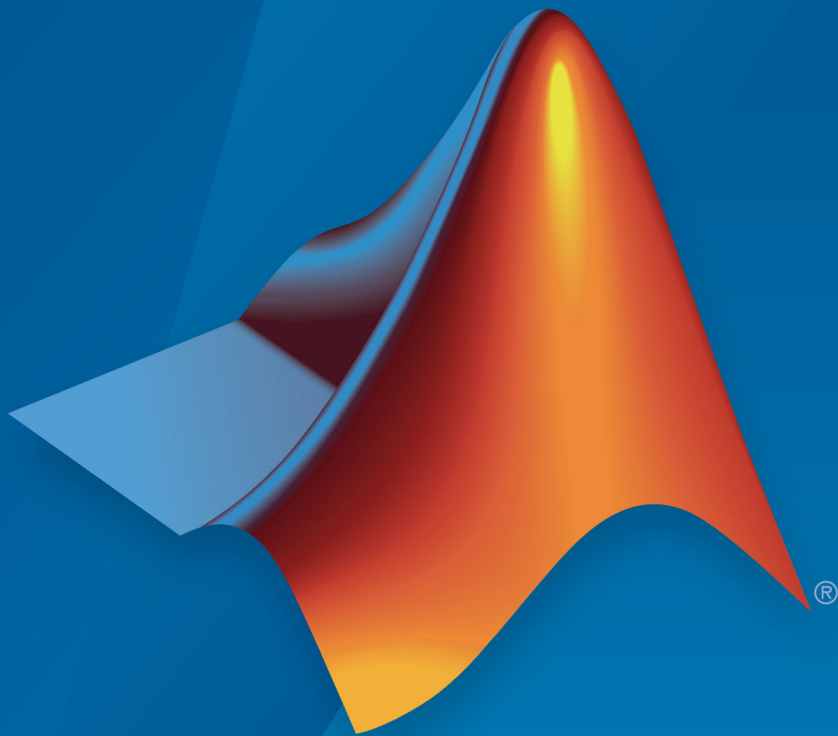


Polyspace[®] Bug Finder[™] Access[™]

User's Guide



R2019a

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Polyspace® Bug Finder™ Access™ User's Guide

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Interpret Polyspace Bug Finder Results

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Interpret Polyspace Bug Finder Access Results

When you open the results of a Bug Finder analysis in the **REVIEW** view of Polyspace Access, you see a list on the **Results List** pane. The results consist of defects, coding rule violations or code metrics.

You can first narrow down the focus of your review:

- Use filters in the toolstrip to narrow down the list. For instance, you can focus on the high-impact defects.
- Click the a column header in the **Results List** to sort the list according to the content of that column. For instance you can sort by **Group** or by **File**.

Once you narrow down and sort the list, you can begin reviewing individual results. This topic describes how to review a result.

The screenshot displays the Polyspace Bug Finder interface. On the left, a 'Results List' table shows various defects. The defect with ID 77758 is selected. On the right, the 'Result Details' pane shows the selected defect's information, including its status, severity, and a detailed description: 'Invalid free of pointer (Impact: High)'. Below this, an event table shows the sequence of operations leading to the defect. At the bottom, the 'Source Code' pane shows the C code snippet where the error occurred, with a red squiggly line under the `free(p);` statement. Annotations with arrows point to these key elements:

- Select a result.** Points to the selected row in the Results List table.
- Read result explanation.** Points to the 'Invalid free of pointer' message in the Result Details pane.
- See source code.** Points to the `free(p);` line in the Source Code pane.

Family	ID	Type	Group	Check
	77620	Defects	Concurrency	Data race
	77622	Defects	Concurrency	Data race
	78171	Defects	Concurrency	Data race through st
	78173	Defects	Concurrency	Double lock
	78175	Defects	Concurrency	Missing unlock
	78179	Defects	Concurrency	Double unlock
	78181	Defects	Concurrency	Deadlock
	77730	Defects	Data flow	Non-initialized variab
	77734	Defects	Data flow	Non-initialized pointe
	77736	Defects	Data flow	Non-initialized variab
	77634	Defects	Dynamic memory	Deallocation of prev
	77756	Defects	Dynamic memory	Use of previously fre
	77758	Defects	Dynamic memory	Invalid free of pointer
	77766	Defects	Numerical	Invalid use of standa
	77768	Defects	Numerical	Invalid use of standa
	77770	Defects	Numerical	Float conversion ove
	77772	Defects	Numerical	Integer conversion o
	77778	Defects	Numerical	Absorption of float o
	77796	Defects	Numerical	Invalid use of standa
	78123	Defects	Numerical	Float division by zero
	78125	Defects	Numerical	Integer division by ze
	76061	Defects	Programming	Invalid use of == ope
	76094	Defects	Programming	Possibly unintended

```

Event | File | Scope
--- | --- | ---
1 | Take the address of variable Y | dynamicmemory.c | bug_badfree()
2 | Argument number 1 of call t... | dynamicmemory.c | bug_badfree()
3 | Invalid free of pointer | dynamicmemory.c | bug_badfree()
  
```

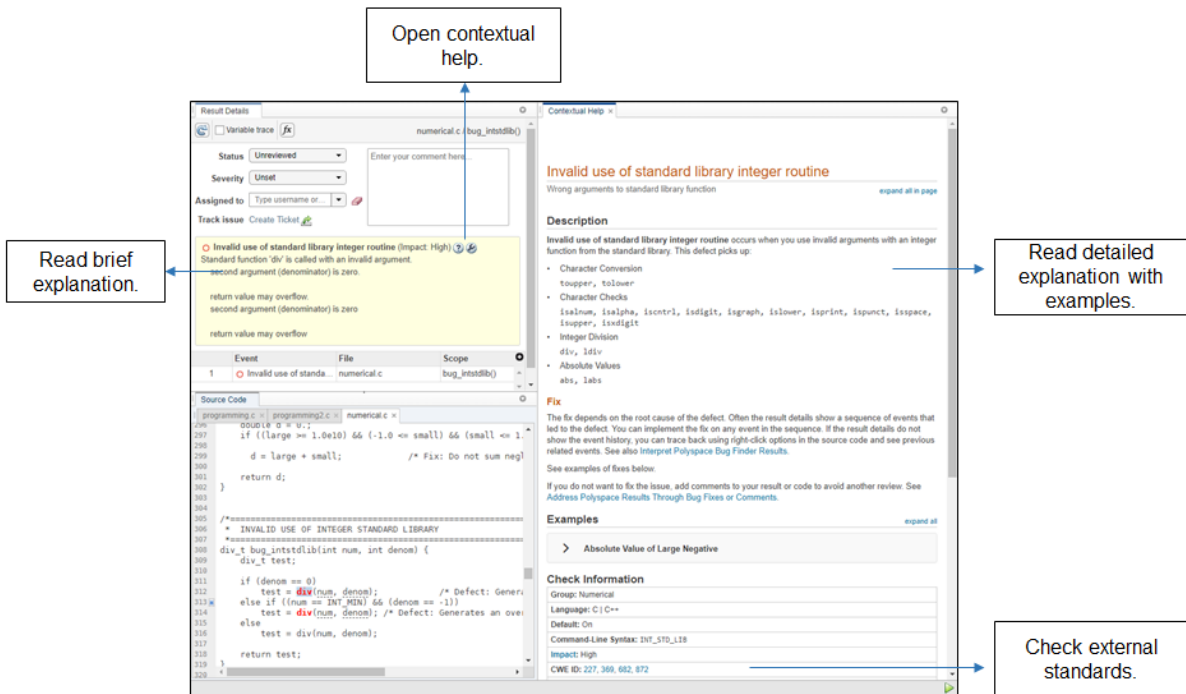
```

Source Code
dynamicmemory.c
58 * @param n the number of elements to free
59 void bug_badfree(int i) {
60     int* p = &i;
61
62     free(p); /* Defect: free on a non-allocated memory */
63
64     void corrupted_badfree(int i) {
65
66
  
```

To begin your review, select a result in the list.

Interpret Result Details Message

1 Interpret Polyspace Bug Finder Results




Interpret Message

The first step is to understand what is wrong. Read the message on the **Result Details** pane and the related line of code on the **Source Code** pane.

Seek Additional Resources for Help

Sometimes, you need additional help for certain results. Click the  icon to open a help page for the selected result. See code examples illustrating the result. Check external

standards such as CERT-C that provide additional rationale for fixing the issue. When available, click the  icon to see fix suggestions for the defect.

At this point, you might be ready to decide whether to fix the issue or not. Once you identify a fix, it might help to review all results of that type together.

Find Root Cause of Result

Sometimes, the root cause might be far from the actual location where the result is displayed. For instance, a variable that you read might be non-initialized because the initialization is not reachable. The defect is shown when you read the variable, but the root cause is perhaps a previous `if` or `while` condition that is always false.

Navigate to Related Events

Typically, the **Result Details** pane shows one sequence of events that leads to the result. The **Source Code** pane also highlights these events.

1 Interpret Polyspace Bug Finder Results

Result Details

dataflow.c / bug_noninitvar()

Status: Unreviewed

Severity: Unset

Assigned to: Type username or...

Track issue [Create Ticket](#)

Non-initialized variable (Impact: High)
Local variable 'value' may be read before being initialized.

	Event	File	Scope
1	Declaration of variable 'value'	dataflow.c	bug_noninitvar()
2	Not entering if statement (if-condition false)	dataflow.c	bug_noninitvar()
3	Non-initialized variable	dataflow.c	bug_noninitvar()

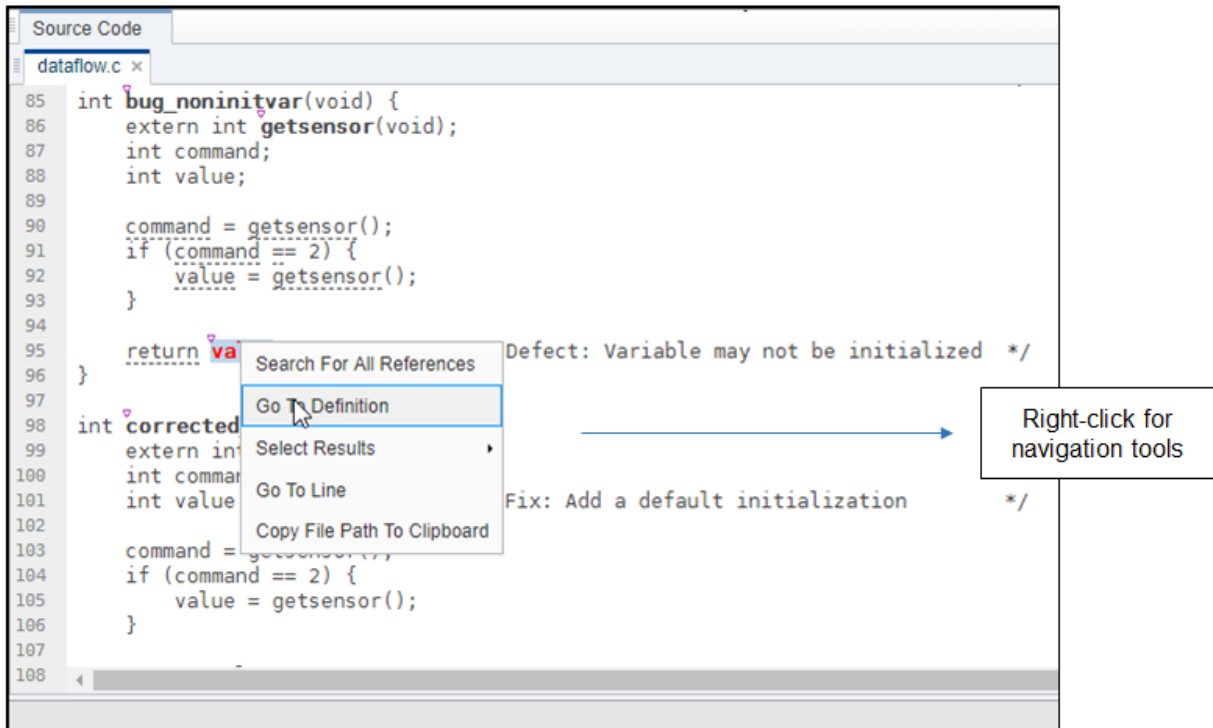
In the above event traceback, this sequence is shown:

- 1 A variable `value` is declared.
- 2 The execution path bypasses an `if` statement. This information might be relevant if the variable is initialized inside the `if` block.
- 3 Location of the current defect: **Non-initialized variable**

Typically, the traceback shows major points in the control flow: entering or bypassing conditional statements or loops, entering a function, and so on. For specific defects, the traceback shows other kinds of events relevant to the defect. For instance, for a **Declaration mismatch** defect, the traceback shows the two locations with conflicting declarations.

Create Your Own Navigation Path

If the event traceback is not available, use other navigation tools to trace your own path through the code.



Before you begin navigating through pathways in your code, ask the question: What am I looking for? Based on your answer, choose the appropriate navigation tool. For instance:


- To investigate a **Non-initialized variable** defect, you might want to make sure that the variable is not initialized at all. To look for previous instances of the variable, on the **Source Code** pane, right-click the variable and select **Search For All**

References. This option lists only instances of a specific variable and not other variables with the same name in other scopes.

- To investigate a violation of **MISRA C:2012 Rule 17.7:**

The value returned by a function having non-void return type shall be used.

you might want to navigate from a function call to the function definition. Right-click the function and select **Go To Definition**.

After you navigate away from the current result, use the  icon on the **Result Details** pane to come back.

To select a different result from the **Source Code** pane, Ctrl-click the result or right-click and select **Select Results At This Location**. The **Results Details** pane updates but the result you select is not highlighted in the **Results List** pane. Clicking a result in the **Results List** updates the **Results Details** and **Source Code** panes.

See Also

More About

- “Address Polyspace Results Through Bug Fixes or Comments” on page 2-2
- “Filter and Sort Results” on page 3-2

Investigate the Cause of Empty Results List

When you run an analysis with Polyspace Bug Finder, the **Results List** pane can be empty or it can display this message:

No results available for currently selected filters,
or no results available for the selected project.

The message can indicate that your code has no defect or coding rule violation. However, before you reach this conclusion:

- 1 Open the **Run Log** pane by going to **Layout > Show/Hide View**.
- 2 Maximize the pane by double-clicking the **Run Log** tab, then use CTRL - F to check for the following.

Possible Cause	Action to Take
Did all your source files compile?	In the Run Log pane, search for: Failed compilation. If a file does not compile, Bug Finder can return some results, but only files with no compilation errors are fully analyzed.
Did you include all your source files in your project?	In the Run Log pane, search for: verifying sources ... Make sure that all the files that you want to analyze are listed under this message.

Possible Cause	Action to Take
Did you configure your project correctly?	<p>In the Run Log pane, search for:</p> <ul style="list-style-type: none">• User: Under this message, verify that the appropriate options are activated to check for coding standards violations and to compute code metrics.• Activated checkers: Under this message you see a list of all the defects checkers selected for this analysis.• <code>-fast-analysis=true</code> If the fast analysis mode is activated, Bug Finder checks for only a subset of defects and coding rules.
Are you applying any filters to the results?	To see which filters you are applying to the results, see the filter bar below the FAMILY FILTERS section of the toolbar. To clear all applied filters, click the eraser icon.

If you review results for an analysis you did not configure, discuss the possible causes of an empty results list with the project build master. If you use `polyspace-configure` as part of your analysis workflow, the **Run Log** might not contain all the analysis configuration parameters. For more information on analysis options and project configuration, see the documentation for Polyspace Bug Finder or Polyspace Bug Finder Server™.

See Also

More About

- “Address Polyspace Results Through Bug Fixes or Comments” on page 2-2

Dashboard

The **Dashboard** perspective provides an overview of the analysis results in graphical format, with clickable fields that let you drill down into your findings by project, file, or category.

When you upload an analysis run to the Polyspace Access database, the **DASHBOARD** updates to display the statistics for the latest run.

1 Interpret Polyspace Bug Finder Results

The screenshot displays the Polyspace Bug Finder Dashboard for a project named 'bugfinder'. The interface includes a top navigation bar with tabs for 'Project Overview', 'Defects', 'Custom Rules', and 'MISRA C:2012'. Below this is a 'PROJECT EXPLORER' on the left and a main dashboard area with several widgets.

Open Issues Summary:

Open	2530
New	2530
Assigned To Me	0
Unassigned	2530

Code Metrics Summary:

- Sub-project(s): 0
- Number of Files: 0
- Number of Lines Without Comment: 0
- Cyclomatic Complexity: 0

Defects Widget: A donut chart showing 'Density' with a red ring. A legend indicates 'To Do' with a value of 248.

Coding Standards Widget: A donut chart showing 'Density' with a purple ring. A legend indicates the following counts: 'To Do' (2139), 'In Progress' (143), and 'Done' (169).

Trends Widget: A line chart titled 'Number of open findings over time' showing a constant value of 248 for 'Open' findings from 1/3/2019 11:40:16 to 1/3/2019 11:40:20.

Details Table:

Name	Total	To Do	In Progress	Done
Defects	248	248	-	-
Coding Standards	2451	2139	143	169

Project Details:

- Name: bugfinder
- Language: C
- Tools: Bug Finder
- Coding Standards: Custom Rules, MISRA C:2012
- Number of Runs: 1
- Current Run (ID 1): Date 1/3/19, 11:40 PM; Job 1.0

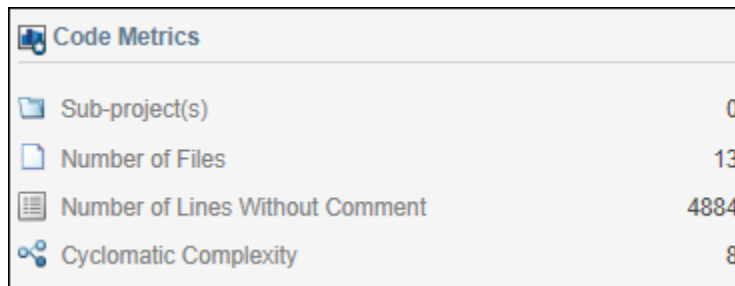
In this perspective, you can open additional dashboards to get a snapshot of the quality of your code. You can see a project overview, or an overview for a family of findings. You can also see an aggregate of statistics for multiple projects under the same folder.

You can also perform the following actions on this pane:

- Select elements on the graphs to filter results from the **Results List** pane. See “Filter and Sort Results” on page 3-2.
- Open the current project findings in the Polyspace desktop interface.
- Manage projects and user authorizations. See “Manage Project Permissions”.

Code Metrics Dashboard

To view the code complexity metrics that Polyspace computes, use the **Code Metrics** dashboard. See “Code Metrics”. Only when you use the option `Calculate code metrics (-code-metrics)` does Polyspace compute the code complexity metrics during analysis. For more information on analysis options, see the documentation for Polyspace Bug Finder or Polyspace Bug Finder Server.



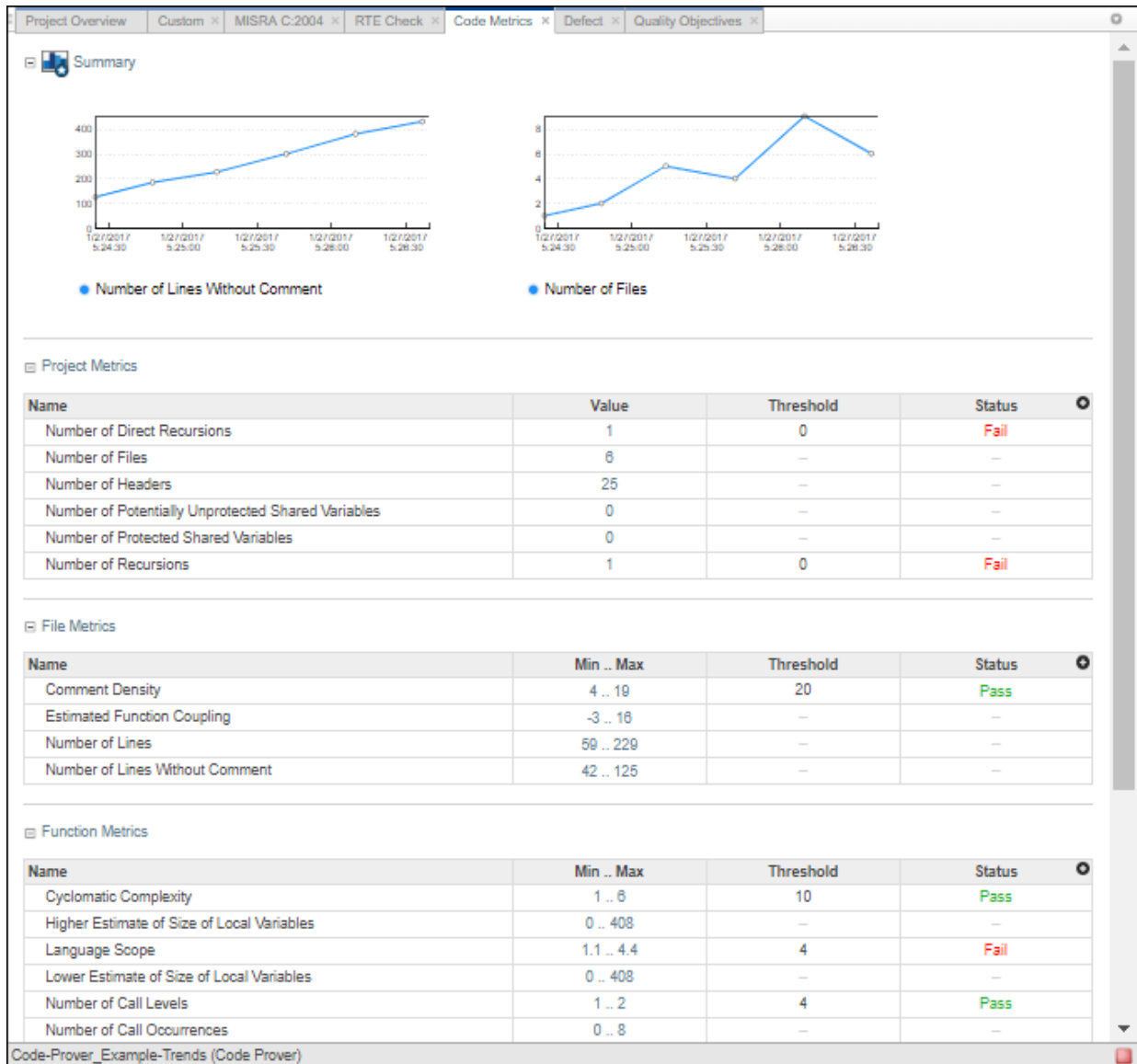
Code Metrics	
Sub-project(s)	0
Number of Files	13
Number of Lines Without Comment	4884
Cyclomatic Complexity	8

In the **PROJECT EXPLORER**, select a project. Use the **Code Metrics** card in the **Project Overview** dashboard to get a quick overview of these code metrics:

- Number of Files
- Number of Lines Without Comment
- Cyclomatic Complexity

If you select a folder in the **PROJECT EXPLORER**, you see the number of **Sub-project(s)** in that folder and an aggregate of the metrics for all the subprojects.

To open the **Code Metrics** dashboard, click the **Code Metrics** icon in the **DASHBOARD** section of the toolbar. Or, click **Code Metrics** on the card in the **Project Overview** dashboard.



In the **Summary** section, you see trend charts of the **Number of lines Without Comment** and **Number of Files** for the project.

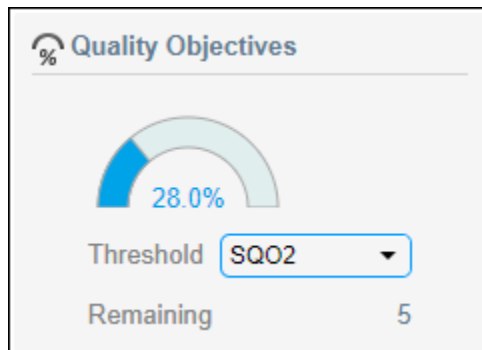
The other sections of the dashboard display tables with the computed value or range of the different project, file, and function metrics. When applicable, the table shows the predefined threshold and pass/fail status for the corresponding code metric. For a list of code complexity metrics thresholds, see “HIS Code Complexity Metrics” on page 1-84. If you select a folder in the **PROJECT EXPLORER**, the tables in the **Code Metrics** dashboard do not show the threshold or pass/fail status. The value or range of the metrics are aggregate of all subprojects in the selected folder. To drill down to a project from this aggregate view, expand a table row and click the project name.

To improve your code quality, use the pass/fail status to identify and lower metrics values that exceeds a threshold. For instance, if the **Number of Called Functions** range exceeds the predefined threshold, click the range in the **Min..Max** column to open the **Results List** for the computed **Number of Called Functions** metric. Review the results that exceed the metric threshold. If several of those functions are always called together, you can write one function that fuses the bodies of those functions. Call that one function instead of the group of functions that are called together.

Quality Objectives Dashboard

The *Quality Objectives* dashboard is available only for *Code Prover* analysis results.

To monitor the quality of your code against predefined “Software Quality Objectives” (Polyspace Code Prover Access), use the **Quality Objectives** dashboard.

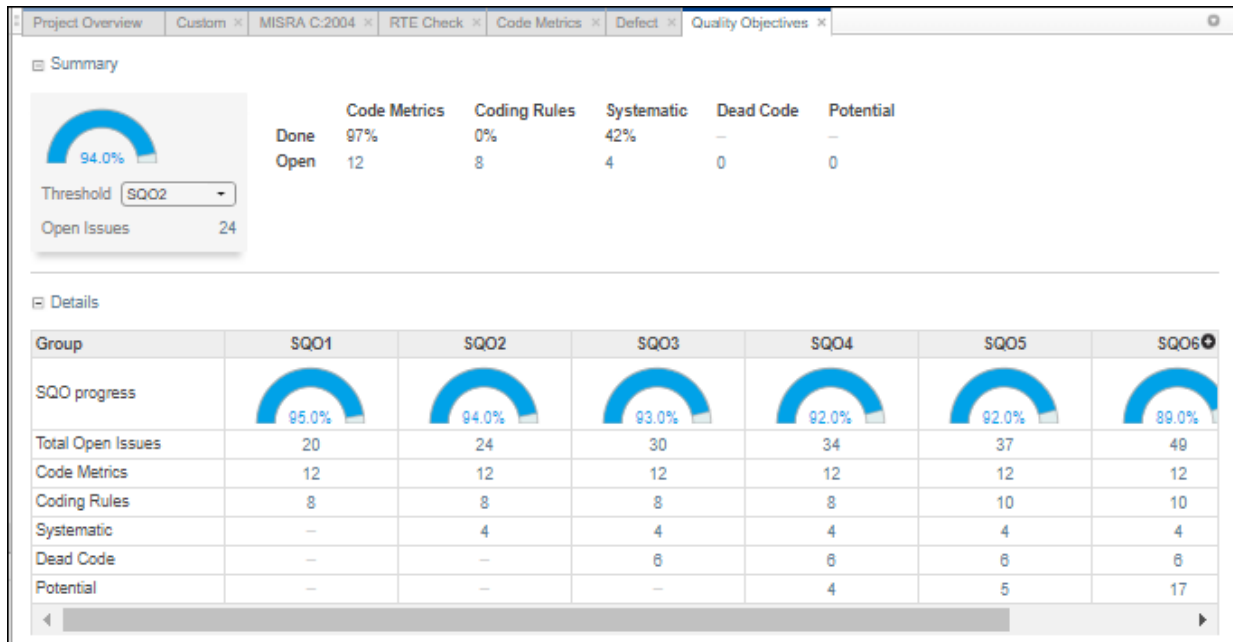


In the **Project Overview** dashboard, use the **Quality Objectives** card to get a quick overview of your progress in achieving a quality objective threshold. From the **Threshold** drop-down list, select a threshold and view the percentage of findings that you have already addressed to achieve the threshold. The card also displays the number of findings you still need to address to reach the threshold. Click this number to open the **REVIEW** perspective and see these findings in the **Results List**.

For a more comprehensive view, open the **Quality Objectives** dashboard. In the **Summary** section you can use the **Threshold** drop-down list to pick a threshold and see the remaining open issues, with a breakdown per category, such as code metrics or coding rules.

In this **Quality Objectives** dashboard, 94% of the findings required to achieve threshold SQ02 have been addressed. There are 24 open issues, including 12 **Code Metrics**, 8 **Coding Rules**, and 4 **Systematic** issues. Open issues are issues with a review status of Unreviewed, To fix, To investigate, or Other.

1 Interpret Polyspace Bug Finder Results



The table shows the current progress of code quality for all quality objective thresholds. To view the **Results List** for a set of open issues, click the corresponding value in the table.

See Also

More About

- “Software Quality Objectives” (Polyspace Code Prover Access)


Results List

The **Results List** pane lists all results along with their attributes.

For each result, the **Results List** pane contains the result attributes, listed in columns:

Attribute	Description
Family	Group to which the result belongs.
ID	Unique identification number of the result.
Type	Defect or coding rule violation.
Group	<p>Category of the result, for instance:</p> <ul style="list-style-type: none"> For defects: Groups such as static memory, numerical, control flow, concurrency, etc. For coding rule violations: Groups defined by the coding rule standard. <p>For instance, MISRA C[®]: 2012 defines groups related to code constructs such as functions, pointers and arrays, etc.</p>
Check	<p>Result name, for instance:</p> <ul style="list-style-type: none"> For defects: Defect name For coding rule violations: Coding rule number
Information	<p>Result sub-type when available.</p> <ul style="list-style-type: none"> For defects: Impact classification. <p>For coding standards: required or mandatory, rule or recommendation.</p>
Detail	<p>Additional information about a result. The column shows the first line of the Result Details pane.</p> <p>For an example of how to use this column, see the result MISRA C:2012 Dir 1.1.</p>
File	File containing the instruction where the result occurs

Attribute	Description
Function	Function containing the instruction where the result occurs. If the function is a method of a class, it appears in the format <code>class_name::function_name</code> .
Status	Review status you have assigned to the result. The possible statuses are: <ul style="list-style-type: none">• Unreviewed (default status)• To investigate• To fix• Justified• No action planned• Not a defect• Other
Severity	Level of severity you have assigned to the result. The possible levels are: <ul style="list-style-type: none">• Unset• High• Medium• Low
Assigned to	User name of reviewer assigned to this result.
Ticket Key	When you create a JIRA issue for a result, this field contains the issue ID. Click the ID to open the issue in the JIRA interface.
Comments	Comments you have entered about the result
Folder	Path to the folder that contains the source file with the result

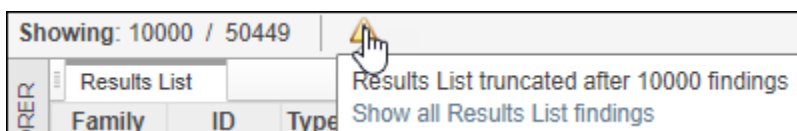
To show or hide any of the columns, click the  icon in the upper-right of the **Results List** pane, then select or clear the title of the column that you want to show or hide.

Using this pane, you can:

- Navigate through the results.

- Organize your result review using filters in the toolstrip or in the context menu. For more information, see “Filter and Sort Results” on page 3-2.
- Right-click a result to get the URL of the result. When you open this URL in a web browser you get see the **Results List** pane filtered to that one result.

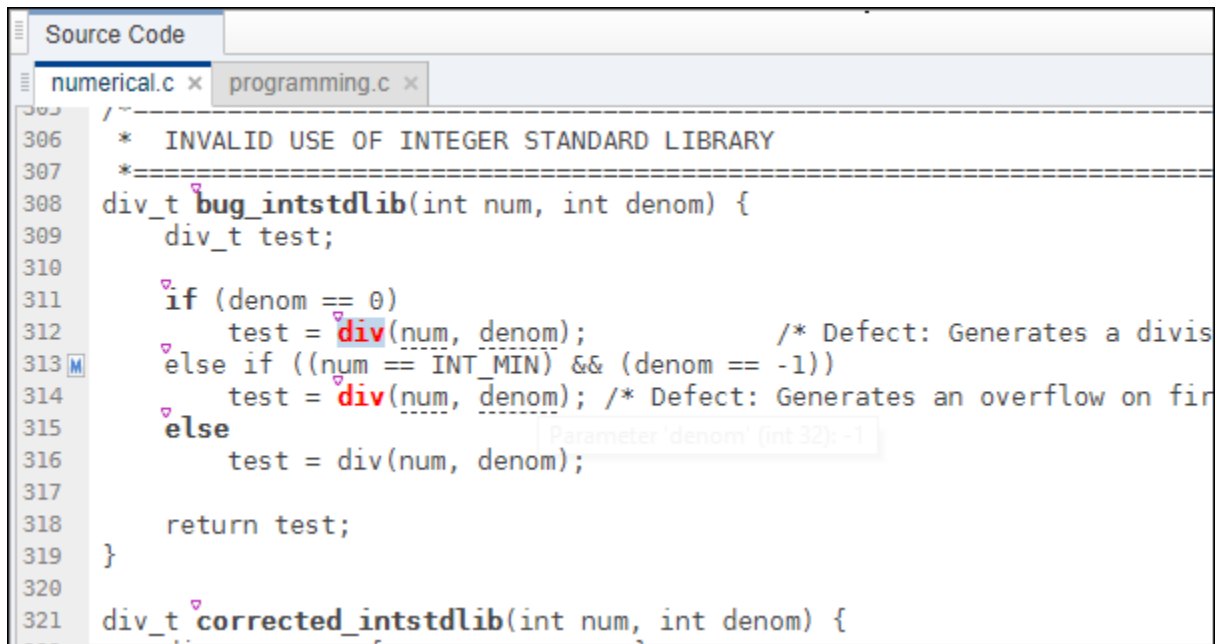
If the **Results List** exceeds 10000 findings, Polyspace Access truncates the list and displays this icon ⚠ in the filters bar. To show all findings, see the contextual help of the icon.



The 10000 findings limit is preset and cannot be changed.

Source Code

The **Source Code** pane shows the source code with the defects colored in red.

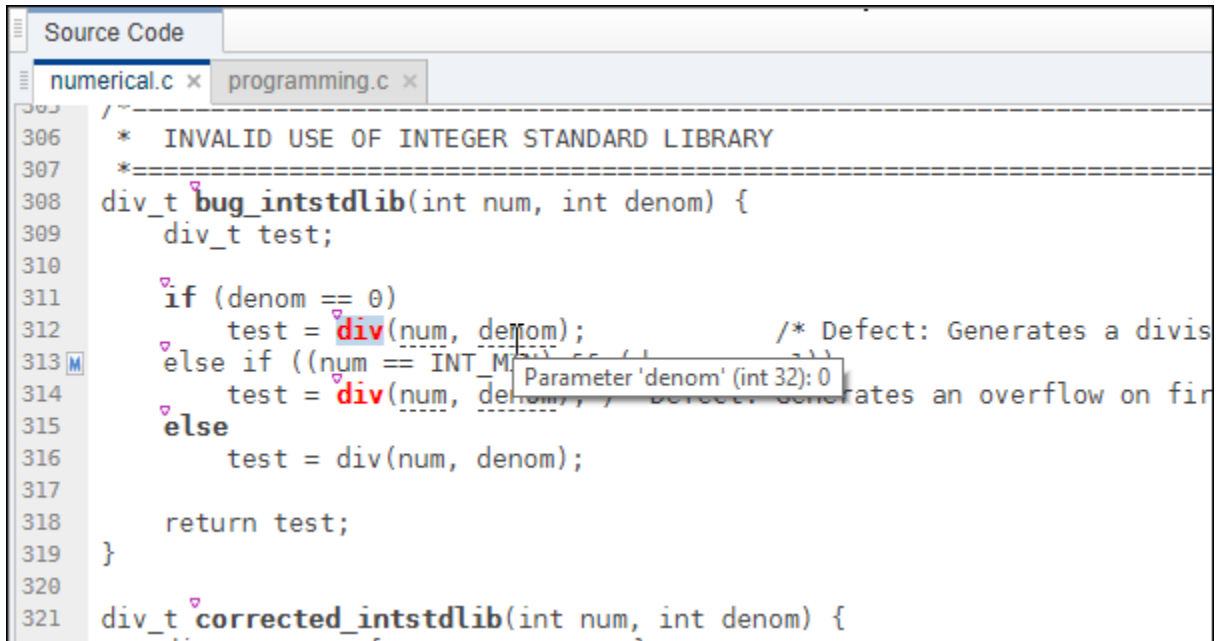


```
Source Code
numerical.c x programming.c x
306  /* INVALID USE OF INTEGER STANDARD LIBRARY
307  *=====
308  div_t bug_intstdlib(int num, int denom) {
309      div_t test;
310
311      if (denom == 0)
312          test = div(num, denom); /* Defect: Generates a divis
313  else if ((num == INT_MIN) && (denom == -1))
314          test = div(num, denom); /* Defect: Generates an overflow on fir
315  else
316          test = div(num, denom);
317
318      return test;
319  }
320
321  div_t corrected_intstdlib(int num, int denom) {
```

Parameter 'denom' (int 32): -1

Tooltips

Placing your cursor over a result displays a tooltip that provides range information for variables, operands, function parameters, and return values.



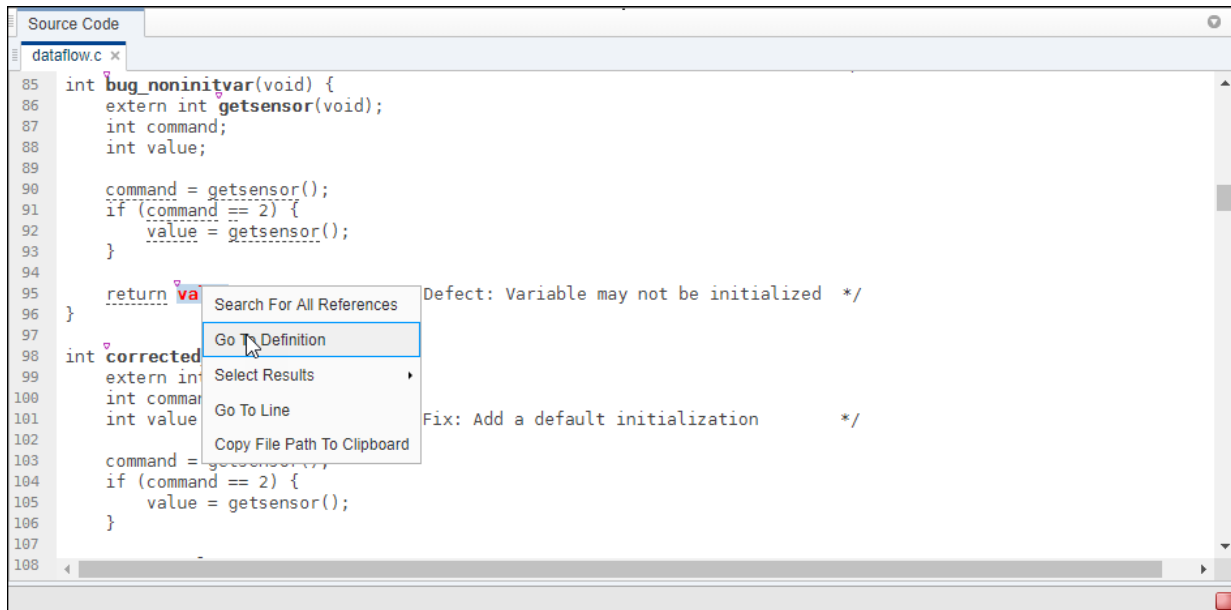
The screenshot shows a source code editor with two tabs: 'numerical.c' and 'programming.c'. The code in 'numerical.c' is as follows:

```
306  /* INVALID USE OF INTEGER STANDARD LIBRARY
307  *=====
308  div_t bug_intstdlib(int num, int denom) {
309      div_t test;
310
311      if (denom == 0)
312          test = div(num, denom);          /* Defect: Generates a divis
313  else if ((num == INT_MAX || num == INT_MIN) && denom == 1)
314          test = div(num, denom);        /* Defect: Generates an overflow on fir
315  else
316          test = div(num, denom);
317
318      return test;
319  }
320
321  div_t corrected_intstdlib(int num, int denom) {
```

A context menu is open over the `div` function call on line 312. The menu item 'Parameter 'denom' (int 32): 0' is selected.


Examine Source Code

On the **Source Code** pane, if you right-click a text string, the context menu provides options to examine your code:



For example, if you right-click the variable, you can use the following options to examine and navigate through your code:


- **Search For All References** — List all references in the **Code Search** pane. The software supports this feature for global and local variables, functions, types, and classes.
- **Go To Definition** — Go to the line of code that contains the definition of *i*. The software supports this feature for global and local variables, functions, types, and classes. If a definition is not available to Polyspace, selecting the option takes you to the declaration.
- **Select Results** -- Show more information about the selected result in the **Results Details** pane and pin the result in the **Source Code** pane.

After you navigate away from the current result, use the  icon on the **Result Details** pane to come back.

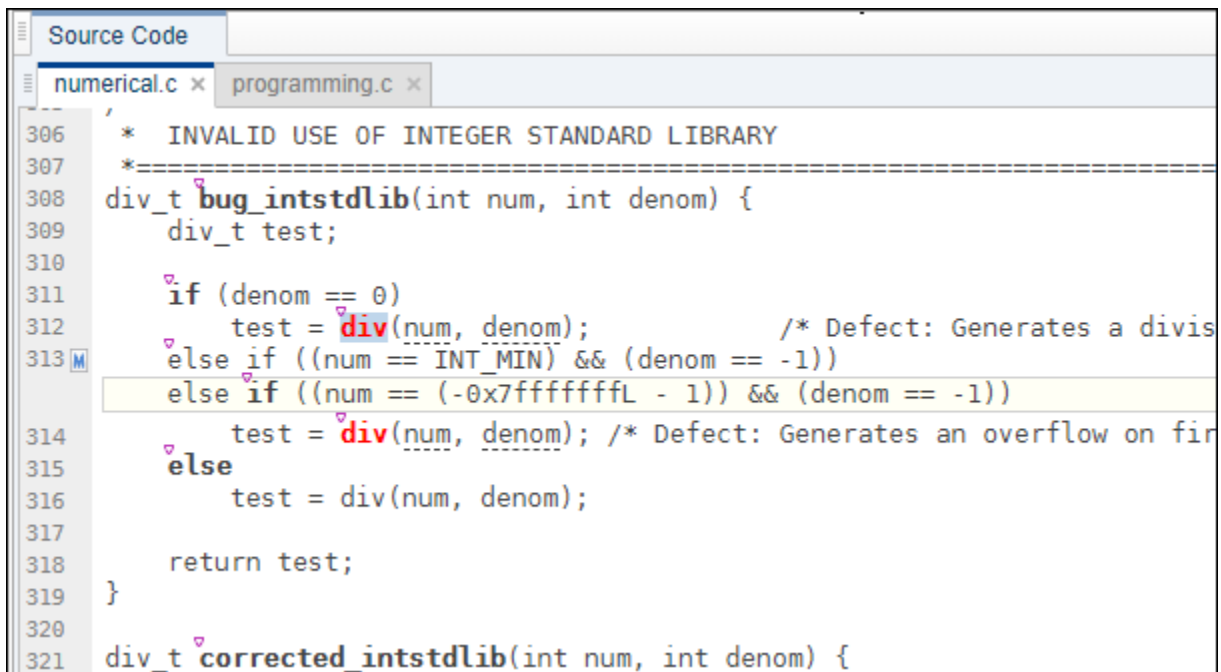
- **Go To Line** — Open the Go to line dialog box. If you specify a line number and click **Enter**, the software displays the specified line of code.

To search for instances of your selection in the **Current Source File** or in **All Source Files**, double-click your selection before you right-click.

Expand Macros

You can view the contents of source code macros in the source code view. A code information bar displays  icons that identify source code lines with macros.

When you click this icon, the software displays the contents of macros on the next line.



```

306  * INVALID USE OF INTEGER STANDARD LIBRARY
307  *=====
308  div_t bug_intstdlib(int num, int denom) {
309      div_t test;
310
311      if (denom == 0)
312          test = div(num, denom);          /* Defect: Generates a divis
313  M  else if ((num == INT_MIN) && (denom == -1))
314      else if ((num == (-0x7fffffffL - 1)) && (denom == -1))
315          test = div(num, denom); /* Defect: Generates an overflow on fir
316      else
317          test = div(num, denom);
318
319      return test;
320  }
321  div_t corrected_intstdlib(int num, int denom) {

```

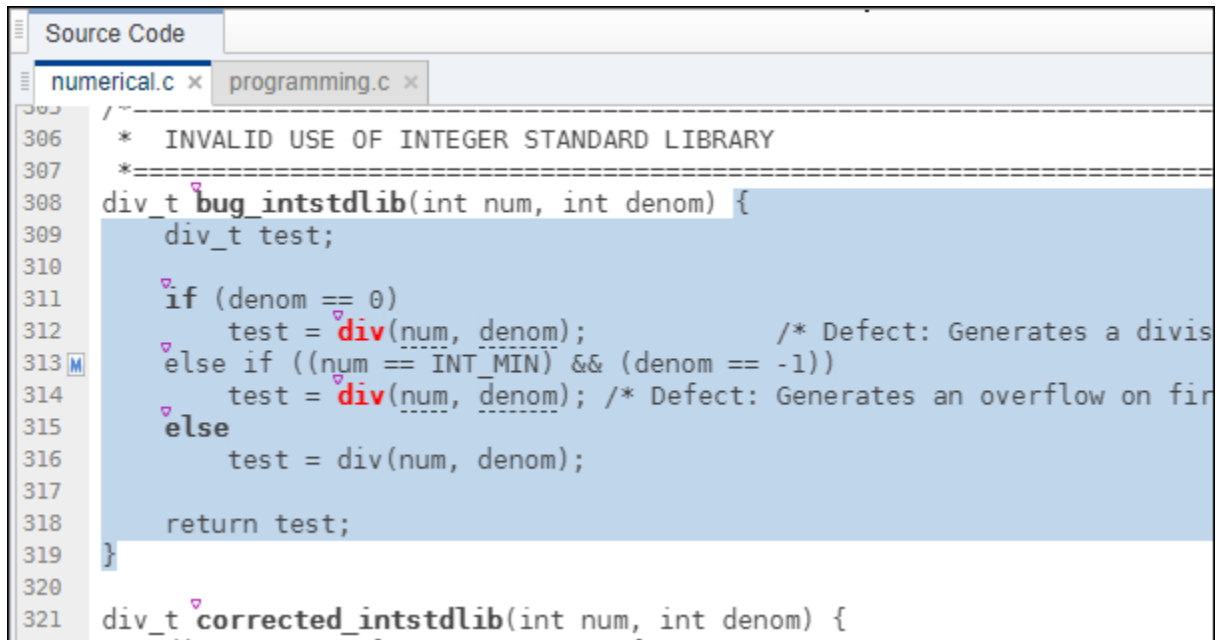
To display the normal source code again, click the icon again.

Note

- 1 The **Result Details** pane also allows you to view the contents of a macro if the check you select lies within a macro.
- 2 You cannot expand OSEK API macros in the **Source Code** pane.

View Code Block

On the **Source Code** pane, to highlight a block of code, click either its opening or closing brace. If the brace itself is highlighted, click the brace twice.



The screenshot shows a code editor window with two tabs: 'numerical.c' and 'programming.c'. The 'numerical.c' tab is active. The code is as follows:



```
305 /-
306 * INVALID USE OF INTEGER STANDARD LIBRARY
307 *=====
308 div_t bug_intstdlib(int num, int denom) {
309     div_t test;
310
311     if (denom == 0)
312         test = div(num, denom);          /* Defect: Generates a divis
313     else if ((num == INT_MIN) && (denom == -1))
314         test = div(num, denom); /* Defect: Generates an overflow on fir
315     else
316         test = div(num, denom);
317
318     return test;
319 }
320
321 div_t corrected_intstdlib(int num, int denom) {
```

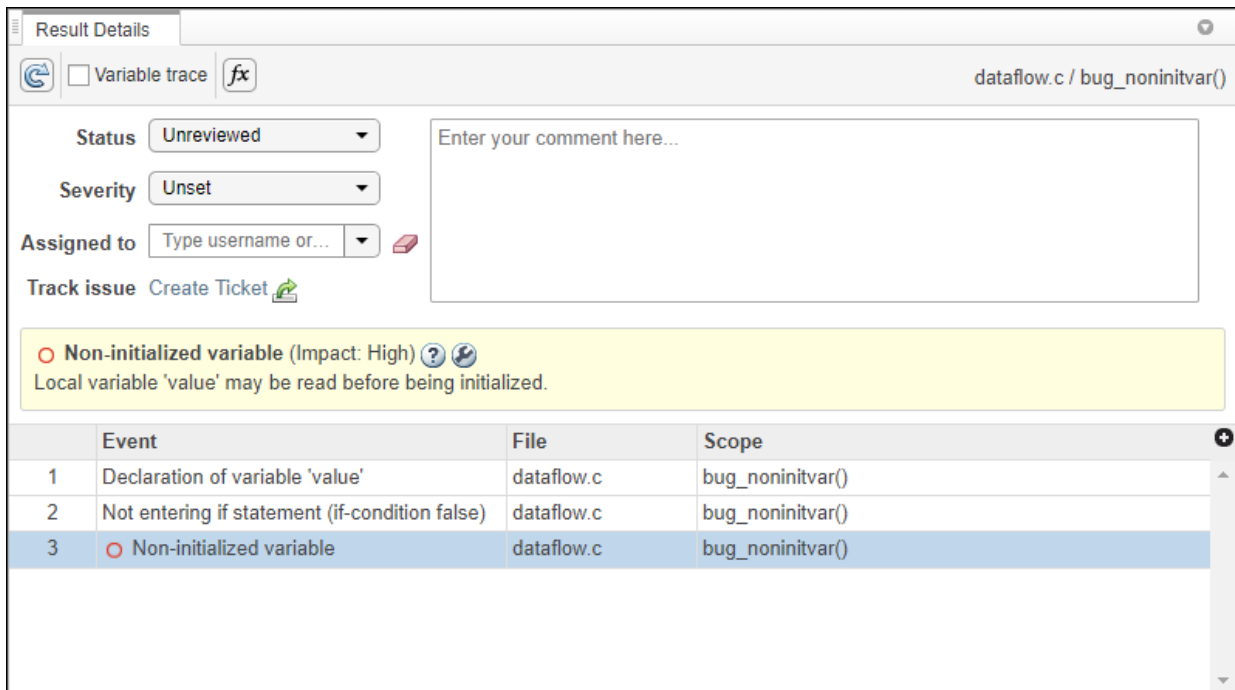
The block of code from line 308 to 319 is highlighted in blue. The opening brace on line 308 and the closing brace on line 319 are highlighted in red. The word 'div' in the function signature and the 'div' function calls are also highlighted in red.

Result Details


The **Result Details** pane contains comprehensive information about a specific defect. To see this information, on the **Results List** pane, select the defect.

- The top right corner shows the file and function containing the defect, in the format *file_name/function_name*.
- The yellow box contains the name of the defect with an explanation of why the defect occurs.

The  button allows you to access documentation for the defect. When available, click the  icon to see fix suggestions for the defect.



The screenshot shows the 'Result Details' pane for a defect in 'dataflow.c / bug_noninitvar()'. The pane includes a 'Status' dropdown set to 'Unreviewed', a 'Severity' dropdown set to 'Unset', and an 'Assigned to' field. A 'Track issue' section contains a 'Create Ticket' link. A yellow box highlights the defect: 'Non-initialized variable (Impact: High)' with a description: 'Local variable 'value' may be read before being initialized.' Below this is a table with three columns: 'Event', 'File', and 'Scope'.

	Event	File	Scope
1	Declaration of variable 'value'	dataflow.c	bug_noninitvar()
2	Not entering if statement (if-condition false)	dataflow.c	bug_noninitvar()
3	 Non-initialized variable	dataflow.c	bug_noninitvar()


On this pane, you can also:

- Assign a **Severity** and **Status** to each check, and enter comments to describe the results of your review.

- Assign a review to the result. When you assign results a reviewer can filter the **Results List** to only show results that are assigned to him or her.
- Create a ticket in a bug tracking tool such as JIRA. Once you create the ticket the **Results Details** for this defect shows a clickable link to the ticket you created.
- View the event traceback.



The **Event** column lists the sequence of code instructions causing the defect. The **Scope** column lists the function containing the instructions. If the instructions are not in a function, the column lists the file containing the instructions.

The **Variable trace** check box allows you to see an additional set of instructions that are related to the defect.

- Click the  icon to open the “Call Hierarchy” on page 1-29.


Call Hierarchy

The **Call Hierarchy** pane displays the call tree of functions in the source code.

For each function `foo`, the **Call Hierarchy** pane lists the functions and tasks that call `foo` (callers) and those called by `foo` (callees). The callers are indicated by . The callees are indicated by . The **Call Hierarchy** pane lists direct function calls and indirect calls through function pointers.

Note In Polyspace Bug Finder Access, you might not see all callers or callees of a function, especially for calls through function pointers and dead code.

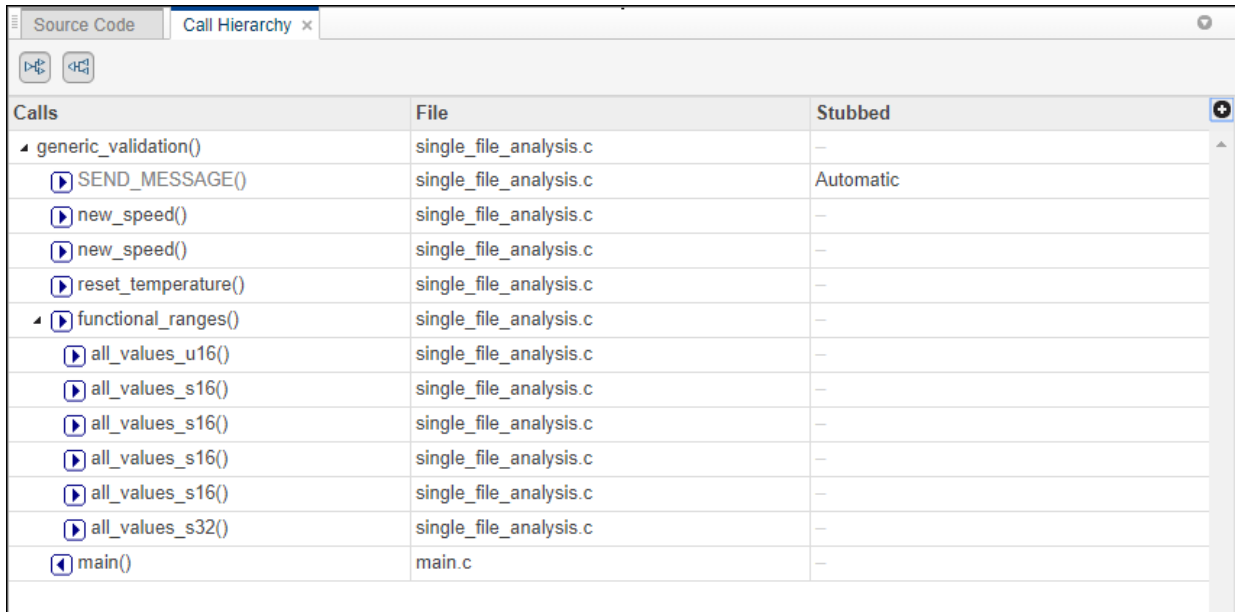
For instance, Polyspace Bug Finder Access does not display the functions registered with `at_exit()` and `at_quick_exit()`, and called by `exit()` and `quick_exit()` respectively.

You open the **Call Hierarchy** pane by using the  icon in your result details. To update the pane:

- You can click a defect on the **Results List** or CTRL-click a result in the **Source Code** pane. You see the function containing the defect with its callers and callees.

In this example, the **Call Hierarchy** pane displays the function `generic_validation`, and with its callers and callees.

1 Interpret Polyspace Bug Finder Results



The screenshot shows the 'Call Hierarchy' pane in Polyspace. It displays a tree view of function calls. The root node is 'generic_validation()', which is expanded to show its callees. The callees include 'SEND_MESSAGE()', 'new_speed()', 'reset_temperature()', and 'functional_ranges()'. 'functional_ranges()' is further expanded to show its callees: 'all_values_u16()', 'all_values_s16()', and 'all_values_s32()'. The 'main()' function is also visible at the bottom of the list. The 'Stubbed' column indicates the status of each function, with 'SEND_MESSAGE()' being 'Automatic' and others being '-'.

Calls	File	Stubbed
generic_validation()	single_file_analysis.c	-
▶ SEND_MESSAGE()	single_file_analysis.c	Automatic
▶ new_speed()	single_file_analysis.c	-
▶ new_speed()	single_file_analysis.c	-
▶ reset_temperature()	single_file_analysis.c	-
▶ functional_ranges()	single_file_analysis.c	-
▶ all_values_u16()	single_file_analysis.c	-
▶ all_values_s16()	single_file_analysis.c	-
▶ all_values_s16()	single_file_analysis.c	-
▶ all_values_s16()	single_file_analysis.c	-
▶ all_values_s16()	single_file_analysis.c	-
▶ all_values_s16()	single_file_analysis.c	-
▶ all_values_s32()	single_file_analysis.c	-
◀ main()	main.c	-

Tip To navigate to the call location in the source code, select a caller or callee name

In the **Call Hierarchy** pane, you can perform these actions:

- **Show/Hide Callers and Callees**

Customize the view to display callers only or callees only. Show or hide callers and callees by clicking this button



- **Navigate Call Hierarchy**

You can navigate the call hierarchy in your source code. For a function, double-click a caller or callee name to navigate to the caller or callee definition in the source code.

- **Determine If Function Is Stubbed**

From the **Stubbed** column, you can determine if a function is stubbed. The entries in the column show why a function was stubbed.

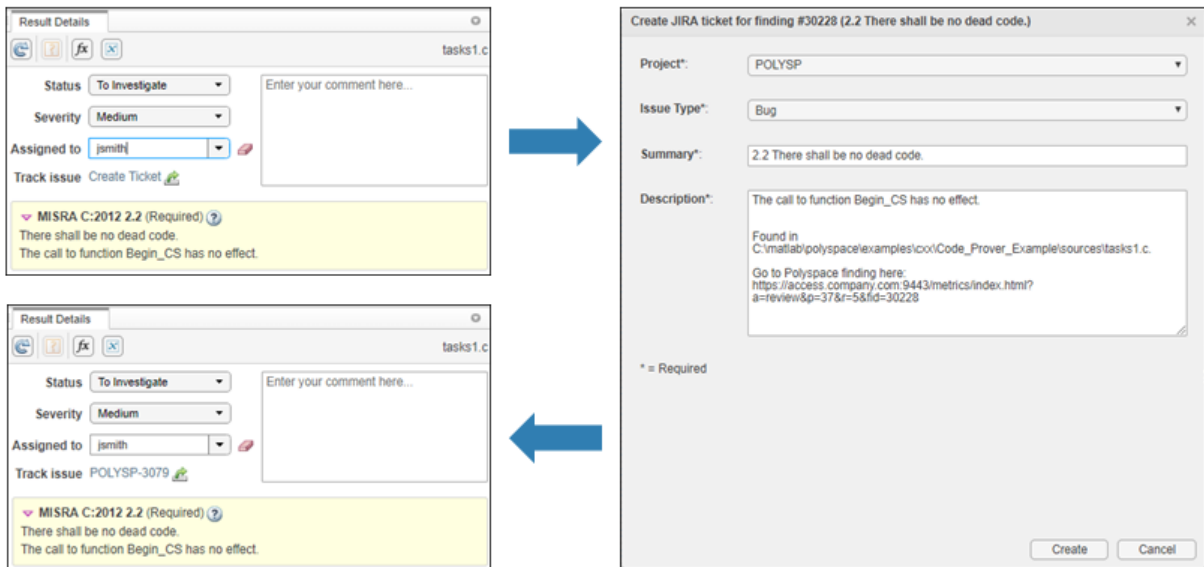
- **Automatic:** Polyspace cannot find the function definition. For instance, you did not provide the file containing the definition.
- **Std library:** The function is a standard library function. You do not provide the function definition explicitly in your Polyspace project.
- **Mapped to std library:** You map the function to a standard library function by using the option `-function-behavior-specifications`. For more information on analysis options, see the documentation for Polyspace Bug Finder or Polyspace Bug Finder Server.

Track Issue in Bug Tracking Tool

If you use JIRA as part of your software development process, you can configure Polyspace Access to create JIRA issues for Polyspace findings and add those issues to your JIRA software project. See “Configure the Web Server and Gateway”.

To create a JIRA issue, select a finding and click **Create Ticket** from the **Results Details** pane in Polyspace Access or in the Polyspace desktop interface. In the desktop interface, you can create a JIRA issue only for results that you open from Polyspace Access.

If you are prompted to log in, use your JIRA credentials.



In the **Create JIRA ticket** window, select a **Project** and **Issue Type** from the drop-down lists. The **Description** includes a URL to the Polyspace Access **Results List** filtered down to the finding for which you created the JIRA issue.

After you create a JIRA issue, click the link in the **Results Details** pane to open the issue in JIRA and track the progress in resolving the issue.

Bug Finder Quality Objective Levels

The Bug Finder Quality Objectives or BF-QOs are a set of thresholds against which you can compare your Bug Finder analysis results. These objectives are adapted from the Polyspace Code Prover™ “Software Quality Objectives” (Polyspace Code Prover Access). You can develop a review process based on the Quality Objectives.

You can use a predefined BF-QO level or define your own. Following are the predefined quality thresholds specified by each BF-QO.

BF-QO Level 1

Metric	Threshold Value
Comment density of a file	20
Number of paths through a function	80
Number of <code>goto</code> statements	0
Cyclomatic complexity	10
Number of calling functions	5
Number of calls	7
Number of parameters per function	5
Number of instructions per function	50
Number of call levels in a function	4
Number of <code>return</code> statements in a function	1
Language scope, an indicator of the cost of maintaining or changing functions. Calculated as follows: $(N1+N2) / (n1+n2)$ <ul style="list-style-type: none"> • $n1$ — Number of different operators • $N1$ — Total number of operators • $n2$ — Number of different operands • $N2$ — Total number of operands 	4
Number of recursions	0
Number of direct recursions	0

Metric	Threshold Value
<p>Number of unjustified violations of the following MISRA C:2004 rules:</p> <ul style="list-style-type: none">• 5.2• 8.11, 8.12• 11.2, 11.3• 12.12• 13.3, 13.4, 13.5• 14.4, 14.7• 16.1, 16.2, 16.7• 17.3, 17.4, 17.5, 17.6• 18.4• 20.4	0
<p>Number of unjustified violations of the following MISRA C:2012 rules:</p> <ul style="list-style-type: none">• 8.8, 8.11, and 8.13• 11.1, 11.2, 11.4, 11.5, 11.6, and 11.7• 14.1 and 14.2• 15.1, 15.2, 15.3, and 15.5• 17.1 and 17.2• 18.3, 18.4, 18.5, and 18.6• 19.2• 21.3	0

Metric	Threshold Value
Number of unjustified violations of the following MISRA® C++ rules: <ul style="list-style-type: none"> • 2-10-2 • 3-1-3, 3-3-2, 3-9-3 • 5-0-15, 5-0-18, 5-0-19, 5-2-8, 5-2-9 • 6-2-2, 6-5-1, 6-5-2, 6-5-3, 6-5-4, 6-6-1, 6-6-2, 6-6-4, 6-6-5 • 7-5-1, 7-5-2, 7-5-4 • 8-4-1 • 9-5-1 • 10-1-2, 10-1-3, 10-3-1, 10-3-2, 10-3-3 • 15-0-3, 15-1-3, 15-3-3, 15-3-5, 15-3-6, 15-3-7, 15-4-1, 15-5-1, 15-5-2 • 18-4-1 	0

BF-QO Level 2 and 3

In addition to all the requirements of BF-QO Level 1, these levels includes the following thresholds:

Metric	Threshold Value
Number of “High Impact Defects” on page 3-8	0

BF-QO Level 4

In addition to all the requirements of BF-QO Level 2 and 3, this level includes the following thresholds:

Metric	Threshold Value
Number of “Medium Impact Defects” on page 3-10	0

BF-QO Level 5

In addition to all the requirements of BF-QO Level 4, this level includes the following thresholds:

Metric	Threshold Value
Number of unjustified violations of the following MISRA C:2004 rules: <ul style="list-style-type: none">• 6.3• 8.7• 9.2, 9.3• 10.3, 10.5• 11.1, 11.5• 12.1, 12.2, 12.5, 12.6, 12.9, 12.10• 13.1, 13.2, 13.6• 14.8, 14.10• 15.3• 16.3, 16.8, 16.9• 19.4, 19.9, 19.10, 19.11, 19.12• 20.3	0
Number of unjustified violations of the following MISRA C:2012 rules: <ul style="list-style-type: none">• 11.8• 12.1 and 12.3• 13.2 and 13.4• 14.4• 15.6 and 15.7• 16.4 and 16.5• 17.4• 20.4, 20.6, 20.7, 20.9, and 20.11	0

Metric	Threshold Value
Number of unjustified violations of the following MISRA C++ rules: <ul style="list-style-type: none"> • 3-4-1, 3-9-2 • 4-5-1 • 5-0-1, 5-0-2, 5-0-7, 5-0-8, 5-0-9, 5-0-10, 5-0-13, 5-2-1, 5-2-2, 5-2-7, 5-2-11, 5-3-3, 5-2-5, 5-2-6, 5-3-2, 5-18-1 • 6-2-1, 6-3-1, 6-4-2, 6-4-6, 6-5-3 • 8-4-3, 8-4-4, 8-5-2, 8-5-3 • 11-0-1 • 12-1-1, 12-8-2 • 16-0-5, 16-0-6, 16-0-7, 16-2-2, 16-3-1 	0

BF-QO Level 6

In addition to all the requirements of BF-QO Level 5, this level includes the following thresholds:

Metric	Threshold Value
Number of "Low Impact Defects" on page 3-15	0

BF-QO Exhaustive

In addition to all the requirements of BF-QO Level 1, this level includes the following thresholds. The thresholds for coding rule violations apply only if you check for coding rule violations.

Metric	Threshold Value
Number of unjustified MISRA C and MISRA C++ coding rule violations	0
Number of unjustified defects	0

Software Quality Objective Subsets (C:2004)

In this section...
“Rules in SQO-Subset1” on page 1-38
“Rules in SQO-Subset2” on page 1-39

Rules in SQO-Subset1

In Polyspace Code Prover, the following set of coding rules will typically reduce the number of unproven results.

Rule number	Description
5.2	Identifiers in an inner scope shall not use the same name as an identifier in an outer scope, and therefore hide that identifier.
8.11	The <i>static</i> storage class specifier shall be used in definitions and declarations of objects and functions that have internal linkage.
8.12	When an array is declared with external linkage, its size shall be stated explicitly or defined implicitly by initialization.
11.2	Conversion shall not be performed between a pointer to an object and any type other than an integral type, another pointer to a object type or a pointer to void.
11.3	A cast should not be performed between a pointer type and an integral type.
12.12	The underlying bit representations of floating-point values shall not be used.
13.3	Floating-point expressions shall not be tested for equality or inequality.
13.4	The controlling expression of a <i>for</i> statement shall not contain any objects of floating type.
13.5	The three expressions of a <i>for</i> statement shall be concerned only with loop control.
14.4	The <i>goto</i> statement shall not be used.
14.7	A function shall have a single point of exit at the end of the function.
16.1	Functions shall not be defined with variable numbers of arguments.

Rule number	Description
16.2	Functions shall not call themselves, either directly or indirectly.
16.7	A pointer parameter in a function prototype should be declared as pointer to const if the pointer is not used to modify the addressed object.
17.3	>, >=, <, <= shall not be applied to pointer types except where they point to the same array.
17.4	Array indexing shall be the only allowed form of pointer arithmetic.
17.5	The declaration of objects should contain no more than 2 levels of pointer indirection.
17.6	The address of an object with automatic storage shall not be assigned to an object that may persist after the object has ceased to exist.
18.3	An area of memory shall not be reused for unrelated purposes.
18.4	Unions shall not be used.
20.4	Dynamic heap memory allocation shall not be used.

Note Polyspace software does not check MISRA rule **18.3**.

Rules in SQO-Subset2

Good design practices generally lead to less code complexity, which can reduce the number of unproven results in Polyspace Code Prover. The following set of coding rules enforce good design practices. The SQO-subset2 option checks the rules in SQO-subset1 and some additional rules.

Rule number	Description
5.2	Identifiers in an inner scope shall not use the same name as an identifier in an outer scope, and therefore hide that identifier.
6.3	<i>typedefs</i> that indicate size and signedness should be used in place of the basic types
8.7	Objects shall be defined at block scope if they are only accessed from within a single function

Rule number	Description
8.11	The <i>static</i> storage class specifier shall be used in definitions and declarations of objects and functions that have internal linkage.
8.12	When an array is declared with external linkage, its size shall be stated explicitly or defined implicitly by initialization.
9.2	Braces shall be used to indicate and match the structure in the nonzero initialization of arrays and structures
9.3	In an enumerator list, the = construct shall not be used to explicitly initialize members other than the first, unless all items are explicitly initialized
10.3	The value of a complex expression of integer type may only be cast to a type that is narrower and of the same signedness as the underlying type of the expression
10.5	Bitwise operations shall not be performed on signed integer types
11.1	Conversion shall not be performed between a pointer to a function and any type other than an integral type
11.2	Conversion shall not be performed between a pointer to an object and any type other than an integral type, another pointer to a object type or a pointer to void.
11.3	A cast should not be performed between a pointer type and an integral type.
11.5	Type casting from any type to or from pointers shall not be used
12.1	Limited dependence should be placed on C's operator precedence rules in expressions
12.2	The value of an expression shall be the same under any order of evaluation that the standard permits
12.5	The operands of a logical && or shall be primary-expressions
12.6	Operands of logical operators (&&, and !) should be effectively Boolean. Expression that are effectively Boolean should not be used as operands to operators other than (&&, or !)
12.9	The unary minus operator shall not be applied to an expression whose underlying type is unsigned
12.10	The comma operator shall not be used

Rule number	Description
12.12	The underlying bit representations of floating-point values shall not be used.
13.1	Assignment operators shall not be used in expressions that yield Boolean values
13.2	Tests of a value against zero should be made explicit, unless the operand is effectively Boolean
13.3	Floating-point expressions shall not be tested for equality or inequality.
13.4	The controlling expression of a <i>for</i> statement shall not contain any objects of floating type.
13.5	The three expressions of a <i>for</i> statement shall be concerned only with loop control.
13.6	Numeric variables being used within a " <i>for</i> " loop for iteration counting should not be modified in the body of the loop
14.4	The <i>goto</i> statement shall not be used.
14.7	A function shall have a single point of exit at the end of the function.
14.8	The statement forming the body of a <i>switch</i> , <i>while</i> , <i>do while</i> or <i>for</i> statement shall be a compound statement
14.10	All <i>if else if</i> constructs should contain a final <i>else</i> clause
15.3	The final clause of a <i>switch</i> statement shall be the <i>default</i> clause
16.1	Functions shall not be defined with variable numbers of arguments.
16.2	Functions shall not call themselves, either directly or indirectly.
16.3	Identifiers shall be given for all of the parameters in a function prototype declaration
16.7	A pointer parameter in a function prototype should be declared as pointer to const if the pointer is not used to modify the addressed object.
16.8	All exit paths from a function with non-void return type shall have an explicit return statement with an expression
16.9	A function identifier shall only be used with either a preceding <i>&</i> , or with a parenthesized parameter list, which may be empty

Rule number	Description
17.3	>, >=, <, <= shall not be applied to pointer types except where they point to the same array.
17.4	Array indexing shall be the only allowed form of pointer arithmetic.
17.5	The declaration of objects should contain no more than 2 levels of pointer indirection.
17.6	The address of an object with automatic storage shall not be assigned to an object that may persist after the object has ceased to exist.
18.3	An area of memory shall not be reused for unrelated purposes.
18.4	Unions shall not be used.
19.4	C macros shall only expand to a braced initializer, a constant, a parenthesized expression, a type qualifier, a storage class specifier, or a do-while-zero construct
19.9	Arguments to a function-like macro shall not contain tokens that look like preprocessing directives
19.10	In the definition of a function-like macro each instance of a parameter shall be enclosed in parentheses unless it is used as the operand of # or ##
19.11	All macro identifiers in preprocessor directives shall be defined before use, except in #ifndef and #ifndef preprocessor directives and the defined() operator
19.12	There shall be at most one occurrence of the # or ## preprocessor operators in a single macro definition.
20.3	The validity of values passed to library functions shall be checked.
20.4	Dynamic heap memory allocation shall not be used.

Note Polyspace software does not check MISRA rule **20.3** directly.

However, you can check this rule by writing manual stubs that check the validity of values. For example, the following code checks the validity of an input being greater than 1:

```
int my_system_library_call(int in) {assert (in>1); if random \  
return -1 else return 0; }
```

See Also

More About

- “Interpret Polyspace Bug Finder Access Results” on page 1-2

Software Quality Objective Subsets (AC AGC)

In this section...
“Rules in SQO-Subset1” on page 1-44
“Rules in SQO-Subset2” on page 1-45

Rules in SQO-Subset1

In Polyspace Code Prover, the following set of coding rules will typically reduce the number of unproven results.

Rule number	Description
5.2	Identifiers in an inner scope shall not use the same name as an identifier in an outer scope, and therefore hide that identifier.
8.11	The <i>static</i> storage class specifier shall be used in definitions and declarations of objects and functions that have internal linkage.
8.12	When an array is declared with external linkage, its size shall be stated explicitly or defined implicitly by initialization.
11.2	Conversion shall not be performed between a pointer to an object and any type other than an integral type, another pointer to a object type or a pointer to void.
11.3	A cast should not be performed between a pointer type and an integral type.
12.12	The underlying bit representations of floating-point values shall not be used.
14.7	A function shall have a single point of exit at the end of the function.
16.1	Functions shall not be defined with variable numbers of arguments.
16.2	Functions shall not call themselves, either directly or indirectly.
17.3	>, >=, <, <= shall not be applied to pointer types except where they point to the same array.
17.6	The address of an object with automatic storage shall not be assigned to an object that may persist after the object has ceased to exist.
18.4	Unions shall not be used.

For more information about these rules, see *MISRA AC AGC Guidelines for the Application of MISRA-C:2004 in the Context of Automatic Code Generation*.

Rules in SQO-Subset2

Good design practices generally lead to less code complexity, which can reduce the number of unproven results in Polyspace Code Prover. The following set of coding rules enforce good design practices. The SQO-subset2 option checks the rules in SQO-subset1 and some additional rules.

Rule number	Description
5.2	Identifiers in an inner scope shall not use the same name as an identifier in an outer scope, and therefore hide that identifier.
6.3	<i>typedefs</i> that indicate size and signedness should be used in place of the basic types
8.7	Objects shall be defined at block scope if they are only accessed from within a single function
8.11	The <i>static</i> storage class specifier shall be used in definitions and declarations of objects and functions that have internal linkage.
8.12	When an array is declared with external linkage, its size shall be stated explicitly or defined implicitly by initialization.
9.3	In an enumerator list, the = construct shall not be used to explicitly initialize members other than the first, unless all items are explicitly initialized
11.1	Conversion shall not be performed between a pointer to a function and any type other than an integral type
11.2	Conversion shall not be performed between a pointer to an object and any type other than an integral type, another pointer to a object type or a pointer to void.
11.3	A cast should not be performed between a pointer type and an integral type.
11.5	Type casting from any type to or from pointers shall not be used
12.2	The value of an expression shall be the same under any order of evaluation that the standard permits

Rule number	Description
12.9	The unary minus operator shall not be applied to an expression whose underlying type is unsigned
12.10	The comma operator shall not be used
12.12	The underlying bit representations of floating-point values shall not be used.
14.7	A function shall have a single point of exit at the end of the function.
16.1	Functions shall not be defined with variable numbers of arguments.
16.2	Functions shall not call themselves, either directly or indirectly.
16.3	Identifiers shall be given for all of the parameters in a function prototype declaration
16.8	All exit paths from a function with non-void return type shall have an explicit return statement with an expression
16.9	A function identifier shall only be used with either a preceding &, or with a parenthesized parameter list, which may be empty
17.3	>, >=, <, <= shall not be applied to pointer types except where they point to the same array.
17.6	The address of an object with automatic storage shall not be assigned to an object that may persist after the object has ceased to exist.
18.4	Unions shall not be used.
19.9	Arguments to a function-like macro shall not contain tokens that look like preprocessing directives
19.10	In the definition of a function-like macro each instance of a parameter shall be enclosed in parentheses unless it is used as the operand of # or ##
19.11	All macro identifiers in preprocessor directives shall be defined before use, except in #ifdef and #ifndef preprocessor directives and the defined() operator
19.12	There shall be at most one occurrence of the # or ## preprocessor operators in a single macro definition.
20.3	The validity of values passed to library functions shall be checked.

Note Polyspace software does not check MISRA rule **20.3** directly.

However, you can check this rule by writing manual stubs that check the validity of values. For example, the following code checks the validity of an input being greater than 1:

```
int my_system_library_call(int in) {assert (in>1); if random \  
return -1 else return 0; }
```

For more information about these rules, see *MISRA AC AGC Guidelines for the Application of MISRA-C:2004 in the Context of Automatic Code Generation*.

See Also

More About

- “Interpret Polyspace Bug Finder Access Results” on page 1-2

Software Quality Objective Subsets (C:2012)

In this section...
“Guidelines in SQO-Subset1” on page 1-48
“Guidelines in SQO-Subset2” on page 1-49

These subsets of MISRA C:2012 guidelines can have a direct or indirect impact on the precision of your Polyspace results. When you set up coding rules checking, you can select these subsets.

Guidelines in SQO-Subset1

The following set of MISRA C:2012 coding guidelines typically reduces the number of unproven results in Polyspace Code Prover.

Rule	Description
8.8	The static storage class specifier shall be used in all declarations of objects and functions that have internal linkage
8.11	When an array with external linkage is declared, its size should be explicitly specified
8.13	A pointer should point to a const-qualified type whenever possible
11.1	Conversions shall not be performed between a pointer to a function and any other type
11.2	Conversions shall not be performed between a pointer to an incomplete type and any other type
11.4	A conversion should not be performed between a pointer to object and an integer type
11.5	A conversion should not be performed from pointer to void into pointer to object
11.6	A cast shall not be performed between pointer to void and an arithmetic type
11.7	A cast shall not be performed between pointer to object and a non-integer arithmetic type
14.1	A loop counter shall not have essentially floating type

Rule	Description
14.2	A for loop shall be well-formed
15.1	The goto statement should not be used
15.2	The goto statement shall jump to a label declared later in the same function
15.3	Any label referenced by a goto statement shall be declared in the same block, or in any block enclosing the goto statement
15.5	A function should have a single point of exit at the end
17.1	The features of <starg.h> shall not be used
17.2	Functions shall not call themselves, either directly or indirectly
18.3	The relational operators >, >=, < and <= shall not be applied to objects of pointer type except where they point into the same object
18.4	The +, -, += and -= operators should not be applied to an expression of pointer type
18.5	Declarations should contain no more than two levels of pointer nesting
18.6	The address of an object with automatic storage shall not be copied to another object that persists after the first object has ceased to exist
19.2	The union keyword should not be used
21.3	The memory allocation and deallocation functions of <stdlib.h> shall not be used

Guidelines in SQO-Subset2

Good design practices generally lead to less code complexity, which can reduce the number of unproven results in Polyspace Code Prover. The following set of coding rules enforce good design practices. The SQO-subset2 option checks the rules in SQO-subset1 and some additional rules.

Rule	Description
8.8	The static storage class specifier shall be used in all declarations of objects and functions that have internal linkage
8.11	When an array with external linkage is declared, its size should be explicitly specified

Rule	Description
8.13	A pointer should point to a const-qualified type whenever possible
11.1	Conversions shall not be performed between a pointer to a function and any other type
11.2	Conversions shall not be performed between a pointer to an incomplete type and any other type
11.4	A conversion should not be performed between a pointer to object and an integer type
11.5	A conversion should not be performed from pointer to void into pointer to object
11.6	A cast shall not be performed between pointer to void and an arithmetic type
11.7	A cast shall not be performed between pointer to object and a non-integer arithmetic type
11.8	A cast shall not remove any const or volatile qualification from the type pointed to by a pointer
12.1	The precedence of operators within expressions should be made explicit
12.3	The comma operator should not be used
13.2	The value of an expression and its persistent side effects shall be the same under all permitted evaluation orders
13.4	The result of an assignment operator should not be used
14.1	A loop counter shall not have essentially floating type
14.2	A for loop shall be well-formed
14.4	The controlling expression of an if statement and the controlling expression of an iteration-statement shall have essentially Boolean type
15.1	The goto statement should not be used
15.2	The goto statement shall jump to a label declared later in the same function
15.3	Any label referenced by a goto statement shall be declared in the same block, or in any block enclosing the goto statement
15.5	A function should have a single point of exit at the end

Rule	Description
15.6	The body of an iteration- statement or a selection- statement shall be a compound- statement
15.7	All if ... else if constructs shall be terminated with an else statement
16.4	Every switch statement shall have a default label
16.5	A default label shall appear as either the first or the last switch label of a switch statement
17.1	The features of <starg.h> shall not be used
17.2	Functions shall not call themselves, either directly or indirectly
17.4	All exit paths from a function with non-void return type shall have an explicit return statement with an expression
18.3	The relational operators >, >=, < and <= shall not be applied to objects of pointer type except where they point into the same object
18.4	The +, -, += and -= operators should not be applied to an expression of pointer type
18.5	Declarations should contain no more than two levels of pointer nesting
18.6	The address of an object with automatic storage shall not be copied to another object that persists after the first object has ceased to exist
19.2	The union keyword should not be used
20.4	A macro shall not be defined with the same name as a keyword
20.6	Tokens that look like a preprocessing directive shall not occur within a macro argument
20.7	Expressions resulting from the expansion of macro parameters shall be enclosed in parentheses
20.9	All identifiers used in the controlling expression of #if or #elif preprocessing directives shall be #define'd before evaluation
20.11	A macro parameter immediately following a # operator shall not immediately be followed by a ## operator
21.3	The memory allocation and deallocation functions of <stdlib.h> shall not be used

See Also

More About

- “Interpret Polyspace Bug Finder Access Results” on page 1-2

Avoid Violations of MISRA C 2012 Rules 8.x

MISRA C:2012 rules 8.1-8.14 enforce good coding practices surrounding declarations and definitions. If you follow these practices, you are less likely to have conflicting declarations or to unintentionally modify variables.

If you do not follow these practices *during coding*, your code might require major changes later to be MISRA C-compliant. You might have too many MISRA C violations. Sometimes, in fixing a violation, you might violate another rule. Instead, keep these rules in mind when coding. Use the MISRA C:2012 checker to spot any issues that you might have missed.

- **Explicitly specify all data types in declarations.**

Avoid implicit data types like this declaration of k:

```
extern void foo (char c, const k);
```

Instead use:

```
extern void foo (char c, const int k);
```

That way, you do not violate MISRA C:2012 Rule 8.1.

- **When declaring functions, provide names and data types for all parameters.**

Avoid declarations without parameter names like these declarations:

```
extern int func(int);  
extern int func2();
```

Instead use:

```
extern int func(int arg);  
extern int func2(void);
```

That way, you do not violate MISRA C:2012 Rule 8.2.

- **If you want to use an object or function in multiple files, declare the object or function once in only one header file.**

To use an object in multiple source files, declare it as `extern` in a header file. Include the header file in all the source files where you need the object. In one of those source files, define the object. For instance:

```
/* header.h */
extern int var;

/* file1.c */
#include "header.h"
/* Some usage of var */

/* file2.c */
#include "header.h"
int var=1;
```

To use a function in multiple source files, declare it in a header file. Include the header file in all the source files where you need the function. In one of those source files, define the function.

That way, you do not violate MISRA C:2012 Rule 8.3, MISRA C:2012 Rule 8.4, MISRA C:2012 Rule 8.5, or MISRA C:2012 Rule 8.6.

- **If you want to use an object or function in one file only, declare and define the object or function with the static specifier.**

Make sure that you use the `static` specifier in all declarations and the definition. For instance, this function `func` is meant to be used only in the current file:

```
static int func(void);
static int func(void){
}
```

That way, you do not violate MISRA C:2012 Rule 8.7 and MISRA C:2012 Rule 8.8.

- **If you want to use an object in one function only, declare the object in the function body.**

Avoid declaring the object outside the function.

For instance, if you use `var` in `func` only, do declare it outside the body of `func`:

```
int var;
void func(void) {
    var=1;
}
```

Instead use:

```
void func(void) {  
    int var;  
    var=1;  
}
```

That way, you do not violate MISRA C:2012 Rule 8.7 and MISRA C:2012 Rule 8.9.

- **If you want to inline a function, declare and define the function with the static specifier.**

Every time you add `inline` to a function definition, add `static` too:

```
static inline double func(int val);  
static inline double func(int val) {  
}
```

That way, you do not violate MISRA C:2012 Rule 8.10.

- **When declaring arrays, explicitly specify their size.**

Avoid implicit size specifications like this:

```
extern int32_t array[];
```

Instead use:

```
#define MAXSIZE 10  
extern int32_t array[MAXSIZE];
```

That way, you do not violate MISRA C:2012 Rule 8.11.

- **When declaring enumerations, try to avoid mixing implicit and explicit specifications.**

Avoid mixing implicit and explicit specifications. You can specify the first enumeration constant explicitly, but after that, use either implicit or explicit specifications. For instance, avoid this type of mix:

```
enum color {red = 2, blue, green = 3, yellow};
```

Instead use:

```
enum color {red = 2, blue, green, yellow};
```

That way, you do not violate MISRA C:2012 Rule 8.12.

- **When declaring pointers, point to a const-qualified type unless you want to use the pointer to modify an object.**

Point to a const-qualified type by default unless you intend to use the pointer for modifying the pointed object. For instance, in this example, `ptr` is not used to modify the pointed object:

```
char last_char(const char * const ptr){  
}
```

That way, you do not violate MISRA C:2012 Rule 8.13.

Software Quality Objective Subsets (C++)

In this section...

“SQO Subset 1 - Direct Impact on Selectivity” on page 1-57

“SQO Subset 2 - Indirect Impact on Selectivity” on page 1-59

SQO Subset 1 - Direct Impact on Selectivity

The following set of MISRA C++ coding rules will typically improve the number of unproven results in Polyspace Code Prover.

MISRA C++ Rule	Description
2-10-2	Identifiers declared in an inner scope shall not hide an identifier declared in an outer scope.
3-1-3	When an array is declared, its size shall either be stated explicitly or defined implicitly by initialization.
3-3-2	The One Definition Rule shall not be violated.
3-9-3	The underlying bit representations of floating-point values shall not be used.
5-0-15	Array indexing shall be the only form of pointer arithmetic.
5-0-18	>, >=, <, <= shall not be applied to objects of pointer type, except where they point to the same array.
5-0-19	The declaration of objects shall contain no more than two levels of pointer indirection.
5-2-8	An object with integer type or pointer to void type shall not be converted to an object with pointer type.
5-2-9	A cast should not convert a pointer type to an integral type.
6-2-2	Floating-point expressions shall not be directly or indirectly tested for equality or inequality.
6-5-1	A for loop shall contain a single loop-counter which shall not have floating type.
6-5-2	If loop-counter is not modified by -- or ++, then, within condition, the loop-counter shall only be used as an operand to <=, <, > or >=.
6-5-3	The loop-counter shall not be modified within condition or statement.

MISRA C++ Rule	Description
6-5-4	The loop-counter shall be modified by one of: --, ++, -=n, or +=n ; where n remains constant for the duration of the loop.
6-6-1	Any label referenced by a goto statement shall be declared in the same block, or in a block enclosing the goto statement.
6-6-2	The goto statement shall jump to a label declared later in the same function body.
6-6-4	For any iteration statement there shall be no more than one break or goto statement used for loop termination.
6-6-5	A function shall have a single point of exit at the end of the function.
7-5-1	A function shall not return a reference or a pointer to an automatic variable (including parameters), defined within the function.
7-5-2	The address of an object with automatic storage shall not be assigned to another object that may persist after the first object has ceased to exist.
7-5-4	Functions should not call themselves, either directly or indirectly.
8-4-1	Functions shall not be defined using the ellipsis notation.
9-5-1	Unions shall not be used.
10-1-2	A base class shall only be declared virtual if it is used in a diamond hierarchy.
10-1-3	An accessible base class shall not be both virtual and nonvirtual in the same hierarchy.
10-3-1	There shall be no more than one definition of each virtual function on each path through the inheritance hierarchy.
10-3-2	Each overriding virtual function shall be declared with the virtual keyword.
10-3-3	A virtual function shall only be overridden by a pure virtual function if it is itself declared as pure virtual.
15-0-3	Control shall not be transferred into a try or catch block using a goto or a switch statement.
15-1-3	An empty throw (throw;) shall only be used in the compound- statement of a catch handler.
15-3-3	Handlers of a function-try-block implementation of a class constructor or destructor shall not reference non-static members from this class or its bases.
15-3-5	A class type exception shall always be caught by reference.

MISRA C++ Rule	Description
15-3-6	Where multiple handlers are provided in a single try-catch statement or function-try-block for a derived class and some or all of its bases, the handlers shall be ordered most-derived to base class.
15-3-7	Where multiple handlers are provided in a single try-catch statement or function-try-block, any ellipsis (catch-all) handler shall occur last.
15-4-1	If a function is declared with an exception-specification, then all declarations of the same function (in other translation units) shall be declared with the same set of type-ids.
15-5-1	A class destructor shall not exit with an exception.
15-5-2	Where a function's declaration includes an exception-specification, the function shall only be capable of throwing exceptions of the indicated type(s).
18-4-1	Dynamic heap memory allocation shall not be used.

SQO Subset 2 - Indirect Impact on Selectivity

Good design practices generally lead to less code complexity, which can improve the number of unproven results in Polyspace Code Prover. The following set of coding rules may help to address design issues in your code. The SQO-subset2 option checks the rules in SQO-subset1 and SQO-subset2.

MISRA C++ Rule	Description
2-10-2	Identifiers declared in an inner scope shall not hide an identifier declared in an outer scope.
3-1-3	When an array is declared, its size shall either be stated explicitly or defined implicitly by initialization.
3-3-2	If a function has internal linkage then all re-declarations shall include the static storage class specifier.
3-4-1	An identifier declared to be an object or type shall be defined in a block that minimizes its visibility.
3-9-2	typedefs that indicate size and signedness should be used in place of the basic numerical types.
3-9-3	The underlying bit representations of floating-point values shall not be used.

MISRA C++ Rule	Description
4-5-1	Expressions with type bool shall not be used as operands to built-in operators other than the assignment operator =, the logical operators &&, , !, the equality operators == and !=, the unary & operator, and the conditional operator.
5-0-1	The value of an expression shall be the same under any order of evaluation that the standard permits.
5-0-2	Limited dependence should be placed on C++ operator precedence rules in expressions.
5-0-7	There shall be no explicit floating-integral conversions of a cvalue expression.
5-0-8	An explicit integral or floating-point conversion shall not increase the size of the underlying type of a cvalue expression.
5-0-9	An explicit integral conversion shall not change the signedness of the underlying type of a cvalue expression.
5-0-10	If the bitwise operators ~ and << are applied to an operand with an underlying type of unsigned char or unsigned short, the result shall be immediately cast to the underlying type of the operand.
5-0-13	The condition of an if-statement and the condition of an iteration- statement shall have type bool
5-0-15	Array indexing shall be the only form of pointer arithmetic.
5-0-18	>, >=, <, <= shall not be applied to objects of pointer type, except where they point to the same array.
5-0-19	The declaration of objects shall contain no more than two levels of pointer indirection.
5-2-1	Each operand of a logical && or shall be a postfix - expression.
5-2-2	A pointer to a virtual base class shall only be cast to a pointer to a derived class by means of dynamic_cast.
5-2-5	A cast shall not remove any const or volatile qualification from the type of a pointer or reference.
5-2-6	A cast shall not convert a pointer to a function to any other pointer type, including a pointer to function type.
5-2-7	An object with pointer type shall not be converted to an unrelated pointer type, either directly or indirectly.

MISRA C++ Rule	Description
5-2-8	An object with integer type or pointer to void type shall not be converted to an object with pointer type.
5-2-9	A cast should not convert a pointer type to an integral type.
5-2-11	The comma operator, && operator and the operator shall not be overloaded.
5-3-2	The unary minus operator shall not be applied to an expression whose underlying type is unsigned.
5-3-3	The unary & operator shall not be overloaded.
5-18-1	The comma operator shall not be used.
6-2-1	Assignment operators shall not be used in sub-expressions.
6-2-2	Floating-point expressions shall not be directly or indirectly tested for equality or inequality.
6-3-1	The statement forming the body of a switch, while, do ... while or for statement shall be a compound statement.
6-4-2	All if ... else if constructs shall be terminated with an else clause.
6-4-6	The final clause of a switch statement shall be the default-clause.
6-5-1	A for loop shall contain a single loop-counter which shall not have floating type.
6-5-2	If loop-counter is not modified by -- or ++, then, within condition, the loop-counter shall only be used as an operand to <=, <, > or >=.
6-5-3	The loop-counter shall not be modified within condition or statement.
6-5-4	The loop-counter shall be modified by one of: --, ++, -=n, or +=n ; where n remains constant for the duration of the loop.
6-6-1	Any label referenced by a goto statement shall be declared in the same block, or in a block enclosing the goto statement.
6-6-2	The goto statement shall jump to a label declared later in the same function body.
6-6-4	For any iteration statement there shall be no more than one break or goto statement used for loop termination.
6-6-5	A function shall have a single point of exit at the end of the function.
7-5-1	A function shall not return a reference or a pointer to an automatic variable (including parameters), defined within the function.

MISRA C++ Rule	Description
7-5-2	The address of an object with automatic storage shall not be assigned to another object that may persist after the first object has ceased to exist.
7-5-4	Functions should not call themselves, either directly or indirectly.
8-4-1	Functions shall not be defined using the ellipsis notation.
8-4-3	All exit paths from a function with non- void return type shall have an explicit return statement with an expression.
8-4-4	A function identifier shall either be used to call the function or it shall be preceded by &.
8-5-2	Braces shall be used to indicate and match the structure in the non- zero initialization of arrays and structures.
8-5-3	In an enumerator list, the = construct shall not be used to explicitly initialize members other than the first, unless all items are explicitly initialized.
9-5-1	Unions shall not be used.
10-1-2	A base class shall only be declared virtual if it is used in a diamond hierarchy.
10-1-3	An accessible base class shall not be both virtual and nonvirtual in the same hierarchy.
10-3-1	There shall be no more than one definition of each virtual function on each path through the inheritance hierarchy.
10-3-2	Each overriding virtual function shall be declared with the virtual keyword.
10-3-3	A virtual function shall only be overridden by a pure virtual function if it is itself declared as pure virtual.
11-0-1	Member data in non- POD class types shall be private.
12-1-1	An object's dynamic type shall not be used from the body of its constructor or destructor.
12-8-2	The copy assignment operator shall be declared protected or private in an abstract class.
15-0-3	Control shall not be transferred into a try or catch block using a goto or a switch statement.
15-1-3	An empty throw (throw;) shall only be used in the compound- statement of a catch handler.

MISRA C++ Rule	Description
15-3-3	Handlers of a function-try-block implementation of a class constructor or destructor shall not reference non-static members from this class or its bases.
15-3-5	A class type exception shall always be caught by reference.
15-3-6	Where multiple handlers are provided in a single try-catch statement or function-try-block for a derived class and some or all of its bases, the handlers shall be ordered most-derived to base class.
15-3-7	Where multiple handlers are provided in a single try-catch statement or function-try-block, any ellipsis (catch-all) handler shall occur last.
15-4-1	If a function is declared with an exception-specification, then all declarations of the same function (in other translation units) shall be declared with the same set of type-ids.
15-5-1	A class destructor shall not exit with an exception.
15-5-2	Where a function's declaration includes an exception-specification, the function shall only be capable of throwing exceptions of the indicated type(s).
16-0-5	Arguments to a function-like macro shall not contain tokens that look like preprocessing directives.
16-0-6	In the definition of a function-like macro, each instance of a parameter shall be enclosed in parentheses, unless it is used as the operand of # or ##.
16-0-7	Undefined macro identifiers shall not be used in #if or #elif preprocessor directives, except as operands to the defined operator.
16-2-2	C++ macros shall only be used for: include guards, type qualifiers, or storage class specifiers.
16-3-1	There shall be at most one occurrence of the # or ## operators in a single macro definition.
18-4-1	Dynamic heap memory allocation shall not be used.

See Also

More About

- “Interpret Polyspace Bug Finder Access Results” on page 1-2

Coding Rule Subsets Checked Early in Analysis

In the initial compilation phase of the analysis, Polyspace checks those coding rules that do not require the run-time error detection part of the analysis. If you want only those rules checked, you can perform a much quicker analysis.

The software provides two predefined subsets of rules that it checks earlier in the analysis. The subsets are available with the options `Check MISRA C:2004 (-misra2)`, `Check MISRA AC AGC (-misra-ac-agc)`, and `Check MISRA C:2012 (-misra3)`. For more on analysis options, see the documentation of Polyspace Bug Finder or Polyspace Bug Finder Server.

Argument	Purpose
<code>single-unit-rules</code>	Check rules that apply only to single translation units. If you detect only coding rule violations and select this subset, a Bug Finder analysis stops after the compilation phase.
<code>system-decidable-rules</code>	Check rules in the <code>single-unit-rules</code> subset and some rules that apply to the collective set of program files. The additional rules are the less complex rules that apply at the integration level. These rules can be checked only at the integration level because the rules involve more than one translation unit. If you detect only coding rule violations and select this subset, a Bug Finder analysis stops after the linking phase.

See also “Interpret Polyspace Bug Finder Access Results” on page 1-2.

MISRA C: 2004 and MISRA AC AGC Rules

The software checks the following rules early in the analysis. The rules that are checked at a system level and appear only in the `system-decidable-rules` subset are indicated by an asterisk.

Environment

Rule	Description
1.1*	All code shall conform to ISO® 9899:1990 "Programming languages - C", amended and corrected by ISO/IEC 9899/COR1:1995, ISO/IEC 9899/AMD1:1995, and ISO/IEC 9899/COR2:1996.

Language Extensions

Rule	Description
2.1	Assembly language shall be encapsulated and isolated.
2.2	Source code shall only use /* */ style comments.
2.3	The character sequence /* shall not be used within a comment.

Documentation

Rule	Description
3.4	All uses of the #pragma directive shall be documented and explained.

Character Sets

Rule	Description
4.1	Only those escape sequences which are defined in the ISO C standard shall be used.
4.2	Trigraphs shall not be used.

Identifiers

Rule	Description
5.1*	Identifiers (internal and external) shall not rely on the significance of more than 31 characters.
5.2	Identifiers in an inner scope shall not use the same name as an identifier in an outer scope, and therefore hide that identifier.
5.3*	A typedef name shall be a unique identifier.
5.4*	A tag name shall be a unique identifier.
5.5*	No object or function identifier with a static storage duration should be reused.
5.6*	No identifier in one name space should have the same spelling as an identifier in another name space, with the exception of structure and union member names.
5.7*	No identifier name should be reused.

Types

Rule	Description
6.1	The plain char type shall be used only for the storage and use of character values.
6.2	Signed and unsigned char type shall be used only for the storage and use of numeric values.
6.3	typedefs that indicate size and signedness should be used in place of the basic types.
6.4	Bit fields shall only be defined to be of type <code>unsigned int</code> or <code>signed int</code> .
6.5	Bit fields of type <code>signed int</code> shall be at least 2 bits long.

Constants

Rule	Description
7.1	Octal constants (other than zero) and octal escape sequences shall not be used.

Declarations and Definitions

Rule	Description
8.1	Functions shall have prototype declarations and the prototype shall be visible at both the function definition and call.
8.2	Whenever an object or function is declared or defined, its type shall be explicitly stated.
8.3	For each function parameter the type given in the declaration and definition shall be identical, and the return types shall also be identical.
8.4*	If objects or functions are declared more than once their types shall be compatible.
8.5	There shall be no definitions of objects or functions in a header file.
8.6	Functions shall always be declared at file scope.
8.7	Objects shall be defined at block scope if they are only accessed from within a single function.
8.8*	An external object or function shall be declared in one file and only one file.
8.9*	An identifier with external linkage shall have exactly one external definition.
8.10*	All declarations and definitions of objects or functions at file scope shall have internal linkage unless external linkage is required.
8.11	The <code>static</code> storage class specifier shall be used in definitions and declarations of objects and functions that have internal linkage
8.12	When an array is declared with external linkage, its size shall be stated explicitly or defined implicitly by initialization.

Initialization

Rule	Description
9.2	Braces shall be used to indicate and match the structure in the nonzero initialization of arrays and structures.
9.3	In an enumerator list, the <code>=</code> construct shall not be used to explicitly initialize members other than the first, unless all items are explicitly initialized.

Arithmetic Type Conversion

Rule	Description
10.1	<p>The value of an expression of integer type shall not be implicitly converted to a different underlying type if:</p> <ul style="list-style-type: none">• It is not a conversion to a wider integer type of the same signedness, or• The expression is complex, or• The expression is not constant and is a function argument, or• The expression is not constant and is a return expression
10.2	<p>The value of an expression of floating type shall not be implicitly converted to a different type if</p> <ul style="list-style-type: none">• It is not a conversion to a wider floating type, or• The expression is complex, or• The expression is a function argument, or• The expression is a return expression
10.3	<p>The value of a complex expression of integer type may only be cast to a type that is narrower and of the same signedness as the underlying type of the expression.</p>
10.4	<p>The value of a complex expression of float type may only be cast to narrower floating type.</p>
10.5	<p>If the bitwise operator <code>~</code> and <code><<</code> are applied to an operand of underlying type <code>unsigned char</code> or <code>unsigned short</code>, the result shall be immediately cast to the underlying type of the operand</p>
10.6	<p>The "U" suffix shall be applied to all constants of unsigned types.</p>

Pointer Type Conversion

Rule	Description
11.1	Conversion shall not be performed between a pointer to a function and any type other than an integral type.
11.2	Conversion shall not be performed between a pointer to an object and any type other than an integral type, another pointer to a object type or a pointer to void.
11.3	A cast should not be performed between a pointer type and an integral type.
11.4	A cast should not be performed between a pointer to object type and a different pointer to object type.
11.5	A cast shall not be performed that removes any <code>const</code> or <code>volatile</code> qualification from the type addressed by a pointer

Expressions

Rule	Description
12.1	Limited dependence should be placed on C's operator precedence rules in expressions.
12.3	The <code>sizeof</code> operator should not be used on expressions that contain side effects.
12.5	The operands of a logical <code>&&</code> or <code> </code> shall be primary-expressions.
12.6	Operands of logical operators (<code>&&</code> , <code> </code> and <code>!</code>) should be effectively Boolean. Expression that are effectively Boolean should not be used as operands to operators other than (<code>&&</code> , <code> </code> or <code>!</code>).
12.7	Bitwise operators shall not be applied to operands whose underlying type is signed.
12.9	The unary minus operator shall not be applied to an expression whose underlying type is unsigned.
12.10	The comma operator shall not be used.
12.11	Evaluation of constant unsigned expression should not lead to wraparound.
12.12	The underlying bit representations of floating-point values shall not be used.
12.13	The increment (<code>++</code>) and decrement (<code>--</code>) operators should not be mixed with other operators in an expression

Control Statement Expressions

Rule	Description
13.1	Assignment operators shall not be used in expressions that yield Boolean values.
13.2	Tests of a value against zero should be made explicit, unless the operand is effectively Boolean.
13.3	Floating-point expressions shall not be tested for equality or inequality.
13.4	The controlling expression of a <code>for</code> statement shall not contain any objects of floating type.
13.5	The three expressions of a <code>for</code> statement shall be concerned only with loop control.
13.6	Numeric variables being used within a <code>for</code> loop for iteration counting should not be modified in the body of the loop.

Control Flow

Rule	Description
14.3	All non-null statements shall either <ul style="list-style-type: none">• have at least one side effect however executed, or• cause control flow to change.
14.4	The <code>goto</code> statement shall not be used.
14.5	The <code>continue</code> statement shall not be used.
14.6	For any iteration statement, there shall be at most one <code>break</code> statement used for loop termination.
14.7	A function shall have a single point of exit at the end of the function.
14.8	The statement forming the body of a <code>switch</code> , <code>while</code> , <code>do while</code> or <code>for</code> statement shall be a compound statement.
14.9	An <code>if</code> (expression) construct shall be followed by a compound statement. The <code>else</code> keyword shall be followed by either a compound statement, or another <code>if</code> statement.
14.10	All <code>if else if</code> constructs should contain a final <code>else</code> clause.

Switch Statements

Rule	Description
15.0	Unreachable code is detected between <code>switch</code> statement and first <code>case</code> .
15.1	A <code>switch</code> label shall only be used when the most closely-enclosing compound statement is the body of a <code>switch</code> statement
15.2	An unconditional <code>break</code> statement shall terminate every non-empty <code>switch</code> clause.
15.3	The final clause of a <code>switch</code> statement shall be the <code>default</code> clause.
15.4	A <code>switch</code> expression should not represent a value that is effectively Boolean.
15.5	Every <code>switch</code> statement shall have at least one <code>case</code> clause.

Functions

Rule	Description
16.1	Functions shall not be defined with variable numbers of arguments.
16.3	Identifiers shall be given for all of the parameters in a function prototype declaration.
16.4*	The identifiers used in the declaration and definition of a function shall be identical.
16.5	Functions with no parameters shall be declared with parameter type <code>void</code> .
16.6	The number of arguments passed to a function shall match the number of parameters.
16.8	All exit paths from a function with non- <code>void</code> return type shall have an explicit return statement with an expression.
16.9	A function identifier shall only be used with either a preceding <code>&</code> , or with a parenthesized parameter list, which may be empty.

Pointers and Arrays

Rule	Description
17.4	Array indexing shall be the only allowed form of pointer arithmetic.
17.5	A type should not contain more than 2 levels of pointer indirection.

Structures and Unions

Rule	Description
18.1	All structure or union types shall be complete at the end of a translation unit.
18.4	Unions shall not be used.

Preprocessing Directives

Rule	Description
19.1	<code>#include</code> statements in a file shall only be preceded by other preprocessors directives or comments.
19.2	Nonstandard characters should not occur in header file names in <code>#include</code> directives.
19.3	The <code>#include</code> directive shall be followed by either a <code><filename></code> or "filename" sequence.
19.4	C macros shall only expand to a braced initializer, a constant, a parenthesized expression, a type qualifier, a storage class specifier, or a do-while-zero construct.
19.5	Macros shall not be <code>#defined</code> and <code>#undefd</code> within a block.
19.6	<code>#undef</code> shall not be used.
19.7	A function should be used in preference to a function like-macro.
19.8	A function-like macro shall not be invoked without all of its arguments.
19.9	Arguments to a function-like macro shall not contain tokens that look like preprocessing directives.
19.10	In the definition of a function-like macro, each instance of a parameter shall be enclosed in parentheses unless it is used as the operand of <code>#</code> or <code>##</code> .
19.11	All macro identifiers in preprocessor directives shall be defined before use, except in <code>#ifdef</code> and <code>#ifndef</code> preprocessor directives and the <code>defined()</code> operator.
19.12	There shall be at most one occurrence of the <code>#</code> or <code>##</code> preprocessor operators in a single macro definition.
19.13	The <code>#</code> and <code>##</code> preprocessor operators should not be used.
19.14	The <code>defined</code> preprocessor operator shall only be used in one of the two standard forms.
19.15	Precautions shall be taken in order to prevent the contents of a header file being included twice.
19.16	Preprocessing directives shall be syntactically meaningful even when excluded by the preprocessor.

Rule	Description
19.17	All <code>#else</code> , <code>#elif</code> and <code>#endif</code> preprocessor directives shall reside in the same file as the <code>#if</code> or <code>#ifdef</code> directive to which they are related.

Standard Libraries

Rule	Description
20.1	Reserved identifiers, macros and functions in the standard library, shall not be defined, redefined or undefined.
20.2	The names of standard library macros, objects and functions shall not be reused.
20.4	Dynamic heap memory allocation shall not be used.
20.5	The error indicator <code>errno</code> shall not be used.
20.6	The macro <code>offsetof</code> , in library <code><stddef.h></code> , shall not be used.
20.7	The <code>setjmp</code> macro and the <code>longjmp</code> function shall not be used.
20.8	The signal handling facilities of <code><signal.h></code> shall not be used.
20.9	The input/output library <code><stdio.h></code> shall not be used in production code.
20.10	The library functions <code>atof</code> , <code>atoi</code> and <code>atoll</code> from library <code><stdlib.h></code> shall not be used.
20.11	The library functions <code>abort</code> , <code>exit</code> , <code>getenv</code> and <code>system</code> from library <code><stdlib.h></code> shall not be used.
20.12	The time handling functions of library <code><time.h></code> shall not be used.

The rules that are checked at a system level and appear only in the `system-decidable-rules` subset are indicated by an asterisk.

MISRA C: 2012 Rules

The software checks the following rules early in the analysis. The rules that are checked at a system level and appear only in the `system-decidable-rules` subset are indicated by an asterisk.

Standard C Environment

Rule	Description
1.1	The program shall contain no violations of the standard C syntax and constraints, and shall not exceed the implementation's translation limits.
1.2	Language extensions should not be used.

Unused Code

Rule	Description
2.3*	A project should not contain unused type declarations.
2.4*	A project should not contain unused tag declarations.
2.5*	A project should not contain unused macro declarations.
2.6	A function should not contain unused label declarations.
2.7	There should be no unused parameters in functions.

Comments

Rule	Description
3.1	The character sequences <code>/*</code> and <code>//</code> shall not be used within a comment.
3.2	Line-splicing shall not be used in <code>//</code> comments.

Character Sets and Lexical Conventions

Rule	Description
4.1	Octal and hexadecimal escape sequences shall be terminated.
4.2	Trigraphs should not be used.

Identifiers

Rule	Description
5.1*	External identifiers shall be distinct.
5.2	Identifiers declared in the same scope and name space shall be distinct.
5.3	An identifier declared in an inner scope shall not hide an identifier declared in an outer scope.
5.4	Macro identifiers shall be distinct.
5.5	Identifiers shall be distinct from macro names.
5.6*	A typedef name shall be a unique identifier.
5.7*	A tag name shall be a unique identifier.
5.8*	Identifiers that define objects or functions with external linkage shall be unique.
5.9*	Identifiers that define objects or functions with internal linkage should be unique.

Types

Rule	Description
6.1	Bit-fields shall only be declared with an appropriate type.
6.2	Single-bit named bit fields shall not be of a signed type.

Literals and Constants

Rule	Description
7.1	Octal constants shall not be used.
7.2	A "u" or "U" suffix shall be applied to all integer constants that are represented in an unsigned type.
7.3	The lowercase character "l" shall not be used in a literal suffix.
7.4	A string literal shall not be assigned to an object unless the object's type is "pointer to const-qualified char".

Declarations and Definitions

Rule	Description
8.1	Types shall be explicitly specified.
8.2	Function types shall be in prototype form with named parameters.
8.3*	All declarations of an object or function shall use the same names and type qualifiers.
8.4	A compatible declaration shall be visible when an object or function with external linkage is defined.
8.5*	An external object or function shall be declared once in one and only one file.
8.6*	An identifier with external linkage shall have exactly one external definition.
8.7*	Functions and objects should not be defined with external linkage if they are referenced in only one translation unit.
8.8	The <code>static</code> storage class specifier shall be used in all declarations of objects and functions that have internal linkage.
8.9*	An object should be defined at block scope if its identifier only appears in a single function.
8.10	An inline function shall be declared with the <code>static</code> storage class.
8.11	When an array with external linkage is declared, its size should be explicitly specified.
8.12	Within an enumerator list, the value of an implicitly-specified enumeration constant shall be unique.
8.14	The <code>restrict</code> type qualifier shall not be used.

Initialization

Rule	Description
9.2	The initializer for an aggregate or union shall be enclosed in braces.
9.3	Arrays shall not be partially initialized.
9.4	An element of an object shall not be initialized more than once.
9.5	Where designated initializers are used to initialize an array object the size of the array shall be specified explicitly.

The Essential Type Model

Rule	Description
10.1	Operands shall not be of an inappropriate essential type.
10.2	Expressions of essentially character type shall not be used inappropriately in addition and subtraction operations.
10.3	The value of an expression shall not be assigned to an object with a narrower essential type or of a different essential type category.
10.4	Both operands of an operator in which the usual arithmetic conversions are performed shall have the same essential type category.
10.5	The value of an expression should not be cast to an inappropriate essential type.
10.6	The value of a composite expression shall not be assigned to an object with wider essential type.
10.7	If a composite expression is used as one operand of an operator in which the usual arithmetic conversions are performed then the other operand shall not have wider essential type.
10.8	The value of a composite expression shall not be cast to a different essential type category or a wider essential type.

Pointer Type Conversion

Rule	Description
11.1	Conversions shall not be performed between a pointer to a function and any other type.
11.2	Conversions shall not be performed between a pointer to an incomplete type and any other type.
11.3	A cast shall not be performed between a pointer to object type and a pointer to a different object type.
11.4	A conversion should not be performed between a pointer to object and an integer type.
11.5	A conversion should not be performed from pointer to void into pointer to object.
11.6	A cast shall not be performed between pointer to void and an arithmetic type.
11.7	A cast shall not be performed between pointer to object and a non-integer arithmetic type.
11.8	A cast shall not remove any const or volatile qualification from the type pointed to by a pointer.
11.9	The macro NULL shall be the only permitted form of integer null pointer constant.

Expressions

Rule	Description
12.1	The precedence of operators within expressions should be made explicit.
12.3	The comma operator should not be used.
12.4	Evaluation of constant expressions should not lead to unsigned integer wrap-around.

Side Effects

Rule	Description
13.3	A full expression containing an increment (++) or decrement (--) operator should have no other potential side effects other than that caused by the increment or decrement operator.
13.4	The result of an assignment operator should not be used.
13.6	The operand of the sizeof operator shall not contain any expression which has potential side effects.

Control Statement Expressions

Rule	Description
14.4	The controlling expression of an if statement and the controlling expression of an iteration-statement shall have essentially Boolean type.

Control Flow

Rule	Description
15.1	The goto statement should not be used.
15.2	The goto statement shall jump to a label declared later in the same function.
15.3	Any label referenced by a goto statement shall be declared in the same block, or in any block enclosing the goto statement.
15.4	There should be no more than one break or goto statement used to terminate any iteration statement.
15.5	A function should have a single point of exit at the end
15.6	The body of an iteration-statement or a selection-statement shall be a compound statement.
15.7	All if ... else if constructs shall be terminated with an else statement.

Switch Statements

Rule	Description
16.1	All <code>switch</code> statements shall be well-formed.
16.2	A <code>switch</code> label shall only be used when the most closely-enclosing compound statement is the body of a <code>switch</code> statement.
16.3	An unconditional <code>break</code> statement shall terminate every <code>switch</code> -clause.
16.4	Every <code>switch</code> statement shall have a <code>default</code> label.
16.5	A <code>default</code> label shall appear as either the first or the last <code>switch</code> label of a <code>switch</code> statement.
16.6	Every <code>switch</code> statement shall have at least two <code>switch</code> -clauses.
16.7	A <code>switch</code> -expression shall not have essentially Boolean type.

Functions

Rule	Description
17.1	The features of <code><starg.h></code> shall not be used.
17.3	A function shall not be declared implicitly.
17.4	All exit paths from a function with non-void return type shall have an explicit return statement with an expression.
17.6	The declaration of an array parameter shall not contain the <code>static</code> keyword between the <code>[]</code> .
17.7	The value returned by a function having non-void return type shall be used.

Pointers and Arrays

Rule	Description
18.4	The <code>+</code> , <code>-</code> , <code>+=</code> and <code>-=</code> operators should not be applied to an expression of pointer type.
18.5	Declarations should contain no more than two levels of pointer nesting.
18.7	Flexible array members shall not be declared.
18.8	Variable-length array types shall not be used.

Overlapping Storage

Rule	Description
19.2	The union keyword should not be used.

Preprocessing Directives

Rule	Description
20.1	<code>#include</code> directives should only be preceded by preprocessor directives or comments.
20.2	The <code>'</code> , <code>"</code> , or <code>\</code> characters and the <code>/*</code> or <code>//</code> character sequences shall not occur in a header file name.
20.3	The <code>#include</code> directive shall be followed by either a <code><filename></code> or <code>"filename"</code> sequence.
20.4	A macro shall not be defined with the same name as a keyword.
20.5	<code>#undef</code> should not be used.
20.6	Tokens that look like a preprocessing directive shall not occur within a macro argument.
20.7	Expressions resulting from the expansion of macro parameters shall be enclosed in parentheses.
20.8	The controlling expression of a <code>#if</code> or <code>#elif</code> preprocessing directive shall evaluate to 0 or 1.
20.9	All identifiers used in the controlling expression of <code>#if</code> or <code>#elif</code> preprocessing directives shall be <code>#define</code> 'd before evaluation.
20.10	The <code>#</code> and <code>##</code> preprocessor operators should not be used.
20.11	A macro parameter immediately following a <code>#</code> operator shall not immediately be followed by a <code>##</code> operator.
20.12	A macro parameter used as an operand to the <code>#</code> or <code>##</code> operators, which is itself subject to further macro replacement, shall only be used as an operand to these operators.
20.13	A line whose first token is <code>#</code> shall be a valid preprocessing directive.
20.14	All <code>#else</code> , <code>#elif</code> and <code>#endif</code> preprocessor directives shall reside in the same file as the <code>#if</code> , <code>#ifdef</code> or <code>#ifndef</code> directive to which they are related.

Standard Libraries

Rule	Description
21.1	<code>#define</code> and <code>#undef</code> shall not be used on a reserved identifier or reserved macro name.
21.2	A reserved identifier or macro name shall not be declared.
21.3	The memory allocation and deallocation functions of <code><stdlib.h></code> shall not be used.
21.4	The standard header file <code><setjmp.h></code> shall not be used.
21.5	The standard header file <code><signal.h></code> shall not be used.
21.6	The Standard Library input/output functions shall not be used.
21.7	The <code>atof</code> , <code>atoi</code> , <code>atol</code> , and <code>atoll</code> functions of <code><stdlib.h></code> shall not be used.
21.8	The library functions <code>abort</code> , <code>exit</code> , <code>getenv</code> and <code>system</code> of <code><stdlib.h></code> shall not be used.
21.9	The library functions <code>bsearch</code> and <code>qsort</code> of <code><stdlib.h></code> shall not be used.
21.10	The Standard Library time and date functions shall not be used.
21.11	The standard header file <code><tgmath.h></code> shall not be used.
21.12	The exception handling features of <code><fenv.h></code> should not be used.

The rules that are checked at a system level and appear only in the `system-decidable-rules` subset are indicated by an asterisk.

See Also

More About

- “Interpret Polyspace Bug Finder Access Results” on page 1-2

HIS Code Complexity Metrics

The following list shows the Hersteller Initiative Software (HIS) standard metrics that Polyspace evaluates. These metrics and the recommended limits for their values are part of a standard defined by a major group of Original Equipment Manufacturers or OEMs.

Project

Polyspace evaluates the following HIS metrics at the project level.

Metric	Recommended Upper Limit
Number of direct recursions	0
Number of recursions	0

File

Polyspace evaluates the HIS metric, comment density, at the file level. The recommended lower limit is 20.

Function

Polyspace evaluates the following HIS metrics at the function level.

Metric	Recommended Upper Limit
Cyclomatic complexity	10
Language scope	4
Number of call levels	4
Number of calling functions	5
Number of called functions	7
Number of function parameters	5
Number of goto statements	0
Number of instructions	50
Number of paths	80

Metric	Recommended Upper Limit
Number of return statements	1

See Also

More About

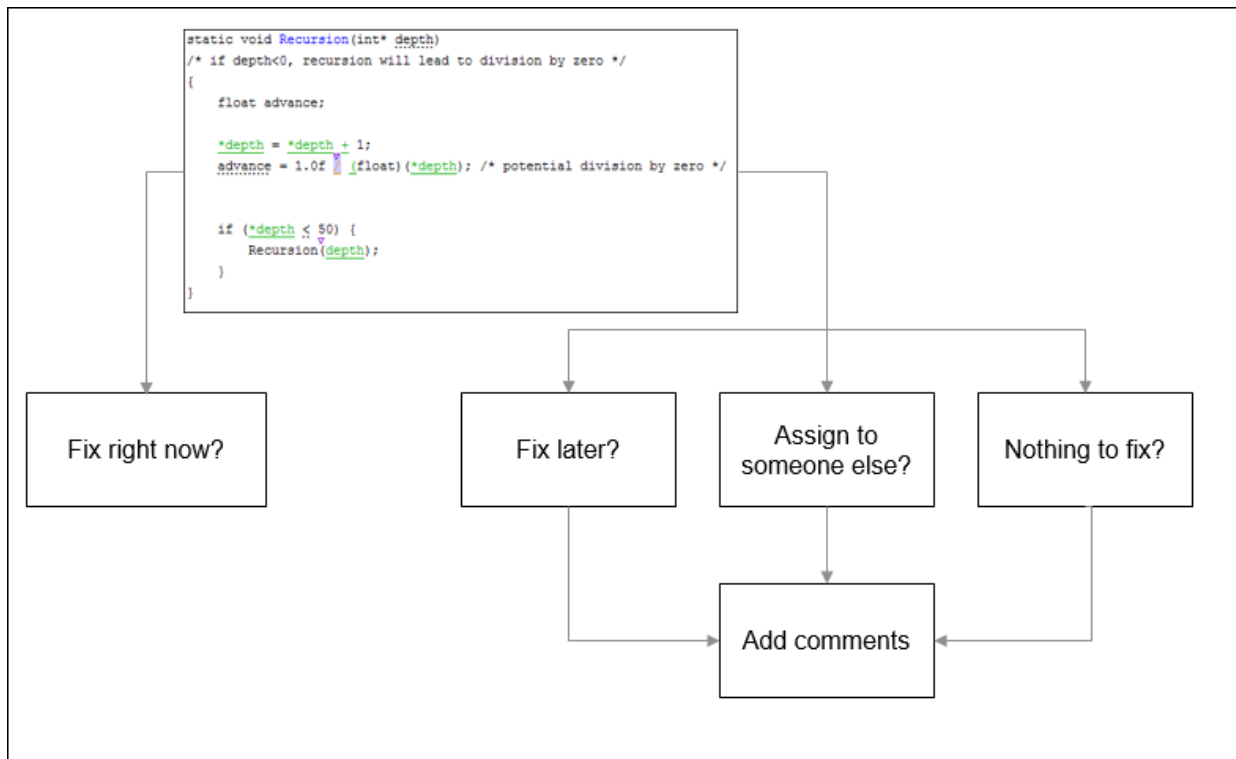
- “Code Metrics”

Fix or Comment Polyspace Results

- “Address Polyspace Results Through Bug Fixes or Comments” on page 2-2
- “Annotate Code and Hide Known or Acceptable Results” on page 2-5
- “Short Names of Bug Finder Defect Checkers” on page 2-12
- “Short Names of Code Complexity Metrics” on page 2-29
- “Annotate Code for Known or Acceptable Results (Not Recommended)” on page 2-32
- “Define Custom Annotation Format” on page 2-37
- “Annotation Description Full XML Template” on page 2-46

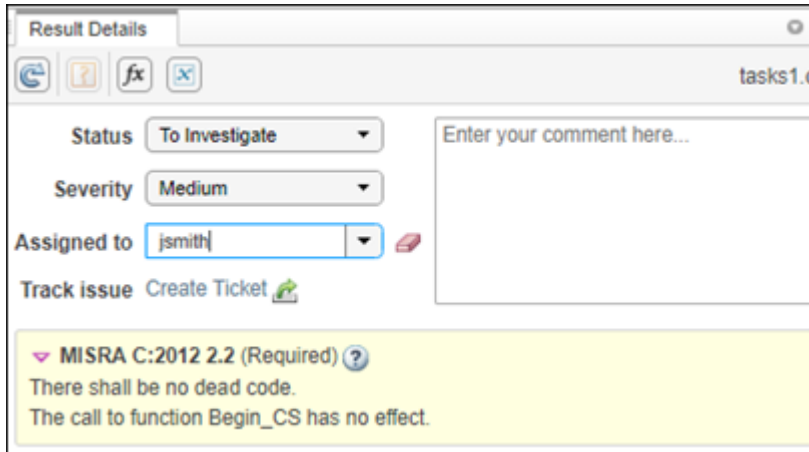
Address Polyspace Results Through Bug Fixes or Comments

Once you understand the root cause of a Polyspace finding, you can fix your code. Otherwise, add comments to your Polyspace results to fix the code later or to justify the result. You can use the comments to keep track of your review progress.



If you add comments to your results file, they carry over to the next analysis on the same project. If you add comments to your code (annotate), they carry over to any subsequent analysis of the code, whether in the same project or not.

Comment in Result Details pane



Set the **Status**, **Severity**, and comment fields in the **Result Details** pane. The status indicates your response to the Polyspace result. If you do not plan to fix your code in response to a result, assign one of the following statuses:

- Justified
- No Action Planned
- Not a Defect

Based on the status, Polyspace considers that you have given due consideration and justified that result (retained the code despite the result).

Comment or Annotate in Code

If you enter code comments or annotations in a specific syntax, the software can read them and populate the **Severity**, **Status**, and comment fields in the next analysis of the code. Open your source code in an editor and enter the annotation on the same line as the result.

For the annotation syntax, see “Annotate Code and Hide Known or Acceptable Results” on page 2-5.

If you do not specify a status in your annotation, Polyspace assumes that you have set a status of `No Action Planned`.

See Also

More About

- “Annotate Code and Hide Known or Acceptable Results” on page 2-5

Annotate Code and Hide Known or Acceptable Results

To facilitate your review workflow, Polyspace Access classifies analysis findings as **To Do**, **In Progress**, or **Done**. In the **DASHBOARD** perspective, open issues are findings that are **To Do** or **In Progress**.

If a Polyspace analysis of your code finds known or acceptable defects or coding rule violations, you can remove the defects or violations from the list of **Open Issues** in subsequent analyses. Add code annotations indicating that you have reviewed the issues and that you do not intend to fix them.

Add annotations by typing them directly in your code. For the general workflow, see “Address Polyspace Results Through Bug Fixes or Comments” on page 2-2. This topic shows the annotation syntax. If you annotate a finding in your code, you cannot edit the status, severity, or comment fields in the Polyspace Access interface.

Code Annotation Syntax

To add comments directly to your source file, use the Polyspace annotation syntax. The syntax is not case sensitive, and has this format:

- Annotation for current line of code:

```
line of code; /* polyspace Family:Result_name */
```

- Annotation for current line of code and n following lines:

```
code; /* polyspace +n Family:Result_name */
```

- Annotation for block of code:

```
/* polyspace-begin Family:Result_name */
code;
/* polyspace-end Family:Result_name */
```

Annotations begin with the keyword `polyspace` and must include `Family` and `Result_name` field values. You can optionally specify `Status`, `Severity`, and `Comment` field values.

```
polyspace Family:Result_name [Status:Severity] "Comment"
```

When you annotate a block of code, if subsequent annotations nested within that block of code apply to the same `Family` and `Result_name`, they are ignored.

For example, in this code, the annotation on line 9 is ignored and the block annotation is applied instead.

```
1 /*polyspace-begin MISRA-C:14.9 [High:To fix] "Block annotation"*/
2
3 int main(void) /*polyspace MISRA-C:14.7 "Annotation applied"*/
4 {
5     int x = 1;
6     int y = x / 2;
7
8
9     if (x > y) /*polyspace MISRA-C:14.9 "Annotation ignored"*/
10        return x;
11    return x;
12 }
13 /*polyspace-end MISRA-C:14.9 [High:To fix] "Block annotation"*/
```

If you do not specify a status, Polyspace Access considers the result **Done**, and assigns the status **No action planned** to the result.

To replace the different annotation fields with their allowed values, use the values in this table or see the examples on page 2-9.

Field	Allowed Value
<i>Family</i>	<p>Type of analysis result:</p> <ul style="list-style-type: none"> • DEFECT (Polyspace Bug Finder) • RTE, for run-time checks (Polyspace Code Prover) • CODE-METRICS, for function-level code complexity metrics • VARIABLE, for global variables (Polyspace Code Prover) • MISRA-C or MISRA2004 for MISRA C: 2004 rule violations • MISRA-AC-AGC for violations of MISRA C:2004 rules applicable to generated code • MISRA-C3 or MISRA2012 for MISRA C: 2012 rule violations. The annotation works even for the rules applicable to generated code. • CERT-C for CERT® C coding standard violations • CERT-CPP for CERT C++ coding standard violations • ISO-17961 for ISO/IEC TS 17961 coding standard violations • MISRA-CPP for MISRA C++ rule violations • AUTOSAR-CPP14 for AUTOSAR C++14 rule violations • JSF for JSF®++ rule violations • CUSTOM for violations of custom coding rules <p>To specify all analysis results, use the asterisk character * : *.</p>

Field	Allowed Value
<i>Result_name</i>	<p>For DEFECT, use short names of checkers. See “Short Names of Bug Finder Defect Checkers” on page 2-12.</p> <p>For RTE, use short names of run-time checks. See “Short Names of Code Prover Run-Time Checks” (Polyspace Code Prover Access).</p> <p>For CODE-METRICS, use short names of code complexity metrics. See “Short Names of Code Complexity Metrics” on page 2-29.</p> <p>For VARIABLE, the only allowed value is the asterisk character " *".</p> <p>For coding standard violations, specify the rule number or numbers.</p> <p>To specify all parts of a result name [MISRA2012:17.*] or all result names in a family [DEFECT:*], use the asterisk character.</p>
<i>Status</i>	<p>Text to indicate how you intend to address the error in your code. This value populates the Status column in the Results List pane as:</p> <ul style="list-style-type: none"> • Unreviewed • To investigate • To fix • Justified • No action planned • Not a defect • Other <p>Polyspace Access removes results annotated with status Justified, No action planned, or Not a defect from the list of Open Issues in subsequent analyses.</p>

Field	Allowed Value
<i>Severity</i>	Text to indicate how critical you consider the error in your code. This value populates the Severity column in the Results List pane as: <ul style="list-style-type: none"> • Unset • High • Medium • Low
<i>Comment</i>	Additional text, such as a keyword or an explanation for the status and severity. This value populates the Comment column in the Results List pane.

Syntax Examples

Annotate a Single Defect

Enter an annotation on the same line as the defect and specify the *Family* (DEFECT) and the *Result_name* (INT_OVFL). When you do not specify a status, Polyspace assigns the status `No action planned` and the result is considered **Done** in subsequent analyses.

```
int var = INT_MAX;
var++; /* polyspace DEFECT:INT_OVFL */
```

Annotate a Single Coding Standard Violation

Justify a coding standard violation, for instance, a CERT-C violation.

Enter an annotation on the same line as the violation and specify the *Family* (CERT-C) and the *Result_name* (the rule number, for instance, STR31-C). Assign the status `Justified`, severity `Low` and a comment.

```
code; /* polyspace CERT-C:STR31-C [Justified:Low] "Overflow cannot happen" */
```

Annotate All MISRA C: 2012 Violations Over Multiple Lines

Enter an annotation with `+n` between `polyspace` and the *Family:Result_name* entries. The annotation applies to the same line and the `n` following lines.

This annotation applies to lines 4-7. The line count includes code, comments, and blank lines.

```
4. code ; // polyspace +3 MISRA2012:*  
5. //comment  
6.  
7. code;  
8. code;
```

Annotate All Code Metrics on Function

To annotate function-level code complexity metrics, in the function definition, enter an annotation on the same line as the function name.

This annotation suppresses all code complexity metrics for function `func`:

```
char func(char param) { //polyspace CODE-METRICS:*  
    ...  
}
```

Specify Multiple Families in the Same Annotation

Enter each family separated by a space. This annotation applies to all MISRA C:2012 rules 17 and to all run-time checks.

```
some code; /* polyspace MISRA2012:17.* RTE:* */
```

Specify Multiple Result Names in the Same Annotation

After you specify the *Family* (DEFECT), enter each *Result_name* separated by a comma.

```
system("rm ~/.config"); /* polyspace DEFECT:UNSAFE_SYSTEM_CALL,RETURN_NOT_CHECKED */
```

Add Explanatory Comments to Annotation

After you specify a *Family* and a *Result_name*, you can add a *Comment* with additional information for your justification. You can provide a comment for all families and result names, or a comment for each family or result name.


```
//Single comment
code; /* polyspace DEFECT:BAD_FREE MISRA2004:* "OK Defect and MISRA" */
//Multiple comments incorrect syntax:
code; /* polyspace DEFECT:* "OK defect" MISRA2004:5.2 "OK MISRA" */
//Multiple comments correct syntax:
code; /* polyspace DEFECT:* "OK defect" polyspace MISRA2004:5.2 "OK MISRA" */
```

In annotations, Polyspace ignores all text following double quotes. To specify additional *Family:Result_name*, *[Status:Severity]* or *Comment* entries, you must reenter the keyword polyspace after text in double quotes.

Set Status and Severity

You can specify allowed values on page 2-5 or enter custom values for status and severity.

```
//Set Status only
code; /* polyspace DEFECT:* [To fix] "some comment" */

//Set Status 'To fix' and Severity 'High'
code; /* polyspace VARIABLE:* [To fix: High] "some comment"*/

//Set custom status 'Assigned' and Severity 'Medium'
code; /* polyspace MISRA2012:12.* [Assigned: Medium] */
```

See Also

More About

- “Define Custom Annotation Format” on page 2-37
- “Short Names of Bug Finder Defect Checkers” on page 2-12
- “Short Names of Code Complexity Metrics” on page 2-29

Short Names of Bug Finder Defect Checkers

To justify defects through code annotations, use the command-line names, or short names, listed in the following table.

You can also enable the detection of a specific defect by using its short name as argument of the `-checkers` option. Instead of listing individual defects, you can also specify groups of defects by the group name, for instance, `numerical`, `data_flow`, and so on. See analysis option `Find defects (-checkers)` in the documentation for Polyspace Bug Finder or Polyspace Bug Finder Server.

Defect	Command-line Name
*this not returned in copy assignment operator	RETURN_NOT_REF_TO_THIS
Abnormal termination of exit handler	EXIT_ABNORMAL_HANDLER
Absorption of float operand	FLOAT_ABSORPTION
Accessing object with temporary lifetime	TEMP_OBJECT_ACCESS
Alignment changed after memory reallocation	ALIGNMENT_CHANGE
Alternating input and output from a stream without flush or positioning call	IO_INTERLEAVING
Ambiguous declaration syntax	MOST_VEXING_PARSE
Arithmetic operation with NULL pointer	NULL_PTR_ARITH
Array access out of bounds	OUT_BOUND_ARRAY
Array access with tainted index	TAINTED_ARRAY_INDEX
Assertion	ASSERT

Defect	Command-line Name
Atomic load and store sequence not atomic	ATOMIC_VAR_SEQUENCE_NOT_ATOMIC
Atomic variable accessed twice in an expression	ATOMIC_VAR_ACCESS_TWICE
Bad file access mode or status	BAD_FILE_ACCESS_MODE_STATUS
Bad order of dropping privileges	BAD_PRIVILEGE_DROP_ORDER
Base class assignment operator not called	MISSING_BASE_ASSIGN_OP_CALL
Base class destructor not virtual	DTOR_NOT_VIRTUAL
Bitwise and arithmetic operation on the same data	BITWISE_ARITH_MIX
Bitwise operation on negative value	BITWISE_NEG
Blocking operation while holding lock	BLOCKING_WHILE_LOCKED
Buffer overflow from incorrect string format specifier	STR_FORMAT_BUFFER_OVERFLOW
C++ reference to const-qualified type with subsequent modification	WRITE_REFERENCE_TO_CONST_TYPE
C++ reference type qualified with const or volatile	CV_QUALIFIED_REFERENCE_TYPE
Call through non-prototyped function pointer	UNPROTOTYPED_FUNC_CALL
Call to memset with unintended value	MEMSET_INVALID_VALUE

Defect	Command-line Name
Character value absorbed into EOF	CHAR_EOF_CONFUSED
Closing a previously closed resource	DOUBLE_RESOURCE_CLOSE
Code deactivated by constant false condition	DEACTIVATED_CODE
Command executed from externally controlled path	TAINTED_PATH_CMD
Constant block cipher initialization vector	CRYPTO_CIPHER_CONSTANT_IV
Constant cipher key	CRYPTO_CIPHER_CONSTANT_KEY
Context initialized incorrectly for cryptographic operation	CRYPTO_PKEY_INCORRECT_INIT
Context initialized incorrectly for digest operation	CRYPTO_MD_BAD_FUNCTION
Conversion or deletion of incomplete class pointer	INCOMPLETE_CLASS_PTR
Copy constructor not called in initialization list	MISSING_COPY_CTOR_CALL
Copy of overlapping memory	OVERLAPPING_COPY
Copy operation modifying source operand	COPY_MODIFYING_SOURCE
Data race	DATA_RACE
Data race including atomic operations	DATA_RACE_ALL

Defect	Command-line Name
Data race through standard library function call	DATA_RACE_STD_LIB
Dead code	DEAD_CODE
Deadlock	DEADLOCK
Deallocation of previously deallocated pointer	DOUBLE_DEALLOCATION
Declaration mismatch	DECL_MISMATCH
Delete of void pointer	DELETE_OF_VOID_PTR
Destination buffer overflow in string manipulation	STRLIB_BUFFER_OVERFLOW
Destination buffer underflow in string manipulation	STRLIB_BUFFER_UNDERFLOW
Destruction of locked mutex	DESTROY_LOCKED
Deterministic random output from constant seed	RAND_SEED_CONSTANT
Double lock	DOUBLE_LOCK
Double unlock	DOUBLE_UNLOCK
Environment pointer invalidated by previous operation	INVALID_ENV_POINTER
Errno not checked	ERRNO_NOT_CHECKED
Errno not reset	MISSING_ERRNO_RESET
Exception caught by value	EXCP_CAUGHT_BY_VALUE
Exception handler hidden by previous handler	EXCP_HANDLER_HIDDEN

Defect	Command-line Name
Execution of a binary from a relative path can be controlled by an external actor	RELATIVE_PATH_CMD
Execution of externally controlled command	TAINTED_EXTERNAL_CMD
File access between time of check and use (TOCTOU)	TOCTOU
File descriptor exposure to child process	FILE_EXPOSURE_TO_CHILD
File manipulation after chroot without chdir	CHROOT_MISUSE
Float conversion overflow	FLOAT_CONV_OVFL
Float division by zero	FLOAT_ZERO_DIV
Floating point comparison with equality operators	BAD_FLOAT_OP
Float overflow	FLOAT_OVFL
Format string specifiers and arguments mismatch	STRING_FORMAT
Function called from signal handler not asynchronous-safe	SIG_HANDLER_ASYNC_UNSAFE
Function called from signal handler not asynchronous-safe (strict)	SIG_HANDLER_ASYNC_UNSAFE_STRICT
Function pointer assigned with absolute address	FUNC_PTR_ABSOLUTE_ADDR

Defect	Command-line Name
Function that can spuriously fail not wrapped in loop	SPURIOUS_FAILURE_NOT_WRAPPED_IN_LOOP
Function that can spuriously wake up not wrapped in loop	SPURIOUS_WAKEUP_NOT_WRAPPED_IN_LOOP
Hard-coded buffer size	HARD_CODED_BUFFER_SIZE
Hard-coded loop boundary	HARD_CODED_LOOP_BOUNDARY
Hard-coded object size used to manipulate memory	HARD_CODED_MEM_SIZE
Host change using externally controlled elements	TAINTED_HOSTID
Improper array initialization	IMPROPER_ARRAY_INIT
Inappropriate I/O operation on device files	INAPPROPRIATE_IO_ON_DEVICE
Incompatible padding for RSA algorithm operation	CRYPTO_RSA_BAD_PADDING
Incompatible types prevent overriding	VIRTUAL_FUNC_HIDING
Inconsistent cipher operations	CRYPTO_CIPHER_BAD_FUNCTION
Incorrect data type passed to va_arg	VA_ARG_INCORRECT_TYPE
Incorrect key for cryptographic algorithm	CRYPTO_PKEY_INCORRECT_KEY
Incorrect order of network connection operations	BAD_NETWORK_CONNECT_ORDER

Defect	Command-line Name
Incorrect pointer scaling	BAD_PTR_SCALING
Incorrect type data passed to va_start	VA_START_INCORRECT_TYPE
Incorrect use of offsetof in C++	OFFSETOF_MISUSE
Incorrect use of va_start	VA_START_MISUSE
Incorrect syntax of flexible array member size	FLEXIBLE_ARRAY_MEMBER_INCORRECT_SIZE
Information leak via structure padding	PADDING_INFO_LEAK
Inline constraint not respected	INLINE_CONSTRAINT_NOT_RESPECTED
Integer constant overflow	INT_CONSTANT_OVFL
Integer conversion overflow	INT_CONV_OVFL
Integer division by zero	INT_ZERO_DIV
Integer overflow	INT_OVFL
Integer precision exceeded	INT_PRECISION_EXCEEDED
Invalid assumptions about memory organization	INVALID_MEMORY_ASSUMPTION
Invalid deletion of pointer	BAD_DELETE
Invalid file position	INVALID_FILE_POS
Invalid free of pointer	BAD_FREE
Invalid use of = (assignment) operator	BAD_EQUAL_USE

Defect	Command-line Name
Invalid use of == (equality) operator	BAD_EQUAL_EQUAL_USE
Invalid use of standard library floating point routine	FLOAT_STD_LIB
Invalid use of standard library integer routine	INT_STD_LIB
Invalid use of standard library memory routine	MEM_STD_LIB
Invalid use of standard library routine	OTHER_STD_LIB
Invalid use of standard library string routine	STR_STD_LIB
Invalid va_list argument	INVALID_VA_LIST_ARG
Large pass-by-value argument	PASS_BY_VALUE
Library loaded from externally controlled path	TAINTED_PATH_LIB
Line with more than one statement	MORE_THAN_ONE_STATEMENT
Load of library from a relative path can be controlled by an external actor	RELATIVE_PATH_LIB
Loop bounded with tainted value	TAINTED_LOOP_BOUNDARY
Member not initialized in constructor	NON_INIT_MEMBER
Memory allocation with tainted size	TAINTED_MEMORY_ALLOC_SIZE
Memory comparison of float-point values	MEMCMP_FLOAT

Defect	Command-line Name
Memory comparison of padding data	MEMCMP_PADDING_DATA
Memory comparison of strings	MEMCMP_STRINGS
Memory leak	MEM_LEAK
Mismatch between data length and size	DATA_LENGTH_MISMATCH
Mismatched alloc/dealloc functions on Windows	WIN_MISMATCH_DEALLOC
Missing blinding for RSA algorithm	CRYPTO_RSA_NO_BLINDING
Missing block cipher initialization vector	CRYPTO_CIPHER_NO_IV
Missing break of switch case	MISSING_SWITCH_BREAK
Missing byte reordering when transferring data	MISSING_BYTESWAP
Missing case for switch condition	MISSING_SWITCH_CASE
Missing cipher algorithm	CRYPTO_CIPHER_NO_ALGORITHM
Missing cipher data to process	CRYPTO_CIPHER_NO_DATA
Missing cipher final step	CRYPTO_CIPHER_NO_FINAL
Missing cipher key	CRYPTO_CIPHER_NO_KEY
Missing data for encryption, decryption or signing operation	CRYPTO_PKEY_NO_DATA
Missing explicit keyword	MISSING_EXPLICIT_KEYWORD
Missing lock	BAD_UNLOCK
Missing null in string array	MISSING_NULL_CHAR

Defect	Command-line Name
Missing overload of allocation or deallocation function	MISSING_OVERLOAD_NEW_DELETE_PAIR
Missing padding for RSA algorithm	CRYPTO_RSA_NO_PADDING
Missing parameters for key generation	CRYPTO_PKEY_NO_PARAMS
Missing peer key	CRYPTO_PKEY_NO_PEER
Missing private key	CRYPTO_PKEY_NO_PRIVATE_KEY
Missing public key	CRYPTO_PKEY_NO_PUBLIC_KEY
Missing reset of a freed pointer	MISSING_FREED_PTR_RESET
Missing return statement	MISSING_RETURN
Missing unlock	BAD_LOCK
Missing virtual inheritance	MISSING_VIRTUAL_INHERITANCE
Misuse of a FILE object	FILE_OBJECT_MISUSE
Misuse of errno	ERRNO_MISUSE
Misuse of errno in a signal handler	SIG_HANDLER_ERRNO_MISUSE
Misuse of narrow or wide character string	NARROW_WIDE_STR_MISUSE
Misuse of readlink()	READLINK_MISUSE
Misuse of return value from nonreentrant standard function	NON_REENTRANT_STD_RETURN
Misuse of sign-extended character value	CHARACTER_MISUSE
Misuse of structure with flexible array member	FLEXIBLE_ARRAY_MEMBER_STRUCT_MISUSE

Defect	Command-line Name
Modification of internal buffer returned from nonreentrant standard function	WRITE_INTERNAL_BUFFER_RETURNED_FROM_STD_FUNC
Non-initialized pointer	NON_INIT_PTR
Non-initialized variable	NON_INIT_VAR
Nonsecure hash algorithm	CRYPTO_MD_WEAK_HASH
Nonsecure parameters for key generation	CRYPTO_PKEY_WEAK_PARAMS
Nonsecure RSA public exponent	CRYPTO_RSA_LOW_EXPONENT
Nonsecure SSL/TLS protocol	CRYPTO_SSL_WEAK_PROTOCOL
Null pointer	NULL_PTR
Object slicing	OBJECT_SLICING
Opening previously opened resource	DOUBLE_RESOURCE_OPEN
Overlapping assignment	OVERLAPPING_ASSIGN
Partially accessed array	PARTIALLY_ACCESSED_ARRAY
Partial override of overloaded virtual functions	PARTIAL_OVERRIDE
Pointer access out of bounds	OUT_BOUND_PTR
Pointer dereference with tainted offset	TAINED_PTR_OFFSET
Pointer or reference to stack variable leaving scope	LOCAL_ADDR_ESCAPE

Defect	Command-line Name
Pointer to non-initialized value converted to const pointer	NON_INIT_PTR_CONV
Possible invalid operation on boolean operand	INVALID_OPERATION_ON_BOOLEAN
Possible misuse of sizeof	SIZEOF_MISUSE
Possibly unintended evaluation of expression because of operator precedence rules	OPERATOR_PRECEDENCE
Precision loss in integer to float conversion	INT_TO_FLOAT_PRECISION_LOSS
Predefined macro used as an object	MACRO_USED_AS_OBJECT
Predictable block cipher initialization vector	CRYPTO_CIPHER_PREDICTABLE_IV
Predictable cipher key	CRYPTO_CIPHER_PREDICTABLE_KEY
Predictable random output from predictable seed	RAND_SEED_PREDICTABLE
Preprocessor directive in macro argument	PRE_DIRECTIVE_MACRO_ARG
Privilege drop not verified	MISSING_PRIVILEGE_DROP_CHECK
Qualifier removed in conversion	QUALIFIER_MISMATCH
Resource leak	RESOURCE_LEAK

Defect	Command-line Name
Returned value of a sensitive function not checked	RETURN_NOT_CHECKED
Return from computational exception signal handler	SIG_HANDLER_COMP_EXCP_RETURN
Return of non const handle to encapsulated data member	BREAKING_DATA_ENCAPSULATION
Self assignment not tested in operator	MISSING_SELF_ASSIGN_TEST
Sensitive data printed out	SENSITIVE_DATA_PRINT
Sensitive heap memory not cleared before release	SENSITIVE_HEAP_NOT_CLEARED
Shared data access within signal handler	SIG_HANDLER_SHARED_OBJECT
Shift of a negative value	SHIFT_NEG
Shift operation overflow	SHIFT_OVFL
Side effect in arguments to unsafe macro	SIDE_EFFECT_IN_UNSAFE_MACRO_ARG
Side effect of expression ignored	SIDE_EFFECT_IGNORED
Signal call from within signal handler	SIG_HANDLER_CALLING_SIGNAL
Signal call in multithreaded program	SIGNAL_USE_IN_MULTITHREADED_PROGRAM
Sign change integer conversion overflow	SIGN_CHANGE
Standard function call with incorrect arguments	STD_FUNC_ARG_MISMATCH

Defect	Command-line Name
Static uncalled function	UNCALLED_FUNC
Stream argument with possibly unintended side effects	STREAM_WITH_SIDE_EFFECT
Subtraction or comparison between pointers to different arrays	PTR_TO_DIFF_ARRAY
Tainted division operand	TAINTED_INT_DIVISION
Tainted modulo operand	TAINTED_INT_MOD
Tainted NULL or non-null-terminated string	TAINTED_STRING
Tainted sign change conversion	TAINTED_SIGN_CHANGE
Tainted size of variable length array	TAINTED_VLA_SIZE
Tainted string format	TAINTED_STRING_FORMAT
Thread-specific memory leak	THREAD_MEM_LEAK
Too many va_arg calls for current argument list	TOO_MANY_VA_ARG_CALLS
Typedef mismatch	TYPEDEF_MISMATCH
Umask used with chmod-style arguments	BAD_UMASK
Uncleared sensitive data in stack	SENSITIVE_STACK_NOT_CLEARED
Universal character name from token concatenation	PRE_UCNAME_JOIN_TOKENS
Unprotected dynamic memory allocation	UNPROTECTED_MEMORY_ALLOCATION
Unreachable code	UNREACHABLE

Defect	Command-line Name
Unreliable cast of function pointer	FUNC_CAST
Unreliable cast of pointer	PTR_CAST
Unsafe call to a system function	UNSAFE_SYSTEM_CALL
Unsafe conversion between pointer and integer	BAD_INT_PTR_CAST
Unsafe conversion from string to numerical value	UNSAFE_STR_TO_NUMERIC
Unsafe standard encryption function	UNSAFE_STD_CRYPT
Unsafe standard function	UNSAFE_STD_FUNC
Unsigned integer constant overflow	UINT_CONSTANT_OVFL
Unsigned integer conversion overflow	UINT_CONV_OVFL
Unsigned integer overflow	UINT_OVFL
Unused parameter	UNUSED_PARAMETER
Useless if	USELESS_IF
Use of automatic variable as putenv-family function argument	PUTENV_AUTO_VAR
Use of dangerous standard function	DANGEROUS_STD_FUNC
Use of externally controlled environment variable	TAINTED_ENV_VARIABLE

Defect	Command-line Name
Use of indeterminate string	INDETERMINATE_STRING
Use of memset with size argument zero	MEMSET_INVALID_SIZE
Use of non-secure temporary file	NON_SECURE_TEMP_FILE
Use of obsolete standard function	OBSOLETE_STD_FUNC
Use of path manipulation function without maximum sized buffer checking	PATH_BUFFER_OVERFLOW
Use of plain char type for numerical value	BAD_PLAIN_CHAR_USE
Use of previously closed resource	CLOSED_RESOURCE_USE
Use of previously freed pointer	FREED_PTR
Use of setjmp/longjmp	SETJMP_LONGJMP_USE
Use of signal to kill thread	THREAD_KILLED_WITH_SIGNAL
Use of tainted pointer	TAINTED_PTR
Variable length array with nonpositive size	NON_POSITIVE_VLA_SIZE
Variable shadowing	VAR_SHADOWING
Vulnerable path manipulation	PATH_TRAVERSAL
Vulnerable permission assignments	DANGEROUS_PERMISSIONS
Vulnerable pseudo-random number generator	VULNERABLE_PRNG
Weak cipher algorithm	CRYPTO_CIPHER_WEAK_CIPHER
Weak cipher mode	CRYPTO_CIPHER_WEAK_MODE

Defect	Command-line Name
Weak padding for RSA algorithm	CRYPTO_RSA_WEAK_PADDING
Write without a further read	USELESS_WRITE
Writing to const qualified object	CONSTANT_OBJECT_WRITE
Writing to read-only resource	READ_ONLY_RESOURCE_WRITE
Wrong allocated object size for cast	OBJECT_SIZE_MISMATCH
Wrong type used in sizeof	PTR_SIZEOF_MISMATCH

See Also

More About

- “Annotate Code and Hide Known or Acceptable Results” on page 2-5

Short Names of Code Complexity Metrics

When annotating your code to justify metrics or creating custom software quality objectives, you use short names of code complexity metrics instead of the full names. The following table lists the short names for code complexity metrics.

Note that you can only annotate your code for function level code complexity metrics only.

Project Metrics

Code Metric	Acronym
Number of Direct Recursions	AP_CG_DIRECT_CYCLE
Number of Header Files	INCLUDES
Number of Files	FILES
Number of Protected Shared Variables (Code Prover only)	PSHV
Number of Recursions	AP_CG_CYCLE
Number of Potentially Unprotected Shared Variables (Code Prover only)	UNPSHV
Program Maximum Stack Usage (Code Prover only)	PROG_MAX_STACK
Program Minimum Stack Usage (Code Prover only)	PROG_MIN_STACK

File Metrics

Code Metric	Acronym
Comment Density	COMF
Estimated Function Coupling	FCO
Number of Lines	TOTAL_LINES
Number of Lines Without Comment	LINES_WITHOUT_CMT

Function Metrics

Code Metric	Acronym
Cyclomatic Complexity	VG
Higher Estimate of Local Variable Size	LOCAL_VARS_MAX
Language Scope	VOCF
Language Scope	LOCAL_VARS_MIN
Minimum Stack Usage (Code Prover only)	MIN_STACK
Maximum Stack Usage (Code Prover only)	MAX_STACK
Number of Call Levels	LEVEL
Number of Call Occurrences	NCALLS
Number of Called Functions	CALLS
Number of Calling Functions	CALLING
Number of Executable Lines	FXLN
Number of Function Parameters	PARAM
Number of Goto Statements	GOTO
Number of Instructions	STMT
Number of Lines Within Body	FLIN
Number of Local Non-Static Variables	LOCAL_VARS
Number of Local Static Variables	LOCAL_STATIC_VARS
Number of Paths	PATH
Number of Return Statements	RETURN

See Also

More About

- “Annotate Code and Hide Known or Acceptable Results” on page 2-5

Annotate Code for Known or Acceptable Results (Not Recommended)

Note Starting R2017b, Polyspace uses a simpler annotation format. See “Annotate Code and Hide Known or Acceptable Results” on page 2-5.

If Polyspace finds defects in your code that you cannot or will not fix, you can add annotations to your code. These annotations are code comments that indicate known or acceptable defects or coding rule violations. By using these annotations, you can:

- Avoid reviewing defects or coding rule violations from previous analyses.
- Preserve review comments and classifications.

Note Source code annotations do not apply to code comments. You cannot annotate these rules:

- MISRA C:2004 Rules 2.2 and 2.3
 - MISRA C:2012 Rules 3.1 and 3.2
 - MISRA-C++ Rule 2-7-1
 - JSF++ Rules 127 and 133
-

Add Annotations Manually

This method shows you how to enter comments directly into your source files by using the Polyspace code annotation syntax. The syntax is not case-sensitive and applies to the first uncommented line of C/C++ code following the annotation.

- 1 Open your source file in an editor and locate the line or section of code that you want to annotate.
- 2 Add one of the following annotations:
 - For a single line of code, add the following text directly before the line of code that you want to annotate.

```
/* polyspace<Type:Kind1[,Kind2] : [Severity] : [Status] > [Notes] */
```

- For a section of code, use the following syntax.

```
/* polyspace:begin<Type:Kind1[,Kind2] : [Severity] : [Status] > [Notes] */
... Code section ...
/* polyspace:end<Type:Kind1[,Kind2] : [Severity] : [Status] > */
```

If a macro expands to multiple lines, use the syntax for code sections even though the macro itself covers one line. The single-line syntax applies only to results that appear in the first line of the expanded macro.

- 3 Replace the words *Type*, *Kind1*, *[Kind2]*, *[Severity]*, *[Status]*, and *[Additional text]* with allowed values, indicated in the following table. The text with square brackets *[]* is optional and you can delete it. See “Syntax Examples” on page 2-35.

Word	Allowed Values
<i>Type</i>	The type of results: <ul style="list-style-type: none"> • Defect (Polyspace Bug Finder) • RTE, for run-time checks (Polyspace Code Prover) • VARIABLE, for global variables (Polyspace Code Prover) • CODE-METRIC, for code complexity metrics. • MISRA-C, for MISRA C:2004 • MISRA-AC-AGC • MISRA-C3, for MISRA C:2012 • MISRA-CPP • JSF • Custom, for custom coding rule violations.

Word	Allowed Values
<i>Kind1,</i> <i>[Kind2],...</i>	<p>For defects, run-time checks and code metrics, use the short names of checkers. See:</p> <ul style="list-style-type: none">• “Short Names of Bug Finder Defect Checkers” on page 2-12• “Short Names of Code Prover Run-Time Checks” (Polyspace Code Prover Access)• “Short Names of Code Complexity Metrics” on page 2-29 <p>For coding rule violations, specify the rule number or numbers.</p> <p>For global variables, the only allowed value is ALL.</p> <p>If you want the comment to apply to all possible defects or coding rules, specify ALL.</p>
<i>Severity</i>	<p>Text that indicates how critical you consider the defect. Enter one of the following:</p> <ul style="list-style-type: none">• Unset• High• Medium• Low <p>This text populates the Severity column on the Results List pane.</p>

Word	Allowed Values
<i>Status</i>	<p>Text that indicates how you intend to correct the error in your code. Enter one of the following or any other text:</p> <ul style="list-style-type: none"> • Unreviewed • To investigate • To fix • Justified • No action planned • Not a defect • Other <p>This text populates the Status column on the Results List pane. The status is also used in Polyspace Access to determine whether a result is Done. To justify a result, use Justified, No action planned or Not a defect.</p>
<i>Notes</i>	Additional comments, such as a keyword or an explanation for the status and severity.

Syntax Examples

- A single defect:

```
/* polyspace<Defect:HARD_CODED_BUFFER_SIZE:Medium:To investigate> Known issue */
int table[100];
```

- A single run-time check:

```
/* polyspace<RTE: ZDV : High : To Fix > Denominator cannot be zero */
y=1/x;
```

- A MISRA C:2012 rule violation:

```
/* polyspace<MISRA-C3: 13.1 : Low : Justified> Known issue */
int arr[2] = {x++,y};
```

- Unused global variable:

```
/* polyspace<VARIABLE: ALL : Low : Justified> Variable to use later*/
int var_unused;
```

- Multiple defects:

```
polyspace<Defect:USELESS_WRITE,DEAD_CODE:Low:No Action Planned> OK issue
```

- Multiple JSF rule violations:
polyspace<JSF:9,13:Low:Justified> Known issue

Define Custom Annotation Format

This example shows how to create and edit an XML file to define an annotation format and map it to the Polyspace annotation syntax.

To get started, copy the following code to a text editor and save it on your machine as `annotations_description.xml`.

```
<?xml version="1.0" encoding="UTF-8"?>
<Annotations xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="annotations_xml_schema.xsd"
  Group="example XML">

  <Expressions Search_For_Keywords="myKeyword"
    Separator_Result_Name=" " >
    <!-- Define annotation format in this
      section by adding <Expression/> elements -->

    <Expression Mode="SAME_LINE"
      Regex="myKeyword\s+(\w+(\s*,\s*\w+)*)"
      Rule_Identifier_Position="1"
    />

    <Expression Mode="GOTO_INCREMENT"
      Regex="myKeyword\s+(\w+\d+\s)(\w+(\s*,\s*\w+)*)"
      Increment_Position="1"
      Rule_Identifier_Position="2"
    />

    <Expression Mode="BEGIN"
      Regex="myKeyword\s*(\w+(\s*,\s*\w+)*)\s*Block_on"
      Rule_Identifier_Position="1"
      Case_Insensitive="true"
    />

    <Expression Mode="END"
      Regex="myKeyword\s*(\w+(\s*,\s*\w+)*)\s*Block_off"
      Rule_Identifier_Position="1"
    />

    <Expression Mode="END_ALL"
      Regex="myKeyword\sBlock_off_all"
    />

    <Expression Mode="SAME_LINE"

    Regex="myKeywords\s+(\w+(\s*,\s*\w+)*)
    (\s*\[(\w+\s*)*([:]\s*(\w+\s*)+)*\])*(\s*-*\s*)*([\^]*)(\s*.*)*"
    Rule_Identifier_Position="1"
    Status_Position="4"
    Severity_Position="6"
    Comment_Position="8"
    />

    <! -- Put the regular expression on a single line instead of two line
    when you copy it to a text editor -->

    <!-- SAME_LINE example with more complex regular expression.
      Matches the following annotations:
      //myKeywords 50 [my_status:my_severity] -Additional comment-
      //myKeywords 50 [my_status]
      //myKeywords 50 [:my_severity]
      //myKeywords 50 -Additional comment-
      -->

  </Expressions>
</Mapping>
```

```

<!-- Map your annotation syntax to the Polyspace annotation
syntax by adding <Result_Name_Mapping /> elements in this section -->

<Result_Name_Mapping Rule_Identifier="100" Family="DEFECT" Result_Name="INT_ZERO_DIV"/>

<Result_Name_Mapping Rule_Identifier="50" Family="MISRA-C3" Result_Name="8.4"/>
<Result_Name_Mapping Rule_Identifier="51" Family="MISRA-C3" Result_Name="8.7"/>
<Result_Name_Mapping Rule_Identifier="ALL_MISRA" Family="MISRA-C3" Result_Name="*" />
</Mapping>
</Annotations>

```

The XML file consists of two parts:

- `<Expressions>...</Expressions>` where you define the format of your annotation syntax.
- `<Mapping>...</Mapping>` where you map your syntax to the Polyspace annotation syntax.

After you edit this file, Polyspace can interpret your custom code annotation when you invoke the option `-xml-annotations-description`. For more on analysis options, see the documentation for Polyspace Bug Finder or Polyspace Bug Finder Server .

Define Annotation Syntax Format

To define an annotation syntax in Polyspace, your syntax must follow a pattern that you can represent with a regular expression. See Regular Expressions. It is recommended that you include a keyword in the pattern of your annotation syntax to help identify it. In this example, the keyword is `myKeyword`. Set the attribute `Search_For_Keywords` equal to this keyword.

Once you know the pattern of your annotation, you can define it in the XML by adding an `<Expression/>` element and specifying at least the attributes `Mode`, `Regex`, and `Rule_Identifier_Position`. For instance, the first `<Expression/>` element in `annotations_description.xml` defines an annotation with these attributes:

- `Mode="SAME_LINE"`. The annotation applies to code on the same line.
- `Regex="myKeyword\s+(\w+(\s*,\s*\w+)*)"`. Polyspace uses the regular expression to search for a string that begins with `myKeyword`, followed by a space `\s+`. Polyspace then searches for a capturing group `(\w+(\s*,\s*\w+)*)` that includes an alphanumeric rule identifier `\w+` and, optionally, additional comma-separated rule identifiers `(\s*,\s*\w+)*`.

- `Rule_Identifier_Position="1"`. The integer value of this attribute corresponds to the number of opening parentheses preceding the relevant capturing group in the regular expression. In `myKeyword\s+(\w+(\s*,\s*\w+)*)`, one opening parenthesis precedes the capturing group of the rule identifier (`\w+(\s*,\s*\w+)*`). If you want to match rule identifiers captured by `(\s*,\s*\w+)`, then you set `Rule_Identifier_Position="2"` because two opening parentheses precede this capturing group.

The list of attributes and their values are listed in this table. The example column refers to the format defined in `annotations_description.xml`.

Attribute	Use	Value	Example
Mode	Required	SAME_LINE	Applies only on the same line as the annotation. <code>code; //myKeyword 100</code>
		GOTO_INCREMENT	Applies on the same line as the annotation and the following n lines: <ol style="list-style-type: none"> 3. <code>code; // myKeyword +3 ALL_MISRA</code> 4. <code>/*comments */</code> 5. 6. <code>code;</code> 7. <code>code;</code> The preceding annotation applies to lines 3-6 only.
		BEGIN	Applies to the same line and all following lines until a corresponding expression with attribute <code>Mode="END"</code> or <code>"END_ALL"</code> , or until the end of the file. <code>//myKeyword 50, 51 Block_on</code> <code>Code block 1;</code> ...

Attribute	Use	Value	Example
		END	<p>Stops the application of a rule identifier declared by a corresponding expression with attribute Mode="BEGIN".</p> <pre>//myKeyword 50, 51 Block_on Code block 1; ... More code; //myKeyword 50 Block_off</pre> <p>Only rule identifier 50 is turned off. Rule identifier 51 still applies.</p>
		END_ALL	<p>Stops all rule identifiers declared by an expression with attribute Mode="BEGIN".</p> <pre>//myKeyword 50, 51 Block_on Code block 1; ... More code; //myKeyword Block_off_all</pre> <p>Rule identifiers 50 and 51 are turned off.</p>
Regex	Required	Regular expression search string	<p>See Regular Expressions. Regex="myKeyword\s+(\w+(\s*,\s*\w+)*)" matches these expressions:</p> <pre>// myKeyword 50, 51 /* myKeyword ALL_MISRA, 100 */</pre>

Attribute	Use	Value	Example
Rule_Identifier_Position	Required, except when you set Mode="END_ALL"	Integer	<p>The integer value of this attribute corresponds to the number of opening parentheses in the regular expression before the relevant search expression.</p> <pre data-bbox="872 487 1341 630"><Expression Mode="GOTO_INCREMENT" Regex="myKeyword\s+(\+\d+\s) (\w+(\s*,\s*\w+)*)" Increment_Position="1" Rule_Identifier_Position="2"/></pre> <hr/> <p>Note Enter the regex expression on a single line when you edit your XML file.</p> <hr/> <p>The search expression for the rule identifier <code>\w+(\s*,\s*\w+)*</code> is after the second opening parenthesis of the regular expression.</p>

Attribute	Use	Value	Example
Increment_Position	Required only when you set Mode="GOTO_INCREMENT"	Integer	<p>The integer value of this attribute corresponds to the number of opening parentheses in the regular expression before the relevant search expression.</p> <pre><Expression Mode="GOTO_INCREMENT" Regex="myKeyword\s+(\+\d+\s) (\w+(\s*,\s*\w+)*)" Increment_Position="1" Rule_Identifier_Position="2"/></pre> <p>Note Enter the regex expression on a single line when you edit your XML file.</p> <p>The search expression for the increment <code>\+\d+\s</code> is after the first opening parenthesis of the regular expression.</p>
Status_Position	Optional	Integer	See Increment_Position example. When you use this attribute, the entry in your annotation is displayed in the Status column on the Results List pane of the user interface.
Severity_Position	Optional	Integer	See Increment_Position example. When you use this attribute, the entry in your annotation is displayed in the Severity column on the Results List pane of the user interface.

Attribute	Use	Value	Example
Comment_Position	Optional	Integer	See Increment_Position example. When you use this attribute, the entry in your annotation is displayed in the Comment column on the Results List pane of the user interface. Your comment is appended to the string <code>Justified by annotation in source:</code>
Case_Insensitive	Optional	True or false	When you set this attribute to "true", the regular expression is case insensitive, otherwise it is case sensitive. If you do not declare this attribute in your expression, the regular expression is case sensitive. For <code>Case_Insensitive="true"</code> , these annotations are equivalent: <pre>//MYKEYWORD ALL_MISRA BLOCK_ON //mykeyword all_misra block_on</pre>

Map Your Annotation to the Polyspace Annotation Syntax

After you define your annotation format, you can map the rule identifiers you are using to their corresponding Polyspace annotation syntax. You can do this mapping by adding an `<Result_Name_Mapping/>` element and specifying attributes `Rule_Identifier`, `Family`, and `Result_Name`. For instance, if rule identifier 50 corresponds to MISRA C: 2012 rule 8.4, map it to the Polyspace syntax `MISRA-C3:8.4` by using this element:

```
<Result_Name_Mapping Rule_Identifier="50" Family="MISRA-C3" Result_Name="8.4"/>
```

The list of attributes and their values are listed in this table. The example column refers to the format defined in `annotations_description.xml`.

Attribute	Use	Value	Example
Rule_Identifier	Required	User defined	See the mapping section of annotations_description.xml
Family	Required	Corresponds to Polyspace results family. For a list of allowed values, see allowed values on page 2-5.	See the mapping section of annotations_description.xml
Result_Name	Required	Corresponds to Polyspace result names. For a list of allowed values, see allowed values on page 2-5.	See the mapping section of annotations_description.xml

See Also

“Annotation Description Full XML Template” on page 2-46

More About

- “Annotate Code and Hide Known or Acceptable Results” on page 2-5

Annotation Description Full XML Template

This table lists all the elements, attributes, and values of the XML that you can use to define an annotation format and map it to the Polyspace annotation syntax. For an example of how to edit an XML to define annotation syntax, see “Define Custom Annotation Format” on page 2-37.

Element	Attribute	Use	Value
Annotations	Group	Required	User defined string. For example, "Custom Annotations"
Expressions	Search_For_Keywords	Required	User defined string. This string is a keyword you include in the pattern of your annotation syntax to help identify it. For example, "myKeyword"
	Separator_Result_Name	Required	User defined string. This string is a separator when you list multiple Polyspace result names in the same annotation. For example ","
	Separator_Family_And_Result_Name	Optional	User defined string. This string is a separator when you list multiple Polyspace results families in the same annotation. For example, " "

Element	Attribute	Use	Value
	Separator_Family	Optional	User defined string. This string is a separator when you list a Polyspace results family and results name in the same annotation. For example, ":"
Expression	Mode	Required	SAME_LINE
			GOTO_INCREMENT
			BEGIN
			END
			END_ALL
			NEXT_CODE_LINE
			The annotation applies to the next line of code. Comments and blank lines are ignored.
			GOTO_LABEL
			LABEL
			XML_START
XML_CONTENT			
The annotation for this expression must be on a single line.			
XML_END			
	Regex	Required	Regular expression search string that matches the pattern of your annotation.

Element	Attribute	Use	Value
	Rule_Identifier_Position	Required, except when you set Mode="END_ALL" or "LABEL"	Integer. The integer value of this attribute corresponds to the number of opening parentheses in the regular expression before the relevant search expression.
	Increment_Position	Required only when you set Mode="GOTO_INCREMENT"	Integer. The integer value of this attribute corresponds to the number of opening parentheses in the regular expression before the relevant search expression.
	Status_Position	Optional	Integer. The integer value of this attribute corresponds to the number of opening parentheses in the regular expression before the relevant search expression.
	Severity_Position	Optional	Integer. The integer value of this attribute corresponds to the number of opening parentheses in the regular expression before the relevant search expression.

Element	Attribute	Use	Value
	Comment_Position	Optional	Integer. The integer value of this attribute corresponds to the number of opening parentheses in the regular expression before the relevant search expression.
	Label_Position	Required only when you set Mode="GOTO_LABEL" or "LABEL"	Integer. The integer value of this attribute corresponds to the number of opening parentheses in the regular expression before the relevant search expression.
	Case_Insensitive	Optional	True or false. When you do not declare this attribute, the default value is false.
	Is_Pragma	Optional	True or false. When you do not declare this attribute, the default value is false. Set this attribute to true if you want to declare your annotation using a pragma instead of a comment.

Element	Attribute	Use	Value
	Applies_Also_On_Same_Line	Optional	True or false. When you do not declare this attribute, the default value is true. Use this attribute to enable annotations with the old Polyspace syntax to apply on the same line of code.
Mapping	None	None	None
Result_Name_Mapping	Rule_Identifier	Required	User defined
	Family	Required	Corresponds to Polyspace results family. For a list of allowed values, see allowed values on page 2-5.
	Result_Name	Required	Corresponds to Polyspace result names. For a list of allowed values, see allowed values on page 2-5.

Example

This example code covers some of the less commonly used attributes for defining annotations in XML.


```

<?xml version="1.0" encoding="UTF-8"?>

<Annotations xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="annotations_xml_schema.xsd"
  Group="XML Template">

  <Expressions Separator_Result_Name=", "
    Search_For_Keywords="myKeyword">

    <Expression Mode="GOTO_LABEL"
      Regex="(\A|\W)myKeyword\s+S\s+(\d+(\s*,\s*\d+)*)\s+([a-zA-Z_]\w+)"
      Rule_Identifier_Position="2"
      Label_Position="4"

      />

    <Expression Mode="LABEL"
      Regex="(\A|\W)myKeyword\s:L:(\w+)"
      Label_Position="2"

      />

    <!-- Annotation applies starting current line until
      next declaration of label word "myLabel"
      Example:

      code; // myKeyword S 100 myLabel
      ...
      more code;
      // myKeyword L myLabel
    -->

    <Expression Mode="BEGIN"
      Regex="#\s*pragma\s+myKeyword_MESSAGES_ON\s+(\w+)"
      Rule_Identifier_Position="1"
      Is_Pragma="true"
      />

    <!-- Annotation declared with pragma instead of comment
      Example:#pragma myKeyword_MESSAGES_ON 100 -->

    <!-- Comment declaration with XML format-->

    <!-- XML_START must be declared before XML_CONTENT -->
    <Expression Mode="XML_START"
      Regex="\s*myKeyword_COMMENT\s*"

      />

    <!-- Example: <myKeyword_COMMENT> -->

    <Expression Mode="XML_CONTENT"
      Regex="\s*(\d*)\s*>(((?![*/])(?!<).)*)</\s*(\d*)\s*"
      Rule_Identifier_Position="1"
      Comment_Position="2"

      />

    <!-- Example: <100>This is my comment</100>
      XML_CONTENT must be declare on a single line.

      <100>This is my comment
      </100>
      is incorrect.
  </Expressions>
</Annotations>

```

```
-->
  <Expression Mode="XML_END"
             Regex="</\s*myKeyword_COMMENT\s*>"
             />
  <!--      Example: </myKeyword_COMMENT> -->
</Expressions>

<Mapping>
  <Result_Name_Mapping Rule_Identifier="100" Family="MISRA-C" Result_Name="4.1"/>
</Mapping>
</Annotations>
```

See Also

More About

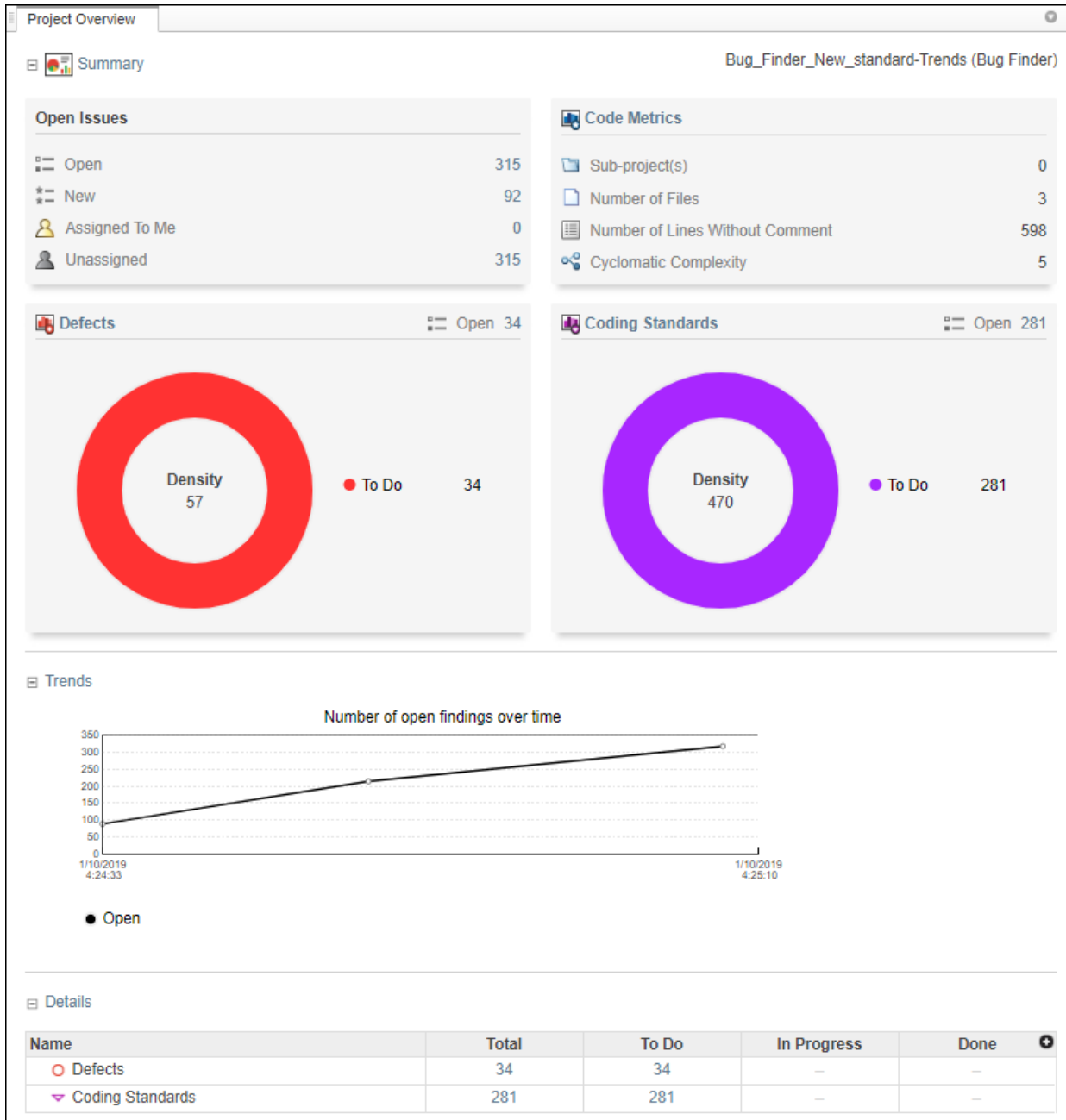
- “Annotate Code and Hide Known or Acceptable Results” on page 2-5

Manage Results

- “Filter and Sort Results” on page 3-2
- “Classification of Defects by Impact” on page 3-7
- “Bug Finder Defect Groups” on page 3-19

Filter and Sort Results

When you open the results of a Polyspace analysis in the **DASHBOARD** view of Polyspace Access, you see statistics about your project in the **Project Overview** dashboard. The statistics cover findings for defects (Bug Finder), run-time checks (Code Prover), coding rule violations or other results. To organize your review, you can narrow down the list or group results by file or result type.



Some of the ways you can use filtering are:

- You can display certain types of defects or run-time checks only.

For instance, for a Bug Finder analysis, you can display only high-impact defects. See “Classification of Defects by Impact” on page 3-7.

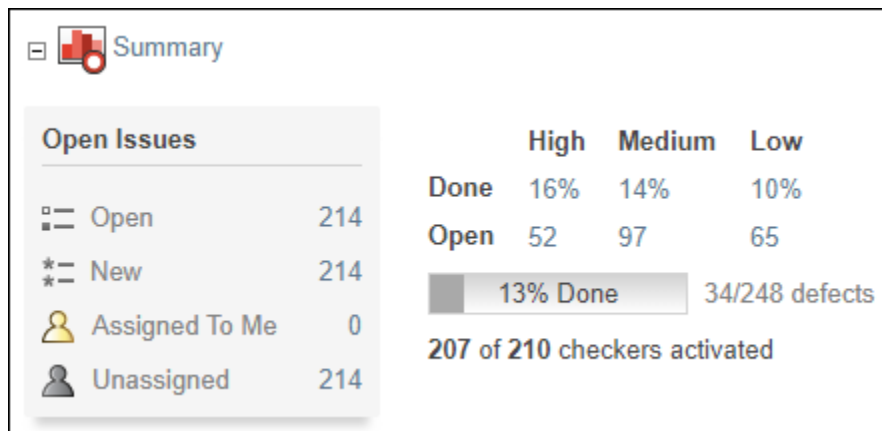
- You can display only new results found since the last analysis.
- You can display only the results that you have not justified. Results that are not justified are considered **Open**. They are results with status Unreviewed, To Investigate, To Fix, or Other.

For information on justification, see “Address Polyspace Results Through Bug Fixes or Comments” on page 2-2.

Filter Results

You can filter results by drilling down on a set of results in a dashboard, or directly in the **Results List** pane by using the **REVIEW** toolstrip filters.

Filter Using Dashboards

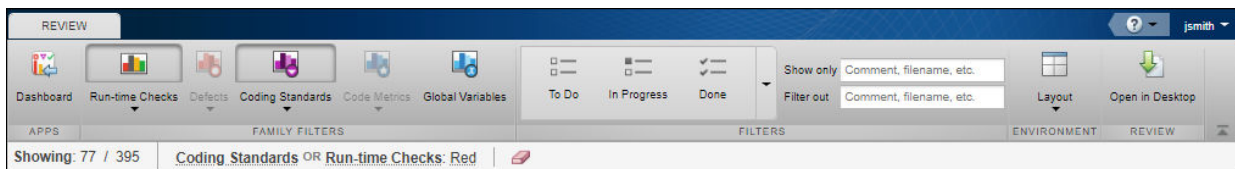


In the **DASHBOARD** view, you can open dashboards for different families of results, then click a number to open a list filtered to the corresponding set of results. For instance:

- To see only high-impact defects that are still **Open** in a Bug Finder analysis, click the corresponding number in the **Summary** section of the **Defects** dashboard. **Open** results have status Unreviewed, To Investigate, To Fix, or Other.
- To see only red checks that are **Done** in a Code Prover analysis, click the corresponding number in the **Summary** section of the **Run-time Checks** dashboard. **Done** results have status Justified, No Action Planned, or Not A Defect.
- To see violations of the MISRAC C:2012 coding standards in a particular file, use the table in the **Details** section of the **MISRA C:2012** dashboard.

If you select a folder that contains multiple projects in the **PROJECT EXPLORER**, the dashboards display an aggregate of results for all the projects. Most of the fields in the dashboard are not clickable when you look at the statistics for multiple projects.

Filter Using REVIEW Toolstrip



In the **REVIEW** view, you can filter using the buttons in the toolstrip. The filter bar underneath the toolstrip shows how many findings are displayed out of the total findings, along with which filters are currently applied.

The buttons in the **FILTERS** section of the toolstrip are global. They apply to all families of findings. To filter out by the content of a column in the “Results List” on page 1-19, right-click the content of the column for that result.

If you do not want to filter by the exact contents of a column, you can use the **Show only** and **Filter out** text filters instead. For instance, you want to filter out subfolders of a

specific folder. Instead of filtering out the full folder path using the right-click menu, then sorting the **Folder** and **Filter out** filters.

Filters you apply do not carry over to the next analysis.

See Also

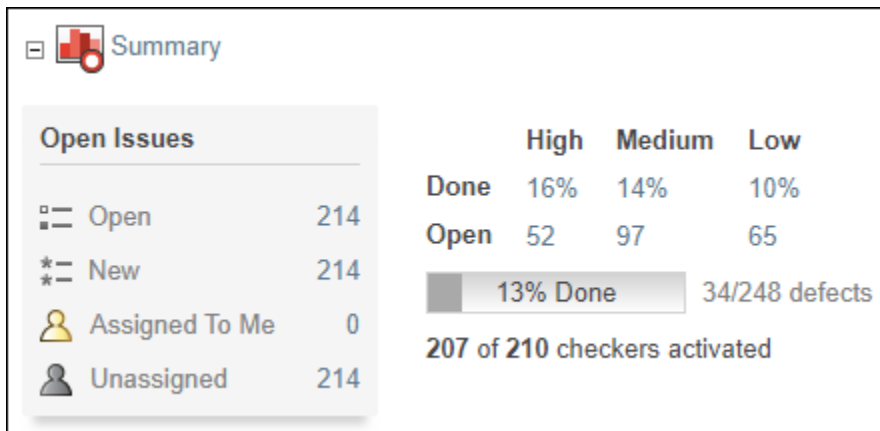
More About

- “Classification of Defects by Impact” on page 3-7

Classification of Defects by Impact

To prioritize your review of Polyspace Bug Finder defects, you can use the **Impact** attribute assigned to the defect. This attribute appears on:

- The **Summary** section of the **Defects** dashboard.



You can view at a glance whether you have many high impact defects, and how many defects are still open. Open defects are defects that have a status **Unreviewed**, **To Investigate**, **To Fix**, or **Other**. You can click a number to open the corresponding set of results in the **Results List** pane. See “Filter and Sort Results” on page 3-2.

- The **Results List** pane, in the **REVIEW** view. Use the drop-down selection under the **Defects** button in the toolbar.

You can filter out low and/or medium impact defects using this button. See “Filter and Sort Results” on page 3-2.

- The **Result Details** pane, beside the defect name.

The impact is assigned to a defect based on the following considerations:

- Criticality, or whether the defect is likely to cause a code failure.

If a defect is likely to cause a code to fail, it is treated as a high impact defect. If the defect currently does not cause code failure but can cause problems with code maintenance in the future, it is a low impact defect.

- Certainty, or the rate of false positives.

For instance, the defect **Integer division by zero** is a high-impact defect because it is almost certain to cause a code crash. On the other hand, the defect **Dead code** has low impact because by itself, presence of dead code does not cause code failure. However, the dead code can hide other high-impact defects.

You cannot change the impact assigned to a defect.

High Impact Defects

The following list shows the high-impact defects.

Concurrency

- Data race
- Data race through standard library function call
- Deadlock
- Double lock
- Double unlock
- Missing unlock

Data Flow

- Non-initialized pointer
- Non-initialized variable

Dynamic Memory

- Deallocation of previously deallocated pointer
- Invalid deletion of pointer
- Invalid free of pointer
- Use of previously freed pointer

Numerical

- Absorption of float operand
- Float conversion overflow

- Float division by zero
- Integer conversion overflow
- Integer division by zero
- Invalid use of standard library floating point routine
- Invalid use of standard library integer routine

Object Oriented

- Base class assignment operator not called
- Copy constructor not called in initialization list
- Object slicing

Programming

- Assertion
- Character value absorbed into EOF
- Declaration mismatch
- Errno not reset
- Invalid use of == (equality) operator
- Invalid use of standard library routine
- Invalid va_list argument
- Misuse of errno
- Misuse of narrow or wide character string
- Misuse of return value from nonreentrant standard function
- Possible misuse of sizeof
- Possibly unintended evaluation of expression because of operator precedence rules
- Typedef mismatch
- Variable length array with nonpositive size
- Writing to const qualified object
- Wrong type used in sizeof

Resource Management

- Closing a previously closed resource
- Resource leak
- Use of previously closed resource
- Writing to read-only resource

Security

- Bad order of dropping privileges
- Privilege drop not verified
- Returned value of a sensitive function not checked
- Unsafe call to a system function
- Use of non-secure temporary file

Static Memory

- Array access out of bounds
- Buffer overflow from incorrect string format specifier
- Destination buffer overflow in string manipulation
- Destination buffer underflow in string manipulation
- Invalid use of standard library memory routine
- Invalid use of standard library string routine
- Null pointer
- Pointer access out of bounds
- Pointer or reference to stack variable leaving scope
- Subtraction or comparison between pointers to different arrays
- Use of automatic variable as putenv-family function argument
- Use of path manipulation function without maximum sized buffer checking
- Wrong allocated object size for cast

Medium Impact Defects

The following list shows the medium-impact defects.

Concurrency

- Atomic load and store sequence not atomic
- Atomic variable accessed twice in an expression
- Data race including atomic operations
- Destruction of locked mutex
- Missing lock
- Thread-specific memory leak

Cryptography

- Constant block cipher initialization vector
- Constant cipher key
- Context initialized incorrectly for cryptographic operation
- Context initialized incorrectly for digest operation
- Incompatible padding for RSA algorithm operation
- Inconsistent cipher operations
- Incorrect key for cryptographic algorithm
- Missing blinding for RSA algorithm
- Missing block cipher initialization vector
- Missing cipher algorithm
- Missing cipher data to process
- Missing cipher final step
- Missing cipher key
- Missing data for encryption, decryption or signing operation
- Missing padding for RSA algorithm
- Missing parameters for key generation
- Missing peer key
- Missing private key
- Missing public key
- Nonsecure hash algorithm
- Nonsecure parameters for key generation

- Nonsecure RSA public exponent
- Nonsecure SSL/TLS protocol
- Predictable block cipher initialization vector
- Predictable cipher key
- Weak cipher algorithm
- Weak cipher mode
- Weak padding for RSA algorithm

Data Flow

- Pointer to non-initialized value converted to const pointer
- Unreachable code
- Useless if

Dynamic Memory

- Memory leak

Numerical

- Bitwise operation on negative value
- Integer constant overflow
- Integer overflow
- Sign change integer conversion overflow
- Use of plain char type for numerical value

Object Oriented

- Base class destructor not virtual
- Conversion or deletion of incomplete class pointer
- Copy operation modifying source operand
- Incompatible types prevent overriding
- Member not initialized in constructor
- Missing virtual inheritance
- Partial override of overloaded virtual functions

- Return of non const handle to encapsulated data member
- Self assignment not tested in operator

Programming

- Abnormal termination of exit handler
- Bad file access mode or status
- Call through non-prototyped function pointer
- Copy of overlapping memory
- Environment pointer invalidated by previous operation
- Exception caught by value
- Exception handler hidden by previous handler
- Floating point comparison with equality operators
- Function called from signal handler not asynchronous-safe
- Function called from signal handler not asynchronous-safe (strict)
- Improper array initialization
- Incorrect data type passed to va_arg
- Incorrect pointer scaling
- Incorrect type data passed to va_start
- Incorrect use of offsetof in C++
- Incorrect use of va_start
- Inline constraint not respected
- Invalid assumptions about memory organization
- Invalid file position
- Invalid use of = (assignment) operator
- Memory comparison of padding data
- Memory comparison of strings
- Missing byte reordering when transferring data
- Misuse of errno in a signal handler
- Misuse of sign-extended character value
- Shared data access within signal handler

- Side effect in arguments to unsafe macro
- Signal call from within signal handler
- Standard function call with incorrect arguments
- Too many `va_arg` calls for current argument list
- Unsafe conversion between pointer and integer
- Use of indeterminate string
- Use of `memset` with size argument zero

Resource Management

- Opening previously opened resource

Security

- Deterministic random output from constant seed
- `Errno` not checked
- Execution of a binary from a relative path can be controlled by an external actor
- File access between time of check and use (TOCTOU)
- File descriptor exposure to child process
- File manipulation after `chroot` without `chdir`
- Inappropriate I/O operation on device files
- Incorrect order of network connection operations
- Load of library from a relative path can be controlled by an external actor
- Mismatch between data length and size
- Misuse of `readlink()`
- Predictable random output from predictable seed
- Sensitive data printed out
- Sensitive heap memory not cleared before release
- Uncleared sensitive data in stack
- Unsafe standard encryption function
- Unsafe standard function

- Vulnerable permission assignments
- Vulnerable pseudo-random number generator

Static Memory

- Unreliable cast of function pointer
- Unreliable cast of pointer

Tainted Data

- Array access with tainted index
- Command executed from externally controlled path
- Execution of externally controlled command
- Host change using externally controlled elements
- Library loaded from externally controlled path
- Loop bounded with tainted value
- Memory allocation with tainted size
- Tainted sign change conversion
- Tainted size of variable length array
- Use of externally controlled environment variable

Low Impact Defects

The following list shows the low-impact defects.

Concurrency

- Blocking operation while holding lock
- Function that can spuriously fail not wrapped in loop
- Function that can spuriously wake up not wrapped in loop
- Signal call in multithreaded program
- Use of signal to kill thread

Data Flow

- Code deactivated by constant false condition

- Dead code
- Missing return statement
- Partially accessed array
- Static uncalled function
- Variable shadowing
- Write without a further read

Dynamic Memory

- Alignment changed after memory reallocation
- Mismatched alloc/dealloc functions on Windows
- Unprotected dynamic memory allocation

Good Practice

- Ambiguous declaration syntax
- Bitwise and arithmetic operation on a same data
- C++ reference to const-qualified type with subsequent modification
- C++ reference type qualified with const or volatile
- Delete of void pointer
- Hard coded buffer size
- Hard coded loop boundary
- Hard-coded object size used to manipulate memory
- Incorrect syntax of flexible array member size
- Large pass-by-value argument
- Line with more than one statement
- Missing break of switch case
- Missing overload of allocation or deallocation function
- Missing reset of a freed pointer
- Unused parameter
- Use of setjmp/longjmp

Numerical

- Float overflow
- Integer precision exceeded
- Possible invalid operation on boolean operand
- Precision loss from integer to float conversion
- Shift of a negative value
- Shift operation overflow
- Unsigned integer constant overflow
- Unsigned integer conversion overflow
- Unsigned integer overflow

Object Oriented

- *this not returned in copy assignment operator
- Missing explicit keyword

Programming

- Accessing object with temporary lifetime
- Alternating input and output from a stream without flush or positioning call
- Call to memset with unintended value
- Format string specifiers and arguments mismatch
- Memory comparison of float-point values
- Missing null in string array
- Misuse of a FILE object
- Misuse of structure with flexible array member
- Modification of internal buffer returned from nonreentrant standard function
- Overlapping assignment
- Predefined macro used as an object
- Preprocessor directive in macro argument
- Qualifier removed in conversion

- Return from computational exception signal handler
- Side effect of expression ignored
- Stream argument with possibly unintended side effects
- Universal character name from token concatenation
- Unsafe string to numeric value conversion

Security

- Function pointer assigned with absolute address
- Information leak via structure padding
- Missing case for switch condition
- Umask used with chmod-style arguments
- Use of dangerous standard function
- Use of obsolete standard function
- Vulnerable path manipulation

Static Memory

- Arithmetic operation with NULL pointer

Tainted Data

- Pointer dereference with tainted offset
- Tainted division operand
- Tainted modulo operand
- Tainted NULL or non-null-terminated string
- Tainted string format
- Use of tainted pointer

See Also

More About

- “Filter and Sort Results” on page 3-2

Bug Finder Defect Groups

In this section...

“Concurrency” on page 3-19
“Cryptography” on page 3-20
“Data flow” on page 3-20
“Dynamic Memory” on page 3-21
“Good Practice” on page 3-21
“Numerical” on page 3-21
“Object Oriented” on page 3-22
“Programming” on page 3-22
“Resource Management” on page 3-22
“Static Memory” on page 3-23
“Security” on page 3-23
“Tainted data” on page 3-23

For convenience, the defect checkers in Bug Finder are classified into various groups.

- In certain projects, you can choose to focus only on specific groups of defects. Specify the group name for the option `Find defects (-checkers)`. See the documentation for Polyspace Bug Finder or Polyspace Bug Finder Server.
- When reviewing results, you can review all results of a certain group together. Filter out other results during review. See “Manage Results”.

This topic gives an overview of the various groups.

Concurrency

These defects are related to multitasking code.

Data Race Defects

The data race defects occur when multiple tasks operate on a shared variable or call a nonreentrant standard library function without protection.

For the specific defects, see “Concurrency Defects”.

Command-Line Parameter: concurrency

Locking Defects

The locking defects occur when the critical sections are not set up appropriately. For example:

- The critical sections are involved in a deadlock.
- A lock function does not have the corresponding unlock function.
- A lock function is called twice without an intermediate call to an unlock function.

Critical sections protect shared variables from concurrent access. Polyspace expects critical sections to follow a certain format. The critical section must lie between a call to a lock function and a call to an unlock function.

For the specific defects, see “Concurrency Defects”.

Command-Line Parameter: concurrency

Cryptography

These defects are related to incorrect use of cryptography routines from the OpenSSL library. For instance:

- Use of cryptographically weak algorithms
- Absence of essential elements such as cipher key or initialization vector
- Wrong order of cryptographic operations

For the specific defects, see “Cryptography Defects”.

Command-Line Parameter: cryptography

Data flow

These defects are errors relating to how information moves throughout your code. The defects include:

- Dead or unreachable code
- Unused code

- Non-initialized information

For the specific defects, see “Data Flow Defects”.

Command-Line Parameter: data_flow

Dynamic Memory

These defects are errors relating to memory usage when the memory is dynamically allocated. The defects include:

- Freeing dynamically allocated memory
- Unprotected memory allocations

For specific defects, see “Dynamic Memory Defects”.

Command-Line Parameter: dynamic_memory

Good Practice

These defects allow you to observe good coding practices. The defects by themselves might not cause a crash, but they sometimes highlight more serious logic errors in your code. The defects also make your code vulnerable to attacks and hard to maintain.

The defects include:

- Hard-coded constants such as buffer size and loop boundary
- Unused function parameters

For specific defects, see “Good Practice Defects”.

Command-Line Parameter: good_practice

Numerical

These defects are errors relating to variables in your code; their values, data types, and usage. The defects include:

- Mathematical operations

- Conversion overflow
- Operational overflow

For specific defects, see “Numerical Defects”.

Command-Line Parameter: `numerical`

Object Oriented

These defects are related to the object-oriented aspect of C++ programming. The defects highlight class design issues or issues in the inheritance hierarchy.

The defects include:

- Data member not initialized or incorrectly initialized in constructor
- Incorrect overriding of base class methods
- Breaking of data encapsulation

For specific defects, see “Object Oriented Defects”.

Command-Line Parameter: `object_oriented`

Programming

These defects are errors relating to programming syntax. These defects include:

- Assignment versus equality operators
- Mismatches between variable qualifiers or declarations
- Badly formatted strings

For specific defects, see “Programming Defects”.

Command-Line Parameter: `programming`

Resource Management

These defects are related to file handling. The defects include:

- Unclosed file stream

- Operations on a file stream after it is closed

For specific defects, see “Resource Management Defects”.

Command-Line Parameter: `resource_management`

Static Memory

These defects are errors relating to memory usage when the memory is statically allocated. The defects include:

- Accessing arrays outside their bounds
- Null pointers
- Casting of pointers

For specific defects, see “Static Memory Defects”.

Command-Line Parameter: `static_memory`

Security

These defects highlight places in your code which are vulnerable to hacking or other security attacks. Many of these defects do not cause runtime errors, but instead point out risky areas in your code. The defects include:

- Managing sensitive data
- Using dangerous or obsolete functions
- Generating random numbers
- Externally controlled paths and commands

For more details about specific defects, see “Security Defects”.

Command-Line Parameter: `security`

Tainted data

These defects highlight elements in your code which are from unsecured sources. Malicious attackers can use input data or paths to attack your program and cause

failures. These defects highlight elements in your code that are vulnerable. Defects include:

- Use of tainted variables or pointers
- Externally controlled paths

For more details about specific defects, see “Tainted Data Defects”.

Command-Line Parameter: tainted_data

See Also

Coding Rule Sets and Concepts

- “Polyspace MISRA C 2004 and MISRA AC AGC Checkers” on page 4-2
- “MISRA C:2004 and MISRA AC AGC Coding Rules” on page 4-3
- “Polyspace MISRA C:2012 Checkers” on page 4-50
- “Essential Types in MISRA C: 2012 Rules 10.x” on page 4-52
- “Unsupported MISRA C:2012 Guidelines” on page 4-55
- “Polyspace MISRA C++ Checkers” on page 4-56
- “Unsupported MISRA C++ Coding Rules” on page 4-57
- “Polyspace JSF C++ Checkers” on page 4-62
- “JSF C++ Coding Rules” on page 4-63

Polyspace MISRA C 2004 and MISRA AC AGC Checkers

The Polyspace MISRA C:2004 checker helps you comply with the MISRA C 2004 coding standard.¹

When MISRA C rules are violated, the MISRA C checker enables Polyspace software to provide messages with information about the rule violations. Most messages are reported during the compile phase of an analysis.

The MISRA C checker can check nearly all of the **142** MISRA C:2004 rules.

The MISRA AC AGC checker checks rules from the OBL (obligatory) and REC (recommended) categories specified by *MISRA AC AGC Guidelines for the Application of MISRA-C:2004 in the Context of Automatic Code Generation*.

There are subsets of MISRA coding rules that can have a direct or indirect impact on the selectivity (reliability percentage) of your results. When you set up rule checking, you can select these subsets directly. These subsets are defined in:

- “Software Quality Objective Subsets (C:2004)” on page 1-38
- “Software Quality Objective Subsets (AC AGC)” on page 1-44

Note The Polyspace MISRA checker is based on MISRA C:2004, which also incorporates MISRA C Technical Corrigendum.

See Also

More About

- “MISRA C:2004 and MISRA AC AGC Coding Rules” on page 4-3

1. MISRA and MISRA C are registered trademarks of MIRA Ltd., held on behalf of the MISRA Consortium.

MISRA C:2004 and MISRA AC AGC Coding Rules

In this section...

“Supported MISRA C:2004 and MISRA AC AGC Rules” on page 4-3

“Troubleshooting” on page 4-3

“List of Supported Coding Rules” on page 4-4

“Unsupported MISRA C:2004 and MISRA AC AGC Rules” on page 4-47

Supported MISRA C:2004 and MISRA AC AGC Rules

The following tables list MISRA C:2004 coding rules that the Polyspace coding rules checker supports. Details regarding how the software checks individual rules and any limitations on the scope of checking are described in the “Polyspace Specification” column.

Note The Polyspace coding rules checker:

- Supports MISRA-C:2004 Technical Corrigendum 1 for rules 4.1, 5.1, 5.3, 6.1, 6.3, 7.1, 9.2, 10.5, 12.6, 13.5, and 15.0.
 - Checks rules specified by *MISRA AC AGC Guidelines for the Application of MISRA-C:2004 in the Context of Automatic Code Generation*.
-

The software reports most violations during the compile phase of an analysis. However, the software detects violations of rules 9.1 (Non-initialized variable), 12.11 (one of the overflow checks) using `-scalar-overflows-checks signed-and-unsigned`), 13.7 (dead code), 14.1 (dead code), 16.2 and 21.1 during code analysis, and reports these violations as run-time errors.

Note Some violations of rules 13.7 and 14.1 are reported during the compile phase of analysis.

Troubleshooting

If you expect a rule violation but do not see it, check out .

List of Supported Coding Rules

- “Environment” on page 4-5
- “Language Extensions” on page 4-7
- “Documentation” on page 4-8
- “Character Sets” on page 4-8
- “Identifiers” on page 4-9
- “Types” on page 4-10
- “Constants” on page 4-12
- “Declarations and Definitions” on page 4-12
- “Initialization” on page 4-15
- “Arithmetic Type Conversion” on page 4-17
- “Pointer Type Conversion” on page 4-22
- “Expressions” on page 4-23
- “Control Statement Expressions” on page 4-27
- “Control Flow” on page 4-31
- “Switch Statements” on page 4-34
- “Functions” on page 4-35
- “Pointers and Arrays” on page 4-37
- “Structures and Unions” on page 4-38
- “Preprocessing Directives” on page 4-38
- “Standard Libraries” on page 4-43
- “Runtime Failures” on page 4-47

Environment

N.	MISRA Definition	Messages in report file	Polyspace Specification
1.1	All code shall conform to ISO 9899:1990 "Programming languages - C", amended and corrected by ISO/IEC 9899/COR1:1995, ISO/IEC 9899/AMD1:1995, and ISO/IEC 9899/COR2:1996.	<p>The text <i>All code shall conform to ISO 9899:1990 Programming languages C, amended and corrected by ISO/IEC 9899/COR1:1995, ISO/IEC 9899/AMD1:1995, and ISO/IEC 9899/COR2:1996</i> precedes each of the following messages:</p> <ul style="list-style-type: none"> • ANSI® C does not allow '#include_next' • ANSI C does not allow macros with variable arguments list • ANSI C does not allow '#assert' • ANSI C does not allow '#unassert' • ANSI C does not allow testing assertions • ANSI C does not allow '#ident' • ANSI C does not allow '#sccs' • text following '#else' violates ANSI standard. • text following '#endif' violates ANSI standard. • text following '#else' or '#endif' violates ANSI standard. 	All the supported extensions lead to a violation of this MISRA rule. Standard compilation error messages do not lead to a violation of this MISRA rule and remain unchanged.

N.	MISRA Definition	Messages in report file	Polyspace Specification
1.1 (cont.)		<p>The text <i>All code shall conform to ISO 9899:1990 Programming languages C, amended and corrected by ISO/IEC 9899/COR1:1995, ISO/IEC 9899/AMD1:1995, and ISO/IEC 9899/COR2:1996</i> precedes each of the following messages:</p> <ul style="list-style-type: none"> • ANSI C90 forbids 'long long int' type. • ANSI C90 forbids 'long double' type. • ANSI C90 forbids long long integer constants. • Keyword 'inline' should not be used. • Array of zero size should not be used. • Integer constant does not fit within unsigned long int. • Integer constant does not fit within long int. • Too many nesting levels of #includes: N_1. The limit is N_0. • Too many macro definitions: N_1. The limit is N_0. • Too many nesting levels for control flow: N_1. The limit is N_0. 	

N.	MISRA Definition	Messages in report file	Polyspace Specification
		<ul style="list-style-type: none"> Too many enumeration constants: N_1. The limit is N_0. 	

Language Extensions

N.	MISRA Definition	Messages in report file	Polyspace Specification
2.1	Assembly language shall be encapsulated and isolated.	Assembly language shall be encapsulated and isolated.	No warnings if code is encapsulated in the following: <ul style="list-style-type: none"> asm functions or asm pragma Macros
2.2	Source code shall only use /* */ style comments	C++ comments shall not be used.	C++ comments are handled as comments but lead to a violation of this MISRA rule Note: This rule cannot be annotated in the source code.
2.3	The character sequence /* shall not be used within a comment	The character sequence /* shall not appear within a comment.	This rule violation is also raised when the character sequence /* inside a C++ comment. Note: This rule cannot be annotated in the source code.

Documentation

Rule	MISRA Definition	Messages in report file	Polyspace Specification
3.4	All uses of the <i>#pragma</i> directive shall be documented and explained.	All uses of the <i>#pragma</i> directive shall be documented and explained.	To check this rule, you must list the pragmas that are allowed in source files by using the option <code>Allowed pragmas (-allowed-pragmas)</code> . If Polyspace finds a pragma not in the allowed pragma list, a violation is raised. For more on analysis options, see the documentation for Polyspace Bug Finder or Polyspace Bug Finder Server

Character Sets

N.	MISRA Definition	Messages in report file	Polyspace Specification
4.1	Only those escape sequences which are defined in the ISO C standard shall be used.	<code>\<character></code> is not an ISO C escape sequence Only those escape sequences which are defined in the ISO C standard shall be used.	
4.2	Trigraphs shall not be used.	Trigraphs shall not be used.	Trigraphs are handled and converted to the equivalent character but lead to a violation of the MISRA rule

Identifiers

N.	MISRA Definition	Messages in report file	Polyspace Specification
5.1	Identifiers (internal and external) shall not rely on the significance of more than 31 characters	Identifier 'XX' should not rely on the significance of more than 31 characters.	All identifiers (global, static and local) are checked. For easier review, the rule checker shows all identifiers that have the same first 31 characters as one rule violation. You can see all instances of conflicting identifier names in the event history of that rule violation.
5.2	Identifiers in an inner scope shall not use the same name as an identifier in an outer scope, and therefore hide that identifier.	<ul style="list-style-type: none"> • Local declaration of XX is hiding another identifier. • Declaration of parameter XX is hiding another identifier. 	Assumes that rule 8.1 is not violated.
5.3	A typedef name shall be a unique identifier	{typedef name}'%s' should not be reused. (already used as {typedef name} at %s:%d)	Warning when a typedef name is reused as another identifier name.
5.4	A tag name shall be a unique identifier	{tag name}'%s' should not be reused. (already used as {tag name} at %s:%d)	Warning when a tag name is reused as another identifier name
5.5	No object or function identifier with a static storage duration should be reused.	{static identifier/parameter name}'%s' should not be reused. (already used as {static identifier/parameter name} with static storage duration at %s:%d)	Warning when a static name is reused as another identifier name Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.

N.	MISRA Definition	Messages in report file	Polyspace Specification
5.6	No identifier in one name space should have the same spelling as an identifier in another name space, with the exception of structure and union member names.	{member name}'%s' should not be reused. (already used as {member name} at %s:%d)	Warning when an idf in a namespace is reused in another namespace
5.7	No identifier name should be reused.	{identifier}'%s' should not be reused. (already used as {identifier} at %s:%d)	No violation reported when: <ul style="list-style-type: none"> • Different functions have parameters with the same name • Different functions have local variables with the same name • A function has a local variable that has the same name as a parameter of another function

Types

N.	MISRA Definition	Messages in report file	Polyspace Specification
6.1	The plain char type shall be used only for the storage and use of character values	Only permissible operators on plain chars are '=', '==' or '!=' operators, explicit casts to integral types and '?' (for the 2nd and 3rd operands)	Warning when a plain char is used with an operator other than =, ==, !=, explicit casts to integral types, or as the second or third operands of the ? operator.

N.	MISRA Definition	Messages in report file	Polyspace Specification
6.2	Signed and unsigned char type shall be used only for the storage and use of numeric values.	<ul style="list-style-type: none"> • Value of type plain char is implicitly converted to signed char. • Value of type plain char is implicitly converted to unsigned char. • Value of type signed char is implicitly converted to plain char. • Value of type unsigned char is implicitly converted to plain char. 	Warning if value of type plain char is implicitly converted to value of type signed char or unsigned char.
6.3	<i>typedefs</i> that indicate size and signedness should be used in place of the basic types	typedefs that indicate size and signedness should be used in place of the basic types.	No warning is given in typedef definition.
6.4	Bit fields shall only be defined to be of type <i>unsigned int</i> or <i>signed int</i> .	Bit fields shall only be defined to be of type unsigned int or signed int.	
6.5	Bit fields of type <i>signed int</i> shall be at least 2 bits long.	Bit fields of type signed int shall be at least 2 bits long.	No warning on anonymous signed int bitfields of width 0 - Extended to all signed bitfields of size ≤ 1 (if Rule 6.4 is violated).

Constants

N.	MISRA Definition	Messages in report file	Polyspace Specification
7.1	Octal constants (other than zero) and octal escape sequences shall not be used.	<ul style="list-style-type: none"> • Octal constants other than zero and octal escape sequences shall not be used. • Octal constants (other than zero) should not be used. • Octal escape sequences should not be used. 	

Declarations and Definitions

N.	MISRA Definition	Messages in report file	Polyspace Specification
8.1	Functions shall have prototype declarations and the prototype shall be visible at both the function definition and call.	<ul style="list-style-type: none"> • Function XX has no complete prototype visible at call. • Function XX has no prototype visible at definition. 	Prototype visible at call must be complete.
8.2	Whenever an object or function is declared or defined, its type shall be explicitly stated	Whenever an object or function is declared or defined, its type shall be explicitly stated.	
8.3	For each function parameter the type given in the declaration and definition shall be identical, and the return types shall also be identical.	Definition of function 'XX' incompatible with its declaration.	Assumes that rule 8.1 is not violated. The rule is restricted to compatible types. Can be turned to Off

N.	MISRA Definition	Messages in report file	Polyspace Specification
8.4	If objects or functions are declared more than once their types shall be compatible.	<ul style="list-style-type: none"> • If objects or functions are declared more than once their types shall be compatible. • Global declaration of 'XX' function has incompatible type with its definition. • Global declaration of 'XX' variable has incompatible type with its definition. 	<p>Violations of this rule might be generated during the link phase.</p> <p>Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.</p>
8.5	There shall be no definitions of objects or functions in a header file	<ul style="list-style-type: none"> • Object 'XX' should not be defined in a header file. • Function 'XX' should not be defined in a header file. • Fragment of function should not be defined in a header file. 	<p>Tentative definitions are considered as definitions. For objects with file scope, tentative definitions are declarations that:</p> <ul style="list-style-type: none"> • Do not have initializers. • Do not have storage class specifiers, or have the static specifier
8.6	Functions shall always be declared at file scope.	Function 'XX' should be declared at file scope.	This rule maps to ISO/IEC TS 17961 ID addresscape .
8.7	Objects shall be defined at block scope if they are only accessed from within a single function	Object 'XX' should be declared at block scope.	Restricted to static objects.

N.	MISRA Definition	Messages in report file	Polyspace Specification
8.8	An external object or function shall be declared in one file and only one file	Function/Object 'XX' has external declarations in multiple files.	<p>Restricted to explicit extern declarations (tentative definitions are ignored).</p> <p>Polyspace considers that variables or functions declared <code>extern</code> in a non-header file violate this rule.</p> <p>Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.</p>
8.9	Definition: An identifier with external linkage shall have exactly one external definition.	<ul style="list-style-type: none"> • Procedure/Global variable XX multiply defined. • Forbidden multiple tentative definitions for object XX • Global variable has multiple tentative definitions • Undefined global variable XX 	<p>The checker flags multiple definitions only if the definitions occur in different files.</p> <p>No warnings appear on predefined symbols.</p> <p>Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.</p>
8.10	All declarations and definitions of objects or functions at file scope shall have internal linkage unless external linkage is required	Function/Variable XX should have internal linkage.	<p>Assumes that 8.1 is not violated. No warning if 0 uses.</p> <p>Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.</p>
8.11	The <i>static</i> storage class specifier shall be used in definitions and declarations of objects and functions that have internal linkage	static storage class specifier should be used on internal linkage symbol XX.	

N.	MISRA Definition	Messages in report file	Polyspace Specification
8.12	When an array is declared with external linkage, its size shall be stated explicitly or defined implicitly by initialization	Size of array 'XX' should be explicitly stated.	

Initialization

N.	MISRA Definition	Messages in report file	Polyspace Specification
9.1	All automatic variables shall have been assigned a value before being used.		<p>Checked during code analysis.</p> <p>Violations displayed as Non-initialized variable results.</p> <p>Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results. In Code Prover, you can also see a difference in results based on your choice for the option <code>Verification level (-to)</code>. See the documentation for Polyspace Bug Finder or Polyspace Bug Finder Server for more on analysis options and how to check for coding standard violations..</p>
9.2	Braces shall be used to indicate and match the structure in the nonzero initialization of arrays and structures.	Braces shall be used to indicate and match the structure in the nonzero initialization of arrays and structures.	

N.	MISRA Definition	Messages in report file	Polyspace Specification
9.3	In an enumerator list, the = construct shall not be used to explicitly initialize members other than the first, unless all items are explicitly initialized.	In an enumerator list, the = construct shall not be used to explicitly initialize members other than the first, unless all items are explicitly initialized.	

Arithmetic Type Conversion

N.	MISRA Definition	Messages in report file	Polyspace Specification
10.1	<p>The value of an expression of integer type shall not be implicitly converted to a different underlying type if:</p> <ul style="list-style-type: none"> • it is not a conversion to a wider integer type of the same signedness, or • the expression is complex, or • the expression is not constant and is a function argument, or • the expression is not constant and is a return expression 	<ul style="list-style-type: none"> • Implicit conversion of the expression of underlying type XX to the type XX that is not a wider integer type of the same signedness. • Implicit conversion of one of the binary operands whose underlying types are XX and XX • Implicit conversion of the binary right hand operand of underlying type XX to XX that is not an integer type. • Implicit conversion of the binary left hand operand of underlying type XX to XX that is not an integer type. • Implicit conversion of the binary right hand operand of underlying type XX to XX that is not a wider integer type of the same signedness or Implicit conversion of the binary ? left hand operand of underlying type XX to XX, but it is a complex expression. • Implicit conversion of complex integer expression of underlying type XX to XX. 	<p>ANSI C base types order (signed char, short, int, long) defines that T2 is wider than T1 if T2 is on the right hand of T1 or T2 = T1. The same interpretation is applied on the unsigned version of base types.</p> <p>An expression of bool or enum types has int as underlying type.</p> <p>Plain char may have signed or unsigned underlying type (depending on Polyspace target configuration or option setting).</p> <p>The underlying type of a simple expression of struct.bitfield is the base type used in the bitfield definition, the bitfield width is not token into account and it assumes that only signed unsigned int are used for bitfield (Rule 6.4).</p> <p>This rule violation is not produced on operations involving pointers.</p> <p>No violation reported when:</p> <ul style="list-style-type: none"> • The implicit conversion is a type widening, without

N.	MISRA Definition	Messages in report file	Polyspace Specification
		<ul style="list-style-type: none"> • Implicit conversion of non-constant integer expression of underlying type XX in function return whose expected type is XX. • Implicit conversion of non-constant integer expression of underlying type XX as argument of function whose corresponding parameter type is XX. 	<p>change of signedness of integer</p> <ul style="list-style-type: none"> • The expression is an argument expression or a return expression <p>No violation reported when the following are true:</p> <ul style="list-style-type: none"> • Implicit conversion applies to a constant expression and is a type widening, with a possible change of signedness of integer. • The conversion does not change the representation of the constant value or the result of the operation. • The expression is an argument expression or a return expression or an operand expression of a non-bitwise operator. <p>Conversions of constants are not reported for these cases to avoid flagging too many violations. If the constant can be represented in both the original and converted type, the conversion is less of an issue.</p>

N.	MISRA Definition	Messages in report file	Polyspace Specification
10.2	<p>The value of an expression of floating type shall not be implicitly converted to a different type if</p> <ul style="list-style-type: none"> • it is not a conversion to a wider floating type, or • the expression is complex, or • the expression is a function argument, or • the expression is a return expression 	<ul style="list-style-type: none"> • Implicit conversion of the expression from XX to XX that is not a wider floating type. • Implicit conversion of the binary ? right hand operand from XX to XX, but it is a complex expression. • Implicit conversion of the binary ? right hand operand from XX to XX that is not a wider floating type or Implicit conversion of the binary ? left hand operand from XX to XX, but it is a complex expression. • Implicit conversion of complex floating expression from XX to XX. • Implicit conversion of floating expression of XX type in function return whose expected type is XX. • Implicit conversion of floating expression of XX type as argument of function whose corresponding parameter type is XX. 	<p>ANSI C base types order (float, double) defines that T2 is wider than T1 if T2 is on the right hand of T1 or T2 = T1.</p> <p>No violation reported when:</p> <ul style="list-style-type: none"> • The implicit conversion is a type widening • The expression is an argument expression or a return expression.

N.	MISRA Definition	Messages in report file	Polyspace Specification
10.3	<p>The value of a complex expression of integer type may only be cast to a type that is narrower and of the same signedness as the underlying type of the expression</p>	<p>Complex expression of underlying type XX may only be cast to narrower integer type of same signedness, however the destination type is XX.</p>	<ul style="list-style-type: none"> The rule checker raises a defect only if the result of a composite expression is cast to a different or wider essential type. <p>For instance, in this example, a violation is shown in the first assignment to <code>i</code> but not the second. In the first assignment, a composite expression <code>i+1</code> is directly cast from a signed to an unsigned type. In the second assignment, the composite expression is first cast to the same type and then the result is cast to a different type.</p> <pre> typedef int int32_T; typedef unsigned char uint8_T; int32_T i; i = (uint8_T)(i+1); /* Noncompliant */ i = (uint8_T)((int32_T)(i+1)); /* Compliant */ </pre> <ul style="list-style-type: none"> ANSI C base types order (signed char, short, int, long) defines that T1 is narrower than T2 if T2 is on the right hand of T1 or T1 = T2. The same methodology is applied on the unsigned version of base types.

N.	MISRA Definition	Messages in report file	Polyspace Specification
			<ul style="list-style-type: none"> • An expression of bool or enum types has int as underlying type. • Plain char may have signed or unsigned underlying type (depending on target configuration or option setting). • The underlying type of a simple expression of struct.bitfield is the base type used in the bitfield definition, the bitfield width is not token into account and it assumes that only signed, unsigned int are used for bitfield (Rule 6.4).
10.4	The value of a complex expression of float type may only be cast to narrower floating type	Complex expression of XX type may only be cast to narrower floating type, however the destination type is XX.	ANSI C base types order (float, double) defines that T1 is narrower than T2 if T2 is on the right hand of T1 or T2 = T1.
10.5	If the bitwise operator ~ and << are applied to an operand of underlying type <i>unsigned char</i> or <i>unsigned short</i> , the result shall be immediately cast to the underlying type of the operand	Bitwise [<< ~] is applied to the operand of underlying type [unsigned char unsigned short], the result shall be immediately cast to the underlying type.	

N.	MISRA Definition	Messages in report file	Polyspace Specification
10.6	The "U" suffix shall be applied to all constants of <i>unsigned</i> types	No explicit 'U suffix on constants of an unsigned type.	<p>Warning when the type determined from the value and the base (octal, decimal or hexadecimal) is unsigned and there is no suffix u or U.</p> <p>For example, when the size of the <code>int</code> and <code>long int</code> data types is 32 bits, the coding rule checker will report a violation of rule 10.6 for the following line:</p> <pre>int a = 2147483648;</pre> <p>There is a difference between decimal and hexadecimal constants when <code>int</code> and <code>long int</code> are not the same size.</p>

Pointer Type Conversion

N.	MISRA Definition	Messages in report file	Polyspace Specification
11.1	Conversion shall not be performed between a pointer to a function and any type other than an integral type	Conversion shall not be performed between a pointer to a function and any type other than an integral type.	<p>Casts and implicit conversions involving a function pointer.</p> <p>Casts or implicit conversions from <code>NULL</code> or <code>(void*)0</code> do not give any warning.</p>
11.2	Conversion shall not be performed between a pointer to an object and any type other than an integral type, another pointer to a object type or a pointer to void	Conversion shall not be performed between a pointer to an object and any type other than an integral type, another pointer to a object type or a pointer to void.	<p>There is also a warning on qualifier loss</p> <p>This rule maps to ISO/IEC TS 17961 ID <code>alignconv</code>.</p>

N.	MISRA Definition	Messages in report file	Polyspace Specification
11.3	A cast should not be performed between a pointer type and an integral type	A cast should not be performed between a pointer type and an integral type.	Exception on zero constant. Extended to all conversions This rule maps to ISO/IEC TS 17961 ID alignconv.
11.4	A cast should not be performed between a pointer to object type and a different pointer to object type.	A cast should not be performed between a pointer to object type and a different pointer to object type.	
11.5	A cast shall not be performed that removes any <i>const</i> or <i>volatile</i> qualification from the type addressed by a pointer	A cast shall not be performed that removes any <i>const</i> or <i>volatile</i> qualification from the type addressed by a pointer	Extended to all conversions

Expressions

N.	MISRA Definition	Messages in report file	Polyspace Specification
12.1	Limited dependence should be placed on C's operator precedence rules in expressions	Limited dependence should be placed on C's operator precedence rules in expressions	
12.2	The value of an expression shall be the same under any order of evaluation that the standard permits.	<ul style="list-style-type: none"> • The value of '<i>sym</i>' depends on the order of evaluation. • The value of volatile '<i>sym</i>' depends on the order of evaluation because of multiple accesses. 	<p>Rule 12.2 check assumes that no assignment in expressions that yield a Boolean values (rule 13.1).</p> <p>The expression is a simple expression of symbols. <code>i = i ++;</code> is a violation, but <code>tab[2] = tab[2] ++;</code> is not a violation.</p>
12.3	The <code>sizeof</code> operator should not be used on expressions that contain side effects.	The <code>sizeof</code> operator should not be used on expressions that contain side effects.	No warning on volatile accesses

N.	MISRA Definition	Messages in report file	Polyspace Specification
12.4	The right hand operand of a logical && or operator shall not contain side effects.	The right hand operand of a logical && or operator shall not contain side effects.	No warning on volatile accesses
12.5	The operands of a logical && or shall be primary-expressions.	<ul style="list-style-type: none">• operand of logical && is not a primary expression• operand of logical is not a primary expression• The operands of a logical && or shall be primary-expressions.	<p>During preprocessing, violations of this rule are detected on the expressions in #if directives.</p> <p>Allowed exception on associatively (a && b && c), (a b c).</p>

N.	MISRA Definition	Messages in report file	Polyspace Specification
12.6	<p>Operands of logical operators (&&, and !) should be effectively Boolean.</p> <p>Expression that are effectively Boolean should not be used as operands to operators other than (&&, or !).</p>	<ul style="list-style-type: none"> • Operand of '!' logical operator should be effectively Boolean. • Left operand of '%s' logical operator should be effectively Boolean. • Right operand of '%s' logical operator should be effectively Boolean. • %s operand of '%s' is effectively Boolean. Boolean should not be used as operands to operators other than '&&', ' ', '!', '=', '==', '!=' and '?:'. 	<p>The operand of a logical operator should be a Boolean data type. Although the C standard does not explicitly define the Boolean data type, the standard implicitly assumes the use of the Boolean data type.</p> <p>Some operators may return Boolean-like expressions, for example, (<code>var == 0</code>).</p> <p>Consider the following code:</p> <pre>unsigned char flag; if (!flag)</pre> <p>The rule checker reports a violation of rule 12.6:</p> <p>Operand of '!' logical operator should be effectively Boolean.</p> <p>The operand <code>flag</code> is not a Boolean but an unsigned char.</p> <p>To be compliant with rule 12.6, the code must be rewritten either as</p> <pre>if (!(flag != 0)) or if (flag == 0)</pre> <p>The use of the option -<code>boolean-types</code> may increase or decrease the</p>

N.	MISRA Definition	Messages in report file	Polyspace Specification
			number of warnings generated.
12.7	Bitwise operators shall not be applied to operands whose underlying type is signed	<ul style="list-style-type: none"> • [~/Left Shift/Right shift/&] operator applied on an expression whose underlying type is signed. • Bitwise ~ on operand of signed underlying type XX. • Bitwise [<< >>] on left hand operand of signed underlying type XX. • Bitwise [& ^] on two operands of s 	<p>The underlying type for an integer is signed when:</p> <ul style="list-style-type: none"> • it does not have a u or U suffix • it is small enough to fit into a 64 bits signed number
12.8	The right hand operand of a shift operator shall lie between zero and one less than the width in bits of the underlying type of the left hand operand.	<ul style="list-style-type: none"> • shift amount is negative • shift amount is bigger than 64 • Bitwise [<< >>] count out of range [0 ..X] (width of the underlying type XX of the left hand operand - 1).. 	<p>The numbers that are manipulated in preprocessing directives are 64 bits wide so that valid shift range is between 0 and 63</p> <p>Check is also extended onto bitfields with the field width or the width of the base type when it is within a complex expression</p>
12.9	The unary minus operator shall not be applied to an expression whose underlying type is unsigned.	<ul style="list-style-type: none"> • Unary - on operand of unsigned underlying type XX. • Minus operator applied to an expression whose underlying type is unsigned 	<p>The underlying type for an integer is signed when:</p> <ul style="list-style-type: none"> • it does not have a u or U suffix • it is small enough to fit into a 64 bits signed number
12.10	The comma operator shall not be used.	The comma operator shall not be used.	

N.	MISRA Definition	Messages in report file	Polyspace Specification
12.11	Evaluation of constant unsigned expression should not lead to wraparound.	Evaluation of constant unsigned integer expressions should not lead to wrap-around.	
12.12	The underlying bit representations of floating-point values shall not be used.	The underlying bit representations of floating-point values shall not be used.	Warning when: <ul style="list-style-type: none"> • A float pointer is cast as a pointer to another data type. Casting a float pointer as a pointer to void does not generate a warning. • A float is packed with another data type. For example: <pre style="margin-left: 20px;">union { float f; int i; } ...</pre>
12.13	The increment (++) and decrement (--) operators should not be mixed with other operators in an expression	The increment (++) and decrement (--) operators should not be mixed with other operators in an expression	Warning when ++ or -- operators are not used alone.

Control Statement Expressions

N.	MISRA Definition	Messages in report file	Polyspace Specification
13.1	Assignment operators shall not be used in expressions that yield Boolean values.	Assignment operators shall not be used in expressions that yield Boolean values.	

N.	MISRA Definition	Messages in report file	Polyspace Specification
13.2	Tests of a value against zero should be made explicit, unless the operand is effectively Boolean	Tests of a value against zero should be made explicit, unless the operand is effectively Boolean	No warning is given on integer constants. Example: if (2) The use of the option -boolean-types may increase or decrease the number of warnings generated.
13.3	Floating-point expressions shall not be tested for equality or inequality.	Floating-point expressions shall not be tested for equality or inequality.	Warning on directs tests only.
13.4	The controlling expression of a <i>for</i> statement shall not contain any objects of floating type	The controlling expression of a <i>for</i> statement shall not contain any objects of floating type	If <i>for</i> index is a variable symbol, checked that it is not a float.

N.	MISRA Definition	Messages in report file	Polyspace Specification
13.5	The three expressions of a <i>for</i> statement shall be concerned only with loop control	<ul style="list-style-type: none"> • 1st expression should be an assignment. • Bad type for loop counter (XX). • 2nd expression should be a comparison. • 2nd expression should be a comparison with loop counter (XX). • 3rd expression should be an assignment of loop counter (XX). • 3rd expression: assigned variable should be the loop counter (XX). • The following kinds of for loops are allowed: <ul style="list-style-type: none"> (a) all three expressions shall be present; (b) the 2nd and 3rd expressions shall be present with prior initialization of the loop counter; (c) all three expressions shall be empty for a deliberate infinite loop. 	Checked if the for loop index (V) is a variable symbol; checked if V is the last assigned variable in the first expression (if present). Checked if, in first expression, if present, is assignment of V; checked if in 2nd expression, if present, must be a comparison of V; Checked if in 3rd expression, if present, must be an assignment of V.
13.6	Numeric variables being used within a <i>for</i> loop for iteration counting should not be modified in the body of the loop.	Numeric variables being used within a for loop for iteration counting should not be modified in the body of the loop.	Detect only direct assignments if the for loop index is known and if it is a variable symbol.

N.	MISRA Definition	Messages in report file	Polyspace Specification
13.7	Boolean operations whose results are invariant shall not be permitted	<ul style="list-style-type: none"> • Boolean operations whose results are invariant shall not be permitted. Expression is always true. • Boolean operations whose results are invariant shall not be permitted. Expression is always false. • Boolean operations whose results are invariant shall not be permitted. 	<p>During compilation, check comparisons with at least one constant operand.</p> <p>Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.</p> <ul style="list-style-type: none"> • Bug Finder flags some violations of this rule through the <code>Dead code</code> and <code>Useless if</code> checkers. • Code Prover does not use gray code to flag violations of this rule. <p>In Code Prover, you can also see a difference in results based on your choice for the option <code>Verification level (-to)</code>. See the documentation for Polyspace Bug Finder or Polyspace Bug Finder Server for more on analysis options and how to check for coding standard violations...</p> <p>The rule violation appears when you check whether an enum variable value lies between its lower and upper bound. The violation appears even if you increment or decrement the variable outside its bounds, for</p>

N.	MISRA Definition	Messages in report file	Polyspace Specification
			<p>instance, in this for loop condition:</p> <pre>enum ec {RED, BLUE, GREEN} col; for(col=RED; col<=GREEN; col++) {}</pre> <p>An enum variable can potentially wrap around when incremented outside its range and the loop condition can be always true. To avoid the rule violation, you can cast the enum to an integer before the comparison, for instance:</p> <pre>enum ec {RED, BLUE, GREEN} col; for(col=RED; (int)col<=GREEN; col++) {}</pre>

Control Flow

N.	MISRA Definition	Messages in report file	Polyspace Specification
14.1	There shall be no unreachable code.	There shall be no unreachable code.	Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.
14.2	All non-null statements shall either have at least one side effect however executed, or cause control flow to change	<p>All non-null statements shall either:</p> <ul style="list-style-type: none"> • have at least one side effect however executed, or • cause control flow to change 	

N.	MISRA Definition	Messages in report file	Polyspace Specification
14.3	Before preprocessing, a null statement shall occur on a line by itself; it may be followed by a comment provided that the first character following the null statement is a white-space character.	A null statement shall appear on a line by itself	<p>We assume that a ';' is a null statement when it is the first character on a line (excluding comments). The rule is violated when:</p> <ul style="list-style-type: none"> • there are some comments before it on the same line. • there is a comment immediately after it • there is something else than a comment after the ';' on the same line.
14.4	The <i>goto</i> statement shall not be used.	The goto statement shall not be used.	
14.5	The <i>continue</i> statement shall not be used.	The continue statement shall not be used.	
14.6	For any iteration statement there shall be at most one <i>break</i> statement used for loop termination	For any iteration statement there shall be at most one break statement used for loop termination	
14.7	A function shall have a single point of exit at the end of the function	A function shall have a single point of exit at the end of the function	
14.8	The statement forming the body of a <i>switch</i> , <i>while</i> , <i>do while</i> or <i>for</i> statement shall be a compound statement	<ul style="list-style-type: none"> • The body of a do while statement shall be a compound statement. • The body of a for statement shall be a compound statement. • The body of a switch statement shall be a compound statement 	

N.	MISRA Definition	Messages in report file	Polyspace Specification
14.9	An <i>if (expression)</i> construct shall be followed by a compound statement. The <i>else</i> keyword shall be followed by either a compound statement, or another <i>if</i> statement	<ul style="list-style-type: none">• An <i>if (expression)</i> construct shall be followed by a compound statement.• The <i>else</i> keyword shall be followed by either a compound statement, or another <i>if</i> statement	
14.10	All <i>if else if</i> constructs should contain a final <i>else</i> clause.	All <i>if else if</i> constructs should contain a final <i>else</i> clause.	

Switch Statements

N.	MISRA Definition	Messages in report file	Polyspace Specification
15.0	The MISRA C switch syntax shall be used.	switch statements syntax normative restrictions.	<p>Warning on declarations or any statements before the first switch case.</p> <p>Warning on label or jump statements in the body of switch cases.</p> <p>On the following example, the rule is displayed in the log file at line 3:</p> <pre> 1 ... 2 switch(index) { 3 var = var + 1; // RULE 15.0 // violated 4case 1: ... </pre> <p>The code between switch statement and first case is checked as dead code by Polyspace. It follows ANSI standard behavior.</p> <p>This rule is not considered as a required rule in the MISRA C:2004 rules for generated code. In generated code, if you find a violation of rule 15.0 that does not simultaneously violate a later rule in this group, justify the violation with appropriate comments.</p>

N.	MISRA Definition	Messages in report file	Polyspace Specification
15.1	A switch label shall only be used when the most closely-enclosing compound statement is the body of a <i>switch</i> statement	A switch label shall only be used when the most closely-enclosing compound statement is the body of a switch statement	
15.2	An unconditional <i>break</i> statement shall terminate every non-empty switch clause	An unconditional break statement shall terminate every non-empty switch clause	Warning for each non-compliant case clause.
15.3	The final clause of a <i>switch</i> statement shall be the <i>default</i> clause	The final clause of a switch statement shall be the default clause	
15.4	A <i>switch</i> expression should not represent a value that is effectively Boolean	A switch expression should not represent a value that is effectively Boolean	The use of the option - <i>boolean-types</i> may increase the number of warnings generated.
15.5	Every <i>switch</i> statement shall have at least one <i>case</i> clause	Every switch statement shall have at least one case clause	

Functions

N.	MISRA Definition	Messages in report file	Polyspace Specification
16.1	Functions shall not be defined with variable numbers of arguments.	Function XX should not be defined as varargs.	
16.2	Functions shall not call themselves, either directly or indirectly.	Function %s should not call itself.	Done by Polyspace software (Use the call graph in Polyspace Code Prover). Polyspace also partially checks this rule during the compilation phase.
16.3	Identifiers shall be given for all of the parameters in a function prototype declaration.	Identifiers shall be given for all of the parameters in a function prototype declaration.	Assumes Rule 8.6 is not violated.

N.	MISRA Definition	Messages in report file	Polyspace Specification
16.4	The identifiers used in the declaration and definition of a function shall be identical.	The identifiers used in the declaration and definition of a function shall be identical.	Assumes that rules 8.8 , 8.1 and 16.3 are not violated. All occurrences are detected.
16.5	Functions with no parameters shall be declared with parameter type <i>void</i> .	Functions with no parameters shall be declared with parameter type <i>void</i> .	Definitions are also checked.
16.6	The number of arguments passed to a function shall match the number of parameters.	<ul style="list-style-type: none"> • Too many arguments to XX. • Insufficient number of arguments to XX. 	Assumes that rule 8.1 is not violated. This rule maps to ISO/IEC TS 17961 ID argcomp .
16.7	A pointer parameter in a function prototype should be declared as pointer to <i>const</i> if the pointer is not used to modify the addressed object.	Pointer parameter in a function prototype should be declared as pointer to <i>const</i> if the pointer is not used to modify the addressed object.	Warning if a non- <i>const</i> pointer parameter is either not used to modify the addressed object or is passed to a call of a function that is declared with a <i>const</i> pointer parameter.
16.8	All exit paths from a function with non-void return type shall have an explicit return statement with an expression.	Missing return value for non-void function XX.	Warning when a non-void function is not terminated with an unconditional return with an expression.
16.9	A function identifier shall only be used with either a preceding <i>&</i> , or with a parenthesized parameter list, which may be empty.	Function identifier XX should be preceded by a <i>&</i> or followed by a parameter list.	

N.	MISRA Definition	Messages in report file	Polyspace Specification
16.10	If a function returns error information, then that error information shall be tested.	If a function returns error information, then that error information shall be tested.	<p>Warning if a non-void function is called and the returned value is ignored.</p> <p>No warning if the result of the call is cast to void.</p> <p>No check performed for calls of memcpy, memmove, memset, strcpy, strncpy, strcat, or strncat.</p>

Pointers and Arrays

N.	MISRA Definition	Messages in report file	Polyspace Specification
17.1	Pointer arithmetic shall only be applied to pointers that address an array or array element.	Pointer arithmetic shall only be applied to pointers that address an array or array element.	
17.2	Pointer subtraction shall only be applied to pointers that address elements of the same array	Pointer subtraction shall only be applied to pointers that address elements of the same array.	
17.3	>, >=, <, <= shall not be applied to pointer types except where they point to the same array.	>, >=, <, <= shall not be applied to pointer types except where they point to the same array.	
17.4	Array indexing shall be the only allowed form of pointer arithmetic.	Array indexing shall be the only allowed form of pointer arithmetic.	<p>Warning on:</p> <ul style="list-style-type: none"> • Operations on pointers. (p +I, I+p, and p - I, where p is a pointer and I an integer). • Array indexing on nonarray pointers.

N.	MISRA Definition	Messages in report file	Polyspace Specification
17.5	A type should not contain more than 2 levels of pointer indirection	A type should not contain more than 2 levels of pointer indirection	
17.6	The address of an object with automatic storage shall not be assigned to an object that may persist after the object has ceased to exist.	Pointer to a parameter is an illegal return value. Pointer to a local is an illegal return value.	Warning when assigning address to a global variable, returning a local variable address, or returning a parameter address. This rule maps to ISO/IEC TS 17961 ID accfree .

Structures and Unions

N.	MISRA Definition	Messages in report file	Polyspace Specification
18.1	All structure or union types shall be complete at the end of a translation unit.	All structure or union types shall be complete at the end of a translation unit.	Warning for all incomplete declarations of structs or unions.
18.2	An object shall not be assigned to an overlapping object.	<ul style="list-style-type: none"> An object shall not be assigned to an overlapping object. Destination and source of XX overlap, the behavior is undefined. 	
18.4	Unions shall not be used	Unions shall not be used.	

Preprocessing Directives

N.	MISRA Definition	Messages in report file	Polyspace Specification
19.1	#include statements in a file shall only be preceded by other preprocessors directives or comments	#include statements in a file shall only be preceded by other preprocessors directives or comments	A message is displayed when a #include directive is preceded by other things than preprocessor directives, comments, spaces or "new lines".

N.	MISRA Definition	Messages in report file	Polyspace Specification
19.2	Nonstandard characters should not occur in header file names in <code>#include</code> directives	<ul style="list-style-type: none"> • A message is displayed on characters <code>'</code>, <code>"</code> or <code>/*</code> between <code><</code> and <code>></code> in <code>#include <filename></code> • A message is displayed on characters <code>'</code>, or <code>/*</code> between <code>"</code> and <code>"</code> in <code>#include "filename"</code> 	
19.3	The <code>#include</code> directive shall be followed by either a <code><filename></code> or <code>"filename"</code> sequence.	<ul style="list-style-type: none"> • <code>'#include'</code> expects <code>"FILENAME"</code> or <code><FILENAME></code> • <code>'#include_next'</code> expects <code>"FILENAME"</code> or <code><FILENAME></code> 	

N.	MISRA Definition	Messages in report file	Polyspace Specification
19.4	C macros shall only expand to a braced initializer, a constant, a parenthesized expression, a type qualifier, a storage class specifier, or a do-while-zero construct.	Macro '<name>' does not expand to a compliant construct.	<p>We assume that a macro definition does not violate this rule when it expands to:</p> <ul style="list-style-type: none"> • a braced construct (not necessarily an initializer) • a parenthesized construct (not necessarily an expression) • a number • a character constant • a string constant (can be the result of the concatenation of string field arguments and literal strings) • the following keywords: typedef, extern, static, auto, register, const, volatile, __asm__ and __inline__ • a do-while-zero construct
19.5	Macros shall not be #defined and #undefd within a block.	<ul style="list-style-type: none"> • Macros shall not be #define'd within a block. • Macros shall not be #undef'd within a block. 	
19.6	#undef shall not be used.	#undef shall not be used.	
19.7	A function should be used in preference to a function like-macro.	A function should be used in preference to a function like-macro	Message on all function-like macro definitions.

N.	MISRA Definition	Messages in report file	Polyspace Specification
19.8	A function-like macro shall not be invoked without all of its arguments	<ul style="list-style-type: none"> • arguments given to macro '<name>' • macro '<name>' used without args. • macro '<name>' used with just one arg. • macro '<name>' used with too many (<number>) args. 	
19.9	Arguments to a function-like macro shall not contain tokens that look like preprocessing directives.	Macro argument shall not look like a preprocessing directive.	This rule is detected as violated when the '#' character appears in a macro argument (outside a string or character constant)
19.10	In the definition of a function-like macro each instance of a parameter shall be enclosed in parentheses unless it is used as the operand of # or ##.	Parameter instance shall be enclosed in parentheses.	<p>If x is a macro parameter, the following instances of x as an operand of the # and ## operators do not generate a warning: #x, ##x, and x##. Otherwise, parentheses are required around x.</p> <p>The software does not generate a warning if a parameter is reused as an argument of a function or function-like macro. For example, consider a parameter x. The software does not generate a warning if x appears as (x) or (x, or ,x) or ,x,.</p>

N.	MISRA Definition	Messages in report file	Polyspace Specification
19.11	All macro identifiers in preprocessor directives shall be defined before use, except in <code>#ifdef</code> and <code>#ifndef</code> preprocessor directives and the <code>defined()</code> operator.	'<name>' is not defined.	
19.12	There shall be at most one occurrence of the <code>#</code> or <code>##</code> preprocessor operators in a single macro definition.	More than one occurrence of the <code>#</code> or <code>##</code> preprocessor operators.	
19.13	The <code>#</code> and <code>##</code> preprocessor operators should not be used	Message on definitions of macros using <code>#</code> or <code>##</code> operators	
19.14	The <code>defined</code> preprocessor operator shall only be used in one of the two standard forms.	'defined' without an identifier.	
19.15	Precautions shall be taken in order to prevent the contents of a header file being included twice.	Precautions shall be taken in order to prevent multiple inclusions.	<p>When a header file is formatted as,</p> <pre>#ifndef <control macro> #define <control macro> <contents> #endif</pre> <p>or,</p> <pre>#ifndef <control macro> #error ... #else #define <control macro> <contents> #endif</pre> <p>it is assumed that precautions have been taken to prevent multiple inclusions. Otherwise, a violation of this MISRA rule is detected.</p>

N.	MISRA Definition	Messages in report file	Polyspace Specification
19.16	Preprocessing directives shall be syntactically meaningful even when excluded by the preprocessor.	directive is not syntactically meaningful.	
19.17	All <code>#else</code> , <code>#elif</code> and <code>#endif</code> preprocessor directives shall reside in the same file as the <code>#if</code> or <code>#ifdef</code> directive to which they are related.	<ul style="list-style-type: none"> • <code>'#elif'</code> not within a conditional. • <code>'#else'</code> not within a conditional. • <code>'#elif'</code> not within a conditional. • <code>'#endif'</code> not within a conditional. • unbalanced <code>'#endif'</code>. • unterminated <code>'#if'</code> conditional. • unterminated <code>'#ifdef'</code> conditional. • unterminated <code>'#ifndef'</code> conditional. 	

Standard Libraries

N.	MISRA Definition	Messages in report file	Polyspace Specification
20.1	Reserved identifiers, macros and functions in the standard library, shall not be defined, redefined or undefined.	<ul style="list-style-type: none"> • The macro '<code><name></code>' shall not be redefined. • The macro '<code><name></code>' shall not be undefined. 	

N.	MISRA Definition	Messages in report file	Polyspace Specification
20.2	The names of standard library macros, objects and functions shall not be reused.	Identifier XX should not be used.	<p>In case a macro whose name corresponds to a standard library macro, object or function is defined, the rule that is detected as violated is 20.1.</p> <p>Tentative definitions are considered as definitions. For objects with file scope, tentative definitions are declarations that:</p> <ul style="list-style-type: none">• Do not have initializers.• Do not have storage class specifiers, or have the <code>static</code> specifier

N.	MISRA Definition	Messages in report file	Polyspace Specification
20.3	The validity of values passed to library functions shall be checked.	Validity of values passed to library functions shall be checked	<p>Warning for argument in library function call if the following are all true:</p> <ul style="list-style-type: none"> • Argument is a local variable • Local variable is not tested between last assignment and call to the library function • Library function is a common mathematical function • Corresponding parameter of the library function has a restricted input domain. <p>The library function can be one of the following : sqrt, tan, pow, log, log10, fmod, acos, asin, acosh, atanh, or atan2.</p> <p>Bug Finder and Code Prover check this rule differently. The analysis can produce different results.</p>
20.4	Dynamic heap memory allocation shall not be used.	<ul style="list-style-type: none"> • The macro '<name>' shall not be used. • Identifier XX should not be used. 	In case the dynamic heap memory allocation functions are actually macros and the macro is expanded in the code, this rule is detected as violated. Assumes rule 20.2 is not violated.
20.5	The error indicator errno shall not be used	The error indicator errno shall not be used	Assumes that rule 20.2 is not violated

N.	MISRA Definition	Messages in report file	Polyspace Specification
20.6	The macro <i>offsetof</i> , in library <code><stddef.h></code> , shall not be used.	<ul style="list-style-type: none"> • The macro '<code><name></code>' shall not be used. • Identifier XX should not be used. 	Assumes that rule 20.2 is not violated
20.7	The <i>setjmp</i> macro and the <i>longjmp</i> function shall not be used.	<ul style="list-style-type: none"> • The macro '<code><name></code>' shall not be used. • Identifier XX should not be used. 	In case the <i>longjmp</i> function is actually a macro and the macro is expanded in the code, this rule is detected as violated. Assumes that rule 20.2 is not violated
20.8	The signal handling facilities of <code><signal.h></code> shall not be used.	<ul style="list-style-type: none"> • The macro '<code><name></code>' shall not be used. • Identifier XX should not be used. 	In case some of the signal functions are actually macros and are expanded in the code, this rule is detected as violated. Assumes that rule 20.2 is not violated
20.9	The input/output library <code><stdio.h></code> shall not be used in production code.	<ul style="list-style-type: none"> • The macro '<code><name></code>' shall not be used. • Identifier XX should not be used. 	In case the input/output library functions are actually macros and are expanded in the code, this rule is detected as violated. Assumes that rule 20.2 is not violated
20.10	The library functions <i>atof</i> , <i>atoi</i> and <i>atoll</i> from library <code><stdlib.h></code> shall not be used.	<ul style="list-style-type: none"> • The macro '<code><name></code>' shall not be used. • Identifier XX should not be used. 	In case the <i>atof</i> , <i>atoi</i> and <i>atoll</i> functions are actually macros and are expanded, this rule is detected as violated. Assumes that rule 20.2 is not violated
20.11	The library functions <i>abort</i> , <i>exit</i> , <i>getenv</i> and <i>system</i> from library <code><stdlib.h></code> shall not be used.	<ul style="list-style-type: none"> • The macro '<code><name></code>' shall not be used. • Identifier XX should not be used. 	In case the <i>abort</i> , <i>exit</i> , <i>getenv</i> and <i>system</i> functions are actually macros and are expanded, this rule is detected as violated. Assumes that rule 20.2 is not violated

N.	MISRA Definition	Messages in report file	Polyspace Specification
20.12	The time handling functions of library <time.h> shall not be used.	<ul style="list-style-type: none"> • The macro '<name>' shall not be used. • Identifier XX should not be used. 	In case the time handling functions are actually macros and are expanded, this rule is detected as violated. Assumes that rule 20.2 is not violated

Runtime Failures

N.	MISRA Definition	Messages in report file	Polyspace Specification
21.1	Minimization of runtime failures shall be ensured by the use of at least one of: <ul style="list-style-type: none"> • static verification tools/ techniques; • dynamic verification tools/ techniques; • explicit coding of checks to handle runtime faults. 		Done by Polyspace. Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results. In Code Prover, you can also see a difference in results based on your choice for the option <code>Verification level (-to)</code> . See the documentation for Polyspace Bug Finder or Polyspace Bug Finder Server for more on analysis options and how to check for coding standard violations...

Unsupported MISRA C:2004 and MISRA AC AGC Rules

The Polyspace coding rules checker does not check the following MISRA C:2004 coding rules. These rules cannot be enforced because they are outside the scope of Polyspace software. They may concern documentation, dynamic aspects, or functional aspects of MISRA rules. The “**Polyspace Specification**” column describes the reason each rule is not checked.

Environment

Rule	Description	Polyspace Specification
1.2 (Required)	No reliance shall be placed on undefined or unspecified behavior	Not statically checkable unless the data dynamic properties is taken into account
1.3 (Required)	Multiple compilers and/or languages shall only be used if there is a common defined interface standard for object code to which the language/compiler/assemblers conform.	It is a process rule method.
1.4 (Required)	The compiler/linker/Identifiers (internal and external) shall not rely on significance of more than 31 characters. Furthermore the compiler/linker shall be checked to ensure that 31 character significance and case sensitivity are supported for external identifiers.	To observe this rule, check your compiler documentation.
1.5 (Advisory)	Floating point implementations should comply with a defined floating point standard.	To observe this rule, check your compiler documentation.

Language Extensions

Rule	Description	Polyspace Specification
2.4 (Advisory)	Sections of code should not be "commented out"	One way a tool can check this rule is to determine if the code compiles when commented out sections are uncommented. However, such checking can be expensive and inaccurate.

Documentation

Rule	Description	Polyspace Specification
3.1 (Required)	All usage of implementation-defined behavior shall be documented.	To observe this rule, check your compiler documentation. Error detection is based on undefined behavior, according to choices made for implementation- defined constructions.
3.2 (Required)	The character set and the corresponding encoding shall be documented.	To observe this rule, check your compiler documentation.
3.3 (Advisory)	The implementation of integer division in the chosen compiler should be determined, documented and taken into account.	To observe this rule, check your compiler documentation.
3.5 (Required)	The implementation-defined behavior and packing of bitfields shall be documented if being relied upon.	To observe this rule, check your compiler documentation.
3.6 (Required)	All libraries used in production code shall be written to comply with the provisions of this document, and shall have been subject to appropriate validation.	To observe this rule, check your compiler documentation.

Structures and Unions

Rule	Description	Polyspace Specification
18.3 (Required)	An area of memory shall not be reused for unrelated purposes.	"purpose" is functional design issue.

Polyspace MISRA C:2012 Checkers

The Polyspace MISRA C:2012 checker helps you to comply with the MISRA C 2012 coding standard.²

When MISRA C:2012 guidelines are violated, the Polyspace MISRA C:2012 checker provides messages with information about the violated rule or directive. Most violations are found during the compile phase of an analysis.

Polyspace Bug Finder can check all the MISRA C:2012 rules and most MISRA C:2012 directives. Polyspace Code Prover does not support checking of the following:

- MISRA C:2012 Dir 4.7, 4.13 and 4.14
- MISRA C:2012 Rule 21.13, 21.14, and 21.17 - 21.20
- MISRA C:2012 Rule 22.1 - 22.4 and 22.6 - 22.10

Each guideline is categorized into one of these three categories: mandatory, required, or advisory. When you set up rule checking, you can select subsets of these categories to check. For automatically generated code, some rules change categories, including to one additional category: readability. The `Use generated code requirements (-misra3-agc-mode)` option activates the categorization for automatically generated code. For more on analysis options, see the documentation for Polyspace Bug Finder or Polyspace Bug Finder Server.

There are additional subsets of MISRA C:2012 guidelines defined by Polyspace called Software Quality Objectives (SQA) that can have a direct or indirect impact on the precision of your results. When you set up checking, you can select these subsets. These subsets are defined in “Software Quality Objective Subsets (C:2012)” on page 1-48.

2. MISRA and MISRA C are registered trademarks of MIRA Ltd., held on behalf of the MISRA Consortium.

See Also

See Also

More About

- “MISRA C:2012 Directives and Rules”

Essential Types in MISRA C: 2012 Rules 10.x

MISRA C: 2012 rules 10.x classify data types in categories. The rules treat data types in the same category as essentially similar.

For instance, the data types `float`, `double` and `long double` are considered as essentially floating. Rule 10.1 states that the `%` operation must not have essentially floating operands. This statement implies that the operands cannot have one of these three data types: `float`, `double` and `long double`.

Categories of Essential Types

The essential types fall in these categories:

Essential type category	Standard types
Essentially Boolean	<code>bool</code> or <code>_Bool</code> (defined in <code>stdbool.h</code>) If you define a boolean type through a <code>typedef</code> , you must specify this type name before coding rules checking. For more information, see Effective boolean types (-boolean-tyoes) . For more on analysis options, see the documentation for Polyspace Bug Finder or Polyspace Bug Finder Server .
Essentially character	<code>char</code>
Essentially enum	named enum
Essentially signed	<code>signed char</code> , <code>signed short</code> , <code>signed int</code> , <code>signed long</code> , <code>signed long long</code>
Essentially unsigned	<code>unsigned char</code> , <code>unsigned short</code> , <code>unsigned int</code> , <code>unsigned long</code> , <code>unsigned long long</code>
Essentially floating	<code>float</code> , <code>double</code> , <code>long double</code>

How MISRA C: 2012 Uses Essential Types

These rules use essential types in their statements:

- MISRA C:2012 Rule 10.1: Operands shall not be of an inappropriate essential type.

For instance, the right operand of the << or >> operator must be essentially unsigned. Otherwise, negative values can cause undefined behavior.

- MISRA C:2012 Rule 10.2: Expressions of essentially character type shall not be used inappropriately in addition and subtraction operations.

For instance, the type `char` does not represent numeric values. Do not use a variable of this type in addition and subtraction operations.

- MISRA C:2012 Rule 10.3: The value of an expression shall not be assigned to an object with a narrower essential type or of a different essential type category.

For instance, do not assign a variable of data type `double` to a variable with the narrower data type `float`.

- MISRA C:2012 Rule 10.4: Both operands of an operator in which the usual arithmetic conversions are performed shall have the same essential type category.

For instance, do not perform an addition operation with a signed `int` operand, which belongs to the essentially signed category, and an unsigned `int` operand, which belongs to the essentially unsigned category.

- MISRA C:2012 Rule 10.5: The value of an expression should not be cast to an inappropriate essential type.

For instance, do not perform a cast between essentially floating types and essentially character types.

- MISRA C:2012 Rule 10.6: The value of a composite expression shall not be assigned to an object with wider essential type.

For instance, if a multiplication, binary addition or bitwise operation involves unsigned `char` operands, do not assign the result to a variable having the wider type unsigned `int`.

- MISRA C:2012 Rule 10.7: If a composite expression is used as one operand of an operator in which the usual arithmetic conversions are performed then the other operand shall not have wider essential type.

For instance, if one operand of an addition operation is a composite expression with two unsigned `char` operands, the other operand must not have the wider type unsigned `int`.

See Also

More About

- “MISRA C:2012 Directives and Rules”

Unsupported MISRA C:2012 Guidelines

The Polyspace coding rules checker does not check the following MISRA C:2012 directives. These directives are not checked either in Bug Finder or Code Prover. These directives cannot be enforced because they are outside the scope of Polyspace software. These guidelines concern documentation, dynamic aspects, or functional aspects of MISRA rules.

For the list of supported rules and directives, see “MISRA C:2012 Directives and Rules”.

Number	Category	AGC Category	Definition
Directive 3.1	Required	Required	All code shall be traceable to documented requirements
Directive 4.2	Advisory	Advisory	All usage of assembly language should be documented
Directive 4.4	Advisory	Advisory	Sections of code should not be “commented out”
Directive 4.12	Required	Required	Dynamic memory allocation shall not be used

See Also

More About

- “MISRA C:2012 Directives and Rules”

Polyspace MISRA C++ Checkers

The Polyspace MISRA C++ checker helps you comply with the MISRA C++:2008 coding standard.³

When MISRA C++ rules are violated, the Polyspace software provides messages with information about why the code violates the rule. Most violations are found during the compile phase of an analysis. The MISRA C++ checker can check 202 of the 230 MISRA C++ coding rules.

There are subsets of MISRA C++ coding rules that can have a direct or indirect impact on the selectivity (reliability percentage) of your results. When you set up rule checking, you can select these subsets directly. These subsets are defined in “Software Quality Objective Subsets (C++)” on page 1-57.

Note The Polyspace MISRA C++ checker is based on MISRA C++:2008 - “Guidelines for the use of the C++ language in critical systems.”

See Also

More About

- “MISRA C++:2008 Rules”

3. MISRA is a registered trademark of MIRA Ltd., held on behalf of the MISRA Consortium.

Unsupported MISRA C++ Coding Rules

In this section...

“Language Independent Issues” on page 4-57

“General” on page 4-58

“Lexical Conventions” on page 4-58

“Expressions” on page 4-59

“Declarations” on page 4-59

“Classes” on page 4-60

“Templates” on page 4-60

“Exception Handling” on page 4-60

“Library Introduction” on page 4-61

Polyspace does not check the following MISRAC++ coding rules. These rules are not checked either in Bug Finder or Code Prover. Some of these rules cannot be enforced because they are outside the scope of Polyspace software. The rules concern documentation, dynamic aspects, or functional aspects of MISRA rules.

For the list of supported rules, see “MISRA C++:2008 Rules”.

Language Independent Issues

N.	Category	MISRA Definition	Polyspace Specification
0-1-4	Required	A project shall not contain non-volatile POD variables having only one use.	
0-1-6	Required	A project shall not contain instances of non-volatile variables being given values that are never subsequently used.	
0-1-8	Required	All functions with void return type shall have external side effects.	

N.	Category	MISRA Definition	Polyspace Specification
0-3-1	Required	Minimization of run-time failures shall be ensured by the use of at least one of: (a) static analysis tools/techniques; (b) dynamic analysis tools/techniques; (c) explicit coding of checks to handle run-time faults.	
0-3-2	Required	If a function generates error information, then that error information shall be tested.	
0-4-1	Document	Use of scaled-integer or fixed-point arithmetic shall be documented.	To observe this rule, check your compiler documentation.
0-4-2	Document	Use of floating-point arithmetic shall be documented.	To observe this rule, check your compiler documentation.
0-4-3	Document	Floating-point implementations shall comply with a defined floating-point standard.	To observe this rule, check your compiler documentation.

General

N.	Category	MISRA Definition	Polyspace Specification
1-0-2	Document	Multiple compilers shall only be used if they have a common, defined interface.	To observe this rule, check your compiler documentation.
1-0-3	Document	The implementation of integer division in the chosen compiler shall be determined and documented.	To observe this rule, check your compiler documentation.

Lexical Conventions

N.	Category	MISRA Definition	Polyspace Specification
2-2-1	Document	The character set and the corresponding encoding shall be documented.	To observe this rule, check your compiler documentation.

N.	Category	MISRA Definition	Polyspace Specification
2-7-2	Required	Sections of code shall not be "commented out" using C-style comments.	One way a tool can check this rule is to determine if the code compiles when commented out sections are uncommented. However, such checking can be expensive and inaccurate.
2-7-3	Advisory	Sections of code should not be "commented out" using C++ comments.	One way a tool can check this rule is to determine if the code compiles when commented out sections are uncommented. However, such checking can be expensive and inaccurate.

Expressions

N.	Category	MISRA Definition	Polyspace Specification
5-0-16	Required	A pointer operand and any pointer resulting from pointer arithmetic using that operand shall both address elements of the same array.	
5-17-1	Required	The semantic equivalence between a binary operator and its assignment operator form shall be preserved.	

Declarations

N.	Category	MISRA Definition	Polyspace Specification
7-2-1	Required	An expression with enum underlying type shall only have values corresponding to the enumerators of the enumeration.	
7-4-1	Document	All usage of assembler shall be documented.	To observe this rule, check your compiler documentation.

Classes

N.	Category	MISRA Definition	Polyspace Specification
9-6-1	Document	When the absolute positioning of bits representing a bit-field is required, then the behavior and packing of bit-fields shall be documented.	To observe this rule, check your compiler documentation.

Templates

N.	Category	MISRA Definition	Polyspace Specification
14-5-1	Required	A non-member generic function shall only be declared in a namespace that is not an associated namespace.	
14-7-1	Required	All class templates, function templates, class template member functions and class template static members shall be instantiated at least once.	
14-7-2	Required	For any given template specialization, an explicit instantiation of the template with the template-arguments used in the specialization shall not render the program ill-formed.	

Exception Handling

N.	Category	MISRA Definition	Polyspace Specification
15-0-1	Document	Exceptions shall only be used for error handling.	To observe this rule, check your compiler documentation.
15-1-1	Required	The assignment-expression of a throw statement shall not itself cause an exception to be thrown.	

N.	Category	MISRA Definition	Polyspace Specification
15-3-1	Required	Exceptions shall be raised only after start-up and before termination of the program.	
15-3-4	Required	Each exception explicitly thrown in the code shall have a handler of a compatible type in all call paths that could lead to that point.	

Library Introduction

N.	Category	MISRA Definition	Polyspace Specification
17-0-3	Required	The names of standard library functions shall not be overridden.	
17-0-4	Required	All library code shall conform to MISRA C++.	To observe this rule, check your compiler documentation.

See Also

More About

- “MISRA C++:2008 Rules”

Polyspace JSF C++ Checkers

The Polyspace JSF C++ checker helps you comply with the Joint Strike Fighter® Air Vehicle C++ coding standards (JSF++). These coding standards were developed by Lockheed Martin® for the Joint Strike Fighter program. They are designed to improve the robustness of C++ code, and improve maintainability.

4

When JSF++ rules are violated, the Polyspace JSF C++ checker enables Polyspace software to provide messages with information about the rule violations. Most messages are reported during the compile phase of an analysis.

Note The Polyspace JSF C++ checker is based on JSF++:2005.

See Also

4. JSF and Joint Strike Fighter are Lockheed Martin.

JSF C++ Coding Rules

Supported JSF C++ Coding Rules

Code Size and Complexity

N.	JSF++ Definition	Polyspace Specification
1	Any one function (or method) will contain no more than 200 logical source lines of code (L-SLOCs).	Message in report file: <function name> has <num> logical source lines of code.
3	All functions shall have a cyclomatic complexity number of 20 or less.	Message in report file: <function name> has cyclomatic complexity number equal to <num>.

Environment

N.	JSF++ Definition	Polyspace Specification
8	All code shall conform to ISO/IEC 14882:2002(E) standard C++.	Reports the compilation error message
9	Only those characters specified in the C++ basic source character set will be used.	
11	Trigraphs will not be used.	
12	The following digraphs will not be used: <%, %>, <:, :>, %:, %:%:.	Message in report file: The following digraph will not be used: <digraph>. Reports the digraph. If the rule level is set to warning, the digraph will be allowed even if it is not supported in -compiler iso.
13	Multi-byte characters and wide string literals will not be used.	Report L'c', L"string", and use of wchar_t.
14	Literal suffixes shall use uppercase rather than lowercase letters.	

N.	JSF++ Definition	Polyspace Specification
15	Provision shall be made for run-time checking (defensive programming).	Done with checks in the software.

Libraries

N.	JSF++ Definition	Polyspace Specification
17	The error indicator <code>errno</code> shall not be used.	<code>errno</code> should not be used as a macro or a global with external "C" linkage.
18	The macro <code>offsetof</code> , in library <code><stddef.h></code> , shall not be used.	<code>offsetof</code> should not be used as a macro or a global with external "C" linkage.
19	<code><locale.h></code> and the <code>setlocale</code> function shall not be used.	<code>setlocale</code> and <code>localeconv</code> should not be used as a macro or a global with external "C" linkage.
20	The <code>setjmp</code> macro and the <code>longjmp</code> function shall not be used.	<code>setjmp</code> and <code>longjmp</code> should not be used as a macro or a global with external "C" linkage.
21	The signal handling facilities of <code><signal.h></code> shall not be used.	<code>signal</code> and <code>raise</code> should not be used as a macro or a global with external "C" linkage.
22	The input/output library <code><stdio.h></code> shall not be used.	all standard functions of <code><stdio.h></code> should not be used as a macro or a global with external "C" linkage.
23	The library functions <code>atof</code> , <code>atoi</code> and <code>atol</code> from library <code><stdlib.h></code> shall not be used.	<code>atof</code> , <code>atoi</code> and <code>atol</code> should not be used as a macro or a global with external "C" linkage.
24	The library functions <code>abort</code> , <code>exit</code> , <code>getenv</code> and <code>system</code> from library <code><stdlib.h></code> shall not be used.	<code>abort</code> , <code>exit</code> , <code>getenv</code> and <code>system</code> should not be used as a macro or a global with external "C" linkage.
25	The time handling functions of library <code><time.h></code> shall not be used.	<code>clock</code> , <code>difftime</code> , <code>mktime</code> , <code>asctime</code> , <code>ctime</code> , <code>gmtime</code> , <code>localtime</code> and <code>strftime</code> should not be used as a macro or a global with external "C" linkage.

Pre-Processing Directives

N.	JSF++ Definition	Polyspace Specification
26	Only the following preprocessor directives shall be used: <code>#ifndef</code> , <code>#define</code> , <code>#endif</code> , <code>#include</code> .	
27	<code>#ifndef</code> , <code>#define</code> and <code>#endif</code> will be used to prevent multiple inclusions of the same header file. Other techniques to prevent the multiple inclusions of header files will not be used.	Detects the patterns <code>#if !defined</code> , <code>#pragma once</code> , <code>#ifdef</code> , and missing <code>#define</code> .
28	The <code>#ifndef</code> and <code>#endif</code> preprocessor directives will only be used as defined in AV Rule 27 to prevent multiple inclusions of the same header file.	Detects any use that does not comply with AV Rule 27. Assuming 35/27 is not violated, reports only <code>#ifndef</code> .
29	The <code>#define</code> preprocessor directive shall not be used to create inline macros. Inline functions shall be used instead.	Rule is split into two parts: the definition of a macro function (29.def) and the call of a macrofunction (29.use). Messages in report file: <ul style="list-style-type: none"> • 29.1 : The <code>#define</code> preprocessor directive shall not be used to create inline macros. • 29.2 : Inline functions shall be used instead of inline macros.
30	The <code>#define</code> preprocessor directive shall not be used to define constant values. Instead, the <code>const</code> qualifier shall be applied to variable declarations to specify constant values.	Reports <code>#define</code> of simple constants.
31	The <code>#define</code> preprocessor directive will only be used as part of the technique to prevent multiple inclusions of the same header file.	Detects use of <code>#define</code> that are not used to guard for multiple inclusion, assuming that rules 35 and 27 are not violated.
32	The <code>#include</code> preprocessor directive will only be used to include header (*.h) files.	

Header Files

N.	JSF++ Definition	Polyspace Specification
33	The <code>#include</code> directive shall use the <code><filename.h></code> notation to include header files.	
35	A header file will contain a mechanism that prevents multiple inclusions of itself.	
39	Header files (<code>*.h</code>) will not contain non-const variable definitions or function definitions.	Reports definitions of global variables / function in header.

Style

N.	JSF++ Definition	Polyspace Specification
40	Every implementation file shall include the header files that uniquely define the inline functions, types, and templates used.	Reports when type, template, or inline function is defined in source file. Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.
41	Source lines will be kept to a length of 120 characters or less.	
42	Each expression-statement will be on a separate line.	Reports when two consecutive expression statements are on the same line.
43	Tabs should be avoided.	
44	All indentations will be at least two spaces and be consistent within the same source file.	Reports when a statement indentation is not at least two spaces more than the statement containing it. Does not report bad indentation between opening braces following if/else, do/while, for, and while statements. NB: in final release it will accept any indentation
46	User-specified identifiers (internal and external) will not rely on significance of more than 64 characters.	

N.	JSF++ Definition	Polyspace Specification
47	Identifiers will not begin with the underscore character '_'.	
48	Identifiers will not differ by: <ul style="list-style-type: none"> • Only a mixture of case • The presence/absence of the underscore character • The interchange of the letter 'O'; with the number '0' or the letter 'D' • The interchange of the letter 'I'; with the number '1' or the letter 'l' • The interchange of the letter 'S' with the number '5' • The interchange of the letter 'Z' with the number 2 • The interchange of the letter 'n' with the letter 'h' 	Checked regardless of scope. Not checked between macros and other identifiers. Messages in report file: <ul style="list-style-type: none"> • Identifier <i>Idf1 (file1.cpp line l1 column c1)</i> and <i>Idf2 (file2.cpp line l2 column c2)</i> only differ by the presence/absence of the underscore character. • Identifier <i>Idf1 (file1.cpp line l1 column c1)</i> and <i>Idf2 (file2.cpp line l2 column c2)</i> only differ by a mixture of case. • Identifier <i>Idf1 (file1.cpp line l1 column c1)</i> and <i>Idf2 (file2.cpp line l2 column c2)</i> only differ by letter 0, with the number 0.
50	The first word of the name of a class, structure, namespace, enumeration, or type created with typedef will begin with an uppercase letter. All others letters will be lowercase.	Messages in report file: <ul style="list-style-type: none"> • The first word of the name of a class will begin with an uppercase letter. • The first word of the namespace of a class will begin with an uppercase letter. Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.

N.	JSF++ Definition	Polyspace Specification
51	All letters contained in function and variables names will be composed entirely of lowercase letters.	Messages in report file: <ul style="list-style-type: none"> • All letters contained in variable names will be composed entirely of lowercase letters. • All letters contained in function names will be composed entirely of lowercase letters.
52	Identifiers for constant and enumerator values shall be lowercase.	Messages in report file: <ul style="list-style-type: none"> • Identifier for enumerator value shall be lowercase. • Identifier for template constant parameter shall be lowercase.
53	Header files will always have file name extension of ".h".	.H is allowed if you set the option -dos.
53.1	The following character sequences shall not appear in header file names: ', \, /*, //, or " .	
54	Implementation files will always have a file name extension of ".cpp".	Not case sensitive if you set the option -dos.
57	The public, protected, and private sections of a class will be declared in that order.	
58	When declaring and defining functions with more than two parameters, the leading parenthesis and the first argument will be written on the same line as the function name. Each additional argument will be written on a separate line (with the closing parenthesis directly after the last argument).	Detects that two parameters are not on the same line, The first parameter should be on the same line as function name. Does not check for the closing parenthesis.

N.	JSF++ Definition	Polyspace Specification
59	The statements forming the body of an if, else if, else, while, do ... while or for statement shall always be enclosed in braces, even if the braces form an empty block.	Messages in report file: <ul style="list-style-type: none"> • The statements forming the body of an if statement shall always be enclosed in braces. • The statements forming the body of an else statement shall always be enclosed in braces. • The statements forming the body of a while statement shall always be enclosed in braces. • The statements forming the body of a do ... while statement shall always be enclosed in braces. • The statements forming the body of a for statement shall always be enclosed in braces.
60	Braces ("{}") which enclose a block will be placed in the same column, on separate lines directly before and after the block.	Detects that statement-block braces should be in the same columns.
61	Braces ("{}") which enclose a block will have nothing else on the line except comments.	
62	The dereference operator '*' and the address-of operator '&' will be directly connected with the type-specifier.	Reports when there is a space between type and "*" "&" for variables, parameters and fields declaration.

N.	JSF++ Definition	Polyspace Specification
63	Spaces will not be used around '.' or '->', nor between unary operators and operands.	<p>Reports when the following characters are not directly connected to a white space:</p> <ul style="list-style-type: none"> • . • -> • ! • ~ • - • ++ • — <p>Note that a violation will be reported for "." used in float/double definition.</p>

Classes

N.	JSF++ Definition	Polyspace Specification
67	Public and protected data should only be used in structs - not classes.	
68	Unneeded implicitly generated member functions shall be explicitly disallowed.	Reports when default constructor, assignment operator, copy constructor or destructor is not declared.
71.1	A class's virtual functions shall not be invoked from its destructor or any of its constructors.	Reports when a constructor or destructor directly calls a virtual function.
74	Initialization of nonstatic class members will be performed through the member initialization list rather than through assignment in the body of a constructor.	<p>All data should be initialized in the initialization list except for array. Does not report that an assignment exists in ctor body.</p> <p>Message in report file:</p> <p>Initialization of nonstatic class members "<field>" will be performed through the member initialization list.</p>

N.	JSF++ Definition	Polyspace Specification
75	Members of the initialization list shall be listed in the order in which they are declared in the class.	
76	A copy constructor and an assignment operator shall be declared for classes that contain pointers to data items or nontrivial destructors.	<p>Messages in report file:</p> <ul style="list-style-type: none"> • no copy constructor and no copy assign • no copy constructor • no copy assign <p>Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.</p>
77.1	The definition of a member function shall not contain default arguments that produce a signature identical to that of the implicitly-declared copy constructor for the corresponding class/structure.	Does not report when an explicit copy constructor exists.
78	All base classes with a virtual function shall define a virtual destructor.	
79	All resources acquired by a class shall be released by the class's destructor.	<p>Reports when the number of "new" called in a constructor is greater than the number of "delete" called in its destructor.</p> <hr/> <p>Note A violation is raised even if "new" is done in a "if/else".</p>

N.	JSF++ Definition	Polyspace Specification
81	The assignment operator shall handle self-assignment correctly	<p>Reports when copy assignment body does not begin with “if (this != arg)”</p> <p>A violation is not raised if an empty else statement follows the if, or the body contains only a return statement.</p> <p>A violation is raised when the if statement is followed by a statement other than the return statement.</p>
82	An assignment operator shall return a reference to <code>*this</code> .	<p>The following operators should return <code>*this</code> on method, and <code>*first_arg</code> on plain function.</p> <p><code>operator=operator+=operator-=operator*=operator >=operator <=operator /=operator %=operator =operator &=operator ^=prefix operator++ prefix operator--</code></p> <p>Does not report when no return exists.</p> <p>No special message if type does not match.</p> <p>Messages in report file:</p> <ul style="list-style-type: none"> • An assignment operator shall return a reference to <code>*this</code>. • An assignment operator shall return a reference to its first arg.
83	An assignment operator shall assign all data members and bases that affect the class invariant (a data element representing a cache, for example, would not need to be copied).	Reports when a copy assignment does not assign all data members. In a derived class, it also reports when a copy assignment does not call inherited copy assignments.

N.	JSF++ Definition	Polyspace Specification
88	Multiple inheritance shall only be allowed in the following restricted form: <i>n</i> interfaces plus <i>m</i> private implementations, plus at most one protected implementation.	Messages in report file: <ul style="list-style-type: none"> • Multiple inheritance on public implementation shall not be allowed: <i><public_base_class></i> is not an interface. • Multiple inheritance on protected implementation shall not be allowed : <i><protected_base_class_1></i>. • <i><protected_base_class_2></i> are not interfaces.
88.1	A stateful virtual base shall be explicitly declared in each derived class that accesses it.	
89	A base class shall not be both virtual and nonvirtual in the same hierarchy.	
94	An inherited nonvirtual function shall not be redefined in a derived class.	Does not report for destructor. Message in report file: Inherited nonvirtual function %s shall not be redefined in a derived class.
95	An inherited default parameter shall never be redefined.	
96	Arrays shall not be treated polymorphically.	Reports pointer arithmetic and array like access on expressions whose pointed type is used as a base class.
97	Arrays shall not be used in interface.	Only to prevent array-to-pointer-decay. Not checked on private methods
97.1	Neither operand of an equality operator (== or !=) shall be a pointer to a virtual member function.	Reports == and != on pointer to member function of polymorphic classes (cannot determine statically if it is virtual or not), except when one argument is the null constant.

Namespaces

N.	JSF++ Definition	Polyspace Specification
98	Every nonlocal name, except <code>main()</code> , should be placed in some namespace.	Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.
99	Namespaces will not be nested more than two levels deep.	

Templates

N.	JSF++ Definition	Polyspace Specification
104	A template specialization shall be declared before its use.	Reports the actual compilation error message.

Functions

N.	JSF++ Definition	Polyspace Specification
107	Functions shall always be declared at file scope.	
108	Functions with variable numbers of arguments shall not be used.	
109	A function definition should not be placed in a class specification unless the function is intended to be inlined.	Reports when "inline" is not in the definition of a member function inside the class definition.
110	Functions with more than 7 arguments will not be used.	
111	A function shall not return a pointer or reference to a non-static local object.	Simple cases without alias effect detected.
113	Functions will have a single exit point.	Reports first return, or once per function.
114	All exit points of value-returning functions shall be through return statements.	

N.	JSF++ Definition	Polyspace Specification
116	Small, concrete-type arguments (two or three words in size) should be passed by value if changes made to formal parameters should not be reflected in the calling function.	Report constant parameters references with <code>sizeof <= 2 * sizeof(int)</code> . Does not report for copy-constructor.
119	Functions shall not call themselves, either directly or indirectly (i.e. recursion shall not be allowed).	Direct recursion is reported statically. Indirect recursion reported through the software. Message in report file: Function <F> shall not call directly itself.
121	Only functions with 1 or 2 statements should be considered candidates for inline functions.	Reports inline functions with more than 2 statements.

Comments

N.	JSF++ Definition	Polyspace Specification
126	Only valid C++ style comments (//) shall be used.	
133	Every source file will be documented with an introductory comment that provides information on the file name, its contents, and any program-required information (e.g. legal statements, copyright information, etc).	Reports when a file does not begin with two comment lines. Note: This rule cannot be annotated in the source code.

Declarations and Definitions

N.	JSF++ Definition	Polyspace Specification
135	Identifiers in an inner scope shall not use the same name as an identifier in an outer scope, and therefore hide that identifier.	Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.

N.	JSF++ Definition	Polyspace Specification
136	Declarations should be at the smallest feasible scope.	<p>Reports when:</p> <ul style="list-style-type: none"> • A global variable is used in only one function. • A local variable is not used in a statement (<code>expr</code>, <code>return</code>, <code>init ...</code>) of the same level of its declaration (in the same block) or is not used in two sub-statements of its declaration. <hr/> <p>Note</p> <ul style="list-style-type: none"> • Non-used variables are reported. • Initializations at definition are ignored (not considered an access)
137	All declarations at file scope should be static where possible.	
138	Identifiers shall not simultaneously have both internal and external linkage in the same translation unit.	
139	External objects will not be declared in more than one file.	Reports all duplicate declarations inside a translation unit. Reports when the declaration localization is not the same in all translation units.
140	The register storage class specifier shall not be used.	
141	A class, structure, or enumeration will not be declared in the definition of its type.	

Initialization

N.	JSF++ Definition	Polyspace Specification
142	All variables shall be initialized before use.	Done with Non-initialized variable checks in the software.

N.	JSF++ Definition	Polyspace Specification
144	Braces shall be used to indicate and match the structure in the non-zero initialization of arrays and structures.	This covers partial initialization.
145	In an enumerator list, the '=' construct shall not be used to explicitly initialize members other than the first, unless all items are explicitly initialized.	Generates one report for an enumerator list.

Types

N.	JSF++ Definition	Polyspace Specification
147	The underlying bit representations of floating point numbers shall not be used in any way by the programmer.	Reports on casts with float pointers (except with void*).
148	Enumeration types shall be used instead of integer types (and constants) to select from a limited series of choices.	Reports when non enumeration types are used in switches.

Constants

N.	JSF++ Definition	Polyspace Specification
149	Octal constants (other than zero) shall not be used.	
150	Hexadecimal constants will be represented using all uppercase letters.	
151	Numeric values in code will not be used; symbolic values will be used instead.	<p>Reports direct numeric constants (except integer/float value 1, 0) in expressions, non-const initializations, and switch cases. char constants are allowed. Does not report on templates non-type parameter.</p> <p>Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.</p>

N.	JSF++ Definition	Polyspace Specification
151.1	A string literal shall not be modified.	Report when a <code>char*</code> , <code>char[]</code> , or <code>string</code> type is used not as <code>const</code> . A violation is raised if a string literal (for example, “ ”) is cast as a non <code>const</code> .

Variables

N.	JSF++ Definition	Polyspace Specification
152	Multiple variable declarations shall not be allowed on the same line.	

Unions and Bit Fields

N.	JSF++ Definition	Polyspace Specification
153	Unions shall not be used.	
154	Bit-fields shall have explicitly unsigned integral or enumeration types only.	
156	All the members of a structure (or class) shall be named and shall only be accessed via their names.	Reports unnamed bit-fields (unnamed fields are not allowed).

Operators

N.	JSF++ Definition	Polyspace Specification
157	The right hand operand of a <code>&&</code> or <code> </code> operator shall not contain side effects.	Assumes rule 159 is not violated. Messages in report file: <ul style="list-style-type: none"> • The right hand operand of a <code>&&</code> operator shall not contain side effects. • The right hand operand of a <code> </code> operator shall not contain side effects.

N.	JSF++ Definition	Polyspace Specification
158	The operands of a logical && or shall be parenthesized if the operands contain binary operators.	Messages in report file: <ul style="list-style-type: none"> • The operands of a logical && shall be parenthesized if the operands contain binary operators. • The operands of a logical shall be parenthesized if the operands contain binary operators. Exception for: X Y Z , Z&&Y &&Z
159	Operators , &&, and unary & shall not be overloaded.	Messages in report file: <ul style="list-style-type: none"> • Unary operator & shall not be overloaded. • Operator shall not be overloaded. • Operator && shall not be overloaded.
160	An assignment expression shall be used only as the expression in an expression statement.	Only simple assignment, not +=, ++, etc.
162	Signed and unsigned values shall not be mixed in arithmetic or comparison operations.	
163	Unsigned arithmetic shall not be used.	
164	The right hand operand of a shift operator shall lie between zero and one less than the width in bits of the left-hand operand (inclusive).	
164.1	The left-hand operand of a right-shift operator shall not have a negative value.	Detects constant case +. Found by the software for dynamic cases.
165	The unary minus operator shall not be applied to an unsigned expression.	
166	The sizeof operator will not be used on expressions that contain side effects.	
168	The comma operator shall not be used.	

Pointers and References

N.	JSF++ Definition	Polyspace Specification
169	Pointers to pointers should be avoided when possible.	Reports second-level pointers, except for arguments of main.
170	More than 2 levels of pointer indirection shall not be used.	Only reports on variables/parameters.
171	Relational operators shall not be applied to pointer types except where both operands are of the same type and point to: <ul style="list-style-type: none"> • the same object, • the same function, • members of the same object, or • elements of the same array (including one past the end of the same array). 	Reports when relational operator are used on pointer types (casts ignored).
173	The address of an object with automatic storage shall not be assigned to an object which persists after the object has ceased to exist.	
174	The null pointer shall not be de-referenced.	Done with checks in software.
175	A pointer shall not be compared to NULL or be assigned NULL; use plain 0 instead.	Reports usage of NULL macro in pointer contexts.
176	A typedef will be used to simplify program syntax when declaring function pointers.	Reports non-typedef function pointers, or pointers to member functions for types of variables, fields, parameters. Returns type of function, cast, and exception specification.

Type Conversions

N.	JSF++ Definition	Polyspace Specification
177	User-defined conversion functions should be avoided.	<p>Reports user defined conversion function, non-explicit constructor with one parameter or default value for others (even undefined ones).</p> <p>Does not report copy-constructor.</p> <p>Additional message for constructor case:</p> <p>This constructor should be flagged as "explicit".</p>
178	<p>Down casting (casting from base to derived class) shall only be allowed through one of the following mechanism:</p> <ul style="list-style-type: none"> • Virtual functions that act like dynamic casts (most likely useful in relatively simple cases). • Use of the visitor (or similar) pattern (most likely useful in complicated cases). 	Reports explicit down casting, <code>dynamic_cast</code> included. (Visitor patter does not have a special case.)
179	A pointer to a virtual base class shall not be converted to a pointer to a derived class.	Reports this specific down cast. Allows <code>dynamic_cast</code> .

N.	JSF++ Definition	Polyspace Specification
180	Implicit conversions that may result in a loss of information shall not be used.	<p>Reports the following implicit casts :</p> <pre>integer => smaller integer unsigned => smaller or eq signed signed => smaller or eq un-signed integer => float float => integer</pre> <p>Does not report for cast to bool reports for implicit cast on constant done with the option <code>-scalar-overflows-checks signed-and-unsigned</code></p> <p>Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.</p>
181	Redundant explicit casts will not be used.	Reports useless cast: <code>cast T to T</code> . Casts to equivalent typedefs are also reported.
182	Type casting from any type to or from pointers shall not be used.	Does not report when Rule 181 applies.
184	Floating point numbers shall not be converted to integers unless such a conversion is a specified algorithmic requirement or is necessary for a hardware interface.	Reports <code>float->int</code> conversions. Does not report implicit ones.
185	C++ style casts (<code>const_cast</code> , <code>reinterpret_cast</code> , and <code>static_cast</code>) shall be used instead of the traditional C-style casts.	

Flow Control Standards

N.	JSF++ Definition	Polyspace Specification
186	There shall be no unreachable code.	<p>Done with gray checks in the software.</p> <p>Bug Finder and Code Prover check this coding rule differently. The analyses can produce different results.</p>

N.	JSF++ Definition	Polyspace Specification
187	All non-null statements shall potentially have a side-effect.	
188	Labels will not be used, except in switch statements.	
189	The <code>goto</code> statement shall not be used.	
190	The <code>continue</code> statement shall not be used.	
191	The <code>break</code> statement shall not be used (except to terminate the cases of a switch statement).	
192	All <code>if</code> , <code>else if</code> constructs will contain either a final <code>else</code> clause or a comment indicating why a final <code>else</code> clause is not necessary.	<code>else if</code> should contain an <code>else</code> clause.
193	Every non-empty <code>case</code> clause in a switch statement shall be terminated with a <code>break</code> statement.	
194	All switch statements that do not intend to test for every enumeration value shall contain a final <code>default</code> clause.	Reports only for missing <code>default</code> .
195	A switch expression will not represent a Boolean value.	
196	Every switch statement will have at least two cases and a potential <code>default</code> .	
197	Floating point variables shall not be used as loop counters.	Assumes 1 loop parameter.
198	The initialization expression in a <code>for</code> loop will perform no actions other than to initialize the value of a single <code>for</code> loop parameter.	Reports if <code>loop</code> parameter cannot be determined. Assumes Rule 200 is not violated. The <code>loop variable</code> parameter is assumed to be a variable.
199	The increment expression in a <code>for</code> loop will perform no action other than to change a single loop parameter to the next value for the loop.	Assumes 1 loop parameter (Rule 198), with non class type. Rule 200 must not be violated for this rule to be reported.

N.	JSF++ Definition	Polyspace Specification
200	Null initialize or increment expressions in <code>for</code> loops will not be used; a <code>while</code> loop will be used instead.	
201	Numeric variables being used within a <i>for</i> loop for iteration counting shall not be modified in the body of the loop.	Assumes 1 loop parameter (AV rule 198), and no alias writes.

Expressions

N.	JSF++ Definition	Polyspace Specification
202	Floating point variables shall not be tested for exact equality or inequality.	Reports only direct equality/inequality. Check done for all expressions.
203	Evaluation of expressions shall not lead to overflow/underflow.	Done with overflow checks in the software.
204	<p>A single operation with side-effects shall only be used in the following contexts:</p> <ul style="list-style-type: none"> • by itself • the right-hand side of an assignment • a condition • the only argument expression with a side-effect in a function call • condition of a loop • switch condition • single part of a chained operation 	<p>Reports when:</p> <ul style="list-style-type: none"> • A side effect is found in a return statement • A side effect exists on a single value, and only one operand of the function call has a side effect.

N.	JSF++ Definition	Polyspace Specification
204.1	The value of an expression shall be the same under any order of evaluation that the standard permits.	Reports when: <ul style="list-style-type: none"> • Variable is written more than once in an expression • Variable is read and write in sub-expressions • Volatile variable is accessed more than once <hr/> Note Read-write operations such as ++, are only considered as a write.
205	The volatile keyword shall not be used unless directly interfacing with hardware.	Reports if volatile keyword is used.

Memory Allocation

N.	JSF++ Definition	Polyspace Specification
206	Allocation/deallocation from/to the free store (heap) shall not occur after initialization.	Reports calls to C library functions: malloc / calloc / realloc / free and all new/delete operators in functions or methods.

Fault Handling

N.	JSF++ Definition	Polyspace Specification
208	C++ exceptions shall not be used.	Reports try, catch, throw spec, and throw.

Portable Code

N.	JSF++ Definition	Polyspace Specification
209	The basic types of int, short, long, float and double shall not be used, but specific-length equivalents should be typedef'd accordingly for each compiler, and these type names used in the code.	Only allows use of basic types through direct typedefs.

N.	JSF++ Definition	Polyspace Specification
213	No dependence shall be placed on C++'s operator precedence rules, below arithmetic operators, in expressions.	<p>Reports when a binary operation has one operand that is not parenthesized and is an operation with inferior precedence level.</p> <p>Reports bitwise and shifts operators that are used without parenthesis and binary operation arguments.</p>
215	Pointer arithmetic will not be used.	<p>Reports: <code>p + Ip - Ip++p--p+=p-=</code></p> <p>Allows <code>p[i]</code>.</p>

Unsupported JSF++ Rules

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- “Rules” on page 4-87
- “Environment” on page 4-87
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Code Size and Complexity

N.	JSF++ Definition
2	There shall not be any self-modifying code.

Rules

N.	JSF++ Definition
4	To break a “should” rule, the following approval must be received by the developer: <ul style="list-style-type: none"> • approval from the software engineering lead (obtained by the unit approval in the developmental CM tool)
5	To break a “will” or a “shall” rule, the following approvals must be received by the developer: <ul style="list-style-type: none"> • approval from the software engineering lead (obtained by the unit approval in the developmental CM tool) • approval from the software product manager (obtained by the unit approval in the developmental CM tool)
6	Each deviation from a “shall” rule shall be documented in the file that contains the deviation. Deviations from this rule shall not be allowed, AV Rule 5 notwithstanding.
7	Approval will not be required for a deviation from a “shall” or “will” rule that complies with an exception specified by that rule.

Environment

N.	JSF++ Definition
10	Values of character types will be restricted to a defined and documented subset of ISO 10646 1.

Libraries

N.	JSF++ Definition
16	Only DO-178B level A [15] certifiable or SEAL 1 C/C++ libraries shall be used with safety-critical (i.e. SEAL 1) code.

Header Files

N.	JSF++ Definition
34	Header files should contain logically related declarations only.
36	Compilation dependencies should be minimized when possible.
37	Header (include) files should include only those header files that are required for them to successfully compile. Files that are only used by the associated .cpp file should be placed in the .cpp file — not the .h file.
38	Declarations of classes that are only accessed via pointers (*) or references (&) should be supplied by forward headers that contain only forward declarations.

Style

N.	JSF++ Definition
45	All words in an identifier will be separated by the ‘_’ character.
49	All acronyms in an identifier will be composed of uppercase letters.
55	The name of a header file should reflect the logical entity for which it provides declarations.
56	The name of an implementation file should reflect the logical entity for which it provides definitions and have a “.cpp” extension (this name will normally be identical to the header file that provides the corresponding declarations.) At times, more than one .cpp file for a given logical entity will be required. In these cases, a suffix should be appended to reflect a logical differentiation.

Classes

N.	JSF++ Definition
64	A class interface should be complete and minimal.
65	A structure should be used to model an entity that does not require an invariant.

N.	JSF++ Definition
66	A class should be used to model an entity that maintains an invariant.
69	A member function that does not affect the state of an object (its instance variables) will be declared const. Member functions should be const by default. Only when there is a clear, explicit reason should the const modifier on member functions be omitted.
70	A class will have friends only when a function or object requires access to the private elements of the class, but is unable to be a member of the class for logical or efficiency reasons.
70.1	An object shall not be improperly used before its lifetime begins or after its lifetime ends.
71	Calls to an externally visible operation of an object, other than its constructors, shall not be allowed until the object has been fully initialized.
72	<p>The invariant for a class should be:</p> <ul style="list-style-type: none"> • A part of the postcondition of every class constructor, • A part of the precondition of the class destructor (if any), • A part of the precondition and postcondition of every other publicly accessible operation.
73	Unnecessary default constructors shall not be defined.
77	A copy constructor shall copy all data members and bases that affect the class invariant (a data element representing a cache, for example, would not need to be copied).
80	The default copy and assignment operators will be used for classes when those operators offer reasonable semantics.
84	Operator overloading will be used sparingly and in a conventional manner.
85	When two operators are opposites (such as == and !=), both will be defined and one will be defined in terms of the other.
86	Concrete types should be used to represent simple independent concepts.
87	Hierarchies should be based on abstract classes.
90	Heavily used interfaces should be minimal, general and abstract.
91	Public inheritance will be used to implement “is-a” relationships.

N.	JSF++ Definition
92	<p>A subtype (publicly derived classes) will conform to the following guidelines with respect to all classes involved in the polymorphic assignment of different subclass instances to the same variable or parameter during the execution of the system:</p> <ul style="list-style-type: none">• Preconditions of derived methods must be at least as weak as the preconditions of the methods they override.• Postconditions of derived methods must be at least as strong as the postconditions of the methods they override. <p>In other words, subclass methods must expect less and deliver more than the base class methods they override. This rule implies that subtypes will conform to the Liskov Substitution Principle.</p>
93	<p>“has-a” or “is-implemented-in-terms-of” relationships will be modeled through membership or non-public inheritance.</p>

Namespaces

N.	JSF++ Definition
100	<p>Elements from a namespace should be selected as follows:</p> <ul style="list-style-type: none">• using declaration or explicit qualification for few (approximately five) names,• using directive for many names.

Templates

N.	JSF++ Definition
101	<p>Templates shall be reviewed as follows:</p> <ol style="list-style-type: none">1 with respect to the template in isolation considering assumptions or requirements placed on its arguments.2 with respect to all functions instantiated by actual arguments.
102	<p>Template tests shall be created to cover all actual template instantiations.</p>
103	<p>Constraint checks should be applied to template arguments.</p>
105	<p>A template definition’s dependence on its instantiation contexts should be minimized.</p>
106	<p>Specializations for pointer types should be made where appropriate.</p>

Functions

N.	JSF++ Definition
112	Function return values should not obscure resource ownership.
115	If a function returns error information, then that error information will be tested.
117	Arguments should be passed by reference if NULL values are not possible: <ul style="list-style-type: none"> • 117.1 - An object should be passed as <code>const T&</code> if the function should not change the value of the object. • 117.2 - An object should be passed as <code>T&</code> if the function may change the value of the object.
118	Arguments should be passed via pointers if NULL values are possible: <ul style="list-style-type: none"> • 118.1 - An object should be passed as <code>const T*</code> if its value should not be modified. • 118.2 - An object should be passed as <code>T*</code> if its value may be modified.
120	Overloaded operations or methods should form families that use the same semantics, share the same name, have the same purpose, and that are differentiated by formal parameters.
122	Trivial accessor and mutator functions should be inlined.
123	The number of accessor and mutator functions should be minimized.
124	Trivial forwarding functions should be inlined.
125	Unnecessary temporary objects should be avoided.

Comments

N.	JSF++ Definition
127	Code that is not used (commented out) shall be deleted. Note: This rule cannot be annotated in the source code.
128	Comments that document actions or sources (e.g. tables, figures, paragraphs, etc.) outside of the file being documented will not be allowed.
129	Comments in header files should describe the externally visible behavior of the functions or classes being documented.
130	The purpose of every line of executable code should be explained by a comment, although one comment may describe more than one line of code.

N.	JSF++ Definition
131	One should avoid stating in comments what is better stated in code (i.e. do not simply repeat what is in the code).
132	Each variable declaration, typedef, enumeration value, and structure member will be commented.
134	Assumptions (limitations) made by functions should be documented in the function's preamble.

Initialization

N.	JSF++ Definition
143	Variables will not be introduced until they can be initialized with meaningful values. (See also AV Rule 136, AV Rule 142, and AV Rule 73 concerning declaration scope, initialization before use, and default constructors respectively.)

Types

N.	JSF++ Definition
146	Floating point implementations shall comply with a defined floating point standard. The standard that will be used is the ANSI/IEEE® Std 754 [1].

Unions and Bit Fields

N.	JSF++ Definition
155	Bit-fields will not be used to pack data into a word for the sole purpose of saving space.

Operators

N.	JSF++ Definition
167	The implementation of integer division in the chosen compiler shall be determined, documented and taken into account.

Type Conversions

N.	JSF++ Definition
183	Every possible measure should be taken to avoid type casting.

Expressions

N.	JSF++ Definition
204	<p>A single operation with side-effects shall only be used in the following contexts:</p> <ol style="list-style-type: none"> 1 by itself 2 the right-hand side of an assignment 3 a condition 4 the only argument expression with a side-effect in a function call 5 condition of a loop 6 switch condition 7 single part of a chained operation

Memory Allocation

N.	JSF++ Definition
207	Unencapsulated global data will be avoided.

Portable Code

N.	JSF++ Definition
210	Algorithms shall not make assumptions concerning how data is represented in memory (e.g. big endian vs. little endian, base class subobject ordering in derived classes, nonstatic data member ordering across access specifiers, etc.).
210.1	Algorithms shall not make assumptions concerning the order of allocation of nonstatic data members separated by an access specifier.
211	Algorithms shall not assume that shorts, ints, longs, floats, doubles or long doubles begin at particular addresses.
212	Underflow or overflow functioning shall not be depended on in any special way.
214	Assuming that non-local static objects, in separate translation units, are initialized in a special order shall not be done.

Efficiency Considerations

N.	JSF++ Definition
216	Programmers should not attempt to prematurely optimize code.

Miscellaneous

N.	JSF++ Definition
217	Compile-time and link-time errors should be preferred over run-time errors.
218	Compiler warning levels will be set in compliance with project policies.

Testing

N.	JSF++ Definition
219	All tests applied to a base class interface shall be applied to all derived class interfaces as well. If the derived class poses stronger postconditions/invariants, then the new postconditions /invariants shall be substituted in the derived class tests.
220	Structural coverage algorithms shall be applied against flattened classes.
221	Structural coverage of a class within an inheritance hierarchy containing virtual functions shall include testing every possible resolution for each set of identical polymorphic references.

Approximations Used During Bug Finder Analysis

Inputs in Polyspace Bug Finder

A Bug Finder analysis does not return a defect caused by a special value of an unknown input, unless the input is bounded. Polyspace makes no assumption about the value of unbounded inputs when your source code is incomplete. For example, in the following code Bug Finder detects a **division by zero** in `foo_1()`, but not in `foo_2()`:

```
int foo_1(int p)
{
    int x = 0;
    if ( p > -10 && p < 10 ) /* p is bounded by if statement */
        x = 100/p; /* Division by zero detected */

    return x;
}

int foo_2(int p) /* p is unbounded */
{
    int x = 0;
    x = 100/p; /* Division by zero not detected */

    return x;
}
```

Note To set bounds on your input, add constraints in your code such as `assert` or `if`.

See Also

“Global Variables in Polyspace Bug Finder” on page 5-3 | “Bug Finder Analysis Assumptions”

Global Variables in Polyspace Bug Finder

When you run a Bug Finder analysis, Polyspace makes certain assumptions about the initialization of global variables. These assumptions depend on how you declare and define global variables. For example, in this code

```
int foo(void) {  
    return 1/gvar;  
}
```

Bug Finder detects a **division by zero** defect with the variable `gvar` in these cases:

- You define `int gvar;` in the source code and provide a `main` function that calls `foo`. Bug Finder follows ANSI standards that state the variable is initialized to zero.
- You define `int gvar;` or declare `extern int gvar;` in the source code. Another function calls `foo` and sets `gvar=0`. Otherwise, when your source files are incomplete and do not contain a `main` function, Bug Finder makes no assumption about the initialization of `gvar`.
- You declare `const int gvar;`. Bug Finder assumes `gvar` is initialized to zero due to the `const` keyword.

See Also

“Inputs in Polyspace Bug Finder” on page 5-2 | “Bug Finder Analysis Assumptions”

