

# **COBXREF**

A program to create cross references from Cobol source code with all copy statements included in along with all comments.

## **Set up and Usage Manual**



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## Support for Cobxref

Please read all of these notes before use along with the Changelog and README file if present and ensure that the latest entry at the top, matches the current source file version number.

Latest version at <https://sourceforge.net/p/open-cobol/code/HEAD/tree/trunk/contrib/tools/cobxref>  
or <https://sourceforge.net/projects/cobxref/files/>  
or <http://applewood.linkpc.net/files/cobxref-latest/>  
or via anonymous ftp at applewood.linkpc.net : cd pub/cobxref-latest

Note that at Sourceforge, there are two Cobxref versions, one for IBM mainframes under MVS as well as this one for the GnuCobol compiler.

If using ftp with the applewood.linkpc.net url you may find (but unlikely) Alpha releases present, that is under initial testing.

One's marked Beta are somewhat safer to use for production purposes.

Suggestions for updates to vbcoen at gmail.com

Message subject must be 'cobxref requests' or 'cobxref bugs' subject to the issue or problem.

And of course you can use the GnuCOBOL website bug reporting tool for all tools.

If you wish to be on an update & bug report email list for: Printcbl, Cobxref, Profiler (Cobol), Dectrans, Flightlog and anything else related to my/our Cobol development tools or applications send your details to above address with subject: 'Update lists' and you will be added to my address list for such purposes.

This is the only list used to notify of updates and/or also include the newly released files and is not used for any other purpose.

## Why is this program needed ?

One of the problems involved in programming in Cobol is the heavy usage of working storage definitions as well as procedural code. Quite often the programmer sets up variables of one type or another and ends up not fully using them or forgets where and when they are used. The same applies to section and paragraph names. Older versions of the GnuCobol compiler did not have such a facility and the current version does not go in to enough analysis to match our needs but saying this other compilers over the years, suffered similar problems with many not have an xref (cross reference) function at all or at least one that worked, and this is why there is a separate version for running under MVS 3.8J and the IBM ANSI Cobol compiler. For this one, see the Cobxref files section at Sourceforge and on our website under MVS3.8J

Cobxref for GnuCOBOL, produces a full listing of the code with copy libraries included then produces various cross referenced reports by sections showing usage and also where both are not being used. [Note that the MVS version does not process COPY verbs at all although there is coding present for it to be added and this is due to the extra libraries that have to be installed in MVS load libraries.]

While not often used during the coding stage it can be used towards the end and during testing to facilitate a satisfactory and timely conclusion in development.

We use it for all of the other Cobol Tools as well as applications developed and distributed via sourceforge and other websites as O/S (Open Source) with only the FSF license for re-use.

As examples see such Cobol tools as Printcbl, Dectrans and MySQL pre-compilers, as well as applications such as FlightlogC (for record flight crew flight times) and the Accounting software package ACAS which includes General and IRS (abbreviated version of same), Purchase,& Sales Ledgers and Stock Control with support for Cobol files or using Mysql rdbms tables (others might be added at a later date subject to demand).

Cobxref will also produce a printable listing of the Cobol program source that was used as input with all COPYs added, up to a maximum depth of 9.

This means a COPY verb calling a library that in turn calls another COPY verb and this is up to 8 levels in addition to the original source file. Note that the compiler will not go to this depth the Cobol standard specifies source file plus four and many compilers do not go down to this level. Needless to say company standards and mainframe sites restrict the level count to two at most as it shows a poor control of the copy libraries per application within a project.

Cobxref produces a listing breakdown of where variables are used by section within the procedure division namely and in order of:

- File
- Working-Storage
- Local-Storage
- Linkage
- \*Communication      Not used in GnuCOBOL.
- Report
- Screen

In addition breakdown are shown for system Functions, Conditions (88 levels), and Called processes both system and user defined as well as variables defined as Global when used with nested program sources, with limited support for one's defined as External.

Entries within configuration is also supported such as special-names.

Cobxref also includes both a module for obtaining the current compilers list of reserved words, intrinsic functions and system words and a cut down module of our Cobol tool Printcbl which is used for processing copy libraries see the next chapter Copy Support (v2.00) for notes regarding support for the librarian COPY verb.

This program requires the use of the GnuCobol compiler v2 and later to update all of the various reserved word tables and therefore will not work with any other compiler.

## Copy Support (v2.00)

Case is not sensitive, so ' COPY ' ' copy ' and any variation is OK, same as in GnuCOBOL. Both types of quotes (single and double but not mixed)

- 1: COPY foo.
  - 2: COPY "foo" (or 'foo').
  - 3: COPY "foo.ext". different .ext **NOT** searched for
  - 4: COPY foo.ext different .ext **NOT** searched for (same as in 3).
  - 5: for any COPY options adding IN | OF "../par" fully supported.
  - 6: COPY filename.ext | IN | OF path | "relative path" | SUPPRESS | SUPPRESS PRINTING  
The SUPPRESS options only used for a report otherwise ignored.
  7. Support for REPLACING sub clause
- |           |                   |                      |
|-----------|-------------------|----------------------|
| Form 1A:: | Word              | by word              |
| 1B::      | Literal           | by literal           |
| 1C::      | Identifier        | by Identifier        |
| 1D::      | ==pseudo-text-1== | by ==pseudo-text-2== |
| 1E::      | ==text-3==        | by ==text-4==        |

Cases 1 and 2 (if not found, then searched with .extensions of .CPY, .CBL, .COB (as well as lower case version of the same). This is not done if the extension is provided.

For 1D support for LEADING and TRAILING providing both fields are the same size.

All all cases searched in current directory and all search paths in order supplied up to a maximum of 10 paths only.

If both GnuCobol environment variables (COBCPY and COB\_COPY\_DIR) are set and they are the same, only one will be used otherwise search paths are added in read order with COBCPY first.

As per the Cobol standards **ALL COPY** statements **MUST** be followed directly with '.' (period).

**Note:** In 1 through 6) the copy file name and the copy library is **case sensitive**.

**Replacing** all, *other* than literals are **NOT** case sensitive.

Literals must be on same line. There is no support for continuation on the COPY statements or the source target but this allows for partial, line by line replacement.

### **Warning:**

1. When using fixed format source, it is the programmers **responsibility** to ensure that the replacing clause element fits within the area available and does NOT exceed column 72. The same applies to the compiler. (See the Cobol standards manual).

This means the result of a replace that exceeds column 72 is undefined but could extend beyond the Form B area. Also note that cc7 '-' is ignored. and replacing will use '"' & ' at end of source (cc70) and next line will have a quote on cc12.

This does not effect the operation of Cobxref which does not work with literals cross referencing wise. Well that's the theory anyway.

# Pre usage actions on first install

## Program Source code Set up

1. As of version 2.0 Cobxref uses the compilers CDF facility and there are system changes that happen at the start of the source file that the various nested programs access to adjust the default set ups and these are within the section marked as CONFIGURATION SETTINGS.

You can change the first one if needed but the others are only there for programmer testing, but if changed can and will produce a **lot** of output on screen and in the output files.:

1. See the line starting with:

```
>>DEFINE CONSTANT C-Compiler-Line-Cnt AS 55
```

Change the number 55 if and **only** if the following applies:

Cobxref uses the field Compiler-Line-Cnt to hold the default cobc report page size of 55 so if you have changed the one in cobc sources for any reason, you should consider changing this field to match before compiling it by changing the value as shown above which is preset as 55.

As Cobxref produces a print file with the name of the source file and extension of .lst you can pass it to your printer however another option is to use the supplied extra script prtpdf to create a pdf file.

To use it you must also install enscript and ghostscript which if you are using Linux, obtain from your distributions repositories and you might want to amend the prtpdf file to match up with your requirements.

2. See line starting with :

```
>>DEFINE CONSTANT C-OS-Delimiter AS "/"
```

This is set for use in \*nix environments which includes Linux and MSYS/MinGW etc. I understand it will also work with Windows v10.

Change it for "\" if and **only** if, you are using a native version of the Cobol compiler built by Microsoft Visual Studio or a similar compiler.

3. The program will examine the Environment Variable LC\_TIME for producing the date printed in your local format and the values are :

en\_GB to set to using the UK format (dd/mm/yyyy)

en\_US to set to using the USA format (mm/dd/yyyy)

anything else, it is left as 3 = International and Unix format (yyyy/mm/dd).

You can add a check for other value/s for your country/region but please let the programmer know [by email with subject Cobxref] so it can be added to the main source files held at the SF website areas.

If you do not normally use these two, you can also run Cobxref within a script that sets the LC\_TIME value up using the command 'export LC\_TIME=en\_ABC' etc, before running Cobxref.

In all cases this, along with the time as hh:mm:ss:nn is printed in the headings.

Note that the time is updated for each heading printed as it acts as a simple way of seeing just how long it takes in milliseconds to run looking at the first and last heading times.

4. You are now ready to compile and there is a supplied Linux script that will do it named comp-cobxref.sh which just runs:

```
cobc -x -fmissing-statement=ok cobxref.cbl  
chmod +x cobxref
```



You can now run :

```
mv cobxref ~/bin
```

or whatever other bin directory that is in your environment path variable.

The program has been tested with GnuCobol v3.

Note that omitting the '-fmissing-statement=ok' for the compile will produce a number of warning messages that can be ignored but its inclusion just keeps the compiler output tidy.

**5.** You can now use it from any working directory for which you have full access.

**6.** Read the following notes on requirements and usage.

## Cobxref      Program Usage

Caution: This program has only been tested against source files that have gone through the GnuCOBOL compiler with **no** reported errors and I recommend that you do the same.

The GnuCobol compiler (cobc) must be in the executables path as it is called by Cobxref.

Parameters for running Cobxref are in the form:

cobxref 1 [ 2 3 4 5 6 7 8 9 10] where parameters 3 through 9 are all optional with 10 & 11 and possibly hidden ones, only when requested by Cobxref technical support.

Note: Param 1 **Must** be first parameter, 2 through 8 can be in any order.

Param 2 **Must** be specified if using Free format sources.

Params 3 through 8 as needed.

Param 9 for testing against other cross reference products only

Params 10 and 11 are for programmer testing ONLY.

Param 12 For help the same as shown below.

- 1:      SFN [Source File name] (**Mandatory**)
- 2:      -FREE          Format selection if using the free source format.  
                         Omit if **only** using the fixed source format.  
                         Incorrect usage of this parameter will produce a lot of error messages.
- 3:      -R          Do not print out the source code.  
                         Omit and cobxref will always do so prior to the cross reference listings.
- 4:      -L          Reports all in lowercase (defaults to uppercase or actual case used).
- 5:      -DR      Displays **All** reserved words, followed by Functions then system calls and then stops.  
                         You **Must** still specify a source file even if a dummy (non existent file).
- 6:      -VT      Do not display messages when updating any reserved word tables.
- 7:      -E          Create compressed source file (same as cobc -E).  
                         by producing free format source in filename.src.
- 8:      -AX      Produce Xrefs at end of all program listings
- 9:      -G          Produces group print out in addition to normal so that comparing xref's  
                         with Microfocus or IBM can be more easily done.  
                         This is not yet implemented - depends on requests.
- 10:     -TEST          Produces testing info (and this can be a lot of output).  
                         Used for Debugging by or on behalf of programmers.
- 11:     -V          Verbose output - for testing only - can be a lot of output.
- 12:     -H          Displays program parameter info (same as when run without any parameters}  
                         --H          same as -H both show this list.

Normally, just call as 'cobxref sfn.cbl -FREE'

Where sfn = source file name.

Cobxref will normally produce two files:

sourcefilename.pro	The output from copying over all copybooks (if present). Can be deleted.
sourcefilename.lst	The file containing the source and cross reference listings.

During the Beta release cycle, also creates :

Part1.tmp	Temporary work file holding unsorted xref data.
Part2.tmp	Temporary sorted work file holding sorted xref data. Both files are small.

These files are stored on your temporary directory, location depends on compiler set up but often in ~/tmp. They can be deleted if you need to, but can help if bugs are suspected or found.

*Note* if you have nested program sources, they only show the data for the last one processed.

This next file is only created if requested by usage of parameter -E.

sfn.src	Contains free formatted source with extra spaces removed and file is the same as running cobc with --save-temps but without blank or comment lines as well as trailing comments. This file which is smaller than the cobol source file can also be deleted unless needed for bug reporting.
---------	---

Cobxref will during the run, produce up to three displays reporting on the updating of the internal tables of the various reserved word types against the installed version of GnuCOBOL compiler see Messages used in get-reserved-lists within Cobxref page 16 for more information.

If there has not been a change of table size the specific display will not occur.

These displays can be:

Msg13 Intrinsic word table was successfully updated  
Msg14 Reserve word table was successfully updated  
Msg16 System word table was successfully updated

It is normal for the first two to appear and for GnuCOBOL v3, the third does not.

This action can be turned off by parameter '-VT' if required.

When processing copy libraries the contents of the GnuCOBOL environment variables COBCPY and COB\_COPY\_DIR are searched for the libraries after looking in the current directory

Note that if both env. vars. are found and have the same contents, then just one is used, otherwise they are searched in order of COBCPY then COB\_COPY\_DIR

There is a total of 10 paths allowed, so only the first 10 are used.

e.g., if both env. variables are used and you have:

COBCPY=a:b:c:d:e:f  
COB\_COPY\_DIR=g:h:i:j:k:l:m

Only a through i are searched as well as the directory containing the source program.

*Any errors found during processing such as not finding a copy book along with any warnings or information messages will appear in the updated source file (.pro) and in the cobxref listings.*

*These messages are prefixed with the comment flags ">" or ">>" so they do not get flagged by the compiler. The prefix's "\*\*\*>E ", or "\*\*~>>P " is used to high light possible issues. There are others.*

# Compiler Requirements for building Cobxref

Any version that supports:

## *Functions:*

1. SUBSTITUTE
2. SUBSTITUTE-CASE
3. CURRENT-DATE
4. UPPER-CASE
5. LOWER-CASE

## *Called Procedures:*

6. SYSTEM
7. CBL\_CHECK\_FILE\_EXIST
8. CBL\_CLOSE\_FILE
9. CBL\_DELETE\_FILE
10. CBL\_GET\_CURRENT\_DIR
11. CBL\_OPEN\_FILE
12. CBL\_READ\_FILE

## 13. Environment variable capture e.g.:

accept Cobcpy	from Environment "COBCPY".
accept Cob_Copy_Dir	from Environment "COB_COPY_DIR"
accept Arg-Number	from argument-number.
accept Arg-Value	from argument-value

As far as I know all versions from v2 do so, but not tested against older ones. There may be a problem with v1.1 and Substitute if you do not have the patches installed.  
It is recommended that you upgrade your compiler to version 2.2 or later.

All current development, testing and production is with v3.

If this is a problem let me know and I will look at recoding it to replace this.

# TODO List in Copy library processing (within PrintCbl)

1. None.

## Noticeable changes since v1.07

1. Support for multiple depths for copy statements instead of 1, i.e., copy within a copy is depth 2. It will now go to a depth of 9, e.g., source with nine copy within copy.

According to the Cobol standards, GnuCOBOL should go to 5 levels at least. which when last checked it does but that was some versions ago.

2. Support for up to 50 REPLACING sub-clauses per COPY, but LEADING, TRAILING is ignored. (This is a result of the usage of the function substitute that has no support for such). I may have to re-look at this subject if support of substitute in v1.1 of GC has been retro included by patch. However SUBSTITUTE does not have any options it is a From / To tool only.

3. Limitations for current version based on tables sizes etc.:
  - A. Total number of copy's with copy's within original source file 9, e.g., depth 9.
  - B. Maximum number of REPLACING clauses with a COPY: 50.
  - C. Maximum size of a Replacing Source or Target field: 2048 bytes/Chars.
  - D. Maximum size of complete COPY statement: 1 MB (1024 \* 1024).
  - E. Maximum file buffer size: 1 MB. [Source files are read in 1 MB blocks].
  - F. Warning, Error, Caution messages held in table currently 10 in English.
  - G. Maximum size of a free format source line: 255 Chars [as per Cobol standards].
  - H. Maximum number of source file extensions: 7 [cpy, CPY, cbl, CBL, cob, COB] and space.

4. Support for REPLACING LEADING, TRAILING sub-clauses added. These are processed by the program providing both source and target are the same size.

Special source user changes now only done at the source file beginning in GnuCOBOL CDF section. See Program Source code Set up page 8.

Also see Appendix A for more information on changes.

## Literal treatment within PrintCbl module

Please note the way (or not) literals are processed.

No processing takes place of continuation of literals both in the COPY clause or the source code as such.

So if you need to change one line of literal you only need to specify the content of that one line in a COPY statement.

E.g., copy library source code:

03 filler pic x any length value "This is an example of left hand heads"

03 filler pic x any length value " but this is an extension line of more rubbish" &  
" as such makes absolutely no sense".

COPY foo.bar replacing

"This is an example of left hand heads" by "Top form for Fred"

" but this is an extension line of more rubbish" by "Centre heading 1"

" as such makes absolutely no sense" by "Page number ".

Also if in line 3 of source, started in fixed form as:

- " as such makes absolutely no sense".

It should also work.

NOTE that it has always been the responsibility of the programmer that when using fixed format sources to ensure that replacing clauses will result in the same limitations of no line exceeding column 72. This applies to the compiler as well as per the Cobol standards.

Therefore PrintCbl does not check it under all circumstances however the replacing clauses are checked and correct sizing maintained, where ever possible.

Within cobxref literals are ignored for cross reference processing anyway.

# Messages used in Cobxref

## Processing breakdown

The caution, warning and error messages are broken down by what sub system within Cobxref produced them namely Cobxref itself, get-reserved-lists or printcbl.

To help understand them, a simple indication of the steps run is now provided:

Cobxref starts by running get-reserved-lists which in turn runs cobc to output the various sets of reserved words and these are then used to update the one's held within its tables.

Then the parameters passed to Cobxref are read in and verified, next printcbl is run, to include any copy verbs creating a new source file (.pro) and this is then used by Cobxref as input to create a compressed file with all excess spaces (more than one) removed which then used as source to produce the source listings and cross references. The compressed file can be retained using -E

The messages are mostly prefixed by a message number in the form of Msgnn where nn is :

01 through 10, 18 & 19 are from Cobxref.

11 through 16 are from get-reserved-lists.

21 through 31 are from printcbl.

Some of these messages are output to the updated source file by PrintCbl prefixed by '\*>> '.

## Displays from Cobxref:

1. Msg1 Aborting: No input stream
2. Msg2 Aborting: Early eof on source
3. Msg4 Logic Error:Lost1 wsFoundWord2 numeric? = xyz
4. Msg5 Logic Error:Lost2 wsFoundWord2 = xyz
5. Msg6 Error: Con table size needs > 5000
6. Msg7 bb050 Error: Logic error
7. Msg8 Error: Eof on source again
8. Msg9 Error: File not present Try Again!
9. Msg10 Error: Git Table size exceeds 10,000
10. Msg18 Error: Eof on source possible logic error at aa047 ASSUMING again
11. Msg19 Possible prob. with cobc and therefore with no reserved word list

## Message Explanations:

1. No data found in sorted temporary work file, unless an empty source file was used should not happen possibly a Cobol sort error - attempts to continue but more msg1 can occur
2. Unexpected end of copy source file - Aborted processing.
3. Suspected programming error - report to support (see inside front cover) - Aborted.
4. Suspected programming error - report to support (see inside front cover) - Aborted.
5. Conditions table of 5,000 exceeded - continues but new one's found will not be added. This table records 88 levels against their corresponding variable data element. Report it as you have a very large program needing this table to be set higher.
6. Suspected programming error - report to support (see inside front cover) - Continuing.
7. Got a EOF (end of file) condition more than once suspected programming error - report to support (see inside front cover) but attempting to continue.
8. Cannot open the file created by printcbl containing copy libraries if any - Aborted.
9. Global Data table exceeds 10,000 will attempt to continue but xref will be inaccurate. Report to support (see inside front cover) - should not be happening!
10. Suspected programming error - report to support (see inside front cover) - Aborted.
11. get-reserved-lists could not obtain the reserved word list whole or in part. - Continuing but also see msg 11, 12 or 15.

# Messages used in get-reserved-lists within Cobxref

## Displays from get-reserved-lists:

1. Msg11 Cannot run 'cobc --list-intrinsics', cobc not in path?
2. Msg12 Cannot run 'cobc --list-reserved', cobc not in path?
3. Msg13 Intrinsic word table was successfully updated
4. Msg14 Reserve word table was successfully updated
5. Msg15 Cannot run 'cobc --list-sytem', cobc not in path?
6. Msg16 System word table was successfully updated
7. Msg19 Possible prob. with cobc and therefore with no reserved word list updates

## Message Explanations:

12. Cannot run cobc aborting.
13. Same as 1.
14. Information only.
15. Information only.
16. Same as 1.
17. Information only.
18. See 1, 2 & 5 Cobxref will run without having an up to date reserved, function or system list.

When running v3 of the compiler it is normal for messages 3 and 4 to be displayed but message 6 does not, as the internal table is up to date. That can change with a later version or build of the compiler.



# Messages used in PrintCbl within Cobxref

## Listings from PrintCbl module:

1. Msg21 Error: Too many levels (9) of COPY
3. Msg22 Error: Copy File Not Found
4. Msg27 Error: Cannot Find File, & tried six different .Exts
5. Msg28 Error: Abnormal end of input
6. Msg29 Caution: One or more replacing sources not found
7. Msg25 (P): On Read. Ret.code = nn
8. Info: Total Copy Depth Used = nn
9. Caution messages issued = nn
15. Msg32 Error: Recursive Copy File Name = CFN - Above is IGNORED

## Displays from PrintCbl module :

1. Msg21 Error: Too many levels (9) of COPY
2. Msg23 Error: File Not Found
5. Msg28 Error: Abnormal end of input
7. Msg25 (P): On Read. Ret.code = nn
11. Msg24 (P): File Not Closed? = xxx.yyy
12. Msg26 Error: When opening I/P file got = nn
13. Msg31 (P): Bad RT on Get-Directory
14. Errors: Note and Hit return to quit

## Message Explanations:

1. Your program exceeded nine levels of copy e.g., source file copy calls copy that calls 9+.
2. Source file not found, program aborts process or copy level.
3. Cannot find the file specified in the Copy statement that has an extension in the name.
4. Cannot find the file specified in the Copy statement that does not have an extension.
5. Unexpected end of file. You did *NOT* terminate a copy statement with a full stop / period!
6. Listed after a copy statement when one or more replacing sources NOT found in the copy file.
7. Possible program issue, file terminated with unexpected error condition. Please report this to the lead programmer listed on inside front cover via email with any other helpful details.
8. Information: As it says. Printed at end of source listing along with number of copy files not found (see line after each copy statement and warning if any Caution (see 6.) messages listed.
9. Warning that one or more message 6. listed. Also see (8).
10. Unused.
11. Possible program issue, unexpected error value when closing file. Please report this to the lead programmer listed on inside front cover via email with any other helpful details.
12. Possible program issue, unexpected error value when opening file but was tested present. Please report this to the lead programmer listed on inside front cover via email with any other helpful details - program aborts.
13. Failure when trying to get the current directory. This would be caused by a compiler error.
14. As it says and process will abort, issued after some of the above messages.
15. Copy file name is used recursively, it is ignored.

Messages in the listing will be prefixed by \*>>, \*>>>, \*>C, \*>>E or \*>>P so that they stand out. The prefix ">C" is for the original COPY statement that is remarked out in Free format and for fixed just an asterisk in cc7.

There is always an ">>> Info" message as the last entry in the source listing element giving totals. This is ignored by the GnuCobol compiler.

## Appendix A - Update Log

### *Since v1.07*

1. Cobxref now accepts both fixed and free Cobol formats and does not process the sfn.i created from cobc -E option. This was a feature requested by Roger While and is no longer needed. Should never have removed the COPY processing code !
2. All COPY verbs must be terminated by a period / full stop as per the Cobol standard.
3. Any Cobol source must go through the compiler error and major warning free.
4. Support for FUNCTION-ID in addition to PROGRAM-ID but all other subclauses are ignored.
5. Full support for System calls as well as User defined one's and these are reported on.
6. Clean up help screen.
7. Add to manual regarding default copy libs are from COBCPY and COB\_COPY\_DIR as well as current source directory.
8. Website address updated for linkpc.net.
9. Updated copyright notices and replaced references to GnuCobol.
10. Documentation clean ups.
11. Cobxref as well as the other modules, now uses CDF facilities for preset user site variables. See start of source code.
12. Debug lines copy statements now ignored both formats.
13. Renamed warning and error messages to tie up with Printcbl.
14. Code brought in to line with Printcbl but with reporting code removed.
15. Various bugs fixed regarding fixed format and CB (copy book) processing with non literal CB's and one's without extension specified.
16. Minor listing tidy ups.
17. At program start use base source file name for headings until program / function ID found.
18. Reporting multi programs (nested) by adding new field to sorting records the current active program/function name. Reporting is still the same.
19. New program parameter function to turn on block xrefs for nested program source. See (18). Activated by parameter -AX ----- Not yet added as subject to user requests.
20. Using new parameter option -E program will create a source file the same as cobc -E but without any blank or comment lines. This data is exactly the same as processed through Cobxref after COPY verbs processed and all extra spaces above one removed to aid processing. There are some possible bugs that could occur where this file output is handy for diagnostics otherwise of no use to most users.
21. Cobxref no longer will process COPY words in comment areas (cobc does via -T option).
22. All comments are ignored including floating one's.
23. When replacing text without pseudo option it will only replace text with space before and after and not any text within text as only pseudo can. For more details on this and many others see the Changelog supplied with program that gives a detailed breakdown of bugs,fixes and new features but this is for the programmers aid !
24. New parameter -VT to turn off messages for updating the various internal reserved word tables in module get-reserved-lists. I find it handy but when running many sources through cobxref it can get a little tiresome but it does prove that the compiler is installed as accessible.
25. Using pseudo replacing does on all examples of the from code and it is the only option that will.
26. Replacing using literals does an exact match only with continuation characters ignored such as - in cc7 (fixed) and '&' for both.
27. Complete tidy up of all messages both displayed and printed - includes renaming.
28. Lots more, see the Changelog if really interested.
29. Updated printcbl module to match changes in printcbl program. Fixed bug regarding fixed format - using wrong field when testing for it and both fixed and free 88's clashed and GC did not report the issue.

**30.** Re-match messages against this manual etc.

**31.** Replacing Leading | Trailing pseudo where size of both fields are exactly the same.

## Appendix B - Copy statement Formats

**WARNING:** This does NOT mean that all variants are implemented in a given version of GnuCOBOL.

With definitions as per ISO/IEC 1989:2014 CD 1.1 (E)

### 7.2.1.2 Source text and library text

Source text is the primary input to the compiler for a single compilation group. Library text is secondary input to the compiler as a result of processing a COPY statement.

The source text and library text processed by text manipulation consists of indicators, character-strings, comments, and separators. A character-string is either a text-word or the word 'COPY'.

### 7.2.1.3 Pseudo-text

Pseudo-text is an operand in the REPLACE statement and in the REPLACING phrase of the COPY statement.

Pseudo-text may be any sequence of zero or more text-words, comments, and the separator space bounded by, but not including, pseudo-text delimiters. The opening pseudo-text delimiter and the closing pseudo-text delimiter consist of the two contiguous COBOL characters '=='.

### 7.2.1.4 Text-words

A text-word is a character-string in source text or in library text that constitutes an element processed by text manipulation. A text-word may be one of the following:

- 1) a separator, except for: a space; a pseudo-text delimiter; and the opening and closing delimiters for alphanumeric, boolean, and national literals. In determining which character sequences form text-words, the colon, the right parenthesis, and the left parenthesis characters, in any context except within alphanumeric or national literals, are treated as separators;
- 2) an alphanumeric, boolean, or national literal including the opening and closing delimiters that bound the literal;
- 3) any other sequence of contiguous COBOL characters bounded by separators, except for: comments and the word 'COPY'.

### 7.2.2 COPY statement

The COPY statement incorporates library text into a COBOL compilation group.

#### 7.2.2.1 General format

#### 7.2.2.2 Syntax rules

- 1) A COPY statement may be specified anywhere in source text or in library text that a character-string or a separator, other than the closing delimiter of a literal, may appear except that a COPY statement shall not appear within a COPY statement.
- 2) A COPY statement shall be preceded by a space except when it is the first statement in a compilation group.
- 3) Within one COBOL library, each text-name shall be unique.
- 4) A concatenation expression or figurative constant shall not be specified for literal-1, literal-2, literal-3, or literal-4.
- 5) Literal-1 and literal-2 shall be alphanumeric literals. The allowable value of literal-1 and literal-2 is defined by the implementer.
- 6) Pseudo-text-1 shall contain one or more text-words, at least one of which shall be neither a

separator comma nor a separator semicolon.

7) Pseudo-text-2 shall contain zero, one, or more text-words.

8) Character-strings within pseudo-text-1 and pseudo-text-2 may be continued in accordance with the rules of reference format.

9) Text-1 and text-2 shall be one of the following formats of identifiers: function-identifier, qualified-data-name with-subscripts, reference-modification, qualified-linage-counter, or qualified-report-counter.

NOTE Text-1 and text-2 are archaic features and their use should be avoided.

If subscripting is specified, it shall not include any arithmetic expressions as subscripts with the exception of a single literal or identifier, or an identifier plus or minus an integer.

The format of any identifier specified in

```

COPY          literal-1
{             text-name-1 }
{ }          [ ] OF/IN
              literal-2
              library-name-1 ]

[ ] [ SUPPRESS PRINTING ]
    REPLACING
              == pseudo-text-1 ==
              text-1
              literal-3
              word-1
              BY
              == pseudo-text-2 ==
              text-2
              literal-4
              word-2

[ ] [ ] LEADING/TRAILING
[ ]
              == partial-word-1 == BY == partial-word-2 ==
[ ]
```

Subscripts, reference modifiers, or function arguments shall be: a function-identifier, qualified-data-name with- subscripts, reference-modification, qualified-linage-counter, or qualified-report-counter. Function identifiers in text-1 or text-2 shall be intrinsic function references only.

10) Word-1 or word-2 may be any single COBOL word except 'COPY', the compiler directive indicator, or the comment indicator.

11) The length of a text-word within pseudo-text and within library text shall be from 1 through 65,535 character positions.

12) Compiler directive lines shall not be specified within pseudo-text-1, pseudo-text-2, partial-word-1, or partial-word-2.

13) Partial-word-1 shall consist of one text-word.

14) Partial-word-2 shall consist of zero or one text-word.

15) An alphanumeric, boolean, or national literal shall not be specified as partial-word-1 or partial-

word-2.

### 7.2.2.3 General rules

- 1) Text-name-1 or literal-1 identifies the library text to be processed by the COPY statement.
- 2) Library-name-1 names a resource that shall be available to the compiler and shall provide access to the library text referenced by text name-1.
- 3) The implementer shall define the rules for locating the library text referenced by text-name-1 or literal-1. When neither library-name-1 nor literal-2 is specified, a default COBOL library is used. The implementer defines the mechanism for identifying the default COBOL library.
- 4) If the SUPPRESS phrase is specified, library text incorporated as a result of COPY statement processing is not listed. If a listing is being produced, the COPY statement itself is listed.
- 5) At the completion of copying the library text into the compilation group, the LISTING directive that is in effect for the COPY statement itself is considered to be in effect, regardless of any LISTING directives in the library text.
- 6) The effect of processing a COPY statement is that the library text associated with text-name-1 or the value of literal-1 is copied into the compilation group, logically replacing the entire COPY statement beginning with the reserved word COPY and ending with the separator period, inclusive.
- 7) If the REPLACING phrase is not specified, the library text is included in the resultant text unchanged.
- 8) If the REPLACING phrase is specified, library text is modified during creation of the structured compilation group that is described in 7.2, Text manipulation. Each matched occurrence of pseudo-text-1, text-1, word-1, literal-3, or partial-word-1 in the library text is replaced by the corresponding pseudo-text-2, text-2, word-2, literal-4, or partial-word-2 in accordance with subsequent rules of the COPY statement.
- 9) For purposes of matching, text-1, word-1, and literal-3 are treated as pseudo-text containing only text-1, word-1, or literal-3, respectively.
- 10) The comparison operation to determine text replacement occurs in the following manner:
  - a) The leftmost library text-word that is not a separator comma or a separator semicolon is the first text-word used for comparison. Any text-word or space preceding this text-word is copied into the resultant text.

Starting with the first text-word for comparison and first pseudo-text-1, text-1, word-1, literal-3, or partial-word-1 that was specified in the REPLACING phrase, the entire REPLACING phrase operand that precedes the reserved word BY is compared to an equivalent number of contiguous library text-words.
  - b) Pseudo-text-1, text-1, word-1, or literal-3 match the library text only if the ordered sequence of text-words that forms pseudo-text-1, text-1, word-1, or literal-3 is equal, character for character, to the ordered sequence of library text-words. When the LEADING phrase is specified, partial-word-1 matches the library text only if the contiguous sequence of characters that forms partial-word-1 is equal, character for character, to an equal number of contiguous characters starting with the leftmost character position of a library text-word. When the TRAILING phrase is specified, partial-word-1 matches the library text only if the contiguous sequence of characters that forms partial-word-1 is equal, character for character, to an equal number of contiguous characters ending with the rightmost character position of a library text-word.
  - c) The following rules apply for the purpose of matching:
    1. Each occurrence of a separator comma, semicolon, or space in pseudo-text-1 or in the library text is considered to be a single space. Each sequence of one or more space separators is considered to

be a single space.

2. Each operand and operator of a concatenation expression is a separate text-word.

3. Except when used in the non-hexadecimal formats of alphanumeric and national literals, each alphanumeric character is equivalent to its corresponding national character and each lower case letter

is equivalent to its corresponding upper case letter, as specified for the COBOL character repertoire in the COBOL character repertoire.

4. For alphanumeric, boolean and national literals:

a. The two representations of the quotation symbol match when specified in the opening and closing delimiters of the literal.

NOTE The opening and closing delimiters are required to be in the same representation.

b. In the content of the literal, two contiguous occurrences of the character used as the quotation symbol in the opening delimiter are treated as a single occurrence of that character.

5. Each occurrence of a compiler directive line is treated as a single space.

6. Comments, if any, are treated as a single space.

NOTE Because comments are removed during logical conversion, none are expected.

d) If no match occurs, the comparison is repeated with each next successive pseudo-text-1, text-1, word-1, literal-3, or partial-word-1, if any, in the REPLACING phrase until either a match is found or there is no next successive REPLACING operand.

e) When all the REPLACING phrase operands have been compared and no match has occurred, the leftmost library text-word is copied into the resultant text. The next successive library text-word is then considered as the leftmost library text-word, and the comparison cycle starts again with the first pseudo-text-1, text-1, word-1, literal-3, or partial-word-1 specified in the REPLACING phrase.

f) When a match occurs between pseudo-text-1, text-1, word-1, or literal-3 and the library text, the corresponding pseudo-text-2, text-2, word-2, or literal-4 is placed into the resultant text. When a match occurs between partial-word-1 and the library text-word, the library text-word is placed into the resultant text with the matched characters either replaced by partial-word-2 or deleted when partial-word-2 consists of zero text-words. The library text-word immediately following the rightmost text-word that participated in the match is then considered as the leftmost text-word. The comparison cycle starts again with the first pseudo-text-1, text-1, word-1, literal-3, or partial-word-1 specified in the REPLACING phrase.

g) The comparison operation continues until the rightmost text-word in the library text has either participated in a match or been considered as a leftmost library text-word and participated in a complete comparison cycle.

11) If the REPLACING phrase is specified, the library text shall not contain a COPY statement.

12) The resultant text after replacement shall be in logical free-form reference format. When copying text-words into the resultant text, additional spaces may be introduced only between text-words where there already exists a space or where a space is assumed.

NOTE A space is assumed at the end of a source line.

13) If the REPLACING phrase is not specified, the library text may contain a COPY statement that does not include a REPLACING phrase. The implementation shall support nesting of at least 5 levels, including the first COPY statement in the sequence. The library text being copied shall not cause the processing of a COPY statement that directly or indirectly copies itself.

14) The replacing action of a COPY statement shall not introduce a COPY statement, a SOURCE FORMAT directive, a comment, or a blank line.

Well, that was well explained. You might want to read it again.

**WARNING:** Regardless of the above text, it does ***not*** mean that these procedures have been implemented into this program, or for that matter the GnuCOBOL compiler.

What it does show is that when processing literals or text that goes over one line that this program may well adopt the free source format for the COPY libraries that are called for inclusion in order to expand said literals correctly and this format may well be used in the listings in a similar manner to GnuCOBOL (see the .i file when produced by various GC parameters including '--save-temps' , -E etc).

See the other parts of this manual for what exactly, ***is*** implemented for any specific version of the program.

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Version 3, 29 June 2007

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