QuantityWare

Bulk Calculations Solution

QuantityWare Interface – PRA Measurement System

A Working Paper describing principles and configuration steps required for the use of QuantityWare Calculations with the PRA Measurement System

Version History

Version	Date	Description
00	2015-03-27	Initial Version
00_01	2017-08-02	Editorially revised and confirmed
00_02	2020-07-17	Editorial revision
02	2021-09-24	Modern QW document style applied

Contents

1. PRA Measurement System

The PRA (Production Revenue Accounting) Measurement System provides a flexible method of recording measurement readings for all PRA business objects. It supports and calls the Quantity Conversion Interface (SAP QCI). The PRA Measurement System is called by PRA to:

- Provide a single point of data entry for the observed reading data e.g. from wells or measurement points
- Call the SAP QCI to convert a reading volume into standardized units
- Pass the required data back to the calling PRA transactions

During daily operations PRA will require various values, such as Measurement Point Volumes (MP_VOLUMES) or Well Completion Volumes (WC_VOLUMES).

The standardized values required by PRA are dependent on the product type:

- For oil and condensate: Volume and density
- For gas: Volume or energy, or both and heating value

1.1. Types of Calculations

There are different types of calculations. The QCI is called by the function “OIU_QCI_STD_CONVERSION” for:

- Calculations of oil products and condensates
- Calculations of gas products via BAdI implementation

1.1.1. Gas Products

The current PRA solution can process gas under low pressure and dry or wet conditions.

The conversion group USGS - NATURAL GAS U.S. BASE CONDITIONS has been developed to support such calculations, via the SAP QCI low pressure conversion routines, and wet to dry conversions being based on an example BAdI implementation OIU_WET_DRY_EXAMPLE, which implements a formula defined by the PRA development team based on legacy calculation logic defined in the PREMAS system. There is currently no need to support any other standard in the United States; therefore the settings provided by SAP can be used after thorough validation.

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1.1.2. Oil, Condensate, Liquids

The measured quantities of these products have to be converted to standard conditions.

For such conversions, SAP provides an interface supporting the ASTM D1250-80 standard, based on the legacy “C-Code” implementation from the API. The related conversion group and Measurement System customizing settings are also provided.

For various reasons, we recommend usage of the QuantityWare ABAP D1250-80 solution instead of the legacy “C-Codes” or, that customer’s use the current standard ASTM D1250-04 – (as required by the CBP - Customs and Border Protection). For business reasons (e.g. existing customer agreements), customers may need to use different versions of ASTM D1250 standard for different materials.

Additional standards may be required to support addition products. E.g. GPA 8217 / TP-27 (legacy version TP-25) is required for the calculation of LPG.

The PRA Measurement System provides the flexibility to handle such cases.

It is possible to customize the use of different standards by different networks and also to change the calculation standard of existing networks.

1.2. Main objects of the Measurement System

The Measurement System contains objects to select and control measurements, their conversion and transport of the conversions' results.

1.2.1. Measurement Classes

Are used for the classification of business objects, such as WC_VOLUMES (Well Completion Volumes), etc. Each Measurement Class has a set of Measurement Types assigned to it. The Measurement Classes are hard coded in the PRA measurement transactions.

1.2.2. Measurement Types

Are a consistent set of readings to be taken for a business object in a Measurement Class.

These control:

- Input screen fields, their layout and defaults
- The calculation to be used
- Field transport and measurement documents

1.3. Controlling the Measurement Process

Besides the Measurement Class of the PRA transaction, two more objects control the measurement process:

1. **Material** - with the related Major and Minor Product code assigned

   E.g.:

   - Material EP100
   - Major Product code: 0 - Oil
   - Minor Product Code: 00 - general oil

   The Measurement Type will be selected by:

   - Measurement Class WC_VOLUMES
   - Major Product Type 0
   - Minor Product Type 00

E.g.: WC_VOLUMES, 0, 00 => WCDVLLOILC

This is the Measurement Type which contains all required settings and controls for the related measurement process. All possible fields, the conversion and the field transport are assigned to the Measurement Type.

The selected Measurement Type is also responsible for the QCI Interface fields' definition.

2. **Measurement Group** with the assigned CONVGR (Conversion Group) and UOMGR (Unit of Measure Group).E.g.: 125004_60A with the assigned:

   CONVGR: Q108 - ASTM D1250-05, CRUDE OIL 2004 API GRAVITY 60 °F

   UOMGR: USL - Units BB6, LB

The CONVGR controls the QCI Conversion Group and the UOMGR defines for what Units of Measure the quantities are calculated, and the input screen field defaults.

1.3.1. Process Overview

1. Selection of Measurement type by:
    - Measurement Class
    - Material with assigned Major and Minor Product Code

2. The selected Measurement Type contains:
    - All needed screen input fields and their characteristics
    - The calculation and needed interface fields
    - The required field transports

3. The Measurement group with the assigned Conversion Group and Unit of Measure Group determines:
    - The QCI Conversion Group to be used
    - The selected input fields' default values and characteristics.

1.4. Measurement System Flexibility

As described in Chapter 1.3, the Measurement System can be customized to create and control any required input screen. It can call any assigned existing QCI calculation function by using the standardized QCI interface and it can show the results on the input screen generated.

It passes the results to the PRA application as defined by the field transports.

It fulfils all current productive requirements of the PRA solution, however it is limited by the current PRA solution functional extent.

E.g.: It is possible to configure the Measurement System to calculate the vapour mass of an LPG tank, however that quantity is unknown by the PRA solution and cannot be processed.

The Measurement System can be configured to call multiple standards such as ASTM D1250-80, ASTM D1250-04 (with and without pressure) and GPA TP-25 or GPA 8217 / TP-27 for LPG.

Any quantity conversion “standard” that provides PRA-required calculation results can be customized in the Measurement System, even the parallel use of differing standards by different Networks and for different Materials or Units of Measurements.

2. Standards Support Examples

The Measurement System's flexibility allows the use of any available standard that supports the SAP QCI interface. All currently available standards are implemented by QuantityWare based on the Standard SAP QCI Interface.

Since the current PRA Gas solution cannot use any standard other than the hard-coded formula (example BAdI), no further explanation is necessary and we shall continue with descriptions for the implementation for Oil, Condensates and Liquids.

SAP provides example settings for the use of ASTM D1250-80 via legacy C-Codes.

The C-Codes and the QuantityWare BCS ABAP implementation of the ASTM D1250-80 standard are using the same SAP QCI interface and have been proven to calculate identically If both calculations have been licensed and installed, conversion group settings dictate whether legacy C-Codes or the QuantityWare ABAP implementation will be used.

Simply put, by changing the assigned conversion group the system can switched between using the legacy C-Codes or the QuantityWare ABAP solution. It is also possible to change existing conversion group settings to facilitate the swap between legacy C-Codes or the QuantityWare ABAP solution usage.

2.1. SAP Settings for ASTM D1250-80

SAP provides, without warrantee, examples of configuration required for the use of ASTM D1250-80 calculations.

Owing to their age, the related conversion groups are designed to call the legacy external C-Codes originally provided by the API; we will use a conversion group that calls the QuantityWare ABAP implementation instead.

See ASTM D1250-80 for technical details and an example.

2.2. ASTM D1250-04 without Pressure

ASTM D1250-04 (revision from 2013) is the current version of ASTM D1250. It also provides more calculation functionalities and includes many improvements registered with and made by the ASTM in the 33 years since the Release of ASTM D1250-80.

More details can be found here: Comparison of ASTM D1250 standard implementations

ASTM D1250-04 can also be called with the same input parameters as the superseded version ASTM D1250-80. If additional fields such as pressure are not provided with values, they will be considered as "initial" and not included into the calculation. As all input fields are identical, it is possible to use QuantityWare ASTM D1250-04 calculations by replacement or by changing the appropriate conversion group.

No other Measurement System changes are needed.

See ASTM D1250-04 without PressureASTM D1250-04 with PressureASTM D1250-04 with Pressurefor technical details and an example.

2.3. ASTM D1250-04 with Pressure

If pressure values are provided, ASTM D1250-04 includes these into the "correction factor" calculation. To use pressure values, the related Measurement Type's fields must be customised to allow such values to be passed to the calculation.

If standard ASTM D1250-80 is also in use via the same Measurement Type, the pressure field will appear on the input screen even although it is not needed. Thus, we recommend the creation of a new Measurement Type for ASTM D1250-04 usage, which can be a copy of an existing D1250-80 measurement type, but with the pressure field added.

See ASTM D1250-04 with Pressurefor technical details and an example.

2.4. GPA 8217 / TP-27 - LPG

This is an example of quantity conversion standard configuration for a standard currently unknown to PRA. In this instance, the following steps must be completed:

Customizing:

- Create a new Measurement Type and assign the required input fields and field transfers.
- Assign required fields to the calculation (input of GPA 8217 / TP-27)
- Assign the new Measurement Type to the Measurement Classes.

In the PRA application:

- Create a material and assign the proper Major and Minor Product codes
- Assign Measurement Type to the Measurement Class, Major and Minor Product Code
- Create a new Measurement Group with the desired Conversion Group and Unit of Measurement Group.

See GPA 8217 / TP-27 – LPG for technical details.

3. Conclusion

The SAP PRA application can support a wide variety of quantity conversion standards, including the latest, legally required standards for oil, condensate and liquid products for the United States market.

For gaseous products, standards support is defined by the current architectural limitations of the SAP PRA product.

QuantityWare BCS seamlessly plugs into SAP PRA, however a PRA Measurement System Expert is recommended to be available. This working paper provides guidance how to proceed with such a task.

Appendix

In this section we define the necessary basic settings to allow the use of the standards previously discussed in the document, including examples of the Well Completion Volume Transaction and Measurement Class **WC_VOLUMES.**

Read and understand ASTM D1250-80 before trying to approach any other listed configuration and customising scenarios. ASTM D1250-80describes the SAP-provided example settings along with explanations.

QuantityWare has created, tested and validated all configuration in the following apendices in internal QuantityWare systems.

There are no customer namespaces available for the necessary customising.

SAP recommends never to modify or delete SAP standard shipment objects, but create and assign new ones instead.

Appendix A. ASTM D1250-80

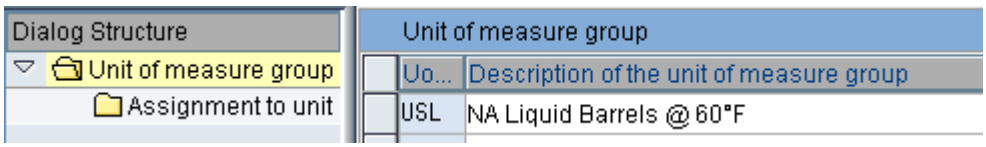
All needed settings of the Measurement System are provided by SAP.

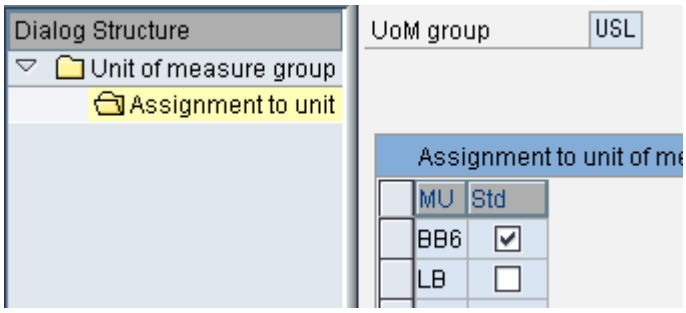
We have to set up a Delivery Network and use the settings of the Measurement System.

A.1. Delivery Network

Unit of Measure Group

It is possible to create a new group or use the existing one:





Measurement Group

We create a new group:

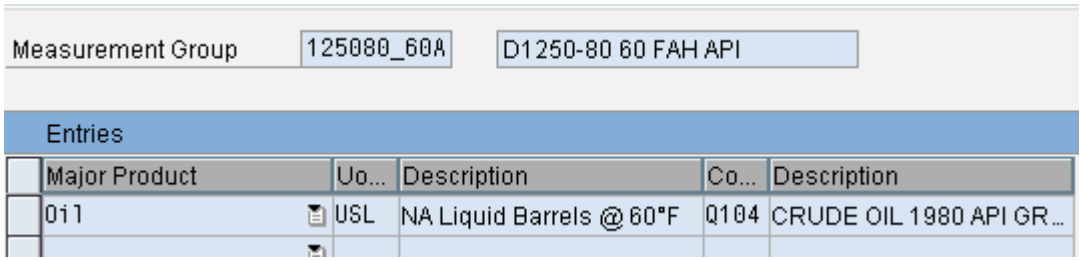
Unit of Measure Group: 125080_60A

Major Product Code: Oil (0)

Conversion Group: Q104

Unit of Measure Group: USL with BB6 and LB

If needed, we can add more Major Products to the group. The entry will be selected by the Material.



Material and Assignment to the Product Codes:

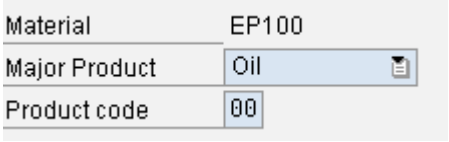
The material has to exist in table MARA (Material Master), but only as reference.

It has to be defined in the PRA General Master Date Maintenance.

We use the existing material or create a new one.

Major Product Code: OIL

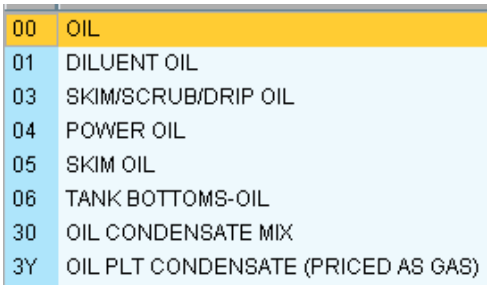
Minor Product Code: 00



Minor Product Codes:

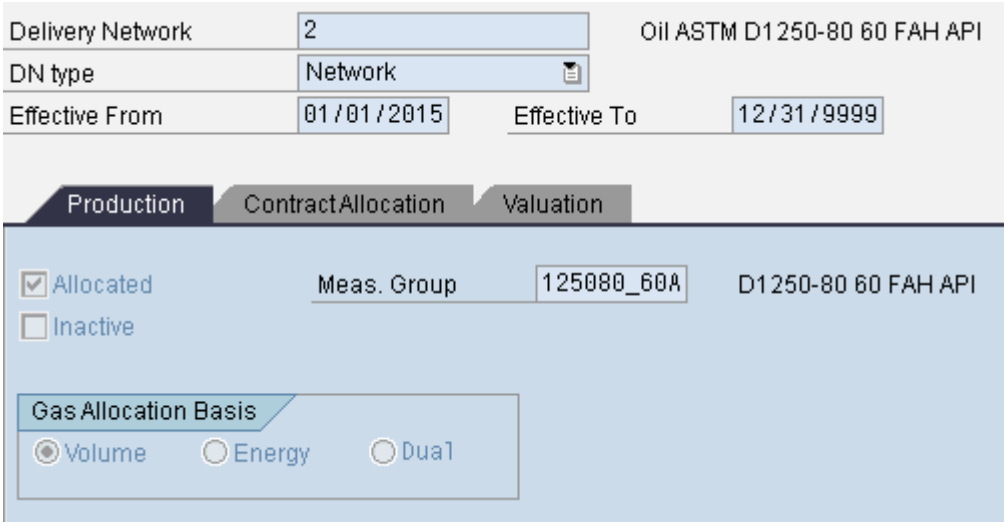
SAP provides a reference set, but we can define additional codes as shown later.

These codes will be used to select the Measurement Type.



Delivery Network

Now we have all we need to create a Delivery Network and Delivery Network Dated.



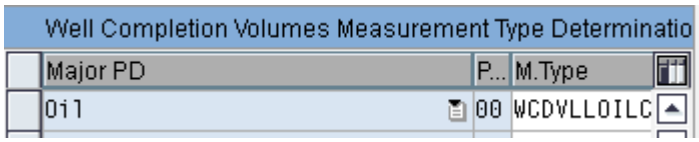
This Network has to be completed by creating Wells, Well Completions and Measurement Points and assign them to the network (DN Downstream Nodes), Allocation Profile, etc.

A.2. Measurement System

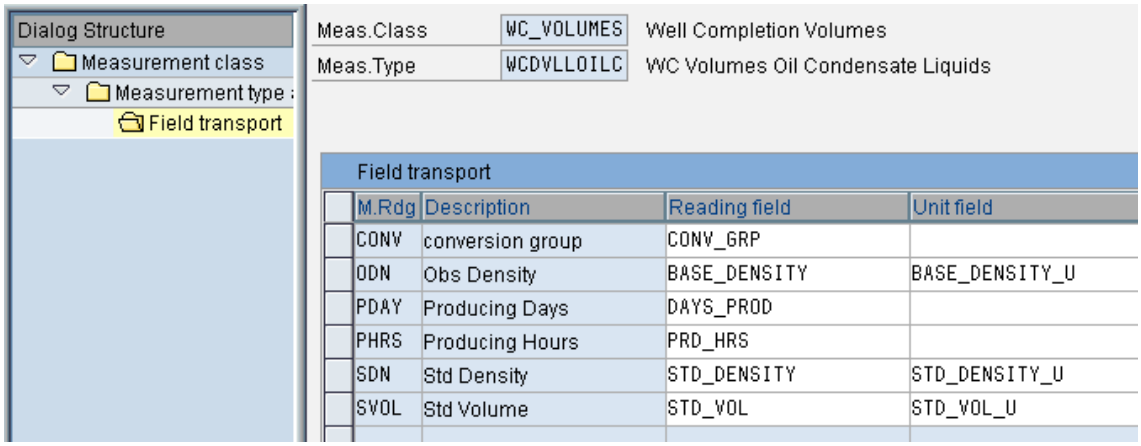
Measurement Type

The assignment of the Measurement Type to the Major and Minor Product Code has already been done and can be used.

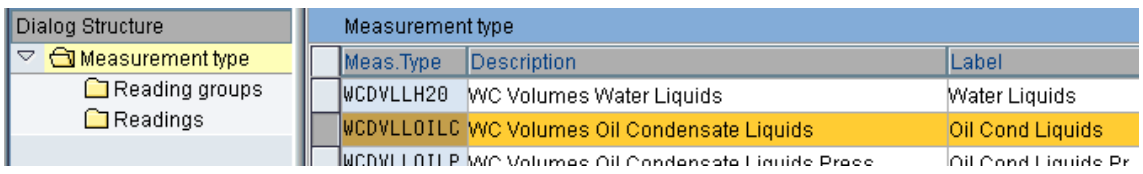
The Measurement Type **WCDVLLOILC** is selected:



The **Field Transport** of Measurement Class and Measurement Type has been already set up and can be used:



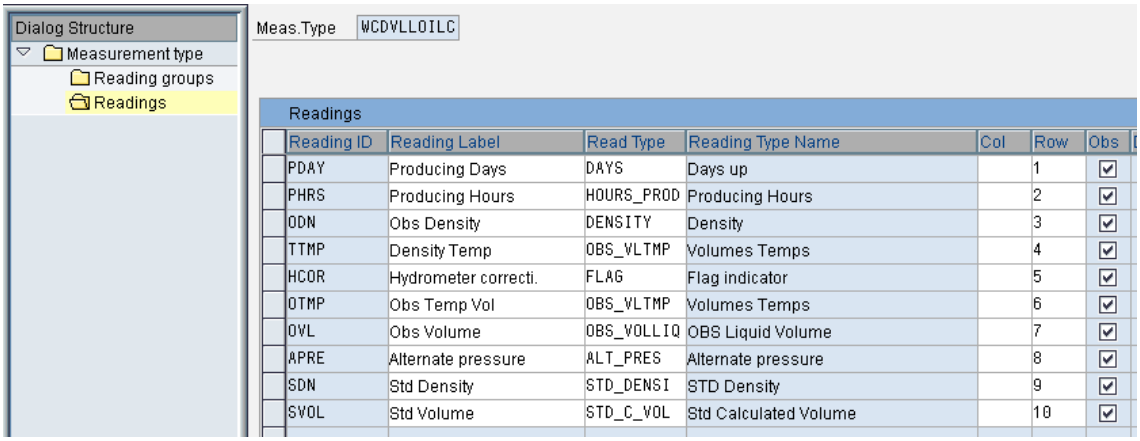
Measurement Type Settings – Readings



We do not need to create a Reading Group.

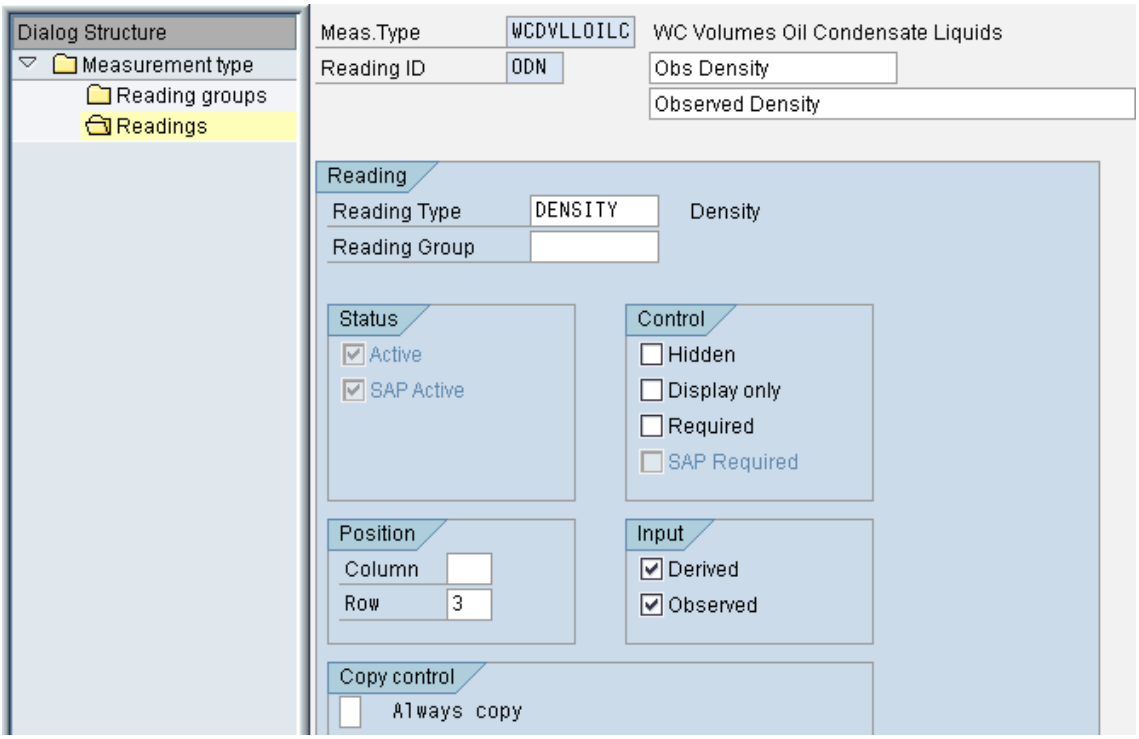
All readings have already been set and can be used.

The selected fields will be generated into the input screen in the order defined in column “Row”.



Reading ID	Reading Label	Read Type	Reading Type Name	Col	Row	Obs
PDAY	Producing Days	DAYS	Days up		1	☑
PHRS	Producing Hours	HOURS_PROD	Producing Hours		2	☑
ODN	Obs Density	DENSITY	Density		3	☑
TTMP	Density Temp	OBS_VLTMP	Volumes Temps		4	☑
HCOR	Hydrometer correcti.	FLAG	Flag indicator		5	☑
OTMP	Obs Temp Vol	OBS_VLTMP	Volumes Temps		6	☑
OVL	Obs Volume	OBS_VOLLIQ	OBS Liquid Volume		7	☑
APRE	Alternate pressure	ALT_PRES	Alternate pressure		8	☑
SDN	Std Density	STD_DENSI	STD Density		9	☑
SVOL	Std Volume	STD_C_VOL	Std Calculated Volume		10	☑

The specifications of each field can be shown/set/changed by double clicking on the line of the reading.
E.g. Reading ODN:



For each reading a Reading Type is assigned. In that case above:

Reading ID: ODN

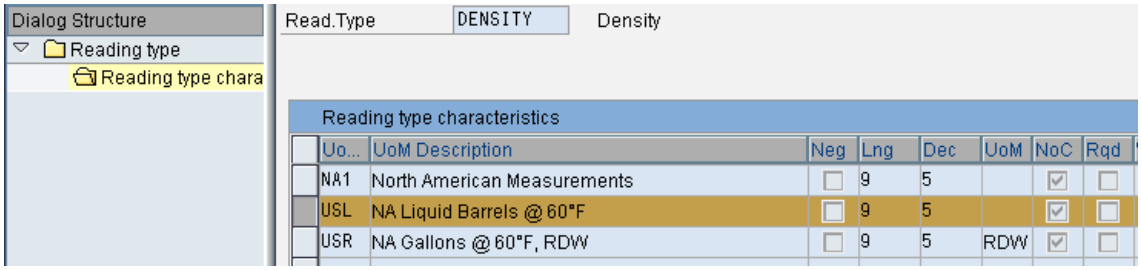
Reading Type: DENSITY

Reading Types

Reading Types contain the characteristics of the reading field, they are used to define the generation of the input screen field.

Reading Types can be defined for specific Unit of Measure Groups or generically for all assigned Readings.

Here the example of Reading Type DENSITY:

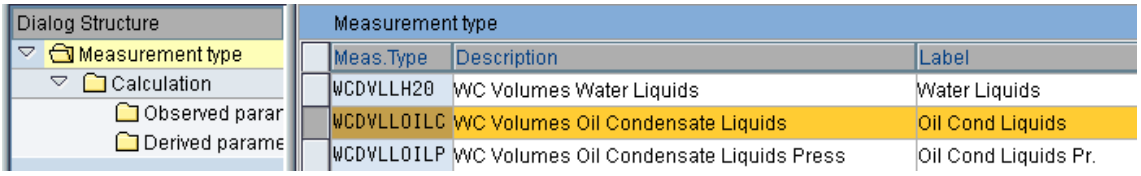


Calculation

The function OIU_QCI_STD_CONVERSION is provided by SAP allowing PRA to call the QCI.

All possible parameters for that calculation have been already defined by SAP and can be selected for use in the desired call.

We have to assign this calculation to our Measurement Type and define the necessary parameters.

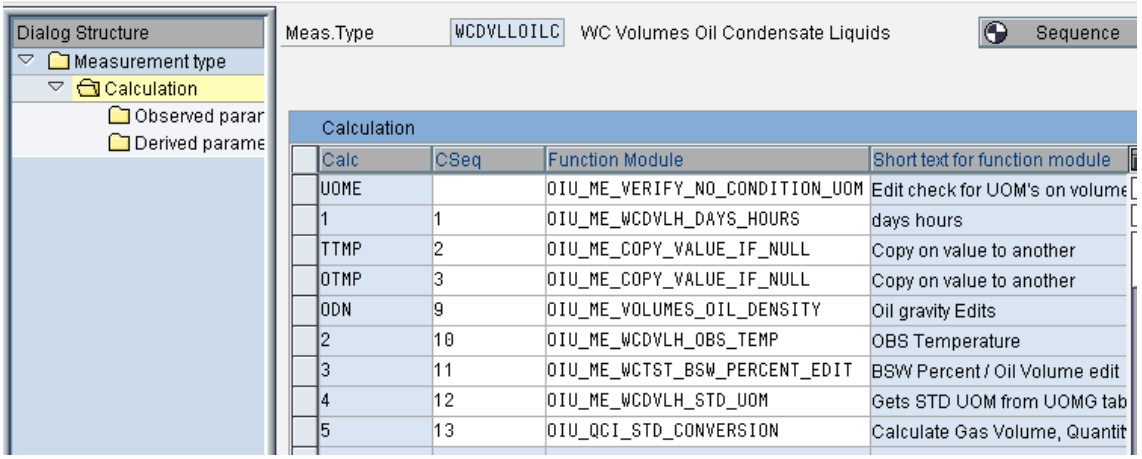


Each calculation contains a calling sequence of ABAP Functions.

The final one (that calls the QCI) is OIU_QCI_STD_CONVERSION.

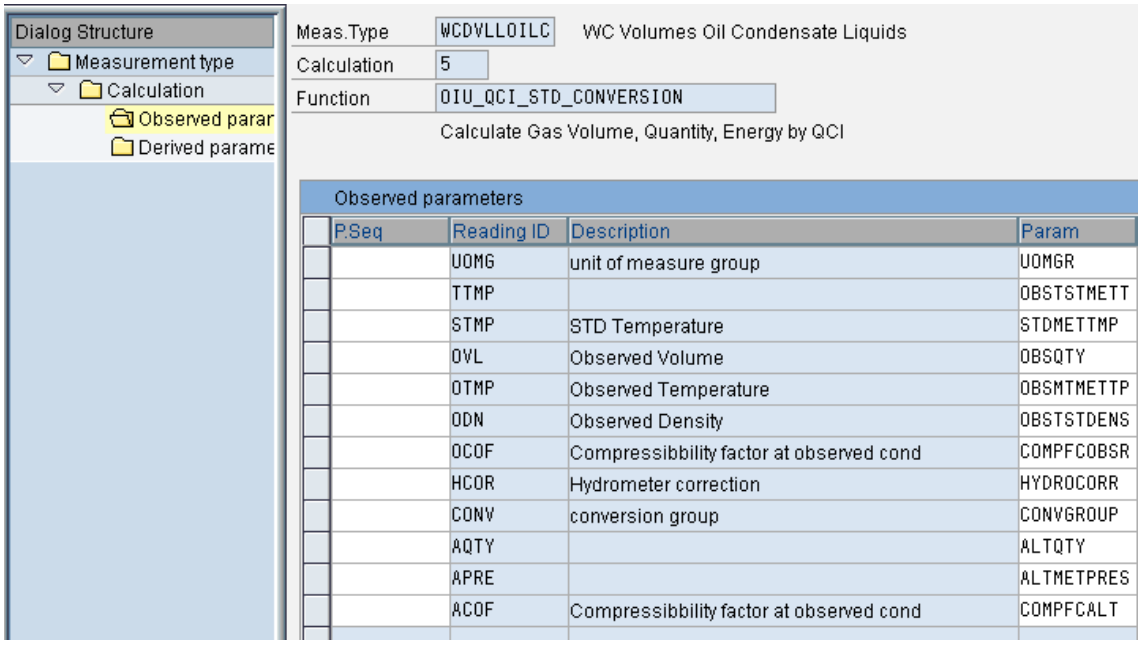
Previous functions are used to validate input data and to transfer fields.

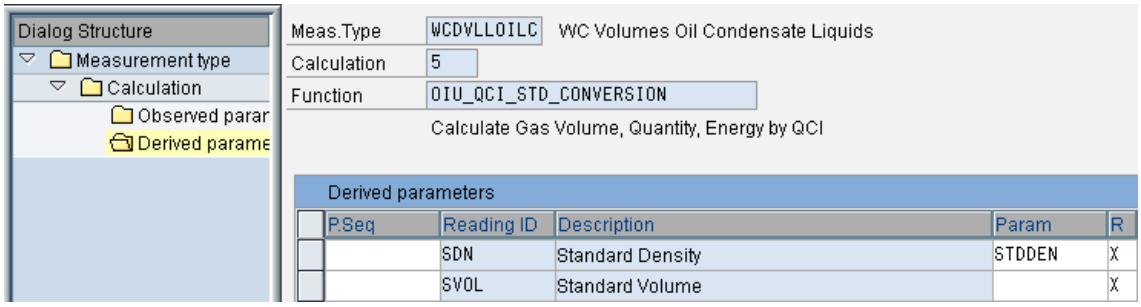
Since QuantityWare offers the possibility to define ranges for each of the input data, input checks should not be done here.



All parameters have been set by SAP in their example and no changes are necessary in our case, e.g. function OIU_QCI_STD_CONVERSION parameters for the final QCI-call.

It is important to assign the Reading ID to the proper QCI Parameter (column Param) to pass those values to the QCI. In our case, these have been previously set in SAP example.

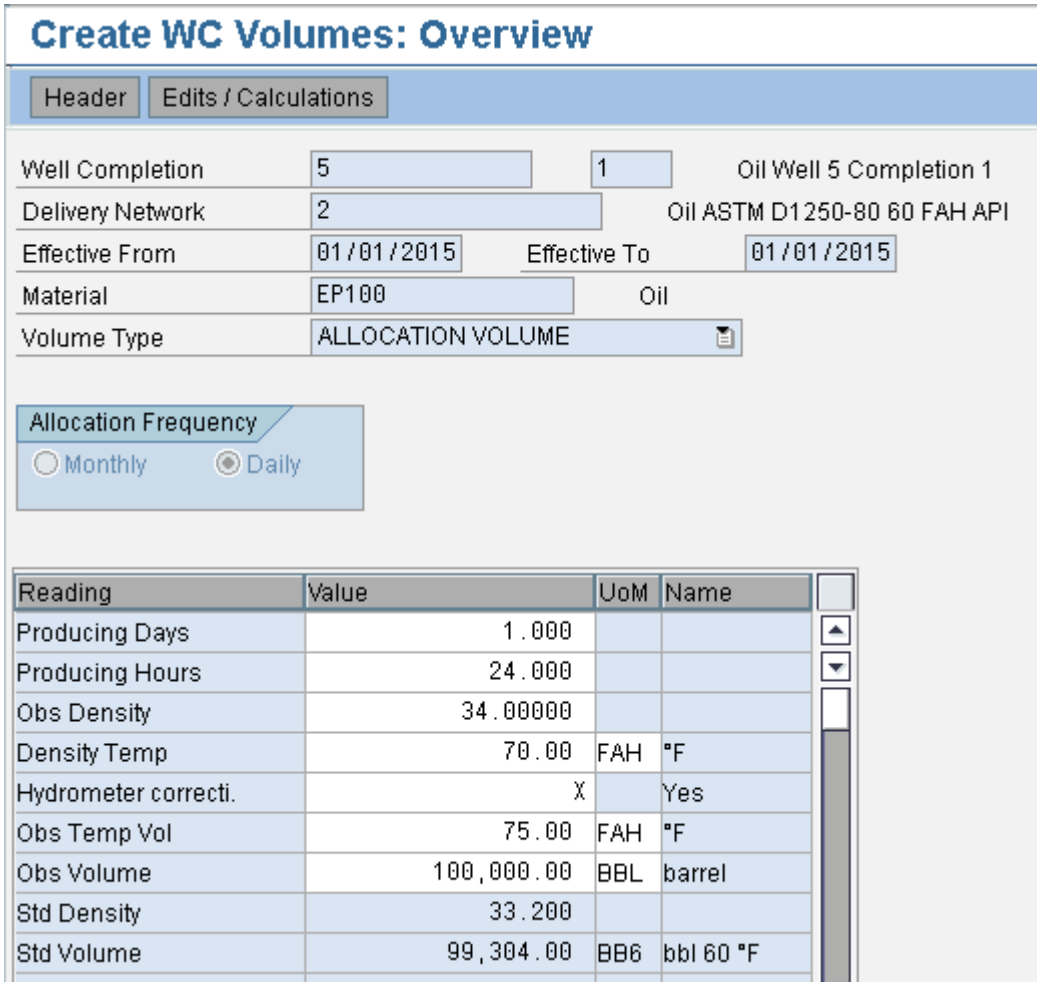




Finished. This is all that we need to call the PRA Volume Transaction to collect measurements, standardize them and pass them back to the calling transaction. The Measurement System creates a Measurement Reading and a Measurement Document.

Here, the generated sub screen with the calculated results.

WC Volume Transaction



Appendix B. ASTM D1250-04 without Pressure

If no field for pressure is passed to the calculation function of ASTM D1250-04, pressure will not be included into the calculation, thus no changes of the input fields are necessary to change between ASTM D1250-80 and ASTM D1250-04.

We can replace the Conversion Group assigned to the Measurement Group or create a new Measurement Group and assign it to the Network.

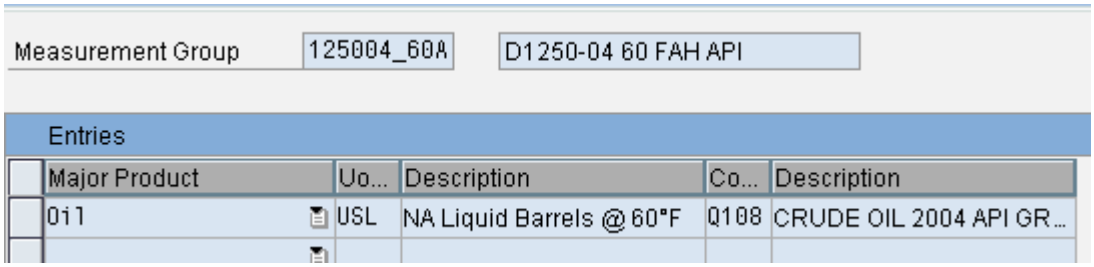
Measurement Group

Unit of Measure Group: 125004_60A

Major Product Code: Oil (0)

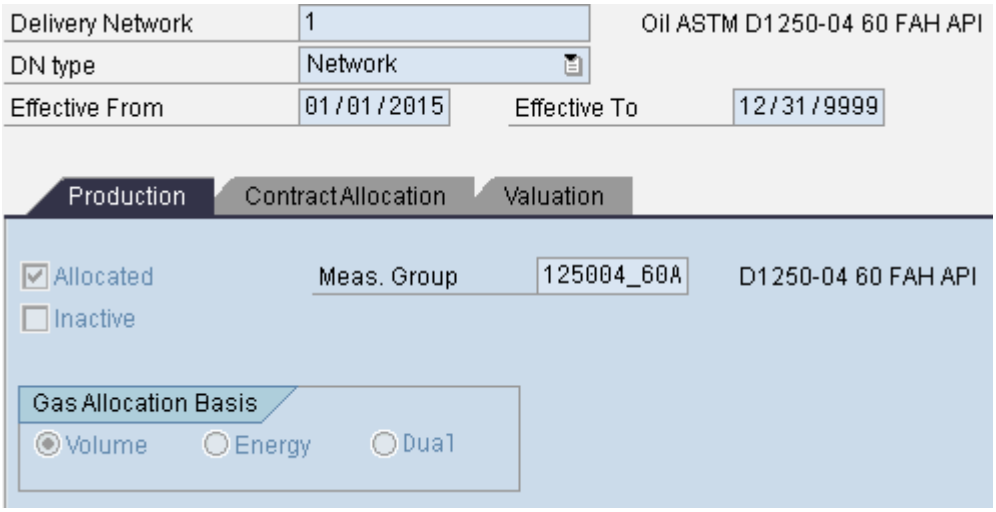
Conversion Group: Q108

Unit of Measure Group: USL with BB6 and LB



Delivery Network

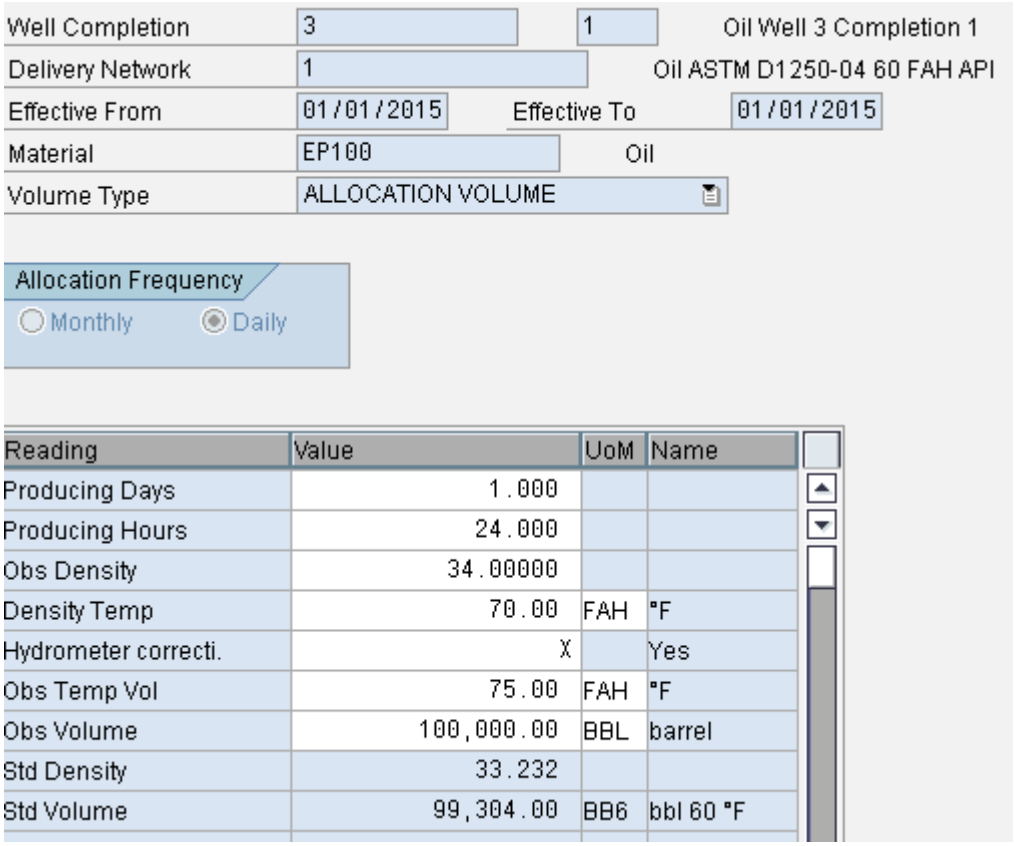
Assign the Measurement Group to the Network.



Now you can call the Well Completion Volumes transaction using standard ASTM D1250-04 without pressure.

Here, the generated sub screen with the calculated results.

WC Volume Transaction



Appendix C. ASTM D1250-04 with Pressure

The settings are fundamentally the same as for ASTM D1250-80 and ASTM D1250-04 without pressure, however we additionally need the pressure field to appear at the generated input screen and for its values to be passed to the QCI.

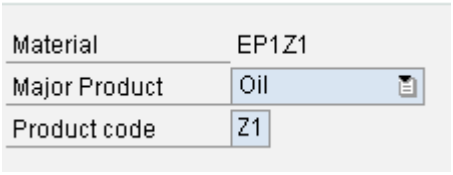
When we add the field to the Measurement Type, it will appear at all calculations involving that Type; to avoid this and errors if using ASTM D1250-80 in parallel, we have to create a new Measurement Type and select it by the Major Product Code Oil and a new Minor Product code.

C.1. PRA settings

Material, Major and Minor Product Code

We create a new Material and a new Minor Product Code;

Pd	Product Code Description
00	OIL
01	DILUENT OIL
03	SKIM/SCRUB/DRIP OIL
04	POWER OIL
05	SKIM OIL
06	TANK BOTTOMS-OIL
30	OIL CONDENSATE MIX
3Y	OIL PLT CONDENSATE (PRICED AS GAS)
Z1	OIL under pressure

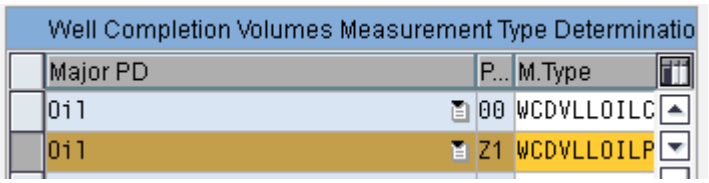


C.2. Measurement System Settings

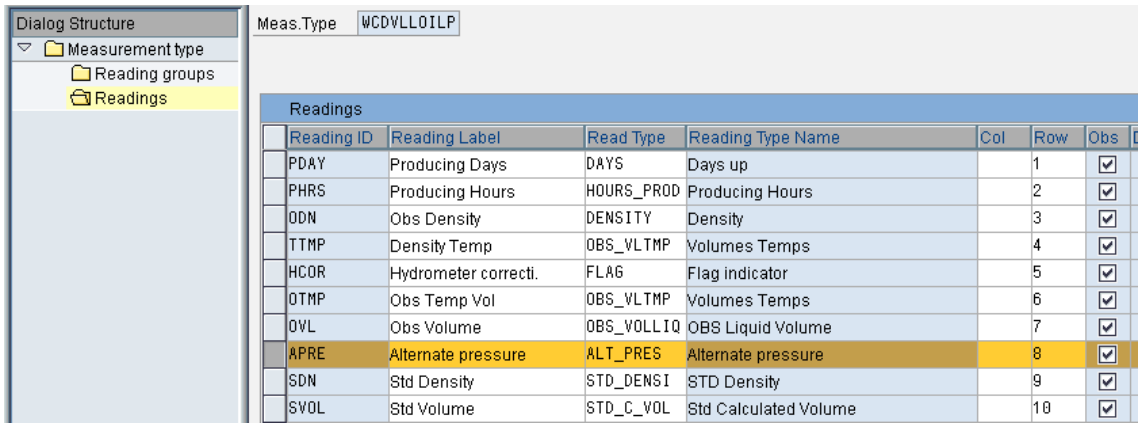
Measurement Type

We copy the new measurement Type WCDVLLOILP from the existing WCDVLLOILC.

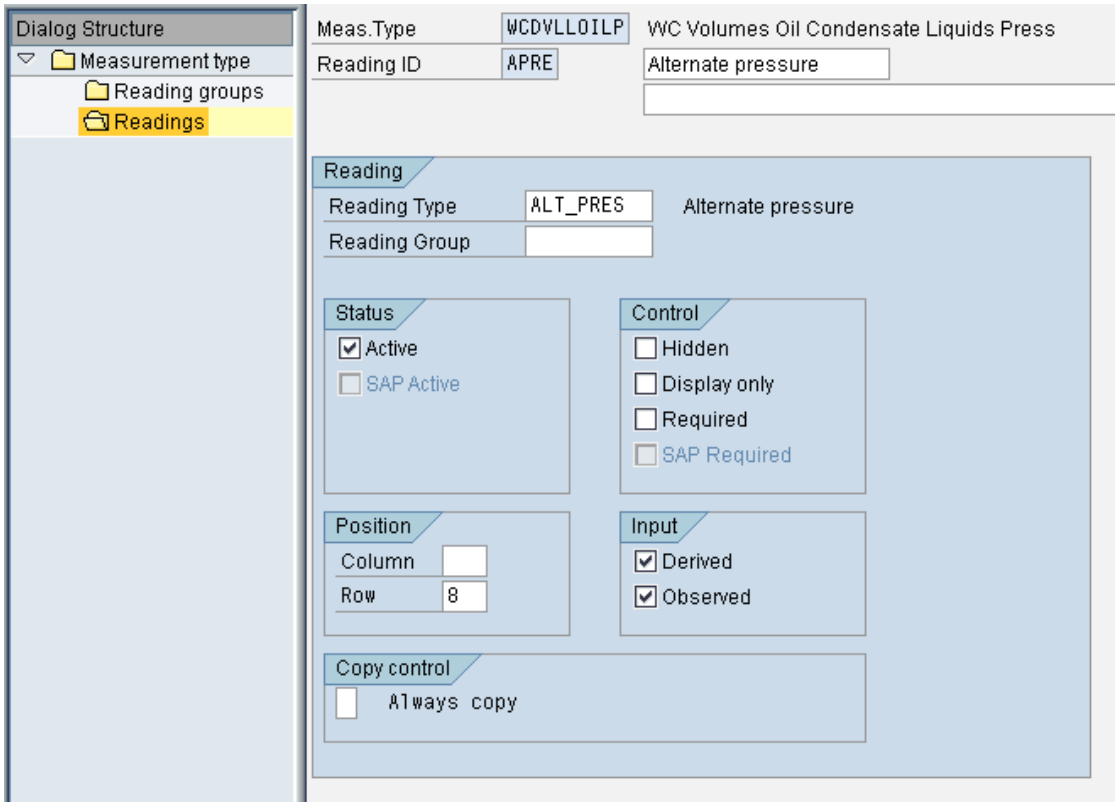
Then we assign the new Measurement Type to the Major and Minor Product Code.



Now we add the pressure field to the Readings of the Measurement Type:

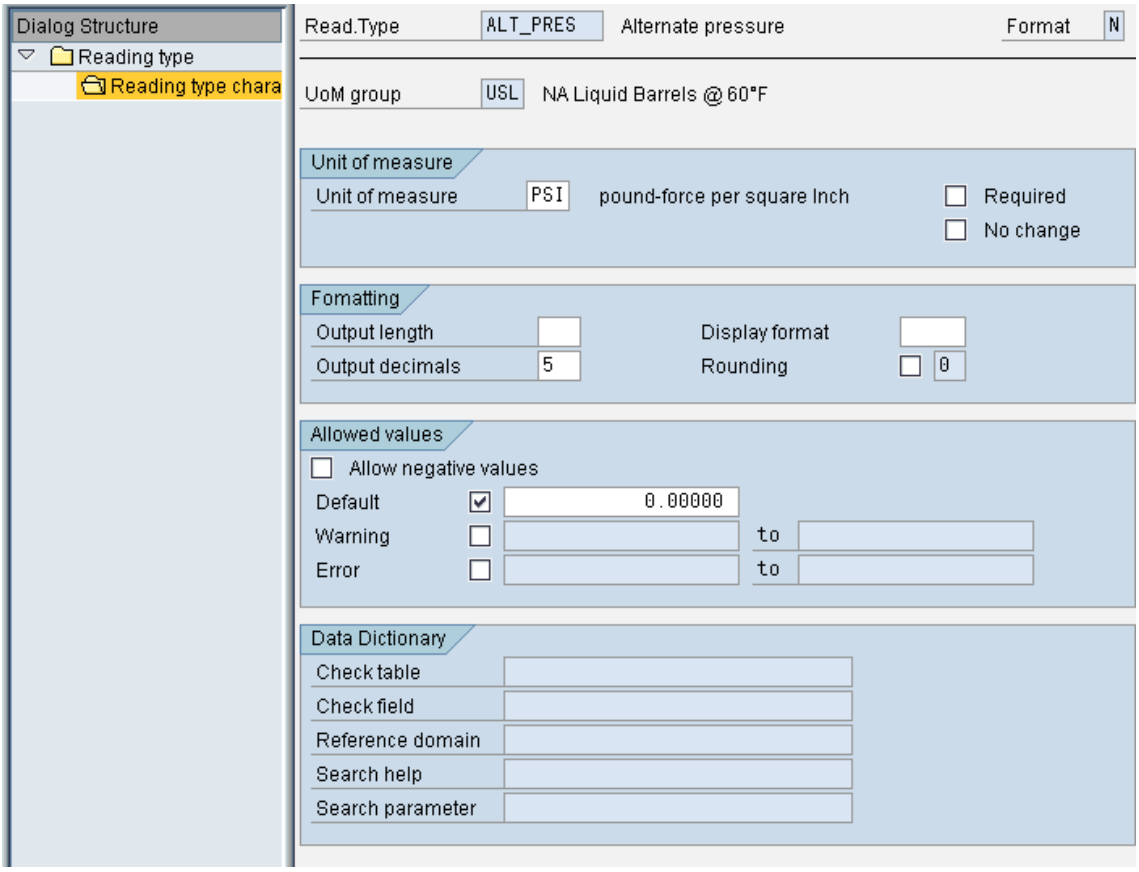


And maintain the details of the new Reading:



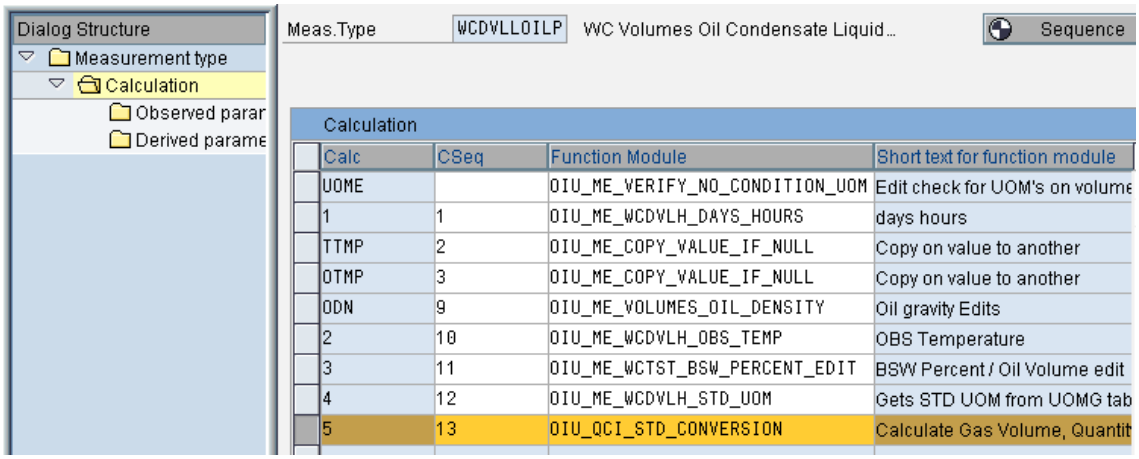
Reading Type – ALT_PRES

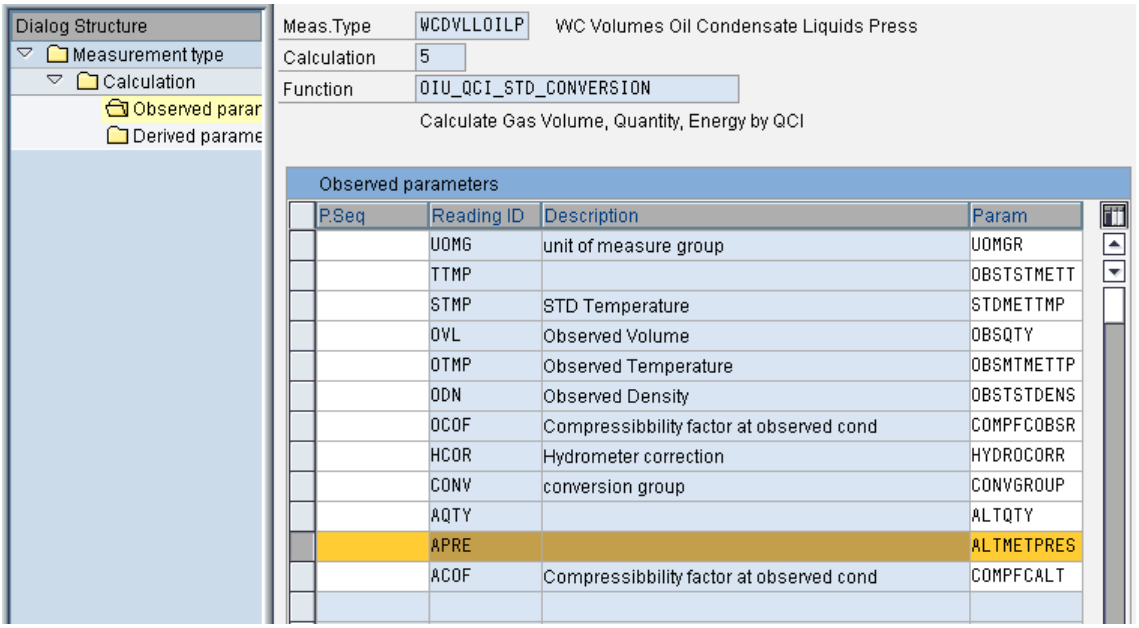
We create the settings of the Reading Type ALT_PRES for Unit of Measure Group USL:



Function OIU_QCI_STD_CONVERSION – add new field

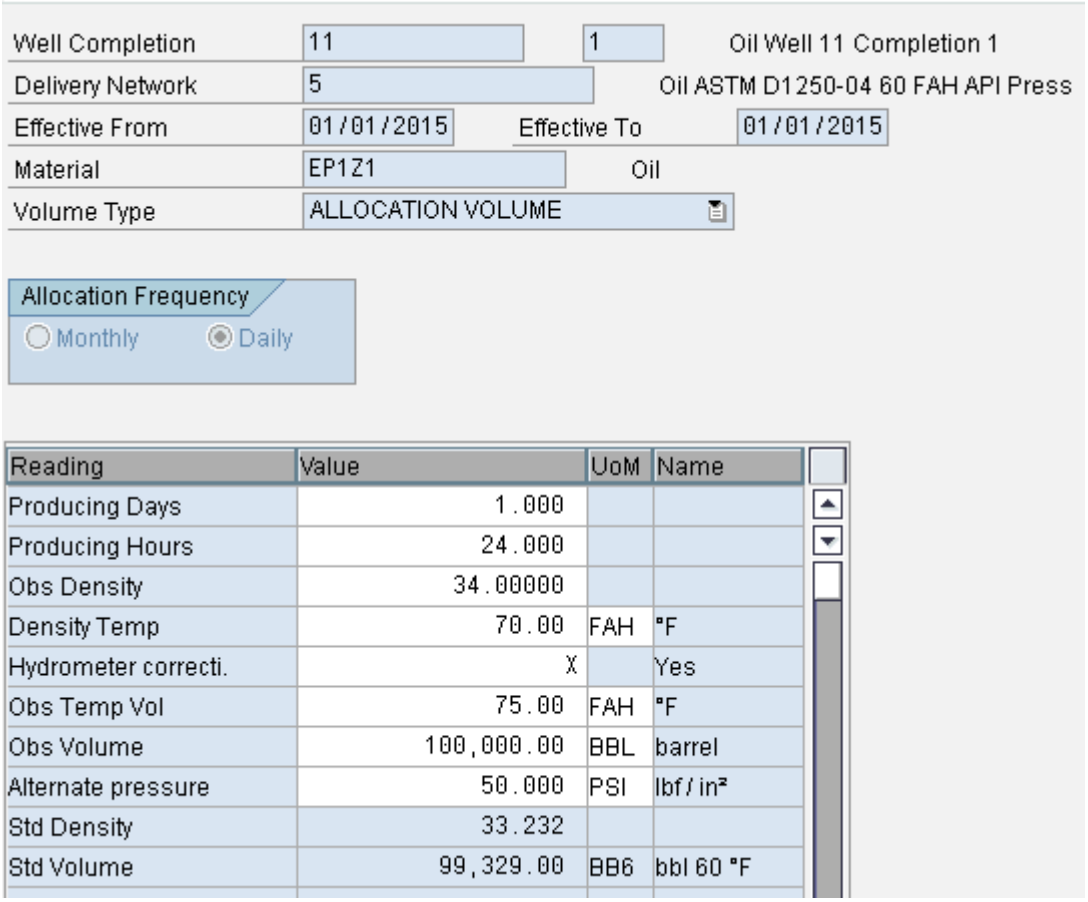
We have to make sure that the pressure field will be passed to the QCI.





Here, the generated sub screen with the calculated results.

WC Volume Transaction



Well Completion	11	1	Oil Well 11 Completion 1
Delivery Network	5		Oil ASTM D1250-04 60 FAH API Press
Effective From	01/01/2015	Effective To	01/01/2015
Material	EP1Z1	Oil	
Volume Type	ALLOCATION VOLUME		

Allocation Frequency: ○ Monthly ◉ Daily

Reading	Value	UoM	Name
Producing Days	1.000		
Producing Hours	24.000		
Obs Density	34.00000		
Density Temp	70.00	FAH	°F
Hydrometer correcti.	X		Yes
Obs Temp Vol	75.00	FAH	°F
Obs Volume	100,000.00	BBL	barrel
Alternate pressure	50.000	PSI	lbf / in²
Std Density	33.232		
Std Volume	99,329.00	BB6	bbl 60 °F

Appendix D. GPA 8217 / TP-27 – LPG

There is no example for LPG provided by SAP.

Since PRA supports only the calculated Standard Volume and Standard Density, we can use a simple conversion group and ignore all other functionality provided by BCP, such as vapour mass and energy calculations, etc.

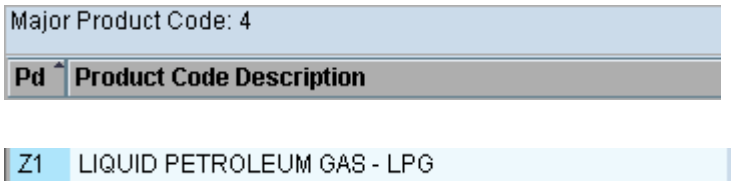
The structure of this configuration will be the same as for ASTM D1250-04 with pressure, see ASTM D1250-04 with Pressure.

D.1. PRA Settings

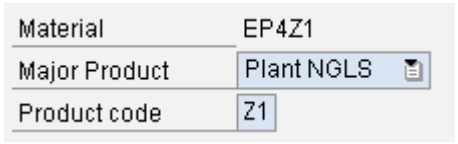
Material, Major and Minor Product Code

We create a new Material and a new Minor Product Code at the Major Product code

Plant NGLS – 4.



Assign the product codes to the material.



Measurement Group

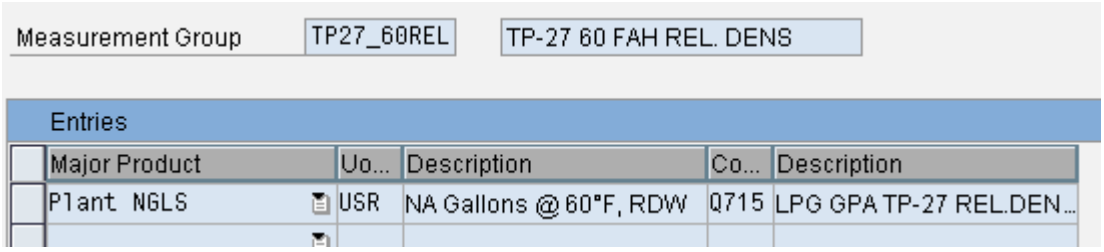
– create a new one

Unit of Measure Group: TP27_60REL

Major Product Code: Plant NGLS (4)

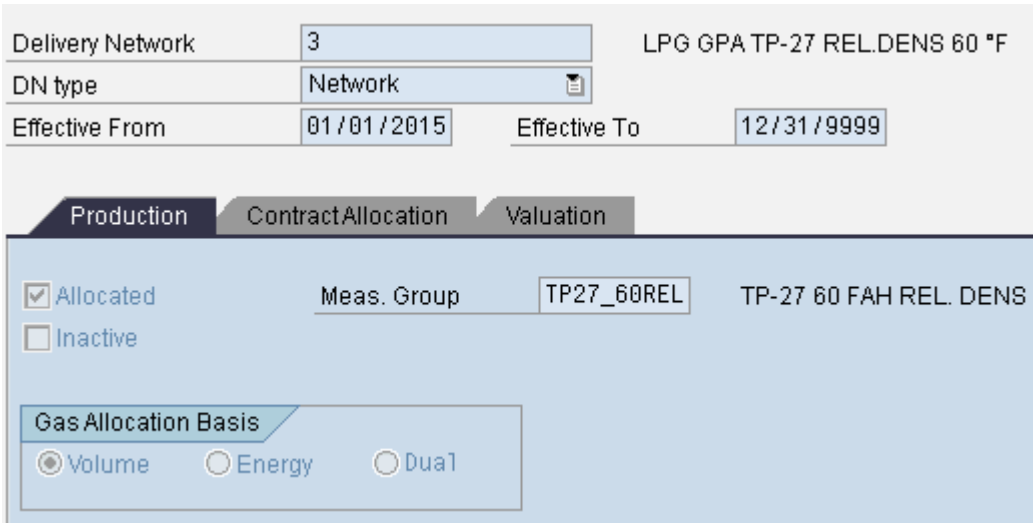
Conversion Group: Q715

Unit of Measure Group: USR with IG6 and LB



Delivery Network

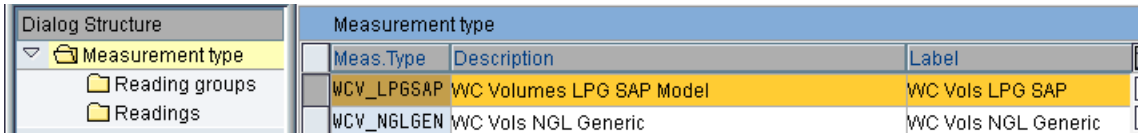
Assign the Measurement Group to the Network.



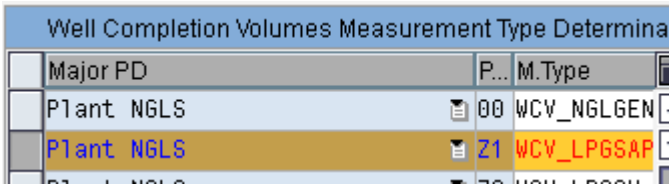
D.2. Measurement System settings

Measurement Type

We copy the new measurement Type WCV_LPGSAP from the existing WCDVLLOILC; also copying the field transport which can be used as defined.



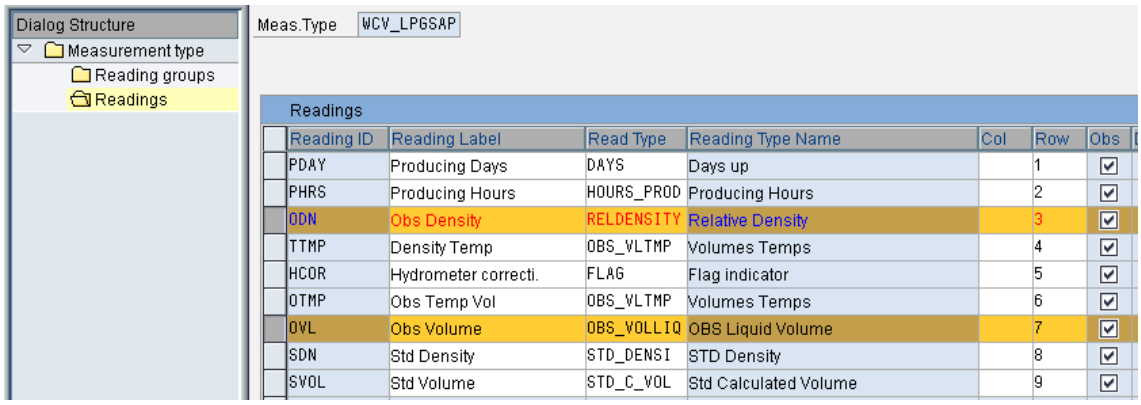
Then we assign the new Measurement Type to the Major and Minor Product Codes.



Readings

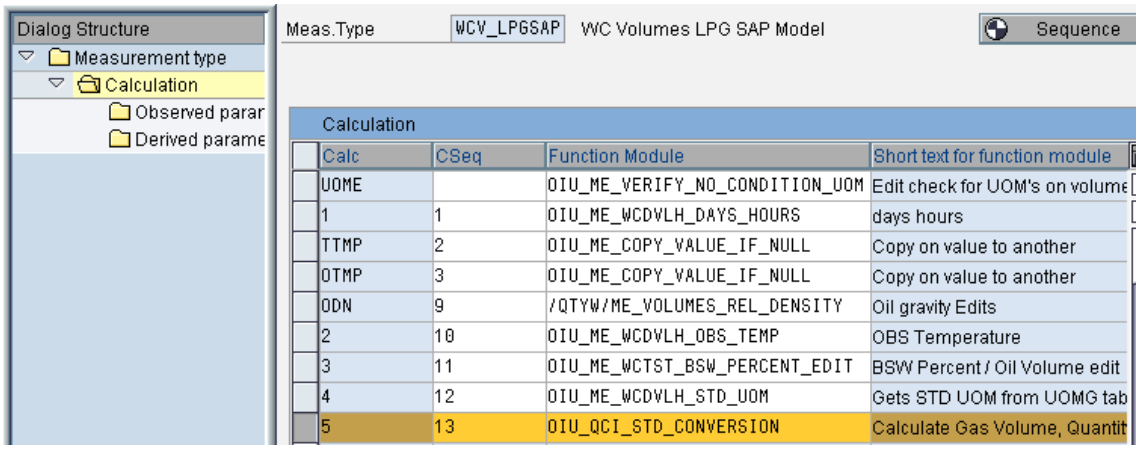
We do not need to define a Reading Group.

The readings have already been copied with the Measurement Type, but need to be maintained. The Reading Types of the marked readings have to be set as they have to appear on the input screen using Unit of Measure Group USR.



Function OIU_QCI_STD_CONVERSION

ODN (Observed Density) calculations are not necessary; the corresponding function can be deleted or changed to relative density.

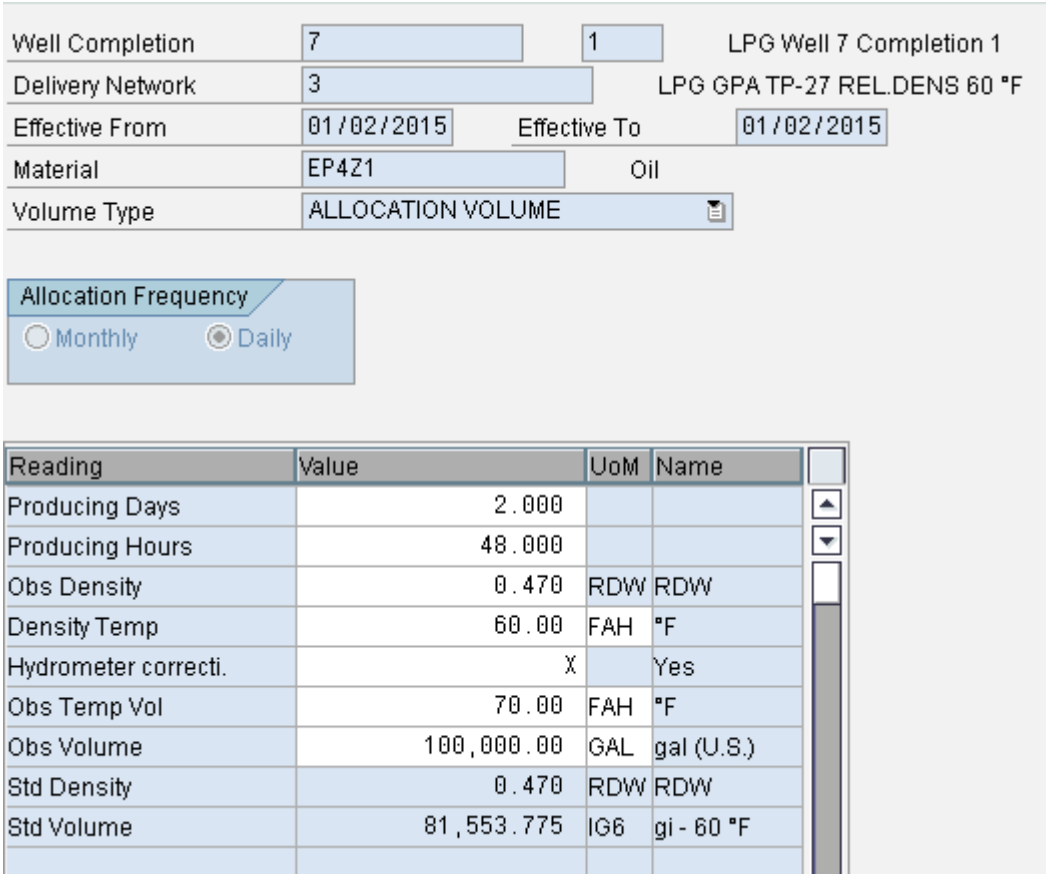


The copied parameters can be used as defined.

All necessary settings have been completed and the WC Volume Transaction can be used.

Here, the generated sub screen with the calculated results.

WC Volume Transaction



Well Completion	7	1	LPG Well 7 Completion 1
Delivery Network	3		LPG GPA TP-27 REL.DENS 60 °F
Effective From	01/02/2015	Effective To	01/02/2015
Material	EP4Z1	Oil	
Volume Type	ALLOCATION VOLUME		

Allocation Frequency: ○ Monthly ◉ Daily

Reading	Value	UoM	Name
Producing Days	2.000		
Producing Hours	48.000		
Obs Density	0.470	RDW	RDW
Density Temp	60.00	FAH	°F
Hydrometer correcti.	X		Yes
Obs Temp Vol	70.00	FAH	°F
Obs Volume	100,000.00	GAL	gal (U.S.)
Std Density	0.470	RDW	RDW
Std Volume	81,553.775	IG6	gi - 60 °F

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