



ERBAqua®

Volumetric and Coulometric Reagents for titration for water determination according to Karl Fischer method



DASITGROUP

CARLO ERBA

REAGENTS

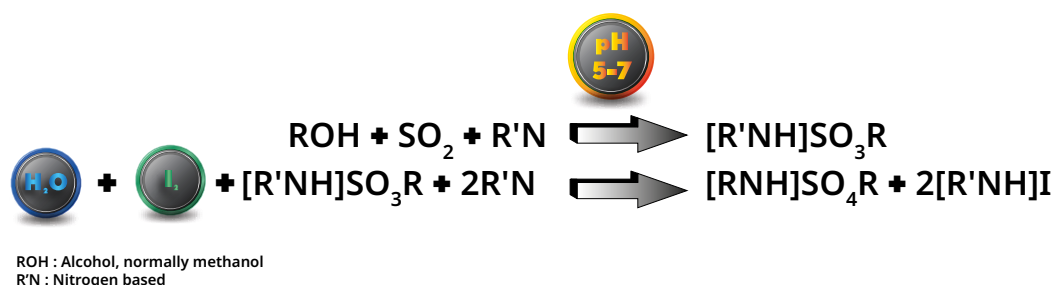
It is often important to determine the amount of water inside in a sample, as it can affect the quality, reactivity, stability, shelf life, and structure of products.

Karl Fischer titration is the reference method, widely recognized by the scientific community for nearly a century, for determining water content. This method is valued for its efficiency and versatility, thanks to its selectivity, ease of use, and broad range of applications. It can detect even very low levels of water in samples.

Method

Karl Fischer titration is based on the Bunsen reaction, which Karl Fischer adapted in 1935 from the original reaction discovered in 1853. This method works through a rapid two-step reaction, with a stoichiometric relationship between iodine (I₂) and the amount of water in the sample.

In this reaction, the water in the sample is consumed by the oxidation of alkylsulfite to alkylsulfate, using the iodine supplied by the Karl Fischer reagent. The required base neutralizes the acidic intermediate formed during the process.



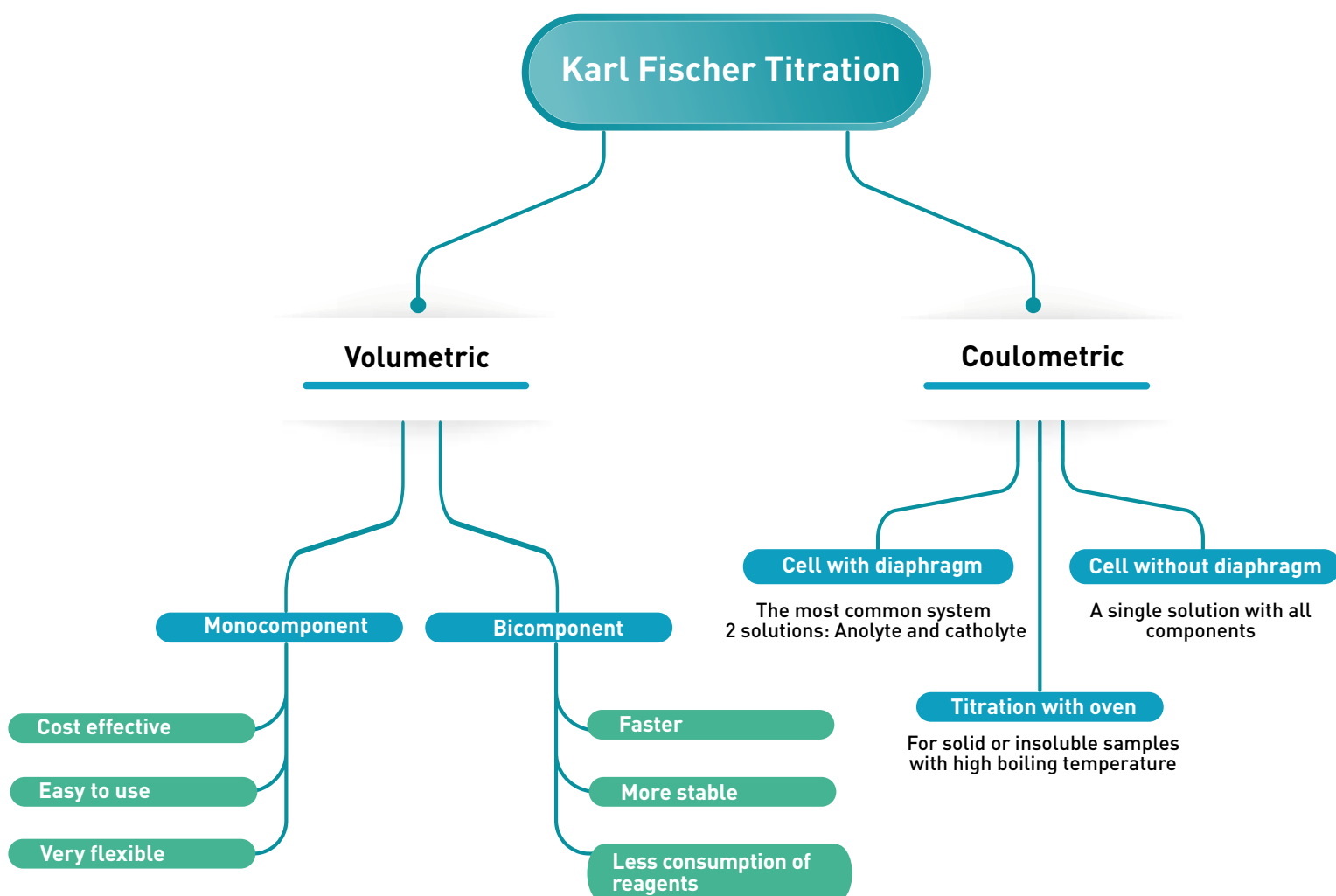
In CARLO ERBA Reagents' products, pyridine has been replaced with imidazole, a more reactive base, and a second base, 2-methylimidazole, has been added to enhance stability and reduce the formation of crystals.

Types of Titrations

The amount of iodine can be measured using two methods: volumetric or coulometric. The choice of method depends on the expected water content in the sample.

- **Coulometric Method:** Ideal for measuring very low quantities of water with high precision
- **Volumetric Method:** Recommended for water contents between 1% and 2%.

Selecting the most appropriate method is essential to get precise and reliable results.



With ERBAqua[®], CARLO ERBA Reagents is the *partner in your choice* for pyridine-free Karl Fischer reagents, combining efficiency and ease of use.

Explore the ERBAqua[®] range and find out the ideal solutions to meet your titration needs with accuracy and reliability!

MONOCOMPONENT VOLUMETRIC TITRATION

For Monocomponent volumetric titration, ERBAqua® reagents contain all the essential elements for the Karl Fischer reaction: iodine, base, sulfur dioxide, and alcohol.

The ERBAqua® range offers reagents with several iodine concentrations, allowing titration adjustment according to water content. Additionally, a specific alcohol-free mixture is available for the titration of aldehydes and ketones.

One of the key factors to consider when choosing single-component reagents is the speed of titration. Thanks to our new formulation, the average stabilization time is halved under the same analytical conditions.

To ensure optimal Karl Fischer reactions, different additives can be introduced into the measurement cell:

- **Formamide** enhances the solubility of carbohydrates, proteins, and inorganic salts in methanol, facilitating a better reaction.
- **Acid Buffer:** For acidic samples, it is recommended to use an acid buffer to neutralize the working medium and maintain a pH between 5 and 7, thereby ensuring reaction stability.

With this flexibility and a wide selection of solvents suitable for a diverse range of samples, ERBAqua® meets several analytical applications.

	Product	Features	Pkg	Code
Reagents Monocomponent	Reagents 5 mg H ₂ O/ml	1 ml of titrant contains approx. 5 mg of water	1 l	572111
	Reagents 2 mg H ₂ O/ml	1 ml of titrant contains approx. 2 mg of water	1 l	572121
	Reagents 5 mg H ₂ O/ml for aldehydes and ketones	1 ml of titrant contains approx. 5 mg of water	1 l	572131
Media for Single-Component Titration	Methanol	Water content < 0.02%	1 l 2.5 l	414881 414883
	Methanol Fast	Enhanced Formulation for Faster Titration	1 l	572101
	Medium for aldehydes and ketones	Methanol has been replaced with another solvent which does not react with aldehydes and ketones	1 l	572161
	Chloroform	Water content < 0.005%	1 l	438531
	Formamide	Water content < 0,02%	1 l	572171
Additives	Acid buffer	Specific for Highly Acidic Samples	1 l	572141

WHY CHOOSE OUR PRODUCTS?

Advantages of ERBAqua® Monocomponent Products

- Ideal for high water content titrations
- Equilibrium point reached quickly and stably
- Long shelf life
- Convenient and easy to use
- All components necessary for the Karl Fischer reaction combined in a single bottle

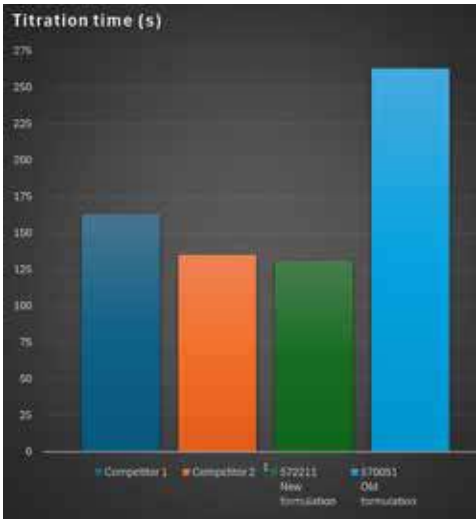
BICOMPONENT VOLUMETRIC TITRATION

In bicomponent volumetric titration, the reagents are shared between the titrants and the solvents.

In the ERBAqua® range, the titrants contain iodine at various concentrations to accommodate different water content levels, while the solvents include the base and sulfur dioxide, enabling the dissolution of a wide variety of samples.

This separation of components enhances the long-term stability of the solutions, thereby reducing the frequency of titration factor checks.

The following histogram compares the titration speed of two market-leading titrants with CARLO ERBA Reagents' formulations. The new formulation delivers superior results and outperforms even our previous formulation.



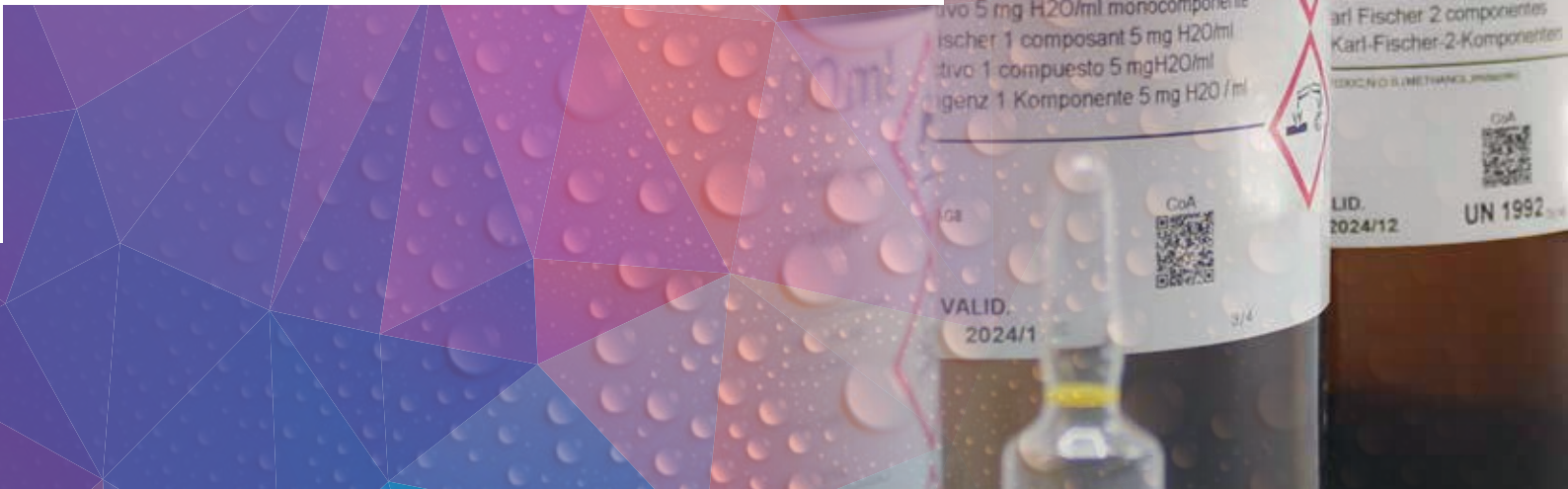
Comparison of titration stabilization times under identical analysis conditions for the previous formulation, the new formulation, and two other market competitors.

	Product	Features	Pkg	Code
Titrants Bicomponent	Titrant 5 mg H2O/ml	1 ml of titrant contains approx. 5 mg of water	1 l	572211
	Titrant 2 mg H2O/ml	1 ml of titrant contains approx. 2 mg of water	1 l	572221
Solvents Bicomponent	Solvent	Water content < 0.02%	1 l	572201
	Solvent CM for the titration of Non-Polar Samples	Improves the solubility of long-chain hydrocarbons. Contains chloroform.	1 l	572241
	Solvent CM for oil titration	Improves the solubility of long-chain hydrocarbons. Contains 1-hexanol (halogen-free).	1 l	572231

WHY CHOOSE OUR PRODUCTS?

Advantages of ERBAqua® Bicomponent Products

- Reduce the frequency of calibrations
- Precise and stable titrant concentration
- Longer shelf life
- Improved accuracy for low water quantities



COULOMETRIC TITRATION

Coulometric titration is the most suitable method for measuring the water content in a sample when it ranges between 10 ppm and 1%, or when the sample is valuable.

There are two types of titration cells: with or without a diaphragm. In both cases, the iodine required for the reaction is generated directly in the cell at the anode by oxidation of iodide. The water concentration is precisely calculated based on the electrical current required for this redox reaction.

The ERBAqua® range offers reagents suited for both types of titration cells, as well as specific mixtures for the titration of aldehydes and ketones without methanol.

- **Cells with diaphragm** : requires both an Anolyte solution and a Catholyte solution.
- **Cells without diaphragm** : only requires a specific Anolyte solution, with no need for a Catholyte solution.

	Product	Features	Pkg	Code
Anolyte solution for cells with a diaphragm	Anolyte solution A	To be inserted into the anode compartment of the cell and used exclusively with ERBAqua® Coulometric C	500 ml	572302
	Anolyte solution for oils	To be inserted into the anode compartment of the cell and used exclusively with ERBAqua® Coulometric C	100 ml	572343
	Anolyte solution AK for aldehydes and ketones	To be inserted into the anode compartment of the cell and used exclusively with ERBAqua® Coulometric CGK	500 ml	572332
Anolyte solution for cells without diaphragm	Anolyte solution AG	Optimized for cells without diaphragm	500 ml	572312
	Anolyte solution AD	Optimized for cells without diaphragm. Chloroform free	500 ml	572322
Catholyte solution for cells with a diaphragm	Catholyte solution C	To be inserted into the cathode compartment of the cell and used exclusively with ERBAqua® Coulometric A or oil	100 ml	572353
	Catholyte solution CGK for the determination of water content in aldehydes and ketones	To be inserted into the cathode compartment of the cell and used exclusively with ERBAqua® Coulometric AK	10x5 ml	572364

WHY CHOOSE OUR PRODUCTS?

Advantages of ERBAqua® Coulometric Solutions

- High precision for low water content
- Wide product range
- Long shelf life

TITRATION WITH OVEN

In the field of coulometric titrations, using a Karl Fischer oven allows the analysis of a larger range of samples. This technique is particularly suitable for insoluble solids with high boiling points.

The oven is connected to the Karl Fischer equipment and is used to heat the sample to the optimal temperature to release water. The water molecules are then transported to the Karl Fischer device by a carrier gas, typically air or nitrogen, which has been pre-dried using molecular sieve. Once inside the cell, the Karl Fischer reaction occurs, enabling the measurement of the water released from the heated sample.

The oven's temperature is adjusted based on the sample's stability to prevent decomposition. This ensures the titration is carried out accurately, delivering reliable results regarding the water content released while minimizing the risk of unwanted side reactions with the medium.

Product	Features	Pkg	Code
Anolyte solution for oven	Developed with minimal drift and extremely stable	500 ml	572372



REFERENCE MATERIALS

To ensure the most reliable and comparable results, it is essential to regularly verify the titer of Karl Fischer reagents. For this purpose, reference materials with a known water content are used.

CARLO ERBA Reagents offers two types of standards:

- **Solid standards:** disodium tartrate dihydrate, stable and non-hygroscopic, with a water content of approximately 15.66%.
- **Liquid standards:** available in 0.01%, 0.1%, and 1% concentrations, packaged in inert atmospheres. Each ampoule contains enough standard for a single titration. The 0.5% standard is ideal for routine calibrations and equipment validation.



Product	Features	Pkg	Code
Standard Solution 0.01%	0.1 mg H ₂ O/g	10 x 8ml	572434
Standard Solution 0.1%	1.0 mg H ₂ O/g	10 x 4ml	572414
Standard Solution 1	10.0 mg H ₂ O/g	10 x 8ml	572424
Standard Solution 0.5%	5.0 mg H ₂ O/ml	100 ml	572403
Disodium Tartrate Dihydrate	Water content 15.6%	100 g	483561

WHY CHOOSE OUR PRODUCTS?

Advantages of ERBAqua® Reference Materials

- ☛ Verified according to NIST
- ☛ Ergonomic packaging
- ☛ Comprehensive Certificate of Analysis
- ☛ Long Shelf Life

TITRATORS - TitroLine® 7500 KF & 7500 KF Trace

CARLO ERBA Reagents offers several Karl Fischer TitroLine® 7500 KF titrators for volumetric and coulometric titrations. These titrators can be adapted to a wide range of water content determination of your sample.

Titration TitroLine® 7500 KF and 7500 KF Trace

- Fast, Easy, and Accurate
- Standard Methods for Various Applications
- High-Visibility Color Screen
- Real-Time Display of Curve and Drift Measurement
- Smart Interchangeable Burette Bodies of 5, 10, or 20 ml for Volumetric Method (TitroLine® 7500 KF)
- Up to 50 Programmable User Methods
- Compatible with TitriSoft Software
- Result Storage via USB and LAN Ports
- Available in Ready-to-Use Complete Packs
- Numerous Accessories Available



TitroLine® 7500 KF Trace
Coulometric Method :
1 ppm at 5% H₂O



TitroLine® 7500 KF
Volumetric Method :
10 ppm at 100% H₂O

SI Analytics
a xylem brand

Essential for Karl Fischer Titration!

Specific Options for TitroLine® 7500 KF Trace

Oven KF Headspace TO 7280

This oven is used to separate the water which has to be titrated from liquid, solid, and pasty samples. The sample is weighed and heated. The water vapor is conveyed to a titration vessel where the water is immediately titrated using the coulometric method.

Sample Passer TW 7650

- Recommended for complete automation of your measurements starting from 15 samples per day.
- Up to 49 samples can be titrated at different temperatures.
- Can be added to your equipment at a later stage.



Titration TitroLine® 7500 KF Trace with oven KF Head-space TO 7280 and sample passer TW 7650

Code	Description	Content of the delivery
XYL0285220810	TitroLine® 7500 KF 05 Volumetric Titrator	Titration unit, interchangeable module WA 05, TM 235 KF titration stand with integrated stirrer and pump, titration vessel TZ 1770, micro-dual platinum electrode KF 1100 and starter kit, power supply 100-240 V
XYL0285220820	TitroLine® 7500 KF 10 Volumetric Titrator	Titration unit, interchangeable module WA 10, TM 235 KF titration stand with integrated stirrer and pump, titration vessel TZ 1770, micro-dual platinum electrode KF 1100 and starter kit, power supply 100-240 V
XYL0285220830	TitroLine® 7500 KF 20 Volumetric Titrator	Titration unit, interchangeable module WA 20, TM 235 KF titration stand with integrated stirrer and pump, titration vessel TZ 1770, micro-dual platinum electrode KF 1100 and starter kit, power supply 100-240 V
XYL0285220860	TitroLine® 7500 KF Trace M1 Coulometric Titrator	Titration unit, generator electrode TZ 1752 without diaphragm, magnetic stirrer TM 235, titration vessel TZ 1751, micro-dual platinum electrode KF 1150, support rod
XYL0285220870	TitroLine® 7500 KF Trace M2 Coulometric Titrator	Titration unit, generator electrode TZ 1752 without diaphragm, TM 235 KF titration stand with integrated stirrer and pump, titration vessel TZ 1754, micro-dual platinum electrode KF 1150, support rod
XYL0285220880	TitroLine® 7500 KF Trace M3 Coulometric Titrator	Titration unit, generator electrode TZ 1753 with diaphragm, magnetic stirrer TM 235, titration vessel TZ 1751, microdual platinum electrode KF 1150, support rod
XYL0285220890	TitroLine® 7500 KF Trace M4 Coulometric Titrator	Titration unit, generator electrode TZ 1753 with diaphragm, TM 235 KF titration stand with integrated stirrer and pump, titration vessel TZ 1754, micro-dual platinum electrode KF 1150, support rod

For accessories not included in packs, please contact us.

Related Products

It is recommended to replace or dry the sieve in your instruments every 4 weeks. The corresponding consumable can be found in this table:

Product	Pkg	Code
Molecular sieves 3A	1 kg	P1810017
Glass wool	250 g	457521
Cotton Rolls width 20 cm	500 g	LLG04681029

SELECTION GUIDE

Once you have selected the product suitable for your application, make sure to use all compatible products for your titration. These compatibilities are indicated in the cross-reference table by an „X.“

	572111	572131	572121	572211	572221	572302	572332	572343	572322*	572312*	572372*
	Complete 5mg/ml	Complete 5mg/ml for Aldehydes and Ketones	Complete 2mg/ml	Titant 5mg/ml	Titant 2mg/ml	Anolyte Solution, Coulomat A	Anolyte solution, Coulomat AK for Aldehydes & Ketones	Anolyte solution, Coulomat for Oils	Anolyte Solution, Coulomat AD	Anolyte Solution, Coulomat AG	Anolyte Solution, Coulomat AG Oven
414881 Methanol	X		X						*The anolyte solutions without diaphragme, Coulomat AD (572322), Coulomat AG (572312) and Coulomat AG for oven (572372) are sufficient on their own. No catholyte solution to add.		
572101 Methanol Fast	X		X								
438531 Chloroform	X		X								
572161 Medium K for Aldehydes & Ketones		X									
572141 Acid buffer	X		X								
572171 Dry Formamide	X		X								
572201 Solvent				X	X						
572241 Solvent CM				X	X						
572231 Solvent for oil				X	X						
572353 Catholyte solution CG						X		X			
572364 Catholyte solution, Coulomat CGK for Aldehydes & Ketones							X				

Which use ?		Code		Description	Pkg
VOLUMETRIC	1 component	Reagent	572111	Complete 5mg/ml	1 l
			572131	Complete 5mg/ml for Aldehydes and Ketones	1 l
			572121	Complete 2mg/ml	1 l
		Solvents	414881	Methanol	1 l
			414883	Methanol	2.5 l
			572101	Methanol Fast	1 l
	2 component	Additives	438531	Chloroform	1 l
			572161	Medium K for Aldehydes and Ketones	1 l
			572141	Acid buffer	1 l
		Titrants	572171	Dry Formamide	1 l
			572211	Titant 5mg/ml	1 l
			572221	Titant 2mg/ml	1 l
COULOMETRIC	Cells with diaphragm	Solvents	572201	Solvent	1 l
			572241	Solvent CM	1 l
			572231	Solvent for Oil	1 l
			572302	Anolyte Solution, Coulomat A	500 ml
			572343	Anolyte solution, Coulomat for oil	100 ml
			572332	Anolyte solution, Coulomat AK for Aldehydes and Ketones	500 ml
	Cells without diaphragm	Additives	572353	Catholyte solution, Coulomat CG	100 ml
			572364	Catholyte solution, Coulomat CGK for Aldehydes and Ketones	10 x 5 ml
	Cells with or without diaphragme	Titrants	572322	Anolyte Solution, Coulomat AD	500 ml
			572312	Anolyte Solution, Coulomat AG	500 ml
STANDARDS	Liquid	Additives	572372	Anolyte Solution, Coulomat AG Oven	500 ml
			572434	Standard solution 0.01%	10 x 8 ml
			572414	Standard solution 0.1%	10 x 4 ml
			572424	Standard solution 1%	10 x 8 ml
	Solid	Additives	572403	Standard solution 0.5%	100 ml
			483561	Sodium tartrate	100 g

Order your reagents on our website
www.carloerbareagents.com



www.carloerbareagents.com



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