

GNATcheck Reference Manual

Coding Standard Verifier

The GNAT Ada Compiler
GNAT GPL Edition, Version 2012
Configuration level: 188972
Date: 2012/04/23

AdaCore

Copyright © 2009-2012, AdaCore

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.1 or any later version published by the Free Software Foundation; with the Invariant Sections being “GNU Free Documentation License”, with the Front-Cover Texts being “GNATcheck Reference Manual”, and with no Back-Cover Texts. A copy of the license is included in the section entitled “GNU Free Documentation License”.

About This Manual

The `gnatcheck` tool in GNAT can be used to enforce coding conventions by analyzing Ada source programs with respect to a set of *rules* supplied at tool invocation. This manual describes the complete set of predefined rules that `gnatcheck` can take as input.

What This Manual Contains

This manual contains a description of `gnatcheck`, an ASIS-based utility that checks properties of Ada source files according to a given set of semantic rules

- [Chapter 1 \[Introduction\], page 3](#), gives the general overview of the `gnatcheck` tool
- [Chapter 2 \[Format of the Report File\], page 5](#), describes the structure of the report file generated by `gnatcheck`
- [Chapter 3 \[General gnatcheck Switches\], page 7](#), describes switches control the general `gnatcheck` behavior
- [Chapter 4 \[gnatcheck Rule Options\], page 9](#), describes options used to control a set of rules to be checked by `gnatcheck`
- [Chapter 5 \[Adding the Results of Compiler Checks to gnatcheck Output\], page 11](#), explains how the results of the check performed by the GNAT compiler can be added to the report generated by `gnatcheck`
- [Chapter 6 \[Project-Wide Checks\], page 13](#), explains how to apply `gnatcheck` to all the sources of your project
- [Chapter 7 \[Rule exemption\], page 15](#), explains how to turn off a rule check for a specified fragment of a source file
- [Chapter 8 \[Predefined Rules\], page 17](#), contains a description of each predefined `gnatcheck` rule, organized into categories.
- [Chapter 9 \[Example of gnatcheck Usage\], page 47](#), contains a full example of `gnatcheck` usage
- [Appendix A \[List of Rules\], page 51](#), gives an alphabetized list of all predefined rules, for ease of reference.

The name of each rule (the “rule identifier”) denotes the condition that is detected and flagged by `gnatcheck`. The rule identifier is used as a parameter of the ‘+R’ or ‘-R’ switch to `gnatcheck`.

What You Should Know Before Reading This Manual

You should be familiar with the Ada language and with the usage of GNAT in general; please refer to the *GNAT User’s Guide*.

1 Introduction

The `gnatcheck` tool is an ASIS-based utility that checks properties of Ada source files according to a given set of semantic rules.

In order to check compliance with a given rule, `gnatcheck` has to semantically analyze the Ada sources. Therefore, checks can only be performed on legal Ada units. Moreover, when a unit depends semantically upon units located outside the current directory, the source search path has to be provided when calling `gnatcheck`, either through a specified project file or through `gnatcheck` switches as described below.

A number of rules are predefined in `gnatcheck` and are described later in this chapter. You can also add new rules, by modifying the `gnatcheck` code and rebuilding the tool. In order to add a simple rule making some local checks, a small amount of straightforward ASIS-based programming is usually needed.

Project support for `gnatcheck` is provided by the GNAT driver (see *The GNAT Driver and Project Files* section in *GNAT User's Guide*).

Invoking `gnatcheck` on the command line has the form:

```
$ gnatcheck [switches] {filename}
             [-files={arg_list_filename}]
             [-cargs gcc_switches] -rules rule_options
```

where

- *switches* specify the general tool options
- Each *filename* is the name (including the extension) of a source file to process. “Wildcards” are allowed, and the file name may contain path information.
- Each *arg_list_filename* is the name (including the extension) of a text file containing the names of the source files to process, separated by spaces or line breaks.
- *gcc_switches* is a list of switches for `gcc`. They will be passed on to all compiler invocations made by `gnatcheck` to generate the ASIS trees. Here you can provide ‘-I’ switches to form the source search path, and use the ‘-gnat05’ switch to set the configuration file, use the ‘-gnat05’ switch if sources should be compiled in Ada 2005 mode etc.
- *rule_options* is a list of options for controlling a set of rules to be checked by `gnatcheck` (see [Chapter 4 \[gnatcheck Rule Options\], page 9](#)).

Either a ‘*filename*’ or an ‘*arg_list_filename*’ must be supplied.

2 Format of the Report File

The `gnatcheck` tool outputs on `'stderr'` all messages concerning rule violations except if running in quiet mode. It also creates a text file that contains the complete report of the last `gnatcheck` run. By default this file is named `'gnatcheck.out'` and it is located in the current directory; the `'-o'` option can be used to change the name and/or location of the report file. This report contains:

- general details of the `gnatcheck` run: date and time of the run, the version of the tool that has generated this report, full parameters of the `gnatcheck` invocation, reference to the list of checked sources and applied rules (coding standard);
- summary of the run (number of checked sources and detected violations);
- list of exempted coding standard violations;
- list of non-exempted coding standard violations;
- list of problems in the definition of exemption sections;
- list of language violations (compile-time errors) detected in processed sources;

3 General `gnatcheck` Switches

The following switches control the general `gnatcheck` behavior

- '-a' Process all units including those with read-only ALI files such as those from the GNAT Run-Time library.
- '-dx' Activate internal debugging switches. *x* is a letter or digit, or string of letters or digits, which specifies the type of debugging outputs desired. Normally these are used only for internal development or system debugging purposes. You can find full documentation for these switches in the body of the `ASIS_UL.Debug` unit in the ASIS Utility Library source file `'asis_ul-debug.adb'`.
- '-dd' Activate a specific debug switch that does not generate any debug output but turns on a progress indicator. This switch also changes the format of the diagnostic messages sent to `'stderr'` by adding a string *check:* between the source location and the text of the diagnosis. This switch is mostly used when `gnatcheck` is called from GPS.
- '-h' List all the rules checked by the given `gnatcheck` version.
- '-l' Use full source locations references in the report file. For a construct from a generic instantiation a full source location is a chain from the location of this construct in the generic unit to the place where this unit is instantiated.
- '-log' Duplicate all the output sent to `'stderr'` into a log file. The log file is named `'gnatcheck.log'` and is located in the current directory.
- '-mnnnn' Maximum number of diagnostics to be sent to `'stdout'`, where *nnnn* is in the range 0 . . . 1000; the default value is 500. Zero means that there is no limitation on the number of diagnostic messages to be output.
- '-q' Quiet mode. All the diagnostics about rule violations are placed in the `gnatcheck` report file only, without duplication on `'stdout'`.
- '-s' Short format of the report file (no version information, no list of applied rules, no list of checked sources is included)
- '--include-file=*file*'
Append the content of the specified text file to the report file
- '-t' Print out execution time.
- '-v' Verbose mode; `gnatcheck` generates version information and then a trace of sources being processed.

'-o *report_file*'

Set name of report file file to *report_file* .

'--write-rules=*template_file*'

Write to *template_file* the template rule file that contains all the rules currently implemented in `gnatcheck` turned off. A user may edit this template file manually to get his own coding standard file.

4 gnatcheck Rule Options

The following options control the processing performed by gnatcheck.

`+Rrule_id[:param]`

Turn on the check for a specified rule with the specified parameter, if any. *rule_id* must be the identifier of one of the currently implemented rules (use `-h` for the list of implemented rules). Rule identifiers are not case-sensitive. The *param* item must be a string representing a valid parameter(s) for the specified rule. If it contains any space characters then this string must be enclosed in quotation marks.

`-Rrule_id[:param]`

Turn off the check for a specified rule with the specified parameter, if any.

`-from=rule_option_filename`

Read the rule options from the text file *rule_option_filename*, referred to as a “coding standard file” below.

The default behavior is that all the rule checks are disabled.

If more than one rule option is specified for the same rule, these options are summed together. If a new option contradicts the rule settings specified by previous options for this rule, the new option overrides the previous settings.

A coding standard file is a text file that contains a set of rule options described above. The file may contain empty lines and Ada-style comments (comment lines and end-of-line comments). There can be several rule options on a single line (separated by a space).

A coding standard file may reference other coding standard files by including more `-from=rule_option_filename` options, each such option being replaced with the content of the corresponding coding standard file during processing. In case a cycle is detected (that is, `rule_file_1` reads rule options from `rule_file_2`, and `rule_file_2` reads (directly or indirectly) rule options from `rule_file_1`), processing fails with an error message.

5 Adding the Results of Compiler Checks to `gnatcheck` Output

The `gnatcheck` tool can include in the generated diagnostic messages and in the report file the results of the checks performed by the compiler. Though disabled by default, this effect may be obtained by using `+R` with the following rule identifiers and parameters:

`'Restrictions'`

To record restrictions violations (which are performed by the compiler if the pragma `Restrictions` or `Restriction_Warnings` are given), use the `Restrictions` rule with the same parameters as pragma `Restrictions` or `Restriction_Warnings`.

`'Style_Checks'`

To record compiler style checks (see *Style Checking* section in *GNAT User's Guide*), use the `Style_Checks` rule. This rule takes a parameter in one of the following forms:

- `All_Checks`, which enables the standard style checks corresponding to the `'-gnatyy'` GNAT style check option, or
- a string with the same structure and semantics as the `string_LITERAL` parameter of the GNAT pragma `Style_Checks` (for further information about this pragma, see section “Pragma `Style_Checks`” in *GNAT Reference Manual*).

For example, the `+RStyle_Checks:0` rule option activates the compiler style check that corresponds to `-gnaty0` style check option.

`'Warnings'`

To record compiler warnings (see *Warning Message Control* section in *GNAT User's Guide*), use the `Warnings` rule with a parameter that is a valid *static_string_expression* argument of the GNAT pragma `Warnings` (for further information about this pragma, see section “Pragma `Warnings`” in *GNAT Reference Manual*). Note that in case of `gnatcheck` `'s'` parameter, that corresponds to the GNAT `'-gnatws'` option, disables all the specific warnings, but not suppresses the warning mode, and `'e'` parameter, corresponding to `'-gnatwe'` that means "treat warnings as errors", does not have any effect.

To disable a specific restriction check, use `-RRestrictions` `gnatcheck` option with the corresponding restriction name as a parameter. `-R` is not available for `Style_Checks` and `Warnings` options, to disable warnings and style checks, use the corresponding warning and style options.

6 Project-Wide Checks

In order to perform checks on all units of a given project, you can use the GNAT driver along with the ‘-P’ option:

```
gnat check -Pproj -rules -from=my_rules
```

If the project `proj` depends upon other projects, you can perform checks on the project closure using the ‘-U’ option:

```
gnat check -Pproj -U -rules -from=my_rules
```

Finally, if not all the units are relevant to a particular main program in the project closure, you can perform checks for the set of units needed to create a given main program (unit closure) using the ‘-U’ option followed by the name of the main unit:

```
gnat check -Pproj -U main -rules -from=my_rules
```


7 Rule exemption

One of the most useful applications of `gnatcheck` is to automate the enforcement of project-specific coding standards, for example in safety-critical systems where particular features must be restricted in order to simplify the certification effort. However, it may sometimes be appropriate to violate a coding standard rule, and in such cases the rationale for the violation should be provided in the source program itself so that the individuals reviewing or maintaining the program can immediately understand the intent.

The `gnatcheck` tool supports this practice with the notion of a “rule exemption” covering a specific source code section. Normally rule violation messages are issued both on `stderr` and in a report file. In contrast, exempted violations are not listed on `stderr`; thus users invoking `gnatcheck` interactively (e.g. in its GPS interface) do not need to pay attention to known and justified violations. However, exempted violations along with their justification are documented in a special section of the report file that `gnatcheck` generates.

7.1 Using pragma Annotate to Control Rule Exemption

Rule exemption is controlled by `pragma Annotate` when its first argument is “`gnatcheck`”. The syntax of `gnatcheck`’s exemption control annotations is as follows:

```
pragma Annotate (gnatcheck, exemption_control, Rule_Name, [justification]);

exemption_control ::= Exempt_On | Exempt_Off

Rule_Name          ::= string_literal

justification      ::= string_literal
```

When a `gnatcheck` annotation has more than four arguments, `gnatcheck` issues a warning and ignores the additional arguments. If the additional arguments do not follow the syntax above, `gnatcheck` emits a warning and ignores the annotation.

The `Rule_Name` argument should be the name of some existing `gnatcheck` rule. Otherwise a warning message is generated and the `pragma` is ignored. If `Rule_Name` denotes a rule that is not activated by the given `gnatcheck` call, the `pragma` is ignored and no warning is issued. The exception from this rule is that exemption sections for `Warnings` rule are fully processed when `Restrictions` rule is activated.

A source code section where an exemption is active for a given rule is delimited by an `exempt_on` and `exempt_off` annotation pair:

```
pragma Annotate (gnatcheck, Exempt_On, Rule_Name, "justification");
```

```
-- source code section
pragma Annotate (gnatcheck, Exempt_Off, Rule_Name);
```

7.2 gnatcheck Annotations Rules

- An “Exempt_Off” annotation can only appear after a corresponding “Exempt_On” annotation.
- Exempted source code sections are only based on the source location of the annotations. Any source construct between the two annotations is part of the exempted source code section.
- Exempted source code sections for different rules are independent. They can be nested or intersect with one another without limitation. Creating nested or intersecting source code sections for the same rule is not allowed.
- Malformed exempted source code sections are reported by a warning, and the corresponding rule exemptions are ignored.
- When an exempted source code section does not contain at least one violation of the exempted rule, a warning is emitted on ‘stderr’.
- If an “Exempt_On” annotation pragma does not have a matching “Exempt_Off” annotation pragma in the same compilation unit, then the exemption for the given rule is ignored and a warning is issued.

8 Predefined Rules

The description of the rules currently implemented in `gnatcheck` is given in this chapter. The rule identifier is used as a parameter of `gnatcheck`'s '+R' or '-R' switches.

Be aware that most of these rules apply to specialized coding requirements developed by individual users and may well not make sense in other environments. In particular, there are many rules that conflict with one another. Proper usage of `gnatcheck` involves selecting the rules you wish to apply by looking at your independently developed coding standards and finding the corresponding `gnatcheck` rules.

8.1 Style-Related Rules

The rules in this section may be used to enforce various feature usages consistent with good software engineering, for example as described in *Ada 95 Quality and Style*.

8.1.1 Tasking

The rules in this subsection may be used to enforce various feature usages related to concurrency.

8.1.1.1 `Multiple_Entries_In_Protected_Definitions`

Flag each protected definition (i.e., each protected object/type declaration) that defines more than one entry. Diagnostic messages are generated for all the entry declarations except the first one. An entry family is counted as one entry. Entries from the private part of the protected definition are also checked.

This rule has no parameters.

8.1.1.2 `Volatile_Objects_Without_Address_Clauses`

Flag each volatile object that does not have an address clause.

The following check is made: if the pragma `Volatile` is applied to a data object or to its type, then an address clause must be supplied for this object.

This rule does not check the components of data objects, array components that are volatile as a result of the pragma `Volatile_Components`, or objects that are volatile because they are atomic as a result of pragmas `Atomic` or `Atomic_Components`.

Only variable declarations, and not constant declarations, are checked.

This rule has no parameters.

8.1.2 Object Orientation

The rules in this subsection may be used to enforce various feature usages related to Object-Oriented Programming.

8.1.2.1 `Deep_Inheritance_Hierarchies`

Flags a tagged derived type declaration or an interface type declaration if its depth (in its inheritance hierarchy) exceeds the value specified by the ‘*N*’ rule parameter.

The inheritance depth of a tagged type or interface type is defined as 0 for a type with no parent and no progenitor, and otherwise as 1 + max of the depths of the immediate parent and immediate progenitors.

This rule does not flag private extension declarations. In the case of a private extension, the corresponding full declaration is checked.

This rule has the following (mandatory) parameter for the ‘+R’ option:

N Integer not less than -1 specifying the maximal allowed depth of any inheritance hierarchy. If the rule parameter is set to -1, the rule flags all the declarations of tagged and interface types.

8.1.2.2 `Direct_Calls_To_Primitives`

Flags any non-dispatching call to a dispatching primitive operation, except for two cases:

- the common idiom where a primitive subprogram for a tagged type directly calls the same primitive subprogram of the type’s immediate ancestor;
- the type for that the called operation is a primitive operation is declared as private non tagged type (with the full view tagged), and at the place of the call the full declaration of the type is not visible;

This rule has no parameters.

8.1.2.3 `Too_Many_Parents`

Flag any tagged type declaration, interface type declaration, single task declaration or single protected declaration that has more than ‘*N*’ *parents*, where ‘*N*’ is a parameter of the rule. A *parent* here is either a (sub)type denoted by the subtype mark from the `parent_subtype_indication` (in case of a derived type declaration), or any of the progenitors from the interface list (if any).

This rule has the following (mandatory) parameters for the ‘+R’ option:

N Positive integer specifying the maximal allowed number of parents/progenitors.

8.1.2.4 `Visible_Components`

Flag all the type declarations located in the visible part of a library package or a library generic package that can declare a visible component. A visible component can be declared in a *record definition* which appears on its own or as part of a record extension. The *record definition* is flagged even if it contains no components.

Record definitions located in private parts of library (generic) packages or in local (generic) packages are not flagged. *Record definitions* in private packages, in package bodies, and in the main subprogram body are not flagged.

This rule has no parameters.

8.1.3 Portability

The rules in this subsection may be used to enforce various feature usages that support program portability.

8.1.3.1 `Forbidden_Attributes`

Flag each use of the specified attributes. The attributes to be detected are named in the rule's parameters.

This rule has the following parameters:

- For the '+R' option

Attribute_Designator

Adds the specified attribute to the set of attributes to be detected and sets the detection checks for all the specified attributes ON. If *Attribute_Designator* does not denote any attribute defined in the Ada standard or in [section "Implementation Defined Attributes" in GNAT Reference Manual](#), it is treated as the name of unknown attribute.

GNAT All the GNAT-specific attributes are detected; this sets the detection checks for all the specified attributes ON.

ALL All attributes are detected; this sets the rule ON.

- For the '-R' option

Attribute_Designator

Removes the specified attribute from the set of attributes to be detected without affecting detection checks for other attributes. If *Attribute_Designator* does not correspond to any attribute defined in the Ada standard or in [section "Implementation Defined Attributes" in GNAT Reference Manual](#), this option is treated as turning OFF detection of all unknown attributes.

GNAT Turn OFF detection of all GNAT-specific attributes

ALL Clear the list of the attributes to be detected and turn the rule OFF.

Parameters are not case sensitive. If *Attribute_Designator* does not have the syntax of an Ada identifier and therefore can not be considered as a (part of an) attribute designator, a diagnostic message is generated and the corresponding parameter is ignored. (If an attribute allows a static expression to be a part of the attribute designator, this expression is ignored by this rule.)

When more than one parameter is given in the same rule option, the parameters must be separated by commas.

If more than one option for this rule is specified for the gnatcheck call, a new option overrides the previous one(s).

The '+R' option with no parameters turns the rule ON, with the set of attributes to be detected defined by the previous rule options. (By default this set is empty, so if the only option specified for the rule is '+RForbidden_Attributes' (with no parameter), then the rule is enabled, but it does not detect anything). The '-R' option with no parameter turns the rule OFF, but it does not affect the set of attributes to be detected.

8.1.3.2 Forbidden_Pragmas

Flag each use of the specified pragmas. The pragmas to be detected are named in the rule's parameters.

This rule has the following parameters:

- For the '+R' option

Pragma_Name

Adds the specified pragma to the set of pragmas to be checked and sets the checks for all the specified pragmas ON. *Pragma_Name* is treated as a name of a pragma. If it does not correspond to any pragma name defined in the Ada standard or to the name of a GNAT-specific pragma defined in [section "Implementation Defined Pragmas" in GNAT Reference Manual](#), it is treated as the name of unknown pragma.

GNAT All the GNAT-specific pragmas are detected; this sets the checks for all the specified pragmas ON.

ALL All pragmas are detected; this sets the rule ON.

- For the '-R' option

Pragma_Name

Removes the specified pragma from the set of pragmas to be checked without affecting checks for other pragmas. *Pragma_Name* is treated as a name of a pragma. If it does

not correspond to any pragma defined in the Ada standard or to any name defined in section “Implementation Defined Pragas” in *GNAT Reference Manual*, this option is treated as turning OFF detection of all unknown pragmas.

GNAT	Turn OFF detection of all GNAT-specific pragmas
ALL	Clear the list of the pragmas to be detected and turn the rule OFF.

Parameters are not case sensitive. If *Pragma Name* does not have the syntax of an Ada identifier and therefore can not be considered as a pragma name, a diagnostic message is generated and the corresponding parameter is ignored.

When more than one parameter is given in the same rule option, the parameters must be separated by a comma.

If more than one option for this rule is specified for the `gnatcheck` call, a new option overrides the previous one(s).

The ‘+R’ option with no parameters turns the rule ON with the set of pragmas to be detected defined by the previous rule options. (By default this set is empty, so if the only option specified for the rule is ‘+RForbidden_Pragmas’ (with no parameter), then the rule is enabled, but it does not detect anything). The ‘-R’ option with no parameter turns the rule OFF, but it does not affect the set of pragmas to be detected.

8.1.3.3 `Implicit_SMALL_For_Fixed_Point_Types`

Flag each fixed point type declaration that lacks an explicit representation clause to define its ‘`Small`’ value. Since ‘`Small`’ can be defined only for ordinary fixed point types, decimal fixed point type declarations are not checked.

This rule has no parameters.

8.1.3.4 `No_Scalar_Storage_Order_Specified`

Flag each record type declaration, record extension declaration, and untagged derived record type declaration if a `record_representation_clause` that has at least one component clause applies to it (or an ancestor), but neither the type nor any of its ancestors has an explicitly specified `Scalar_Storage_Order` attribute.

This rule has no parameters.

8.1.3.5 `Predefined_Numeric_Types`

Flag each explicit use of the name of any numeric type or subtype defined in package `Standard`.

The rationale for this rule is to detect when the program may depend on platform-specific characteristics of the implementation of the predefined numeric types. Note that this rule is overly pessimistic; for example, a program

that uses `String` indexing likely needs a variable of type `Integer`. Another example is the flagging of predefined numeric types with explicit constraints:

```
subtype My_Integer is Integer range Left .. Right;
Vy_Var : My_Integer;
```

This rule detects only numeric types and subtypes defined in `Standard`. The use of numeric types and subtypes defined in other predefined packages (such as `System.Any_Priority` or `Ada.Text_IO.Count`) is not flagged

This rule has no parameters.

8.1.3.6 `Separate_Numeric_Error_Handlers`

Flags each exception handler that contains a choice for the predefined `Constraint_Error` exception, but does not contain the choice for the predefined `Numeric_Error` exception, or that contains the choice for `Numeric_Error`, but does not contain the choice for `Constraint_Error`.

This rule has no parameters.

8.1.4 Program Structure

The rules in this subsection may be used to enforce feature usages related to program structure.

8.1.4.1 `Deeply_Nested_Generics`

Flags a generic declaration nested in another generic declaration if the nesting level of the inner generic exceeds a value specified by the ‘`N`’ rule parameter. The nesting level is the number of generic declarations that enclose the given (generic) declaration. Formal packages are not flagged by this rule.

This rule has the following (mandatory) parameters for the ‘`+R`’ option:

`N` Positive integer specifying the maximal allowed nesting level for a generic declaration.

8.1.4.2 `Local_Packages`

Flag all local packages declared in package and generic package specs. Local packages in bodies are not flagged.

This rule has no parameters.

8.1.4.3 `Non_Visible_Exceptions`

Flag constructs leading to the possibility of propagating an exception out of the scope in which the exception is declared. Two cases are detected:

- An exception declaration in a subprogram body, task body or block statement is flagged if the body or statement does not contain a handler for that exception or a handler with an `others` choice.

- A `raise` statement in an exception handler of a subprogram body, task body or block statement is flagged if it (re)raises a locally declared exception. This may occur under the following circumstances:
 - it explicitly raises a locally declared exception, or
 - it does not specify an exception name (i.e., it is simply `raise;`) and the enclosing handler contains a locally declared exception in its exception choices.

Renamings of local exceptions are not flagged.

This rule has no parameters.

8.1.4.4 `Raising_External_Exceptions`

Flag any `raise` statement, in a program unit declared in a library package or in a generic library package, for an exception that is neither a predefined exception nor an exception that is also declared (or renamed) in the visible part of the package.

This rule has no parameters.

8.1.5 Programming Practice

The rules in this subsection may be used to enforce feature usages that relate to program maintainability.

8.1.5.1 `Anonymous_Arrays`

Flag all anonymous array type definitions (by Ada semantics these can only occur in object declarations).

This rule has no parameters.

8.1.5.2 `Enumeration_Ranges_In_CASE_Statements`

Flag each use of a range of enumeration literals as a choice in a `case` statement. All forms for specifying a range (explicit ranges such as `A .. B`, subtype marks and `'Range` attributes) are flagged. An enumeration range is flagged even if contains exactly one enumeration value or no values at all. A type derived from an enumeration type is considered as an enumeration type.

This rule helps prevent maintenance problems arising from adding an enumeration value to a type and having it implicitly handled by an existing `case` statement with an enumeration range that includes the new literal.

This rule has no parameters.

8.1.5.3 Exceptions_As_Control_Flow

Flag each place where an exception is explicitly raised and handled in the same subprogram body. A `raise` statement in an exception handler, package body, task body or entry body is not flagged.

The rule has no parameters.

8.1.5.4 Exits_From_Conditional_Loops

Flag any exit statement if it transfers the control out of a `for` loop or a `while` loop. This includes cases when the `exit` statement applies to a `FOR` or `while` loop, and cases when it is enclosed in some `for` or `while` loop, but transfers the control from some outer (unconditional) loop statement.

The rule has no parameters.

8.1.5.5 EXIT_Statements_With_No_Loop_Name

Flag each `exit` statement that does not specify the name of the loop being exited.

The rule has no parameters.

8.1.5.6 GOTO_Statements

Flag each occurrence of a `goto` statement.

This rule has no parameters.

8.1.5.7 Improper_Returns

Flag each explicit `return` statement in procedures, and multiple `return` statements in functions. Diagnostic messages are generated for all `return` statements in a procedure (thus each procedure must be written so that it returns implicitly at the end of its statement part), and for all `return` statements in a function after the first one. This rule supports the stylistic convention that each subprogram should have no more than one point of normal return.

This rule has no parameters.

8.1.5.8 Non_Short_Circuit_Operators

Flag all calls to predefined `and` and `or` operators for any boolean type. Calls to user-defined `and` and `or` and to operators defined by renaming declarations are not flagged. Calls to predefined `and` and `or` operators for modular types or boolean array types are not flagged.

This rule has no parameters.

8.1.5.9 OTHERS_In_Aggregates

Flag each use of an `others` choice in extension aggregates. In record and array aggregates, an `others` choice is flagged unless it is used to refer to all components, or to all but one component.

If, in case of a named array aggregate, there are two associations, one with an `others` choice and another with a discrete range, the `others` choice is flagged even if the discrete range specifies exactly one component; for example, `(1..1 => 0, others => 1)`.

This rule has no parameters.

8.1.5.10 OTHERS_In_CASE_Statements

Flag any use of an `others` choice in a `case` statement.

This rule has no parameters.

8.1.5.11 OTHERS_In_Exception_Handlers

Flag any use of an `others` choice in an exception handler.

This rule has no parameters.

8.1.5.12 Overly_Nested_Control_Structures

Flag each control structure whose nesting level exceeds the value provided in the rule parameter.

The control structures checked are the following:

- `if` statement
- `case` statement
- `loop` statement
- selective accept statement
- timed entry call statement
- conditional entry call statement
- asynchronous select statement

The rule has the following parameter for the `'+R'` option:

N Positive integer specifying the maximal control structure nesting level that is not flagged

If the parameter for the `'+R'` option is not specified or if it is not a positive integer, `'+R'` option is ignored.

If more than one option is specified for the `gnatcheck` call, the later option and new parameter override the previous one(s).

8.1.5.13 `Positional_Actuals_For_Defaulted_Generic_Parameters`

Flag each generic actual parameter corresponding to a generic formal parameter with a default initialization, if positional notation is used.

This rule has no parameters.

8.1.5.14 `Positional_Actuals_For_Defaulted_Parameters`

Flag each actual parameter to a subprogram or entry call where the corresponding formal parameter has a default expression, if positional notation is used.

This rule has no parameters.

8.1.5.15 `Positional_Components`

Flag each array, record and extension aggregate that includes positional notation.

This rule has no parameters.

8.1.5.16 `Positional_Generic_Parameters`

Flag each positional actual generic parameter except for the case when the generic unit being instantiated has exactly one generic formal parameter.

This rule has no parameters.

8.1.5.17 `Positional_Parameters`

Flag each positional parameter notation in a subprogram or entry call, except for the following:

- Parameters of calls to of prefix or infix operators are not flagged
- If the called subprogram or entry has only one formal parameter, the parameter of the call is not flagged;
- If a subprogram call uses the *Object.Operation* notation, then
 - the first parameter (that is, *Object*) is not flagged;
 - if the called subprogram has only two parameters, the second parameter of the call is not flagged;

This rule has no parameters.

8.1.5.18 `Recursive_Subprograms`

Flags specs (and bodies that act as specs) of recursive subprograms. A subprogram is considered as recursive in a given context if there exists a chain of direct calls starting from the body of, and ending at this subprogram within this context. A context is provided by the set of Ada sources specified as arguments

of a given `gnatcheck` call. Neither dispatching calls nor calls through access-to-subprograms are considered as direct calls by this rule.

Generic subprograms and subprograms detected in generic units are not flagged. Recursive subprograms in expanded generic instantiations are flagged.

This rule has no parameters.

8.1.5.19 `Unconditional_Exits`

Flag unconditional `exit` statements.

This rule has no parameters.

8.1.5.20 `Unnamed_Blocks_And_Loops`

Flag each unnamed block statement and loop statement.

The rule has no parameters.

8.1.5.21 `USE_PACKAGE_Clauses`

Flag all `use` clauses for packages; `use type` clauses are not flagged.

This rule has no parameters.

8.1.6 Readability

The rules described in this subsection may be used to enforce feature usages that contribute towards readability.

8.1.6.1 `Identifier_Casing`

Flag each defining identifier that does not have a casing corresponding to the kind of entity being declared. All defining names are checked. For the defining names from the following kinds of declarations a special casing scheme can be defined:

- type and subtype declarations;
- enumeration literal specifications (not including character literals) and function renaming declarations if the renaming entity is an enumeration literal;
- constant and number declarations (including object renaming declarations if the renamed object is a constant);
- exception declarations and exception renaming declarations.

The rule may have the following parameters for '+R':

`Type=casing_scheme`

Specifies casing for names from type and subtype declarations.

`Enum=casing_scheme`

Specifies the casing of defining enumeration literals and for the defining names in a function renaming declarations if the renamed entity is an enumeration literal.

`Constant=casing_scheme`

Specifies the casing for defining names from constants and named number declarations, including the object renaming declaration if the renamed object is a constant

`Exception=casing_scheme`

Specifies the casing for names from exception declarations and exception renaming declarations.

`Others=casing_scheme`

Specifies the casing for all defining names for which no special casing scheme is specified. If this parameter is not set, the casing for the entities that do not correspond to the specified parameters is not checked.

`Exclude=dictionary_file`

Specifies casing exceptions.

Where:

`casing_scheme ::= upper|lower|mixed`

upper means that the defining identifier should be upper-case. *lower* means that the defining identifier should be lower-case *mixed* means that the first defining identifier letter and the first letter after each underscore should be upper-case, and all the other letters should be lower-case

If a defining identifier is from a declaration for which a specific casing scheme can be set, but the corresponding parameter is not specified for the rule, then the casing scheme defined by `Others` parameter is used to check this identifier. If `Others` parameter also is not set, the identifier is not checked.

dictionary_file is the name of the text file that contains casing exceptions. The way how this rule is using the casing exception dictionary file is consistent with using the casing exception dictionary in the GNAT pretty-printer `gnatpp`, see *GNAT User's Guide*.

There are two kinds of exceptions:

identifier If a dictionary file contains an identifier, then each occurrence of that (defining) identifier in the checked source should use the casing specified included in *dictionary_file*

wildcard A wildcard has the following syntax

`wildcard ::= *simple_identifier* |
 *simple_identifier |`

```

simple_identifier*
simple_identifier ::= letter{letter_or_digit}

```

`simple_identifier` specifies the casing of subwords (the term “subword” is used below to denote the part of a name which is delimited by “_” or by the beginning or end of the word and which does not contain any “_” inside). A wildcard of the form `simple_identifier*` defines the casing of the first subword of a defining name to check, the wildcard of the form `*simple_identifier` specifies the casing of the last subword, and the wildcard of the form `*simple_identifier*` specifies the casing of any subword.

If for a defining identifier some of its subwords can be mapped onto wildcards, but some other cannot, the casing of the identifier subwords that are not mapped onto wildcards from casing exception dictionary is checked against the casing scheme defined for the corresponding entity.

If some identifier is included in the exception dictionary both as a whole identifier and can be mapped onto some wildcard from the dictionary, then it is the identifier and not the wildcard that is used to check the identifier casing.

If more than one dictionary file is specified, or a dictionary file contains more than one exception variant for the same identifier, the new casing exception overrides the previous one.

Casing check against dictionary file(s) has a higher priority than checks against the casing scheme specified for a given entity/declaration kind.

‘+R’ option should contain at least one parameter.

There is no parameter for ‘-R’ option, it just turns the rule off.

8.1.6.2 Identifier_Prefixes

Flag each defining identifier that does not have a prefix corresponding to the kind of declaration it is defined by. The defining names in the following kinds of declarations are checked:

- type and subtype declarations (task, protected and access types are treated separately);
- enumeration literal specifications (not including character literals) and function renaming declarations if the renaming entity is an enumeration literal;
- exception declarations and exception renaming declarations;
- constant and number declarations (including object renaming declarations if the renamed object is a constant).

Defining names declared by single task declarations or single protected declarations are not checked by this rule.

The defining name from the full type declaration corresponding to a private type declaration or a private extension declaration is never flagged. A defining name from an incomplete type declaration is never flagged.

The defining name from a subprogram renaming-as-body declaration is never flagged.

For a deferred constant, the defining name in the corresponding full constant declaration is never flagged.

The defining name from a body that is a completion of a program unit declaration or a proper body of a subunit is never flagged.

The defining name from a body stub that is a completion of a program unit declaration is never flagged.

Note that the rule checks only defining names. Usage name occurrence are not checked and are never flagged.

The rule may have the following parameters:

- For the '+R' option:

`Type=string`

Specifies the prefix for a type or subtype name.

`Concurrent=string`

Specifies the prefix for a task and protected type/subtype name. If this parameter is set, it overrides for task and protected types the prefix set by the `Type` parameter.

`Access=string`

Specifies the prefix for an access type/subtype name. If this parameter is set, it overrides for access types the prefix set by the `Type` parameter.

`Class_Access=string`

Specifies the prefix for the name of an access type/subtype that points to some class-wide type. If this parameter is set, it overrides for such access types and subtypes the prefix set by the `Type` or `Access` parameter.

`Subprogram_Access=string`

Specifies the prefix for the name of an access type/subtype that points to a subprogram. If this parameter is set, it overrides for such access types/subtypes the prefix set by the `Type` or `Access` parameter.

`Derived=string1:string2`

Specifies the prefix for a type that is directly derived from a given type or from a subtype thereof. *string1* should be a full expanded Ada name of the ancestor type (starting from the full

expanded compilation unit name), *string2* defines the prefix to check. If this parameter is set, it overrides for types that are directly derived from the given type the prefix set by the `Type` parameter.

`Constant=string`

Specifies the prefix for defining names from constants and named number declarations, including the object renaming declaration if the renamed object is a constant

`Enum=string`

Specifies the prefix for defining enumeration literals and for the defining names in a function renaming declarations if the renamed entity is an enumeration literal.

`Exception=string`

Specifies the prefix for defining names from exception declarations and exception renaming declarations.

`Exclusive`

Check that only those kinds of names for which specific prefix is defined have that prefix (e.g., only type/subtype names have prefix *T*., but not variable or package names), and flag all defining names that have any of the specified prefixes but do not belong to the kind of entities this prefix is defined for. By default the exclusive check mode is ON.

For the ‘-R’ option:

`All_Prefixes`

Removes all the prefixes specified for the identifier prefix checks, whether by default or as specified by other rule parameters and disables the rule.

`Type`

Removes the prefix specified for type/subtype names. This does not remove prefixes specified for specific type kinds and does not disable checks for these specific kinds.

`Concurrent`

Removes the prefix specified for task and protected types.

`Access`

Removes the prefix specified for access types. This does not remove prefixes specified for specific access types (access to subprograms and class-wide access)

`Class_Access`

Removes the prefix specified for access types pointing to class-wide types.

<code>Subprogram_Access</code>	Removes the prefix specified for access types pointing to subprograms.
<code>Derived</code>	Removes prefixes specified for derived types that are directly derived from specific types.
<code>Constant</code>	Removes the prefix specified for constant and number names and turns off the check for these names.
<code>Exception</code>	Removes the prefix specified for exception names and turns off the check for exception names.
<code>Enum</code>	Removes the prefix specified for enumeration literal names and turns off the check for them.
<code>Exclusive</code>	Turns of the check that only names of specific kinds of entities have prefixes specified for these kinds.

If more than one parameter is used, parameters must be separated by commas.

If more than one option is specified for the gnatcheck invocation, a new option overrides the previous one(s).

The `'+RIdentifier_Prefixes'` option (with no parameter) enables checks for all the name prefixes specified by previous options used for this rule. If no prefix is specified, the rule is not enabled.

The `'-RIdentifier_Prefixes'` option (with no parameter) disables all the checks but keeps all the prefixes specified by previous options used for this rule.

There is no default prefix setting for this rule. All checks for name prefixes are case-sensitive

If any error is detected in a rule parameter, that parameter is ignored. In such a case the options that are set for the rule are not specified.

8.1.6.3 `Misnamed_Controlling_Parameters`

Flag a declaration of a dispatching operation, if the first parameter is not a controlling one and its name is not `This` (the check for parameter name is not case-sensitive). Declarations of dispatching functions with a controlling result and no controlling parameter are never flagged.

A subprogram body declaration, subprogram renaming declaration, or subprogram body stub is flagged only if it is not a completion of a prior subprogram declaration.

This rule has no parameters.

8.1.6.4 Misnamed_Identifiers

Flag the declaration of each identifier that does not have a suffix corresponding to the kind of entity being declared. The following declarations are checked:

- type declarations
- subtype declarations
- constant declarations (but not number declarations)
- package renaming declarations (but not generic package renaming declarations)

This rule may have parameters. When used without parameters, the rule enforces the following checks:

- type-defining names end with `_T`, unless the type is an access type, in which case the suffix must be `_A`
- constant names end with `_C`
- names defining package renamings end with `_R`

Defining identifiers from incomplete type declarations are never flagged.

For a private type declaration (including private extensions), the defining identifier from the private type declaration is checked against the type suffix (even if the corresponding full declaration is an access type declaration), and the defining identifier from the corresponding full type declaration is not checked.

For a deferred constant, the defining name in the corresponding full constant declaration is not checked.

Defining names of formal types are not checked.

The rule may have the following parameters:

- For the '+R' option:

`Default` Sets the default listed above for all the names to be checked.

`Type_Suffix=string`

Specifies the suffix for a type name.

`Access_Suffix=string`

Specifies the suffix for an access type name. If this parameter is set, it overrides for access types the suffix set by the `Type_Suffix` parameter. For access types, *string* may have the following format: *suffix1(suffix2)*. That means that an access type name should have the *suffix1* suffix except for the case when the designated type is also an access type, in this case the type name should have the *suffix1 & suffix2* suffix.

`Class_Access_Suffix=string`

Specifies the suffix for the name of an access type that points to some class-wide type. If this parameter is set, it overrides for

such access types the suffix set by the `Type_Suffix` or `Access_Suffix` parameter.

`Class_Subtype_Suffix=string`

Specifies the suffix for the name of a subtype that denotes a class-wide type.

`Constant_Suffix=string`

Specifies the suffix for a constant name.

`Renaming_Suffix=string`

Specifies the suffix for a package renaming name.

- For the ‘-R’ option:

`All_Suffixes`

Remove all the suffixes specified for the identifier suffix checks, whether by default or as specified by other rule parameters. All the checks for this rule are disabled as a result.

`Type_Suffix`

Removes the suffix specified for types. This disables checks for types but does not disable any other checks for this rule (including the check for access type names if `Access_Suffix` is set).

`Access_Suffix`

Removes the suffix specified for access types. This disables checks for access type names but does not disable any other checks for this rule. If `Type_Suffix` is set, access type names are checked as ordinary type names.

`Class_Access_Suffix`

Removes the suffix specified for access types pointing to class-wide type. This disables specific checks for names of access types pointing to class-wide types but does not disable any other checks for this rule. If `Type_Suffix` is set, access type names are checked as ordinary type names. If `Access_Suffix` is set, these access types are checked as any other access type name.

`Class_Subtype_Suffix=string`

Removes the suffix specified for subtype names. This disables checks for subtype names but does not disable any other checks for this rule.

`Constant_Suffix`

Removes the suffix specified for constants. This disables checks for constant names but does not disable any other checks for this rule.

`Renaming_Suffix`

Removes the suffix specified for package renamings. This disables checks for package renamings but does not disable any other checks for this rule.

If more than one parameter is used, parameters must be separated by commas.

If more than one option is specified for the `gnatcheck` invocation, a new option overrides the previous one(s).

The `+RMisnamed_Identifiers` option (with no parameter) enables checks for all the name suffixes specified by previous options used for this rule.

The `-RMisnamed_Identifiers` option (with no parameter) disables all the checks but keeps all the suffixes specified by previous options used for this rule.

The *string* value must be a valid suffix for an Ada identifier (after trimming all the leading and trailing space characters, if any). Parameters are not case sensitive, except the *string* part.

If any error is detected in a rule parameter, the parameter is ignored. In such a case the options that are set for the rule are not specified.

8.1.6.5 `Name_Clashes`

Check that certain names are not used as defining identifiers. To activate this rule, you need to supply a reference to the dictionary file(s) as a rule parameter(s) (more than one dictionary file can be specified). If no dictionary file is set, this rule will not cause anything to be flagged. Only defining occurrences, not references, are checked. The check is not case-sensitive.

This rule is enabled by default, but without setting any corresponding dictionary file(s); thus the default effect is to do no checks.

A dictionary file is a plain text file. The maximum line length for this file is 1024 characters. If the line is longer than this limit, extra characters are ignored.

Each line can be either an empty line, a comment line, or a line containing a list of identifiers separated by space or HT characters. A comment is an Ada-style comment (from `--` to end-of-line). Identifiers must follow the Ada syntax for identifiers. A line containing one or more identifiers may end with a comment.

8.1.6.6 `Uncommented_BEGIN_In_Package_Bodies`

Flags each package body with declarations and a statement part that does not include a trailing comment on the line containing the `begin` keyword; this trailing comment needs to specify the package name and nothing else. The `begin` is not flagged if the package body does not contain any declarations.

If the `begin` keyword is placed on the same line as the last declaration or the first statement, it is flagged independently of whether the line contains a trailing comment. The diagnostic message is attached to the line containing the first statement.

This rule has no parameters.

8.1.7 Source Code Presentation

This subsection is a placeholder; there are currently no rules in this category.

8.2 Feature Usage Rules

The rules in this section can be used to enforce specific usage patterns for a variety of language features.

8.2.1 Abstract_Type_Declarations

Flag all declarations of abstract types. For an abstract private type, both the private and full type declarations are flagged.

This rule has no parameters.

8.2.2 Anonymous_Subtypes

Flag all uses of anonymous subtypes (except cases when subtype indication is a part of a record component definition, and this subtype indication depends on a discriminant). A use of an anonymous subtype is any instance of a subtype indication with a constraint, other than one that occurs immediately within a subtype declaration. Any use of a range other than as a constraint used immediately within a subtype declaration is considered as an anonymous subtype.

An effect of this rule is that `for` loops such as the following are flagged (since `1..N` is formally a “range”):

```
for I in 1 .. N loop
  ...
end loop;
```

Declaring an explicit subtype solves the problem:

```
subtype S is Integer range 1..N;
...
for I in S loop
  ...
end loop;
```

This rule has no parameters.

8.2.3 Blocks

Flag each block statement.

This rule has no parameters.

8.2.4 `Complex_Inlined_Subprograms`

Flags a subprogram (or generic subprogram) if pragma `Inline` is applied to the subprogram and at least one of the following conditions is met:

- it contains at least one complex declaration such as a subprogram body, package, task, protected declaration, or a generic instantiation (except instantiation of `Ada.Unchecked_Conversion`);
- it contains at least one complex statement such as a loop, a case or a if statement, or a short circuit control form;
- the number of statements exceeds a value specified by the ‘N’ rule parameter;

This rule has the following (mandatory) parameter for the ‘+R’ option:

N Positive integer specifying the maximum allowed total number of statements in the subprogram body.

8.2.5 `Controlled_Type_Declarations`

Flag all declarations of controlled types. A declaration of a private type is flagged if its full declaration declares a controlled type. A declaration of a derived type is flagged if its ancestor type is controlled. Subtype declarations are not checked. A declaration of a type that itself is not a descendant of a type declared in `Ada.Finalization` but has a controlled component is not checked.

This rule has no parameters.

8.2.6 `Declarations_In_Blocks`

Flag all block statements containing local declarations. A `declare` block with an empty *declarative part* or with a *declarative part* containing only pragmas and/or `use` clauses is not flagged.

This rule has no parameters.

8.2.7 `Deeply_Nested_Inlining`

Flags a subprogram (or generic subprogram) if pragma `Inline` has been applied to the subprogram but the subprogram calls to another inlined subprogram that results in nested inlining with nesting depth exceeding the value specified by the ‘N’ rule parameter.

This rule requires the global analysis of all the compilation units that are `gnatcheck` arguments; such analysis may affect the tool’s performance.

This rule has the following (mandatory) parameter for the ‘+R’ option:

N Positive integer specifying the maximal allowed level of nested inlining.

8.2.8 Default_Parameters

Flag all default expressions in parameters specifications. All parameter specifications are checked: in subprograms (including formal, generic and protected subprograms) and in task and protected entries (including accept statements and entry bodies).

This rule has no parameters.

8.2.9 Discriminated_Records

Flag all declarations of record types with discriminants. Only the declarations of record and record extension types are checked. Incomplete, formal, private, derived and private extension type declarations are not checked. Task and protected type declarations also are not checked.

This rule has no parameters.

8.2.10 Explicit_Full_Discrete_Ranges

Flag each discrete range that has the form `A'First .. A'Last`.

This rule has no parameters.

8.2.11 Float_Equality_Checks

Flag all calls to the predefined equality operations for floating-point types. Both “=” and “/=” operations are checked. User-defined equality operations are not flagged, nor are “=” and “/=” operations for fixed-point types.

This rule has no parameters.

8.2.12 Function_Style_Procedures

Flag each procedure that can be rewritten as a function. A procedure can be converted into a function if it has exactly one parameter of mode `out` and no parameters of mode `in out`. Procedure declarations, formal procedure declarations, and generic procedure declarations are always checked. Procedure bodies and body stubs are flagged only if they do not have corresponding separate declarations. Procedure renamings and procedure instantiations are not flagged.

If a procedure can be rewritten as a function, but its `out` parameter is of a limited type, it is not flagged.

Protected procedures are not flagged. Null procedures also are not flagged.

This rule has no parameters.

8.2.13 Generics_In_Subprograms

Flag each declaration of a generic unit in a subprogram. Generic declarations in the bodies of generic subprograms are also flagged. A generic unit nested

in another generic unit is not flagged. If a generic unit is declared in a local package that is declared in a subprogram body, the generic unit is flagged.

This rule has no parameters.

8.2.14 `Implicit_IN_Mode_Parameters`

Flag each occurrence of a formal parameter with an implicit `in` mode. Note that `access` parameters, although they technically behave like `in` parameters, are not flagged.

This rule has no parameters.

8.2.15 `Improperly_Located_Instantiations`

Flag all generic instantiations in library-level package specs (including library generic packages) and in all subprogram bodies.

Instantiations in task and entry bodies are not flagged. Instantiations in the bodies of protected subprograms are flagged.

This rule has no parameters.

8.2.16 `Library_Level_Subprograms`

Flag all library-level subprograms (including generic subprogram instantiations).

This rule has no parameters.

8.2.17 `Non_Qualified_Aggregates`

Flag each non-qualified aggregate. A non-qualified aggregate is an aggregate that is not the expression of a qualified expression. A string literal is not considered an aggregate, but an array aggregate of a string type is considered as a normal aggregate. Aggregates of anonymous array types are not flagged.

This rule has no parameters.

8.2.18 `Numeric_Literals`

Flag each use of a numeric literal in an index expression, and in any circumstance except for the following:

- a literal occurring in the initialization expression for a constant declaration or a named number declaration, or
- an integer literal that is less than or equal to a value specified by the ‘`N`’ rule parameter.
- a literal occurring in a declaration in case the ‘`Statements_Only`’ rule parameter is given

This rule may have the following parameters for the ‘`+R`’ option:

- N* *N* is an integer literal used as the maximal value that is not flagged (i.e., integer literals not exceeding this value are allowed)
- ALL All integer literals are flagged
- Statements_Only Numeric literals are flagged only when used in statements

If no parameters are set, the maximum unflagged value is 1, and the check for literals is not limited by statements only.

The last specified check limit (or the fact that there is no limit at all) is used when multiple '+R' options appear.

The '-R' option for this rule has no parameters. It disables the rule and restores its default operation mode. If the '+R' option subsequently appears, will be 1, and the check will not be limited by statements only.

8.2.19 Parameters_Out_Of_Order

Flag each subprogram and entry declaration whose formal parameters are not ordered according to the following scheme:

- in and access parameters first, then in out parameters, and then out parameters;
- for in mode, parameters with default initialization expressions occur last

Only the first violation of the described order is flagged.

The following constructs are checked:

- subprogram declarations (including null procedures);
- generic subprogram declarations;
- formal subprogram declarations;
- entry declarations;
- subprogram bodies and subprogram body stubs that do not have separate specifications

Subprogram renamings are not checked.

This rule has no parameters.

8.2.20 Raising_Predefined_Exceptions

Flag each raise statement that raises a predefined exception (i.e., one of the exceptions Constraint_Error, Numeric_Error, Program_Error, Storage_Error, or Tasking_Error).

This rule has no parameters.

8.2.21 Unassigned_OUT_Parameters

Flag procedures' `out` parameters that are not assigned.

An `out` parameter is flagged if the *sequence of statements* of the procedure body (before the procedure body's exception part, if any) contains no assignment to the parameter.

An `out` parameter is flagged in an *exception handler* in the exception part of the procedure body, if the *exception handler* contains neither an assignment to the parameter nor a raise statement.

Bodies of generic procedures are also considered.

The following are treated as assignments to an `out` parameter:

- an assignment statement, with the parameter or some component as the target
- passing the parameter (or one of its components) as an `out` or `in out` parameter.

This rule has no parameters.

8.2.22 Unconstrained_Array_Returns

Flag each function returning an unconstrained array. Function declarations, function bodies (and body stubs) having no separate specifications, and generic function instantiations are flagged. Function calls and function renamings are not flagged.

Generic function declarations, and function declarations in generic packages, are not flagged. Instead, this rule flags the results of generic instantiations (that is, expanded specification and expanded body corresponding to an instantiation).

This rule has the following (optional) parameters for the '+R' option:

Except_String

Do not flag functions that return the predefined `String` type or a type derived from it, directly or indirectly.

8.3 Metrics-Related Rules

The rules in this section can be used to enforce compliance with specific code metrics, by checking that the metrics computed for a program lie within user-specifiable bounds. Depending on the metric, there may be a lower bound, an upper bound, or both. A construct is flagged if the value of the metric exceeds the upper bound or is less than the lower bound.

The name of any metrics rule consists of the prefix `Metrics_` followed by the name of the corresponding metric: `Essential_Complexity`, `Cyclomatic_Complexity`, or `LSLOC`. (The "LSLOC" acronym stands for "Logical Source Lines

Of Code”.) The meaning and the computed values of the metrics are the same as in `gnatmetric`.

For the ‘+R’ option, each metrics rule has a numeric parameter specifying the bound (integer or real, depending on a metric). The ‘-R’ option for the metrics rules does not have a parameter.

Example: the rule

```
+RMetrics_Cyclomatic_Complexity : 7
```

means that all bodies with cyclomatic complexity exceeding 7 will be flagged.

To turn OFF the check for cyclomatic complexity metric, use the following option:

```
-RMetrics_Cyclomatic_Complexity
```

8.3.1 Metrics_Essential_Complexity

The `Metrics_Essential_Complexity` rule takes a positive integer as upper bound. A program unit that is an executable body exceeding this limit will be flagged.

8.3.2 Metrics_Cyclomatic_Complexity

The `Metrics_Cyclomatic_Complexity` rule takes a positive integer as upper bound. A program unit that is an executable body exceeding this limit will be flagged.

8.3.3 Metrics_LSLOC

The `Metrics_LSLOC` rule takes a positive integer as upper bound. A program unit declaration or a program unit body exceeding this limit will be flagged.

8.4 SPARK Ada Rules

The rules in this section can be used to enforce compliance with the Ada subset allowed by the SPARK tools.

8.4.1 Annotated_Comments

Flags comments that are used as annotations or as special sentinels/markers. Such comments have the following structure

```
--<special_character> <comment_marker>
```

where

<special_character>

character (such as ‘#’, ‘\$’, ‘|’ etc.) indicating that the comment is used for a specific purpose

`<comment_marker>`

a word identifying the annotation or special usage (word here is any sequence of characters except white space)

There may be any amount of white space (including none at all) between `<special_character>` and `<comment_marker>`, but no white space is permitted between `'--'` and `<special_character>`. (A white space here is either a space character or horizontal tabulation)

`<comment_marker>` must not contain any white space.

`<comment_marker>` may be empty, in which case the rule flags each comment that starts with `--<special_character>` and that does not contain any other character except white space

The rule has the following (mandatory) parameter for the `'+R'` option:

S String with the following interpretation: the first character is the special comment character, and the rest is the comment marker. **S** must not contain white space.

The `'-R'` option erases all definitions of special comment annotations specified by the previous `+R` options.

The rule is case-sensitive.

Example:

The rule

```
+RAnnotated_Comments:#hide
```

will flag the following comment lines

```
--#hide
--# hide
--#           hide
```

```
    I := I + 1; --# hide
```

But the line

```
-- # hide
```

will not be flagged, because of the space between `'-'` and `'#'`.

The line

```
--#Hide
```

will not be flagged, because the string parameter is case sensitive.

8.4.2 Boolean_Relational_Operators

Flag each call to a predefined relational operator ("`<`", "`>`", "`<=`", "`>=`", "`=`" and "`/=`") for the predefined Boolean type. (This rule is useful in enforcing the SPARK language restrictions.)

Calls to predefined relational operators of any type derived from `Standard.Boolean` are not detected. Calls to user-defined functions with

these designators, and uses of operators that are renamings of the predefined relational operators for `Standard.Boolean`, are likewise not detected.

This rule has no parameters.

8.4.3 Expanded_Loop_Exit_Names

Flag all expanded loop names in `exit` statements.

This rule has no parameters.

8.4.4 Non_SPARK_Attributes

The SPARK language defines the following subset of Ada 95 attribute designators as those that can be used in SPARK programs. The use of any other attribute is flagged.

- 'Adjacent
- 'Aft
- 'Base
- 'Ceiling
- 'Component_Size
- 'Compose
- 'Copy_Sign
- 'Delta
- 'Denorm
- 'Digits
- 'Exponent
- 'First
- 'Floor
- 'Fore
- 'Fraction
- 'Last
- 'Leading_Part
- 'Length
- 'Machine
- 'Machine_Emax
- 'Machine_Emin
- 'Machine_Mantissa
- 'Machine_Overflows
- 'Machine_Radix

- 'Machine_Rounds
- 'Max
- 'Min
- 'Model
- 'Model_Emin
- 'Model_Epsilon
- 'Model_Mantissa
- 'Model_Small
- 'Modulus
- 'Pos
- 'Pred
- 'Range
- 'Remainder
- 'Rounding
- 'Safe_First
- 'Safe_Last
- 'Scaling
- 'Signed_Zeros
- 'Size
- 'Small
- 'Succ
- 'Truncation
- 'Unbiased_Rounding
- 'Val
- 'Valid

This rule has no parameters.

8.4.5 Non_Tagged_Derived_Types

Flag all derived type declarations that do not have a record extension part.

This rule has no parameters.

8.4.6 Outer_Loop_Exits

Flag each `exit` statement containing a loop name that is not the name of the immediately enclosing `loop` statement.

This rule has no parameters.

8.4.7 `Overloaded_Operators`

Flag each function declaration that overloads an operator symbol. A function body is checked only if the body does not have a separate spec. Formal functions are also checked. For a renaming declaration, only renaming-as-declaration is checked

This rule has no parameters.

8.4.8 `Slices`

Flag all uses of array slicing

This rule has no parameters.

8.4.9 `Universal_Ranges`

Flag discrete ranges that are a part of an index constraint, constrained array definition, or `for`-loop parameter specification, and whose bounds are both of type *universal_integer*. Ranges that have at least one bound of a specific type (such as `1 .. N`, where `N` is a variable or an expression of non-universal type) are not flagged.

This rule has no parameters.

9 Example of gnatcheck Usage

Here is a simple example. Suppose that in the current directory we have a project file named 'gnatcheck_example.gpr' with the following content:

```
project Gnatcheck_Example is

  for Source_Dirs use ("src");
  for Object_Dir use "obj";
  for Main use ("main.adb");

  package Check is
    for Default_Switches ("ada") use ("-rules", "-from=coding_standard");
  end Check;

end Gnatcheck_Example;
```

And the file named 'coding_standard' is also located in the current directory and has the following content:

```
-----
-- This is a sample gnatcheck coding standard file --
-----

-- First, turning on rules, that are directly implemented in gnatcheck
+RAbstract_Type_Declarations
+RAnonymous_Arrays
+RLocal_Packages
+RFloat_Equality_Checks
+REXIT_Statements_With_No_Loop_Name

-- Then, activating compiler checks of interest:
+RStyle_Checks:e
-- This style check checks if a unit name is present on END keyword that
-- is the end of the unit declaration
```

And the subdirectory 'src' contains the following Ada sources:

```
'pack.ads':
package Pack is
  type T is abstract tagged private;
  procedure P (X : T) is abstract;

  package Inner is
    type My_Float is digits 8;
    function Is_Equal (L, R : My_Float) return Boolean;
  end Inner;
private
  type T is abstract tagged null record;
end;

'pack.adb':
```

```
package body Pack is
  package body Inner is
    function Is_Equal (L, R : My_Float) return Boolean is
    begin
      return L = R;
    end;
  end Inner;
end Pack;
and 'main.adb'
with Pack; use Pack;
procedure Main is

  pragma Annotate
    (gnatcheck, Exempt_On, "Anonymous_Arrays", "this one is fine");
  Float_Array : array (1 .. 10) of Inner.My_Float;
  pragma Annotate (gnatcheck, Exempt_Off, "Anonymous_Arrays");

  Another_Float_Array : array (1 .. 10) of Inner.My_Float;

  use Inner;

  B : Boolean := False;

begin
  for J in Float_Array'Range loop
    if Is_Equal (Float_Array (J), Another_Float_Array (J)) then
      B := True;
      exit;
    end if;
  end loop;
end Main;
```

And suppose we call `gnatcheck` from the current directory using the `gnat` driver:

```
gnat check -Pgnatcheck_example.gpr
```

As a result, `gnatcheck` is called to check all the files from the project `'gnatcheck_example.gpr'` using the coding standard defined by the file `'coding_standard'`. As the result, the `gnatcheck` report file named `'gnatcheck.out'` will be created in the current directory, and it will have the following content:

```
RULE CHECKING REPORT
```

1. OVERVIEW

```
Date and time of execution: 2009.10.28 14:17
```

```
Tool version: GNATCHECK (built with ASIS 2.0.R for GNAT Pro 6.3.0w (20091016))
```

```
Command line:
```

```
gnatcheck -files=... -cargs -gnatc=... -rules -from=coding_standard
```

Coding standard (applied rules):

- Abstract_Type_Declarations
- Anonymous_Arrays
- EXIT_Statements_With_No_Loop_Name
- Float_Equality_Checks
- Local_Packages

Compiler style checks: -gnatye

Number of coding standard violations: 6

Number of exempted coding standard violations: 1

2. DETECTED RULE VIOLATIONS

2.1. NON-EXEMPTED VIOLATIONS

Source files with non-exempted violations

- pack.ads
- pack.adb
- main.adb

List of violations grouped by files, and ordered by increasing source location:

- pack.ads:2:4: declaration of abstract type
- pack.ads:5:4: declaration of local package
- pack.ads:10:30: declaration of abstract type
- pack.ads:11:1: (style) "end Pack" required
- pack.adb:5:19: use of equality operation for float values
- pack.adb:6:7: (style) "end Is_Equal" required
- main.adb:9:26: anonymous array type
- main.adb:19:10: exit statement with no loop name

2.2. EXEMPTED VIOLATIONS

Source files with exempted violations

- main.adb

List of violations grouped by files, and ordered by increasing source location:

- main.adb:6:18: anonymous array type
(this one is fine)

2.3. SOURCE FILES WITH NO VIOLATION

No files without violations

END OF REPORT

Appendix A List of Rules

This Appendix contains an alphabetized list of all the predefined GNATcheck rules.

- `Abstract_Type_Declarations`
See [Section 8.2.1 \[Abstract_Type_Declarations\]](#), page 36.
- `Anonymous_Arrays`
See [Section 8.1.5.1 \[Anonymous_Arrays\]](#), page 23.
- `Anonymous_Subtypes`
See [Section 8.2.2 \[Anonymous_Subtypes\]](#), page 36.
- `Blocks`
See [Section 8.2.3 \[Blocks\]](#), page 36.
- `Boolean_Relational_Operators`
See [Section 8.4.2 \[Boolean_Relational_Operators\]](#), page 43.
- `Complex_Inlined_Subprograms`
See [Section 8.2.4 \[Complex_Inlined_Subprograms\]](#), page 37.
- `Controlled_Type_Declarations`
See [Section 8.2.5 \[Controlled_Type_Declarations\]](#), page 37.
- `Declarations_In_Blocks`
See [Section 8.2.6 \[Declarations_In_Blocks\]](#), page 37.
- `Deep_Inheritance_Hierarchies`
See [Section 8.1.2.1 \[Deep_Inheritance_Hierarchies\]](#), page 18.
- `Deeply_Nested_Generics`
See [Section 8.1.4.1 \[Deeply_Nested_Generics\]](#), page 22.
- `Deeply_Nested_Inlining`
See [Section 8.2.7 \[Deeply_Nested_Inlining\]](#), page 37.
- `Default_Parameters`
See [Section 8.2.8 \[Default_Parameters\]](#), page 38.
- `Direct_Calls_To_Primitives`
See [Section 8.1.2.2 \[Direct_Calls_To_Primitives\]](#), page 18.
- `Discriminated_Records`
See [Section 8.2.9 \[Discriminated_Records\]](#), page 38.
- `Enumeration_Ranges_In_CASE_Statements`
See [Section 8.1.5.2 \[Enumeration_Ranges_In_CASE_Statements\]](#), page 23.
- `Exceptions_As_Control_Flow`
See [Section 8.1.5.3 \[Exceptions_As_Control_Flow\]](#), page 23.
- `Exits_From_Conditional_Loops`
See [Section 8.1.5.4 \[Exits_From_Conditional_Loops\]](#), page 24.

- EXIT_Statements_With_No_Loop_Name
See [Section 8.1.5.5 \[EXIT_Statements_With_No_Loop_Name\]](#), page 24.
- Expanded_Loop_Exit_Names
See [Section 8.4.3 \[Expanded_Loop_Exit_Names\]](#), page 44.
- Explicit_Full_Discrete_Ranges
See [Section 8.2.10 \[Explicit_Full_Discrete_Ranges\]](#), page 38.
- Float_Equality_Checks
See [Section 8.2.11 \[Float_Equality_Checks\]](#), page 38.
- Forbidden_Attributes
See [Section 8.1.3.1 \[Forbidden_Attributes\]](#), page 19.
- Forbidden_Pragmas
See [Section 8.1.3.2 \[Forbidden_Pragmas\]](#), page 20.
- Function_Style_Procedures
See [Section 8.2.12 \[Function_Style_Procedures\]](#), page 38.
- Generics_In_Subprograms
See [Section 8.2.13 \[Generics_In_Subprograms\]](#), page 38.
- GOTO_Statements
See [Section 8.1.5.6 \[GOTO_Statements\]](#), page 24.
- Implicit_IN_Mode_Parameters
See [Section 8.2.14 \[Implicit_IN_Mode_Parameters\]](#), page 39.
- Implicit_SMALL_For_Fixed_Point_Types
See [Section 8.1.3.3 \[Implicit_SMALL_For_Fixed_Point_Types\]](#), page 21.
- Improperly_Located_Instantiations
See [Section 8.2.15 \[Improperly_Located_Instantiations\]](#), page 39.
- Improper_Returns
See [Section 8.1.5.7 \[Improper_Returns\]](#), page 24.
- Library_Level_Subprograms
See [Section 8.2.16 \[Library_Level_Subprograms\]](#), page 39.
- Local_Packages
See [Section 8.1.4.2 \[Local_Packages\]](#), page 22.
- Metrics_Cyclomatic_Complexity
See [Section 8.3.2 \[Metrics_Cyclomatic_Complexity\]](#), page 42.
- Metrics_Essential_Complexity
See [Section 8.3.1 \[Metrics_Essential_Complexity\]](#), page 42.
- Metrics_LSLOC
See [Section 8.3.3 \[Metrics_LSLOC\]](#), page 42.
- Misnamed_Controlling_Parameters
See [Section 8.1.6.3 \[Misnamed_Controlling_Parameters\]](#), page 32.

- Misnamed_Identifiers
See Section 8.1.6.4 [Misnamed_Identifiers], page 33.
- Multiple_Entries_In_Protected_Definitions
See Section 8.1.1.1 [Multiple_Entries_In_Protected_Definitions], page 17.
- Name_Clashes
See Section 8.1.6.5 [Name_Clashes], page 35.
- Non_Qualified_Aggregates
See Section 8.2.17 [Non_Qualified_Aggregates], page 39.
- Non_Short_Circuit_Operators
See Section 8.1.5.8 [Non_Short_Circuit_Operators], page 24.
- Non_SPARK_Attributes
See Section 8.4.4 [Non_SPARK_Attributes], page 44.
- Non_Tagged_Derived_Types
See Section 8.4.5 [Non_Tagged_Derived_Types], page 45.
- Non_Visible_Exceptions
See Section 8.1.4.3 [Non_Visible_Exceptions], page 22.
- Numeric_Literals
See Section 8.2.18 [Numeric_Literals], page 39.
- OTHERS_In_Aggregates
See Section 8.1.5.9 [OTHERS_In_Aggregates], page 24.
- OTHERS_In_CASE_Statements
See Section 8.1.5.10 [OTHERS_In_CASE_Statements], page 25.
- OTHERS_In_Exception_Handlers
See Section 8.1.5.11 [OTHERS_In_Exception_Handlers], page 25.
- Outer_Loop_Exits
See Section 8.4.6 [Outer_Loop_Exits], page 45.
- Overloaded_Operators
See Section 8.4.7 [Overloaded_Operators], page 46.
- Overly_Nested_Control_Structures
See Section 8.1.5.12 [Overly_Nested_Control_Structures], page 25.
- Parameters_Out_Of_Order
See Section 8.2.19 [Parameters_Out_Of_Order], page 40.
- Positional_Actuals_For_Defaulted_Generic_Parameters
See Section 8.1.5.13 [Positional_Actuals_For_Defaulted_Generic_Parameters], page 26.
- Positional_Actuals_For_Defaulted_Parameters
See Section 8.1.5.14 [Positional_Actuals_For_Defaulted_Parameters], page 26.

- `Positional_Components`
See [Section 8.1.5.15 \[Positional_Components\]](#), page 26.
- `Positional_Generic_Parameters`
See [Section 8.1.5.16 \[Positional_Generic_Parameters\]](#), page 26.
- `Positional_Parameters`
See [Section 8.1.5.17 \[Positional_Parameters\]](#), page 26.
- `Predefined_Numeric_Types`
See [Section 8.1.3.5 \[Predefined_Numeric_Types\]](#), page 21.
- `Raising_External_Exceptions`
See [Section 8.1.4.4 \[Raising_External_Exceptions\]](#), page 23.
- `Raising_Predefined_Exceptions`
See [Section 8.2.20 \[Raising_Predefined_Exceptions\]](#), page 40.
- `Separate_Numeric_Error_Handlers`
See [Section 8.1.3.6 \[Separate_Numeric_Error_Handlers\]](#), page 22.
- `Slices`
See [Section 8.4.8 \[Slices\]](#), page 46.
- `Too_Many_Parents`
See [Section 8.1.2.3 \[Too_Many_Parents\]](#), page 18.
- `Unassigned_OUT_Parameters`
See [Section 8.2.21 \[Unassigned_OUT_Parameters\]](#), page 41.
- `Uncommented_BEGIN_In_Package_Bodies`
See [Section 8.1.6.6 \[Uncommented_BEGIN_In_Package_Bodies\]](#), page 35.
- `Recursive_Subprograms`
See [Section 8.1.5.18 \[Recursive_Subprograms\]](#), page 26.
- `Unconditional_Exits`
See [Section 8.1.5.19 \[Unconditional_Exits\]](#), page 27.
- `Unconstrained_Array>Returns`
See [Section 8.2.22 \[Unconstrained_Array>Returns\]](#), page 41.
- `Universal_Ranges`
See [Section 8.4.9 \[Universal_Ranges\]](#), page 46.
- `Unnamed_Blocks_And_Loops`
See [Section 8.1.5.20 \[Unnamed_Blocks_And_Loops\]](#), page 27.
- `USE_PACKAGE_Clauses`
See [Section 8.1.5.21 \[USE_PACKAGE_Clauses\]](#), page 27.
- `Visible_Components`
See [Section 8.1.2.4 \[Visible_Components\]](#), page 19.
- `Volatile_Objects_Without_Address_Clauses`
See [Section 8.1.1.2 \[Volatile_Objects_Without_Address_Clauses\]](#), page 17.

Appendix B GNU Free Documentation License

Version 1.1, March 2000

Copyright © 2000 Free Software Foundation, Inc.
59 Temple Place, Suite 330, Boston, MA 02111-1307 USA

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

0. PREAMBLE

The purpose of this License is to make a manual, textbook, or other written document “free” in the sense of freedom: to assure everyone the effective freedom to copy and redistribute it, with or without modifying it, either commercially or noncommercially. Secondly, this License preserves for the author and publisher a way to get credit for their work, while not being considered responsible for modifications made by others.

This License is a kind of “copyleft”, which means that derivative works of the document must themselves be free in the same sense. It complements the GNU General Public License, which is a copyleft license designed for free software.

We have designed this License in order to use it for manuals for free software, because free software needs free documentation: a free program should come with manuals providing the same freedoms that the software does. But this License is not limited to software manuals; it can be used for any textual work, regardless of subject matter or whether it is published as a printed book. We recommend this License principally for works whose purpose is instruction or reference.

1. APPLICABILITY AND DEFINITIONS

This License applies to any manual or other work that contains a notice placed by the copyright holder saying it can be distributed under the terms of this License. The “Document”, below, refers to any such manual or work. Any member of the public is a licensee, and is addressed as “you”.

A “Modified Version” of the Document means any work containing the Document or a portion of it, either copied verbatim, or with modifications and/or translated into another language.

A “Secondary Section” is a named appendix or a front-matter section of the Document that deals exclusively with the relationship of the publishers or authors of the Document to the Document’s overall subject (or to related

matters) and contains nothing that could fall directly within that overall subject. (For example, if the Document is in part a textbook of mathematics, a Secondary Section may not explain any mathematics.) The relationship could be a matter of historical connection with the subject or with related matters, or of legal, commercial, philosophical, ethical or political position regarding them.

The “Invariant Sections” are certain Secondary Sections whose titles are designated, as being those of Invariant Sections, in the notice that says that the Document is released under this License.

The “Cover Texts” are certain short passages of text that are listed, as Front-Cover Texts or Back-Cover Texts, in the notice that says that the Document is released under this License.

A “Transparent” copy of the Document means a machine-readable copy, represented in a format whose specification is available to the general public, whose contents can be viewed and edited directly and straightforwardly with generic text editors or (for images composed of pixels) generic paint programs or (for drawings) some widely available drawing editor, and that is suitable for input to text formatters or for automatic translation to a variety of formats suitable for input to text formatters. A copy made in an otherwise Transparent file format whose markup has been designed to thwart or discourage subsequent modification by readers is not Transparent. A copy that is not “Transparent” is called “Opaque”.

Examples of suitable formats for Transparent copies include plain ASCII without markup, Texinfo input format, LaTeX input format, SGML or XML using a publicly available DTD, and standard-conforming simple HTML designed for human modification. Opaque formats include PostScript, PDF, proprietary formats that can be read and edited only by proprietary word processors, SGML or XML for which the DTD and/or processing tools are not generally available, and the machine-generated HTML produced by some word processors for output purposes only.

The “Title Page” means, for a printed book, the title page itself, plus such following pages as are needed to hold, legibly, the material this License requires to appear in the title page. For works in formats which do not have any title page as such, “Title Page” means the text near the most prominent appearance of the work’s title, preceding the beginning of the body of the text.

2. VERBATIM COPYING

You may copy and distribute the Document in any medium, either commercially or noncommercially, provided that this License, the copyright notices, and the license notice saying this License applies to the Document are reproduced in all copies, and that you add no other conditions whatsoever to those of this License. You may not use technical measures to obstruct or control the reading

or further copying of the copies you make or distribute. However, you may accept compensation in exchange for copies. If you distribute a large enough number of copies you must also follow the conditions in section 3.

You may also lend copies, under the same conditions stated above, and you may publicly display copies.

3. COPYING IN QUANTITY

If you publish printed copies of the Document numbering more than 100, and the Document's license notice requires Cover Texts, you must enclose the copies in covers that carry, clearly and legibly, all these Cover Texts: Front-Cover Texts on the front cover, and Back-Cover Texts on the back cover. Both covers must also clearly and legibly identify you as the publisher of these copies. The front cover must present the full title with all words of the title equally prominent and visible. You may add other material on the covers in addition. Copying with changes limited to the covers, as long as they preserve the title of the Document and satisfy these conditions, can be treated as verbatim copying in other respects.

If the required texts for either cover are too voluminous to fit legibly, you should put the first ones listed (as many as fit reasonably) on the actual cover, and continue the rest onto adjacent pages.

If you publish or distribute Opaque copies of the Document numbering more than 100, you must either include a machine-readable Transparent copy along with each Opaque copy, or state in or with each Opaque copy a publicly-accessible computer-network location containing a complete Transparent copy of the Document, free of added material, which the general network-using public has access to download anonymously at no charge using public-standard network protocols. If you use the latter option, you must take reasonably prudent steps, when you begin distribution of Opaque copies in quantity, to ensure that this Transparent copy will remain thus accessible at the stated location until at least one year after the last time you distribute an Opaque copy (directly or through your agents or retailers) of that edition to the public.

It is requested, but not required, that you contact the authors of the Document well before redistributing any large number of copies, to give them a chance to provide you with an updated version of the Document.

4. MODIFICATIONS

You may copy and distribute a Modified Version of the Document under the conditions of sections 2 and 3 above, provided that you release the Modified Version under precisely this License, with the Modified Version filling the role of the Document, thus licensing distribution and modification of the Modified

Version to whoever possesses a copy of it. In addition, you must do these things in the Modified Version:

- A. Use in the Title Page (and on the covers, if any) a title distinct from that of the Document, and from those of previous versions (which should, if there were any, be listed in the History section of the Document). You may use the same title as a previous version if the original publisher of that version gives permission.
- B. List on the Title Page, as authors, one or more persons or entities responsible for authorship of the modifications in the Modified Version, together with at least five of the principal authors of the Document (all of its principal authors, if it has less than five).
- C. State on the Title page the name of the publisher of the Modified Version, as the publisher.
- D. Preserve all the copyright notices of the Document.
- E. Add an appropriate copyright notice for your modifications adjacent to the other copyright notices.
- F. Include, immediately after the copyright notices, a license notice giving the public permission to use the Modified Version under the terms of this License, in the form shown in the Addendum below.
- G. Preserve in that license notice the full lists of Invariant Sections and required Cover Texts given in the Document's license notice.
- H. Include an unaltered copy of this License.
- I. Preserve the section entitled "History", and its title, and add to it an item stating at least the title, year, new authors, and publisher of the Modified Version as given on the Title Page. If there is no section entitled "History" in the Document, create one stating the title, year, authors, and publisher of the Document as given on its Title Page, then add an item describing the Modified Version as stated in the previous sentence.
- J. Preserve the network location, if any, given in the Document for public access to a Transparent copy of the Document, and likewise the network locations given in the Document for previous versions it was based on. These may be placed in the "History" section. You may omit a network location for a work that was published at least four years before the Document itself, or if the original publisher of the version it refers to gives permission.
- K. In any section entitled "Acknowledgements" or "Dedications", preserve the section's title, and preserve in the section all the substance and tone of each of the contributor acknowledgements and/or dedications given therein.
- L. Preserve all the Invariant Sections of the Document, unaltered in their text and in their titles. Section numbers or the equivalent are not considered part of the section titles.

- M. Delete any section entitled “Endorsements”. Such a section may not be included in the Modified Version.
- N. Do not retitle any existing section as “Endorsements” or to conflict in title with any Invariant Section.

If the Modified Version includes new front-matter sections or appendices that qualify as Secondary Sections and contain no material copied from the Document, you may at your option designate some or all of these sections as invariant. To do this, add their titles to the list of Invariant Sections in the Modified Version’s license notice. These titles must be distinct from any other section titles.

You may add a section entitled “Endorsements”, provided it contains nothing but endorsements of your Modified Version by various parties – for example, statements of peer review or that the text has been approved by an organization as the authoritative definition of a standard.

You may add a passage of up to five words as a Front-Cover Text, and a passage of up to 25 words as a Back-Cover Text, to the end of the list of Cover Texts in the Modified Version. Only one passage of Front-Cover Text and one of Back-Cover Text may be added by (or through arrangements made by) any one entity. If the Document already includes a cover text for the same cover, previously added by you or by arrangement made by the same entity you are acting on behalf of, you may not add another; but you may replace the old one, on explicit permission from the previous publisher that added the old one.

The author(s) and publisher(s) of the Document do not by this License give permission to use their names for publicity for or to assert or imply endorsement of any Modified Version.

5. COMBINING DOCUMENTS

You may combine the Document with other documents released under this License, under the terms defined in section 4 above for modified versions, provided that you include in the combination all of the Invariant Sections of all of the original documents, unmodified, and list them all as Invariant Sections of your combined work in its license notice.

The combined work need only contain one copy of this License, and multiple identical Invariant Sections may be replaced with a single copy. If there are multiple Invariant Sections with the same name but different contents, make the title of each such section unique by adding at the end of it, in parentheses, the name of the original author or publisher of that section if known, or else a unique number. Make the same adjustment to the section titles in the list of Invariant Sections in the license notice of the combined work.

In the combination, you must combine any sections entitled “History” in the various original documents, forming one section entitled “History”; likewise

combine any sections entitled “Acknowledgements”, and any sections entitled “Dedications”. You must delete all sections entitled “Endorsements.”

Heading 6. COLLECTIONS OF DOCUMENTS

You may make a collection consisting of the Document and other documents released under this License, and replace the individual copies of this License in the various documents with a single copy that is included in the collection, provided that you follow the rules of this License for verbatim copying of each of the documents in all other respects.

You may extract a single document from such a collection, and distribute it individually under this License, provided you insert a copy of this License into the extracted document, and follow this License in all other respects regarding verbatim copying of that document.

7. AGGREGATION WITH INDEPENDENT WORKS

A compilation of the Document or its derivatives with other separate and independent documents or works, in or on a volume of a storage or distribution medium, does not as a whole count as a Modified Version of the Document, provided no compilation copyright is claimed for the compilation. Such a compilation is called an “aggregate”, and this License does not apply to the other self-contained works thus compiled with the Document, on account of their being thus compiled, if they are not themselves derivative works of the Document.

If the Cover Text requirement of section 3 is applicable to these copies of the Document, then if the Document is less than one quarter of the entire aggregate, the Document’s Cover Texts may be placed on covers that surround only the Document within the aggregate. Otherwise they must appear on covers around the whole aggregate.

8. TRANSLATION

Translation is considered a kind of modification, so you may distribute translations of the Document under the terms of section 4. Replacing Invariant Sections with translations requires special permission from their copyright holders, but you may include translations of some or all Invariant Sections in addition to the original versions of these Invariant Sections. You may include a translation of this License provided that you also include the original English version of this License. In case of a disagreement between the translation and the original English version of this License, the original English version will prevail.

9. TERMINATION

You may not copy, modify, sublicense, or distribute the Document except as expressly provided for under this License. Any other attempt to copy, modify,

sublicense or distribute the Document is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

10. FUTURE REVISIONS OF THIS LICENSE

The Free Software Foundation may publish new, revised versions of the GNU Free Documentation License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. See <http://www.gnu.org/copyleft/>.

Each version of the License is given a distinguishing version number. If the Document specifies that a particular numbered version of this License “or any later version” applies to it, you have the option of following the terms and conditions either of that specified version or of any later version that has been published (not as a draft) by the Free Software Foundation. If the Document does not specify a version number of this License, you may choose any version ever published (not as a draft) by the Free Software Foundation.

ADDENDUM: How to use this License for your documents

To use this License in a document you have written, include a copy of the License in the document and put the following copyright and license notices just after the title page:

Copyright (c) YEAR YOUR NAME.

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.1 or any later version published by the Free Software Foundation; with the Invariant Sections being LIST THEIR TITLES, with the Front-Cover Texts being LIST, and with the Back-Cover Texts being LIST. A copy of the license is included in the section entitled “GNU Free Documentation License”.

If you have no Invariant Sections, write “with no Invariant Sections” instead of saying which ones are invariant. If you have no Front-Cover Texts, write “no Front-Cover Texts” instead of “Front-Cover Texts being LIST”; likewise for Back-Cover Texts.

If your document contains nontrivial examples of program code, we recommend releasing these examples in parallel under your choice of free software license, such as the GNU General Public License, to permit their use in free software.

Index

+

'+R' (gnatcheck) 9

-

'--include-file=file' 7

'--write-rules' 8

'-a' 7

'-d' 7

'-dd' 7

'-from' (gnatcheck) 9

'-h' 7

'-l' 7

'-log' 7

'-m' 7

'-o' 7

'-q' 7

'-R' (gnatcheck) 9

'-s' 7

'-t' 7

'-v' 7

A

Abstract_Type_Declarations 36

Annotated_Comments 42

Anonymous_Arrays 23

Anonymous_Subtypes 36

ASIS 3

B

Blocks 36

Boolean_Relational_Operators 43

C

Coding standard file (for gnatcheck) 9

Complex_Inlined_Subprograms 37

Controlled_Type_Declarations 37

D

Declarations_In_Blocks 37

Deep_Inheritance_Hierarchies 18

Deeply_Nested_Generics 22

Deeply_Nested_Inlining 37

Default_Parameters 38

Direct_Calls_To_Primitives 18

Discriminated_Records 38

E

Enumeration_Ranges_In_CASE_Statements
..... 23

Exceptions_As_Control_Flow 24

EXIT_Statements_With_No_Loop_Name 24

Exits_From_Conditional_Loops 24

Expanded_Loop_Exit_Names 44

Explicit_Full_Discrete_Ranges 38

F

Feature usage related rules 36

Float_Equality_Checks 38

Forbidden_Attributes 19

Forbidden_Pragmas 20

Format of the Report File 5

Free Documentation License, GNU 55

Function_Style_Procedures 38

G

Generics_In_Subprograms 38

gnatcheck annotations rules 16

GNU Free Documentation License 55

GOTO_Statements 24

I

Identifier_Casing 27

Identifier_Prefixes 29

Implicit_IN_Mode_Parameters 39

Implicit_SMALL_For_Fixed_Point_Types
..... 21

Improper>Returns 24

Improperly_Located_Instantiations.....	39	Positional_Components.....	26
		Positional_Generic_Parameters.....	26
		Positional_Parameters.....	26
L		Predefined Rules.....	17
Library_Level_Subprograms.....	39	Predefined_Numeric_Types.....	21
License, GNU Free Documentation.....	55	Program Structure related rules.....	22
Local_Packages.....	22	Programming Practice related rules.....	23
		Project-Wide Checks.....	13
M			
Metrics-related rules.....	41	R	
Metrics_Cyclomatic_Complexity.....	42	Raising_External_Exceptions.....	23
Metrics_Essential_Complexity.....	42	Raising_Predefined_Exceptions.....	40
Metrics_LSLLOC.....	42	Readability-related rules.....	27
Misnamed_Controlling_Parameters.....	32	Recursive_Subprograms rule.....	26
Misnamed_Identifiers.....	33	Rule exemption.....	15
Multiple_Entries_In_Protected_			
Definitions.....	17	S	
N		Separate_Numeric_Error_Handlers.....	22
Name_Clashes.....	35	Slices.....	46
No_Scalar_Storage_Order_Specified.....	21	Source code presentation related rules.....	36
Non_Qualified_Aggregates.....	39	SPARK Ada related rules.....	42
Non_Short_Circuit_Operators.....	24	Style-related rules.....	17
Non_SPARK_Attributes.....	44		
Non_Tagged_Derived_Types.....	45	T	
Non_Visible_Exceptions rule.....	22	Tasking-related rules.....	17
Numeric_Literals.....	39	Too_Many_Parents.....	18
O			
Object-Orientation related rules.....	18	U	
OTHERS_In_Aggregates.....	25	Unassigned_OUT_Parameters.....	41
OTHERS_In_CASE_Statements.....	25	Uncommented_BEGIN_In_Package_Bodies ..	35
OTHERS_In_Exception_Handlers.....	25	Unconditional_Exits rule.....	27
Outer_Loop_Exits.....	45	Unconstrained_Array_Returns.....	41
Overloaded_Operators.....	46	Universal_Ranges rule.....	46
Overly_Nested_Control_Structures.....	25	Unnamed_Blocks_And_Loops.....	27
		USE_PACKAGE_Clauses.....	27
P		Using pragma Annotate to control rule	
Parameters_Out_Of_Order.....	40	exemption.....	15
Portability-related rules.....	19	V	
Positional_Actuals_For_Defaulted_		Visible_Components.....	19
Generic_Parameters.....	26	Volatile_Objects_Without_Address_Clauses	
Positional_Actuals_For_Defaulted_		17
Parameters rule.....	26		

Table of Contents

About This Manual	1
What This Manual Contains.....	1
What You Should Know Before Reading This Manual.....	1
1 Introduction	3
2 Format of the Report File	5
3 General gnatcheck Switches	7
4 gnatcheck Rule Options	9
5 Adding the Results of Compiler Checks to gnatcheck Output	11
6 Project-Wide Checks	13
7 Rule exemption	15
7.1 Using pragma Annotate to Control Rule Exemption.....	15
7.2 gnatcheck Annotations Rules.....	16
8 Predefined Rules	17
8.1 Style-Related Rules.....	17
8.1.1 Tasking.....	17
8.1.1.1 Multiple_Entries_In_Protected_Definitions.....	17
8.1.1.2 Volatile_Objects_Without_Address_Clauses.....	17
8.1.2 Object Orientation.....	18
8.1.2.1 Deep_Inheritance_Hierarchies.....	18
8.1.2.2 Direct_Calls_To_Primitives.....	18
8.1.2.3 Too_Many_Parents.....	18
8.1.2.4 Visible_Components.....	19
8.1.3 Portability.....	19
8.1.3.1 Forbidden_Attributes.....	19
8.1.3.2 Forbidden_Pragmas.....	20
8.1.3.3 Implicit_SMALL_For_Fixed_Point_Types.....	21

8.1.3.4	No_Scalar_Storage_Order_Specified.....	21
8.1.3.5	Predefined_Numeric_Types.....	21
8.1.3.6	Separate_Numeric_Error_Handlers.....	22
8.1.4	Program Structure	22
8.1.4.1	Deeply_Nested_Generics.....	22
8.1.4.2	Local_Packages.....	22
8.1.4.3	Non_Visible_Exceptions.....	22
8.1.4.4	Raising_External_Exceptions.....	23
8.1.5	Programming Practice	23
8.1.5.1	Anonymous_Arrays.....	23
8.1.5.2	Enumeration_Ranges_In_CASE_Statements.....	23
8.1.5.3	Exceptions_As_Control_Flow.....	23
8.1.5.4	Exits_From_Conditional_Loops.....	24
8.1.5.5	EXIT_Statements_With_No_Loop_Name.....	24
8.1.5.6	GOTO_Statements.....	24
8.1.5.7	Improper>Returns.....	24
8.1.5.8	Non_Short_Circuit_Operators.....	24
8.1.5.9	OTHERS_In_Aggregates.....	24
8.1.5.10	OTHERS_In_CASE_Statements.....	25
8.1.5.11	OTHERS_In_Exception_Handlers.....	25
8.1.5.12	Overly_Nested_Control_Structures.....	25
8.1.5.13	Positional_Actuals_For_Defaulted_Generic_Parameters	26
8.1.5.14	Positional_Actuals_For_Defaulted_Parameters.....	26
8.1.5.15	Positional_Components.....	26
8.1.5.16	Positional_Generic_Parameters.....	26
8.1.5.17	Positional_Parameters.....	26
8.1.5.18	Recursive_Subprograms.....	26
8.1.5.19	Unconditional_Exits.....	27
8.1.5.20	Unnamed_Blocks_And_Loops.....	27
8.1.5.21	USE_PACKAGE_Clauses.....	27
8.1.6	Readability	27
8.1.6.1	Identifier_Casing.....	27
8.1.6.2	Identifier_Prefixes.....	29
8.1.6.3	Misnamed_Controlling_Parameters.....	32
8.1.6.4	Misnamed_Identifiers.....	33
8.1.6.5	Name_Clashes.....	35
8.1.6.6	Uncommented_BEGIN_In_Package_Bodies.....	35
8.1.7	Source Code Presentation	36
8.2	Feature Usage Rules	36
8.2.1	Abstract_Type_Declarations.....	36
8.2.2	Anonymous_Subtypes.....	36

8.2.3	Blocks	36
8.2.4	Complex_Inlined_Subprograms	37
8.2.5	Controlled_Type_Declarations	37
8.2.6	Declarations_In_Blocks	37
8.2.7	Deeply_Nested_Inlining	37
8.2.8	Default_Parameters	38
8.2.9	Discriminated_Records	38
8.2.10	Explicit_Full_Discrete_Ranges	38
8.2.11	Float_Equality_Checks	38
8.2.12	Function_Style_Procedures	38
8.2.13	Generics_In_Subprograms	38
8.2.14	Implicit_IN_Mode_Parameters	39
8.2.15	Improperly_Located_Instantiations	39
8.2.16	Library_Level_Subprograms	39
8.2.17	Non_Qualified_Aggregates	39
8.2.18	Numeric_Literals	39
8.2.19	Parameters_Out_Of_Order	40
8.2.20	Raising_Predefined_Exceptions	40
8.2.21	Unassigned_OUT_Parameters	41
8.2.22	Unconstrained_Array_Returns	41
8.3	Metrics-Related Rules	41
8.3.1	Metrics_Essential_Complexity	42
8.3.2	Metrics_Cyclomatic_Complexity	42
8.3.3	Metrics_LSLOC	42
8.4	SPARK Ada Rules	42
8.4.1	Annotated_Comments	42
8.4.2	Boolean_Relational_Operators	43
8.4.3	Expanded_Loop_Exit_Names	44
8.4.4	Non_SPARK_Attributes	44
8.4.5	Non_Tagged_Derived_Types	45
8.4.6	Outer_Loop_Exits	45
8.4.7	Overloaded_Operators	46
8.4.8	Slices	46
8.4.9	Universal_Ranges	46
9	Example of gnatcheck Usage	47
Appendix A	List of Rules	51
Appendix B	GNU Free Documentation License....	55
Index	63

