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U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

COBOL

CATEGORY: SOFTWARE STANDARD
SUBCATEGORY: PROGRAMMING LANGUAGE

U. S. DEPARTMENT OF COMMERCE, Rogers C. B. Morton, *Secretary*

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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 Part 6 of Title 15 Code of Federal Regulations. The entire series constitutes the FEDERAL INFORMATION PROCESSING STANDARDS REGISTER.

The 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 reference source is cited.

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

ERNEST AMBLER, *Acting Director*

Abstract

This FIPS PUB announces the adoption of the American National Standard COBOL (X3.23–1974) as the Federal Standard COBOL. This revision supersedes FIPS PUB 21 and reflects major changes and improvements to the COBOL specifications. The American National Standard defines the elements of the COBOL Programming Language and the rules for their use. The standard is used by implementors as the reference authority in developing compilers and by users for writing programs in COBOL. The primary purpose of the standard is to promote a high degree of interchangeability of programs for use on a variety of automatic data processing systems. The COBOL language is intended for use in computer applications that emphasize the manipulation of characters, records, and files.

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

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Federal Information Processing Standards Publication 21-1

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ANNOUNCING THE STANDARD FOR

COBOL

Federal Information Processing Standards Publications are issued by the National Bureau of Standards pursuant to the Federal Property and Administrative Services Act of 1949 as amended, Public Law 89–306 (79 Stat. 1127), as implemented by Executive Order 11717 (38 FR 12315, dated May 11, 1973), and Part 6 of Title 15 CFR (Code of Federal Regulations).

1. Name of Standard. COBOL (FIPS PUB 21–1).

2. Category of Standard. Software Standard, Programming Language.

3. Explanation. This publication announces the adoption of American National Standard COBOL, X3.23–1974, as amplified herein as a Federal Standard. This revision supersedes FIPS PUB 21 and reflects major changes and improvements to the COBOL specifications. The American National Standard defines the elements of the COBOL Programming Language and the rules for their use. The standard is used by implementors as the reference authority in developing compilers and by users for writing programs in COBOL. The primary purpose of the standard is to promote a high degree of interchangeability of programs for use on a wide variety of information processing systems. Other languages, appropriate for applications that are not adequately serviced by COBOL, are being considered for adoption as Federal Standards.

4. Approving Authority. Secretary of Commerce.

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

6. Cross Index. American National Standard X3.23–1974, COBOL.

7. Related Documents.

a. Federal Information Processing Standards Publication 29, Interpretation Procedures for Federal Standard COBOL.

b. Federal Property Management Regulation 101–32.1305–1, Implementation of Federal Information Processing Standards Publications (FIPS PUB) into Solicitation Documents, Software Standards.

c. Federal Information Processing Standards Publication 43, Aids for COBOL Program Conversion (FIPS PUB 21 to FIPS PUB 21–1).

8. Objectives. The basic objectives in applying Federal Standard COBOL are: (1) to achieve the long-recognized advantages that are inherent in the use of higher level languages, and (2) to maximize and protect program investments by making it easier and less expensive to exchange programs among different computer systems, including replacement systems.

The attainment of these objectives, from a government-wide point of view, depends upon the widespread use of Federal Standard COBOL. Thus, the general intent of this publication is to provide a standard language that can be used in programming information processing applications except in circumstances, discussed below, where such use would not be advantageous.

9. Applicability. Federal Standard COBOL will be used in programming computer applications and programs that emphasize the manipulation of characters, records, files and input/output (as contrasted with those concerned primarily with computational problem solving) which are developed or acquired for government use. Specifically, the standard will be used for such applications whenever:

—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 possibly be run on equipment other than that for which the program is initially written

—it is anticipated that the life of the program will be longer than the life of the presently installed equipment

—the application or program is under constant review for updating of the specifications, and changes may result frequently

—the advantages of the use of this higher level language can accrue locally irrespective of interchange potential (e.g., ease of coding, ease of documentation, improved understanding, and ease of debugging).

Exceptions to the use of Federal Standard COBOL may be made when:

a. A comparative analysis shows that the advantages inherent in the use of Federal Standard COBOL are clearly offset by even greater advantages obtainable through use of an alternative language. The language selection should be made in consideration of the government's overall objectives. Such exceptions to the use of Federal Standard COBOL shall be subject to a waiver procedure approved by the head of the agency. The special circumstances identified in paragraphs b through e below are exempted from the requirement for a waiver at the discretion of the head of an agency. See paragraph 12, Waivers.

b. The program requirements are more economically and efficiently satisfied through the use of report generation, data base management, or text processing languages.

c. The program is to be processed on systems for which COBOL compilers are normally not developed. If, however, a COBOL compiler is available on a system other than the target system and the compiler generates object code for the target system (cross-compiler), COBOL should be used to the extent practicable. This exception alone is not to be construed as allowing exemption to the requirement for the use of COBOL on small computer systems, such as mini-computers, where they are being used for applications covered above.

d. The program is to be processed on systems that are in the Federal inventory and for which a standard COBOL compiler is not available.

e. The computer installation is oriented toward the use of scientific and engineering applications in which case incidental information processing applications may be programmed in locally used languages.

Federal agencies should give special attention to ensuring that programs for applications that will or are likely to be used by organizations outside the Federal Government (i.e., State and local governments and others) are written and made available in Federal Standard COBOL, in order to provide maximum interchangeability in their use.

10. Specifications. Federal Standard COBOL specifications are the language specifications contained in American National Standard COBOL, X3.23–1974. For purposes of Federal Standard COBOL, the modules defined in X3.23–1974 are combined into four levels. The four levels of Federal Standard COBOL are identified as: Low, Low-Intermediate, High-Intermediate, and High. Each Federal Standard COBOL level is composed of either the high or low levels of the nucleus and ten of the eleven Functional Processing Modules (FPM's) defined in X3.23–1974. The four Federal Standard COBOL levels are reflected in the following table. The numbers in the table refer to the level within the FPM or nucleus as designated in X3.23–1974, and a dash in the table denotes the corresponding FPM is omitted.

	Low Level	Low Intermediate Level	High Intermediate Level	High Level
Nucleus	1	1	2	2
FPM's				
Table Handling	1	1	2	2
Sequential I–O	1	1	2	2
Relative I–O	—	1	2	2
Indexed I–O	—	—	—	2
Sort-Merge	—	—	1	2
Report Writer	—	—	—	—
Segmentation	—	1	1	2
Library	—	1	1	2
Debug	—	1	2	2
Inter-Program Communication	—	1	2	2
Communication	—	—	2	2

NOTE: The "REPORT WRITER" module is not mandatory in any Federal level. However, the specifications contained in X3.23–1974 should be used to the extent practical, consistent with the requirements.

11. Implementation. Implementation of the Federal Standard COBOL is divided into five areas of consideration: acquisition of COBOL compilers, transition to FIPS PUB 21–1, conformance to Federal Standard COBOL, interpretation of Federal Standard COBOL, and use of COBOL in application programs.

11.1 Acquisition of COBOL Compilers. The provisions reflected in this publication are effective upon the date of this document. All COBOL compilers specified for procurement on or after the effective date must be identified as implementing one of the levels of Federal Standard COBOL. The requirements set forth in this paragraph are applicable to compilers developed in-house, compilers acquired as part of an ADP system procurement, compilers acquired by separate procurement and compilers used under an ADP leasing arrangement.

11.2 Transition to FIPS PUB 21–1. The adoption of American National Standard COBOL, X3.23–1974, as a revised Federal Standard requires that provisions be made for the orderly transition to the revised standard. The transition period will begin on the date of this publication and will continue for eighteen months thereafter. The policies for the acquisition of COBOL compilers during the transition period are:

a. The provisions of FIPS PUB 21 will apply to orders placed before the date of this publication for compilers which are to be delivered subsequent to the date of this publication.

b. The provisions of FIPS PUB 21–1 will apply to orders placed after the date of this publication; however, a compiler conforming to FIPS PUB 21 may be acquired for interim use until the compiler conforming to the revised standard is available. Delivery of the compiler conforming to the revised standard may be deferred to, but not to exceed, the close of the transition period (18 months from the date of this publication).

11.3 Conformance to Federal Standard COBOL. A compiler implemented in conformance to Federal Standard COBOL must satisfy at least the following requirements:

a. The implementation must include *all* of the language elements of at least one of the levels of Federal Standard COBOL.

b. The implementation must satisfy all of the requirements, defined in American National Standard COBOL, X3.23–1974, section I, paragraph 1.5, Definition of an Implementation of American National Standard COBOL. Any requirement stated herein that may differ from the requirements for an implementation of American National Standard COBOL takes precedence over the requirements stated in X3.23–1974.

c. The implementation must provide a facility for the user to optionally specify a level of Federal Standard COBOL for monitoring his source program at compile time. The monitoring may be specified for any level of Federal Standard COBOL at or below the highest level

for which the compiler is implemented. The monitoring will be an analysis of the syntax used in a source program against the syntax included in the specified level of Federal Standard COBOL. Any syntax used in the source program that does not conform to that allowed by the user selected level of Federal Standard COBOL will be diagnosed. The syntax diagnosed as not conforming to the specified level will be identified to the user through a diagnostic message on the source program listing. The diagnostic message will contain at least: (1) the identification of the source program line number in which the non-conforming syntax occurs, and (2) the identification of the level of Federal Standard COBOL that supports the syntax or that the syntax is non-standard COBOL.

In order to confirm that an implementation satisfies the requirements of a designated level of Federal Standard COBOL, programs (which include the Report Writer module) have been developed for testing COBOL compilers. A Federal COBOL Compiler Testing Service (FCCTS) also is available to provide testing services. Policies concerning required testing of COBOL compilers are currently being developed and will be published in the near future by the General Services Administration as an appropriate modification to FPMR 101-32.1305. For further information regarding COBOL Compiler Testing Services contact:

Director, Federal COBOL Compiler Testing Service
Department of the Navy
ADPE Selection Office
Washington, D.C. 20376

11.4 Interpretation of Federal Standard COBOL. During the use of Federal Standard COBOL, whether implementing compilers, testing compilers or writing source programs, questions may arise from time to time as to the meaning of specific language specifications. It is desirable when this happens to apply a solution to these questions that can be used uniformly throughout the Federal Government and by all implementors of Federal Standard COBOL and the Report Writer module. To achieve this objective, a Federal COBOL Interpretations Committee has been organized. Procedures for processing interpretation of Federal Standard COBOL are provided in FIPS PUB 29 (paragraph 7a). For further information contact:

Chairman, Federal COBOL Interpretations Committee
Computer Science Section
Systems and Software Division
Institute for Computer Sciences and Technology
National Bureau of Standards
Washington, D.C. 20234

11.5 Use of COBOL. Federal Standard COBOL will be used as defined in paragraph 9, Applicability, as soon as compilers that conform to the standard are available and acquired. It is not intended that existing programs be rewritten solely for the purpose of conforming to the standard.

Programs should, to the extent practicable, be limited to the elements of one of the specified levels of Federal Standard COBOL. It should be recognized that the use of any non-standard language elements may compromise interchangeability of programs between various systems or may complicate future conversion to a replacement system. Extensions should, therefore, be employed only when their use will result in efficiencies that clearly outweigh the difficulties they may cause. To the extent that specifications for the required extensions have already been included in the CODASYL COBOL Journal of Development, use of these specifications should minimize future conversion difficulties.

12. Waivers.

12.1 Policy. Heads of agencies are permitted to waive the requirements stated in this publication in the following circumstances. Each waiver will cover only the specific requirements of this publication related to the need for a waiver.

a. A waiver may be granted for an exception to any of the requirements stated in this publication provided it can be clearly demonstrated that there are appreciable and continuing performance or cost advantages to be gained or that the extenuating circumstances are such that the overall interests of the Federal Government are served by granting the requested waiver.

b. Special capabilities may be required to accommodate the needs of a particular application that cannot be achieved through the use of Federal Standard COBOL. A waiver must be obtained before these special capabilities are specified for implementation or acquisition. Requests for waiver must clearly demonstrate an appreciable and continuing performance or cost advantage will be obtained through the use of these special capabilities.

12.2 Reporting. Waivers granted in the acquisition of compilers will be reported to the National Bureau of Standards, with the following supporting documentation, within seven working days after approval by the head of the agency.

a. Relevant documentation considered by the head of the agency in authorizing the waiver.

b. Detailed technical specifications of the language deviations granted. In the case of deletions, exact reference to the items in X3.23–1974 is all that is required. In case of additions that are already developed and approved by CODASYL, exact reference to the items in the CODASYL COBOL Journal of Development is all that is required.

c. A recommendation for action by NBS concerning future development of COBOL, relative to the waiver, should be included, as appropriate. Correspondence should be addressed to the Associate Director for ADP Standards, Institute for Computer Sciences and Technology, National Bureau of Standards, Washington, D.C. 20234.

13. Special Information.

a. Development and maintenance of the COBOL language are the responsibilities of the Programming Languages Committee of the Conference on Data Systems Languages (CODASYL), a voluntary organization comprised of interested organizations. Standardization of COBOL in the United States is in the purview of the American National Standards Institute (ANSI), X3J4 Committee. The technical specifications of American National Standard COBOL, herein adopted as a Federal Standard, are based on the specifications contained in CODASYL COBOL Journal of Development, 1973, and changes that were made to the JOD in response to X3J4 requests. The COBOL language is under continual review by the CODASYL organization for modification and extension. These changes are then reviewed by ANSI for incorporation in revised editions of ANS COBOL.

b. In the event that there is no prospect for the development of a COBOL compiler conforming to this standard for the machine used, serious consideration should be given to using the existing COBOL compiler, if available, for new or revised applications to ease the eventual conversion to a new system employing a standard COBOL compiler.

14. Where To Obtain Copies of COBOL Publications.

a. Federal Government activities should obtain copies of this publication from established sources within each agency. When there is no established source, purchase orders should be submitted to the National Bureau of Standards, Institute for Computer Sciences and Technology, Office of ADP Standards Management, Technology Building, Washington, D.C. 20234. Refer to Federal Information Processing Standard Publication 21–1 (FIPS PUB 21–1). Copies of the American National Standard COBOL, X3.23–1974, accompany each copy of FIPS PUB 21–1.

b. Others may obtain copies of the FIPS PUB from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (SD Catalog Number C13.52:21–1). 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. Copies of the ANSI standard may be obtained from the American National Standards Institute, Inc., 1430 Broadway, New York, New York 10018. Refer to American National Standard X3.23–1974, Standard Programming Language COBOL.

c. Copies of the CODASYL COBOL Journal of Development may be obtained from the Technical Services Branch, Department of Supply and Services, 5th Floor, 88 Metcalfe Street, Ottawa, Ontario, Canada K1A OS5.

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21-1

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FIPS 21-1, COBOL
Federal Standard COBOL Interpretation No. 1 - the COMPUTE Statement

This office has a record of your interest in receiving changes to the above FIPS PUB. The change(s) indicated below have been provided by the Maintenance Agency for this publication and will be included in the next published revision to this FIPS PUB. Questions or requests for additional information should be addressed to the Maintenance Agency:

Department of Commerce
National Bureau of Standards
Institute for Computer Sciences and Technology
Washington, D.C. 20234

CHANGE ITEM(S)

Attached is a reprint from the September 14, 1976 FEDERAL REGISTER which provides an interpretation to the Federal COBOL Standard (FIPS 21-1). This interpretation is effective on October 14, 1976 and becomes an integral part of the Federal standard and, as such, is considered to be included whenever reference is made to Federal Standard COBOL. This interpretation should be filed with FIPS 21-1.

Copies of FIPS 21-1 are available from:

National Technical Information Service (NTIS)
ATTN: Sales Office, Sills Building
5285 Port Royal Road
Springfield, Virginia 22161

Phone - 703/557-4650 Office Hours - 7:45am to 4:15pm

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highlights

DEPARTMENT OF COMMERCE

National Bureau of Standards

FEDERAL STANDARD COBOL (FIPS PUB 21 AND 21–1)

Approved Interpretation

Under the provisions of Pub. L. 89–306 and Executive Order 11717, the Secretary of Commerce is authorized to establish uniform Federal ADP Standards. FIPS PUB 21–1 specifies Federal Standard COBOL. The Standard defines the elements of the COBOL Programming Language and the rules for their use. During the use of the standard, questions arise as to the meaning of certain language specifications. FIPS PUB 29 defines the procedures to be followed in providing solutions to these questions. The procedures allow for the solutions to be used uniformly throughout the Federal Government and by all implementors of compilers acquired by the Federal Government. Accordingly, in the January 15, 1976 issue of the FEDERAL REGISTER (FR Doc. 76–1184, page 2270), the National Bureau of Standards published a notice of proposed interpretation of Federal Standard COBOL as pertains to the evaluation of arithmetic expressions in the COMPUTE statements. All comments submitted about the proposed interpretation have been duly considered.

The following approved interpretation contains a definition of the problem, discussion of the issues, approved language interpretation, necessary clarifications to Federal Standard COBOL, and the effective date of the interpretation. The approved interpretation, as of the effective date, becomes an integral part of Federal Standard COBOL and, as such, is considered to be included whenever reference is made to Federal Standard COBOL.

Interested parties may, in accordance with FIPS PUB 29—Interpretation Procedures for Federal Standard COBOL, dated June 30, 1974, submit comments concerning interpretations of Federal Standard COBOL to the Chairman, Federal COBOL Interpretations Committee, c/o Associate Director for ADP Standards, Institute for Computer Sciences and Technology, National Bureau of Standards, Washington, D.C. 20234.

Dated: September 3, 1976.

ERNEST AMBLER,
Acting Director.

FEDERAL STANDARD COBOL INTERPRETATION No. 1—THE COMPUTE STATEMENT

Problem. There is no standard interpretation of the accuracy of the arithmetic operations and the timing and scope of the ROUNDED phrase among implementations of the COMPUTE statement. Both of these problems involve intermediate results. This situation not only adversely impacts the portability of COBOL programs, but also creates a major problem in the development of test programs in this area.

Issue. The variations in the implementation of the COMPUTE statement are due in part to the lack of specifications which address the following issues in the Federal COBOL Standard:

a. The number of decimal digits to be provided for intermediate result fields.

b. The behavior of the decimal point, if specified, in an intermediate result field.

c. The scope of applicability of the ROUNDED phrase in the COMPUTE statement.

d. Whether rounding or truncation will be applied to an intermediate result field.

Interpretation. This interpretation applies to both American National Standard COBOL X3.23–1968 and X3.23–1974 as they have been adopted as Federal Standard COBOL, FIPS PUBS 21 and 21–1, respectively. The interpretation is in four parts. Each part addresses one of the four issues related above.

a. The size of the intermediate result field is implementor-defined.

b. Decimal point alignment is required throughout the evaluation of the arithmetic expression.

c. The ROUNDED phrase in the COMPUTE statement applies only to the assignment of the intermediate result field to the identifier to the left of the equal sign. If the ROUNDED phrase is not specified, truncation, if required, will apply to the assignment of the intermediate result field to the identifier to the left of the equal sign.

d. The implementor will define whether truncation or rounding will occur on the intermediate result when it exceeds the size of the intermediate results field.

Discussion. The following discusses the rationale supporting each of the four points in the interpretation.

a. ANS X3.23–1968 (page 2–71, paragraph 5.1.3(5)) and ANS X3.23–1974 (page II–40, paragraph 5.1.3(5)) specify that "each implementor will indicate the technique used in handling arithmetic expressions". This specification is interpreted to mean the techniques defined by the implementor include determination of the size of the intermediate result field.

b. ANS X3.23–1968 (page 2–78, paragraph 5.4.4(1)) and ANS X3.23–1974 (page II–51, paragraph 5.3.4(1)) specify that "* * * decimal point alignment is supplied throughout the calculation". Decimal point alignment is therefore required throughout the development of the final result in the intermediate result field dependent only on the operands involved in an arithmetic expression.

c. ANS X3.23–1968 (page 2–76, paragraph 5.4.1) and ANS X3.23–1974 (page II–50, paragraph 5.3.1) specify that when rounding is requested (the presence of the ROUNDED phrase), the absolute value of the resultant-identifier is increased. Truncation will take place, as necessary, when the ROUNDED phrase is not specified. The standard does not specify or imply that the presence or absence of the ROUNDED phrase in the COMPUTE statement has any effect on the intermediate result field prior to the assignment of that field to the resultant-identifier.

d. The techniques defined by the implementor to be used in the handling of arithmetic expressions is interpreted to include the application of rounding or truncation to the intermediate result field.

Clarification to the Federal COBOL Standard. None.

Effective Date of the Interpretation. This interpretation is effective on or before October 14, 1976.

[FR Doc.76–26812 Filed 9–13–76;8:45 am]