The size of the data pane shall not change as a result of using the zoom functions.

8.8.6 **Centre Function:** The user shall have the capability to activate a CENTRE function, which would relocate the centre of a graphic to the point that the position cursor indicates without scrolling.

8.8.7 **Full Screen:** The user shall have the capability to enlarge a graphic to the full size of a client area by activating the FULL SCREEN function.

8.8.8 **Tables:** Tabular information shall be displayed as cells of textual information or as a graphic. When tables contain textual elements, those elements shall conform to the requirements as set in this specification for textual information. Graphical elements within a table shall conform to the requirements of this guide for graphic material.

8.8.9 **Scrolling to Tables:** The user shall have the capability to manipulate displayed tables by activating a SCROLL function if the table exceeds the size of the data pane. When a table is made scrollable, the table headers shall not scroll within the base.

8.9 **Formatting & User Interaction Features for the Display:** The IETM shall be displayed by an EDD which shall have the capability to form displayed windows of information formed by combining primitive information components, each individually displayed using general display format described above. The general formatting and user interaction requirements of the succeeding sub clauses shall apply to all IETM.

8.9.1 **Initial Set Up:** The initial set up or input conditions, where required, shall be provided at the beginning of every task. The initial set up lists information that the technician must know before starting a task.

8.9.2 **Test Equipment Required:** A listing of the government approved test equipment applicable to the required task shall be provided. The description shall include equipment capacity, range etc. If alternate equipment can be used, the notation "or equivalent" shall follow the nomenclature. If no test equipment is needed, the entry shall state "None". If an equivalent alternate piece of test equipment cannot be used, the notation "No Substitution" shall follow the item name and description.

8.9.3 **Tools Required:** A list of tools by name, part number and manufacturer's name shall be provided.

8.9.4 **System Preparation Check List:** A check list of all procedures which should be performed by the technician, to assure that all preparations have been completed prior to the start of the procedure, particularly those involving personnel safety and prevention of equipment damage, shall be provided.

8.9.5 **General Safety Instructions:** A safety summary of any general safety information that applies throughout the task shall be provided.

9.0 GUIDE LINES FOR FORMULATION OF SPECIFICATIONS FOR IETM DATA BASE (IETMDB)

9.1 The creation of Interactive Electronic Technical Manual (IETM) for a weapon system or other equipment requires Interactive Electronic Technical Manual Data Base (IETMDB) to be constructed. The guidelines for formulation of the specifications for the construction of IETMDB are given in the succeeding sub clauses.

9.2 **IETMDB Capabilities:** An IETM is a complete collection of Data base elements relating to a weapon system or other equipment and constructed in a standardised manner in order to provide the following capabilities:

- (a) The IETMDB can serve as the basis for construction and update of Electronically displayed IETM through the use of automated authoring systems, for the entire suite of weapon system, or other equipment.

(b) The user concerned with the logistic support for the weapon system or other equipment involved can access the Data base directly to obtain need based logistic support information for specific purposes.

(c) The IETMDB, or portions of it, can be interchanged by means of standardised formats and procedures throughout the Defence Services, R & D Organisations and Defence PSUs, whenever necessary for any purpose.

9.3 **Format Free Technical Information:** The IETMDB will consist of an assemblage of data elements, including a listing of the specific attributes possessed by the data elements, and a list of explicit relationships providing logical links among the data elements. The relationships incorporated into the Data base by the IETMDB author provide the basis of the technical structure of the IETM and other logistic support TI, which will be extracted from it. The IETMDB itself will, of course, require a format (Data base structure); but these guidelines do not impose structural requirements on the actual Data base Management System (DBMS) methodology to be employed (e.g., the Data base may be either relational or object oriented).

9.4 **Data Portability:** Elimination of formatting requirements for the IETMDB reduces the overall magnitude of Data base and data interchange Standardisation effort and permits the use of a less complex DBMS, which is, in turn, less expensive and easier to modify. The "Format-Free" nature of the IETMDB is intended to provide the following capabilities:

(a) Acquire or access the data in a variety of ways (IETM, other types of logistics reports, training TI etc.).

(b) Subsequently, format and style the data in a variety of ways for Electronic display options. Since one of the functions of the IETMDB is to provide direct online data access to a variety of users and to a number of automated logistics support and management information systems throughout the Defence Services, establishment of standard identifiers, data entry relationships and multiple path access routes to individual data elements is an important part of IETMDB design and construction.

9.5 **Content Data Model:** The IETM Content Data Model (CDM) provides a representation of technical information documents and their relationships. The CDM employs

a two layered approach to define technical information. The top layer called the "Generic Layer", defines the semantic rules for the data characteristics. The generic layer provides structure and content of documents and is defined in Appendix "B". The generic layer tag set descriptions are shown at Appendix "C". The bottom layer called the "Content Specific Layer" employs the generic layer when defining elements for system specific TI. A Content Specific Layer Model developed for organisational level maintenance is placed at Appendix "D" and the Content Specific Layer Tag Set descriptions are placed at Appendix "E". The CDM linking elements are taken from the HyTime model. These elements provide the capability to link between CDM elements and other SGML/XML files.

9.6 **Data Maintainability:** The IETMDB shall be constructed with provisions to allow the incorporation of any change to automatically update all aspects of the Data base affected by that change. This data maintainability requirement shall involve changes to the IETMDB of the following two kinds:

- (a) Additions to, elimination of or changes to individual data elements and attributes.
- (b) Changes to relationships, including establishment of new relationships and elimination of old relationships.

10. GUIDE LINES FOR FORMULATION OF SPECIFICATIONS ON QUALITY ASSURANCE OF IETM

(Note: The succeeding sub clauses describe the general guidelines and the basic requirements, beginning with "Scope" for formulation of specifications on QA of IETM)

10.1 **Scope** - This specification prescribes the requirements of Quality Assurances (QA) Program for Interactive Electronic Technical Manuals (IETM) and the associated IETM Database (IETMDB).

10.2 **Summary of Requirements:** This specification provides detail requirements for the following:

- (a) Preparation of a quality assurance program plan (QAPP)
- (b) Validation of the IETM and Technical Information (TI)
- (c) When specified, preparation of a verification supports plan.
- (d) Preparation, retention, and analysis of QA records.

10.3 **Requirements:** The quality assurance program (QAP) shall encompass the accountability for and development of QA functions related to the following IETM program elements:

- (a) Source data management.
- (b) Evaluation of draft material.
- (c) Data base integrity maintenance.
- (d) Authoring system capability.
- (e) Validation
- (f) Record keeping.
- (g) Verification support.
- (h) Final product preparation.
- (j) Sampling producers where authorized.

10.4 **Components of the QAPP -** The QAPP shall contain the following:

- (a) Scope and applicability of the QAPP including the list of deliverable IETM items to which the QAPP applies.
- (b) A description of the function and structure of the vendor's QA organization.
- (c) A description of the authoring system.
- (d) A listing of the vendor's written operating producers involved in IETM generation.
- (e) A listing of the vendor's producers for quality reviews.
- (f) Sampling producers and criteria.
- (g) A validation approach summary
- (h) A validation support approach summary
- (j) A classification of defects table.

10.4.1 **Scope and Applicability of QAPP** - The QAPP shall identify the scope and applicability of the QA effort. The QAPP shall identify all the contractually deliverable IETM items, the contract specifications with which they must comply, and the schedule for their inspection and delivery.

10.4.2 QA Organization

(a) **Function** - The vendor's QA organization shall have the responsibility for implementation, administration and conduct of the QA program, and shall function as the point of contact between the vendor and the purchasing authority in all the matters related to QA.

(b) **Structure** - The QAPP shall describe the vendor's QA organization. This description shall indicate how the vendor's QA personnel are organized to retain their independence from personnel responsible for IETM generation, so as to be able to carry out their QA responsibilities in an objective manner.

10.4.3 **Description of the Authoring System** - The authoring system must possess the following capabilities, in order to effectively produce an IETM:

- (a) Support technical manual planning and control.
- (b) Capture data from a wide variety of computerized Data bases, including text, graphics, and tables.
- (c) Create and change TI, including text, graphics and tabular data; and the ability to merge these information elements into a single composite element.
- (d) Provide the author with access to files in the system Data base {the interactive Electronic technical manual Data base (IETMDB)} so that the author can prepare the IETM.
- (e) Provide prompts to the author so as to propose proper sequences of writing, to identify omissions in pre-established plans, and to identify faulty authoring logic.
- (f) Provide author with a view of his finished product in a form identical to that in which it will be viewed by the end user.

10.4.4 Vendor Quality Reviews - The QAPP shall describe the proposed quality review producers for each individual type of IETM deliverable where a given process applies to several deliverable, the producer need to be presented only once, but may be referred to as often as necessary. The QAPP shall also explain producers for maintaining records of defects found and corrective actions taken. The QAPP shall include measures proposed by the vendors to assure the effective use of design and manufacturing drawings of the IETM generation without the necessity to completely redo the drawings. The QAPP shall describe the approach by which the vendor shall ensure that IETM products prepared by sub vendors and vendors satisfy all contractual requirements.

10.4.5 Sampling Inspection Plan - The QAPP shall describe the overall sampling inspection plan.

10.4.6 Validation Approach Summary - The QAPP shall contain a validation approach summary covering the approach the vendor intends to the use of validation. This summary shall outline the intended methodology upon which the vendor intends to base the validation plan.

10.4.7 Classifications of Defects Table - The QAPP shall contain classification of defects table in which a complete listing of the possible types of defects discovered in the IETM will be classified into major or minor categories, depending upon their portable impact.

10.5 Inspections by Purchasing Authority: The Purchasing Authority and other Defence production agencies shall reserve the right to make any inspection it deems necessary to assure that IETM and its related elements meet contract requirements. The vendor shall support these inspections by providing access to all QA records and IETM documentation.

10.5.1 QA Process Inspections (QAPI): Each Service, including other Defence production agencies, shall conduct a series of schedules for QAPI to establish that the QAPP is being properly followed, product quality reviews are being correctly implemented, defects are being identified and appropriate corrective actions are being taken. During the initial QAPI in addition to other demonstration or presentations, the concerned Service, may require, the vendor shall provide specific demonstrations of the following:

- (a) The use of the authoring system to be employed in generating the IETM, including a demonstration that the authoring system functions outlined in the QAPP are in working order and are being used in the IETM generation process.
- (b) Use of the relevant EDD for QA reviews, validation, and post validation review.

10.5.2 **Vendor Quality Assurance Inspection and Records:** The vendor shall maintain, and provide to the concerned Service, upon request, records documenting all vendor process and product inspections. These records shall include.

- (a) Name of the operation or product inspected.
- (b) Date
- (c) Names of inspectors.
- (d) Defects found.
- (e) Procedure or inspection leading to identification of defect.
- (f) Method of defect correction or explanation for no correction of defect.
- (g) Name of persons making correction.
- (h) Name of the person certifying that the products have been corrected or, where applicable, that the operations have been modified and written procedures corrected, as necessary.

10.6 **Review of Maintenance and Operation Procedure –** Quality review procedures shall assure as a minimum the following requirements:

- (a) All input conditions for maintenance and operating procedures contained in the IETM are explicitly identified.
- (b) Steps contained in the maintenance and operating procedures use concise text and simple graphics to instruct the user.
- (c) Each task is cross-referenced with appropriate descriptive, trouble shooting, parts, and operational information.
- (d) Steps within a maintenance/operating procedure are presented sequentially and in their entirety.
- (e) Information that is not applicable is not displayed.

(f) All warnings, cautions, and notes associated with a maintenance or operation action are presented so that the user is aware of all potentially dangerous or damaging situation prior to initiation of the action.

(g) Maintenance and operating procedures are suitable for presentation on an EDD.

10.7 **Validation** – The objective of validation is to ensure that the vendor has provided for support of the equipment involved, accurate and adequate IETM and an IETMDB in accordance with an approved validation plan. The vendor shall deliver a validation plan, which covers each IETM item required by contract and details the anticipated schedule requirements and producers for performing validation. The validation plan shall contain as much as a minimum in the following items:

- (a) Titles and identification numbers of all deliverables shall be validated.
- (b) Site locations, support, equipment, contractual end items, and tools required during validation.
- (c) General characteristics relating to skill level of target audience type personnel to be used in validation of procedural TI.
- (d) Identification of next higher assemblies /system required to support the effort
- (e) Special safety precautions.
- (f) Any special environmental requirements.
- (g) Record keeping system to be used in validation.
- (h) How validation of producers is to be accomplished.
- (j) A proposed fault stimulation list for use in validation of trouble shooting producers.
- (k) Approach to evaluation of usability of the IETM as generated by the vendor; specifically, establishment of the adequacy and accuracy of information access producers, and identifications of any potential man machine interface problems involving effective use of the IETM on the specified EDD.
- (l) Applications of results of test during the validation process of the correction of deficiencies. performed

10.8 **Validation of IETMDB** - Validation of the IETMDB shall be carried out procedurally in the same fashion as the validation of the several types of TI included in the IETM. Validation of the IETMDB shall establish the following:

- (a) The IETMDB meets all specific requirements of specification as per clause 9.
- (b) All information contained in the IETMDB is technically accurate, based on comparison of the data entries with actual hardware.
- (c) All relationships as defined in the data element dictionary of the IETMDB, are in place, valid and operable.
- (d) There are no open loops in the fault isolation tasks.
- (e) There are no un-referenced or inaccessible data entities in the system.
- (f) The IETMDB is capable of being used to construct individual IETM to support the weapon system.

10.9 **IETM System Validation** - The IETM system validation shall consist of two parts, a demonstration of the system, and system software tests.

(a) **IETM System Demonstration:** The IETM system demonstration shall:

- (i) Be performed entirely on an EDD provided/specified by the purchasing authority.
- (ii) Demonstrate the system's compliance with applicable specifications.
- (iii) Demonstrate maintenance tasks, displayed for a selected sampling of the various systems, in various levels of complexity.
- (iv) Introduce a selected sampling of fault codes to exercise the retrieval capabilities of the system.
- (v) Demonstrate all system utilities and special functions, including ad hoc user access to data.
- (vi) Demonstrate the general visibility and readability of the IETM as displayed on the EDD.

(b) **System Software Tests** - The vendor shall develop a software routine capable of exhaustively testing the IETM system. This program shall:

- (i) Check that all data access links and branches are valid and operable.
- (ii) Ensure that there are no "open loops" in the fault isolation tasks.
- (iii) Ensure that there are no un-referenced or inaccessible data in the system.
- (iv) Check that all special functions are fully operable.

10.10 Quality Assurance Provisions

10.10.1 **Responsibility for Inspection:** Unless otherwise specified in the contract or purchase order, the vendor is responsible for the performance of all inspection requirements. Except as otherwise specified in the contract or purchase order, the vendor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Purchasing Authority.

10.10.2 **IETM Acceptance Tests:** Acceptance tests shall be performed entirely on a standard EDD for IETM as specified by the Purchasing Authority. Such a device will be provided/specified by the purchaser, for use by the vendor, in validating the IETM and in performing QA inspections. It may be borne in mind that compatibility with a specified EDD type is a primary contract requirement for the IETM. Hence, the entire interactive display concept of digitized technical manual information requires establishment of information calling sequences and the exercise of special functions, with both processes dependent on software which is functionally common to the automated authoring system and to the display device. The proof that an IETM is satisfactory, therefore, is that it may be scrutinized in a way, which demonstrates conformance with all specification requirements on the device, which the end user handles.

10.10.3 **Test Sequence:** Tests will be conducted in two phases as under:

- (a) Tests to assure that the IETM functions satisfactorily when viewed with a test display device: specifically that all special functions are available, calling sequences are correct, and in general that all capabilities requested have in fact been provided.
- (b) A thorough review of the content of each screen to assure the following:

- (i) That no procedure has been left out;
- (ii) That the material is written comprehensibly;
- (iii) That the TI is error free;
- (iv) That troubleshooting information in fact leads to fault isolation in all branches and that the technician is informed as to the calling sequences for required information and can obtain it quickly and directly. These tests are outlined in greater detail in the succeeding clauses.

10.10.4 Tests of IETM Functions: Following four functions shall apply:

(a) **Screen Sequencing:** Using the required calling algorithm based on screen references, every screen in the IETM will be viewed from the first to the last, and the logical sequences applicable to the maintenance procedure and to troubleshooting will be evaluated.

(b) **Special Functions:** Each of the special functions provided in the EDD would be checked to see that it performs properly with the IETM being evaluated. The ability of a technician to exercise these functions using the function keys and touch screen capability of the display device will be evaluated.

(c) **Display Characteristics:** Tests outlined in this section are not tests of the display device but of the IETM. The individual screens shall be displayed so that they can be seen and understood properly by the technician, within the limitations of the screen size, resolution etc. The visibility of each screen provided will accordingly be checked in this context.

(d) **Capability to Access Information:** One of the primary reasons for preparation of IETM is to provide a technician with the ability to reach needed information immediately, without searching through hundreds of paper pages. For this reason, the IETM is designed to provide multipath calling methods to access the information required directly (i.e. without proceeding via numerous successive menus). The ability of the technician to retrieve the information he needs for specific problems will accordingly be evaluated based on a number of input

requests. A software routine is developed capable of being used to test exhaustively this aspect of the automated TI when used with the EDD, to assure that:

- (i) All calling sequences (data access links) established by the author are valid and operable.
- (ii) Calling sequences implied by special function keys are fully operable.
- (iii) User established calling sequences perform as indicated.
- (iv) There are no 'lost' (unreachable) data in the entire body of TI.

10.10.5 Evaluation of IETM Content, Format and Style

(a) **Selected Screens:** Selected screens will be used to perform a detailed evaluation of TM content, format, style and user-interaction characteristics. For example, a number of maintenance tasks will be followed through each subtask and step to evaluate completeness, accuracy, competence of the graphics, arrangement, conformance to style requirements, inclusion of warnings, cautions, and notes, completeness of the setup information, and the like.

(b) **Evaluation of Troubleshooting TI:** Beginning with operationally realistic defective performance reports, a series of troubleshooting paths will be followed in detail to establish the effectiveness of these tests sequences in isolating the fault. Experienced technicians will evaluate not only the mechanical effectiveness but also the technical competence of the troubleshooting procedure designed by the author for fleet system troubleshooting under operational conditions.

10.11 Packaging

10.11.1 **Preparation for Delivery.** Items shall be packed in the most economical manner that will provide adequate protection during shipment in accordance with accepted industrial packaging procedures.

11. VERSION MANAGEMENT OF IETM

11.1 The Version No. of the IETM shall be allotted based on the following factors:

- (a) All modifications made to an IETM since its inception (in case the IETM is developed new)
- (b) All modifications to an IETM from its previous release (in case these modifications are undertaken after its previous release)

11.2 **Naming Convention for Version Control:** Every IETM shall clearly be identified by a "Title" followed by a "Version Number", indicated by 2 integers, starting from "00". Every change from the release of the IETM will be clearly identified as an incremental integer from "00". For example:

"IETM for Radio Station RRF Ver. 00" - Initial release version

"IETM for Radio Station RRF Ver. 01" - First revised version

12. SUGGESTIONS FOR IMPROVEMENT

12.1 Any suggestion for improvement in this document may be forwarded to:

The Director,
Directorate of Standardisation,
Ministry of Defence,
'H' Block, DHQ PO,
New Delhi - 110 011.

APPENDIX "A"

DEFINITIONS FOR CLASSES OF
INTERACTIVE ELECTRONIC TECHNICAL MANUALS

	<u>Class 1</u> <u>Electronically</u> <u>Indexed Pages</u>	<u>Class 2</u> <u>Electronically</u> <u>Scrolling</u> <u>Documents</u>	<u>Class 3</u> <u>Linearly</u> <u>Structured</u> <u>IETM</u>	<u>Class 4</u> <u>Hierarchically</u> <u>Structured</u> <u>IETM</u>	<u>Class 5</u> <u>Integrated Data</u> <u>base</u>
Display	<ul style="list-style-type: none"> • Full page viewing • Page turner/next function • Intelligent index for user access to page images • Page integrity preserved 	<ul style="list-style-type: none"> • Primary view is scrolling window. • Hot-spot access (Hyperlinks) to other text or graphics. • User selection and navigation aids (key work search, on-line indices). • Minimal text-formatting for display. 	<ul style="list-style-type: none"> • View smaller logical block of text with less use of scrolling. • Interaction through dialogue boxes. • Interaction as per MIL-M-87268 to the extent possible. • Text and graphic simultaneously displayed in separate window when keyed together. 	<ul style="list-style-type: none"> • View smaller logical block of text with very limited use of scrolling. • Interaction through dialogue boxes with user prompts. • Interaction as per MIL-M-87268 to the extent possible. • Text and graphic simultaneously displayed in separate window when keyed together. 	<ul style="list-style-type: none"> • Same as Class 4 for IETM function. • Interactive Electronic display as per MIL-M- 87268. • Expert system allows same display session and view system, to provide simultaneous access to many differing functions (e.g. supply, training troubleshooting).

	<u>Class 1</u> <u>Electronically</u> <u>Indexed Pages</u>	<u>Class 2</u> <u>Electronically</u> <u>Scrolling</u> <u>Documents</u>	<u>Class 3</u> <u>Linearly</u> <u>Structured</u> <u>IETM</u>	<u>Class 4</u> <u>Hierarchically</u> <u>Structured</u> <u>IETM</u>	<u>Class 5</u> <u>Integrated Data</u> <u>base</u>
Data Format	<ul style="list-style-type: none"> • Bitmap (raster) • Indexing and header files (Navy MIL-STD-29532) • MIL-R-28001 or postscript pages. • Generic COTS imaging formats. 	<ul style="list-style-type: none"> • Text-ASCII • Graphics, whatever viewer supports, e.g. BMP or CALS. • Can be SGML tagged-no page breaks (browser). 	<ul style="list-style-type: none"> • Linear ASCII with SGML/XML tags. • SGML/XML with content wise format tags. • Maximum use of MIL-D-87269. • Generic SGML/XML tags equivalent to MIL-D-87269. 	<ul style="list-style-type: none"> • Fully attributed Data base elements as per MIL-D-87269. • MIL-D-87269 content tags with full conformance to Generic Level Object Outlines (architectural forms). • Authored directly to Data base for interactive Electronic output. • Data managed by a DBMS. • Interactive features authored in vice added on • Generic: COTS equal to MIL-D-87269 data definition and tags. 	<ul style="list-style-type: none"> • IETM information integrated at the data level with other application information. • Does not use separate Data bases for other application data. • Identical to Class 4 standards for IETM applications data as per MIL-D-87269. • Coding for expert systems and AI modules when used. • Generic: COTS equal to MIL-D-87269 data definition and tags.

	<u>Class 1</u> <u>Electronically</u> <u>Indexed Pages</u>	<u>Class 2</u> <u>Electronically</u> <u>Scrolling</u> <u>Documents</u>	<u>Class 3</u> <u>Linearly</u> <u>Structured</u> <u>IETM</u>	<u>Class 4</u> <u>Hierarchically</u> <u>Structured</u> <u>IETM</u>	<u>Class 5</u> <u>Integrated Data</u> <u>base</u>
Function ality	<ul style="list-style-type: none"> • Access pages by intelligent index/ header info. • View page with pan, zoom, etc. tools. • Limited use of hot spots. • Useful for library or reference use 	<ul style="list-style-type: none"> • Browse through scrolling info. • User selection graphics or hotspot reference to more text. • Hot spot and cross-reference usually added after original authoring. 	<ul style="list-style-type: none"> • Dialogue-driven interaction. • Logical display of data in accordance with content. • Logical NEXT and BACK functions. • User-selectable cross-reference and indices. • Content specific help available. 	<ul style="list-style-type: none"> • Dialogue – driven interaction. • Logical display of data in accordance with content. • Logic and NEXT and BACK functions. • Useful as interactive maintenance aid. • User-selectable cross-reference and indices. • Content specific help available. 	<ul style="list-style-type: none"> • Single viewing system for simultaneous access to multiple information sources. • Same as Class 4 for IETM functions. • Expert system to assist in NEXT functions based on info gathered in session.

B. GENERIC LAYER

B.1 **Generic Layer** – The generic layer defines general characteristics, which are common across all applications. The generic layer defines the templates, linking elements, and context filtering elements, which are used to create the content of specific Document Type Definitions (DTD). The generic layer includes a definition of each template and attribute lists associated with the template. The following paragraphs provide a description of the components of the generic layer.

B.1.1 **Templates** – The following section defines the generic layer templates. These templates define semantic rules for creating content specific elements. These semantic rules make up the minimum set of constraints on content specific elements. The templates provide the structure for creating composite nodes, context dependent filtering, interaction and branching. Each template has two components: (a) a set of semantic rules that govern the template activities, and (b) a list of attributes. The generic layer contains five templates: node, node alternatives, node sequence, if node, and loop node.

B.1.1.1 **Node Template** – The NODE template provides the capability to create composite structures within the content specific layer. Composite structures may contain sub components that employ the NODE, NODE ALTS, or NODE SEQ. templates. The NODE sub components may be composite structures themselves or they may be primitives NODES (text, tables, graphics, audio, video, process, and dialogue). Composite structures create hierarchy within the CDM. When composite nodes contain other composite nodes, there is an implied hierarchy elements, employing the node template, shall have a set of required attributes as follows: -

(a) **Name** – The "name" attribute of the element shall consist of the standard nomenclature for an instance of the element.

(b) **Item-ID** – The "Item-ID" attribute shall specify the reference designator(s) and other indefinable designator(s), subassemblies, or part (s) referred to by the element.

(c) **Type** – The “type” attribute shall specify the type of information contained in the element.

(d) **CDM** – The “cdm” attribute shall identify the type of template being employed by the content specific element.

(e) **Ref** – The “ref” attribute shall facilitate the reduction of data redundancy by allowing data elements to be referenced.

B.1.1.2 Node Alternatives (Alts) Template – All elements conforming to the node shall contain a list of mutually exclusive nodes, only one of which will be used at the time of presentation. The following semantic rules apply to any content specific element employing the NODE ALTS template:

(a) The element must contain components that employ the NODE template.

(b) The components must be the same element type and at the same level in the hierarchy.

(c) At presentation time, the precondition for each NODE alternative will be evaluated. The NODE whose precondition evaluates to “true” is elected for presentation.

(d) These components must contain mutually exclusive preconditions. In any specific situation, at most one node would have a precondition, which to true.

(e) There need not be an applicable component for every possible situation.

B.1.1.3 Node Sequence (Seq.) Template – The NODE Seq. template is the mechanism for creating interactive sequences with the user. The following semantic rules apply to the NODE SEQ. template.

- (a) Any content specific element employing NODE Seq. must contain components that employ the NODE, NODE ALTS, IF NODE or LOOP NODE templates.
- (b) The components of NODE SEQ. are always traversed in the order they appear. This traversal includes the branching and iteration implicit in any IF NODES or LOOP NODES in the sequence logic.
- (c) **If Node Template:** Elements conforming to IF NODE template provide a method for conditional branching. These elements shall use the same logic as the IF-THEN-ELSE statement in a programming language. The "IF" part is the expression in the content model.
- (d) **Loop Node Template.** The Loop Node template provides the equivalent of a loop in a programming language. This element shall provide the capability to create either a "FOR" loop or a "WHILE" loop within the data.

B.2 Relational Links – Elements shall have relationship to other elements in TI, when applicable. These relationships shall be represented through two or more link ends. The link element shall provide the capability to show the relationship between several elements. Links shall be used to reduce the number of redundant elements by referencing common elements. The "link" element provides the capability for creating relational links within the CDM. "Link" is included within the content model of the NODE template, therefore, any content specific element employing the NODE template may include relational links. The 'HyTime' attribute indicates that "link" employs the "link" architectural from (template) from the HyTime model. The end types define the allowable anchors to which a node may point. The initial end types defined are links to descriptive information, parts information or any primitive.

B.3 Primitive Elements: An IETMDB shall be composed of the primitive elements defined in the generic layer DTD as follows.

(a) **Textual Information** – Textual information shall consist of alphanumeric (i.e., character) data. Textual information shall also contain embedded references to some higher level elements such as those describing parts or consumables.

(b) **Tables** – Tables shall be represented as a series of separate entities, each entry being associated with a specific row and column intersection (cell) of a table. Each entry in the table may be associated with other primitives of information presentation and attributes. Each entry may refer (through a relationship) to any other template element or primitive element in the IETMDB.

(c) **Graphics**: Graphics drawings, illustration information shall be structured in a hierarchical manner and consist of logically related groups. Graphics shall be composed of series of illustrations, which can be overlaid on each to build a complete graphic. These graphic building blocks are called graphic primitives. Graphic primitives may be combined to produce composite information, which can be referenced and selected. Graphics are integral part of technical information. Therefore, all possible standard representations should be included.

(d) **Audio, Video and Process** – The element audio, video, and process provide the capability for author to define an audio sequence, a video sequence, or a call to a software process.

(e) **Dialogues** – Dialogue element is the basic element, which provides the capability for user inter-section with the TI. During the presentation these elements shall be used to prompt the user to input the response select a choice from the set from a set of alternatives, or to select items from within a text, table or graphic (selection).

B.4 Context Dependent Filtering – Provides the capability to present the user with only the information that applies to a specific situation. The precondition and post-condition elements provide the mechanism for context depending filtering. The precondition element enables the selection of the appropriate information for presentation. The post-condition element enables the recording of presentation events for later filtering. Context dependent filtering shall be accomplished through author-defined preconditions. A precondition shall

contain an expression, which contain all the information necessary to identify what condition must be present to display the TI.

B.4.1 Preconditions - The precondition element enables the selection of the appropriate information for presentation. A precondition shall contain an expression, which contain all the information necessary to identify what condition must be present to display the TI. Precondition elements may be referenced by node elements. This implies that the element information is relevant only if the preconditions are true in the presentation situation.

B.4.2 Post conditions - The post-condition element enables the recording of presentation events for later filtering. Post-condition asserts the value of an expression to a property. Once these property values are asserted, they shall be accessible to the presentation software for later testing and processing to determine the user situation.

B.4.3 Expressions - Any expression developed for an IETMDB shall conform to four types of expressions defined in the CDM as under:

- (a) The first is a binary operation between two expressions.
- (b) The second is the unary operation, which is applied to an expression.
- (c) The third and fourth are to identify a unique property or a value to be used in an expression.

C. GENERIC LAYER TAG SET DESCRIPTIONS

- C.1 **Scope:** This appendix provides the detailed description of the elements and attributes to be included in an IETMDB. It is formulated as a description of possible tags or name for components in an IETMDB whose structure is defined by the generic layer DTD specified within appendix 'A' of this specification. The information contained is intended for compliance.
- C.2 **Agent:** Used in the dialogue element, this attribute defines to whom the question is asked. The value of this attribute contains character data, which identifies the person or computer to the dialogue should be presented. The default value is 'human'.
- C.3 **Assertion:** This element is used to make an assertion from within the content model of an application of specific element. Whenever an assertion appears in an element's content model, there shall be set of semantic rules describing when the assertion is to be evaluated. For example, under required conditions the assertion is only evaluated when the user decides to skip task reference.
- C.4 **Audio:** This element is used to hold an audio sequence.
- C.5 **Choice:** This element defines a choice in a menu. Choices consist of a piece of text or a graphic to be displayed. Once the user selects from a menu, the presentation system will either assert some Post-condition or will branch to another dialogue.
- C.6 **Default:** Used by the choice element, this attribute contains an enumerated list with values of either a 'yes' or 'no'. The default attribute provides a method of indicating whether a choice is designated as default for the menu. The default value of the attribute is 'no'.
- C.7 **Dialogue:** This element provides the capability of the user interaction. A dialogue could contain a sub dialogue, menu, selection or any combination of the four. It may also contain an optional text string, which would be the title of the composite dialogue.

C.8 **Expression:** The expression element provides the capability to create mathematical expressions to be used for preconditions and post-conditions. There can be one of four types of expressions: a binary operation between two expressions, a unary operation with an expression, a property, or a value.

C.9 **Graphic:** This element represents a composite graphic, which is made up of graphic primitives or other graphic components.

C.10 **HyTime** - Used by the link element, this attribute is fixed default value (i.e. Cannot be changed by the entry of another value).

C.11 **IF-Node:** The node template provides a method of conditional branching within an interactive sequence. The template uses the same logic as the IF-THEN-ELSE statement in a programming language.

C.12 **Itemid:** Used in all node elements, which identify the components of the system being repaired, as they relate to formation elements. The item identification attribute, specifies the reference designator or other identifiable designator of the system, subassemblies, or parts referred to by the element. The permissible values of this attribute are dependent upon the content specific application using this primitive.

C.13 **Link:** This element provides the capability for creating relational links with the data. It employs the HyTime link architectural from template and may contain 'anchors' called to identify to or more link ends. The link element may contain the name of the relation.

C.14 **Menu:** This element defines a menu for user interaction. It consists of prompts followed by one or more choice elements.

C.15 **Name:** Used in all node elements, this attribute holds the standard nomenclature for the element expressed in character data. The permissible values of this attribute depend on the specific element type.

- C.16 **Node:** This template by which technical information is defined. The node template contains the content of technical information. The node template creates hierarchy within the CDM. The node template also contains context filtering preconditions and Post-conditions. The link element within the node template provides the capability to cross-reference other technical information. The use of link, from the HYTIME model, provides additional functionality by allowing a link to be made to a document outside the CDM specification boundary. The node template provides the capability to create composite structures within the content specific layer. Composite structures may contain sub components that employ the node, node alternatives or node sequence templates. The node sub components may be composite structures themselves or they may be primitive nodes composite structure creates hierarchy within the CDM. When composite nodes contain other composite nodes, there is an implied hierarchy. The composite node is the content model is a lower level in the hierarchy.
- C.17 **Prompt:** This element defines the prompt to be displayed to the user for the presentation of a fill in or a menu. It allows the prompt to be either a text string or a graphic.
- C.18 **Row:** Used in the entry element, the value of this attribute consists of the row number of that entry tabular information.
- C.19 **Select:** Used in the menu element, the value of this attribute allows the author to designate the number of choices that may be selected by the user. The choices are either single or multiple, with default selection choice being single.
- C.20 **Selection:** The element provides the capability of creating a special menu that allows selection within a even picture, text string or a table.
- C.21 **Sequence:** The element is defined as being an ordered sequence of data.
- C.22 **Table:** This element defines how a table is constructed. A table will contain a column header followed by one or more entities. The combination of the column headers and entries may be repeated for as many columns as the table requires.

C.23 **Text:** This element defines how text is constructed. Within a text string, there may be embedded text elements which allow the referencing of other elements through the link location mechanism of HyTime.

C.24 **Video:** This element will be used to include a video sequence into technical information.

C.25 **Window:** Used in the graphic and graphprim elements, this attribute indicates the sub-rectangle within a graphic, which should be displayed in those cases where the author wishes to display only a portion of a large graphic of the user.

APPENDIX "D"D. CONTENT SPECIFIC LAYER

D.1 The creation of a content specific Document Type Definition (DTD) represents the second layer of the Content Data Model (CDM). It identifies all the content specific elements and their relationships for a given application. In this instance, the application happens to be the display of organizational level data to the technician. This document breaks down data into a hierarchy based upon the system/subsystem structure of the weapon system. It identifies four different types of information, which may be referenced within the document. They are procedural, descriptive, parts and fault data. Each type of information is appropriately referenced and structured in accordance with a content specific DTD. One content specific DTD shall apply for an entire range of information regardless of the desired access to the information.

D.2 The general layer of the CDM shall define a set of primitive elements. These elements shall cover any content specific layer DTD that includes the generic layer in an entity declaration. Elements defined within content specific DTD that require the use of any of the primitive elements need only include text, table, graphic or dialogue within its content model. The elements using the primitive elements shall be restricted to the structure of the primitive elements as defined within the generic layer. Elements within a content specific DTD shall conform to one of the templates defined within the generic layer. Elements shall include the attributes listed under the "generic layer" definition of the templates. The following describes the requirements for the content specific DTD that are included in this specification:

(a) **Item/System Hierarchy:** The weapon system or other equipment that is being maintained and operated is composed of several layers of subsystems, components, and parts. This hierarchical representation of the equipment being maintained and operated shall be accomplished by use of a system element that is used recursively, and which decomposes the equipment into only those components that are being maintained or operated. Each component of this hierarchy has associated with it one or more of the following four categories of information.

- (i) Descriptive information
- (ii) Procedural information
- (iii) Trouble shooting information
- (iv) Parts information

(b) **Descriptive Information:** Descriptive information may provide information on system (subsystem, component, and part), physical arrangement, functional behavior, theory of operation, and other aspects. Descriptive information shall contain a hierarchy of narrative paragraphs. Paragraphs, in turn, may refer to primitive elements.

(c) **Procedural Information:** Procedural information shall be composed primarily of task statements. Each task element shall be associated with attributes which provide related information such as: estimated completion time; maintenance level(s) where the task is to be performed; required conditions which must be met before performing the task; and the number of people required to perform the task. A procedural element may be linked to other elements, which define the support equipment, and consumables that the task requires, through the establishment of appropriate relationships.

(d) **Trouble Shooting Information:** Trouble shooting information shall contain data necessary to isolate faults found in a system. Trouble shooting information shall contain fault elements, fault state elements, test elements, outcome elements, and rectification elements.

- (i) **Fault Elements:** Fault elements shall identify potential faults, which might occur in the system.
- (ii) **Fault State Elements:** Fault state elements shall present a list of faults implicated as the result of a test that has been performed. Each suspected fault in the list shall be weighted, based on the probability that it is the cause of the observed malfunction. The fault state element

may also present a list of possible faults that have been eliminated from consideration as the result of tests performed.

- (iii) **Test Elements:** Test elements shall contain a link to the procedural instructions a technician must follow to carry out a required task at a particular juncture in the trouble shooting procedure. Test elements shall also provide all possible test outcomes.
 - (iv) **Outcome Elements:** Outcome elements shall contain definitions of new fault states associated with the results of a particular test. Outcome elements shall also contain a description of the state of the item being maintained. The final outcome element of a fault isolation procedure shall have a relationship, which associates it with an identified fault. The identified fault has, in turn, associated with it the initial element of the appropriate corrective maintenance action.
 - (v) **Rectification Elements:** Rectification (i.e. corrective maintenance actions) elements shall contain references to procedural rectification tasks, checkout tests used to report the success of completed rectification tasks, and a list of all faults that the rectification shall repair.
- (e) **Parts Information:** Two types of parts information shall be included:
- (i) **Maintainer/Operator Information, and Supply Information:** Elements containing either type shall refer explicitly to corresponding elements of the other type. Parts information provided for a system maintainer and/or operator shall include such items as units per assembly, usable-on code, Mean Time Between Failures (MTBF), and reference designator, if applicable.
 - (ii) Parts information provided for the parts supply process shall constitute unambiguous identification on a part so that it can be reordered, and may consist of such items as: the part number, description, source, system, maintenance etc.

CONTENT SPECIFIC LAYER TAG SET - DESCRIPTIONS

- This appendix provides the detailed description of the IETM content specific elements and attributes to be included in an IETMDB. It is formulated as a description of possible tags or names for components in an IETMDB whose structure is defined by a DTD specified or developed in accordance with this JSG. The information contained herein is intended for compliance.
- E.2 **Action** - Used in the rectification (rect) element, this attribute contains character data describing the type of maintenance action required to rectify, or fix, a fault. The action can be a 'swap' which means it is a removal/replacement action or it can be a 'maint' action, which means it is an adjustment, alignment, or similar action. The default value is 'swap'.
- E.3 **Alert** - This element identifies an alert that may accompany a task or a step. The type attribute may designate an "Alert" to be a warning, caution or note which may be displayed to the user. A warning notifies the user that a task or step may be harmful to him or another human if not properly performed. A caution is used in technical information to emphasize a procedure that, if not strictly followed, or a condition that, if not strictly maintained, may result in damage to the equipment. A note signifies additional information, which aids the technician in completing the step or task. A note is used in technical information to emphasize an especially important procedure or condition.
- E.4 **Attach** - This element identifies all the attaching parts required for a given part information element.
- E.5 **Connection** - This element is used to identify a connection between two "part information" elements (e.g. a connection between pin 123 and wire ABC).
- E.6 **Consum** - This element identifies all the consumable required for the completion of the task.
- E.7 **Desc info** - The element "Desc info" is used to define general purpose, non-procedural, narrative information such as theory of operation, schematics, etc. which are

ated with a system component. The "Desc info" element is very flexible. It can be used to describe any arbitrary, hierarchical Hyper Text like node.

Equip - An "Equip" element identifies the equipment needed to perform a particular task. Equip usually refers to a piece of test equipment, support equipment or a tool.

Fault - The element "Fault" is used to identify a potential failure, which may occur in a weapon system.

Faultinf - The "Faultinf" element is used to define all the tests and faults associated with the system that references it.

Fltstate - The "Fltstate" element identifies a set of implicated or exculpated faults. Implicated faults are faults suspected of being bad; exculpated faults are faults known to be good. Each implicated fault will have a weight associated based on its likelihood of causing a discrepancy. The 'Type' attribute will designate whether the list of faults are 'implicated' or 'exculpated'.

Follow-On - A "Follow-on" condition is a maintenance condition, which must be accomplished sometime allowing the completion of a task to clean up or undo actions performed during the task. For example, in order to fix a component, a task might require that an access panel be removed. The panel would then need to be replaced as a follow on action. This task might be performed sometime after the repair task is completed, but not immediately after the repair task. Other maintenance tasks might be performed in the same time before the follow on task is accomplished. A follow-on element contains a set of pre-conditions, which define the follow-on maintenance condition, which must be satisfied, optional links, a text element which verbally describes the follow on condition, a list of step(s), which provide instructions for accomplishing the follow on condition, and a list of post-conditions, which define the state changes to be made once the follow on condition is accomplished.

Input - The input element contains the personnel required, the consumable used, the equipment used and the required conditions for accomplishing a given task.

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- E.14 **MTBF** - Used in the "Fault" and "Partinfo" elements, the value of this attribute signifies, for a particular interval, the total functional life of a population of an item divided by the total number of failures within the population during the measurement interval. The definition holds for time, rounds (cycles), miles, events, or other measure-of-life units.
- E.15 **Outcome** - This element represents a possible outcome from a test. It identifies a fault state (fltstate) for use in a dynamic fault model, and a test or fault for the static tree model.
- E.16 **Partbase** - This element describes the view of the "part information" of the supply system. It describes the item in terms of its part number.
- E.17 **Partinfo** - This element describes the view of the "part information" of the maintainer. It identifies "part information" within its relative position in the weapon system.
- E.18 **Partnum** - Used in the "Partbase" element, this attribute signifies any number, other than a government activity stock number, used to identify an item of production or supply.
- E.19 **Rect** - The "Rectification" (rect) element identifies the prescribed task that will repair the fault causing the discrepancy and all other faults that could be fixed by the rectification. Upon completion of the task, a test is performed to verify the effect of the rectification.
- E.20 **REPLVL** - Used in the "Partinfo" element, this "Replenish level" (REPLVL) attribute represents the minimum quantity of a part in stock that will trigger a recorder or stock action.
- E.21 **REQCOND** - A "Reqcond" element contains a list of preliminary conditions which must be met prior to beginning a task. If any condition is not met, it contains the task or step, which will satisfy the condition. It also contains post-conditions, which will record the state changes made in satisfying the conditions.
- E.22 **SMR** - Used in the "Partbase" element, SMR (Supply, maintenance and recoverability) codes are alphabetic or alphanumeric symbols used at the time of provisioning

to indicate the source of supply of an item, its maintenance implications, and its recoverability characteristics.

E.23 **Step** - The "Step" element is the primary component of a maintenance procedure. It describes the actions to be performed in order to successfully complete a task.

E.24 **System** - The "System" element defines the system/ subsystem/subassembly hierarchy for the weapon system. A "System" element must be created for any component (system, subsystem, and subassembly) which has associated technical information (descriptive, procedural, fault, or part data).

E.25 **Task** - The "Task" element is a set of directive steps, which make up a specific maintenance procedure. A maintenance procedure could be a preventive or corrective maintenance task. Preventive tasks are performed at regular intervals to ensure that the system will continue to operate correctly and safely (such as inspect, clean, lubricate, etc). Corrective (or unscheduled) maintenance procedures are performed when required to repair faulty items or systems that have been identified by trouble shooting procedures. A procedural task is made up of steps and links the required text, graphics, messages, prompts, and references. A task element contains linking information necessary to link one task to other tasks.

E.26 **Test** - This element indicates a diagnostic test that will lead to outcomes and guides the user towards rectification.

E.27 **USABLEON** - Used in the "Partinfo" element, this attribute identifies the different configurations in which a part or assembly may appear within a system or vehicle.

E.28 **Version** - This element identifies the currency of the data by providing the last revision information and change information necessary for taking delivery of partial Data base.

E.29 **Weight** - Used in the "Fltstate" element, this attribute represents a probability associated with a given fault within a list of faults in a "Fault state" (fltstate).

CONTENT SPECIFIC LAYER TAG SET - DESCRIPTIONS

- E.1 **Scope** - This appendix provides the detailed description of the IETM content specific elements and attributes to be included in an IETMDB. It is formulated as a description of possible tags or names for components in an IETMDB whose structure is defined by a DTD specified or developed in accordance with this JSG. The information contained herein is intended for compliance.
- E.2 **Action** - Used in the rectification (rect) element, this attribute contains character data describing the type of maintenance action required to rectify, or fix, a fault. The action can be a 'swap' which means it is a removal/replacement action or it can be a 'maint' action which means it is an adjustment, alignment, or similar action. The default value is 'swap'.
- E.3 **Alert** - This element identifies an alert that may accompany a task or a step. The type attribute may designate an "Alert" to be a warning, caution or note which may be displayed to the user. A warning notifies the user that a task or step may be harmful to him or another human if not properly performed. A caution is used in technical information to emphasize a procedure that, if not strictly followed, or a condition that, if not strictly maintained, may result in damage to the equipment. A note signifies additional information, which aids the technician in completing the step or task. A note is used in technical information to emphasize an especially important procedure or condition.
- E.4 **Attach** - This element identifies all the attaching parts required for a given part information element.
- E.5 **Connection** - This element is used to identify a connection between two "part information" elements (e.g. a connection between pin 123 and wire ABC).
- E.6 **Consum** - This element identifies all the consumable required for the completion of the task.
- E.7 **Desc info** - The element "Desc info" is used to define general purpose, non-procedural, narrative information such as theory of operation, schematics, etc. which are