

## **Bulk Calculations - Petroleum BCP 3.0**

### Supported Standards Manual

Lists the standards supported  
by BCP 3.0 at the time of  
document publication

## Notes

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### Valid for BCS 3.0 “Technical” Releases:

SAP Release	BCS Release	CSP Level
ECC600+	30A	001
S/4HANA 1610	30B	000
S/4HANA 1709	30B	000
tba	tba	tba

Your release level can be determined via:

“/o/QTYW/COCKPIT” -> “Cockpit” -> “Support Package Level”

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## Version History

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BCS 3.0 CSP01 v00	31.03.2017	Initial Release
<b>BCS 3.0</b>	26.05.2017	IMPORTANT: Nomenclature changed to support additional SAP basis releases for BCS 3.0 (see page ii/v)
BCS 3.0	26.05.2017	Updated ISO 91:2017 support/clarified ISO 91-1:1992 support
BCS 3.0	10.11.2017	S/4HANA 1709 validity added - Support of ASTM D1555(M)-2016 and ISO 6578:2017 (LPG) added



## Bulk Calculations Petroleum – Supported Standards

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Bulk product quantity conversions in SAP Oil & Gas systems are defined by four different types of measurement standards. All four types of standards are equally relevant and need to be considered for your quantity conversion configuration:

- Standards defining the calculation model
- Standards defining Correction factors due to effects of Temperature and Pressure on Liquid product volumes – CTPL standards
- Standards defining conversions between mass and weight
- Standards defining conversion factors between units of measure (UoM) of the same quantity (SAP dimension)

BCP 3.0 provides implementation procedures and preconfigured conversion groups that are based on these four standard types. The exact designation of these standards is listed in the following sections.

### Standards - Calculation Model

1. API MPMS Chapter 12
2. EN ISO 4267 - Part 2
3. DIN 51650-06
4. Business practice models – linear DCF (Density Correction Factor) model
5. SAP QCI legacy model with BAdI implementations

Added complexity must be considered (e.g. for LPG vapor space calculations, sediment & water calculations, alcohol % calculations, different base conversion unit sets etc.) such that at the time of document publication, QuantityWare BCP 3.0 supports 17 calculation models for liquid bulk products. Note that not all calculation model correction factors of API MPMS Chapter 12 and EN ISO 4267 - 2 are relevant for ERP processes and are thus not supported in the respective models.

### Standards - Temperature and Pressure Corrections – CTPL Standards

1. ISO 91:2017
2. API MPMS Chapter 9.1 - ASTM D1298-99
3. API MPMS Chapter 11.1 – 2004 - ASTM D1250-04
4. API MPMS Chapter 11.1 – 1980 - ASTM D1250-80 (including 1984 and 1988 revisions)
5. Petroleum Measurement Tables 1952 - Historical Edition – ASTM D1250-52: Table 6
6. API MPMS Chapter 11.2.1(M)
7. API MPMS Chapter 11.2.2(M)
8. API MPMS Chapter 11.2.4 - GPA TP-27
9. API MPMS Chapter 11.2.5 - GPA TP-15
10. API MPMS Chapter 11.3.3 – 2015
11. API MPMS Chapter 11.3.3 – 2011
12. QuantityWare extension of GPA TP-27 for 20 °C (and other base temperatures)
13. GPA TP-25
14. QuantityWare extension of GPA TP-25 for 15 °C and 60 °F
15. ASTM D1555-16
16. ASTM D1555M-16
17. ASTM D1555M-08
18. ASTM D1555-09
19. ASTM D1555-04a
20. ASTM D1555M-04a



21. ASTM D1550-94(15)
22. ASTM D4311-15
23. QuantityWare extension for 20 °C base temperature of ASTM D4311-15
24. ASTM D4311-09
25. QuantityWare extension for 20 °C base temperature of ASTM D4311-09
26. ASTM D4311-04
27. ASTM D633-11(16)
28. ASTM D633-97(05)
29. ASTM D2962-10
30. ASTM D2962-97(07)
31. ABNT NBR 5992-08
32. ABNT NBR 5992-80
33. Bol. téc. PETROBRAS, Rio de Janeiro, 43 (1): 11-18, jan./mar. 2000
34. BS EN 14214:2012
35. Linear density correction factor (DCF) calculation
36. Linear volume correction factor (VCF) calculation
37. DIN 51757-11
38. DIN 51757-94
39. ISO 6578:2017 - LPG
40. ISO 6578:1991 - LPG
41. C.N.P. 6 – 70 Tabela 2
42. ISO 91-1:1992<sup>1</sup>
43. ISO 91-2:1991
44. ISO 3675:1998

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<sup>1</sup> Support of historical 1953 metric edition - Tables 53 and 54 for LPG - not included

### Standards - Conversions between Mass and Weight

1. ISO 91:2017
2. API MPMS Chapter 11.5, Part 1, 2 and 3 - ASTM D1250-08(13)<sup>e1</sup>
3. ISO 91-1:1992 - Tables 8, 26, 56
4. Petroleum Measurement Tables Volume XI/XII - ASTM D1250-80: Tables 8, 26, 56
5. Petroleum Measurement Tables 1952 - Historical Edition – ASTM D1250-52: Table 11
6. DIN 51757-11
7. DIN 51757-94

### Standards - UoM Conversion Factors

1. API MPMS Chapter 15 – Guidelines for the Use of the International System of Units (SI) in the Petroleum and Allied Industries
2. API MPMS Chapter 11.5 – Annex D - ASTM D1250-08(13)<sup>e1</sup>
3. Petroleum Measurement Tables Volume XI/XII - ASTM D1250-80: Table 1
4. IEEE/ASTM SI 10<sup>TM</sup> – American National Standard for the Use of the International System of Units (SI): The Modern Metric System (2002)
5. NIST – Guide for the Use of the International System of Units (SI) - Special Publication 811 – 2008
6. BIPM – Le Système international d’unités (SI) – 2006

## Annex A: Products - ASTM D1250

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BCP 3.0 covers all procedures of the:

*API Manual of Petroleum Measurement Standards*

*Chapter 11- Physical Properties Data*

*Section 1            Temperature and Pressure Volume*

*Correction Factors for Generalized*

*Crude Oils, Refined Products, and Lubricating Oils*

*Adjunct to: ASTM D1250-04 and IP 200/04*

### ***Herein referred to as ASTM D1250-04***

BCP 3.0 covers all procedures of the:

*API Manual of Petroleum Measurement Standards*

*Chapter 11- Physical Properties Data*

*Section 1            Temperature Volume*

*Correction Factors for Generalized*

*Crude Oils, Refined Products, and Lubricating Oils*

*Adjunct to: ASTM D1250-80 and IP 200/80, ISO 91-1*

### ***Herein referred to as ASTM D1250-80***

Both ASTM D1250-04 and ASTM D1250-80 support the same products and coexist next to each other (See Annex A1 (Mandatory Information) in ASTM D1250-08(13)). Read the QuantityWare working paper WP\_QuantityWare\_Comparison\_ASTM\_D1250\_2004\_1980 available in the Knowledge base at [www.quantityware.com](http://www.quantityware.com) if you are interested in the differences between these two versions.

## Crude Oil

Generalized crude oils in the range of  $-10^{\circ}\text{API}$  to  $100^{\circ}\text{API}$  gravity are supported.

## Refined Products

### Gasoline

Motor gasoline and unfinished gasoline blending stock with a base density range between approximately  $50^{\circ}\text{API}$  and  $85^{\circ}\text{API}$ . Examples:

- premium gasoline
- gasoline
- unleaded gasoline
- motor spirit
- clear gasoline
- low lead gas
- motor gasoline
- catalyst gas
- alkylate
- catalytic cracked gasoline
- naphtha
- reformulated gasoline
- aviation gasoline

### Jet Fuels

Jet fuels, kerosene, and Stoddard solvents with a base density range between approximately  $37^{\circ}\text{API}$  and  $50^{\circ}\text{API}$ . Examples:

- jet fuel A
- jet kerosene
- aviation jet A
- kerosene
- aviation turbine fuel
- Stoddard solvent
- white kerosene
- JP-2
- JP-8

### Fuel Oils

Diesel oils, heating oils and fuel oils with a base density range between approximately  $-10$  °API and  $37$  °API. Examples:

- No. 6 fuel oil
- fuel oil PA
- low sulfur fuel
- LT (low temperature) fuel oil
- fuel oil
- fuel oil LLS (light low sulfur)
- No. 2 furnace oil
- furnace oil
- auto diesel
- gas oil
- No. 2 burner fuel
- diesel fuel
- heating fuel
- premium diesel

### Lubricating Oils

Generalized lubricating oils with an initial boiling point greater than  $700$  °F ( $370$  °C) and in the density range between approximately  $-10$  °API to  $45$  °API are supported.

### Special Applications

Products derived from petroleum or petroleum-based with minor proportions of other constituents and have been tested to establish a specific thermal expansion factor.

### Waxy Crudes

Certain ranges can be calculated using ASTM D1250.

### Natural and Drip Gasolines

Certain ranges can be calculated using ASTM D1250.

Natural gasolines are a part of the Generalized Crude Oil commodity group. Drip gasoline is a mixture of natural gas liquids, primarily butanes, pentanes, hexanes, and heptanes. Drip gasoline is also a part of the Generalized Crude Oil commodity group. Aromatic natural gasoline is a part of the Generalized Refined Products commodity group.

### Reformulated Fuels

The Special Application procedure can be used for all gasoline, oxygenates, and mixtures. See API MPMS Chapter 11.1.

### MTBE

Methyl tertiary butyl ether can be calculated as special application at 60 °F with a thermal expansion factor of  $789.0e-06 / ^\circ\text{F}$ .

### JP-4

JP-4 is best represented as Generalized Crude Oil or Special Application. See API MPMS Chapter 11.1 for details.

### Pure Compounds

- Pure paraffinic compounds (C5+) are well represented as Generalized Crude Oil.
- Non-paraffinic pure compounds (C5+) can be treated as a Special Application.

### Gasohol

Gasohol can be calculated as Special Application at 60 °F with a thermal expansion factor of  $714.34e-06 / ^\circ\text{F}$ . (Products up to and including a 10% ethanol component).

### Ethanol Fuel Mixtures

E5 and E7 and E10 are covered by ASTM D1250.

▲ *The product list in this Annex is cited from:*  
*“THE USE OF THE PETROLEUM MEASUREMENT TABLES – Manual of Petroleum Measurement Standards, Chapter 11.1, American Petroleum Institute, Revised October 1995” and API MPMS Chapter 11.1 – 2004*

### Biofuels

Read the QuantityWare working paper "Biofuel Measurement Standards Selection" for detailed guidance, which is available in the Knowledge Base at [www.quantityware.com](http://www.quantityware.com).

## Annex B: Products – Other Standards

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### LPG and NGL

1. Should be calculated using API MPMS 11.2.4 - GPA TP-27. This standard is implemented in BCP 3.0. The preceding standard, GPA TP-25, has been superseded by GPA TP-27.
2. If an LPG product contains 20% or more of unsaturated hydrocarbons, the density shall be calculated given one of the methods in ISO 6578. ISO 6578 is implemented in BCP 3.0.
3. If the sale of product or the calculation of densities and quantity conversion takes place in Germany, use the X method defined in DIN 51757 and calculation procedures defined in DIN51650. This standard is implemented in BCP 3.0.

### LNG

Standards concerning these products are not implemented in BCP 3.0. LNG calculations are fully supported in the separately licensable QuantityWare product BCG 3.0 - Bulk Calculations - Gas.

### Cyclohexane and Industrial Aromatic Hydrocarbons

1. Use ASTM D1555 or 1555M. This standard is implemented in BCP 3.0.
2. If the sale of product or the calculation of densities and quantity conversion takes place in Germany, use the Y method defined in DIN 51757 and calculation procedures defined in DIN51650. This standard is implemented in BCP 3.0.

### Asphalt

1. Asphalt can be calculated using ASTM D4311. This standard is implemented in BCP 3.0. QuantityWare has implemented the formula based calculation as defined in ASTM D4311-04, ASTM D4311-09 and ASTM D4311-15.
2. If the sale of product or the calculation of densities and quantity conversion takes place in Germany, use the X method defined in DIN 51757 and calculation procedures defined in DIN51650. This standard is implemented in BCP 3.0.

▲ Note that when calculating a volume correction factor using the formula and constants defined in ASTM D4311-04/09, the results do not always match with the printed table values in ASTM D4311-04/09.

### Road Tars

Road Tars should be calculated using ASTM D633. This standard is implemented in BCP 3.0.

### Bio Diesel

Automotive fuels – Fatty acid methyl esters (FAME) for diesel engines according to the European standard: BS EN 14214:2012 Bio Diesel. This standard is implemented in BCP 3.0. This European Standard specifies requirements and test methods for marketed and delivered FAME to be used either as automotive fuel for diesel engines at 100% concentration, or as an extender for automotive fuel for diesel engines in accordance with the requirements of EN 590. For bio fuel mixtures, read the QuantityWare working paper "Biofuel Measurement Standards Selection" for detailed guidance, which is available in the Knowledge Base at [www.quantityware.com](http://www.quantityware.com)

### Ethanol

1. Ethanol conversions are supported with ABNT NBR 5992-80 and ABNT NBR 5992-08. This standard is implemented in BCP 3.0. This standard calculates volumes (at the base temperature of 20 °C and various alternate temperature bases) and masses and weights (total product and alcohol portion) based on the input values (mass ratio and observed volume or test density) for a temperature range of 10 °C to 40 °C.
2. Alternatively, API MPMS Chapter 11.3.3 "Miscellaneous Hydrocarbon Product Properties – Ethanol Density and Volume Correction Factors" may be used. This standard is implemented in BCP 3.0.
3. Linear DCF calculations are also relevant for ethanol quantity conversions.

### Ethylene and Propylene

1. The temperature correction should be calculated using API MPMS Chapter 11.3.2.1 and 11.3.2.2 - not implemented with BCS 3.0.
2. ISO 6578 also supports temperature correction calculations for propane/propylene mixtures. This standard is implemented in BCP 3.0.
3. The ASTM D1250-04 standard can be used to calculate the pressure portion of the volume correction factor if required.

### Butadiene

1. The temperature corrections should be calculated using ASTM D1550. An implementation is included in BCP 3.0.
2. The ASTM D1250-04 standard can be used to calculate the pressure portion of the volume correction factor if required.



### **Bulk Chemicals**

Bulk chemicals can be calculated utilizing a linear density correction factor (DCF) best practice standard, which is globally used by terminal operating companies. This standard is implemented in BCP 3.0.

## Annex C: CPL Standard Integration

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The following three standards define CPL calculations:

- API MPMS Chapter 11.2.1(M): Crude oil & products
- API MPMS Chapter 11.2.2(M): LPG
- API MPMS Chapter 11.1 -2004: Crude oil & products

Due to technical restrictions within the SAP QCI calculation logic, support of CPL calculations is only possible and thus provided for MQCI conversion groups, in conjunction with the appropriate CTL standard.

1. If static tank vapor space calculations are applied, no CPL correction is applied.
2. The CPL calculation introduces the material/observed pressure and allows calculation of a CTPL to correct observed volumes (or transaction - observed and standard - volumes only).
3. Test density values are not corrected and are assumed to be either available at base conditions or to require temperature corrections only.

For the following MQCI CTL standards the CPL calculation is supported:

- API MPMS Chapter 11.1-2004 adjunct to ASTM D1250-04
- API MPMS Chapter 11.1-1980 adjunct to ASTM D1250-80
- ASTM D1250-52 – Table 6
- C.N.P. No. 6 1970 Table II
- API MPMS Chapter 11.2.4 - GPA TP-27
- ISO 6578-91- LPG

## Annex D: Standard Range Limit Extensions

CTPL and mass/weight conversion standard implementations are typically valid for defined range limits of input data (density, temperature, pressure values). The most complex limit definitions are those defined for ASTM D1250-04 and ASTM D1250-80, which are documented here:

### Temperature, Pressure, and Density Limits of ASTM D1250-04

Density limits

Density	Crude Oil	Refined Products	Lubricating Oils
Density kg/m <sup>3</sup> @ 60 °F	610.6 to 1 163.5	610.6 to 1 163.5	800.9 to 1 163.5
Relative Density @ 60 °F	0.611 20 to 1.164 64	0.61120 to 1.164 64	0.801 68 to 1.16 46
°API Gravity @ 60 °F	100.0 to -10.0	100.0 to -10.0	45.0 to -10.0
Density kg/m <sup>3</sup> @ 15 °C	611.16 to 1 163.79	611.16 to 1 163.86	801.25 to 1 163.85
Density kg/m <sup>3</sup> @ 20 °C	606.12 to 1 161.15	606.12 to 1 160.62	798.11 to 1 160.71

Temperature and pressure limits

Unit	Crude Oil, Refined Products, Lubricating Oils
°C	-50.00 to 150.00
°F	-58.0 to 302.0
Psi(gauge)	0 to 1 500
kPa(gauge)	0 to 1.034e+04
Bar(gauge)	0 to 103.4
Alpha 60/°F	230.0e-06 to 930.0e-06
Alpha 60/°C	414.0e-06 to 1674.0e-06

## Temperature and Density Limits of ASTM D1250-80

### Density Limits

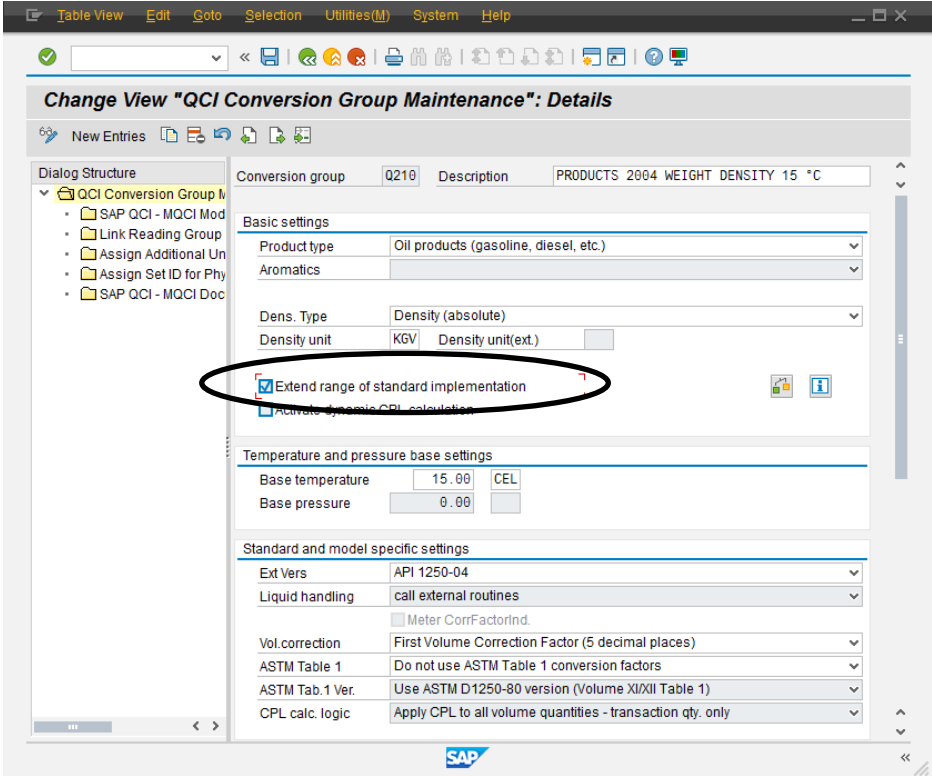
Density	Crude Oil	Refined Products	Lubricating Oils
Relative Density @ 60 °F	0.611 0 to 1.076 0	0.653 0 to 1.076 0	0.800 0 to 1.164 0
°API Gravity @ 60 °F	100.0 to 0.0	85.0 to 0.0	45.0 to -10.0
Density kg/m <sup>3</sup> @ 15 °C	610.0 to 1 075.0	653.0 to 1 075.0	800.0 to 1 164.0
Density kg/m <sup>3</sup> @ 20 °C	610.0 to 1 075.0	653.0 to 1 075.0	800.0 to 1 164.0

### Temperature

Unit	Crude Oil, Refined Products, Lubricating Oils
	-18 to 150 (Crude, Refined, Special)
°C	-20 to 150 (Lubricants)
°F	0 to 300
Alpha 60/°F	270.0e-06 to 970.0e-06
Alpha 15/°C	486.0e-06 to 1 674.0e-06

Although the range limits of ASTM D1250-04 have been extended in comparison to ASTM D1250-80, it may still be a business requirement to further extend these limits.

Whenever it is technically feasible, QuantityWare ABAP implementations of all CTPL and mass-to-weight standard support such range extensions via one single customizing setting, where you simply set the “Extend range of standard implementation” indicator for a conversion group.



If you decide to extend the range limits for a certain conversion group, it is strongly recommended to define customer specific range limit checks for that conversion group, in order to prevent fraudulent usage or input of corrupted data.

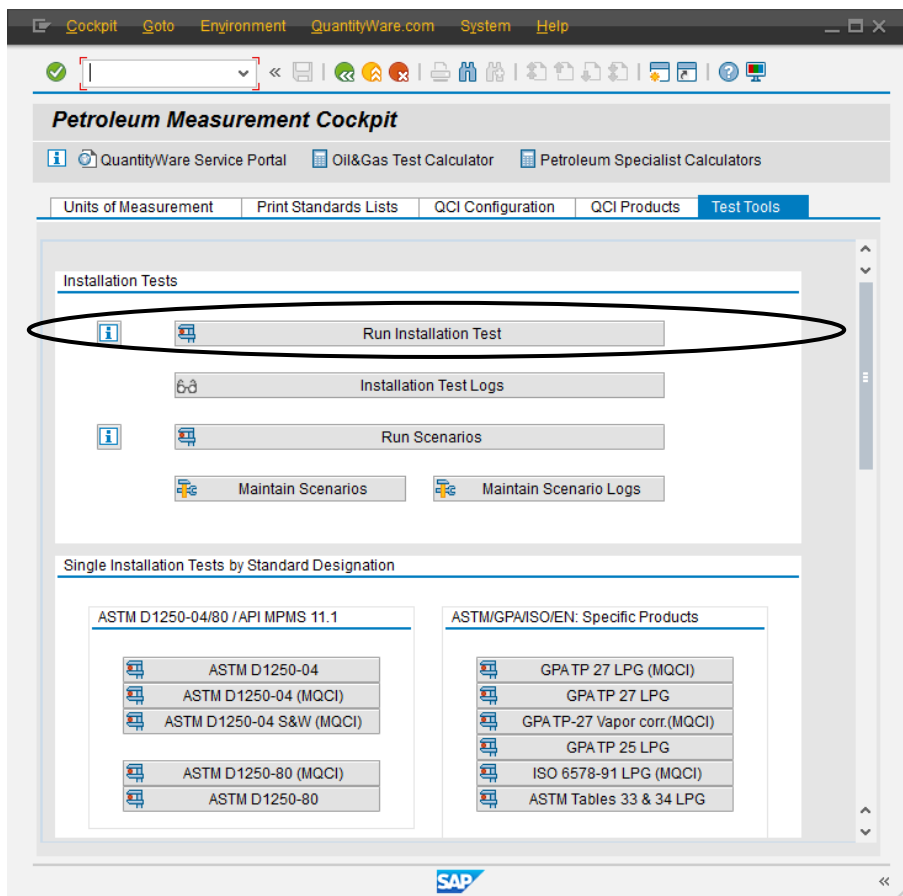
## Annex E: Supported Standards – Installation Test

For all standard implementations, QuantityWare delivers an individual installation test, which is accessible via the PMC. Each test is implemented as a SAP test report, which typically executes two test cases. The BCP 3.0 Installation Test is then the sum of:

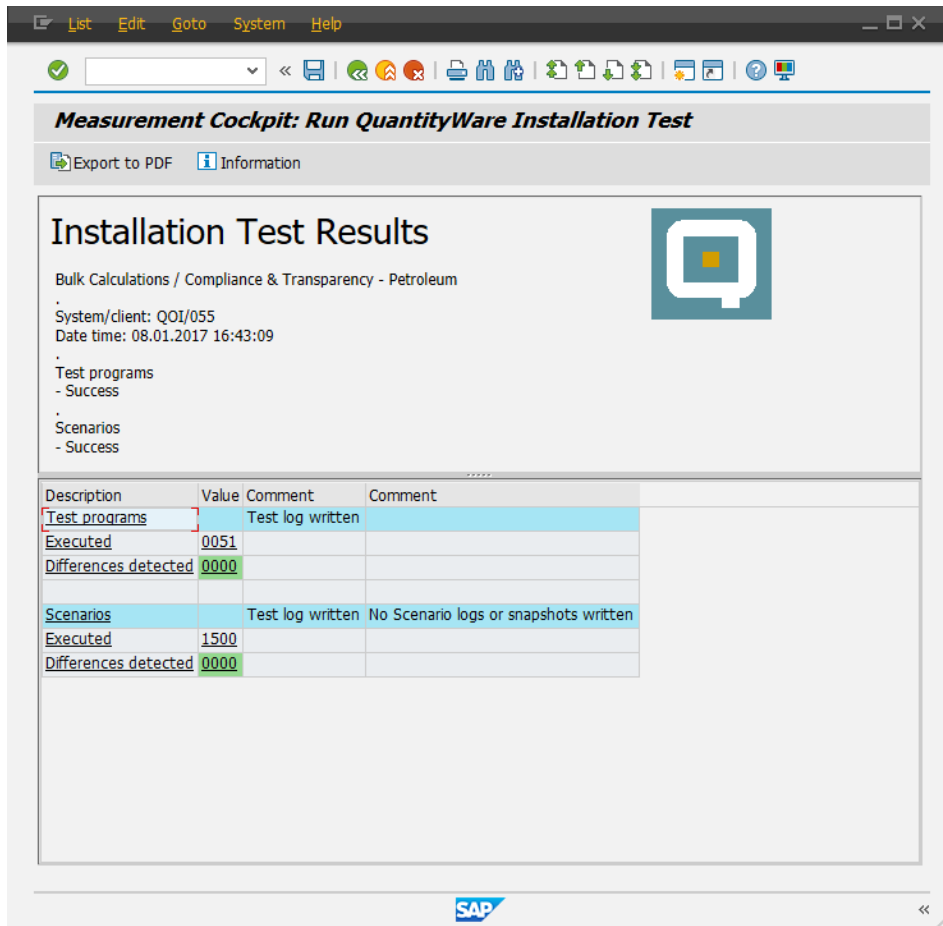
- All individual standard installation tests
- Additional integration test reports
- 1 500 Test Scenarios

The BCP 3.0 Installation Test is executed with one click from the PMC and is to be performed only in the QuantityWare template client 045, in one dedicated system in your system landscape:

Execution of the Installation Test is started while logged on to the BCP 3.0 template client (045), where you simply click on “Run Installation Test” in tab strip “Test Tools” of the PMC:



If the test is executed successfully, you see the following list:



**Installation Test Results**

Bulk Calculations / Compliance & Transparency - Petroleum

System/client: QOI/055  
Date time: 08.01.2017 16:43:09

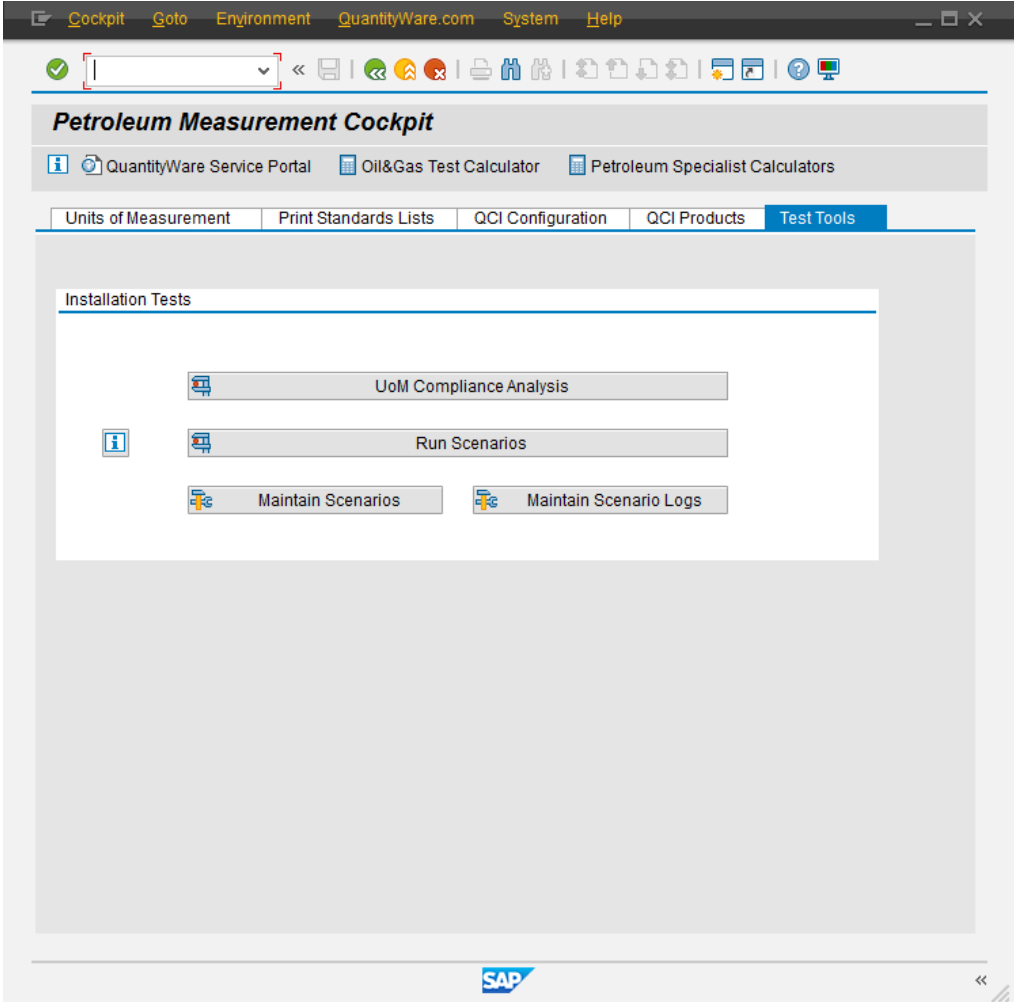
Test programs  
- Success

Scenarios  
- Success

Description	Value	Comment	Comment
Test programs		Test log written	
Executed	0051		
Differences detected	0000		
Scenarios		Test log written	No Scenario logs or snapshots written
Executed	1500		
Differences detected	0000		

If you want to execute a single test for a specific standard, you may access all tests from this list directly.

▲ *If you log on to a client where the QuantityWare BC set has not been activated, you will not have access to the BCP 3.0 Installation Test via the Petroleum Measurement Cockpit – without the configuration template data delivered with the BC set, the Installation Test would only run with errors due to missing configuration data.*



More details can be found in the BCP 3.0 Documentation Reference Manual.