



# Licensed Program Specifications

## IBM COBOL for OS/390 & VM Version 2 Release 2 Program Number 5648-A25

IBM COBOL for OS/390 & VM is an IBM COBOL compiler that provides features such as COBOL 85 Standard language support, intrinsic functions, object-oriented language extensions on OS/390, year 2000 coding capabilities, extended addressing, reentrancy, and subsystem support. In addition, COBOL for OS/390 & VM adds the following key new functions:

- Support for the development and execution of COBOL applications in the OS/390 UNIX System Services environment
- Improved S/390 platform support using 31-digit decimal data, TRUNC(BIN) performance enhancement, and a new COMP-5 data type
- Enhanced capabilities for debugging production applications
- Improved usability with the new DB2 coprocessor support for COBOL programs containing SQL statements

COBOL for OS/390 & VM uses Language Environment as its run-time environment. Language Environment provides common services and language-specific routines in a single run-time library for C, C++, COBOL, FORTRAN, and PL/I. If you order the Full Function feature of COBOL for OS/390 & VM, you receive IBM Debug Tool.

### Specified Operating Environment

#### Year 2000 Readiness

COBOL for OS/390 & VM, when used in accordance with its associated documentation, is capable of correctly processing, providing, and receiving date data within and between the twentieth and twenty-first centuries, provided that all products (for example, hardware, software, and firmware) used with COBOL for OS/390 & VM properly exchange accurate date data with it.

### Machine Requirements

COBOL for OS/390 & VM and its generated object programs can run on any IBM System/390 processor supported by the operating systems listed under "Programming Requirements."

IBM devices supported by VSAM and QSAM on the above systems can be used with object programs produced by COBOL for OS/390 & VM.

When the ARITH(EXTEND) compiler option is in effect, the ESA/390 HFP-extensions package is required for application execution. This package includes support for additional hexadecimal floating-point instructions and provides 16 (rather than 4) floating-point registers. Support for this capability is available in G5 or later processors, or through the software emulation provided in OS/390 Version 2 Release 6 or later. The software emulation is not recommended for a production environment.

### Programming Requirements

COBOL for OS/390 & VM runs under the control of, or in conjunction with, the following IBM licensed programs and their subsequent releases unless otherwise announced by IBM.

For information on programs listed below that mention the need to apply program temporary fixes (PTFs), see the COBOL for OS/390 & VM program directory.

**Required Licensed Programs:** COBOL for OS/390 & VM and its generated object programs run under the following System/390 operating systems:

- OS/390 Version 2 Release 4 (5647-A01)
- VM/ESA Version 2 Release 3 (5654-030)

The following new features are exceptions:

- Support for programs compiled with ARITH(EXTEND) requires OS/390 Version 2 Release 6 or later.

- Support for coexistence of dynamic CALL and dynamic link library (DLL) linkages within a COBOL rununit requires OS/390 Version 2 Release 9 or later.
- Support for large (greater than 32K) block sizes for QSAM files requires OS/390 Version 2 Release 10 or later.

The following provides the execution environment and library of COBOL run-time services required to compile and run COBOL applications using COBOL for OS/390 & VM:

- On OS/390: OS/390 Language Environment element plus PTFs for APAR PQ39908
- On VM/ESA: IBM Language Environment for MVS & VM Release 8 (5688-198) plus PTFs for APAR PQ41256

The following OS/390 optional feature is required to develop object-oriented COBOL applications on OS/390:

- OS/390 SOMobjects for MVS Application Development Environment (ADE) plus PTFs

For installation on OS/390, one of the following is required:

- OS/390 SMP/E element
- SMP/E Release 8.1 (5668-949) — if you are using MVS to maintain your OS/390 products

One of the following is required for customization during or after installation:

- OS/390 High Level Assembler element
- High Level Assembler/MVS & VM & VSE (5696-234)

### **Optional Features of OS/390**

- C/C++
- DFSORT

The following PTFs are required for the DFSMS binder, so that the binder does not make CEESTART the entry point of a COBOL program-object (APAR OW39175):

- For DFSMS 1.4, PTF UW59712
- For DFSMS 1.5, PTF UW59713

The following prerequisites are needed for DB2:

- DB2 Version 5 or later, with APAR PQ35280, PTF number UQ43452, enabling DB2 pre-processor support for 31-digit COBOL packed- and zoned-decimal data items
- DB2 Version 7 for SQL statement coprocessor support

### **Optional Licensed Programs**

*Table 1. Optional Licensed Programs for OS/390*

<b>Optional Licensed Program</b>	<b>Version Release</b>	<b>Program Number</b>
CICS/ESA	Version 4 Release 1	5655-018
CICS Transaction Server for OS/390	Version 1	5655-147
Database 2 (DB2)	Version 4	5695-DB2
DB2 for OS/390	Version 5	5655-DB2
DB2 UDB for OS/390	Version 6	5645-DB2
DB2 UDB for OS/390	Version 7	5675-DB2
DFSMS/MVS <sup>1</sup>	Release 3	5695-DF1
DFSORT	Release 13	5740-SM1
High Level Assembler/MVS & VM & VSE <sup>1</sup>	Release 2	5696-234
IBM COBOL Report Writer Precompiler	Release 3	5798-DYR
IMS/ESA	Version 5	5695-176
IMS/ESA	Version 6	5655-158
IMS/ESA	Version 7	5655-B01
OS PL/I	Version 2 Release 3	5668-909, 5668-910, 5668-911
PL/I for MVS & VM	Release 1.1	5688-235
TCP/IP for MVS <sup>1</sup>	Version 3 Release 2	5655-HAL
VisualAge PL/I for OS/390	Version 2 Release 2	5655-B22
VS FORTRAN	Version 2 Release 6	5668-806, 5688-087

#### **Note:**

1 Provided as a base element of OS/390.

Table 2. Optional Licensed Programs for VM

Optional Licensed Program	Version Release	Program Number
C for VM/ESA	Version 3 Release 1	5654-033
DFSORT/CMS	Version 2	5684-134
High Level Assembler/MVS & VM & VSE	Release 2	5696-234
IBM COBOL Report Writer Precompiler	Release 3	5798-DYR
ISPF for VM	Version 3 Release 2	5684-043
ISPF/PDF for VM	Version 3 Release 2	5684-123
OS PL/I	Version 2 Release 3	5668-909, 5668-910, 5668-911
PL/I for MVS & VM	Release 1.1	5688-235
SQL/DS	Version 3 Release 5	5688-103
VisualAge PL/I for OS/390	Version 2 Release 2	5655-B22
VSE/VSAM for VM (for support on VM for VSAM data sets)	Version 6	5686-081

## Industry Standards

COBOL for OS/390 & VM supports the following industry standards in both OS/390 and VM/ESA environments:

1. ISO 1989:1985, Programming languages - COBOL.

ISO 1989/Amendment 1, Programming languages - COBOL - Amendment 1: Intrinsic function module.

ISO 1989/Amendment 2, Programming languages - COBOL - Amendment 2: Correction and clarification amendment for COBOL.

ISO 1989:1985 is identical to X3.23-1985, American National Standard for Information Systems - Programming Language - COBOL.

ISO 1989/Amendment 1 is identical to X3.23a-1989, American National Standard for Information Systems - Programming Language - Intrinsic Function Module for COBOL.

ISO 1989/Amendment 2 is identical to X3.23b-1989, American National Standard for Information Systems - Programming Language - Correction Amendment for COBOL.

All required modules are supported at the highest level defined by the standard.

The following optional modules of the standard are supported:

- Intrinsic Functions (1 ITR 0,1)
- Debug (1 DEB 0,2)
- Segmentation (2 SEG 0,2)

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)

2. ANSI X3.23-1985, American National Standard for Information Systems - Programming Language - COBOL.

ANSI X3.23a-1989, American National Standard for Information Systems - Programming Language - Intrinsic Function Module for COBOL.

ANSI X3.23b-1993, American National Standard for Information Systems - Correction Amendment for COBOL.

All required modules are supported at the highest level defined by the standard.

The following optional modules of the standard are supported:

- Intrinsic Functions (1 ITR 0,1)
- Debug (1 DEB 0,2)
- Segmentation (2 SEG 0,2)

The following optional modules of the standard are not supported:

- Communications
- Debug (2 DEB 0,2)

3. FIPS Publication 21-4, Federal Information Processing Standard 21-4, COBOL high subset.

**Note:** The term “COBOL 85 Standard” is used in this document to refer to the ISO and

ANSI standards listed in items 1 and 2 above.

COBOL for OS/390 & VM has the following restrictions related to industry standards:

- OPEN EXTEND is not supported for ASCII encoded tapes (CODESET STANDARD-1 or STANDARD-2).
- On VM/ESA, the RERUN phrase is not supported because there is no Checkpoint/Restart feature.
- When division by zero occurs in an arithmetic expression and an ON SIZE ERROR phrase is not specified, processing abnormally terminates.

The following compiler options are **required** to support the above standards: ADV, DYNAM, INTDATE(ANSI), LIB, NAME(ALIAS) or NAME(NOALIAS), NOCMPR2, NOCURRENCY, NODATEPROC, NODBCS, NODLL, NOFASTSRT, NOFLAGMIG, NONUMBER, NOSEQUENCE, NUMPROC(NOPFD) (or NUMPROC(MIG)), TRUNC(STD), NOWORD, QUOTE, and ZWB.

The following Language Environment run-time options are **required** to support the above standards: AIXBLD, CBLQDA(ON), and TRAP(ON).

The following Language Environment run-time options are used in support of the above standards: UPSI, DEBUG, and NODEBUG.

## Compatibility Features

### ***Cross-Operating System Compatibility:***

COBOL for OS/390 & VM generally supports cross-operating system compatibility. COBOL for OS/390 & VM programs compiled on VM can run on OS/390. And, COBOL for OS/390 & VM programs compiled on OS/390 can run on VM.

***Compatibility with OS/VS COBOL:*** COBOL for OS/390 & VM produces object code to be run in the OS/390 Language Environment (on OS/390) or IBM Language Environment for MVS & VM Release 8 (on VM) or later run-time environment. Many IBM extensions supported by OS/VS COBOL Release 2 are supported in COBOL for OS/390 & VM. Any invalid language that may

have executed in OS/VS COBOL is not guaranteed to work in COBOL for OS/390 & VM.

Object modules produced from valid programs compiled with OS/VS COBOL Release 2 will generally execute compatibly with the Language Environment library and with valid programs compiled with COBOL for OS/390 & VM under the corresponding operating system, except:

- Programs using OS/VS COBOL SYMDMP, FLOW, STATE, COUNT, or TEST option. These options function only for OS/VS COBOL object modules if the Language Environment run-time option TRAP(ON) is specified. The options are not enabled when an error occurs in a SORT input or output procedure.
- The QUEUE run-time option of OS/VS COBOL is not supported in Language Environment.
- For the non-CICS environment, OS/VS COBOL programs must be executed in a single run unit.

With these same exceptions, and with the OSDECK compiler option, object module compatibility is achieved for VM/ESA-compiled programs that are run under OS/390. That is, valid programs compiled under OS/VS COBOL Release 2 under VM will execute compatibly with COBOL for OS/390 & VM programs under OS/390.

Compatibility is not maintained for programs dependent on a specific implementation of the OS/VS COBOL compiler, such as specific code sequences, program structure, internal control block formats, and listing formats.

In COBOL for OS/390 & VM, many 1968 standard language elements and obsolete extensions supported by OS/VS COBOL are not included. These unsupported obsolete semantics will be diagnosed as errors in COBOL for OS/390 & VM.

### ***Compatibility with VS COBOL II Release 2:***

Implementation of support for the COBOL 85 Standard, beginning with VS COBOL II Release 3, caused some language elements to behave in a different manner than in VS COBOL II Release 2. Any valid VS COBOL II Release 2 program that is compiled using COBOL for OS/390 & VM with the CMPR2 compiler option specified will provide, when run with Language Environment, equivalent run-time results.

**Compatibility with VS COBOL II Release 3.x:**

COBOL for OS/390 & VM provides generally upward source program compatibility with VS COBOL II Release 3.x, with the following exceptions:

- New COBOL for OS/390 & VM reserved words (listed under VS COBOL II Release 4 compatibility below).
- Three exceptions resulting from conformance with the published ANSI interpretation of X3.23-1985 COBOL standard. These exceptions are:
  - Different treatment of blank lines and comment lines appearing in pseudo-text-1 of COPY REPLACING and REPLACE
  - Precedence of USE procedures in contained programs
  - Maximum length receiver rule applying to variable-length group receivers that contain their own OCCURS DEPENDING ON (ODO) object not followed by a nonsubordinate item, and reference-modified with a reference modifier that does not specify a length

**Compatibility with VS COBOL II Release 4:**

COBOL for OS/390 & VM generally provides upward source program compatibility with VS COBOL II Release 4, with the exception of:

- New reserved words CLASS-ID, COMP-5, END-INVOKE, EXEC, END-EXEC, FACTORY, FUNCTION, INHERITS, INVOKE, LOCAL-STORAGE, METACLASS, METHOD, METHOD-ID, OBJECT, OVERRIDE, PROCEDURE-POINTER, RECURSIVE, REPOSITORY, RETURNING, SELF, SQL, and SUPER
- The behavior of the TRUNC(BIN) option has changed for unsigned binary fields that contain values larger than the corresponding signed binary field could have contained
- New run-time diagnostics are produced for some situations that were unsupported in prior releases, but the restrictions were not enforced

**Compatibility with IBM COBOL for MVS & VM:**

COBOL for OS/390 & VM is fully source and object compatible with IBM COBOL for MVS & VM Version 1, except for:

- New reserved words FACTORY, COMP-5, EXEC, END-EXEC, SQL
- Programs using object-oriented elements must be recompiled and relinked using dynamic link library (DLL) support to produce executables that can run with OS/390 SOMObjects
- The behavior of the TRUNC(BIN) option has changed for unsigned binary fields that contain values larger than the corresponding signed binary field could have contained
- The default destination of DISPLAY output under OS/390 UNIX has changed from stderr to stdout
- New run-time diagnostics are produced for some situations that were unsupported in prior releases, but the restrictions were not enforced

**Compatibility with COBOL for OS/390 & VM**

**Version 2 Release 1:** COBOL for OS/390 & VM is fully source and object compatible with COBOL for OS/390 & VM V2 R1 except for:

- New reserved words FACTORY, COMP-5, EXEC, END-EXEC, SQL
- The behavior of the TRUNC(BIN) option has changed for unsigned binary fields that contain values larger than the corresponding signed binary field could have contained
- The default destination of DISPLAY output under OS/390 UNIX has changed from stderr to stdout
- New run-time diagnostics are produced for some situations that were unsupported in prior releases, but the restrictions were not enforced

**Link-Editing Requirements:** If any part of a load module is compiled with COBOL for OS/390 & VM, the load module must be linked with the OS/390 Language Environment (on OS/390 V2R4 or later) or IBM Language Environment for MVS & VM Release 8 (on VM) or later library. Note that with COBOL for OS/390 & VM, relinked load modules are **not** self-contained.

**Debugging Considerations:** Programs compiled with COBOL for OS/390 & VM can be debugged using the Debug Tool, which is included with COBOL for OS/390 & VM if you order the Full Function offering. COBOL for OS/390 & VM and Language Environment do not support COBTEST or TESTCOB.

The Debug Tool can also be used to debug programs compiled with the TEST option using:

- VS COBOL II (Release 3 and Release 4 only) running under Language Environment
- COBOL/370
- IBM COBOL for MVS & VM

The Full Function offerings of the OS/390 C/C++ optional feature, IBM PL/I for MVS & VM Version 1 Release 1.1, and IBM COBOL for MVS & VM Version 1 Release 2, also contain the Debug Tool. Users who currently have any of these Full Function offerings, and other existing Debug Tool users, can order PTFs or a service upgrade that will provide the support for COBOL for OS/390 & VM under their existing Debug Tool feature.

**CICS Considerations:** For migration from OS/VS COBOL to COBOL for OS/390 & VM, CICS Command Level programs must be compiled with the RENT and NODYNAM options provided by the CICS Translator. Macro-level COBOL source is not supported.

### **Licensed Program Materials Availability**

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

### **Supplemental Terms**

**Designated Machine Identification:** Designated Machine Identification Required—Yes.

### **Testing Period**

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

**Installation/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/Duration of Program Services**

- Central Service.
- Until discontinued by IBM with a minimum of six months written notice.

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DFSORT	System/370
IBM	System/390
IMS/ESA	VisualAge
Language Environment	VM/ESA

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