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USER'S GUIDE FOR THE PHIGS VALIDATION TESTS (VERSION 1.0)

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by

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ABSTRACT: The PHIGS Validation Tests (PVT), developed by NIST, consist of a large set of Fortran programs which may be used to test how well implementations of PHIGS conform to the standard. The tests are organized into a hierarchical structure of modules which corresponds to the conceptual overview of the standard. The tests are associated with the standard via a set of semantic requirements which are derived directly from the standard. Cross-reference tables allow the user to find tests relating to specific PHIGS functions and data structures. Directions for installation and operation of the tests are included.

KEYWORDS: conformance testing; graphics standards; PHIGS; testing of software; validation of software

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1 INTRODUCTION

PHIGS stands for Programmer's Hierarchical Interactive Graphics System. The PHIGS standard defines a set of functions to be used by a programmer to manipulate and display 3-D graphical objects. For a full description of the features of PHIGS, see [PHIGS88]. The standard has been approved by the American National Standards Institute (ANSI) as ANSI X3.144-1988, by the International Organization for Standards (ISO) as ISO 9592:1988, and by the Federal government as Federal Information Processing Standard (FIPS) 153.

The PHIGS Validation Test (PVT) suite is a product of the National Computer Systems Laboratory (NCSL) of the National Institute of Standards and Technology (NIST). The function of this suite is to test whether implementations of PHIGS conform to the PHIGS standard. The PVT is available to individuals and organizations for use in developing or testing PHIGS implementations. NCSL intends to use future versions of this suite to validate PHIGS implementations which have been submitted for testing, and to make it available to other accredited testing laboratories for the same purpose.

The PVT suite embodies NCSL's best technical judgment concerning the requirements for conforming implementations in the PHIGS standard. Nevertheless, there are parts of the standard which can reasonably be construed in various ways. NCSL intends to update the PVT suite periodically to reflect official ANSI or ISO interpretations that conflict with the assumptions upon which the current version of the PVT is based.

This document describes the general rules and procedures for PHIGS conformance testing, using the PVT suite. Detailed information for specific tests may be found in the module documentation, as described in section 2.5. For a discussion of PVT design issues, see [CUGI90].

We welcome any comments or suggestions regarding the PVT. Such comments may include reports of errors in the PVT, suggestions for additional test cases, interpretation questions, or any other ideas on how to improve the PVT. Please send all correspondence to:

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This report identifies certain commercial software products in order to illustrate some of the concepts discussed herein. Such identification does not imply recommendation or endorsement by NIST.

2 STRUCTURE AND FORMAT OF PVT SUITE

The PVT suite is implemented as a set of documentation files and source code files. This section describes the relationship among these files, and the format conventions they follow.

2.1 Tree Structure

The PVT suite is organized in a hierarchical, or tree, structure. This tree closely resembles the organization of section 4 of the generic ANSI PHIGS standard, which contains the basic conceptual description of PHIGS. See Appendix B for the complete description of the PVT tree.

Concretely, the tree structure is expressed by storing the modules of the PVT system in a hierarchical file directory, such as that supported by VAX/VMS, Unix, and MS-DOS. For illustrative purposes we shall adopt a neutral naming convention, wherein the levels of a file structure are separated by the "~" character, for example: PVT~05~03~DOC.TXT as the name of the documentation file for module 05~03. As distributed, the root of the PVT tree contains a number of system files:

a. USER_GUIDE.PRT: User's Guide for the PVT; the file you are now reading

b. DESIGN_DOC.PRT: Discussion of PVT design issues

c. SYS_DICT.PRT: Dictionary file to specify the numbering of PHIGS functions and data structures

d. INITPH.FOR: Source code for initializer of PVT configuration file

e. TRANS_SUBLIB.FOR: Source code for transformation subroutine library

f. SUBLIB.FOR: Source code for global subroutine library

2.2 Modules

There is at most one PVT module per node in the tree. Every leaf node contains a module. A non-leaf node may contain a module, or may be empty, serving simply to organize the system. Every module contains exactly one documentation file, conventionally named DOC.TXT, and one or more program files, named P01.FOR, P02.FOR, etc. The documentation file contains the set of semantic requirements (SRs) for the module, together with the design for each of the module's programs. The programs contain the test cases

(TCs) for the module. Format details are explained below. See Figure 1 for a schematic diagram of the structure of a module.

```
Module
   DOC.TXT (Documentation file)
      Semantic Requirements
         SR1
         SR2
         ...
      P01 design
      P02 design
      ...
   P01.FOR (Program file)
      TC #1
      TC #2
      ...
   P02.FOR (Program file)
   ...
```

Figure 1: File Structure of a Module

2.3 Subroutine Libraries

The only other entities of the PVT system not in the root, besides the documentation and source code files, are the subroutine libraries (also in source code) used by the main programs. These libraries are in the tree structure, and are associated not with individual modules, but with the set of modules below them in the tree or at the same level. Thus, if programs in modules 05-01-01, 05-01-03, 05-02, and 05-04 all use a library of common subroutines, this library will reside in PVT-05. Libraries are named SUBLIB.FOR. There is a global subroutine library, at the PVT level, containing routines used throughout the PVT system. Finally, there is a special-purpose library, anomalously named TRANS_SUBLIB.FOR in the root node, containing routines that simulate the geometric transformation utility functions of PHIGS and perform other mathematical functions.

2.4 Order

There is never any order-dependence between modules, nor is there a required order for program execution within a module. Following the PVT tree structure, depth-first, may be the most natural way to proceed through the modules, but there is no requirement to do so.

2.5 Module Documentation

Module documentation is written for a reasonably knowledgeable PHIGS user. Questions about PHIGS itself must be answered by reference to the standard [PHIGS88].

Figure 2 contains a schematic outline of the module documentation. Refer to it, or to an actual example of module documentation when reading this section.

```
TITLE:
MODULE#:
DESCRIPTION:
SEMANTIC REQUIREMENTS:
  SR1:
    #F functions
    #D data structures
    #S references to standard
    #T test cases
    #X module cross-references
    #C comments
  SR2:
    #F
    #D
    #S
  ...

LOCAL DICTIONARY:

SEMANTIC CROSS-REFERENCES: (if applicable)

LOCAL SUBROUTINES: (if applicable)

PROGRAM 1
  CHARACTERISTICS:
  OPERATOR SCRIPT:
  DESIGN:
    TEST: #SR
          "Text of test case message."
    ...
    TEST: #SR
    ...
END PROGRAM 1

PROGRAM 2
  ...
END PROGRAM 2

...
```

Figure 2: Format of Module Documentation

2.5.1 Introductory Headings -

The first heading, "TITLE", contains a brief phrase describing the main topic of the module. The second heading, "MODULE#" contains the identifying number of the module, which may be simply related to its location in the file hierarchy, e.g., the files of MODULE# 02.01.02 are in the PVT-02-01-02 sub-directory. All level numbers are two-digit. The third heading, "DESCRIPTION" contains a free-format paragraph explaining the scope of the module.

2.5.2 Semantic Requirements -

Next comes the list of semantic requirements associated with the PHIGS feature under test. These are assigned sequential identifying numbers, which will be referred to by the relevant TCs. Each SR is a simple declarative sentence, stating some requirement on the behavior of conforming implementations. Although intended to be clear and unambiguous, these have to be read in a "reasonable" way, with appropriate assumptions about context. The SRs are not "conditionalized" into absolute truths by explicitly stating all the normal pre-conditions that may apply (e.g., if a structure is open and if the system has space left to allocate, and if there is no power failure, then ..).

The SRs use the terminology of the standard when referring to functions or data structures. By convention, angle brackets are used when referring to the generic names of functions, e.g., <set element pointer>. Note that the words "valid" and "realizable" have a technical meaning: the former indicates simply that a parameter is accepted by a function without generating an error, while the latter indicates that the implementation must actually be able to render the graphical attribute in question. The wording of the SR applies to the generic standard, and is not language-dependent.

Immediately following each SR there are a number of associated fields, one per line, each prefaced by a "#". The first four of these, #F, #D, #S, and #T are mandatory.

2.5.2.1 Related Functions -

#F is used to list the functions associated with this SR, i.e., those whose behavior is at least partially constrained by the SR. Functions are referred to by an identifying number (1-319) which corresponds to the order in which they appear in section 5 of the standard. The SYS_DICT.PRT file contains a complete table of function numbers.

2.5.2.2 Related Data Structures -

The #D entry lists the data structures which are relevant to this SR, i.e., those whose contents are changed or inspected in the course of checking the SR. The data structures are referred to by an identifying hierarchical number which reflects the organization of section 6 of the standard. The SYS_DICT.PRT file contains a complete table of data structure numbers. Note that the data structure number need not be a leaf node. If the SR affects everything under a non-leaf node, then an entry for that node implicitly covers all those below it.

2.5.2.3 Basis In The Standard -

The #S entry lists those parts of the standard upon which the SR is logically based. These references are in the form: <section-number> / <page-number> / <paragraph-number>, all of which refer to the 1988 ANSI PHIGS standard, [PHIGS88]. The rules for counting paragraphs within a page of the standard are as follows. Whatever partial chunk of text is at the top of the page is number 1. Subsequent paragraphs are deemed to start by a blank line (even if half-height) followed by text at extreme left hand margin (not indented), but not counting section titles. Thus, page 39 has 7 paragraphs: 1 partial completing section 4.5.1, and 2-7 in section 4.5.2. Figures are associated with the preceding paragraph. For example, page 47 has 3 paragraphs with figure 7 as part of the first.

The page numbers of the relevant functions, as listed under #F, are <u>not</u> included; if a function is relevant, it is to be assumed that its description in section 5 of the standard will have some bearing on the SR. If there is no basis in the standard for the SR besides the description of the relevant functions, an "n" appears in the #S entry.

2.5.2.4 Test Cases -

Each SR, under the #T entry, lists the TCs which depend on it. The format of each TC reference is: P <program-number> / <test-case-number>. The test case number simply refers to its sequential position in the text of the program. Note that not all TCs are always executed; under certain conditions specific to the implementation, some may be skipped.

2.5.2.5 Module Cross-references -

In some cases an SR may be significantly related to the topics of several modules. When this happens, we assign the SR to the most strongly related module, and use the #X entry to list the other relevant modules.

2.5.2.6 Comments -

The #C entry is for free-form comments to allow explanation of any unusual aspect of the SR. For instance, if the support in the standard for the SR is obscure or indirect, the comment field might be used to explain the validity of the SR.

2.5.3 Local Dictionary -

Since the #F and #D entries under the SRs are not self-explanatory, the documentation supplies the subset of the global function and data structure dictionary needed to decode the entries of this module.

2.5.4 Semantic Cross-references -

If this module is pointed to by an entry in the #X field of another module, that pointer is noted here in the format <module-number>/SR<sr-number>. For example, if SR4 in module 02.01 contains a #X entry for module 04.01.01.01, then the latter module will have "02.01/SR4" as a semantic cross-reference entry.

2.5.5 Local Subroutines -

If the programs of this module use any local subroutines (i.e., any besides those in the root-level global library), it is noted here, together with a general description of the purpose of the subroutines. For detailed documentation of the logic and parameters of subroutines, please see the source code.

2.5.6 Program Design -

The second major part of the documentation of the module is a description of the programs and TCs which actually test the SRs of the module. The programs are numbered sequentially. The design is intended to be language-independent, relying only on the generic standard and not on language binding details.

2.5.6.1 Headings -

Each program design starts with a "PROGRAM" header, which includes the ordinal number of the program within this module and a descriptive title. The next entry, "CHARACTERISTICS" contains a four-character code ("y" or "n" for yes or no) to indicate various properties of the program:

1. requires graphical output features of the primary workstation, which must be of category OUTIN or OUTPUT,

2. requires graphical input features of the primary workstation, which must be of category OUTIN or INPUT,

3. the presence of incidental non-graphical input, i.e., the need to gather information at run-time from the operator, but where the input facilities themselves are not under test

4. the need for visual (or other human) interpretation, i.e., the program cannot completely determine pass/fail results, but must rely to some degree on the operator

The last heading is "OPERATOR SCRIPT." This contains the instructions to be followed by the operator when running the test. If there is no need for operator intervention, then this entry will say "passive test." All tests in version 1.0 are, by design, passive.

Each program design is terminated explicitly by an "END PROGRAM" heading, followed by the identifying ordinal number of the program.

2.5.6.2 Logic And TCs -

The core of each program design is a body of pseudo-code which describes the flow of logic and data representation within the program. It should be clear from this pseudo-code why the embedded TCs are supposed to work. The pseudo-code describes only the logic of the program relevant to the TCs; incidental processing, such as opening PHIGS, or opening a structure is not included. The goal is to give the user an understanding of the basic logic of the code, not to depict all the programming details. For the latter, one can consult the code itself.

The style of the pseudo-code is meant to be informal and self-explanatory. Only a few common control structures are used, such as looping, if-then-else, and goto. Labels (the object of goto statements) begin in column 1 and terminate with a colon. The heading "TEST:" heralds the beginning of a test case. This is followed on the same line by "#SR" and then a list of the SRs upon

which this TC is logically based. Beginning on the next line is the textual statement of the expected (correct) result of the test, surrounded by double-quotes. The text is unique within the program and thus serves as the identifier of the TC.

The result of each test is determined by executing either a "pass" or "fail" procedure, denoted in the pseudo-code simply by those words. Every TC should cause execution of either one or the other (but not both, of course) of these. In many cases, where the result depends directly on a single condition, instead of coding:

```
if (condition) then
   pass
else
   fail
endif
```

we use the short-hand form:

```
pass/fail depending on (condition)
```

2.6 Source Code Conventions

In this section we discuss characteristics which pertain to the source code throughout the PVT system. The code itself is written to be comprehensible by a PHIGS- and Fortran-literate reader.

2.6.1 Language -

The language of version 1.0 of the PVT system is full Fortran as defined in [FORT78]. The language binding to PHIGS is the full Fortran binding [PHFOR88].

2.6.2 All Variables Declared -

Although not required by the Fortran standard, the code explicitly declares the type of all program variables. We believe this is useful for several purposes: it helps avoid certain programming errors (misspelled variables), it enhances self-documentation of the code, and it may prove useful for automatic conversion to other languages, such as C.

2.6.3 Standard PHIGS Names -

Where appropriate, the code uses the standard symbolic constant names recommended in section 6 (Enumeration Types) of the Fortran binding standard.

2.6.4 Dummy Parameters -

When the code invokes a PHIGS function some of whose output parameters are not used in the subsequent logic, these parameters are assigned names in the format: <type>dum<digit>, where <type> is "i" for integer, "r" for real, "l" for logical, and "c" for character, and where <digit> is some differentiating digit. This tells the reader which parameters are relevant to the logic of the program and which are incidental.

2.6.5 Program Banner -

Each test program starts with comment lines forming a banner. This banner identifies the program with a unique "TEST NUMBER" and a "TEST TITLE". These appear in a box of asterisks. The format of the test number is <module-number> / <program-number>. For example, "04.04.01.02/03" identifies program number 3 in module 04.04.01.02. Thus, the program's file name is P03.FOR in directory PVT~04~04~01~02.

2.6.6 Common -

Each test program contains a set of identical declarations for certain variables in COMMON. These are used to convey information within the system. For a full description of each of these global variables, see Appendix A.

2.7 Ubiquitous Subroutines

In this section, we discuss briefly the function of some of the more commonly-used subroutines. Since these are used throughout the PVT system, anyone wishing to understand the code should be familiar with their purpose. There are many other subroutines, however. All PVT subroutine libraries are self-documented, so when questions arise, the code itself should be consulted.

2.7.1 Initialization And Clean-up Of Test Programs -

Normally, the first executable statement within a program will be a call to INITGL. This routine performs all the work needed to set up the environment for the program; in particular, it initializes the values in COMMON, so that they may be used freely (e.g., workstation type needed to open a workstation). It does this by reading certain constant values from the PVT configuration file (see section 4.2 on Running INITPH). The program supplies its identifying TEST NUMBER (see section above on Banner) as the single parameter.

The last executable statement is a call to WINDUP. This writes out summary results, closes files, and performs any other processing needed to finish the test program.

2.7.2 TC Subroutines -

There are a number of subroutines needed to implement a given TC in the code. These correspond closely to the way a TC is set up in the pseudo-code. The SETMSG subroutine sets up a "current TC message" for the condition about to be tested, which contains both the SR references and the text describing the condition under test. Depending on the results of the TC, the program then executes either the PASS or FAIL subroutine, which records the result. The IFPF subroutine is a shorthand form, which accepts a single logical expression as a parameter and invokes PASS if it evaluates as true, and FAIL if false.

2.7.3 Message Subroutines -

The only output of each test program is a series of messages. The following subroutines generate messages of the indicated type:

Subroutine	Message-type	Function
INITGL	SY	initialize program
WINDUP	SY	finalize program
PASS	OK	record TC passed
FAIL	FA	record TC failed
IFPF	OK or FA	record TC result
INMSG	IN	information
UNMSG	UN	abort
NCMSG	NC	abort
CHKINQ	NC	continue or abort

See section 4.4.3 on for the interpretation of messages and message-types. The subroutines UNMSG and NCMSG are used when the program must be aborted, as opposed to normal program conclusion

which is done via WINDUP. No further code is executed after either of these is encountered in the flow of control.

2.7.4 CHKINQ -

It is very common within the PVT system for an inquire function to be incidental to the main purpose of the test. Since the test relies on the result of the inquire, we wish to ensure that it has completed successfully. Every incidental use of an inquire, therefore, is followed by CHKINQ, which simply checks that the error indicator from the function is zero. If not, CHKINQ invokes NOMSG and therefore aborts the program. Otherwise there is no effect.

Of course, when an inquire function is being purposefully tested, its error indicator is checked explicitly as part of the usual PASS/FAIL determination.

3 INSTALLATION

This section covers the steps needed to install the PVT code on a typical computer system. The advice is necessarily general, since many aspects of installation are system-dependent. Installation consists of the following steps:

1. Copy files into hierarchical directory
2. Customize code, especially naming of configuration file
3. Set up procedures for automatic execution of source code

3.1 File Hierarchy

Copy the PVT files from the medium on which they are delivered to the hosting system. If the medium is magnetic tape, there is an accompanying information sheet to describe the physical format of the files.

Store the files in a hierarchical directory as described in section 2.1 and Appendix B. In particular, use the same two-digit level numbers as in the files' own self-identification. The name of the PVT root level is arbitrary; a name like USER~PVT~... is a reasonable choice. See section 2.1 for a list of the files that belong in the PVT root directory. The global and module-level documentation need not be stored on-line, although this may be convenient for automatic searching for entities within the PVT suite.

Assign the source code filenames in the format "Pxx.FOR" where "xx" indicates the ordinal number within the module, and ".FOR" indicates the source language. For example, the program with the header

```
C  ************************************************************
C  *                                                          *
C  *    TEST NUMBER: 04.05.01.02/03                           *
C  *    TEST TITLE : WSL pattern table initialized            *
C  *                 properly                                 *
C  *                                                          *
C  *    PHIGS Validation Tests, produced by NIST              *
C  *                                                          *
C  ************************************************************
```

should be stored as "USER~PVT~04~05~01~02~P03.FOR". Different operating systems have various conventions for the suffix to denote Fortran source code, such as ".f" or ".FTN". Any such convention is acceptable as long as it is consistently applied. It is strongly recommended, however, that the initial part of the name be in the format "Pxx". Throughout the PVT documentation, programs are always identified according to this format, and it avoids confusion if the program's physical name matches its logical identification.

Likewise, copy subroutine libraries into the appropriate tree nodes. The banner of each subroutine identifies the correct node for the library. The recommended file name is SUBLIB.FOR.

When done, check your file hierarchy against the PVT tree structure as described in appendix B to ensure that all the files have been copied.

3.2 Customization Of Code

Some of the source code may need to be changed in order to run on your system. Use any text editor to perform these changes. The first change, naming the PVT configuration file, is mandatory for all systems. All the other changes are optional.

3.2.1 Naming PVT Configuration File -

First, choose a name for the PVT configuration file. The name you pick must be absolute, i.e., it must be valid when used from any part of the hierarchy. We recommend locating the PVT configuration file in the PVT root.

This name must be inserted in three locations all of which are in the PVT root:

1. the INITPH.FOR program which writes the file

2. the INITGL subroutine which reads the file and is located in the global SUBLIB.FOR file

3. the MULTWS subroutine which reads the file, also located in the global SUBLIB.FOR file

In all three cases, search for the string "INITPH$DAT" (the name we used) in these routines to locate the insertion point.

The PVT configuration report file is a human-readable version of the PVT configuration file. Pick a name for it as well, such as "INITPH.PRT", and insert it into the INITPH.FOR program.

3.2.2 Naming Individual Message File -

If you request that the test programs generate individual message files (see section 4.2.3) INITGL will, by default, form the name of the file by using "P" as a prefix, the two-digit ordinal number of the program, and ".MSG" as a suffix; e.g., P04.FOR will write to P04.MSG. If you prefer another naming convention, search for ".MSG" in the INITGL routine and change the code accordingly.

3.2.3 Resolution Of Parameters For <Open Workstation> -

The INITGL and MULTWS subroutines read the PVT configuration file in order to determine the parameter values needed to open the primary and secondary workstations (workstation identifier, connection identifier, and workstation type), and report these back to the calling program. INITGL sets the value of three variables in COMMON to do this, while MULTWS returns the values in its output parameters. In both cases, the assumption is that the correct values are static and can be set once by the INITPH procedure (see section 4.2, below). If your system is such that this information can be determined only at run-time, you must re-code the relevant sections of INITGL and MULTWS, so that they still deliver the required values.

3.2.4 Providing Valid Names For Archive Files -

The subroutine AVARNM, in node 03 of the PVT tree, must return to the caller an integer representing the valid name of an available empty archive file. The code assumes that this name should be interpreted as a Fortran logical unit number. If your system has a different interpretation, or has special requirements for opening an archive file, you must modify this subroutine

accordingly.

3.2.5 Time-stamping Message Files -

The Fortran standard provides no function for determining time or date. If, however, your implementation does provide such a feature and you wish to include this information in the PVT output, we suggest you alter the INITGL subroutine at the point where it formulates the header system message. This is done at the very end of the subroutine, in the last call to BRDMSG.

3.2.6 Operator Communication -

The OPMSG and OPYN routines in the global SUBLIB.FOR library write messages to and read messages from the operator. Because a workstation may not be open at the time these are executed, the PVT code resorts to the use of Fortran's print and read statements. If there is a better way to send a character string to and from the operator in your system, you may re-code these routines accordingly. If print and read work well within your system no change is necessary.

3.2.7 End Of File -

If you specify a global message file (see section 4.2.3), the INITGL routine in SUBLIB.FOR must position the file pointer at end of file so as to append new messages. In standard Fortran, the only way to do this is to read through the whole file. If your Fortran system provides a more efficient (though non-portable) way to do this, you may wish to substitute that method in INITGL. Otherwise, no change is needed.

3.3 Linking Subroutines

In most systems, you will wish to compile all the subroutine files (TRANS_SUBLIB.FOR and SUBLIB.FOR in the root and all the local SUBLIB.FOR files) so as to create subroutine libraries, which may then be linked in with each test program. Of course not all the test programs use all the subroutines, so do whatever your system requires such that only needed subroutines are linked in.

We strongly recommend setting up a command procedure to compile, link, and execute a test program solely by referring to the name of the program. In particular, all local subroutine libraries (those above the program in the directory tree) and the global libraries must be made available, as well as linking to the

code of the PHIGS implementation. Note that the global SUBLIB.FOR contains a PERHND subroutine - the standard PHIGS-Fortran name for an error-handler. Some PHIGS implementations may require special treatment to link in PERHND. Since most linkers prefer to be given access to libraries in order from caller to called procedure, you should arrange access first to the local PVT libraries, then the global PVT libraries, and finally to the PHIGS library. See Appendix E for two examples of how this might be done.

The local subroutine libraries are assigned to nodes of the tree only for the purpose of clarifying the logical relationship among the test programs and subroutines. If linking in several libraries is difficult in your system, you can simply concatenate all the subroutine source code together as one large file, and compile it as one library, presumably in the root. No two PVT subroutines have the same name, so no name clashes will occur.

3.4 Suggested Setup For Batch Execution

If you want to run entire modules in batch mode (no operator intervention), you need only set up a procedure for that module to execute all its programs. For instance, in VAX/VMS, if a module had three programs, and if a PHF command had been set up to compile and execute a PHIGS program, the procedure would be:

```
$ phf p01
$ phf p02
$ phf p03
```

The grouping of programs from several modules is almost as simple. Most systems allow the user to append a directory name so as to invoke lower-level code. For instance, if you wanted to execute all the programs under node 06 of the PVT tree, the VAX/VMS procedure would be:

```
$ phf [user.pvt.06.01.01]p01
$ phf [user.pvt.06.01.01]p02
  ...
$ phf [user.pvt.06.01.01]p07
$ phf [user.pvt.06.01.02]p01
$ phf [user.pvt.06.01.02]p02
$ phf [user.pvt.06.01.02]p03
  ...
$ phf [user.pvt.06.03]p04
```

4 OPERATION

In this section, we cover the steps needed to run and

interpret the PVT system. Like other conformance test systems, the PVT is not, nor can it be, a totally automated process. The PVT code and documentation are best seen as components of an integrated and interdependent system, which includes the operator as its active, directing component. We include in the notion of operation the process of interpreting the behavior of the programs, particularly with regard to conformance.

4.1 PVT Sessions And Workstations

Let us refer to the execution of a set of PVT programs as a session. For each session, a primary workstation must be specified, together with an optional set of secondary workstations. The primary workstation is the one whose features are thoroughly tested by the PVT programs. Secondary workstations are tested only by certain special-purpose programs such as those dealing with multiple workstations. Thus, for each workstation to be tested in depth, the operator must run a distinct session.

In order to conform, a PHIGS implementation must support at least one workstation of category OUTIN. No other workstations need be supported. If other workstations are accessible, however, they must have the capabilities associated with their categories.

Thus, a typical scenario for conformance testing is first, a session in which an OUTIN workstation is designated as primary and in which all the PVT programs are executed. Such a session checks the minimum requirements for conformance.

Subsequent sessions deal with the capabilities of other workstations of whatever category. Each of these workstations is designated in turn as primary and an appropriate subset of the PVT is executed for it. Since there is no need to re-run tests which are not relevant to the capabilities of these other workstations, not all PVT programs need be executed in these subsequent sessions. Use the information in the CHARACTERISTICS entry of the program design documentation (summarized in appendix C) to decide which programs are pertinent, according to the table below.

Workstation Category	CHARACTERISTICS
OUTIN	yn.. or ny.. or yy..
OUTPUT	yn..
INPUT	ny..

It may also prove useful to construct a batch procedure for each category of workstation, so that you can automatically invoke the correct subset of programs.

4.2 Running INITPH For PVT Configuration

The PVT Configuration file contains the information which is specific to the PHIGS implementation being tested, but the same for all test programs within the PVT session. Its purpose is to allow an operator to specify such information only once at the beginning of each session, rather than repeating it for each program. The INITPH program creates this file, based on the operator's responses. The program is stored as INITPH.FOR in the PVT root. It is a simple Fortran program, with no calls to any PVT or PHIGS subroutines. Simply compile and execute the program, and respond as prompted. Most responses are in the form of an integer. You should be prepared to supply the following information to INITPH:

1. parameters for <open phigs> (error file and memory units)

2. number of workstations accessible in this session

3. <open workstation> parameters for each accessible workstation (workstation identifier, connection identifier, workstation type)

4. whether to suppress "pass" messages

5. choice of destination(s) for messages (screen, individual files, or global file)

6. logical unit numbers for message files (if used)

7. file name for global message file (if used)

8. maximum line length for messages

4.2.1 Parameters For Opening PHIGS -

The first two questions concern the input parameters to be passed to the <open phigs> function, whenever that function is needed in a PVT program. Simply supply the values your implementation requires.

4.2.2 Parameters For Opening Workstations -

The next questions concern the workstations accessible to this implementation. Tell INITPH the total number of accessible workstations (primary and secondary). Then, for each of these, supply the three parameters by which <open workstation> can open it: workstation identifier, connection identifier, and workstation type. Be sure that the first set of parameters refers to the primary workstation.

4.2.3 Control Of Messages -

Next, INITPH will ask you whether you want a message to be generated whenever the implementation successfully passes a TC in a test program. You can specify either that such messages are always suppressed, always generated, or that each program asks the operator what to do, so that he or she can selectively suppress pass-messages at run-time. No other type of message can be suppressed.

The next questions deal with the destination of messages as they are generated. First, indicate whether or not messages are to be sent to the operator (typically on the screen). Next, indicate to which files messages should be written. Individual message files are created once per execution of a test program. By default they are given the same name as the program, but with a "MSG" suffix, rather than "FOR". The global message file is a cumulative file to which messages are appended whenever a test program is run.

These are independent choices; messages can be sent to any combination of the three destinations: operator, individual file, or global file. Each enabled destination receives exactly the same set of messages.

If you specify a global file, you must then provide an absolute name for this file, so that all programs can write to it. You may want to specify a distinct name for the global message file of each PVT session. This response is, of course, not in the form of an integer, as are the others. Since some operating systems have reserved logical unit numbers in Fortran, you are also asked to provide these for the individual and/or global file, if they have been designated as destinations.

Finally, you must specify the maximum number of characters per line which should be generated when the PVT system formats a message. Some messages may be quite long and would not fit on a reasonably-sized single line. Message text is never truncated; rather, it is simply broken into lines of the specified size.

At the successful conclusion of INITPH, the operator receives a report on the names of the files to which the PVT configuration file and PVT configuration report file (the human-readable version) have been written.

4.3 Background Documentation

In order to understand the significance of the programs' output for conformance, you should read over the module documentation and those sections of the standard referred to in the #S entries of the SRs. You will then have the appropriate background information to allow you to focus on the details of each test result. The version 1.0 PVT has only passive tests, but for

later versions, you will have to be familiar with the OPERATOR SCRIPT for each interactive program.

4.4 Execution And Interpretation

Invoke the system-dependent command(s) needed to compile, link and execute each program in the session. There are a number of possible outcomes, each of which are dealt with below. We assume throughout the following sections that the PVT programs are themselves valid. If you encounter some aspect of a program which you believe is incorrect, please submit a software error report, as described in section 1.

4.4.1 Failure To Compile Or Link -

If your compiler does not support some feature of ANSI Fortran [FORT78] used by a PVT program, you must find a different way to perform the equivalent operation. Similarly, problems in the system software which performs linking of subroutines must be resolved by you. Any problem with system software which prevents a valid invocation of a PHIGS function by a program renders the implementation non-conforming.

4.4.2 Failure To Complete Execution -

The PVT programs are written conservatively so as to fall well within the operational limits of any reasonable PHIGS implementation. Furthermore, the PERHND subroutine should handle any errors signalled by PHIGS functions. Therefore, it is to be expected that every PVT program, once started, will proceed until completion under the control of the appropriate PVT subroutine, such as WINDUP for successful completion, or UNMSG for aborted completion.

If the PHIGS system itself aborts execution, it means that the implementation fails the test and does not conform, since no unhandled PHIGS error conditions should arise within the PVT code. If not otherwise evident, this outcome is indicated by the absence of two SY-type messages (the first containing the error count, the second to identify PVT completion) at the end of the message file(s).

4.4.3 Completion Of Execution And Message Type -

The PVT programs sometimes examine whether they can proceed to execute, or whether anomalous conditions have arisen such that further execution is futile. In the latter case, before stopping, the program will issue a message of type UN or NC, indicating the reason for aborting further testing. Normally, all the TCs within the program that are appropriate for the implementation are executed.

In either case, the output of a completed PVT program consists of a sequence of messages. These messages are sent to the destinations specified in the PVT configuration file. They are followed by three records each consisting of a single period. This serves to separate visually the output of each test in the global message file.

The messages are categorized into six types in order to help the operator assess their significance. The output is formatted so that these types appear in the leftmost columns, with the text of the messages indented. The following table describes the circumstances associated with each of the message types.

Message Types

SY: System message, generated by INITGL and WINDUP. These messages herald the beginning and completion of execution of a PVT program. The next-to-last message contains a summary of the number of TCs executed and errors detected.

OK: The standard message resulting from a passed test case, generated by PASS or IFPF. INITPH allows the operator to suppress messages of this type.

FA: The standard message resulting from a failed test case, generated by FAIL or IFPF.

IN: Informational message, generated by INMSG or SIGTST. Some situation was encountered which, while not erroneous, is worth noting, for example, the implementation is such that a certain condition cannot be tested. Also, this type of message can be used for the purpose of conveying useful but not conformance-related information about the implementation, such as support of optional PHIGS features.

UN: Unanticipated error message, generated by UNMSG. This message is generated when the program detects some anomalous condition that prevents further processing. No inference is to be drawn concerning implementation conformance.

NC: Unanticipated non-conformance error message, generated by NCMSG or CHKINQ. The program must abort because a feature of PHIGS which is not under test, but needed for the test,

has failed. Since the incidental feature is mandated by the standard, its failure indicates non-conformance. Most commonly, this message type is generated by CHKINQ when a required inquire function fails.

The operator may inspect the output at several levels of detail. In the simplest case, he or she may simply look at the error count at the end, to see whether or not all tests were passed. By scanning the left column for FA or NC type messages, the operator can focus on problems of non-conformance and ignore the other output. Finally, one can note the content of informational messages, which tests were passed or failed, which SRs are implicated in the result, and what the precise conditions of the test were.

4.5 Customization For Debugging

Users who are interested in debugging as well as conformance checking may wish to augment the tests so as to produce more detailed information. We recommend that the extra output from such enhancements follow the usual conventions of the PVT system. In particular, we recommend that the information be formatted into a character variable (using Fortran's WRITE statement) and then written out as an IN type message with the INMSG subroutine. There are many examples of this in the normal code. See these if you need further guidance.

REFERENCES

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[PHFOR88] Computer Graphics - Programmer's Hierarchical Interactive Graphics System (PHIGS) Part 1: FORTRAN Binding, ANSI X3.144.1-1988, American National Standards Institute, New York, NY, 1988.

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APPENDIX A

GLOBAL VARIABLES

Below is a description of the variables in COMMON in the Fortran source code. They are used globally throughout PVT.

Variable	Type*		Description
CONID	S	I	Connection identifier, for <open workstation>
CTLHND	D	I	Tell PERHND whether to abort (0) or return (1)
DUMCH	S	C	Dummy character variables for future use
DUMINT	S	I	Dummy integer variables for future use
DUMRL	S	R	Dummy real variables for future use
ERRIND	D	I	Error indicator, returned from inquire functions
ERRFIL	S	I	PHIGS error file, for <open phigs>
ERRSIG	D	I	Signalled error code returned by PERHND
ERRSW	S	I	Indicates whether to send messages to operator
FUNCID	D	C	Function signalling the error, returned by PERHND
GLBERR	S	C	Absolute name of global message file
GLBLUN	S	I	Logical unit number of global message file
IERRCT	D	I	Count of errors detected by test
IFLERR	S	I	Controls writing of messages to message files
INDLUN	S	I	Logical unit number of individual message file
MAXLIN	S	I	Maximum characters per line in messages
MEMUN	S	I	Number of memory units, for <open phigs>
PASSSW	S	I	Controls writing/suppression of pass-messages
PIDENT	D	C	Unique program identifier - hierarchical number
TESTCT	D	I	Count of conditions tested so far within program
TSTMSG	D	C	Text for next condition to be reported.
UNERR	D	I	Count of unanticipated errors detected by test
WKID	S	I	Workstation identifier, for <open workstation>
WTYPE	S	I	Workstation type, for <open workstation>

* S: Static value read from configuration file
D: Dynamic variable, altered during test execution

I: Integer
C: Character
R: Real

APPENDIX B

PVT TREE STRUCTURE

This appendix describes the tree structure of the PVT system. The status of each node of the tree is specified in the left column, and is one of the following:

a. Node does not contain a module. Denoted by "-".

b. Node contains a module. Denoted by a positive integer, n, indicating the number of programs in the module. The node contains exactly one DOC.TXT file, and n program files, numbered 1 through n.

c. Future module(s); the node, or its descendants will contain modules in future versions of the PVT. Denoted by "f".

The second column indicates whether the node contains a local subroutine library, named SUBLIB.FOR, to be used by modules within that node's subtree. If so, an "s" appears in the column.

PVT Tree Structure

```
01     01   Opening and closing PHIGS

-      02   Manipulating the CSS
03   s 02.01   Creation and inquiry of CSS networks.
10     02.01.01   Individual structure creation
-      02.01.02   Structure deletion functions
06     02.01.02.01   Individual structure deletion
14   s 02.01.02.02   Structure network deletion
02     02.01.02.03   Global structure deletion
-    s 02.01.03   Structure identification and references
03     02.01.03.01   Change structure identifier
03     02.01.03.02   Change structure references
03     02.01.03.03   Change structure identifier and references
-      02.02   Element-level Operations
02     02.02.01   Opening and closing structures
03     02.02.02   Miscellaneous CSS elements
02     02.02.03   Set edit mode and control of element pointer.
```

```
05     02.02.04   Deletion of structure elements
01     02.02.05   Copy all elements from structure
-      02.03   Examining CSS structures
02     02.03.01   Inquiring element type and size, and content
02     02.03.02   Element search
07   s 02.03.03   Incremental spatial search
f      02.04   Traversal semantics: inheritance and restore

-    s 03. Archive files
01     03.01   Opening and closing archive files
01     03.02   Conflict resolution flags
08   s 03.03   Archiving and retrieving structures
04   s 03.04   Examining structures in an archive
04   s 03.05   Deleting archived structures

-      04   Graphical Output
-      04.01   Primitives
01     04.01.01   Polyline
01     04.01.02   Polymarker
01     04.01.03   Text
01     04.01.04   Annotation text relative
01     04.01.05   Fill area
01     04.01.06   Fill area set
01     04.01.07   Cell array
01     04.01.08   Generalized drawing primitive
01     04.02   Bundle/individual control (asf)
-      04.03   Individual attributes (CSS-level)
-      04.03.01   Polyline
01     04.03.01.01   Setting and inquiring
f      04.03.01.02   Defaults and facilities
-      04.03.02   Polymarker
01     04.03.02.01   Setting and inquiring
f      04.03.02.02   Defaults and facilities
-      04.03.03   Text
01     04.03.03.01   Setting and inquiring
f      04.03.03.02   Defaults and facilities
-      04.03.04   Annotation text
01     04.03.04.01   Setting and inquiring
f      04.03.04.02   Defaults and facilities
-      04.03.05   Fill area
01     04.03.05.01   Setting and inquiring
f      04.03.05.02   Defaults and facilities
-      04.03.06   Fill area set
01     04.03.06.01   Setting and inquiring
f      04.03.06.02   Defaults and facilities
-      04.04   Bundled attributes (Workstation-level)
-      04.04.01   Polyline
02     04.04.01.01   Setting and inquiring
06     04.04.01.02   Defaults and facilities
-      04.04.02   Polymarker
02     04.04.02.01   Setting and inquiring
06     04.04.02.02   Defaults and facilities
-      04.04.03   Text
02     04.04.03.01   Setting and inquiring
```

```
08     04.04.03.02   Defaults and facilities
04   s 04.04.03.03   Inquire text extent
-      04.04.04    Interior
02     04.04.04.01   Setting and inquiring
07     04.04.04.02   Defaults and facilities
-      04.04.05    Edge
02     04.04.05.01   Setting and inquiring
07     04.04.05.02   Defaults and facilities
-      04.05   Generic attributes
-    s 04.05.01    Pattern
02     04.05.01.01   Pattern table - setting and inquiring
04     04.05.01.02   Pattern table - defaults and facilities
-    s 04.05.02    Colour
02     04.05.02.01   Colour table - setting and inquiring
01     04.05.02.02   Colour model - setting and inquiring
06     04.05.02.03   Colour - defaults and facilities
-      04.05.03    HLHSR
02     04.05.03.01   Setting and inquiring
02     04.05.03.02   Defaults and facilities
-      04.05.04    Namesets and filters
03   s 04.05.04.01   Namesets
02     04.05.04.02   Filters

-      05   Workstations
-      05.01   Accessibility and Facilities
03     05.01.01   Opening and closing a workstation
01     05.01.02   Characterization of workstation
08   s 05.02   Workstation Updating
02   s 05.03   Posting
f      05.04   Message

-      06   Geometry
-      06.01   Modelling
07     06.01.01   Modelling Utilities
08   s 06.01.02   Modelling transformations in the CSS
-      06.02   Viewing
03   s 06.02.01   Viewing Utilities
07   s 06.02.02   Control of workstation view table
04     06.03   Workstation transformations

f      07  Input

f      08  Metafiles

f      09  Error handling

f      10  Escape

01     11  Fortran Utilities
```

APPENDIX C

TEST PROGRAM CHARACTERISTICS

The following table summarizes the CHARACTERISTICS entry for all of the PVT programs. See section 2.5.6.1 for an explanation of the codes.

```
01 /            P01: nnnn
02.01 /         P01: nnnn   P02: nnnn   P03: nnnn
02.01.01 /      P01: nnnn   P02: nnnn   P03: nnnn   P04: ynnn
                P05: nnnn   P06: nnnn   P07: nnnn   P08: nnnn
                P09: nnnn   P10: ynnn
02.01.02.01 /   P01: nnnn   P02: nnnn   P03: nnnn   P04: nnnn
                P05: ynnn   P06: nnnn
02.01.02.02 /   P01: nnnn   P02: nnnn   P03: nnnn   P04: ynnn
                P05: ynnn   P06: ynnn   P07: ynnn   P08: nnnn
                P09: ynnn   P10: ynnn   P11: ynnn   P12: ynnn
                P13: ynnn   P14: nnnn
02.01.02.03 /   P01: nnnn   P02: nnnn
02.01.03.01 /   P01: ynnn   P02: ynnn   P03: nnnn
02.01.03.02 /   P01: nnnn   P02: nnnn   P03: ynnn
02.01.03.03 /   P01: ynnn   P02: ynnn   P03: nnnn
02.02.01 /      P01: nnnn   P02: nnnn
02.02.02 /      P01: nnnn   P02: nnnn   P03: nnnn
02.02.03 /      P01: nnnn   P02: nnnn
02.02.04 /      P01: nnnn   P02: nnnn   P03: nnnn   P04: nnnn
                P05: nnnn
02.02.05 /      P01: nnnn
02.03.01 /      P01: nnnn   P02: nnnn
02.03.02 /      P01: nnnn   P02: nnnn
02.03.03 /      P01: nnnn   P02: nnnn   P03: ynnn   P04: nnnn
                P05: ynnn   P06: nnnn   P07: nnnn
03.01 /         P01: nnnn
03.02 /         P01: nnnn
03.03 /         P01: nnnn   P02: nnnn   P03: nnnn   P04: nnnn
                P05: nnnn   P06: nnnn   P07: nnnn   P08: nnnn
03.04 /         P01: nnnn   P02: nnnn   P03: nnnn   P04: nnnn
03.05 /         P01: nnnn   P02: nnnn   P03: nnnn   P04: nnnn
04.01.01 /      P01: nnnn
04.01.02 /      P01: nnnn
04.01.03 /      P01: nnnn
04.01.04 /      P01: nnnn
```

```
04.01.05 /     P01: nnnn
04.01.06 /     P01: nnnn
04.01.07 /     P01: nnnn
04.01.08 /     P01: ynnn
04.02 /        P01: nnnn
04.03.01.01 / P01: nnnn
04.03.02.01 / P01: nnnn
04.03.03.01 / P01: nnnn
04.03.04.01 / P01: nnnn
04.03.05.01 / P01: nnnn
04.03.06.01 / P01: nnnn
04.04.01.01 / P01: ynnn   P02: ynnn
04.04.01.02 / P01: ynnn   P02: ynnn   P03: ynnn   P04: ynnn
              P05: ynnn   P06: ynnn
04.04.02.01 / P01: ynnn   P02: ynnn
04.04.02.02 / P01: ynnn   P02: ynnn   P03: ynnn   P04: ynnn
              P05: ynnn   P06: ynnn
04.04.03.01 / P01: ynnn   P02: ynnn
04.04.03.02 / P01: ynnn   P02: ynnn   P03: ynnn   P04: ynnn
              P05: ynnn   P06: ynnn   P07: ynnn   P08: ynnn
04.04.03.03 / P01: ynnn   P02: ynnn   P03: ynnn   P04: ynnn
04.04.04.01 / P01: ynnn   P02: ynnn
04.04.04.02 / P01: ynnn   P02: ynnn   P03: ynnn   P04: ynnn
              P05: ynnn   P06: ynnn   P07: ynnn
04.04.05.01 / P01: ynnn   P02: ynnn
04.04.05.02 / P01: ynnn   P02: ynnn   P03: ynnn   P04: ynnn
              P05: ynnn   P06: ynnn   P07: ynnn
04.05.01.01 / P01: ynnn   P02: ynnn
04.05.01.02 / P01: ynnn   P02: ynnn   P03: ynnn   P04: ynnn
04.05.02.01 / P01: ynnn   P02: ynnn
04.05.02.02 / P01: ynnn
04.05.02.03 / P01: ynnn   P02: ynnn   P03: ynnn   P04: ynnn
              P05: ynnn   P06: ynnn
04.05.03.01 / P01: ynnn   P02: ynnn
04.05.03.02 / P01: ynnn   P02: ynnn
04.05.04.01 / P01: nnnn   P02: nnnn   P03: nnnn
04.05.04.02 / P01: ynnn   P02: ynnn
05.01.01 /     P01: nnnn   P02: nnnn   P03: nnnn
05.01.02 /     P01: nnnn
05.02 /        P01: ynnn   P02: ynnn   P03: ynnn   P04: ynnn
               P05: ynnn   P06: yynn   P07: ynnn   P08: ynnn
05.03 /        P01: nnnn   P02: ynnn
06.01.01 /     P01: nnnn   P02: nnnn   P03: nnnn   P04: nnnn
               P05: nnnn   P06: nnnn   P07: nnnn
06.01.02 /     P01: nnnn   P02: nnnn   P03: nnnn   P04: nnnn
               P05: nnnn   P06: nnnn   P07: nnnn   P08: nnnn
06.02.01 /     P01: nnnn   P02: nnnn   P03: nnnn
06.02.02 /     P01: ynnn   P02: ynnn   P03: ynnn   P04: ynnn
               P05: ynnn   P06: ynnn   P07: nnnn
06.03 /        P01: ynnn   P02: ynnn   P03: ynnn   P04: nnnn
11 /           P01: nnnn
```

APPENDIX D

DICTIONARY OF SUBROUTINES AND FUNCTIONS

This table lists all subroutines and functions in the PVT, in alphabetical order. The two columns following each function name indicate whether it is a subroutine or function, and its location. For example, ACTST is a subroutine in PVT~02~01~03~SUBLIB.FOR, APPEQ is a logical function in PVT~SUBLIB.FOR, and ARRTP3 is a subroutine in PVT~TRANS_SUBLIB.FOR.

abend	SUBROUT GL	actst	SUBROUT 02.01.03
appeq	LOG-FUN GL	arcpth	SUBROUT 03.04
arreq	LOG-FUN 04.05.01	arrtp3	SUBROUT TR
avarnm	SUBROUT 03	brdmsg	SUBROUT GL
chkelp	SUBROUT GL	chkinq	SUBROUT GL
chkmcv	SUBROUT 06.01.02	chkpst	SUBROUT 05.03
chmono	SUBROUT 04.04.03.03	chtxrc	SUBROUT 04.04.03.03
comtok	SUBROUT 06.01.02	crossp	SUBROUT TR
csseq	LOG-FUN GL	cssids	LOG-FUN 03.03
csspth	SUBROUT GL	curnms	SUBROUT 04.05.04.01
deblnk	SUBROUT GL	delcss	SUBROUT 02.01.02.02
doimod	SUBROUT 05.02	dotprd	REA-FUN TR
ebltm	SUBROUT TR	ebltm3	SUBROUT TR
ecom	SUBROUT TR	ecom3	SUBROUT TR
ecotm	SUBROUT TR	ecotm3	SUBROUT TR
eevmm	SUBROUT TR	eevom	SUBROUT TR
eevom3	SUBROUT TR	elstr	SUBROUT 02.01.03
ero	SUBROUT TR	erox	SUBROUT TR
eroy	SUBROUT TR	eroz	SUBROUT TR
errctl	SUBROUT GL	esc	SUBROUT TR
esc3	SUBROUT TR	etp	SUBROUT TR
etp3	SUBROUT TR	etr	SUBROUT TR
etr3	SUBROUT TR	exp34	SUBROUT TR
fail	SUBROUT GL	fltran	SUBROUT 02.03.03
gtroot	SUBROUT GL	hueang	SUBROUT 04.05.02
iareq	LOG-FUN GL	iareql	LOG-FUN GL
idmat	SUBROUT TR	ifpf	SUBROUT GL
inarea	INT-FUN TR	initgl	SUBROUT GL
inmsg	SUBROUT GL	invol	SUBROUT TR
ispths	SUBROUT TR	issab	SUBROUT TR
issdis	SUBROUT TR	issflt	SUBROUT 02.03.03

issgeo	SUBROUT 02.03.03	isspf	SUBROUT 02.03.03
itrim	INT-FUN GL	matmul	SUBROUT TR
modsep	REA-FUN 04.05.02	multws	SUBROUT GL
ncmsg	SUBROUT GL	opmsg	SUBROUT GL
opyn	SUBROUT GL	pass	SUBROUT GL
perhnd	SUBROUT GL	pervec	SUBROUT TR
pf	SUBROUT GL	picchg	SUBROUT 05.02
picenv	SUBROUT 05.02	prsint	SUBROUT GL
prsrl	SUBROUT GL	prsuin	SUBROUT GL
pt2cof	SUBROUT TR	pt3pl	SUBROUT TR
pthseq	SUBROUT 02.01	ptlnds	SUBROUT TR
ptplds	SUBROUT TR	ptregd	REA-FUN TR
ptspl	SUBROUT TR	rareq	LOG-FUN GL
red43	SUBROUT TR	retopn	SUBROUT 03.03
satan2	REA-FUN TR	set2d	SUBROUT GL
setdif	SUBROUT 03.05	seteq	LOG-FUN GL
setfil	SUBROUT 02.03.03	setis	LOG-FUN GL
setmsg	SUBROUT GL	setpcl	SUBROUT 05.02
setpst	SUBROUT 05.03	setrvs	SUBROUT GL
setstr	SUBROUT GL	setsvr	SUBROUT 05.02
setval	SUBROUT GL	setvs	SUBROUT GL
sigmsg	SUBROUT GL	sigtst	SUBROUT GL
stdcss	SUBROUT GL	strcon	LOG-FUN GL
surfok	LOG-FUN 05.02	svrexp	INT-FUN 05.02
svrok	LOG-FUN 05.02	tcscid	SUBROUT 02.01.03
tcscir	SUBROUT 02.01.03	tranhs	SUBROUT 06.01.02
trnseq	LOG-FUN TR	tstcid	SUBROUT 02.01.03
tstcir	SUBROUT 02.01.03	tstcor	SUBROUT 06.02.01
tstprj	SUBROUT 06.02.01	tstvip	SUBROUT 06.02.02
tx2dex	SUBROUT 02.03.03	txcomp	SUBROUT 04.04.03.03
unmsg	SUBROUT GL	vec1	SUBROUT TR
vecang	REA-FUN TR	vecl	REA-FUN TR
vecl2	REA-FUN TR	windup	SUBROUT GL

APPENDIX E

EXAMPLES OF COMMAND PROCEDURES

Below are two examples of a compile, link, and execute procedure for PVT programs. The first is for UNIX, the second for the VAX/VMS system. These are for illustrative purposes only.

---------- UNIX ----------

```
#!/bin/csh

# This script:
#    Determines the language of the input file (FTN or C)
#    Compiles the source to object code
#    Searches up the directory tree looking for libraries (*.a).
#      Stops searching at a directory called "STD" or root.
#    Links the executable code with all libraries (*.a) found
#      from topdir down.
#    Executes the program.
#
# If any step fails, the script will exit before proceeding.

# Test searching of libraries by invoking with an argument
# of "hi".  See usage at bottom for usage instructions.

# USER CONFIGURATION VARIABLES

# Change libext if libraries have different extensions.
set libext = '*.a'

# Set PRE_PHIGS_LIB to point to your Phigs libraries.  This is
#   the first library listed in the link command.
set PRE_PHIGS_LIB = ""

# set POST_PHIGS_LIB to your phigs library.  This is listed
#   LAST in the link command.
set POST_PHIGS_LIB = ""

set libs = ""

if ( $#argv == 0 ) goto usage
if ( $1 == "-v" ) then
```

```
    set echocmd = ""
    shift
endif
if ( $#argv < 1 ) goto usage


if ( -r $argv.f ) then          # Fortran source
    set CC=f77 EXT=.f
else if ( -r $argv.c ) then     # C source
    set CC=cc  EXT=.c
else if ( $argv != "hi" ) then
    # if ext. not known & not testing, exit.
    echo ${0}:  Could not read $argv.f or \
         $argv.c\!  Fix and try again.
    exit
endif

if ( $argv != "hi" ) then
    if ( $?echocmd ) echo $CC -c $argv$EXT
    $CC -c $argv$EXT                # compile to .o
    if ( $status != 0 ) then        # Bogus compilation?
        echo ${0}:  Fix compilation errors in \
             $argv$EXT and try again.
        exit
    endif
endif

if ( $?echocmd ) echo -n ${0}: Searching for library archives...

set curdir = `pwd`
while ( $curdir != "" )
    /bin/ls $curdir/$libext >& /dev/null # avoid "no match" msgs
    if ( $status == 0 ) then            # found some!
        set libs = ($libs `/bin/ls $curdir/$libext`)
    endif
    if ( $curdir:t == "STD" ) break     # just processed STD dir?
    set curdir = $curdir:h              # leave head (chop tail)
end
if ( $?echocmd ) echo done.

if ( $#libs == 0 ) then
    echo ${0}:  Warning:  No additional libraries were found.
endif

if ( $argv == "hi" || $?echocmd ) then
    echo ${0}:  Libraries found:
    echo $libs
    exit
endif
                                # link with libraries
if ( $?echocmd ) echo $CC $PRE_PHIGS_LIB $argv.o \
                      $libs $POST_PHIGS_LIB -o $argv
$CC $PRE_PHIGS_LIB $argv.o $libs $POST_PHIGS_LIB -o $argv
if ( $status == 0 ) then        # linked OK
```

```
    if ( $?echocmd ) echo ./$argv
    ./$argv                         # execute
else
    echo ${0}:  Fix link errors and try again.
    exit
endif
####################
usage:

echo Usage:  $0 '[-v] file'
echo Note:  file has no extension, but file.f or file.c exists.
echo '-v' option will echo commands before they are executed.
exit
```

---------- VAX/VMS ----------

```
$ ! Procedure to invoke DecPHIGS and access PVT libraries
$ set nover
$ define sys$input  sys$command
$ locsub = " "     ! this will be string with names
$                  ! of local sublibs
$ curdir = f$directory()    ! name of current directory
$ pvtloc = f$locate("PVT.", curdir) ! PVT. is root level
$ dirlen = f$length(curdir)  ! length of current directory name
$ numlev = (dirlen - pvtloc - 4) / 3  ! number of levels of PVT
$ backup = 0
$     ! loop up directory levels till root
$ sub_loop:
$     ! back up correct number of levels
$ seekfile = "[" + f$extract(1,backup,"----------") + "]sublib"
$     ! gotfile is null string if no sublib at this level
$ gotfile  = f$search(seekfile + ".olb")
$ if (gotfile .nes. "") then -
     locsub = locsub + seekfile + "/lib," ! tack on next name
$ backup = backup + 1
$ if (backup .lt. numlev) then goto sub_loop
$ set ver
$ fort/warn=all/standard 'p1'  !  compile test program
$ link 'p1', 'locsub' [USER.PVT]TRANS_SUBLIB/LIB, -
    [USER.PVT]SUBLIB/LIB, SYS$LIBRARY:PHIGS$FOR_BND/LIB
$ run  'p1'
```

APPENDIX F

SOFTWARE METRICS

The size of the PVT system may be measured in several ways. The following table presents some size metrics for version 1.0.

number of modules	67
number of test programs	218
number of lines in test programs	40,123
number of subroutine libraries	19
number of subroutines/functions	128
number of lines in subroutines/functions	8,018
number of lines in module documentation	36,552
number of lines in system documentation	9,077
number of SRs (semantic requirements)	897
number of TCs (test cases)	1,336
staff-months of effort (design, code, documentation)	39

APPENDIX G

FUNCTION CROSS-REFERENCE

```
#F 001 <open phigs>:
01/SR01 02.01.01/SR08 02.02.03/SR05 03.01/SR04 03.02/SR01
05.01.01/SR01 05.01.01/SR02

#F 002 <close phigs>:
01/SR02

#F 003 <open workstation>:
04.04.01.02/SR08 04.04.01.02/SR09 04.04.02.02/SR08
04.04.02.02/SR09 04.04.03.02/SR08 04.04.03.02/SR09
04.04.04.02/SR08 04.04.04.02/SR09 04.04.05.02/SR08
04.04.05.02/SR09 04.05.01.02/SR09 04.05.01.02/SR10
04.05.02.03/SR08 04.05.02.03/SR09 04.05.04.02/SR03
04.05.04.02/SR07 05.01.01/SR06 05.01.01/SR08 05.01.01/SR11
05.01.02/SR06 05.02/SR08 05.02/SR09 05.03/SR10 06.02.02/SR09
06.02.02/SR10 06.02.02/SR11 06.02.02/SR19 06.03/SR05

#F 004 <close workstation>:
05.01.01/SR12 05.03/SR11

#F 005 <redraw all structures>:
05.02/SR16

#F 006 <update workstation>:
05.02/SR17 05.02/SR18

#F 007 <set display update state>:
05.02/SR01 05.02/SR02 05.02/SR03 05.02/SR08 05.02/SR22 05.02/SR23
05.02/SR24 05.02/SR25 05.02/SR26 05.02/SR27 05.02/SR28 05.02/SR29
05.02/SR31 05.02/SR32

#F 009 <polyline 3>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR12 04.01.01/SR01
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 010 <polyline>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR12 04.01.01/SR04
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42
```

#F 011 <polymarker 3>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR11 04.01.02/SR01
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 012 <polymarker>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR11 04.01.02/SR04
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 013 <text 3>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR15 04.01.03/SR01
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 014 <text>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR15 04.01.03/SR04
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 015 <annotation text relative 3>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR16 04.01.04/SR01
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 016 <annotation text relative>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR16 04.01.04/SR04
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 017 <fill area 3>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR13 04.01.05/SR01
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 018 <fill area>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR13 04.01.05/SR04
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 019 <fill area set 3>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR14 04.01.06/SR01
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 020 <fill area set>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR14 04.01.06/SR04
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 021 <cell array 3>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR17 04.01.07/SR01
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 022 <cell array>:
02.03.03/SR06 02.03.03/SR10 02.03.03/SR17 04.01.07/SR04
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 023 <generalized drawing primitive 3>:
02.03.03/SR06 02.03.03/SR10 04.01.08/SR01 05.02/SR19 05.02/SR20
05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 024 <generalized drawing primitive>:

02.03.03/SR06 02.03.03/SR10 04.01.08/SR06 05.02/SR19 05.02/SR20
05.02/SR21 06.01.02/SR17 06.01.02/SR42

#F 025 <set polyline index>:
04.03.01.01/SR10 05.02/SR19 05.02/SR20 05.02/SR21

#F 026 <set polymarker index>:
04.03.02.01/SR10 05.02/SR19 05.02/SR20 05.02/SR21

#F 027 <set text index>:
04.03.03.01/SR31 05.02/SR19 05.02/SR20 05.02/SR21

#F 028 <set interior index>:
04.03.05.01/SR11 05.02/SR19 05.02/SR20 05.02/SR21

#F 029 <set edge index>:
04.03.06.01/SR14 05.02/SR19 05.02/SR20 05.02/SR21

#F 030 <set linetype>:
04.03.01.01/SR01 05.02/SR19 05.02/SR20 05.02/SR21

#F 031 <set linewidth scale factor>:
04.03.01.01/SR04 05.02/SR19 05.02/SR20 05.02/SR21

#F 032 <set polyline colour index>:
04.03.01.01/SR07 05.02/SR19 05.02/SR20 05.02/SR21

#F 033 <set marker type>:
04.03.02.01/SR01 05.02/SR19 05.02/SR20 05.02/SR21

#F 034 <set marker size scale factor>:
04.03.02.01/SR04 05.02/SR19 05.02/SR20 05.02/SR21

#F 035 <set polymarker colour index>:
04.03.02.01/SR07 05.02/SR19 05.02/SR20 05.02/SR21

#F 036 <set text font>:
04.03.03.01/SR01 05.02/SR19 05.02/SR20 05.02/SR21

#F 037 <set text precision>:
04.03.03.01/SR04 04.03.03.01/SR07 05.02/SR19 05.02/SR20
05.02/SR21

#F 038 <set character expansion factor>:
04.03.03.01/SR08 05.02/SR19 05.02/SR20 05.02/SR21

#F 039 <set character spacing>:
04.03.03.01/SR11 05.02/SR19 05.02/SR20 05.02/SR21

#F 040 <set text colour index>:
04.03.03.01/SR14 05.02/SR19 05.02/SR20 05.02/SR21

#F 041 <set character height>:
04.03.03.01/SR17 05.02/SR19 05.02/SR20 05.02/SR21

#F 042 <set character up vector>:
04.03.03.01/SR20 05.02/SR19 05.02/SR20 05.02/SR21

#F 043 <set text path>:
04.03.03.01/SR23 04.03.03.01/SR26 05.02/SR19 05.02/SR20
05.02/SR21

#F 044 <set text alignment>:
04.03.03.01/SR27 04.03.03.01/SR30 05.02/SR19 05.02/SR20
05.02/SR21

#F 045 <set annotation text character height>:
04.03.04.01/SR01 05.02/SR19 05.02/SR20 05.02/SR21

#F 046 <set annotation text character up vector>:
04.03.04.01/SR04 05.02/SR19 05.02/SR20 05.02/SR21

#F 047 <set annotation text path>:
04.03.04.01/SR07 04.03.04.01/SR10 05.02/SR19 05.02/SR20
05.02/SR21

#F 048 <set annotation text alignment>:
04.03.04.01/SR11 04.03.04.01/SR14 05.02/SR19 05.02/SR20
05.02/SR21

#F 049 <set annotation style>:
04.03.04.01/SR15 05.02/SR19 05.02/SR20 05.02/SR21

#F 050 <set interior style>:
04.03.05.01/SR01 04.03.05.01/SR04 05.02/SR19 05.02/SR20
05.02/SR21

#F 051 <set interior style index>:
04.03.05.01/SR05 05.02/SR19 05.02/SR20 05.02/SR21

#F 052 <set interior colour index>:
04.03.05.01/SR08 05.02/SR19 05.02/SR20 05.02/SR21

#F 053 <set edge flag>:
04.03.06.01/SR01 04.03.06.01/SR04 05.02/SR19 05.02/SR20
05.02/SR21

#F 054 <set edgetype>:
04.03.06.01/SR05 05.02/SR19 05.02/SR20 05.02/SR21

#F 055 <set edgewidth scale factor>:
04.03.06.01/SR08 05.02/SR19 05.02/SR20 05.02/SR21

#F 056 <set edge colour index>:
04.03.06.01/SR11 05.02/SR19 05.02/SR20 05.02/SR21

#F 057 <set pattern size>:
04.03.05.01/SR14 05.02/SR19 05.02/SR20 05.02/SR21

#F 058 <set pattern reference point and vectors>:
04.03.05.01/SR17 05.02/SR19 05.02/SR20 05.02/SR21

#F 059 <set pattern reference point>:
04.03.05.01/SR20 05.02/SR19 05.02/SR20 05.02/SR21

#F 060 <add names to set>:
02.03.03/SR06 02.03.03/SR18 02.03.03/SR19 02.03.03/SR20
04.05.04.01/SR01 04.05.04.01/SR09 04.05.04.01/SR10
04.05.04.01/SR12 05.02/SR19 05.02/SR20 05.02/SR21

#F 061 <remove names from set>:
02.03.03/SR06 02.03.03/SR18 02.03.03/SR19 02.03.03/SR20
04.05.04.01/SR04 04.05.04.01/SR09 04.05.04.01/SR10
04.05.04.01/SR13 05.02/SR19 05.02/SR20 05.02/SR21

#F 062 <set individual asf>:
04.02/SR01 04.02/SR04 04.02/SR05 05.02/SR19 05.02/SR20 05.02/SR21

#F 063 <set polyline representation>:
04.04.01.01/SR01 04.04.01.01/SR04 04.04.01.01/SR05
04.04.01.01/SR06 04.04.01.01/SR07 04.04.01.02/SR02
04.04.01.02/SR17 04.04.01.02/SR18 04.04.01.02/SR21
04.04.01.02/SR22 04.04.01.02/SR23 04.04.01.02/SR25
04.04.01.02/SR26 05.02/SR19 05.02/SR20 05.02/SR21

#F 064 <set polymarker representation>:
04.04.02.01/SR01 04.04.02.01/SR04 04.04.02.01/SR05
04.04.02.01/SR06 04.04.02.01/SR07 04.04.02.02/SR02
04.04.02.02/SR17 04.04.02.02/SR18 04.04.02.02/SR21
04.04.02.02/SR22 04.04.02.02/SR23 04.04.02.02/SR25
04.04.02.02/SR26 05.02/SR19 05.02/SR20 05.02/SR21

#F 065 <set text representation>:
04.04.03.01/SR01 04.04.03.01/SR04 04.04.03.01/SR05
04.04.03.01/SR06 04.04.03.01/SR07 04.04.03.02/SR02
04.04.03.02/SR15 04.04.03.02/SR16 04.04.03.02/SR17
04.04.03.02/SR18 04.04.03.02/SR19 04.04.03.02/SR20
04.04.03.02/SR24 04.04.03.02/SR26 04.04.03.02/SR27
04.04.03.02/SR28 04.04.03.02/SR29 04.04.03.02/SR30
04.04.03.02/SR31 04.04.03.02/SR32 04.04.03.02/SR33
04.04.03.02/SR34 04.04.03.02/SR35 05.02/SR19 05.02/SR20
05.02/SR21

#F 066 <set interior representation>:
04.04.04.01/SR01 04.04.04.01/SR04 04.04.04.01/SR05
04.04.04.01/SR06 04.04.04.01/SR07 04.04.04.02/SR02
04.04.04.02/SR14 04.04.04.02/SR16 04.04.04.02/SR19
04.04.04.02/SR20 04.04.04.02/SR22 04.04.04.02/SR23
04.04.04.02/SR30 04.04.04.02/SR32 04.04.04.02/SR33 05.02/SR19
05.02/SR20 05.02/SR21

#F 067 <set edge representation>:

04.04.05.01/SR01 04.04.05.01/SR04 04.04.05.01/SR05
04.04.05.01/SR06 04.04.05.01/SR07 04.04.05.02/SR02
04.04.05.02/SR13 04.04.05.02/SR18 04.04.05.02/SR19
04.04.05.02/SR22 04.04.05.02/SR23 04.04.05.02/SR24
04.04.05.02/SR26 04.04.05.02/SR27 05.02/SR19 05.02/SR20
05.02/SR21

#F 068 <set pattern representation>:
04.05.01.01/SR01 04.05.01.01/SR04 04.05.01.01/SR05
04.05.01.01/SR06 04.05.01.01/SR07 04.05.01.02/SR03
04.05.01.02/SR12 04.05.01.02/SR14 04.05.01.02/SR15 05.02/SR19
05.02/SR20 05.02/SR21

#F 069 <set colour representation>:
04.05.02.01/SR01 04.05.02.01/SR04 04.05.02.01/SR05
04.05.02.01/SR06 04.05.02.01/SR07 04.05.02.03/SR02
04.05.02.03/SR11 04.05.02.03/SR13 04.05.02.03/SR15
04.05.02.03/SR18 04.05.02.03/SR19 04.05.02.03/SR31 05.02/SR19
05.02/SR20 05.02/SR21

#F 070 <set highlighting filter>:
04.05.04.02/SR01 04.05.04.02/SR04 04.05.04.02/SR09
04.05.04.02/SR10 04.05.04.02/SR11 05.02/SR19 05.02/SR20
05.02/SR21

#F 071 <set invisibility filter>:
04.05.04.02/SR05 04.05.04.02/SR08 04.05.04.02/SR09
04.05.04.02/SR10 04.05.04.02/SR11 05.02/SR19 05.02/SR20
05.02/SR21

#F 072 <set colour model>:
04.05.02.02/SR01 04.05.02.02/SR03 04.05.02.02/SR04
04.05.02.03/SR18 04.05.02.03/SR19 04.05.02.03/SR25
04.05.02.03/SR31

#F 073 <set hlhsr identifier>:
04.05.03.01/SR01 05.02/SR19 05.02/SR20 05.02/SR21

#F 074 <set hlhsr mode>:
04.05.03.01/SR04 04.05.03.01/SR06 04.05.03.01/SR07
04.05.03.02/SR04 05.02/SR19 05.02/SR20 05.02/SR21

#F 075 <set local transformation 3>:
02.03.03/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR01
06.01.02/SR07 06.01.02/SR08 06.01.02/SR16 06.01.02/SR17

#F 076 <set local transformation>:
02.03.03/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR04
06.01.02/SR07 06.01.02/SR16 06.01.02/SR17 06.01.02/SR18

#F 077 <set global transformation 3>:
02.03.03/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR09
06.01.02/SR15 06.01.02/SR16 06.01.02/SR17

#F 078 <set global transformation>:
02.03.03/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR12
06.01.02/SR16 06.01.02/SR17 06.01.02/SR18

#F 079 <set modelling clipping volume 3>:
02.03.03/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR24
06.01.02/SR38 06.01.02/SR39 06.01.02/SR40 06.01.02/SR41
06.01.02/SR42 06.01.02/SR45 06.01.02/SR46 06.01.02/SR47
06.01.02/SR48

#F 080 <set modelling clipping volume>:
02.03.03/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR19
06.01.02/SR27 06.01.02/SR38 06.01.02/SR39 06.01.02/SR40
06.01.02/SR41 06.01.02/SR42

#F 081 <set modelling clipping indicator>:
05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR30 06.01.02/SR36

#F 082 <restore modelling clipping volume>:
02.03.03/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.01.02/SR33
06.01.02/SR42 06.01.02/SR49

#F 083 <set view index>:
05.02/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.02.02/SR01

#F 084 <set view representation 3>:
05.02/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.02.02/SR14
06.02.02/SR15 06.02.02/SR23

#F 085 <set view representation>:
05.02/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.02.02/SR14
06.02.02/SR15 06.02.02/SR16 06.02.02/SR23

#F 086 <set view transformation input priority>:
06.02.02/SR21 06.02.02/SR22

#F 087 <set workstation window 3>:
05.02/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.03/SR06 06.03/SR08
06.03/SR14

#F 088 <set workstation window>:
05.02/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.03/SR07 06.03/SR08
06.03/SR14

#F 089 <set workstation viewport 3>:
05.02/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.03/SR09 06.03/SR11
06.03/SR14

#F 090 <set workstation viewport>:
05.02/SR10 05.02/SR19 05.02/SR20 05.02/SR21 06.03/SR10 06.03/SR11
06.03/SR14

#F 091 <translate 3>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR03

#F 092 <translate>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR04

#F 093 <scale 3>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR05

#F 094 <scale>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR06

#F 095 <rotate x>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR07

#F 096 <rotate y>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR08

#F 097 <rotate z>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR09

#F 098 <rotate>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR10

#F 099 <compose matrix 3>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR11

#F 100 <compose matrix>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR12

#F 101 <transform point 3>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR13

#F 102 <transform point>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR14

#F 103 <build transformation matrix 3>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR15

#F 104 <build transformation matrix>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR16

#F 105 <compose transformation matrix 3>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR17

#F 106 <compose transformation matrix>:
06.01.01/SR01 06.01.01/SR02 06.01.01/SR18

#F 107 <evaluate view orientation matrix 3>:
06.02.01/SR01 06.02.01/SR02 06.02.01/SR03 06.02.01/SR04

#F 108 <evaluate view orientation matrix>:
06.02.01/SR01 06.02.01/SR02 06.02.01/SR05 06.02.01/SR06

#F 109 <evaluate view mapping matrix 3>:
06.02.01/SR01 06.02.01/SR02 06.02.01/SR07 06.02.01/SR08

06.02.01/SR09 06.02.01/SR10

#F 110 <evaluate view mapping matrix>:
06.02.01/SR01 06.02.01/SR02 06.02.01/SR11 06.02.01/SR12
06.02.01/SR13

#F 111 <open structure>:
02.01.01/SR01 02.01.01/SR09 02.01.01/SR10 02.02.01/SR01
02.02.01/SR02 02.02.01/SR03 05.03/SR09

#F 112 <close structure>:
02.02.01/SR04

#F 113 <execute structure>:
02.01/SR01 02.01/SR05 02.01/SR06 02.01.01/SR03 02.01.01/SR09
02.01.01/SR10 02.03.03/SR02 03.04/SR07 03.04/SR08 03.04/SR09
04.05.04.01/SR14 05.02/SR19 05.02/SR20 05.02/SR21 05.03/SR09
06.01.02/SR21 06.01.02/SR22 06.01.02/SR23 06.01.02/SR44

#F 114 <label>:
02.02.02/SR01

#F 115 <application data>:
02.02.02/SR04

#F 116 <generalized structure element>:
02.02.02/SR07 02.02.02/SR08 02.02.02/SR11 05.02/SR19 05.02/SR20
05.02/SR21

#F 117 <set edit mode>:
02.02.03/SR01 02.02.03/SR02 02.02.03/SR03 02.02.03/SR04
02.02.03/SR05 02.02.03/SR06

#F 118 <copy all elements from structure>:
02.02.05/SR01 02.02.05/SR02 02.02.05/SR03 02.02.05/SR04
05.02/SR19 05.02/SR20 05.02/SR21

#F 119 <set element pointer>:
02.02.03/SR07 02.02.03/SR10

#F 120 <offset element pointer>:
02.02.03/SR08 02.02.03/SR10

#F 121 <set element pointer at label>:
02.02.03/SR09

#F 122 <delete element>:
02.02.04/SR01 02.02.04/SR02 02.02.04/SR07 05.02/SR19 05.02/SR20
05.02/SR21

#F 123 <delete element range>:
02.02.04/SR03 02.02.04/SR04 02.02.04/SR07 05.02/SR19 05.02/SR20
05.02/SR21

#F 124 <delete elements between labels>:
02.02.04/SR05 02.02.04/SR06 02.02.04/SR07 05.02/SR19 05.02/SR20
05.02/SR21

#F 125 <empty structure>:
02.01.01/SR02 02.01.01/SR09 02.01.01/SR10 02.02.04/SR08
02.02.04/SR09 02.02.04/SR10 02.02.04/SR11 05.02/SR19 05.02/SR20
05.02/SR21 05.03/SR09

#F 126 <delete structure>:
02.01.02.01/SR01 02.01.02.01/SR02 02.01.02.01/SR03
02.01.02.01/SR04 02.01.02.01/SR05 02.01.02.01/SR06
02.01.02.01/SR07 05.02/SR19 05.02/SR20 05.02/SR21

#F 127 <delete structure network>:
02.01.02.02/SR01 02.01.02.02/SR02 02.01.02.02/SR03
02.01.02.02/SR04 02.01.02.02/SR05 02.01.02.02/SR06
02.01.02.02/SR07 02.01.02.02/SR08 02.01.02.02/SR09
02.01.02.02/SR10 02.01.02.02/SR11 02.01.02.02/SR12 05.02/SR19
05.02/SR20 05.02/SR21

#F 128 <delete all structures>:
02.01.02.03/SR01 02.01.02.03/SR02 05.02/SR19 05.02/SR20
05.02/SR21

#F 129 <change structure identifier>:
02.01.01/SR05 02.01.01/SR09 02.01.01/SR10 02.01.03.01/SR01
02.01.03.01/SR02 02.01.03.01/SR03 02.01.03.01/SR04
02.01.03.01/SR05 02.01.03.01/SR06 05.02/SR19 05.02/SR20
05.02/SR21

#F 130 <change structure references>:
02.01.01/SR06 02.01.01/SR09 02.01.01/SR10 02.01.03.02/SR01
02.01.03.02/SR02 02.01.03.02/SR03 02.01.03.02/SR04
02.01.03.02/SR05 02.01.03.02/SR06 02.01.03.03/SR07
02.01.03.03/SR08 05.02/SR19 05.02/SR20 05.02/SR21

#F 131 <change structure identifier and references>:
02.01.01/SR07 02.01.01/SR09 02.01.01/SR10 02.01.03.03/SR01
02.01.03.03/SR02 02.01.03.03/SR03 02.01.03.03/SR04
02.01.03.03/SR05 02.01.03.03/SR06 02.01.03.03/SR07
02.01.03.03/SR08 05.02/SR19 05.02/SR20 05.02/SR21

#F 132 <post structure>:
02.01.01/SR04 02.01.01/SR09 02.01.01/SR10 04.05.04.01/SR11
05.02/SR10 05.02/SR19 05.02/SR20 05.02/SR21 05.03/SR01 05.03/SR02
05.03/SR03 06.01.02/SR20 06.01.02/SR43

#F 133 <unpost structure>:
05.02/SR19 05.02/SR20 05.02/SR21 05.03/SR04 05.03/SR05 05.03/SR06

#F 134 <unpost all structures>:
05.02/SR19 05.02/SR20 05.02/SR21 05.03/SR07 05.03/SR08

#F 135 <open archive file>:
03.01/SR05 03.01/SR06 03.01/SR07

#F 136 <close archive file>:
03.01/SR08 03.01/SR09

#F 137 <archive structures>:
03.01/SR07 03.03/SR01 03.03/SR04 03.03/SR05 03.03/SR06 03.03/SR07
03.03/SR08

#F 138 <archive structure networks>:
03.01/SR07 03.03/SR02 03.03/SR04 03.03/SR05 03.03/SR06 03.03/SR07
03.03/SR08

#F 139 <archive all structures>:
03.01/SR07 03.03/SR03 03.03/SR04 03.03/SR05 03.03/SR06 03.03/SR07
03.03/SR08

#F 140 <set conflict resolution>:
03.02/SR02

#F 141 <retrieve structure identifiers>:
03.01/SR07 03.04/SR01

#F 142 <retrieve structures>:
03.01/SR07 03.03/SR09 03.03/SR12 03.03/SR13 03.03/SR14 03.03/SR15
03.03/SR16 03.03/SR17 03.03/SR18 03.03/SR19 05.02/SR19 05.02/SR20
05.02/SR21

#F 143 <retrieve structure networks>:
03.01/SR07 03.03/SR10 03.03/SR12 03.03/SR13 03.03/SR14 03.03/SR15
03.03/SR16 03.03/SR17 03.03/SR18 03.03/SR19 05.02/SR19 05.02/SR20
05.02/SR21

#F 144 <retrieve all structures>:
03.01/SR07 03.03/SR11 03.03/SR12 03.03/SR13 03.03/SR14 03.03/SR15
03.03/SR16 03.03/SR17 03.03/SR18 03.03/SR19 05.02/SR19 05.02/SR20
05.02/SR21

#F 145 <retrieve paths to ancestors>:
03.01/SR07 03.04/SR05 03.04/SR07 03.04/SR08 03.04/SR10 03.04/SR12
03.04/SR13 03.04/SR16

#F 146 <retrieve paths to descendants>:
03.01/SR07 03.04/SR06 03.04/SR07 03.04/SR08 03.04/SR09 03.04/SR11
03.04/SR14 03.04/SR15 03.04/SR17

#F 147 <delete structures from archive>:
03.01/SR07 03.05/SR01 03.05/SR04 03.05/SR05

#F 148 <delete structure networks from archive>:
03.01/SR07 03.05/SR02 03.05/SR04 03.05/SR05

#F 149 <delete all structures from archive>:

```
03.01/SR07 03.05/SR03 03.05/SR04 03.05/SR05

#F 150 <set pick identifier>:
05.02/SR19 05.02/SR20 05.02/SR21

#F 164 <set locator mode>:
05.02/SR30

#F 165 <set stroke mode>:
05.02/SR30

#F 166 <set valuator mode>:
05.02/SR30

#F 167 <set choice mode>:
05.02/SR30

#F 168 <set pick mode>:
05.02/SR30

#F 169 <set string mode>:
05.02/SR30

#F 170 <request locator 3>:
05.02/SR30

#F 171 <request locator>:
05.02/SR30

#F 172 <request stroke 3>:
05.02/SR30

#F 173 <request stroke>:
05.02/SR30

#F 174 <request valuator>:
05.02/SR30

#F 175 <request choice>:
05.02/SR30

#F 176 <request pick>:
05.02/SR30

#F 177 <request string>:
05.02/SR30

#F 200 <inquire system state value>:
01/SR03

#F 201 <inquire workstation state value>:
05.01.01/SR02 05.01.01/SR03 05.01.01/SR04 05.01.01/SR05

#F 202 <inquire structure state value>:
```

02.02.01/SR09

#F 203 <inquire archive state value>:
03.01/SR03 03.01/SR05 03.01/SR08 03.01/SR10

#F 204 <inquire list of available workstation types>:
05.01.02/SR04 05.01.02/SR05 05.01.02/SR06 05.01.02/SR07

#F 205 <inquire phigs facilities>:
02.03.03/SR21 02.03.03/SR22 03.01/SR01 03.01/SR02 04.01.03/SR07
04.01.03/SR08 04.05.04.01/SR07 04.05.04.01/SR08 05.01.01/SR09
05.01.01/SR10 05.01.01/SR11

#F 206 <inquire generalized structure element facilities>:
02.02.02/SR11 02.02.02/SR12

#F 207 <inquire modelling clipping facilities>:
06.01.02/SR37 06.01.02/SR38 06.01.02/SR39

#F 208 <inquire edit mode>:
02.02.03/SR11

#F 209 <inquire set of open workstations>:
05.01.01/SR01 05.01.01/SR06 05.01.01/SR07 05.01.01/SR12

#F 210 <inquire structure identifiers>:
02.01/SR02 02.01.01/SR09

#F 211 <inquire archive files>:
03.01/SR04 03.01/SR06 03.01/SR09 03.01/SR11

#F 212 <inquire conflict resolution>:
03.02/SR01 03.02/SR03

#F 213 <inquire all conflicting structures>:
03.04/SR02

#F 214 <inquire conflicting structures in network>:
03.04/SR03 03.04/SR04

#F 216 <inquire workstation connection and type>:
05.01.02/SR08

#F 217 <inquire list of view indices>:
06.02.02/SR08 06.02.02/SR18 06.02.02/SR19 06.02.02/SR20

#F 218 <inquire view representation>:
06.02.02/SR09 06.02.02/SR10 06.02.02/SR11 06.02.02/SR17
06.02.02/SR24 06.02.02/SR25 06.02.02/SR26 06.02.02/SR27
06.02.02/SR28 06.02.02/SR29

#F 219 <inquire hlhsr mode>:
04.05.03.01/SR05 04.05.03.01/SR06 04.05.03.01/SR07
04.05.03.02/SR04 04.05.03.02/SR05 04.05.03.02/SR06

04.05.03.02/SR07 04.05.03.02/SR08

#F 220 <inquire posted structures>:
05.03/SR13 05.03/SR14

#F 221 <inquire display update state>:
04.05.03.01/SR06 04.05.03.01/SR07 05.02/SR01 05.02/SR02
05.02/SR04 05.02/SR11 05.02/SR12 05.02/SR13 05.02/SR14 05.02/SR15
05.02/SR22 05.02/SR23 05.02/SR24 05.02/SR25 05.02/SR26 05.02/SR27
05.02/SR28 05.02/SR29 05.02/SR31 05.02/SR32 06.02.02/SR27
06.02.02/SR28 06.03/SR18 06.03/SR19

#F 222 <inquire list of polyline indices>:
04.04.01.01/SR03 04.04.01.01/SR08 04.04.01.01/SR09
04.04.01.02/SR08 04.04.01.02/SR09

#F 223 <inquire polyline representation>:
04.04.01.01/SR02 04.04.01.01/SR08 04.04.01.01/SR09
04.04.01.02/SR08 04.04.01.02/SR09 04.04.01.02/SR24
04.04.01.02/SR25 04.04.01.02/SR26

#F 224 <inquire list of polymarker indices>:
04.04.02.01/SR03 04.04.02.01/SR08 04.04.02.01/SR09
04.04.02.02/SR08 04.04.02.02/SR09

#F 225 <inquire polymarker representation>:
04.04.02.01/SR02 04.04.02.01/SR08 04.04.02.01/SR09
04.04.02.02/SR08 04.04.02.02/SR09 04.04.02.02/SR24
04.04.02.02/SR25 04.04.02.02/SR26

#F 226 <inquire list of text indices>:
04.04.03.01/SR03 04.04.03.01/SR08 04.04.03.01/SR09
04.04.03.02/SR08 04.04.03.02/SR09

#F 227 <inquire text representation>:
04.04.03.01/SR02 04.04.03.01/SR08 04.04.03.01/SR09
04.04.03.02/SR08 04.04.03.02/SR09 04.04.03.02/SR17
04.04.03.02/SR18 04.04.03.02/SR19 04.04.03.02/SR26
04.04.03.02/SR27 04.04.03.02/SR28 04.04.03.02/SR29
04.04.03.02/SR32 04.04.03.02/SR34 04.04.03.02/SR35
04.04.03.02/SR36

#F 228 <inquire list of interior indices>:
04.04.04.01/SR03 04.04.04.01/SR08 04.04.04.01/SR09
04.04.04.02/SR08 04.04.04.02/SR09

#F 229 <inquire interior representation>:
04.04.04.01/SR02 04.04.04.01/SR08 04.04.04.01/SR09
04.04.04.02/SR08 04.04.04.02/SR09 04.04.04.02/SR14
04.04.04.02/SR17 04.04.04.02/SR21 04.04.04.02/SR22
04.04.04.02/SR23 04.04.04.02/SR31 04.04.04.02/SR32
04.04.04.02/SR33

#F 230 <inquire list of edge indices>:

04.04.05.01/SR03 04.04.05.01/SR08 04.04.05.01/SR09
04.04.05.02/SR08 04.04.05.02/SR09

#F 231 <inquire edge representation>:
04.04.05.01/SR02 04.04.05.01/SR08 04.04.05.01/SR09
04.04.05.02/SR08 04.04.05.02/SR09 04.04.05.02/SR13
04.04.05.02/SR25 04.04.05.02/SR26 04.04.05.02/SR27

#F 232 <inquire list of pattern indices>:
04.05.01.01/SR03 04.05.01.01/SR08 04.05.01.01/SR09
04.05.01.02/SR09 04.05.01.02/SR10

#F 233 <inquire pattern representation>:
04.05.01.01/SR02 04.05.01.01/SR08 04.05.01.01/SR09
04.05.01.02/SR09 04.05.01.02/SR10 04.05.01.02/SR13
04.05.01.02/SR14 04.05.01.02/SR15

#F 234 <inquire colour model>:
04.05.02.02/SR02 04.05.02.03/SR25 04.05.02.03/SR26

#F 235 <inquire list of colour indices>:
04.04.03.02/SR34 04.04.03.02/SR35 04.05.02.01/SR03
04.05.02.01/SR08 04.05.02.01/SR09 04.05.02.03/SR08
04.05.02.03/SR09

#F 236 <inquire colour representation>:
04.05.02.01/SR02 04.05.02.01/SR08 04.05.02.01/SR09
04.05.02.03/SR08 04.05.02.03/SR09 04.05.02.03/SR12
04.05.02.03/SR13 04.05.02.03/SR15 04.05.02.03/SR18
04.05.02.03/SR19 04.05.02.03/SR31

#F 237 <inquire highlighting filter>:
04.05.04.02/SR02 04.05.04.02/SR03

#F 238 <inquire invisibility filter>:
04.05.04.02/SR06 04.05.04.02/SR07

#F 239 <inquire workstation transformation 3>:
06.03/SR12 06.03/SR15 06.03/SR16 06.03/SR17 06.03/SR18 06.03/SR19
06.03/SR20

#F 240 <inquire workstation transformation>:
06.03/SR13 06.03/SR15 06.03/SR16 06.03/SR17 06.03/SR18 06.03/SR19
06.03/SR20

#F 253 <inquire workstation category>:
05.01.02/SR01 05.01.02/SR02 05.01.02/SR03 05.01.02/SR04
05.01.02/SR10

#F 254 <inquire display space size 3>:
05.01.02/SR01 06.03/SR02 06.03/SR04

#F 255 <inquire display space size>:
05.01.02/SR01 06.03/SR03 06.03/SR04

#F 256 <inquire hlhsr facilities>:
04.05.03.02/SR01 04.05.03.02/SR02 04.05.03.02/SR03
04.05.03.02/SR04 05.01.02/SR01

#F 257 <inquire view facilities>:
05.01.02/SR01 06.02.02/SR04 06.02.02/SR05

#F 258 <inquire predefined view representation>:
05.01.02/SR01 06.02.02/SR06 06.02.02/SR07 06.02.02/SR09

#F 259 <inquire workstation classification>:
05.01.02/SR01 05.01.02/SR09 05.01.02/SR10

#F 260 <inquire dynamics of workstation attributes>:
04.05.03.01/SR06 04.05.03.01/SR07 05.01.02/SR01 05.02/SR06
05.02/SR19 05.02/SR20 05.02/SR21 05.02/SR24 05.02/SR25 05.02/SR26
05.02/SR27 05.02/SR28 05.02/SR29 05.02/SR31 05.02/SR32

#F 261 <inquire default display update state>:
05.01.02/SR01 05.02/SR01 05.02/SR02 05.02/SR05

#F 262 <inquire polyline facilities>:
04.04.01.02/SR03 04.04.01.02/SR05 04.04.01.02/SR09
04.04.01.02/SR10 04.04.01.02/SR11 04.04.01.02/SR13
04.04.01.02/SR14 04.04.01.02/SR15 04.04.01.02/SR16
04.04.01.02/SR17 04.04.01.02/SR18 04.04.01.02/SR19
04.04.01.02/SR20 04.04.01.02/SR21 05.01.02/SR01

#F 263 <inquire predefined polyline representation>:
04.04.01.02/SR04 04.04.01.02/SR05 04.04.01.02/SR06
04.04.01.02/SR07 04.04.01.02/SR08 04.04.01.02/SR10
04.04.01.02/SR11 04.04.01.02/SR12 05.01.02/SR01

#F 264 <inquire polymarker facilities>:
04.04.02.02/SR03 04.04.02.02/SR05 04.04.02.02/SR09
04.04.02.02/SR10 04.04.02.02/SR11 04.04.02.02/SR13
04.04.02.02/SR14 04.04.02.02/SR15 04.04.02.02/SR16
04.04.02.02/SR17 04.04.02.02/SR18 04.04.02.02/SR19
04.04.02.02/SR20 04.04.02.02/SR21 05.01.02/SR01

#F 265 <inquire predefined polymarker representation>:
04.04.02.02/SR04 04.04.02.02/SR05 04.04.02.02/SR06
04.04.02.02/SR07 04.04.02.02/SR08 04.04.02.02/SR10
04.04.02.02/SR11 04.04.02.02/SR12 05.01.02/SR01

#F 266 <inquire text facilities>:
04.04.03.02/SR03 04.04.03.02/SR05 04.04.03.02/SR09
04.04.03.02/SR10 04.04.03.02/SR11 04.04.03.02/SR13
04.04.03.02/SR14 04.04.03.02/SR15 04.04.03.02/SR16
04.04.03.02/SR17 04.04.03.02/SR18 04.04.03.02/SR19
04.04.03.02/SR20 04.04.03.02/SR21 04.04.03.02/SR22
04.04.03.02/SR23 04.04.03.02/SR24 04.04.03.02/SR25
04.04.03.02/SR26 04.04.03.02/SR27 04.04.03.02/SR28 05.01.02/SR01

#F 267 <inquire predefined text representation>:
04.04.03.02/SR04 04.04.03.02/SR05 04.04.03.02/SR06
04.04.03.02/SR07 04.04.03.02/SR08 04.04.03.02/SR10
04.04.03.02/SR11 04.04.03.02/SR12 04.04.03.02/SR17 05.01.02/SR01

#F 268 <inquire annotation facilities>:
05.01.02/SR01

#F 269 <inquire text extent>:
04.04.03.03/SR01 04.04.03.03/SR02 04.04.03.03/SR03
04.04.03.03/SR04 04.04.03.03/SR05 04.04.03.03/SR06
04.04.03.03/SR07 04.04.03.03/SR08 04.04.03.03/SR09
04.04.03.03/SR10 04.04.03.03/SR11 04.04.03.03/SR12
04.04.03.03/SR13 04.04.03.03/SR14 04.04.03.03/SR15 05.01.02/SR01

#F 270 <inquire interior facilities>:
04.04.04.02/SR03 04.04.04.02/SR05 04.04.04.02/SR10
04.04.04.02/SR12 04.04.04.02/SR14 04.04.04.02/SR15
04.04.04.02/SR16 04.04.04.02/SR18 04.04.04.02/SR24
04.04.04.02/SR25 04.04.04.02/SR26 04.04.04.02/SR27
04.04.04.02/SR28 04.04.04.02/SR29 05.01.02/SR01

#F 271 <inquire predefined interior representation>:
04.04.04.02/SR04 04.04.04.02/SR05 04.04.04.02/SR06
04.04.04.02/SR07 04.04.04.02/SR08 04.04.04.02/SR09
04.04.04.02/SR10 04.04.04.02/SR11 04.04.04.02/SR12
04.04.04.02/SR13 04.04.04.02/SR14 05.01.02/SR01

#F 272 <inquire edge facilities>:
04.04.05.02/SR03 04.04.05.02/SR05 04.04.05.02/SR10
04.04.05.02/SR11 04.04.05.02/SR14 04.04.05.02/SR15
04.04.05.02/SR16 04.04.05.02/SR17 04.04.05.02/SR18
04.04.05.02/SR19 04.04.05.02/SR20 04.04.05.02/SR21
04.04.05.02/SR22 05.01.02/SR01

#F 273 <inquire predefined edge representation>:
04.04.05.02/SR04 04.04.05.02/SR05 04.04.05.02/SR06
04.04.05.02/SR07 04.04.05.02/SR08 04.04.05.02/SR09
04.04.05.02/SR10 04.04.05.02/SR11 04.04.05.02/SR12
04.04.05.02/SR13 05.01.02/SR01

#F 274 <inquire pattern facilities>:
04.04.04.02/SR11 04.04.04.02/SR18 04.05.01.02/SR04
04.05.01.02/SR06 04.05.01.02/SR07 05.01.02/SR01

#F 275 <inquire predefined pattern representation>:
04.05.01.02/SR05 04.05.01.02/SR06 04.05.01.02/SR08
04.05.01.02/SR09 04.05.01.02/SR10 04.05.01.02/SR11 05.01.02/SR01

#F 276 <inquire colour model facilities>:
04.05.02.03/SR10 04.05.02.03/SR22 04.05.02.03/SR23
04.05.02.03/SR24 04.05.02.03/SR25 04.05.02.03/SR26
04.05.02.03/SR27 04.05.02.03/SR28 04.05.02.03/SR29

04.05.02.03/SR30 05.01.02/SR01

#F 277 <inquire colour facilities>:
04.04.01.02/SR12 04.04.02.02/SR12 04.04.03.02/SR12
04.04.04.02/SR13 04.04.05.02/SR12 04.05.01.02/SR11
04.05.02.03/SR03 04.05.02.03/SR14 04.05.02.03/SR15
04.05.02.03/SR16 04.05.02.03/SR17 04.05.02.03/SR18
04.05.02.03/SR19 04.05.02.03/SR20 04.05.02.03/SR21 05.01.02/SR01

#F 278 <inquire predefined colour representation>:
04.05.02.03/SR04 04.05.02.03/SR05 04.05.02.03/SR06
04.05.02.03/SR07 04.05.02.03/SR08 04.05.02.03/SR09
04.05.02.03/SR10 05.01.02/SR01

#F 279 <inquire list of available generalized drawing primitives 3>:
04.01.08/SR04 05.01.02/SR01

#F 280 <inquire list of available generalized drawing primitives>:
04.01.08/SR09 05.01.02/SR01

#F 281 <inquire generalized drawing primitive 3>:
04.01.08/SR05 05.01.02/SR01

#F 282 <inquire generalized drawing primitive>:
04.01.08/SR10 05.01.02/SR01

#F 283 <inquire list of available generalized structure elements>:
02.02.02/SR11 02.02.02/SR13 05.01.02/SR01

#F 284 <inquire number of display priorities supported>:
05.01.02/SR01 05.03/SR15 05.03/SR16 05.03/SR17 05.03/SR18

#F 285 <inquire workstation state table lengths>:
04.04.01.02/SR01 04.04.01.02/SR02 04.04.02.02/SR01
04.04.02.02/SR02 04.04.03.02/SR01 04.04.03.02/SR02
04.04.04.02/SR01 04.04.04.02/SR02 04.04.05.02/SR01
04.04.05.02/SR02 04.05.01.02/SR01 04.05.01.02/SR02
04.05.01.02/SR03 04.05.02.03/SR01 04.05.02.03/SR02 05.01.02/SR01
06.02.02/SR12 06.02.02/SR13

#F 286 <inquire dynamics of structures>:
05.01.02/SR01 05.02/SR07 05.02/SR19 05.02/SR20 05.02/SR21
05.02/SR24 05.02/SR25 05.02/SR26 05.02/SR27 05.02/SR28 05.02/SR29
05.02/SR31 05.02/SR32

#F 287 <inquire number of available logical input devices>:
05.01.02/SR01

#F 288 <inquire default locator device data 3>:
05.01.02/SR01

#F 289 <inquire default locator device data>:
05.01.02/SR01

#F 290 <inquire default stroke device data 3>:
05.01.02/SR01

#F 291 <inquire default stroke device data>:
05.01.02/SR01

#F 292 <inquire default valuator device data 3>:
05.01.02/SR01

#F 293 <inquire default valuator device data>:
05.01.02/SR01

#F 294 <inquire default choice device data 3>:
05.01.02/SR01

#F 295 <inquire default choice device data>:
05.01.02/SR01

#F 296 <inquire default pick device data 3>:
05.01.02/SR01

#F 297 <inquire default pick device data>:
05.01.02/SR01

#F 298 <inquire default string device data 3>:
05.01.02/SR01

#F 299 <inquire default string device data>:
05.01.02/SR01

#F 300 <inquire set of workstations to which posted>:
05.03/SR12

#F 301 <inquire open structure>:
02.02.01/SR05 02.02.01/SR06

#F 302 <inquire element pointer>:
02.02.01/SR08

#F 303 <inquire current element type and size>:
02.02.02/SR02 02.02.02/SR05 02.02.02/SR09 02.03.01/SR01
02.03.01/SR02 04.01.01/SR02 04.01.01/SR05 04.01.02/SR02
04.01.02/SR05 04.01.03/SR02 04.01.03/SR05 04.01.04/SR02
04.01.04/SR05 04.01.05/SR02 04.01.05/SR05 04.01.06/SR02
04.01.06/SR05 04.01.07/SR02 04.01.07/SR05 04.01.08/SR02
04.01.08/SR07 04.02/SR02 04.03.01.01/SR02 04.03.01.01/SR05
04.03.01.01/SR08 04.03.01.01/SR11 04.03.02.01/SR02
04.03.02.01/SR05 04.03.02.01/SR08 04.03.02.01/SR11
04.03.03.01/SR02 04.03.03.01/SR05 04.03.03.01/SR09
04.03.03.01/SR12 04.03.03.01/SR15 04.03.03.01/SR18
04.03.03.01/SR21 04.03.03.01/SR24 04.03.03.01/SR28
04.03.03.01/SR32 04.03.04.01/SR02 04.03.04.01/SR05
04.03.04.01/SR08 04.03.04.01/SR12 04.03.04.01/SR16
04.03.05.01/SR02 04.03.05.01/SR06 04.03.05.01/SR09

04.03.05.01/SR12 04.03.05.01/SR15 04.03.05.01/SR18
04.03.05.01/SR21 04.03.06.01/SR02 04.03.06.01/SR06
04.03.06.01/SR09 04.03.06.01/SR12 04.03.06.01/SR15
04.05.03.01/SR02 04.05.04.01/SR02 04.05.04.01/SR05 06.01.02/SR02
06.01.02/SR05 06.01.02/SR10 06.01.02/SR13 06.01.02/SR25
06.01.02/SR28 06.01.02/SR31 06.01.02/SR34 06.02.02/SR02

#F 304 <inquire current element content>:
02.02.02/SR03 02.02.02/SR06 02.02.02/SR10 02.03.01/SR03
04.01.01/SR03 04.01.01/SR06 04.01.02/SR03 04.01.02/SR06
04.01.03/SR03 04.01.03/SR06 04.01.04/SR03 04.01.04/SR06
04.01.05/SR03 04.01.05/SR06 04.01.06/SR03 04.01.06/SR06
04.01.07/SR03 04.01.07/SR06 04.01.08/SR03 04.01.08/SR08
04.02/SR03 04.03.01.01/SR03 04.03.01.01/SR06 04.03.01.01/SR09
04.03.01.01/SR12 04.03.02.01/SR03 04.03.02.01/SR06
04.03.02.01/SR09 04.03.02.01/SR12 04.03.03.01/SR03
04.03.03.01/SR06 04.03.03.01/SR10 04.03.03.01/SR13
04.03.03.01/SR16 04.03.03.01/SR19 04.03.03.01/SR22
04.03.03.01/SR25 04.03.03.01/SR29 04.03.03.01/SR33
04.03.04.01/SR03 04.03.04.01/SR06 04.03.04.01/SR09
04.03.04.01/SR13 04.03.04.01/SR17 04.03.05.01/SR03
04.03.05.01/SR07 04.03.05.01/SR10 04.03.05.01/SR13
04.03.05.01/SR16 04.03.05.01/SR19 04.03.05.01/SR22
04.03.06.01/SR03 04.03.06.01/SR07 04.03.06.01/SR10
04.03.06.01/SR13 04.03.06.01/SR16 04.05.03.01/SR03
04.05.04.01/SR03 04.05.04.01/SR06 06.01.02/SR03 06.01.02/SR06
06.01.02/SR11 06.01.02/SR14 06.01.02/SR26 06.01.02/SR29
06.01.02/SR32 06.01.02/SR35 06.02.02/SR03

#F 305 <inquire element type and size>:
02.03.01/SR04 02.03.01/SR05

#F 306 <inquire element content>:
02.03.01/SR06

#F 307 <inquire structure status>:
02.02.01/SR07

#F 308 <inquire paths to ancestors>:
02.01/SR03 02.01/SR05 02.01/SR06 02.01/SR07 02.01/SR09 02.01/SR10
02.01/SR13

#F 309 <inquire paths to descendants>:
02.01/SR04 02.01/SR05 02.01/SR06 02.01/SR08 02.01/SR11 02.01/SR12
02.01/SR14

#F 310 <element search>:
02.03.02/SR01 02.03.02/SR02 02.03.02/SR03 02.03.02/SR04
02.03.02/SR05 02.03.02/SR06 02.03.02/SR07 02.03.02/SR08

#F 311 <incremental spatial search 3>:
02.03.03/SR01 02.03.03/SR02 02.03.03/SR03 02.03.03/SR04
02.03.03/SR05 02.03.03/SR06 02.03.03/SR07 02.03.03/SR08
02.03.03/SR09 02.03.03/SR10 02.03.03/SR11 02.03.03/SR12

02.03.03/SR13 02.03.03/SR14 02.03.03/SR15 02.03.03/SR16
02.03.03/SR17 02.03.03/SR18 02.03.03/SR19 02.03.03/SR20
02.03.03/SR22 04.05.04.01/SR11 06.01.02/SR20 06.01.02/SR43

#F 312 <incremental spatial search>:
02.03.03/SR01 02.03.03/SR02 02.03.03/SR03 02.03.03/SR04
02.03.03/SR05 02.03.03/SR06 02.03.03/SR07 02.03.03/SR08
02.03.03/SR09 02.03.03/SR10 02.03.03/SR11 02.03.03/SR12
02.03.03/SR13 02.03.03/SR14 02.03.03/SR15 02.03.03/SR16
02.03.03/SR17 02.03.03/SR18 02.03.03/SR19 02.03.03/SR20
02.03.03/SR22 04.05.04.01/SR11 06.01.02/SR20 06.01.02/SR43

#F 320 <pack data record>:
11/SR01

#F 321 <unpack data record>:
11/SR02

APPENDIX H

DATA STRUCTURE CROSS-REFERENCE

```
#D 1.1:
01/SR01 01/SR02 01/SR03

#D 1.2:
05.01.01/SR02 05.01.01/SR03 05.01.01/SR04 05.01.01/SR05

#D 1.3:
02.01.03.01/SR01 02.01.03.01/SR03 02.01.03.03/SR01
02.01.03.03/SR03 02.02.01/SR09

#D 1.4:
03.01/SR03 03.01/SR05 03.01/SR08 03.01/SR10

#D 2.1:
05.01.02/SR07

#D 2.2:
02.02.02/SR11 05.01.02/SR05 05.01.02/SR06

#D 2.2.1:
05.01.01/SR08 05.01.02/SR01 05.01.02/SR02 05.01.02/SR04

#D 2.3:
05.01.01/SR09 05.01.01/SR10 05.01.01/SR11

#D 2.4:
03.01/SR01 03.01/SR02

#D 2.5:
04.05.04.01/SR07 04.05.04.01/SR08 04.05.04.01/SR09
04.05.04.01/SR10 04.05.04.02/SR11

#D 2.7:
04.01.03/SR07 04.01.03/SR08

#D 2.8:
02.03.03/SR21 02.03.03/SR22
```

#D 2.9:
02.03.03/SR21 02.03.03/SR22

#D 2.18:
02.02.02/SR11 02.02.02/SR12

#D 2.22:
04.05.04.01/SR11

#D 2.23.1:
06.01.02/SR20

#D 2.23.2:
06.01.02/SR20

#D 2.23.3:
06.01.02/SR43

#D 2.23.5:
06.01.02/SR37 06.01.02/SR39

#D 2.23.6:
06.01.02/SR37 06.01.02/SR38

#D 2.23.7:
06.01.02/SR37 06.01.02/SR38

#D 3:
02.03.03/SR02 02.03.03/SR03 02.03.03/SR04 02.03.03/SR05
02.03.03/SR06

#D 3.3.12:
02.03.03/SR15

#D 3.3.13:
02.03.03/SR15

#D 3.3.14:
02.03.03/SR15

#D 3.3.15:
02.03.03/SR15

#D 3.3.16:
02.03.03/SR15

#D 3.3.17:
02.03.03/SR15

#D 3.3.18:
02.03.03/SR15

#D 3.11:
02.03.03/SR06 02.03.03/SR18 02.03.03/SR19 02.03.03/SR20

04.05.04.01/SR11 04.05.04.01/SR12 04.05.04.01/SR13
04.05.04.01/SR14

#D 3.12.1:
02.03.03/SR10 06.01.02/SR15 06.01.02/SR16 06.01.02/SR17
06.01.02/SR20 06.01.02/SR21 06.01.02/SR22 06.01.02/SR47

#D 3.12.2:
02.03.03/SR10 06.01.02/SR08 06.01.02/SR16 06.01.02/SR17
06.01.02/SR20 06.01.02/SR21 06.01.02/SR23 06.01.02/SR47

#D 3.12.3:
02.03.03/SR10 06.01.02/SR42 06.01.02/SR43 06.01.02/SR44
06.01.02/SR48 06.01.02/SR49

#D 4.1:
05.01.01/SR01 05.01.01/SR04 05.01.01/SR05 05.01.01/SR06
05.01.01/SR07 05.01.01/SR11 05.01.01/SR12

#D 4.2:
02.01.02.01/SR05 02.01.02.02/SR01 02.01.02.02/SR02
02.01.02.02/SR05 02.01.02.02/SR06 02.01.02.03/SR02
02.01.03.01/SR01 02.01.03.01/SR03 02.01.03.03/SR01
02.01.03.03/SR03 02.02.01/SR01 02.02.01/SR04 02.02.01/SR05
02.02.01/SR06 02.02.01/SR09 02.03.01/SR01 02.03.01/SR02
02.03.01/SR03

#D 4.3:
02.01.02.01/SR06 02.01.02.01/SR07 02.01.02.02/SR11
02.01.02.02/SR12 02.01.03.01/SR04 02.01.03.01/SR05
02.01.03.01/SR06 02.01.03.03/SR04 02.01.03.03/SR05
02.01.03.03/SR06 02.02.01/SR02 02.02.01/SR03 02.02.01/SR08
02.02.03/SR02 02.02.03/SR03 02.02.03/SR04 02.02.03/SR06
02.02.03/SR07 02.02.03/SR08 02.02.03/SR09 02.02.03/SR10
02.02.04/SR01 02.02.04/SR02 02.02.04/SR06 02.02.04/SR07
02.02.04/SR11 02.02.05/SR01 02.02.05/SR02 02.02.05/SR03
02.03.01/SR01 02.03.01/SR02 02.03.01/SR03 03.03/SR18

#D 4.4:
02.02.03/SR01 02.02.03/SR02 02.02.03/SR03 02.02.03/SR04
02.02.03/SR05 02.02.03/SR06 02.02.03/SR11

#D 4.5:
02.01.01/SR01 02.01.01/SR02 02.01.01/SR03 02.01.01/SR04
02.01.01/SR05 02.01.01/SR06 02.01.01/SR07 02.01.01/SR08
02.01.01/SR10 02.01.02.01/SR01 02.01.02.01/SR03 02.01.02.01/SR05
02.01.02.02/SR01 02.01.02.02/SR02 02.01.02.02/SR03
02.01.02.02/SR04 02.01.02.02/SR05 02.01.02.02/SR06
02.01.02.02/SR07 02.01.02.02/SR08 02.01.02.03/SR01
02.01.02.03/SR02 02.02.01/SR07 03.04/SR02 03.04/SR03 03.04/SR04

#D 4.5.1:
02.02.01/SR05 02.02.01/SR06

#D 4.6:
03.01/SR04 03.01/SR06 03.01/SR07 03.01/SR09 03.01/SR11

#D 4.7:
03.02/SR01 03.02/SR02 03.02/SR03 03.03/SR06 03.03/SR07 03.03/SR08

#D 4.8:
03.02/SR01 03.02/SR02 03.02/SR03 03.03/SR14 03.03/SR15 03.03/SR16
03.03/SR17

#D 5.1:
05.01.01/SR06 05.01.01/SR12

#D 5.2:
05.01.02/SR08

#D 5.3:
05.01.01/SR08 05.01.02/SR02 05.01.02/SR08

#D 5.4:
05.02/SR10

#D 5.4.1:
06.02.02/SR08

#D 5.4.2:
06.02.02/SR09 06.02.02/SR10 06.02.02/SR17 06.02.02/SR18
06.02.02/SR19 06.02.02/SR20 06.02.02/SR21 06.02.02/SR22
06.02.02/SR25 06.02.02/SR26

#D 5.4.2.1:
06.02.02/SR08 06.02.02/SR18 06.02.02/SR19 06.02.02/SR20
06.02.02/SR21 06.02.02/SR22

#D 5.4.2.2:
06.02.02/SR11 06.02.02/SR24 06.02.02/SR27 06.02.02/SR28
06.02.02/SR29

#D 5.4.2.3:
06.02.01/SR01 06.02.01/SR02

#D 5.4.2.4:
06.02.01/SR01 06.02.01/SR02

#D 5.4.2.9:
06.02.01/SR01 06.02.01/SR02 06.02.02/SR14 06.02.02/SR15
06.02.02/SR16 06.02.02/SR23

#D 5.4.2.10:
06.02.01/SR01 06.02.01/SR02 06.02.02/SR14 06.02.02/SR15
06.02.02/SR16 06.02.02/SR23

#D 5.4.2.11:
06.02.02/SR14 06.02.02/SR15 06.02.02/SR16 06.02.02/SR23

#D 5.4.2.12:
06.02.02/SR14 06.02.02/SR15 06.02.02/SR23

#D 5.4.2.13:
06.02.02/SR14 06.02.02/SR15 06.02.02/SR16 06.02.02/SR23

#D 5.4.2.14:
06.02.02/SR14 06.02.02/SR15 06.02.02/SR16 06.02.02/SR23

#D 5.5:
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#D 5.5.1:
04.05.03.01/SR06 04.05.03.01/SR07 04.05.03.02/SR05
04.05.03.02/SR08

#D 5.5.2:
04.05.03.01/SR06 04.05.03.01/SR07 04.05.03.02/SR06

#D 5.5.3:
04.05.03.01/SR04 04.05.03.02/SR07

#D 5.6:
05.02/SR10 06.03/SR05 06.03/SR16 06.03/SR17

#D 5.6.1:
06.03/SR15 06.03/SR18 06.03/SR19 06.03/SR20

#D 5.6.2:
06.03/SR01 06.03/SR06 06.03/SR07 06.03/SR08 06.03/SR12 06.03/SR13
06.03/SR14

#D 5.6.3:
06.03/SR01 06.03/SR08 06.03/SR12 06.03/SR13

#D 5.6.4:
06.03/SR01 06.03/SR09 06.03/SR10 06.03/SR11 06.03/SR12 06.03/SR13
06.03/SR14

#D 5.6.5:
06.03/SR01 06.03/SR11 06.03/SR12 06.03/SR13

#D 5.7:
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02.01.03.01/SR03 02.01.03.02/SR05 02.01.03.02/SR06
02.01.03.03/SR01 02.01.03.03/SR03 05.02/SR10 05.03/SR06
05.03/SR08 05.03/SR09 05.03/SR10 05.03/SR13

#D 5.7.1:
05.03/SR02 05.03/SR05 05.03/SR14

#D 5.7.2:
05.03/SR03 05.03/SR05 05.03/SR14

#D 5.8.1:
04.05.03.01/SR06 04.05.03.01/SR07 05.02/SR01 05.02/SR03
05.02/SR04 05.02/SR08 05.02/SR22 05.02/SR23 05.02/SR24 05.02/SR25
05.02/SR26 05.02/SR27 05.02/SR28 05.02/SR29 05.02/SR31 05.02/SR32

#D 5.8.2:
04.05.03.01/SR06 05.02/SR02 05.02/SR03 05.02/SR04 05.02/SR08
05.02/SR23 05.02/SR24 05.02/SR25 05.02/SR26 05.02/SR27 05.02/SR28
05.02/SR29 05.02/SR31 05.02/SR32

#D 5.8.3:
04.05.03.01/SR06 04.05.03.01/SR07 05.02/SR04 05.02/SR09
05.02/SR11 05.02/SR12

#D 5.8.4:
05.02/SR04 05.02/SR09 05.02/SR11 05.02/SR12 05.02/SR13 05.02/SR14
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05.02/SR24 05.02/SR25 05.02/SR26 05.02/SR27 05.02/SR28 05.02/SR29
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06.03/SR19

#D 5.9:
04.04.01.02/SR02

#D 5.9.1:
04.04.01.01/SR03 04.04.01.01/SR04 04.04.01.01/SR05
04.04.01.01/SR06 04.04.01.01/SR07 04.04.01.01/SR08

#D 5.9.2:
04.04.01.01/SR01 04.04.01.01/SR02 04.04.01.01/SR09
04.04.01.02/SR08 04.04.01.02/SR09 04.04.01.02/SR24

#D 5.9.2.1:
04.04.01.01/SR03 04.04.01.01/SR04 04.04.01.01/SR05
04.04.01.01/SR06 04.04.01.01/SR07 04.04.01.01/SR08

#D 5.9.2.2:
04.04.01.02/SR17 04.04.01.02/SR18

#D 5.9.2.3:
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#D 5.9.2.4:
04.04.01.02/SR23 04.04.01.02/SR25 04.04.01.02/SR26

#D 5.10:
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#D 5.10.1:
04.04.02.01/SR03 04.04.02.01/SR04 04.04.02.01/SR05
04.04.02.01/SR06 04.04.02.01/SR07 04.04.02.01/SR08

#D 5.10.2:

04.04.02.01/SR01 04.04.02.01/SR02 04.04.02.01/SR09
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#D 5.10.2.1:
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04.04.02.01/SR06 04.04.02.01/SR07 04.04.02.01/SR08

#D 5.10.2.2:
04.04.02.02/SR17 04.04.02.02/SR18

#D 5.10.2.3:
04.04.02.02/SR21 04.04.02.02/SR22

#D 5.10.2.4:
04.04.02.02/SR23 04.04.02.02/SR25 04.04.02.02/SR26

#D 5.11:
04.04.03.02/SR02

#D 5.11.1:
04.04.03.01/SR03 04.04.03.01/SR04 04.04.03.01/SR05
04.04.03.01/SR06 04.04.03.01/SR07 04.04.03.01/SR08

#D 5.11.2:
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#D 5.11.2.1:
04.04.03.01/SR03 04.04.03.01/SR04 04.04.03.01/SR05
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#D 5.11.2.2:
04.04.03.02/SR18 04.04.03.02/SR20 04.04.03.02/SR21

#D 5.11.2.3:
04.04.03.02/SR15 04.04.03.02/SR16 04.04.03.02/SR17
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04.04.03.02/SR21

#D 5.11.2.4:
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04.04.03.02/SR30

#D 5.11.2.5:
04.04.03.02/SR31 04.04.03.02/SR32

#D 5.11.2.6:
04.04.03.02/SR33 04.04.03.02/SR34 04.04.03.02/SR35

#D 5.12:
04.04.04.02/SR02

#D 5.12.1:
04.04.04.01/SR03 04.04.04.01/SR04 04.04.04.01/SR05

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04.04.04.01/SR06 04.04.04.01/SR07 04.04.04.01/SR08

#D 5.12.2:
04.04.04.01/SR01 04.04.04.01/SR02 04.04.04.01/SR09
04.04.04.02/SR08 04.04.04.02/SR09

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04.04.04.01/SR03 04.04.04.01/SR04 04.04.04.01/SR05
04.04.04.01/SR06 04.04.04.01/SR07 04.04.04.01/SR08

#D 5.12.2.2:
04.04.04.02/SR14 04.04.04.02/SR17 04.04.04.02/SR29

#D 5.12.2.3:
04.04.04.02/SR19 04.04.04.02/SR20 04.04.04.02/SR21
04.04.04.02/SR22 04.04.04.02/SR23 04.04.04.02/SR29

#D 5.12.2.4:
04.04.04.02/SR30 04.04.04.02/SR31 04.04.04.02/SR32
04.04.04.02/SR33

#D 5.13:
04.04.05.02/SR02

#D 5.13.1:
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04.04.05.01/SR06 04.04.05.01/SR07 04.04.05.01/SR08

#D 5.13.2:
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04.04.05.02/SR08 04.04.05.02/SR09

#D 5.13.2.1:
04.04.05.01/SR03 04.04.05.01/SR04 04.04.05.01/SR05
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#D 5.13.2.2:
04.04.05.02/SR13

#D 5.13.2.3:
04.04.05.02/SR18 04.04.05.02/SR19

#D 5.13.2.4:
04.04.05.02/SR22 04.04.05.02/SR23

#D 5.13.2.5:
04.04.05.02/SR24 04.04.05.02/SR25 04.04.05.02/SR26
04.04.05.02/SR27

#D 5.14:
04.05.01.02/SR03

#D 5.14.1:
04.05.01.01/SR03 04.05.01.01/SR04 04.05.01.01/SR05
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04.05.01.01/SR06 04.05.01.01/SR07 04.05.01.01/SR08

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04.05.01.01/SR03 04.05.01.01/SR04 04.05.01.01/SR05
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04.05.01.01/SR09

#D 5.14.2.2:
04.05.01.02/SR12 04.05.01.02/SR13 04.05.01.02/SR14
04.05.01.02/SR15

#D 5.15.1:
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04.05.02.03/SR31

#D 5.15.2:
04.05.02.01/SR03 04.05.02.01/SR04 04.05.02.01/SR05
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04.05.02.01/SR09

#D 5.15.3:
04.04.01.02/SR25 04.04.01.02/SR26 04.04.02.02/SR25
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04.04.05.02/SR26 04.04.05.02/SR27 04.05.01.02/SR14
04.05.01.02/SR15 04.05.02.01/SR01 04.05.02.01/SR02
04.05.02.03/SR02 04.05.02.03/SR08 04.05.02.03/SR09
04.05.02.03/SR13 04.05.02.03/SR31

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04.05.02.01/SR07 04.05.02.01/SR08 04.05.02.01/SR09

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04.05.02.03/SR19

#D 5.16:
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04.05.04.02/SR04 04.05.04.02/SR09 04.05.04.02/SR10
04.05.04.02/SR11

#D 5.17:
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04.05.04.02/SR11

#D 5.18.1.2:

05.02/SR30 05.02/SR31 05.02/SR32

#D 5.18.2.2:
05.02/SR30 05.02/SR31 05.02/SR32

#D 5.18.3.2:
05.02/SR30 05.02/SR31 05.02/SR32

#D 5.18.4.2:
05.02/SR30 05.02/SR31 05.02/SR32

#D 5.18.5.2:
05.02/SR30 05.02/SR31 05.02/SR32

#D 5.18.6.2:
05.02/SR30 05.02/SR31 05.02/SR32

#D 6:
05.01.02/SR01

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05.01.02/SR02 05.01.02/SR06

#D 6.2:
05.01.02/SR02 05.01.02/SR03 05.01.02/SR04 05.01.02/SR10

#D 6.3:
06.03/SR04

#D 6.4:
06.03/SR02 06.03/SR03

#D 6.5:
04.05.03.02/SR01

#D 6.5.2:
04.05.03.02/SR02

#D 6.5.4:
04.05.03.02/SR03 04.05.03.02/SR04

#D 6.6.1:
06.02.02/SR04 06.02.02/SR05

#D 6.6.2:
06.02.02/SR06 06.02.02/SR09

#D 6.6.2.1:
06.02.02/SR07

#D 6.6.2.2:
06.02.02/SR07

#D 6.6.2.3:

06.02.02/SR07

#D 6.6.2.4:
06.02.02/SR07

#D 6.6.2.5:
06.02.02/SR07

#D 6.6.2.6:
06.02.02/SR07

#D 6.7:
05.01.02/SR09 05.01.02/SR10

#D 6.8:
05.02/SR19 05.02/SR20 05.02/SR21 05.02/SR24 05.02/SR25 05.02/SR26
05.02/SR27 05.02/SR28 05.02/SR29 05.02/SR31 05.02/SR32

#D 6.8.1:
05.02/SR06

#D 6.8.2:
05.02/SR06

#D 6.8.3:
05.02/SR06

#D 6.8.4:
05.02/SR06

#D 6.8.5:
05.02/SR06

#D 6.8.6:
05.02/SR06

#D 6.8.7:
05.02/SR06

#D 6.8.8:
05.02/SR06

#D 6.8.9:
05.02/SR06

#D 6.8.10:
05.02/SR06

#D 6.8.11:
05.02/SR06

#D 6.8.12:
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#D 6.9.1:
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#D 6.9.2:
05.02/SR02 05.02/SR05 05.02/SR08

#D 6.10.1.1:
04.04.01.02/SR13 04.04.01.02/SR15 04.04.01.02/SR16
04.04.01.02/SR17

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04.04.01.02/SR18

#D 6.10.1.3:
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#D 6.10.1.4:
04.04.01.02/SR11 04.04.01.02/SR19 04.04.01.02/SR20
04.04.01.02/SR21

#D 6.10.1.5:
04.04.01.02/SR11 04.04.01.02/SR19 04.04.01.02/SR20
04.04.01.02/SR21

#D 6.10.1.6:
04.04.01.02/SR11 04.04.01.02/SR19 04.04.01.02/SR20
04.04.01.02/SR21

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04.04.01.02/SR03 04.04.01.02/SR05

#D 6.10.2:
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04.04.01.02/SR07 04.04.01.02/SR08 04.04.01.02/SR09

#D 6.10.2.1:
04.04.01.02/SR10

#D 6.10.2.2:
04.04.01.02/SR11

#D 6.10.2.3:
04.04.01.02/SR12

#D 6.11.1.1:
04.04.02.02/SR13 04.04.02.02/SR15 04.04.02.02/SR16
04.04.02.02/SR17

#D 6.11.1.2:
04.04.02.02/SR10 04.04.02.02/SR13 04.04.02.02/SR14
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#D 6.11.1.3:
04.04.02.02/SR19 04.04.02.02/SR21

#D 6.11.1.4:
04.04.02.02/SR11 04.04.02.02/SR19 04.04.02.02/SR20
04.04.02.02/SR21

#D 6.11.1.5:
04.04.02.02/SR11 04.04.02.02/SR19 04.04.02.02/SR20
04.04.02.02/SR21

#D 6.11.1.6:
04.04.02.02/SR11 04.04.02.02/SR19 04.04.02.02/SR20
04.04.02.02/SR21

#D 6.11.1.7:
04.04.02.02/SR03 04.04.02.02/SR05

#D 6.11.2:
04.04.02.02/SR04 04.04.02.02/SR05 04.04.02.02/SR06
04.04.02.02/SR07 04.04.02.02/SR08 04.04.02.02/SR09

#D 6.11.2.1:
04.04.02.02/SR10

#D 6.11.2.2:
04.04.02.02/SR11

#D 6.11.2.3:
04.04.02.02/SR12

#D 6.12.1.1:
04.04.03.02/SR10 04.04.03.03/SR01

#D 6.12.1.2:
04.04.03.02/SR10 04.04.03.02/SR13 04.04.03.02/SR15
04.04.03.02/SR16 04.04.03.02/SR18 04.04.03.03/SR01

#D 6.12.1.2.1:
04.04.03.02/SR14 04.04.03.02/SR17 04.04.03.02/SR19
04.04.03.02/SR20 04.04.03.02/SR21

#D 6.12.1.4:
04.04.03.03/SR08

#D 6.12.1.5:
04.04.03.03/SR08

#D 6.12.1.6:
04.04.03.02/SR11 04.04.03.02/SR22 04.04.03.02/SR24
04.04.03.02/SR28

#D 6.12.1.7:

04.04.03.02/SR11 04.04.03.02/SR22 04.04.03.02/SR23
04.04.03.02/SR25 04.04.03.02/SR26 04.04.03.03/SR05

#D 6.12.1.8:
04.04.03.02/SR11 04.04.03.02/SR22 04.04.03.02/SR23
04.04.03.02/SR25 04.04.03.02/SR27 04.04.03.03/SR05

#D 6.12.1.9:
04.04.03.02/SR03 04.04.03.02/SR05

#D 6.12.2:
04.04.03.02/SR04 04.04.03.02/SR05 04.04.03.02/SR06
04.04.03.02/SR07 04.04.03.02/SR08 04.04.03.02/SR09

#D 6.12.2.1:
04.04.03.02/SR10

#D 6.12.2.2:
04.04.03.02/SR10 04.04.03.02/SR17

#D 6.12.2.3:
04.04.03.02/SR11

#D 6.12.2.4:
04.04.03.02/SR32

#D 6.12.2.5:
04.04.03.02/SR12

#D 6.14.1.2:
04.04.04.02/SR10 04.04.04.02/SR14 04.04.04.02/SR15
04.04.04.02/SR18 04.04.04.02/SR24 04.04.04.02/SR25
04.05.01.02/SR02 04.05.01.02/SR07

#D 6.14.1.2.1:
04.04.04.02/SR16 04.04.04.02/SR26 04.04.04.02/SR27
04.04.04.02/SR28 04.04.04.02/SR29

#D 6.14.1.3:
04.04.04.02/SR24 04.04.04.02/SR25 04.04.04.02/SR26
04.04.04.02/SR27 04.04.04.02/SR28

#D 6.14.1.4:
04.04.04.02/SR12 04.04.04.02/SR22 04.04.04.02/SR23
04.04.04.02/SR26 04.04.04.02/SR27 04.04.04.02/SR28
04.04.04.02/SR29

#D 6.14.1.5:
04.04.04.02/SR03 04.04.04.02/SR05

#D 6.14.2:
04.04.04.02/SR04 04.04.04.02/SR05 04.04.04.02/SR06
04.04.04.02/SR07 04.04.04.02/SR08 04.04.04.02/SR09

#D 6.14.2.1:
04.04.04.02/SR10 04.04.04.02/SR11 04.04.04.02/SR12
04.04.04.02/SR14

#D 6.14.2.2:
04.04.04.02/SR11 04.04.04.02/SR12

#D 6.14.2.3:
04.04.04.02/SR13

#D 6.15.1.1:
04.04.05.02/SR14 04.04.05.02/SR16 04.04.05.02/SR17

#D 6.15.1.2:
04.04.05.02/SR10 04.04.05.02/SR14 04.04.05.02/SR15
04.04.05.02/SR16 04.04.05.02/SR17 04.04.05.02/SR18
04.04.05.02/SR19

#D 6.15.1.3:
04.04.05.02/SR20 04.04.05.02/SR22

#D 6.15.1.4:
04.04.05.02/SR11 04.04.05.02/SR20 04.04.05.02/SR21
04.04.05.02/SR22

#D 6.15.1.5:
04.04.05.02/SR11 04.04.05.02/SR20 04.04.05.02/SR21
04.04.05.02/SR22

#D 6.15.1.6:
04.04.05.02/SR11 04.04.05.02/SR20 04.04.05.02/SR21
04.04.05.02/SR22

#D 6.15.1.7:
04.04.05.02/SR03 04.04.05.02/SR05

#D 6.15.2:
04.04.05.02/SR04 04.04.05.02/SR05 04.04.05.02/SR06
04.04.05.02/SR07 04.04.05.02/SR08 04.04.05.02/SR09

#D 6.15.2.1:
04.04.05.02/SR13

#D 6.15.2.2:
04.04.05.02/SR10

#D 6.15.2.3:
04.04.05.02/SR11

#D 6.15.2.4:
04.04.05.02/SR12

#D 6.16.1.1:
04.04.04.02/SR11 04.04.04.02/SR18 04.04.04.02/SR22

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04.05.01.02/SR07

#D 6.16.2:
04.05.01.02/SR05 04.05.01.02/SR06 04.05.01.02/SR08
04.05.01.02/SR09 04.05.01.02/SR10

#D 6.16.2.1:
04.05.01.02/SR11

#D 6.17.1.2:
04.05.02.03/SR22 04.05.02.03/SR23 04.05.02.03/SR24
04.05.02.03/SR25 04.05.02.03/SR27 04.05.02.03/SR28
04.05.02.03/SR29 04.05.02.03/SR30

#D 6.17.1.3:
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04.05.02.03/SR26

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04.05.02.03/SR13 04.05.02.03/SR20 04.05.02.03/SR21

#D 6.17.2.2:
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#D 6.17.2.3:
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04.05.02.03/SR18 04.05.02.03/SR19

#D 6.17.2.4:
04.04.01.02/SR12 04.04.02.02/SR12 04.04.03.02/SR12
04.04.04.02/SR13 04.04.05.02/SR12 04.05.01.02/SR11
04.05.02.03/SR03

#D 6.17.3:
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04.05.02.03/SR10

#D 6.18.2:
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#D 6.18.2.3:
04.01.08/SR05

#D 6.18.4:
04.01.08/SR09

#D 6.18.4.3:
04.01.08/SR10

#D 6.19.2:
02.02.02/SR11 02.02.02/SR13

#D 6.20:
05.03/SR15 05.03/SR16 05.03/SR17 05.03/SR18

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#D 6.21.2:
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#D 6.21.3:
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#D 6.21.4:
04.04.04.02/SR01 04.04.04.02/SR02

#D 6.21.5:
04.04.05.02/SR01 04.04.05.02/SR02

#D 6.21.6:
04.05.01.02/SR01 04.05.01.02/SR02 04.05.01.02/SR03

#D 6.21.7:
04.05.02.03/SR01 04.05.02.03/SR02

#D 6.21.8:
06.02.02/SR12 06.02.02/SR13

#D 6.22:
05.02/SR19 05.02/SR20 05.02/SR21 05.02/SR24 05.02/SR25 05.02/SR26
05.02/SR27 05.02/SR28 05.02/SR29 05.02/SR31 05.02/SR32

#D 6.22.1:
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#D 6.22.2:
05.02/SR07

#D 6.22.3:
05.02/SR07

#D 6.22.4:
05.02/SR07

#D 6.22.5:
05.02/SR07

#D 7:
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02.01.02.02/SR07 02.01.02.02/SR08 02.01.02.02/SR09
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02.03.03/SR03 02.03.03/SR04 02.03.03/SR05 02.03.03/SR06

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02.01.01/SR09 02.01.01/SR10 02.01.02.01/SR01 02.01.02.01/SR03
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02.03.01/SR05 02.03.01/SR06 02.03.02/SR01 02.03.02/SR02
02.03.02/SR06 02.03.03/SR07 02.03.03/SR08 03.03/SR02 03.03/SR03
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03.03/SR19 03.04/SR02 03.04/SR03 03.04/SR04

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05.03/SR09 05.03/SR10 05.03/SR12

#D 7.2.1:
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02.01.02.02/SR12 02.02.01/SR07 02.02.03/SR02 02.02.03/SR03
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02.02.04/SR11 02.02.05/SR01 02.02.05/SR02 02.02.05/SR03
02.02.05/SR04 02.03.01/SR01 02.03.01/SR02 02.03.01/SR03
02.03.01/SR04 02.03.01/SR05 02.03.01/SR06 02.03.02/SR01
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04.01.01/SR03 06.01.02/SR17 06.01.02/SR42

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04.01.01/SR06 06.01.02/SR17 06.01.02/SR42

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06.01.02/SR17 06.01.02/SR42

#D 7.3.16:
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06.01.02/SR17 06.01.02/SR42

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#D 7.3.19:
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#D 7.3.21:
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#D 7.3.56:
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06.01.02/SR18

#D 7.3.57:
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#D 7.3.58:
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06.01.02/SR10 06.01.02/SR11 06.01.02/SR15 06.01.02/SR18

#D 7.3.59:
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#D 7.3.60:
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06.01.02/SR26 06.01.02/SR40 06.01.02/SR41 06.01.02/SR45
06.01.02/SR46 06.01.02/SR47 06.01.02/SR48

#D 7.3.61:
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02.01/SR14 02.01.02.01/SR02 02.01.02.01/SR06 02.01.02.01/SR07
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02.03.03/SR08 03.03/SR02 03.03/SR19 03.04/SR03 04.05.04.01/SR14
06.01.02/SR21 06.01.02/SR22 06.01.02/SR23 06.01.02/SR44

#D 7.3.66:
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03.01/SR07

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03.03/SR17 03.04/SR01 03.04/SR02 03.04/SR03 03.04/SR04 03.04/SR05
03.04/SR06 03.04/SR07 03.04/SR08 03.04/SR09 03.04/SR10 03.04/SR11
03.04/SR12 03.04/SR13 03.04/SR14 03.04/SR15 03.04/SR16 03.04/SR17
03.05/SR01 03.05/SR02 03.05/SR03 03.05/SR04 03.05/SR05

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03.04/SR09 03.04/SR10 03.04/SR11 03.04/SR12 03.04/SR13 03.04/SR14
03.04/SR15 03.04/SR16 03.04/SR17 03.05/SR02

APPENDIX I

STANDARD SPECIFICATIONS CROSS-REFERENCE

#S 4.4.1/23/1:
02.01.01/SR09

#S 4.4.1/23/3:
04.01.01/SR01 04.01.01/SR04 04.01.02/SR01 04.01.02/SR04
04.01.03/SR01 04.01.03/SR04 04.01.04/SR01 04.01.04/SR04
04.01.05/SR01 04.01.05/SR04 04.01.06/SR01 04.01.06/SR04
04.01.07/SR01 04.01.07/SR04 04.01.08/SR01 04.01.08/SR06

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04.03.02.01/SR07 04.03.02.01/SR10 04.03.03.01/SR01
04.03.03.01/SR04 04.03.03.01/SR08 04.03.03.01/SR11
04.03.03.01/SR14 04.03.03.01/SR17 04.03.03.01/SR20
04.03.03.01/SR23 04.03.03.01/SR27 04.03.03.01/SR31
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04.03.05.01/SR05 04.03.05.01/SR08 04.03.05.01/SR11
04.03.05.01/SR14 04.03.05.01/SR17 04.03.05.01/SR20
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#S 4.4.2/25/3:
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#S 4.4.2/26/2:
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#S 4.4.2/26/3:
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#S 4.4.3/26/4:
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#S 4.4.3/26/5:
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05.03/SR08

#S 4.4.3/26/8:
05.03/SR03 05.03/SR14

#S 4.4.3/29/1:
04.05.04.01/SR14 06.01.02/SR21 06.01.02/SR44

#S 4.4.4/29/4:
02.03.02/SR04

#S 4.4.4/29/5:
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02.02.01/SR05 02.02.01/SR06

#S 4.4.4/29/6:
02.02.01/SR03 02.02.01/SR08

#S 4.4.4/29/7:
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02.02.03/SR10

#S 4.4.4/30/1:
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#S 4.4.4/30/2:
02.02.05/SR01 02.02.05/SR02 02.02.05/SR03 02.02.05/SR04

#S 4.4.4/30/3:
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02.02.04/SR05 02.02.04/SR06 02.02.04/SR07

#S 4.4.4/30/4:
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02.02.04/SR11

#S 4.4.4/30/5:
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02.02.02/SR09 02.02.02/SR10 02.03.01/SR01 02.03.01/SR02
02.03.01/SR03 04.01.01/SR02 04.01.01/SR03 04.01.01/SR05
04.01.01/SR06 04.01.02/SR02 04.01.02/SR03 04.01.02/SR05
04.01.02/SR06 04.01.03/SR02 04.01.03/SR03 04.01.03/SR05
04.01.03/SR06 04.01.04/SR02 04.01.04/SR03 04.01.04/SR05
04.01.04/SR06 04.01.05/SR02 04.01.05/SR03 04.01.05/SR05
04.01.05/SR06 04.01.06/SR02 04.01.06/SR03 04.01.06/SR05
04.01.06/SR06 04.01.07/SR02 04.01.07/SR03 04.01.07/SR05
04.01.07/SR06 04.01.08/SR02 04.01.08/SR03 04.01.08/SR07
04.01.08/SR08 04.02/SR02 04.02/SR03 04.03.01.01/SR02
04.03.01.01/SR03 04.03.01.01/SR05 04.03.01.01/SR06
04.03.01.01/SR08 04.03.01.01/SR09 04.03.01.01/SR11
04.03.01.01/SR12 04.03.02.01/SR02 04.03.02.01/SR03
04.03.02.01/SR05 04.03.02.01/SR06 04.03.02.01/SR08

04.03.02.01/SR09 04.03.02.01/SR11 04.03.02.01/SR12
04.03.03.01/SR02 04.03.03.01/SR03 04.03.03.01/SR05
04.03.03.01/SR06 04.03.03.01/SR09 04.03.03.01/SR10
04.03.03.01/SR12 04.03.03.01/SR13 04.03.03.01/SR15
04.03.03.01/SR16 04.03.03.01/SR18 04.03.03.01/SR19
04.03.03.01/SR21 04.03.03.01/SR22 04.03.03.01/SR24
04.03.03.01/SR25 04.03.03.01/SR28 04.03.03.01/SR29
04.03.03.01/SR32 04.03.03.01/SR33 04.03.04.01/SR02
04.03.04.01/SR03 04.03.04.01/SR05 04.03.04.01/SR06
04.03.04.01/SR08 04.03.04.01/SR09 04.03.04.01/SR12
04.03.04.01/SR13 04.03.04.01/SR16 04.03.04.01/SR17
04.03.05.01/SR02 04.03.05.01/SR03 04.03.05.01/SR06
04.03.05.01/SR07 04.03.05.01/SR09 04.03.05.01/SR10
04.03.05.01/SR12 04.03.05.01/SR13 04.03.05.01/SR15
04.03.05.01/SR16 04.03.05.01/SR18 04.03.05.01/SR19
04.03.05.01/SR21 04.03.05.01/SR22 04.03.06.01/SR02
04.03.06.01/SR03 04.03.06.01/SR06 04.03.06.01/SR07
04.03.06.01/SR09 04.03.06.01/SR10 04.03.06.01/SR12
04.03.06.01/SR13 04.03.06.01/SR15 04.03.06.01/SR16
04.05.03.01/SR02 04.05.03.01/SR03 04.05.04.01/SR02
04.05.04.01/SR03 04.05.04.01/SR05 04.05.04.01/SR06 06.01.02/SR02
06.01.02/SR03 06.01.02/SR05 06.01.02/SR06 06.01.02/SR10
06.01.02/SR11 06.01.02/SR13 06.01.02/SR14 06.01.02/SR25
06.01.02/SR26 06.01.02/SR28 06.01.02/SR29 06.01.02/SR31
06.01.02/SR32 06.01.02/SR34 06.01.02/SR35 06.02.02/SR02
06.02.02/SR03

#S 4.4.5/30/7:
02.01.02.01/SR01 02.01.02.01/SR02 02.01.02.01/SR06
02.01.02.01/SR07 02.01.02.02/SR11 02.01.02.02/SR12
02.01.02.03/SR01 02.01.02.03/SR02

#S 4.4.5/30/8:
02.01.02.02/SR01 02.01.02.02/SR02 02.01.02.02/SR03
02.01.02.02/SR04 02.01.02.02/SR05 02.01.02.02/SR06
02.01.02.02/SR07 02.01.02.02/SR08 02.01.02.02/SR09
02.01.02.02/SR11 02.01.02.02/SR12

#S 4.4.5/30/9:
02.01.02.01/SR04 02.01.02.02/SR10

#S 4.4.5/31/1:
02.01.01/SR05 02.01.01/SR07 02.01.03.01/SR01 02.01.03.01/SR02
02.01.03.01/SR03 02.01.03.02/SR01 02.01.03.02/SR02
02.01.03.02/SR03 02.01.03.02/SR04 02.01.03.02/SR05
02.01.03.02/SR06 02.01.03.03/SR01 02.01.03.03/SR02
02.01.03.03/SR03 02.01.03.03/SR07 02.01.03.03/SR08

#S 4.4.5/31/2:
02.01/SR02 02.01.01/SR09

#S 4.4.6/31/4:
02.03.01/SR04 02.03.01/SR05 02.03.01/SR06

#S 4.4.6/31/5:
02.01/SR03 02.01/SR04 02.01/SR05 02.01/SR06 02.01/SR09 02.01/SR10
02.01/SR11 02.01/SR12 02.01/SR13 02.01/SR14

#S 4.4.6/31/6:
02.03.02/SR01 02.03.02/SR02 02.03.02/SR03 02.03.02/SR04
02.03.02/SR05 02.03.02/SR06 02.03.02/SR07 02.03.02/SR08

#S 4.4.6/31/9:
02.03.03/SR02 02.03.03/SR03 02.03.03/SR04 02.03.03/SR06
02.03.03/SR07

#S 4.4.6/32/1:
02.03.03/SR06 02.03.03/SR09

#S 4.4.6/32/2:
02.03.03/SR15

#S 4.4.6/32/3:
02.03.03/SR16

#S 4.4.6/32/4:
02.03.03/SR04

#S 4.4.6/32/5:
02.03.03/SR04 02.03.03/SR08

#S 4.4.6/32/6:
02.03.03/SR05

#S 4.4.6/32/9:
02.03.03/SR20

#S 4.4.6/32/11:
02.03.03/SR18 02.03.03/SR19

#S 4.4.7/33/3:
03.03/SR01 03.03/SR02 03.03/SR03 03.03/SR09 03.03/SR10 03.03/SR11
03.03/SR12 03.05/SR01 03.05/SR02 03.05/SR03

#S 4.4.7/33/4:
03.01/SR01 03.01/SR07 03.03/SR04 03.05/SR04 03.05/SR05

#S 4.4.7/33/5:
03.01/SR05 03.01/SR08 03.01/SR10 03.01/SR11 03.04/SR01

#S 4.4.7/33/6:
03.04/SR05 03.04/SR06 03.04/SR07 03.04/SR08 03.04/SR12 03.04/SR13
03.04/SR14 03.04/SR15 03.04/SR16 03.04/SR17

#S 4.4.7/33/7:
03.02/SR02 03.02/SR03 03.03/SR06 03.03/SR07 03.03/SR08

#S 4.4.7/34/1:

03.03/SR06 03.03/SR07 03.03/SR08 03.03/SR14 03.03/SR15 03.03/SR16
03.03/SR17

#S 4.4.7/34/2:
03.04/SR02 03.04/SR03 03.04/SR04

#S 4.4.8/34/3:
02.02.02/SR07

#S 4.4.9/34/4:
02.02.02/SR04

#S 4.5.1/35/1:
02.03.03/SR11 02.03.03/SR12 02.03.03/SR13 02.03.03/SR14
02.03.03/SR15 02.03.03/SR16 02.03.03/SR17 04.01.01/SR01
04.01.01/SR04 04.01.02/SR01 04.01.02/SR04 04.01.03/SR01
04.01.03/SR04 04.01.04/SR01 04.01.04/SR04 04.01.05/SR01
04.01.05/SR04 04.01.06/SR01 04.01.06/SR04 04.01.07/SR01
04.01.07/SR04 04.01.08/SR01 04.01.08/SR06

#S 4.5.1/36/1:
02.03.03/SR15

#S 4.5.1/36/2:
04.01.03/SR08

#S 4.5.1/36/4:
02.03.03/SR13 02.03.03/SR14

#S 4.5.1/36/6:
02.03.03/SR13 02.03.03/SR14

#S 4.5.1/36/7:
02.03.03/SR13 02.03.03/SR14

#S 4.5.1/37/1:
02.03.03/SR17

#S 4.5.1/38/1:
02.03.03/SR17

#S 4.5.2/40/5:
04.02/SR04 04.02/SR05

#S 4.5.2/40/6:
04.02/SR01

#S 4.5.2/41/1:
04.05.03.01/SR01 04.05.03.01/SR04

#S 4.5.2/43/3:
04.04.01.01/SR01 04.04.01.02/SR06 04.04.01.02/SR08
04.04.01.02/SR09 04.04.02.01/SR01 04.04.02.02/SR06
04.04.02.02/SR08 04.04.02.02/SR09 04.04.03.01/SR01

04.04.03.02/SR06 04.04.03.02/SR08 04.04.03.02/SR09
04.04.04.02/SR06 04.04.04.02/SR08 04.04.04.02/SR09
04.04.05.02/SR06 04.04.05.02/SR08 04.04.05.02/SR09
04.05.01.01/SR01 04.05.01.02/SR09 04.05.01.02/SR10
04.05.02.01/SR01 04.05.02.03/SR06 04.05.02.03/SR08
04.05.02.03/SR09

#S 4.5.2/44/2:
04.04.01.01/SR04 04.04.01.01/SR05 04.04.01.01/SR06
04.04.02.01/SR04 04.04.02.01/SR05 04.04.02.01/SR06
04.04.03.01/SR04 04.04.03.01/SR05 04.04.03.01/SR06
04.04.04.01/SR04 04.04.04.01/SR05 04.04.04.01/SR06
04.04.05.01/SR04 04.04.05.01/SR05 04.04.05.01/SR06
04.05.01.01/SR04 04.05.01.01/SR05 04.05.01.01/SR06
04.05.02.01/SR04 04.05.02.01/SR05 04.05.02.01/SR06

#S 4.5.3/44/4:
04.03.01.01/SR01 04.03.01.01/SR04 04.03.01.01/SR07
04.03.01.01/SR10

#S 4.5.3/44/5:
04.04.01.02/SR14 04.04.01.02/SR18

#S 4.5.4/44/7:
04.03.02.01/SR01 04.03.02.01/SR04 04.03.02.01/SR07
04.03.02.01/SR10

#S 4.5.4/45/2:
04.04.02.02/SR14 04.04.02.02/SR18

#S 4.5.5/45/8:
04.03.03.01/SR17 04.03.03.01/SR20 04.03.03.01/SR23
04.03.03.01/SR27

#S 4.5.5/45/10:
04.03.03.01/SR01 04.03.03.01/SR04 04.03.03.01/SR08
04.03.03.01/SR11 04.03.03.01/SR14 04.03.03.01/SR31

#S 4.5.5/46/2:
04.03.03.01/SR26 04.04.03.03/SR01 04.04.03.03/SR04
04.04.03.03/SR05 04.04.03.03/SR07 04.04.03.03/SR08
04.04.03.03/SR09

#S 4.5.5/46/3:
04.04.03.03/SR06

#S 4.5.5/46/4:
04.04.03.03/SR13

#S 4.5.5/46/6:
04.03.03.01/SR30 04.04.03.03/SR10 04.04.03.03/SR11

#S 4.5.5/47/1:
04.04.03.03/SR10 04.04.03.03/SR11

#S 4.5.5/47/3:
04.04.03.03/SR10 04.04.03.03/SR11

#S 4.5.5/48/1:
04.04.03.03/SR10 04.04.03.03/SR11

#S 4.5.5/48/4:
04.01.03/SR08 04.04.03.02/SR13 04.04.03.02/SR14

#S 4.5.5/48/5:
04.03.03.01/SR07 04.04.03.02/SR17 04.04.03.02/SR26
04.04.03.02/SR27 04.04.03.02/SR32

#S 4.5.5/49/1:
04.04.03.02/SR29 04.04.03.02/SR32

#S 4.5.5/49/5:
04.04.03.02/SR14 04.04.03.02/SR19 04.04.03.02/SR20
04.04.03.03/SR02

#S 4.5.5/49/6:
04.04.03.03/SR02 04.04.03.03/SR11

#S 4.5.5/50/1:
04.04.03.03/SR11

#S 4.5.5/50/5:
04.04.03.02/SR29

#S 4.5.5/52/1:
04.04.03.03/SR06

#S 4.5.5/53/1:
04.04.03.03/SR06

#S 4.5.6/56/2:
04.03.04.01/SR01 04.03.04.01/SR04 04.03.04.01/SR07
04.03.04.01/SR10 04.03.04.01/SR11 04.03.04.01/SR14
04.03.04.01/SR15

#S 4.5.7/56/7:
04.04.03.03/SR01 04.04.03.03/SR03 04.04.03.03/SR12
04.04.03.03/SR13

#S 4.5.7/57/1:
04.04.03.03/SR12

#S 4.5.7/57/2:
04.04.03.03/SR13

#S 4.5.7/57/3:
04.04.03.03/SR14 04.04.03.03/SR15

#S 4.5.7/58/1:
04.04.03.03/SR06 04.04.03.03/SR14 04.04.03.03/SR15

#S 4.5.8/59/1:
04.03.05.01/SR14 04.03.05.01/SR17 04.03.05.01/SR20

#S 4.5.8/59/2:
04.03.05.01/SR01 04.03.05.01/SR05 04.03.05.01/SR08
04.03.05.01/SR11 04.04.04.01/SR01

#S 4.5.8/59/3:
04.03.05.01/SR04 04.04.04.02/SR14

#S 4.5.8/62/2:
04.04.04.02/SR29

#S 4.5.8/63/2:
04.04.04.02/SR15

#S 4.5.9/63/4:
04.03.06.01/SR01 04.03.06.01/SR05 04.03.06.01/SR08
04.03.06.01/SR11 04.04.05.01/SR01

#S 4.5.9/63/5:
04.03.06.01/SR04 04.03.06.01/SR14 04.04.05.02/SR13

#S 4.5.9/63/7:
04.04.05.02/SR15 04.04.05.02/SR19

#S 4.5.12/64/5:
04.05.02.03/SR02 04.05.02.03/SR05 04.05.02.03/SR06
04.05.02.03/SR07

#S 4.5.12/64/6:
04.05.02.03/SR26

#S 4.5.12/64/7:
04.05.02.01/SR01 04.05.02.01/SR02 04.05.02.01/SR04
04.05.02.01/SR05 04.05.02.01/SR06 04.05.02.01/SR07
04.05.02.01/SR08 04.05.02.03/SR12

#S 4.5.12/64/8:
04.05.02.02/SR01 04.05.02.02/SR02 04.05.02.02/SR03
04.05.02.02/SR04 04.05.02.03/SR31

#S 4.5.12/65/1:
04.05.02.03/SR22 04.05.02.03/SR23 04.05.02.03/SR24
04.05.02.03/SR27 04.05.02.03/SR28 04.05.02.03/SR29
04.05.02.03/SR30

#S 4.5.12/65/2:
04.05.02.03/SR13

#S 4.5.12/65/3:

04.05.02.03/SR16 04.05.02.03/SR17 04.05.02.03/SR18
04.05.02.03/SR19

#S 4.5.15/65/7:
04.05.04.01/SR01 04.05.04.01/SR04 04.05.04.01/SR12
04.05.04.01/SR13

#S 4.5.15/65/8:
04.05.04.02/SR01 04.05.04.02/SR04 04.05.04.02/SR05
04.05.04.02/SR08

#S 4.5.15/66/2:
04.05.04.01/SR12 04.05.04.01/SR13

#S 4.5.15/66/4:
04.05.04.01/SR07 04.05.04.01/SR08 04.05.04.01/SR09
04.05.04.02/SR09 04.05.04.02/SR10

#S 4.6.1/67/2:
05.01.01/SR08 05.01.02/SR01

#S 4.6.1/68/1:
05.01.02/SR02

#S 4.6.2/68/7:
05.01.01/SR06 05.01.01/SR08 05.01.02/SR01 05.01.02/SR06

#S 4.6.3/69/2:
04.05.03.01/SR06 04.05.03.01/SR07 05.02/SR06 05.02/SR07

#S 4.6.3/69/3:
05.02/SR19 05.02/SR20 05.02/SR21

#S 4.6.3/70/1:
05.02/SR03

#S 4.6.3/70/2:
05.02/SR11 05.02/SR12 05.02/SR13 05.02/SR14 05.02/SR15

#S 4.6.3/70/3:
05.02/SR04

#S 4.6.3/70/4:
05.02/SR01

#S 4.6.3/70/5:
05.02/SR22

#S 4.6.3/70/6:
05.02/SR29

#S 4.6.3/70/7:
05.02/SR30 05.02/SR31 05.02/SR32

#S 4.6.3/70/9:
04.05.03.01/SR06 04.05.03.01/SR07 05.02/SR16 05.02/SR17
05.02/SR23 05.02/SR24 05.02/SR25 05.02/SR26 05.02/SR27 05.02/SR28

#S 4.6.3/71/1:
04.05.03.01/SR06 04.05.03.01/SR07 05.02/SR02 05.02/SR23
05.02/SR25 05.02/SR26 05.02/SR27 05.02/SR28

#S 4.6.3/72/1:
05.02/SR16 05.02/SR17 05.02/SR22 05.02/SR23 05.02/SR24 05.02/SR25
05.02/SR26 05.02/SR27 05.02/SR28 05.02/SR29 05.02/SR31 05.02/SR32

#S 4.6.3/73/1:
05.02/SR16 05.02/SR17 05.02/SR22 05.02/SR23 05.02/SR24 05.02/SR25
05.02/SR26 05.02/SR27 05.02/SR28 05.02/SR29 05.02/SR31 05.02/SR32

#S 4.6.3/74/1:
05.02/SR19

#S 4.6.3/75/1:
05.02/SR19

#S 4.6.3/75/3:
05.02/SR23

#S 4.6.6/76/3:
04.05.03.01/SR01 04.05.03.01/SR04 04.05.03.02/SR02
04.05.03.02/SR03

#S 4.7.2/77/3:
06.01.01/SR01 06.01.01/SR02 06.01.02/SR16 06.01.02/SR17
06.02.01/SR01 06.02.01/SR02

#S 4.7.2/77/4:
06.01.02/SR20

#S 4.7.2/77/6:
06.01.02/SR21

#S 4.7.2/77/7:
06.01.02/SR01 06.01.02/SR04 06.01.02/SR07 06.01.02/SR08

#S 4.7.2/78/2:
06.01.02/SR09 06.01.02/SR12 06.01.02/SR15

#S 4.7.2/78/3:
06.01.02/SR42

#S 4.7.2/78/4:
06.01.02/SR24 06.01.02/SR27 06.01.02/SR45 06.01.02/SR46
06.01.02/SR48

#S 4.7.2/78/5:
06.01.02/SR47

#S 4.7.2/78/6:
06.01.02/SR46

#S 4.7.2/78/7:
06.01.02/SR48

#S 4.7.2/79/1:
06.01.02/SR38

#S 4.7.2/79/2:
06.01.02/SR33 06.01.02/SR49

#S 4.7.2/79/3:
06.01.02/SR30 06.01.02/SR36

#S 4.7.3/79/4:
06.01.01/SR03 06.01.01/SR04 06.01.01/SR05 06.01.01/SR06
06.01.01/SR07 06.01.01/SR08 06.01.01/SR09 06.01.01/SR10
06.01.01/SR11 06.01.01/SR12 06.01.01/SR13 06.01.01/SR14
06.01.01/SR15 06.01.01/SR16 06.01.01/SR17 06.01.01/SR18

#S 4.7.3/80/1:
02.03.03/SR10

#S 4.7.4/82/1:
06.02.01/SR01

#S 4.7.4/83/3:
06.02.02/SR08

#S 4.7.4/83/4:
06.02.02/SR07

#S 4.7.4/83/6:
06.02.02/SR09 06.02.02/SR10 06.02.02/SR11 06.02.02/SR14
06.02.02/SR15

#S 4.7.4/83/7:
06.02.02/SR16

#S 4.7.4/84/1:
06.02.02/SR23

#S 4.7.4/84/2:
06.02.02/SR25 06.02.02/SR26 06.02.02/SR27

#S 4.7.4/84/3:
06.02.02/SR29

#S 4.7.4/84/4:
06.02.02/SR28

#S 4.7.4/84/5:

06.02.02/SR19 06.02.02/SR20

#S 4.7.4/84/6:
06.02.02/SR01

#S 4.7.5/84/7:
06.02.01/SR01

#S 4.7.5/84/8:
06.02.01/SR01

#S 4.7.5/84/9:
06.02.01/SR03

#S 4.7.5/84/10:
06.02.01/SR04

#S 4.7.5/85/3:
06.02.01/SR05

#S 4.7.5/85/4:
06.02.01/SR06

#S 4.7.5/86/4:
06.02.01/SR07

#S 4.7.5/86/5:
06.02.01/SR09

#S 4.7.5/86/6:
06.02.01/SR08

#S 4.7.5/86/9:
06.02.01/SR10

#S 4.7.5/89/1:
06.02.01/SR11

#S 4.7.5/89/2:
06.02.01/SR13

#S 4.7.5/89/3:
06.02.01/SR12

#S 4.7.6/90/5:
06.03/SR01

#S 4.7.6/90/6:
06.03/SR04

#S 4.7.6/91/2:
05.02/SR10 06.03/SR01 06.03/SR08 06.03/SR11

#S 4.7.6/91/3:

06.03/SR06 06.03/SR07 06.03/SR09 06.03/SR10

#S 4.7.6/91/4:
06.03/SR14 06.03/SR15

#S 4.7.6/91/5:
06.03/SR16 06.03/SR18

#S 4.7.6/91/6:
06.03/SR20

#S 4.7.6/91/7:
06.03/SR17 06.03/SR19

#S 4.7.6/92/4:
06.03/SR05

#S 4.10/107/2:
01/SR01 01/SR02

#S 4.10/107/3:
05.01.01/SR03 05.01.01/SR04 05.01.01/SR05

#S 4.10/107/4:
02.02.01/SR09

#S 4.10/107/6:
02.02.01/SR09 05.01.01/SR02

#S 4.10/107/8:
02.01.01/SR08

#S 4.11/108/1:
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04.05.02.03/SR12 04.05.03.01/SR05

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04.04.03.02/SR13

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04.04.05.02/SR06 04.04.05.02/SR15 04.05.02.03/SR24 06.01.02/SR38
06.01.02/SR39

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04.04.04.02/SR06 04.04.04.02/SR18 04.04.04.02/SR24
04.05.01.02/SR03 04.05.01.02/SR06 04.05.01.02/SR07
04.05.02.03/SR24 05.01.02/SR04 05.03/SR16 06.01.02/SR38
06.01.02/SR39 06.02.02/SR05 06.02.02/SR13

#S 4.14/114/3:
04.04.03.03/SR05 04.04.03.03/SR08

#S 5.4.2/137/8:
04.04.03.02/SR26 04.04.03.02/SR27 04.04.03.03/SR04

#S 5.4.2/139/1:
04.04.03.03/SR07

#S 5.12.1/232/1:
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04.04.04.02/SR10 04.04.05.02/SR10 04.04.05.02/SR11
04.05.01.02/SR11

#S 6.1/306/7:
05.03/SR03 05.03/SR14

#S 6.2/309/1:
03.01/SR03 05.01.01/SR02

#S 6.2/309/2:
05.01.01/SR04 05.01.01/SR05

#S 6.3/310/1:
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06.01.02/SR39 06.01.02/SR43

#S 6.3/312/4:
06.01.02/SR38

#S 6.5/315/1:
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03.02/SR02 05.01.01/SR01

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06.03/SR15

#S 6.6/317/4:
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04.04.04.02/SR12 04.04.04.02/SR13 04.04.04.02/SR14
04.04.04.02/SR24 04.04.04.02/SR26 04.04.05.02/SR05
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04.05.01.02/SR09 04.05.01.02/SR10 04.05.02.03/SR06
04.05.02.03/SR07 04.05.02.03/SR08 04.05.02.03/SR09
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04.05.02.03/SR20 04.05.02.03/SR21 04.05.02.03/SR24 05.03/SR16
05.03/SR17 05.03/SR18

#S 6.7/325/1:
04.04.01.02/SR02 04.04.02.02/SR02 04.04.03.02/SR02
04.04.04.02/SR02 04.04.05.02/SR02 04.05.01.02/SR02
04.05.01.02/SR03 04.05.02.03/SR02 06.02.02/SR13

APPENDIX J

MODULE CROSS-REFERENCE

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#X   Module 01:
04.01.03/SR07

#X   Module 02.01.03.01:
02.01.01/SR05

#X   Module 02.01.03.02:
02.01.01/SR06

#X   Module 02.01.03.03:
02.01.01/SR07

#X   Module 02.02.01:
02.01.01/SR01

#X   Module 02.02.03:
02.01.02.01/SR06 02.01.02.01/SR07 02.01.02.02/SR11
02.01.02.02/SR12

#X   Module 02.02.04:
02.01.01/SR02

#X   Module 04.04.03.03:
02.03.03/SR15

#X   Module 04.04.04.02:
04.05.01.02/SR06 04.05.01.02/SR07

#X   Module 04.05.01.02:
04.04.04.02/SR18

#X   Module 04.05.02.01:
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04.04.04.02/SR30 04.04.05.02/SR24

#X   Module 04.05.04.01:
02.03.03/SR20
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#X   Module 05.01.02:
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04.04.04.02/SR08 04.04.04.02/SR09 04.04.05.02/SR08
04.04.05.02/SR09 04.05.01.02/SR09 04.05.01.02/SR10

#X   Module 05.02:
04.05.03.01/SR06 04.05.03.01/SR07 06.02.02/SR27 06.02.02/SR28
06.03/SR18 06.03/SR19

#X   Module 05.03:
02.01.01/SR04 02.01.02.01/SR04 02.01.02.02/SR10 02.01.03.01/SR01
02.01.03.02/SR05 02.01.03.02/SR06 02.01.03.03/SR01

#X   Module 06.01.02:
02.03.03/SR10
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The PHIGS Validation Tests (PVT), developed by NIST, consist of a large set of Fortran programs which may be used to test how well implementations of PHIGS conform to the standard. The tests are organized into a hierarchical structure of modules which corresponds to the conceptual overview of the standard. The tests are associated with the standard via a set of semantic requirements which are derived directly from the standard. Cross-reference tables allow the user to find tests relating to specific PHIGS functions and data structures. Directions for installation and operation of the tests are included.

12. KEY WORDS (6 TO 12 ENTRIES; ALPHABETICAL ORDER; CAPITALIZE ONLY PROPER NAMES; AND SEPARATE KEY WORDS BY SEMICOLONS)

Conformance testing; graphics standards; PHIGS; testing of software; validation of software.

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