Scharlau

The wise choice

Aquagent®

The new range of pyridine-free reagents for reliable Karl Fischer titration

More stable and robust factor
Faster initial stabilisation
Greater reaction speed
More stable end point

On many occasions it is essential to know the amount of water present in a sample. Water can influence the reactivity, stability, and shelf life, etc, of products. Karl Fischer titration has been the globally accepted method for the determination of water since the beginning of the 20th century. It is based on the Bunsen reaction, a fast, two-phase reaction, with a stoichiometric relationship between the I_2 consumed and the amount of water in the sample.

$$ROH + SO_2 + R'N \longrightarrow [R'NH]SO_3R$$

$$H_2O + I_2 + [R'NH]SO_3R + 2R'N \longrightarrow [RNH]SO_4R + 2[R'NH]I$$

pH 5-7

ROH = Alcohol, normally methanol
R'N = Nitrogen based

The first KF reagents developed contained pyridine in their formulation, supposedly essential for the reaction, but later experiments showed that pyridine only acts as a buffer substance, and could be replaced by other basic compounds capable of carrying out the same function. For this reason, the new Karl Fischer Aquagent® reagents contain imidazoles instead of pyridine, alternative bases with good buffering capacity that allow stable titration end points to be quickly obtained.
The newly developed manufacturing and control method allows us to launch a new Aquagent® with multiple advantages for the user.

New Aquagent® advantages

- **More stable and robust factor**
- **Faster initial stabilisation**
- **Greater reaction speed**
- **More stable endpoint**
- **Greater homogeneity between batches and within the same batch**
- **Suitable for a wide variety of matrices**
- **Greater variety of formats**
- **Less environmental impact**
- **Longer shelf life**

Aquagent®
Reliable results in Karl Fischer volumetric and coulometric titration

Aquagent®: new range of reagents

Aquagent® is the Scharlau name given to a wide range of Karl Fischer titration reagents. We offer a wide, improved range of reagents for sample titration with reliable results, which satisfy the needs of modern-day laboratories in the determination of water using Karl Fischer.

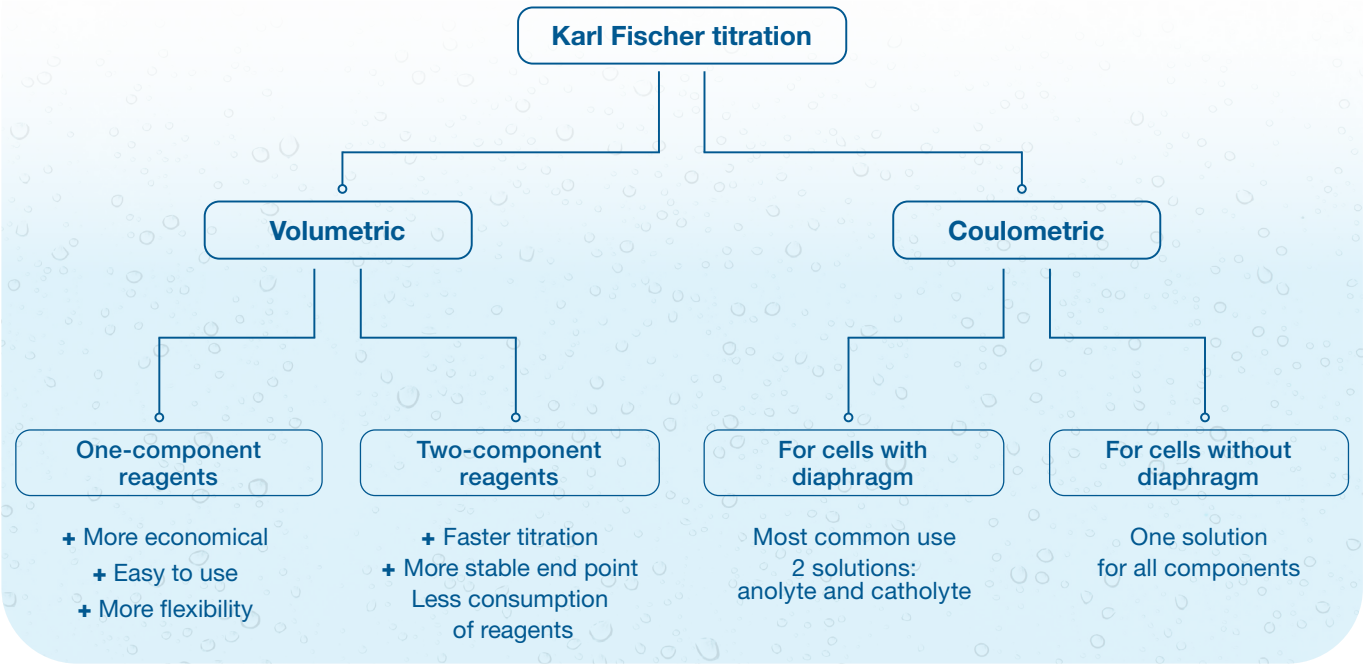
Aquagent® comprises:

- **One or two-component reagents for volumetric titration**
- **Reagents for coulometric titration in cells with or without diaphragm**
- **Standards**

Suitable for specific applications:

- **Ketones and aldehydes**
- **Carbohydrates, inorganic salts and proteins**
- **Oils and fats**
- **Crude and related products**
- **Strong acids**
- **Bases**

There are two methods based on Karl Fischer titration for the determination of water in a sample: volumetric and coulometric. The choice of one over the other depends upon the quantity of water expected in the sample. Choosing the correct method is essential to obtain accurate, reliable results.



Aquagent® volumetric solutions: One-component reagents

In Karl Fischer one-component volumetric titration, all the substances needed for the reaction are included in a single reagent: the titrant. One-component reagents are easy to use and allow for greater flexibility in the choice of the most suitable solvent for each type of sample. On the other hand, due to the reactivity of their components, the factor of one-component reagents must be checked regularly.

Scharlau offers a range of one-component reagents suitable for both general as well as specific applications.

GENERAL PURPOSE

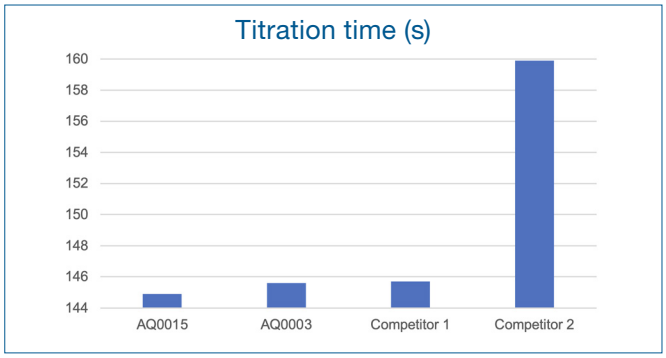
REAGENTS:

Aquagent® Complet 2

A general-purpose reagent for samples with low or medium water content. 1 ml titrates approximately 2 mg of water. It is generally used in combination with methanol as a solvent.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Complet 2	500 ml	AQ00330500
	1 l	AQ00331000
	2.5 l	AQ00332500

One of the important points to consider in the choice of one-component reagents is titration speed. In the following graph, we can see the titration speed of the new Aquagent® Complet 5, it is one of the fastest on the market, improving on our previous formulation.

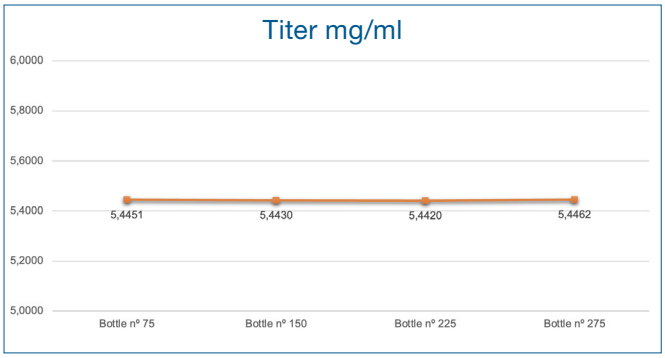


Aquagent® Complet 5

A general-purpose reagent for samples with medium or high water content. 1 ml titrates approximately 5 mg of water. It is generally used in combination with methanol as a solvent.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Complet 5	500 ml	AQ00150500
	1 l	AQ00151000
	2.5 l	AQ00152500

The new, more robust manufacturing process allows us to guarantee greater consistency between batches and within the same batch.
Within the same batch, the factor of all the bottles is kept constant, as seen in the graph below.



Advantages of the new one-component Aquagent® reagents

More stable and robust factor
Faster initial stabilisation
Greater reaction speed
More stable endpoint

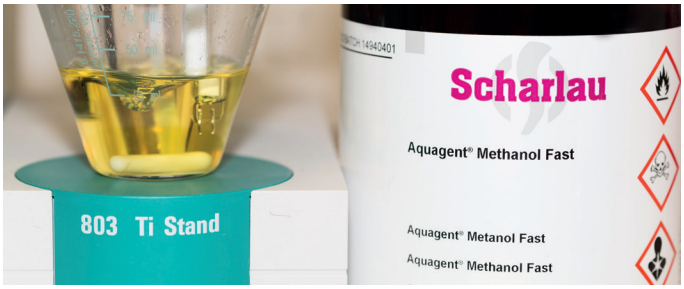
Suitable for a wide variety of matrices
Longer shelf life
Minimized precipitation risk

SOLVENTS:

Dry methanol

To correctly determine the water content of a sample, it must previously be dissolved in a dry solvent. The most common is dry methanol. If the sample is not soluble in methanol, it is possible to use other solvents (see the section on Specific Applications).

DESCRIPTION	PACKAGING	REFERENCE
Methanol, dry (max. 0.005% H_2O), for analysis	1 l	ME03041000
	2.5 l	ME03042500



Aquagent® Methanol Fast

Thanks to its improved formula, it allows faster Karl Fischer titration.

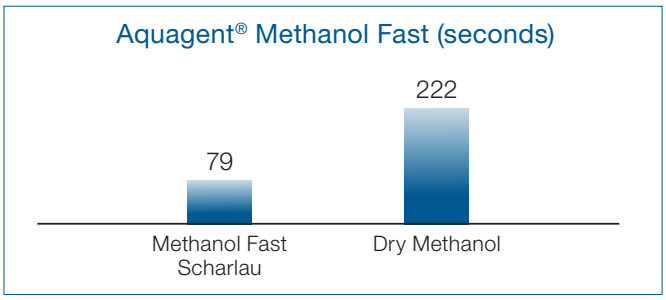


FIGURE: Shows the time needed to reach the end point in the KF titration reaction with one-component reagents using different types of methanol as solvent. Sample: 20 mg H_2O injection by weight.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Methanol Fast	1 l	AQ00111000
	2.5 l	AQ00112500

SPECIFIC APPLICATIONS

Aquagent® Complet 5K for Aldehydes and Ketones

Aldehydes and ketones react with methanol to form water. Therefore, when the sample contains aldehydes and/or ketones, the use of methanol can give inaccurate results. In the case of samples with aldehydes and ketones, a specific reagent is needed: Aquagent® Complet 5K. It is used in combination with Aquagent® Medium K, a specific solvent that does not contain methanol. This reagent can titrate 5 mg of water/ml.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Complet 5K	500 ml	AQ00340500
	1 l	AQ00341000

Aquagent® Medium K

Methanol reacts with aldehydes and ketones producing water as a by-product. Therefore, when the sample contains aldehydes or ketones, methanol must be substituted for another solvent; our Aquagent® Medium K.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Medium K	500 ml	AQ00050500
	1 l	AQ00051000

Aquagent® Buffer Acid (additive)

For an optimum Karl Fischer reaction, pH must be between 5 and 7. For a correct determination of the water content in strong acids, it is recommended to neutralize the working medium with our Aquagent® Buffer Acid.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Buffer, acid	500 ml	AQ00090500
	1 l	AQ00091000

Dry formamide (additive)

Formamide improves the solubility of carbohydrates, proteins and inorganic salts in methanol. This solvent can be added to methanol in no more than 50% in volume.

DESCRIPTION	PACKAGING	REFERENCE
Formamide dry (max. 0.02% H_2O), for analysis	1 l	FO00281000

Aquagent® volumetric solutions:
Two-component reagents

In the two-component system, the solvent not only acts as a medium to dissolve the sample, but it also contains part of the reagents needed for the reaction to occur. This allows for greater reagent shelf life and avoids the need of frequently determining the factor. Compared with one-component reagents, two-component reagents are more costly, but they also have important advantages: faster titration, less consumption of reagents and greater long-term stability.

Scharlau offers a range of two-component reagents suitable for both general as well as specific application use.

GENERAL USE

Aquagent® Titrant 2
A general use reagent which contains iodine and methanol. It titrates approximately 2 mg of water/ml. It must be used with Aquagent® Solvent.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Titrant 2	500 ml	AQ00600500
	1 l	AQ00601000

Aquagent® Titrant 5
A general use reagent which contains iodine and methanol. It titrates approximately 5 mg of water/ml. It must be used with Aquagent® Solvent.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Titrant 5	500 ml	AQ00590500
	1 l	AQ00591000
	2.5 l	AQ00592500

Scharlau offers a general solvent, as well as others for specific applications:

Aquagent® Solvent
A general reagent which contains SO_2, imidazole and methanol. It must be used with Aquagent® Titrant.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Solvent	1 l	AQ00291000
	2.5 l	AQ00292500

Advantages of the new two-component Aquagent® reagents

More stable and robust factor
Faster and more stable titration than one-component reagents
Greater accuracy

SPECIFIC APPLICATIONS

Aquagent® Solvent CM

It acts as a solvent for the titration of fats and oils. It is modified to improve the solubility of long-chain hydrocarbons.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Solvent CM	1 l	AQ00081000
	2.5 l	AQ00082500

Aquagent® Solvent OIL

It acts as a solvent for the titration of fats and oils, halogenated hydrocarbon free.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Solvent OIL	1 l	AQ00101000

Aquagent® coulometric solutions:
For cells with or without diaphragm

Coulometric titration is the method used for samples with a low water content (<0.1%) or for the determination of the quantity of water in valuable samples. In coulometric titrations, the iodine required is generated in the titrated cell by the iodide oxidation on the anode. The concentration of water is precisely calculated from the current used for a determined time period. The cell measured contains two compartments: anode and cathode, which may be separated by a membrane or diaphragm. The titration cells can, therefore, have a diaphragm or not depending on whether they are separated.

Scharlau offers its Aquagent® reagents suitable for both cell types.

Aquagent® for cells with diaphragm

ANOLYTE:

Aquagent® Coulometric A
Anolyte for KF coulometric titrations

It is suitable for cells with diaphragm. This general-purpose reagent contains the components for the anode compartment of the electrolytic cell. It must be used with Aquagent® Coulometric CG.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Coulometric A, anolyte	500 ml	AQ00180500

Aquagent® Coulometric Oil
Anolyte for KF coulometric titrations

It is suitable for cells with diaphragm. This reagent for the anode compartment is especially formulated for petroleum samples and its derivatives. It must be used with Aquagent® Coulometric CG.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Coulometric Oil, anolyte	100 ml	AQ00250100

CATHOLYTE:

Aquagent® Coulometric CG
Catholyte for KF coulometric titrations

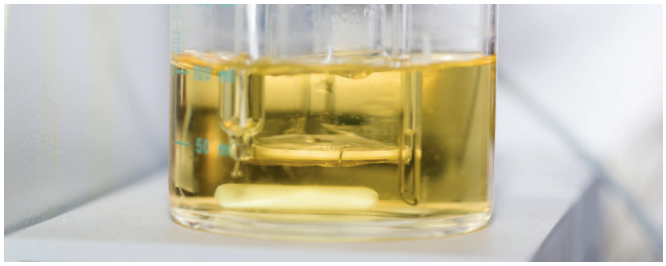
It is suitable for cells with diaphragm. This reagent contains the components for the cathode compartment of the electrolytic cell. It must be used with Aquagent® Coulometric A or Oil.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Coulometric CG, catholyte	100 ml	AQ00140100
	10 x 5 ml	AQ00140050

Aquagent® Coulometric AK
Anolyte for KF coulometric titrations

It is suitable for cells with diaphragm. This reagent contains the component for the anode compartment of the electrolytic cell needed to analyse samples with aldehydes and ketones. It must be used with Aquagent® Coulometric CG-K.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Coulometric AK, anolyte	500 ml	AQ00320500



CATHOLYTE:

Aquagent® Coulometric CG-K
Catholyte for KF coulometric titrations

It is suitable for cells with diaphragm. This reagent contains the component for the cathode compartment of the electrolytic cell needed to analyse samples with aldehydes and ketones. It must be used with Aquagent® Coulometric AK.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Coulometric CG-K, catholyte	10 x 5 ml	AQ00130050

Aquagent® for cells without diaphragm

ANOLYTE:

Aquagent® Coulometric AG
For KF coulometric titrations

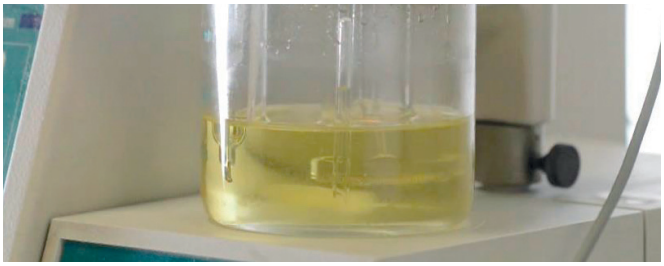
It is suitable for cells with or without diaphragm.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Coulometric AG	500 ml	AQ00580500
	1 l	AQ00581000

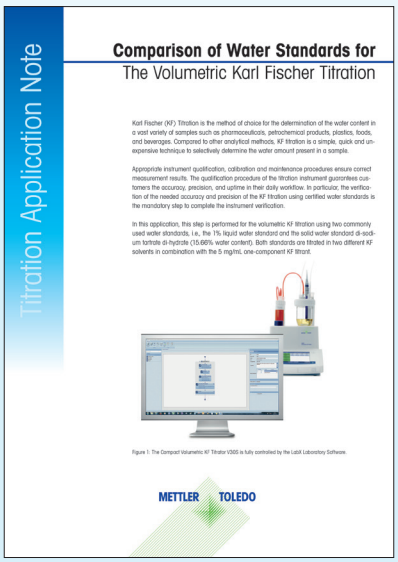
Aquagent® Coulometric AD
For KF coulometric titration

Optimised for cells without diaphragm.
It contains all the reaction components in a single reagent.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® Coulometric AD, anolyte	500 ml	AQ00390500



Equipment manufacturers recommend us



Aquagent®: Scharlau standards for Karl Fischer titration

To determine the titre of the reagents, standards with a known quantity of water must be used. Water standards are every time more in demand, to offer more reliable results which are comparable.
Our family of Aquagent® standards offer:

- **Solid standards:** di-Sodium tartrate dihydrate, stable, non-hygroscopic, with a water content of around 15.66%.
- **Liquid standards:** Aquagent® Standard 0.01% and 0.1% for coulometric titrations and Aquagent® Standard 1% for volumetric titrations. We package our standards in vials of 0.01%, 0.1% and 1% to keep their conditions optimum until opening. Each vial contains enough standard for one titration. Our Aquagent® Standard 0.5% is suitable for routine factorisation of reagents, as well as equipment validation.

DESCRIPTION	PACKAGING	REFERENCE
Aquagent® di-Sodium tartrate dihydrate	25 g	AQ00300025
	100 g	AQ00300100
Aquagent® standard solution 0.01%* (0.1 mg/g)	10 x 8 ml	AQ00120080
Aquagent® standard solution 0.1%* (1 mg/g)	10 x 4 ml	AQ00190040
Aquagent® standard solution 1%* (10 mg/g)	10 x 8 ml	AQ00200080
Aquagent® standard solution 0.5% (5 mg/ml)	100 ml	AQ00210100
	500 ml	AQ00210500

*Traceable to NIST

Advantages of the new Aquagent® standards

Traceable to NIST
Longer shelf life

Practical packaging
Full Certificate of Analysis

Aquagent®: Quick guide

	ME0304 Methanol, dry	AQ0011 Aquagent® Methanol Fast	AQ0005 Aquagent® Medium K	AQ0009 Aquagent® Buffer	FO0028 Formamide, dry	AQ0029 Aquagent® Solvent	AQ0008 Aquagent® Solvent CM	AQ0010 Aquagent® Solvent OIL	AQ0014 Aquagent® Coulometric CG	AQ0013 Aquagent® Coulometric CG-K
AQ0033 Aquagent® Complet 2	●	●		●	●					
AQ0015 Aquagent® Complet 5	●	●		●	●					
AQ0034 Aquagent® Complet 5K			●							
AQ0060 Aquagent® Titrant 2						●	●	●		
AQ0059 Aquagent® Titrant 5						●	●	●		
AQ0018 Aquagent® Coulometric A									●	
AQ0032 Aquagent® Coulometric AK										●
AQ0025 Aquagent® Coulometric Oil									●	
AQ0058 Aquagent® Coulometric AG										
AQ0039 Aquagent® Coulometric AD										

Aquagent®: Order information

AQUAGENT® PRODUCT FAMILY				PACKAGING	REFERENCE
Volumetric		Reagents	Aquagent® Complet 2	500 ml	AQ00330500
				1 l	AQ00331000
				2.5 l	AQ00332500
			Aquagent® Complet 5	500 ml	AQ00150500
				1 l	AQ00151000
				2.5 l	AQ00152500
			Aquagent® Complet 5K	500 ml	AQ00340500
				1 l	AQ00341000
		Solvents	Methanol, dry (max. 0.005% H_2O), for analysis	1 l	ME03041000
				2.5 l	ME03042500
			Aquagent® Methanol Fast	1 l	AQ00111000
				2.5 l	AQ00112500
			Aquagent® Medium K	500 ml	AQ00050500
				1 l	AQ00051000
		Additives	Aquagent® Buffer, acid	500 ml	AQ00090500
				1 l	AQ00091000
			Formamide, dry (max. 0.02% H_2O), for analysis	1 l	FO00281000
		Titrants	Aquagent® Titrant 2	500 ml	AQ00600500
				1 l	AQ00601000
			Aquagent® Titrant 5	500 ml	AQ00590500
				1 l	AQ00591000
				2.5 l	AQ00592500
		Solvents	Aquagent® Solvent	1 l	AQ00291000
				2.5 l	AQ00292500
			Aquagent® Solvent CM	1 l	AQ00081000
				2.5 l	AQ00082500
			Aquagent® Solvent OIL	1 l	AQ00101000
Coulometric	Cells with diaphragm		Aquagent® Coulometric A, anolyte	500 ml	AQ00180500
			Aquagent® Coulometric Oil, anolyte	100 ml	AQ00250100
			Aquagent® Coulometric CG, catholyte	10 x 5 ml	AQ00140050
				100 ml	AQ00140100
			Aquagent® Coulometric AK, anolyte	500 ml	AQ00320500
			Aquagent® Coulometric CG-K, catholyte	10 x 5 ml	AQ00130050
	Cells without diaphragm		Aquagent® Coulometric AG	500 ml	AQ00580500
				1 l	AQ00581000
			Aquagent® Coulometric AD	500 ml	AQ00390500
Standards	Liquids		Aquagent® standard solution 0.01%	10 x 8 ml	AQ00120080
			Aquagent® standard solution 0.1%	10 x 4 ml	AQ00190040
			Aquagent® standard solution 1%	10 x 8 ml	AQ00200080
			Aquagent® standard solution 0.5%	100 ml	AQ00210100
				500 ml	AQ00210500
	Solids		Aquagent® di-Sodium tartrate dihydrate	25 g	AQ00300025
				100 g	AQ00300100

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Internal use

Visit our website:

F-AQUENG23