

GNAT Reference Manual

GNAT Reference Manual , Jan 09, 2026

AdaCore

Copyright © 2008-2026, Free Software Foundation

Table of Contents

1	About This Guide	2
1.1	What This Reference Manual Contains	2
1.2	Conventions	3
1.3	Related Information	3
2	Implementation Defined Pragas	5
2.1	Pragma Abort_Defer	5
2.2	Pragma Abstract_State	5
2.3	Pragma Ada_83	6
2.4	Pragma Ada_95	7
2.5	Pragma Ada_05	7
2.6	Pragma Ada_2005	7
2.7	Pragma Ada_12	8
2.8	Pragma Ada_2012	8
2.9	Pragma Ada_2022	8
2.10	Pragma Aggregate_Individually_Assign	9
2.11	Pragma Allow_Integer_Address	9
2.12	Pragma Always_Terminates	10
2.13	Pragma Annotate	10
2.14	Pragma Assert	10
2.15	Pragma Assert_And_Cut	11
2.16	Pragma Assertion_Level	11
2.17	Pragma Assertion_Policy	12
2.18	Pragma Assume	13
2.19	Pragma Assume_No_Invalid_Values	14
2.20	Pragma Async_Readers	14
2.21	Pragma Async_Writers	14
2.22	Pragma Attribute_Definition	15
2.23	Pragma C_Pass_By_Copy	15
2.24	Pragma Check	15
2.25	Pragma Check_Float_Overflow	16
2.26	Pragma Check_Name	16
2.27	Pragma Check_Policy	17
2.28	Pragma Comment	18
2.29	Pragma Common_Object	18
2.30	Pragma Compile_Time_Error	19
2.31	Pragma Compile_Time_Warning	19
2.32	Pragma Complete_Representation	19
2.33	Pragma Complex_Representation	20
2.34	Pragma Component_Alignment	20
2.35	Pragma Constant_After_Elaboration	21
2.36	Pragma Contract_Cases	21
2.37	Pragma Convention_Identifier	22

2.38	Pragma CPP_Class	23
2.39	Pragma CPP_Constructor	23
2.40	Pragma CPP_Virtual	24
2.41	Pragma CPP_Vtable	24
2.42	Pragma CPU	24
2.43	Pragma Deadline_Floor	24
2.44	Pragma Debug	24
2.45	Pragma Debug_Policy	25
2.46	Pragma Default_Initial_Condition	25
2.47	Pragma Default_Scalar_Storage_Order	25
2.48	Pragma Default_Storage_Pool	26
2.49	Pragma Depends	26
2.50	Pragma Detect_Blocking	27
2.51	Pragma Disable_Atomic_Synchronization	27
2.52	Pragma Dispatching_Domain	28
2.53	Pragma Effective_Reads	28
2.54	Pragma Effective_Writes	28
2.55	Pragma Elaboration_Checks	28
2.56	Pragma Eliminate	28
2.57	Pragma Enable_Atomic_Synchronization	31
2.58	Pragma Exceptional_Cases	31
2.59	Pragma Exit_Cases	31
2.60	Pragma Export_Function	31
2.61	Pragma Export_Object	32
2.62	Pragma Export_Procedure	33
2.63	Pragma Export_Valued_Procedure	34
2.64	Pragma Extend_System	34
2.65	Pragma Extensions_Allowed	35
2.66	Pragma Extensions_Visible	35
2.67	Pragma External	36
2.68	Pragma External_Name_Casing	36
2.69	Pragma Fast_Math	37
2.70	Pragma Favor_Top_Level	37
2.71	Pragma Finalize_Storage_Only	37
2.72	Pragma Float_Representation	38
2.73	Pragma Ghost	38
2.74	Pragma Global	38
2.75	Pragma Ident	39
2.76	Pragma Ignore_Pragma	39
2.77	Pragma Implementation_Defined	39
2.78	Pragma Implemented	39
2.79	Pragma Implicit_Packing	40
2.80	Pragma Import_Function	41
2.81	Pragma Import_Object	42
2.82	Pragma Import_Procedure	42
2.83	Pragma Import_Valued_Procedure	43
2.84	Pragma Independent	44

2.85	Pragma Independent_Components	44
2.86	Pragma Initial_Condition	44
2.87	Pragma Initialize_Scalars	45
2.88	Pragma Initializes	46
2.89	Pragma Inline_Always	46
2.90	Pragma Inline_Generic	47
2.91	Pragma Interface	47
2.92	Pragma Interface_Name	47
2.93	Pragma Interrupt_Handler	47
2.94	Pragma Interrupt_State	48
2.95	Pragma Interrupts_System_By_Default	49
2.96	Pragma Invariant	49
2.97	Pragma Keep_Names	49
2.98	Pragma License	50
2.99	Pragma Link_With	51
2.100	Pragma Linker_Alias	51
2.101	Pragma Linker_Constructor	52
2.102	Pragma Linker_Destructor	52
2.103	Pragma Linker_Section	52
2.104	Pragma Lock_Free	53
2.105	Pragma Loop_Invariant	54
2.106	Pragma Loop_Optimize	55
2.107	Pragma Loop_Variant	55
2.108	Pragma Machine_Attribute	56
2.109	Pragma Main	56
2.110	Pragma Main_Storage	56
2.111	Pragma Max_Queue_Length	57
2.112	Pragma No_Body	57
2.113	Pragma No_Caching	57
2.114	Pragma No_Component_Reordering	57
2.115	Pragma No_Elaboration_Code_All	58
2.116	Pragma No_Heap_Finalization	58
2.117	Pragma No_Inline	58
2.118	Pragma No_Raise	59
2.119	Pragma No_Return	59
2.120	Pragma No_Strict_Aliasing	59
2.121	Pragma No_Tagged_Streams	59
2.122	Pragma Normalize_Scalars	60
2.123	Pragma Obsolescent	61
2.124	Pragma Optimize_Alignment	63
2.125	Pragma Ordered	64
2.126	Pragma Overflow_Mode	65
2.127	Pragma Overriding_Renamings	65
2.128	Pragma Part_Of	66
2.129	Pragma Partition_Elaboration_Policy	66
2.130	Pragma Passive	66
2.131	Pragma Persistent_BSS	67

2.132	Pragma Post	67
2.133	Pragma Postcondition	67
2.134	Pragma Post_Class	70
2.135	Pragma Pre	70
2.136	Pragma Precondition	70
2.137	Pragma Predicate	71
2.138	Pragma Predicate_Failure	72
2.139	Pragma Preelaborable_Initialization	72
2.140	Pragma Prefix_Exception_Messages	72
2.141	Pragma Pre_Class	72
2.142	Pragma Priority_Specific_Dispatching	73
2.143	Pragma Profile	73
2.144	Pragma Profile_Warnings	76
2.145	Pragma Program_Exit	76
2.146	Pragma Propagate_Exceptions	76
2.147	Pragma Provide_Shift_Operators	76
2.148	Pragma Psect_Object	77
2.149	Pragma Pure_Function	77
2.150	Pragma Rational	78
2.151	Pragma Ravenscar	78
2.152	Pragma Refined_Depends	78
2.153	Pragma Refined_Global	79
2.154	Pragma Refined_Post	79
2.155	Pragma Refined_State	79
2.156	Pragma Relative_Deadline	80
2.157	Pragma Remote_Access_Type	80
2.158	Pragma Rename_Pragma	80
2.159	Pragma Restricted_Run_Time	81
2.160	Pragma Restriction_Warnings	81
2.161	Pragma Reviewable	81
2.162	Pragma Secondary_Stack_Size	82
2.163	Pragma Share_Generic	83
2.164	Pragma Shared	83
2.165	Pragma Short_Circuit_And_Or	83
2.166	Pragma Short_Descriptors	84
2.167	Pragma Side_Effects	84
2.168	Pragma Simple_Storage_Pool_Type	84
2.169	Pragma Source_File_Name	85
2.170	Pragma Source_File_Name_Project	86
2.171	Pragma Source_Reference	87
2.172	Pragma SPARK_Mode	87
2.173	Pragma Static_Elaboration_Desired	88
2.174	Pragma Stream_Convert	88
2.175	Pragma Style_Checks	89
2.176	Pragma Subprogram_Variant	91
2.177	Pragma Subtitle	92
2.178	Pragma Suppress	92

2.179	Pragma Suppress_All	93
2.180	Pragma Suppress_Debug_Info	93
2.181	Pragma Suppress_Exception_Locations	93
2.182	Pragma Suppress_Initialization	94
2.183	Pragma Task_Name	94
2.184	Pragma Task_Storage	95
2.185	Pragma Test_Case	95
2.186	Pragma Thread_Local_Storage	96
2.187	Pragma Time_Slice	96
2.188	Pragma Title	97
2.189	Pragma Type_Invariant	97
2.190	Pragma Type_Invariant_Class	97
2.191	Pragma Unchecked_Union	98
2.192	Pragma Unevaluated_Use_Of_Old	98
2.193	Pragma User_Aspect_Definition	98
2.194	Pragma Unimplemented_Unit	99
2.195	Pragma Universal_Aliasing	99
2.196	Pragma Unmodified	99
2.197	Pragma Unreferenced	100
2.198	Pragma Unreferenced_Objects	101
2.199	Pragma Unreserve_All_Interrupts	101
2.200	Pragma Unsuppress	101
2.201	Pragma Unused	102
2.202	Pragma Use_VADS_Size	102
2.203	Pragma Validity_Checks	102
2.204	Pragma Volatile	103
2.205	Pragma Volatile_Full_Access	103
2.206	Pragma Volatile_Function	104
2.207	Pragma Warning_As_Error	104
2.208	Pragma Warnings	105
2.209	Pragma Weak_External	107
2.210	Pragma Wide_Character-Encoding	108
3	Implementation Defined Aspects	109
3.1	Aspect Abstract_State	109
3.2	Aspect Always_Terminates	109
3.3	Aspect Annotate	109
3.4	Aspect Async_Readers	110
3.5	Aspect Async_Writers	110
3.6	Aspect Constant_After_Elaboration	110
3.7	Aspect Contract_Cases	110
3.8	Aspect Depends	110
3.9	Aspect Default_Initial_Condition	110
3.10	Aspect Dimension	110
3.11	Aspect Dimension_System	111
3.12	Aspect Disable_Controlled	112

3.13	Aspect Effective_Reads	112
3.14	Aspect Effective_Writes	112
3.15	Aspect Exceptional_Cases	112
3.16	Aspect Exit_Cases	112
3.17	Aspect Extended_Access	112
3.18	Aspect Extensions_Visible	113
3.19	Aspect Favor_Top_Level	114
3.20	Aspect Ghost	114
3.21	Aspect Ghost_Predicate	114
3.22	Aspect Global	114
3.23	Aspect Initial_Condition	114
3.24	Aspect Initializes	114
3.25	Aspect Inline_Always	114
3.26	Aspect Invariant	114
3.27	Aspect Invariant'Class	114
3.28	Aspect Iterable	114
3.29	Aspect Linker_Section	115
3.30	Aspect Local_Restrictions	115
3.31	Aspect Lock_Free	116
3.32	Aspect Max_Queue_Length	116
3.33	Aspect No_Caching	116
3.34	Aspect No_Elaboration_Code_All	116
3.35	Aspect No_Inline	116
3.36	Aspect No_Raise	116
3.37	Aspect No_Tagged_Streams	117
3.38	Aspect No_Task_Parts	117
3.39	Aspect Object_Size	117
3.40	Aspect Obsolescent	117
3.41	Aspect Part_Of	117
3.42	Aspect Persistent_BSS	117
3.43	Aspect Potentially_Invalid	117
3.44	Aspect Predicate	117
3.45	Aspect Program_Exit	117
3.46	Aspect Pure_Function	117
3.47	Aspect Refined_Depends	118
3.48	Aspect Refined_Global	118
3.49	Aspect Refined_Post	118
3.50	Aspect Refined_State	118
3.51	Aspect Relaxed_Initialization	118
3.52	Aspect Remote_Access_Type	118
3.53	Aspect Scalar_Storage_Order	118
3.54	Aspect Secondary_Stack_Size	118
3.55	Aspect Shared	118
3.56	Aspect Side_Effects	118
3.57	Aspect Simple_Storage_Pool	118
3.58	Aspect Simple_Storage_Pool_Type	118
3.59	Aspect SPARK_Mode	119

3.60	Aspect Subprogram_Variant	119
3.61	Aspect Suppress_Debug_Info	119
3.62	Aspect Suppress_Initialization	119
3.63	Aspect Test_Case	119
3.64	Aspect Thread_Local_Storage	119
3.65	Aspect Universal_Aliasing	119
3.66	Aspect Unmodified	119
3.67	Aspect Unreferenced	119
3.68	Aspect Unreferenced_Objects	119
3.69	Aspect User_Aspect	119
3.70	Aspect Value_Size	120
3.71	Aspect Volatile_Full_Access	120
3.72	Aspect Volatile_Function	120
3.73	Aspect Warnings	120
4	Implementation Defined Attributes	121
4.1	Attribute Abort_Signal	121
4.2	Attribute Address_Size	121
4.3	Attribute Asm_Input	121
4.4	Attribute Asm_Output	121
4.5	Attribute Atomic_Always_Lock_Free	122
4.6	Attribute Bit	122
4.7	Attribute Bit_Position	122
4.8	Attribute Code_Address	122
4.9	Attribute Compiler_Version	123
4.10	Attribute Constrained	123
4.11	Attribute Default_Bit_Order	123
4.12	Attribute Default_Scalar_Storage_Order	123
4.13	Attribute Deref	123
4.14	Attribute Descriptor_Size	123
4.15	Attribute Elaborated	124
4.16	Attribute Elab_Body	124
4.17	Attribute Elab_Spec	124
4.18	Attribute Elab_Subp_Body	124
4.19	Attribute Emax	124
4.20	Attribute Enabled	125
4.21	Attribute Enum_Rep	125
4.22	Attribute Enum_Val	125
4.23	Attribute Epsilon	126
4.24	Attribute Fast_Math	126
4.25	Attribute Finalization_Size	126
4.26	Attribute Fixed_Value	126
4.27	Attribute From_Address	126
4.28	Attribute From_Any	127
4.29	Attribute Has_Access_Values	127
4.30	Attribute Has_Discriminants	127

4.31	Attribute Has_Tagged_Values.....	127
4.32	Attribute Img.....	127
4.33	Attribute Initialized.....	128
4.34	Attribute Integer_Value.....	128
4.35	Attribute Invalid_Value.....	128
4.36	Attribute Large.....	128
4.37	Attribute Library_Level.....	128
4.38	Attribute Loop_Entry.....	129
4.39	Attribute Machine_Size.....	129
4.40	Attribute Mantissa.....	129
4.41	Attribute Maximum_Alignment.....	129
4.42	Attribute Max_Integer_Size.....	129
4.43	Attribute Mechanism_Code.....	130
4.44	Attribute Null_Parameter.....	130
4.45	Attribute Object_Size.....	130
4.46	Attribute Old.....	131
4.47	Attribute Passed_By_Reference.....	131
4.48	Attribute Pool_Address.....	131
4.49	Attribute Range_Length.....	132
4.50	Attribute Restriction_Set.....	132
4.51	Attribute Result.....	133
4.52	Attribute Round.....	133
4.53	Attribute Safe_Emax.....	133
4.54	Attribute Safe_Large.....	133
4.55	Attribute Safe_Small.....	133
4.56	Attribute Scalar_Storage_Order.....	133
4.57	Attribute Simple_Storage_Pool.....	136
4.58	Attribute Small.....	136
4.59	Attribute Small_Denominator.....	137
4.60	Attribute Small_Numerator.....	137
4.61	Attribute Storage_Unit.....	137
4.62	Attribute Stub_Type.....	137
4.63	Attribute System_Allocator_Alignment.....	137
4.64	Attribute Target_Name.....	137
4.65	Attribute To_Address.....	138
4.66	Attribute To_Any.....	138
4.67	Attribute Type_Class.....	138
4.68	Attribute Type_Key.....	138
4.69	Attribute TypeCode.....	138
4.70	Attribute Unconstrained_Array.....	139
4.71	Attribute Universal_Literal_String.....	139
4.72	Attribute Unrestricted_Access.....	139
4.73	Attribute Update.....	142
4.74	Attribute Valid_Value.....	143
4.75	Attribute Valid_Scalars.....	143
4.76	Attribute VADS_Size.....	144
4.77	Attribute Value_Size.....	144

4.78	Attribute Wchar_T_Size	144
4.79	Attribute Word_Size	144

5 Standard and Implementation

Defined Restrictions 145

5.1	Partition-Wide Restrictions	145
5.1.1	Immediate_Reclamation	145
5.1.2	Max_Asynchronous_Select_Nesting	145
5.1.3	Max_Entry_Queue_Length	145
5.1.4	Max_Protected_Entries	145
5.1.5	Max_Select_Alternatives	145
5.1.6	Max_Storage_At_Blocking	146
5.1.7	Max_Task_Entries	146
5.1.8	Max_Tasks	146
5.1.9	No_Abort_Statements	146
5.1.10	No_Access_Parameter_Allocators	146
5.1.11	No_Access_Subprograms	146
5.1.12	No_Allocators	146
5.1.13	No_Anonymous_Allocators	146
5.1.14	No_Asynchronous_Control	146
5.1.15	No_Calendar	146
5.1.16	No_Coextensions	146
5.1.17	No_Default_Initialization	147
5.1.18	No_Delay	147
5.1.19	No_Dependence	147
5.1.20	No_Direct_Boolean_Operators	147
5.1.21	No_Dispatch	147
5.1.22	No_Dispatching_Calls	147
5.1.23	No_Dynamic_Attachment	149
5.1.24	No_Dynamic_Priorities	149
5.1.25	No_Entry_Calls_In_Elaboration_Code	149
5.1.26	No_Enumeration_Maps	149
5.1.27	No_Exception_Handlers	149
5.1.28	No_Exception_Propagation	149
5.1.29	No_Exception_Registration	150
5.1.30	No_Exceptions	150
5.1.31	No_Finalization	150
5.1.32	No_Fixed_Point	150
5.1.33	No_Floating_Point	150
5.1.34	No_Implicit_Conditionals	150
5.1.35	No_Implicit_Dynamic_Code	151
5.1.36	No_Implicit_Heap_Allocations	151
5.1.37	No_Implicit_Protected_Object_Allocations	151
5.1.38	No_Implicit_Task_Allocations	151
5.1.39	No_InitializeScalars	151
5.1.40	No_IO	151

5.1.41	No_Local_Allocators	151
5.1.42	No_Local_Protected_Objects	151
5.1.43	No_Local_Tagged_Types	151
5.1.44	No_Local_Timing_Events	152
5.1.45	No_Long_Long_Integers	152
5.1.46	No_Multiple_Elaboration	152
5.1.47	No_Nested_Finalization	152
5.1.48	No_Protected_Type_Allocators	152
5.1.49	No_Protected_Types	152
5.1.50	No_Recursion	152
5.1.51	No_Reentrancy	152
5.1.52	No_Relative_Delay	152
5.1.53	No_Requeue_Statements	152
5.1.54	No_Secondary_Stack	153
5.1.55	No_Select_Statements	153
5.1.56	No_Specific_Termination_Handlers	153
5.1.57	No_Specification_of_Aspect	153
5.1.58	No_Standard_Allocators_After_Elaboration	153
5.1.59	No_Standard_Storage_Pools	153
5.1.60	No_Stream_Optimizations	153
5.1.61	No_Streams	153
5.1.62	No_Tagged_Type_Registration	154
5.1.63	No_Task_Allocators	154
5.1.64	No_Task_At_Interrupt_Priority	154
5.1.65	No_Task_Attributes_Package	154
5.1.66	No_Task_Hierarchy	154
5.1.67	No_Task_Termination	154
5.1.68	No_Tasking	154
5.1.69	No_Terminate_Alternatives	154
5.1.70	No_Unchecked_Access	155
5.1.71	No_Unchecked_Conversion	155
5.1.72	No_Unchecked_Deallocation	155
5.1.73	No_Use_Of_Attribute	155
5.1.74	No_Use_Of_Entity	155
5.1.75	No_Use_Of_Pragma	155
5.1.76	Pure_Barriers	155
5.1.77	Simple_Barriers	156
5.1.78	Static_Priorities	156
5.1.79	Static_Storage_Size	156
5.2	Program Unit Level Restrictions	156
5.2.1	No_Elaboration_Code	156
5.2.2	No_Dynamic_Accessibility_Checks	157
5.2.3	No_Dynamic_Sized_Objects	157
5.2.4	No_Entry_Queue	158
5.2.5	No_Implementation_Aspect_Specifications	158
5.2.6	No_Implementation_Attributes	158
5.2.7	No_Implementation_Identifiers	158

6.36	RM A.5.2(46-47): Random Number Generation	170
6.37	RM A.10.7(23): <code>Get_Immediate</code>	171
6.38	RM A.18: <code>Containers</code>	171
6.39	RM B.1(39-41): <code>Pragma Export</code>	171
6.40	RM B.2(12-13): <code>Package Interfaces</code>	172
6.41	RM B.3(63-71): Interfacing with C	172
6.42	RM B.4(95-98): Interfacing with COBOL	173
6.43	RM B.5(22-26): Interfacing with Fortran	173
6.44	RM C.1(3-5): Access to Machine Operations	174
6.45	RM C.1(10-16): Access to Machine Operations	174
6.46	RM C.3(28): Interrupt Support	175
6.47	RM C.3.1(20-21): Protected Procedure Handlers	175
6.48	RM C.3.2(25): <code>Package Interrupts</code>	175
6.49	RM C.4(14): Pre-elaboration Requirements	175
6.50	RM C.5(8): <code>Pragma Discard_Names</code>	175
6.51	RM C.7.2(30): The Package <code>Task_Attributes</code>	175
6.52	RM D.3(17): Locking Policies	176
6.53	RM D.4(16): Entry Queuing Policies	176
6.54	RM D.6(9-10): Preemptive Abort	176
6.55	RM D.7(21): Tasking Restrictions	176
6.56	RM D.8(47-49): Monotonic Time	176
6.57	RM E.5(28-29): Partition Communication Subsystem	177
6.58	RM F(7): COBOL Support	177
6.59	RM F.1(2): Decimal Radix Support	177
6.60	RM G: Numerics	177
6.61	RM G.1.1(56-58): Complex Types	178
6.62	RM G.1.2(49): Complex Elementary Functions	178
6.63	RM G.2.4(19): Accuracy Requirements	179
6.64	RM G.2.6(15): Complex Arithmetic Accuracy	179
6.65	RM H.6(15/2): <code>Pragma Partition_Elaboration_Policy</code>	179
7	Implementation Defined Characteristics	180
8	Intrinsic Subprograms	199
8.1	Intrinsic Operators	199
8.2	<code>Compilation_ISO_Date</code>	199
8.3	<code>Compilation_Date</code>	199
8.4	<code>Compilation_Time</code>	199
8.5	<code>Enclosing_Entity</code>	200
8.6	<code>Exception_Information</code>	200
8.7	<code>Exception_Message</code>	200
8.8	<code>Exception_Name</code>	200
8.9	<code>File</code>	200
8.10	<code>Line</code>	200
8.11	<code>Shifts and Rotates</code>	201
8.12	<code>Source_Location</code>	201

9	Representation Clauses and Pragmas	202
9.1	Alignment Clauses	202
9.2	Size Clauses	203
9.3	Storage_Size Clauses	204
9.4	Size of Variant Record Objects	205
9.5	Biased Representation	207
9.6	Value_Size and Object_Size Clauses	207
9.7	Component_Size Clauses	210
9.8	Bit_Order Clauses	211
9.9	Effect of Bit_Order on Byte Ordering	212
9.10	Pragma Pack for Arrays	216
9.11	Pragma Pack for Records	218
9.12	Record Representation Clauses	219
9.13	Handling of Records with Holes	220
9.14	Enumeration Clauses	221
9.15	Address Clauses	222
9.16	Use of Address Clauses for Memory-Mapped I/O	227
9.17	Effect of Convention on Representation	227
9.18	Conventions and Anonymous Access Types	228
9.19	Determining the Representations chosen by GNAT	230
10	Standard Library Routines	233
11	The Implementation of Standard I/O	244
11.1	Standard I/O Packages	244
11.2	FORM Strings	245
11.3	Direct_IO	245
11.4	Sequential_IO	245
11.5	Text_IO	246
11.5.1	Stream Pointer Positioning	247
11.5.2	Reading and Writing Non-Regular Files	247
11.5.3	Get_Immediate	248
11.5.4	Treating Text_IO Files as Streams	248
11.5.5	Text_IO Extensions	248
11.5.6	Text_IO Facilities for Unbounded Strings	248
11.6	Wide_Text_IO	249
11.6.1	Stream Pointer Positioning	251
11.6.2	Reading and Writing Non-Regular Files	252
11.7	Wide_Wide_Text_IO	252
11.7.1	Stream Pointer Positioning	253
11.7.2	Reading and Writing Non-Regular Files	253
11.8	Stream_IO	254
11.9	Text Translation	254
11.10	Shared Files	254
11.11	Filenames encoding	255

12.132	Interfaces.VxWorks (i-vxwork.ads).....	277
12.133	Interfaces.VxWorks.IO (i-vxwoio.ads).....	277
12.134	System.Address_Image (s-addima.ads).....	277
12.135	System.Assertions (s-assert.ads).....	278
12.136	System.Atomic_Counters (s-atocou.ads).....	278
12.137	System.Memory (s-memory.ads).....	278
12.138	System.Multiprocessors (s-multip.ads).....	278
12.139	System.Multiprocessors.Dispatching_Domains (s-mudido.ads) ..	278
12.140	System.Partition_Interface (s-parint.ads).....	278
12.141	System.Pool_Global (s-pooglo.ads).....	278
12.142	System.Pool_Local (s-pooloc.ads).....	279
12.143	System.Restrictions (s-restri.ads).....	279
12.144	System.Rident (s-rident.ads).....	279
12.145	System.Strings.Stream_Ops (s-ststop.ads).....	279
12.146	System.Unsigned_Types (s-unstyp.ads).....	279
12.147	System.Wch_Cnv (s-wchcnv.ads).....	279
12.148	System.Wch_Con (s-wchcon.ads).....	279
13	Interfacing to Other Languages	280
13.1	Interfacing to C.....	280
13.2	Interfacing to C++.....	281
13.3	Interfacing to COBOL.....	284
13.4	Interfacing to Fortran.....	284
13.5	Interfacing to non-GNAT Ada code.....	284
14	Specialized Needs Annexes	286
15	Implementation of Specific Ada Features ..	287
15.1	Machine Code Insertions	287
15.2	GNAT Implementation of Tasking.....	289
15.2.1	Mapping Ada Tasks onto the Underlying Kernel Threads ..	289
15.2.2	Ensuring Compliance with the Real-Time Annex.....	290
15.2.3	Support for Locking Policies	290
15.3	GNAT Implementation of Shared Passive Packages	291
15.4	Code Generation for Array Aggregates.....	292
15.4.1	Static constant aggregates with static bounds.....	292
15.4.2	Constant aggregates with unconstrained nominal types ..	293
15.4.3	Aggregates with static bounds	293
15.4.4	Aggregates with nonstatic bounds	293
15.4.5	Aggregates in assignment statements	293
15.5	The Size of Discriminated Records with Default Discriminants ..	294
15.6	Image Values For Nonscalar Types	295
15.7	Strict Conformance to the Ada Reference Manual.....	295

17.3.14	Structural Generic Instantiation	360
17.3.14.1	Syntax	360
17.3.14.2	Legality Rules	360
17.3.14.3	Static Semantics	360
18	Security Hardening Features	363
18.1	Register Scrubbing	363
18.2	Stack Scrubbing	363
18.3	Hardened Conditionals	365
18.4	Hardened Booleans	367
18.5	Control Flow Redundancy	368
19	Obsolescent Features	371
19.1	PolyORB	371
19.2	pragma No_Run_Time	371
19.3	pragma Ravenscar	371
19.4	pragma Restricted_Run_Time	371
19.5	pragma Task_Info	371
19.6	package System.Task_Info (s-tasinf.ads)	372
20	Compatibility and Porting Guide	373
20.1	Writing Portable Fixed-Point Declarations	373
20.2	Compatibility with Ada 83	374
20.2.1	Legal Ada 83 programs that are illegal in Ada 95	374
20.2.2	More deterministic semantics	376
20.2.3	Changed semantics	376
20.2.4	Other language compatibility issues	376
20.3	Compatibility between Ada 95 and Ada 2005	377
20.4	Implementation-dependent characteristics	378
20.4.1	Implementation-defined pragmas	378
20.4.2	Implementation-defined attributes	378
20.4.3	Libraries	378
20.4.4	Elaboration order	378
20.4.5	Target-specific aspects	379
20.5	Compatibility with Other Ada Systems	379
20.6	Representation Clauses	380
20.7	Compatibility with HP Ada 83	381
21	GNU Free Documentation License	382
	Index	389

‘GNAT, The GNU Ada Development Environment’

GCC version 16.0.1

AdaCore

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.3 or any later version published by the Free Software Foundation; with no Invariant Sections, with the Front-Cover Texts being “GNAT Reference Manual”, and with no Back-Cover Texts. A copy of the license is included in the section entitled [GNU Free Documentation License], page 381.

1 About This Guide

This manual contains useful information in writing programs using the GNAT compiler. It includes information on implementation dependent characteristics of GNAT, including all the information required by Annex M of the Ada language standard.

GNAT implements Ada 95, Ada 2005, Ada 2012 and Ada 2022, and it may also be invoked in Ada 83 compatibility mode. By default, GNAT assumes Ada 2012, but you can override with a compiler switch to explicitly specify the language version. (Please refer to the ‘GNAT User’s Guide’ for details on these switches.) Throughout this manual, references to ‘Ada’ without a year suffix apply to all the Ada versions of the language.

Ada is designed to be highly portable. In general, a program will have the same effect even when compiled by different compilers on different platforms. However, since Ada is designed to be used in a wide variety of applications, it also contains a number of system dependent features to be used in interfacing to the external world.

Note: Any program that makes use of implementation-dependent features may be non-portable. You should follow good programming practice and isolate and clearly document any sections of your program that make use of these features in a non-portable manner.

1.1 What This Reference Manual Contains

This reference manual contains the following chapters:

- * [Implementation Defined Pragmas], page 4, lists GNAT implementation-dependent pragmas, which can be used to extend and enhance the functionality of the compiler.
- * [Implementation Defined Attributes], page 120, lists GNAT implementation-dependent attributes, which can be used to extend and enhance the functionality of the compiler.
- * [Standard and Implementation Defined Restrictions], page 144, lists GNAT implementation-dependent restrictions, which can be used to extend and enhance the functionality of the compiler.
- * [Implementation Advice], page 159, provides information on generally desirable behavior which are not requirements that all compilers must follow since it cannot be provided on all systems, or which may be undesirable on some systems.
- * [Implementation Defined Characteristics], page 179, provides a guide to minimizing implementation dependent features.
- * [Intrinsic Subprograms], page 198, describes the intrinsic subprograms implemented by GNAT, and how they can be imported into user application programs.
- * [Representation Clauses and Pragmas], page 201, describes in detail the way that GNAT represents data, and in particular the exact set of representation clauses and pragmas that is accepted.
- * [Standard Library Routines], page 232, provides a listing of packages and a brief description of the functionality that is provided by Ada’s extensive set of standard library routines as implemented by GNAT.
- * [The Implementation of Standard I/O], page 243, details how the GNAT implementation of the input-output facilities.
- * [The GNAT Library], page 261, is a catalog of packages that complement the Ada predefined library.

- * [Interfacing to Other Languages], page 279, describes how programs written in Ada using GNAT can be interfaced to other programming languages.
- * [Specialized Needs Annexes], page 285, describes the GNAT implementation of all of the specialized needs annexes.
- * [Implementation of Specific Ada Features], page 286, discusses issues related to GNAT's implementation of machine code insertions, tasking, and several other features.
- * [Implementation of Ada 2022 Features], page 296, describes the status of the GNAT implementation of the Ada 2022 language standard.
- * [Security Hardening Features], page 362, documents GNAT extensions aimed at security hardening.
- * [Obsolescent Features], page 370, documents implementation dependent features, including pragmas and attributes, which are considered obsolescent, since there are other preferred ways of achieving the same results. These obsolescent forms are retained for backwards compatibility.
- * [Compatibility and Porting Guide], page 372, presents some guidelines for developing portable Ada code, describes the compatibility issues that may arise between GNAT and other Ada compilation systems (including those for Ada 83), and shows how GNAT can expedite porting applications developed in other Ada environments.
- * [GNU Free Documentation License], page 381, contains the license for this document.

This reference manual assumes a basic familiarity with the Ada 95 language, as described in the *International Standard ANSI/ISO/IEC-8652:1995*. It does not require knowledge of the new features introduced by Ada 2005 or Ada 2012. All three reference manuals are included in the GNAT documentation package.

1.2 Conventions

Following are examples of the typographical and graphic conventions used in this guide:

- * **Functions, utility program names, standard names, and classes.**
- * **Option flags**
- * **File names**
- * **Variables**
- * ‘**Emphasis**’
- * [optional information or parameters]
- * Examples are described by text
 and then shown this way.
- * Commands that are entered by the user are shown as preceded by a prompt string comprising the \$ character followed by a space.

1.3 Related Information

See the following documents for further information on GNAT:

- * *GNAT User's Guide for Native Platforms*, which provides information on how to use the GNAT development environment.

- * *Ada 95 Reference Manual*, the Ada 95 programming language standard.
- * *Ada 95 Annotated Reference Manual*, which is an annotated version of the Ada 95 standard. The annotations describe detailed aspects of the design decision, and in particular contain useful sections on Ada 83 compatibility.
- * *Ada 2005 Reference Manual*, the Ada 2005 programming language standard.
- * *Ada 2005 Annotated Reference Manual*, which is an annotated version of the Ada 2005 standard. The annotations describe detailed aspects of the design decision.
- * *Ada 2012 Reference Manual*, the Ada 2012 programming language standard.
- * *DEC Ada, Technical Overview and Comparison on DIGITAL Platforms*, which contains specific information on compatibility between GNAT and DEC Ada 83 systems.
- * *DEC Ada, Language Reference Manual*, part number AA-PYZAB-TK, which describes in detail the pragmas and attributes provided by the DEC Ada 83 compiler system.

2 Implementation Defined Pragmas

Ada defines a set of pragmas that can be used to supply additional information to the compiler. These language defined pragmas are implemented in GNAT and work as described in the Ada Reference Manual.

In addition, Ada allows implementations to define additional pragmas whose meaning is defined by the implementation. GNAT provides a number of these implementation-defined pragmas, which can be used to extend and enhance the functionality of the compiler. This section of the GNAT Reference Manual describes these additional pragmas.

Note that any program using these pragmas might not be portable to other compilers (although GNAT implements this set of pragmas on all platforms). Therefore if portability to other compilers is an important consideration, the use of these pragmas should be minimized.

2.1 Pragma Abort_Defer

Syntax:

```
pragma Abort_Defer;
```

This pragma must appear at the start of the statement sequence of a handled sequence of statements (right after the `begin`). It has the effect of deferring aborts for the sequence of statements (but not for the declarations or handlers, if any, associated with this statement sequence). This can also be useful for adding a polling point in Ada code, where asynchronous abort of tasks is checked when leaving the statement sequence, and is lighter than, for example, using `delay 0.0;`, since with zero-cost exception handling, propagating exceptions (implicitly used to implement task abort) cannot be done reliably in an asynchronous way.

An example of usage would be:

```
-- Add a polling point to check for task aborts

begin
  pragma Abort_Defer;
end;
```

2.2 Pragma Abstract_State

Syntax:

```
pragma Abstract_State (ABSTRACT_STATE_LIST);

ABSTRACT_STATE_LIST ::=
  null
  | STATE_NAME_WITH_OPTIONS
  | (STATE_NAME_WITH_OPTIONS {, STATE_NAME_WITH_OPTIONS} )

STATE_NAME_WITH_OPTIONS ::=
  STATE_NAME
  | (STATE_NAME with OPTION_LIST)
```

```

OPTION_LIST ::= OPTION {, OPTION}

OPTION ::=
    SIMPLE_OPTION
  | NAME_VALUE_OPTION

SIMPLE_OPTION ::= Ghost | Synchronous

NAME_VALUE_OPTION ::=
    Part_Of => ABSTRACT_STATE
  | External [=> EXTERNAL_PROPERTY_LIST]

EXTERNAL_PROPERTY_LIST ::=
    EXTERNAL_PROPERTY
  | (EXTERNAL_PROPERTY {, EXTERNAL_PROPERTY} )

EXTERNAL_PROPERTY ::=
    Async_Readers      [=> static_boolean_EXPRESSION]
  | Async_Writers      [=> static_boolean_EXPRESSION]
  | Effective_Reads    [=> static_boolean_EXPRESSION]
  | Effective_Writes   [=> static_boolean_EXPRESSION]
  | others              => static_boolean_EXPRESSION

STATE_NAME ::= defining_identifier

ABSTRACT_STATE ::= name

```

For the semantics of this pragma, see the entry for aspect `Abstract_State` in the SPARK 2014 Reference Manual, section 7.1.4.

2.3 Pragma `Ada_83`

Syntax:

```
pragma Ada_83;
```

A configuration pragma that establishes Ada 83 mode for the unit to which it applies, regardless of the mode set by the command line switches. In Ada 83 mode, GNAT attempts to be as compatible with the syntax and semantics of Ada 83, as defined in the original Ada 83 Reference Manual as possible. In particular, the keywords added by Ada 95 and Ada 2005 are not recognized, optional package bodies are allowed, and generics may name types with unknown discriminants without using the (<>) notation. In addition, some but not all of the additional restrictions of Ada 83 are enforced.

Like all configuration pragmas, if the pragma is placed before a library level package specification it is not propagated to the corresponding package body (see RM 10.1.5(8)); it must be added explicitly to the package body.

Ada 83 mode is intended for two purposes. Firstly, it allows existing Ada 83 code to be compiled and adapted to GNAT with less effort. Secondly, it aids in keeping code backwards

compatible with Ada 83. However, there is no guarantee that code that is processed correctly by GNAT in Ada 83 mode will in fact compile and execute with an Ada 83 compiler, since GNAT does not enforce all the additional checks required by Ada 83.

2.4 Pragma Ada_95

Syntax:

```
pragma Ada_95;
```

A configuration pragma that establishes Ada 95 mode for the unit to which it applies, regardless of the mode set by the command line switches. This mode is set automatically for the `Ada` and `System` packages and their children, so you need not specify it in these contexts. This pragma is useful when writing a reusable component that itself uses Ada 95 features, but which is intended to be usable from either Ada 83 or Ada 95 programs.

Like all configuration pragmas, if the pragma is placed before a library level package specification it is not propagated to the corresponding package body (see RM 10.1.5(8)); it must be added explicitly to the package body.

2.5 Pragma Ada_05

Syntax:

```
pragma Ada_05;  
pragma Ada_05 (local_NAME);
```

A configuration pragma that establishes Ada 2005 mode for the unit to which it applies, regardless of the mode set by the command line switches. This pragma is useful when writing a reusable component that itself uses Ada 2005 features, but which is intended to be usable from either Ada 83 or Ada 95 programs.

Like all configuration pragmas, if the pragma is placed before a library level package specification it is not propagated to the corresponding package body (see RM 10.1.5(8)); it must be added explicitly to the package body.

The one argument form (which is not a configuration pragma) is used for managing the transition from Ada 95 to Ada 2005 in the run-time library. If an entity is marked as `Ada_2005` only, then referencing the entity in `Ada_83` or `Ada_95` mode will generate a warning. In addition, in `Ada_83` or `Ada_95` mode, a preference rule is established which does not choose such an entity unless it is unambiguously specified. This avoids extra subprograms marked this way from generating ambiguities in otherwise legal pre-Ada_2005 programs. The one argument form is intended for exclusive use in the GNAT run-time library.

2.6 Pragma Ada_2005

Syntax:

```
pragma Ada_2005;
```

This configuration pragma is a synonym for `pragma Ada_05` and has the same syntax and effect.

2.7 Pragma Ada_12

Syntax:

```
pragma Ada_12;  
pragma Ada_12 (local_NAME);
```

A configuration pragma that establishes Ada 2012 mode for the unit to which it applies, regardless of the mode set by the command line switches. This mode is set automatically for the `Ada` and `System` packages and their children, so you need not specify it in these contexts. This pragma is useful when writing a reusable component that itself uses Ada 2012 features, but which is intended to be usable from Ada 83, Ada 95, or Ada 2005 programs.

Like all configuration pragmas, if the pragma is placed before a library level package specification it is not propagated to the corresponding package body (see RM 10.1.5(8)); it must be added explicitly to the package body.

The one argument form, which is not a configuration pragma, is used for managing the transition from Ada 2005 to Ada 2012 in the run-time library. If an entity is marked as `Ada_2012` only, then referencing the entity in any pre-`Ada_2012` mode will generate a warning. In addition, in any pre-`Ada_2012` mode, a preference rule is established which does not choose such an entity unless it is unambiguously specified. This avoids extra subprograms marked this way from generating ambiguities in otherwise legal pre-`Ada_2012` programs. The one argument form is intended for exclusive use in the GNAT run-time library.

2.8 Pragma Ada_2012

Syntax:

```
pragma Ada_2012;
```

This configuration pragma is a synonym for `pragma Ada_12` and has the same syntax and effect.

2.9 Pragma Ada_2022

Syntax:

```
pragma Ada_2022;  
pragma Ada_2022 (local_NAME);
```

A configuration pragma that establishes Ada 2022 mode for the unit to which it applies, regardless of the mode set by the command line switches. This mode is set automatically for the `Ada` and `System` packages and their children, so you need not specify it in these contexts. This pragma is useful when writing a reusable component that itself uses Ada 2022 features, but which is intended to be usable from Ada 83, Ada 95, Ada 2005 or Ada 2012 programs.

Like all configuration pragmas, if the pragma is placed before a library level package specification it is not propagated to the corresponding package body (see RM 10.1.5(8)); it must be added explicitly to the package body.

The one argument form, which is not a configuration pragma, is used for managing the transition from Ada 2012 to Ada 2022 in the run-time library. If an entity is marked as `Ada_2022` only, then referencing the entity in any pre-`Ada_2022` mode will generate a

warning. In addition, in any pre-Ada_2012 mode, a preference rule is established which does not choose such an entity unless it is unambiguously specified. This avoids extra subprograms marked this way from generating ambiguities in otherwise legal pre-Ada_2022 programs. The one argument form is intended for exclusive use in the GNAT run-time library.

2.10 Pragma Aggregate_Individually_Assign

Syntax:

```
pragma Aggregate_Individually_Assign;
```

Where possible, GNAT will store the binary representation of a record aggregate in memory for space and performance reasons. This configuration pragma changes this behavior so that record aggregates are instead always converted into individual assignment statements.

2.11 Pragma Allow_Integer_Address

Syntax:

```
pragma Allow_Integer_Address;
```

In almost all versions of GNAT, `System.Address` is a private type in accordance with the implementation advice in the RM. This means that integer values, in particular integer literals, are not allowed as address values. If the configuration pragma `Allow_Integer_Address` is given, then integer expressions may be used anywhere a value of type `System.Address` is required. The effect is to introduce an implicit unchecked conversion from the integer value to type `System.Address`. The reverse case of using an address where an integer type is required is handled analogously. The following example compiles without errors:

```
pragma Allow_Integer_Address;
with System; use System;
package AddrAsInt is
  X : Integer;
  Y : Integer;
  for X'Address use 16#1240#;
  for Y use at 16#3230#;
  m : Address := 16#4000#;
  n : constant Address := 4000;
  p : constant Address := Address (X + Y);
  v : Integer := y'Address;
  w : constant Integer := Integer (Y'Address);
  type R is new integer;
  RR : R := 1000;
  Z : Integer;
  for Z'Address use RR;
end AddrAsInt;
```

Note that pragma `Allow_Integer_Address` is ignored if `System.Address` is not a private type. In implementations of GNAT where `System.Address` is a visible integer type, this pragma serves no purpose but is ignored rather than rejected to allow common sets of sources to be used in the two situations.

2.12 Pragma Always_Terminates

Syntax:

```
pragma Always_Terminates [ (boolean_EXPRESSION) ];
```

For the semantics of this pragma, see the entry for aspect `Always_Terminates` in the SPARK 2014 Reference Manual, section 6.1.11.

2.13 Pragma Annotate

Syntax:

```
pragma Annotate (IDENTIFIER [, IDENTIFIER {, ARG}] [, entity => local_NAME]);
```

```
ARG ::= NAME | EXPRESSION
```

This pragma is used to annotate programs. `IDENTIFIER` identifies the type of annotation. GNAT verifies that it is an identifier, but does not otherwise analyze it. The second optional identifier is also left unanalyzed, and by convention is used to control the action of the tool to which the annotation is addressed. The remaining `ARG` arguments can be either string literals or more generally expressions. String literals (and concatenations of string literals) are assumed to be either of type `Standard.String` or else `Wide_String` or `Wide_Wide_String` depending on the character literals they contain. All other kinds of arguments are analyzed as expressions, and must be unambiguous. The last argument if present must have the identifier `Entity` and GNAT verifies that a local name is given.

The analyzed pragma is retained in the tree, but not otherwise processed by any part of the GNAT compiler, except to generate corresponding note lines in the generated ALI file. For the format of these note lines, see the compiler source file `lib-writ.ads`. This pragma is intended for use by external tools. The use of pragma `Annotate` does not affect the compilation process in any way. This pragma may be used as a configuration pragma.

2.14 Pragma Assert

Syntax:

```
pragma Assert (
  boolean_EXPRESSION
  [, string_EXPRESSION]);
```

The effect of this pragma depends on whether the corresponding command line switch is set to activate assertions. The pragma expands into code equivalent to the following:

```
if assertions-enabled then
  if not boolean_EXPRESSION then
    System.Assertions.Raise_Assert_Failure
      (string_EXPRESSION);
  end if;
end if;
```

The string argument, if given, is the message that will be associated with the exception occurrence if the exception is raised. If no second argument is given, the default message is `file:nnn`, where `file` is the name of the source file containing the assert, and `nnn` is the line number of the assert.

Note that, as with the `if` statement to which it is equivalent, the type of the expression is either `Standard.Boolean`, or any type derived from this standard type.

Assert checks can be either checked or ignored. By default they are ignored. They will be checked if either the command line switch ‘-gnata’ is used, or if an `Assertion_Policy` or `Check_Policy` pragma is used to enable `Assert_Checks`.

If assertions are ignored, then there is no run-time effect (and in particular, any side effects from the expression will not occur at run time). (The expression is still analyzed at compile time, and may cause types to be frozen if they are mentioned here for the first time).

If assertions are checked, then the given expression is tested, and if it is `False` then `System.Assertions.Raise_Assert_Failure` is called which results in the raising of `Assert_Failure` with the given message.

You should generally avoid side effects in the expression arguments of this pragma, because these side effects will turn on and off with the setting of the assertions mode, resulting in assertions that have an effect on the program. However, the expressions are analyzed for semantic correctness whether or not assertions are enabled, so turning assertions on and off cannot affect the legality of a program.

Note that the implementation defined policy `DISABLE`, given in a pragma `Assertion_Policy`, can be used to suppress this semantic analysis.

Note: this is a standard language-defined pragma in versions of Ada from 2005 on. In GNAT, it is implemented in all versions of Ada, and the `DISABLE` policy is an implementation-defined addition.

This is an assertion kind pragma that can associate a set of its arguments with an assertion level. See SPARK 2014 Reference Manual, section 11.4.2.

2.15 Pragma `Assert_And_Cut`

Syntax:

```
pragma Assert_And_Cut (
    boolean_EXPRESSION
    [, string_EXPRESSION]);
```

The effect of this pragma is identical to that of pragma `Assert`, except that in an `Assertion_Policy` pragma, the identifier `Assert_And_Cut` is used to control whether it is ignored or checked (or disabled).

The intention is that this be used within a subprogram when the given test expression sums up all the work done so far in the subprogram, so that the rest of the subprogram can be verified (informally or formally) using only the entry preconditions, and the expression in this pragma. This allows dividing up a subprogram into sections for the purposes of testing or formal verification. The pragma also serves as useful documentation.

This is an assertion kind pragma that can associate a set of its arguments with an assertion level. See SPARK 2014 Reference Manual, section 11.4.2.

2.16 Pragma `Assertion_Level`

Syntax:

```
pragma Assertion_Level (LEVEL_IDENTIFIER
```

```
[, depends => DEPENDENCY_DESCRIPTOR]);
```

```
DEPENDENCY_DESCRIPTOR ::= LEVEL_IDENTIFIER | LEVEL_IDENTIFIER_LIST
```

```
LEVEL_IDENTIFIER_LIST ::= '[' LEVEL_IDENTIFIER {, LEVEL_IDENTIFIER} ']'
```

For the semantics of this pragma, see the SPARK 2014 Reference Manual, section 11.4.3.

2.17 Pragma Assertion_Policy

Syntax:

```
pragma Assertion_Policy (CHECK | DISABLE | IGNORE | SUPPRESSIBLE);
```

```
pragma Assertion_Policy (
  ASSERTION_KIND => POLICY_IDENTIFIER
  {, ASSERTION_KIND => POLICY_IDENTIFIER});
```

```
ASSERTION_KIND ::= RM_ASSERTION_KIND | ID_ASSERTION_KIND | ASSERTION_LEVEL
```

```
RM_ASSERTION_KIND ::= Assert
                    Static_Predicate
                    Dynamic_Predicate
                    Pre
                    Pre'Class
                    Post
                    Post'Class
                    Type_Invariant
                    Type_Invariant'Class
                    Default_Initial_Condition
```

```
ID_ASSERTION_KIND ::= Assertions
                    Assert_And_Cut
                    Assume
                    Contract_Cases
                    Debug
                    Ghost
                    Initial_Condition
                    Invariant
                    Invariant'Class
                    Loop_Invariant
                    Loop_Variant
                    Postcondition
                    Precondition
                    Predicate
                    Refined_Post
                    Statement_Assertions
                    Subprogram_Variant
```

POLICY_IDENTIFIER ::= Check | Disable | Ignore | Suppressible

This is a standard Ada 2012 pragma that is available as an implementation-defined pragma in earlier versions of Ada. The assertion kinds **RM_ASSERTION_KIND** are those defined in the Ada standard. The assertion kinds **ID_ASSERTION_KIND** are implementation defined additions recognized by the GNAT compiler.

Additionally the pragma can apply to an assertion level defined by the **Assertion_Level** pragma. For more details see the SPARK 2014 Reference Manual, section 11.4.2.

The pragma applies in both cases to pragmas and aspects with matching names, e.g. **Pre** applies to the **Pre** aspect, and **Precondition** applies to both the **Precondition** pragma and the aspect **Precondition**. Note that the identifiers for pragmas **Pre_Class** and **Post_Class** are **Pre'Class** and **Post'Class** (not **Pre_Class** and **Post_Class**), since these pragmas are intended to be identical to the corresponding aspects.

If the policy is **CHECK**, then assertions are enabled, i.e. the corresponding pragma or aspect is activated. If the policy is **IGNORE**, then assertions are ignored, i.e. the corresponding pragma or aspect is deactivated. This pragma overrides the effect of the ‘-gnata’ switch on the command line. If the policy is **SUPPRESSIBLE**, then assertions are enabled by default, however, if the ‘-gnatp’ switch is specified all assertions are ignored.

The implementation defined policy **DISABLE** is like **IGNORE** except that it completely disables semantic checking of the corresponding pragma or aspect. This is useful when the pragma or aspect argument references subprograms in a with'ed package which is replaced by a dummy package for the final build.

The implementation defined assertion kind **Assertions** applies to all assertion kinds. The form with no assertion kind given implies this choice, so it applies to all assertion kinds (RM defined, and implementation defined).

The implementation defined assertion kind **Statement_Assertions** applies to **Assert**, **Assert_And_Cut**, **Assume**, **Loop_Invariant**, and **Loop_Variant**.

2.18 Pragma Assume

Syntax:

```
pragma Assume (
  boolean_EXPRESSION
  [, string_EXPRESSION]);
```

The effect of this pragma is identical to that of pragma **Assert**, except that in an **Assertion_Policy** pragma, the identifier **Assume** is used to control whether it is ignored or checked (or disabled).

The intention is that this be used for assumptions about the external environment. So you cannot expect to verify formally or informally that the condition is met, this must be established by examining things outside the program itself. For example, we may have code that depends on the size of **Long_Long_Integer** being at least 64. So we could write:

```
pragma Assume (Long_Long_Integer'Size >= 64);
```

This assumption cannot be proved from the program itself, but it acts as a useful run-time check that the assumption is met, and documents the need to ensure that it is met by reference to information outside the program.

This is an assertion kind pragma that can associate a set of its arguments with an assertion level. See SPARK 2014 Reference Manual, section 11.4.2.

2.19 Pragma Assume_No_Invalid_Values

Syntax:

```
pragma Assume_No_Invalid_Values (On | Off);
```

This is a configuration pragma that controls the assumptions made by the compiler about the occurrence of invalid representations (invalid values) in the code.

The default behavior (corresponding to an Off argument for this pragma), is to assume that values may in general be invalid unless the compiler can prove they are valid. Consider the following example:

```
V1 : Integer range 1 .. 10;
V2 : Integer range 11 .. 20;
...
for J in V2 .. V1 loop
  ...
end loop;
```

if V1 and V2 have valid values, then the loop is known at compile time not to execute since the lower bound must be greater than the upper bound. However in default mode, no such assumption is made, and the loop may execute. If `Assume_No_Invalid_Values (On)` is given, the compiler will assume that any occurrence of a variable other than in an explicit `'Valid` test always has a valid value, and the loop above will be optimized away.

The use of `Assume_No_Invalid_Values (On)` is appropriate if you know your code is free of uninitialized variables and other possible sources of invalid representations, and may result in more efficient code. A program that accesses an invalid representation with this pragma in effect is erroneous, so no guarantees can be made about its behavior.

It is peculiar though permissible to use this pragma in conjunction with validity checking (`-gnatVa`). In such cases, accessing invalid values will generally give an exception, though formally the program is erroneous so there are no guarantees that this will always be the case, and it is recommended that these two options not be used together.

2.20 Pragma Async_Readers

Syntax:

```
pragma Async_Readers [ (static_boolean_EXPRESSION) ];
```

For the semantics of this pragma, see the entry for aspect `Async_Readers` in the SPARK 2014 Reference Manual, section 7.1.2.

2.21 Pragma Async_Writers

Syntax:

```
pragma Async_Writers [ (static_boolean_EXPRESSION) ];
```

For the semantics of this pragma, see the entry for aspect `Async_Writers` in the SPARK 2014 Reference Manual, section 7.1.2.

2.22 Pragma Attribute_Definition

Syntax:

```
pragma Attribute_Definition
  ([Attribute =>] ATTRIBUTE_DESIGNATOR,
   [Entity    =>] LOCAL_NAME,
   [Expression =>] EXPRESSION | NAME);
```

If **Attribute** is a known attribute name, this pragma is equivalent to the attribute definition clause:

```
for Entity'Attribute use Expression;
```

If **Attribute** is not a recognized attribute name, the pragma is ignored, and a warning is emitted. This allows source code to be written that takes advantage of some new attribute, while remaining compilable with earlier compilers.

2.23 Pragma C_Pass_By_Copy

Syntax:

```
pragma C_Pass_By_Copy
  ([Max_Size =>] static_integer_EXPRESSION);
```

Normally the default mechanism for passing C convention records to C convention subprograms is to pass them by reference, as suggested by RM B.3(69). Use the configuration pragma **C_Pass_By_Copy** to change this default, by requiring that record formal parameters be passed by copy if all of the following conditions are met:

- * The size of the record type does not exceed the value specified for **Max_Size**.
- * The record type has **Convention C**.
- * The formal parameter has this record type, and the subprogram has a foreign (non-Ada) convention.

If these conditions are met the argument is passed by copy; i.e., in a manner consistent with what C expects if the corresponding formal in the C prototype is a struct (rather than a pointer to a struct).

You can also pass records by copy by specifying the convention **C_Pass_By_Copy** for the record type, or by using the extended **Import** and **Export** pragmas, which allow specification of passing mechanisms on a parameter by parameter basis.

2.24 Pragma Check

Syntax:

```
pragma Check (
  [Name    =>] CHECK_KIND,
  [Check   =>] Boolean_EXPRESSION
  [, [Message =>] string_EXPRESSION] );
```

```
CHECK_KIND ::= IDENTIFIER          |
               Pre'Class            |
               Post'Class           |
```

```

Type_Invariant'Class |
Invariant'Class

```

This pragma is similar to the predefined pragma `Assert` except that an extra identifier argument is present. In conjunction with pragma `Check_Policy`, this can be used to define groups of assertions that can be independently controlled. The identifier `Assertion` is special, it refers to the normal set of pragma `Assert` statements.

Checks introduced by this pragma are normally deactivated by default. They can be activated either by the command line option ‘-gnata’, which turns on all checks, or individually controlled using pragma `Check_Policy`.

The identifiers `Assertions` and `Statement_Assertions` are not permitted as check kinds, since this would cause confusion with the use of these identifiers in `Assertion_Policy` and `Check_Policy` pragmas, where they are used to refer to sets of assertions.

2.25 Pragma `Check_Float_Overflow`

Syntax:

```
pragma Check_Float_Overflow;
```

In Ada, the predefined floating-point types (`Short_Float`, `Float`, `Long_Float`, `Long_Long_Float`) are defined to be ‘unconstrained’. This means that even though each has a well-defined base range, an operation that delivers a result outside this base range is not required to raise an exception. This implementation permission accommodates the notion of infinities in IEEE floating-point, and corresponds to the efficient execution mode on most machines. GNAT will not raise overflow exceptions on these machines; instead it will generate infinities and NaN’s as defined in the IEEE standard.

Generating infinities, although efficient, is not always desirable. Often the preferable approach is to check for overflow, even at the (perhaps considerable) expense of run-time performance. This can be accomplished by defining your own constrained floating-point subtypes – i.e., by supplying explicit range constraints – and indeed such a subtype can have the same base range as its base type. For example:

```
subtype My_Float is Float range Float'Range;
```

Here `My_Float` has the same range as `Float` but is constrained, so operations on `My_Float` values will be checked for overflow against this range.

This style will achieve the desired goal, but it is often more convenient to be able to simply use the standard predefined floating-point types as long as overflow checking could be guaranteed. The `Check_Float_Overflow` configuration pragma achieves this effect. If a unit is compiled subject to this configuration pragma, then all operations on predefined floating-point types including operations on base types of these floating-point types will be treated as though those types were constrained, and overflow checks will be generated. The `Constraint_Error` exception is raised if the result is out of range.

This mode can also be set by use of the compiler switch ‘-gnateF’.

2.26 Pragma `Check_Name`

Syntax:

```
pragma Check_Name (check_name_IDENTIFIER);
```

This is a configuration pragma that defines a new implementation defined check name (unless IDENTIFIER matches one of the predefined check names, in which case the pragma has no effect). Check names are global to a partition, so if two or more configuration pragmas are present in a partition mentioning the same name, only one new check name is introduced.

An implementation defined check name introduced with this pragma may be used in only three contexts: `pragma Suppress`, `pragma Unsuppress`, and as the prefix of a `Check_Name'Enabled` attribute reference. For any of these three cases, the check name must be visible. A check name is visible if it is in the configuration pragmas applying to the current unit, or if it appears at the start of any unit that is part of the dependency set of the current unit (e.g., units that are mentioned in `with` clauses).

Check names introduced by this pragma are subject to control by compiler switches (in particular `-gnatp`) in the usual manner.

2.27 Pragma Check_Policy

Syntax:

```
pragma Check_Policy
  ([Name    =>] CHECK_KIND,
   [Policy =>] POLICY_IDENTIFIER);

pragma Check_Policy (
  CHECK_KIND => POLICY_IDENTIFIER
  {, CHECK_KIND => POLICY_IDENTIFIER});

ASSERTION_KIND ::= RM_ASSERTION_KIND | ID_ASSERTION_KIND

CHECK_KIND ::= IDENTIFIER
              Pre'Class
              Post'Class
              Type_Invariant'Class |
              Invariant'Class
```

The identifiers `Name` and `Policy` are not allowed as `CHECK_KIND` values. This avoids confusion between the two possible syntax forms for this pragma.

```
POLICY_IDENTIFIER ::= ON | OFF | CHECK | DISABLE | IGNORE
```

This pragma is used to set the checking policy for assertions (specified by aspects or pragmas), the `Debug` pragma, or additional checks to be checked using the `Check` pragma. It may appear either as a configuration pragma, or within a declarative part of package. In the latter case, it applies from the point where it appears to the end of the declarative region (like pragma `Suppress`).

The `Check_Policy` pragma is similar to the predefined `Assertion_Policy` pragma, and if the check kind corresponds to one of the assertion kinds that are allowed by `Assertion_Policy`, then the effect is identical.

If the first argument is `Debug`, then the policy applies to `Debug` pragmas, disabling their effect if the policy is `OFF`, `DISABLE`, or `IGNORE`, and allowing them to execute with normal semantics if the policy is `ON` or `CHECK`. In addition if the policy is `DISABLE`, then the procedure call in `Debug` pragmas will be totally ignored and not analyzed semantically.

Finally the first argument may be some other identifier than the above possibilities, in which case it controls a set of named assertions that can be checked using pragma `Check`. For example, if the pragma:

```
pragma Check_Policy (Critical_Error, OFF);
```

is given, then subsequent `Check` pragmas whose first argument is also `Critical_Error` will be disabled.

The check policy is `OFF` to turn off corresponding checks, and `ON` to turn on corresponding checks. The default for a set of checks for which no `Check_Policy` is given is `OFF` unless the compiler switch ‘-gnata’ is given, which turns on all checks by default.

The check policy settings `CHECK` and `IGNORE` are recognized as synonyms for `ON` and `OFF`. These synonyms are provided for compatibility with the standard `Assertion_Policy` pragma. The check policy setting `DISABLE` causes the second argument of a corresponding `Check` pragma to be completely ignored and not analyzed.

2.28 Pragma Comment

Syntax:

```
pragma Comment (static_string_EXPRESSION);
```

This is almost identical in effect to pragma `Ident`. It allows the placement of a comment into the object file and hence into the executable file if the operating system permits such usage. The difference is that `Comment`, unlike `Ident`, has no limitations on placement of the pragma (it can be placed anywhere in the main source unit), and if more than one pragma is used, all comments are retained.

2.29 Pragma Common_Object

Syntax:

```
pragma Common_Object (
    [Internal =>] LOCAL_NAME
    [, [External =>] EXTERNAL_SYMBOL]
    [, [Size    =>] EXTERNAL_SYMBOL] );
```

```
EXTERNAL_SYMBOL ::=
    IDENTIFIER
    | static_string_EXPRESSION
```

This pragma enables the shared use of variables stored in overlaid linker areas corresponding to the use of `COMMON` in Fortran. The single object `LOCAL_NAME` is assigned to the area designated by the `External` argument. You may define a record to correspond to a series of fields. The `Size` argument is syntax checked in GNAT, but otherwise ignored.

`Common_Object` is not supported on all platforms. If no support is available, then the code generator will issue a message indicating that the necessary attribute for implementation of this pragma is not available.

2.30 Pragma Compile_Time_Error

Syntax:

```
pragma Compile_Time_Error
    (boolean_EXPRESSION, static_string_EXPRESSION);
```

This pragma can be used to generate additional compile time error messages. It is particularly useful in generics, where errors can be issued for specific problematic instantiations. The first parameter is a boolean expression. The pragma ensures that the value of an expression is known at compile time, and has the value False. The set of expressions whose values are known at compile time includes all static boolean expressions, and also other values which the compiler can determine at compile time (e.g., the size of a record type set by an explicit size representation clause, or the value of a variable which was initialized to a constant and is known not to have been modified). If these conditions are not met, an error message is generated using the value given as the second argument. This string value may contain embedded ASCII.LF characters to break the message into multiple lines.

2.31 Pragma Compile_Time_Warning

Syntax:

```
pragma Compile_Time_Warning
    (boolean_EXPRESSION, static_string_EXPRESSION);
```

Same as pragma Compile_Time_Error, except a warning is issued instead of an error message. If switch ‘-gnatw-C’ is used, a warning is only issued if the value of the expression is known to be True at compile time, not when the value of the expression is not known at compile time. Note that if this pragma is used in a package that is with’ed by a client, the client will get the warning even though it is issued by a with’ed package (normally warnings in with’ed units are suppressed, but this is a special exception to that rule).

One typical use is within a generic where compile time known characteristics of formal parameters are tested, and warnings given appropriately. Another use with a first parameter of True is to warn a client about use of a package, for example that it is not fully implemented.

In previous versions of the compiler, combining ‘-gnatwe’ with Compile_Time_Warning resulted in a fatal error. Now the compiler always emits a warning. You can use [Pragma Compile_Time_Error], page 18, to force the generation of an error.

2.32 Pragma Complete_Representation

Syntax:

```
pragma Complete_Representation;
```

This pragma must appear immediately within a record representation clause. Typical placements are before the first component clause or after the last component clause. The effect is to give an error message if any component is missing a component clause. This pragma may be used to ensure that a record representation clause is complete, and that this invariant is maintained if fields are added to the record in the future.

2.33 Pragma Complex_Representation

Syntax:

```
pragma Complex_Representation
    ([Entity =>] LOCAL_NAME);
```

The **Entity** argument must be the name of a record type which has two fields of the same floating-point type. The effect of this pragma is to force gcc to use the special internal complex representation form for this record, which may be more efficient. Note that this may result in the code for this type not conforming to standard ABI (application binary interface) requirements for the handling of record types. For example, in some environments, there is a requirement for passing records by pointer, and the use of this pragma may result in passing this type in floating-point registers.

2.34 Pragma Component_Alignment

Syntax:

```
pragma Component_Alignment (
    [Form =>] ALIGNMENT_CHOICE
    [, [Name =>] type_LOCAL_NAME]);

ALIGNMENT_CHOICE ::=
    Component_Size
  | Component_Size_4
  | Storage_Unit
  | Default
```

Specifies the alignment of components in array or record types. The meaning of the **Form** argument is as follows:

‘Component_Size’

Aligns scalar components and subcomponents of the array or record type on boundaries appropriate to their inherent size (naturally aligned). For example, 1-byte components are aligned on byte boundaries, 2-byte integer components are aligned on 2-byte boundaries, 4-byte integer components are aligned on 4-byte boundaries and so on. These alignment rules correspond to the normal rules for C compilers on all machines except the VAX.

‘Component_Size_4’

Naturally aligns components with a size of four or fewer bytes. Components that are larger than 4 bytes are placed on the next 4-byte boundary.

‘Storage_Unit’

Specifies that array or record components are byte aligned, i.e., aligned on boundaries determined by the value of the constant **System.Storage_Unit**.

‘Default’

Specifies that array or record components are aligned on default boundaries, appropriate to the underlying hardware or operating system or both. The **Default** choice is the same as **Component_Size** (natural alignment).

If the `Name` parameter is present, `type_LOCAL_NAME` must refer to a local record or array type, and the specified alignment choice applies to the specified type. The use of `Component_Alignment` together with a `pragma Pack` causes the `Component_Alignment` pragma to be ignored. The use of `Component_Alignment` together with a record representation clause is only effective for fields not specified by the representation clause.

If the `Name` parameter is absent, the pragma can be used as either a configuration pragma, in which case it applies to one or more units in accordance with the normal rules for configuration pragmas, or it can be used within a declarative part, in which case it applies to types that are declared within this declarative part, or within any nested scope within this declarative part. In either case it specifies the alignment to be applied to any record or array type which has otherwise standard representation.

If the alignment for a record or array type is not specified (using `pragma Pack`, `pragma Component_Alignment`, or a record rep clause), the GNAT uses the default alignment as described previously.

2.35 Pragma Constant_After_Elaboration

Syntax:

```
pragma Constant_After_Elaboration [ (static_boolean_EXPRESSION) ];
```

For the semantics of this pragma, see the entry for aspect `Constant_After_Elaboration` in the SPARK 2014 Reference Manual, section 3.3.1.

2.36 Pragma Contract_Cases

Syntax:

```
pragma Contract_Cases (CONTRACT_CASE {, CONTRACT_CASE});
```

```
CONTRACT_CASE ::= CASE_GUARD => CONSEQUENCE
```

```
CASE_GUARD ::= boolean_EXPRESSION | others
```

```
CONSEQUENCE ::= boolean_EXPRESSION
```

The `Contract_Cases` pragma allows defining fine-grain specifications that can complement or replace the contract given by a precondition and a postcondition. Additionally, the `Contract_Cases` pragma can be used by testing and formal verification tools. The compiler checks its validity and, depending on the assertion policy at the point of declaration of the pragma, it may insert a check in the executable. For code generation, the contract cases

```
pragma Contract_Cases (
  Cond1 => Pred1,
  Cond2 => Pred2);
```

are equivalent to

```
C1 : constant Boolean := Cond1;  -- evaluated at subprogram entry
C2 : constant Boolean := Cond2;  -- evaluated at subprogram entry
pragma Precondition ((C1 and not C2) or (C2 and not C1));
pragma Postcondition (if C1 then Pred1);
pragma Postcondition (if C2 then Pred2);
```

The precondition ensures that one and only one of the case guards is satisfied on entry to the subprogram. The postcondition ensures that for the case guard that was True on entry, the corresponding consequence is True on exit. Other consequence expressions are not evaluated.

A precondition *P* and postcondition *Q* can also be expressed as contract cases:

```
pragma Contract_Cases (P => Q);
```

The placement and visibility rules for `Contract_Cases` pragmas are identical to those described for preconditions and postconditions.

The compiler checks that boolean expressions given in case guards and consequences are valid, where the rules for case guards are the same as the rule for an expression in `Precondition` and the rules for consequences are the same as the rule for an expression in `Postcondition`. In particular, attributes `'Old` and `'Result` can only be used within consequence expressions. The case guard for the last contract case may be `others`, to denote any case not captured by the previous cases. The following is an example of use within a package spec:

```
package Math_Functions is
...
  function Sqrt (Arg : Float) return Float;
  pragma Contract_Cases (((Arg in 0.0 .. 99.0) => Sqrt'Result < 10.0,
                                Arg >= 100.0           => Sqrt'Result >= 10.0,
                                others                  => Sqrt'Result = 0.0));
...
end Math_Functions;
```

The meaning of contract cases is that only one case should apply at each call, as determined by the corresponding case guard evaluating to True, and that the consequence for this case should hold when the subprogram returns.

This is an assertion kind pragma that can associate a set of its arguments with an assertion level. See SPARK 2014 Reference Manual, section 11.4.2.

2.37 Pragma Convention_Identifier

Syntax:

```
pragma Convention_Identifier (
  [Name =>] IDENTIFIER,
  [Convention =>] convention_IDENTIFIER);
```

This pragma provides a mechanism for supplying synonyms for existing convention identifiers. The `Name` identifier can subsequently be used as a synonym for the given convention in other pragmas (including for example `pragma Import` or another `Convention_Identifier` pragma). As an example of the use of this, suppose you had legacy code which used `Fortran77` as the identifier for Fortran. Then the pragma:

```
pragma Convention_Identifier (Fortran77, Fortran);
```

would allow the use of the convention identifier `Fortran77` in subsequent code, avoiding the need to modify the sources. As another example, you could use this to parameterize convention requirements according to systems. Suppose you needed to use `Stdcall` on windows systems, and `C` on some other system, then you could define a convention identifier

Library and use a single **Convention_Identifier** pragma to specify which convention would be used system-wide.

2.38 Pragma **CPP_Class**

Syntax:

```
pragma CPP_Class ([Entity =>] LOCAL_NAME);
```

The argument denotes an entity in the current declarative region that is declared as a record type. It indicates that the type corresponds to an externally declared C++ class type, and is to be laid out the same way that C++ would lay out the type. If the C++ class has virtual primitives then the record must be declared as a tagged record type.

Types for which **CPP_Class** is specified do not have assignment or equality operators defined (such operations can be imported or declared as subprograms as required). Initialization is allowed only by constructor functions (see pragma **CPP_Constructor**). Such types are implicitly limited if not explicitly declared as limited or derived from a limited type, and an error is issued in that case.

See [Interfacing to C++], page 281, for related information.

Note: Pragma **CPP_Class** is currently obsolete. It is supported for backward compatibility but its functionality is available using pragma **Import** with **Convention = CPP**.

2.39 Pragma **CPP_Constructor**

Syntax:

```
pragma CPP_Constructor ([Entity =>] LOCAL_NAME
    [, [External_Name =>] static_string_EXPRESSION ]
    [, [Link_Name      =>] static_string_EXPRESSION ]);
```

This pragma identifies an imported function (imported in the usual way with pragma **Import**) as corresponding to a C++ constructor. If **External_Name** and **Link_Name** are not specified then the **Entity** argument is a name that must have been previously mentioned in a pragma **Import** with **Convention = CPP**. Such name must be of one of the following forms:

- * 'function' **Fname** 'return' T'
- * 'function' **Fname** 'return' T'Class
- * 'function' **Fname** (...) 'return' T'
- * 'function' **Fname** (...) 'return' T'Class

where T is a limited record type imported from C++ with pragma **Import** and **Convention = CPP**.

The first two forms import the default constructor, used when an object of type T is created on the Ada side with no explicit constructor. The latter two forms cover all the non-default constructors of the type. See the GNAT User's Guide for details.

If no constructors are imported, it is impossible to create any objects on the Ada side and the type is implicitly declared abstract.

Pragma **CPP_Constructor** is intended primarily for automatic generation using an automatic binding generator tool (such as the **-fdump-ada-spec** GCC switch). See [Interfacing to C++], page 281, for more related information.

Note: The use of functions returning class-wide types for constructors is currently obsolete. They are supported for backward compatibility. The use of functions returning the type T leave the Ada sources more clear because the imported C++ constructors always return an object of type T; that is, they never return an object whose type is a descendant of type T.

2.40 Pragma CPP_Virtual

This pragma is now obsolete and, other than generating a warning if warnings on obsolescent features are enabled, is completely ignored. It is retained for compatibility purposes. It used to be required to ensure compatibility with C++, but is no longer required for that purpose because GNAT generates the same object layout as the G++ compiler by default. See [Interfacing to C++], page 281, for related information.

2.41 Pragma CPP_Vtable

This pragma is now obsolete and, other than generating a warning if warnings on obsolescent features are enabled, is completely ignored. It used to be required to ensure compatibility with C++, but is no longer required for that purpose because GNAT generates the same object layout as the G++ compiler by default.

See [Interfacing to C++], page 281, for related information.

2.42 Pragma CPU

Syntax:

```
pragma CPU (EXPRESSION);
```

This pragma is standard in Ada 2012, but is available in all earlier versions of Ada as an implementation-defined pragma. See Ada 2012 Reference Manual for details.

2.43 Pragma Deadline_Floor

Syntax:

```
pragma Deadline_Floor (time_span_EXPRESSION);
```

This pragma applies only to protected types and specifies the floor deadline inherited by a task when the task enters a protected object. It is effective only when the EDF scheduling policy is used.

2.44 Pragma Debug

Syntax:

```
pragma Debug ([CONDITION, ]PROCEDURE_CALL_WITHOUT_SEMICOLON);

PROCEDURE_CALL_WITHOUT_SEMICOLON ::=
  PROCEDURE_NAME
  | PROCEDURE_PREFIX ACTUAL_PARAMETER_PART
```

The procedure call argument has the syntactic form of an expression, meeting the syntactic requirements for pragmas.

If debug pragmas are not enabled or if the condition is present and evaluates to False, this pragma has no effect. If debug pragmas are enabled, the semantics of the pragma is exactly equivalent to the procedure call statement corresponding to the argument with a terminating semicolon. Pragmas are permitted in sequences of declarations, so you can use pragma `Debug` to intersperse calls to debug procedures in the middle of declarations. Debug pragmas can be enabled either by use of the command line switch ‘-gnata’ or by use of the pragma `Check_Policy` with a first argument of `Debug`.

This is an assertion kind pragma that can associate a set of its arguments with an assertion level. See SPARK 2014 Reference Manual, section 11.4.2.

2.45 Pragma `Debug_Policy`

Syntax:

```
pragma Debug_Policy (CHECK | DISABLE | IGNORE | ON | OFF);
```

This pragma is equivalent to a corresponding `Check_Policy` pragma with a first argument of `Debug`. It is retained for historical compatibility reasons.

2.46 Pragma `Default_Initial_Condition`

Syntax:

```
pragma Default_Initial_Condition [ (null | boolean_EXPRESSION) ];
```

For the semantics of this pragma, see the entry for aspect `Default_Initial_Condition` in the SPARK 2014 Reference Manual, section 7.3.3.

This is an assertion kind pragma that can associate a set of its arguments with an assertion level. See SPARK 2014 Reference Manual, section 11.4.2.

2.47 Pragma `Default_Scalar_Storage_Order`

Syntax:

```
pragma Default_Scalar_Storage_Order (High_Order_First | Low_Order_First);
```

Normally if no explicit `Scalar_Storage_Order` is given for a record type or array type, then the scalar storage order defaults to the ordinary default for the target. But this default may be overridden using this pragma. The pragma may appear as a configuration pragma, or locally within a package spec or declarative part. In the latter case, it applies to all subsequent types declared within that package spec or declarative part.

The following example shows the use of this pragma:

```
pragma Default_Scalar_Storage_Order (High_Order_First);
with System; use System;
package DSS01 is
  type H1 is record
    a : Integer;
  end record;

  type L2 is record
    a : Integer;
  end record;
```

```

    for L2'Scalar_Storage_Order use Low_Order_First;

    type L2a is new L2;

    package Inner is
        type H3 is record
            a : Integer;
        end record;

        pragma Default_Scalar_Storage_Order (Low_Order_First);

        type L4 is record
            a : Integer;
        end record;
    end Inner;

    type H4a is new Inner.L4;

    type H5 is record
        a : Integer;
    end record;
end DSS01;

```

In this example record types with names starting with ‘L’ have *Low_Order_First* scalar storage order, and record types with names starting with ‘H’ have *High_Order_First*. Note that in the case of H4a, the order is not inherited from the parent type. Only an explicitly set *Scalar_Storage_Order* gets inherited on type derivation.

If this pragma is used as a configuration pragma which appears within a configuration pragma file (as opposed to appearing explicitly at the start of a single unit), then the binder will require that all units in a partition be compiled in a similar manner, other than run-time units, which are not affected by this pragma. Note that the use of this form is discouraged because it may significantly degrade the run-time performance of the software, instead the default scalar storage order ought to be changed only on a local basis.

2.48 Pragma Default_Storage_Pool

Syntax:

```
pragma Default_Storage_Pool (storage_pool_NAME | null);
```

This pragma is standard in Ada 2012, but is available in all earlier versions of Ada as an implementation-defined pragma. See Ada 2012 Reference Manual for details.

2.49 Pragma Depends

Syntax:

```
pragma Depends (DEPENDENCY_RELATION);
```

```
DEPENDENCY_RELATION ::=
```

```

    null
  | (DEPENDENCY_CLAUSE {, DEPENDENCY_CLAUSE})

DEPENDENCY_CLAUSE ::=
    OUTPUT_LIST =>[+] INPUT_LIST
  | NULL_DEPENDENCY_CLAUSE

NULL_DEPENDENCY_CLAUSE ::= null => INPUT_LIST

OUTPUT_LIST ::= OUTPUT | (OUTPUT {, OUTPUT})

INPUT_LIST ::= null | INPUT | (INPUT {, INPUT})

OUTPUT ::= NAME | FUNCTION_RESULT
INPUT  ::= NAME

```

where `FUNCTION_RESULT` is a function `Result` `attribute_reference`

For the semantics of this pragma, see the entry for aspect `Depends` in the SPARK 2014 Reference Manual, section 6.1.5.

2.50 Pragma `Detect_Blocking`

Syntax:

```
pragma Detect_Blocking;
```

This is a standard pragma in Ada 2005, that is available in all earlier versions of Ada as an implementation-defined pragma.

This is a configuration pragma that forces the detection of potentially blocking operations within a protected operation, and to raise `Program_Error` if that happens.

2.51 Pragma `Disable_Atomic_Synchronization`

Syntax:

```
pragma Disable_Atomic_Synchronization [(Entity)];
```

```
pragma Enable_Atomic_Synchronization [(Entity)];
```

Ada requires that accesses (reads or writes) of an atomic variable be regarded as synchronization points in the case of multiple tasks. Particularly in the case of multi-processors this may require special handling, e.g. the generation of memory barriers. This synchronization is performed by default, but can be turned off using pragma `Disable_Atomic_Synchronization`. The `Enable_Atomic_Synchronization` pragma turns it back on.

The placement and scope rules for these pragmas are the same as those for `pragma Suppress`. In particular they can be used as configuration pragmas, or in a declaration sequence where they apply until the end of the scope. If an `Entity` argument is present, the action applies only to that entity.

2.52 Pragma Dispatching_Domain

Syntax:

```
pragma Dispatching_Domain (EXPRESSION);
```

This pragma is standard in Ada 2012, but is available in all earlier versions of Ada as an implementation-defined pragma. See Ada 2012 Reference Manual for details.

2.53 Pragma Effective_Reads

Syntax:

```
pragma Effective_Reads [ (static_boolean_EXPRESSION) ];
```

For the semantics of this pragma, see the entry for aspect `Effective_Reads` in the SPARK 2014 Reference Manual, section 7.1.2.

2.54 Pragma Effective_Writes

Syntax:

```
pragma Effective_Writes [ (static_boolean_EXPRESSION) ];
```

For the semantics of this pragma, see the entry for aspect `Effective_Writes` in the SPARK 2014 Reference Manual, section 7.1.2.

2.55 Pragma Elaboration_Checks

Syntax:

```
pragma Elaboration_Checks (Dynamic | Static);
```

This is a configuration pragma which specifies the elaboration model to be used during compilation. For more information on the elaboration models of GNAT, consult the chapter on elaboration order handling in the ‘GNAT User’s Guide’.

The pragma may appear in the following contexts:

- * Configuration pragmas file
- * Prior to the context clauses of a compilation unit’s initial declaration

Any other placement of the pragma will result in a warning and the effects of the offending pragma will be ignored.

If the pragma argument is `Dynamic`, then the dynamic elaboration model is in effect. If the pragma argument is `Static`, then the static elaboration model is in effect.

2.56 Pragma Eliminate

Syntax:

```
pragma Eliminate (
    [ Unit_Name      => ] IDENTIFIER | SELECTED_COMPONENT ,
    [ Entity         => ] IDENTIFIER |
                                SELECTED_COMPONENT |
                                STRING_LITERAL
    [, Source_Location => SOURCE_TRACE ] );
```

```
SOURCE_TRACE      ::= STRING_LITERAL
```

This pragma indicates that the given entity is not used in the program to be compiled and built, thus allowing the compiler to eliminate the code or data associated with the named entity. Any reference to an eliminated entity causes a compile-time or link-time error.

The pragma has the following semantics, where **U** is the unit specified by the **Unit_Name** argument and **E** is the entity specified by the **Entity** argument:

- * **E** must be a subprogram that is explicitly declared either:
 - * Within **U**, or
 - * Within a generic package that is instantiated in **U**, or
 - * As an instance of generic subprogram instantiated in **U**.

Otherwise the pragma is ignored.

- * If **E** is overloaded within **U** then, in the absence of a **Source_Location** argument, all overloadings are eliminated.
- * If **E** is overloaded within **U** and only some overloadings are to be eliminated, then each overloading to be eliminated must be specified in a corresponding pragma **Eliminate** with a **Source_Location** argument identifying the line where the declaration appears, as described below.
- * If **E** is declared as the result of a generic instantiation, then a **Source_Location** argument is needed, as described below.

Pragma **Eliminate** allows a program to be compiled in a system-independent manner, so that unused entities are eliminated but without needing to modify the source text. Normally the required set of **Eliminate** pragmas is constructed automatically using the **gnatelim** tool.

Any source file change that removes, splits, or adds lines may make the set of **Eliminate** pragmas invalid because their **Source_Location** argument values may get out of date.

Pragma **Eliminate** may be used where the referenced entity is a dispatching operation. In this case all the subprograms to which the given operation can dispatch are considered to be unused (are never called as a result of a direct or a dispatching call).

The string literal given for the source location specifies the line number of the declaration of the entity, using the following syntax for **SOURCE_TRACE**:

```
SOURCE_TRACE      ::= SOURCE_REFERENCE [ LBRACKET SOURCE_TRACE RBRACKET ]
```

```
LBRACKET          ::= '['
```

```
RBRACKET          ::= ']'
```

```
SOURCE_REFERENCE ::= FILE_NAME : LINE_NUMBER
```

```
LINE_NUMBER       ::= DIGIT {DIGIT}
```

Spaces around the colon in a **SOURCE_REFERENCE** are optional.

The source trace that is given as the **Source_Location** must obey the following rules (or else the pragma is ignored), where **U** is the unit **U** specified by the **Unit_Name** argument and **E** is the subprogram specified by the **Entity** argument:

- * `FILE_NAME` is the short name (with no directory information) of the Ada source file for `U`, using the required syntax for the underlying file system (e.g. case is significant if the underlying operating system is case sensitive). If `U` is a package and `E` is a subprogram declared in the package specification and its full declaration appears in the package body, then the relevant source file is the one for the package specification; analogously if `U` is a generic package.
- * If `E` is not declared in a generic instantiation (this includes generic subprogram instances), the source trace includes only one source line reference. `LINE_NUMBER` gives the line number of the occurrence of the declaration of `E` within the source file (as a decimal literal without an exponent or point).
- * If `E` is declared by a generic instantiation, its source trace (from left to right) starts with the source location of the declaration of `E` in the generic unit and ends with the source location of the instantiation, given in square brackets. This approach is applied recursively with nested instantiations: the rightmost (nested most deeply in square brackets) element of the source trace is the location of the outermost instantiation, and the leftmost element (that is, outside of any square brackets) is the location of the declaration of `E` in the generic unit.

Examples:

```
pragma Eliminate (Pkg0, Proc);
-- Eliminate (all overloadings of) Proc in Pkg0

pragma Eliminate (Pkg1, Proc,
                  Source_Location => "pkg1.ads:8");
-- Eliminate overloading of Proc at line 8 in pkg1.ads

-- Assume the following file contents:
--   gen_pkg.ads
--   1: generic
--   2:   type T is private;
--   3: package Gen_Pkg is
--   4:   procedure Proc(N : T);
--   ...   ...
--   ... end Gen_Pkg;
--
--   q.adb
--   1: with Gen_Pkg;
--   2: procedure Q is
--   3:   package Inst_Pkg is new Gen_Pkg(Integer);
--   ...   -- No calls on Inst_Pkg.Proc
--   ... end Q;

-- The following pragma eliminates Inst_Pkg.Proc from Q
pragma Eliminate (Q, Proc,
                  Source_Location => "gen_pkg.ads:4[q.adb:3]");
```

2.57 Pragma Enable_Atomic_Synchronization

Syntax:

```
pragma Enable_Atomic_Synchronization [(Entity)];
```

Reenables atomic synchronization; see `pragma Disable_Atomic_Synchronization` for details.

2.58 Pragma Exceptional_Cases

Syntax:

```
pragma Exceptional_Cases (EXCEPTIONAL_CASE_LIST);
```

```
EXCEPTIONAL_CASE_LIST ::= EXCEPTIONAL_CASE {, EXCEPTIONAL_CASE}
EXCEPTIONAL_CASE      ::= exception_choice {'|' exception_choice} => CONSEQUENCE
CONSEQUENCE           ::= Boolean_expression
```

For the semantics of this aspect, see the SPARK 2014 Reference Manual, section 6.1.9.

2.59 Pragma Exit_Cases

Syntax:

```
pragma Exit_Cases (EXIT_CASE_LIST);
```

```
EXIT_CASE_LIST ::= EXIT_CASE {, EXIT_CASE}
EXIT_CASE      ::= GUARD => EXIT_KIND
EXIT_KIND      ::= Normal_Return
                  | Exception_Raised
                  | (Exception_Raised => exception_name)
                  | Program_Exit
GUARD          ::= Boolean_expression
```

For the semantics of this aspect, see the SPARK 2014 Reference Manual, section 6.1.10.

2.60 Pragma Export_Function

Syntax:

```
pragma Export_Function (
    [Internal          =>] LOCAL_NAME
    [, [External       =>] EXTERNAL_SYMBOL]
    [, [Parameter_Types =>] PARAMETER_TYPES]
    [, [Result_Type    =>] result_SUBTYPE_MARK]
    [, [Mechanism      =>] MECHANISM]
    [, [Result_Mechanism =>] MECHANISM_NAME]);

EXTERNAL_SYMBOL ::=
    IDENTIFIER
  | static_string_EXPRESSION
  | ""
```

```

PARAMETER_TYPES ::=
    null
  | TYPE_DESIGNATOR {, TYPE_DESIGNATOR}

TYPE_DESIGNATOR ::=
    subtype_NAME
  | subtype_Name ' Access

MECHANISM ::=
    MECHANISM_NAME
  | (MECHANISM_ASSOCIATION {, MECHANISM_ASSOCIATION})

MECHANISM_ASSOCIATION ::=
    [formal_parameter_NAME =>] MECHANISM_NAME

MECHANISM_NAME ::= Value | Reference

```

Use this pragma to make a function externally callable and optionally provide information on mechanisms to be used for passing parameter and result values. We recommend, for the purposes of improving portability, this pragma always be used in conjunction with a separate pragma `Export`, which must precede the pragma `Export_Function`. GNAT does not require a separate pragma `Export`, but if none is present, `Convention Ada` is assumed, which is usually not what is wanted, so it is usually appropriate to use this pragma in conjunction with a `Export` or `Convention` pragma that specifies the desired foreign convention. Pragma `Export_Function` (and `Export`, if present) must appear in the same declarative region as the function to which they apply.

The `internal_name` must uniquely designate the function to which the pragma applies. If more than one function name exists of this name in the declarative part you must use the `Parameter_Types` and `Result_Type` parameters to achieve the required unique designation. The *subtype_marks* in these parameters must exactly match the subtypes in the corresponding function specification, using positional notation to match parameters with subtype marks. The form with an `'Access` attribute can be used to match an anonymous access parameter.

Special treatment is given if the `EXTERNAL` is an explicit null string or a static string expressions that evaluates to the null string. In this case, no external name is generated. This form still allows the specification of parameter mechanisms.

2.61 Pragma `Export_Object`

Syntax:

```

pragma Export_Object (
    [Internal =>] LOCAL_NAME
    [, [External =>] EXTERNAL_SYMBOL]
    [, [Size      =>] EXTERNAL_SYMBOL]);

EXTERNAL_SYMBOL ::=
    IDENTIFIER

```

```
| static_string_EXPRESSION
```

This pragma designates an object as exported, and apart from the extended rules for external symbols, is identical in effect to the use of the normal `Export` pragma applied to an object. You may use a separate `Export` pragma (and you probably should from the point of view of portability), but it is not required. `Size` is syntax checked, but otherwise ignored by GNAT.

2.62 Pragma `Export_Procedure`

Syntax:

```
pragma Export_Procedure (
    [Internal      =>] LOCAL_NAME
    [, [External   =>] EXTERNAL_SYMBOL]
    [, [Parameter_Types =>] PARAMETER_TYPES]
    [, [Mechanism   =>] MECHANISM]);

EXTERNAL_SYMBOL ::=
    IDENTIFIER
  | static_string_EXPRESSION
  | ""

PARAMETER_TYPES ::=
    null
  | TYPE_DESIGNATOR {, TYPE_DESIGNATOR}

TYPE_DESIGNATOR ::=
    subtype_NAME
  | subtype_Name ' Access

MECHANISM ::=
    MECHANISM_NAME
  | (MECHANISM_ASSOCIATION {, MECHANISM_ASSOCIATION})

MECHANISM_ASSOCIATION ::=
    [formal_parameter_NAME =>] MECHANISM_NAME

MECHANISM_NAME ::= Value | Reference
```

This pragma is identical to `Export_Function` except that it applies to a procedure rather than a function and the parameters `Result_Type` and `Result_Mechanism` are not permitted. GNAT does not require a separate pragma `Export`, but if none is present, `Convention Ada` is assumed, which is usually not what is wanted, so it is usually appropriate to use this pragma in conjunction with a `Export` or `Convention` pragma that specifies the desired foreign convention.

Special treatment is given if the `EXTERNAL` is an explicit null string or a static string expressions that evaluates to the null string. In this case, no external name is generated. This form still allows the specification of parameter mechanisms.

2.63 Pragma Export_Valued_Procedure

Syntax:

```
pragma Export_Valued_Procedure (
    [Internal          =>] LOCAL_NAME
    [, [External       =>] EXTERNAL_SYMBOL]
    [, [Parameter_Types =>] PARAMETER_TYPES]
    [, [Mechanism      =>] MECHANISM]);

EXTERNAL_SYMBOL ::=
    IDENTIFIER
  | static_string_EXPRESSION
  | ""

PARAMETER_TYPES ::=
    null
  | TYPE_DESIGNATOR {, TYPE_DESIGNATOR}

TYPE_DESIGNATOR ::=
    subtype_NAME
  | subtype_Name ' Access

MECHANISM ::=
    MECHANISM_NAME
  | (MECHANISM_ASSOCIATION {, MECHANISM_ASSOCIATION})

MECHANISM_ASSOCIATION ::=
    [formal_parameter_NAME =>] MECHANISM_NAME

MECHANISM_NAME ::= Value | Reference
```

This pragma is identical to `Export_Procedure` except that the first parameter of `LOCAL_NAME`, which must be present, must be of mode `out`, and externally the subprogram is treated as a function with this parameter as the result of the function. GNAT provides for this capability to allow the use of `out` and `in out` parameters in interfacing to external functions (which are not permitted in Ada functions). GNAT does not require a separate pragma `Export`, but if none is present, `Convention Ada` is assumed, which is almost certainly not what is wanted since the whole point of this pragma is to interface with foreign language functions, so it is usually appropriate to use this pragma in conjunction with a `Export` or `Convention` pragma that specifies the desired foreign convention.

Special treatment is given if the `EXTERNAL` is an explicit null string or a static string expressions that evaluates to the null string. In this case, no external name is generated. This form still allows the specification of parameter mechanisms.

2.64 Pragma Extend_System

Syntax:

```
pragma Extend_System ([Name =>] IDENTIFIER);
```

This pragma is used to provide backwards compatibility with other implementations that extend the facilities of package `System`. In GNAT, `System` contains only the definitions that are present in the Ada RM. However, other implementations, notably the DEC Ada 83 implementation, provide many extensions to package `System`.

For each such implementation accommodated by this pragma, GNAT provides a package `Aux_xxx`, e.g., `Aux_DEC` for the DEC Ada 83 implementation, which provides the required additional definitions. You can use this package in two ways. You can `with` it in the normal way and access entities either by selection or using a `use` clause. In this case no special processing is required.

However, if existing code contains references such as `System.xxx` where ‘xxx’ is an entity in the extended definitions provided in package `System`, you may use this pragma to extend visibility in `System` in a non-standard way that provides greater compatibility with the existing code. Pragma `Extend_System` is a configuration pragma whose single argument is the name of the package containing the extended definition (e.g., `Aux_DEC` for the DEC Ada case). A unit compiled under control of this pragma will be processed using special visibility processing that looks in package `System.Aux_xxx` where `Aux_xxx` is the pragma argument for any entity referenced in package `System`, but not found in package `System`.

You can use this pragma either to access a predefined `System` extension supplied with the compiler, for example `Aux_DEC` or you can construct your own extension unit following the above definition. Note that such a package is a child of `System` and thus is considered part of the implementation. To compile it you will have to use the ‘-gnatg’ switch for compiling `System` units, as explained in the GNAT User’s Guide.

2.65 Pragma `Extensions_Allowed`

Syntax:

```
pragma Extensions_Allowed (On | Off | All_Extensions);
```

This configuration pragma enables (via the “On” or “All_Extensions” argument) or disables (via the “Off” argument) the implementation extension mode; the pragma takes precedence over the `-gnatX` and `-gnatX0` command switches.

If an argument of “On” is specified, the latest version of the Ada language is implemented (currently Ada 2022) and, in addition, a curated set of GNAT specific extensions are recognized. (See the list here [here], page 330)

An argument of “All_Extensions” has the same effect except that some extra experimental extensions are enabled (See the list here [here], page 341)

2.66 Pragma `Extensions_Visible`

Syntax:

```
pragma Extensions_Visible [ (static_boolean_EXPRESSION) ];
```

For the semantics of this pragma, see the entry for aspect `Extensions_Visible` in the SPARK 2014 Reference Manual, section 6.1.7.

2.67 Pragma External

Syntax:

```
pragma External (
  [ Convention      =>] convention_IDENTIFIER,
  [ Entity          =>] LOCAL_NAME
  [, [External_Name =>] static_string_EXPRESSION ]
  [, [Link_Name     =>] static_string_EXPRESSION ] );
```

This pragma is identical in syntax and semantics to pragma **Export** as defined in the Ada Reference Manual. It is provided for compatibility with some Ada 83 compilers that used this pragma for exactly the same purposes as pragma **Export** before the latter was standardized.

2.68 Pragma External_Name_Casing

Syntax:

```
pragma External_Name_Casing (
  Uppercase | Lowercase
  [, Uppercase | Lowercase | As_Is]);
```

This pragma provides control over the casing of external names associated with Import and Export pragmas. There are two cases to consider:

- * Implicit external names

Implicit external names are derived from identifiers. The most common case arises when a standard Ada Import or Export pragma is used with only two arguments, as in:

```
pragma Import (C, C_Routine);
```

Since Ada is a case-insensitive language, the spelling of the identifier in the Ada source program does not provide any information on the desired casing of the external name, and so a convention is needed. In GNAT the default treatment is that such names are converted to all lower case letters. This corresponds to the normal C style in many environments. The first argument of pragma **External_Name_Casing** can be used to control this treatment. If **Uppercase** is specified, then the name will be forced to all uppercase letters. If **Lowercase** is specified, then the normal default of all lower case letters will be used.

This same implicit treatment is also used in the case of extended DEC Ada 83 compatible Import and Export pragmas where an external name is explicitly specified using an identifier rather than a string.

- * Explicit external names

Explicit external names are given as string literals. The most common case arises when a standard Ada Import or Export pragma is used with three arguments, as in:

```
pragma Import (C, C_Routine, "C_routine");
```

In this case, the string literal normally provides the exact casing required for the external name. The second argument of pragma **External_Name_Casing** may be used to modify this behavior. If **Uppercase** is specified, then the name will be forced to all uppercase letters. If **Lowercase** is specified, then the name will be forced to all

lowercase letters. A specification of **As_Is** provides the normal default behavior in which the casing is taken from the string provided.

This pragma may appear anywhere that a pragma is valid. In particular, it can be used as a configuration pragma in the **gnat.adc** file, in which case it applies to all subsequent compilations, or it can be used as a program unit pragma, in which case it only applies to the current unit, or it can be used more locally to control individual Import/Export pragmas.

It was primarily intended for use with OpenVMS systems, where many compilers convert all symbols to upper case by default. For interfacing to such compilers (e.g., the DEC C compiler), it may be convenient to use the pragma:

```
pragma External_Name_Casing (Uppercase, Uppercase);
```

to enforce the upper casing of all external symbols.

2.69 Pragma Fast_Math

Syntax:

```
pragma Fast_Math;
```

This is a configuration pragma which activates a mode in which speed is considered more important for floating-point operations than absolutely accurate adherence to the requirements of the standard. Currently the following operations are affected:

‘Complex Multiplication’

The normal simple formula for complex multiplication can result in intermediate overflows for numbers near the end of the range. The Ada standard requires that this situation be detected and corrected by scaling, but in **Fast_Math** mode such cases will simply result in overflow. Note that to take advantage of this you must instantiate your own version of **Ada.Numerics.Generic_Complex_Types** under control of the pragma, rather than use the preinstantiated versions.

2.70 Pragma Favor_Top_Level

Syntax:

```
pragma Favor_Top_Level (type_LOCAL_NAME);
```

The argument of pragma **Favor_Top_Level** must be a named access-to-subprogram type. This pragma is an efficiency hint to the compiler, regarding the use of **'Access** or **'Unrestricted_Access** on nested (non-library-level) subprograms. The pragma means that nested subprograms are not used with this type, or are rare, so that the generated code should be efficient in the top-level case. When this pragma is used, dynamically generated trampolines may be used on some targets for nested subprograms. See restriction **No_Implicit_Dynamic_Code**.

2.71 Pragma Finalize_Storage_Only

Syntax:

```
pragma Finalize_Storage_Only (first_subtype_LOCAL_NAME);
```

The argument of pragma `Finalize_Storage_Only` must denote a local type which is derived from `Ada.Finalization.Controlled` or `Limited_Controlled`. The pragma suppresses the call to `Finalize` for declared library-level objects of the argument type. This is mostly useful for types where finalization is only used to deal with storage reclamation since in most environments it is not necessary to reclaim memory just before terminating execution, hence the name. Note that this pragma does not suppress `Finalize` calls for library-level heap-allocated objects (see pragma `No_Heap_Finalization`).

2.72 Pragma `Float_Representation`

Syntax:

```
pragma Float_Representation (FLOAT_REP[, float_type_LOCAL_NAME]);

FLOAT_REP ::= VAX_Float | IEEE_Float
```

In the one argument form, this pragma is a configuration pragma which allows control over the internal representation chosen for the predefined floating point types declared in the packages `Standard` and `System`. This pragma is only provided for compatibility and has no effect.

The two argument form specifies the representation to be used for the specified floating-point type. The argument must be `IEEE_Float` to specify the use of IEEE format, as follows:

- * For a digits value of 6, 32-bit IEEE short format will be used.
- * For a digits value of 15, 64-bit IEEE long format will be used.
- * No other value of digits is permitted.

2.73 Pragma `Ghost`

Syntax:

```
pragma Ghost [ (static_boolean_EXPRESSION) ];
```

For the semantics of this pragma, see the entry for aspect `Ghost` in the SPARK 2014 Reference Manual, section 6.9.

2.74 Pragma `Global`

Syntax:

```
pragma Global (GLOBAL_SPECIFICATION);

GLOBAL_SPECIFICATION ::=
    null
  | (GLOBAL_LIST)
  | (MODED_GLOBAL_LIST {, MODED_GLOBAL_LIST})

MODED_GLOBAL_LIST ::= MODE_SELECTOR => GLOBAL_LIST

MODE_SELECTOR ::= In_Out | Input | Output | Proof_In
GLOBAL_LIST   ::= GLOBAL_ITEM | (GLOBAL_ITEM {, GLOBAL_ITEM})
```

`GLOBAL_ITEM ::= NAME`

For the semantics of this pragma, see the entry for aspect `Global` in the SPARK 2014 Reference Manual, section 6.1.4.

2.75 Pragma Ident

Syntax:

`pragma Ident (static_string_EXPRESSION);`

This pragma is identical in effect to pragma `Comment`. It is provided for compatibility with other Ada compilers providing this pragma.

2.76 Pragma Ignore_Pragma

Syntax:

`pragma Ignore_Pragma (pragma_IDENTIFIER);`

This is a configuration pragma that takes a single argument that is a simple identifier. Any subsequent use of a pragma whose pragma identifier matches this argument will be silently ignored. Any preceding use of a pragma whose pragma identifier matches this argument will be parsed and then ignored. This may be useful when legacy code or code intended for compilation with some other compiler contains pragmas that match the name, but not the exact implementation, of a GNAT pragma. The use of this pragma allows such pragmas to be ignored, which may be useful in CodePeer mode, or during porting of legacy code.

2.77 Pragma Implementation_Defined

Syntax:

`pragma Implementation_Defined (local_NAME);`

This pragma marks a previously declared entity as implementation-defined. For an overloaded entity, applies to the most recent homonym.

`pragma Implementation_Defined;`

The form with no arguments appears anywhere within a scope, most typically a package spec, and indicates that all entities that are defined within the package spec are `Implementation_Defined`.

This pragma is used within the GNAT runtime library to identify implementation-defined entities introduced in language-defined units, for the purpose of implementing the `No_Implementation_Identifiers` restriction.

2.78 Pragma Implemented

Syntax:

`pragma Implemented (procedure_LOCAL_NAME, implementation_kind);`

`implementation_kind ::= By_Entry | By_Protected_Procedure | By_Any`

This is an Ada 2012 representation pragma which applies to protected, task and synchronized interface primitives. The use of pragma `Implemented` provides a way to impose a

static requirement on the overriding operation by adhering to one of the three implementation kinds: entry, protected procedure or any of the above. This pragma is available in all earlier versions of Ada as an implementation-defined pragma.

```

type Synch_Iface is synchronized interface;
procedure Prim_Op (Obj : in out Iface) is abstract;
pragma Implemented (Prim_Op, By_Protected_Procedure);

protected type Prot_1 is new Synch_Iface with
  procedure Prim_Op; -- Legal
end Prot_1;

protected type Prot_2 is new Synch_Iface with
  entry Prim_Op;      -- Illegal
end Prot_2;

task type Task_Typ is new Synch_Iface with
  entry Prim_Op;      -- Illegal
end Task_Typ;

```

When applied to the `procedure_or_entry_NAME` of a `requeue` statement, pragma `Implemented` determines the runtime behavior of the `requeue`. Implementation kind `By_Entry` guarantees that the action of `requeueing` will proceed from an entry to another entry. Implementation kind `By_Protected_Procedure` transforms the `requeue` into a dispatching call, thus eliminating the chance of blocking. Kind `By_Any` shares the behavior of `By_Entry` and `By_Protected_Procedure` depending on the target's overriding subprogram kind.

2.79 Pragma `Implicit_Packing`

Syntax:

```
pragma Implicit_Packing;
```

This is a configuration pragma that requests implicit packing for packed arrays for which a size clause is given but no explicit pragma `Pack` or specification of `Component_Size` is present. It also applies to records where no record representation clause is present. Consider this example:

```

type R is array (0 .. 7) of Boolean;
for R'Size use 8;

```

In accordance with the recommendation in the RM (RM 13.3(53)), a `Size` clause does not change the layout of a composite object. So the `Size` clause in the above example is normally rejected, since the default layout of the array uses 8-bit components, and thus the array requires a minimum of 64 bits.

If this declaration is compiled in a region of code covered by an occurrence of the configuration pragma `Implicit_Packing`, then the `Size` clause in this and similar examples will cause implicit packing and thus be accepted. For this implicit packing to occur, the type in question must be an array of small components whose size is known at compile time, and the `Size` clause must specify the exact size that corresponds to the number of elements in the array multiplied by the size in bits of the component type (both single and multi-dimensioned arrays can be controlled with this pragma).

Similarly, the following example shows the use in the record case

```
type r is record
  a, b, c, d, e, f, g, h : boolean;
  chr                    : character;
end record;
for r'size use 16;
```

Without a pragma Pack, each Boolean field requires 8 bits, so the minimum size is 72 bits, but with a pragma Pack, 16 bits would be sufficient. The use of pragma Implicit_Packing allows this record declaration to compile without an explicit pragma Pack.

2.80 Pragma Import_Function

Syntax:

```
pragma Import_Function (
  [Internal          =>] LOCAL_NAME,
  [, [External       =>] EXTERNAL_SYMBOL]
  [, [Parameter_Types =>] PARAMETER_TYPES]
  [, [Result_Type    =>] SUBTYPE_MARK]
  [, [Mechanism      =>] MECHANISM]
  [, [Result_Mechanism =>] MECHANISM_NAME]);

EXTERNAL_SYMBOL ::=
  IDENTIFIER
| static_string_EXPRESSION

PARAMETER_TYPES ::=
  null
| TYPE_DESIGNATOR {, TYPE_DESIGNATOR}

TYPE_DESIGNATOR ::=
  subtype_NAME
| subtype_Name ' Access

MECHANISM ::=
  MECHANISM_NAME
| (MECHANISM_ASSOCIATION {, MECHANISM_ASSOCIATION})

MECHANISM_ASSOCIATION ::=
  [formal_parameter_NAME =>] MECHANISM_NAME

MECHANISM_NAME ::=
  Value
| Reference
```

This pragma is used in conjunction with a pragma Import to specify additional information for an imported function. The pragma Import (or equivalent pragma Interface) must

precede the `Import_Function` pragma and both must appear in the same declarative part as the function specification.

The `Internal` argument must uniquely designate the function to which the pragma applies. If more than one function name exists of this name in the declarative part you must use the `Parameter_Types` and `Result_Type` parameters to achieve the required unique designation. Subtype marks in these parameters must exactly match the subtypes in the corresponding function specification, using positional notation to match parameters with subtype marks. The form with an `'Access` attribute can be used to match an anonymous access parameter.

You may optionally use the `Mechanism` and `Result_Mechanism` parameters to specify passing mechanisms for the parameters and result. If you specify a single mechanism name, it applies to all parameters. Otherwise you may specify a mechanism on a parameter by parameter basis using either positional or named notation. If the mechanism is not specified, the default mechanism is used.

2.81 Pragma `Import_Object`

Syntax:

```
pragma Import_Object (
    [Internal =>] LOCAL_NAME
    [, [External =>] EXTERNAL_SYMBOL]
    [, [Size      =>] EXTERNAL_SYMBOL]);

EXTERNAL_SYMBOL ::=
    IDENTIFIER
    | static_string_EXPRESSION
```

This pragma designates an object as imported, and apart from the extended rules for external symbols, is identical in effect to the use of the normal `Import` pragma applied to an object. Unlike the subprogram case, you need not use a separate `Import` pragma, although you may do so (and probably should do so from a portability point of view). `size` is syntax checked, but otherwise ignored by GNAT.

2.82 Pragma `Import_Procedure`

Syntax:

```
pragma Import_Procedure (
    [Internal      =>] LOCAL_NAME
    [, [External    =>] EXTERNAL_SYMBOL]
    [, [Parameter_Types =>] PARAMETER_TYPES]
    [, [Mechanism    =>] MECHANISM]);

EXTERNAL_SYMBOL ::=
    IDENTIFIER
    | static_string_EXPRESSION

PARAMETER_TYPES ::=
    null
```

```

| TYPE_DESIGNATOR {, TYPE_DESIGNATOR}

TYPE_DESIGNATOR ::=
    subtype_NAME
| subtype_Name ' Access

MECHANISM ::=
    MECHANISM_NAME
| (MECHANISM_ASSOCIATION {, MECHANISM_ASSOCIATION})

MECHANISM_ASSOCIATION ::=
    [formal_parameter_NAME =>] MECHANISM_NAME

MECHANISM_NAME ::= Value | Reference

```

This pragma is identical to `Import_Function` except that it applies to a procedure rather than a function and the parameters `Result_Type` and `Result_Mechanism` are not permitted.

2.83 Pragma `Import_Valued_Procedure`

Syntax:

```

pragma Import_Valued_Procedure (
    [Internal          =>] LOCAL_NAME
    [, [External       =>] EXTERNAL_SYMBOL]
    [, [Parameter_Types =>] PARAMETER_TYPES]
    [, [Mechanism      =>] MECHANISM]);

EXTERNAL_SYMBOL ::=
    IDENTIFIER
| static_string_EXPRESSION

PARAMETER_TYPES ::=
    null
| TYPE_DESIGNATOR {, TYPE_DESIGNATOR}

TYPE_DESIGNATOR ::=
    subtype_NAME
| subtype_Name ' Access

MECHANISM ::=
    MECHANISM_NAME
| (MECHANISM_ASSOCIATION {, MECHANISM_ASSOCIATION})

MECHANISM_ASSOCIATION ::=
    [formal_parameter_NAME =>] MECHANISM_NAME

MECHANISM_NAME ::= Value | Reference

```

This pragma is identical to `Import_Procedure` except that the first parameter of `LOCAL_NAME`, which must be present, must be of mode `out`, and externally the subprogram is treated as a function with this parameter as the result of the function. The purpose of this capability is to allow the use of `out` and `in out` parameters in interfacing to external functions (which are not permitted in Ada functions). You may optionally use the `Mechanism` parameters to specify passing mechanisms for the parameters. If you specify a single mechanism name, it applies to all parameters. Otherwise you may specify a mechanism on a parameter by parameter basis using either positional or named notation. If the mechanism is not specified, the default mechanism is used.

Note that it is important to use this pragma in conjunction with a separate pragma `Import` that specifies the desired convention, since otherwise the default convention is `Ada`, which is almost certainly not what is required.

2.84 Pragma Independent

Syntax:

```
pragma Independent (component_LOCAL_NAME);
```

This pragma is standard in Ada 2012 mode (which also provides an aspect of the same name). It is also available as an implementation-defined pragma in all earlier versions. It specifies that the designated object or all objects of the designated type must be independently addressable. This means that separate tasks can safely manipulate such objects. For example, if two components of a record are independent, then two separate tasks may access these two components. This may place constraints on the representation of the object (for instance prohibiting tight packing).

2.85 Pragma Independent_Components

Syntax:

```
pragma Independent_Components (Local_NAME);
```

This pragma is standard in Ada 2012 mode (which also provides an aspect of the same name). It is also available as an implementation-defined pragma in all earlier versions. It specifies that the components of the designated object, or the components of each object of the designated type, must be independently addressable. This means that separate tasks can safely manipulate separate components in the composite object. This may place constraints on the representation of the object (for instance prohibiting tight packing).

2.86 Pragma Initial_Condition

Syntax:

```
pragma Initial_Condition (boolean_EXPRESSION);
```

For the semantics of this pragma, see the entry for aspect `Initial_Condition` in the SPARK 2014 Reference Manual, section 7.1.6.

This is an assertion kind pragma that can associate a set of its arguments with an assertion level. See SPARK 2014 Reference Manual, section 11.4.2.

2.87 Pragma InitializeScalars

Syntax:

```
pragma InitializeScalars
  [ ( TYPE_VALUE_PAIR {, TYPE_VALUE_PAIR} ) ];

TYPE_VALUE_PAIR ::=
  SCALAR_TYPE => static_EXPRESSION

SCALAR_TYPE :=
  Short_Float
| Float
| Long_Float
| Long_Long_Float
| Signed_8
| Signed_16
| Signed_32
| Signed_64
| Unsigned_8
| Unsigned_16
| Unsigned_32
| Unsigned_64
```

This pragma is similar to `NormalizeScalars` conceptually but has two important differences.

First, there is no requirement for the pragma to be used uniformly in all units of a partition. In particular, it is fine to use this just for some or all of the application units of a partition, without needing to recompile the run-time library. In the case where some units are compiled with the pragma, and some without, then a declaration of a variable where the type is defined in package `Standard` or is locally declared will always be subject to initialization, as will any declaration of a scalar variable. For composite variables, whether the variable is initialized may also depend on whether the package in which the type of the variable is declared is compiled with the pragma.

The other important difference is that the programmer can control the value used for initializing scalar objects. This effect can be achieved in several different ways:

- * At compile time, the programmer can specify the invalid value for a particular family of scalar types using the optional arguments of the pragma.

The compile-time approach is intended to optimize the generated code for the pragma, by possibly using fast operations such as `memset`. Note that such optimizations require using values where the bytes all have the same binary representation.

- * At bind time, the programmer has several options:
 - * Initialization with invalid values (similar to `NormalizeScalars`, though for `InitializeScalars` it is not always possible to determine the invalid values in complex cases like signed component fields with nonstandard sizes).
 - * Initialization with high values.
 - * Initialization with low values.

- * Initialization with a specific bit pattern.

See the GNAT User's Guide for binder options for specifying these cases.

The bind-time approach is intended to provide fast turnaround for testing with different values, without having to recompile the program.

- * At execution time, the programmer can specify the invalid values using an environment variable. See the GNAT User's Guide for details.

The execution-time approach is intended to provide fast turnaround for testing with different values, without having to recompile and rebind the program.

Note that pragma `Initialize_Scalars` is particularly useful in conjunction with the enhanced validity checking that is now provided in GNAT, which checks for invalid values under more conditions. Using this feature (see description of the '-gnatV' flag in the GNAT User's Guide) in conjunction with pragma `Initialize_Scalars` provides a powerful new tool to assist in the detection of problems caused by uninitialized variables.

Note: the use of `Initialize_Scalars` has a fairly extensive effect on the generated code. This may cause your code to be substantially larger. It may also cause an increase in the amount of stack required, so it is probably a good idea to turn on stack checking (see description of stack checking in the GNAT User's Guide) when using this pragma.

2.88 Pragma `Initializes`

Syntax:

```
pragma Initializes (INITIALIZATION_LIST);

INITIALIZATION_LIST ::=
    null
  | (INITIALIZATION_ITEM {, INITIALIZATION_ITEM})

INITIALIZATION_ITEM ::= name [=> INPUT_LIST]

INPUT_LIST ::=
    null
  | INPUT
  | (INPUT {, INPUT})

INPUT ::= name
```

For the semantics of this pragma, see the entry for aspect `Initializes` in the SPARK 2014 Reference Manual, section 7.1.5.

2.89 Pragma `Inline_Always`

Syntax:

```
pragma Inline_Always (NAME [, NAME]);
```

Similar to pragma `Inline` except that inlining is unconditional. `Inline_Always` instructs the compiler to inline every direct call to the subprogram or else to emit a compilation error, independently of any option, in particular '-gnatn' or '-gnatN' or the optimization level. It

is an error to take the address or access of **NAME**. It is also an error to apply this pragma to a primitive operation of a tagged type. Thanks to such restrictions, the compiler is allowed to remove the out-of-line body of **NAME**.

2.90 Pragma Inline_Generic

Syntax:

```
pragma Inline_Generic (GNAME {, GNAME});

GNAME ::= generic_unit_NAME | generic_instance_NAME
```

This pragma is provided for compatibility with Dec Ada 83. It has no effect in GNAT (which always inlines generics), other than to check that the given names are all names of generic units or generic instances.

2.91 Pragma Interface

Syntax:

```
pragma Interface (
    [Convention      =>] convention_identifier,
    [Entity          =>] local_NAME
    [, [External_Name =>] static_string_expression]
    [, [Link_Name     =>] static_string_expression]);
```

This pragma is identical in syntax and semantics to the standard Ada pragma **Import**. It is provided for compatibility with Ada 83. The definition is upwards compatible both with pragma **Interface** as defined in the Ada 83 Reference Manual, and also with some extended implementations of this pragma in certain Ada 83 implementations. The only difference between pragma **Interface** and pragma **Import** is that there is special circuitry to allow both pragmas to appear for the same subprogram entity (normally it is illegal to have multiple **Import** pragmas). This is useful in maintaining Ada 83/Ada 95 compatibility and is compatible with other Ada 83 compilers.

2.92 Pragma Interface_Name

Syntax:

```
pragma Interface_Name (
    [Entity          =>] LOCAL_NAME
    [, [External_Name =>] static_string_EXPRESSION]
    [, [Link_Name     =>] static_string_EXPRESSION]);
```

This pragma provides an alternative way of specifying the interface name for an interfaced subprogram, and is provided for compatibility with Ada 83 compilers that use the pragma for this purpose. You must provide at least one of **External_Name** or **Link_Name**.

2.93 Pragma Interrupt_Handler

Syntax:

```
pragma Interrupt_Handler (procedure_LOCAL_NAME);
```


The `LOCAL_NAME` argument must refer to an enumeration first subtype in the current declarative part. The effect is to retain the enumeration literal names for use by `Image` and `Value` even if a global `Discard_Names` pragma applies. This is useful when you want to generally suppress enumeration literal names and for example you therefore use a `Discard_Names` pragma in the `gnat.adc` file, but you want to retain the names for specific enumeration types.

2.98 Pragma License

Syntax:

```
pragma License (Unrestricted | GPL | Modified_GPL | Restricted);
```

This pragma is provided to allow automated checking for appropriate license conditions with respect to the standard and modified GPL. A pragma `License`, which is a configuration pragma that typically appears at the start of a source file or in a separate `gnat.adc` file, specifies the licensing conditions of a unit as follows:

- * `Unrestricted` This is used for a unit that can be freely used with no license restrictions. Examples of such units are public domain units, and units from the Ada Reference Manual.
- * `GPL` This is used for a unit that is licensed under the unmodified GPL, and which therefore cannot be `with`d by a restricted unit.
- * `Modified_GPL` This is used for a unit licensed under the GNAT modified GPL that includes a special exception paragraph that specifically permits the inclusion of the unit in programs without requiring the entire program to be released under the GPL.
- * `Restricted` This is used for a unit that is restricted in that it is not permitted to depend on units that are licensed under the GPL. Typical examples are proprietary code that is to be released under more restrictive license conditions. Note that restricted units are permitted to `with` units which are licensed under the modified GPL (this is the whole point of the modified GPL).

Normally a unit with no `License` pragma is considered to have an unknown license, and no checking is done. However, standard GNAT headers are recognized, and license information is derived from them as follows.

A GNAT license header starts with a line containing 78 hyphens. The following comment text is searched for the appearance of any of the following strings.

If the string ‘GNU General Public License’ is found, then the unit is assumed to have GPL license, unless the string ‘As a special exception’ follows, in which case the license is assumed to be modified GPL.

If one of the strings ‘This specification is adapted from the Ada Semantic Interface’ or ‘This specification is derived from the Ada Reference Manual’ is found then the unit is assumed to be unrestricted.

These default actions means that a program with a restricted license pragma will automatically get warnings if a GPL unit is inappropriately `with`d. For example, the program:

```
with Sem_Ch3;
with GNAT.Sockets;
procedure Secret_Stuff is
```



```

    i : Integer := 1;
    pragma Export (C, i);

    new_name_for_i : Integer;
    pragma Linker_Alias (new_name_for_i, "i");
end p;

```

2.101 Pragma Linker_Constructor

Syntax:

```
pragma Linker_Constructor (procedure_LOCAL_NAME);
```

`procedure_LOCAL_NAME` must refer to a parameterless procedure that is declared at the library level. A procedure to which this pragma is applied will be treated as an initialization routine by the linker. It is equivalent to `__attribute__((constructor))` in GNU C and causes `procedure_LOCAL_NAME` to be invoked before the entry point of the executable is called (or immediately after the shared library is loaded if the procedure is linked in a shared library), in particular before the Ada run-time environment is set up.

Because of these specific contexts, the set of operations such a procedure can perform is very limited and the type of objects it can manipulate is essentially restricted to the elementary types. In particular, it must only contain code to which pragma Restrictions (No_Elaboration_Code) applies.

This pragma is used by GNAT to implement auto-initialization of shared Stand Alone Libraries, which provides a related capability without the restrictions listed above. Where possible, the use of Stand Alone Libraries is preferable to the use of this pragma.

2.102 Pragma Linker_Destructor

Syntax:

```
pragma Linker_Destructor (procedure_LOCAL_NAME);
```

`procedure_LOCAL_NAME` must refer to a parameterless procedure that is declared at the library level. A procedure to which this pragma is applied will be treated as a finalization routine by the linker. It is equivalent to `__attribute__((destructor))` in GNU C and causes `procedure_LOCAL_NAME` to be invoked after the entry point of the executable has exited (or immediately before the shared library is unloaded if the procedure is linked in a shared library), in particular after the Ada run-time environment is shut down.

See `pragma Linker_Constructor` for the set of restrictions that apply because of these specific contexts.

2.103 Pragma Linker_Section

Syntax:

```

pragma Linker_Section (
  [Entity =>] LOCAL_NAME,
  [Section =>] static_string_EXPRESSION);

```

`LOCAL_NAME` must refer to an object, type, or subprogram that is declared at the library level. This pragma specifies the name of the linker section for the given entity. It is

equivalent to `__attribute__((section))` in GNU C and causes `LOCAL_NAME` to be placed in the `static_string_EXPRESSION` section of the executable (assuming the linker doesn't rename the section). GNAT also provides an implementation defined aspect of the same name.

In the case of specifying this aspect for a type, the effect is to specify the corresponding section for all library-level objects of the type that do not have an explicit linker section set. Note that this only applies to whole objects, not to components of composite objects.

In the case of a subprogram, the linker section applies to all previously declared matching overloaded subprograms in the current declarative part which do not already have a linker section assigned. The linker section aspect is useful in this case for specifying different linker sections for different elements of such an overloaded set.

Note that an empty string specifies that no linker section is specified. This is not quite the same as omitting the pragma or aspect, since it can be used to specify that one element of an overloaded set of subprograms has the default linker section, or that one object of a type for which a linker section is specified should have the default linker section.

The compiler normally places library-level entities in standard sections depending on the class: procedures and functions generally go in the `.text` section, initialized variables in the `.data` section and uninitialized variables in the `.bss` section.

Other, special sections may exist on given target machines to map special hardware, for example I/O ports or flash memory. This pragma is a means to defer the final layout of the executable to the linker, thus fully working at the symbolic level with the compiler.

Some file formats do not support arbitrary sections so not all target machines support this pragma. The use of this pragma may cause a program execution to be erroneous if it is used to place an entity into an inappropriate section (e.g., a modified variable into the `.text` section). See also `pragma Persistent_BSS`.

-- Example of the use of `pragma Linker_Section`

```
package IO_Card is
  Port_A : Integer;
  pragma Volatile (Port_A);
  pragma Linker_Section (Port_A, ".bss.port_a");

  Port_B : Integer;
  pragma Volatile (Port_B);
  pragma Linker_Section (Port_B, ".bss.port_b");

  type Port_Type is new Integer with Linker_Section => ".bss";
  PA : Port_Type with Linker_Section => ".bss.PA";
  PB : Port_Type; -- ends up in linker section ".bss"

  procedure Q with Linker_Section => "Qsection";
end IO_Card;
```

2.104 Pragma Lock_Free

Syntax:

```
pragma Lock_Free [ (static_boolean_EXPRESSION) ];
```

This pragma may be specified for protected types or objects. It specifies that the implementation of protected operations must be implemented without locks. Compilation fails if the compiler cannot generate lock-free code for the operations.

The current conditions required to support this pragma are:

- * Protected type declarations may not contain entries
- * Protected subprogram declarations may not have nonelementary parameters

In addition, each protected subprogram body must satisfy:

- * May reference only one protected component
- * May not reference nonconstant entities outside the protected subprogram scope
- * May not contain address representation items, allocators, or quantified expressions
- * May not contain delay, goto, loop, or procedure-call statements
- * May not contain exported and imported entities
- * May not dereferenced access values
- * Function calls and attribute references must be static

If the `Lock_Free` aspect is specified to be `True` for a protected unit and the `Ceiling_Locking` locking policy is in effect, then the run-time actions associated with the `Ceiling_Locking` locking policy (described in Ada RM D.3) are not performed when a protected operation of the protected unit is executed.

2.105 Pragma `Loop_Invariant`

Syntax:

```
pragma Loop_Invariant ( boolean_EXPRESSION );
```

The effect of this pragma is similar to that of `pragma Assert`, except that in an `Assertion_Policy` pragma, the identifier `Loop_Invariant` is used to control whether it is ignored or checked (or disabled).

`Loop_Invariant` can only appear as one of the items in the sequence of statements of a loop body, or nested inside block statements that appear in the sequence of statements of a loop body. The intention is that it be used to represent a “loop invariant” assertion, i.e. something that is true each time through the loop, and which can be used to show that the loop is achieving its purpose.

Multiple `Loop_Invariant` and `Loop_Variant` pragmas that apply to the same loop should be grouped in the same sequence of statements.

To aid in writing such invariants, the special attribute `Loop_Entry` may be used to refer to the value of an expression on entry to the loop. This attribute can only be used within the expression of a `Loop_Invariant` pragma. For full details, see documentation of attribute `Loop_Entry`.

This is an assertion kind pragma that can associate a set of its arguments with an assertion level. See SPARK 2014 Reference Manual, section 11.4.2.

types declared in units to which the pragma applies and there is a requirement that this pragma be used consistently within a partition.

2.115 Pragma No_Elaboration_Code_All

Syntax:

```
pragma No_Elaboration_Code_All [(program_unit_NAME)];
```

This is a program unit pragma (there is also an equivalent aspect of the same name) that establishes the restriction `No_Elaboration_Code` for the current unit and any extended main source units (body and subunits). It also has the effect of enforcing a transitive application of this aspect, so that if any unit is implicitly or explicitly with'ed by the current unit, it must also have the *No_Elaboration_Code_All* aspect set. It may be applied to package or subprogram specs or their generic versions.

2.116 Pragma No_Heap_Finalization

Syntax:

```
pragma No_Heap_Finalization [ (first_subtype_LOCAL_NAME) ];
```

Pragma `No_Heap_Finalization` may be used as a configuration pragma or as a type-specific pragma.

In its configuration form, the pragma must appear within a configuration file such as `gnat.adc`, without an argument. The pragma suppresses the call to `Finalize` for heap-allocated objects created through library-level named access-to-object types in cases where the designated type requires finalization actions.

In its type-specific form, the argument of the pragma must denote a library-level named access-to-object type. The pragma suppresses the call to `Finalize` for heap-allocated objects created through the specific access type in cases where the designated type requires finalization actions.

It is still possible to finalize such heap-allocated objects by explicitly deallocating them.

A library-level named access-to-object type declared within a generic unit will lose its `No_Heap_Finalization` pragma when the corresponding instance does not appear at the library level.

2.117 Pragma No_Inline

Syntax:

```
pragma No_Inline (NAME {, NAME});
```

This pragma suppresses inlining for the callable entity or the instances of the generic subprogram designated by `NAME`, including inlining that results from the use of pragma `Inline`. This pragma is always active, in particular it is not subject to the use of option `'-gnatn'` or `'-gnatN'`. It is illegal to specify both pragma `No_Inline` and pragma `Inline_Always` for the same `NAME`.

and the largest positive number is not, in which case the largest positive value is used. This choice will always generate an invalid value if one exists.

‘Floating-Point Types’

Objects of all floating-point types are initialized to all 1-bits. For standard IEEE format, this corresponds to a NaN (not a number) which is indeed an invalid value.

‘Fixed-Point Types’

Objects of all fixed-point types are treated as described above for integers, with the rules applying to the underlying integer value used to represent the fixed-point value.

‘Modular types’

Objects of a modular type are initialized to all one bits, except in the special case where zero is excluded from the subtype, in which case all zero bits are used. This choice will always generate an invalid value if one exists.

‘Enumeration types’

Objects of an enumeration type are initialized to all one-bits, i.e., to the value `2 ** typ'Size - 1` unless the subtype excludes the literal whose Pos value is zero, in which case a code of zero is used. This choice will always generate an invalid value if one exists.

2.123 Pragma Obsolescent

Syntax:

```
pragma Obsolescent;

pragma Obsolescent (
  [Message =>] static_string_EXPRESSION
  [, [Version =>] Ada_05]);

pragma Obsolescent (
  [Entity =>] NAME
  [, [Message =>] static_string_EXPRESSION
  [, [Version =>] Ada_05]]);
```

This pragma can occur immediately following a declaration of an entity, including the case of a record component. If no Entity argument is present, then this declaration is the one to which the pragma applies. If an Entity parameter is present, it must either match the name of the entity in this declaration, or alternatively, the pragma can immediately follow an enumeration type declaration, where the Entity argument names one of the enumeration literals.

This pragma is used to indicate that the named entity is considered obsolescent and should not be used. Typically this is used when an API must be modified by eventually removing or modifying existing subprograms or other entities. The pragma can be used at an intermediate stage when the entity is still present, but will be removed later.

The effect of this pragma is to output a warning message on a reference to an entity thus marked that the subprogram is obsolescent if the appropriate warning option in the compiler

is activated. If the **Message** parameter is present, then a second warning message is given containing this text. In addition, a reference to the entity is considered to be a violation of pragma **Restrictions** (**No_Obsolescent_Features**).

This pragma can also be used as a program unit pragma for a package, in which case the entity name is the name of the package, and the pragma indicates that the entire package is considered obsolescent. In this case a client **with**ing such a package violates the restriction, and the **with** clause is flagged with warnings if the warning option is set.

If the **Version** parameter is present (which must be exactly the identifier **Ada_05**, no other argument is allowed), then the indication of obsolescence applies only when compiling in Ada 2005 mode. This is primarily intended for dealing with the situations in the predefined library where subprograms or packages have become defined as obsolescent in Ada 2005 (e.g., in **Ada.Characters.Handling**), but may be used anywhere.

The following examples show typical uses of this pragma:

```
package p is
  pragma Obsolescent (p, Message => "use pp instead of p");
end p;

package q is
  procedure q2;
  pragma Obsolescent ("use q2new instead");

  type R is new integer;
  pragma Obsolescent
    (Entity => R,
     Message => "use RR in Ada 2005",
     Version => Ada_05);

  type M is record
    F1 : Integer;
    F2 : Integer;
    pragma Obsolescent;
    F3 : Integer;
  end record;

  type E is (a, bc, 'd', quack);
  pragma Obsolescent (Entity => bc)
  pragma Obsolescent (Entity => 'd')

  function "+"
    (a, b : character) return character;
  pragma Obsolescent (Entity => "+");
end;
```

Note that, as for all pragmas, if you use a pragma argument identifier, then all subsequent parameters must also use a pragma argument identifier. So if you specify **Entity =>** for the **Entity** argument, and a **Message** argument is present, it must be preceded by **Message =>**.

2.124 Pragma Optimize_Alignment

Syntax:

```
pragma Optimize_Alignment (TIME | SPACE | OFF);
```

This is a configuration pragma which affects the choice of default alignments for types and objects where no alignment is explicitly specified. There is a time/space trade-off in the selection of these values. Large alignments result in more efficient code, at the expense of larger data space, since sizes have to be increased to match these alignments. Smaller alignments save space, but the access code is slower. The normal choice of default alignments for types and individual alignment promotions for objects (which is what you get if you do not use this pragma, or if you use an argument of OFF), tries to balance these two requirements.

Specifying SPACE causes smaller default alignments to be chosen in two cases. First any packed record is given an alignment of 1. Second, if a size is given for the type, then the alignment is chosen to avoid increasing this size. For example, consider:

```
type R is record
  X : Integer;
  Y : Character;
end record;

for R'Size use 5*8;
```

In the default mode, this type gets an alignment of 4, so that access to the Integer field X are efficient. But this means that objects of the type end up with a size of 8 bytes. This is a valid choice, since sizes of objects are allowed to be bigger than the size of the type, but it can waste space if for example fields of type R appear in an enclosing record. If the above type is compiled in `Optimize_Alignment (Space)` mode, the alignment is set to 1.

However, there is one case in which SPACE is ignored. If a variable length record (that is a discriminated record with a component which is an array whose length depends on a discriminant), has a pragma Pack, then it is not in general possible to set the alignment of such a record to one, so the pragma is ignored in this case (with a warning).

Specifying SPACE also disables alignment promotions for standalone objects, which occur when the compiler increases the alignment of a specific object without changing the alignment of its type.

Specifying SPACE also disables component reordering in unpacked record types, which can result in larger sizes in order to meet alignment requirements.

Specifying TIME causes larger default alignments to be chosen in the case of small types with sizes that are not a power of 2. For example, consider:

```
type R is record
  A : Character;
  B : Character;
  C : Boolean;
end record;

pragma Pack (R);
for R'Size use 17;
```



```

function Odd (X : Natural) return Boolean;
pragma Postcondition
  (Odd'Result =
    (x = 1
     or else
     (x /= 0 and then Even (X - 1))));

function Even (X : Natural) return Boolean;
pragma Postcondition
  (Even'Result =
    (x = 0
     or else
     (x /= 1 and then Odd (X - 1))));

end Parity_Functions;

```

There are no restrictions on the complexity or form of conditions used within `Postcondition` pragmas. The following example shows that it is even possible to verify performance behavior.

```

package Sort is

  Performance : constant Float;
  -- Performance constant set by implementation
  -- to match target architecture behavior.

  procedure Treesort (Arg : String);
  -- Sorts characters of argument using N*logN sort
  pragma Postcondition
    (Float (Clock - Clock'Old) <=
      Float (Arg'Length) *
      log (Float (Arg'Length)) *
      Performance);

end Sort;

```

Note: `postcondition` pragmas associated with subprograms that are marked as `Inline_Always`, or those marked as `Inline` with front-end inlining (`-gnatN` option set) are accepted and legality-checked by the compiler, but are ignored at run-time even if `postcondition` checking is enabled.

Note that `pragma Postcondition` differs from the language-defined `Post` aspect (and corresponding `Post` pragma) in allowing multiple occurrences, allowing occurrences in the body even if there is a separate spec, and allowing a second string parameter, and the use of the pragma identifier `Check`. Historically, `pragma Postcondition` was implemented prior to the development of Ada 2012, and has been retained in its original form for compatibility purposes.

This is an assertion kind pragma that can associate a set of its arguments with an assertion level. See SPARK 2014 Reference Manual, section 11.4.2.

