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FIPS PUB 21-4

FEDERAL INFORMATION PROCESSING STANDARDS PUBLICATION
(Supersedes FIPS PUB 21-3—1990 January 12)

COBOL

CATEGORY: SOFTWARE STANDARD

SUBCATEGORY: PROGRAMMING LANGUAGE

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Computer Systems Laboratory
National Institute of Standards and Technology
Gaithersburg, MD 20899-0001

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U.S. Department of Commerce
Ronald H. Brown, Secretary

Technology Administration
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National Institute of Standards
and Technology
Arati Prabhakar, Director

Foreword

The Federal Information Processing Standards Publication Series of the National Institute of Standards and Technology (NIST) is the official publication relating to standards and guidelines adopted and promulgated under the provisions of Section 111(d) of the Federal Property and Administrative Services Act of 1949 as amended by the Computer Security Act of 1987, Public Law 100-235. These mandates have given the Secretary of Commerce and NIST important responsibilities for improving the utilization and management of computer and related telecommunications systems in the Federal Government. The NIST, through its Computer Systems Laboratory, provides leadership, technical guidance, and coordination of Government efforts in the development of standards and guidelines in these areas.

Comments concerning Federal Information Processing Standards Publications are welcomed and should be addressed to the Director, Computer Systems Laboratory, National Institute of Standards and Technology, Gaithersburg, MD 20899.

James H. Burrows, Director
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Abstract

This publication announces the adoption of American National Standard COBOL, as specified in ANSI X3.23-1985, X3.23a-1989 and ANSI X3.23b-1993, as a Federal Information Processing Standard (FIPS). This revision supersedes FIPS PUB 21-3 and reflects corrections and clarifications to the COBOL specifications. The American National Standards define the elements of the COBOL programming language and the rules for their use. The purpose of the standards is to promote portability of COBOL programs for use on a variety of data processing systems. The standards are used by implementors as the reference authority in developing processors and by users who need to know the precise syntactic and semantic rules of the standard language.

Key words: COBOL; data processing; Federal Information Processing Standard; information interchange; information processing; Intrinsic Function; programming language; software; standards conformance.

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Announcing the Standard for

COBOL

Federal Information Processing Standards Publications (FIPS PUBS) are issued by the National Institute of Standards and Technology (NIST) after approval by the Secretary of Commerce pursuant to Section 111 (d) of the Federal Property and Administrative Services Act of 1949 as amended by the Computer Security Act of 1987, Public Law 100-235.

1. **Name of Standard.** COBOL (FIPS PUB 21-4).
2. **Category of Standard.** Software Standard, Programming Language.
3. **Explanation.** This publication announces the adoption of American National Standard COBOL, as specified in ANSI X3.23-1985, X3.23a-1989 and ANSI X3.23b-1993, as a Federal Information Processing Standard (FIPS). This revision supersedes FIPS PUB 21-3 and reflects corrections and clarifications to the COBOL specifications. The American National Standards define the elements of the COBOL programming language and the rules for their use. The purpose of the standards is to promote portability of COBOL programs for use on a variety of data processing systems. The standards are used by implementors as the reference authority in developing processors and by users who need to know the precise syntactic and semantic rules of the standard language.
4. **Approving Authority.** Secretary of Commerce.
5. **Maintenance Agency.** Department of Commerce, National Institute of Standards and Technology (NIST).
6. **Cross Index.**
 - a. American National Standard for Information Systems—Programming Language—COBOL, ANSI X3.23-1985, ISO 1989-1985.
 - b. American National Standard for Information Systems—Programming Language—Intrinsic Function Module for COBOL, ANSI X3.23a-1989.
 - c. American National Standard for Information Systems—Programming Language—Correction and Clarification Amendment for COBOL, ANSI X3.23b-1993.
7. **Related Documents.***
 - a. Federal Information Resources Management Regulation (FIRMR) Subpart 201.20.303, Standards, and Subpart 201.39.1002, Federal Standards.
 - b. Federal Information Processing Standards Publication 29, Interpretation Procedures for Federal Information Processing Standards for Software.
 - c. NBS Special Publication 500-117, Selection and Use of General-Purpose Programming Languages.

* Refers to most recent revision of FIPS PUBS.

8. Objectives. Federal standards for high level programming languages permit Federal departments and agencies to exercise more effective control over the production, management, and use of the Government's information resources. The primary objectives of Federal programming language standards are:

- to encourage more effective utilization and management of programmers by insuring that programming skills acquired on one job are transportable to other jobs, thereby reducing the cost of programmer re-training;
- to reduce the cost of program development by achieving the increased programmer productivity that is inherent in the use of high level programming languages;
- to reduce the overall software costs by making it easier and less expensive to maintain programs and to transfer programs among different computer systems, including replacement systems; and
- to protect the existing software assets of the Federal Government by insuring to the maximal feasible extent that Federal programming language standards are technically sound and that subsequent revisions are compatible with the installed base.

9. Applicability.

a. Federal standards for high level programming languages should be used for computer applications and programs that are either developed or acquired for government use. FIPS COBOL is one of the high level programming language standards provided for use by all Federal departments and agencies. FIPS COBOL is especially suited for applications that emphasize the manipulation of characters, records, files, and input/output (in contrast to those primarily concerned with scientific and numeric computations).

b. The use of FIPS high level programming languages is strongly recommended when one or more of the following situations exist:

- It is anticipated that the life of the program will be longer than the life of the presently utilized equipment.
- The application or program is under constant review for updating of the specifications, and changes may result frequently.
- The application is being designed and programmed centrally for a decentralized system that employs computers of different makes, models and configurations.
- The program will or might be run on equipment other than for which the program is initially written.
- The program is to be understood and maintained by programmers other than the original ones.
- The advantages of improved program design, debugging, documentation and intelligibility can be obtained through the use of this high level language regardless of interchange potential.
- The program is or is likely to be used by organizations outside the Federal Government (i.e., State and local governments, and others).

c. Nonstandard language features should be used only when the needed operation or function cannot reasonably be implemented with the standard features alone. Although nonstandard language features can be very useful, it should be recognized that their use may make the interchange of programs and future conversion to a revised standard or replacement processor more difficult and costly.

d. It is recognized that programmatic requirements may be more economically and efficiently satisfied through the use of report generation, database management, or text processing languages. The use of any facility should be considered in the context of system life, system cost, data integrity, and the potential for data sharing.

e. Programmatic requirements may be also more economically and efficiently satisfied by the use of automatic program generators. However, if the final output of a program generator is a COBOL source program, then the resulting program should conform to the conditions and specifications of FIPS COBOL.

f. When it is determined that a programming language that has been adopted as a FIPS is to be used for an application or program, a processor conforming to the FIPS programming language shall be used, if available. It is not intended that existing programs be rewritten solely for the purpose of conforming to a FIPS programming language. If a program is to be part of an existing application written in a programming language not conforming to a FIPS, the language processor used for the existing application may be used for the new program.

10. Specifications. FIPS COBOL specifications are the same as American National Standard COBOL as specified in ANSI X3.23-1985, ANSI X3.23a-1989 and ANSI X3.23b-1993.

ANSI X3.23-1985, ANSI X3.23a-1989 and ANSI X3.23a-1993 specify the form of a program written in COBOL, formats for data, and rules for program and data interpretation.

The standards do not specify limits on the size of programs, minimum system requirements, the means of supervisory control of programs, or the means of transforming programs internally for processing.

In addition, the following requirements apply:

a. For purposes of FIPS COBOL, the modules defined in ANSI X3.23-1985 and ANSI X3.23a-1989 are combined into three subsets and four optional modules. The three subsets are identified as Minimum, Intermediate, and High. The four optional modules are Report Writer, Communication, Debug, and Segmentation. These four optional modules may be associated with any of the subsets.

The high subset is composed of all language elements of the highest level of all required modules. The intermediate subset is composed of all language elements of level 1 of all required modules except the Intrinsic Function module. The minimum subset is composed of all language elements of level 1 of the Nucleus, Sequential I-O, and Inter-Program Communication modules.

The following table reflects the composition of the required subsets and the relationship of the subsets and the optional modules. The numbers in the table refer to the level within a module as designated in ANSI X3.23-1985 and ANSI X3.23A-1989, and a dash denotes the corresponding module is omitted or may be omitted.

Modules	COBOL Subsets		
	Minimum	Intermediate	High
Required			
Nucleus	1	1	2
Sequential I-O	1	1	2
Relative I-O	-	1	2
Indexed I-O	-	1	2
Inter-Program			
Communication	1	1	2
Sort-Merge	-	1	1
Source Text	-	1	2
Manipulation			
Intrinsic Function	-	-	1
Optional			
Report Writer,	-, or 1	-, or 1	-, or 1
Communication	-, 1, or 2	-, 1, or 2	-, 1, or 2
Debug	-, 1, or 2	-, 1, or 2	-, 1, or 2
Segmentation	-, 1, or 2	-, 1, or 2	-, 1, or 2

b. A facility must be available in the processor for the user to optionally specify monitoring of the source program at compile time. The monitoring may be specified for a FIPS COBOL subset, for any of the optional modules, for all of the obsolete language elements included in the processor, or for a combination of a FIPS COBOL subset, optional modules, and all obsolete elements. The monitoring may be specified for any FIPS COBOL subset at or below the highest subset for which the processor is implemented and for a level of an optional module at or below the level of the optional module for which the processor is implemented. The monitoring is an analysis of the syntax used in the source program against the syntax included in the user selected FIPS COBOL subset and optional modules. Any syntax used in the source program that does not conform to that included in the user selected FIPS COBOL subset and optional modules will be diagnosed and identified to the user through a message on the source program listing. Any syntax for an obsolete language element included in the processor and used in the source program will also be diagnosed and identified through a message on the source program listing. The determination of the need to flag any given source program syntax in accordance with these requirements cannot be logically resolved until the syntactic correctness of the source program has been established. The message provided will identify:

- The level indicator, clause, statement or header that directly contains the nonconforming or obsolete syntax. (For the purpose of this requirement the definitions of level indicator, clause, statement and header contained in American National Standard COBOL, ANSI X3.23-1985, Section III, Glossary, and the definition of syntax contained in American National Dictionary for Information Processing Systems, (ANDIS), ANSI X3.172-1990, apply.)
- The source program line and an indication of the beginning location within the line of the level indicator, clause, statement or header which contains the nonconforming or obsolete syntax.
- The syntax as “nonconforming standard” if the nonconforming syntax is included in the processor but is not within the user selected FIPS COBOL subset or optional modules unless monitoring is selected for the obsolete category; in that case obsolete language elements are only flagged as “obsolete”.
- The syntax as “nonconforming nonstandard” if the nonconforming syntax is a nonstandard extension included in the processor.
- The syntax as “obsolete” if the syntax identified is in the obsolete category within a FIPS COBOL subset or optional module included in the processor.

11. Implementation. The implementation of FIPS COBOL involves three areas of consideration: acquisition of COBOL processors, interpretation of FIPS COBOL, and validation of COBOL processors.

11.1 Acquisition of COBOL Processors. This publication is effective July 17, 1995. COBOL processors acquired for Federal use after this date should implement at least one of the required subsets of FIPS COBOL. If the functionality of one or more of the optional modules meets programmatic requirements, then those optional modules also should be acquired. Each optional module that is needed to meet programmatic requirements should be explicitly cited as a requirement in the order for the processor. Conformance to FIPS COBOL should be considered whether COBOL processors are developed internally, acquired as part of an ADP system procurement, acquired by separate procurement, used under an ADP leasing arrangement, or specified for use in contracts for programming services.

A transition period provides time for industry to produce COBOL processors conforming to the standard. The transition period begins on the effective date and continues for one (1) year thereafter. The following apply during the transition period:

a. The provisions of FIPS PUB 21-3 apply to processors ordered before the effective date but delivered subsequent to the effective date.

b. The provisions of this publication apply to orders placed after the effective date; however, a processor conforming to FIPS PUB 21-4, if available, may be acquired for use prior to the effective date. If a conforming processor is not available, a processor conforming to FIPS PUB 21-3 may be acquired for interim use during the transition period.

11.2 Interpretation of FIPS COBOL. NIST provides for the resolution of questions regarding FIPS COBOL specifications and requirements, and issues official interpretations as needed. All questions about the interpretation of FIPS COBOL should be addressed to:

National Institute of Standards and Technology
ATTN: COBOL Interpretation
Technology Building, Room B-154
Gaithersburg, MD 20899

11.3 Validation of COBOL Processors. NIST provides a service for the purpose of validating the conformance to this standard of processors offered for Federal procurement. The validation system reports the nature of any deviations that are detected. This service is offered on a reimbursable basis. Further information about the validation service can be obtained from the Software Standards Validation Group, COBOL Validation, National Institute of Standards and Technology, Gaithersburg, MD 20899 (301) 975-3247.

12. Waivers. Under certain exceptional circumstances, the heads of Federal departments and agencies may approve waivers to Federal Information Processing Standards (FIPS). The head of such agency may redelegate such authority only to a senior official designated pursuant to section 3506(b) of Title 44, United States Code. Waivers shall be granted only when:

- a. Compliance with a standard would adversely affect the accomplishment of the mission of an operator of a Federal computer system, or
- b. Cause a major adverse financial impact on the operator which is not offset by Government-wide savings.

Agency heads may act upon a written waiver request containing the information detailed above. Agency heads may also act without a written waiver request when they determine that conditions for meeting the standard cannot be met. Agency heads may approve waivers only by a written decision which explains the basis on which the agency head made the required finding(s). A copy of each such decision, with procurement-sensitive or classified portions clearly identified, shall be sent to: National Institute of Standards and Technology; ATTN: FIPS Waiver Decisions, Technology Building, Room B-154; Gaithersburg, MD 20899.

In addition notice of each waiver granted and each delegation of authority to approve waivers shall be sent promptly to the Committee on Government Operations of the House of Representatives and the Committee on Governmental Affairs of the Senate and shall be published promptly in the *Federal Register*.

When the determination on a waiver applies to the procurement of equipment and/or services, a notice of the waiver determination must be published in the *Commerce Business Daily* as a part of the notice of solicitation for offers of an acquisition or, if the waiver determination is made after that notice is published, by amendment to such notice.

A copy of the waiver, any supporting documents, the document approving the waiver and any supporting and accompanying documents, with such deletions as the agency is authorized and decides to make under 5 U.S.C. Sec. 552(b), shall be part of the procurement documentation and retained by the agency.

13. Where to Obtain Copies. Copies of this publication are for sale by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161. (Sale of the included specifications document is by arrangement with the American National Standards Institute.) When ordering, refer to Federal Information Processing Standards Publication 21-4 (FIPSPUB21-4), and title. Payment may be made by check, money order, or deposit account.



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