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Ada* Compiler Validation Summary Report:

Compiler Name: AlsyCOMP_023, Version 3.5

Certificate Number: #880528N1.09064

Host:

IBM 370 3084Q
MVS
Version 3.2

Target:

IBM 370 3084Q
MVS
Version 3.2

Testing Completed 28 May 1988 Using ACVC 1.9

This report has been reviewed and is approved.

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Ada* COMPILER
VALIDATION SUMMARY REPORT:
Certificate Number: #880528N1.09064
ALSYS LTD
AlsyCOMP_023, Version 3.5
IBM 370 3084Q

Completion of On-site Testing:
28 May 1988

Prepared By:
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CHAPTER 1

INTRODUCTION

This Validation Summary Report (VSR) describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability (ACVC). An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard.

Even though all validated Ada Compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report.

The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. The purpose of validating is to ensure conformity of the compiler to the Ada Standard by testing that the compiler properly implements legal language constructs and that it identifies and rejects illegal language constructs. The testing also identifies behaviour that is implementation dependent but permitted by the Ada Standard. Six classes of tests are used. These tests are designed to perform checks at compile time, at link time, and during execution.

INTRODUCTION

1.1 PURPOSE OF THIS VALIDATION SUMMARY REPORT

This VSR documents the results of the validation testing performed on an Ada compiler. Testing was carried out for the following purposes:-

- . To attempt to identify any language constructs supported by the compiler that do not conform to the Ada Standard
- . To attempt to identify any language constructs not supported by the compiler but required by the Ada Standard
- . To determine that the implementation-dependent behaviour is allowed by the Ada Standard.

Testing of this compiler was conducted by NCC under the direction of the AVF according to procedures established by the Ada Joint Program Office and administered by the Ada Validation Organization (AVO). On-site testing was completed <STOP_DATES> at Alslys Ltd, Partridge House, Newtown Rd, Henley on Thames, Oxon.

1.2 USE OF THIS VALIDATION SUMMARY REPORT

Consistent with the national laws of the originating country, the AVO may make full and free public disclosure of this report. In the United States, this is provided in accordance with the "Freedom of Information Act" (5 U.S.C. #552). The results of this validation apply only to the computers, operating systems, and compiler versions identified in this report.

The organizations represented on the signature page of this report do not represent or warrant that all statements set forth in this report are accurate and complete, or that the subject compiler has no nonconformities to the Ada Standard other than those presented. Copies of this report are available to the public from:

Ada Information Clearinghouse
Ada Joint Program Office
OUSDRE
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or from:-

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Questions regarding this report or the validation test results should be directed to the AVF listed above or to:-

Ada Validation Organization
Institute for Defense Analyses
1801 North Beauregard Street
Alexandria VA 22311

1.3 REFERENCES

1. Reference Manual for the Ada Programming Language, ANSI/MIL-STD-1815A, February 1983 and ISO 8652-1987.
2. Ada Compiler Validation Procedures and Guidelines, Ada Joint Program Office, 1 January 1987.
3. Ada Compiler Validation Capability Implementers' Guide, SofTech, Inc., December 1986.
4. Ada Compiler Validation Capability User's Guide, December 1986.

1.4 DEFINITION OF TERMS

ACVC	The Ada Compiler Validation Capability. The set of Ada programs that tests the conformity of an Ada compiler to the Ada programming language.
Ada	An Ada Commentary contains all information relevant to the point addressed by a comment on the Ada Standard. These comments are given a unique identification number having the form AI-ddddd.
Ada Standard	ANSI/MIL-STD-1815A, February 1983 and ISO 8652-1987.
Applicant	The agency requesting validation.
AVF	The Ada Validation Facility. The AVF is responsible for conducting compiler validations according to procedures contained in the Ada Validation Procedures and Guidelines.
AVO	The Ada Validation Organization. The AVO has oversight authority over all AVF practices for the purpose of maintaining a uniform process for validation of Ada compilers. The AVO provides administrative and technical support for Ada validations to ensure consistent practices.
Compiler	A processor for the Ada language. In the context of this report, a compiler is any language processor, including cross-compilers, translators, and interpreters.
Failed test	An ACVC test for which the compiler generates a result that demonstrates nonconformity to the Ada Standard.
Host	The computer on which the compiler resides.
Inapplicable test	An ACVC test that uses features of the language that a compiler is not required to support or may legitimately support in a way other than the one expected by the test.
Passed test	An ACVC test for which a compiler generates the expected result.
Target	The computer for which a compiler generates code.

INTRODUCTION

Test	A program that checks a compiler's conformity regarding a particular feature or a combination of features to the Ada Standard. In the context of this report, the term is used to designate a single test, which may comprise one or more files.
Withdrawn test	An ACVC test found to be incorrect and not used to check conformity to the Ada Standard. A test may be incorrect because it has an invalid test objective, fails to meet its test objective, or contains illegal or erroneous use of the language.

1.5 ACVC TEST CLASSES

Conformity to the Ada Standard is measured using the ACVC. The ACVC contains both legal and illegal Ada programs structured into six test classes: A, B, C, D, E, and L. The first letter of a test name identifies the class to which it belongs. Class A, C, D, and E tests are executable, and special program units are used to report their results during execution. Class B tests are expected to produce compilation errors. Class L tests are expected to produce compilation or link errors.

Class A tests check that legal Ada programs can be successfully compiled and executed. There are no explicit program components in a Class A test to check semantics. For example, a Class A test checks that reserved words of another language (other than those already reserved in the Ada language) are not treated as reserved words by an Ada compiler. A Class A test is passed if no errors are detected at compile time and the program executes to produce a PASSED message.

Class B tests check that a compiler detects illegal language usage. Class B tests are not executable. Each test in this class is compiled and the resulting compilation listing is examined to verify that every syntax or semantic error in the test is detected. A Class B test is passed if every illegal construct that it contains is detected by the compiler.

Class C tests check that legal Ada programs can be correctly compiled and executed. Each Class C test is self-checking and produces a PASSED, FAILED, or NOT APPLICABLE message indicating the result when it is executed.

Class D tests check the compilation and execution capacities of a compiler. Since there are no capacity requirements placed on a compiler by the Ada Standard for some parameters--for example, the number of identifiers permitted in a compilation or the number of units in a library--a compiler may refuse to compile a Class D test and still be a conforming compiler. Therefore, if a Class D test fails to

INTRODUCTION

compile because the capacity of the compiler is exceeded, the test is classified as inapplicable. If a Class D test compiles successfully, it is self-checking and produces a PASSED or FAILED message during execution.

Each Class E test is self-checking and produces a NOT APPLICABLE PASSED, or FAILED message when it is compiled and executed. However, the Ada Standard permits an implementation to reject programs containing some features addressed by Class E tests during compilation. Therefore, a Class E test is passed by a compiler if it is compiled successfully and executes to produce a PASSED message, or if it is rejected by the compiler for an allowable reason.

Class L tests check that incomplete or illegal Ada programs involving multiple, separately compiled units are detected and not allowed to execute. Class L tests are compiled separately and execution is attempted. A Class L test passes if it is rejected at link time--that is, an attempt to execute the main program must generate an error message before any declarations in the main program or any units referenced by the main program are elaborated.

Two library units, the package REPORT and the procedure CHECK_FILE, support are self-checking features of the executable tests. The package REPORT provides the mechanism by which executable tests report PASSED, FAILED, or NOT APPLICABLE results. It also provides a set of identity functions used to defeat some compiler optimizations allowed by the Ada Standard that would circumvent a test objective. The procedure CHECK_FILE is used to check the contents of text files written by some of the Class C tests for chapter 14 of the Ada Standard. The operation of REPORT and CHECK_FILE is checked by a set of executable tests. These tests produce messages that are examined to verify that the units are operating correctly. If these units are not operating correctly, then the validation is not attempted.

The text of the tests in the ACVC follow conventions that are intended to ensure that the tests are reasonably portable without modification. For example, the tests make use of only the basic set of 55 characters, contain lines with a maximum length of 72 characters, use small numeric values, and place features that may not be supported by all implementations in separate tests. However, some tests contain values that require the test to be customized according to implementation-specific values--for example, an illegal file name. A list of the values used for this validation is provided in Appendix C.

A compiler must correctly process each of the tests in the suite and demonstrate conformity to the Ada Standard by either meeting the pass criteria given for the test or by showing that the test is inapplicable to the implementation. The applicability of a test to an implementation is considered each time the implementation is validated.

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A test that is inapplicable for one validation is not necessarily inapplicable for a subsequent validation. Any test that was determined to contain an illegal language construct or an erroneous language construct is withdrawn from the ACVC and, therefore, is not used in testing a compiler. The tests withdrawn at the time of this validation are given in Appendix D.

CHAPTER 2

CONFIGURATION INFORMATION

2.1 CONFIGURATION TESTED

The candidate compilation system for this validation was tested under the following configuration:

Compiler: AlsyCOMP_023, Version 3.5

ACVC Version: 1.9

Certificate Number: #880528N1.09064

Host Computer:

Machine: IBM 370 3084Q

Operating System: MVS
Version 3.2

Memory Size: 6MB partition

Target Computer:

Machine: IBM 370 3084Q

Operating System: MVS
Version 3.2

Memory Size: 1MB partition

CONFIGURATION INFORMATION

2.2 IMPLEMENTATION CHARACTERISTICS

One of the purposes of validating compilers is to determine the behaviour of a compiler in those areas of the Ada Standard that permit implementations to differ. Class D and E tests specifically check for such implementation differences. However, tests in other classes also characterize an implementation. The tests demonstrate the following characteristics:

- . Capacities.

The compiler correctly processes tests containing loop statements nested to 65 levels, block statements nested to 65 levels, and recursive procedures separately compiled as subunits nested to 17 levels. It correctly processes a compilation containing 723 variables in the same declarative part. (See tests D55A03A..H (8 tests), D56001B, D64005E..G (3 tests), and D20002K.)

- . Universal integer calculations.

An implementation is allowed to reject universal integer calculations having values that exceed `SYSTEM.MAX_INT`. This implementation processes 64 bit integer calculations. (See tests D4A002A, D4A002B, D4A004A, and D4A004B.)

- . Predefined types.

This implementation supports the additional predefined types `SHORT_INTEGER`, `SHORT_FLOAT`, and `LONG_FLOAT`, in the package `STANDARD`. (See tests B86001C and B86001D.)

- . Based literals.

An implementation is allowed to reject a based literal with a value exceeding `SYSTEM.MAX_INT` during compilation, or it may raise `NUMERIC_ERROR` or `CONSTRAINT_ERROR` during execution. This implementation raises `NUMERIC_ERROR` during execution. (See test E24101A.)

CONFIGURATION INFORMATION

. Expression evaluation.

Apparently some default initialization expressions for record components are evaluated before any value is checked to belong to a component's subtype. (See test C32117A.)

Assignments for subtypes are performed with the same precision as the base type. (See test C35712B.)

This implementation uses no extra bits for extra precision. This implementation uses all extra bits for extra range. (See test C35903A.)

Apparently `NUMERIC_ERROR` is raised when an integer literal operand in a comparison or membership test is outside the range of the base type. (See test C45232A.)

Sometimes `NUMERIC_ERROR` is raised when a literal operand in a fixed-point comparison or membership test is outside the range of the base type. (See test C45252A.)

Apparently underflow is not gradual. (See tests C45524A..Z.)

. Rounding.

The method used for rounding to integer is apparently round away from zero (See tests C46012A..Z.)

The method used for rounding to longest integer is apparently round away from zero (See tests C46012A..Z.)

The method used for rounding to integer in static universal real expressions is apparently round away from zero. (See test C4A014A.)

. Array types.

An implementation is allowed to raise `NUMERIC_ERROR` or `CONSTRAINT_ERROR` for an array having a `'LENGTH` that exceeds `STANDARD.INTEGER'LAST` and/or `SYSTEM.MAX_INT`. For this implementation:

Declaration of an array type or subtype declaration with more than `SYSTEM.MAX_INT` components raises `NUMERIC_ERROR`. (See test C36003A.)

CONFIGURATION INFORMATION

No exception is raised when 'LENGTH is applied to an array type with INTEGER'LAST + 2 components. NUMERIC_ERROR is raised when an array type with INTEGER'LAST + 2 components is declared. (See test C36202A.)

No exception is raised when 'LENGTH is applied to an array type with SYSTEM.MAX_INT + 2 components. NUMERIC_ERROR is raised when an array type with SYSTEM.MAX_INT + 2 components is declared. (See test C36202B.)

A packed BOOLEAN array having a 'LENGTH exceeding INTEGER'LAST raises NUMERIC_ERROR when the array type is declared. (See test C52103X).

A packed two-dimensional BOOLEAN array with more than INTEGER'LAST components raises NUMERIC_ERROR when the array type is declared. (See test C52104Y.)

A null array with one dimension of length greater than INTEGER'LAST may raise NUMERIC_ERROR or CONSTRAINT_ERROR either when declared or assigned. Alternatively, an implementation may accept the declaration. However, lengths must match in array slice assignments. This implementation raises NUMERIC_ERROR when the array type is declared. (See test E52103Y.)

In assigning one-dimensional array types, the expression appears to be evaluated in its entirety before CONSTRAINT_ERROR is raised when checking whether the expression's subtype is compatible with the target's subtype. In assigning two-dimensional array types, the expression does not appear to be evaluated in its entirety before CONSTRAINT_ERROR is raised when checking whether the expression's subtype is compatible with the target's subtype. (See test C52013A.)

Discriminated types.

During compilation, an implementation is allowed to either accept or reject an incomplete type with discriminants that is used in an access type definition with a compatible discriminant constraint. This implementation accepts such subtype indications. (See test E38104A.)

In assigning record types with discriminants, the expression appears to be evaluated in its entirety before CONSTRAINT_ERROR is raised when checking whether the expression's subtype is compatible with the target's subtype. (See test C52013A.)

CONFIGURATION INFORMATION

. Aggregates.

In the evaluation of a multi-dimensional aggregate, all choices appear to be evaluated before checking against the index type . (See tests C43207A and C43207B.)

In the evaluation of an aggregate containing subaggregates, not all choices are evaluated before being checked for identical bounds. (See test E43212B.)

All choices are evaluated before CONSTRAINT_ERROR is raised if a bound in a non-null range of a non-null aggregate does not belong to an index subtype. (See test E43211B.)

. Representation clauses.

An implementation might legitimately place restrictions on representation clauses used by some of the tests. If a representation clause is used by a test in a way that violates a restriction, then the implementation must reject it.

Enumeration representation clauses containing noncontiguous values for enumeration types other than character and boolean types are supported. (See tests C35502I..J, C35502M..N, and A39005F.)

Enumeration representation clauses containing noncontiguous values for character types are supported. (See tests C35507I..J, C35507M..N, and C55B16A.)

Enumeration representation clauses for boolean types containing representational values other than (FALSE => 0, TRUE => 1) are supported. (See tests C35508I..J and C35508M..N.)

Length clauses with SIZE specifications for enumeration types are supported. (See test A39005B.)

Length clauses with STORAGE_SIZE specifications for access types are supported. (See tests A39005C and C87B62B.)

Length clauses with STORAGE_SIZE specifications for task types are supported. (See tests A39005D and C87B62D.)

Length clauses with SMALL specifications are supported. (See tests A39005E and C87B62C.)

CONFIGURATION INFORMATION

Record representation clauses are supported to the byte level only. (See test A39005G.)

Length clauses with SIZE specifications for derived integer types are supported. (See test C87B62A.)

Pragmas.

The pragma `INLINE` is supported for procedure and function calls from within a body. The pragma `INLINE` for function calls within a declaration is not supported. (See tests LA3004A, LA3004B, EA3004C, EA3004D, CA3004E, and CA3004F.)

Input/output.

The package `SEQUENTIAL_IO` can be instantiated with unconstrained array types and record types with discriminants without defaults. (See tests AE2101C, EE2201D, and EE2201E.)

The package `DIRECT_IO` cannot be instantiated with unconstrained array types and record types with discriminants without defaults. (See tests AE2101H, EE2401D, and EE2401G.)

Modes `IN_FILE` and `OUT_FILE` are supported for `SEQUENTIAL_IO`. (See tests CE2102D and CE2102E.)

Modes `IN_FILE`, `OUT_FILE`, and `INOUT_FILE` are supported for `DIRECT_IO`. (See tests CE2102F, CE2102I, and CE2102J.)

`RESET` and `DELETE` are supported for `SEQUENTIAL_IO` and `DIRECT_IO`. (See tests CE2102G and CE2102K.)

Dynamic creation and deletion of files are supported for `SEQUENTIAL_IO` and `DIRECT_IO`. (See tests CE2106A and CE2106B.)

Overwriting to a sequential file truncates the file to last element written. (See test CE2208B.)

CONFIGURATION INFORMATION

An existing text file can be opened in `OUT_FILE` mode, can be created in `OUT_FILE` mode, and can be created in `IN_FILE` mode. (See test EE3102C.)

More than one internal file can be associated with each external file for text I/O for reading only. (See tests CE3111A..E (5 tests), CE3114B, and CE3115A.)

More than one internal file can be associated with each external file for sequential I/O for reading only. (See tests CE2107A..D (4 tests), CE2110B, and CE2111D.)

More than one internal file can be associated with each external file for direct I/O for reading only. (See tests CE2107F..I (5 tests), CE2110B, and CE2111H.)

An internal sequential access file and an internal direct access file cannot be associated with a single external file for writing. (See test CE2107E.)

An external file associated with more than one internal file cannot be deleted for `SEQUENTIAL_IO`, `DIRECT_IO`, and `TEXT_IO`. (See test CE2110B.)

Temporary sequential files are given names. Temporary direct files are given names. Temporary files given names are deleted when they are closed. (See tests CE2108B and CE2108C.)

. Generics.

Generic subprogram declarations and bodies can be compiled in separate compilations. (See tests CA1012A and CA2009F.)

Generic package declarations and bodies can be compiled in separate compilations. (See tests CA2009C, BC3204C, and BC3205D.)

Generic unit bodies and their subunits can be compiled in separate compilations. (See test CA3011A.)

CHAPTER 3
TEST INFORMATION

3.1 TEST RESULTS

Version 1.9 of the ACVC comprises 3122 tests. When this compiler was tested, 27 tests had been withdrawn because of test errors. The AVF determined that 203 tests were inapplicable to this implementation. All inapplicable tests were processed during validation testing except for 159 executable tests that use floating-point precision exceeding that supported by the implementation. Modifications to the code, processing, or grading for 23 tests were required to successfully demonstrate the test objective. (See section 3.6.)

The AVF concludes that the testing results demonstrate acceptable conformity to the Ada Standard.

3.2 SUMMARY OF TEST RESULTS BY CLASS

RESULT	TEST CLASS						TOTAL
	A	B	C	D	E	L	
Passed	108	1048	1657	17	16	46	2892
Inapplicable	2	3	196	0	2	0	203
Withdrawn	3	2	21	0	1	0	27
TOTAL	113	1053	1874	17	19	46	3122

TEST INFORMATION

3.3 SUMMARY OF TEST RESULTS BY CHAPTER

RESULT	CHAPTER														TOTAL
	2	3	4	5	6	7	8	9	10	11	12	13	14		
Passed	193	515	563	245	166	98	141	327	137	36	234	3	234	2892	
Inapplicable	11	57	111	3	0	0	2	0	0	0	0	0	19	203	
Withdrawn	2	14	3	0	0	1	2	0	0	0	2	1	2	27	
TOTAL	206	586	677	248	166	99	145	327	137	36	236	4	255	3122	

3.4 WITHDRAWN TESTS

The following 27 tests were withdrawn from ACVC Version 1.9 at the time of this validation:

B28003A	C35904A	C37215C	C41402A	CC1311B
	C35904B		C45332A	
E28005C	C35A03E	C37215E	C45614C	BC3105A
C34004A	C35A03R	C37215G	A74016C	AD1A01A
C35502P	C37213H	C37215H	C85018B	CE2401H
A35902C	C37213J	C38102C	C87B04B	CE3208A

3.5 INAPPLICABLE TESTS

Some tests do not apply to all compilers because they make use of features that a compiler is not required by the Ada Standard to support. Others may depend on the result of another test that is either inapplicable or withdrawn. The applicability of a test to an implementation is considered each time a validation is attempted. A test that is inapplicable for one validation attempt is not necessarily inapplicable for a subsequent attempt. For this validation attempt, 203 tests were inapplicable for the reasons indicated:

- A39005G uses a record representation clause at the bit level. This compiler only supports such clauses to the byte level.

TEST INFORMATION

- . The following tests use LONG_INTEGER, which is not supported by this compiler:

C45231C	C45304C	C45502C	C45503C	C45504C
C45504F	C45611C	C45613C		C45631C
C45632C	B52004D	C55B07A	B55B09C	

- . C45231D requires a macro substitution for any predefined numeric types other than INTEGER, SHORT_INTEGER, LONG_INTEGER, FLOAT, SHORT_FLOAT, and LONG_FLOAT. This compiler does not support any such types.
- . C45531M, C45531N, C45532M, and C45532N use fine 48-bit fixed-point base types which are not supported by this compiler.
- . C45531O, C45531P, C45532O, and C45532P use coarse 48-bit fixed-point base types which are not supported by this compiler.
- . B86001D requires a predefined numeric type other than those defined by the Ada language in package STANDARD. There is no such type for this implementation.
- . C86001F redefines package SYSTEM, but TEXT_IO is made obsolete by this new definition in this implementation and the test cannot be executed since the package REPORT is dependent on the package TEXT_IO.
- . AE2101H, EE2401D, and EE2401G use instantiations of package DIRECT_IO with unconstrained array types and record types having discriminants without defaults. These instantiations are rejected by this compiler.
- . CE2107B..E (4 tests), CE2107G..I (3 tests), CE2110B, CE2111D, CE2111H, CE3111B..E (4 tests), CE3114B, and CE3115A are inapplicable because multiple internal files cannot be associated with the same external file when one file is open for writing. The proper exception is raised when multiple access is attempted.
- . The following 159 tests require a floating-point accuracy that exceeds the maximum of 18 digits supported by this implementation:

C241130..Y (11 tests)	C357050..Y (11 tests)
C357060..Y (11 tests)	C357070..Y (11 tests)
C357080..Y (11 tests)	C358020..Z (12 tests)
C452410..Y (11 tests)	C453210..Y (11 tests)
C454210..Y (11 tests)	C455210..Z (12 tests)
C455240..Z (12 tests)	C456210..Z (12 tests)
C456410..Y (11 tests)	C460120..Z (12 tests)

TEST INFORMATION

3.6 TEST, PROCESSING, AND EVALUATION MODIFICATIONS

It is expected that some tests will require modifications of code, processing, or evaluation in order to compensate for legitimate implementation behaviour. Modifications are made by the AVF in cases where legitimate implementation behaviour prevents the successful completion of an (otherwise) applicable test. Examples of such modifications include: adding a length clause to alter the default size of a collection; splitting a Class B test into subtests so that all errors are detected; and confirming that messages produced by an executable test demonstrate conforming behaviour that wasn't anticipated by the test (such as raising one exception instead of another).

Modifications were required for 16 Class B tests, 6 Class C tests, and 1 Class E tests.

The following Class B tests were split because syntax errors at one point resulted in the compiler not detecting other errors in the test:

B24007A	B24009A	B32202A	B32202B	B32202C
B33001A	B37004A	B45102A	B61012A	B62001B
B62001C	B62001D	B91004A	B95069A	B95069B
BC3205C				

The following tests have modified evaluation criteria as specified by the AVO. The tests require that attribute 'STORAGE_SIZE' return a value that is greater than 1 when applied to a (derived) access type; but this requirement is challenged and before the ALMP for resolution. The tests were, therefore, considered to have passed by indicating the failure message "INCORRECT 'STORAGE SIZE'" and no other.

C34007A	C34007D	C34007G	C34007M	C34007P
C34007S				

EA3004D, when processed, produces only two of the expected three errors: the implementation fails to detect an error on line 27 of file EA3004D6M. This is because the pragma `INLINE` has no effect when its object is within a package specification. AFTER file D5 (the re-compilation of the "with"ed package that makes the various earlier units obsolete), the re-ordered test executed and produced the expected `NOT_APPLICABLE` result (as though `INLINE` were not supported at all). The re-ordering of EA3004D test files was: 0-1-4-5-2-3-6. The AVO ruled that the test should be counted as passed.

3.7 ADDITIONAL TESTING INFORMATION

3.7.1 Prevalidation

Prior to validation, a set of test results for ACVC Version 1.9 produced by the AlsyCOMP_023 was submitted to the AVF by the applicant for review. Analysis of these results demonstrated that the compiler successfully passed all applicable tests, and the compiler exhibited the expected behaviour on all inapplicable tests.

3.7.2 Test Method

Testing of the AlsyCOMP_23 using ACVC Version 1.9 was conducted on-site by a validation team from the AVF. The configuration consisted of a IBM 370 3084Q operating under MVS, Version 3.2.

A Magnetic Tape containing all tests was taken on-site by the validation team for processing. Tests that make use of implementation-specific values were customized before being written to the Magnetic Tape. Tests requiring modifications during the pre-validation testing were not included in their modified form on the Magnetic Tape.

The contents of the Magnetic Tape were not loaded directly onto the host computer. Instead the magnetic tape was loaded onto a DEC VAX 750 computer running VMS 4.7, where required modifications were performed by use of the DEC EDT editor driven by command scripts. From the VAS the modified sources were transferred via Ethernet to a SUN 3/160 computer running BSD 4.2 Unix, where a new magnetic tape in IBM format was produced. The tape was then loaded onto an IBM 370 3081K running VM/CMS 3.1.

The IBM 370 3081K machine was used to control the validation process, by submitting batch jobs to the MVS 3.2 system running on an IBM 370 3084Q and retrieving the output of these jobs. The process was controlled by command scripts to submit sources and associated JCL to compile, bind, link and execute tests, using between 4 and 7 simultaneous batch streams on a single host computer. Once a test completed, its output was returned to the CMS system and processed by scripts that made the output easier to understand.

Listings were written to magnetic tapes in CMS dump format which were loaded onto the SUN 3/160 system. Run results were transferred to the SUN system via a SUN file transfer program IBM FTP. The test outputs, compilation listings, etc, were transferred from the SUN 3/160 via Ethernet to the DEC VAX 750. Results were printed from the VAX 750 for examination on-site by the validation team.

TESTING INFORMATION

The compiler was tested using command scripts provided by Alsys Limited and reviewed by the validation team. The compiler was tested using all default option settings except for the following:

Option Switch	Effect
PAGE_LENGTH = 45	Control length of compiler listing pages
PAGE_WIDTH = 132	Control width of compiler listing pages
ERRORS = 999	Control number of errors detected before compiler aborts
TEXT	Include full source code in listing

Tests were compiled, linked, and executed (as appropriate) using a single host computer. Test output, compilation listings, and job logs were captured on Magnetic Tape and archived at the AVF. The listings examined on-site by the validation team were also archived.

3.7.3 Test Site

Testing was conducted at Alsys Ltd, Partridge House, Newtown Rd, Henley on Thames and was completed on 28 May 1988.

APPENDIX A
DECLARATION OF CONFORMANCE

Alsys Limited has submitted the following Declaration of Conformance concerning the AlsyCOMP_023.

DECLARATION OF CONFORMANCE

DECLARATION OF CONFORMANCE

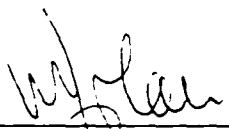
Compiler Implementor: Alsys Ltd
Ada* Validation Facility: The National Computing Centre Ltd
Ada Compiler Validation Capability (ACVC) Version: 1.9

Base Configuration

Base Compiler Name: AlsyCOMP_023	Version: 3.5
Host Architecture ISA: IBM 370 3084Q	OS&VER #: MVS 3.2
Target Architecture ISA: IBM 370 3084Q	OS&VER #: MVS 3.2

Implementor's declaration

I, the undersigned, representing Alsys Ltd, have implemented no deliberate extensions to the Ada Language Standard ANSI/MIL-STD-1815A in the compiler(s) listed in this declaration. I declare that Alsys Ltd is the owner of record of the Ada language compiler(s) listed above and, as such, is responsible for maintaining said compiler(s) in conformance to ANSI/MIL-STD 1815A. All certificates and registrations for Ada language compiler(s) listed in this declaration shall be made only in the owner's corporate name.

 _____ Date: 29th May 1988

Alsys Limited

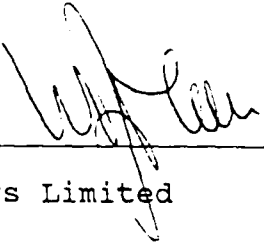
M L J Jordan, Marketing Director

*Ada is a registered trademark of the United States Government (Ada Joint Program Office).

DECLARATION OF CONFORMANCE

Owner's Declaration

I, the undersigned, representing Alsys Ltd, take full responsibility for the implementation and maintenance of the Ada compiler(s) listed above, and agree to the public disclosure of the final Validation Summary Report. I further agree to continue to comply with the Ada trademark policy, as defined by the Ada Joint Program Office. I declare that all of the Ada language compilers listed, and their host/target performance, are in compliance with the Ada Language Standard ANSI/MIL-STD-1815A.



Date: 23rd May 1983

Alsys Limited

M L J Jordan, Marketing Director

APPENDIX B

APPENDIX F OF THE Ada STANDARD

The only allowed implementation dependencies correspond to implementation-dependent pragmas, to certain machine-dependent conventions as mentioned in chapter 13 of the Ada Standard, and to certain allowed restrictions on representation clauses. The implementation-dependent characteristics of the AlsyCOMP 23 Version 3.5 are described in the following sections, which discuss topics in Appendix F of the Ada Standard. Implementation-specific portions of the package STANDARD are also included in this appendix.

package STANDARD is

...

type INTEGER is range -2147483648 .. 2147483647;
type SHORT_INTEGER is range -32768 .. 32767;

type FLOAT is digits 15 range $-(1.0-2.0^{**}-56)*2.0^{**}252..$
 $(1.0-2.0^{**}-56)*2.0^{**}252$

type SHORT_FLOAT is digits 6 range $-(1.0-2.0^{**}24)*2.0^{**}252$

type LONG_FLOAT is digits 18 range $-(1.0-2.0^{**}112)*2.0^{**}252..$
 $(1.0-2.0^{**}112)*2.0^{**}252;$

type DURATION is delta 1.0E-4 range -86400.0 .. 864.0;

...

end STANDARD;

Alsys IBM 370 Ada* Compiler

APPENDIX F
for VM/CMS and MVS
Implementation - Dependent Characteristics

Version 3.5

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PREFACE

This *Alsys IBM 370 Ada Compiler Appendix F* is for programmers, software engineers, project managers, educators and students who want to develop an Ada program for any IBM System/370 processor that runs either VM/CMS or MVS.

This appendix is a required part of the *Reference Manual for the Ada Programming Language*, ANSI/MIL-STD 1815A, February 1983 (throughout this appendix, citations in square brackets refer to this manual). It assumes that the user is already familiar with the CMS and MVS operating systems, and has access to the following IBM documents:

CMS User Guide, Release 3, SC19-6210

CMS Command and Macro Reference, Release 3, SC19-6209

OS/VS2 MVS Overview, GC28-0984

OS/VS2 System Programming Library: Job Management, GC28-1303

OS/VS2 MVS JCL, GC28-1350

IBM System/370 Principles of Operation, GA22-7000

IBM System/370 System Summary, GA22-7001

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APPENDIX F

Implementation-Dependent Characteristics

This appendix summarises the implementation-dependent characteristics of the Aلسys IBM 370 Ada Compiler for both VM/CMS and MVS.

The sections of this appendix are as follows:

1. The form, allowed places, and effect of every implementation-dependent pragma.
2. The name and type of every implementation-dependent attribute.
3. The specification of the package SYSTEM.
4. The list of all restrictions on representation clauses.
5. The conventions used for any implementation-generated names denoting implementation-dependent components.
6. The interpretation of expressions that appear in address clauses, including those for interrupts.
7. Any restrictions on unchecked conversions.
8. Any implementation-dependent characteristics of the input-output packages.
9. Characteristics of numeric types.
10. Other implementation-dependent characteristics.

The name *Ada Run-Time Executive* refers to the run-time library routines provided for all Ada programs. These routines implement the Ada heap, exceptions, tasking, IO, and other utility functions.

1 Implementation-Dependent Pragas

Ada programs can interface to subprograms written in assembler or other languages through the use of the predefined pragma INTERFACE [13.9] and the implementation-defined pragma INTERFACE_NAME.

1.1 INTERFACE

Pragma INTERFACE specifies the name of an interfaced subprogram and the name of the programming language for which calling and parameter passing conventions will be generated. Pragma INTERFACE takes the form specified in the *Reference Manual*:

```
pragma INTERFACE (language_name, subprogram_name);
```

where

- *language_name* is the name of the other language whose calling and parameter passing conventions are to be used.
- *subprogram_name* is the name used within the Ada program to refer to the interfaced subprogram.

The only language name currently accepted by pragma INTERFACE is ASSEMBLER.

The language name used in the pragma INTERFACE does not necessarily correspond to the language used to write the interfaced subprogram. It is used only to tell the compiler how to generate subprogram calls, that is, which calling conventions and parameter passing techniques to use. ASSEMBLER is used to refer to the standard IBM 370 calling and parameter passing conventions. The programmer can use the language name ASSEMBLER to interface Ada subprograms with subroutines written in any language that follows the standard IBM 370 calling conventions.

Calling Conventions

The contents of the general purpose registers 12 and 13 must be left unchanged by the call. On entry to the subprogram, register 13 contains the address of a register save area provided by the caller.

Registers 15 and 14 contain the entry point address and return address, respectively, of the called subprogram.

The Ada Run-Time Executive treats any interruption occurring during the execution of the body of the subprogram as an exception being raised at the point of call of the subprogram. The exception raised following a program interruption in interfaced code is a `NUMERIC_ERROR` for the following cases:

- Fixed-pt overflow *
- Fixed-pt divide
- Decimal overflow *
- Decimal divide
- Exponent overflow
- Exponent underflow *
- Significance *
- Floating-pt divide

In other cases, `PROGRAM_ERROR` is raised. The classes of interruptions marked with an asterisk (*) may be masked by setting the program mask. Note that the program mask should be restored to its original value before returning to Ada code.

Parameter-Passing Conventions

On entry to the subprogram, register 1 contains the address of a parameter address list. Each word in this list is an address corresponding to a parameter. The last word in the list has its bit 0 (sign bit) set.

For actual parameters which are literal values, the address is that of a copy of the value of the parameter; for all other parameters it is the address of the parameter object. Interfaced subprograms have no notion of parameter modes; hence parameters whose addresses are passed are not protected from modification by the interfaced subprogram, even though they may be formally declared to be of mode in.

If the subprogram is a function, on exit register 0 is used to return the result. Scalar values are returned in register 0. Non-scalar values are returned by address in register 0.

No consistency checking is performed between the subprogram parameters declared in Ada and the corresponding parameters of the interfaced subprogram. It is the programmer's responsibility to ensure correct access to the parameters.

An example of an interfaced subprogram is:

```
* 64-bit integer addition: use an array rather than a record to
* represent the integer so as not to rely on record ordering if the
* components are accessed in Ada.
*
* type DOUBLE is array (1..2) of INTEGER;
* procedure ADD (LEFT, RIGHT : in DOUBLE;
*               RESULT      : out DOUBLE);
ADD  CSECT
      USING  ADD,15
      STM   2,6,12(13)
      L     2,0(1)   Address of LEFT
      LM   3,4,0(2)  Value of LEFT
      L     2,4(1)   Address of RIGHT
      AL   4,4(2)    Add low-order components (no interruption)
      BC   12,$1     Branch if no carry
      A    3,=F'1'   Add carry (NUMERIC_ERROR possible)
$1    A    3,0(2)    Add high-order (NUMERIC_ERROR possible)
      L     2,8(1)   Address of RESULT
      STM  3,4,0(2)  Value of result
      LM   2,6,12(13)
      BR   14
      LTORG
      DROP
      END
```

Parameter Representations

This section describes the representation of values of the types that can be passed as parameters to an interfaced subprogram.

Integer Types [3.5.4]

Ada integer types occupy 16 (SHORT_INTEGER) or 32 (INTEGER) bits.

Enumeration Types [3.5.1]

Values of an Ada enumeration type are represented internally as unsigned values representing their position in the list of enumeration literals defining the type. The first literal in the list corresponds to a value of zero.

Enumeration types with 256 elements or fewer are represented in 8 bits, those with more than 256 elements in 16 bits. The maximum number of values an enumeration type can include is 65536 (2^{16}).

The Ada predefined type CHARACTER [3.5.2] is represented in 8 bits, using the standard ASCII codes [C].

Floating Point Types [3.5.7, 3.5.8]

Ada floating-point values occupy 32 (SHORT_FLOAT), 64 (FLOAT) or 128 (LONG_FLOAT) bits, and are held in IBM 370 (short, long or extended floating point) format.

Fixed Point Types [3.5.9, 3.5.10]

Ada fixed-point types are managed by the Compiler as the product of a signed *mantissa* and a constant *small*. The mantissa is implemented as a 16 or 32 bit integer value. *Small* is a compile-time quantity which is the power of two equal or immediately inferior to the delta specified in the declaration of the type.

The attribute MANTISSA is defined as the smallest number such that:

$$2 ** MANTISSA \geq \max(\text{abs}(\text{upper_bound}), \text{abs}(\text{lower_bound})) / \text{small}$$

The size of a fixed point type is:

MANTISSA	Size
1 .. 15	16 bits
16 .. 31	32 bits

Fixed point types requiring a MANTISSA greater than 31 are not supported.

Access Types [3.8]

Values of access types are represented internally by the 31-bit address of the designated object held in a 32 bit word. Users should not alter the bits of this word which are ignored by the architecture on which the program is running. The value zero is used to represent **null**.

Array Types [3.6]

Ada arrays are passed by reference; the value passed is the address of the first element of the array. When an array is passed as a parameter to an interfaced subprogram, the usual consistency checking between the array bounds declared in the calling program and the subprogram is not enforced. It is the programmer's responsibility to ensure that the subprogram does not violate the bounds of the array.

Values of the predefined type STRING [3.6.3] are arrays, and are passed in the same way: the address of the first character in the string is passed. Elements of a string are represented in 8 bits, using the standard ASCII codes.

Record Types [3.7]

Ada records are passed by reference, by passing the address of the first component of the record. Components of a record are aligned on their natural boundaries (e.g. INTEGER on a four-byte boundary). If a record contains discriminants or components having a dynamic size, implicit components may be added to the record. Thus the exact internal structure of the record in memory may not be inferred directly from its Ada declaration.

Restrictions on Interfaced Subprograms

The Ada Run-Time Executive uses the SPIE (SVC 14) macro. Interfaced subprograms should avoid use of this facility, or else restore interruption processing to its original state before returning to the Ada program. Failure to do so may lead to unpredictable results.

Similarly, interfaced subprograms must not change the program mask in the Program Status Word (PSW) of the machine without restoring it before returning.

1.2 INTERFACE_NAME

Pragma `INTERFACE_NAME` associates the name of an interfaced subprogram, as declared in Ada, with its name in the language of origin. If pragma `INTERFACE_NAME` is not used, then the two names are assumed to be identical. This pragma takes the form

```
pragma INTERFACE_NAME (subprogram_name, string_literal);
```

where

- *subprogram_name* is the name used within the Ada program to refer to the interfaced subprogram.
- *string_literal* is the name by which the interfaced subprogram is referred to at link-time.

The use of `INTERFACE_NAME` is optional, and is not needed if a subprogram has the same name in Ada as in the language of origin. It is useful, for example, if the name of

the subprogram in its original language contains characters that are not permitted in Ada identifiers. Ada identifiers can contain only letters, digits and underscores, whereas the IBM 370 linkage editor/loader allows external names to contain other characters, e.g. the plus or minus sign. These characters can be specified in the *string_literal* argument of the pragma `INTERFACE_NAME`.

The pragma `INTERFACE_NAME` is allowed at the same places of an Ada program as the pragma `INTERFACE` [13.9]. However, the pragma `INTERFACE_NAME` must always occur after the pragma `INTERFACE` declaration for the interfaced subprogram.

In order to conform to the naming conventions of the IBM 370 linkage editor/loader, the link-time name of an interfaced subprogram will be truncated to 8 characters and converted to upper case.

Example

```
package SAMPLE_DATA is
    function SAMPLE_DEVICE (X : INTEGER) return INTEGER;
    function PROCESS_SAMPLE (X : INTEGER) return INTEGER;
private
    pragma INTERFACE (ASSEMBLER, SAMPLE_DEVICE);
    pragma INTERFACE (ASSEMBLER, PROCESS_SAMPLE);
    pragma INTERFACE_NAME (PROCESS_SAMPLE, "PSAMPLE");
end SAMPLE_DATA;
```

1.3 INDENT

This pragma is only used with the Alsys Reformatter; this tool offers the functionalities of a source reformatter in an Ada environment.

The pragma is placed in the source file and interpreted by the Reformatter.

```
pragma INDENT(OFF)
```

The Reformatter does not modify the source lines after the OFF pragma `INDENT`.

```
pragma INDENT(ON)
```

The Reformatter resumes its action after the ON pragma `INDENT`. Therefore any source lines that are bracketed by the OFF and ON pragma `INDENTs` are not modified by the Alsys Reformatter.

1.4 Other Pragmas

No other implementation-dependent pragmas are supported in the current version of this compiler.

2 Implementation-Dependent Attributes

In addition to the Representation Attributes of [13.7.2] and [13.7.3], there are the four attributes listed in section 5 (Conventions for Implementation-Generated Names), for use in record representation clauses, and the attribute described below.

T'DEScriptor_SIZE Yields the size (in bits) required to hold a descriptor for an object of type T, allocated on the heap or written to a file. If T is constrained, T'DEScriptor_SIZE will yield 0.

Limitations on the use of the attribute ADDRESS

The attribute ADDRESS is implemented for all prefixes that have meaningful addresses. The following entities do not have meaningful addresses and will therefore cause a compilation error if used as a prefix to ADDRESS:

- A constant that is implemented as an immediate value i.e. does not have any space allocated for it.
- A package specification that is not a library unit.
- A package body that is not a library unit or subunit.

3 Specification of the Package SYSTEM

package SYSTEM is

```
type NAME is (IBM_370);

SYSTEM_NAME : constant NAME := NAME'FIRST;
MIN_INT      : constant := -(2**31);
MAX_INT      : constant := 2**31-1;
MEMORY_SIZE  : constant := 2**24;

type ADDRESS is range MIN_INT .. MAX_INT;

STORAGE_UNIT : constant := 8;
MAX_DIGITS    : constant := 18;
MAX_MANTISSA  : constant := 31;
FINE_DELTA    : constant := 2#1.0#e-31;
TICK          : constant := 0.01;
NULL_ADDRESS  : constant ADDRESS := 0;

subtype PRIORITY is INTEGER range 1 .. 10;

-- These subprograms are provided to perform
-- READ/WRITE operations in memory.
```

```

generic
  type ELEMENT_TYPE is private;
function FETCH (FROM : ADDRESS) return ELEMENT_TYPE;

generic
  type ELEMENT_TYPE is private;
procedure STORE (INTO : ADDRESS; OBJECT : ELEMENT_TYPE);

end SYSTEM;

```

The generic function `FETCH` may be used to read data objects from given addresses in store. The generic procedure `STORE` may be used to write data objects to given addresses in store.

4 Restrictions on Representation Clauses

This version of the Alsys IBM 370 Ada Compiler supports representation clauses [13.1] with the following exceptions:

- There is no bit level implementation for any of the representation clauses.
- Address clauses are not supported.
- Changes of representation for `RECORD` types are not implemented.
- Machine code insertions are not supported.
- For the length clause:
 - Size specification: `T'SIZE` is not implemented for types declared in a generic unit.
 - Specification of *small* for a fixed point type: `T'SMALL` is restricted to a power of 2, and the absolute value of the exponent must be less than 31.
- The Enumeration Clause is not allowed if there is a range constraint on the parent subtype.
- The Record Clause is not allowed for a derived record type.
- The pragma `PACK` [13.1] is also not supported. However, its presence in a program does not in itself make the program illegal; the Compiler will simply issue a warning message and ignore the pragma.

5 Conventions for Implementation-Generated Names

Special record components are introduced by the compiler for certain record type definitions. Such record components are implementation-dependent; they are used by the compiler to improve the quality of the generated code for certain operations on the record types. The existence of these components is established by the compiler depending on implementation-dependent criteria. Attributes have been defined for

referring to them in record representation clauses. An error message is issued by the compiler if the user refers to an implementation-dependent attribute that does not exist. If the implementation-dependent component exists, the compiler checks that the storage location specified in the component clause is compatible with the treatment of this component and the storage locations of other components. An error message is issued if this check fails.

There are four such attributes:

T'RECORD_SIZE For a prefix T that denotes a record type. This attribute refers to the record component introduced by the compiler in a record to store the size of the record object. This component exists for objects of a record type with defaulted discriminants when the sizes of the record objects depend on the values of the discriminants.

T'VARIANT_INDEX For a prefix T that denotes a record type. This attribute refers to the record component introduced by the compiler in a record to assist in the efficient implementation of discriminant checks. This component exists for objects of a record type with variant type.

C'ARRAY_DESCRIPTOR For a prefix C that denotes a record component of an array type whose component subtype definition depends on discriminants. This attribute refers to the record component introduced by the compiler in a record to store information on subtypes of components that depend on discriminants.

C'RECORD_DESCRIPTOR For a prefix C that denotes a record component of a record type whose component subtype definition depends on discriminants. This attribute refers to the record component introduced by the compiler in a record to store information on subtypes of components that depend on discriminants.

6 Address Clauses

Address clauses [13.5] are not supported in this version of the Alsys IBM 370 Ada Compiler.

7 Restrictions on Unchecked Conversions

Unchecked conversions [13.10.2] are allowed only between types which have the same value for their 'SIZE attribute.

8 Input-Output Packages

The predefined input-output packages `SEQUENTIAL_IO` [14.2.3], `DIRECT_IO` [14.2.5], and `TEXT_IO` [14.3.10] are implemented as described in the Language Reference Manual, as is the package `IO_EXCEPTIONS` [14.5], which specifies the exceptions that can be raised by the predefined input-output packages.

The package `LOW_LEVEL_IO` [14.6], which is concerned with low-level machine-dependent input-output, has not been implemented.

8.1 VM/CMS

8.1.1 Specifying External Files

The `NAME` parameter supplied to the Ada procedures `CREATE` or `OPEN` [14.2.1] may represent a CMS file name or DDNAME specified using a `FILEDEF` command.

Files

The syntax of a CMS file name as specified in the Ada `NAME` parameter is as follows:

filename ::= fn [ft [fm]] | %ddname

where

fn is the CMS filename

ft is the CMS filetype

fm is the CMS filemode

If the filenames or filetypes exceed 8 characters then they are truncated. As indicated above, the filetype and filemode fields are not mandatory components of the `NAME` parameter. If the filemode is omitted, it defaults to "A1" for Ada mode OUT; for Ada mode IN and INOUT, all accessed minidisks are searched and the CMS filemode is set to that of the first file with the appropriate filename and filetype. If, in addition, the filetype is omitted it defaults to "FILE".

The file name parameter may also be a DDNAME. If the file name parameter starts with a % character, the remainder of the string (excluding trailing blanks) is taken as a DDNAME previously specified using the `FILEDEF` command. If the DDNAME has not been specified using `FILEDEF`, `NAME_ERROR` will be raised. If `DELETE` is called for a file opened using a DDNAME, `USE_ERROR` will be raised, but the file will be closed.

FORM Parameter

The `FORM` parameter comprises a set of attributes formulated according to the lexical rules of [2], separated by commas. The `FORM` parameter may be given as a null string except when `DIRECT_IO` is instantiated with an unconstrained type; in this case the

RECORD_SIZE attribute must be provided. Attributes are comma-separated; blanks may be inserted between lexical elements as desired. In the descriptions below the meanings of *natural*, *positive*, etc., are as in Ada; attribute keywords (represented in upper case) are identifiers [2.3] and as such may be specified without regard to case.

USE_ERROR is raised if the FORM parameter does not conform to these rules.

The attributes are as follows:

File sharing attribute

This attribute allows control over the sharing of one external file between several internal files within a single program. In effect it establishes rules for subsequent OPEN and CREATE calls which specify the same external file. If such rules are violated or if a different file sharing attribute is specified in a later OPEN or CREATE call, USE_ERROR will be raised. The syntax is as follows:

NOT_SHARED | SHARED => *access_mode*

where

access_mode ::= READERS | SINGLE_WRITER | ANY

A file sharing attribute of:

NOT_SHARED

implies only one internal file may access the external file.

SHARED => READERS

imposes no restrictions on internal files of mode IN_FILE, but prevents any internal files of mode OUT_FILE or INOUT_FILE being associated with the external file.

SHARED => SINGLE_WRITER

is as SHARED => READERS, but in addition allows a single internal file of mode OUT_FILE or INOUT_FILE.

SHARED => ANY

places no restrictions on external file sharing.

If a file of the same name has previously been opened or created, the default is taken from that file's sharing attribute, otherwise the default depends on the mode of the file: for mode IN_FILE the default is SHARED => READERS, for modes INOUT_FILE and OUT_FILE the default is NOT_SHARED.

Record format attribute

This attribute controls the record format (RECFM) of an external file created in Ada. The attribute may only be used in the FORM parameter of the CREATE command; if used in the FORM parameter of the OPEN command, USE_ERROR will be raised.

By default, files are created according to the following rules:

- for TEXT_IO, and instantiations of SEQUENTIAL_IO of unconstrained types, variable-length record files (RECFM = V) are created.
- for DIRECT_IO, and instantiations of SEQUENTIAL_IO of constrained types, fixed-length record files (RECFM = F) are created.

The syntax of the record format attribute is as follows:

RECFM => V | F

Record size attribute

This attribute controls the logical record length (LRECL) of an external file created in Ada. The attribute may only be used in the FORM parameter of the CREATE command; if used in the FORM parameter of the OPEN command, USE_ERROR will be raised.

In the case of RECFM F files (see record format attribute) the record size attribute specifies the record length of each record; in the case of RECFM V files, the record size attribute specifies the maximum record length.

In the case of DIRECT_IO.CREATE for unconstrained types the user is required to specify the RECORD_SIZE attribute (otherwise USE_ERROR will be raised by the OPEN or CREATE procedures).

In the case of DIRECT_IO and SEQUENTIAL_IO for constrained types the value given must not be smaller than ELEMENT_TYPE'SIZE / SYSTEM.STORAGE_UNIT; USE_ERROR will be raised if this rule is violated.

In the case of DIRECT_IO and SEQUENTIAL_IO for unconstrained types the value given must not be smaller than ELEMENT_TYPE'DEScriptor_SIZE / SYSTEM.STORAGE_UNIT plus the size of the largest record which is to be read or written. If a larger record is processed, DATA_ERROR will be raised by the READ or WRITE.

In the case of TEXT_IO, output lines will be padded to the requisite length with spaces on output and truncated on input; this fact should be borne in mind when re-reading files generated using TEXT_IO with the record size attribute set.

The syntax of the record size attribute is as follows:

RECORD_SIZE | LRECL => *natural*

where *natural* is a size in bytes.

The default is

`RECORD_SIZE => element_length`

where

`element_length = ELEMENT_TYPE'SIZE / SYSTEM.STORAGE_UNIT`

for input-output of constrained types, and

`RECORD_SIZE => 0`

(meaning variable-length records) for input-output of unconstrained types other than via `DIRECT_IO` in which case the `RECORD_SIZE` attribute must be provided by the user.

Block size attribute

This attribute controls the block size of an external file. The block size must be at least as large as the record size (if specified) or must obey the same rules for specifying the record size.

The default is

`BLOCK_SIZE => record_size`

for RECFM F files and

`BLOCK_SIZE => 4096`

for RECFM V files.

Carriage control

This attribute applies to `TEXT_IO` only, and is intended for files destined to be sent to a printer.

For a file of mode `OUT_FILE`, this attribute causes the output procedures of `TEXT_IO` to place a carriage control character as the first character of every output record; '1' (skip to channel 1) if the record follows a page terminator, or space (skip to next line) otherwise. Subsequent characters are output as normal as the result of calls of the output subprograms of `TEXT_IO`.

For a file of mode `IN_FILE`, this attribute causes the input procedures of `TEXT_IO` to interpret the first character of each record as a carriage control character, as described in the previous paragraph. Carriage control characters are not explicitly returned as a result of an input subprogram, but will (for example) affect the result of `END_OF_PAGE`.

The user should naturally be careful to ensure the carriage control attribute of a file of mode `IN_FILE` has the same value as that specified when creating the file.

The syntax of the carriage control attribute is as follows:

`CARRIAGE_CONTROL => boolean`

The default is set according to the filetype of the file: if the filetype is LISTING, the default is `CARRIAGE_CONTROL => TRUE` otherwise the default is `CARRIAGE_CONTROL => FALSE`.

Truncate

This attribute applies to TEXT_IO files of mode IN_FILE, and causes the input procedures of TEXT_IO to remove trailing blanks from records read.

The syntax of the TRUNCATE attribute is as follows:

`TRUNCATE => boolean`

The default is `TRUNCATE => FALSE`.

Note that truncation is always performed for TEXT_IO files for which the record size attribute is set (i.e. RECFM = F).

Append

This attribute may only be used in the FORM parameter of the OPEN command; if used in the FORM parameter of the CREATE command, USE_ERROR will be raised.

The affect of this attribute is to cause writing to commence at the end of the existing file.

The syntax of the APPEND attribute is as follows:

`APPEND [=> boolean]`

The default is `APPEND => FALSE`.

Eof string

This attribute applies only to files associated with the terminal opened using TEXT_IO, and controls the logical *end_of_file* string. If a line equal to the logical *end_of_file* string is typed in, END_OF_FILE will become TRUE. If an attempt is made to read from a file for which END_OF_FILE is TRUE, END_ERROR will be raised.

The syntax of the EOF_STRING attribute is as follows:

`EOF_STRING => sequence_of_characters`

The default is `EOF_STRING => /*`

The EOF_STRING may not contain commas or spaces.

If the `END_OF_FILE` function is called, a "look-ahead read" will be required. This means that (for example) a question-and-answer session at the terminal coded as follows:

```
while not END_OF_FILE loop
  PUT_LINE ("Enter value:");
  GET_LINE ( ... );
end loop;
```

will cause the prompt to appear only after the first value has been input. If the example is recoded without the explicit call to `END_OF_FILE` (but perhaps within a handler for `END_ERROR`) the behaviour will be appropriate.

STANDARD_INPUT and STANDARD_OUTPUT

The Ada internal files `STANDARD_INPUT` and `STANDARD_OUTPUT` are associated with the external files `%SYSIN` and `%SYSOUT`, respectively. By default, the `DDNAMEs` `SYSIN` and `SYSOUT` are defined to be the terminal, but the user may redefine their assignments using the `FILEDEF` command before running any program.

8.2 MVS

`TEXT_IO` and `SEQUENTIAL_IO` files are implemented as `DSORG PS (QSAM)`. `DIRECT_IO` files are implemented as `DSORG DA (BDAM)`.

8.2.1 Specifying External Files

The `NAME` parameter supplied to the Ada procedures `CREATE` or `OPEN` [14.2.1] may represent an MVS dataset name (`DSNAME`) or a `DDNAME`.

Files

An MVS dataset name as specified in the Ada `NAME` parameter may be given in any of the following forms:

```
OPEN (F, NAME => "UNQUALIFIED.NAME", ...);
OPEN (F, NAME => "FULLY.QUALIFIED.NAME", ...);
OPEN (F, NAME => "UNQUALIFIED.PDS (MEMBER)", ...);
OPEN (F, NAME => "FULLY.QUALIFIED.PDS (MEMBER)", ...);
```

An unqualified name (not enclosed in apostrophes) is first prefixed by the name (if any) given as the `QUALIFIER` parameter in the program `PARM` string when the program is run.

The `QUALIFIER` parameter may be specified as in the following example:

```
//STEP20 EXEC PGM=IEB73,PARM='/QUALIFIER(PAYROLL.ADA)'
```

A fully qualified name (enclosed in single quotes) is not so prefixed. The result of the NAME function is always in the form of a fully qualified name, i.e. enclosed in single quotes.

The file name parameter may also be a DDNAME. If the file name parameter starts with a % character, the remainder of the string (including trailing blanks) is taken as a DDNAME which must be defined in the JCL used to execute the program; otherwise NAME_ERROR will be raised.

If DELETE is called for a file opened using a DDNAME, USE_ERROR will be raised, but the file will be closed.

FORM Parameter

The FORM parameter comprises a set of attributes formulated according to the lexical rules of [2], separated by commas. The FORM parameter may be given as a null string except when DIRECT_IO is instantiated with an unconstrained type; in this case the RECORD_SIZE attribute must be provided. Attributes are comma-separated; blanks may be inserted between lexical elements as desired. In the descriptions below the meanings of *natural*, *positive*, etc., are as in Ada; attribute keywords (represented in upper case) are identifiers [2.3] and as such may be specified without regard to case.

USE_ERROR is raised if the FORM parameter does not conform to these rules.

The attributes described in 8.1 are also available under MVS. In addition the following attributes are available for MVS only. If any of these attributes are specified under VM/CMS then a USE_ERROR will be raised.

Unit attribute

This attribute allows control over the unit on which a file is allocated. The syntax is as follows:

UNIT => *unit_name*

where *unit_name* specifies a group name, a device type or a specific unit address.

The default is the local system generation default.

Volume attribute

This attribute allows control over the volume on which a file is allocated. The syntax is as follows:

VOLUME => *volume_name*

where *volume_name* specifies the volume serial number.

The default is the local system generation default.

Primary attribute

This attribute allows control over the primary space allocation for a file. The syntax is as follows:

PRIMARY => *natural*

where *natural* is the number of blocks allocated to the file.

The default is the local system generation default.

Secondary attribute

This attribute allows control over the secondary space allocation for a file. The syntax is as follows:

SECONDARY => *natural*

where *natural* is the number of additional blocks allocated to the file if more space is needed.

The default is the local system generation default.

8.3 USE_ERROR

The following conditions will cause USE_ERROR to be raised:

- Specifying a FORM parameter whose syntax does not conform to the rules given above.
- Specifying the EOF_STRING FORM parameter attribute for files other than TEXT_IO files of mode IN_FILE.
- Specifying the CARRIAGE_CONTROL FORM parameter attribute for files other than TEXT_IO files.
- Specifying the BLOCK_SIZE FORM parameter attribute to have a value less than RECORD_SIZE.
- Specifying the RECORD_SIZE FORM parameter attribute to have a value of zero, or failing to specify RECORD_SIZE, for instantiations of DIRECT_IO for unconstrained types.
- Specifying a RECORD_SIZE FORM parameter attribute to have a value less than that required to hold the element for instantiations of DIRECT_IO and SEQUENTIAL_IO for constrained types.
- Violating the file sharing rules stated above.
- Attempting to delete a file opened by DDNAME.

- For CMS, attempting to write a zero length record to other than the terminal.
- Errors detected whilst reading or writing (e.g. writing to a file on a read-only disk).

8.4 Text Terminators

Line terminators [14.3] are not implemented using a character, but are implied by the end of physical record.

Page terminators [14.3] are implemented using the EBCDIC character 0C (hexadecimal).

File terminators [14.3] are not implemented using a character, but are implied by the end of physical file. Note that for terminal input a line consisting of the EOF_STRING (see 8.1.1) is interpreted as a file terminator. Thus, entering such a line to satisfy a read from the terminal will raise the END_ERROR exception.

The user should avoid the explicit output of the character ASCII.FF [C], as this will not cause a page break to be emitted. If the user explicitly outputs the character ASCII.LF, this is treated as a call of NEW_LINE [14.3.4].

The following characters have special meaning for VM/SP; this should be borne in mind when reading from the display terminal:

Character	Default VM/SP meaning	May be changed using
#	logical line end symbol	CP TERMINAL LINEND
"	logical escape character	CP TERMINAL ESCAPE
@	logical character delete symbol	CP TERMINAL CHARDEL

8.5 EBCDIC and ASCII

All I/O using TEXT_IO is performed using ASCII/EBCDIC translation. CHARACTER and STRING values are held internally in ASCII but represented in external files in EBCDIC. For SEQUENTIAL_IO and DIRECT_IO no translation takes place, and the external file contains a binary image of the internal representation of the Ada element (see section 8.6).

It should be noted that the EBCDIC character set is larger than the (7 bit) ASCII and that the use of EBCDIC and ASCII control characters may not produce the desired results when using TEXT_IO (the input and output of control characters is in any case not defined by the Ada language [14.3]). Furthermore, the user is advised to exercise caution in the use of BAR (!) and SHARP (*), which are part of the lexis of Ada; if their use is prevented by translation between ASCII and EBCDIC, EXCLAM (!) and COLON (:), respectively, should be used instead [2.10].

Various translation tables exist to translate between ASCII and EBCDIC. The predefined package EBCDIC is provided to allow access to the translation facilities used by TEXT_IO and SYSTEM_ENVIRONMENT (see *Character Code Translation Tables in the Compiler User's Guide*).

The specification of this package is as follows:

package EBCDIC is

```
type EBCDIC_CHARACTER is (  
    nul,          -- 0 = 0h  
    soh,          -- 1 = 1h  
    stx,          -- 2 = 2h  
    etx,          -- 3 = 3h  
    E_4,  
    ht,           -- 5 = 5h  
    E_6,  
    del,          -- 7 = 7h  
    E_8,  
    E_9,  
    E_A,  
    vt,           -- 11 = 0Bh  
    np,           -- 12 = 0Ch  
    cr,           -- 13 = 0Dh  
    so,           -- 14 = 0Eh  
    si,           -- 15 = 0Fh  
    dle,          -- 16 = 10h  
    dc1,          -- 17 = 11h  
    dc2,          -- 18 = 12h  
    dc3,          -- 19 = 13h  
    E_14,  
    nl,           -- 21 = 15h  
    bs,           -- 22 = 16h  
    E_17,  
    can,          -- 24 = 18h  
    em,           -- 25 = 19h  
    E_1A,  
    E_1B,  
    E_1C,  
    gs,           -- 29 = 1Dh  
    rs,           -- 30 = 1Eh  
    us,           -- 31 = 1Fh  
    E_20,  
    E_21,  
    fs,           -- 34 = 22h  
    E_23,  
    E_24,  
    E_25,  
    etb,          -- 38 = 26h  
    esc,          -- 39 = 27h  
    E_28,  
    E_29,  
    E_2A,  
    E_2B,  
    E_2C,  
    enq,          -- 45 = 2Dh  
    ack,          -- 46 = 2Eh  
    bel,          -- 47 = 2Fh
```

E_30,	
E_31,	
syn,	-- 50 = 32h
E_33,	
E_34,	
E_35,	
E_36,	
eot,	-- 55 = 37h
E_38,	
E_39,	
E_3A,	
E_3B,	
dc4,	-- 60 = 3Ch
nak,	-- 61 = 3Dh
E_3E,	
sub,	-- 63 = 3Fh
'',	-- 64 = 40h
E_41,	
E_42,	
E_43,	
E_44,	
E_45,	
E_46,	
E_47,	
E_48,	
E_49,	
E_4A,	
';',	-- 75 = 4Bh
'<',	-- 76 = 4Ch
'(',	-- 77 = 4Dh
'+',	-- 78 = 4Eh
' ',	-- 79 = 4Fh
'&',	-- 80 = 50H
E_51,	
E_52,	
E_53,	
E_54,	
E_55,	
E_56,	
E_57,	
E_58,	
E_59,	
'!',	-- 90 = 5Ah
'\$',	-- 91 = 5Bh
'*',	-- 92 = 5Ch
')',	-- 93 = 5Dh
':',	-- 94 = 5Eh
':*',	-- 95 = 5Fh
':-',	-- 96 = 60h
':/',	-- 97 = 61h
E_62,	
E_63,	
E_64,	

E_65,	
E_66,	
E_67,	
E_68,	
E_69,	
E_6A,	
';',	--107 = 6Bh
'%',	--108 = 6Ch
'_',	--109 = 6Dh
'>',	--110 = 6Eh
'?',	--111 = 6Fh
E_70,	
E_71,	
E_72,	
E_73,	
E_74,	
E_75,	
E_76,	
E_77,	
E_78,	
'"',	--121 = 79h
':',	--122 = 7Ah
'#',	--123 = 7Bh
'@',	--124 = 7Ch
'"',	--125 = 7Dh
'=',	--126 = 7Eh
'"',	--127 = 7Fh
E_80,	
'a',	--129 = 81h
'b',	--130 = 82h
'c',	--131 = 83h
'd',	--132 = 84h
'e',	--133 = 85h
'f',	--134 = 86h
'g',	--135 = 87h
'h',	--136 = 88h
'i',	--137 = 89h
E_8A,	
E_8B,	
E_8C,	
E_8D,	
E_8E,	
E_8F,	
E_90,	
'j',	--145 = 91h
'k',	--146 = 92h
'l',	--147 = 93h
'm',	--148 = 94h
'n',	--149 = 95h
'o',	--150 = 96h
'p',	--151 = 97h
'q',	--152 = 98h
'r',	--153 = 99h

E_9A,	
E_9B,	
E_9C,	
E_9D,	
E_9E,	
E_9F,	
E_A0,	
'.',	--161 = 0A1h
's',	--162 = 0A2h
't',	--163 = 0A3h
'u',	--164 = 0A4h
'v',	--165 = 0A5h
'w',	--166 = 0A6h
'x',	--167 = 0A7h
'y',	--168 = 0A8h
'z',	--169 = 0A9h
E_AA,	
E_AB,	
E_AC,	
' ',	--173 = 0ADh
E_AE,	
E_AF,	
E_B0,	
E_B1,	
E_B2,	
E_B3,	
E_B4,	
E_B5,	
E_B6,	
E_B7,	
E_B8,	
E_B9,	
E_BA,	
E_BB,	
E_BC,	
'}',	--189 = 0BDh
E_BE,	
E_BF,	
'{',	--192 = 0C0h
'A',	--193 = 0C1h
'B',	--194 = 0C2h
'C',	--195 = 0C3h
'D',	--196 = 0C4h
'E',	--197 = 0C5h
'F',	--198 = 0C6h
'G',	--199 = 0C7h
'H',	--200 = 0C8h
'I',	--201 = 0C9h
E_CA,	
E_CB,	
E_CC,	
E_CD,	
E_CE,	

```

E_CF,
'),          --208 = 0D0h
'J',        --209 = 0D1h
'K',        --210 = 0D2h
'L',        --211 = 0D3h
'M',        --212 = 0D4h
'N',        --213 = 0D5h
'O',        --214 = 0D6h
'P',        --215 = 0D7h
'Q',        --216 = 0D8h
'R',        --217 = 0D9h
E_DA,
E_DB,
E_DC,
E_DD,
E_DE,
E_DF,
'\',        --224 = 0E0h
E_E1,
'S',        --226 = 0E2h
'T',        --227 = 0E3h
'U',        --228 = 0E4h
'V',        --229 = 0E5h
'W',        --230 = 0E6h
'X',        --231 = 0E7h
'Y',        --232 = 0E8h
'Z',        --233 = 0E9h
E_EA,
E_EB,
E_EC,
E_ED,
E_EE,
E_EF,
'0',        --240 = 0F0h
'1',        --241 = 0F1h
'2',        --242 = 0F2h
'3',        --243 = 0F3h
'4',        --244 = 0F4h
'5',        --245 = 0F5h
'6',        --246 = 0F6h
'7',        --247 = 0F7h
'8',        --248 = 0F8h
'9',        --249 = 0F9h
E_FA,
E_FB,
E_FC,
E_FD,
E_FE,
E_FF);

```

```

SEL      : constant EBCDIC_CHARACTER := E_4;
RNL      : constant EBCDIC_CHARACTER := E_6;
GE       : constant EBCDIC_CHARACTER := E_8;

```

```

SPS      : constant EBCDIC_CHARACTER := E_9;
RPT      : constant EBCDIC_CHARACTER := E_A;
RES      : constant EBCDIC_CHARACTER := E_4;
ENP      : constant EBCDIC_CHARACTER := E_4;
POC      : constant EBCDIC_CHARACTER := E_17;
UBS      : constant EBCDIC_CHARACTER := E_1A;
CU1      : constant EBCDIC_CHARACTER := E_1B;
IFS      : constant EBCDIC_CHARACTER := E_1C;
DS       : constant EBCDIC_CHARACTER := E_20;
SOS      : constant EBCDIC_CHARACTER := E_21;
WUS      : constant EBCDIC_CHARACTER := E_23;
BYP      : constant EBCDIC_CHARACTER := E_24;
INP      : constant EBCDIC_CHARACTER := E_24;
LF       : constant EBCDIC_CHARACTER := E_25;
SA       : constant EBCDIC_CHARACTER := E_28;
SFE      : constant EBCDIC_CHARACTER := E_29;
SM       : constant EBCDIC_CHARACTER := E_2A;
SW       : constant EBCDIC_CHARACTER := E_2A;
CSP      : constant EBCDIC_CHARACTER := E_2B;
MFA      : constant EBCDIC_CHARACTER := E_2C;
IR       : constant EBCDIC_CHARACTER := E_33;
PP       : constant EBCDIC_CHARACTER := E_34;
TRN      : constant EBCDIC_CHARACTER := E_35;
NBS      : constant EBCDIC_CHARACTER := E_36;
SBS      : constant EBCDIC_CHARACTER := E_38;
IT       : constant EBCDIC_CHARACTER := E_39;
RFF      : constant EBCDIC_CHARACTER := E_3A;
CU3      : constant EBCDIC_CHARACTER := E_3B;
SP       : constant EBCDIC_CHARACTER := ' ';
RSP      : constant EBCDIC_CHARACTER := E_41;
CENT     : constant EBCDIC_CHARACTER := E_4A;
SHY      : constant EBCDIC_CHARACTER := E_CA;
HOOK     : constant EBCDIC_CHARACTER := E_CC;
FORK     : constant EBCDIC_CHARACTER := E_CE;
NSP      : constant EBCDIC_CHARACTER := E_E1;
CHAIR    : constant EBCDIC_CHARACTER := E_EC;
EO       : constant EBCDIC_CHARACTER := E_FF;

```

```

E_0      : constant EBCDIC_CHARACTER := nul;
E_1      : constant EBCDIC_CHARACTER := soh;
E_2      : constant EBCDIC_CHARACTER := stx;
E_3      : constant EBCDIC_CHARACTER := etx;
E_5      : constant EBCDIC_CHARACTER := ht;
E_7      : constant EBCDIC_CHARACTER := del;
E_B      : constant EBCDIC_CHARACTER := vt;
E_C      : constant EBCDIC_CHARACTER := np;
E_D      : constant EBCDIC_CHARACTER := cr;
E_E      : constant EBCDIC_CHARACTER := so;
E_F      : constant EBCDIC_CHARACTER := si;
E_10     : constant EBCDIC_CHARACTER := dle;
E_11     : constant EBCDIC_CHARACTER := dcl;
E_12     : constant EBCDIC_CHARACTER := dc2;

```

```

E_13      : constant EBCDIC_CHARACTER := dc3;
E_15      : constant EBCDIC_CHARACTER := nl;
E_16      : constant EBCDIC_CHARACTER := ba;
E_18      : constant EBCDIC_CHARACTER := can;
E_19      : constant EBCDIC_CHARACTER := em;
E_1D      : constant EBCDIC_CHARACTER := gs;
E_1E      : constant EBCDIC_CHARACTER := rs;
E_1F      : constant EBCDIC_CHARACTER := us;
E_22      : constant EBCDIC_CHARACTER := fs;
E_26      : constant EBCDIC_CHARACTER := etb;
E_27      : constant EBCDIC_CHARACTER := esc;
E_2D      : constant EBCDIC_CHARACTER := enq;
E_2E      : constant EBCDIC_CHARACTER := ack;
E_2F      : constant EBCDIC_CHARACTER := bel;
E_32      : constant EBCDIC_CHARACTER := syn;
E_37      : constant EBCDIC_CHARACTER := eot;
E_3C      : constant EBCDIC_CHARACTER := dc4;
E_3D      : constant EBCDIC_CHARACTER := nak;
E_3F      : constant EBCDIC_CHARACTER := sub;
E_40      : constant EBCDIC_CHARACTER := ' ';
E_4B      : constant EBCDIC_CHARACTER := '!';
E_4C      : constant EBCDIC_CHARACTER := '<';
E_4D      : constant EBCDIC_CHARACTER := '(';
E_4E      : constant EBCDIC_CHARACTER := '+';
E_4F      : constant EBCDIC_CHARACTER := '|';
E_50      : constant EBCDIC_CHARACTER := '&';
E_5A      : constant EBCDIC_CHARACTER := '!';
E_5B      : constant EBCDIC_CHARACTER := '$';
E_5C      : constant EBCDIC_CHARACTER := '"';
E_5D      : constant EBCDIC_CHARACTER := ')';
E_5E      : constant EBCDIC_CHARACTER := ';';
E_5F      : constant EBCDIC_CHARACTER := '~';
E_60      : constant EBCDIC_CHARACTER := '-';
E_61      : constant EBCDIC_CHARACTER := '/';
E_6B      : constant EBCDIC_CHARACTER := ' ';
E_6C      : constant EBCDIC_CHARACTER := '%';
E_6D      : constant EBCDIC_CHARACTER := '_';
E_6E      : constant EBCDIC_CHARACTER := '>';
E_6F      : constant EBCDIC_CHARACTER := '?';
E_79      : constant EBCDIC_CHARACTER := '"';
E_7A      : constant EBCDIC_CHARACTER := ':';
E_7B      : constant EBCDIC_CHARACTER := '#';
E_7C      : constant EBCDIC_CHARACTER := '@';
E_7D      : constant EBCDIC_CHARACTER := '"';
E_7E      : constant EBCDIC_CHARACTER := '=';
E_7F      : constant EBCDIC_CHARACTER := '"';
E_81      : constant EBCDIC_CHARACTER := 'a';
E_82      : constant EBCDIC_CHARACTER := 'b';
E_83      : constant EBCDIC_CHARACTER := 'c';
E_84      : constant EBCDIC_CHARACTER := 'd';
E_85      : constant EBCDIC_CHARACTER := 'e';
E_86      : constant EBCDIC_CHARACTER := 'f';
E_87      : constant EBCDIC_CHARACTER := 'g';

```

```

E_88      : constant EBCDIC_CHARACTER := 'h';
E_89      : constant EBCDIC_CHARACTER := 'i';
E_91      : constant EBCDIC_CHARACTER := 'j';
E_92      : constant EBCDIC_CHARACTER := 'k';
E_93      : constant EBCDIC_CHARACTER := 'l';
E_94      : constant EBCDIC_CHARACTER := 'm';
E_95      : constant EBCDIC_CHARACTER := 'n';
E_96      : constant EBCDIC_CHARACTER := 'o';
E_97      : constant EBCDIC_CHARACTER := 'p';
E_98      : constant EBCDIC_CHARACTER := 'q';
E_99      : constant EBCDIC_CHARACTER := 'r';
E_A1      : constant EBCDIC_CHARACTER := 's';
E_A2      : constant EBCDIC_CHARACTER := 't';
E_A3      : constant EBCDIC_CHARACTER := 'u';
E_A4      : constant EBCDIC_CHARACTER := 'v';
E_A5      : constant EBCDIC_CHARACTER := 'w';
E_A6      : constant EBCDIC_CHARACTER := 'x';
E_A7      : constant EBCDIC_CHARACTER := 'y';
E_A8      : constant EBCDIC_CHARACTER := 'z';
E_A9      : constant EBCDIC_CHARACTER := '[';
E_AD      : constant EBCDIC_CHARACTER := ']';
E_BD      : constant EBCDIC_CHARACTER := '{';
E_C1      : constant EBCDIC_CHARACTER := 'A';
E_C2      : constant EBCDIC_CHARACTER := 'B';
E_C3      : constant EBCDIC_CHARACTER := 'C';
E_C4      : constant EBCDIC_CHARACTER := 'D';
E_C5      : constant EBCDIC_CHARACTER := 'E';
E_C6      : constant EBCDIC_CHARACTER := 'F';
E_C7      : constant EBCDIC_CHARACTER := 'G';
E_C8      : constant EBCDIC_CHARACTER := 'H';
E_C9      : constant EBCDIC_CHARACTER := 'I';
E_D0      : constant EBCDIC_CHARACTER := 'J';
E_D1      : constant EBCDIC_CHARACTER := 'K';
E_D2      : constant EBCDIC_CHARACTER := 'L';
E_D3      : constant EBCDIC_CHARACTER := 'M';
E_D4      : constant EBCDIC_CHARACTER := 'N';
E_D5      : constant EBCDIC_CHARACTER := 'O';
E_D6      : constant EBCDIC_CHARACTER := 'P';
E_D7      : constant EBCDIC_CHARACTER := 'Q';
E_D8      : constant EBCDIC_CHARACTER := 'R';
E_D9      : constant EBCDIC_CHARACTER := 'S';
E_E0      : constant EBCDIC_CHARACTER := 'T';
E_E1      : constant EBCDIC_CHARACTER := 'U';
E_E2      : constant EBCDIC_CHARACTER := 'V';
E_E3      : constant EBCDIC_CHARACTER := 'W';
E_E4      : constant EBCDIC_CHARACTER := 'X';
E_E5      : constant EBCDIC_CHARACTER := 'Y';
E_E6      : constant EBCDIC_CHARACTER := 'Z';
E_E7      : constant EBCDIC_CHARACTER := '[';
E_E8      : constant EBCDIC_CHARACTER := ']';
E_E9      : constant EBCDIC_CHARACTER := '{';
E_F0      : constant EBCDIC_CHARACTER := '0';
E_F1      : constant EBCDIC_CHARACTER := '1';

```

```

E_F2      : constant EBCDIC_CHARACTER := '2';
E_F3      : constant EBCDIC_CHARACTER := '3';
E_F4      : constant EBCDIC_CHARACTER := '4';
E_F5      : constant EBCDIC_CHARACTER := '5';
E_F6      : constant EBCDIC_CHARACTER := '6';
E_F7      : constant EBCDIC_CHARACTER := '7';
E_F8      : constant EBCDIC_CHARACTER := '8';
E_F9      : constant EBCDIC_CHARACTER := '9';

type EBCDIC_STRING is array (POSITIVE range <>) of EBCDIC_CHARACTER;

function ASCII_TO_EBCDIC (S : STRING) return EBCDIC_STRING;

function ASCII_TO_EBCDIC (C : CHARACTER) return EBCDIC_CHARACTER;

-- CONSTRAINT_ERROR is raised if E_STRING'LENGTH /= A_STRING'LENGTH;
procedure ASCII_TO_EBCDIC (A_STRING : in STRING;
                          E_STRING : out EBCDIC_STRING);

function EBCDIC_TO_ASCII (S : EBCDIC_STRING) return STRING;

function EBCDIC_TO_ASCII (C : EBCDIC_CHARACTER) return CHARACTER;

-- CONSTRAINT_ERROR is raised if E_STRING'LENGTH /= A_STRING'LENGTH;
procedure EBCDIC_TO_ASCII (E_STRING : in EBCDIC_STRING;
                          A_STRING : out STRING);

end EBCDIC;

```

The subprograms `ASCII_TO_EBCDIC` and `EBCDIC_TO_ASCII` convert between ASCII encoded STRINGS and EBCDIC_STRINGS as appropriate.

The procedures `ASCII_TO_EBCDIC` and `EBCDIC_TO_ASCII` are much more efficient than the corresponding functions, as they do not make use of the program heap. Note that if the in and out string parameters are of different lengths (i.e. `A_STRING'LENGTH /= E_STRING'LENGTH`), the procedures will raise the exception `CONSTRAINT_ERROR`.

Note that the user may alter the ASCII to EBCDIC and EBCDIC to ASCII mappings used by the Alsyls IBM 370 Ada compiler, as described in the *Installation Guides*.

Note also that in many ways EBCDIC_STRINGS may be manipulated exactly as the predefined type STRING; in particular, string literals and catenations are available.

8.6 Characteristics of Disk Files

A disk file that has already been created and is opened takes on the characteristics that are already associated with that file.

The characteristics of disk files that are created using the predefined input-output packages are set up as described below.

TEXT_IO

- A carriage control character is placed in column 1 if the CARRIAGE control attribute is specified in the FORM parameter.
- Data is translated between ASCII and EBCDIC so that the external file is readable using other System/370 tools.

SEQUENTIAL_IO

- No translation is performed between ASCII and EBCDIC; the data in the external file is a memory image of the elements written, preceded by a descriptor in the case of unconstrained types.

DIRECT_IO

- No translation is performed between ASCII and EBCDIC; the data in the external file is a memory image of the elements written, preceded by a descriptor in the case of unconstrained types.
- Under CMS DIRECT_IO files may be read using SEQUENTIAL_IO (and vice-versa if a RECORD_SIZE component is specified).

9 Characteristics of Numeric Types

9.1 Integer Types

The ranges of values for integer types declared in package STANDARD are as follows:

SHORT_INTEGER	-32768 .. 32767	-- 2**15 - 1
INTEGER	-2147483648 .. 2147483647	-- 2**31 - 1

For the packages DIRECT_IO and TEXT_IO, the ranges of values for types COUNT and POSITIVE_COUNT are as follows:

COUNT	0 .. 2147483647	-- 2**31 - 1
POSITIVE_COUNT	1 .. 2147483647	-- 2**31 - 1

For the package TEXT_IO, the range of values for the type FIELD is as follows:

FIELD	0 .. 255	-- 2**8 - 1
-------	----------	-------------

9.2 Floating Point Type Attributes

SHORT_FLOAT

		Approximate value
DIGITS	6	
MANTISSA	21	
EMAX	84	
EPSILON	$2.0^{** -20}$	9.54E-07
SMALL	$2.0^{** -85}$	2.58E-26
LARGE	$2.0^{** 84} * (1.0 - 2.0^{** -21})$	1.93E+25
SAFE_EMAX	252	
SAFE_SMALL	$2.0^{** -253}$	6.91E-77
SAFE_LARGE	$2.0^{** 127} * (1.0 - 2.0^{** -21})$	1.70E+38
FIRST	$-2.0^{** 252} * (1.0 - 2.0^{** -24})$	-7.24E+75
LAST	$2.0^{** 252} * (1.0 - 2.0^{** -24})$	7.24E+75
MACHINE_RADIX	16	
MACHINE_MANTISSA	6	
MACHINE_EMAX	63	
MACHINE_EMIN	-64	
MACHINE_ROUNDS	FALSE	
MACHINE_OVERFLOWS	TRUE	
SIZE	32	

FLOAT

		Approximate value
DIGITS	15	
MANTISSA	51	
EMAX	204	
EPSILON	$2.0^{** -50}$	8.88E-16
SMALL	$2.0^{** -205}$	1.94E-62
LARGE	$2.0^{** 204} * (1.0 - 2.0^{** -51})$	2.57E+61
SAFE_EMAX	252	
SAFE_SMALL	$2.0^{** -253}$	6.91E-77
SAFE_LARGE	$2.0^{** 252} * (1.0 - 2.0^{** 51})$	7.24E+75
FIRST	$-2.0^{** 252} * (1.0 - 2.0^{** -56})$	-7.24E+75
LAST	$2.0^{** 252} * (1.0 - 2.0^{** -56})$	7.24E+75
MACHINE_RADIX	16	
MACHINE_MANTISSA	14	
MACHINE_EMAX	63	
MACHINE_EMIN	-64	
MACHINE_ROUNDS	FALSE	
MACHINE_OVERFLOWS	TRUE	
SIZE	64	

LONG_FLOAT

		Approximate value
DIGITS	18	
MANTISSA	61	
EMAX	244	
EPSILON	2.0 ** -60	8.67E-19
SMALL	2.0 ** -245	1.77E-74
LARGE	2.0 ** 244 * (1.0 - 2.0 ** -61)	2.83E+73
SAFE_EMAX	252	
SAFE_SMALL	2.0 ** -253	6.91E-77
SAFE_LARGE	2.0 ** 252 * (1.0 - 2.0 ** -61)	7.24E+75
FIRST	-2.0 ** 252 * (1.0 - 2.0 ** -112)	-7.24E+75
LAST	2.0 ** 252 * (1.0 - 2.0 ** -112)	7.24E+75
MACHINE_RADIX	16	
MACHINE_MANTISSA	28	
MACHINE_EMAX	63	
MACHINE_EMIN	-64	
MACHINE_ROUNDS	FALSE	
MACHINE_OVERFLOWS	TRUE	
SIZE	128	

9.3 Attributes of Type DURATION

DURATION'DELTA	2.0 ** -14
DURATION'SMALL	2.0 ** -14
DURATION'LARGE	131072.0
DURATION'FIRST	-86400.0
DURATION'LAST	86400.0

10 Other Implementation-Dependent Characteristics

10.1 Characteristics of the Heap

All objects created by allocators go into the heap. Also, portions of the Ada Run-Time Executive's representation of task objects, including the task stacks, are allocated in the heap.

All objects whose visibility is linked to a subprogram or block have their storage reclaimed at exit.

10.2 Characteristics of Tasks

The default task stack size is 16 Kbytes, but by using the Binder option TASK the size for all task stacks in a program may be set to any size from 4 Kbytes to 16 Mbytes.

Timeslicing is implemented for task scheduling. The default time slice is 1000 milliseconds, but by using the Binder option SLICE the time slice may be set to any

multiple of 10 milliseconds. It is also possible to use this option to specify no timeslicing, i.e. tasks are scheduled only at explicit synchronisation points. Timeslicing is started only upon activation of the first task in the program, so the SLICE option has no effect for sequential programs.

Normal priority rules are followed for preemption, where PRIORITY values run in the range 1 .. 10. All tasks with "undefined" priority (no pragma PRIORITY) are considered to have a priority of 0.

The minimum timeable delay is 10 milliseconds.

The maximum number of active tasks is limited only by memory usage. Tasks release their storage allocation as soon as they have terminated.

The acceptor of a rendezvous executes the accept body code in its own stack. A rendezvous with an empty accept body (e.g. for synchronisation) does not cause a context switch.

The main program waits for completion of all tasks dependent on library packages before terminating. Such tasks may select a terminate alternative only after completion of the main program.

Abnormal completion of an aborted task takes place immediately, except when the abnormal task is the caller of an entry that is engaged in a rendezvous. Any such task becomes abnormally completed as soon as the rendezvous is completed.

If a global deadlock situation arises because every task (including the main program) is waiting for another task, the program is aborted and the state of all tasks is displayed.

10.3 Definition of a Main Program

A main program must be a non-generic, parameterless, library procedure.

10.4 Ordering of Compilation Units

The Alsys IBM 370 Ada Compiler imposes no additional ordering constraints on compilations beyond those required by the language.

10.5 Package SYSTEM_ENVIRONMENT

The implementation-defined package SYSTEM_ENVIRONMENT enables an Ada program to communicate with the environment in which it is executed.

The specification of package SYSTEM_ENVIRONMENT is as follows:

```
package SYSTEM_ENVIRONMENT is

    subtype EXIT_STATUS is INTEGER;

    type STACK_MODE is (LIFO, FIFO);

    function ARG_LINE return STRING;

    function ARG_LINE_LENGTH return NATURAL;

    procedure ARG_LINE (LINE : out STRING;
                       LAST : out NATURAL);

    function ARG_START return NATURAL;

    procedure SET_EXIT_STATUS (STATUS : in EXIT_STATUS);

    function GET_EXIT_STATUS return EXIT_STATUS;

    function EXECUTE_COMMAND (COMMAND : in STRING)
        return EXIT_STATUS;

    procedure EXECUTE_COMMAND (COMMAND : in STRING);

    procedure STACK (COMMAND : in STRING;
                    MODE      : in STACK_MODE := LIFO);

    function SENTRIES return NATURAL;

    procedure ABORT_PROGRAM (STATUS : in EXIT_STATUS);

    function SYSTIME return DURATION;

    function USRTIME return DURATION;

    function EXISTS (FILE : in STRING) return BOOLEAN;

    function LAST_EXCEPTION_NAME return STRING;

end SYSTEM_ENVIRONMENT;
```

ARG_LINE

The ARG_LINE subprograms give access to the CMS command line or to the program PARM string as specified in the JCL used to run an MVS program. The procedure ARG_LINE is more efficient than the corresponding function, as it does not make use of the program heap. The out parameter LAST specifies the character in LINE which holds the last character of the command line. Note, if LINE is not long enough to hold the command line given, CONSTRAINT_ERROR will be raised. The command line

returned includes the name of the program executed for CMS, but not any run-time options specified.

ARG_START

The function ARG_START returns the index in the command line of the first parameter, i.e. ignoring the executed program name, for CMS; for MVS it always returns the value 1.

SET_EXIT_STATUS

The exit status of the program (returned in register 15 on exit) can be set by a call of SET_EXIT_STATUS. Subsequent calls of SET_EXIT_STATUS will overwrite the exit status, which is by default 0. If SET_EXIT_STATUS is not called, a positive exit code may be set by the Ada Run-Time Executive if an unhandled exception is propagated out of the main subprogram, or if a deadlock situation is detected.

The following exit codes relate to unhandled exceptions:

Exception	Code	Cause of exception
NUMERIC_ERROR:	1	divide by zero
	2	numeric overflow
CONSTRAINT_ERROR:	3	discriminant error
	4	lower bound index error
	5	upper bound index error
	6	length error
	7	lower bound range error
	8	upper bound range error
	9	null access value
STORAGE_ERROR:	10	frame overflow (overflow on subprogram entry)
	11	stack overflow (overflow otherwise)
	12	heap overflow
PROGRAM_ERROR:	13	access before elaboration
	14	function left without return
SPURIOUS_ERROR:	15-20	<an erroneous program>
NUMERIC_ERROR	21	(other than for the above reasons)
CONSTRAINT_ERROR	22	(other than for the above reasons)
	23	anonymously raised exception (an exception re-raised using the raise statement without an exception name)
	24	<unused>
	25	static exception (an exception raised using the raise statement with an exception name)

Code 100 is used if a deadlocking situation is detected and the program is aborted as a result.

Codes 1000-1999 are used to indicate other anomalous conditions in the initialisation of the program, messages concerning which are displayed on the terminal.

GET_EXIT_STATUS

The function GET_EXIT_STATUS returns the current exit status.

EXECUTE_COMMAND

Under CMS the EXECUTE_COMMAND subprograms with a non-null parameter execute the given CMS SUBSET command. The result of the EXECUTE_COMMAND function is the return code of the command. Under MVS a call of the EXECUTE_COMMAND subprograms has no effect and the function always returns the value zero.

Under CMS, if a null string is given as the parameter, the program exits to the CMS subset level. This allows CMS SUBSET commands to be executed directly. Issuing the command RETURN from the CMS subset level will return to the Ada program. The return code of the EXECUTE_COMMAND function with a null COMMAND string is always zero.

STACK

Under CMS the STACK procedure allows a command to be placed on the console stack: either last-in-first-out (LIFO) or first-in-first-out (FIFO). Under MVS a call of the STACK procedure has no effect.

SENTRIES

Under CMS, the SENTRIES function returns the number of lines in the program stack. Under MVS, it returns the value 0.

ABORT_PROGRAM

The program may be aborted, returning the specified exit code, by a call of the ABORT_PROGRAM procedure.

SYSTIME, USRTIME

Under CMS the SYSTIME and USRTIME functions allow access to the amount of system and user time, respectively, used by the program since its execution. Under MVS a call of one of these functions has no effect and returns the value 0.0.

EXISTS

The EXISTS function returns a boolean to indicate whether the file specified by the file name string exists or not.

LAST_EXCEPTION_NAME

The function LAST_EXCEPTION_NAME returns the name of the most recently raised exception in the current task. It may usefully be used in handlers to identify the exception, e.g.:

```
...
when others =>
    TEXT_IO.PUT (SYSTEM_ENVIRONMENT.LAST_EXCEPTION_NAME);
    TEXT_IO.PUT_LINE (" raised");
```


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APPENDIX C

TEST PARAMETERS

Certain tests in the ACVC make use of implementation-dependent values, such as the maximum length of an input line and invalid file names. A test that makes use of such values is identified by the extension .TST in its file name. Actual values to be substituted are represented by names that begin with a dollar sign. A value must be substituted for each of these names before the test is run. The values used for this validation are given below.

Name and Meaning	Value
\$BIG_ID1 Identifier the size of the maximum input line length with varying last character.	X2345678901234567890123456789 01234567890123456789012345 A...A1 ---- 199 characters
\$BIG_ID2 Identifier the size of the maximum input line length with varying last character.	X2345678901234567890123456789 01234567890123456789012345 A...A2 ---- 199 characters
\$BIG_ID3 Identifier the size of the maximum input line length with varying middle character.	X12345678901234567890123456789 01234567890123456789012345 A...A3 A...A -99- -100-
\$BIG_ID4 Identifier the size of the maximum input line length with varying middle character.	X2345678901234567890123456789 01234567890123456789012345 A...A4 A...A -99- -100- characters
\$BIG_INT_LIT An integer literal of value 298 with enough leading zeroes so that it is the size of the maximum line length.	0....0298 ---- 252 characters
\$BIG_REAL_LIT A universal real literal of value 690.0 with enough leading zeroes to be the size of the maximum line length.	0....0690.0 ---- 250 characters
\$BIG_STRING1 A string literal which when catenated with BIG_STRING2 yields the image of BIG_ID1.	"X2345678901234567890123456789 01234567890123456789012345 A...A" ---- 72 characters

TEST PARAMETERS

Name_and_Meaning_____	Value_____
<p>\$BIG_STRING2 A string literal which when catenated to the end of BIG_STRING1 yields the image of BIG_ID1.</p>	<p>"A....A1" ---- 127 characters</p>
<p>\$BLANKS A sequence of blanks twenty characters less than the size of the maximum line length.</p>	<p>235 blanks</p>
<p>\$COUNT_LAST A universal integer literal whose value is TEXT_IO.COUNT'LAST.</p>	<p>2147483647</p>
<p>\$FIELD_LAST A universal integer literal whose value is TEXT_IO.FIELD'LAST.</p>	<p>255</p>
<p>\$FILE_NAME_WITH_BAD_CHARS An external file name that either contains invalid characters or is too long.</p>	<p>T??????? LISTING A1</p>
<p>\$FILE_NAME_WITH_WILD_CARD_CHAR An external file name that either contains a wild card character or is too long.</p>	<p>TOOLONGNAME TOOLONGTYPE TOOLONGMODE</p>
<p>\$GREATER_THAN_DURATION A universal real literal that lies between DURATION'BASE'LAST and DURATION'LAST or any value in the range of DURATION.</p>	<p>100000.0</p>
<p>\$GREATER_THAN_DURATION_BASE_LAST A universal real literal that is greater than DURATION'BASE'LAST.</p>	<p>10000000.0</p>
<p>\$ILLEGAL_EXTERNAL_FILE_NAME1 An external file name which contains invalid characters.</p>	<p>T??????? LISTING A1</p>
<p>\$ILLEGAL_EXTERNAL_FILE_NAME2 An external file name which is too long.</p>	<p>TOOLONGNAME TOOLONGTYPE TOOLONGMODE</p>

TEST PARAMETERS

Name_and_Meaning_____	Value_____
\$INTEGER_FIRST A universal integer literal whose value is INTEGER'FIRST.	-2147483648
\$INTEGER_LAST A universal integer literal whose value is INTEGER'LAST.	2147483647
\$INTEGER_LAST_PLUS_1 A universal integer literal whose value is INTEGER'LAST + 1.	2147483648
\$LESS_THAN_DURATION A universal real literal that lies between DURATION'BASE'FIRST and DURATION'FIRST or any value in the range of DURATION.	-100000.0
\$LESS_THAN_DURATION_BASE_FIRST A universal real literal that is less than DURATION'BASE'FIRST.	-10000000.0
\$MAX_DIGITS Maximum digits supported for floating-point types.	18
\$MAX_IN_LEN Maximum input line length permitted by the implementation.	255
\$MAX_INT A universal integer literal whose value is SYSTEM.MAX_INT.	2147483647
\$MAX_INT_PLUS_1 A universal integer literal whose value is SYSTEM.MAX_INT+1.	2147483648
\$MAX_LEN_INT_BASED_LITERAL A universal integer based literal whose value is 2#11# with enough leading zeroes in the mantissa to be MAX_IN_LEN long.	2:0....011: ---- 250 characters

TEST PARAMETERS

Name_and_Meaning_____	Value_____
<p>\$MAX_LEN_REAL_BASED_LITERAL</p> <p>A universal real based literal whose value is 16:F.E: with enough leading zeroes in the mantissa to be MAX_IN_LEN long.</p>	<p>16:0....OF.E:</p> <p> ---- </p> <p>248 characters</p>
<p>\$MAX_STRING_LITERAL</p> <p>A string literal of size MAX_IN_LEN, including the quote characters.</p>	<p>"X234567890123456789012345679</p> <p>01234567890123456789012345</p> <p>A....A3"</p> <p> ---- 197 characters</p>
<p>\$MIN_INT</p> <p>A universal integer literal whose value is SYSTEM.MIN_INT.</p>	<p>-2147483648</p>
<p>\$NAME</p> <p>A name of a predefined numeric type other than FLOAT, INTEGER, SHORT_FLOAT, SHORT_INTEGER, LONG_FLOAT, or LONG_INTEGER.</p>	<p>NO_SUCH-TYPE</p>
<p>\$NEG_BASED_INT</p> <p>A based integer literal whose highest order nonzero bit falls in the sign bit position of the representation for SYSTEM.MAX_INT.</p>	<p>8#20000000000#</p>

APPENDIX D

WITHDRAWN TESTS

Some tests are withdrawn from the ACVC because they do not conform to the Ada Standard. The following 27 tests had been withdrawn at the time of validation testing for the reasons indicated. A reference of the form "AI-ddddd" is to an Ada Commentary.

- B28003A: A basic declaration (line 36) wrongly follows a later declaration.
- E28005C: This test requires that 'PRAGMA LIST (ON);' not appear in a listing that has been suspended by a previous "pragma LIST (OFF);"; the Ada Standard is not clear on this point, and the matter will be reviewed by the ALMP.
- C34004A: The expression in line 168 wrongly yields a value outside of the range of the target T, raising CONSTRAINT_ERROR.
- C35502P: The equality operators in lines 62 and 69 should be inequality operators.
- A35902C: Line 17's assignment of the nominal upper bound of a fixed point type to an object of that type raises CONSTRAINT_ERROR for that value lies outside of the actual range of the type.
- C35904A: The elaboration of the fixed-point subtype on line 28 wrongly raises CONSTRAINT_ERROR, because its upper bound exceeds that of the type.
- C35904B: The subtype declaration that is expected to raise CONSTRAINT_ERROR when its compatibility is checked against that of various types passed as actual generic parameters, may in fact raise NUMERIC_ERROR or CONSTRAINT_ERROR for reasons not anticipated by the test.
- C35A03E: This test assumes that attribute 'MANTISSA' returns 0 when applied to a fixed-point type with a null range, but the Ada Standard doesn't support this assumption.
- C35A03R: This test assumes that attribute 'MANTISSA' returns 0 when applied to a fixed-point type with a null range, but the Ada Standard doesn't support this assumption.

WITHDRAWN TESTS

- C37213H: The subtype declaration of SCONS in line 100 is wrongly expected to raise an exception when elaborated.
- C37213J: The aggregate in line 451 wrongly raises CONSTRAINT_ERROR.
- C37215C: Various discriminant constraints are wrongly expected to be
C37215E: incompatible with type CONS.
C37215G:
C37215H:
- C38102C: The fixed-point conversion on line 3 wrongly raises CONSTRAINT_ERROR.
- C41402A: 'STORAGE_SIZE' is wrongly applied to an object of an access type.
- C45332A: The test expects that either an expression in line 52 will raise an exception or else MACHINE_OVERFLOW is FALSE. However, an implementation may evaluate the expression correctly using a type with a wider range than the base type of the operands, and MACHINE_OVERFLOW may still be TRUE.
- C45614C: REPORT_IDENT_INT has an argument of the wrong type (LONG_INTEGER).
- A74016C: A bound specified in a fixed-point subtype declaration lies
C85018B: outside that calculated for the base type, raising
C87B04B: CONSTRAINT_ERROR. Errors of this sort occur re lines 37 and
CC1311B: 59, 142 and 143, 16 and 48, 252 and 253 of the four tests respectively (and possibly elsewhere).
- BC3105A: Lines 159..168 are wrongly expected to be incorrect; they are correct.
- AD1A01A: The declaration of subtype INT3 raises CONSTRAINT_ERROR for implementations that select INT'SIZE to be 16 or greater.
- CE2401H: The record aggregates in lines 105 and 117 contain the wrong values.
- CE3208A: This test expects that an attempt to open the default output file (after it was closed) with mode IN_FILE raises NAME_ERROR or USE_ERROR; by Commentary AI-00048, MODE_ERROR should be raised.