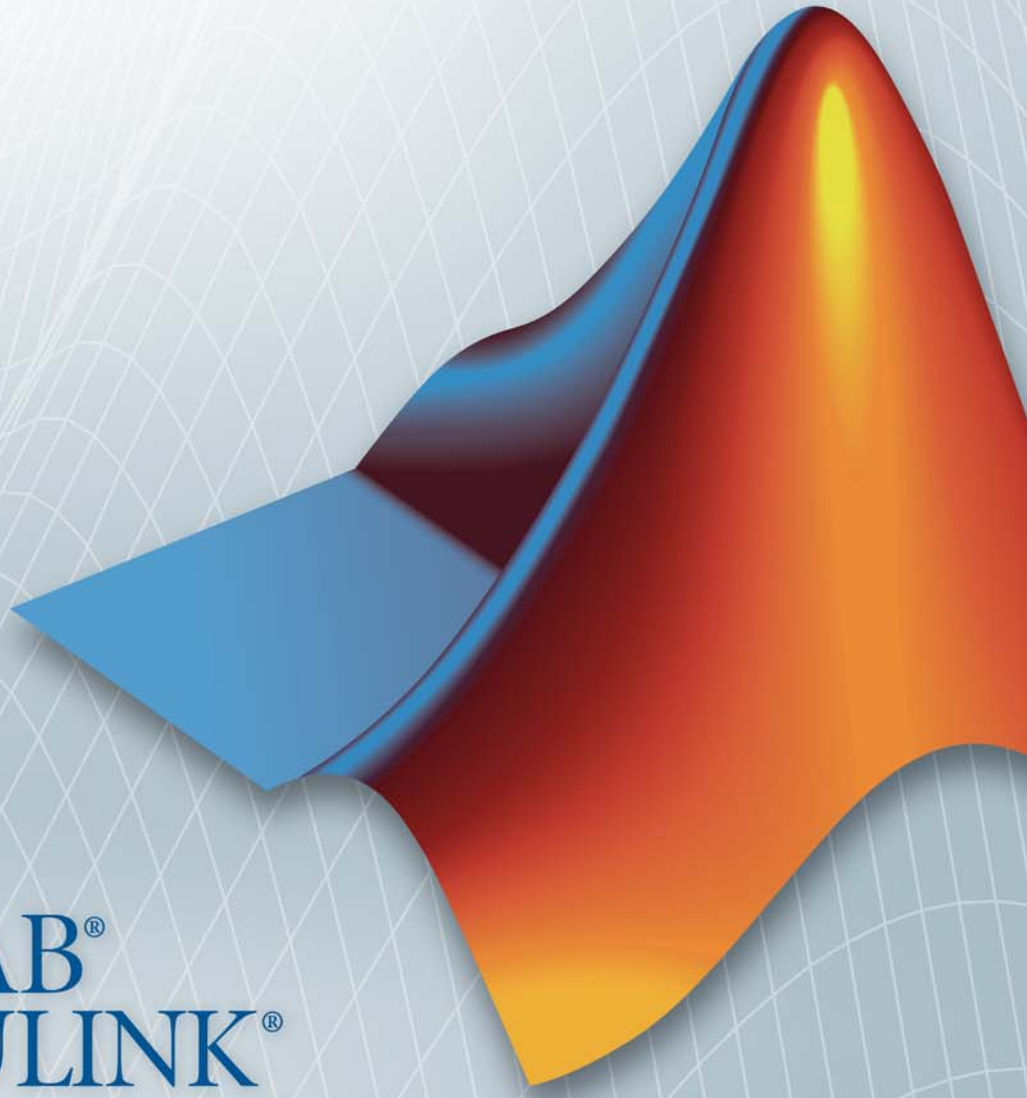
DO Qualification Kit

User's Guide

R2011b



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DO Qualification Kit User's Guide

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- "Qualification Process Summary" on page 1-12

DO Qualification Kit Product Overview

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What is the DO Qualification Kit Product?

The DO Qualification Kit product is a package of document templates, test cases, and test procedures that you can use to qualify MathWorks® software verification tools for DO-178B or DO-254 certification. Using the product, you can achieve and benefit from schedule, cost, and product quality process improvements.

To view the document templates, test cases, and test procedures that are part of the DO Qualification Kit product, use the Certification Artifacts Explorer. For more information, see Chapter 3, "Accessing and Managing Qualification Artifacts".

What is a Verification Tool?

Verification tools automate verification, validation, and testing activities to achieve efficiency and detect certain errors. A verification tool does not introduce errors, but might fail to detect errors that already exist in a product. (See DO-178B Section 12.2 and DO-254 Section 11.4.)

What is Software Verification Tool Qualification for DO-178B?

Software that is included in avionic systems must be certified by meeting objectives of the DO-178B standard. To achieve credit for the use of a tool in the certification of an avionic system, you must qualify that tool if the output of the tool is not verified. The DO Qualification Kit product provides resources for qualifying MathWorks software verification tools. The tool user (not the tool vendor) is responsible for the qualification.

For guidance on how to use the DO Qualification Kit product to qualify MathWorks software verification tools, see "Qualification Process Summary" on page 1-12.

For information on criteria used to determine whether a tool needs to be qualified, see the "Requirement for Qualification" section of the Tool Qualification Plan for the relevant MathWorks verification tool.

Can You Apply the DO Qualification Kit Product to DO-254?

You can use the DO Qualification Kit product to qualify verification tools for projects that follow DO-254. The process for tool qualification is described in Section 11.4 of DO-254. The following verification tool capabilities are applicable to DO-254 projects:

- Simulink® Verification and Validation™ — DO-178B checks
- Simulink Verification and Validation — model coverage
- SystemTest™ — Limit Check element
- Simulink® Report Generator™ — System Design Description report

To take credit for DO-254 for the verification tool capabilities that are applicable to your project, modify all references to DO-178B to refer to the appropriate sections of DO-254. For example, modify references to DO-178B Section 12.2 to refer to DO-254 Section 11.4. The following tables list the items to modify and what files correspond to these items.

Simulink Verification and Validation Verification Tool

Item to Modify	File

Document templates	`qualkitdo_slvnv_tqp.rtf`
	`qualkitdo_slvnv_tor.rtf`
	`qualkitdo_slvnv_tcpr.rtf`

Test cases, procedures, and results	`qualkitdo_slvnv_tcpr1.xls*`
	`qualkitdo_slvnv_tcpr2.xls`
	`qualkitdo_slvnv_tcpr3.xls`
	`qualkitdo_slvnv_tcpr4.xls`
	`qualkitdo_slvnv_tcpr5.xls`
	`qualkitdo_slvnv_tcpr6.xls`

*The Model Advisor checks **Check safety-related optimization settings** and **Check safety-related code generation settings** are not applicable to DO-254. In `qualkitdo_slvnv_tcpr1.xls`, delete the rows corresponding to these checks. After deleting the rows, when you generate the report using `qualkitdo_slvnv_tcpr1.rpt`, the report does not include these two checks. Therefore, the report you generate does not match the example report `qualkitdo_slvnv_qualificationreport1.html`.

SystemTest Verification Tool

Item to Modify	File

Document templates	`qualkitdo_systemtest_tqp.rtf`
	`qualkitdo_systemtest_tor.rtf`
	`qualkitdo_systemtest_tcpr.rtf`

Test cases, procedures, and results	`qualkitdo_systemtest_tcpr.test`

Simulink Report Generator Verification Tool

Item to Modify	File

Document templates	`qualkitdo_rptgenext_tqp.rtf`
	`qualkitdo_rptgenext_tor.rtf`
	`qualkitdo_rptgenext_tcpr.rtf`

DO Qualification Kit Components

- "Model-Based Design Workflow for DO-178B" on page 1-5
- "Supported MathWorks Software Verification Tools" on page 1-5
- "Simulink® Verification and Validation Product" on page 1-6
- "SystemTest Product" on page 1-7
- "Polyspace Products for C/C++" on page 1-8
- "Simulink® Report Generator Product" on page 1-9

Model-Based Design Workflow for DO-178B

The DO-178B software life cycle consists of objectives that must be met for each of the life cycle stages. In Appendix A of DO-178B, these objectives are summarized in tables. The *DO Qualification Kit Model-Based Design Workflow for DO-178B* document summarizes those tables and provides recommendations on meeting the objectives using a Model-Based Design process.

The workflow document is in the following folder:

```
matlabroot/toolbox/qualkits/do/
```

The following table lists available workflow documents.

Workflow Document	File
Model-Based Design Workflow for DO-178B	`qualkitdo_workflow.pdf`

Supported MathWorks Software Verification Tools

The DO Qualification Kit product includes document templates, test cases, and test procedures that you need to qualify the following MathWorks software verification tools:

- Simulink Verification and Validation (DO-178B checks; model coverage)
- SystemTest (Limit Check element)

- Polyspace® Client™ for C/C++; Polyspace® Server™ for C/C++
- Simulink Report Generator (System Design Description report)

Note By qualifying the model coverage capability of the Simulink Verification and Validation product, you can claim credit for demonstrating completeness and correctness of the test cases generated by Simulink® Design Verifier™. Use the model coverage capability instead of reviewing the Simulink Design Verifier report. You can demonstrate completeness and correctness by running the generated test cases against the model, measuring the model coverage, and reviewing the model coverage report. You can run the test cases on the executable object code and compare the actual results to the simulation results. The model coverage capability does not assess the correctness of the simulation results, only the test case coverage of the model. Therefore, you must verify that the expected results from the model are correct.

In addition to this documentation, the DO Qualification Kit product consists of the qualification documents described in the following sections. The qualification documents are located in your MATLAB® installation folder at *matlabroot*`/toolbox/qualkits/do`. Although the kit contains the documents and tests that you need to qualify the supported tools, you must determine how to apply the documents and tests to your specific project or application.

Refer to the `PDF` version of a qualification document to become familiar with the qualification process and the required content. To customize the qualification documents for your specific project or application, modify the `RTF` versions.

Simulink Verification and Validation Product

The DO Qualification Kit product supports qualifying the following versions and features of the Simulink Verification and Validation verification tool:

- Version 3.2 (R2011b): DO-178B checks
- Version 3.2 (R2011b): Model coverage

Document templates, test cases, and test procedures are in the following folder:

matlabroot/toolbox/qualkits/do/slvnv/r2011b/

The following table lists qualification documents, and the primary files associated with the qualification documents.

Qualification Documents	Files
Tool Qualification Plan (TQP)	qualkitdo_slvnv_tqp.pdf qualkitdo_slvnv_tqp.rtf
Tool Operational Requirements (TOR) and supporting documentation	qualkitdo_slvnv_tor.pdf qualkitdo_slvnv_tor.rtf qualkitdo_slvnv_ma_ui.pdf qualkitdo_slvnv_mc_ui.pdf
Test Cases, Procedures, and Results (TCPR), and supporting documentation	qualkitdo_slvnv_tcpr.pdf qualkitdo_slvnv_tcpr.rtf qualkitdo_slvnv_tcpr*.rpt qualkitdo_slvnv_tcpr*.xls tests*.mdl outputs\ qualkitdo_slvnv_qualificationreport*.html

SystemTest Product

The DO Qualification Kit product supports qualifying the following version and feature of the SystemTest verification tool:

Version 2.6.2 (R2011b): Limit Check element

Document templates, test cases, and test procedures are in the following folder:

matlabroot/toolbox/qualkits/do/systemtest/r2011b/

The following table lists qualification documents, and the primary files associated with the qualification documents.

Qualification Documents	Files
Tool Qualification Plan (TQP)	`qualkitdo_systemtest_tqp.pdf` `qualkitdo_systemtest_tqp.rtf`

Tool Operational Requirements (TOR) and supporting documentation	`qualkitdo_systemtest_tor.pdf`
	`qualkitdo_systemtest_tor.rtf`
	`qualkitdo_systemtest_lc_ui.pdf`

Test Cases, Procedures, and Results (TCPR), and supporting documentation	`qualkitdo_systemtest_tcpr.pdf`
	`qualkitdo_systemtest_tcpr.rtf`
	`qualkitdo_systemtest_tcpr.test`
	`outputs\qualkitdo_systemtest_tcpr_report\`
	`qualkitdo_systemtest_qualificationreport.html`

Polyspace Products for C/C++

The DO Qualification Kit product supports qualifying the following version and feature of Polyspace® code verification tools:

Version 8.2 (R2011b): Polyspace Client for C/C++; Polyspace Server for C/C++

Document templates, test cases, and test procedures are in the following folder:

matlabroot`/toolbox/qualkits/do/polyspace/r2011b/`

The following table lists qualification documents, and the primary files associated with the qualification documents.

Qualification Documents	Files
Theoretical Foundation (TF)	`qualkitdo_polyspace_tf.pdf` `qualkitdo_polyspace_tf.rtf`
Tool Qualification Plan (TQP)	`qualkitdo_polyspace_tqp.pdf` `qualkitdo_polyspace_tqp.rtf`

Qualification Documents	Files
Tool Operational Requirements (TOR)	`qualkitdo_polyspace_tor.pdf` `qualkitdo_polyspace_tor.rtf`

Tests Cases, Procedures, and Results (TCPR), and supporting documentation	`qualkitdo_polyspace_tcpr.pdf`
	`qualkitdo_polyspace_tcpr.rtf`
	`Matrix_*.txt`
	`tests\qualkitdo_polyspace_tcpr.*`
	`tests\tor-checks\tor-checks.txt`
	`tests\*\*_rules.txt`
	`tests\*\*.c`
	`tests\*\*.cpp`
	`outputs\`
	`qualkitdo_polyspace_qualificationreport_*.txt`

Simulink Report Generator Product

The DO Qualification Kit product supports qualifying the following version and feature of the Simulink Report Generator verification tool:

Version 3.11 (R2011b): System Design Description report

Document templates, test cases, and test procedures are in the following folder:

matlabroot`/toolbox/qualkits/do/rptgenext/r2011b/`

The following table lists qualification documents, and the primary files associated with the qualification documents.

Qualification Documents	Files
Tool Qualification Plan (TQP)	qualkitdo_rptgenext_tqp.pdf qualkitdo_rptgenext_tqp.rtf
Tool Operational Requirements (TOR) and supporting documentation	qualkitdo_rptgenext_tor.pdf qualkitdo_rptgenext_tor.rtf qualkitdo_rptgenext_sdd_ui.pdf
Test Cases, Procedures, and Results (TCPR), and supporting documentation	qualkitdo_rptgenext_tcpr.pdf qualkitdo_rptgenext_tcpr.rtf qualkitdo_rptgenext_tcpr.rpt outputs\ qualkitdo_rptgenext_qualificationreport.pdf qualkitdo_rptgenext_qualificationreport_*.html qualkitdo_rptgenext_qualificationreport_*.doc qualkitdo_rptgenext_qualificationreport_*.rtf qualkitdo_rptgenext_qualificationreport_*.pdf

What Certification Credit Can be Achieved By Qualifying MathWorks Verification Tools?

For a list of areas of the DO-178B standard for which some certification credit (meet or replace DO-178B objectives) can be achieved by qualifying MathWorks verification tools, see the "Certification Credit" section of the Tool Qualification Plan for the relevant tool. The amount of credit that can be achieved is dependent upon the development processes used and how verification tools are applied within the processes.

Required Knowledge

Before using the DO Qualification Kit product, make sure that you have:

- Knowledge about developing safety-critical software.
- Knowledge of DO-178B, Software Considerations in Airborne Systems and Equipment Certification, or DO-254, Design Assurance Guidance for Airborne Electronic Hardware.
- Experience using features of MathWorks verification tools that you want to qualify (and related required software, such as MATLAB and Simulink®):

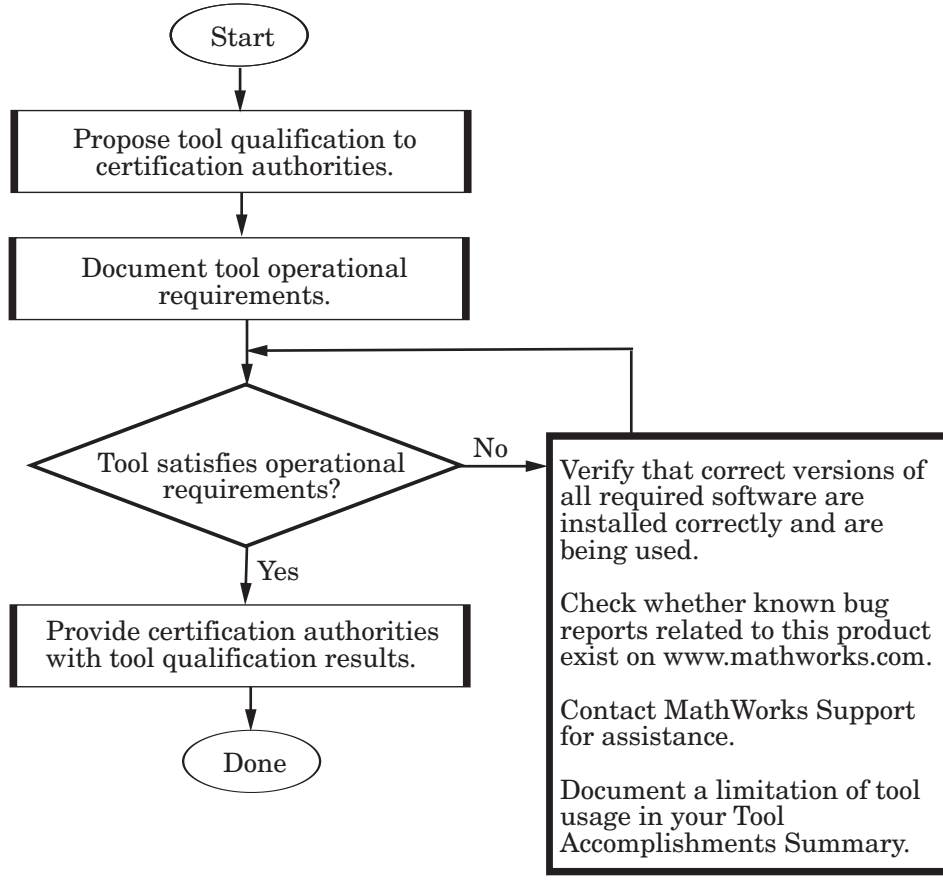
- Simulink Verification and Validation (DO-178B checks, model coverage)
- SystemTest (Limit Check element)
- Polyspace Client for C/C++, Polyspace Server for C/C++
- Simulink Report Generator (System Design Description report)

Also, become familiar with the following information:

- "Modeling Guidelines for High-Integrity Systems" in the Simulink documentation.
- If you have a Embedded Coder™ license, "Developing Models and Code That Comply with the DO-178B Standard" in the Embedded Coder documentation.

Qualification Process Summary

1. Provide certification authorities with a tool qualification plan.
2. Document tool operational requirements.
3. Verify that the tool satisfies tool operational requirements and define limitations and restrictions of the tool.
4. Provide certification authorities with tool qualification results, including limitations and restrictions.



Note The `rights.txt` file, located at *`matlabroot`*`/toolbox/qualkits/do`, describes allowed uses of the MathWorks DO Qualification Kit product.

2

Qualifying Tools for DO-178B Certification

- "Proposing Tool Qualification Plan to Certification Authorities" on page 2-2
- "Document Tool Operational Requirements" on page 2-4
- "Verifying That the Tool Satisfies Tool Operational Requirements" on page 2-5
- "Provide Certification Authorities with Tool Qualification Results" on page 2-7

Proposing Tool Qualification Plan to Certification Authorities

The first step of the qualification process is to propose a Tool Qualification Plan to the DO-178B certification authorities. To propose a Tool Qualification Plan, complete the following steps for each tool that you plan to qualify:

1. Identify a MathWorks software verification tool that you plan to qualify.

2. Locate the PDF version of the Tool Qualification Plan document provided for the tool in the DO Qualification Kit product. Review the document for applicability to your project.

3. Locate and make a copy of the `.rtf` Tool Qualification Plan template file for that tool.

   The Tool Qualification Plan provides the following information:

   - Introduction
   - Title and version of the Tool Operational Requirements (TOR)
   - Certification considerations — basis for qualifying the tool and objectives for which you are seeking certification credit
   - Tool development lifecycle — planning, requirement documents and activity, verification documents and activity
   - Tool lifecycle data — mapping of application documents to the DO-178B process lifecycle
   - Qualification schedule

4. Edit the template, as necessary, for your application and make the document available for review. This typically includes adding the following information:

   - In the table located in “Tool Lifecycle Data”, where indicated, references to the documents:
     - Plan for Software Aspects of Certification (PSAC)
     - Software Accomplishment Summary (SAS)
     - Tool Qualification Accomplishment Summary (TQAS)

- Tool qualification schedule located in a section titled “Schedule”

5. Add a reference to the tool that you are qualifying and justification why the tool requires qualification to the application PSAC, indicating your intent to use the verification tool.

6. Submit the PSAC to the certification authorities. If you want, you can also submit the Tool Qualification Plan with the PSAC. These documents inform the certification authorities of your intent to use a tool and initiates a dialog regarding your plans for certification.

After you complete this procedure, document the Tool Operational Requirements, as described in “Document Tool Operational Requirements” on page 2-4.

Document Tool Operational Requirements

After you propose a Tool Qualification Plan to certification authorities, develop a Tool Operational Requirements document. To do this, complete the following steps for each tool that you plan to qualify:

1. Locate the PDF version of the Tool Operational Requirements document provided for the tool in the DO Qualification Kit product, and review the document for applicability to your project.

   The Tool Operational Requirements document provides the following information:

   - Introduction
   - Operational requirements — description of the functionality of the tool and how it is used
   - Installation information
   - Operational environment

2. Install and configure the required software in your project configuration management system, as cited in the Tool Operational Requirements document.

3. Locate and make a copy of the `.rtf` Tool Operational Requirements document template file for the tool.

4. Edit the template, as necessary for your application, and make the document available for review by certification authorities.

After you complete this procedure, verify that the tool satisfies Tool Operational Requirements, as described in "Verifying That the Tool Satisfies Tool Operational Requirements" on page 2-5.

Verifying That the Tool Satisfies Tool Operational Requirements

After you document the Tool Operational Requirements, verify that the tool satisfies the Tool Operational Requirements. To do this, complete the following steps for each tool that you plan to qualify:

1. Locate the PDF version of the Test Cases, Procedures, and Results (TCPR) document provided for the tool in the DO Qualification Kit product, and review the test cases and procedures described in the document for applicability to your project.

   The Test Cases, Procedures, and Results document provides the following information:

   - Introduction
   - Description of test cases and procedures
   - Traceability matrix between operational requirements and test cases and procedures
   - Procedure for executing the test cases and procedures
   - Test results

2. Locate and make a copy of the `.rtf` Test Cases, Procedures, and Results document template file for the tool.

3. Edit the test cases and procedures sections of the template, as necessary for your application, and finalize the document. For example, you might need to modify content in the Expected Result column of the table in the traceability matrix.

4. Locate and configure the test cases and procedures in your project configuration management system.

5. Execute the test cases and procedures in the installed and configured environment. For more information, see “Executing the Test Cases and Procedures” in the Test Cases, Procedures, and Results document for the verification tool you are qualifying.

6. Review the test results. If the results are not correct:

- Verify that correct versions of all required MathWorks software are installed correctly and being used.
- Check whether known bug reports related to this product exist on the MathWorks Web site (`www.mathworks.com`).
- Contact MathWorks support for assistance.
- Document a limitation of the tool usage in your Tool Accomplishments Summary if you cannot resolve the test failure.

7 Configure the test results in your project configuration management system.

After you complete this procedure, document and provide the results to certification authorities, as described in "Provide Certification Authorities with Tool Qualification Results" on page 2-7.

Provide Certification Authorities with Tool Qualification Results

After you verify whether the tool satisfies tool operational requirements, complete the following steps for each tool that you are qualifying.

1. Document the test results in a Tool Accomplishment Summary.
2. Add an entry that summarizes the results of the tool qualification to the Software Accomplishment Summary (SAS). You can also submit the Tool Accomplishment Summary with the SAS.
3. Submit the SAS to the certification authorities so that they can approve the results. The data can provide a record of the qualification status of the tool.

3

Accessing and Managing Qualification Artifacts

- "Accessing Qualification Artifacts Using the Certification Artifacts Explorer" on page 3-2
- "Managing Qualification Artifacts Using the Certification Artifacts Explorer" on page 3-4
- "Limitations of the Certification Artifacts Explorer" on page 3-6

Accessing Qualification Artifacts Using the Certification Artifacts Explorer

In this section...
"Qualification Artifacts in the DO Qualification Kit Product" on page 3-2 "How To Access Qualification Artifacts" on page 3-2

Qualification Artifacts in the DO Qualification Kit Product

The DO Qualification Kit product includes document templates, test cases, and test procedures that you need to qualify MathWorks software verification tools.

For more information about the qualification artifacts that are part of the DO Qualification Kit product, see "DO Qualification Kit Components" on page 1-5.

For more information about qualifying software tools, see Chapter 2, "Qualifying Tools for DO-178B Certification".

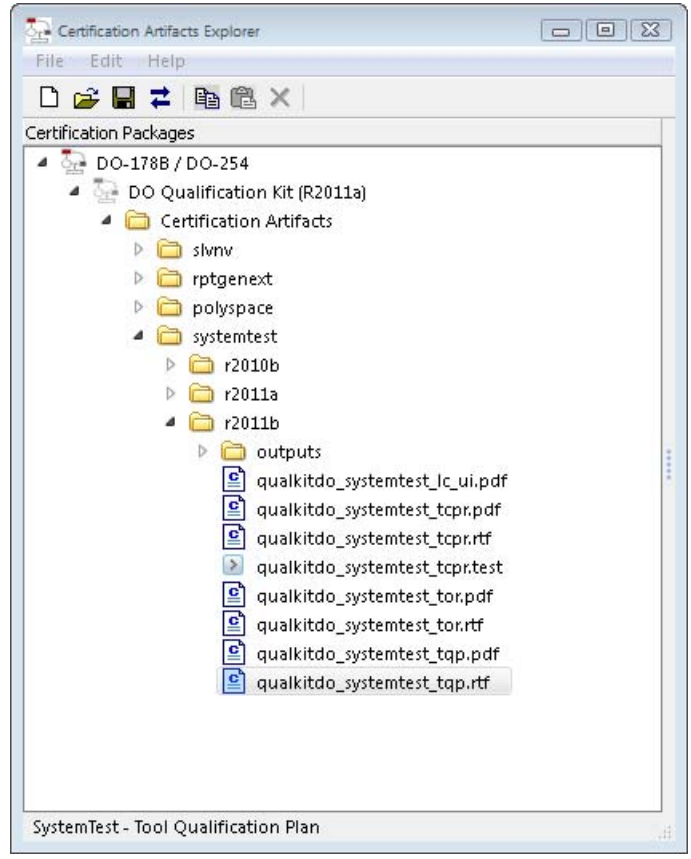
How To Access Qualification Artifacts

You can use the Certification Artifacts Explorer to access qualification artifacts. To start the Certification Artifacts Explorer, use one of the following methods.

To start the Certification Artifacts Explorer...	Do this:
From the MATLAB **Start** menu	Select **Start > Simulink > DO Qualification Kit > Certification Artifacts Explorer**.
From the MATLAB command line	Enter `qualkitdo`.

The Certification Artifacts Explorer window displays the qualification artifacts that are available with the DO Qualification Kit product. If the DO Qualification Kit product contains artifacts for more than one release, the Certification Artifacts Explorer lists the artifacts for each release. As you select folders and files, relevant information about the current selection is dynamically displayed in the status bar. Additionally,

- To display the properties of a certification package, right-click the package name and select **Properties**.
- To open an artifact, right-click the artifact and select **Open File**.



Managing Qualification Artifacts Using the Certification Artifacts Explorer

In this section...
"Managing Tool Qualification Artifacts" on page 3-4
"Deleting Certification Packages" on page 3-5

Managing Tool Qualification Artifacts

To manage tool qualification artifacts using the Certification Artifacts Explorer:

1. Create a new certification package.
2. Name the certification package.
3. Define the location where the Certification Artifacts Explorer stores the certification package.
4. Save the certification package. The saved package has a KIT extension.
5. Copy the tool qualification artifacts for the product of interest into the certification package.
6. Delete qualification artifacts that are not required for your project.
7. Optionally, add related files to the certification package using a file browser such as Microsoft® Windows® Explorer.

   Tip When you add files, to refresh the file list, use **File > Refresh**.

8. Use the Certification Artifacts Explorer to access tool qualification artifacts.

When you create and save new certification packages, the Certification Artifacts Explorer displays them. The certification packages that are listed remain visible unless you delete them from the Certification Artifacts Explorer.

Deleting Certification Packages

The Certification Artifacts Explorer displays all certification packages that you create or open. If you delete a certification package from the Certification Artifacts Explorer, the files associated with the package are still available on your computer. To delete the files, use a file browser such as Windows Explorer.

Limitations of the Certification Artifacts Explorer

The Certification Artifacts Explorer has the following limitations:

- The Certification Artifacts Explorer works on Microsoft Windows platforms only.
- For optimal performance, ensure that Microsoft Internet Explorer® is available on your machine. Internet Explorer does not have to be your default web browser.

4

Supporting Qualification-Related Development Activities

- "Generating a Traceability Matrix" on page 4-2
- "Adding Comments to a Traceability Matrix" on page 4-6
- "Traceability Matrix Limitations" on page 4-8

Generating a Traceability Matrix

In this section...

"About Traceability Matrices" on page 4-2

"Traceability Matrix Limitations" on page 4-8

"Prerequisites for Generating a Traceability Matrix" on page 4-3

"How to Generate a Traceability Matrix" on page 4-4

About Traceability Matrices

When you use Model-Based Design and production code generation to develop application software components, you can generate a *traceability matrix*. The traceability matrix provides traceability among model objects, generated code, and model requirements. You can add comments to the generated traceability matrix. If you change the model and regenerate the traceability matrix, the software retains your comments.

For a given model, the generated traceability matrix can provide information about:

- Model objects that are traceable between the model and generated code, such as Simulink blocks, Stateflow® objects, and MATLAB functions.
- Model objects that are untraceable between the model and generated code, such as eliminated and virtual blocks.
- Requirements documents that you link to model objects using the Simulink Verification and Validation Requirements Management Interface (RMI).

Generate the traceability matrix using either the `do178b.ExportTraceReport` function from the MATLAB Command Window or the **Generate Traceability Matrix** button in the generated HTML code generation report for your model. Either method creates an XLS file that contains the following worksheets:

- **Report** — Traceability information for each model object, including model, generated code, and requirements. Each row in the worksheet pertains to a single occurrence of a model object. The information for a model object is in more than one row if the object:

  - Appears more than once in the generated code.
  - Links to more than one requirement.
- **Model Information** — Summary of the model configuration and checksum. The summary includes the model name, version, author, creation date, last saved by, last updated date, checksum, and the selection of **Traceability Report Contents** parameters.
- **Code Interface** — Information about the generated code interface, such as function prototype and timing information for the model initialize and step functions.
- **Code Files** — File folders and names of the generated code files.

Prerequisites for Generating a Traceability Matrix

Before generating a traceability matrix for model objects, generated code, and model requirements, perform the following steps:

1. Optionally, attach requirements documents. For more information, see "Requirements Traceability" in the Simulink Verification and Validation documentation.
2. In the Configuration Parameters dialog box, on the **Code Generation > Report** pane, select:
   a. **"Create code generation report"**
   b. At least one of the following **Traceability Report Contents** parameters:
      - **"Eliminated / virtual blocks"**
      - **"Traceable Simulink blocks"**
      - **"Traceable Stateflow objects"**
      - **"Traceable MATLAB functions"**

   Tip If you want to generate the traceability matrix directly from the code generation report, select **"Launch report automatically"**.
3. Generate code for the model.

Tip You do not have to build an executable to generate a traceability matrix. To generate code only, on the **Code Generation > General** pane, select **Generate code only**.

How to Generate a Traceability Matrix

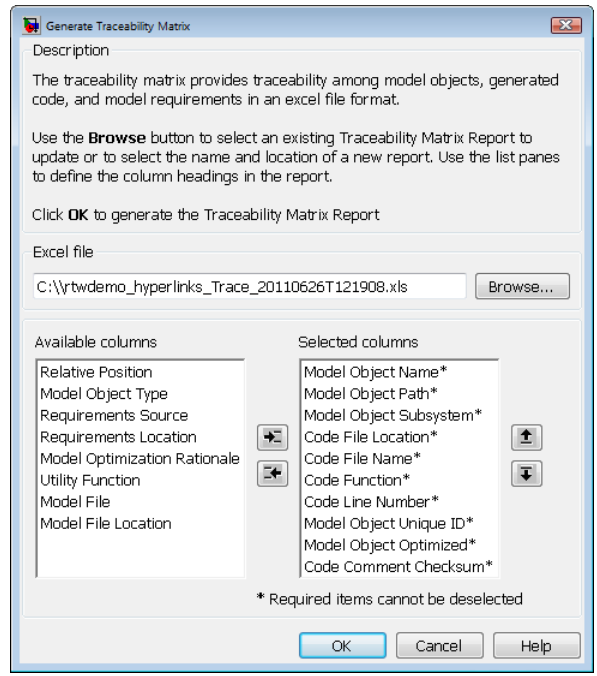
To generate a traceability matrix:

1. Open the model if it is not already open.
2. Ensure that you have completed the "Prerequisites for Generating a Traceability Matrix" on page 4-3.
3. Generate the traceability matrix using one of the following methods:
   - In the MATLAB Command Window, enter the following command, where *model_name* is the name of the model:

     ```
     do178b.ExportTraceReport('model_name')
     ```

     The software generates the traceability matrix.
   - Open the code generation report for the model if it is not already open. Go to the **Traceability Report** section and click the **Generate Traceability Matrix** button. For example:

     When you click the button, the Generate Traceability Matrix dialog box appears.



You can use this dialog box to browse to an existing matrix file to update or specify a new matrix file to create. Optionally, you can also use this dialog box to select and order the columns that appear in the generated matrix. Click **OK** to update or create the specified report.

4 Review the traceability matrix and add comments in new columns. For more information, see "Adding Comments to a Traceability Matrix" on page 4-6.

Adding Comments to a Traceability Matrix

In this section...

"Requirements for Adding Comments to a Traceability Matrix" on page 4-6

"How To Retain Comments" on page 4-7

Requirements for Adding Comments to a Traceability Matrix

You can add comments to the traceability matrix that you generated using the `do178b.ExportTraceReport` function.

To add comments to the traceability matrix, you must:

- Create new columns for your comments.
- Use unique column headings. All columns that you add must have headings.
- Add at least one entry to the column, other than the column heading.
- Retain the following columns:
  - Model Object Name
  - Model Object Path
  - Model Object Subsystem
  - Code File Location
  - Code File Name
  - Code Function
  - Code Line Number
  - Model Object Unique ID
  - Model Object Optimized
  - Code Comment Checksum

Note All comments must resolve to a text string. For example, a link to an image resolves to a text string, but a copy of the image does not.

How To Retain Comments

To regenerate a traceability matrix and retain your comments:

1. Navigate to the working folder of the model.
2. Optionally, regenerate code for your model. Regenerating code before generating the traceability matrix ensures that you have the latest model-to-code traceability information.
3. In the MATLAB Command Window, enter the following command. *`file_name`* is the name of the existing traceability matrix that you are regenerating. If the existing traceability matrix is in a different folder, include the full path to that folder in *`path`*.

   ```
   do178b.ExportTraceReport('model_name', 'file_name', 'path')
   ```

   The traceability matrix regenerates.

Traceability Matrix Limitations

The traceability matrix generation capability has the following limitations:

- Does not support generating a traceability matrix for referenced models. When you generate a traceability matrix for a model that contains referenced models, the traceability matrix contains information about the Model block only. The traceability matrix does not contain information about the contents of the referenced model. If your model contains referenced models, generate a traceability matrix for the top-level model and each referenced model separately.
- Works with the Microsoft Windows platform only.
- In most cases, identifies comments that you add to the traceability matrix, but when comments cannot be identified, the traceability matrix includes the text:

  Row is not unique: *`comment`*

- Does not support information stored in external `.req` files. For example, when you generate a traceability matrix for a model with externally stored requirements information, the traceability matrix does not include the requirements information.

5

Function Reference

Qualification Artifacts Management (p. 5-2)	Manage qualification artifacts
Qualification-Related Development Activities (p. 5-2)	Document generated code

Qualification Artifacts Management

`qualkitdo`	Open Certification Artifacts Explorer

Qualification-Related Development Activities

`do178b.ExportTraceReport`	Generate XLS file that contains traceability matrix

6

Functions — Alphabetical List

do178b.ExportTraceReport

Purpose

Generate XLS file that contains traceability matrix

Syntax

```
do178b.ExportTraceReport('model_name')
do178b.ExportTraceReport('model_name', 'file_name')
do178b.ExportTraceReport('model_name', 'file_name', 'path')
```

Description

`do178b.ExportTraceReport('model_name')` generates an XLS file that contains a "Traceability Matrix" on page 6-3. *`model_name`* is the name of the model.

`do178b.ExportTraceReport('model_name', 'file_name')` generates an XLS file that contains a "Traceability Matrix" on page 6-3. *`file_name`* is a string that specifies the name of the file. The first time that you call `do178b.ExportTraceReport`, *`file_name`* is optional. If you do not provide *`file_name`*, the function names the file using the following convention. *`modelUpdate`* is the date and time that you last updated the model:

`model_name``_Trace_`*`modelUpdate`*`.xls`

To regenerate the traceability matrix, you must specify *`file_name`*.

`do178b.ExportTraceReport('model_name', 'file_name', 'path')` generates an XLS file that contains a "Traceability Matrix" on page 6-3. *`path`* is an optional string that specifies the full path to the location where you want the software to save the file.

Tips

- The `do178b.ExportTraceReport` function works in Microsoft Windows platforms only.
- To include requirements documentation in the traceability matrix, attach requirements documents to the model before using `do178b.ExportTraceReport`.
- You must generate a code generation traceability report (requires an Embedded Coder license) for your model before using `do178b.ExportTraceReport`.
- The `do178b.ExportTraceReport` function does not support generating a traceability matrix for referenced models. When you

generate a traceability matrix for a model that contains referenced models, the traceability matrix contains information about the Model block only. The traceability matrix does not contain information about the contents of the referenced model. If your model contains referenced models, generate a traceability matrix for the top-level model and each referenced model separately.

- In most cases, the `do178b.ExportTraceReport` function identifies comments that you add to the traceability matrix. When the function cannot identify comments, the traceability matrix includes the text:

  Row is not unique: *`comment`*

For more information, see "Prerequisites for Generating a Traceability Matrix" on page 4-3.

Definitions

Traceability Matrix

A traceability matrix provides traceability among model objects, generated code, and model requirements. You can add comments to the generated traceability matrix. If you change the model and regenerate the traceability matrix, the software retains your comments.

Examples

Generate a traceability matrix with traceability between model objects and generated code for the `rtwdemo_hyperlinks` model:

Note This example requires an Embedded Coder license.

```
% Open the model.
open_system('rtwdemo_hyperlinks');
% Generate code only.
set_param('rtwdemo_hyperlinks', 'GenCodeOnly', 'on');
% Initiate the build process.
rtwbuild('rtwdemo_hyperlinks');
% Generate a traceability matrix.
do178b.ExportTraceReport('rtwdemo_hyperlinks');
```

Generate a traceability matrix with traceability among model objects, generated code, and model requirements for the `slvnvdemo_fuelsys_docreq` model:

Note This example requires a Simulink Verification and Validation license.

```
% Open the model.
open_system('slvnvdemo_fuelsys_docreq');
% Select the code generation report and traceability report parameters.
set_param('slvnvdemo_fuelsys_docreq', 'GenerateReport', 'on');
set_param('slvnvdemo_fuelsys_docreq', 'GenerateTraceReport', 'on');
set_param('slvnvdemo_fuelsys_docreq', 'GenerateTraceReportSl', 'on');
set_param('slvnvdemo_fuelsys_docreq', 'GenerateTraceReportSf', 'on');
set_param('slvnvdemo_fuelsys_docreq', 'GenerateTraceReportEml', 'on');
% Generate code only.
set_param('slvnvdemo_fuelsys_docreq', 'GenCodeOnly', 'on');
% Initiate the build process.
rtwbuild('slvnvdemo_fuelsys_docreq');
% Generate a traceability matrix.
do178b.ExportTraceReport('slvnvdemo_fuelsys_docreq');
```

Alternatives

You can generate a traceability matrix directly from the code generation report for your model. Go to the **Traceability Report** section and click the **Generate Traceability Matrix** button.

How To

- “Generating a Traceability Matrix” on page 4-2
- “Adding Comments to a Traceability Matrix” on page 4-6
- “Code Tracing”
- “Requirements Traceability”

Purpose

Open Certification Artifacts Explorer

Syntax

```
qualkitdo
```

Description

`qualkitdo` opens the Certification Artifacts Explorer and displays qualification artifacts.

Tips

- The `qualkitdo` function works in Microsoft Windows platforms only.
- For optimal performance, ensure that Microsoft Internet Explorer is available on your machine. Internet Explorer does not have to be your default web browser.

Alternatives

Open the Certification Artifacts Explorer by selecting **Start > Simulink > DO Qualification Kit > Certification Artifacts Explorer**.

How To

- Chapter 3, “Accessing and Managing Qualification Artifacts”
- Chapter 2, “Qualifying Tools for DO-178B Certification”

A

References

Normative References

RTCA Special Committee 167. *Software Considerations in Airborne Systems and Equipment Certification*, DO-178B. RTCA, Inc., 1992.

RTCA Special Committee 180. *Design Assurance Guidance for Airborne Electronic Hardware*, DO-254. RTCA, Inc., 2000.

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