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Guidelines
**FOR
DESCRIBING
INFORMATION
INTERCHANGE
FORMATS**

**U.S.
DEPARTMENT
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Foreword

The Federal Information Processing Standards Publication Series of the National Bureau of Standards is the official publication relating to standards adopted and promulgated under the provisions of Public Law 89 306, and under Office of Management and Budget Circular A-86. The entire series constitutes the FEDERAL INFORMATION PROCESSING STANDARDS REGISTER.

This series is used to announce Federal Information Processing Standards, and to provide standards information of general interest and an index of relevant standards publications and specifications. Publications that announce adoption of standards provide the necessary policy, administrative, and guidance information for effective standards implementation and use. The technical specifications of the standard are usually attached to the publication, otherwise a source of copies is cited.

Comments covering Federal Information Processing Standards and Publications are welcomed, and should be addressed to the National Bureau of Standards, Center for Computer Sciences and Technology, Office of Information Processing Standards, Washington, D.C. 20234. Such comments will be either considered by NBS or forwarded to the responsible activity as appropriate.

LEWIS M. BRANSCOMB, *Director*

Abstract

This publication provides guidelines which identify and describe the various characteristics of formatted information that should be considered whenever formatted information is interchanged. The objective is to clarify and improve the documentation necessary to effectively provide, process, or use the information involved. The guidelines provided are to be used throughout the Federal Government as a checklist for preparing effective documentation of formatted information interchange.

Key Words: Data processing systems standards; Federal Information Processing Standards; formatted records; information interchange; United States Government.

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ANNOUNCING THE

**GUIDELINES FOR DESCRIBING INFORMATION
INTERCHANGE FORMATS**

Federal Information Processing Standards Publications are issued by the National Bureau of Standards under the direction of the Office of Management and Budget in accordance with the provisions of Public Law 89-306 and Office of Management and Budget Circular A-86.

Name of Standard. Guidelines for Describing Information Interchange Formats.

Category of Standard. Software Standard, Documentation.

Explanation. These Guidelines identify and describe the various characteristics of formatted information that should be considered whenever formatted information is interchanged. The objective is to clarify and improve the documentation necessary to effectively provide, process or use the information involved.

Approving Authority. Office of Management and Budget.

Maintenance Agency. Department of Commerce, National Bureau of Standards (Center for Computer Sciences and Technology).

Cross Index. None.

Applicability. These Guidelines are intended as a reference document only, and are recommended for general use throughout the Federal Government as a check list for preparing effective documentation of formatted information interchange. Its use is encouraged, but is not mandatory.

Implementation. As new systems are being developed or current systems revised, the use of these Guidelines should be considered. Also whenever new information interchange requirements are developed, this FIPS PUB may be useful in the development of format specifications and forms design. It is not the intent to change existing format descriptions. However, the use of this FIPS PUB as a basis for assessing the adequacy of present documentation methods is encouraged.

Specifications. Federal Information Processing Standard 20 (FIPS 20), Guidelines for Describing Information Interchange Formats, (affixed).

Qualifications. The characteristics provided in the Guidelines are based upon many years of information interchange experience and reflect current technologies. As new techniques and equipments become available in the future which effect current practices, these Guidelines will need to be modified accordingly. As experiences are gained through the future use of these Guidelines they may become a basis for the adoption of standards. In this regard, where these Guidelines are used in the development of procedures or forms, it is requested that copies of these be provided to the National Bureau of Standards, Center for Computer Sciences and Technology, Washington, D.C. 20234.

Where to Obtain Copies of the Standard.

a. Copies of this publication are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (25 cents a copy: SD Catalog Number

C13.52:20). There is a 25 percent discount on quantities of 100 or more. When ordering, specify document number, title, and SD Catalog number. Payment may be made by check, money order, coupons, or deposit account.

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Federal Information Processing Standard 20 (Date)



SPECIFICATIONS FOR

GUIDELINES FOR DESCRIBING INFORMATION INTERCHANGE FORMATS

1. Name of Standard. Guidelines for Describing Information Interchange Formats.

2. Category of Standard. Software Standard, Documentation.

3. Explanation. These guidelines identify and describe the various characteristics of formatted information that should be considered whenever formatted information is interchanged. The objective is to clarify and improve the documentation necessary to effectively provide, process or use the information involved.

4. Specifications

4.1. Contents. These specifications are presented in three sections with an appendix that provides a glossary of terms as follows:

4.2. Introduction

4.3. Physical Characteristics

4.4. Logical Characteristics

Appendix A—Glossary

4.2. Introduction. There is a requirement for a clear understanding of the information content whenever information is interchanged. Failure to adequately address this aspect of information interchange has resulted in misinterpretations and needless hours spent in attempting to process the information by both men and machines. These Guidelines are provided to assist personnel directly involved in the documentation of information systems and information interchange.

When information is collected and interchanged, there are many techniques utilized. These techniques vary depending upon the requirements of each system. Some of these techniques are as follows:

1. The collection of information using manual forms which are subsequently converted to machine processable form.

2. The collection of information using machine-readable forms as in mark sensing or optical character recognition.

3. The interchange of information using removable machine sensible media such as punched cards, magnetic tape, magnetic disks, cassettes, or perforated tape.

4. The direct on-line entry of information from a keyboard terminal to a computer or other terminal.

5. The direct on-line interchange of information between computers.

Regardless of the technique employed, there must be a complete understanding between the sender and receiver or the requestor and furnisher of the information involved.

These Guidelines were prepared primarily considering the interchange of information on magnetic tape as the base. These can be readily adopted to other forms of information interchanged by appropriate reference to the characteristics peculiar to the particular interchange medium or technique.

In the interchange of information, there are usually three places where the information is described: 1) on an external label which is affixed to the cover or container (e.g., the adhesive label that is fastened to a reel of tape); 2) in an internal machine sensible form that is part of the interchange information (e.g., a magnetically recorded label on a reel of tape and/or file description); and 3) in a document that either accompanies the information or is specified prior to the interchange. The characteristics identified in these Guide-

lines may appear in any of these three places. (Sometimes the same characteristic may be identified or described in more than one place).

It is not the intent of these Guidelines to specify at which place a certain characteristic must be described as this is better done by the systems personnel due to the differences in various systems. However, it is important that the Guidelines be used as a check list to assure that the applicable characteristics are provided for in one or more of these three areas. In this regard, it is recommended that all applicable characteristics be described in the external documentation in order to facilitate processing due to the differences in equipment reading techniques. The characteristics of the information are divided into two sections, physical and logical. The physical section identifies those characteristics having to do with the manner and form of the physical recording and media. The logical section identifies those characteristics of information that are independent of the media or recording technique and are applicable to the definition, representation, and structure of the information.

4.3. Physical Characteristics. In this section the physical characteristics of information are identified and described. Some characteristics do not apply in all cases of information interchange.

4.3.1. ADP Coordinator. Indicate the organization that produced the information in machine readable form. Provide name, address, and telephone number of person(s) to contact for clarification or further information concerning technical aspects of the recording.

4.3.2. Type of Medium. Indicate magnetic tape, punched cards, cassettes, perforated tape, on-line transmission, or other media information.

4.3.3. Length of Medium. Indicate the length of tape on the reel or cassette or the number of cards in the deck. (e.g., 600, 1200, 2400, 3600 feet or the number cards). If multiple reels, cassettes, or card boxes are used, indicate the number involved.

4.3.4. Width of Medium. Indicate the width of the tape, the number of columns in the

cards, or the width of the perforated tape (e.g., $\frac{1}{2}$, $\frac{3}{4}$, 1 inch or 80, 96 columns).

4.3.5. Number of Tracks. Indicate the number of recording tracks and track-bit assignments for magnetic or perforated tape or the number of rows in punched cards (e.g., 6, 7, 8, 9 tracks or 12 rows).

4.3.6. Recording Density. Indicate the number of bits or characters recorded per inch (BPI) or (CPI) for magnetic tape. (e.g., 200, 556, 800, 1600 BPI).

4.3.7. Recording Method. Indicate the particular recording method used (e.g., non return to zero (NRZI) or phase encoded).

4.3.8. Character Code. Indicate the character code used to record the information (e.g., ASCII, Hollerith, EBCDIC, BCD, binary or other). If there are variations to these established conventions or if a subset of these are used (e.g., upper case letters only), these variations need to be described. If floating point binary representation is used, describe its structure.

4.3.9. Parity. Indicate the framing and/or blocking technique used for the parity bit. (e.g., even, odd, or mixed) If mixed, describe the particular method(s) used.

4.3.10. Recorded Label. Indicate if a recorded label is used. If used, describe the labeling technique, standard, or procedure used. (e.g., American National Standard X3.27-1969).

4.3.11. Control Characters. If tape marks or control characters are used to signify beginning or ending of files or for other purpose(s), identify the characters, their codes, their use and location.

4.3.12. Record Size. Indicate the type size of the records (e.g., fixed, variable, or mixed). If fixed, indicate size in number of words, characters, or bytes. If variable or mixed, describe techniques used to control and indicate size. If known, indicate the maximum, minimum, and modal (average) size of the variable length record. When indicating size in terms of number of words, also indicate word size.

4.3.13. Block Size. Indicate the type size of the blocks (e.g., fixed, variable, or mixed). If fixed, indicate size in number of words, characters, or bytes. If the block is variable or mixed describe control techniques and indicate maximum, minimum and average (modal) sizes. When indicating size in terms of words, also indicate word size.

4.3.14. Blocking Factor. Indicate the relationship between the physical block and the record. (e.g., multiple records contained in a single block or a single record contained in multiple blocks.) Also describe padding techniques employed.

4.3.15. Recording Equipment and System. Indicate the manufacturers' model numbers of the terminal, computer (CPU), tape drives, or other devices used to record the data. If computer generated, indicate the operating system, version, and level or type. For magnetic tape, describe the characteristics of the interrecord gap.

4.3.16. Creation Date. Indicate the date that the information was created or last updated. This date may or may not be the same as the recording date.

4.3.17. Recording Date. Indicate the date that the information on this particular medium was generated. This may or may not be the date of the information (i.e., If a tape is copied, the date of the copy is the recording date not the date of the information).

4.3.18. Obsolescent Date. If the information is of a terminal nature, indicate the date after which it should be retired or replaced.

4.3.19. Single or Multiple File. Indicate if more than one file is recorded on the reel, if multiple files are recorded on a single reel or if multiple reels are used to record a single file. If multiple files are recorded on a single reel, the number of files, their relative position, and any specialized access information should be described.

4.3.20. Number of Records. Indicate the number of records in the file, if known.

4.3.21. Privacy (Security Classification). Indicate any restrictions (release limitations) on

the use of the information and/or its security classification.

4.4. Logical Characteristics. In this section the logical characteristics of the information are identified and described. Some characteristics do not apply in all cases of information interchange.

4.4.1. File Characteristics

4.4.1.1. File Name. Indicate the name used to identify the file (e.g., Payroll Master).

4.4.1.2. File Identification Number. Indicate the number or symbolic tag used to identify the file.

4.4.1.3. File Date. Indicate the "as of date" of the information in the file. For files that contain information extending over a period of time, indicate the beginning and ending dates of the included period.

4.4.1.4. File Structure. Indicate and describe the data organization method or methods of the file (e.g., sequential, random, or list organization). If file is made up of different types of records, each type needs to be identified.

4.4.1.5. Sponsor of the File. Indicate the organization that sponsored the establishment of the file and is aware of its contents. Provide name, address, and telephone number of person(s) to contact for clarification or further information. This may differ from the ADP Coordinator (paragraph 4.3.1.) who is responsible for its processing.

4.4.1.6. Documentation. Identify the documentation (e.g., procedure, instruction, systems manual and/or other documents) that describe the file and its uses.

4.4.1.7. Primary Subject of the File. Identify the data element(s), (field name(s)) that are the primary subject of the file.

4.4.1.8. Collating Sequence. Indicate how the records are sorted to form the particular record arrangement of the file. If a special sort key is derived for sequencing, explain how this is accomplished. If sorting is performed using character values other than those assigned in recognized character codes (paragraph 4.3.8),

provide a table of the characters and values assigned to each.

4.4.1.9. Related Records and Processes. If the records in the file are produced from or are used to produce other files/records indicate these and the processes involved.

4.4.1.10. Hash/Control Total Information. If hash counts or control totals are incorporated in the file, these should be identified and explained.

4.4.1.11. Subset File. If the information on the file is a subset of a larger file, describe how the subset was derived.

4.4.2. Record Characteristics. (Each different record type should be described).

4.4.2.1. Record Name. Indicate the title or name used to identify the record.

4.4.2.2. Record Identification Number. Indicate the number or symbolic tag used to identify the record (e.g., form number, transaction number or code, or other type number).

4.4.2.3. Originator of the Record. Identify the source of the information in this record.

4.4.2.4. Record Date. If the record contains a date used to identify when it was added to the file or last updated, describe method utilized.

4.4.2.5. Obsolescent Date. If the information in the record is of a terminal nature, indicate the date after which the information should be retired or replaced.

4.4.2.6. Privacy (Security Classification). There may be different restrictions on different records in a file. If this is the case, this needs to be indicated and explained.

4.4.2.7. Record Layout. Provide a layout that locates the position of each field and the identification of the data elements contained therein. Also, indicate the abbreviations or symbols used to identify the elements on associated forms or listings.

4.4.2.8. Record Index. If this technique is used provide a description of the index and its use.

4.4.3. Data Elements

4.4.3.1. Data Element Name. Indicate the name of the element (field name).

4.4.3.2. Data Element Abbreviation. If used, indicate the abbreviation of the element.

4.4.3.3. Data Element Tag. If used, indicate the symbolic tag or code used to identify the element.

4.4.3.4 Composite/Variable Name Data Element. If this element is a composite or variable name data element, identify and define its items. The items may also have abbreviations and tags, if so these should be indicated.

4.4.3.5. Relationship Element. Indicate whether the element is a primary element or attribute element. If an attribute element, identify the associated element(s).

4.4.3.6 General Definition. Provide a concise definition using non-technical terms to describe the meaning of the element.

4.4.3.7. Context Dependent Definition. Provide a definition of the element used by specialists or those skilled in the subject area.

4.4.3.8. Data Element Source. Indicate the source or provider of this particular data element.

4.4.3.9. Data Element Update. In some applications the date and/or time that certain elements are changed (added or modified) is indicated. If this technique is employed, this should be explained.

4.4.4. Field Characteristics

4.4.4.1. Location of Field. Indicate card columns, character positions in tape record, or other means for locating the field (beginning and ending positions). If the data items in the field are of a composite or variable name element, the location of each item needs to be specified.

4.4.4.2. Field Separators. If these are used in the record, specify the character(s) or byte(s) used and the technique employed.

4.4.4.3. Field Length Type and Size. Indicate whether the field is fixed or variable in length and its size in number of words, characters, or bytes. When indicating size in number of words, also indicate word size.

4.4.4.4. Character Type. Indicate the type of characters or representation used to express the data item(s) i.e., alphabetic, pure alphabetic, numeric, pure numeric, alphanumeric, pure alphanumeric, binary, packed numeric, other.

4.4.4.5. Justification. Indicate whether the value (data item) representation is left or right justified in the field.

4.4.4.6. Implied Attributes. If the value represented has implied measure (e.g., dollars, thousands of dollars, degrees, etc.) or other attributes that need to be defined before full understanding can be obtained, these attributes should be indicated.

4.4.4.7. Level of Accuracy. Indicate the level of accuracy of the data element (e.g., validated or unvalidated).

4.4.4.8. Truncation/Rounding. If the value or representation has been shortened in any way, the technique used should be indicated.

4.4.4.9. Form of Representation. Indicate the form of representation used to express the data item(s) (i.e., name, abbreviation, code or numeric value.)

4.4.4.10. Names. If the representation is a name, indicate its structure or syntax rules used.

4.4.4.11. Abbreviations. If the representation

is an abbreviation, indicate the abbreviation construction rules used or cite the source or reference of the abbreviations.

4.4.4.12. Codes. Indicate the characteristics of the code and cite the source or reference of the codes.

4.4.4.13. Significance. Indicate whether the code is significant or nonsignificant. If significant explain the type of significance.

4.4.4.14 Dependency. If the code has dependent segments, indicate the structure and dependence of the segments.

4.4.4.15. Self-checking code. If a self-checking code is appended to the code, indicate its position and method of derivation.

4.4.4.16. Source. Indicate the reference or source of the codes used.

4.4.4.17. Numeric Value. Indicate how the value was derived (i.e., measured (describe measurement technique), counted, estimated, computer (describe method) or other means). If the numeric value is signed (+ or -), describe the location of sign and its representation.

4.4.4.18. Permissible Values. If only certain values or range of values are allowed, indicate these.

4.4.4.19. Null State Condition. In some applications, certain values, such as all blanks, are used to indicate that no value has been reported for this field (null state). If this technique is employed, this needs to be explained.



GLOSSARY OF TERMS

This Glossary provides definitions of terms used in these Guidelines where it was felt that these would be helpful to the reader. The terms and definitions are either from established vocabularies or have been developed for purposes of these Guidelines.

ASCII—American Standard Code for Information Interchange (FIPS 1).

Attribute data element—A data element that is used to qualify or quantify another data element (e.g., “Date of Birth” and “Mailing Address” would be attribute data elements in a personnel file where the primary element(s) is/are used to identify the person).

Character type—An indication of the type of characters or bytes to represent a value (i.e., alphabetic, numeric, pure adphabetic, pure numeric, binary, packed numeric, etc.).

Alphabetic—A representation which is expressed using only letters and punctuation symbols.

Alphanumeric—A representation which is expressed using letters, numbers, and punctuation symbols.

Binary—A representation of numbers which is expressed using only the numbers 0 and 1, e.g., 5 is expressed as 101.

Numeric—A representation which is expressed using only numbers and selected mathematical punctuation symbols.

Packed numeric—A representation of numeric values that compresses each character representation in such a way that the original value can be recovered, e.g., in an eight bit byte, two numeric characters can be represented by two four bit units.

Pure alphabetic—A representation which is expressed using only letters.

Pure alphanumeric—A representation which is expressed using only letters and numbers.

Pure numeric—A representation which is expressed using only numbers.

Composite data element (data chain)—A data element that has an ordered string of related data items that can be treated as a group or singly, e.g., a data element named “Date of Birth” could have the data items, “Year”, “Month”, and “Day of Month”.

Context dependent definition—A statement of meaning that relies upon a situation, background, or environment for proper interpretation.

Data code—A coded representation used to identify a data item. Usually codes are designed according to established rules and criteria, and only by chance form a phonetic word or phrase.

Data element—A basic unit of identifiable and definable information. A data element occupies the space provided by fields in a record or blocks on a form. It has an identifying name and value or values for expressing a specific fact e.g., employee name, employee number, date of birth, mailing address, color of eyes, height and weight.

Data element abbreviation—An abbreviated form of the data element name.

Data element definition—A statement of the meaning of a data element.

Data element name—A name used to identify a data element.

Data element source—An identification of the source or provider of the particular data element, i.e., individual, organization, sensor, computation, etc.

Data element tag (data element code)—A symbolic tag used to identify a data element.

Data item—The expression of a particular fact of a data element e.g., “Blue” may be a data item of the data element named “Color of eyes”.

Data item abbreviation—An abbreviated form of the data item name.

Data item definition—A statement of the meaning of a data item.

Data item name—A name used to identify a data item.

Dependent code—A code that has segments which are dependent upon other segments in order to provide unique identification of the coded item. Usually, codes having classification significance are dependent codes.

EBCDIC—Extended Binary Coded Decimal Interchange Code.

Field—In a record, a specific area used for representing a particular category of data, e.g., a group of card columns used to express a wage rate.

Field length—A measure of the length (size) of a field, usually expressed in units of characters, words, or bytes.

Field length type—An indication of whether the field of a record is a fixed or variable in length.

Fixed length field—A field whose length does not vary.

Variable length field—A field whose length varies. Usually, the boundaries of this type of field are identified by field separators.

Field separator—A character or byte used to identify the boundary between fields.

File structure—The manner in which data are organized (arrangement and interrelationship) in a file.

Sequential organization—The arrangement of records in a file according to a specified sequence.

Random organization—The arrangement of records in a file based on a predictable relationship between one of the elements of the record and the address of the location where the record is stored.

List organization—The arrangement of data in a matter that divorces the logical organization from the physical organization through the use of pointers. There are three

basic types of list organizations: simple lists, inverted lists and rings.

Filler character—A specific character or bit combination used to fill the remainder of a field after justification.

Formatted information—An arrangement of information into discrete units and structures in a manner to facilitate its access and processing. Contrasted with narrative information that is arranged according to rules of grammar.

General definition—A statement of meaning that can be interpreted without regard to a specific situation, background, or environment.

Information interchange—The transfer of data representing information between or among two or more points (devices, locations, organizations, or persons) of the same or different (dissimilar) information system or systems.

Justification—To adjust the value representation in a field to either the right or left boundary (margin).

Left justify—Adjustment of a value representation to the left boundary (high order) of a field.

Right justify—Adjustment of a value representation to the right boundary (low order) of a field.

Non-significant code—A code that provides for the identification of a particular fact but does not yield any further information, e.g. random numbers used as codes. Contrasted with significant code.

Numeric value—The expression of a data item which denotes a measurement, count, or mathematical concept, usually represented by numerals and a limited number of special characters (i.e., plus (+), minus (-), decimal point (.), comma (,), asterisk (*), and slant (/)).

Padding—A technique used to fill a field, record, or block with dummy data (usually zeros or spaces).

Primary data element—A data element or elements that is/are the subject of a record. Usually the other elements, called attribute data elements, qualify or quantify the primary data

element (e.g., in a personnel field, the element(s) that is/are used to identify the individual are primary; other elements such as "Date of Birth" and "Mailing Address" are attribute data elements).

Radix point—A character, usually a period, that separates the integer part of a number from the fractional part. In decimal (base 10) notation the radix point is called the decimal point.

Record—A collection of related elements of data treated as a unit.

Record index—An ordered reference list of the contents of a record together with keys or reference notations for identifying and locating the contents.

Record layout—A description of the arrangement and structure of information in a record, including the sequence and size of each identified component.

Record length—A measure of the length (size) of a record, usually expressed in units of characters, words, or bytes.

Record length type—An indication of whether the records of a file are fixed or variable in length.

Fixed length record—Pertaining to a file in which the records are uniform in length.

Variable length record—Pertaining to a file in which the records are not uniform in length.

Rounding (Roundoff)—To delete the least significant digit or digits of a numeral, and to adjust the part retained in accordance with some rule.

Self-checking code—A code that is appended to another code to provide for validity checking. A self-checking code is derived mathematically from the characteristics of the base code.

Significant code—A code which in addition to identifying a particular fact also yields further information, e.g., catalog numbers in addition to identifying a particular item also often indicate the classification of the item. Contrasted with non-significant code.

Time of observation—The date and/or time of the actual occurrence or reporting of the fact(s).

Truncate—To delete characters from a character string, usually from either end of the string.

Type of code significance—An indication of the type of significance that a particular code yields.

Collating significance—A code designed in such a way that it facilitates ordering of the coded item.

Mnemonic significance—A code designed in such a way as to facilitate the human recall of the name of the coded items.

Classification significance—A code designed in such a way as to facilitate the classifying of the coded items into classes and sub-classes.

Type of observation—An indication as to how the data was collected or reported i.e., estimated, immediate observation, measurement technique, etc.

Variable name data element—A data element that identifies a set (array) of similar values (data items). By varying certain identifiers in the name the entire set (array) of values can be identified. For example, a set of values that give population by State and Year could be identified by the data element "Population of (State) in (Year)" where State and Year are variable names. The variable names are used to identify particular values in an array (e.g., "Population of (New Jersey) in 1970)" was 7,168,164.) In this example "New Jersey" and "1970" are variable names used to identify a specific value "7,168,164" in an array.

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