



Bulk Calculations – Petroleum

BCP 3.0

Documentation Reference Manual

Notes

The latest version of this documentation can be found in the QuantityWare [Knowledge Base](#). All documentation is kept current for the combinations of latest BCS release with the latest supported SAP Oil, Gas, & Energy release. For all currently supported combinations see [Note #000086 "Support and Release \(Lifecycle\) details" page 2, "Release Lifecycle"](#).

Your release level can be determined via:

`"/o/QTYW/COCKPIT" -> "Cockpit" -> "Support Package Level"`

Version History

Version	Date	Description
01	2017-03-31	Initial Version
02	2017-11-10	S/4HANA 1709 validation
03	2019-02-17	S/4HANA 1809 validation
04	2021-09-23	S/4HANA 2020 / 2020_EX validity confirmed. Modern QW document style applied. 30A CSP02 / 30B CSP01 changes
05	2023-11-01	30A CSP03 / 30B CSP02 changes

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1. Introduction

BCP (Bulk Calculations – Petroleum) is delivered within the Bulk Calculations – Solution (BCS) and activated with a license key. For BCP this document provides:

- An overview of all documentation delivered for BCP
- Links to related documents
- Detailed documentation for specific areas

Read this document and - depending on your project roles - the related documents carefully before you install QuantityWare BCP or start your BCP implementation project.

2. Documentation Overview

The following BCP documents are either published as a chapter of this document, or available as separate documents in the [Knowledge Base](#).

- **BCS Technical Installation Manual:**

Audience: SAP basis experts performing the installation

Content: Describes the technical requirements and procedures to be followed during the technical installation of the BCS.

Publication: Separate Document

- **BCP - Project Assessment and Implementation Guidelines (PAIG):**

Audience: Project team lead responsible for BCP implementation & project members

Content: Describes a high-level project methodology which enables the successful design and configuration of quantity conversion solutions that run in an SAP Oil, Gas, & Energy ERP system, based upon business requirements.

Publication: Separate Document in the [Knowledge Base](#).

- **BCP Test Manual:**

Audience: Project team responsible for BCP implementation

Content: Provides a sequence **of eight (8) test cases** which you may execute in your system (client 045 and your own development/test client) - during your 4 week test period - in order to define a production ready conversion group in your development/test client – including automated test cases - based on the BCP template configuration.

Publication: Separate document in the [Knowledge Base](#).

- **BCP - Petroleum Measurement Cockpit (PMC):**

Audience: BCP implementation project team-lead and project members, as well as petroleum measurement specialists wishing to use the PMC

Content: Describes the PMCs methodology, structure and content.

Publication: This document

- **BCP - Test Scenarios:**

Audience: BCP implementation project team-lead and project members, as well as petroleum measurement specialists wishing to use the PMC

Content: Describes the theory behind and the definition of automated quantity conversion test scenarios.

Publication: This document

- **BCP - Configuration Template:**

Audience: Project members implementing BCP

Content: Explains how to access and analyze the BCS template data via the PMC.

Publication: This document

- **BCP - Supported Standards Manual:**

Audience: Project members implementing BCP and petroleum measurement specialists

Content: Lists all measurement standards that are implemented with BCP and provides detailed product-to-standard mapping information.

Publication: Separate Document in the [Knowledge Base](#).

- **BCP - QuantityWare MQCI:**

Audience: Project members implementing BCP

Content: Describes the functional possibilities of the QuantityWare Model based QCI (MQCI) in detail

Publication: This document

- **BCP - Customizing:**

Audience: Project members implementing BCP

Content: Describes BCP customizing options which can be accessed from the PMC

Publication: This document

- **BCP - Web Services:**

Audience: Project members implementing BCP

Content: Describes how to access BCP quantity conversion web services

Publication: This document

- **BCP - MQCI Customer Specific Extensions:**

Audience: Project experts implementing customer specific BCP functionality

Content: Integration of customer function modules into MQCI calculation sequence

Publication: This document

- **BCP - API C to QuantityWare ABAP Migration:**

Audience: Project experts implementing customer specific BCP functionality

Content: How to map legacy C conversion groups to QuantityWare ABAP conversion groups

Publication: This document

- **BCP - Petroleum Measurement Cockpit - Security:**

Audience: Project members implementing BCP

Content: Lists the QuantityWare single & composite roles delivered with BCS which can be assigned to PMC users

Publication: This document

- **BCP - Protection of Intellectual Property:**

Audience: Project members implementing BCP

Content: Describes the QuantityWare Intellectual Property security measures

Publication: This document



In addition to the above listed documents, QuantityWare publishes BCP notes which are also an integral part of the BCG documentation, all available in the [Knowledge Base](#).

All code corrections published via note are included in the immediately following CSP.

For an overview of note validity, see section 6 of [Note 000067](#) – “Additional Installation Information”.

The associated files must be downloaded from the [QuantityWare Service Portal](#)

Finally, Consulting and Working Papers are published frequently, which are all as well available in the [Knowledge Base](#).

3. BCP - Petroleum Measurement Cockpit

3.1. Introduction

The software package BCP is one important part of the overall QuantityWare solution for the oil industries. The complete solution consists of:

- QuantityWare Software Package
- QuantityWare Training Services
- QuantityWare Support Services

The Petroleum Measurement Cockpit (PMC) is the single access point for measurement specialists and certified BCP consultants to the QuantityWare BCP solution. Here you design, monitor, maintain and enhance complex, measurement standard based quantity conversion implementations that run within the SAP Oil, Gas, & Energy ERP system. The Petroleum Measurement Cockpit (PMC) provides an easy-to-use user interface (UI), which is structured in a way such that measurement experts and technical consultants can organize their work efficiently.

After BCS has been implemented successfully, the Petroleum Measurement Cockpit (PMC) can and should be configured for usage in production such that relevant monitoring functions are available to business users.



After you log on to your SAP ERP system, enter transaction code `/n/QTYW/COCKPIT` to launch the Petroleum Measurement Cockpit (PMC)

Make sure that the required authorization profiles / composite roles are assigned to your user

The technical installation team must enter the BCP license via the PMC too.

3.2. Structure of the Petroleum Measurement Cockpit (PMC)

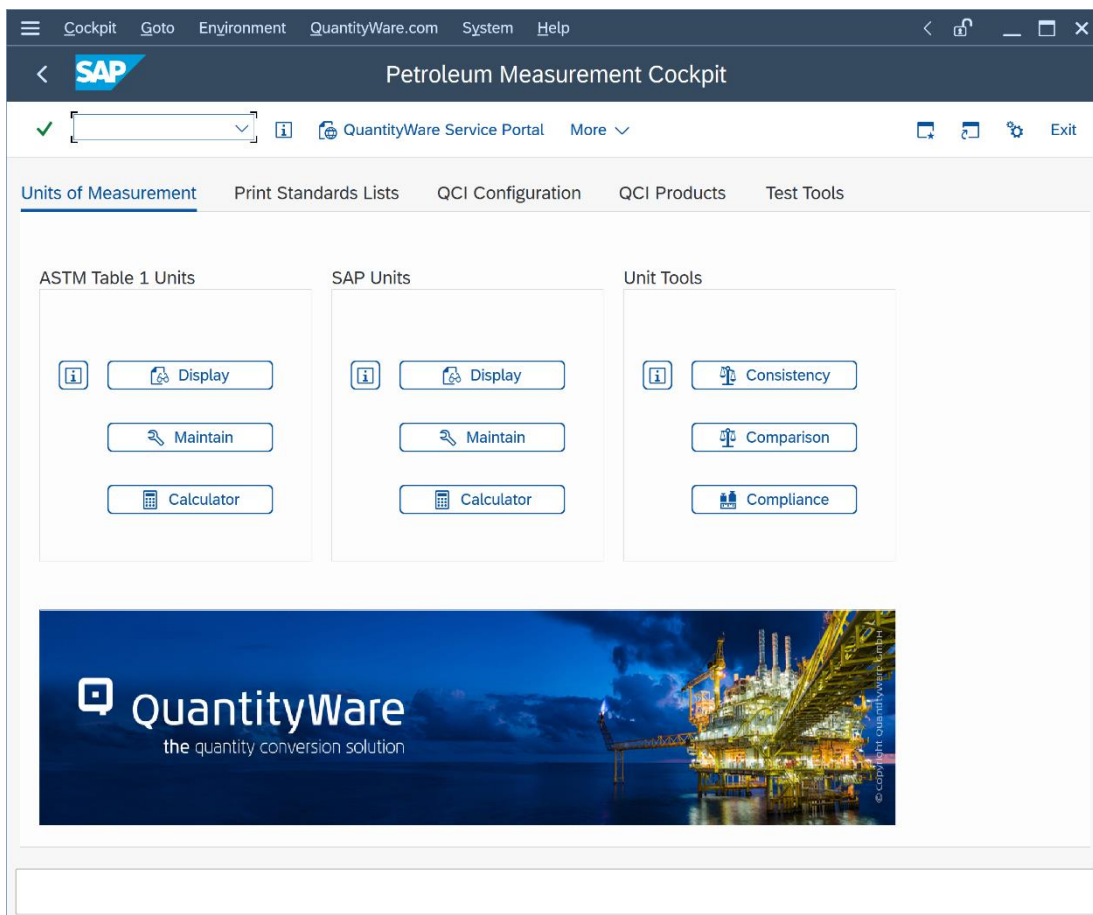
The PMC is structured with Tabs and Menus.

3.2.1. PMC Overview - Tabs

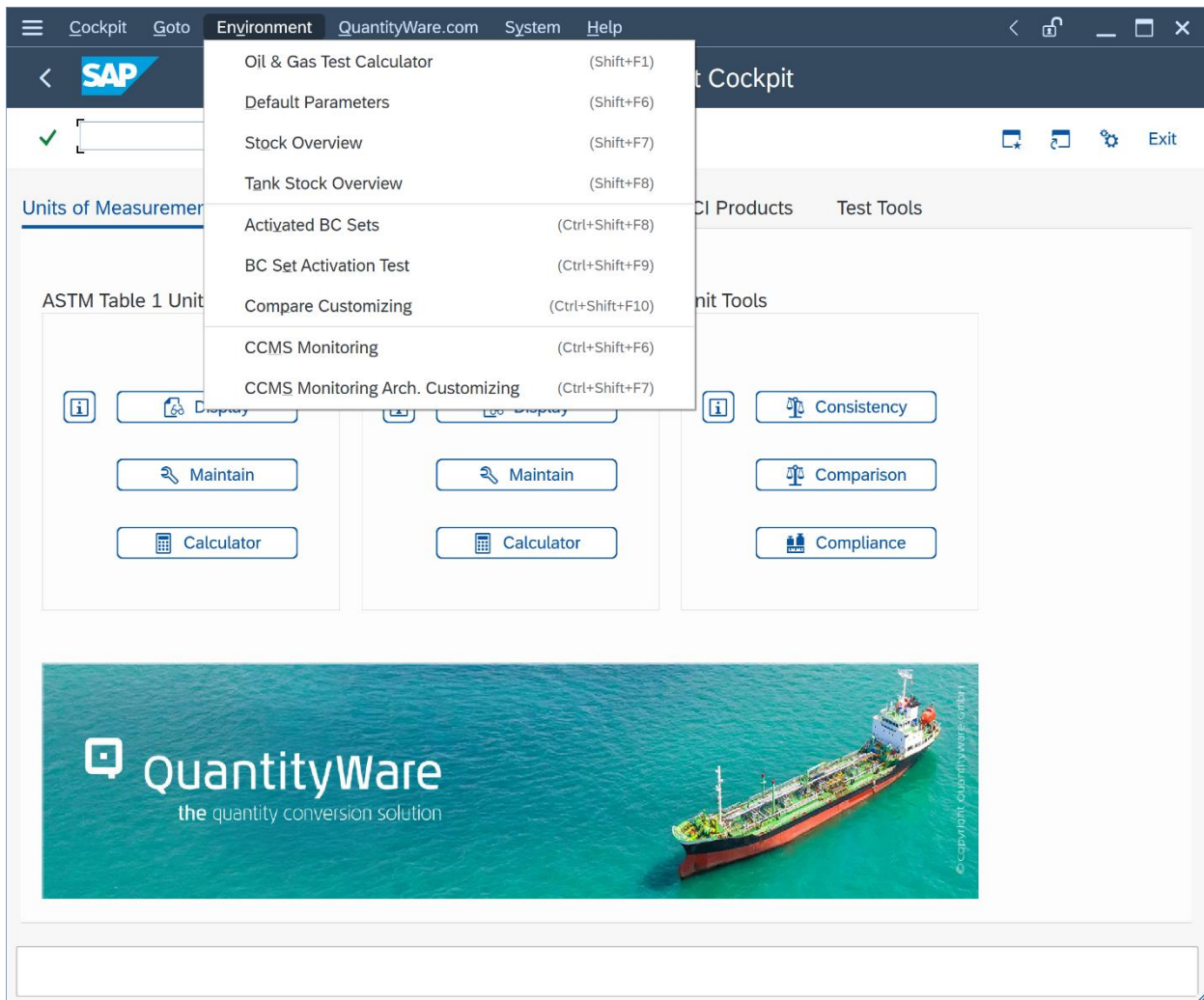
The Petroleum Measurement Cockpit provides five tab pages:

3.2.1.1. Units of Measurement

Here you define, create, change, display and monitor Unit of Measurement (UoM) settings. Detailed documentation for the UoM concepts (SAP standard and ASTM Table 1 concept) is available. You also define the UoM compliance settings and prepare the UoM Compliance Analysis in this tab page.

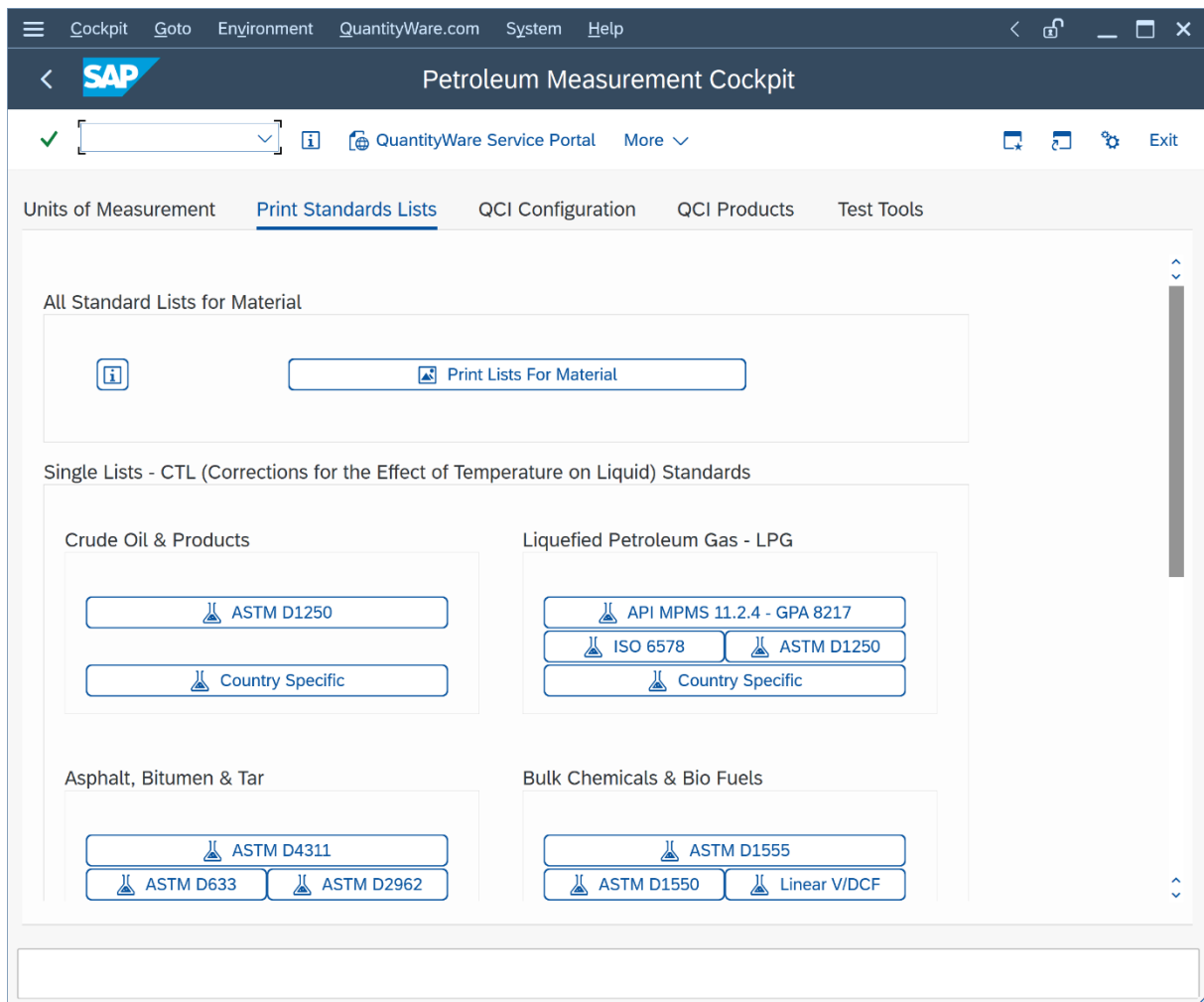


In your productive clients, you may disable access to configuration settings via customizing settings. Specifically, you may disable the Maintenance Access in this tab page (in addition to the general locking via SAP standard settings of customizing transactions), as well as direct customizing and technical tool access via the menu paths “Goto / More -> Goto” and “Environment / More -> Environment”:



3.2.1.2. Print Standards Lists

Here you display and print lists of volume correction factors (CTL & CPL) as well as density **in air** (volume per weight) and density **in vacuum** (volume per mass) values of all measurement standards that are implemented by QuantityWare. Business practice typically requires printed versions of correction factors for inspectors and surveyors during custody transfer of bulk petroleum quantities. Although modern standard implementations are no-longer based on tables, such lists still need to be available as audit documentation for the quantity calculation procedure and for the support of custody transfer procedures.

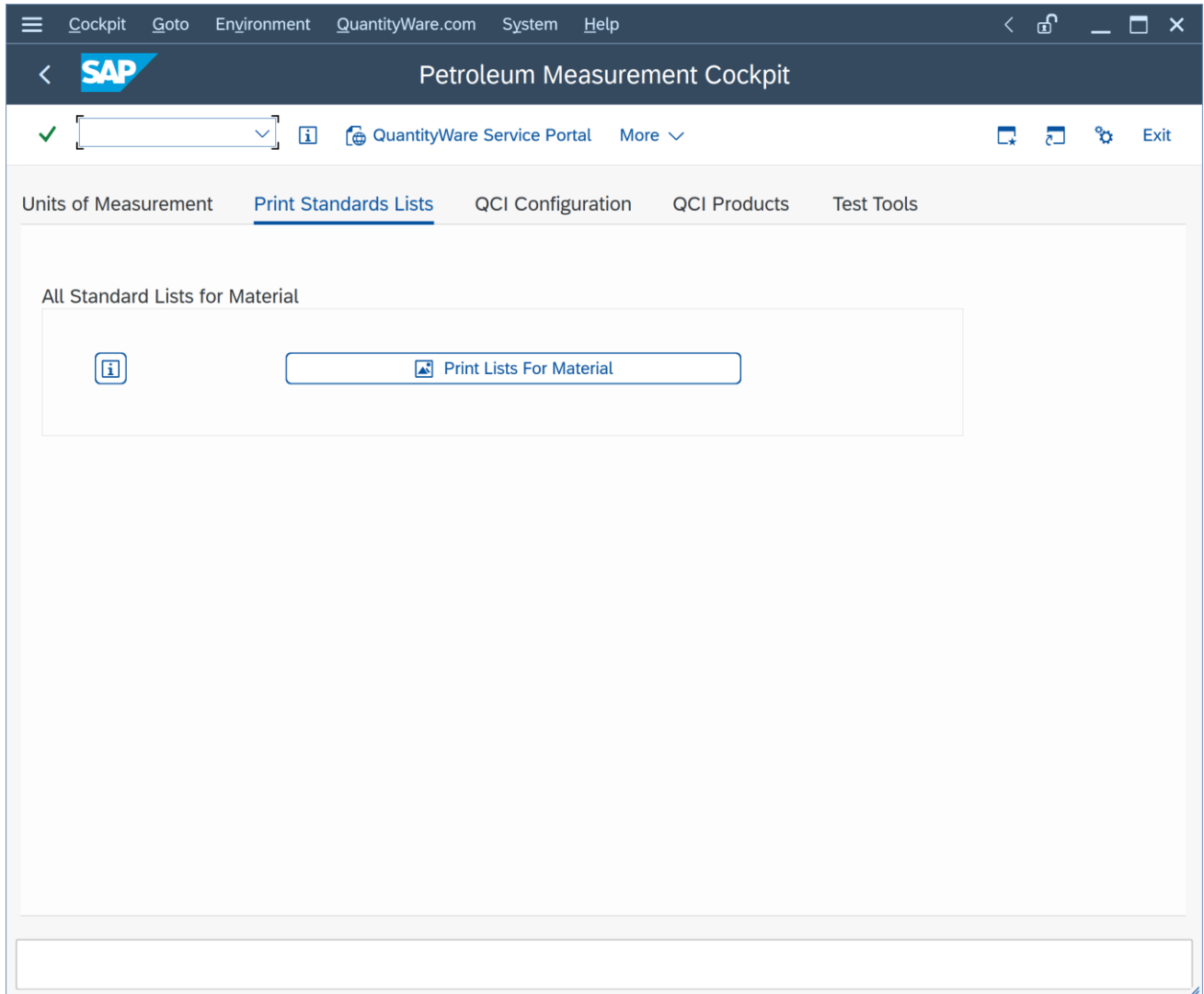


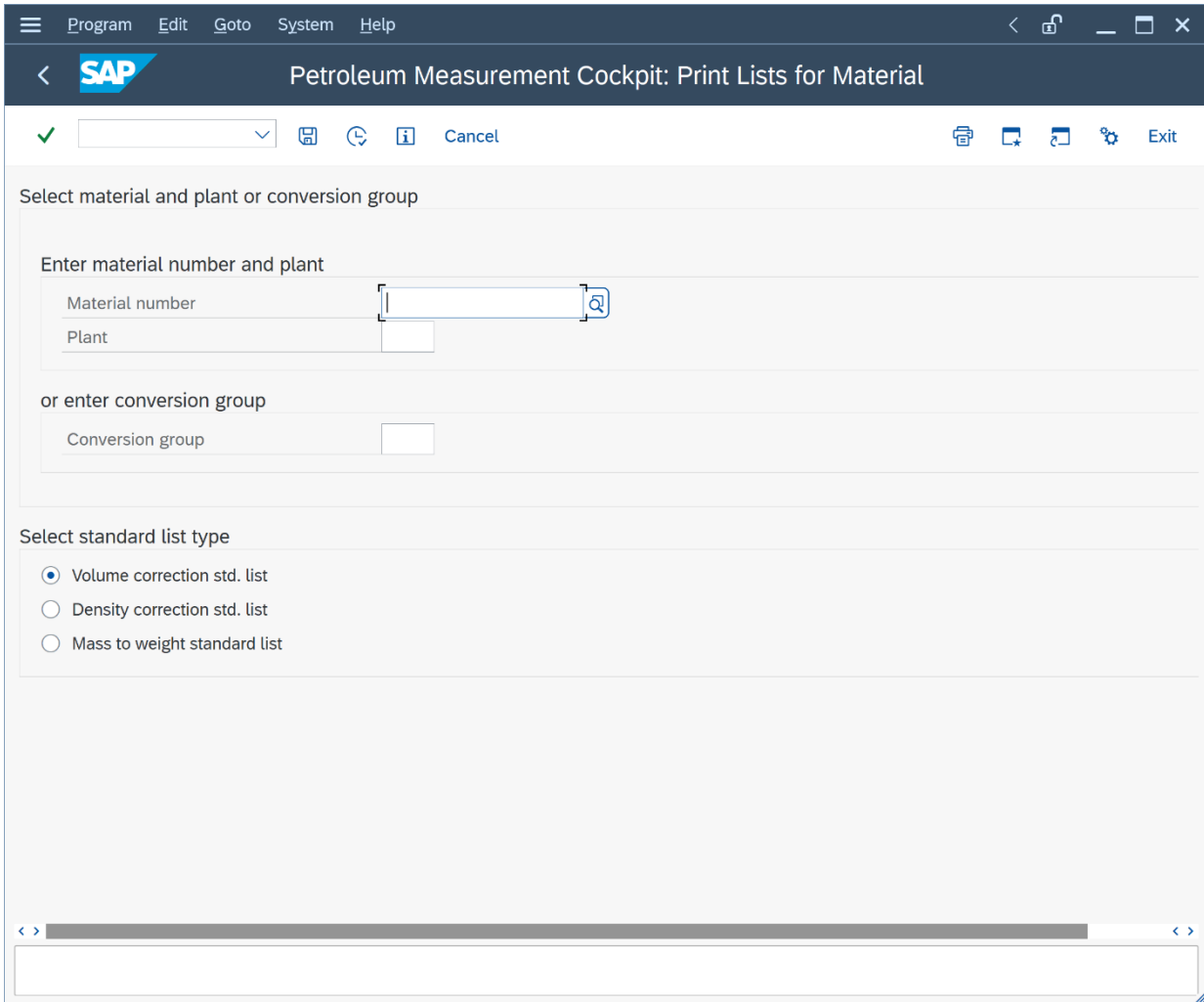
The screenshot displays the SAP Petroleum Measurement Cockpit interface. At the top, the SAP logo and the title "Petroleum Measurement Cockpit" are visible. Below the title bar, there is a navigation menu with options: "Units of Measurement", "Print Standards Lists" (which is currently selected), "QCI Configuration", "QCI Products", and "Test Tools".

The main content area is divided into several sections:

- Units of Measurement:** This section contains two columns of buttons. The left column includes buttons for "ASTM D4311", "ASTM D633", "ASTM D2962", and "Country Specific". The right column includes buttons for "ASTM D1555", "ASTM D1550", "Linear V/DCF", and "Country Specific".
- Single Lists - CPL (Corrections for the Effect of Pressure on Liquid) Standards:** This section is further divided into two sub-sections:
 - Crude Oil & Products:** Contains buttons for "ASTM D1250" and "API MPMS Chapter 11.2.1".
 - Liquefied Petroleum Gas - LPG:** Contains buttons for "API MPMS Chapter 11.2.5" and "API MPMS Chapter 11.2.2".
- Single Lists - Mass/Weight/Volume Intraconversion Standards:** This section includes a sub-section for "Crude Oil & All Products" with buttons for "ASTM D1250" and "Country Specific".

In your productive clients, you may disable access to standard lists by standard designation via configuration settings and simply provide guided access to all lists by material and plant ID:





The screenshot shows the SAP 'Petroleum Measurement Cockpit: Print Lists for Material' dialog box. The window title bar includes 'SAP' and the title 'Petroleum Measurement Cockpit: Print Lists for Material'. The menu bar contains 'Program', 'Edit', 'Goto', 'System', and 'Help'. The toolbar includes a checkmark, a dropdown arrow, a save icon, a refresh icon, an information icon, 'Cancel', a print icon, a copy icon, a refresh icon, a settings icon, and 'Exit'.

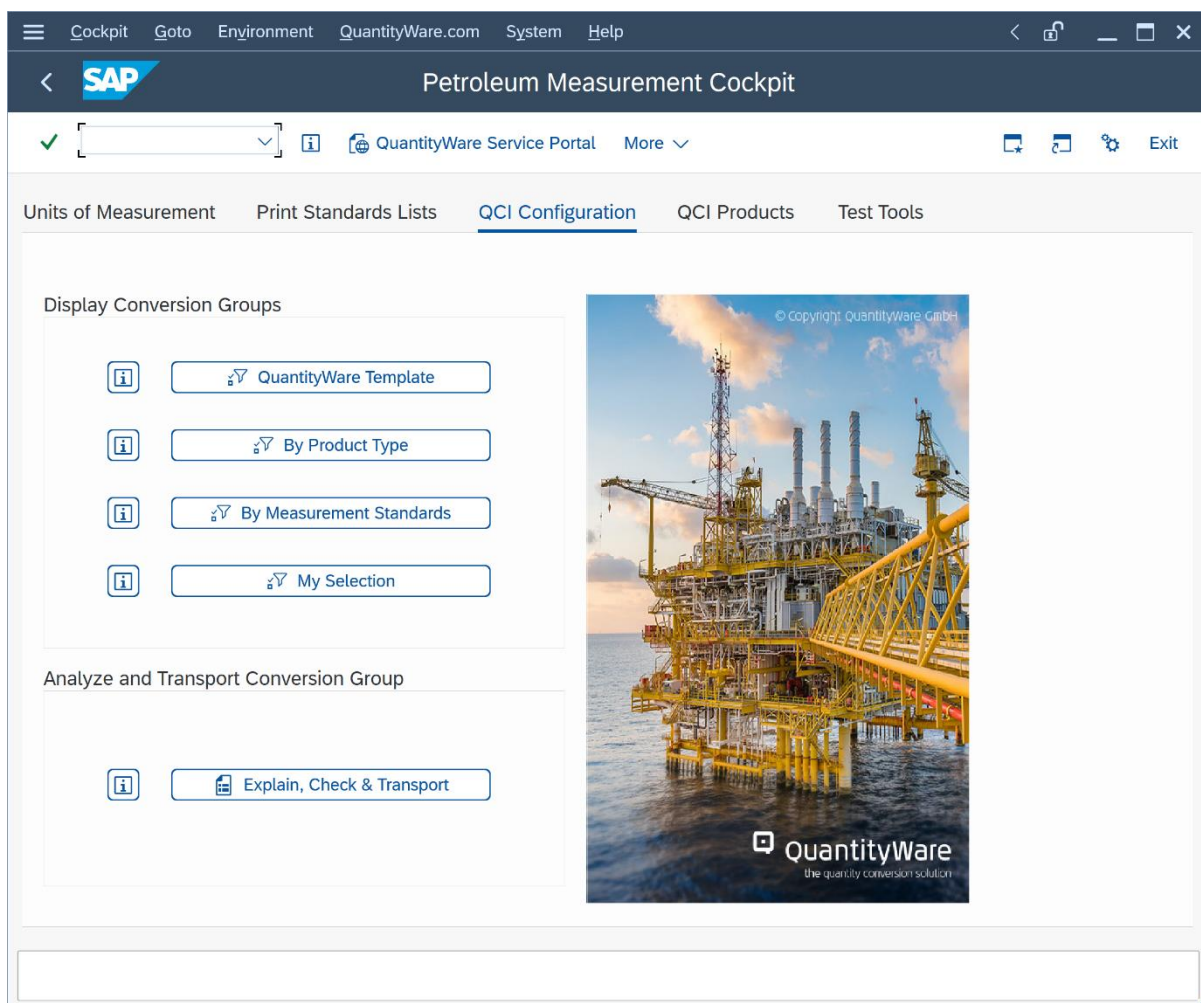
The main content area is divided into three sections:

- Select material and plant or conversion group:**
 - Enter material number and plant:** Includes a 'Material number' field with a search icon and a 'Plant' field.
 - or enter conversion group:** Includes a 'Conversion group' field.
- Select standard list type:** Includes three radio buttons:
 - Volume correction std. list
 - Density correction std. list
 - Mass to weight standard list

At the bottom, there is a horizontal scrollbar and an empty text area.

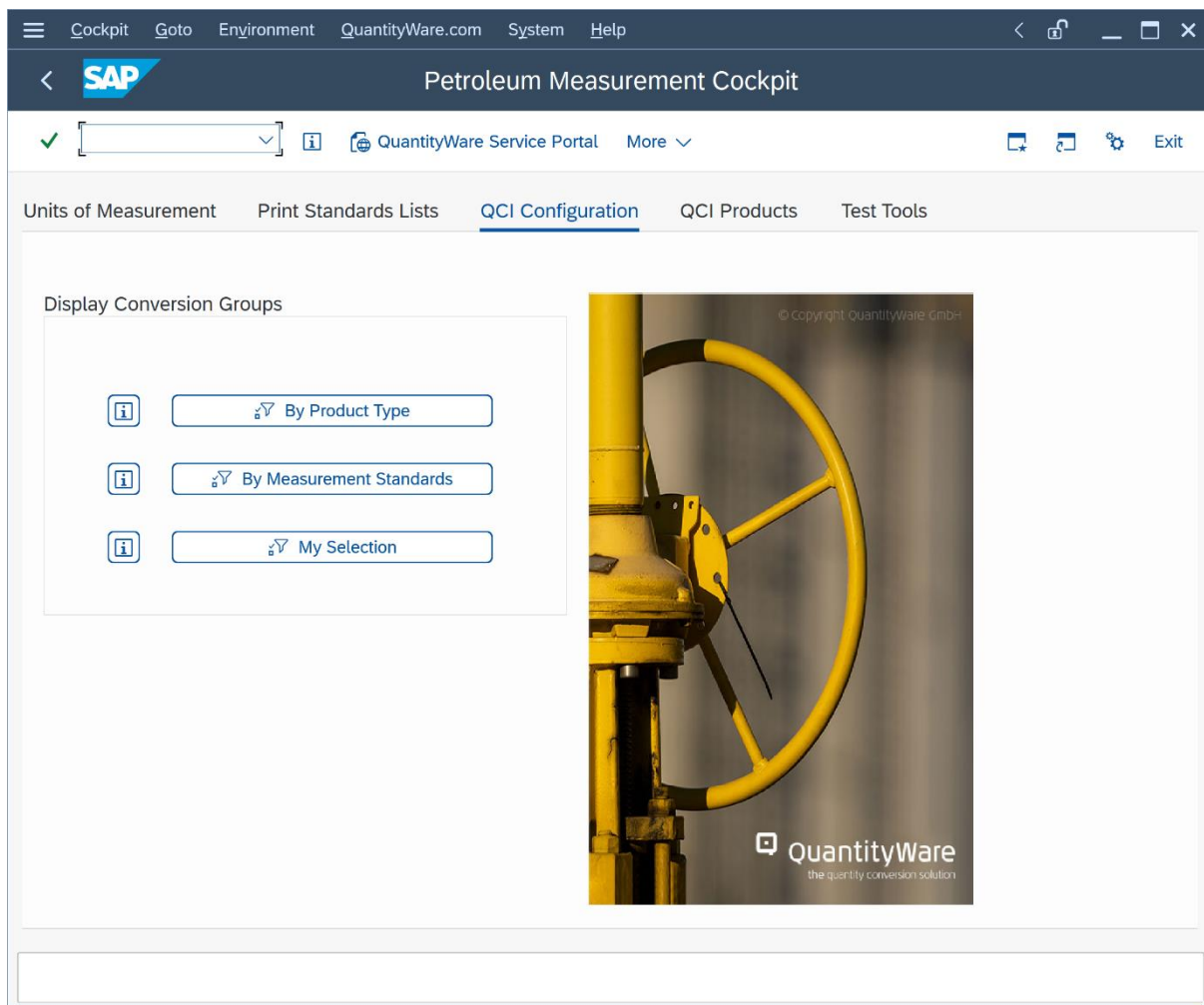
3.2.1.3. QCI Configuration (Template Client)

Here you select the conversion groups from the QuantityWare template which fit your requirements. You may also print a detailed configuration statement for each conversion group (e.g., for audit purposes) and perform automated conversion group configuration checks. You display a list of all UoM definitions that are required for a conversion group and create a customizing transport request to include all UoM definitions for your conversion group; you may also create a customizing transport request that contains all required configuration for a conversion group.



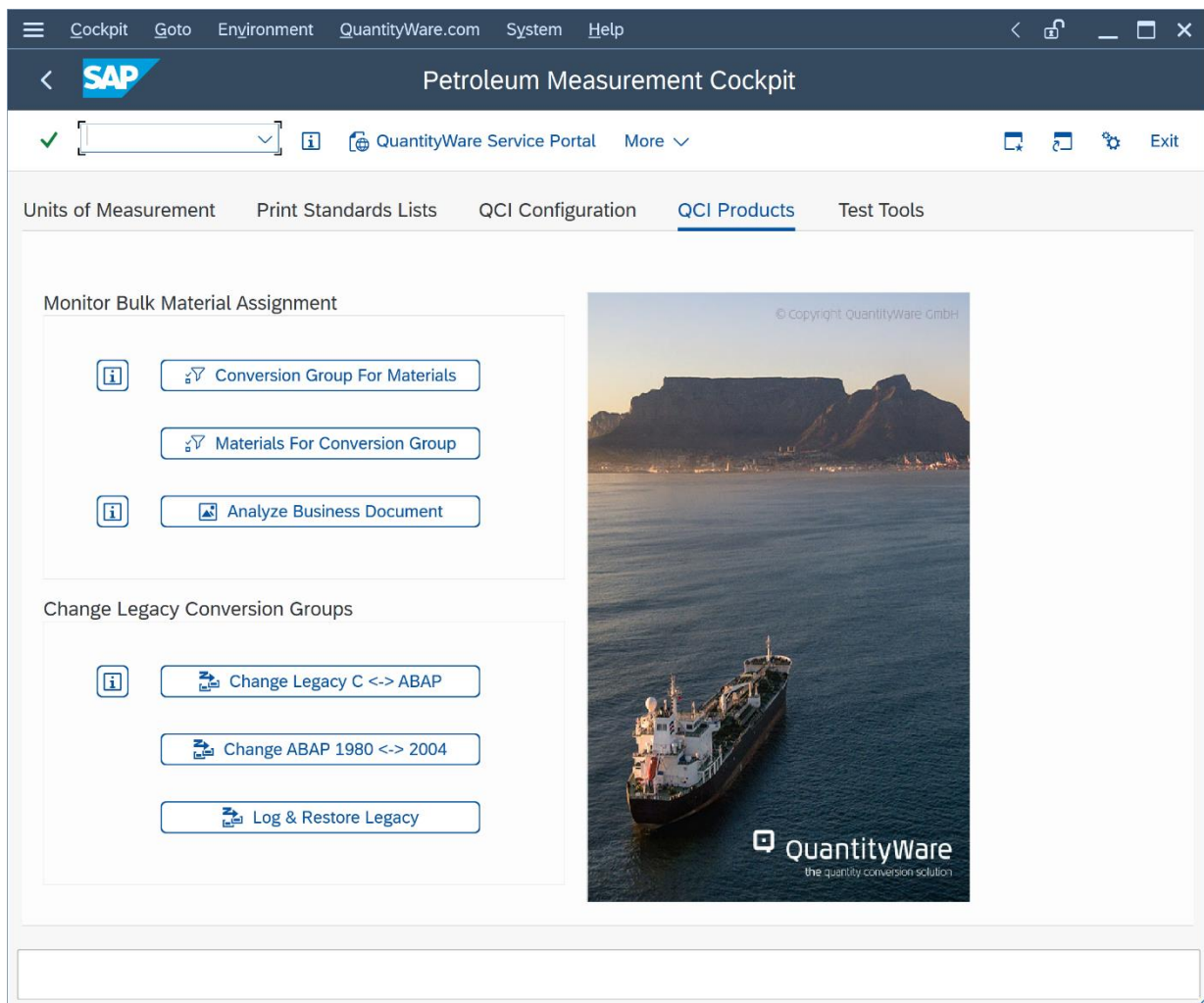
3.2.1.4. QCI Configuration

In clients where the QuantityWare template BC set "/QTYW/BCP_30X" (where "30X" is the current valid installed QuantityWare BCS release – e.g., "30A") is not activated, the template selection push button "QuantityWare Template" is not available. The "Explain, Check and Transport" push button may be also configured to be invisible.



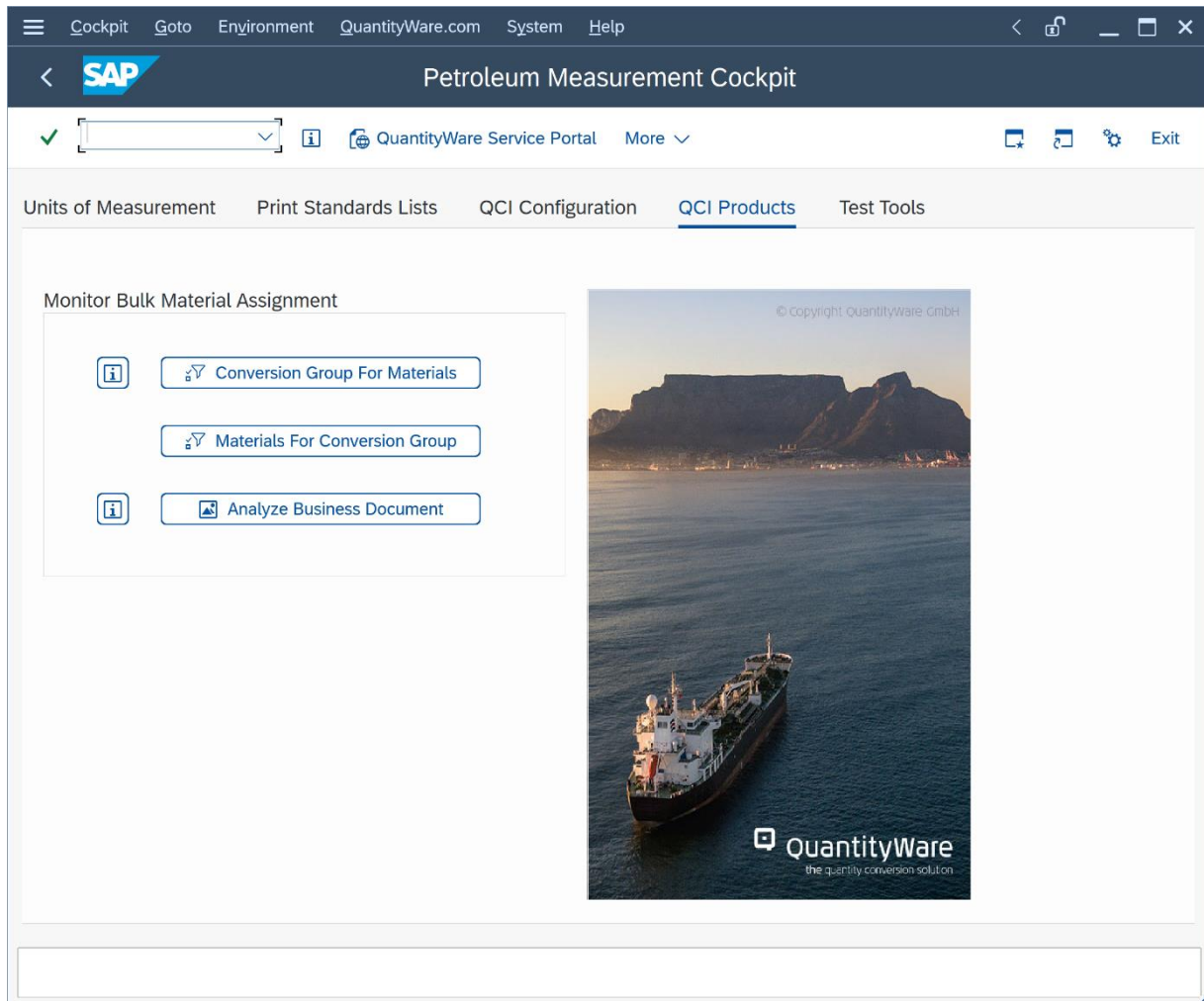
3.2.1.5. QCI Products (Template Client)

Here you display and monitor the assignment of conversion groups to products/materials in your system. You may also analyze business documents (material documents, physical inventory documents and deliveries) with respect to the additional quantity conversion values. You may also convert legacy conversion group configurations to QuantityWare settings with a few clicks.



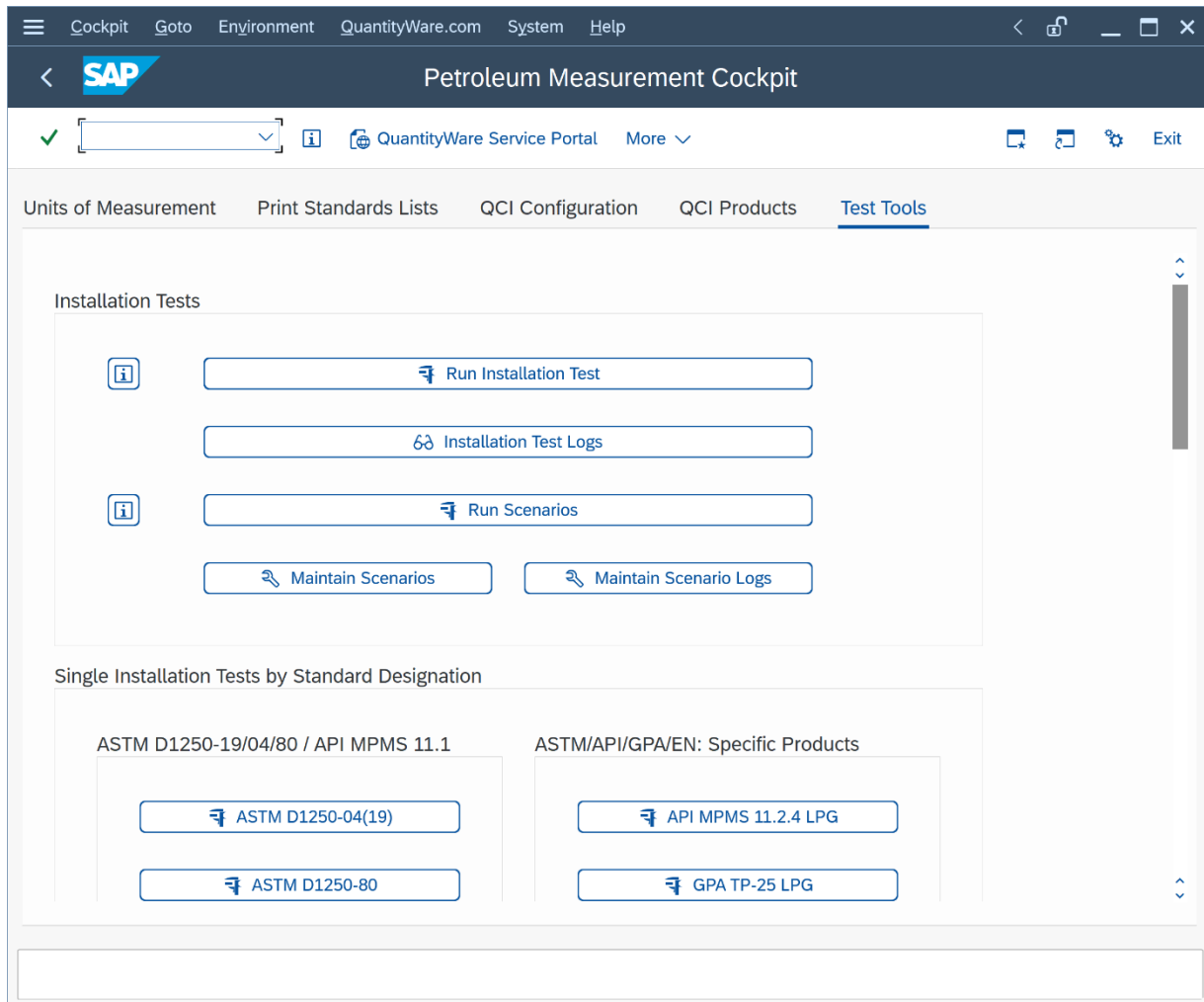
3.2.1.6. QCI Products

Via customizing configuration, you may disable the legacy conversion tool access (e.g.in productive clients). This way, no accidental conversion of your proven legacy conversion groups is triggered if a user ID carries the authorization to do so.



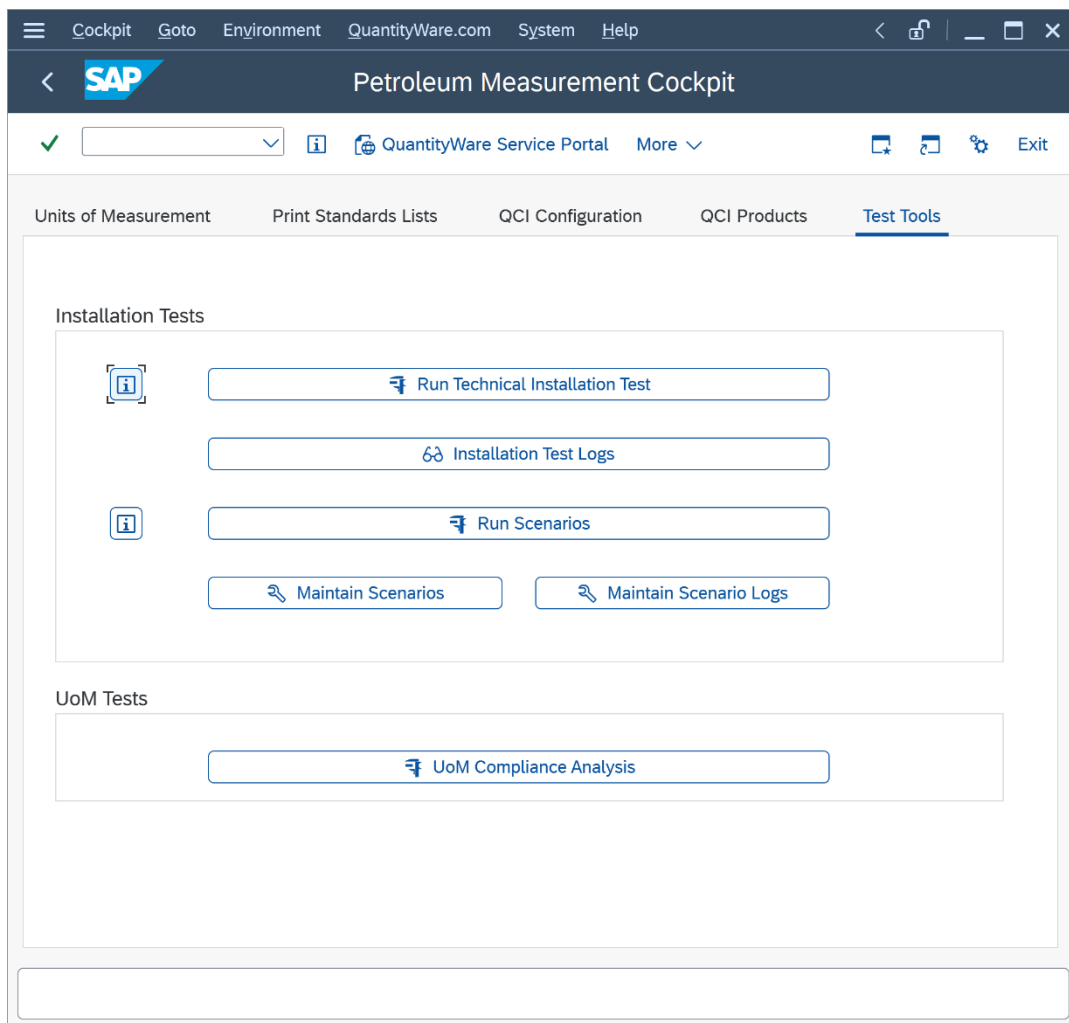
3.2.1.7. Test Tools (Template Client)

In template client 045 you execute the QuantityWare installation test (which includes QuantityWare Test Scenarios) to ensure the correctness of the quantity conversion implementations in your system (see section 3.4.5 Test Tools for details).



3.2.1.8. Test Tools

In all other relevant clients, where the QuantityWare BC set is not activated, template-specific buttons are missing. You execute your own UoM Compliance Analysis test via this tab page, as well as your own test scenarios, which you define during the BCP implementation project. The Technical Installation Test can be executed there as well.



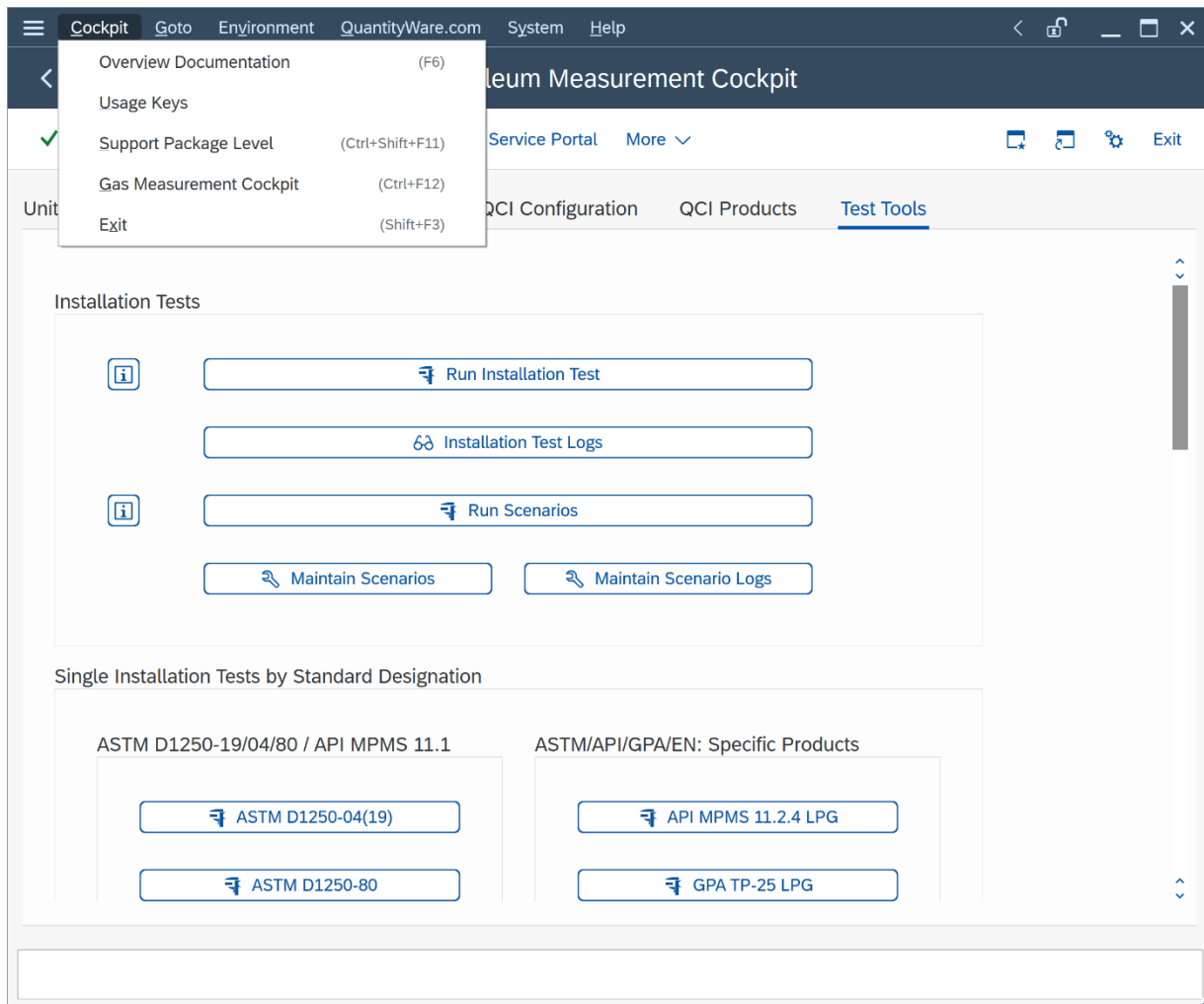
Upon leaving the PMC transaction, the tab page that is active will be the one you see when you next use the PMC.

3.2.2. PMC Overview – Menus

From the PMC menu, you have access via the following menu points to relevant transactions and information resources:

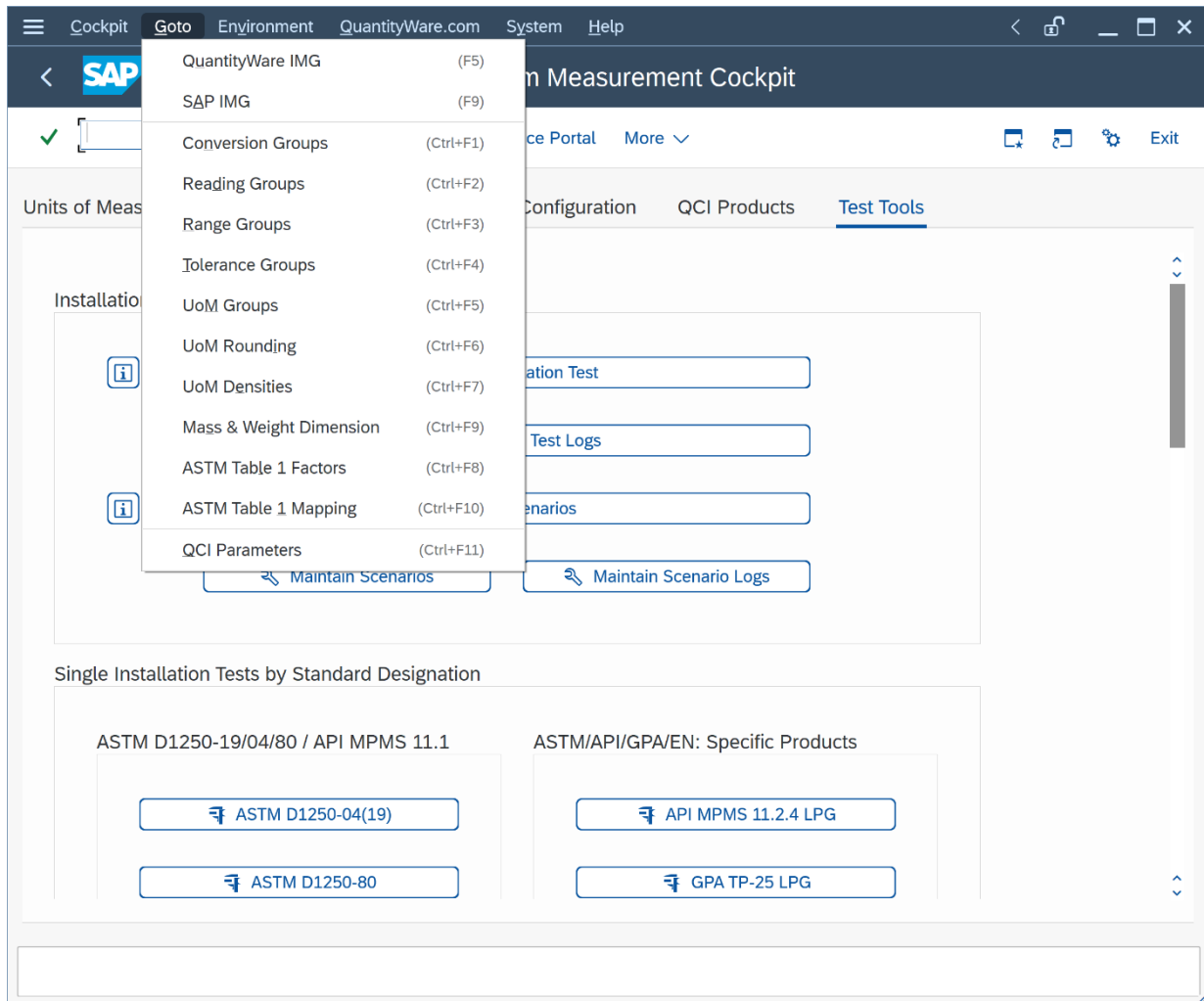
3.2.2.1. Cockpit

Enter or check your QuantityWare BCP license, read the detailed online documentation, determine the QuantityWare support package status or navigate to the Gas Measurement Cockpit:



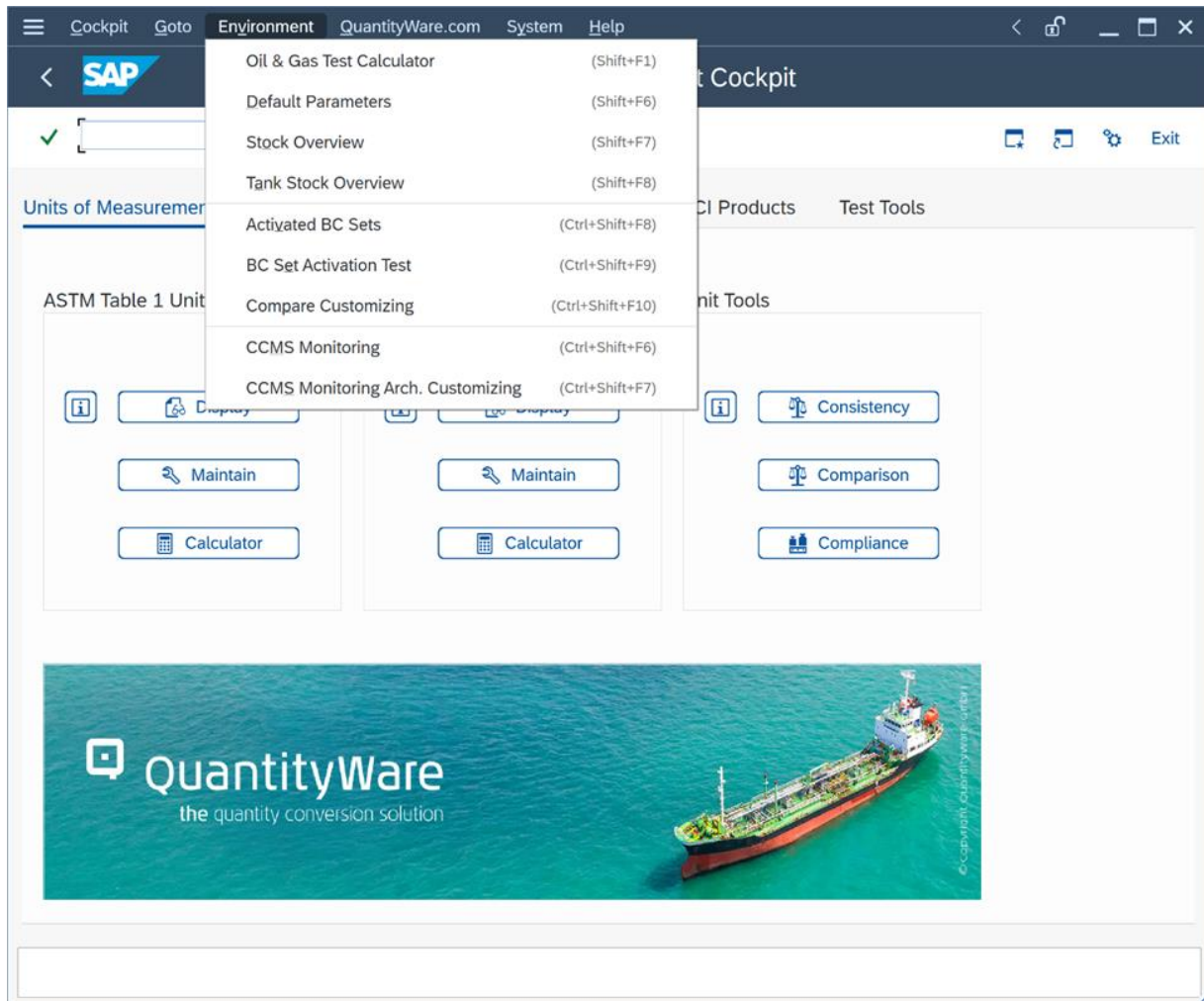
3.2.2.2. Goto

Navigate to all QuantityWare and SAP customizing transactions and create or change data if the client settings allow this. Fast access to most important customizing transactions is also available (which may be disabled in productive clients, as noted in section 3.2.1.1):



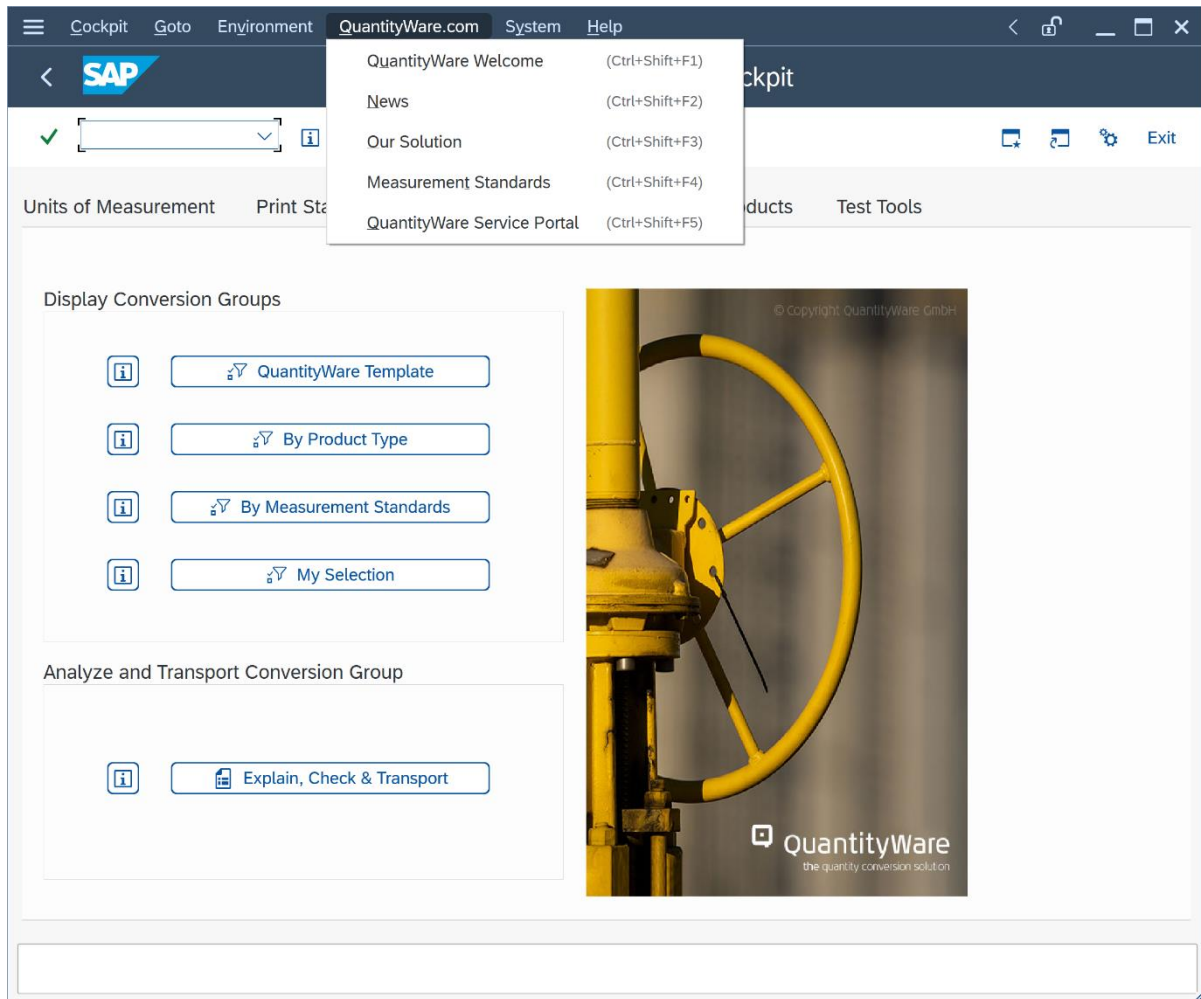
3.2.2.3. Environment

Navigate to related applications like the Oil & Gas Test Calculator, QCI default transaction, material stock overview or the SAP tank management transaction; display BC set data and compare and control UoM compliance & reference data settings.



3.2.2.4. QuantityWare.com

Navigate to selected QuantityWare web site pages and the QuantityWare Service Portal:



3.3. PMC Methodology

The five tab strips are organized so that they group complex implementation project sub tasks into “task packages” and organize regular monitoring and error analysis tasks in a structured way. The QuantityWare Project Assessment and Implementation Guidelines (PAIG) methodology provides the underlying design logic for the PMC. For more details, read the separate PAIG documentation for BCP.

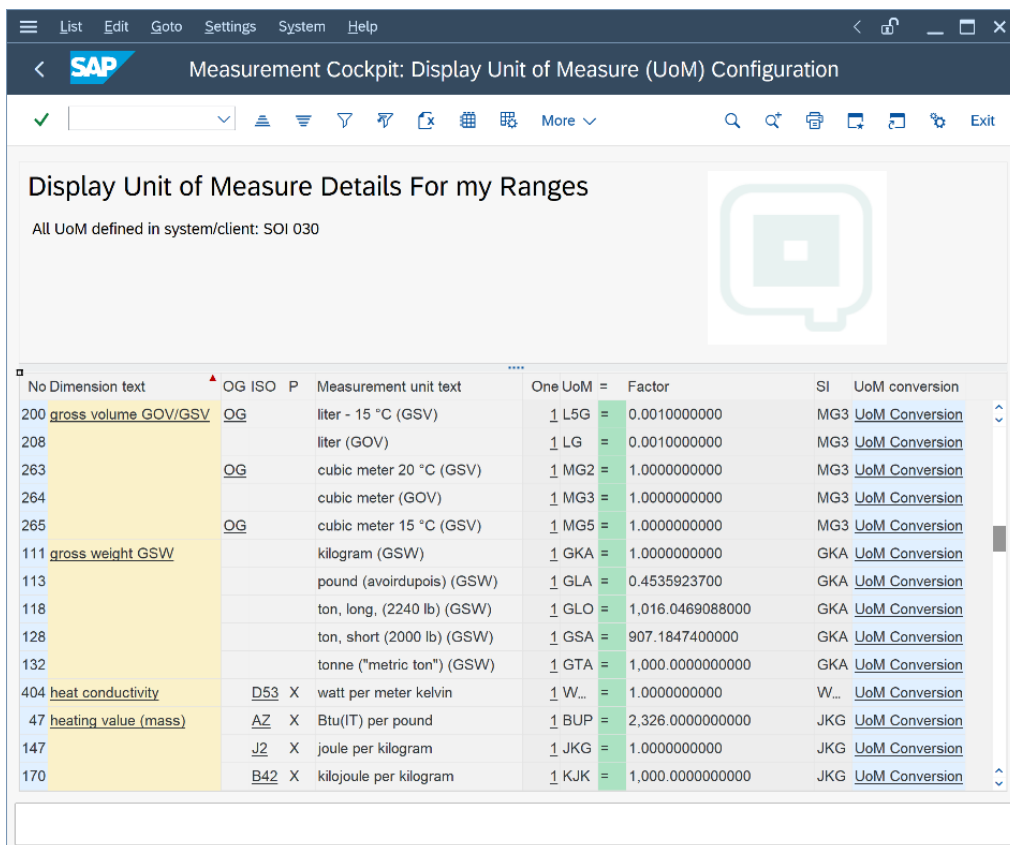
3.4. PMC Tab Strip Details

3.4.1. Units of Measurement

Correct, measurement standards-based, UoM definitions and intra-conversion factors are the basis of all quantity conversions.

You need to ensure that all UoM are correctly defined. For example, you need to decide whether ASTM Table 1 factors or conversion factors from other standards are to be utilized.

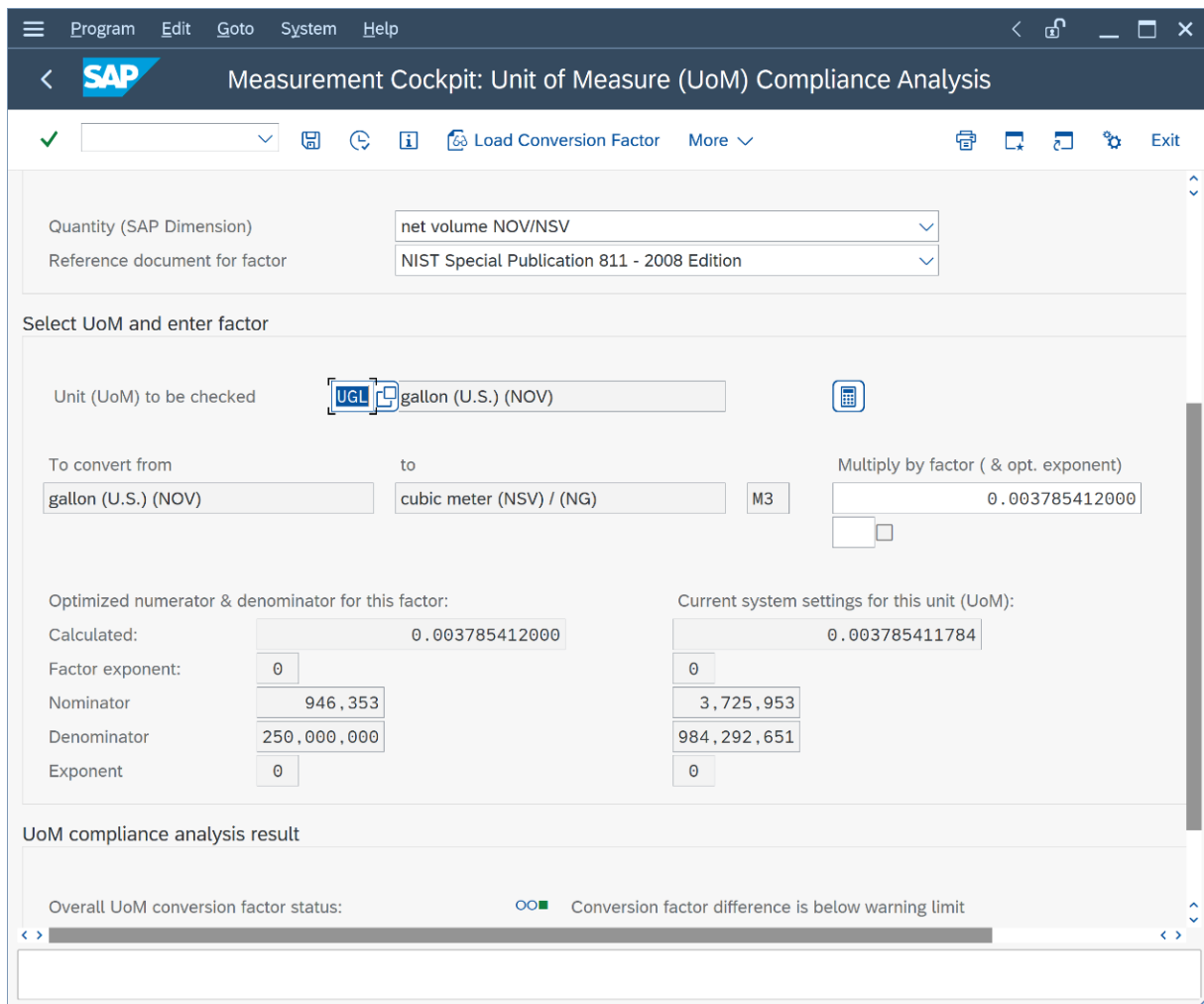
Unit conversion calculators are available for testing the unit of measure settings in your system. Lists of UoM with all details are available:



No	Dimension text	OG	ISO	P	Measurement unit text	One UoM =	Factor	SI	UoM conversion
200	gross volume GOV/GSV	OG			liter - 15 °C (GSV)	1 L5G =	0.0010000000	MG3	UoM Conversion
208					liter (GOV)	1 LG =	0.0010000000	MG3	UoM Conversion
263		OG			cubic meter 20 °C (GSV)	1 MG2 =	1.0000000000	MG3	UoM Conversion
264					cubic meter (GOV)	1 MG3 =	1.0000000000	MG3	UoM Conversion
265		OG			cubic meter 15 °C (GSV)	1 MG5 =	1.0000000000	MG3	UoM Conversion
111	gross weight GSW				kilogram (GSW)	1 GKA =	1.0000000000	GKA	UoM Conversion
113					pound (avoirdupois) (GSW)	1 GLA =	0.4535923700	GKA	UoM Conversion
118					ton, long, (2240 lb) (GSW)	1 GLO =	1,016.0469088000	GKA	UoM Conversion
128					ton, short (2000 lb) (GSW)	1 GSA =	907.1847400000	GKA	UoM Conversion
132					tonne ("metric ton") (GSW)	1 GTA =	1,000.0000000000	GKA	UoM Conversion
404	heat conductivity	D53	X		watt per meter kelvin	1 W... =	1.0000000000	W...	UoM Conversion
47	heating value (mass)	AZ	X		Btu(IT) per pound	1 BUP =	2,326.0000000000	JKG	UoM Conversion
147		J2	X		joule per kilogram	1 JKG =	1.0000000000	JKG	UoM Conversion
170		B42	X		kilojoule per kilogram	1 KJK =	1,000.0000000000	JKG	UoM Conversion

QuantityWare also provides a sophisticated UoM comparison tool which allows you to compare UoM definitions that are delivered in BC sets with UoM definitions in your system clients.

The UoM Compliance Analysis is also available in this tab page:



The screenshot shows the SAP Measurement Cockpit interface for Unit of Measure (UoM) Compliance Analysis. The window title is "Measurement Cockpit: Unit of Measure (UoM) Compliance Analysis". The interface includes a menu bar (Program, Edit, Goto, System, Help) and a toolbar with icons for save, refresh, help, and "Load Conversion Factor".

Key fields and values in the interface:

- Quantity (SAP Dimension): net volume NOV/NSV
- Reference document for factor: NIST Special Publication 811 - 2008 Edition
- Select UoM and enter factor:
 - Unit (UoM) to be checked: UGL gallon (U.S.) (NOV)
 - To convert from: gallon (U.S.) (NOV)
 - to: cubic meter (NSV) / (NG)
 - Multiply by factor (& opt. exponent): 0.003785412000
- Optimized numerator & denominator for this factor:

Calculated:	0.003785412000
Factor exponent:	0
Nominator:	946,353
Denominator:	250,000,000
Exponent:	0
- Current system settings for this unit (UoM):

Calculated:	0.003785411784
Factor exponent:	0
Nominator:	3,725,953
Denominator:	984,292,651
Exponent:	0
- UoM compliance analysis result:

Overall UoM conversion factor status: ● Conversion factor difference is below warning limit

The online documentation provides a detailed explanation how to prepare the UoM compliance analysis:

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Performance Assistant
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Short text

Measurement Cockpit: Unit of Measure (UoM) Compliance Analysis

Purpose

This report is the central UoM compliance analysis tool for your unit of measure (UoM) definitions, with respect to the critical conversion factor settings. The UoM conversion factor settings are maintained via transaction CUNI, which is accessible via the Gas or Petroleum Measurement Cockpit -> Units of Measurement -> SAP Units -> Maintain.

Via transaction CUNI you define a nominator and denominator (and possibly, an exponent) for a UoM, which define the conversion factor of that UoM to the SI unit within a given dimension.

- Dimensionless UoM do not require a conversion factor and are thus not subject of this compliance analysis
- Temperature UoM (typically °F and °C) require a more complex setup, including an additive constant, and are also not subject of this compliance analysis tool

The compliance analysis tool compares the conversion factor defined via transaction CUNI with a validated external reference conversion factor. Such factors are defined in a reference document (e.g., NIST Special Publication 811) and need to be maintained in the reference database in your client.

Prerequisites

The external reference document conversion factors are maintained via QuantityWare BCS customizing -> Product & Standard Specific Settings -> UoM conversion factors for compliance checks, or directly using this tool via the push button "Maintain Reference Data".

QuantityWare delivers more than 500 reference factors for the BCS BC set UoM template, which are utilized to ensure compliance of all UoM definitions (except dimensionless UoM, temperature UoM and oil & gas energy equivalent UoM) within the template client 045.

You may selectively distribute these validated reference conversion factors within your system landscape to relevant clients. Then you may perform your own compliance analysis in these clients.

Selection

You select one out of six activities:

- Analyze single UoM: You may load a conversion factor from the reference database for a UoM, analyze the UoM settings, save your analysis to the analysis database or delete your analysis from the analysis database
- Run analysis for quan. & ref.: If you select "Execute" (F8), the compliance tool selects all reference data defined in your client for your UoM of the selected SAP dimension (quantity) and reference standard, performs the analysis for all these UoM, updates the analysis database and displays the result in a result list.
- Run mass analysis f. all UoM: If you select "Execute" (F8), the compliance tool selects all reference data defined in your client for your UoM, performs the analysis for all UoM, updates the analysis database and displays the result in a result list.
- List data for quantity & ref.: If you select "Execute" (F8), after you chose a quantity (SAP Dimension) and reference standard, the analysis data for these UoM is displayed in a result list
- List analysis data f. all UoM: If you select "Execute" (F8), the analysis data for all combinations (UoM and reference standards) is displayed in a list
- List analysis data - technical: If you select "Execute" (F8), the analysis data is displayed as it is stored on the database.

3.4.2. Print Standards Lists

When either adding a new product line or changing conversions for existing products, the “second task package” is the definition of the correct measurement standard, or several standards, as well as specific rules which may apply for different countries/business contracts. You need to compare legacy system results with available standards - a process which is usually considerably easier when ranges of complex correction factors can be printed. During general operations, you may also need to explain your conversion results to an independent inspector and thus need to print the relevant data. Basically, for your quantity conversion configuration, four different types of standards are relevant, defining:

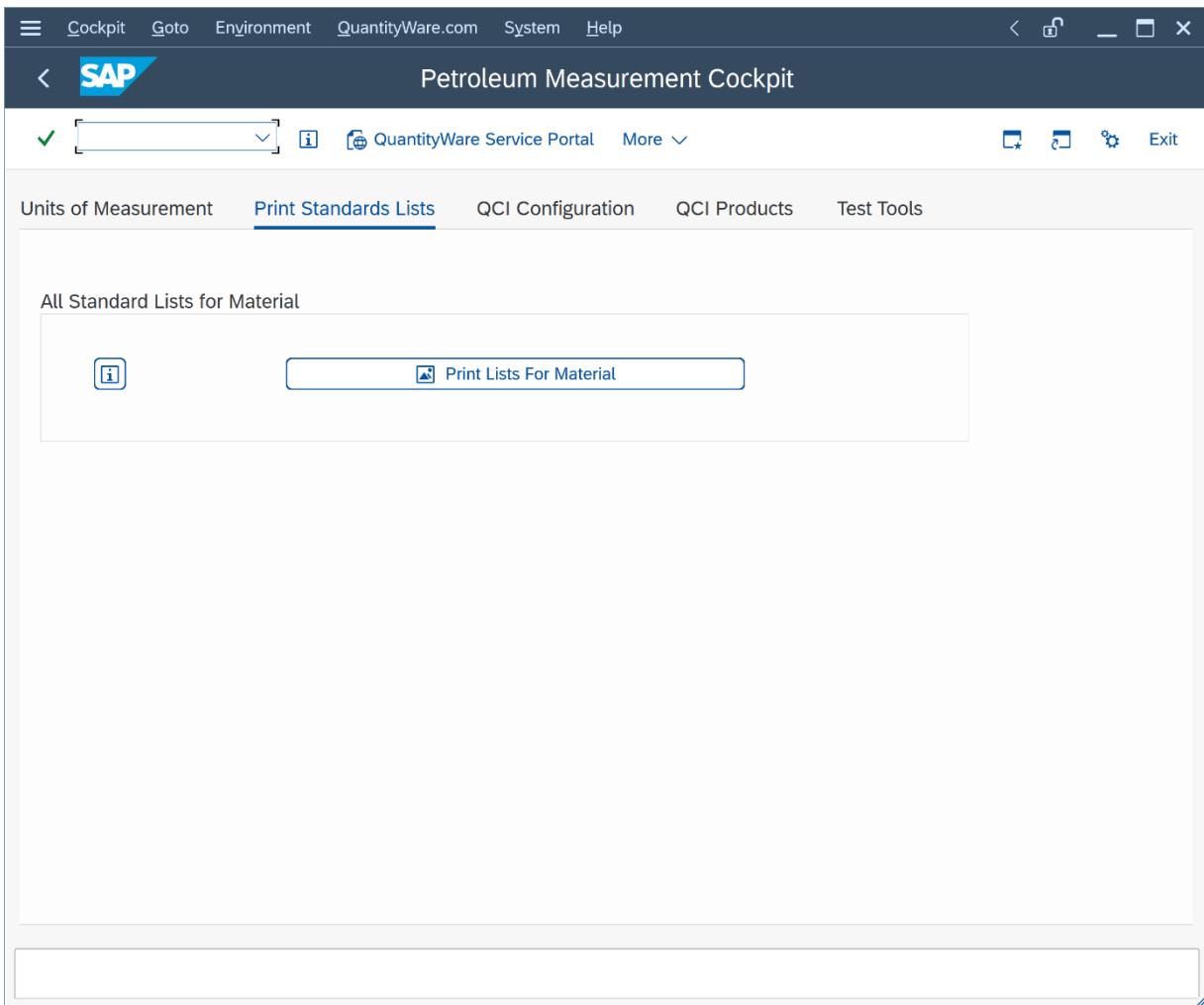
- The detailed calculation models
- Correction factors due to pressure and temperature on Liquids (CTPL)
- Conversion factors between mass and weight
- Conversion factors between UoM of one dimension

For CTL, CPL and mass/weight conversion standards, lists can be printed here. For UoM conversion factors, use the list options within tab strip “Units of Measurement”. You may select to print a standard list for your specific temperature and density range into a local PDF file as well.

You may also determine the relevant standard for a given material and plant configuration in your productive client once the assignment and documentation of your conversion groups is completed.

Example:

You wish to determine the relevant volume correction factor standard for your material CRUDE at plant GP01 and print a list of volume correction factors for that material. From tab strip “Print Standards Lists” you choose push button “Print Lists For Material”:



Program Edit Goto System Help

SAP Petroleum Measurement Cockpit: Print Lists for Material

✓ [] [] [] [] [] Cancel [] [] [] [] [] Exit

Select material and plant or conversion group

Enter material number and plant

Material number	CRUPE
Plant	GP01

or enter conversion group

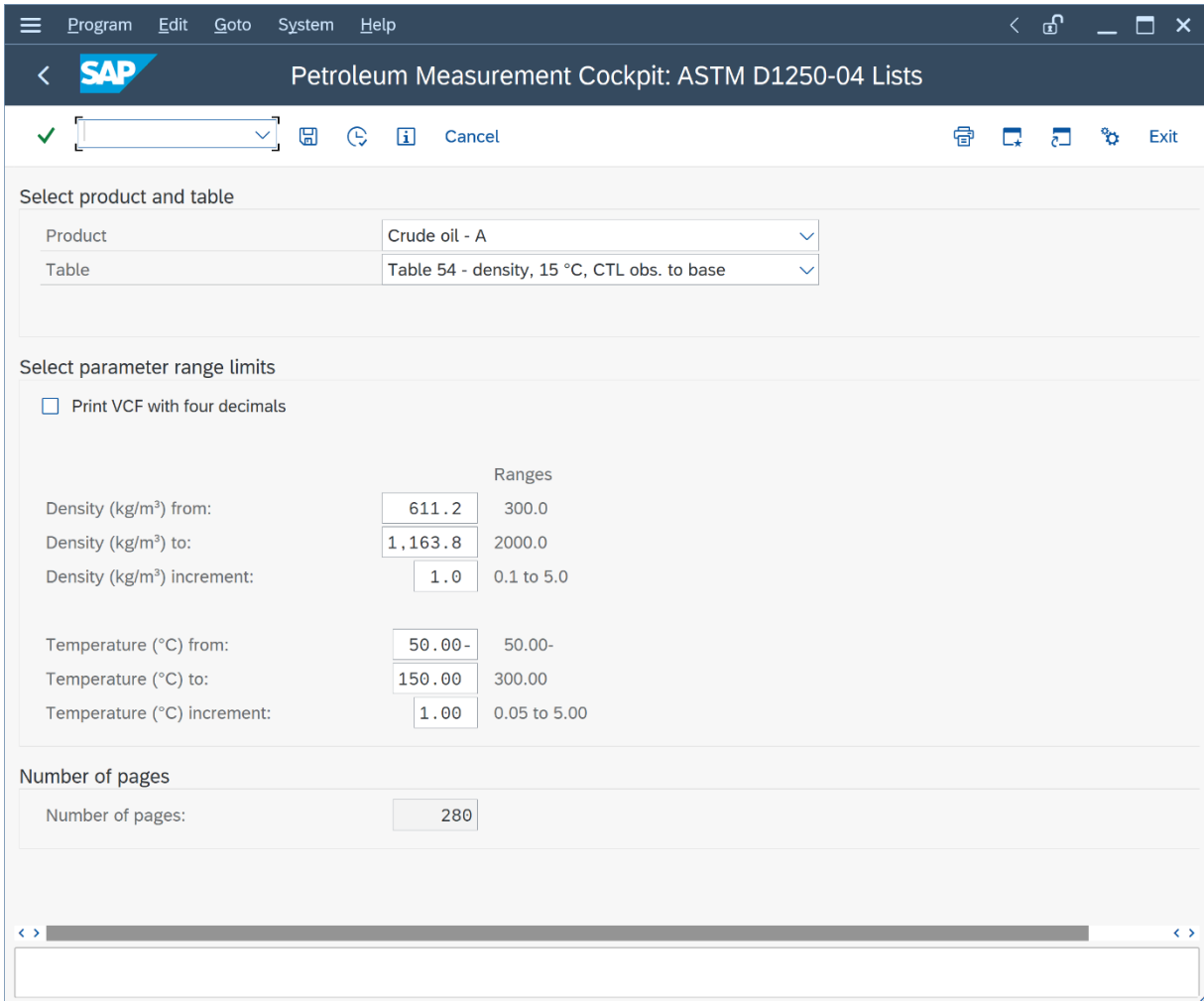
Conversion group	
------------------	--

Select standard list type

- Volume correction std. list
- Density correction std. list
- Mass to weight standard list

<> [] <>

After you select “F8” (Execute) the system navigates to the correct standard, in this case ASTM D1250-04, Table 54A:



The screenshot shows the SAP interface for 'Petroleum Measurement Cockpit: ASTM D1250-04 Lists'. The window title bar includes 'SAP' and the title 'Petroleum Measurement Cockpit: ASTM D1250-04 Lists'. The menu bar contains 'Program', 'Edit', 'Goto', 'System', and 'Help'. The toolbar includes a checkmark, a dropdown menu, a save icon, a refresh icon, an information icon, a 'Cancel' button, a copy icon, a print icon, a refresh icon, a settings icon, and an 'Exit' button.

Select product and table

Product	Crude oil - A
Table	Table 54 - density, 15 °C, CTL obs. to base

Select parameter range limits

Print VCF with four decimals

		Ranges
Density (kg/m ³) from:	611.2	300.0
Density (kg/m ³) to:	1,163.8	2000.0
Density (kg/m ³) increment:	1.0	0.1 to 5.0
Temperature (°C) from:	50.00-	50.00-
Temperature (°C) to:	150.00	300.00
Temperature (°C) increment:	1.00	0.05 to 5.00

Number of pages

Number of pages:	280
------------------	-----

At the bottom of the window, there is a horizontal scrollbar and a large empty text area.

QuantityWare SAP Petroleum Measurement Cockpit: ASTM D1250-04 Lists

Export to PDF Cancel

Petroleum Measurement Cockpit: ASTM D1250-04 Lists 1

ASTM D1250-04 - Table 54A

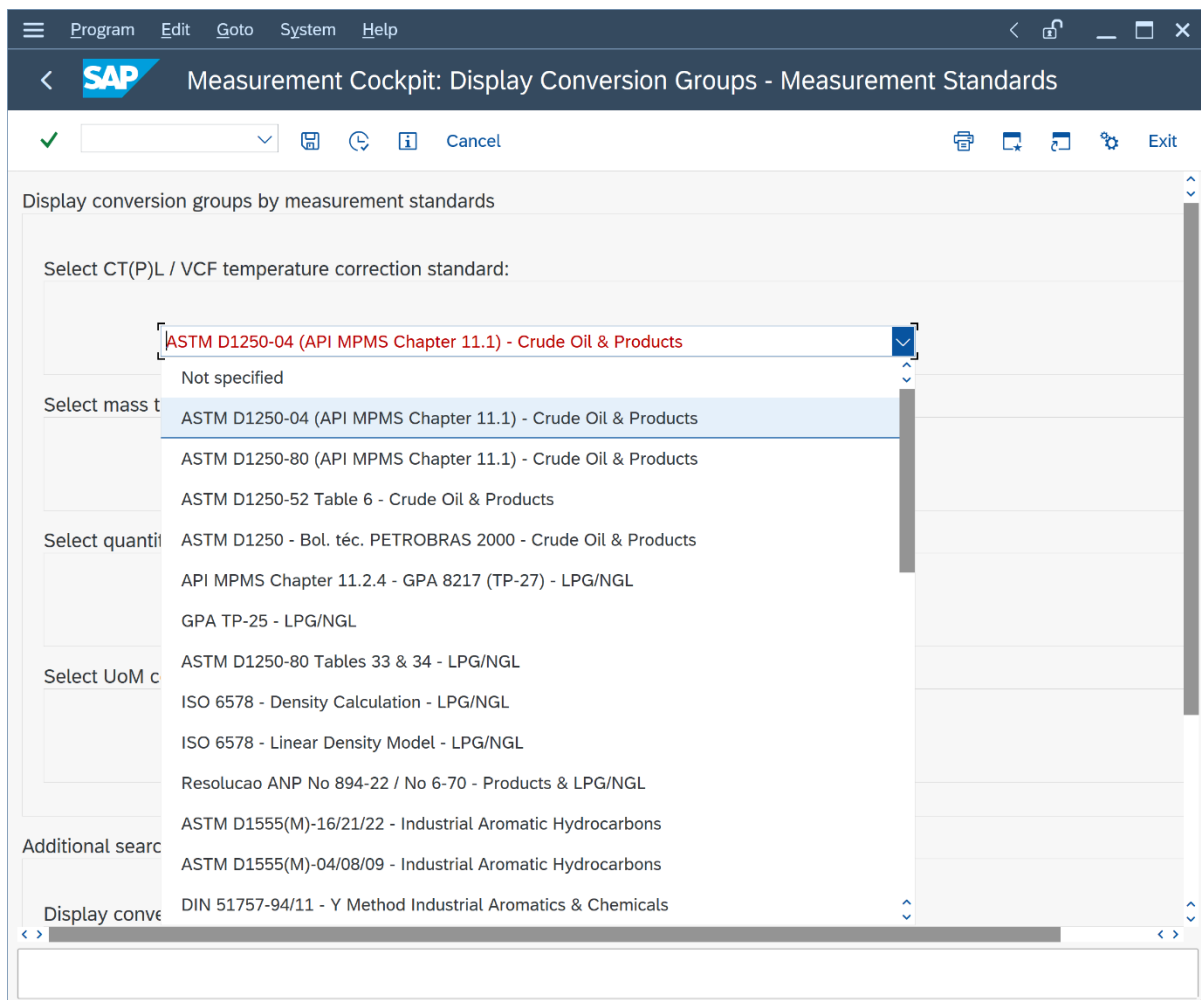
Temp. from to 20.00- 24.00 °C	Product: Crude	Base: Density (kg/m ³) at 15 °C	Calculation: Volume correction factors									
	Density in kg/m ³		from 750.0 to 759.0									
			750.0	751.0	752.0	753.0	754.0	755.0	756.0	757.0	758.0	759.0
20.00-	1.03774	1.03765	1.03755	1.03745	1.03735	1.03725	1.03716	1.03706	1.03696	1.03687		
19.00-	1.03668	1.03658	1.03649	1.03639	1.03630	1.03620	1.03611	1.03601	1.03592	1.03583		
18.00-	1.03562	1.03552	1.03543	1.03534	1.03524	1.03515	1.03506	1.03497	1.03488	1.03479		
17.00-	1.03455	1.03446	1.03437	1.03428	1.03419	1.03410	1.03401	1.03392	1.03383	1.03374		
16.00-	1.03348	1.03339	1.03331	1.03322	1.03313	1.03305	1.03296	1.03287	1.03279	1.03270		
15.00-	1.03241	1.03233	1.03224	1.03216	1.03208	1.03199	1.03191	1.03182	1.03174	1.03166		
14.00-	1.03135	1.03126	1.03118	1.03110	1.03102	1.03094	1.03086	1.03078	1.03069	1.03061		
13.00-	1.03028	1.03020	1.03012	1.03004	1.02996	1.02988	1.02980	1.02972	1.02965	1.02957		
12.00-	1.02921	1.02913	1.02905	1.02898	1.02890	1.02882	1.02875	1.02867	1.02860	1.02852		
11.00-	1.02814	1.02806	1.02799	1.02791	1.02784	1.02777	1.02769	1.02762	1.02755	1.02748		
10.00-	1.02706	1.02699	1.02692	1.02685	1.02678	1.02671	1.02664	1.02657	1.02650	1.02643		
9.00-	1.02599	1.02592	1.02585	1.02579	1.02572	1.02565	1.02558	1.02552	1.02545	1.02538		
8.00-	1.02492	1.02485	1.02479	1.02472	1.02465	1.02459	1.02453	1.02446	1.02440	1.02433		
7.00-	1.02384	1.02378	1.02372	1.02365	1.02359	1.02353	1.02347	1.02341	1.02335	1.02328		
6.00-	1.02277	1.02271	1.02265	1.02259	1.02253	1.02247	1.02241	1.02235	1.02229	1.02223		
5.00-	1.02169	1.02163	1.02158	1.02152	1.02146	1.02141	1.02135	1.02129	1.02124	1.02118		
4.00-	1.02061	1.02056	1.02050	1.02045	1.02040	1.02034	1.02029	1.02024	1.02018	1.02013		
3.00-	1.01954	1.01948	1.01943	1.01938	1.01933	1.01928	1.01923	1.01918	1.01913	1.01908		

After execution of your selection, a list of all volume correction factors (CTL) is calculated and printed.

3.4.3. QCI Configuration

The third and most complex task package is to decide which conversion group needs to be assigned to your materials at which plant. Here you obtain an overview of the QuantityWare-delivered conversion groups, organized via product groups, and inspect the settings. You have several selection choices to determine which template conversion group fits your requirements.

Example: You require a list of all crude oil template conversion groups which are configured to use ASTM D1250-04 temperature corrections, API MPMS Chapter 11.5.1 (°API) weight to mass conversions and ASTM Table 1 UoM 2008 conversion factors. From the QCI configuration tab strip, you choose “By Measurement Standards” and select the three standards as well as the product type for crude oil:



Program Edit Goto System Help

SAP Measurement Cockpit: Display Conversion Groups - Measurement Standards

✓ [] [] [] [] Cancel [] [] [] [] [] Exit

Display conversion groups by measurement standards

Select CT(P)L / VCF temperature correction standard:

ASTM D1250-04 (API MPMS Chapter 11.1) - Crude Oil & Products

Select mass to weight conversion standard:

ASTM D1250-08 (API MPMS Chapter 11.5.3, Dens. - kg/m³ 15 °C)

Select quantity conversion model standard:

Crude Oil Gross Volume Model - S&W - Net & Gross Mass

Select UoM conversion factor standard:

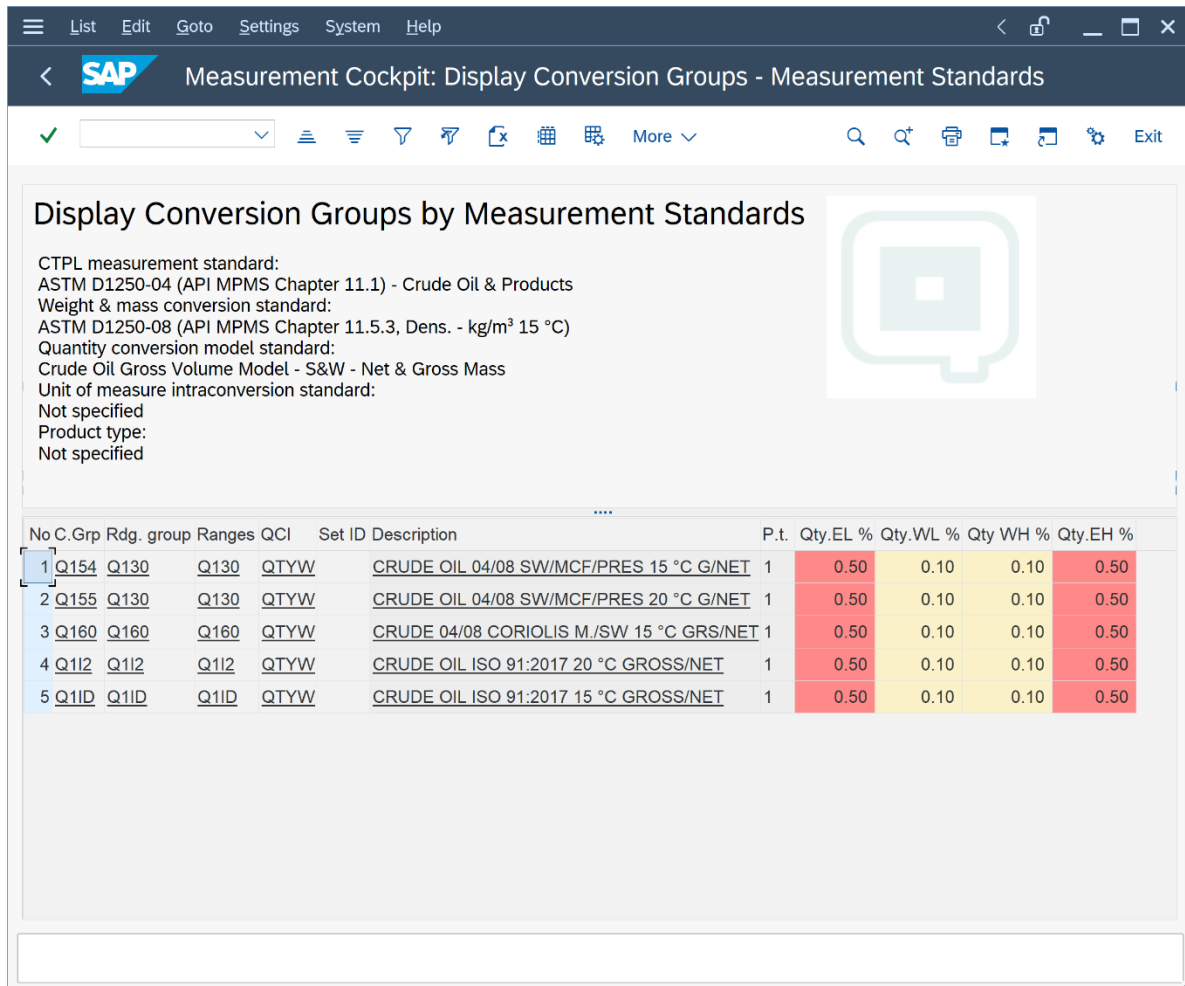
Not specified

Additional search restrictions

Display conversion groups with product type:

[]

After executing the report with your selection, you obtain a comprehensive overview list, with additional navigation details:



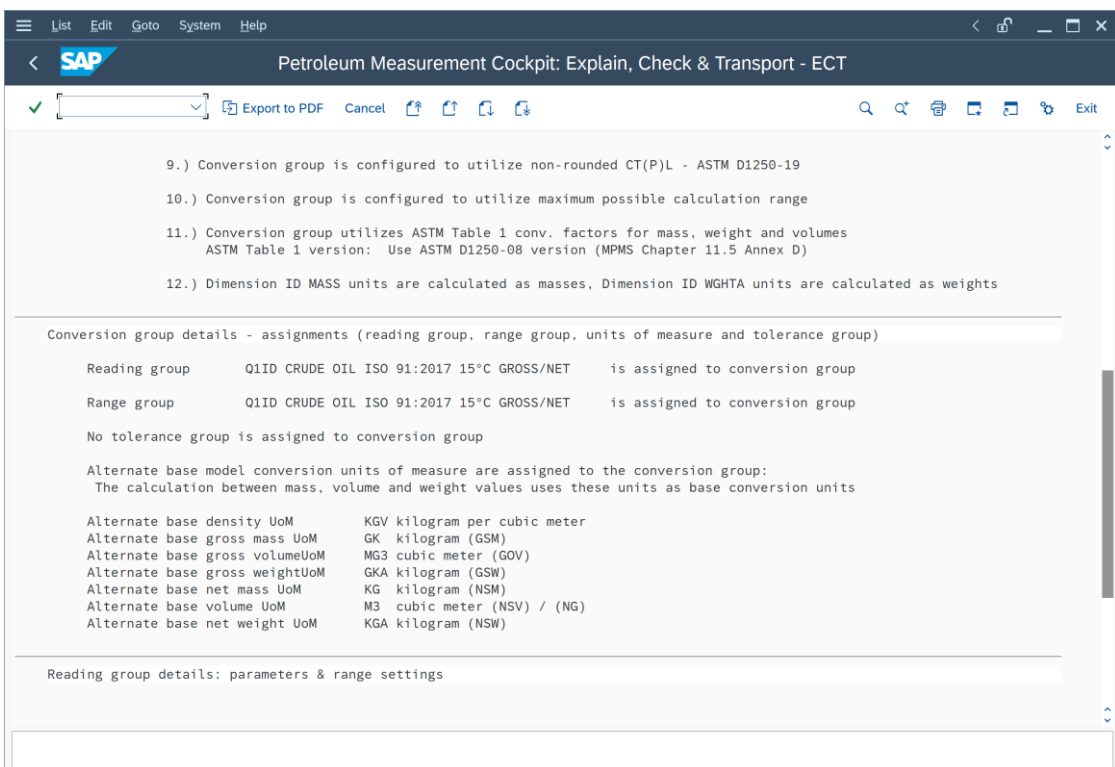
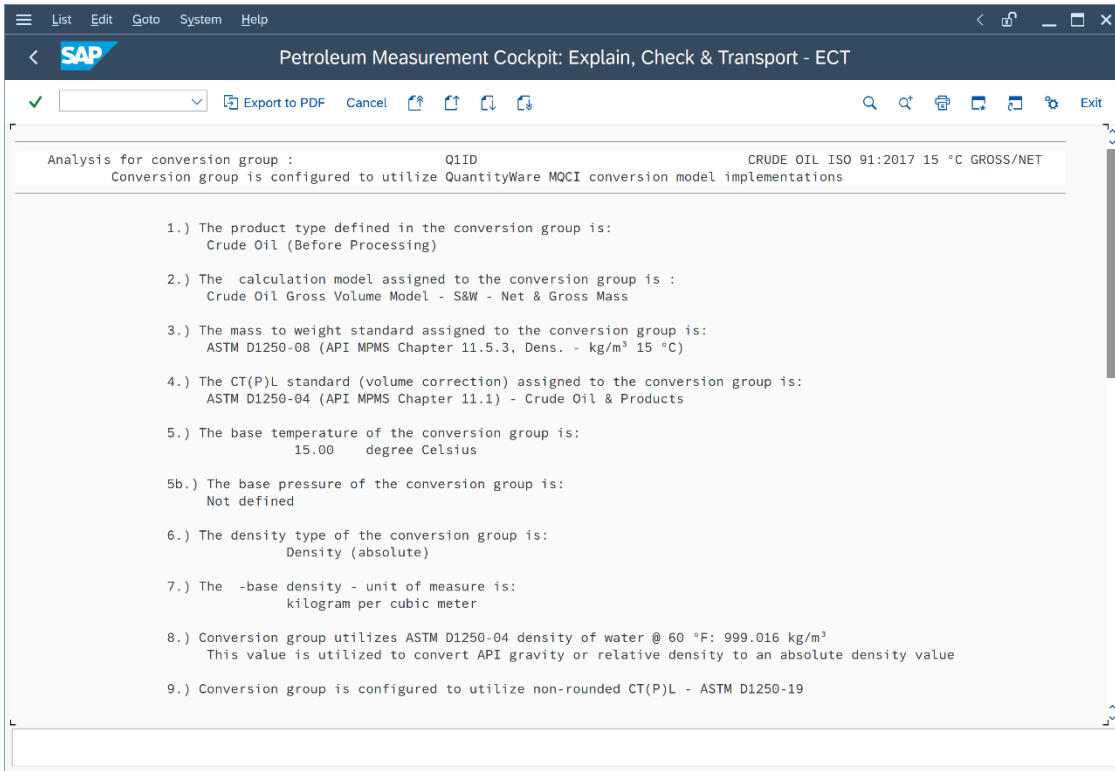
Display Conversion Groups by Measurement Standards

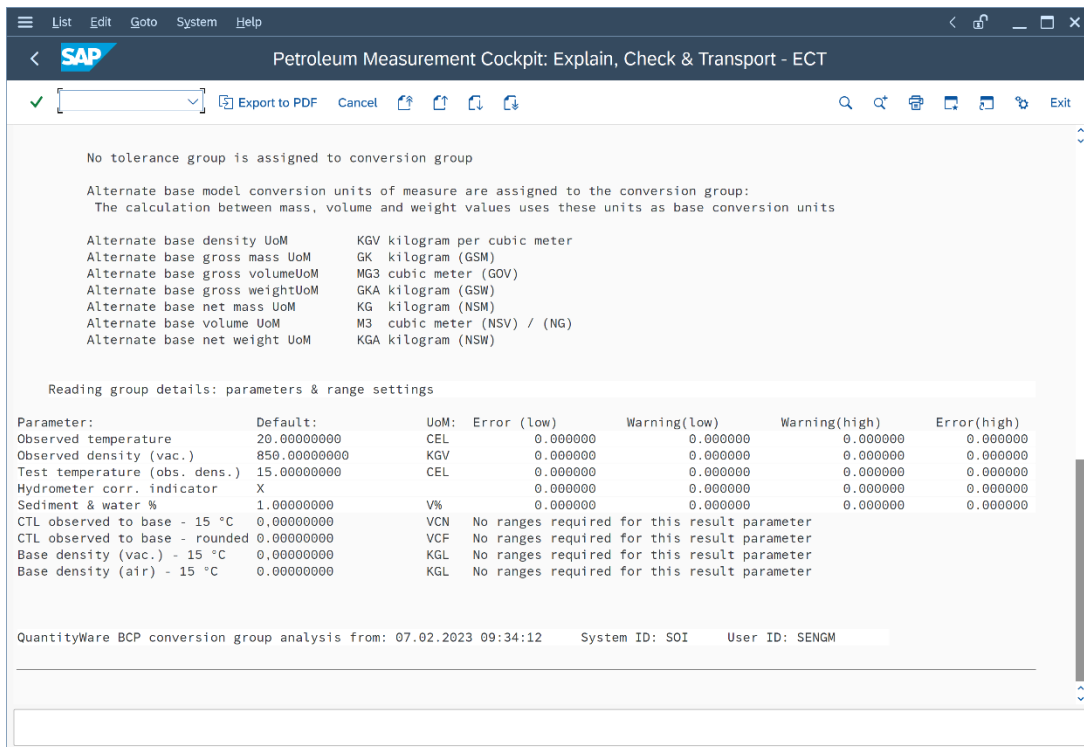
CTPL measurement standard:
 ASTM D1250-04 (API MPMS Chapter 11.1) - Crude Oil & Products
 Weight & mass conversion standard:
 ASTM D1250-08 (API MPMS Chapter 11.5.3, Dens. - kg/m³ 15 °C)
 Quantity conversion model standard:
 Crude Oil Gross Volume Model - S&W - Net & Gross Mass
 Unit of measure intraconversion standard:
 Not specified
 Product type:
 Not specified

No	C.Grp	Rdg. group	Ranges	QCI	Set ID	Description	P.t.	Qty.EL %	Qty.WL %	Qty.WH %	Qty.EH %
1	Q154	Q130	Q130	QTYW		CRUDE OIL 04/08 SW/MCF/PRES 15 °C G/NET	1	0.50	0.10	0.10	0.50
2	Q155	Q130	Q130	QTYW		CRUDE OIL 04/08 SW/MCF/PRES 20 °C G/NET	1	0.50	0.10	0.10	0.50
3	Q160	Q160	Q160	QTYW		CRUDE 04/08 CORIOLIS M./SW 15 °C GRS/NET	1	0.50	0.10	0.10	0.50
4	Q112	Q112	Q112	QTYW		CRUDE OIL ISO 91:2017 20 °C GROSS/NET	1	0.50	0.10	0.10	0.50
5	Q11D	Q11D	Q11D	QTYW		CRUDE OIL ISO 91:2017 15 °C GROSS/NET	1	0.50	0.10	0.10	0.50

From this list, you display detailed customizing settings that are relevant for each conversion group by simply clicking individual overview fields.

If you click the “Description” text of a conversion group, a detailed configuration statement is printed, which can for example be utilized for audit purposes:

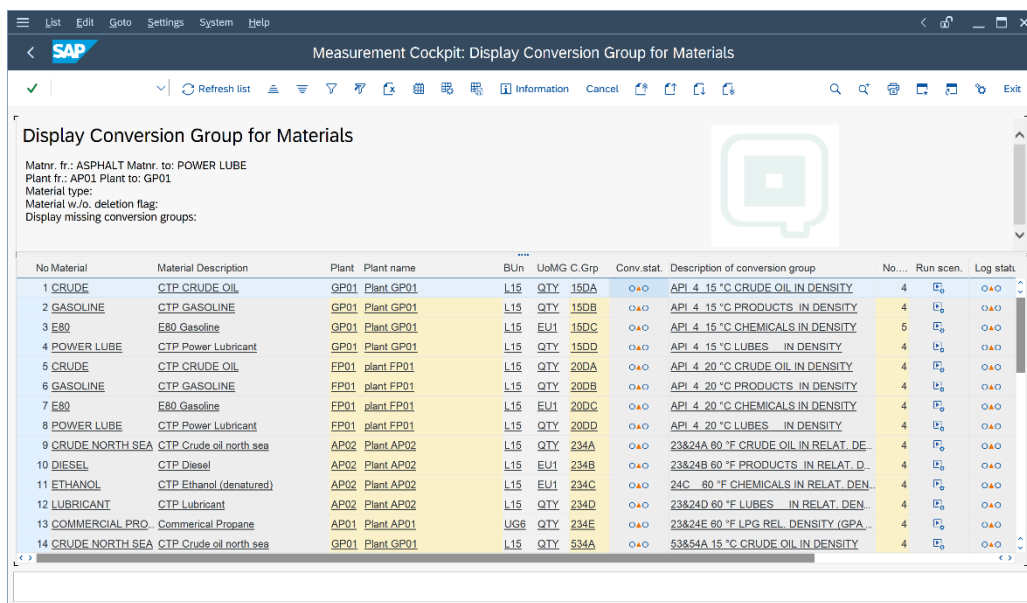




Once you have identified the relevant conversion group, copy it as recommended to your name space (from "Q*" to "Z*") using the appropriate customizing option. Access is provided via the menu path: (More →) Goto → QuantityWare IMG or directly via: (More →) Goto → Conversion Groups.

3.4.4. QCI Products

An inspector report questions whether the transferred quantity values for your product are correct. You determine the conversion group and confirm the base condition and measurement standard settings for the material; such a task is easily performed via the central material assignment list which you generated here with one click:

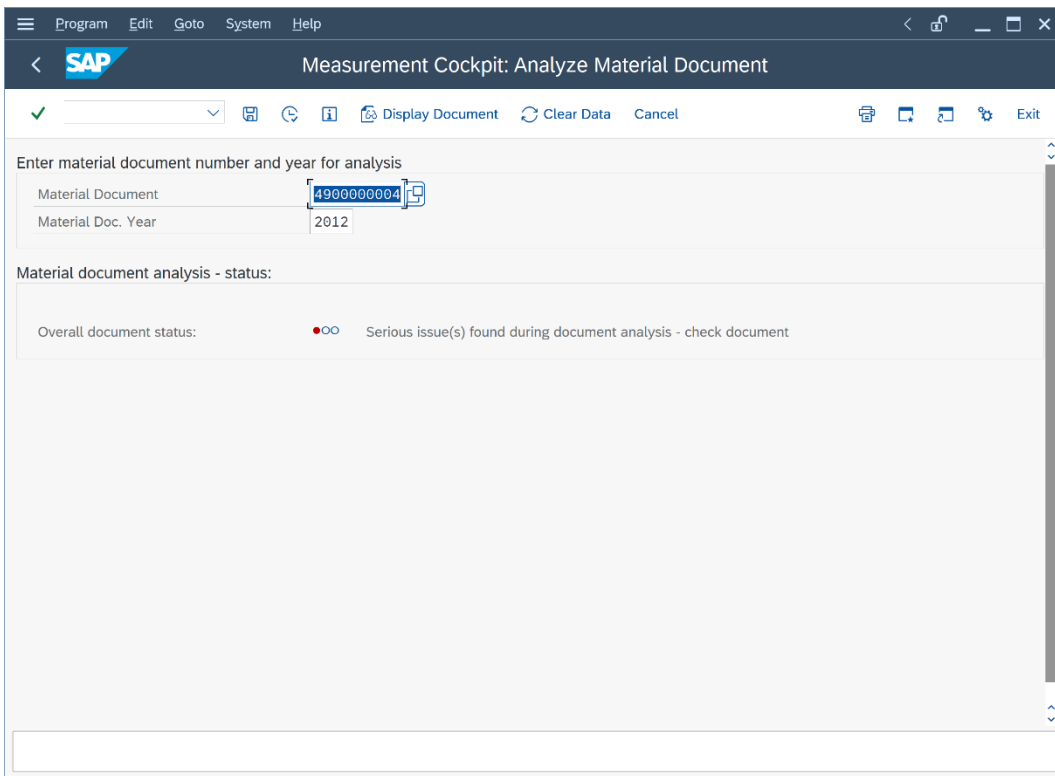


No Material	Material Description	Plant	Plant name	BUIn	UoMG C.Grp	Conv.stat	Description of conversion group	No....	Run scen.	Log statu.
1	CRUDE CTP CRUDE OIL	GP01	Plant GP01	L15	QTY 15DA	o.o	API 4 15 °C CRUDE OIL IN DENSITY	4	o.o	o.o
2	GASOLINE CTP GASOLINE	GP01	Plant GP01	L15	QTY 15DB	o.o	API 4 15 °C PRODUCTS IN DENSITY	4	o.o	o.o
3	E80 E80 Gasoline	GP01	Plant GP01	L15	EU1 15DC	o.o	API 4 15 °C CHEMICALS IN DENSITY	5	o.o	o.o
4	POWER LUBE CTP Power Lubricant	GP01	Plant GP01	L15	QTY 15DD	o.o	API 4 15 °C LUBES IN DENSITY	4	o.o	o.o
5	CRUDE CTP CRUDE OIL	FP01	plant FP01	L15	QTY 20DA	o.o	API 4 20 °C CRUDE OIL IN DENSITY	4	o.o	o.o
6	GASOLINE CTP GASOLINE	FP01	plant FP01	L15	QTY 20DB	o.o	API 4 20 °C PRODUCTS IN DENSITY	4	o.o	o.o
7	E80 E80 Gasoline	FP01	plant FP01	L15	EU1 20DC	o.o	API 4 20 °C CHEMICALS IN DENSITY	4	o.o	o.o
8	POWER LUBE CTP Power Lubricant	FP01	plant FP01	L15	QTY 20DD	o.o	API 4 20 °C LUBES IN DENSITY	4	o.o	o.o
9	CRUDE NORTH SEA CTP Crude oil north sea	AP02	Plant AP02	L15	QTY 234A	o.o	23824A 80 °F CRUDE OIL IN RELAT. DE	4	o.o	o.o
10	DIESEL CTP Diesel	AP02	Plant AP02	L15	EU1 234B	o.o	23824B 80 °F PRODUCTS IN RELAT. D	4	o.o	o.o
11	ETHANOL CTP Ethanol (denatured)	AP02	Plant AP02	L15	EU1 234C	o.o	24C 60 °F CHEMICALS IN RELAT. DEN	4	o.o	o.o
12	LUBRICANT CTP Lubricant	AP02	Plant AP02	L15	QTY 234D	o.o	23824D 60 °F LUBES IN RELAT. DEN	4	o.o	o.o
13	COMMERCIAL PRO. Commerical Propane	AP01	Plant AP01	UG6	QTY 234E	o.o	23824E 60 °F LPG REL. DENSITY (GPA	4	o.o	o.o
14	CRUDE NORTH SEA CTP Crude oil north sea	GP01	Plant GP01	L15	QTY 534A	o.o	53854A 15 °C CRUDE OIL IN DENSITY	4	o.o	o.o

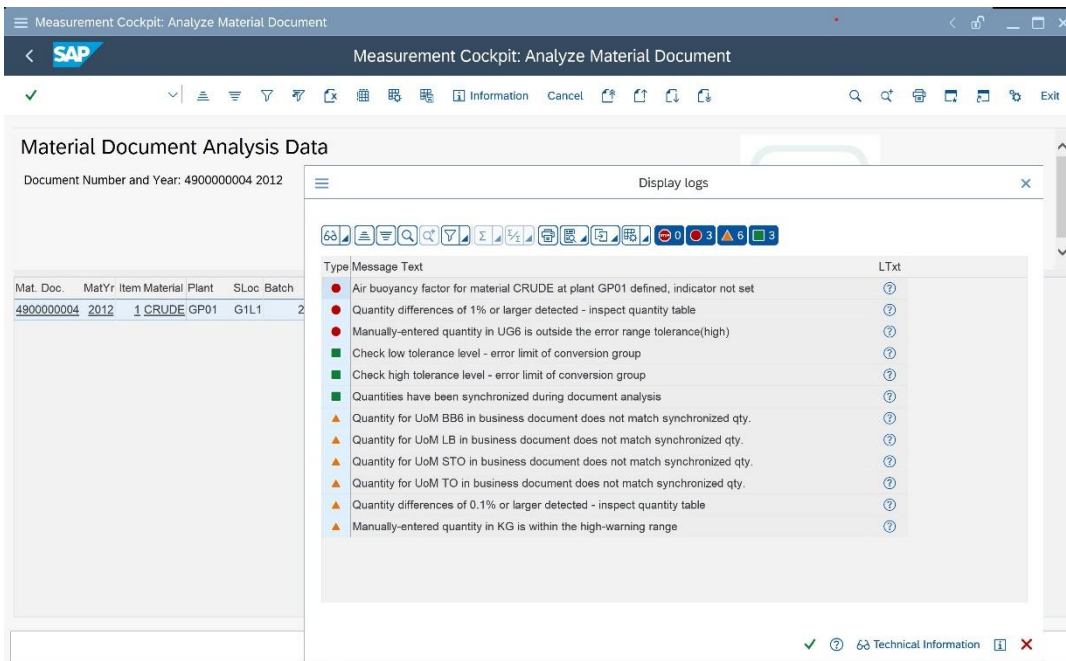
In this list, you monitor that test scenarios are available and executed with status “o.k.” for all materials, as well as the conversion group check status. You also ensure that snapshots are available for all test scenarios, which you may utilize to analyze your configuration, if a scenario reports an error.

You also use this tab for business document analysis.

Example: Your sales manager reports that a customer has issued a complaint which he traced back to a material document. You select the “Analyze Business Document” push button, enter the material document number and year, and then simply press the “Return” key. The overall analysis result is immediately displayed:



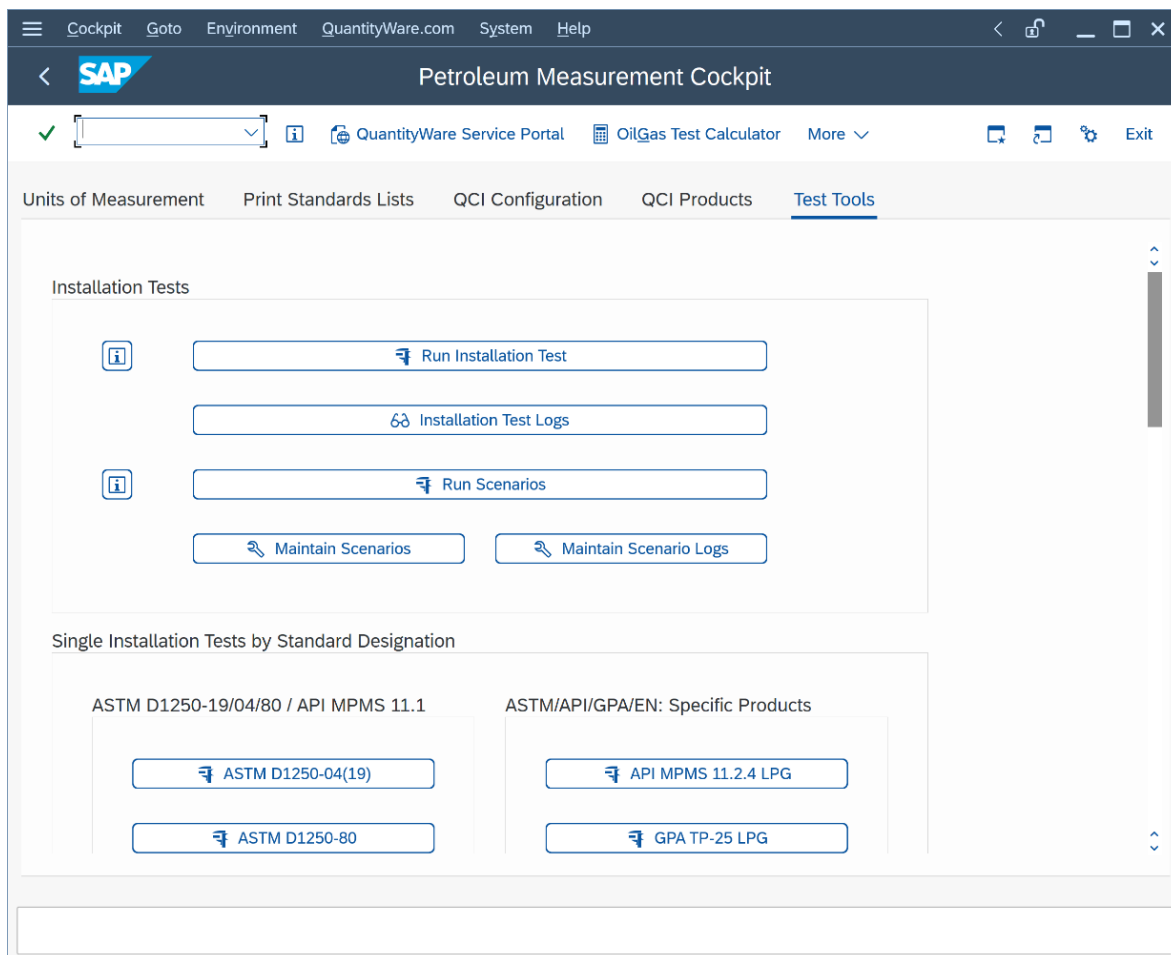
If issues are found, you select "Execute" (F8) and the detailed analysis list is displayed:



If you need to switch thousands of material/plant settings to a new standard version of ASTM D1250, you can do this using the legacy conversion tools provided in this tab strip

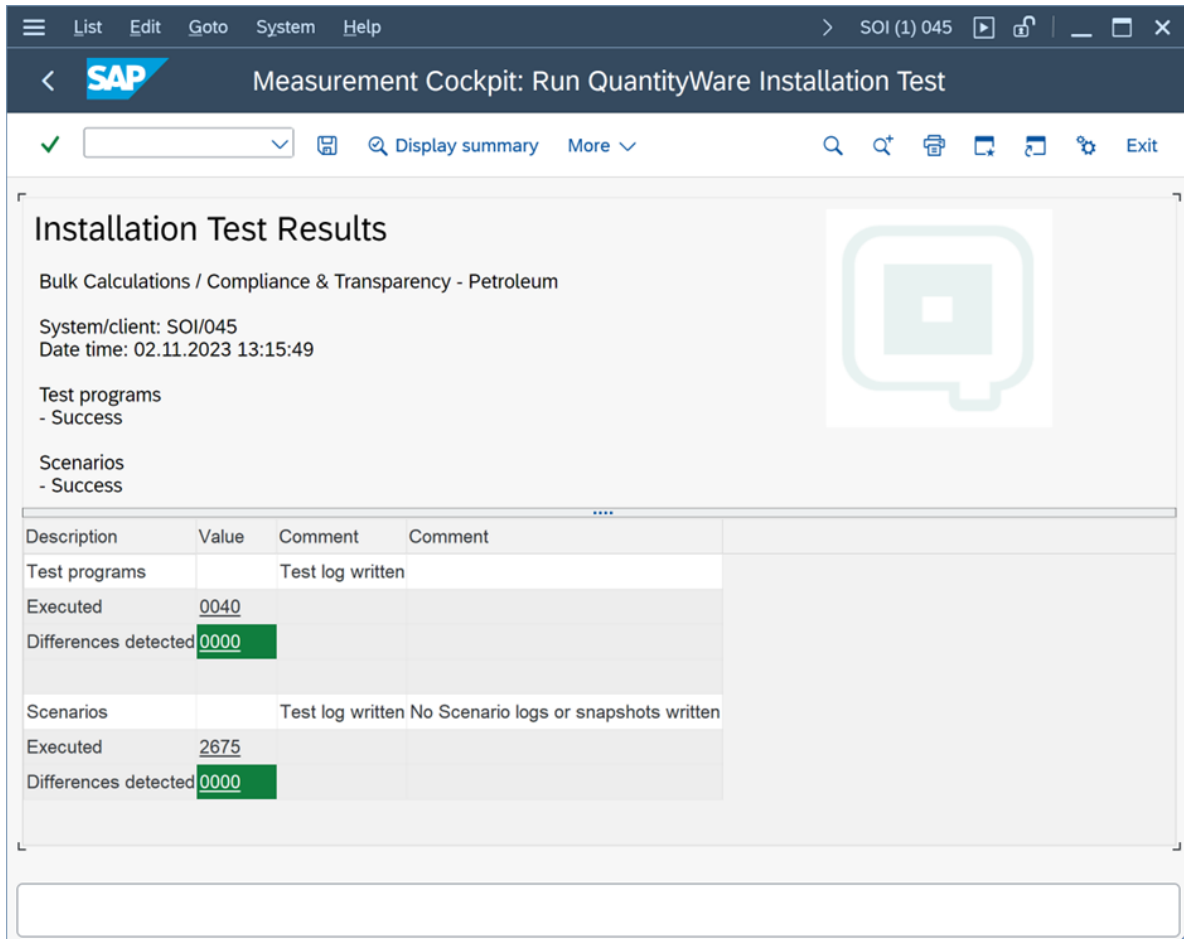
3.4.5. Test Tools

All UoM and quantity conversion settings need rigorous testing and quality control. The QuantityWare installation test needs to be executed from here. You also configure and run your own test scenarios with full logging and execution control to ensure full compliance for your implementation. Via this tab strip you access all QuantityWare test tools that are delivered with BCP:



From this tab, you either:

- In client 045, run the QuantityWare installation test with one click and obtain the test result within seconds:



Installation Test Results

Bulk Calculations / Compliance & Transparency - Petroleum

System/client: SOI/045
Date time: 02.11.2023 13:15:49

Test programs
- Success

Scenarios
- Success

Description	Value	Comment	Comment
Test programs		Test log written	
Executed	0040		
Differences detected	0000		
Scenarios		Test log written	No Scenario logs or snapshots written
Executed	2675		
Differences detected	0000		

- In your other clients: Utilize the QuantityWare Test Scenario Tool (Run Scenarios, Maintain Scenarios, Maintain Scenario Logs) to define your own test scenarios based on your requirements; Run the Technical Installation Test.
- Run the UoM compliance analysis in any client:

SAP Measurement Cockpit: Unit of Measure (UoM) Compliance Analysis

Display Unit of Measure Compliance Analysis Data

All UoM analysis data in system/client: SOI 030

No	Dimension text	UoM	Measurement unit text	SI	Standard	Ref./An.	Ref.Std.Factor	l/s	Cal.Denom.	Cal.Num.	Exp	Sys.Denom.	Sys.Num.	Exp	System Factor	l/s
25	net volume NOV/NSV	BB0	barrel 0 decimals TEMPLATE	M3	1	00	0.158987300000	0	10,000,000	1,589,873	0	259,303,135	41,225,904	0	0.158987294928	
26	net volume NOV/NSV	BB0	barrel 0 decimals TEMPLATE	M3	6	00	0.158987294928	0	259,303,135	41,225,904	0	259,303,135	41,225,904	0	0.158987294928	
27	net volume NOV/NSV	BB6	barrel [42 gallons(U.S.))(NSV)	M3	1	00	0.158987300000	0	10,000,000	1,589,873	0	259,303,135	41,225,904	0	0.158987294928	
28	net volume NOV/NSV	BB6	barrel [42 gallons(U.S.))(NSV)	M3	3	00	0.158987300000	0	10,000,000	1,589,873	0	259,303,135	41,225,904	0	0.158987294928	
29	net volume NOV/NSV	BB6	barrel [42 gallons(U.S.))(NSV)	M3	4	00	0.158987000000	0	1,000,000	158,987	0	259,303,135	41,225,904	0	0.158987294928	
30	net volume NOV/NSV	BB6	barrel [42 gallons(U.S.))(NSV)	M3	5	00	0.158987304000	0	125,000,000	19,873,413	0	259,303,135	41,225,904	0	0.158987294928	
31	net volume NOV/NSV	BB6	barrel [42 gallons(U.S.))(NSV)	M3	6	00	0.158987294928	0	259,303,135	41,225,904	0	259,303,135	41,225,904	0	0.158987294928	
32	net volume NOV/NSV	BBL	barrel [42 gallons(U.S.))(NOV)	M3	1	00	0.158987300000	0	10,000,000	1,589,873	0	259,303,135	41,225,904	0	0.158987294928	
33	net volume NOV/NSV	BBL	barrel [42 gallons(U.S.))(NOV)	M3	3	00	0.158987300000	0	10,000,000	1,589,873	0	259,303,135	41,225,904	0	0.158987294928	
34	net volume NOV/NSV	BBL	barrel [42 gallons(U.S.))(NOV)	M3	4	00	0.158987000000	0	1,000,000	158,987	0	259,303,135	41,225,904	0	0.158987294928	
35	net volume NOV/NSV	BBL	barrel [42 gallons(U.S.))(NOV)	M3	5	00	0.158987304000	0	125,000,000	19,873,413	0	259,303,135	41,225,904	0	0.158987294928	
36	net volume NOV/NSV	BBL	barrel [42 gallons(U.S.))(NOV)	M3	6	00	0.158987294928	0	259,303,135	41,225,904	0	259,303,135	41,225,904	0	0.158987294928	
37	heating value(vol.)	BC1	Btu/cubic foot at 15.025/60/SD	JM3	1	00	37,258.941299999999	0	10,000	372,589,413	0	10,000	372,589,413	0	37,258.941299999999	

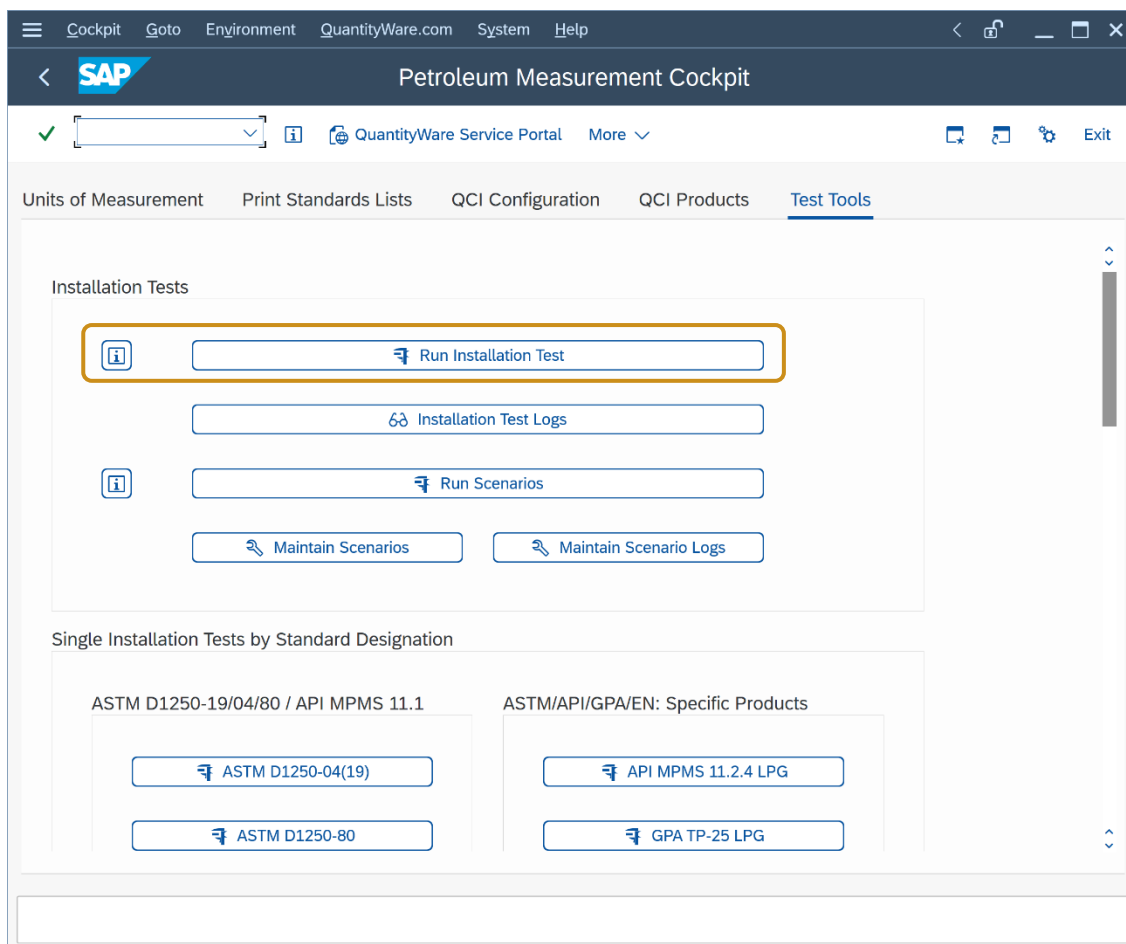
The UoM compliance analysis in client 045 is executed automatically once you execute the installation test and the result of the analysis is stored in your database. QuantityWare delivers validated UoM conversion factors which are utilized for the analysis and which you may also copy for your own analysis e.g. in your productive system and client.

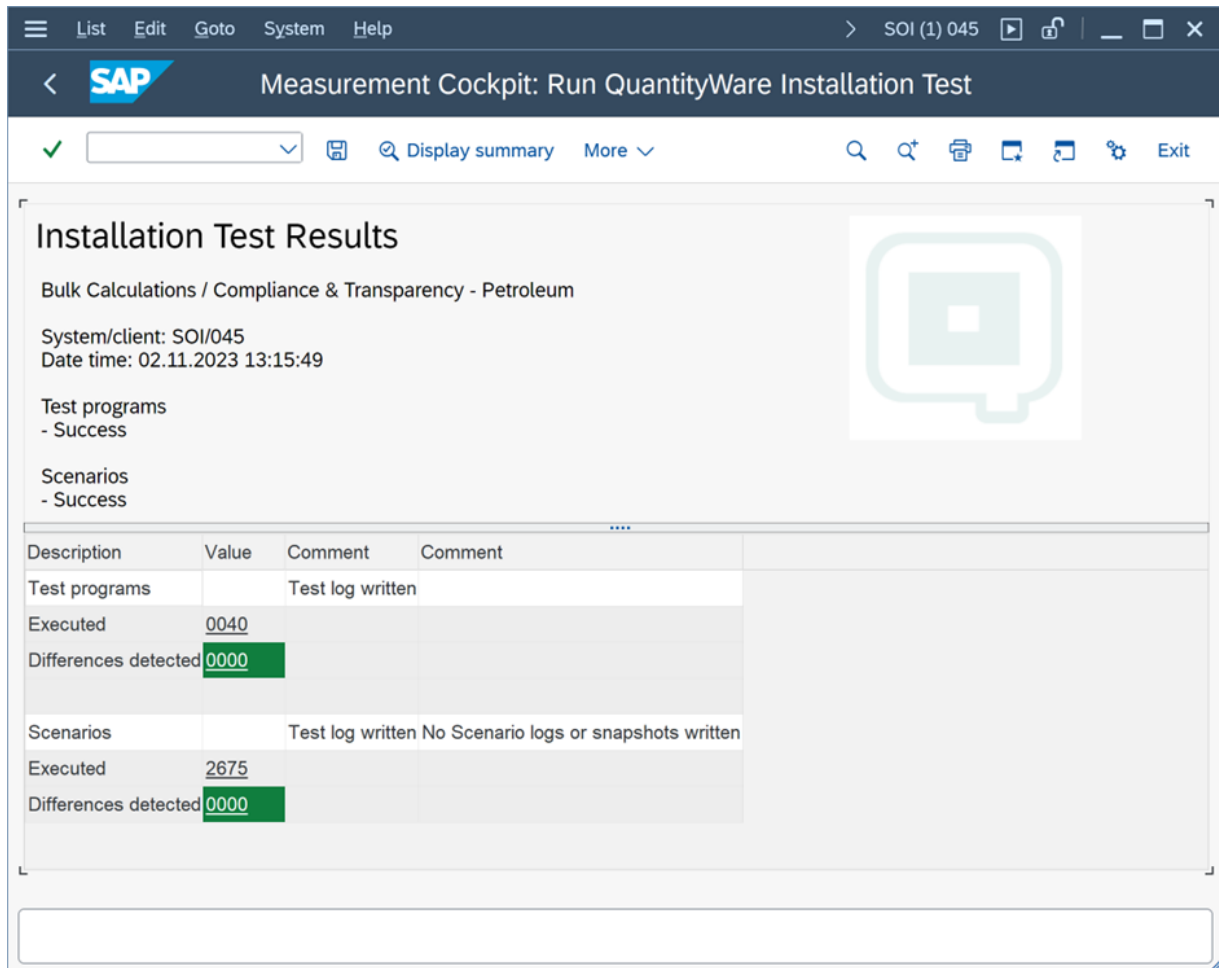
3.4.5.1. BCP Installation Test

- The BCP Installation Test must be executed in one dedicated system per system landscape and client 045 (recommended client number if available).
- The BCP Installation Test requires that the BCP BC set is activated in that client.

The BCP BC Set contains a rich configuration template (containing only client dependent data) on which the installation test performs massive tests in conjunction with the ABAP repository installation. This configuration template is subsequently utilized by certified BCP consultants who select the required configuration objects (UoM definitions, conversion groups, reading groups ...) following the PAIG methodology.

The BCP Installation Test is executed from the Petroleum Measurement Cockpit (PMC), tab strip "Test Tools" with one single click on push button "Run Installation Test":



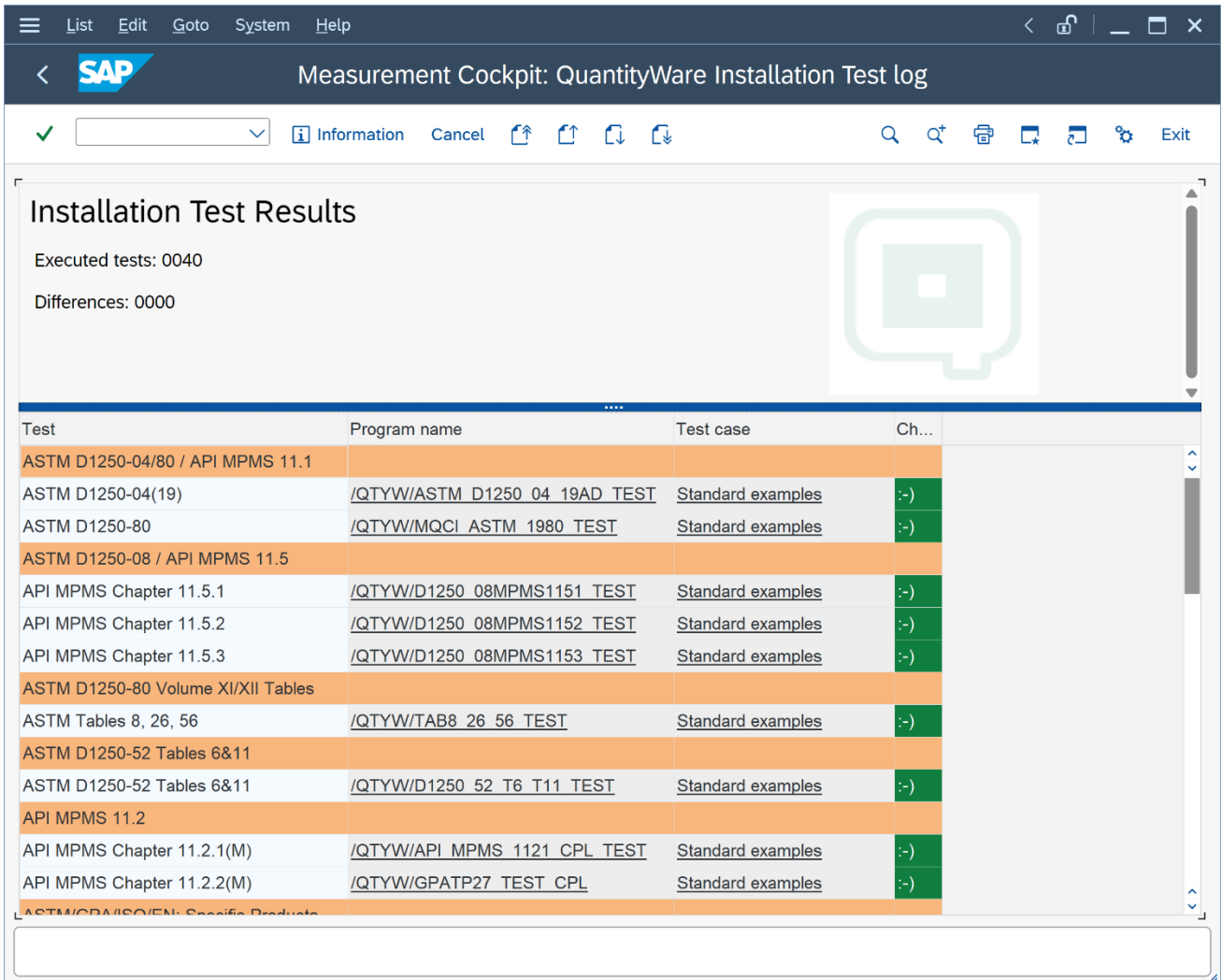


Two types of tests are executed during the installation test:

- **40** Test Programs (number may differ if customer specific developments are present in your system)
- **2 675** Test Scenarios

These results are written to the installation test log database for later reference.

You navigate to the test details (either from this result list or the log database result list) by simply clicking a result line. If you select the test programs, a comprehensive list with all executed test programs and the relevant test cases is displayed:



The screenshot shows the SAP Measurement Cockpit interface for the QuantityWare Installation Test log. The main content area is titled "Installation Test Results" and displays the following summary information:

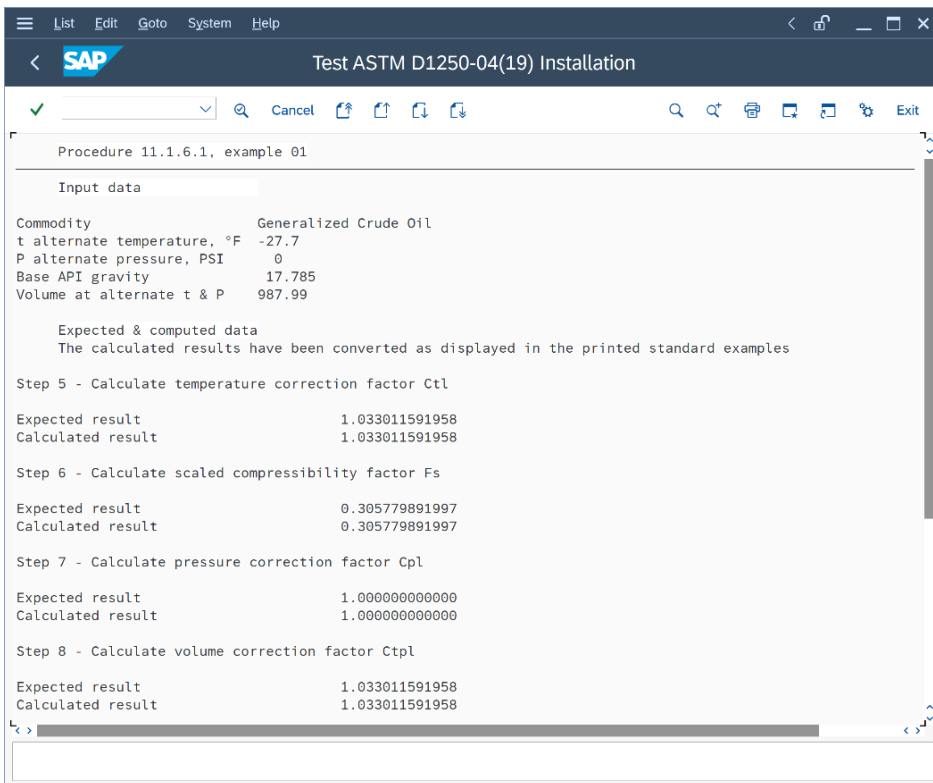
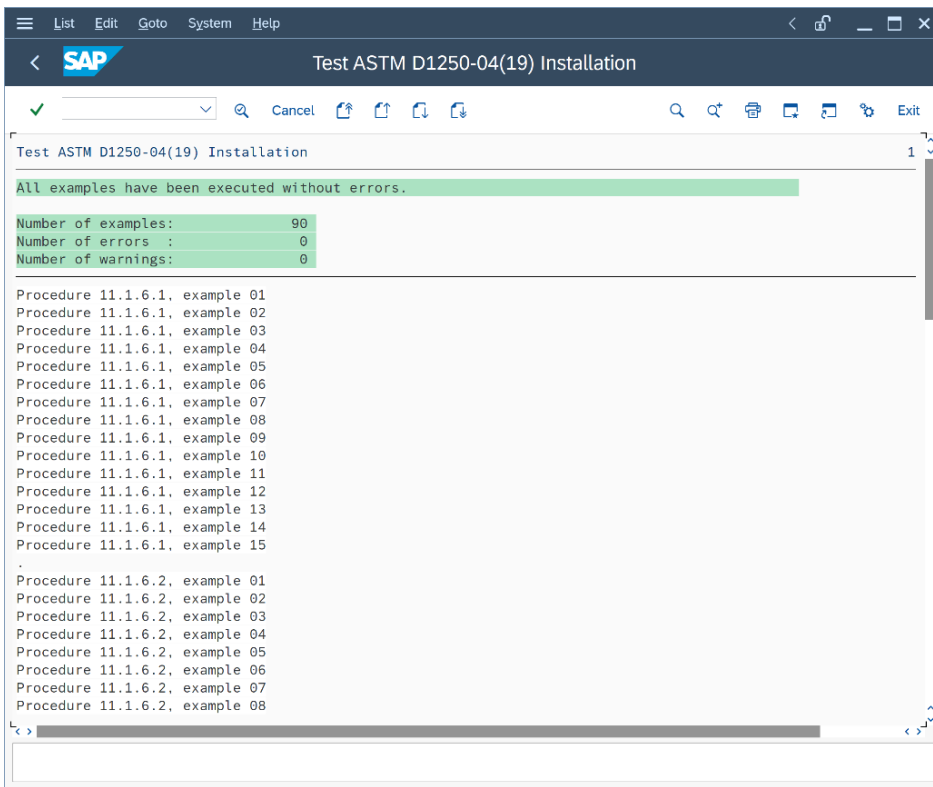
- Executed tests: 0040
- Differences: 0000

Below the summary is a table with the following columns: Test, Program name, Test case, and Ch... (likely Channel). The table lists various test programs and their associated test cases, all of which are marked as "Standard examples" and have a status of "-)".

Test	Program name	Test case	Ch...
ASTM D1250-04/80 / API MPMS 11.1			
ASTM D1250-04(19)	/QTYW/ASTM_D1250_04_19AD_TEST	Standard examples	-)
ASTM D1250-80	/QTYW/MQCI_ASTM_1980_TEST	Standard examples	-)
ASTM D1250-08 / API MPMS 11.5			
API MPMS Chapter 11.5.1	/QTYW/D1250_08MPMS1151_TEST	Standard examples	-)
API MPMS Chapter 11.5.2	/QTYW/D1250_08MPMS1152_TEST	Standard examples	-)
API MPMS Chapter 11.5.3	/QTYW/D1250_08MPMS1153_TEST	Standard examples	-)
ASTM D1250-80 Volume XI/XII Tables			
ASTM Tables 8, 26, 56	/QTYW/TAB8_26_56_TEST	Standard examples	-)
ASTM D1250-52 Tables 6&11			
ASTM D1250-52 Tables 6&11	/QTYW/D1250_52_T6_T11_TEST	Standard examples	-)
API MPMS 11.2			
API MPMS Chapter 11.2.1(M)	/QTYW/API_MPMS_1121_CPL_TEST	Standard examples	-)
API MPMS Chapter 11.2.2(M)	/QTYW/GPATP27_TEST_CPL	Standard examples	-)
ASTM/CIP/ISO/EN: Specific Products			

The Test Programs typically contain one test case. The "Test case" "Standard examples" (see third column above) ensures that all measurement standard examples (expected results) for CTLP and mass/weight conversion standards that are defined in a measurement standard are exactly reproduced. You navigate to all test details from this overview list:

Test case: "Standard examples":



If you select the test scenarios, a comprehensive list with all executed 2 725 test scenarios is displayed:

Measurement Cockpit: QuantityWare Installation Test log

Installation Test Results

Tested scenarios: 2725
Differences: 0000

Scen...	Appl.	Description	Ch...
Q7B7	BCP	BCP 3.0 NGL CTPL	->
Q7B8	BCP	BCP 3.0 NGL CTPL	->
Q7B9	BCP	BCP 3.0 NGL CTPL	->
Q7I0	BCP	BCS 3.0 CSP02 - ISO 91:2017	->
Q7I1	BCP	BCS 3.0 CSP02 - ISO 91:2017	->
Q7I2	BCP	BCS 3.0 CSP02 - ISO 91:2017	->
Q7I3	BCP	BCS 3.0 CSP02 - ISO 91:2017	->
Q7I4	BCP	BCS 3.0 CSP02 - ISO 91:2017	->
Q7I5	BCP	BCS 3.0 CSP02 - ISO 91:2017	->
Q7I6	BCP	BCS 3.0 CSP02 - ISO 91:2017	->
Q7I7	BCP	BCS 3.0 CSP02 - ISO 91:2017	->
Q7I8	BCP	BCS 3.0 CSP02 - ISO 91:2017	->
Q7I9	BCP	BCS 3.0 CSP02 - ISO 91:2017	->

By clicking on a scenario ID (first column, above), you display all test scenario details:

Measurement Cockpit: Run My Scenarios

Results

Scenario ID: Q1B2 - BCS 3.0 CSP02 Matrix Extension
QuantityWare: Bulk Calculations - Petroleum
Con.Grp.: Q156 - CRUDE 04/08 SW/MCF/PRES 60 °F API G/NET
Read.Grp.: Q156 - CRUDE OIL API 60 °F, BSW/MCF/PRESS
UoM Group: QGU - QUANTITYWARE GROSS/NET U.S. UOM TEST
Last changed: SENGM - 25.02.2021 13:41:01

Test mode: Run red on error

Description	Value	Unit	Measurement unit text	Description of QCI parameter
Input parameters:				
Observed temperature	68.940000	FAH	degree Fahrenheit	Observed temperature
Observed pressure (gauge)	120.000000	PSI	pound-force per square Inch	Observed pressure (gauge)
Observed density (vac.)	34.000000	API	API gravity	Observed density (vac.)
Test temperature (obs. dens.)	65.000000	FAH	degree Fahrenheit	Test temperature (obs. dens.)
Hydrometer corr. indicator	X			Hydrometer corr. indicator
Sediment & water %	0.231000	V%	percent (volume)	Sediment & water %
Meter corr. factor	0.000000			Meter corr. factor
Transaction quantity:				
Transaction quantity	100,000.000	GBL	barrel(U.S.) (GOV)	Transaction quantity
Expected parameters:				
Expected parameter	0.996440	VCF	Volume corr. factor - oil	CTPL observed to base
Calculated parameter	0.996440	VCF	Volume corr. factor - oil	CTPL observed to base
Expected parameter	0.133798	LPB	ton, long per barrel(U.S.)	Base density (60 °F, air)



QuantityWare recommends that you develop your own customer specific test scenarios (Maintain Scenarios) that contain your manually calculated results (cross checked by at least two experts) and check the system calculation against these results, such that your customer specific quantity conversion configuration can always be validated in your clients with one click. This way, a high degree of automation is ensured, as well as system compatibility with your measurement standards during productive usage.

The QuantityWare Test Scenario Tool does not require any programming skills; you simply define your expected results for a chosen conversion group and the defined input parameters.

3.5. PMC Online Documentation

Detailed online documentation is available within the PMC for all relevant tools and configuration transactions.

3.6. Summary

The PMC provides an easy-to-use, structured, single point of access to all parties responsible for the configuration, control and development of quantity conversion policy and implementation. The PMCs functionality brings transparency and enables the definition and realization of GRC-promoting procedures for the “bottom-line” of an energy companies’ business – bulk product movements.

4. BCP - Test Scenarios

4.1. Introduction

An important aspect in the definition and configuration of complex quantity conversion calculations is to ensure that the calculation results are reproducible, stable and based on e.g. contractual agreements between business partners, measurement standards and governmental requirements.

QuantityWare delivers a complete configuration template for BCP that contains all customizing configuration that is required to access all petroleum measurement standard implementations.

After installing BCP in your system, you must test this basic configuration implementation delivered with the BC set in client 045 (recommended client) where you have activated the relevant QuantityWare BC set. You run the BCP Installation Test from the PMC Test Tool tab with one click. The PMC is part of BCP and provides the central user interface for Petroleum Measurement Experts and Consultants to BCP.

After defining your relevant conversion groups based on copies from the QuantityWare configuration template, as well as all conversion model settings (e.g., unit of measure rounding, input parameters, range checks etc.), you need to cross check the calculation results with an independent calculation procedure. Ultimately, this needs to be a semi-manual process (typically using a spreadsheet and a pocket calculator, or results from a legacy system).

QuantityWare delivers a test scenario tool which you utilize to define your own test scenarios for your configuration settings (e.g., conversion group and related settings) in your system. This test scenario tool can be accessed via the PMC as well. This chapter describes how to use the test tool.

Typically, in your QA system, you define test scenarios based on your company specific conversion group configurations which can then be run at any time in the system landscape. After definition and testing, you simply transport the test scenarios from your QA system to all relevant systems in your landscape including your production system. A log can be written to the database for each test scenario run, providing a protocol of the test results for later auditing. You may also save a snapshot of each test scenario during a scenario run to the database. Such a snapshot can be written to the database if a scenario runs without error. The snapshot contains all relevant configuration data (customizing settings) and the test scenario data. If a scenario runs into an error, you simply compare the snapshot data with the then current system data to determine if a change of the scenario or the related configuration has caused the error.

For one test scenario, you may create one snapshot. Once you have created your own test scenarios, you should run these test scenarios and write the results including a snapshot to the log tables e.g. after:

- you install a new BCP support package (CSP) or note
- you install an SAP Oil, Gas, & Energy ERP related note or package

Tests can also be scheduled regularly and executed irregularly to ensure that configuration is always consistent.

4.2. Test Scenario – Delivery with BC Set



With BCP, QuantityWare delivers **2 725** test scenarios as part of the BC set template, which you access in your BCP template client 045 where the BC set has been activated

These test scenarios are delivered for two reasons:

1. To provide an additional high precision test matrix which extends the standard QuantityWare BCP installation test. All scenarios are designed to run without errors within the QuantityWare BCP client 045, where the BC set has been activated
2. Provide realistic examples for consultants implementing BCP to ease definition of customer specific test scenarios

4.3. Test Scenario – Definition

A QuantityWare test scenario is an automated, conversion group based calculation, where the calculation parameters (Scenario ID, conversion group with reading group and unit of measure (UoM) group) and the expected calculation results (quantity values and parameters) are defined in the system.

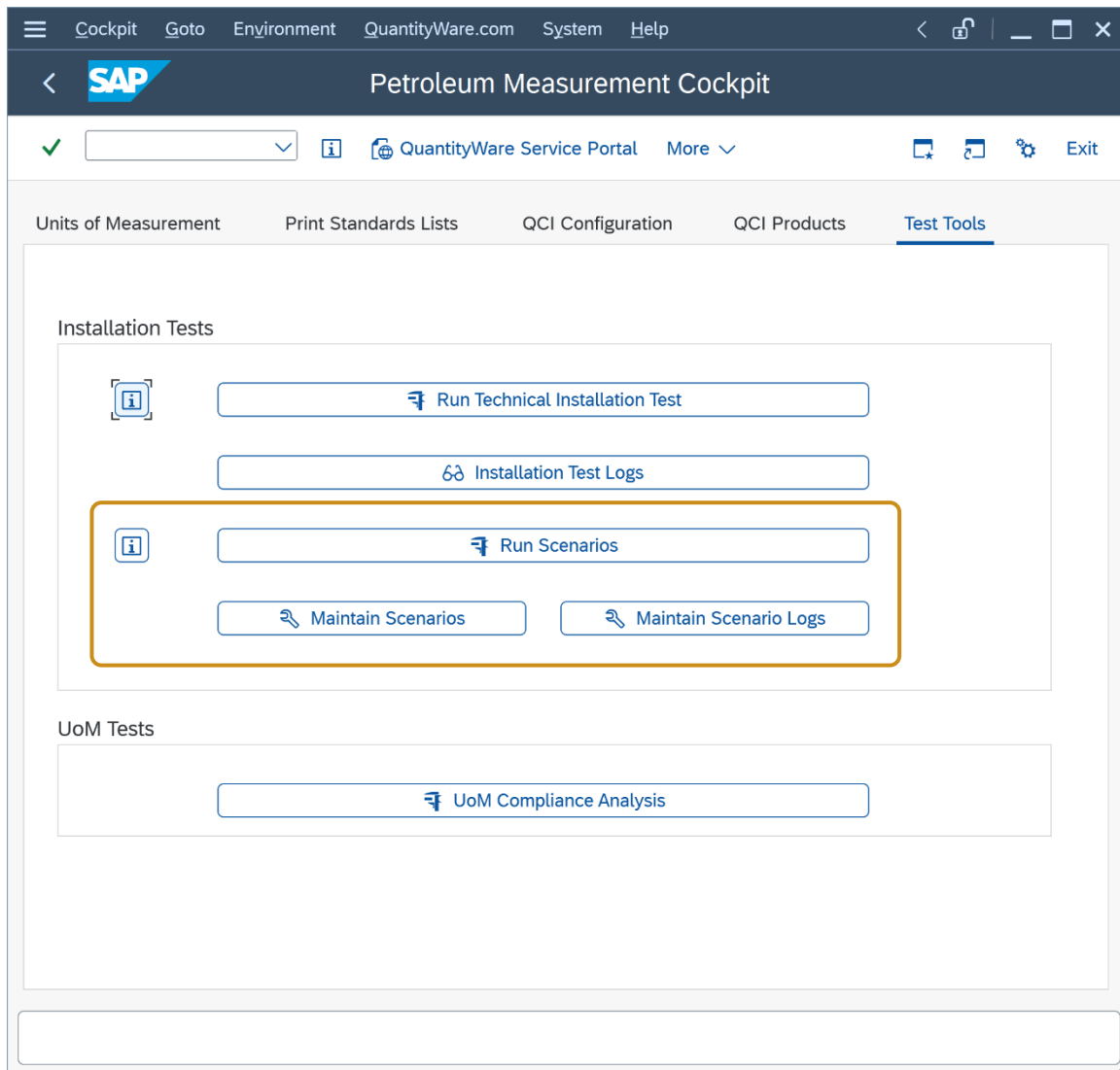
During a test scenario run, which you may start at any point in time, the system calculates the actual results (quantity values and parameters) and compares these actual results with your expected results defined in the test scenario. If all expected and actual results match, the scenario has been executed without error and reports the status “green - o.k.”; otherwise, the differences are reported as “red - not o.k.” and marked as such in the details list which is printed for each scenario.



You also have the option to define a test scenario such that it runs “green - o.k.” **if a pre-defined error message is encountered**. This way, you e.g., automatically test that parameter range limits are correctly defined or that quantity deviations are within the specified limits.

4.4. Access to the Test Scenario Tool

The Test Scenario Tool is accessed via the PMC, tab strip “Test Tools”:



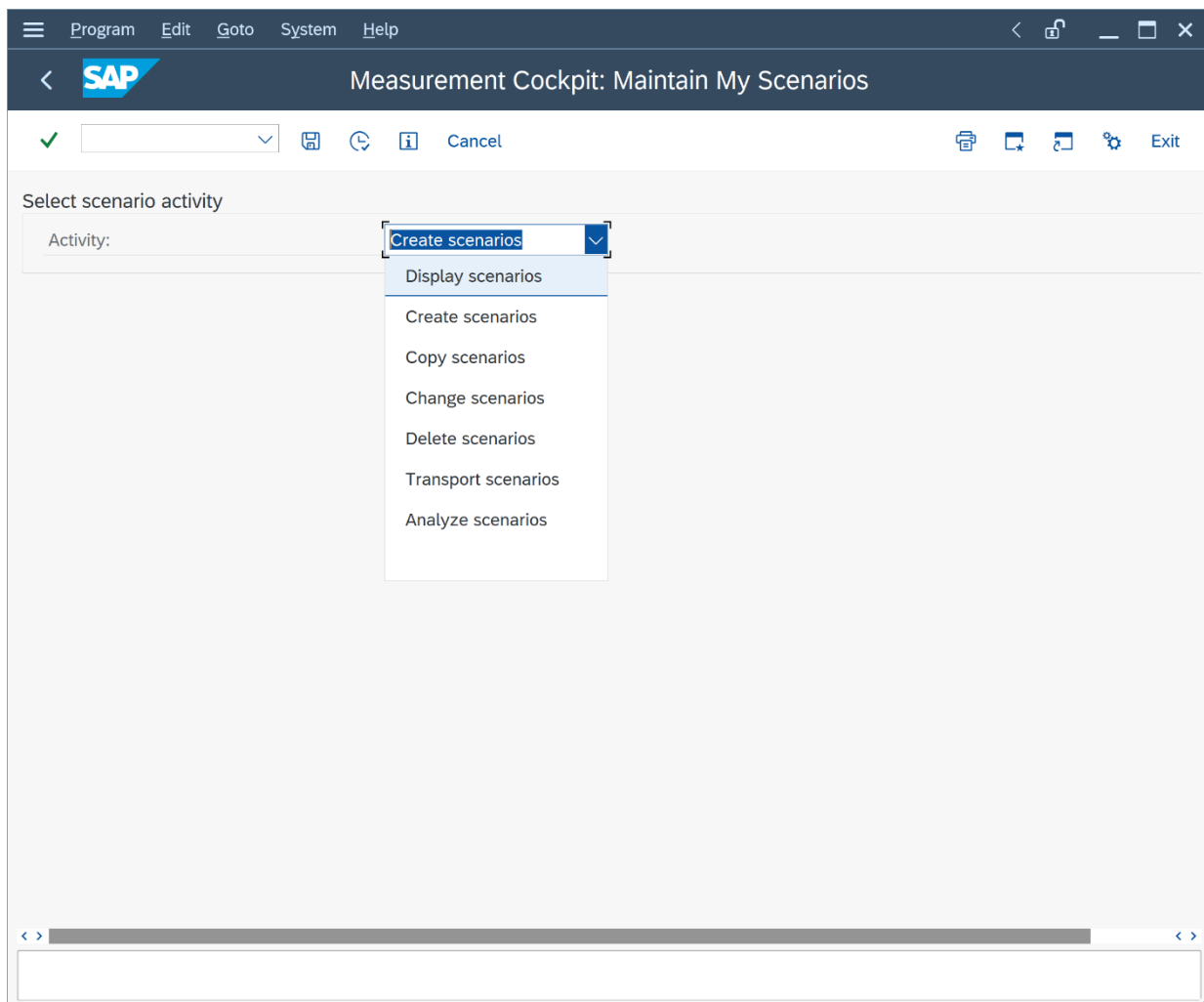
Three push buttons are available. “Run Scenarios”, “Maintain Scenarios” and “Maintain Scenario Logs”.

4.5. Test Scenario Tool Activities

All test scenarios can be transported to any required system and client within your system landscape. Test scenario definition typically takes place in your quality assurance system, after all Z* conversion groups have been configured as required and manual calculations are in accordance with the expected results. Test Scenario execution and log analysis typically takes place in your quality assurance and production system.

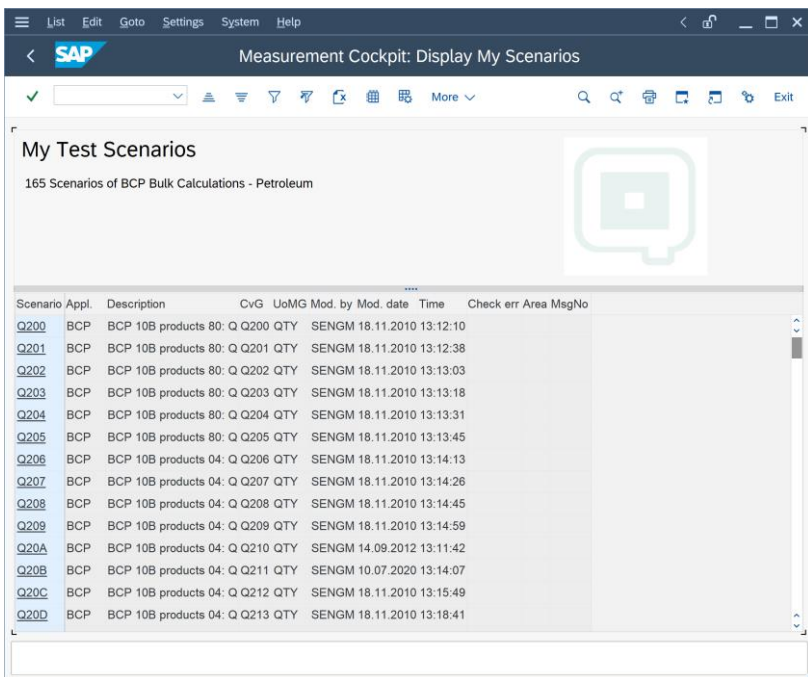
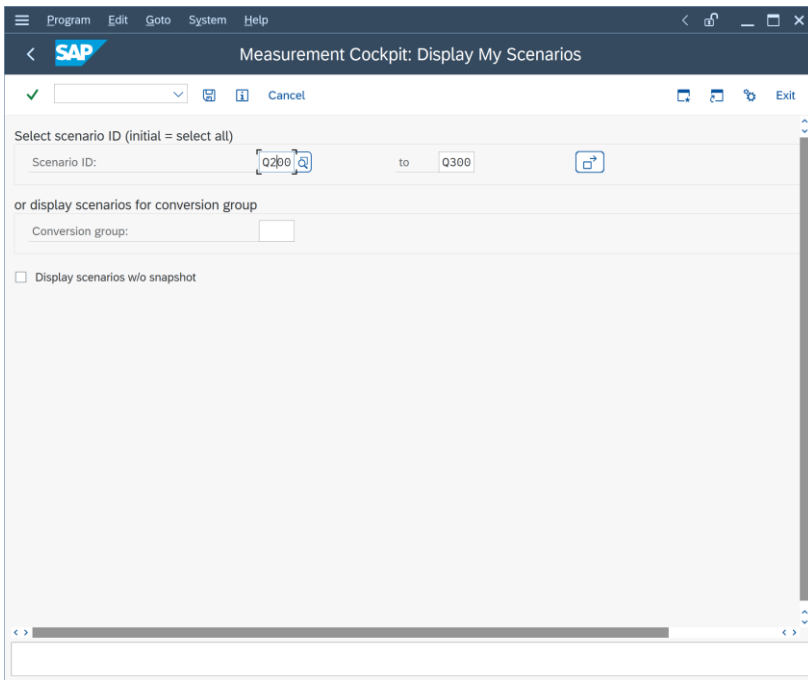
4.5.1. Maintaining Test Scenarios

If you select the “Maintain Scenarios” push button, you have the following options in the field “Activity”:



4.5.1.1. Display Scenarios

If you select this activity, you select a range of scenarios that will be displayed or display all scenarios for a conversion group:



You inspect the scenario details by clicking on a single scenario ID or application ID:

SAP Measurement Cockpit: Display My Scenarios

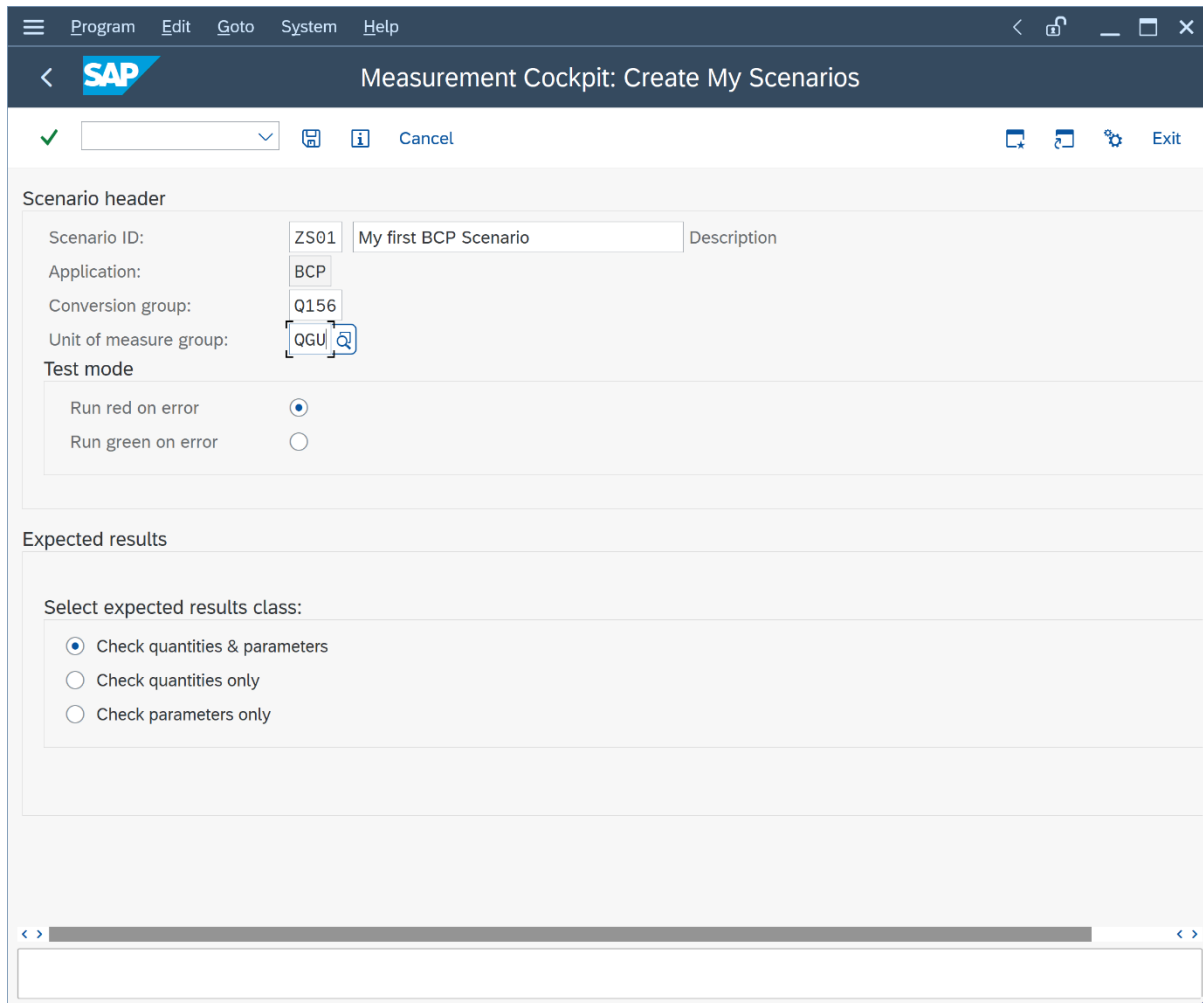
Test Scenario Detail

Scenario ID: Q204 BCP 10B products 80: Q
 QuantityWare: Bulk Calculations - Petroleum
 Con.Grp.: Q204 PRODUCTS 1980 API GRAVITY 60 °F
 Read.Grp.: Q204 PRODUCTS API GRAVITY 60°F
 UoM Group:QTY QUANTITYWARE SAP QCI TEMPLATE TEST
 Last changed by/date: SENGM 18.11.2010 13:13:31

Description	Value	Unit	Measurement unit text
Input parameters:			
Material temperature	75.000000	FAH	degree Fahrenheit
Test temperature (API Gravity)	60.000000	FAH	degree Fahrenheit
Test API Gravity	64.000000	API	API gravity
Hydrometer corr. indicator	X		
Air buoyancy indicator			
Air buoy. fac. (mat. master)	0.000000		
Transaction quantity:			
Transaction quantity	100,000.000	BBL	barrel [42 gallons(U.S.)](NOV)
Expected quantities:			
net volume NOV/NSV	98,939.000	BB6	barrel [42 gallons(U.S.)](NSV)
net mass NSM	11,373,923.941	KG	kilogram (NSM)
net volume NOV/NSV	15,898,729.493	L	liter (NOV)
net volume NOV/NSV	15,719,040.644	L15	liter - 15 °C (NSV)

4.5.1.2. Create Scenarios

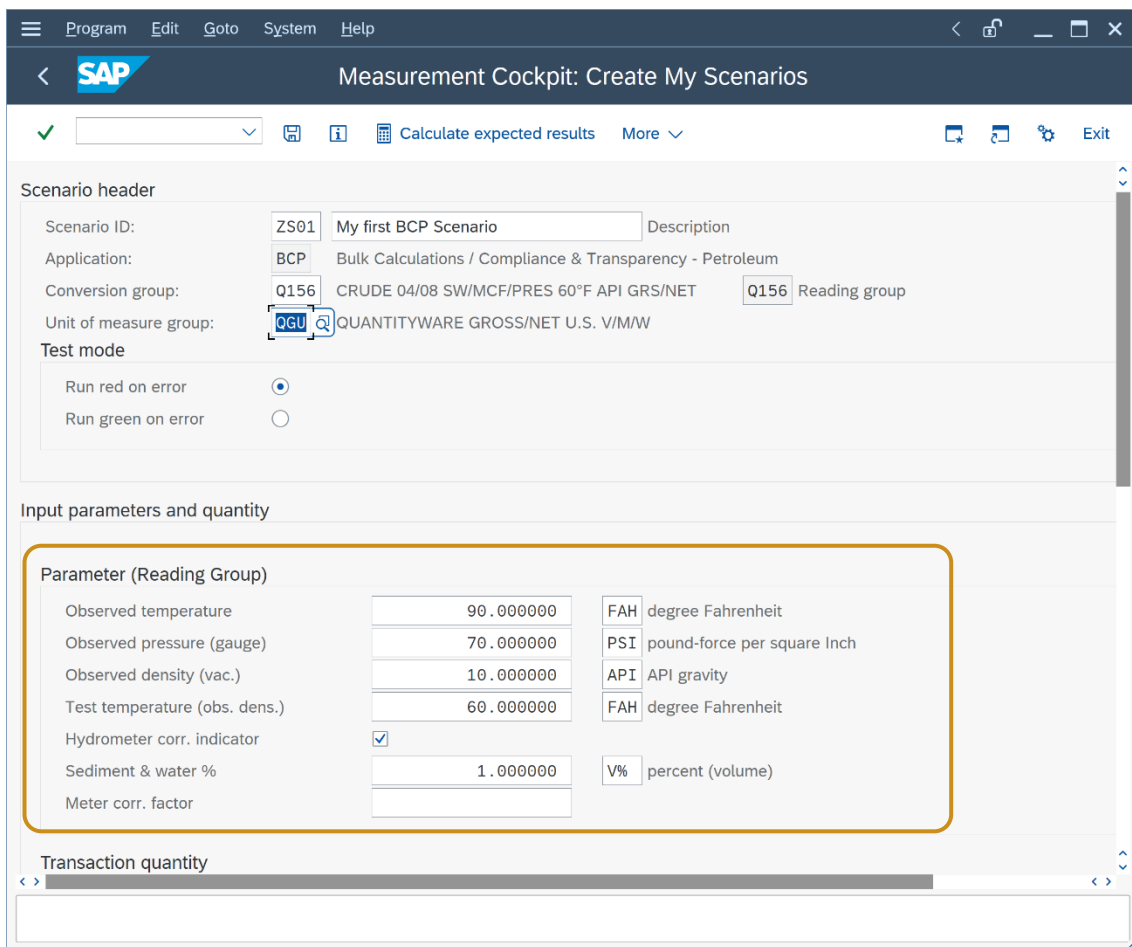
Enter the Scenario ID (four-character field), a description and the conversion group for the test scenario, as well as a unit of measure group that contains the UoM for which the quantity conversion is executed:



The screenshot shows the SAP Measurement Cockpit interface for creating a scenario. The window title is "Measurement Cockpit: Create My Scenarios". The interface includes a menu bar (Program, Edit, Goto, System, Help) and a toolbar with icons for save, info, cancel, and exit. The main form is divided into several sections:

- Scenario header:**
 - Scenario ID: ZS01
 - Application: BCP
 - Conversion group: Q156
 - Unit of measure group: QGU
 - Description: My first BCP Scenario
- Test mode:**
 - Run red on error:
 - Run green on error:
- Expected results:**
 - Select expected results class:
 - Check quantities & parameters
 - Check quantities only
 - Check parameters only

After you press return the system displays the relevant parameters from the reading group that is linked to the conversion group:



The screenshot shows the SAP Measurement Cockpit interface for creating scenarios. The window title is "Measurement Cockpit: Create My Scenarios". The menu bar includes Program, Edit, Goto, System, and Help. The toolbar contains a checkmark, a dropdown menu, a save icon, an information icon, a calculator icon labeled "Calculate expected results", and an "Exit" button.

Scenario header

Scenario ID: ZS01 My first BCP Scenario Description

Application: BCP Bulk Calculations / Compliance & Transparency - Petroleum

Conversion group: Q156 CRUDE 04/08 SW/MCF/PRES 60°F API GRS/NET Q156 Reading group

Unit of measure group: QGU QUANTITYWARE GROSS/NET U.S. V/M/W

Test mode

Run red on error

Run green on error

Input parameters and quantity

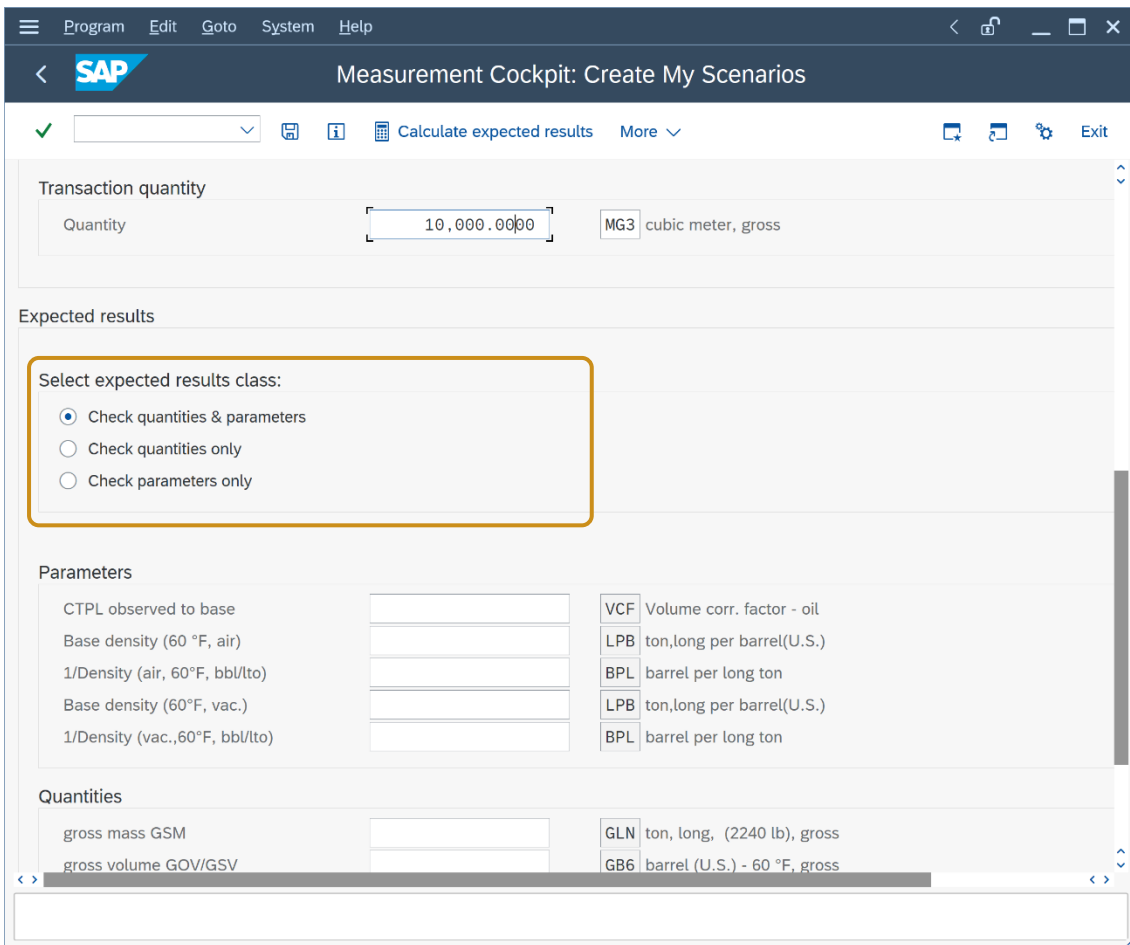
Parameter (Reading Group)

Observed temperature	90.000000	FAH	degree Fahrenheit
Observed pressure (gauge)	70.000000	PSI	pound-force per square Inch
Observed density (vac.)	10.000000	API	API gravity
Test temperature (obs. dens.)	60.000000	FAH	degree Fahrenheit
Hydrometer corr. indicator	<input checked="" type="checkbox"/>		
Sediment & water %	1.000000	V%	percent (volume)
Meter corr. factor			

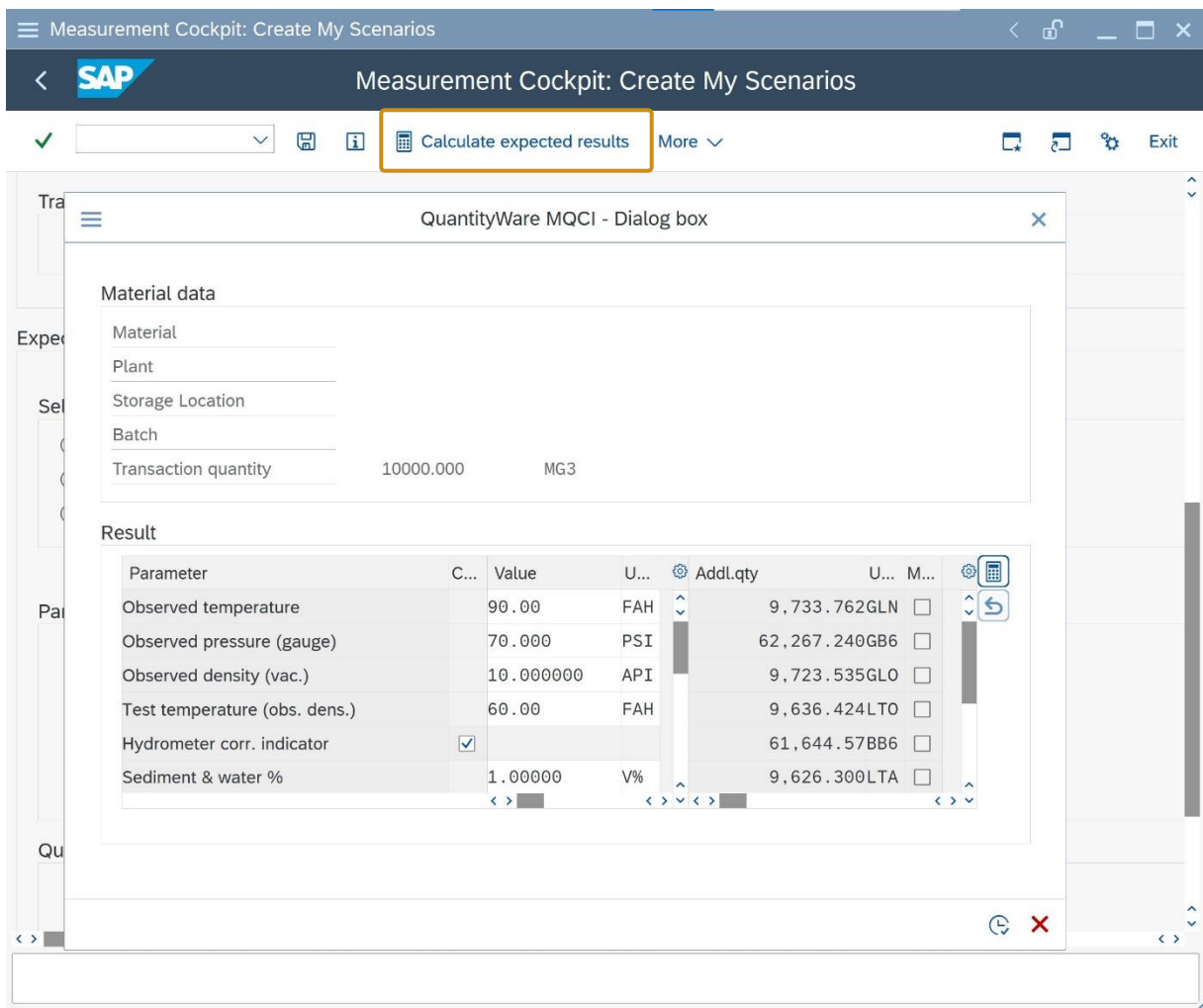
Transaction quantity

For your scenario, you may select whether you want to compare the results for:

- Quantities & parameters
- Quantities only
- Parameters only



Then you enter the transaction quantity and UoM and either manually enter the parameter results and/or quantity results, or you select "Calculate expected results" (if you have already validated the correctness of the calculation) and save the test scenario by selecting the "More -> Save scenario (CTRL + F4)" push button:



4.5.1.3. Change Scenarios:

Here you change an existing scenario.

4.5.1.4. Copy Scenarios

Allows you to copy an existing scenario to a new scenario ID.

4.5.1.5. Delete Scenarios

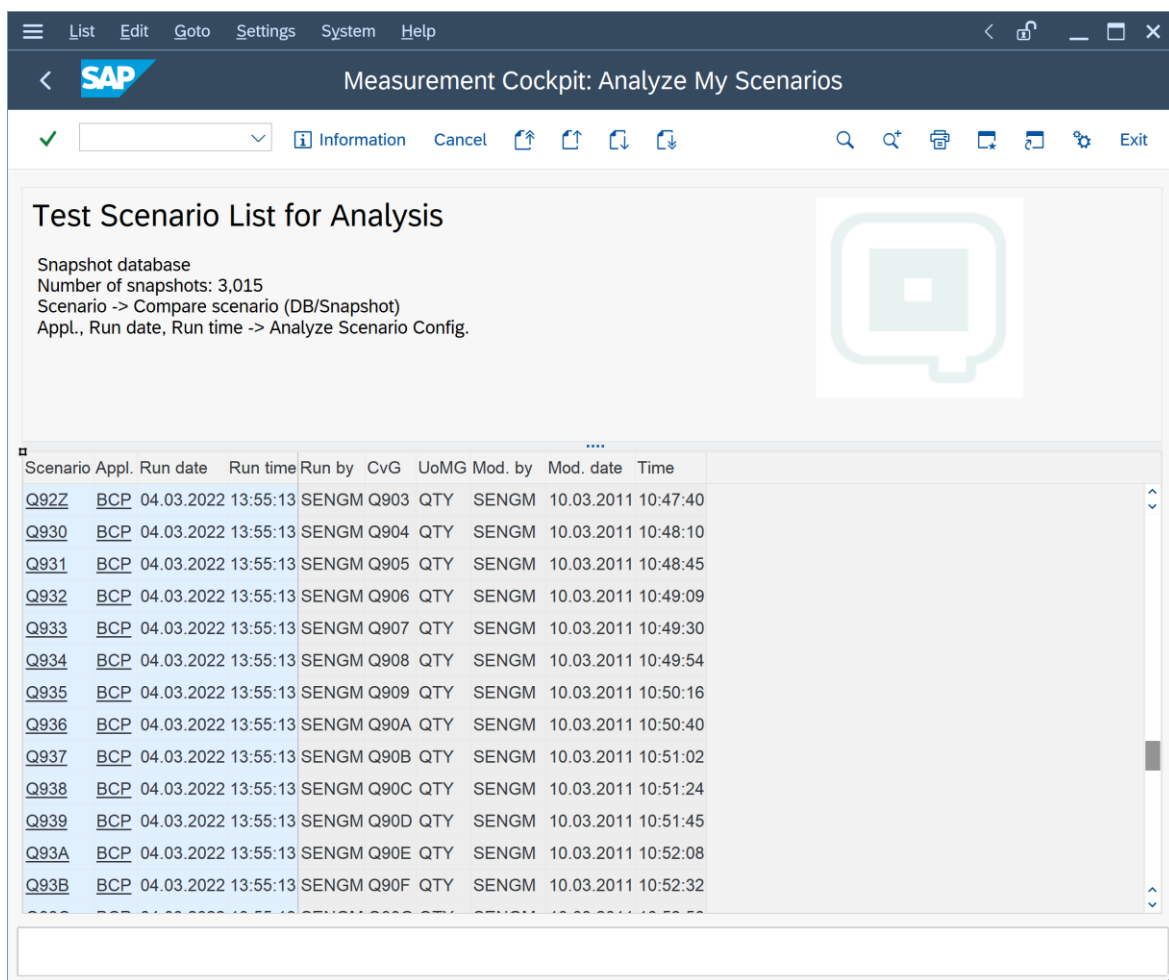
Allows you to list a range of scenarios from which you can then select individual, or multiple scenarios for deletion.

4.5.1.6. Transport Scenarios

Allows you to list a range of scenarios from which you can then select individual, or multiple scenarios for inclusion into a customizing transport. This transport can be moved into another client or system within your system landscape.

4.5.1.7. Analyze Scenarios

Allows you to list a range of scenarios from which you can then select individual, or multiple scenarios for error analysis. Requires that a snapshot for the scenario is available on the snapshot database:



If you click the Scenario ID for the scenario which reported an error, you compare the current scenario definition with the definition stored in the snapshot database:

SAP Measurement Cockpit: Analyze My Scenarios - Compare Definition

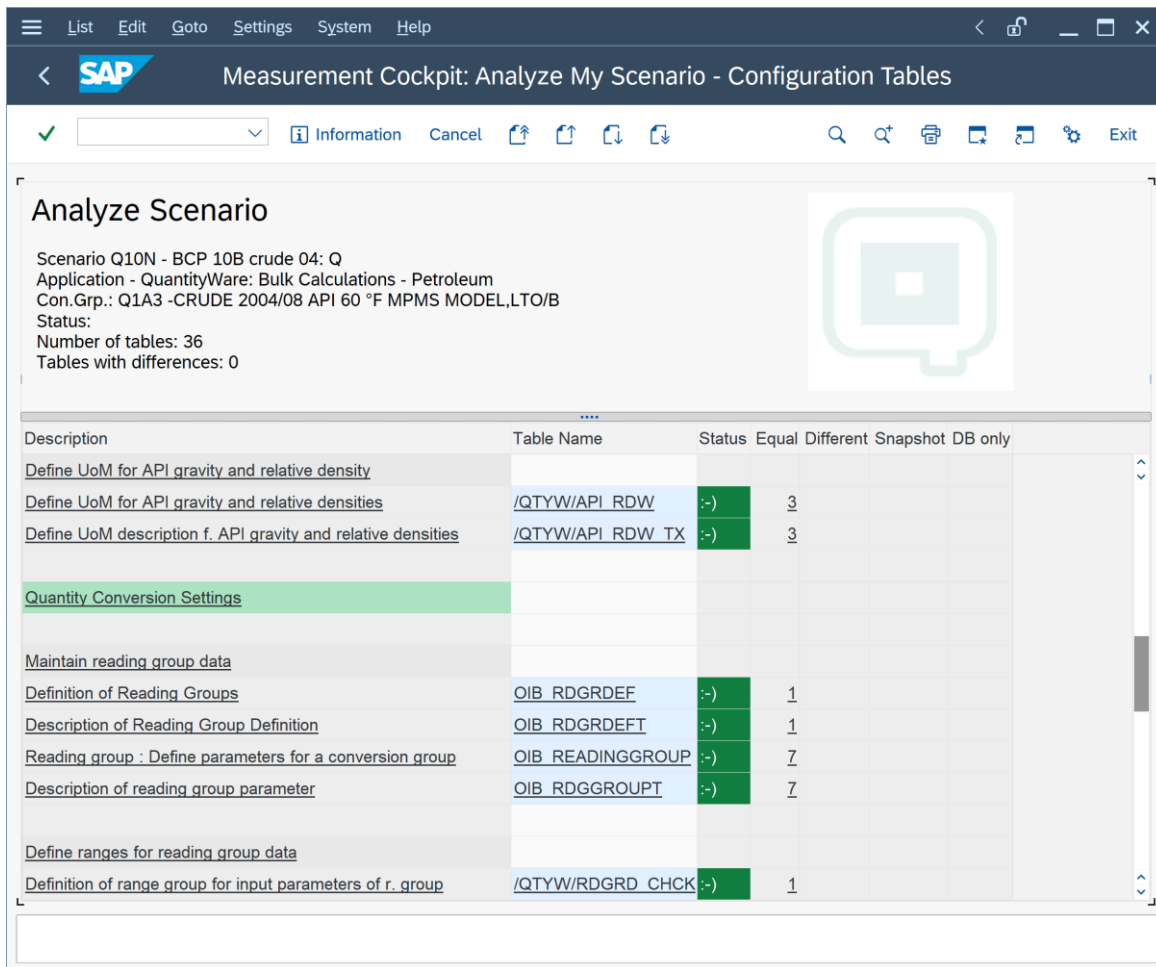
Test Scenario Detail: Comparison Snapshot versus Database da

Scenario ID - Description:
 Q92Z - BCP 10B aromatics: Q & P
 Q92Z - BCP 10B aromatics: Q & P

Application - Description:
 BCP - QuantityWare: Bulk Calculations - Petroleum
 BCP - QuantityWare: Bulk Calculations - Petroleum

Description	Value	Unit	Measurement unit text	Description	Value	Unit	Measurement unit text
Input parameters:				Input parameters:			
Material temperature	20.000000	CEL	degree Celsius	Material temperature	20.000000	CEL	degree Celsius
Test temperature	15.000000	CEL	degree Celsius	Test temperature	15.000000	CEL	degree Celsius
Test density (rel)	0.871470	RDW	relative density (water,60 °F)	Test density (rel)	0.871470	RDW	relative density (water,60 °F)
Air buoyancy indicator				Air buoyancy indicator			
Air buoy. fac. (mat. master)	0.000000			Air buoy. fac. (mat. master)	0.000000		
Transaction quantity:				Transaction quantity:			
Transaction quantity	100,000.000	BBL	barrel [42 gallons(U.S.)]	Transaction quantity	100,000.000	BBL	barrel [42 gallons(U.S.)]
Expected parameters:				Expected parameters:			
Base density	0.871470	RDW	relative density (water,60 °F)	Base density	0.871470	RDW	relative density (water,60 °F)
Expected quantities:				Expected quantities:			
Alternate quantity	13,768,216.432000	KG	kilogram	Alternate quantity	13,768,216.432000	KG	kilogram

If you click on the Application ID (BCP or BCG) you compare the actual configuration settings with the settings stored in the snapshot database. If differences are found, the different entries will be shown in the detailed analysis screen:



Description	Table Name	Status	Equal	Different	Snapshot	DB only
Define UoM for API gravity and relative density						
Define UoM for API gravity and relative densities	/QTYW/API_RDW	:-)	3			
Define UoM description f. API gravity and relative densities	/QTYW/API_RDW_TX	:-)	3			
Quantity Conversion Settings						
Maintain reading_group data						
Definition of Reading Groups	OIB_RDGRDEF	:-)	1			
Description of Reading Group Definition	OIB_RDGRDEFT	:-)	1			
Reading group : Define parameters for a conversion group	OIB_READINGGROUP	:-)	7			
Description of reading_group parameter	OIB_RDGGROUPT	:-)	7			
Define ranges for reading_group data						
Definition of range group for input parameters of r. group	/QTYW/RDGRD_CHK	:-)	1			

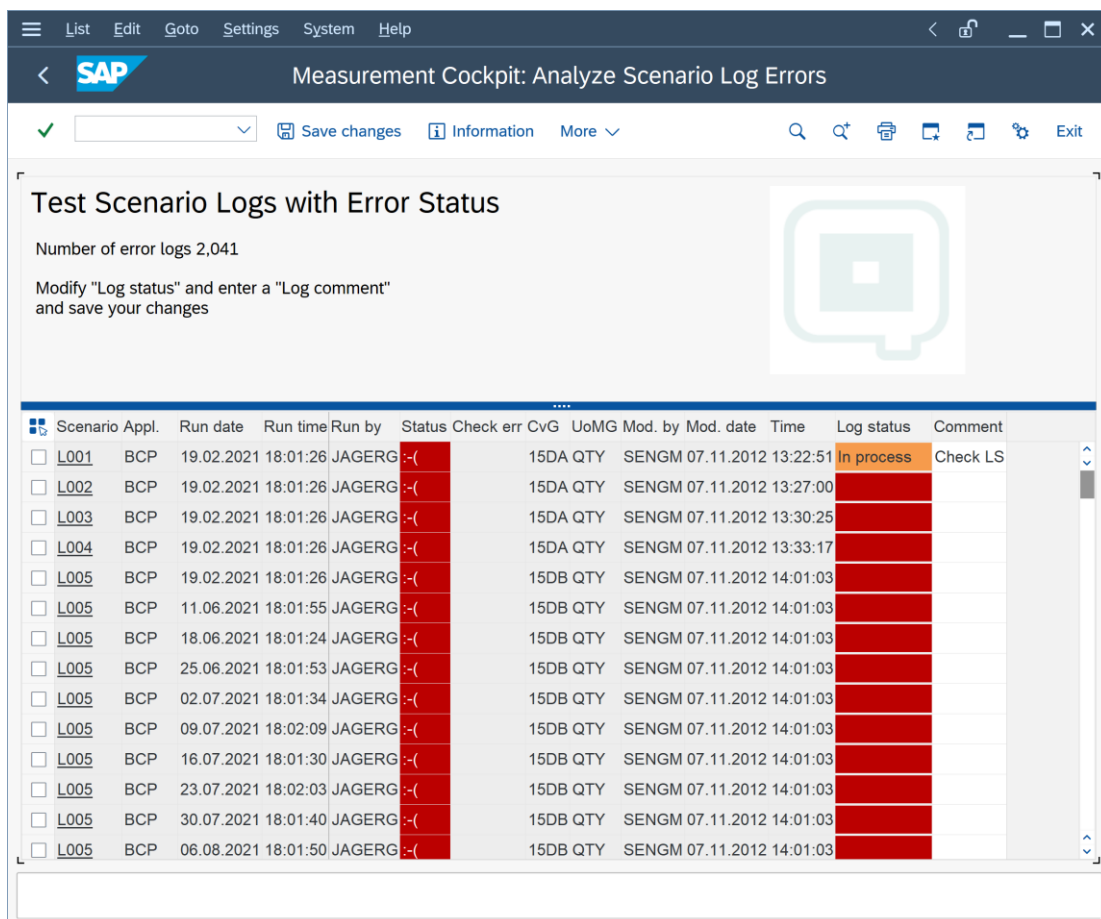
If a scenario runs into an unexpected error and neither the scenario nor the configuration is showing any differences, the ABAP code base is the only remaining source of error. Then you should run the installation test in client 045 and the technical installation test in your current client to ensure a validated code base in that system and check that the code base is consistent through all systems in your system landscape.

4.5.2. Maintain Scenario Logs

If a test scenario runs into an error, you must analyze the reason for the error. Here you either:

- Display a range of scenario logs – from archive, database, or snapshot
- Analyze a range of scenario logs
- Delete a range of scenario logs
- Archive a range of scenario logs

In the analysis activity, you may set the log error status (none – in process – complete – confirmed) and write a comment line into the log:



Test Scenario Logs with Error Status

Number of error logs 2,041

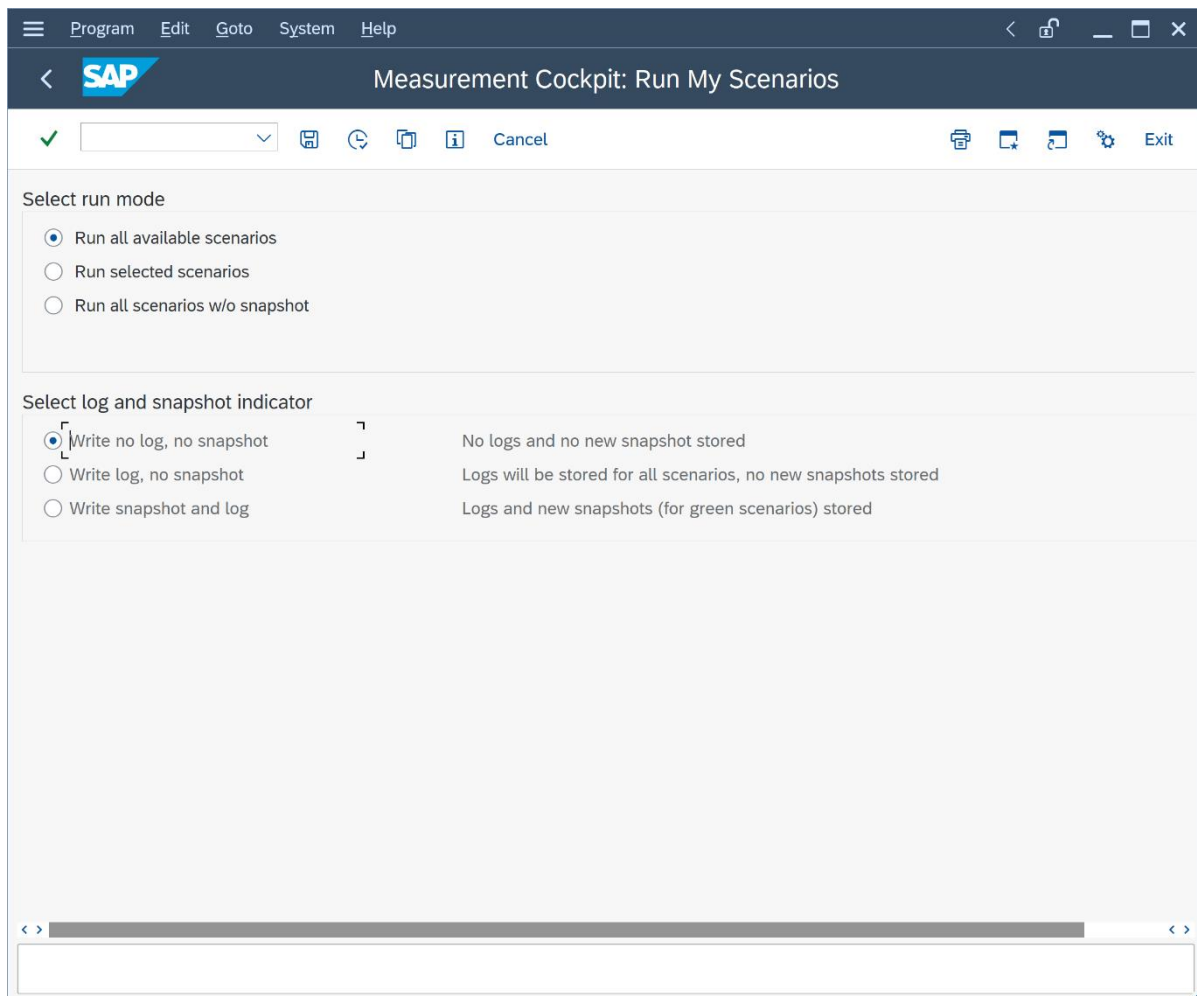
Modify "Log status" and enter a "Log comment" and save your changes

Scenario Appl.	Run date	Run time	Run by	Status	Check err	CvG	UoMG	Mod. by	Mod. date	Time	Log status	Comment
<input type="checkbox"/> L001	BCP	19.02.2021	18:01:26	JAGERG	-(	15DA	QTY	SENGM	07.11.2012	13:22:51	In process	Check LS
<input type="checkbox"/> L002	BCP	19.02.2021	18:01:26	JAGERG	-(	15DA	QTY	SENGM	07.11.2012	13:27:00		
<input type="checkbox"/> L003	BCP	19.02.2021	18:01:26	JAGERG	-(	15DA	QTY	SENGM	07.11.2012	13:30:25		
<input type="checkbox"/> L004	BCP	19.02.2021	18:01:26	JAGERG	-(	15DA	QTY	SENGM	07.11.2012	13:33:17		
<input type="checkbox"/> L005	BCP	19.02.2021	18:01:26	JAGERG	-(	15DB	QTY	SENGM	07.11.2012	14:01:03		
<input type="checkbox"/> L005	BCP	11.06.2021	18:01:55	JAGERG	-(	15DB	QTY	SENGM	07.11.2012	14:01:03		
<input type="checkbox"/> L005	BCP	18.06.2021	18:01:24	JAGERG	-(	15DB	QTY	SENGM	07.11.2012	14:01:03		
<input type="checkbox"/> L005	BCP	25.06.2021	18:01:53	JAGERG	-(	15DB	QTY	SENGM	07.11.2012	14:01:03		
<input type="checkbox"/> L005	BCP	02.07.2021	18:01:34	JAGERG	-(	15DB	QTY	SENGM	07.11.2012	14:01:03		
<input type="checkbox"/> L005	BCP	09.07.2021	18:02:09	JAGERG	-(	15DB	QTY	SENGM	07.11.2012	14:01:03		
<input type="checkbox"/> L005	BCP	16.07.2021	18:01:30	JAGERG	-(	15DB	QTY	SENGM	07.11.2012	14:01:03		
<input type="checkbox"/> L005	BCP	23.07.2021	18:02:03	JAGERG	-(	15DB	QTY	SENGM	07.11.2012	14:01:03		
<input type="checkbox"/> L005	BCP	30.07.2021	18:01:40	JAGERG	-(	15DB	QTY	SENGM	07.11.2012	14:01:03		
<input type="checkbox"/> L005	BCP	06.08.2021	18:01:50	JAGERG	-(	15DB	QTY	SENGM	07.11.2012	14:01:03		

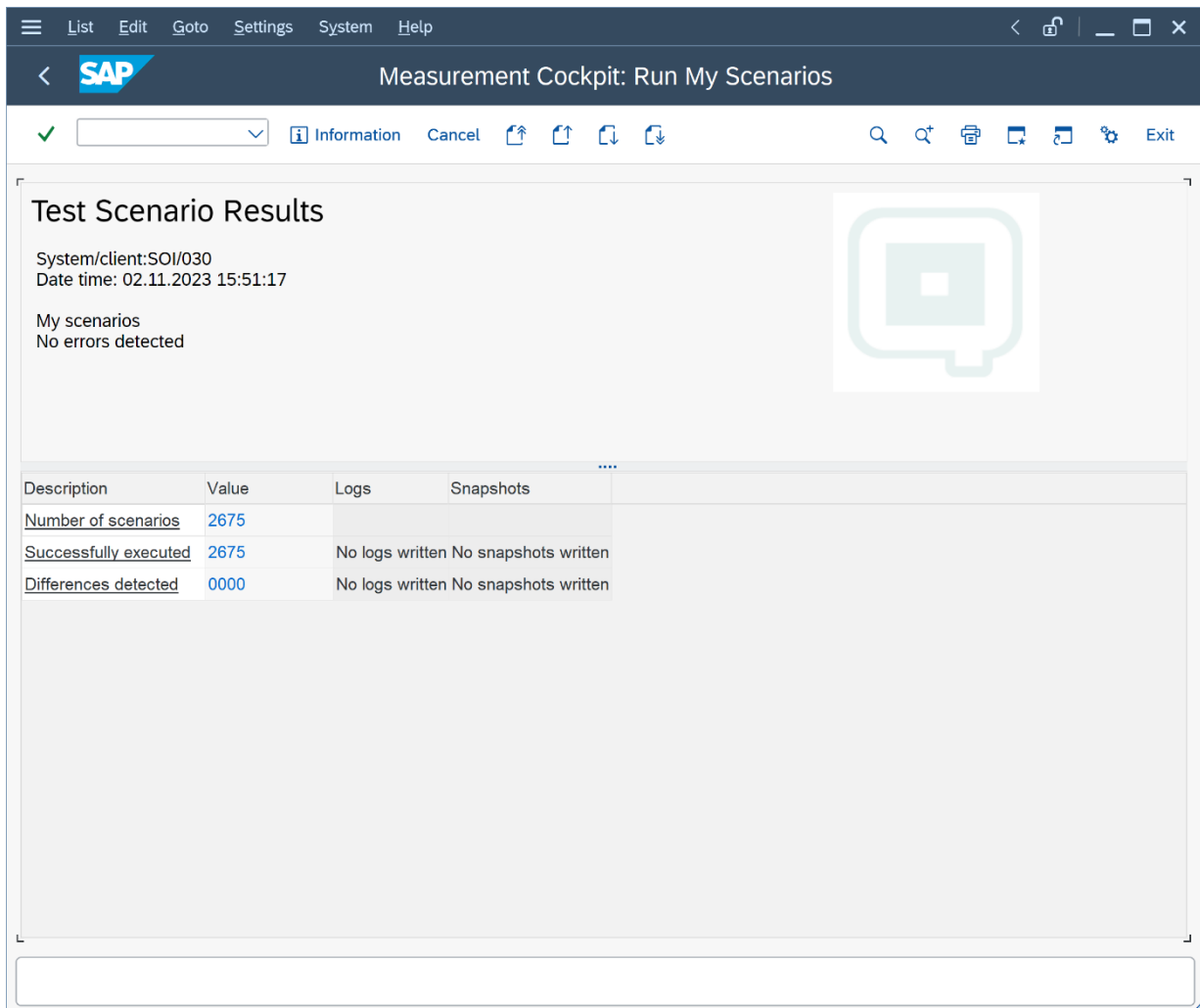
Note that error logs may only be archived if the log status is set to "confirmed".

4.5.3. Running Test Scenarios

If you select the “Run Scenarios” push button, you have the option to run all test scenarios, or one set of user specified scenarios. Here you set an indicator that writes a log protocol and/or snapshot for the scenario execution results.



The results of each scenario run are listed as shown in the next screen print.



The screenshot shows the SAP Measurement Cockpit interface. The title bar reads "Measurement Cockpit: Run My Scenarios". Below the title bar, there is a navigation bar with a green checkmark, a dropdown menu, and buttons for "Information", "Cancel", and several file operation icons. The main content area is titled "Test Scenario Results" and contains the following text:

System/client:SOI/030
Date time: 02.11.2023 15:51:17

My scenarios
No errors detected

Below the text is a table with the following data:

Description	Value	Logs	Snapshots
Number of scenarios	2675		
Successfully executed	2675	No logs written	No snapshots written
Differences detected	0000	No logs written	No snapshots written



Note: all these activities require a careful semi-manual procedure where you calculate your expected results independently from the system results and use at least a four eyes principle to validate your results

4.6. Summary

The QuantityWare Test Scenario Tool provides easy-to-use management functions for all your important quantity conversion test scenarios. With these scenarios, you can continuously monitor and check the correctness of your productive BCP implementations, thus providing maximum security and stability for all logistics processes, which rely on accurate and well-defined quantity conversion data for bulk products. Governance, Risk Management and Control procedures should always include such a state-of-the-art test procedure for bulk quantity values.

5. BCP - Configuration Template

5.1. Introduction

This chapter describes the BCP configuration template that is delivered with BCP within one BC set.

QuantityWare delivers only **client dependent** customizing configuration data (template data) as part of the BC set, which BCP customers must activate in one new test client (045) to run the QuantityWare BCP installation test and validate the BCP installation.

The second important purpose of the template is the provision of a complete blueprint for each customer, such that certified BCP consultants can implement BCP based on customer requirements with reasonable effort.

QuantityWare delivers language-dependent entries in English (EN), French (FR), Spanish (ES) and Portuguese (PT) for all customizing template data which is visible to the business user.



All customizing data can be accessed via the QuantityWare Petroleum Measurement Cockpit (PMC) via transaction /n/qtyw/cockpit, menu path:

More -> Goto -> QuantityWare IMG

If you require detailed information as to how to access all BCP customizing data, see Chapter 7 “BCP - Customizing Transactions”.

QuantityWare requires that customers utilize the template configuration (e.g., conversion groups) in one development system, client 045, and copy the required data into their own name space (X*, Y*, or Z*) before distribution of this configuration into all other appropriate clients and systems.

The template configuration data can be divided into three parts:

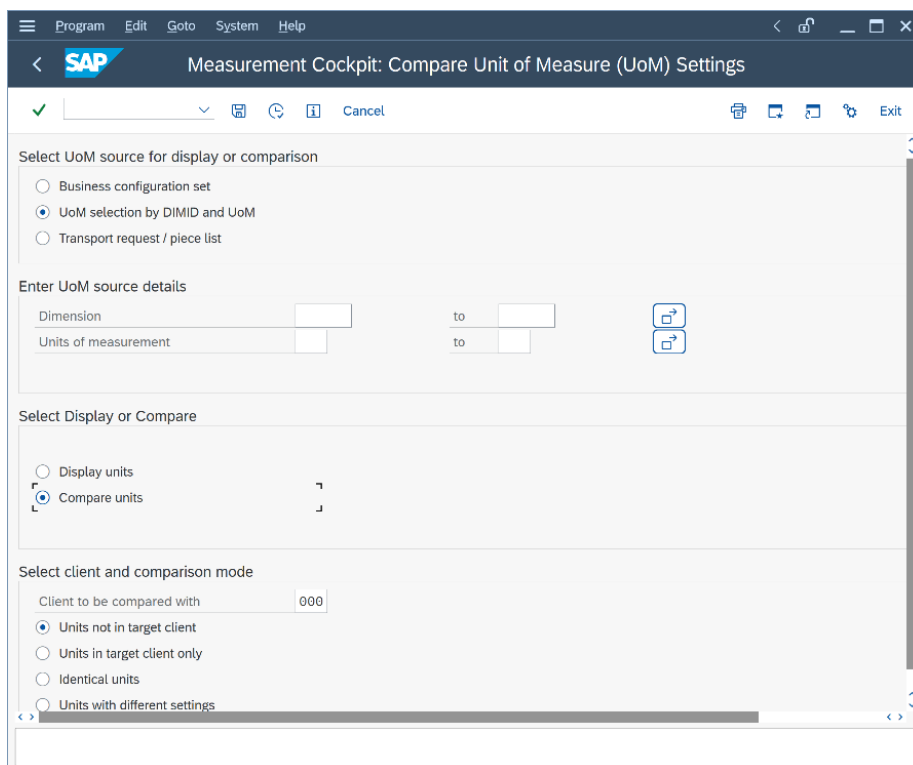
- Unit of measure (UoM) definitions – SAP customizing tables
- Quantity conversion configuration – SAP customizing tables
- Quantity conversion configuration – QuantityWare customizing tables

5.2. Unit of Measure Definitions

QuantityWare delivers Unit of Measure (UoM) definitions and dimension ID as part of the template. These definitions have been carefully checked via the BCP UoM compliance analysis. In addition, ISO/UNECE code definitions are delivered. The UoM definitions fall into three categories:

- UoM definitions which are part of the SAP client 000 template, and which are not adjusted/corrected by QuantityWare with respect to quantity conversions – SAP UoM
- UoM definitions which are part of the SAP client 000 template, and which are corrected by QuantityWare with respect to quantity conversion – SAP UoM corrected
- New QuantityWare UoM definitions which are not part of the SAP client 000 template – QuantityWare UoM

You access and check all UoM configuration data directly from the PMC, via tab strip “Units of Measurement”; here you navigate to the UoM maintenance transaction CUNI “SAP Units -> Maintain” or display lists of UoM in your logon client “SAP Units -> Display” for various selection criteria. If you select “Unit Tools -> Comparison”, you may analyze the QuantityWare BCP BC set and compare UoM delivered within that BC set with UoM definitions in any client in your system:



5.3. Conversion Group Configuration

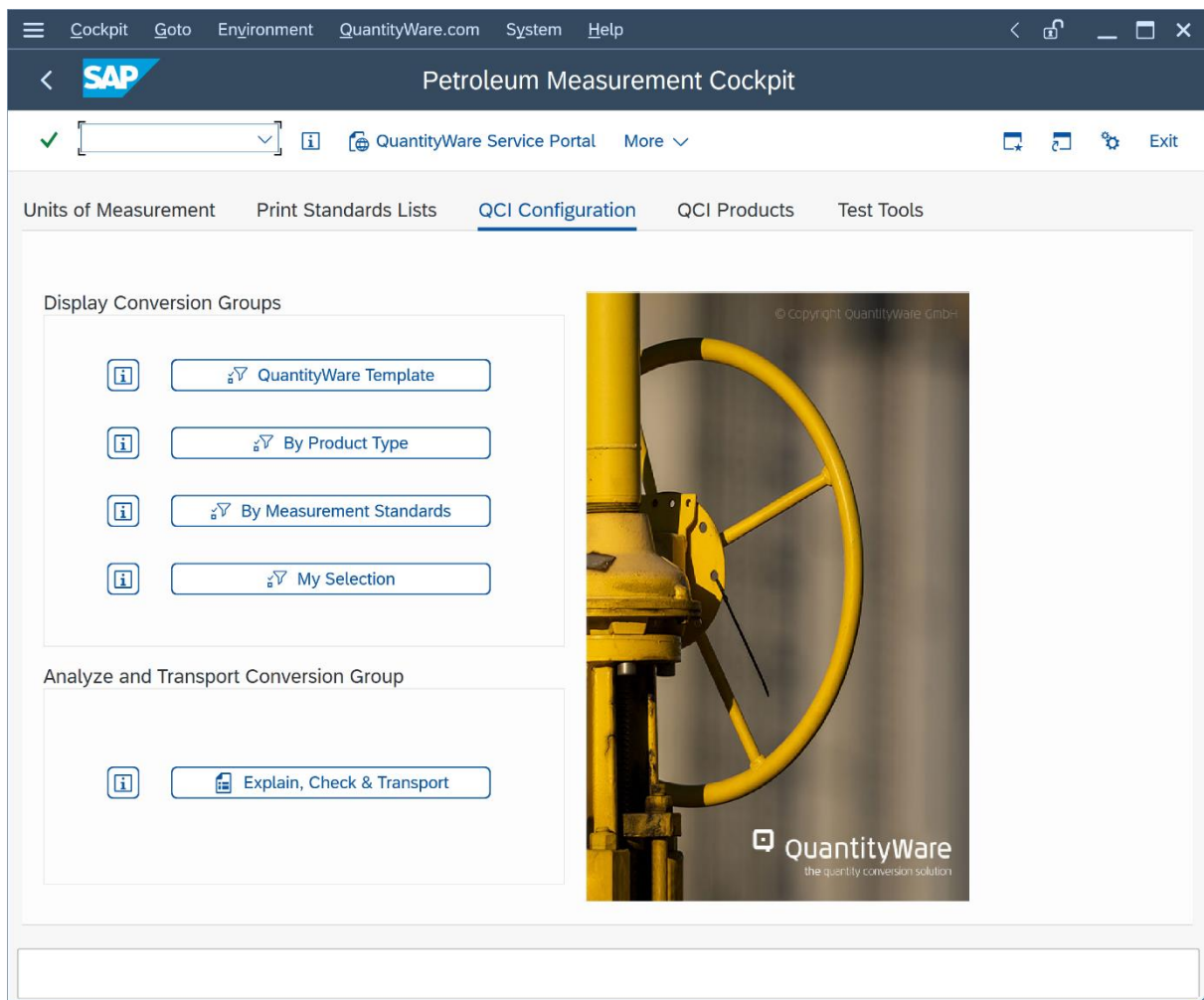
QuantityWare delivers a complete quantity conversion configuration for crude oil & products as part of the BCP template. These definitions are maintained in SAP and QuantityWare customizing tables. More than 500 conversion groups and associated reading groups, range check groups etc. are delivered with the BC set template. QuantityWare conversion groups (and the associated reading groups and range groups) follow the QuantityWare naming convention as described in the table below:

Conversion Group	Product Group
Q00* - Q0U*	Products handled by industry practice formula (e.g. linear density correction)
Crude Oil & Products	
	ASTM D 1250
Q0V* - Q0Z*	ASTM D 1250-52 products
Q1*	Crude Oil
Q2*	Refined Products
Q3*	Special Applications "Chemicals"
Q4*	Lubricating Oils
Other Standards	
Q5*	Asphalt, Bitumen, Road Tar
Q7*	LPG - Liquefied Petroleum Gas
Q9*	Industrial Aromatic Hydrocarbons & Bulk Chemicals
QI*	Renewable Fuels & similar products
QS*	Solids (e.g., sulfur)
Natural Gas - not part of BCP	
QT*	High-pressure hydrogen gas - BCG
QU	LNG - Liquefied Natural Gas - BCG
QV*	Natural gas - high- and low-pressure pipeline - BCG
QWWW	MQCI zero model conversion group - technical

5.3.1. Displaying Conversion Group Configuration – Petroleum Measurement Cockpit

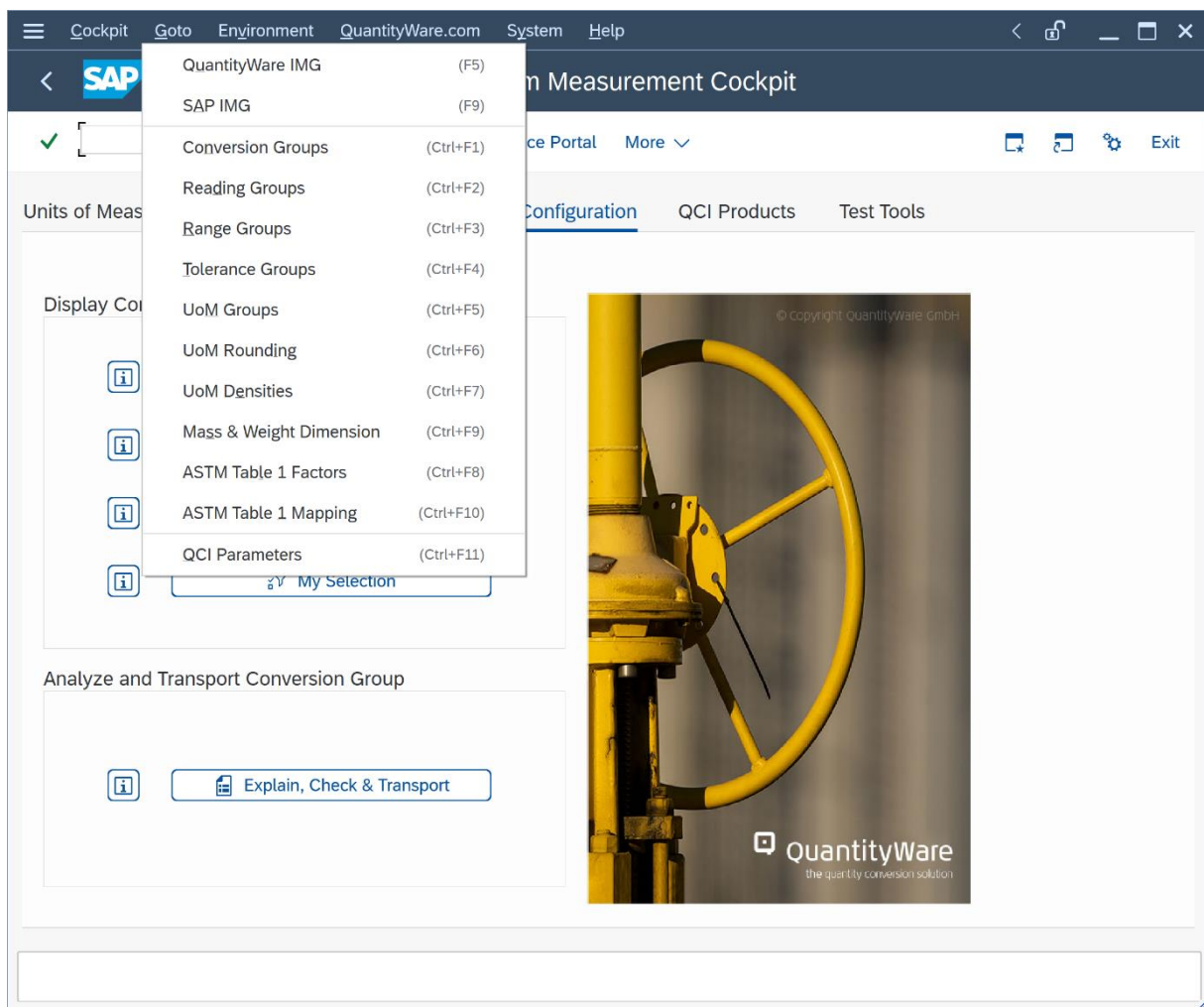
Via the PMC you **display** a list of all template conversion groups if you are logged on to client 045 where the BC set "/QTYW/BCP_30X" (where "30X" is the current valid installed QuantityWare BCS release – e.g. "30A") has been activated:

- Start the cockpit using transaction /QTYW/COCKPIT
- Choose tab strip "QCI Configuration"
- Select "QuantityWare Template" (note the documentation button for further information)



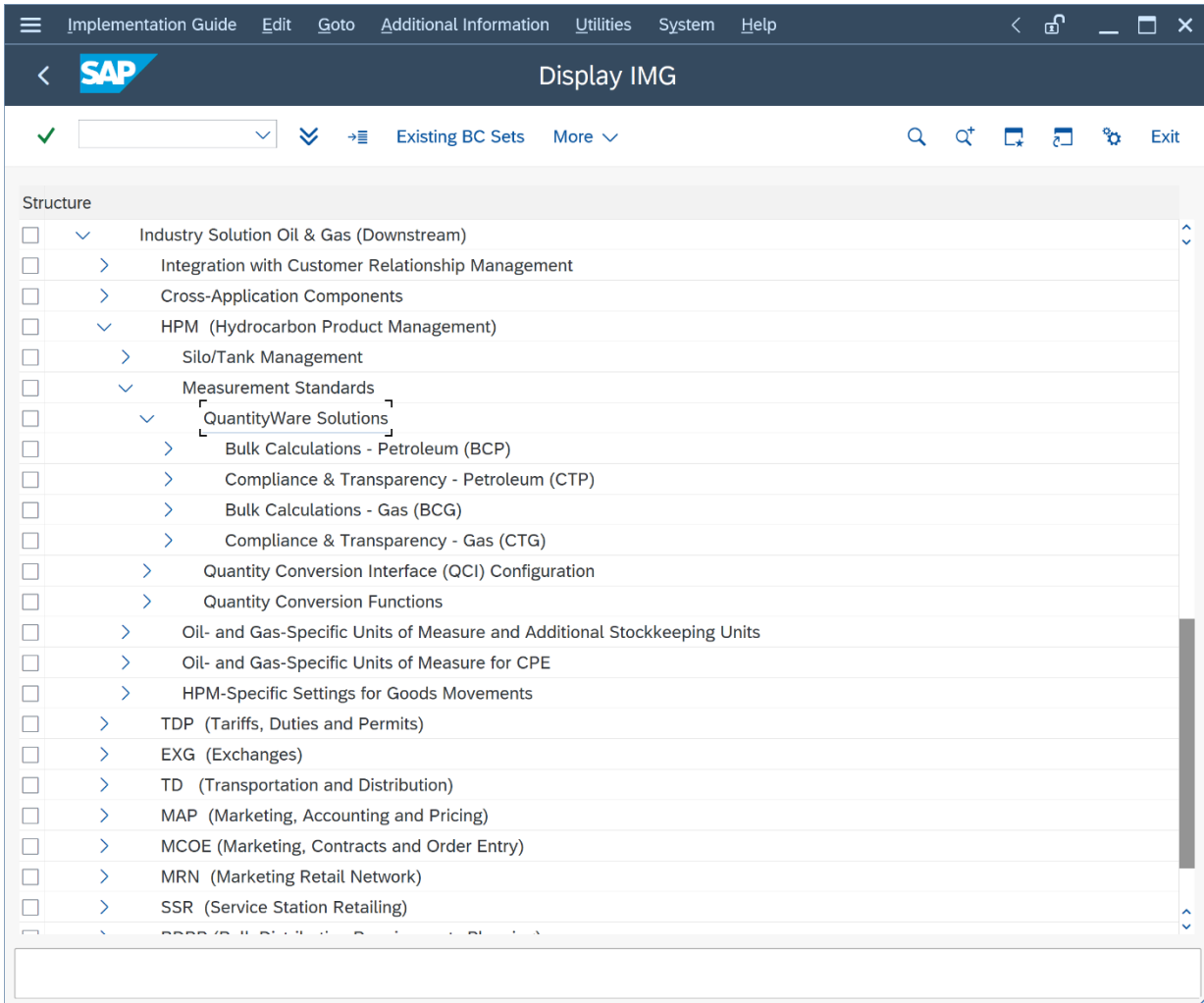
5.4. QuantityWare IMG Access

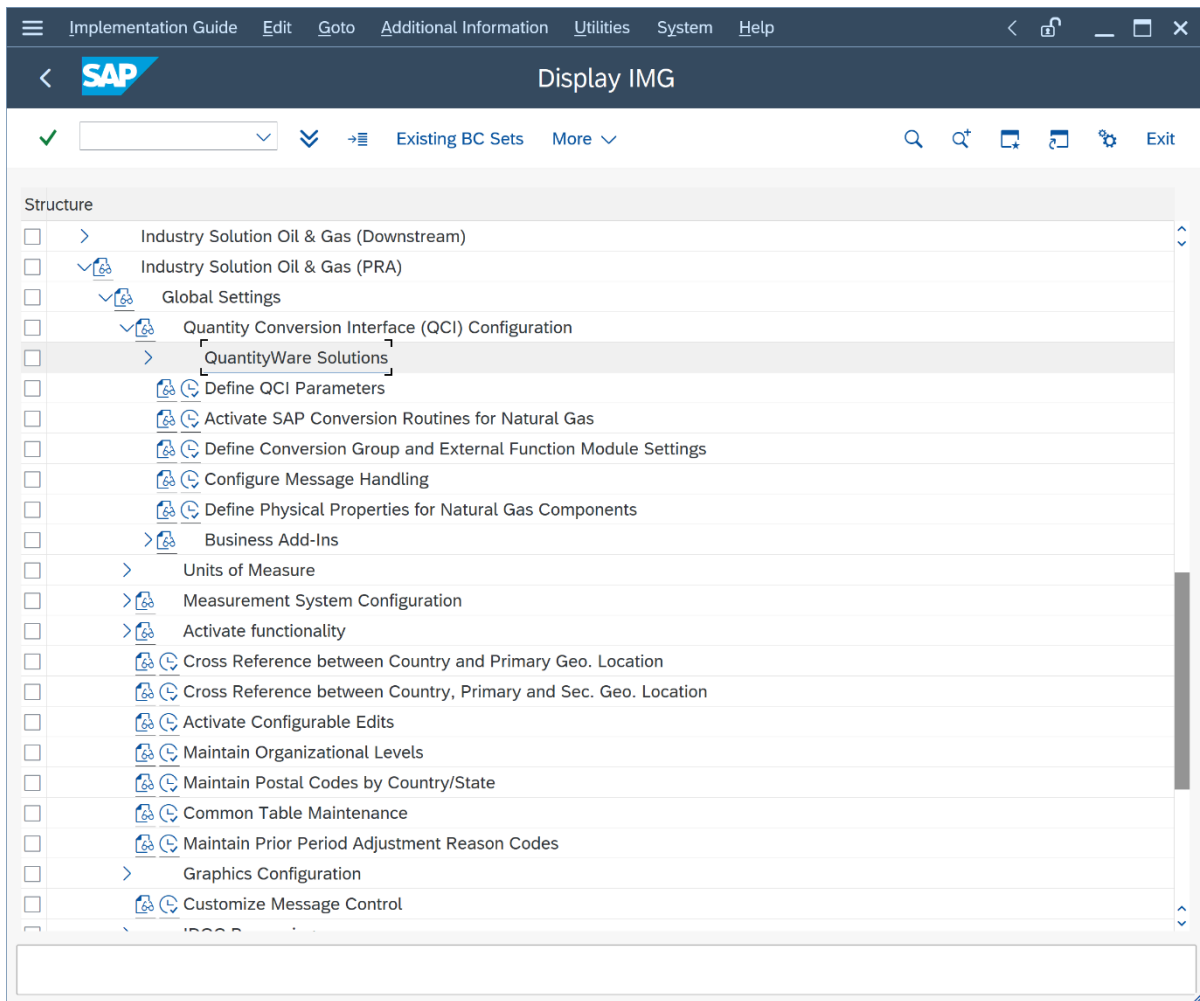
You access and copy/change all configuration data from the PMC via the QuantityWare IMG:



A detailed description is provided in Chapter 7 “BCP - Customizing Transactions”.

The QuantityWare IMG is also integrated into the SAP Reference IMG:





5.5. Summary

A clearly defined template of values describing calculations parameters, as well as the background knowledge as to where the values can be found within SAP DDIC forms the basis of a reliable quantity calculations environment. Without such an extensive framework, true transparency and accurate representation of the calculations required by business processes and their regulatory bodies cannot be practically validated. QuantityWare presents a reference configuration template to meet customers' needs.

6. BCP - QuantityWare MQCI

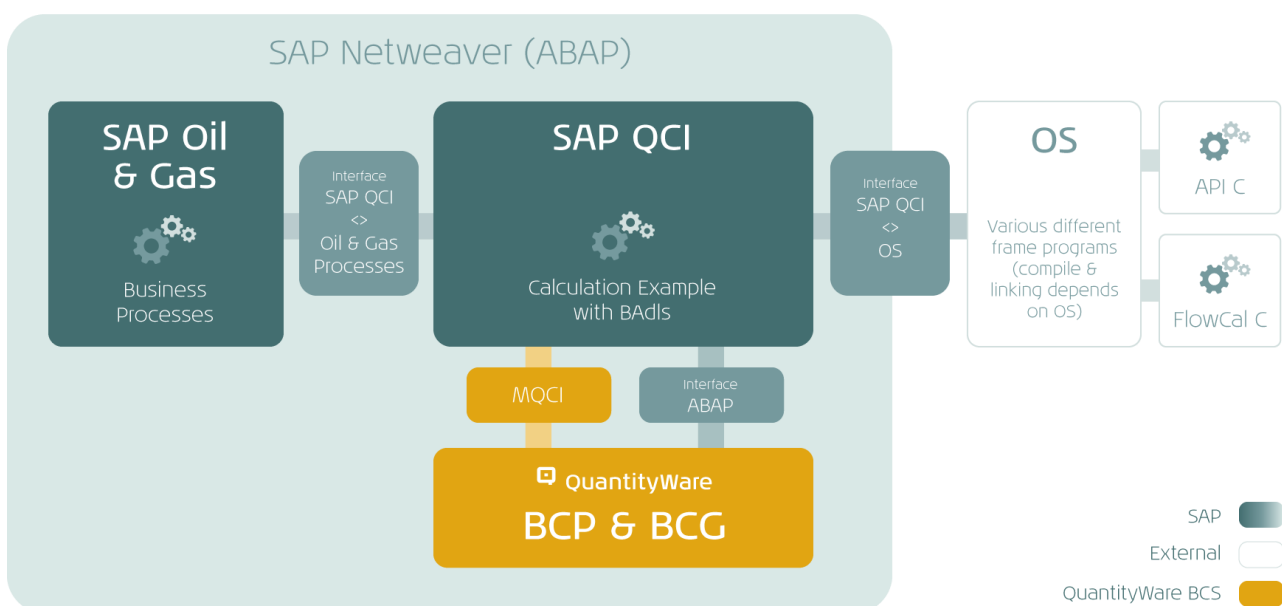
6.1. Introduction

There are several ways in which quantity conversion calculations can be approached, all of which are comprised of distinct “calculation steps”. A sequence of calculation steps, typically including calculation procedures of measurement parameters, the conversion of UoM quantity values for different kinds of quantities (“dimensions” in SAP terminology), as well as rounding procedures, comprise the basic definition of the conversion model.

Different conversion models are defined in national and international measurement standards and are in use within the oil & gas and chemicals industries.

Technically, the implementation of a specific model should be independent of the interface by which the model-based conversion algorithms are accessed.

The standard SAP QCI (Quantity Conversion Interface) provides one calculation model which is integrated within the technical interface. This model can be enhanced via BAdI (Business Add In) implementations to a certain extent but does not allow for deviation from the hard coded SAP QCI calculation model. In addition to this, extension of the standard SAP model to e.g., include weight and mass calculations in parallel is cumbersome and requires code modifications.

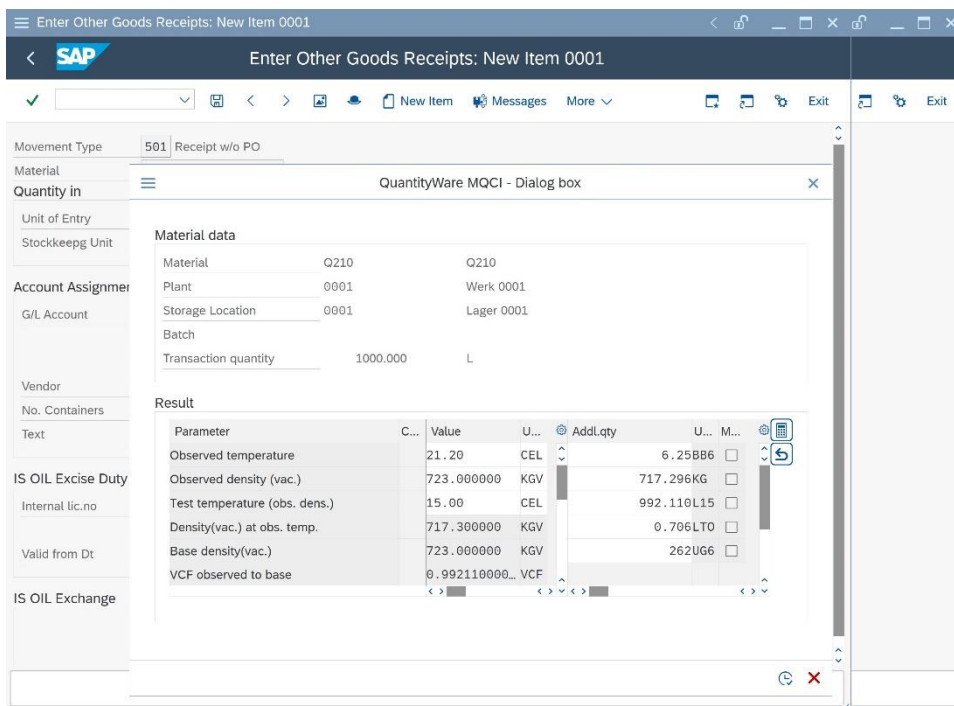


QuantityWare has developed a new model based QCI (MQCI), which enables implementations of any possible model, for any given quantity (weight, mass, net volume, energy, liquid volume (LNG), gross volumes, gross masses, gross weights etc.). The MQCI is seamlessly integrated into the SAP QCI and can be either utilized in parallel with the established SAP QCI conversion logic in any SAP Oil, Gas, & Energy system, or as the single quantity conversion model solution within your SAP Oil, Gas, & Energy system, still allowing all SAP Oil, Gas, & Energy logistics business transactions to access the calculations by the proven SAP QCI interface.

6.2. MQCI – SAP QCI Integration

The QuantityWare MQCI is integrated via the proven SAP QCI Interface into all logistics processes of the SAP Oil, Gas, & Energy system. A conversion group is either configured to utilize the classic SAP QCI or the advanced MQCI quantity conversion logic. Business users will not notice any difference in the behavior of their known SAP transactions, with two exceptions:

- In classic SAP transactions (e.g., TD shipment, physical Inventory, classic goods movement transactions) where the SAP QCI dialog box appears for data entry when using the SAP QCI, a new MQCI dialog box appears for MQCI conversion groups, which is designed based on the known SAP reading group concept. Thus, all reading group parameters are available to the business user for data entry and a process harmonization is achieved. If you do not maintain quantity conversion defaults, this MQCI dialog box shows initial values for all parameters within a classic SAP transaction. You can assign an MQCI default function to the MQCI conversion group function sequence to default the reading group parameters. The function /QTYW/MQCI_GET_READINGGRP_DEF needs to be assigned with function module type 9.



- In classic SAP transactions running as batch input processes (BTI), a new MQCI batch input screen will be processed. Thus, existing BTI maps need to be adjusted if a switch from SAP QCI to MQCI conversions for existing materials is required. SAP OGSD processes that still utilize BTI (e.g., for data collation) need to be adjusted if MQCI conversion groups are utilized.

With the QuantityWare BCP configuration template, QuantityWare delivers more than 500 conversion groups for liquid products. For all major product lines, SAP QCI and QuantityWare MQCI conversion groups are delivered. Depending on each customer's requirements, SAP QCI conversion groups or QuantityWare MQCI conversion groups can be utilized.

6.3. MQCI Technical Integration Details

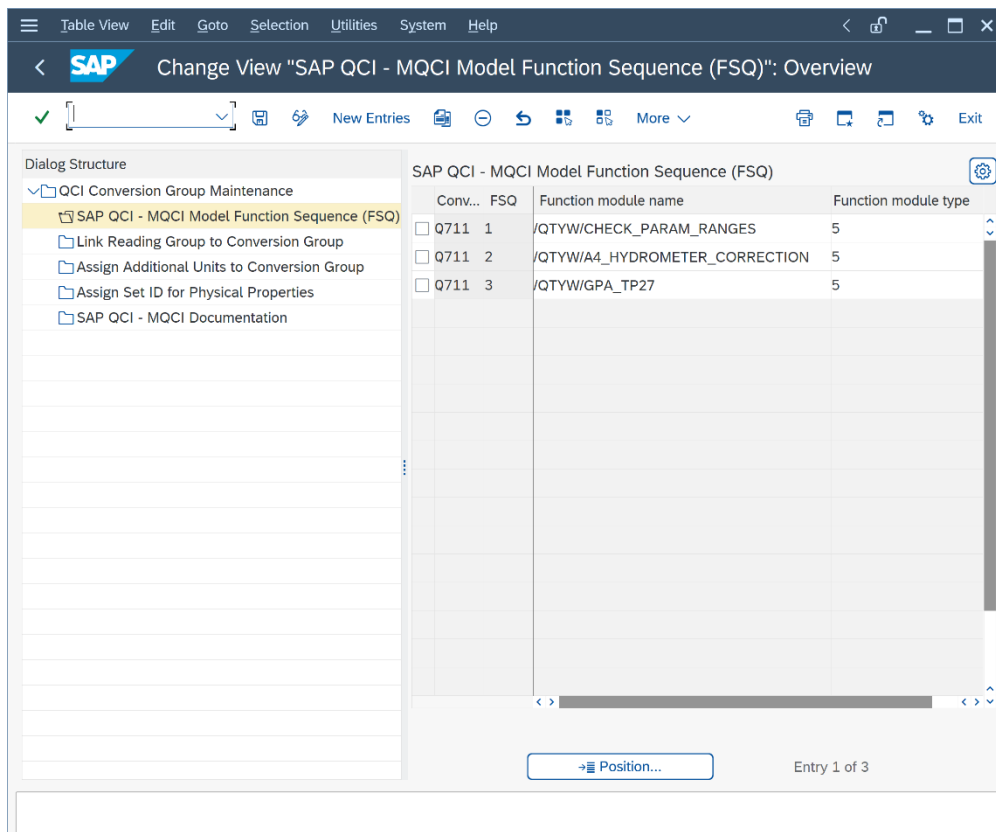
The technical MQCI installation is delivered with software package /QTYW/QCI. The package contains:

- Function groups which implement the model-based quantity conversion interface
- The dialog screen and the BTI screen for classic SAP transactions
- The quantity conversion models
- MQCI functions that solve specific quantity conversion requirements (“plug and play”)



The MQCI integration is realized via **enhancement implementation /QTYW/MQCI** which delivers a dynamic enhancement point in function `OIB_QCI_QUANTITY_CONTROL`. This SAP technology method does not modify your system.

Example: SAP QCI Conversion Group Q711:



The screenshot shows the SAP S/4HANA interface for 'Change View "SAP QCI - MQCI Model Function Sequence (FSQ)": Overview'. The table displays the following data:

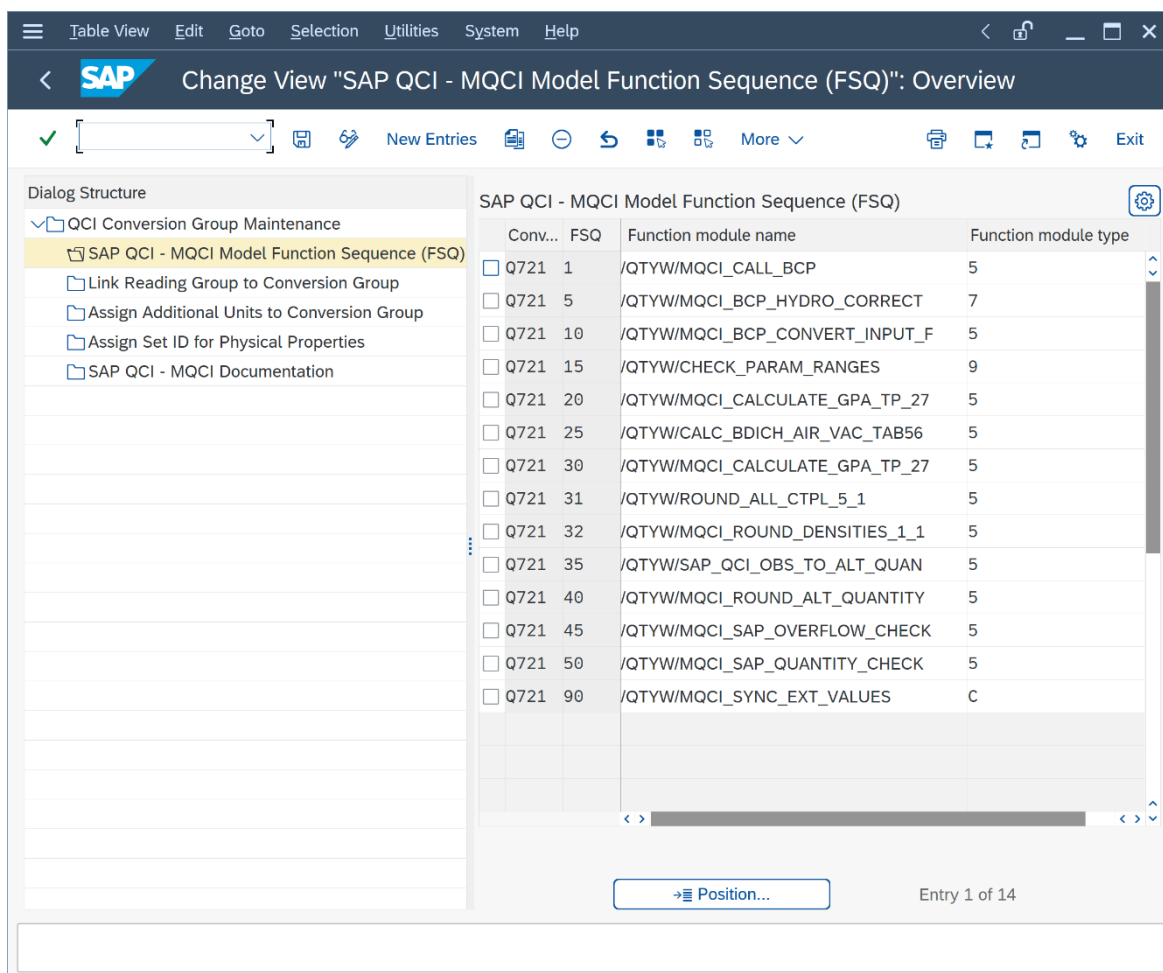
Conv...	FSQ	Function module name	Function module type
<input type="checkbox"/>	Q711 1	/QTYW/CHECK_PARAM_RANGES	5
<input type="checkbox"/>	Q711 2	/QTYW/A4_HYDROMETER_CORRECTION	5
<input type="checkbox"/>	Q711 3	/QTYW/GPA_TP27	5

The interface also includes a 'Dialog Structure' tree on the left and a 'Position...' button at the bottom.

This conversion group calculates LPG quantities, utilizing the SAP QCI calculation model and GPA 8217 / TP-27 CTL calculations. It has three functions assigned, one parameter range check function, a hydrometer correction function, and the CTL calculation function. All other ABAP code executed during a calculation is embedded within the hard-coded standard SAP QCI logic (SAP function group `OIB_QCI`).

Example: MQCI conversion group Q721:

This conversion group also calculates LPG quantities, utilizing an MQCI calculation model (where e.g., masses and weight can be calculated in parallel via ASTM D1250-80 Table 56



The screenshot shows the SAP S/4HANA 'Change View' dialog for 'SAP QCI - MQCI Model Function Sequence (FSQ)'. The dialog is titled 'Change View "SAP QCI - MQCI Model Function Sequence (FSQ)": Overview'. On the left, the 'Dialog Structure' pane shows a tree view with 'QCI Conversion Group Maintenance' expanded, and 'SAP QCI - MQCI Model Function Sequence (FSQ)' selected. The main area displays a table with the following data:

Conv...	FSQ	Function module name	Function module type
<input type="checkbox"/>	Q721 1	/QTYW/MQCI_CALL_BCP	5
<input type="checkbox"/>	Q721 5	/QTYW/MQCI_BCP_HYDRO_CORRECT	7
<input type="checkbox"/>	Q721 10	/QTYW/MQCI_BCP_CONVERT_INPUT_F	5
<input type="checkbox"/>	Q721 15	/QTYW/CHECK_PARAM_RANGES	9
<input type="checkbox"/>	Q721 20	/QTYW/MQCI_CALCULATE_GPA_TP_27	5
<input type="checkbox"/>	Q721 25	/QTYW/CALC_BDICH_AIR_VAC_TAB56	5
<input type="checkbox"/>	Q721 30	/QTYW/MQCI_CALCULATE_GPA_TP_27	5
<input type="checkbox"/>	Q721 31	/QTYW/ROUND_ALL_CTP_L_5_1	5
<input type="checkbox"/>	Q721 32	/QTYW/MQCI_ROUND_DENSITIES_1_1	5
<input type="checkbox"/>	Q721 35	/QTYW/SAP_QCI_OBS_TO_ALT_QUAN	5
<input type="checkbox"/>	Q721 40	/QTYW/MQCI_ROUND_ALT_QUANTITY	5
<input type="checkbox"/>	Q721 45	/QTYW/MQCI_SAP_OVERFLOW_CHECK	5
<input type="checkbox"/>	Q721 50	/QTYW/MQCI_SAP_QUANTITY_CHECK	5
<input type="checkbox"/>	Q721 90	/QTYW/MQCI_SYNC_EXT_VALUES	C

At the bottom of the dialog, there is a 'Position...' button and a status indicator 'Entry 1 of 14'.

The model function sequence contains all required ABAP functions for the calculation of all quantity values, enabling exchange e.g., of the calculation model or hydrometer calculation without code modifications.

6.4. MQCI Calculation Models

All MQCI models are implemented via standard SAP QCI customizing table settings. As described above, a model consists of a sequence of function module calls, which are defined in a conversion group customizing table. This sequence is executed for each conversion calculation to calculate a target quantity based on a set of conversion parameters and a source quantity.

A model sequence typically consists of implementations of complex parameter calculation functions (based on measurement standards, e.g., ASTM D1250) as well as the main conversion calculation model function (also based on measurement standards, e.g., DIN 51650) which are defined in the correct processing order.

This document describes the MQCI and implementations for all available conversion models.

A single conversion model can be utilized for several products, where each product may require a different standard implementation allowing the calculation of e.g., volume correction factors or density values.

6.4.1. SI Base Model – Net Quantities

This model, also known as the SAP QCI model, is a model following DIN 51650 without built-in intermediate rounding.

6.4.2. Alternate Base Model – Net Quantities

This model supports all possible alternate base conversion UoM for density, mass, weight, and volume conversions. The flexibility of this model enables MQCI conversion group configurations for all possible models that utilize a volume correction factor approach and utilize density **in vacuum** and density **in air** data that is calculated as defined in a specific standard.

6.4.3. DIN 51650 SI Base Model – Net Quantities

The DIN 51650 SI Base Model is described in standard DIN 51650 “Testing of mineral oils and related products – determination of quantity”. It describes the relevant conversion formulas used to calculate a target quantity at ambient conditions from a given source quantity for the quantities (“dimensions”):

- Net Mass
- Net Weight

- Net Volume

It also specifies rounding of intermediate results (mass in kg to 0 decimals, volume in L to 0 decimals).

6.4.4. Solid Bulk Products Model – Net Quantities

This model supports two types of conversions for solid products (e.g., sulfur), for which you want to keep stock in several UoM in parallel. The material master standard model supports all conversions that you define in the material master. You just assign a conversion group and UoM group to the material master oil view (e.g., QS01 template conversion group).

Alternatively, you assign a conversion group (e.g., QS00 template conversion group), where you can enter a variable product density.

6.4.5. API MPMS 12.2/11.5.1/2/3 Model – Inv. Dens. – Net Quantities

This model supports all possible alternate base conversion UoM for density, mass, weight, and net volume conversions in conjunction with the inverse density approach defined in API MPMS Chapter 11.5. The flexibility of this model enables MQCI conversion group configurations for all possible models that utilize a volume correction factor approach.

6.4.6. U.S. Base Model - lb/ugl ASTM Tables 8 / 26 – Net Quantities

This U.S. (United States) model uses alternative base conversion units (not the SI units) assigned to a conversion group, to convert between volumes, weights, and masses.

Example - you assign:

- LBA (pound in air) as the alternate base unit for weight
- PPG (pound per gallon) as the alternate base unit for density
- UGL (U.S. gallon) as the alternate base unit for volume

All source volumes are converted to UGL, then using the PPG density conversion to weight is performed (LBA). This way, exact conversions as expected via **ASTM Tables 8 and 26** are possible.

6.4.7. Crude Oil Gross Volume Model - Sediment & Water – Net Mass

This model is based on API MPMS Chapter 12.2 specifications. Indicated volumes (IV) or gross volumes (GV) are converted to gross standard volumes (GSV) and net standard volumes (NSV) considering meter factors and/or sediment and water volume % laboratory data. Masses and weights are calculated as net values.

6.4.8. Crude Oil Gross Volume Model - Sediment & Water – Gross Mass

This model is based on API MPMS Chapter 12.2 specifications. Indicated volumes (IV) or gross volumes (GV) are converted to gross standard volumes (GSV) and net standard volumes (NSV) considering meter factors and/or sediment and water volume % laboratory data. Masses and weights are calculated as gross values.

6.4.9. Crude Oil Gross Volume Model - Sediment & Water – Net & Gross Mass

This model is based on API MPMS Chapter 12.2 specifications. Indicated volumes (IV) or gross volumes (GV) are converted to gross standard volumes (GSV) and net standard volumes (NSV) considering meter factors and/or sediment and water volume % laboratory data. Masses and weights are calculated as gross and net values in parallel if required.

6.4.10. Crude Oil Gross Volume Model - Sediment & Water – API MPMS 12.2/11.5.1/2

This model is based on API MPMS Chapter 12.2 specifications. Indicated volumes (IV) or gross volumes (GV) are converted to gross standard volumes (GSV) and net standard volumes (NSV) considering meter factors and/or sediment and water volume % laboratory data. Masses and weights are calculated as gross and net values in parallel if required. Inverse densities as defined in API MPMS Chapter 11.5.1/2 are utilized for relevant conversions, e.g., from gross mass to net standard volumes (Coriolis metering).

6.4.11. LPG Vapor Alternate Base Model (Mass, Weight, Volume)

This model supports calculation of LPG tank vapor space volumes as defined in DIN 51650 and ISO 6578.

6.4.12. LPG Vapor Alternate Base Model (Mass, Weight, Volume, Energy)

This model supports calculation of LPG tank vapor space volumes as defined in DIN 51650 and ISO 6578, as well as calculation of LPG energy values. This model is implemented in two versions; one version utilizes the LPG base density to convert between masses, weights and volumes, the other version utilizes the LPG observed and alternate density for the conversion. Important: These models calculate the total masses, weights, and energies if vapor space calculations are triggered. Volumes are **not updated** with the equivalent vapor volumes.

6.4.13. ASTM D1550 Vapor Model – SI Base – Net Quantities

This model is available for Butadiene calculations and contains special functions that calculate liquid volume quantities for a vapor space volume (within a tank of known capacity). Source volumes (liquid) are converted to weight and mass and volume UoM, where the weight and mass UoM quantities include the vapor weight or mass quantity. The total volume can be calculated as well as a separate parameter result. The model is defined in ASTM D1550.

6.4.14. ASTM D1550 Vapor Model – Alternate Base – Net Quantities

This model is identical with the ASTM D1550 Butadiene vapor model described above but allows configuration of an alternate (U.S.) base conversion logic. You can define non-SI UoM as base conversion UoM.

6.4.15. Linear Expansion Model - SI Base – Net Quantities

The chemicals (DCF:= Density Correction Factor) model is based on a linear expansion model for thermal expansion which enables calculation of densities at any given temperature. Conversion between quantities is always performed using a density at the observed temperature. No specific volume correction factor is involved in the conversion model – the model is implemented in two versions: one version always utilizes observed densities for conversions between dimensions, the second model utilizes the base densities for mass to weight (and vice versa) conversions.

6.4.16. Linear Expansion Model – Alternate Base – Net Quantities

This model uses the above-described U.S. or alternate base UoM conversion logic in conjunction with the linear (DCF) chemicals model – the model is also implemented in two versions, one version always

utilizes observed densities for conversions between dimensions, the second model utilizes the base densities for mass to weight (and vice versa) conversions.

6.4.17. ABNT NBR Alternate Base Model - Ethanol - Net & Gross Quantities

This model supports all possible alternate base conversion UoM for density, mass, weight, and net volume conversions in conjunction with the inverse density approach defined in API MPMS Chapter 11.5. In addition, the model supports intra conversion between six SAP dimensions: Mass(product), weight(product), volume(product) and mass(alcohol), weight(alcohol) and volume(alcohol) for ethanol quantity conversions. The flexibility of this model enables MQCI conversion group configurations for all possible models that utilize a volume correction factor approach.

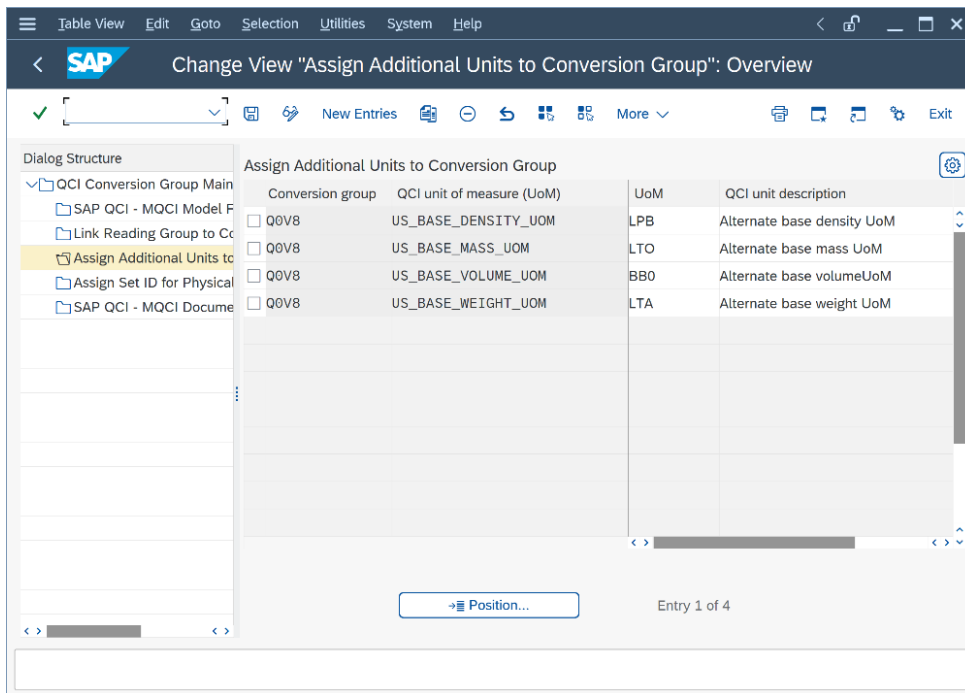
6.5. MQCI Quantity Value Calculation & Rounding

6.5.1. Calculation Steps - MQCI Models

All MQCI models described above perform a sequence of conversion steps to convert a given transaction quantity value (volume, mass, weight etc.) at observed conditions to a target quantity value (volume, mass, weight etc.) at alternate conditions.

- In a first step, the transaction quantity value is converted to the Base Conversion UoM BCU_o_dim1 (where the BCU_o_dim1 is of the dimension of the transaction quantity at observed conditions)
- The BCU_o_dim1 quantity value is then converted to the base temperature (and possibly base pressure) condition, BCU_b_dim1 (Base conversion UoM temperature (and pressure base) in a second step
- This quantity value is then converted to the BCU_b_dim2 (e.g., from volume to weight dimension) in a third step, utilizing base density (vac. or air) values
- Conversion to BCU_a_dim2 at alternate conditions is performed in step 4
- Finally, the BCU_a_dim2 quantity value is converted in step 5 to the target UoM at alternate conditions

BCP Example: Conversion group Q0V8 is defined at standard temperature 60 °F. Base conversion volume UoM is BB0 (U.S. barrel, 0 decimals), Base conversion weight UoM is LTA (long ton in air), Base conversion mass UoM is LTO (long ton in vacuum):



Conversion example 1: Convert 100 000 UGL (gallon) at 82 °F observed temperature (with a density of 32 °API at 60 °F) to L15 (liter at 15 °C).

- Step 1: Convert 100 000 UGL (gallon) to base conversion volume UoM BB0 (barrel)
- Step 2: Convert the BB0 (barrel) value to standard conditions - 60 °F - by applying the correct volume correction factor
- Step 3: trivial case - since we deal with two volumes – move quantity value
- Step 4: Convert the BB0 (barrel) at 60 °F to BB0 (barrel) at 15 °C using the volume correction factor from base to alternate conditions
- Step 5: Convert the BB0 (barrel) at 15 °C to L15 (liter at 15 °C)

Conversion Example 2: Convert 100 000 UGL (gallon) at 82 °F observed temperature (with a density of 32 °API at 60 °F) to LBA (pound in air).

- Step 1: Convert 100 000 UGL (gallon) to base conversion volume UoM BB0 (barrel)
- Step 2: Convert the BB0 (barrel) value to standard conditions: 60 °F by applying the correct volume correction factor

- Step 3: Convert the BB0 (barrel) value at standard conditions to the base weight UoM LTA (long ton, air) by multiplying the BB0 (barrel) value with the density in air in long ton per barrel (base density UoM LPB (long ton per barrel))
- Step 4: trivial, move quantity value
- Step 5: Convert the LTA (long ton, air) value to LBA (pound, air) using either ASTM Table 1 factor or the SAP UoM conversion factor

6.5.2. The Base Conversion Unit Concept

As described previously, the base conversion UoM for density, mass, weight, and volume is defined for each model. The SI based models always use the SI UoM as base conversion UoM. Important for the alternate definitions is, that the base conversion UoM are consistent. If you choose LB (pound) as mass or weight base conversion UoM, and UGL (U.S. gallon) as volume base conversion UoM, the density base conversion UoM must be LB/UGL =: PPG (pounds per gallon) in SAP configuration terminology. If this is not correct, the conversion group check will issue an error message.

For BCP conversion groups, you maintain the base UoM for all relevant dimensions as shown above (Additional UoM assignment). The SI base conversion units for BCP conversion groups are not explicitly maintained in a conversion group for SI models. The SI UoM are specifically marked in transaction CUNI for all dimensions.

6.5.3. Rounding Steps

As described above, up to 5 calculation steps are possible to convert a transaction quantity to a target quantity value. Within each step, you may want to apply UoM specific rounding to the intermediate results.



QuantityWare recommends applying rounding only to the final target quantity value and to utilize maximum floating-point accuracy for the intermediate steps. However, it may also be necessary to apply rounding to intermediate results, if legacy system results need to be mapped, or national standards require such rounding.

6.5.3.1. Transaction Quantity Rounding

The transaction quantity is passed via SAP transactions to the MQCI. SAP transactions typically do not support rounding of the transaction quantity. You can enforce rounding within the MQCI of the transaction quantity by assigning the rounding function /QTYW/MQCI_ROUND_TRAN_QUANTITY to the MQCI configuration. You need to set the UoM rounding settings to the required decimals (see description below in Step 6.5.3.5 how to perform these settings).

6.5.3.2. Base Transaction Quantity Rounding

Base transaction quantity rounding can be achieved by setting the “Round base transaction quantity values” flag in the conversion group. Then, the base quantity value is rounded per UoM rounding settings of the Base conversion UoM.

6.5.3.3. Intermediate Value Rounding

Intermediate rounding is achieved by setting the “round intermediate quantity values” flag in the conversion group. Then, the intermediate quantity value is also rounded UoM rounding settings of the Base conversion UoM.

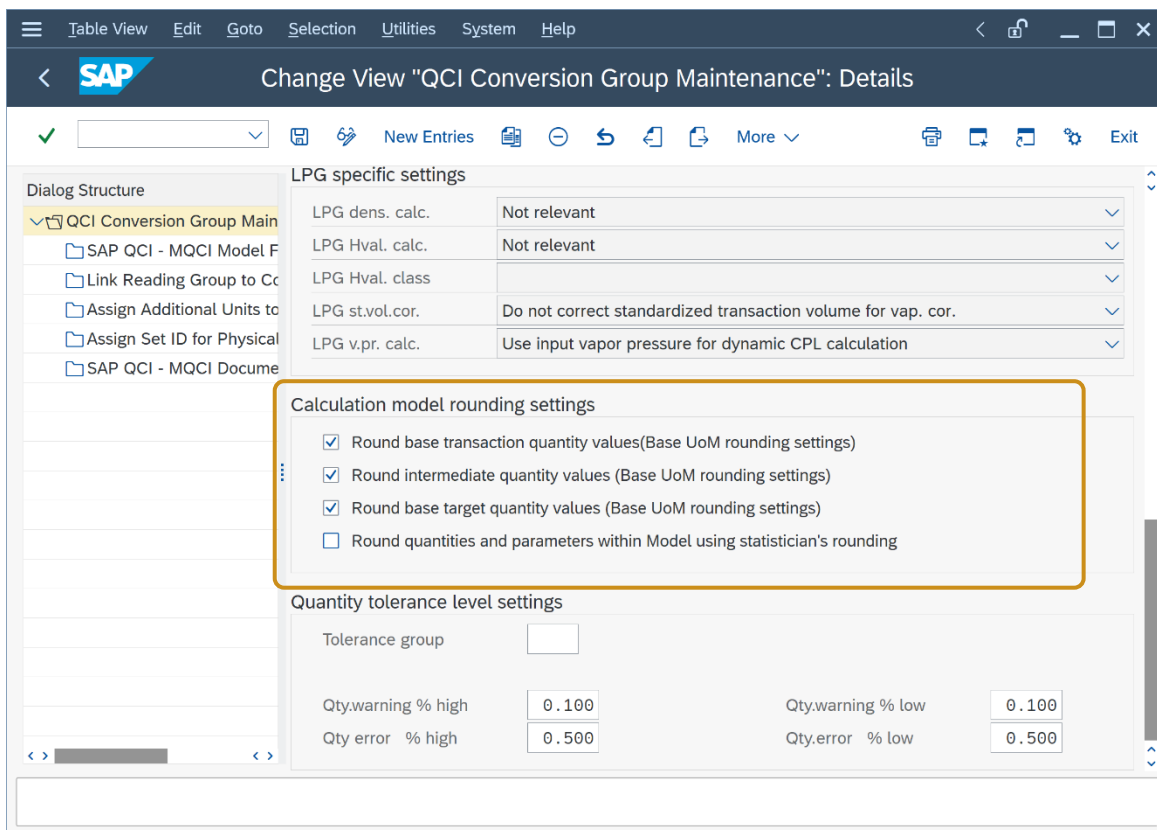
6.5.3.4. Base Target Quantity Rounding

Base target (alternate) quantity rounding can be achieved by setting the “Round base target quantity values” flag in the conversion group. Then, the base target quantity value is rounded per UoM rounding settings of the Base conversion UoM.

6.5.3.5. Target Quantity Rounding

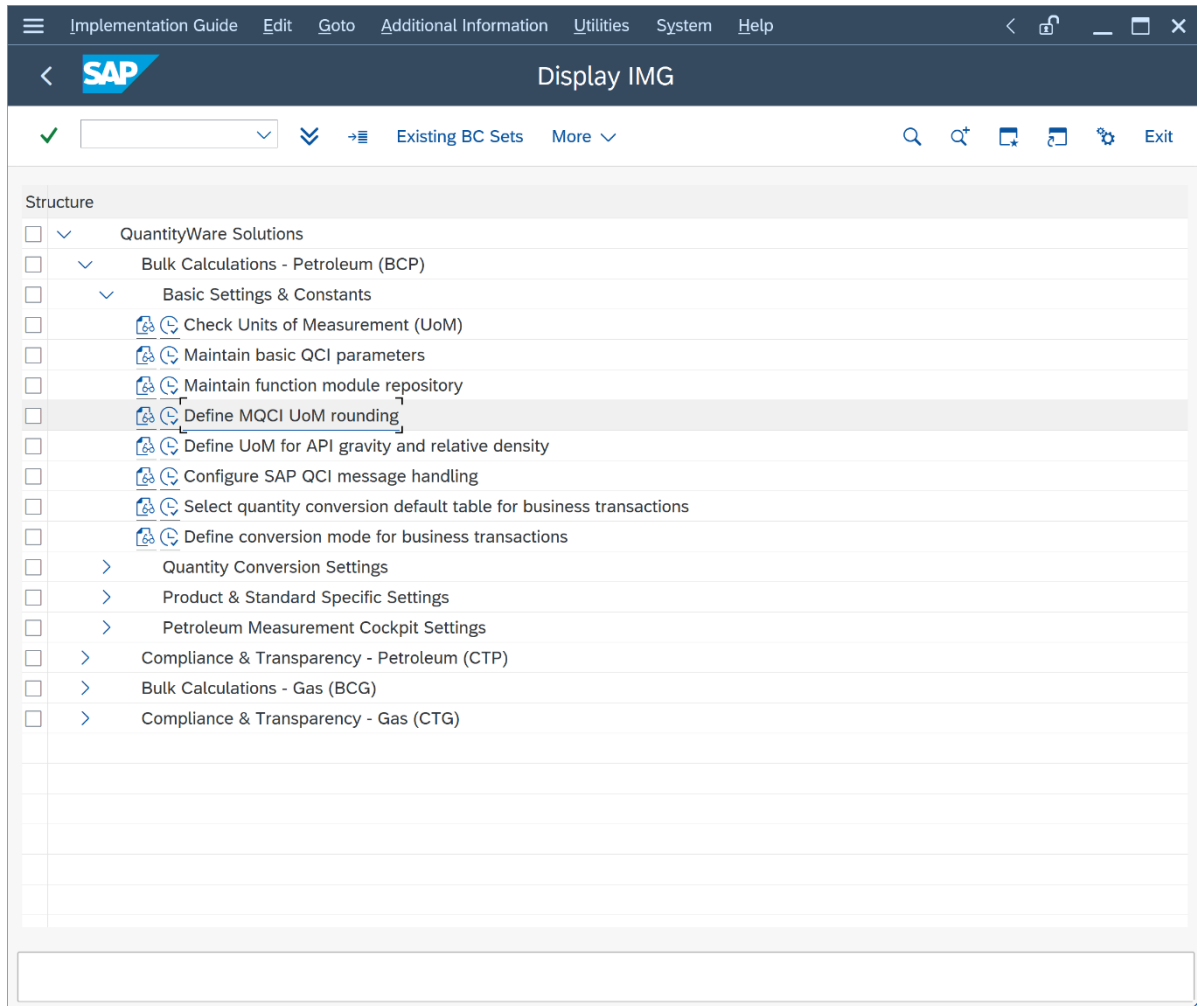
MQCI implementations contain a generic function /QTYW/MQCI_ROUND_ALT_QUANTITY which is part of every conversion group configuration contained in our MQCI template. Within this function, final target/alternate quantity value rounding (masses, volumes, weights, energies etc.) can be performed, if the corresponding unit of measure is to be rounded (defined in customizing, see 6.5.3.6).

Example: Template conversion group Q0V8 is defined to apply intermediate rounding as described above.



6.5.3.6. Rounding Definition

The rounding definition must be made separately via transaction /QTYW/UOM_ROUND for each unit of measure. You can also access this transaction via the QuantityWare Petroleum Measurement Cockpit (BCP): Goto -> QuantityWare IMG:



Rounding settings delivered with the BCP template for testing during the installation test run:

Table View Edit Goto Selection Utilities System Help

SAP Change View "UoM Rounding Settings": Overview

New Entries More

UoM Rounding Settings

Bulk product UoM	Decimal places rounding
<input type="checkbox"/> BB0	
<input type="checkbox"/> BB6	3
<input type="checkbox"/> CBR	10
<input type="checkbox"/> CRD	10
<input type="checkbox"/> KCM	1
<input type="checkbox"/> LTO	3
<input type="checkbox"/> PRD	10
<input type="checkbox"/> R10	10
<input type="checkbox"/> R11	11
<input type="checkbox"/> RP0	
<input type="checkbox"/> RP1	1
<input type="checkbox"/> RP2	2
<input type="checkbox"/> RP3	3
<input type="checkbox"/> RP4	4
<input type="checkbox"/> RP5	5
<input type="checkbox"/> RP6	6
<input type="checkbox"/> RP7	7

→ Position... Entry 1 of 20

If you maintain a valid entry in the field: “Decimal places rounding”, the values for that UoM are rounded. Valid entries for “Decimal places rounding” are:

Any number between 14 and 0 (rounding to the 14th up to zero decimal places after the period)

Any number between -1 and -10 (rounding to the second up to the 10th digit before the period).



Example 1: You set “Decimal places rounding for the unit BBL to 2 (two). The system calculates a volume of **42.227896789 BBL**. Rounding leads to a reported result of **42.23 BBL**.

Example 2: You set “Decimal places rounding for the unit BBL to 1- (one minus). The system calculates a heating value of **42.227896789 BBL**. Rounding leads to a reported result of **40 BBL**.

Important: The rounding definitions defined in the BCP template are merely delivered as examples and for testing purposes and **do not** represent a realistic definition for productive usage.

6.5.3.7. Statistician’s Rounding

In a conversion group, you can define that all rounding within the MQCI model functions is done using statistician’s rounding.

6.6. MQCI Property Rounding

Physical properties like densities (in vacuum and in air), heating values, S&W values etc. may require rounding as defined in business contracts or national standards. MQCI conversion groups can be configured to apply such rounding via dedicated MQCI rounding functions. Examples are provided via Q* template conversion groups.



Not all template conversion groups are equipped with such rounding functions.

This task needs to be completed within your implementation project and requires careful analysis of the property values.

6.7. MQCI and SAP QCI: Parameter Range Checks

Within the standard SAP QCI (without BCP installed), you cannot define that certain measurement parameters must lie within a specified range of values.

An example would be the natural gas heating value. In the standard SAP Oil, Gas, & Energy system, you can enter any value between 0.000 01 and 1 000 000 000.000 MJ/m³ (Mega joule per cubic meter), and the system calculates volume and energy quantity values for any heating value.

Typically, several parameters are required for the quantity conversion and data entry can be cumbersome and, if not checked, lead to erroneous results which may have considerable financial impact on your business. This is true for automated data input via SAP BAPI as well as manual user data entry.

To provide this important requirement, QuantityWare delivers customizing tables which contain - for all template reading groups - the relevant parameter data sets within the configuration template (client 045) with initial values, for which data range checks can be maintained. It is not possible to deliver the datasets with preset range values, since these values highly depend on customer specific business process details and specific product characteristics. If you select one specific reading group, you may select all available parameters for which the following data can be maintained:

- High level error limit: Any number with up to 6 decimal places
- Low level error limit: Any number with up to 6 decimal places
- High level warning limit: Any number with up to 6 decimal places
- Low level warning limit: Any number with up to 6 decimal places
- The unit of measure (UoM) for each parameter
- For character format parameters, you can define an exact match or if a value needs to be excluded

The range check function can be activated for both SAP QCI as well as QuantityWare MQCI conversion groups.

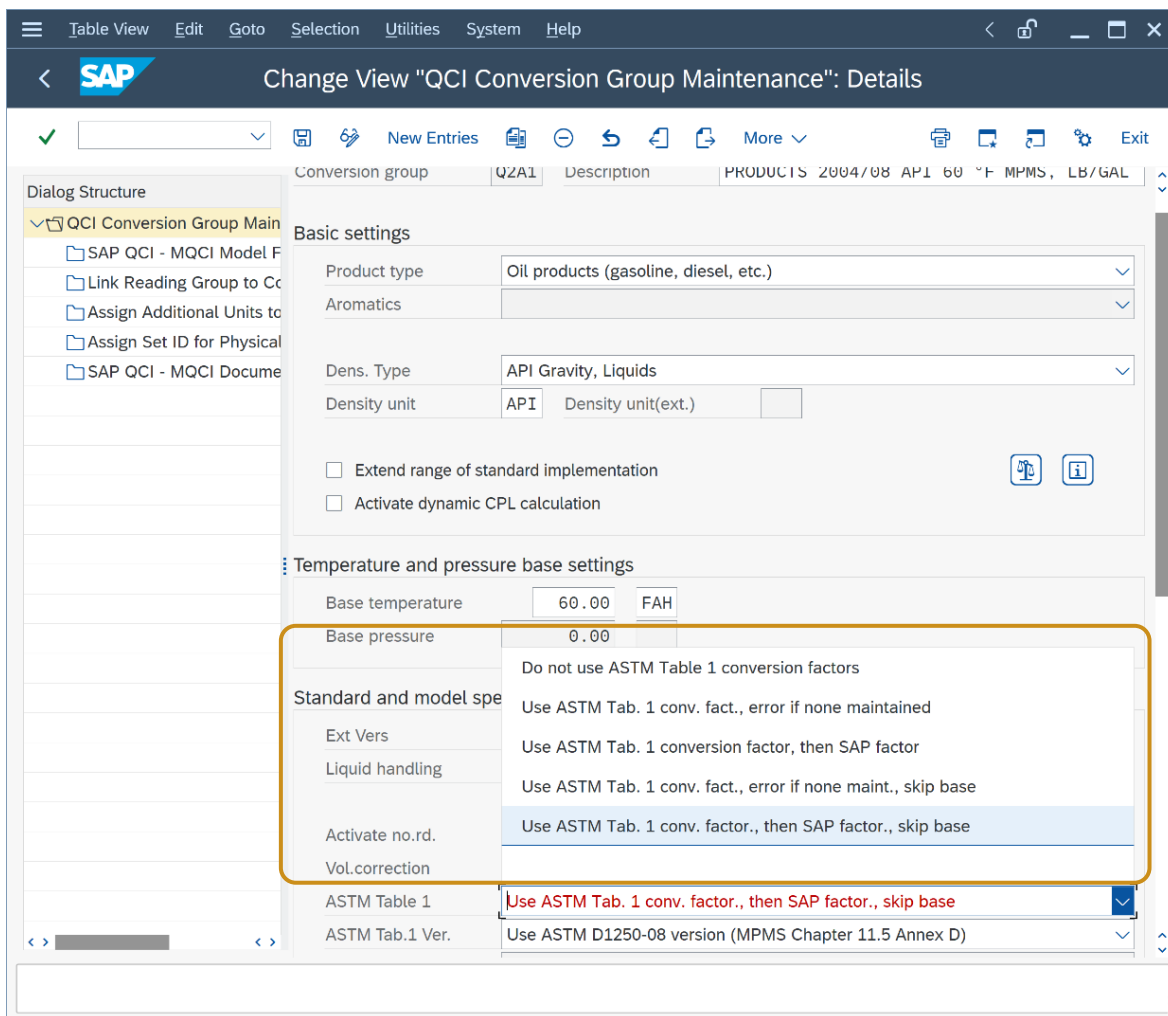


It is not required to maintain all data for all parameters. You may - for example - just maintain lower limits (E and W), or just warning limits.

Technically, the range checks are executed if function `/QTYW/CHECK_PARAM_RANGES` is included within the conversion group. This is the case for all BCP template conversion groups (Q0* to QI*). As soon as range data is maintained, the checks are performed for each quantity conversion calculation.

6.8. MQCI ASTM Table 1 Support

ASTM Table 1 defines conversion factors for volume, weight, and length units. Since this table is a “de facto” industry standard for liquid petroleum products, QuantityWare supports - within the MQCI quantity conversions between masses, weights, and volumes - the ASTM Table 1 factors.



In the “Extended conversion group maintenance” transaction (accessible via the Petroleum Measurement Cockpit) you define if the ASTM Table 1 conversion factors or the standard SAP conversion factors are to be utilized for a conversion group. QuantityWare delivers the ASTM Table 1 values as part of the QuantityWare BCP BC set for SAP Dimension ID (DIMID) VOLUME and QuantityWare Dimension ID (DIMID) WGHTA (Weight in air). For other DIMID (e.g., MASS or VMASS or gross volume GRSVOL) you simply assign the correct UoM to the corresponding WGHTA or VOLUME UoM via the mapping table, that is available in customizing as well.

QuantityWare delivers ASTM Table 1 conversion factors based on ASTM D1250-80 and ASTM D1250-08. You select which version of the factors the conversion group shall utilize.

You also select whether the MQCI solely uses ASTM Table 1 factors, raising an error if an entry is missing, or continues with the SAP standard conversion factor if no ASTM Table 1 conversion factor is maintained or available.

You also choose whether the MQCI skips the conversion to the base UoM if source and target UoM are identical (except for possible temperature assignments). This setting avoids rounding issues that will occur quite naturally due to the limited accuracy and non-symmetric definition of the ASTM Table 1 conversion factors, especially when converting back and forth between base UoM and source and target UoM.



With Note 000055, the ASTM Table 1 concept has been extended considerably. Read QuantityWare [Note 000055](#) for additional configuration options.

6.9. MQCI Flexible Density Type Input

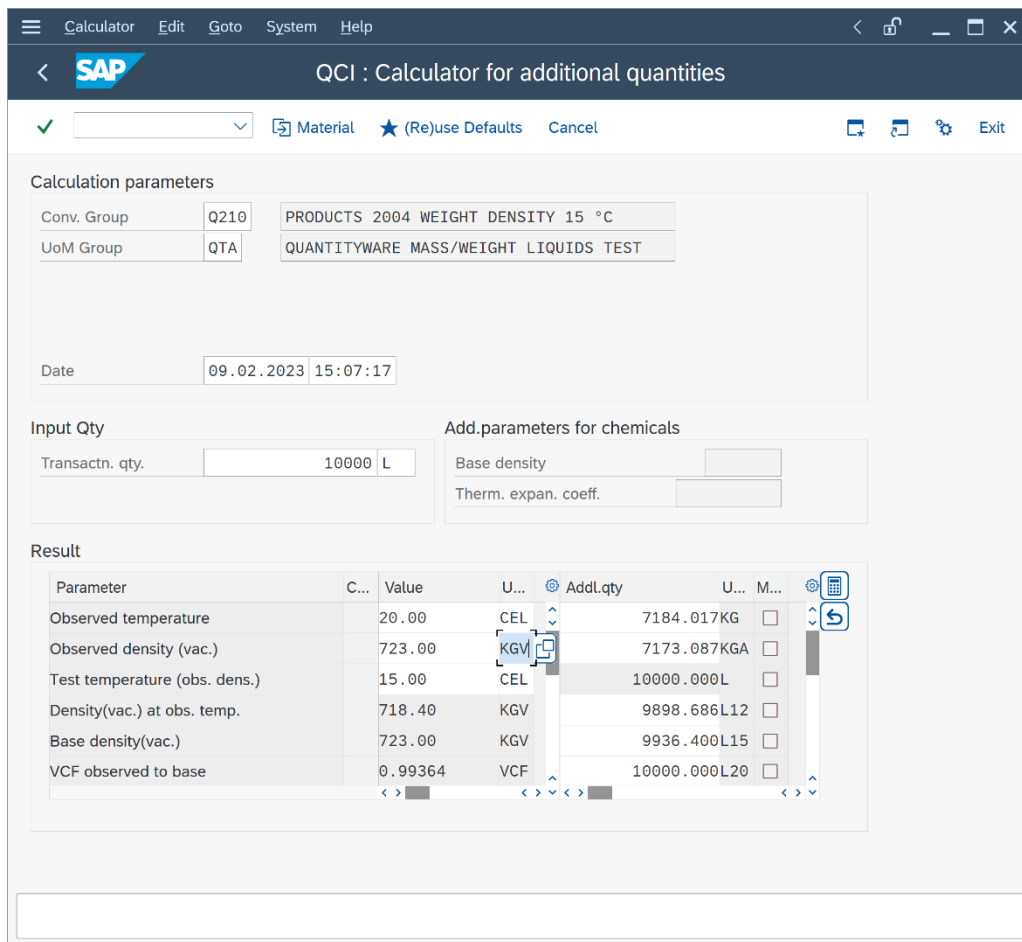
If you utilize a standard SAP QCI conversion group for liquid products, you must define a density type in the conversion group; the system then expects the data entry for densities using the density type specified, which can be either API gravity, relative density, or absolute density.

MQCI conversion groups can be configured to allow density value entry as well as calculation of the base density for all three possible density types.

For API gravity, you then must pass the density UoM API, for relative density RDW, for absolute densities any density UoM.

With BCP, QuantityWare delivers conversion groups Q210, Q212 and Q213 as examples.

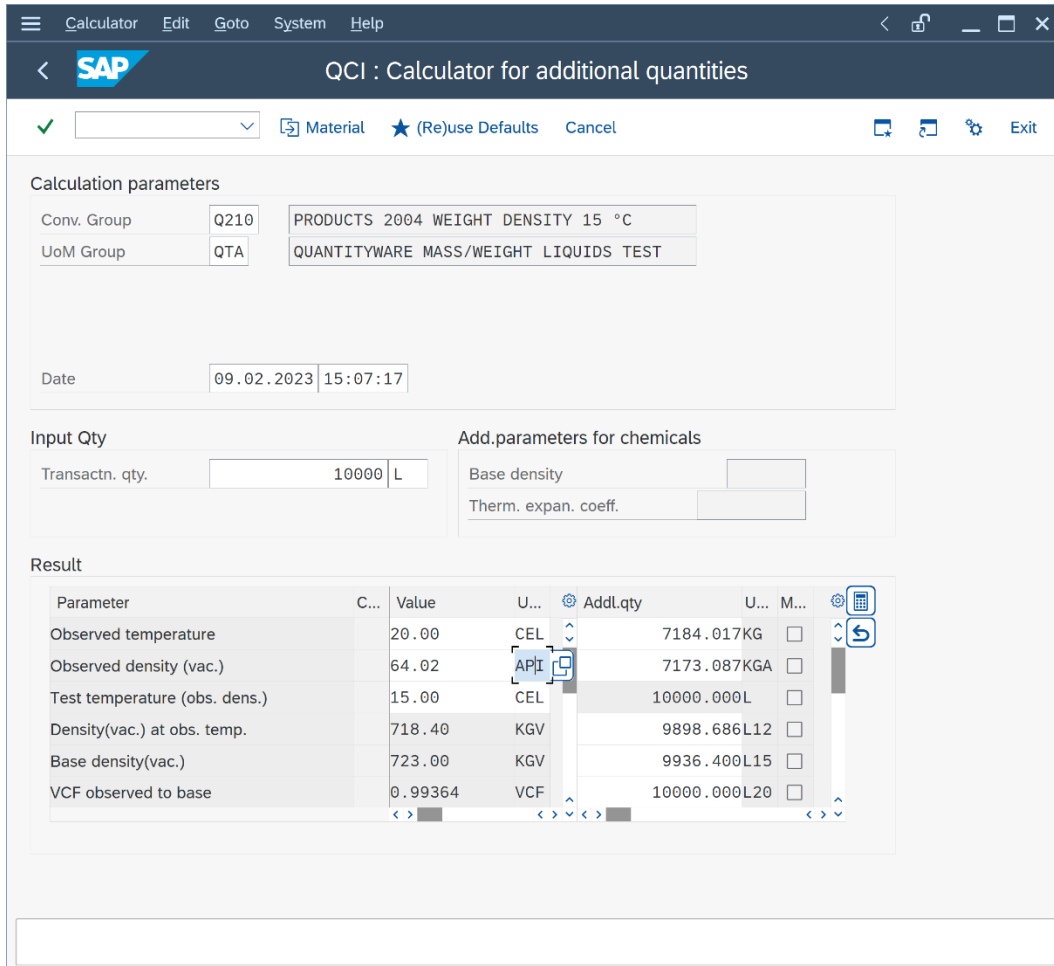
Example: Conversion group Q210 is defined for absolute density values:



The screenshot displays the SAP QCI Calculator interface. The main window title is "SAP QCI : Calculator for additional quantities". The interface includes a menu bar (Calculator, Edit, Goto, System, Help) and a toolbar with icons for Material, (Re)use Defaults, and Cancel. The "Calculation parameters" section shows "Conv. Group" set to Q210 (PRODUCTS 2004 WEIGHT DENSITY 15 °C) and "UoM Group" set to QTA (QUANTITYWARE MASS/WEIGHT LIQUIDS TEST). The "Date" is 09.02.2023 15:07:17. The "Input Qty" section shows "Transactn. qty." as 10000 L. The "Add.parameters for chemicals" section has fields for "Base density" and "Therm. expan. coeff.". The "Result" section contains a table with the following data:

Parameter	C...	Value	U...	AddL.qty	U...	M...
Observed temperature		20.00	CEL		7184.017KG	<input type="checkbox"/>
Observed density (vac.)		723.00	KGV		7173.087KGA	<input type="checkbox"/>
Test temperature (obs. dens.)		15.00	CEL		10000.000L	<input type="checkbox"/>
Density(vac.) at obs. temp.		718.40	KGV		9898.686L12	<input type="checkbox"/>
Base density(vac.)		723.00	KGV		9936.400L15	<input type="checkbox"/>
VCF observed to base		0.99364	VCF		10000.000L20	<input type="checkbox"/>

You can also enter a relative density or API gravity value as test density for the same conversion group:

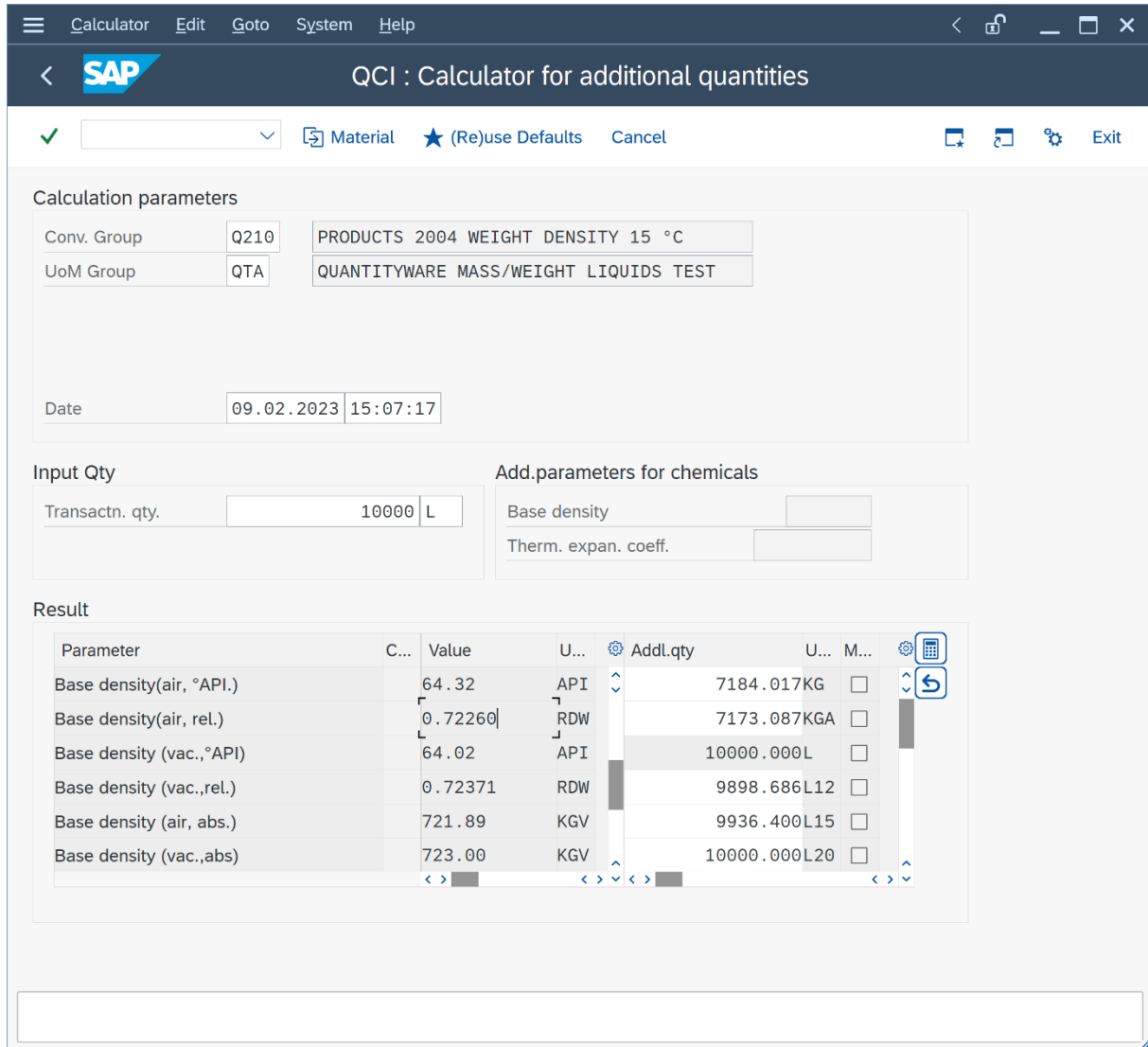


The screenshot shows the SAP QCI Calculator interface. The title bar reads "SAP QCI : Calculator for additional quantities". The main window contains several sections:

- Calculation parameters:**
 - Conv. Group: Q210 (PRODUCTS 2004 WEIGHT DENSITY 15 °C)
 - UoM Group: QTA (QUANTITYWARE MASS/WEIGHT LIQUIDS TEST)
 - Date: 09.02.2023 15:07:17
- Input Qty:**
 - Transactn. qty.: 10000 L
- Add.parameters for chemicals:**
 - Base density: [empty]
 - Therm. expan. coeff.: [empty]
- Result:** A table showing calculated values and units.

Parameter	C...	Value	U...	Addl.qty	U...	M...
Observed temperature		20.00	CEL	7184.017	KG	<input type="checkbox"/>
Observed density (vac.)		64.02	API	7173.087	KGA	<input type="checkbox"/>
Test temperature (obs. dens.)		15.00	CEL	10000.000	L	<input type="checkbox"/>
Density(vac.) at obs. temp.		718.40	KGV	9898.686	L12	<input type="checkbox"/>
Base density(vac.)		723.00	KGV	9936.400	L15	<input type="checkbox"/>
VCF observed to base		0.99364	VCF	10000.000	L20	<input type="checkbox"/>

The MQCI calculates the base density (air and vacuum) for all density types:



Calculation parameters

Conv. Group: Q210 PRODUCTS 2004 WEIGHT DENSITY 15 °C
 UoM Group: QTA QUANTITYWARE MASS/WEIGHT LIQUIDS TEST

Date: 09.02.2023 15:07:17

Input Qty: Transactn. qty. 10000 L

Add.parameters for chemicals: Base density, Therm. expan. coeff.

Result

Parameter	C...	Value	U...	⚙	Add.qty	U...	M...	⚙	📄
Base density(air, °API.)		64.32	API	⬇	7184.017KG		<input type="checkbox"/>	⬆	↶
Base density(air, rel.)		0.72260	RDW	⬇	7173.087KGA		<input type="checkbox"/>	⬆	↶
Base density (vac.,°API)		64.02	API	⬇	10000.000L		<input type="checkbox"/>	⬆	↶
Base density (vac.,rel.)		0.72371	RDW	⬇	9898.686L12		<input type="checkbox"/>	⬆	↶
Base density (air, abs.)		721.89	KGV	⬇	9936.400L15		<input type="checkbox"/>	⬆	↶
Base density (vac.,abs)		723.00	KGV	⬇	10000.000L20		<input type="checkbox"/>	⬆	↶

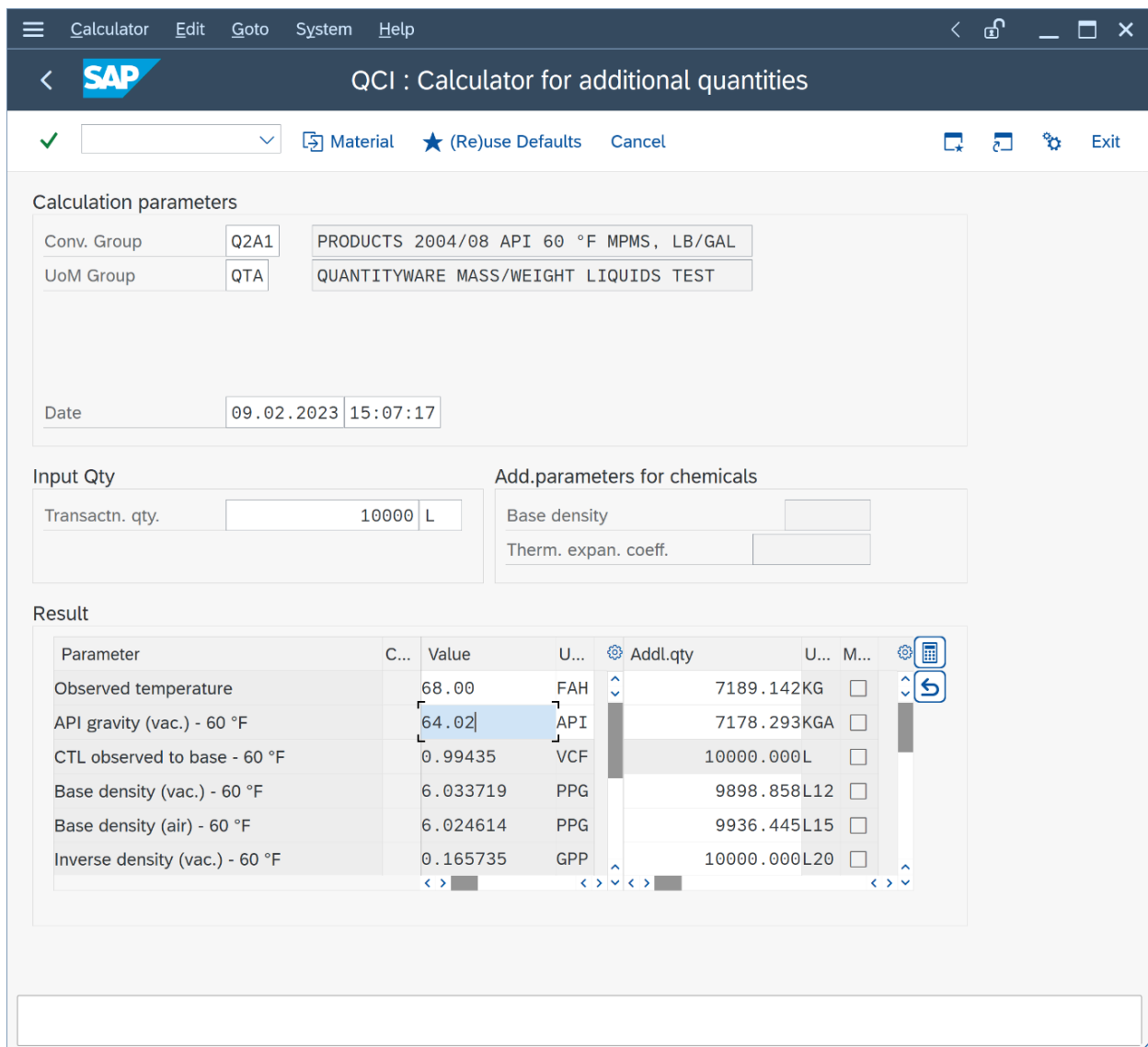


Depending on the rounding settings, and due to input density rounding within standard implementations, you cannot expect to obtain identical quantity value results with an accuracy of more than 5 relevant digits.

6.10. MQCI Base Density Input

All MQCI conversion groups can be configured such that the “test temperature” is not a required input value. This assumes that the test density is always known at base temperature, which is very often the case.

Example: Template conversion group Q2A1:

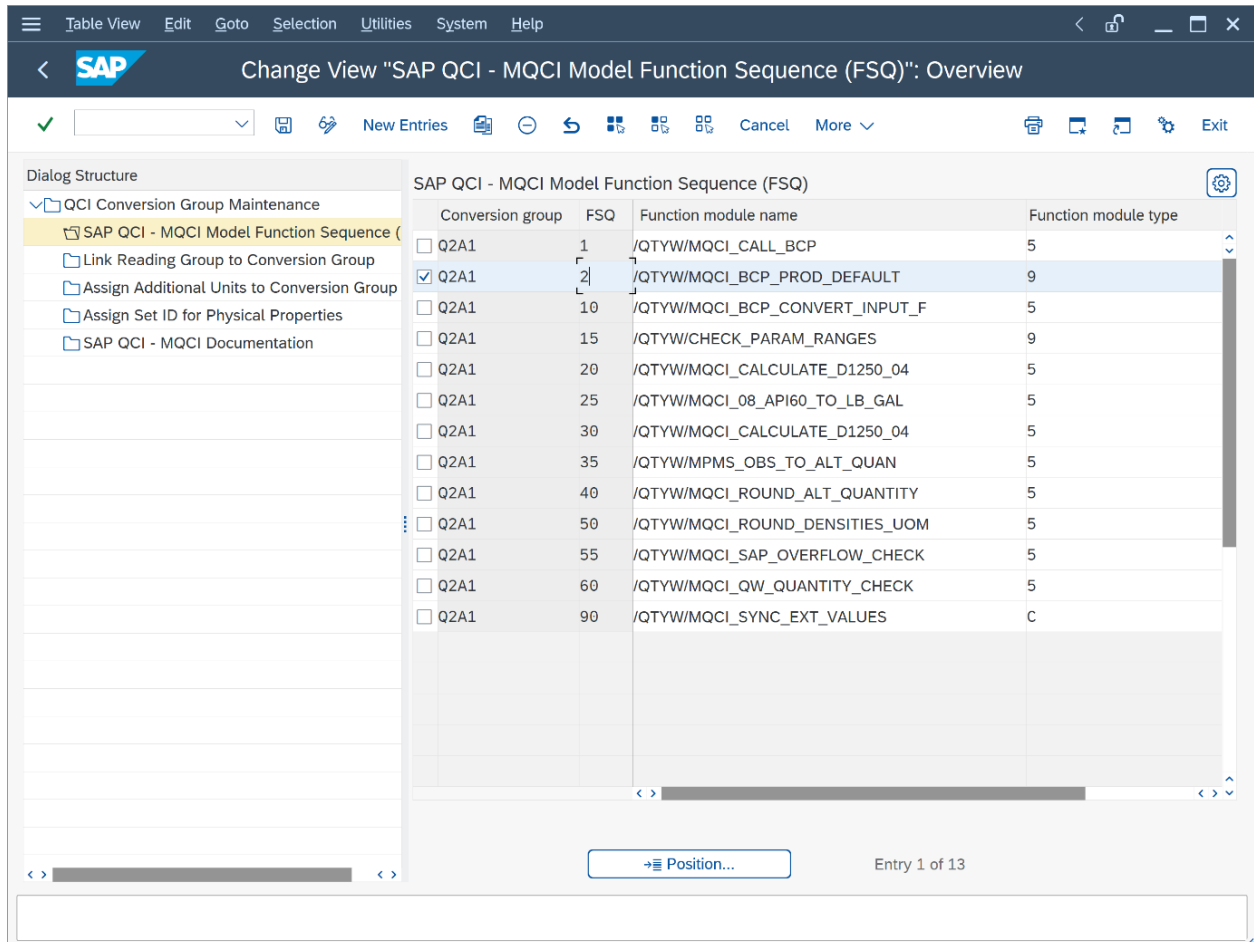


The screenshot shows the SAP QCI Calculator interface. The main window title is "QCI : Calculator for additional quantities". The interface is divided into several sections:

- Calculation parameters:**
 - Conv. Group: Q2A1
 - UoM Group: QTA
 - Material: PRODUCTS 2004/08 API 60 °F MPMS, LB/GAL
 - Test: QUANTITYWARE MASS/WEIGHT LIQUIDS TEST
 - Date: 09.02.2023 15:07:17
- Input Qty:**
 - Transactn. qty.: 10000 L
- Add.parameters for chemicals:**
 - Base density: []
 - Therm. expans. coeff.: []
- Result:**

Parameter	C...	Value	U...	Addl.qty	U...	M...
Observed temperature		68.00	FAH	7189.142KG		<input type="checkbox"/>
API gravity (vac.) - 60 °F		64.02	API	7178.293KGA		<input type="checkbox"/>
CTL observed to base - 60 °F		0.99435	VCF	10000.000L		<input type="checkbox"/>
Base density (vac.) - 60 °F		6.033719	PPG	9898.858L12		<input type="checkbox"/>
Base density (air) - 60 °F		6.024614	PPG	9936.445L15		<input type="checkbox"/>
Inverse density (vac.) - 60 °F		0.165735	GPP	10000.000L20		<input type="checkbox"/>

Function /QTYW/MQCI_BCP_PROD_DEFAULT is assigned to the conversion group such that the base temperature is always defaulted as test temperature and thus the parameter is not required as input and the test density is labelled as base density.



Change View "SAP QCI - MQCI Model Function Sequence (FSQ)": Overview

Dialog Structure

- QCI Conversion Group Maintenance
 - SAP QCI - MQCI Model Function Sequence (FSQ)
 - Link Reading Group to Conversion Group
 - Assign Additional Units to Conversion Group
 - Assign Set ID for Physical Properties
 - SAP QCI - MQCI Documentation

SAP QCI - MQCI Model Function Sequence (FSQ)

Conversion group	FSQ	Function module name	Function module type
<input type="checkbox"/> Q2A1	1	/QTYW/MQCI_CALL_BCP	5
<input checked="" type="checkbox"/> Q2A1	2	/QTYW/MQCI_BCP_PROD_DEFAULT	9
<input type="checkbox"/> Q2A1	10	/QTYW/MQCI_BCP_CONVERT_INPUT_F	5
<input type="checkbox"/> Q2A1	15	/QTYW/CHECK_PARAM_RANGES	9
<input type="checkbox"/> Q2A1	20	/QTYW/MQCI_CALCULATE_D1250_04	5
<input type="checkbox"/> Q2A1	25	/QTYW/MQCI_08_API60_TO_LB_GAL	5
<input type="checkbox"/> Q2A1	30	/QTYW/MQCI_CALCULATE_D1250_04	5
<input type="checkbox"/> Q2A1	35	/QTYW/MPMS_OBS_TO_ALT_QUAN	5
<input type="checkbox"/> Q2A1	40	/QTYW/MQCI_ROUND_ALT_QUANTITY	5
<input type="checkbox"/> Q2A1	50	/QTYW/MQCI_ROUND_DENSITIES_UOM	5
<input type="checkbox"/> Q2A1	55	/QTYW/MQCI_SAP_OVERFLOW_CHECK	5
<input type="checkbox"/> Q2A1	60	/QTYW/MQCI_QW_QUANTITY_CHECK	5
<input type="checkbox"/> Q2A1	90	/QTYW/MQCI_SYNC_EXT_VALUES	C

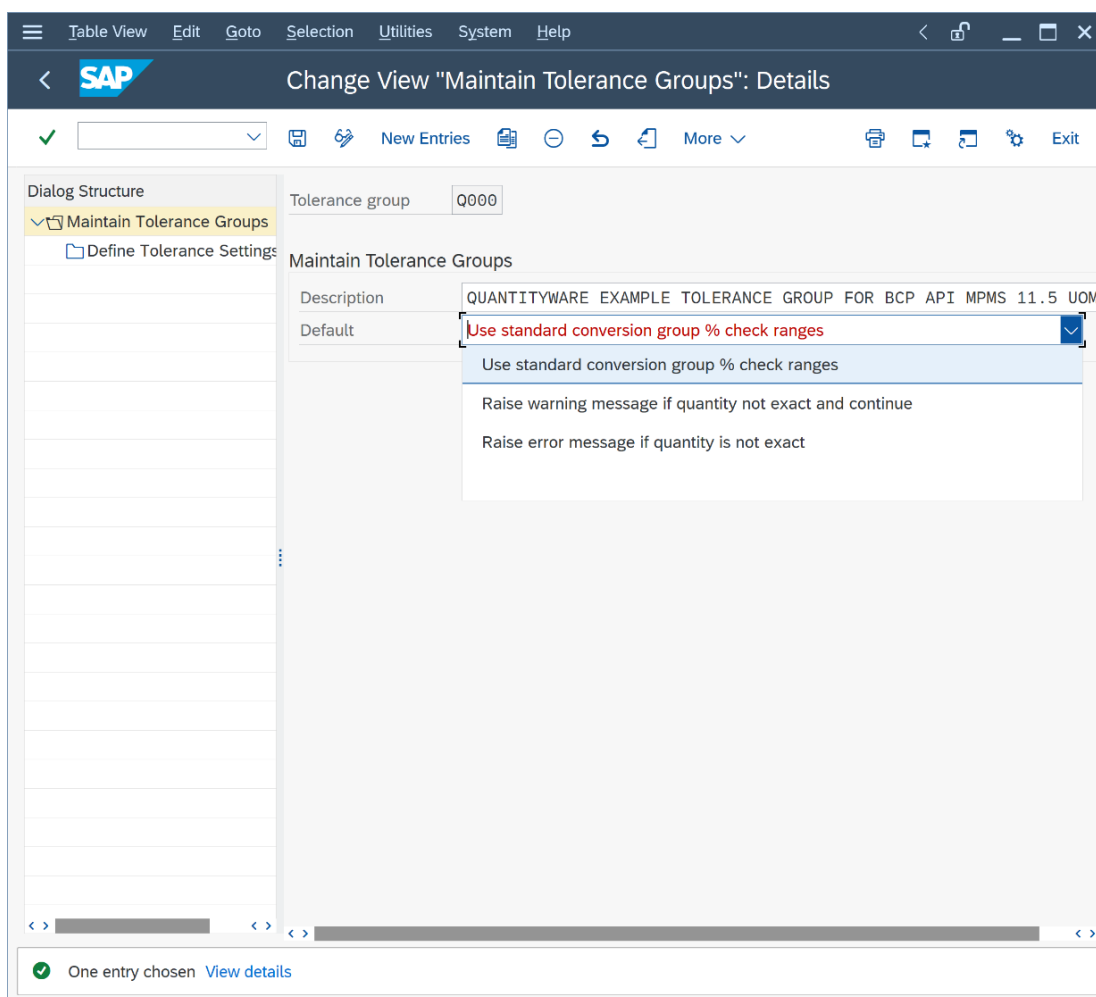
Entry 1 of 13

6.11. MQCI Tolerance Group

As described in the working paper [“Quantity Data Flow in the Oil & Gas Supply Chain”](#) quantity data that is passed from external measurement systems needs to be checked and possibly enriched before ERP documents with financial impact are posted.

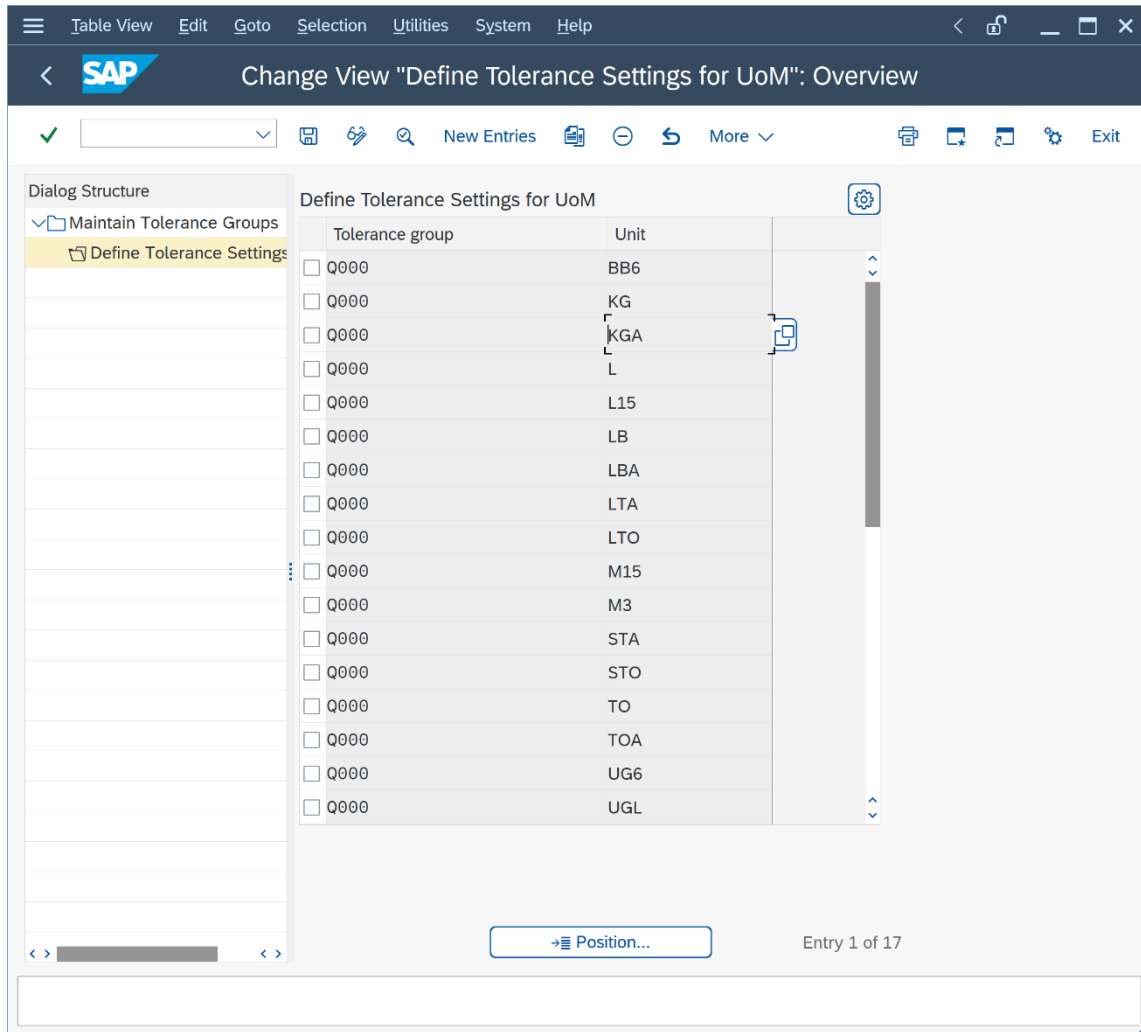
The standard SAP QCI supports the definition of tolerance settings for a conversion group. You define % limits for quantity value deviations, which trigger a warning or error message if quantity values passed from external systems (or manual changes made by users) deviate from the calculated results.

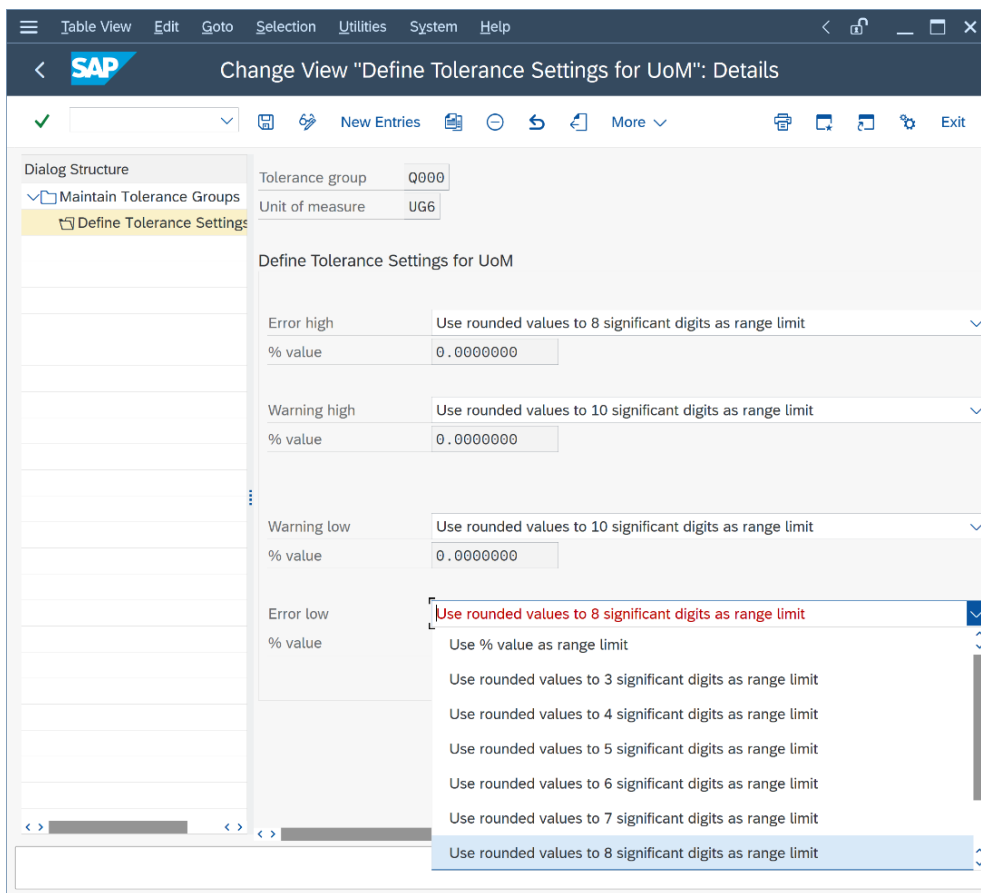
For the QuantityWare MQCI, you may also define tolerance groups in addition to this simple standard SAP check:



You assign all relevant UoM to the tolerance group, for which an individual check is made. In the header of a tolerance group, you define the behavior if no detailed limits for a UoM are defined.

For each UoM, you define either a % deviation or a deviation after rounding to 3, 4, 5...10 significant digits. If a quantity value for that UoM deviates from these defined limits, a warning or error message is raised:





You assign a tolerance group to a conversion group. With this concept, you ensure that quantity values for UoM which are e.g., relevant for pricing and excise duty calculations, deviations are tightly controlled. For UoM that are e.g., relevant for logistics control only, higher deviations are possible. Additionally, the implementing MQCI function /QTYW/MQCI_QW_QUANTITY_CHECK - which you need to assign to your conversion group to activate a tolerance group check - contains the following logic based on the manual entry indicator (SAP domain OIB_MANEN):

- initial Quantity calculated by QCI
- X Quantity checked by QCI, deviation within tolerance
- U Quantity passed through interface or BAPI functions; NOT checked
- C Quantity passed through interface, deviation within tolerance

If the manual indicator is set to "U" or "C", no check will be performed, since the value is passed from external systems and has been checked there - "U" or has already been checked once before within the SAP ERP system - "C". See SAP note 568867 for additional details.

Example:

UoM L15 (liter @ 15 °C) is the basis for your excise duty calculations. Here you define a tolerance limit where equality up to 8 significant digits is required.

UoM L (liter at ambient) is utilized for tank capacity control. Since the L quantity values show a high fluctuation depending on the current observed temperature, you define a 0.1 % deviation which is still acceptable and does not lead to unnecessary process flow interruptions.

6.12. MQCI Quantity Value Synchronization Function

All QuantityWare template conversion groups are configured such that the MQCI function module sequence contains function /QTYW/MQCI_SYNC_EXT_VALUES. This function synchronizes external quantity data with internally calculated values.

Example:

Your depot TAS system passes the product density, and values for L15 and KG to your ERP system. In your UoM group, you also defined pounds (LB) and M15 as relevant UoM.

Since the L15 value is passed and validated externally, as well as the KG value, the M15 and LB calculated values are recalculated from the L15 and KG values to ensure synchronized and exact quantity data in your ERP system.

Read the [Synchronization FAQ](#) for additional examples and details.

6.13. MQCI Advanced Configuration Options

6.13.1. MQCI LPG Configuration Options

For LPG products (e.g., commercial propane, commercial butane, and mixtures) - and other products with a high vapor space at base conditions - (LPG) vapor space calculations as defined in DIN 51650-06 and ISO 6578-1991/2017 are supported by the MQCI.



Mass and energy quantity values are updated with the vapor mass and vapor energy, such that these values contain the total LPG product quantity for valuation purposes. Volume quantity values always contain the liquid volume quantity **without** vapor volume.

For the calculation of LPG quantities (masses, weights, and volumes) the following data is required:

- LPG base density at conversion group base temperature (You may also extend the reading group to enable entry of a density at a temperature different than base temperature)
- LPG observed temperature
- LPG molar weight (required for vapor calculation)
- LPG vapor pressure
- LPG vapor temperature (can be defaulted from observed temperature)
- The tank capacity
- Apply vapor corr. (tank dip): An indicator that triggers static tank measurement vapor calculation
- Vapor recovery (movement) ind.: An indicator that triggers vapor correction for goods movements



All required data parameters such as density, temperature and pressure values may be defaulted using SAP transaction */no3defaults*. In addition, the QuantityWare MQCI design fully supports customer specific defaulting into the MQCI model sequence.

6.13.1.1. Vapor Correction Indicators

Set the “Apply vapor corr. (tank dip)” indicator if you enter a tank dip in SAP tank management and enter the tanks’ capacity. Once this has been entered, the vapor mass is calculated too and added to the liquid product mass and the observed vapor density. Basically, the vapor mass is added to the liquid product mass (and vapor energy to liquid energy, if required) that is derived from the liquid product level.

Typically, you combine an opening and closing tank dip and calculate the quantity differences (masses and volumes) which are then posted as movement quantities. You may do this via SAP tank management BAdI implementations directly.

Alternatively, you may take this data and enter the differences as movement data within your logistics processes (e.g., TD transactions). Here, enter the transferred liquid volume and the density of the liquid being transferred, as well as the final transfer LPG parameters (vapor pressure and temperature) and set the “Vapor recovery (movement)” indicator. As defined in ISO 6578, the mass of the liquid transferred will be calculated (which is basically the mass of the liquid transferred minus the vapor mass displaced by the liquid). This calculation does not require a tank capacity.

You may also directly enter all additional quantities derived from two tank dips (differences between opening and closing quantity values). In this scenario, you must ensure that the tolerance settings allow such postings.

6.13.1.2. Vapor Pressure Correction

Typically, the vapor pressure is measured as gauge pressure and needs to be corrected to absolute pressure. This can be achieved the following way:

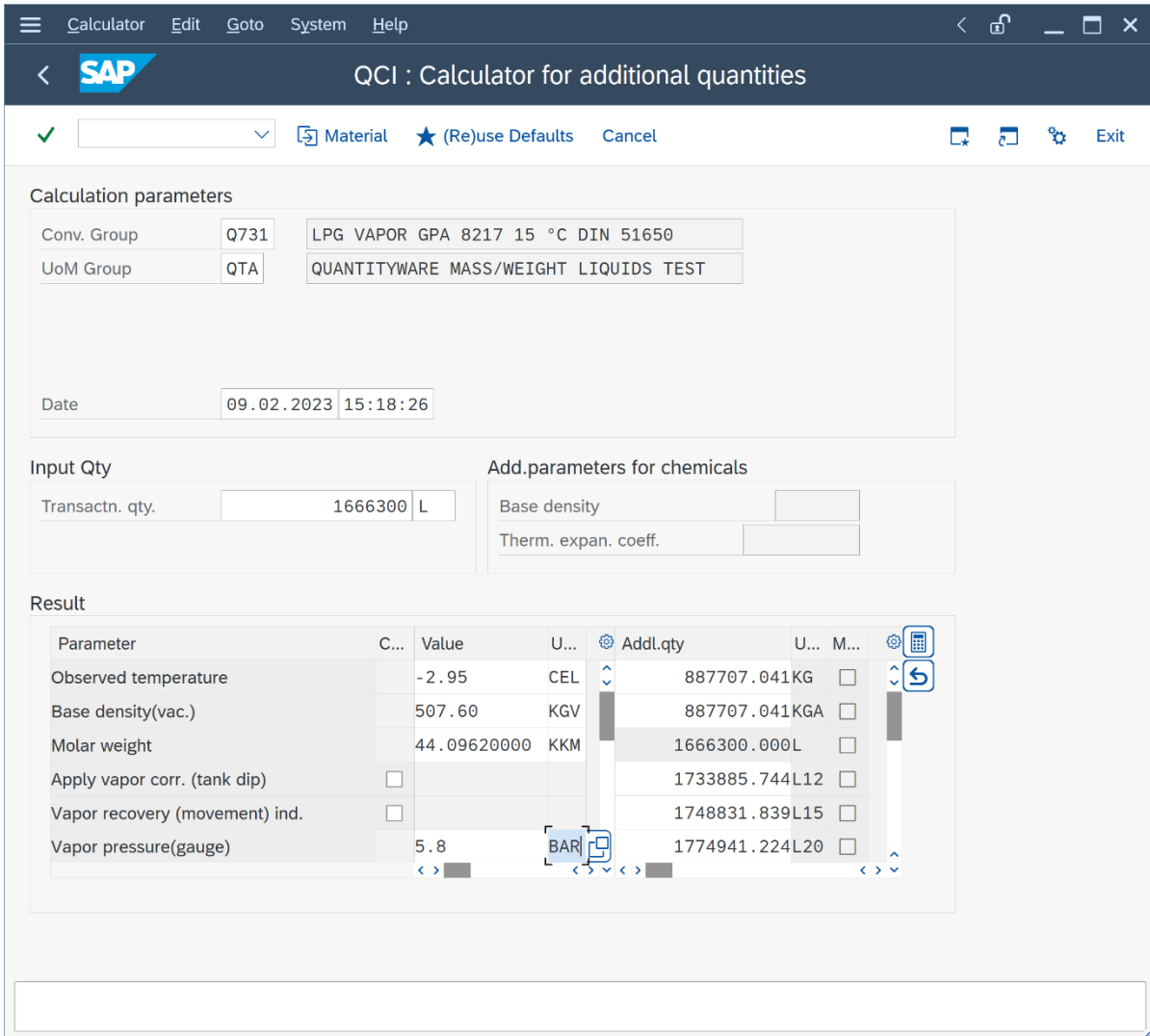
You enter a pressure value using a pressure UoM that is not defined as base pressure UoM in the conversion group (in our template, we utilize kilopascal (kPa, SAP UoM KPA) as a base pressure UoM).

Example:

Conversion group Q731 is defined at the base atmospheric pressure of 101.300 kPa (DIN definition), Q732 and Q733 are defined at 101.325 kPa (ISO definition), Q735 at 14.696 lbf/in² (SAP UoM PSI - U.S. standard base). This value is also used for the vapor calculation formula.

Technically, the vapor correction is calculated by function /QTYW/MQCI_BCP_ABS_PRESS_CALC in the MQCI model sequence, which you may remove if you enter absolute pressure values.

Example: You enter the gauge pressure value of 5.8 bar (SAP UoM BAR):



Calculation parameters

Conv. Group: Q731 | LPG VAPOR GPA 8217 15 °C DIN 51650
 UoM Group: QTA | QUANTITYWARE MASS/WEIGHT LIQUIDS TEST

Date: 09.02.2023 15:18:26

Input Qty

Transactn. qty.: 1666300 L

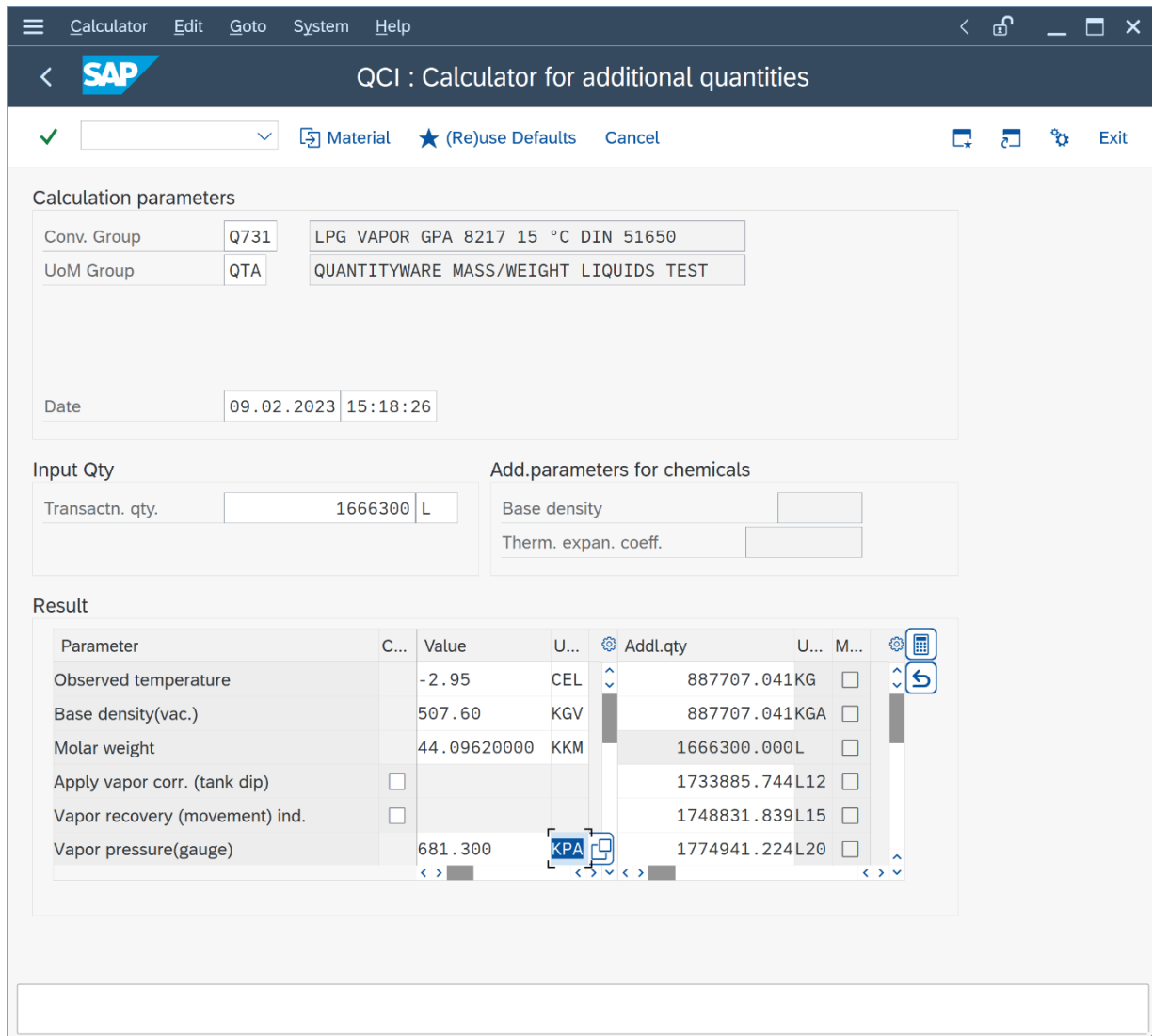
Add.parameters for chemicals

Base density:
 Therm. expan. coeff.:

Result

Parameter	C...	Value	U...	Add.qty	U...	M...
Observed temperature		-2.95	CEL	887707.041	KG	<input type="checkbox"/>
Base density(vac.)		507.60	KGV	887707.041	KGA	<input type="checkbox"/>
Molar weight		44.09620000	KKM	1666300.000	L	<input type="checkbox"/>
Apply vapor corr. (tank dip)	<input type="checkbox"/>			1733885.744	L12	<input type="checkbox"/>
Vapor recovery (movement) ind.	<input type="checkbox"/>			1748831.839	L15	<input type="checkbox"/>
Vapor pressure(gauge)		5.8	BAR	1774941.224	L20	<input type="checkbox"/>

The system converts your pressure value by adding the base pressure defined in the conversion group and utilizes this value for the detailed calculations and displays the corrected absolute pressure in kPa:



The screenshot shows the SAP QCI: Calculator for additional quantities interface. The window title is "QCI : Calculator for additional quantities". The menu bar includes "Calculator", "Edit", "Goto", "System", and "Help". The toolbar contains a checkmark, a dropdown menu, "Material", "(Re)use Defaults", "Cancel", "Exit", and "Exit".

Calculation parameters

Conv. Group: Q731 LPG VAPOR GPA 8217 15 °C DIN 51650
 UoM Group: QTA QUANTITYWARE MASS/WEIGHT LIQUIDS TEST

Date: 09.02.2023 15:18:26

Input Qty **Add.parameters for chemicals**

Transactn. qty.: 1666300 L Base density: Therm. expan. coeff.:

Result

Parameter	C...	Value	U...	Add.qty	U...	M...
Observed temperature		-2.95	CEL	887707.041	KG	<input type="checkbox"/>
Base density(vac.)		507.60	KGV	887707.041	KGA	<input type="checkbox"/>
Molar weight		44.09620000	KKM	1666300.000	L	<input type="checkbox"/>
Apply vapor corr. (tank dip)	<input type="checkbox"/>			1733885.744	L12	<input type="checkbox"/>
Vapor recovery (movement) ind.	<input type="checkbox"/>			1748831.839	L15	<input type="checkbox"/>
Vapor pressure(gauge)		681.300	KPA	1774941.224	L20	<input type="checkbox"/>

6.13.1.3. Tank Capacity Defaulting

Within SAP tank management, you must enter the tank capacity into the quantity conversion sub screen. Conversion group Q732 is configured to default the tank capacity via function /QTYW/LPG_GET_TANK_CAPACITY. This defaulting will only work if you have configured SAP tank management so that a SINGLE storage location is assigned to a SINGLE tank and vice-versa.

If this is not required, you should remove function /QTYW/LPG_GET_TANK_CAPACITY from your MQCI configuration. Read [FAQ SAP Tank Management](#) for additional details.

6.13.1.4. Weight Calculations

LPG products are stored in closed containers. As defined in DIN 51650, the air buoyancy for the gross and tare measurement are basically identical. Thus, the air buoyancy correction can be set to 0, i.e., the density **in vacuum** and **in air** are equal.

Hence the conversion groups Q73* are configured with function `/QTYW/CALC_BDICH_AIR_VAC_LPG_C` in the MQCI function model sequence. If you wish to apply the standard air buoyancy calculation, this function must be replaced with the appropriate MQCI model function.

6.13.2. MQCI Crude Oil Configuration Options

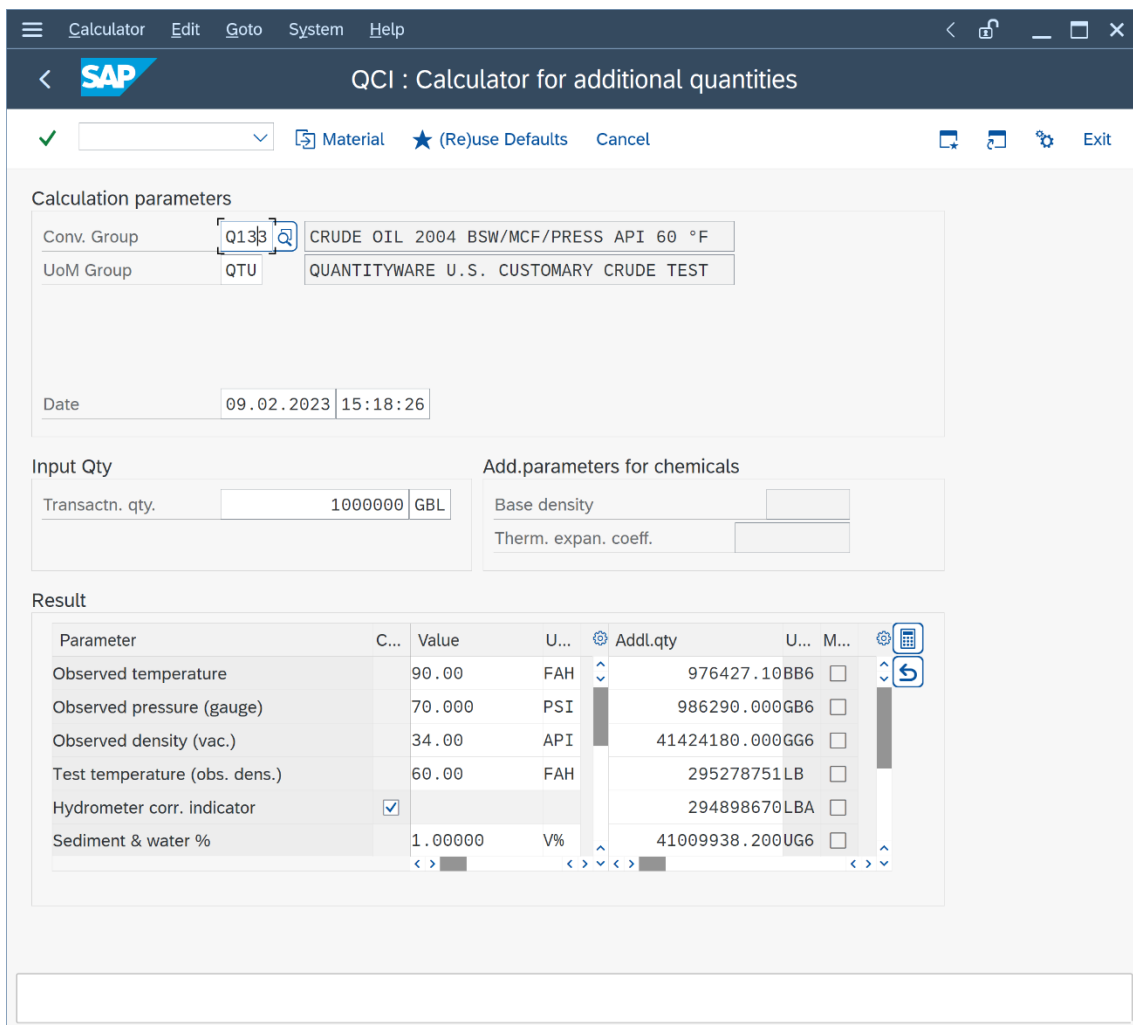
API MPMS Chapter 12.2 specifies the exact calculation sequence for petroleum quantities using dynamic measurement methods and volumetric correction factors.

With BCP, QuantityWare delivers *four(4)* crude oil MQCI conversion models which enables BCP customers to calculate net standard volumes (NSV) and gross standard volumes (GSV) from indicated volumes (IV) or gross volumes (GV) as defined in API MPMS Chapter 12.2. A combined correction factor (not rounded until clear guidance in next API MPMS Chapter 12 is provided) combining the CTPL and meter correction is applied for the calculation to obtain gross standard volumes, which are then converted to net standard volumes by the correction for sediment and water content (CSW).

This is achieved by the unique flexibility of the QuantityWare MQCI in combination with the proven SAP Unit of Measure concept. Via a newly defined QuantityWare dimension ID for gross volumes, customers can clearly distinguish between gross and net volume quantities. Masses are calculated as gross masses (model 1) or net masses (model 2). With BCP, two more crude oil models are delivered where gross masses (and weights) can be calculated in parallel.

Details:

In the screen print, down below, an example calculation is displayed. A crude volume of 1,000,000 GBL (barrel, gross) is transferred through a pipeline at an average temperature and pressure value as shown, with a sediment & water content of 1 % (volume). The gross and net barrel volumes at 60 °F, as well as the gross and net gallon values at 60 °F and the mass and weight in pounds are calculated.



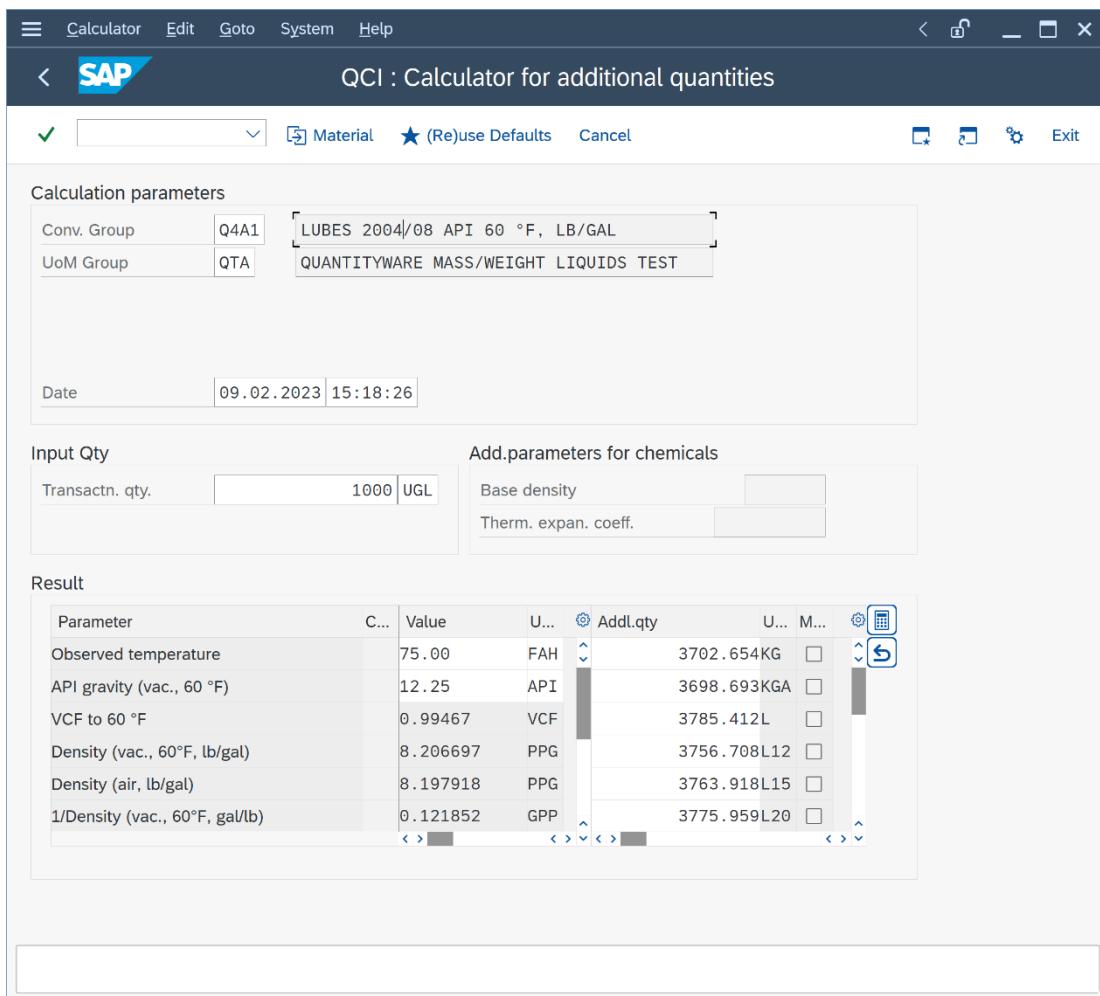
6.13.3. MQCI Energy Calculations

With BCP, energy calculations for LPG products are supported. Preconfigured LPG conversion groups are delivered with the BCP template where you calculate energy values for LPG products based on ISO 6578.

6.13.4. MQCI Parameter Defaulting

With BCP, you can configure all conversion groups so that certain required measurement parameters (e.g., test density temperature is always set to base temperature) are defaulted per your business requirements. This way you minimize the number of parameters required for input.

Example: Template conversion group Q4A1 only requires an observed temperature and the base API gravity as input for the calculation.



6.13.5. MQCI Requirements Integration Logic

BCP contains requirements specific functions (delivered within function group /QTYW/MQCI_COMMON), which you can add to your MQCI conversion group function sequence. QuantityWare welcomes your new requirements for analysis; if a solution is technically feasible, it will be delivered as new integration logic with a CSP. Read [Note 000099](#) for additional details.

6.13.6. MQCI External System Data Synchronization

BCP contains function /QTYW/MQCI_SYNC_EXT_VALUES, which you can add to your own MQCI conversion group logic. This function detects data from external systems passed to the SAP ERP system (via the "manual entry indicator") and synchronizes dependent quantity values based on that data.

All QuantityWare MQCI template conversion groups are configured such that the MQCI function module sequence contains function /QTYW/MQCI_SYNC_EXT_VALUES. If not required, you simply remove that function from your Z*** conversion group. Read the [Synchronization FAQ](#) for details.

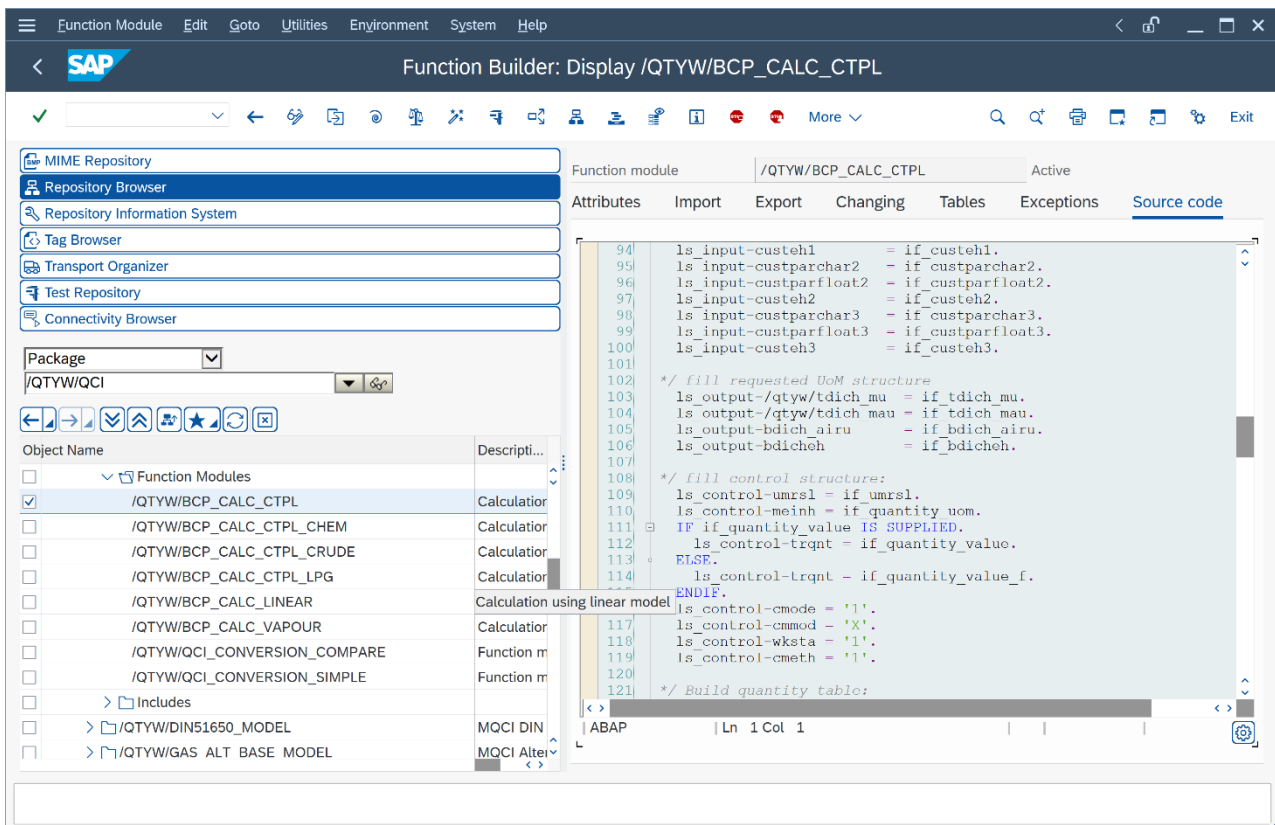
6.13.7. MQCI Country Specific Base Temperature Definition

For ASTM D1250-04 (crude oil and products) and GPA 8217 / TP-27 (LPG) you can configure your SAP QCI and MQCI conversion groups to calculate standard based CTPL for any required base temperature, e.g., 23 °C (Egypt) or 85 °F (Pakistan). While ASTM D1250-04 readily supports such temperature bases, the QuantityWare GPA 8217 / TP-27 implementation has been extended via a soft conversion to support all possible base temperatures as well.

For ASTM D4311-09 and ASTM D4311-15/21, QuantityWare has also extended the implementation to 20 °C base temperature. Others are available on customer request, depending on technical feasibility.

6.14. MQCI Integration Functions

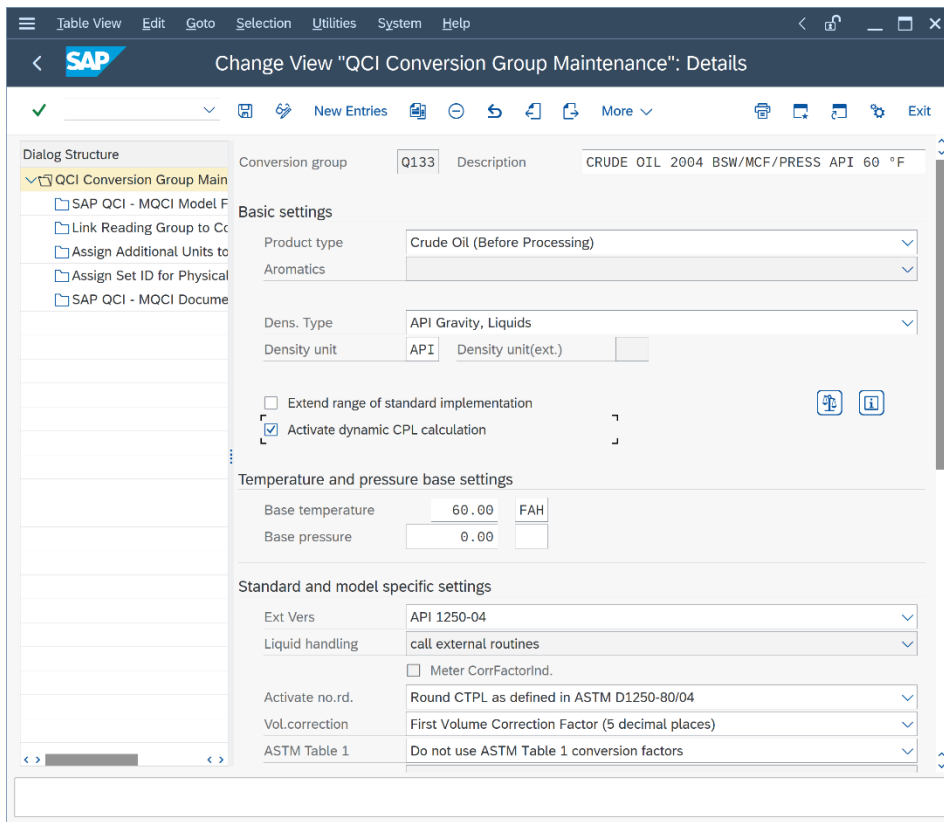
With BCP, QuantityWare delivers Function group /QTYW/CONVERSION, which contains quantity conversion functions that may be utilized within your project to integrate BCP quantity conversions within your customer specific developments. The functions are designed to provide an easy interface which programmers can readily understand:



6.15. MQCI Support of CPL Calculations

Implementations of API MPMS Chapter 11.2.1(M), API MPMS Chapter 11.2.2(M) and GPA 8117 / TP-15 are delivered with BCP, together with template conversion groups for crude oil, products and LPG, which are configured to calculate combined CTL and CPL correction factors based on these standards. List printing of API MPMS Chapter 11.2.1(M) and API MPMS Chapter 11.2.2(M) compressibility factors is provided via the PMC "Print Standards Lists" tab strip.

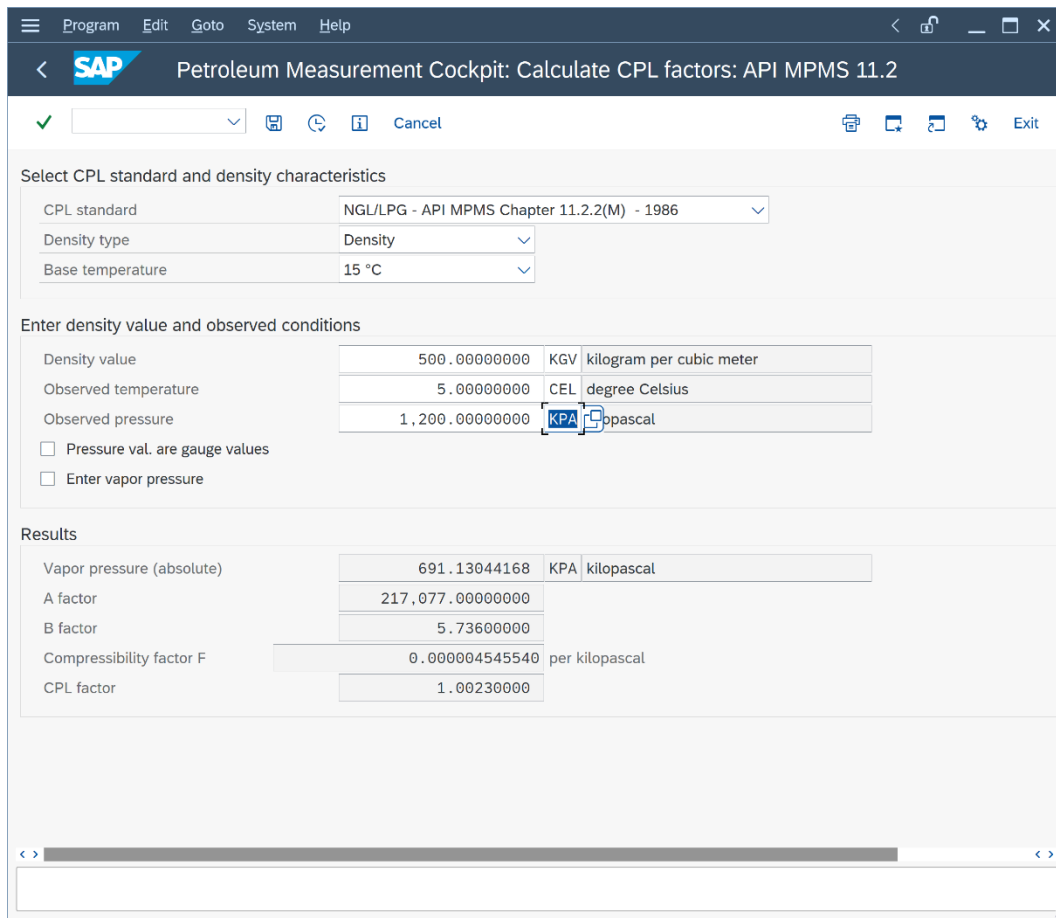
The CPL calculation needs to be activated for a conversion group via customizing and the CPL calculation logic requires a decision how to apply the correction:



CPL calculations are supported for MQCI conversion groups in conjunction with the following CTL standards:

- ASTM D1250-04
- ASTM D1250-80
- ASTM D1250-52 – Table 6
- ANP 894 – 2022 / C.N.P. No. 6 1970 Table I & II
- GPA 8217 / TP-27
- ISO 6578:1991/2017

A CPL calculator is available, allowing CPL factors for API MPMS Chapter 11.2 to be calculated online for control and audit purposes:



Select CPL standard and density characteristics			
CPL standard	NGL/LPG - API MPMS Chapter 11.2.2(M) - 1986		
Density type	Density		
Base temperature	15 °C		

Enter density value and observed conditions			
Density value	500.00000000	KGV	kilogram per cubic meter
Observed temperature	5.00000000	CEL	degree Celsius
Observed pressure	1,200.00000000	KPA	kilopascal
<input type="checkbox"/> Pressure val. are gauge values			
<input type="checkbox"/> Enter vapor pressure			

Results			
Vapor pressure (absolute)	691.13044168	KPA	kilopascal
A factor	217,077.00000000		
B factor	5.73600000		
Compressibility factor F	0.000004545540		per kilopascal
CPL factor	1.00230000		



Printing of API MPMS Chapter 11.1 - 2004 CPL factors is not supported.

6.16. Summary

Leveraging the flexibility of SAPs Oil & Gas solution technical design, the Model-based QCI from QuantityWare can operate as a “single solution”, or in parallel with existing SAP QCI functionality, allowing customers to represent business- and regulatory-driven calculation requirements accurately and transparently in a single, controlled environment, on demand.

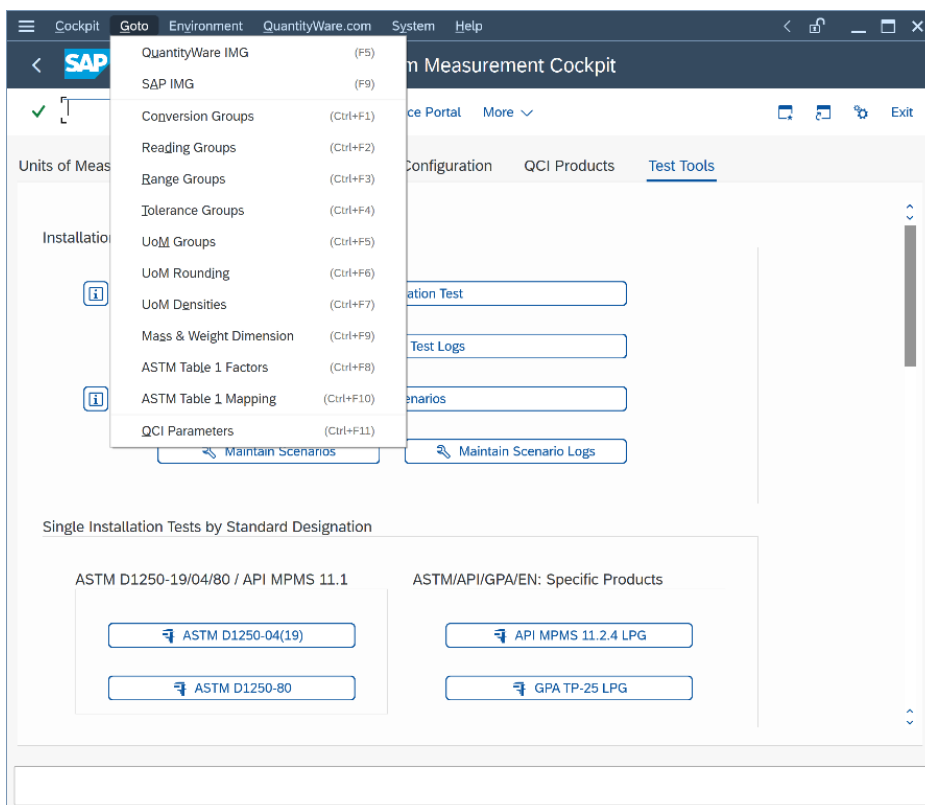
7. BCP - Customizing Transactions

7.1. Introduction

With BCP, QuantityWare delivers a complete industry configuration template. This template is delivered as a BC set for SAP ECC 600 / S/4HANA. QuantityWare requires installation of this template **into exactly one client (045) in one development system**, from where the implementation project team selects the relevant configuration (via SAP customizing transports) based on customer specific requirements. Read the [Client 045 FAQ](#) for more details. Within this chapter, we provide an overview of BCP customizing transaction access, as well as some basic documentation on the configuration options provided via customizing options.

7.2. QuantityWare Customizing Transactions

QuantityWare delivers customizing data for BCP that are maintainable via transactions. All relevant customizing transactions for bulk quantity conversion configuration can be accessed via the QuantityWare PMC (transaction /n/QTYW/COCKPIT):



Under menu path “Goto” you can navigate to the QuantityWare IMG, as well as to the complete SAP IMG. For fast access, the following transactions can be called directly from the menu:

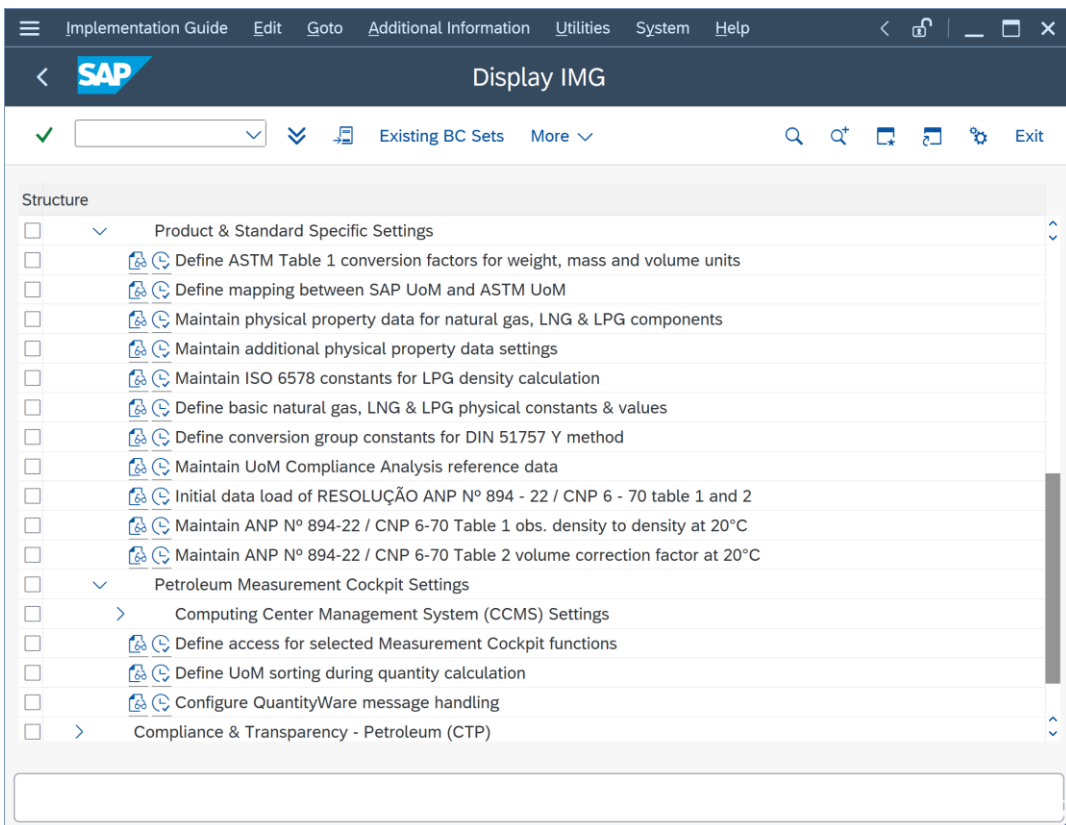
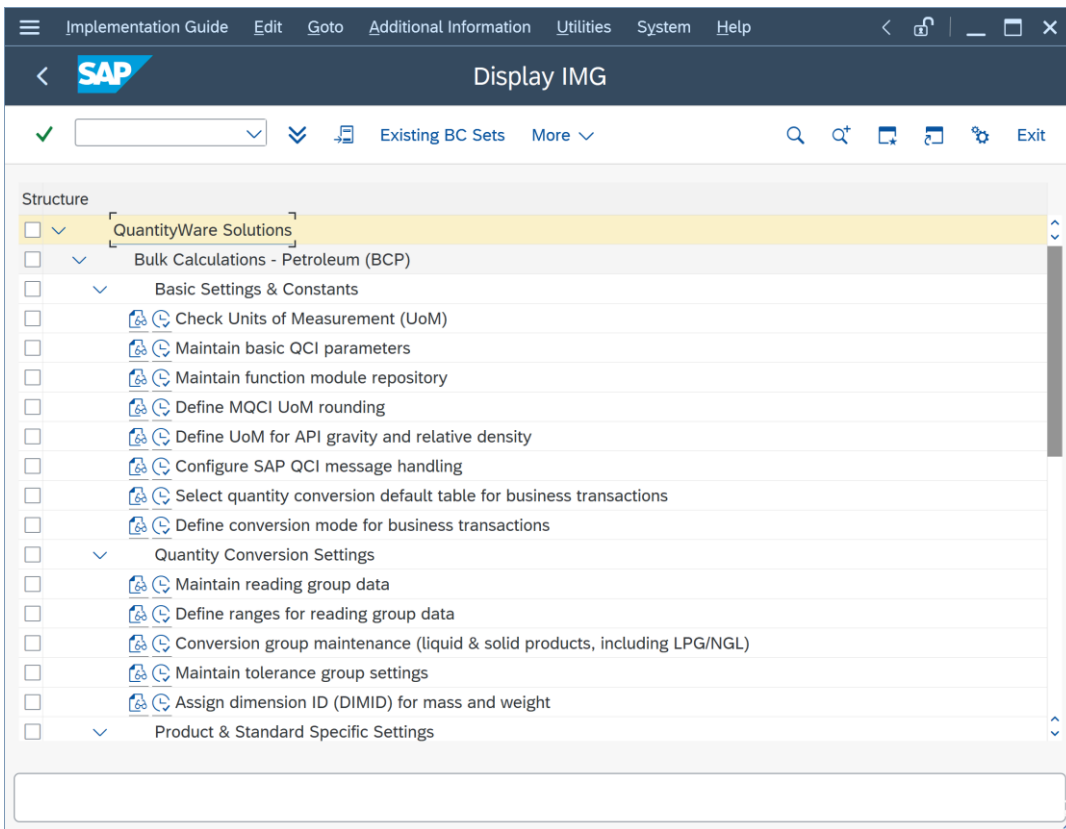
- Conversion Groups - /n/QTYW/MQCI
- Reading Groups - /n/QTYW/READINGGROUP
- Range Groups - /n/QTYW/RANGES
- Tolerance Groups - /n/QTYW/TOLERANCE
- UoM Groups - /n/QTYW/UOMGR
- UoM Rounding - /n/QTYW/UOM_ROUND
- UoM Densities - /n/QTYW/API_RDW
- Mass & Weight Dimension - /n/QTYW/DIM
- ASTM Table 1 Factors - /n/QTYW/ASTM_TAB_1
- ASTM Table 1 Mapping -/n/QTYW/SAP_ASTM
- QCI Parameters - /n/QTYW/PARAMETERS

To provide a structured implementation guide (IMG) for all relevant customizing transactions for bulk quantity conversions, these transactions are collected within a single QuantityWare customizing IMG structure (Transaction SIMGH) named “QuantityWare Solutions”.

This IMG structure is also integrated into the SAP Reference IMG (IS-Oil and PRA nodes).

You access the QuantityWare IMG via the PMC - Menu: Goto – QuantityWare IMG directly. There you expand the QuantityWare BCP node:

All customizing nodes are documented carefully.



With QuantityWare BCP, all business-user-relevant customizing template entries are also delivered in languages French (FR), Spanish (ES) and Portuguese (PT). QuantityWare requires that you perform your configuration work using the PMC in logon language English (EN). As a last step, you should check and possibly enhance the configuration data in your required language. With BCP, you can also launch the PMC in all other logon languages. While the Cockpit user interface (UI) is available in English (EN) only, the customizing data is delivered in French (FR), Spanish (ES) and Portuguese (PT) as well. In detail, the following configuration data is translated within the BCP template:

- All UoM definitions (dimensions, ISO/UNECE codes, UoM short and long texts)
- All conversion group definitions (header texts)
- All reading group definitions (header texts and individual parameter descriptions)
- All range group definitions (header texts and individual parameter descriptions)
- All UoM group definitions (header texts)

7.3. Summary

Via a comprehensive IMG structure, the complex and detailed customizing required for modern quantity conversions can be accessed and governed in an efficient and transparent manner.

8. BCP - Web Services

8.1. Introduction

Web service enablement of ERP-based software solutions is an important technological key development allowing existing large scale ERP installations to be leveraged and integrated into dynamic and flexible web service landscapes. This results in integrated common procedures and greater return on investment (ROI) for the ERP investment and software solutions concerned.

The realization of web-service based business processes is still being heavily debated within various industries. Even although SAP has extensively service-enabled its ERP solution, standardized quantity conversion web services are not available.

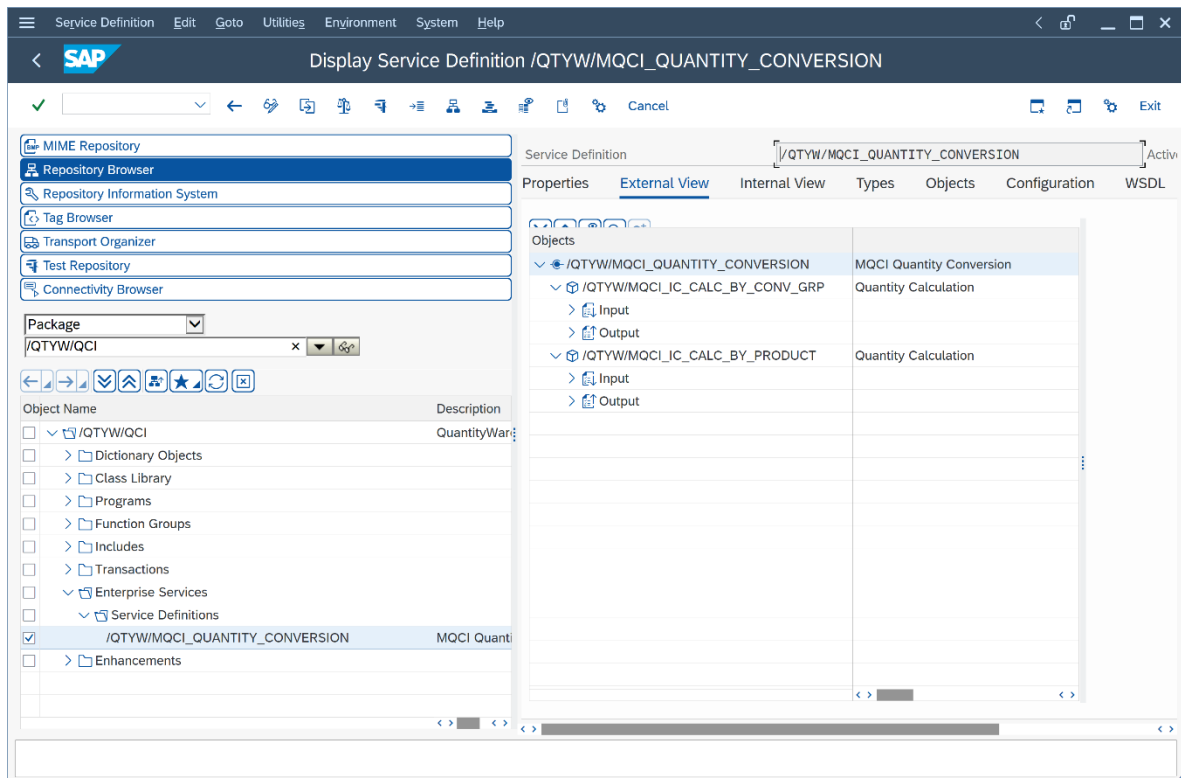
Quantity conversions are required along the complete oil & gas supply chain. While the implementation of a standards-based quantity conversion is a highly complex task, the provision of a quantity conversion service with understandable interface operations is considerably easier; QuantityWare solutions can provide a “plain calculation” service without needing to store any data in a database.

With BCP, QuantityWare delivers a set of two web service enabled function groups, which both provide three quantity conversion operations for a wide range of oil bulk products.

Based on these web service enabled functions, BCP customers can readily extend their high quality BCP quantity conversion implementations from their SAP Oil, Gas, & Energy ERP backend into the web world, either restricting access to locations within company boundaries or, license permitting, even granting access to quantity conversions to external bodies.

8.2. Installation Components

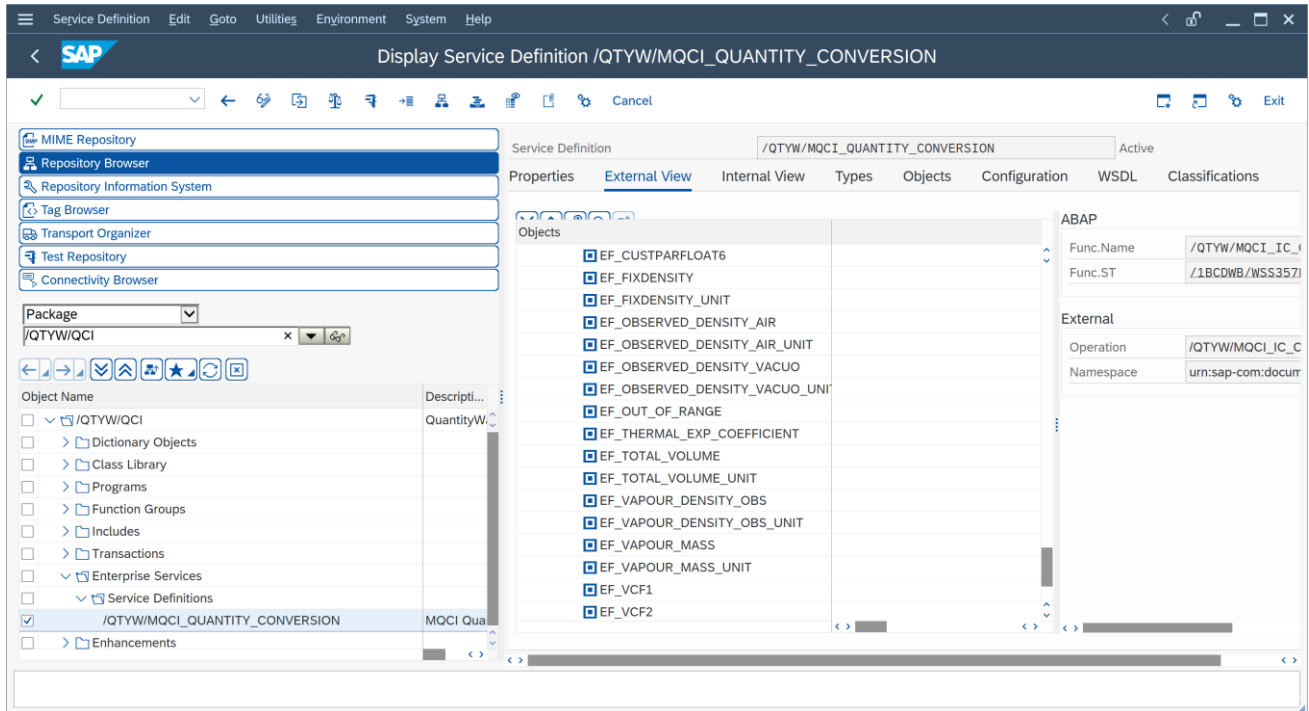
The main part of the web service enablement installation is delivered within software package /QTYW/MQCI for BCP:



As displayed above, two Service Definitions are delivered:

- /QTYW/MQCI_IC_CALC_BY_CONV_GRP
- /QTYW/MQCI_IC_CALC_BY_PRODUCT.

Each service definition consists of one interface which provides all calculation options:



- /QTYW/MQCI_IC_CALC_BY_CONV_GRP calculation requires knowledge of a conversion group
- /QTYW/MQCI_IC_CALC_BY_PRODUCT requires knowledge of the product and plant for which a quantity conversion operation is requested

8.3. Interface Documentation

8.3.1.1. Standard Compliance Methodology – Syntax

With respect to the syntactical standardization of web service interfaces, QuantityWare service definitions rely on the state-of-the-art SAP standards methodology.

8.3.1.2. Standard Compliance Methodology – Semantics

Since BCP is targeted towards the oil & gas and allied industries, the semantics of the interface operations are based on oil & gas industry terminology as defined in various API (American Petroleum Institute) standards, the main reference being the API Manual of Petroleum Measurement “API MPMS” terminology.

Quantity conversion operations require quantity values handling.

Examples of quantity values are:

Volume 120,090 L

Mass 320,001 lb

Weight 320,001 lb

A quantity value thus requires assignment of a specific quantity (e.g., volume, mass, weight) description (ID), a numerical factor and a unit of measure. Two different quantities can thus use the same set of units of measure, e.g., weight and mass utilize the same units of measure. To differentiate between mass and weight, a quantity ID must be communicated with each numerical factor and unit of measure.

The technical implementation of such calculations within SAP ERP systems have led to the following technical representation of quantity values within the service definition:

1. SAP ERP systems **do not support** the assignment of different quantities to one set of units of measure. Thus, units of measure for weight are defined with one set of commercial keys, the units of measure for mass with another differing set of commercial keys. LB is e.g., the customized commercial key for pound (mass) and LBA the customized commercial key for pound (weight). In this way, the commercial keys carry the information for which quantity the quantity value is expressed.
2. SAP ERP systems support unit of measure definitions, where a temperature and/or pressure value is assigned to a unit of measure (an industry requirement). Units such as UG6 (gallon at 60 °F) and L15 (liter at 15 °C) are available. This definition unfortunately violates standardization practices defined in ISO standards; it is also not fully supported by the UNECE recommendation 20, which defines standardized unit of measure codes across industries for electronic trade. However, this design has proven to be practical within the oil & gas industry and describes a de facto industry standard developed by SAP and industry experts.
3. State-of-the-art industry standards by the API define software implementation guidelines for quantity conversions which need to be based on 64bit floating point accuracy.

Based on the above noted circumstances, quantity values for the QuantityWare web service interface definitions require numeric floating-point representation.

For unit of measure representation, we simply utilize the SAP commercial keys, to avoid complex mapping of unit codes (and there are no UNECE recommendation codes for standardized units such as L15, UG6 etc.).

8.4. Summary

Through the leverage of Web Services, QuantityWare BCS can become the central reference calculations engine for an entire landscape of applications, without being limited to the functional and implementation boundaries of the SAP ERP Oil & Gas solution.

9. BCP MQCI – Customer Specific Extensions

9.1. Introduction

With BCP, QuantityWare delivers a complete set of pre-configured conversion groups for all relevant product groups. These pre-configured conversion groups can be divided into two types of conversion groups: “SAP QCI” conversion groups and “MQCI” conversion groups. Both types of conversion groups utilize the SAP QCI interface to business processes, i.e. from a business process point-of-view, seamless integration into all processes is guaranteed for both types of conversion groups.

So, what is the difference between an MQCI and SAP QCI conversion group?

For both types, pre-configured conversion groups for all relevant CTPL (VCF) measurement standards are delivered as part of the BCP BC set.

- All **SAP QCI conversion groups** utilize the same “hard-coded” SAP QCI calculation model, which can be extended and modified via SAP QCI BAdI (Business Add Ins). This SAP QCI calculation model is based on DIN 51650 without intermediate rounding, supports the DIN 51757 mass-to-weight standard (air buoyancy concept) and relies on the SI UoM conversion factor standard. To extend this model, various BAdI methods are provided within the SAP QCI calculation model, by which customers can change the standard SAP QCI calculation logic by implementing their own ABAP code
- The pre-configured **MQCI conversion groups** provide not only support for all relevant CTPL (VCF) measurement standards, but also for all known calculation models, as well as support of all mass-to-weight conversion standards and all UoM conversion standards. Each MQCI conversion group carries its own ABAP code within a sequence of ABAP functions that are assigned to the conversion group in customizing

QuantityWare BCP customers who are already running their ERP system with the classic SAP QCI model **and** who have already implemented their own customer specific BAdI implementations should analyze their BAdI implementations within their QuantityWare implementation project to make the following decision:

- Continue usage of SAP QCI conversion groups delivered with BCP, leveraging the existing BAdI implementations, OR
- Switch to BCP MQCI conversion groups

A simple switch to BCP MQCI conversion groups may be possible if an MQCI conversion group is available which covers the functionality implemented within the existing SAP QCI BAdI logic. If this is not the case, but a customer still wants to switch to an MQCI conversion group, it is the task of the customer implementation team to map the customer-specific BAdI logic to customer-specific Z* ABAP functions, *which can be "plugged into" the MQCI function module sequence.*

- Certified BCP consultants may send their customer's existing BAdI implementation code and the related documentation to QuantityWare support staff via a consulting inquiry ticket in the QuantityWare Service Portal. Upon receiving this information, QuantityWare support staff will perform a quick **feasibility analysis** to determine if a migration is possible and recommended
- In addition, this documentation provides a technical description of how to design the interfaces of customer specific Z* ABAP functions which are then required for such a migration



Beyond the technical documentation concerning general recommendations to the development of such functions, QuantityWare does not provide any detailed implementation support for this task.

9.2. MQCI – Customer Specific Extensions

As described previously, an MQCI conversion group carries its own calculation logic defined in a sequence of ABAP function modules which are assigned to the conversion group.

In general, a business process application calls the central SAP QCI function `OIB_QCI_QUANTITY_CONTROL`, which is defined with the following interface:

```

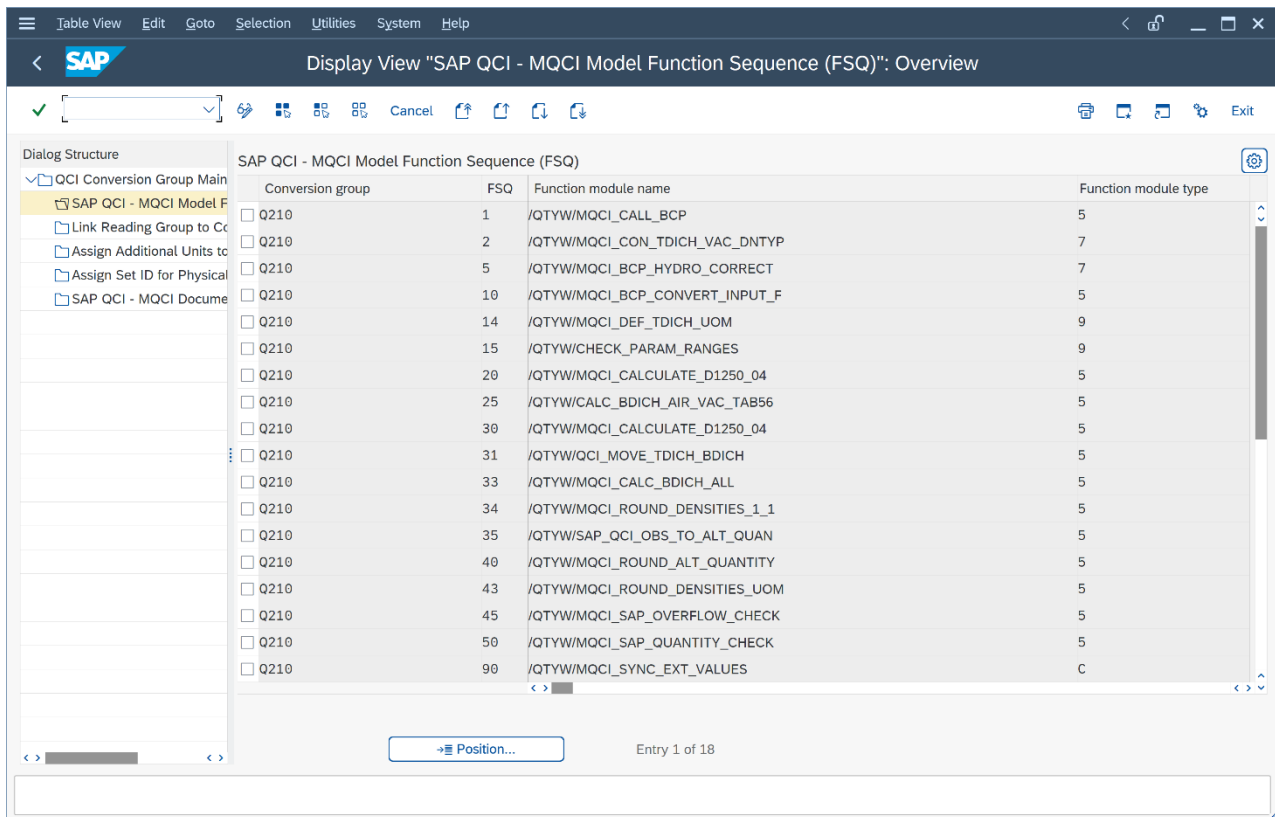
* " -----
* " * "Global Interface:
* " TABLES
* "     T_QT2TAB STRUCTURE  OIB_A05
* "     T_PARAM STRUCTURE  OIB_A10
* "     T_RETURN STRUCTURE  BAPIRET2 OPTIONAL
* " EXCEPTIONS
* "     CALCULATION_FAILURE
* "     CALCULATION_OVERFLOW
* "     TRANS_UOM_NOT_FOUND
* "     UNIT_CONVERSION_ERROR
* "     WINDOW_CANCELLED
* "     INCONSISTENT_DATA
* "     OUT_OF_RANGE
* "     INCONSISTENT_CUSTOMIZING
* " -----

```

- Table `T_QT2TAB` contains a table of UoM, for which the quantity values shall be calculated.
- Table `T_PARAM` contains the source quantity and UoM, as well as all relevant calculation parameters that are required to calculate the correct UoM quantity values defined in Table `T_QT2TAB`.
- Table `T_RETURN` collects all messages that are raised during a calculation.

The calculation process is a “one to many” type calculation, i.e., using the parameters passed via table `T_PARAM`, the calculation model is executed `n` times in a loop over all UoM to calculate each UoM target value separately.

As stated previously, SAP QCI conversion group calculations processed via the “hard-coded” SAP QCI logic including customer specific BAdI implementations. MQCI conversion groups run through the calculation logic defined in the function module sequence of the conversion group. This is illustrated in the following example for BCP template conversion group Q210:



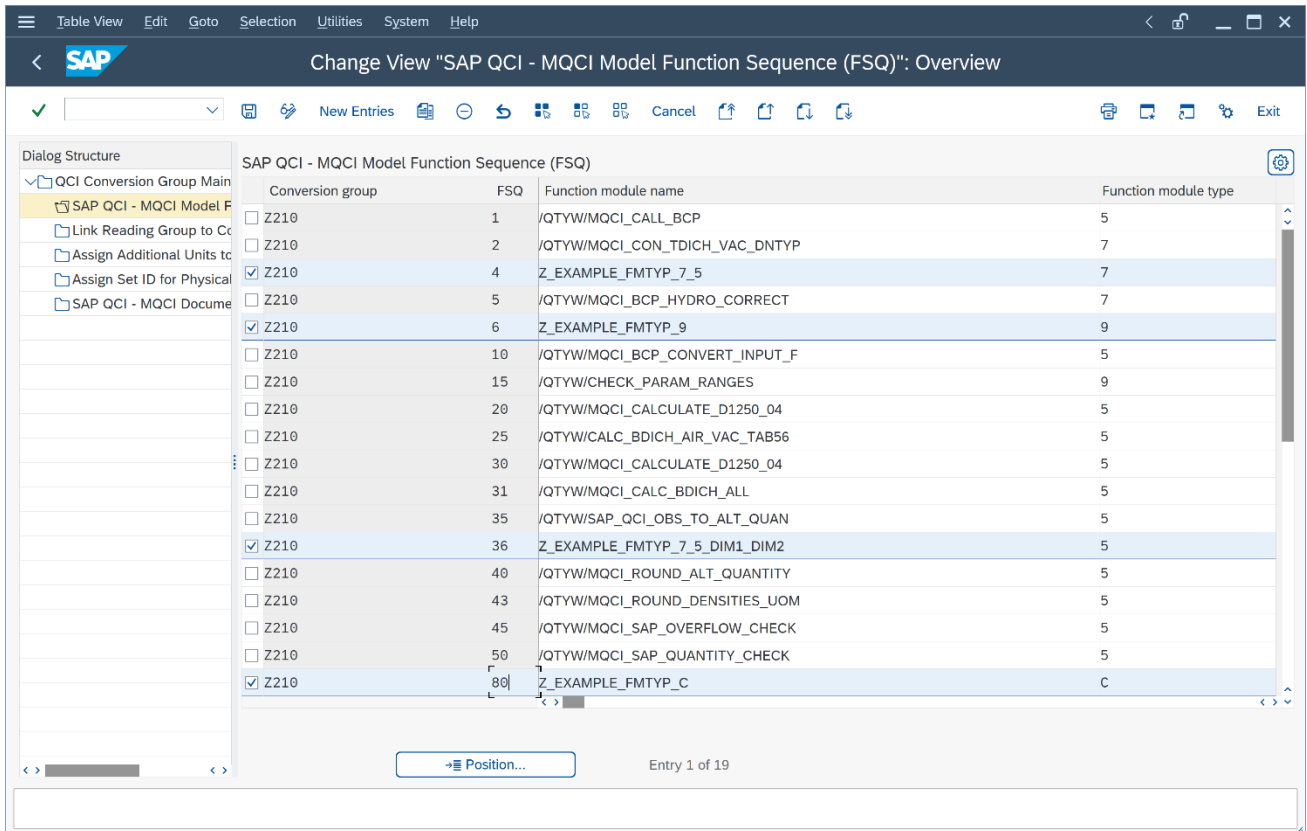
The screenshot shows the SAP Display View for the 'SAP QCI - MQCI Model Function Sequence (FSQ)'. The table lists various function modules and their types. The 'Function module type' column contains values 5, 7, 9, and C.

Conversion group	FSQ	Function module name	Function module type
<input type="checkbox"/> Q210	1	/QTYW/MQCI_CALL_BCP	5
<input type="checkbox"/> Q210	2	/QTYW/MQCI_CON_TDICH_VAC_DNTYP	7
<input type="checkbox"/> Q210	5	/QTYW/MQCI_BCP_HYDRO_CORRECT	7
<input type="checkbox"/> Q210	10	/QTYW/MQCI_BCP_CONVERT_INPUT_F	5
<input type="checkbox"/> Q210	14	/QTYW/MQCI_DEF_TDICH_UOM	9
<input type="checkbox"/> Q210	15	/QTYW/CHECK_PARAM_RANGES	9
<input type="checkbox"/> Q210	20	/QTYW/MQCI_CALCULATE_D1250_04	5
<input type="checkbox"/> Q210	25	/QTYW/CALC_BDICH_AIR_VAC_TAB56	5
<input type="checkbox"/> Q210	30	/QTYW/MQCI_CALCULATE_D1250_04	5
<input type="checkbox"/> Q210	31	/QTYW/QCI_MOVE_TDICH_BDICH	5
<input type="checkbox"/> Q210	33	/QTYW/MQCI_CALC_BDICH_ALL	5
<input type="checkbox"/> Q210	34	/QTYW/MQCI_ROUND_DENSITIES_1_1	5
<input type="checkbox"/> Q210	35	/QTYW/SAP_QCI_OBS_TO_ALT_QUAN	5
<input type="checkbox"/> Q210	40	/QTYW/MQCI_ROUND_ALT_QUANTITY	5
<input type="checkbox"/> Q210	43	/QTYW/MQCI_ROUND_DENSITIES_UOM	5
<input type="checkbox"/> Q210	45	/QTYW/MQCI_SAP_OVERFLOW_CHECK	5
<input type="checkbox"/> Q210	50	/QTYW/MQCI_SAP_QUANTITY_CHECK	5
<input type="checkbox"/> Q210	90	/QTYW/MQCI_SYNC_EXT_VALUES	C

Four function module types (FM Call type) are available:

- **9:** These functions are executed before the actual calculation process. Here, input data checks (e.g., parameter range checks) are executed, in dialog with a user if e.g. O3QCITEST calculations are performed
- **7:** A function of this type is executed exactly once within the loop over all UoM for which a quantity value needs to be calculated, e.g., if the test density needs to be adjusted for a hydrometer reading
- **5:** A function of this type is executed for all UoM calculations within the loop over all UoM
- **C:** A function of this type is executed after the calculation of all UoM (and result parameters) is complete

Customers may extend or change the calculation logic as defined in the example above **at their own risk**. Here is an example for all possible four function module types:



The interface of these four functions including the usage of data service functions is documented in the following sections.

9.2.1. Z_EXAMPLE_FMTYP_9

```

FUNCTION Z_EXAMPLE_FMTYP_9.
*"-----
***"Local Interface:
*"  TABLES
*"    T_OIB_A10 STRUCTURE  OIB_A10
*"  EXCEPTIONS
*"    CALCULATION_FAILURE
*"-----
*****  DISCLAIMER  *****
* This Example Software is provided on an "AS IS" basis with no warranties.
* Licensee agreed to test this software carefully before using in
* systems that contains productive data.
* QuantityWare GmbH can not guarantee the correctness of the formulas
* used in this code nor of the correctness of the results.
* In no event will QuantityWare GmbH be liable for any loss of profits,
* loss of use, direct, incidental, consequential, or special damages,
* regardless of whether QuantityWare GmbH has advance notice of the
* possibility of such damages.
*****

*      EXAMPLE FUNCTION FOR FMTYP 9 - Check logic on MQCI input parameters

DATA:

* Input data incl. example for conversion group:

      ls_input   TYPE /qtyw/mqci_bcp_input,
      ls_oib01   TYPE oib01,
      lf_umrsl   TYPE oib01-umrsl.

* NOTE: OTHER SERVICE FUNCTIONS CAN BE FOUND IN FUNCTION GROUP /QTYW/MQCI_DATA_SERVICES

CALL FUNCTION '/QTYW/MV_BCP_INPUT_FROM_ITAB'
  EXPORTING
    i_all_fields_needed = ' '
  IMPORTING
    e_structure          = ls_input
  TABLES
    t_oib_a10            = t_oib_a10
  EXCEPTIONS
    parameter_not_in_itab = 1
    OTHERS                = 2.
IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

CALL FUNCTION '/QTYW/MOVE_ITAB_TO_VALUE'
  EXPORTING
    i_fieldname          = 'UMRSL'
  IMPORTING
    e_target_field       = lf_umrsl

```

```

TABLES
  t_oib_a10                = t_oib_a10
EXCEPTIONS
  inconsistent_customizing = 1
  parameter_not_in_itab   = 2
  OTHERS                   = 3.

IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

CALL FUNCTION '/QTYW/GET_OIB01'
  EXPORTING
    i_umrsl          = lf_umrsl
  CHANGING
    ie_oib01        = ls_oib01
  EXCEPTIONS
    umrsl_not_exists = 1
    OTHERS           = 2.

IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

```

```

* PLACE YOUR CUSTOMER SPECIFIC CHECK LOGIC INCLUDING MESSAGES HERE:

* END YOUR CUSTOMER SPECIFIC CALCULATION LOGIC INCLUDING MESSAGES HERE:

*/=====

ENDFUNCTION.

```

9.2.2. Z_EXAMPLE_FMTYP_7_5

```

FUNCTION Z_EXAMPLE_FMTYP_7_5.
*"-----
***"Local Interface:
*" TABLES
*"     T_OIB_A10 STRUCTURE OIB_A10
*" EXCEPTIONS
*"     CALCULATION_FAILURE
*"-----
*****  DISCLAIMER  *****
* This Example Software is provided on an "AS IS" basis with no warranties.
* Licensee agreed to test this software carefully before using in
* systems that contains productive data.
* QuantityWare GmbH can not guarantee the correctness of the formulas
* used in this code nor of the correctness of the results.
* In no event will QuantityWare GmbH be liable for any loss of profits,
* loss of use, direct, incidental, consequential, or special damages,
* regardless of whether QuantityWare GmbH has advance notice of the
* possibility of such damages.
*****

*     EXAMPLE FUNCTION FOR FMTYP 7 & 5 - Calculations of parameters
*                               WITHIN UoM Loop

DATA:
* Input/Import data incl. example for conversion group:
  ls_input  TYPE /qtyw/mqci_bcp_input,
  ls_oib01  TYPE oib01,
  lf_umrs1  TYPE oib01-umrs1,
  ls_calc   TYPE /qtyw/mqci_bcp_calc,

* Export/Calculation result data including customer specific fields

  ls_calc_e TYPE /qtyw/mqci_bcp_calc.

* NOTE: OTHER SERVICE FUNCTIONS CAN BE FOUND IN FUNCTION GROUP /QTYW/MQCI_DATA_SERVICES

CALL FUNCTION '/QTYW/MV_BCP_INPUT_FROM_ITAB'
  EXPORTING
    i_all_fields_needed = ' '
  IMPORTING
    e_structure          = ls_input
  TABLES
    t_oib_a10            = t_oib_a10
  EXCEPTIONS
    parameter_not_in_itab = 1
    OTHERS                = 2.
IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

CALL FUNCTION '/QTYW/MV_BCP_CALC_FROM_ITAB'
  EXPORTING
    i_all_fields_needed = ' '
  IMPORTING
    e_structure          = ls_calc
  TABLES

```

```

        t_oib_a10                = t_oib_a10
    EXCEPTIONS
        parameter_not_in_itab = 1
        OTHERS                = 2.
IF sy-subrc <> 0.
    MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
        WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
        RAISING calculation_failure.
ENDIF.

CALL FUNCTION '/QTYW/MOVE_ITAB_TO_VALUE'
    EXPORTING
        i_fieldname            = 'UMRSL'
    IMPORTING
        e_target_field        = lf_umrsl
    TABLES
        t_oib_a10              = t_oib_a10
    EXCEPTIONS
        inconsistent_customizing = 1
        parameter_not_in_itab    = 2
        OTHERS                    = 3.

```

```

IF sy-subrc <> 0.
    MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
        WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
        RAISING calculation_failure.
ENDIF.

```

```

CALL FUNCTION '/QTYW/GET_OIB01'
    EXPORTING
        i_umrsl                = lf_umrsl
    CHANGING
        ie_oib01                = ls_oib01
    EXCEPTIONS
        umrsl_not_exists = 1
        OTHERS            = 2.

```

```

IF sy-subrc <> 0.
    MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
        WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
        RAISING calculation_failure.
ENDIF.

```

```

*/ set the output values as default
ls_calc_e = ls_calc.

```

```

* PLACE YOUR CUSTOMER SPECIFIC CALCULATION INCLUDING MESSAGES HERE:

```

```

* END YOUR CUSTOMER SPECIFIC CALCULATION LOGIC INCLUDING MESSAGES HERE:

```

```

*/=====
*/ Upload / pass back the values
*/=====

```

```

CALL FUNCTION '/QTYW/MV_BCP_CALC_TO_ITAB'
    EXPORTING
        i_structure            = ls_calc_e
        i_non_initial_only    = ' '
    TABLES
        t_oib_a10              = t_oib_a10
    EXCEPTIONS

```

```
        transfer_error      = 1
        OTHERS              = 2.
IF sy-subrc <> 0.
    MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
        WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
        RAISING calculation_failure.
ENDIF.
ENDFUNCTION.
```

9.2.3. Z_EXAMPLE_FMTYP_7_5_DIM1_DIM2

```

FUNCTION z_example_fmtyp_7_5_dim1_dim2.
*-----
*""Local Interface:
*  TABLES
*    T_OIB_A10 STRUCTURE OIB_A10
*  EXCEPTIONS
*    CALCULATION_FAILURE
*-----
*****  DISCLAIMER  *****
* This Example Software is provided on an "AS IS" basis with no warranties.
* Licensee agreed to test this software carefully before using in
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* used in this code nor of the correctness of the results.
* In no event will QuantityWare GmbH be liable for any loss of profits,
* loss of use, direct, incidental, consequential, or special damages,
* regardless of whether QuantityWare GmbH has advance notice of the
* possibility of such damages.
*****

*      EXAMPLE FUNCTION FOR FMTYP 7 & 5 -  Calculations of target UoM
*                                         Quantity WITHIN UoM Loop

* NOTE - ONLY EXPERIENCED ABAP DEVELOPERS (BCP CERTIFIED) SHOULD
* Utilize such an approach to build a customer specific model

*/ Standard Dimensions (T006D) relevant for model
DATA: BEGIN OF ls_dim,
      umrsl      TYPE oib01-umrsl,
      mass       TYPE t006-dimid,      " mass dimension
      volume     TYPE t006-dimid,      " volume dimension
      energy     TYPE t006-dimid,      " energy dimension
      wghta     TYPE t006-dimid,      " weight(air) dimension
      grosvol    TYPE t006-dimid,      " gross volume dimension
      dimless    TYPE t006-dimid,      " dimensionless dimension
END OF ls_dim.

* Input/Import data incl. example for conversion group:
DATA:  ls_work      TYPE /qtyw/mqci_bcp_work,
      ls_qci_control TYPE /qtyw/qci_control,
      ls_calc       TYPE /qtyw/mqci_bcp_calc,
      ls_control1   TYPE /qtyw/sap_qci_control,
      ls_oib01      TYPE oib01,
      lf_trdim      TYPE t006d-dimid,
      lf_tgdim      TYPE t006d-dimid.

* NOTE: OTHER SERVICE FUNCTIONS CAN BE FOUND IN FUNCTION GROUP /QTYW/MQCI_DATA_SERVICES

*/ Load work parameters
CALL FUNCTION '/QTYW/MV_QCI_CONTROL_FROM_ITAB'
  EXPORTING
    i_all_fields_needed = ' '
  IMPORTING
    e_structure          = ls_qci_control
  TABLES
    t_oib_a10            = t_oib_a10

```

```

EXCEPTIONS
  parameter_not_in_itab = 1
  OTHERS                 = 2.
IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

CALL FUNCTION '/QTYW/MV_BCP_CALC_FROM_ITAB'
  EXPORTING
    i_all_fields_needed = ' '
  IMPORTING
    e_structure          = ls_calc
  TABLES
    t_oib_a10            = t_oib_a10
  EXCEPTIONS
    parameter_not_in_itab = 1
    OTHERS                 = 2.
IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

CALL FUNCTION '/QTYW/MV_OIB_A11_FROM_ITAB'
  EXPORTING
    i_all_fields_needed = ' '
  IMPORTING
    e_structure          = ls_control
  TABLES
    t_oib_a10            = t_oib_a10
  EXCEPTIONS
    parameter_not_in_itab = 1
    OTHERS                 = 2.
IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

MOVE-CORRESPONDING ls_calc          TO ls_work.           "#EC ENHOK
MOVE-CORRESPONDING ls_qci_control TO ls_work.           "#EC ENHOK
MOVE-CORRESPONDING ls_control      TO ls_work.           "#EC ENHOK

*/ Are we in display mode: then exit.
IF ls_work-wksta EQ '4'.
  EXIT.
ENDIF.

*/ load all relevant dimension ID:
CALL FUNCTION '/QTYW/GET_ALL_DIMID'
  EXPORTING
    if_umrs1          = ls_work-umrs1
  IMPORTING
    ef_umrs1          = ls_dim-umrs1
    ef_dimid_mass     = ls_dim-mass
    ef_dimid_weight_air = ls_dim-wghta
    ef_dimid_volume   = ls_dim-volume
    ef_dimid_energy   = ls_dim-energy
    ef_dimid_grosvol  = ls_dim-grosvol
    ef_dimid_dimless  = ls_dim-dimless

```



```

EXCEPTIONS
  calculation_failure = 1
  OTHERS              = 2.
IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

* Check target UoM
IF ls_work-tguom IS INITIAL.
  MESSAGE e010(/qtyw/qci) RAISING calculation_failure.
ENDIF.

*/ determine TRDIM and TGDIM
CALL FUNCTION 'DIMENSION_GET_FOR_UNIT'
  EXPORTING
    unit                = ls_work-meinh
    use_buffer_for_text = 'X'
  IMPORTING
    dimension           = lf_trdim
  EXCEPTIONS
    unit_not_found     = 1
    OTHERS              = 2.
IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

CALL FUNCTION 'DIMENSION_GET_FOR_UNIT'
  EXPORTING
    unit                = ls_work-tguom
    use_buffer_for_text = 'X'
  IMPORTING
    dimension           = lf_tgdim
  EXCEPTIONS
    unit_not_found     = 1
    OTHERS              = 2.
IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

* Interface data of SAP QCI Method DIM1 to DIM2:
* I_TRQTY  -> ls_work-trqnt
* I_TRUOM  -> ls_work-meinh
* I_TGUOM  -> ls_work-tguom
* I_TRTMP  -> ls_work-mttmp
* I_TRPRES -> ls_work-mtpres and ls_work-mtpreseh - NOT REQUIRED FOR LIQUIDS
* I_TGTMP  -> ls_work-/QTYW/ALT_TEMP and ls_work-/QTYW/ALT_TEMP_U
* I_TGPRES -> NOT REQUIRED FOR LIQUIDS
* I_TRDIM  -> lf_trdim
* I_TGDIM  -> lf_tgdim
* I_DIMMASS -> ls_dim-mass
* I_DIMMVOLUME -> ls_dim-volume
* I_DIMENERGY -> ls_dim-energy
* I_DIMDIMLESS -> ls_dim-dimless
* ITC_PARAM -> parameters in ls_work, additional data may have to
*             be loaded via additional service functions: FUGR /QTYW/MQCI_DATA_SERVICES
* C_TGQTY  -> ls_work-tgqty

```

```
* CT_RETURN -> not required, message caught automatically, W and I
* messages should be raised at the end of the function!

* PLACE YOUR CUSTOMER SPECIFIC CALCULATION INCLUDING MESSAGES HERE
*   HERE YOU CALCULATE THE QUANTITY FOR UOM ls_work-tguom

* END YOUR CUSTOMER SPECIFIC CALCULATION LOGIC INCLUDING MESSAGES HERE:

*/ load TGQTY back into interface
CALL FUNCTION '/QTYW/MOVE_FIELD_TO_ITAB'
  EXPORTING
    i_par_field_name      = 'TGQTY'
    i_par_unit_name       = 'TGUOM'
    i_par_field           = ls_work-tgqty
    i_par_unit            = ls_work-tguom
  TABLES
    t_oib_a10             = t_oib_a10
  EXCEPTIONS
    parameter_name_not_valid = 1
    unit_missing             = 2
    inconsistent_customizing = 3
    OTHERS                   = 4.

IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

ENDFUNCTION.
```

9.2.4. Z_EXAMPLE_FMTYP_C

```

FUNCTION z_example_fmtyp_c.
*-----
*""Local Interface:
*  TABLES
*    T_OIB_A10 STRUCTURE  OIB_A10
*    T_OIB_A05 STRUCTURE  OIB_A05
*    T_RETURN STRUCTURE  BAPIRET2
*  EXCEPTIONS
*    CALCULATION_FAILURE
*-----
*****  DISCLAIMER  *****
* This Example Software is provided on an "AS IS" basis with no warranties.
* Licensee agreed to test this software carefully before using in
* systems that contains productive data.
* QuantityWare GmbH can not guarantee the correctness of the formulas
* used in this code nor of the correctness of the results.
* In no event will QuantityWare GmbH be liable for any loss of profits,
* loss of use, direct, incidental, consequential, or special damages,
* regardless of whether QuantityWare GmbH has advance notice of the
* possibility of such damages.
*****

*   EXAMPLE FUNCTION FOR_FMTYP C - Own calculation after MQCI calculation

DATA:
* Input data incl. example for conversion group:
  ls_input  TYPE /qtyw/mqci_bcp_input,
  ls_oib01  TYPE oib01,
  lf_umrsl  TYPE oib01-umrsl,
  ls_quan   TYPE oib_a05.
* NOTE: OTHER SERVICE FUNCTIONS CAN BE FOUND IN FUNCTION GROUP /QTYW/MQCI_DATA_SERVICES

CALL FUNCTION '/QTYW/MV_BCP_INPUT_FROM_ITAB'
  EXPORTING
    i_all_fields_needed = ' '
  IMPORTING
    e_structure          = ls_input
  TABLES
    t_oib_a10           = t_oib_a10
  EXCEPTIONS
    parameter_not_in_itab = 1
    OTHERS                = 2.
IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

CALL FUNCTION '/QTYW/MOVE_ITAB_TO_VALUE'
  EXPORTING
    i_fieldname          = 'UMRSL'
  IMPORTING
    e_target_field       = lf_umrsl
  TABLES
    t_oib_a10           = t_oib_a10
  EXCEPTIONS
    inconsistent_customizing = 1
    parameter_not_in_itab   = 2

```

```
OTHERS                = 3.

IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

CALL FUNCTION '/QTYW/GET_OIB01'
  EXPORTING
    i_umrs1          = lf_umrs1
  CHANGING
    ie_oib01        = ls_oib01
  EXCEPTIONS
    umrs1_not_exists = 1
    OTHERS          = 2.

IF sy-subrc <> 0.
  MESSAGE ID sy-msgid TYPE sy-msgty NUMBER sy-msgno
    WITH sy-msgv1 sy-msgv2 sy-msgv3 sy-msgv4
    RAISING calculation_failure.
ENDIF.

LOOP AT t_oib_a05 INTO ls_quan.
* PLACE YOUR CUSTOMER SPECIFIC CHECK AND CALCULATION LOGIC,
* MODIFY t_oib_a05 accordingly

ENDLOOP.

ENDFUNCTION.
```

9.3. SAP QCI BAdI – Mapping to MQCI ABAP Functions

In this chapter, we provide a **high-level assignment** as to how SAP QCI BAdI methods can be mapped to customer specific MQCI ABAP functions.

9.3.1. SAP QCI BAdI OIB_QCI_CUST_PARAM

This BAdI provides one method:

- MOVE_CUST_PAR_TO_RESULT

This method is called after all UoM values of table T_QT2TAB have been calculated. Its purpose is to enable customer specific parameters to be passed back to the business application, allowing the parameters to be stored in business documents.

MQCI conversion groups already provide all possible results defined in the supported measurement standards, thus this BAdI method is classified as functionally obsolete for MQCI conversion groups.

All BCP result parameters are defined in structure /QTYW/MQCI_BCP_RESULTS and can be inspected via transaction SE12.

9.3.2. SAP QCI BAdI OIB_QCI_DET_DEF

This BAdI provides two methods:

- CHANGE_DEFAULT_DET_DATA
- DETERMINE_DEFAULT_DATA

Both methods are called before the SAP QCI function OIB_QCI_QUANTITY_CONTROL is called; thus implementations for this BAdI are also relevant for MQCI conversion groups and not part of the actual calculation logic.

9.3.3. SAP QCI BAdI OIB_QCI_DIM1_TO_DIM2

This BAdI provides two methods:

- DIMENSION_TO_DIMENSION
- AIR_BOUYANCY_OVERWRITE

MQCI conversion groups support all possible mass-to-weight standards, thus method AIR_BOUYANCY_OVERWRITE is classified as functionally obsolete for MQCI conversion groups.

MQCI conversion groups support more than 15 different calculation models, thus method DIMENSION_TO_DIMENSION is classified as functionally obsolete for MQCI conversion groups.

However, customers may have implemented their own code in this method to introduce business specific logic to the calculation or to overwrite the standard SAP QCI calculation logic. In that case, it is recommended to define a Z* ABAP function with function module types (FM Call type) C. Within such a function, a loop at the UOM result table can be implemented, and customer specific logic may be included to either manipulate the calculation results, or to perform additional calculations, which are not defined in the MQCI model function.



All such manipulations of business data must be documented and audited carefully to prevent accidental or purposeful damage to the data processed. Please refer to your existing audit documentation and plan such changes with business and auditing departments.

Only very experienced, BCP-certified ABAP developers should attempt to utilize a Z* ABAP function with function module types (FM Call type) **5** (see **Example function z_example_fmtyp_7_5_dim1_dim2**)

9.3.4. SAP QCI BAdI OIB_QCI_EXTERNALFUNC

This BAdI provides four methods:

- CALL_CUSTOMER_FUNCTION1
- CALL_CUSTOMER_FUNCTION2
- MOD_C_CODE_PARAMETER_B
- MOD_C_CODE_PARAMETER_A

MQCI conversion groups support more than 25 different CTPL (VCF) standards, thus implementations of this BAdI are classified as functionally obsolete for MQCI conversion groups.

Customer specific BAdI Implementations may be replaced by customer specific Z* ABAP function(s) with function module types (FM Call type) 5 or 7.

9.3.5. SAP QCI BAdI OIB_QCI_ROUND_QTY

This BAdI provides five methods:

- ROUND_QTY
- ROUND_AROMATICS_PARAM
- ROUND_INTERMEDIATE
- CHECK_QCI_INPUT
- CHECK_TOLERANCE

MQCI conversion groups support UoM rounding via customizing, thus method ROUND_QTY is classified as functionally obsolete for MQCI conversion groups.

MQCI conversion groups support all standards for industrial aromatic hydrocarbons and intermediate model rounding via customizing, thus methods ROUND_AROMATICS_PARAM and ROUND_INTERMEDIATE are classified as functionally obsolete for MQCI conversion groups.

Customer specific BAdI Implementations for method CHECK_TOLERANCE may be replaced by customer specific Z* ABAP function with function module types (FM Call type) C. Customer specific BAdI Implementations for method CHECK_QCI_INPUT may be replaced by customer specific Z* ABAP function with function module types (FM Call type) 9.

9.3.6. SAP QCI BAdI OIB_QCI_NATURAL_GAS

This BAdI is only relevant for natural gas conversions and is therefore not relevant for BCP conversion groups.

9.3.7. SAP QCI BAdI OIB_QCI_RAWMATERIALS

MQCI conversion groups for raw materials are provided within the template BC set, thus this BAdI is classified as functionally obsolete for MQCI conversion groups.



IMPORTANT

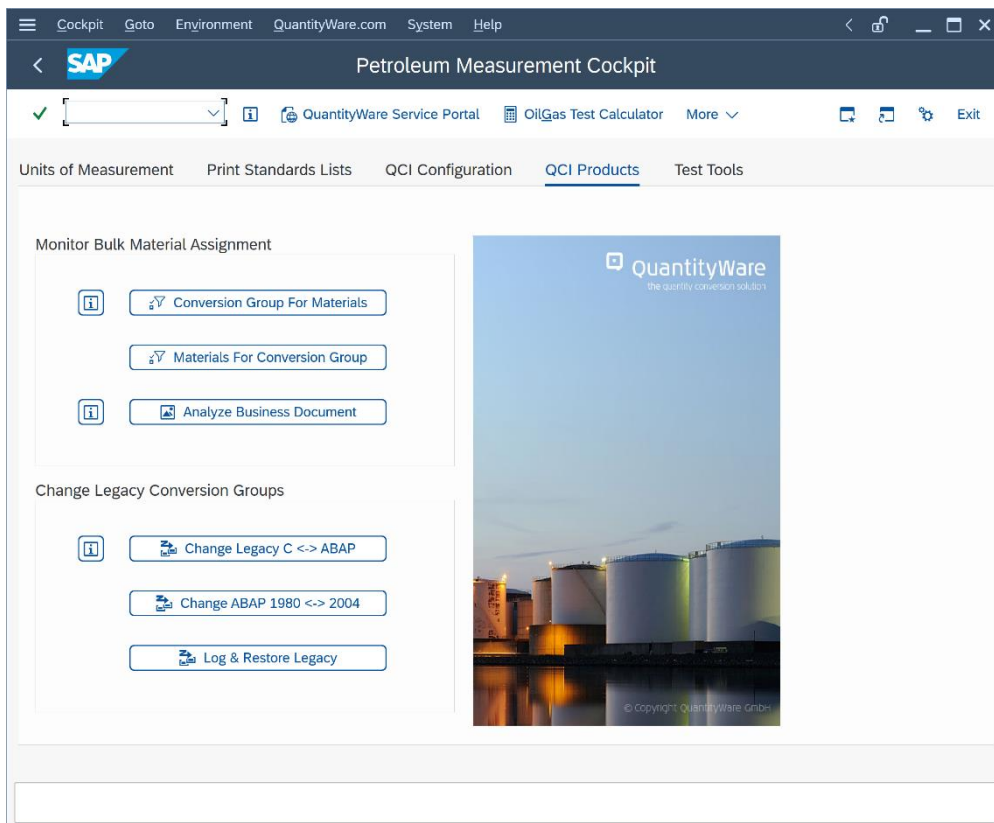
Because of the implementation of "Z*" function modules or the usage of SAP QCI BAdI, customers will no longer be able to use the QuantityWare advanced support tools as described in Note 000052 to streamline any calculation-based support requests. **DO NOT implement such additional logic unless you have created fully documented and audited test scenarios via the QuantityWare Petroleum Measurement Cockpit, as modifications of calculation data can pose significant business risks!**

10. BCP - API C to QuantityWare ABAP Migration

BCP is a non-modifying SAP certified Add-On which can also be installed into existing, productive SAP Oil, Gas, & Energy system landscapes and run in parallel with existing quantity conversion configurations.

Such productive landscapes typically operate the SAP QCI with operating system dependent API C codes for CTPL calculations. That technology is considered legacy for many reasons (high risk of cyberattacks, no transparency of calculation results - "black hole calculations", no documentation of measurement standard compliance etc.). Thus, BCP customers may decide to replace their API C code(s) (which are not designed for ERP system usage) and their associated conversion groups with the corresponding QuantityWare BCP ABAP based conversion groups.

The separate documents "[BCP 3.0 Implementation in Legacy Environments...](#)" provides a detailed migration methodology for this replacement, also using the PMC migration tools:



The migration tools are designed to map and convert SAP template "C" conversion groups to the corresponding QuantityWare ABAP conversion groups. If customers utilize their own Z* "C" conversion groups, this mapping and conversion needs to be done manually, still following the migration

methodology described in the C to ABAP methodology. To support the manual process, the following table provides the mapping of the template conversion groups (C to ABAP):

SAP QCI legacy API C	QuantityWare SAP QCI	"German rounding"
Relative Density, 60 °F:		
234A	Q105	
60RA	Q109	
234B	Q205	
60RB	Q209	
234C	Q303	
60RC	Q307	
234D	Q405	
60RD	Q409	
Density, 15 °C:		
534A	Q100	Q101
15DA	Q106	
534B	Q200	Q201
15DB	Q206	
534C	Q300	
15DC	Q304	
534D	Q400	Q401
15DD	Q406	
API Gravity, 60 °F:		
56A	Q104	
60GA	Q108	
56B	Q204	
60GB	Q208	
56C	Q302	
60GC	Q306	

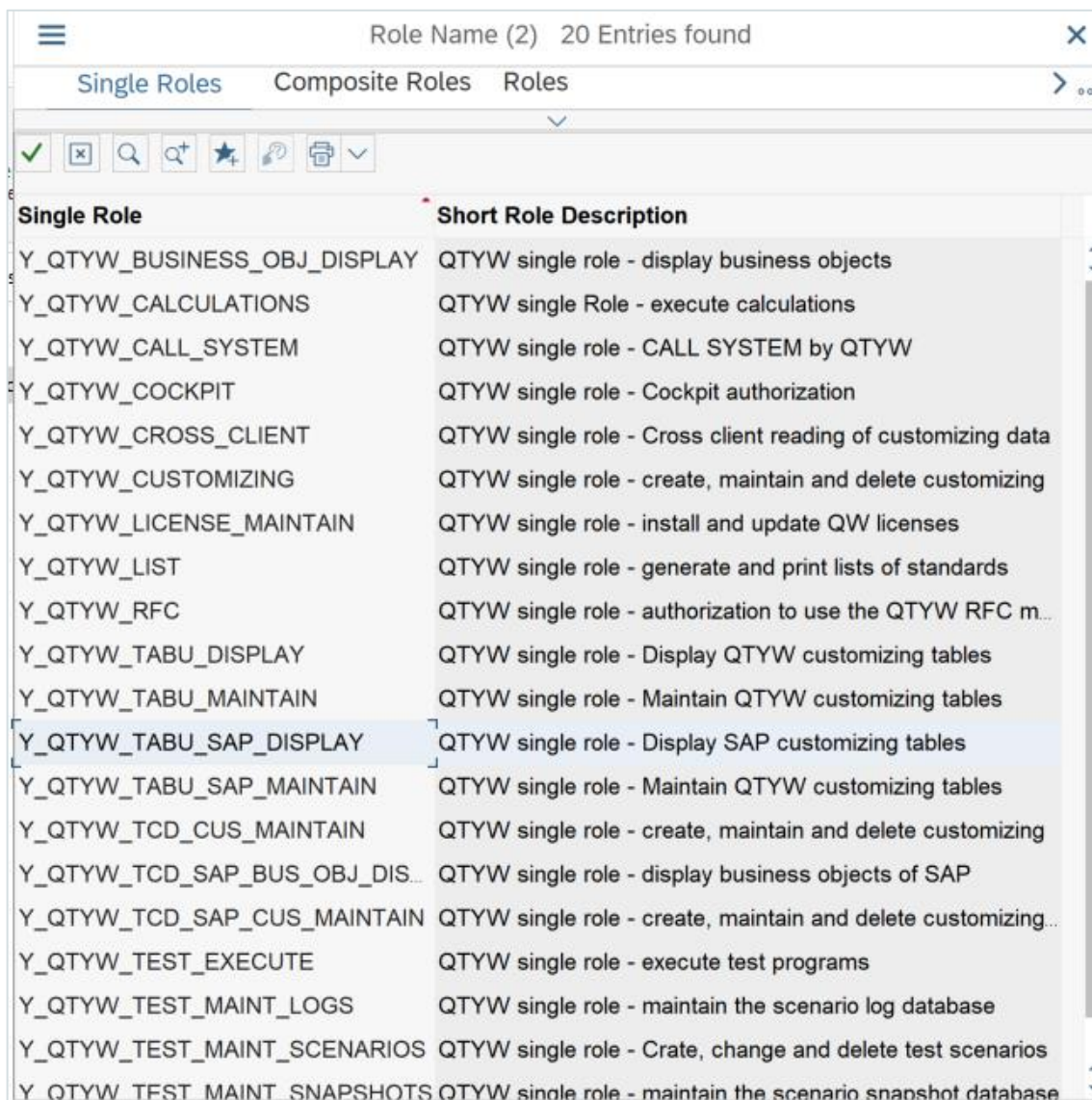
56D	Q404	
60GD	Q408	
Density, 20 °C:		
596A	Q102	Q103
20DA	Q107	
596B	Q202	Q203
20DB	Q207	
596C	Q301	
20DC	Q305	
596D	Q402	Q403
20DD	Q407	

Read QuantityWare [notes 000068](#) and [000069](#) for additional details, as well as the [FAQ C to ABAP](#).

11. BCP – Petroleum Measurement Cockpit - Security

With BCP, single roles and example composite roles for PMC and GMC access and usage (including SAP QCI legacy RFC and “call system” test reports) are defined, implemented and shipped.

13 technical authorization objects are the basis for all single roles, 20 single roles are available:



Single Role	Short Role Description
Y_QTYW_BUSINESS_OBJ_DISPLAY	QTYW single role - display business objects
Y_QTYW_CALCULATIONS	QTYW single Role - execute calculations
Y_QTYW_CALL_SYSTEM	QTYW single role - CALL SYSTEM by QTYW
Y_QTYW_COCKPIT	QTYW single role - Cockpit authorization
Y_QTYW_CROSS_CLIENT	QTYW single role - Cross client reading of customizing data
Y_QTYW_CUSTOMIZING	QTYW single role - create, maintain and delete customizing
Y_QTYW_LICENSE_MAINTAIN	QTYW single role - install and update QW licenses
Y_QTYW_LIST	QTYW single role - generate and print lists of standards
Y_QTYW_RFC	QTYW single role - authorization to use the QTYW RFC m...
Y_QTYW_TABU_DISPLAY	QTYW single role - Display QTYW customizing tables
Y_QTYW_TABU_MAINTAIN	QTYW single role - Maintain QTYW customizing tables
Y_QTYW_TABU_SAP_DISPLAY	QTYW single role - Display SAP customizing tables
Y_QTYW_TABU_SAP_MAINTAIN	QTYW single role - Maintain QTYW customizing tables
Y_QTYW_TCD_CUS_MAINTAIN	QTYW single role - create, maintain and delete customizing
Y_QTYW_TCD_SAP_BUS_OBJ_DIS...	QTYW single role - display business objects of SAP
Y_QTYW_TCD_SAP_CUS_MAINTAIN	QTYW single role - create, maintain and delete customizing...
Y_QTYW_TEST_EXECUTE	QTYW single role - execute test programs
Y_QTYW_TEST_MAINT_LOGS	QTYW single role - maintain the scenario log database
Y_QTYW_TEST_MAINT_SCENARIOS	QTYW single role - Crate, change and delete test scenarios
Y_QTYW_TEST_MAINT_SNAPSHOTS	QTYW single role - maintain the scenario snanshot database

These single roles encompass all Petroleum and Gas Measurement capabilities for which a user may be granted authority.



No additional QuantityWare authority check is performed during actual quantity conversion calculations in business transactions - all QuantityWare implementations are ABAP based calculations which are already secured via the standard SAP-suggested security concepts implemented in these transactions.

3 composite roles are delivered as examples:

Role Name (2) 3 Entries found	
Single Roles	Composite Roles
<div style="display: flex; justify-content: space-between; align-items: center;"> Print Locally </div>	
Composite role	Short Role Description
Y_QTYW_CERTIFIED_CONSULTANT	QTYW composite role - Certified BCS Consultant
Y_QTYW_EXPERT_BUSINESS_USER	QTYW composite role - Expert Business User
Y_QTYW_MEASUREMENT_SPECIALIST	QTYW composite role - Measurement Specialist

All roles are documented and accessible via standard SAP role maintenance. Role Y_QTYW_CERTIFIED_CONSULTANT must be assigned to the user ID which is used to run the QuantityWare implementation and installation test in client 045.

12. BCP - Protection of Intellectual Property

With QuantityWare BCS, QuantityWare delivers a powerful and unique quantity conversion solution to the oil & gas industries. Technically, the solution is delivered as a certified SAP Add-On to the Oil & Gas solution. To enhance customer security and protect QuantityWare GmbH's intellectual property (IP), three protection measures have been defined as an integral part of the technical ABAP solution:

- Every BCS customer requires a valid software license key to execute quantity conversions. The license key is checked each time a quantity conversion is triggered
- The ABAP source code that implements the license check logic, the QuantityWare MQCI and all central ABAP implementations of CTPL / CTPG standards are technically defined – using standard SAP methods – to be SAP system programs and thus cannot be debugged
- All code comments (approx.. 170 000 lines of comments from a total of approx.. 970 000 lines of code & comments) marked internally with */ and empty lines are removed from all BCS ABAP sources before shipment of BCS.

Measurement standards can be divided into four major classes:

- Standards defining the conversion factors between units of measure “of the same kind”
- Standards defining the corrections of the effect of temperature and pressure onto the liquid or gas (CTPL / CTPG)
- Standards defining the mass to weight conversions
- Standards defining the quantity conversion calculation model

Since CTPL / CTPG standards are the most complex to implement and on the other hand, once correctly implemented, do not require any code changes, all such implementations cannot be debugged in customer systems. The functional accuracy and correctness of such implementations is validated via dedicated installation test programs (based on implementation tests defined in the related measurement standards) and list printing reports (accessible via the PMC or GMC) and can be reproduced and tested by each customer without having to debug the ABAP source code. Software license installation is documented in the BCS Technical Installation Guide.



If required, it is still possible to debug SAP QCI or MQCI calculation model steps for any conversion group in customer systems, since the CTPL implementation results (typically calculating a base density or CTPL factor) can be accepted as being correct during debugging and can be validated independently (using the validation procedures described above which are available in the PMC and GMC)

13. Abbreviations

In this section, we provide a list of abbreviations used in the BCP documentation documents. For detailed explanations of the terms, refer to the individual BCP documentation documents:

ABNT Associação Brasileira de Normas Técnicas (Brazilian National Standards Organization)

AGA American Gas Association

API (1) American Petroleum Institute

API (2) SAP commercial key for API gravity unit

ASTM ASTM International (originally, "American Society for Testing and Materials")

BAdI Business Add In (SAP term)

BCG Bulk Calculations - Gas

BCP Bulk Calculations – Petroleum

BCU Base Conversion Unit

BTI BaTch Input (SAP term)

CPL Correction factor for the effect of Pressure on the Liquid

CSP Component Support Package

CTPL Correction factor for the effects of Temperature and Pressure on the Liquid

CTL Correction factor for the effect of Temperature on the Liquid

DIN Deutsches Institut für Normung e.V.

GERG	Groupe Européen de Recherches Gazières
GMC	Gas Measurement Cockpit
GOST	Gossudarstwenny Standard – Russian standard organization
GPA	Gas Processors Association
GRC	Governance, Risk management & Control
HPM	Hydrocarbon Product Management (SAP term)
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MQCI	Model based Quantity Conversion Interface
MPMS	Manual of Petroleum Measurement Standards (API term)
NGL	Natural Gas Liquids
NIST	National Institute of Standards and Technology
PAIG	Project Assessment and Implementation Guidelines
PMC	Petroleum Measurement Cockpit
QCI	Quantity Conversion Interface (SAP term)

ROI Return On Investment

SI Système International d'unités

TD Transportation and Distribution (SAP term)

TSW Traders and Schedulers Workbench (SAP term)

UoM Unit of Measure or Unit of Measurement

VCF Volume Correction Factor

14. BCP - Documentation Rules



The decimal point and thousand separators for numbers and quantity values for BCP documentation documents are defined as follows: The decimal point is a dot '.', the thousand separator is a comma ',' or space ' '. Example: 123,456.987 or 123 456.987. Owing to the definition of business-relevant scenarios in our systems, numbers in screen prints may display differing formats.



For unit of measure symbols and spelling of unit names, NIST special publication 811 (latest version) is relevant – see the document “BCP 3.0 supported standards” for details

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