Enterprise COBOL for z/OS

Licensed Program Specifications

Version 5.2

GI11-9181-02

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Chapter 1. Overview

IBM® Enterprise COBOL for z/OS® is a leading-edge, z/OS-based compiler that helps you create and maintain mission-critical, line-of-business COBOL applications to execute on your z/OS systems. Enterprise COBOL for z/OS gives you access to CICS®, DB2®, IMS™, and other transactional and data systems.

Version 5.2 features

Enterprise COBOL for z/OS V5.2 introduces the following new features and enhancements:

- Support for the new IBM z13 hardware
- New, restored, and enhanced compiler options for ease of migration and programmer productivity
- New features added from the ISO 2002 COBOL Standard
- New IBM extensions to COBOL
- Enhancements to the XML GENERATE statement
- Restored support for AMODE 24 and XMLPARSE(COMPAT)
- New IMS SQL coprocessor
- Java™ interoperability to Java 8 to help you incorporate new, web-based applications as part of your business processes

In addition, for COBOL applications in mobile and web solutions, the z/OS Client Web Enablement Toolkit provides JSON document parsing and generation. Install the PTF for APAR OA46575 to enable z/OS Client Web Enablement Toolkit support on z/OS V2.1.

Version 5.1 features

Enterprise COBOL for z/OS V5.1 introduced two significant compiler options. Based on new code generation and optimization technology, the new ARCH and enhanced OPTIMIZE options allow you to maximize the delivery of z/Architecture® exploitation and performance optimization within your applications.

The new compiler option ARCH gives you the flexibility to have the Enterprise COBOL compiler generate code for higher levels of the z/Architecture. Higher ARCH levels instruct the compiler to exploit newer processor instructions to optimize and tune your application code to the latest levels of z/Architecture.

The enhanced OPTIMIZE compiler option provides you with the flexibility to obtain multiple levels of increasing optimization that run from comprehensive low-level optimizations to more extensive optimizations that can improve the performance of your COBOL applications.

Enterprise COBOL for z/OS V5.1 offers the following new and enhanced functionality:

- XML processing enhancements for improved web interoperability
- Improved capability for programming with UTF-8 Unicode for better national language support in your applications

- Increased compiler limits to help you handle larger data items and larger groups of data and to improve application exploitation of system resources
- Support for unbounded tables and groups to improve usability in defining variable length tables and groups
- A new floating comment indicator to create a comment anywhere in the program-text area
- A new level of z/OS System Management Facilities (SMF) tracking support to reduce your administrative reporting overhead
- Java interoperability to Java 7 to help you incorporate new, web-based applications as part of your business processes
- Support for CICS, DB2, and IMS to provide access to the latest middleware
- A new interface called Common Debug Architecture (CDA) to provide a consistent format for accessing information that can be used by debuggers and program analysis tools

Through the service stream, two major new features were added to Enterprise COBOL V5.1.0 to make V5.1.1:

- AMODE 24 execution of COBOL programs is supported, except for a few exception cases. Many programs compiled by Enterprise COBOL V5.1.1 will execute in AMODE 24 or AMODE 31.
- A new coprocessor, IMS SQL coprocessor (called SQL statement coprocessor by IMS), handles source programs that contain embedded SQLIMS statements. The new SQLIMS compiler option enables the IMS SQL coprocessor.

Chapter 2. Specified operating environment for Enterprise COBOL

This section lists the hardware and software requirements for IBM Enterprise COBOL for z/OS, Version 5.2.

Hardware requirements

Enterprise COBOL for z/OS, V5.2 runs on IBM System z® servers that include:

- z13
- zEnterprise® EC12 and zEnterprise BC12
- zEnterprise 196 or zEnterprise 114
- z10™ Enterprise Class and z10 Business Class
- z9® Enterprise Class or z9 Business Class

Software requirements

Enterprise COBOL for z/OS, V5.2 runs under the control of, or in conjunction with, the currently supported releases of the following programs and their subsequent releases or their equivalents.

For information about programs listed below that require program temporary fixes (PTFs), see the *Enterprise COBOL Program Directory* and the preventive service planning (PSP) bucket.

Required licensed programs

Enterprise COBOL and its generated object programs run under the following zSeries operating systems:

- z/OS V1.13 (5694-A01), or later
- z/OS V2.1 (5650-ZOS), or later

Language Environment® provides the execution environment and library of COBOL run time services required to compile and run COBOL applications using Enterprise COBOL:

- z/OS Language Environment V1.13 with required PTF
- z/OS Language Environment V2.1 with required PTF

For installation on z/OS, the following is required:

- z/OS SMP/E element

The following is required for customization during or after installation:

- z/OS High Level Assembler

Enterprise COBOL XML PARSE statements in programs that are compiled with the XMLPARSE(XMLSS) compiler option require one of the following:

- z/OS XML Systems Services V1.13
- z/OS XML Systems Services V2.1

Optional licensed programs for z/OS

Support for applications using object-oriented COBOL syntax for Java interoperability requires one of the following:

- IBM 31-bit SDK for z/OS, Java Technology Edition V8.0 (5655-DGG)
- IBM 31-bit SDK for z/OS, Java Technology Edition V7.0 (5655-W43)
- IBM 31-bit SDK for z/OS, Java Technology Edition V6.0 (5655-R31)

Support for DB2 integrated coprocessor (SQL compiler option) requires one of the following:

- IBM DB2 11 for z/OS (5615-DB2)
- IBM DB2 10 for z/OS (5605-DB2)

Support for the integrated CICS translator (CICS compiler option) requires one of the following:

- CICS Transaction Server (CICS TS) for z/OS V5 (5655-Y04)
- CICS TS for z/OS V4 (5655-S97)
- CICS TS for z/OS V3 (5655-M15)

Including CICS options in effect as part of the COBOL listing requires one of the following:

- CICS Transaction Server for z/OS V5 (5655-Y04)
- CICS TS for z/OS V4.1 (5655-S97) and PTFs for APAR PK89224
- CICS TS for z/OS V3.2 (5655-M15) and PTFs for APAR PK91041

For sorting and merging, you must use one of the following features of z/OS, or an equivalent product:

- IBM DFSORT element of z/OS V1.13 (5694-A01)
- IBM DFSORT element of z/OS V2 (5650-ZOS)

Programs with Report Writer statements require:

- COBOL Report Writer, Release 4 (5798-DYR, 5798-DZX)

Enterprise COBOL, V5.2 runs with the currently supported releases of the following programs:

- CICS Transaction Server (CICS TS) for z/OS V5 (5655-Y04)
- CICS TS for z/OS Value Unit Edition V5 (5722-DFJ)
- CICS TS for z/OS V4 (5655-S97)
- CICS TS for z/OS V3 (5655-M15)
- IBM DB2 11 for z/OS (5615-DB2)
- IBM DB2 11 for z/OS Value Unit Edition (5697-P43)
- IBM DB2 10 for z/OS (5605-DB2)
- IBM DB2 10 for z/OS Value Unit Edition (5697-P31)
- IBM IMS V13 (5635-A04)
- IBM IMS Transaction Manager Value Unit Edition V13 (5655-TM2)
- IBM IMS Database Value Unit Edition V13 (5655-DSM)
- IBM IMS V12 (5635-A03)
- IBM IMS Transaction Manager Value Unit Edition V12 (5655-TM1)
- IBM IMS Database Value Unit Edition V12 (5655-DSQ)

- IBM High Level Assembler/MVS™ & VM & VSE (5696-234)
- z/OS V2.1 Client Web Enablement Toolkit (5650-ZOS - APAR Number OA46575)
- IBM Debug Tool for z/OS V13.1 (5655-Q10)
- IBM Debug Tool for z/OS V12.1 (5655-W70)
- IBM Fault Analyzer for z/OS V13.1 (5655-Q11)
- IBM Fault Analyzer for z/OS V12.1 (5655-W69)
- IBM File Manager for z/OS V13.1 (5655-Q12)
- IBM File Manager for z/OS V12.1 (5655-W68)
- IBM Application Performance Analyzer for z/OS V13.1 (5655-Q09)
- IBM Application Performance Analyzer for z/OS V12.1 (5655-W71)
- IBM Rational® Developer for System z, V9 (5724-T07)
- COBOL Report Writer Release 4 (5798-DYR, 5798-DZX)
- Enterprise COBOL for z/OS, V4 (5655-S71)
- Enterprise COBOL for z/OS and OS/390®, V3 (5655-G53)
- Enterprise PL/I for z/OS, V4 (5655-W67)
- Enterprise PL/I for z/OS, V3 (5655-H31)
- IBM VS FORTRAN V2 (5668-806, 5668-087)
- For XL C/C++ with Enterprise COBOL - You must use the XL C/C++ feature of z/OS V1.13 (5694-A01) or z/OS V2 (5650-ZOS)

Chapter 3. Industry standards supported by Enterprise COBOL V5.2

Enterprise COBOL supports the following industry standards.

ISO standards

ISO 1989:1985, Programming Languages - COBOL.

ISO/IEC 1989/AMD1:1992, Programming Languages - COBOL: Intrinsic function module.

ISO/IEC 1989/AMD2:1994, Programming Languages - Correction and clarification amendment for COBOL.

ISO/IEC 1989:2002, Information technology - Programming languages - COBOL (partial support)

ISO 1989:1985 is identical to ANSI INCITS 23-1985 (R2001), Programming Languages - COBOL.

ISO/IEC 1989/AMD1:1992 is identical to ANSI INCITS 23a-1989 (R2001), Programming Languages - Intrinsic Function Module for COBOL.

ISO/IEC 1989/AMD2:1994 is identical to ANSI INCITS 23b-1993, Programming Language - Correction Amendment for COBOL.

ISO/IEC 1989:2002 is identical to ANSI INCITS 1989-2002 (R2013), Information technology - Programming languages COBOL

For supported modules, see American National Standards below.

International Reference Version of the ISO 7-bit code defined in *International Standard 646, 7-Bit Coded Character Set for Information Interchange*.

American National standards

ANSI INCITS 23-1985 (R2001), Programming Languages - COBOL.

ANSI INCITS 23a-1989 (R2001), Programming Languages - Intrinsic Function Module for COBOL.

ANSI INCITS 23b-1993 (R2001), Programming Language - Correction Amendment for COBOL.

ANSI INCITS 1989-2002 (R2013), Information technology - Programming languages COBOL (partial support)

ANSI INCITS 1989-2014, Information technology - Programming languages, their environments and system software interfaces - Programming language COBOL (partial support)

The 7-bit coded character set defined in American National Standard X3.4-1977, Code for Information Interchange.

All required modules are supported at the highest level defined by the 85 COBOL Standard. In the following list, the shorthand notation for describing module levels is shown in parentheses. For example, to summarize module information for sequential input and output, the shorthand notation is (2 SEQ 1,2). The first digit indicates the level of language elements within the module supported by Enterprise COBOL. Next is the three-character abbreviation of the module name as used in the standard. Finally, the two digits separated by a comma indicate the minimum and maximum levels of the module. For example, (2 SEQ 1,2) means that Enterprise COBOL supports the sequential I-O module at level 2, while the range of levels in the module is from 1 (minimum) to 2 (maximum).

- Nucleus (2 NUC 1,2)

  Provides internal processing of data within the four basic divisions of a program and the capability for defining and accessing tables.
- Sequential I-O (2 SEQ 1,2)

  Provides access to records of a file in established sequence. The sequence is established as a result of writing the records to the file.
- Relative I-O (2 REL 0,2)

  Provides access to records in either a random or sequential manner. Each record is uniquely identified by an integer specifying the record's logical position in a file.
- Indexed I-O (2 INX 0,2)

  Provides access to records in either a random or sequential manner. Each record in an indexed file is uniquely identified by the value of a key within that record.
- Sort-Merge (1 SRT 0,1)

  Orders one or more files of records, or combines two or more identically ordered files of records, according to a set of user-specified keys.
- Inter-Program Communication (2 IPC 1,2)

  Allows a COBOL program to communicate with other programs through transfers of control and access to common data items.
- Source Text Manipulation (2 STM 0,2)

  Allows the insertion of source program text as part of the compilation of the source program. COBOL libraries contain texts which are available to the compiler at compile time and which can be treated by the compiler as part of the source program.

In addition, the following optional modules of the standard are supported:

- Intrinsic Functions (1 ITR 0,1)

  Provides the capability to reference a data item whose value is derived automatically at the time of reference during the execution of the object program.
- Debug (1 DEB 0,2)

  Monitors object program execution through declarative procedures, special debugging lines, and a special register, DEBUG-ITEM, which gives specific information about execution status.
- Segmentation (2 SEG 0,2)

  Refreshes independent segments when required.

The following optional module of the standard is supported with the optional IBM COBOL Report Writer Precompiler (5798-DYR):

- Report Writer

The following optional modules of the standard are not supported:

- Communications
- Debug (2 DEB 0,2)

Restrictions: Enterprise COBOL has the following restrictions related to industry standards:

- OPEN EXTEND is not supported for ASCII encoded tapes (CODESET STANDARD-1 or STANDARD-2).
- When division by zero occurs in an arithmetic expression and an ON SIZE ERROR phrase is not specified, processing abnormally terminates.
- File status 97 is an informational file status value that represents successful completion of an OPEN statement, rather than an unsuccessful completion as is normally the case for 9x file status values in the 85 COBOL Standard.

Chapter 4. Compatibility with previous product releases

Compatibility, coexistence, and migration

Enterprise COBOL V5.2 provides a high level of source compatibility, object compatibility, and run time environment compatibility with prior versions of IBM COBOL.

Enterprise COBOL V5.2 is source compatible with earlier versions of IBM COBOL, in that the compiler will compile correct COBOL source programs that were developed using Enterprise COBOL Version 4 or earlier, with the exception of obsolete functions that were removed and the addition of new reserved words. The removed function includes obsolete COBOL language syntax and obsolete compiler options. Complete details on removed obsolete functions are documented in the *Enterprise COBOL for z/OS Version 5.2 Migration Guide*. IBM does not expect that many applications will be affected by the removed functions, which in practice are no longer heavily used. To assist in migration, a new compiler option FLAGMIG4 is added to Enterprise COBOL V4.2 through the service stream. This option provides warning diagnostics to flag any use of obsolete syntax and options in existing COBOL programs.

Enterprise COBOL V5.2 is object compatible with prior versions of IBM COBOL, in that applications can be constructed using a mixture of object modules compiled with V5.2 and those compiled with prior versions. All three types of calls can be used: static calls (calls within a link-edited module), dynamic calls (calls between programs link-edited as separate modules), and DLL calls (calls between programs link-edited as DLLs) can be used. The following are exceptions:

- Interoperation with object modules compiled with OS/VS COBOL (5740-CB1) is no longer supported.
- Interoperation with object modules compiled with VS COBOL II (5688-958) is limited to programs compiled with the RES compiler option. Interoperation with VS COBOL II programs that are compiled with the NORES option is no longer supported.

Enterprise COBOL V5.2 is run time compatible with prior versions of IBM COBOL in that correct COBOL programs will continue to produce the same run time results after being recompiled with V5.2. A small number of exception cases are documented in the *Enterprise COBOL for z/OS Version 5.2 Migration Guide*.

Chapter 5. Security, auditability, and control

The announced program uses the security and auditability features of the host operating system software. The customer is responsible for evaluation, selection and implementation of security features, administrative procedures, and appropriate controls in application systems and communication facilities.

Chapter 6. Licensed program materials availability

Restricted materials - No. This licensed program is available without source licensed program materials. It is available in object code only.

Chapter 7. Supplemental terms

Designated Machine Identification

Designated Machine Identification required: Yes.

Testing period

- Basic License: Not applicable.
- DSLO License: Not applicable.

Installation or location license

Not applicable. A separate license is required for each machine on which the licensed program will be used.

Usage restriction

Not applicable.

Type and duration of program services

- Central Service.
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Not applicable.

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Chapter 8. Notices and information for supported standards

Notices and information for supported standards

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This document is a W3C Recommendation. This fifth edition is not a new version of XML. As a convenience to readers, it incorporates the changes dictated by the accumulated errata (available at http://www.w3.org/XML/xml-V10-4e-errata) to the Fourth Edition of XML 1.0, dated 16 August 2006. In particular, erratum [E09] relaxes the restrictions on element and attribute names, thereby providing in XML 1.0 the major end user benefit currently achievable only by using XML 1.1. As a consequence, many possible documents which were not well-formed according to previous editions of this specification are now well-formed, and previously invalid documents using the newly-allowed name characters in, for example, ID attributes, are now valid.

This edition supersedes the previous W3C Recommendation of 16 August 2006.

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with color-coded revision indicators is also provided; this version highlights each change due to an erratum published in the errata list for the previous edition, together with a link to the particular erratum in that list. Most of the errata in the list provide a rationale for the change. The errata list for this fifth edition is available at http://www.w3.org/XML/xml-V10-5e-errata.

An implementation report is available at http://www.w3.org/XML/2008/01/xml10-5e-implementation.html. A Test Suite is maintained to help assessing conformance to this specification.

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- z9
- z/Architecture
- zEnterprise
- z/OS
- zSeries

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