Evaporator

ADP-611

Operation Manual

Please read this manual thoroughly in advance for the best performance of the equipment.

Ver.06

A/N 98-595-0478

Table of contents Page

1. Introduction

1-1. Overview of the instrument

The ADP-611 you have purchased is the Evaporator to be used and connected to KF moisture titrator for moisture titration of solid sample, powder sample or samples that may interfere by side reaction if titrated in direct method.

[Features]

1) **Sample boat by magnetic maneuver**

The magnetic maneuver of sample boat movement within the oven eliminates ambient moisture permeation so that reliable measurement of water content in trace amounts is assured.

2) **Fully alarmed to prevent errors**

About heating temperature : Alarm is displayed when oven temperature does not reach expected degrees in a given length of time or exceeds 350°C.

3) **Scan mode for sample evaporation temperature**

The patented (pending) scan mode determines optimal evaporation temperature based on the relation between extracted water and heating temperature rinsing consecutively in the oven. This mode, when connected to KEM's MKA-610 or MKC-610 moisture titrator, is useful for a sample of which evaporation temperature is unknown.

4) **Heater tube equipped**

The tube line from the oven to moisture titration unit is constantly heated at temperature above 105°C to avoid condensation so that reliable measurement results are obtained.

5) **Option**

Air pump : The built-in air pump eliminates the necessity of a carrier gas container.

Note:

If you should find any description that may differ from your instrument, please refer to the manual that was delivered together with your instrument.

1-2. About the manual

Please keep this manual near your system so that you can easily access to the necessary information you are looking for while operating or preparing for measurement.

The below three boxed messages show the basis symbols of warning, caution and note that you will see in this manual from time to time:

1. Where there exists a danger of physical injury or even possible death:

> **Warning!**
>
> **There exists the danger of physical injury or even possible death if the instruction is disregarded.**

2. Where there exists a danger of property damage:

> **Caution!**
>
> **There exists the danger of property damage if the instruction is ignored.**

3. When there exists a possibility of failure of instrument performance:

> **Note:**
>
> **There exists the possibility of failure of instrument performance. If ignored, warranty may not be covered.**

* If you should find any part in this manual not clear to understand or missing article, contact your local dealer or sales representative.

* Manufacturer will not be liable for any loss or damage directly or indirectly caused by use of the instrument or its consequences.

1-3. ⚠Safety symbols

Always observe these signs and instructions.

You must observe cautionary messages and warnings in order to protect yourself as well as prevent others from physical injury or property damages.

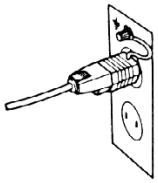
⚠ Warning This symbol means "Danger of severe injury or possible death".	This symbol means prohibition of an act.
⚠ Caution This symbol means "Danger of injury or property damage".	This symbol means mandatory.

⚠ WARNING!

You must ground earth wire of power cable.

Ground the green wire of adapter if power tap is 2-pin outlet.

3-pin plug has earth line to ground by itself when plugged in.



Danger of electric shock if not grounded to earth.

⚠ WARNING!

Use the same type and rating of fuse. Be sure to plug out power cord before replace the fuse.

Danger of fire if a wrong fuse is loaded.

⚠ WARNING!

Do not use volatile chemical or work in flammable gas.

Danger of explosion inside the instrument.

⚠ WARNING!

Wear safety glasses, gloves or protective mask if necessary,and well ventilate the room.

Danger of injury on your skin or in the eyes by splashing chemical.
Also your windpipe may get hurt if toxic gas is breathed in.

⚠ CAUTION!

Do not operate in a way other than specified in the manual.

Danger of fire, electric shock or damage to the instrument.

⚠ CAUTION!

Do not open housing case or overhaul the unit for repair except by an authorized service person.

Danger of fire, shock or malfunctioning of the unit.

⚠ CAUTION!

Do not touch any hot place during and after operation.

Do not touch!

You may get burned if you touch it.

About place for installation

Avoid the use of this instrument under the environment described below.
(Failure can lead to the degradation of performance and reliability of the system.)

- Operation of devices with strong electric motors using common power source
- Near strong magnetic/electric field
- Use of power source with too variable load
- Location of strong vibration
- Exposure to direct sunlight
- Location with large temperature difference
- Exposure to corrosive gas
- Exposure to extreme heat (Operation temperature: 5 to 35°C (41 to 95°F))
- Exposure to high humidity (Over 85%RH)

About power source

- Power for this instrument is AC100-120V±10% or AC220-240V ±10%and 50/60Hz.
- Supply power direct from the outlet, and do not share power from a tap.
- Do not put any obstacle around power outlet just case of need for plugging out power cord to avoid the possible danger of the whole system in trouble.

About place for storage

- Store in a desiccant container the disassembled titration cell as they are after cleansed and dried, if it is not going to be operated for a long period of time. It is recommended to pack the main unit in the carton box in which the instrument was first delivered.
- Avoid the places for storage under inadequate ambient conditions such as extremely high/low temperature, high humidity or heavily dusty atmosphere.

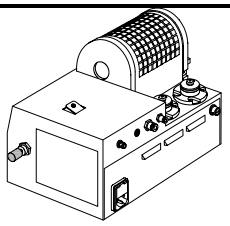
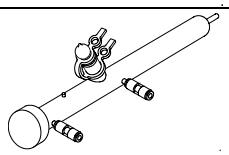
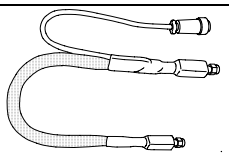
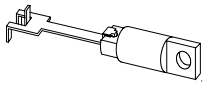
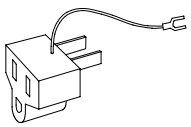
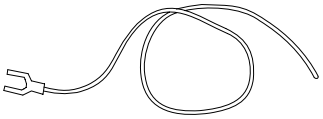
Environmental condition

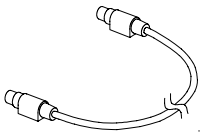
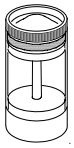
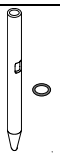
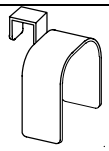
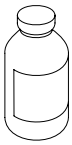
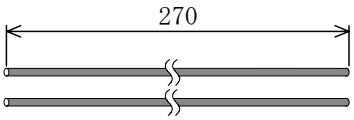
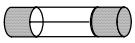
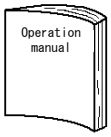
- This instrument is designed for the indoor use under the environmental conditions specified in the Section 1.4 of CE marking (LVD, 73/23/EEC, EN61010-1) and the use of the Category II of Overvoltage and the Pollution Level 2.

2. Preparations for measurement

2-1. Supplied parts

Check the supplied parts referring to the following parts list for ADP-611. If you should find any missing or broken parts including the main unit, accessories or manual, contact your sales representative or local dealer.

Part name	Part code	Qty	Sketch
Main unit	ADP-611	1 unit	
Heating tube	98-433-0102	1 pce	
Heater tube /ADP511	98-433-0015	1 pce	
Boat push rod	98-433-0098	1 pce	
Sample boat	98-710-3399	3 pcs	
Bubbler tube	98-433-0075	1 pce	
Power cord with earth wire (AC 100/110/120V area) (AC 220/230/240V area) (for UK) (for China)	 98-320-3198 98-320-3461 98-320-4199 64-000-1800-48	1 pce	
Adapter for power connector (AC 100/110V only)	98-320-3199	1 pce	
Ground wire (AC 100/110V only)	98-433-3331	1 pce	

Part name	Part code	Qty	Sketch
Connecting cable	98-428-0030	1 pce	
Desiccant tube	98-433-0020	2 pcs	
Nozzle holder	98-550-0147	1 set	
Protect cover	20-012-4300-48	1 pce	
Zeolite (500g)	98-810-3412	1 pce	
Exhaust tube	98-710-3051	1 pce	
Finger shaped sampler	98-710-0038	1 pce	
Tube adapter	98-550-6429	1 pce	
Tube	(98-521-0071)	2 pcs	
Power fuse 4A	(98-338-9502)	2 pcs	
Operation manual	98-595-0478	1 copy	

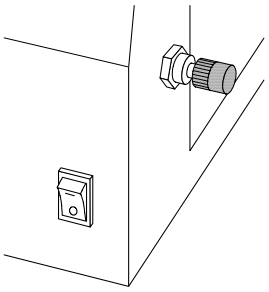
Note:

Parts with parenthesized part code have unique order units or packing forms different from others. Therefore, please refer to the section "7-1. Part list" when ordering these parts.

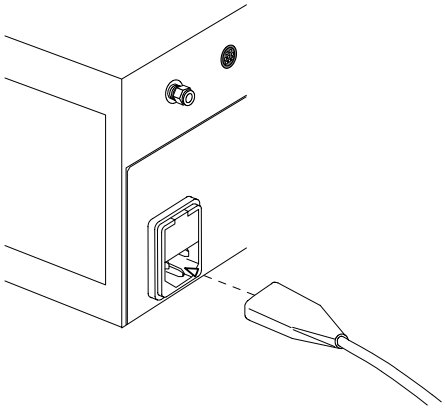
2-2. Installation and start-up preparation

2-2-1. Supplied power

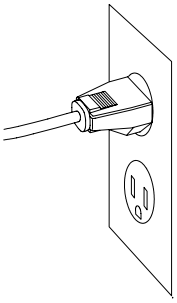
1) Make sure the power switch of Main unit is in OFF position.



2) Plug in the supplied power cable on the back of unit.

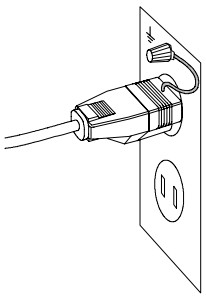


3) Connect the power cable to the power outlet.



< 3-pin plug >

The 3 pins plug has an earth terminal and grounds to the earth by itself.



< 2-pin plug >

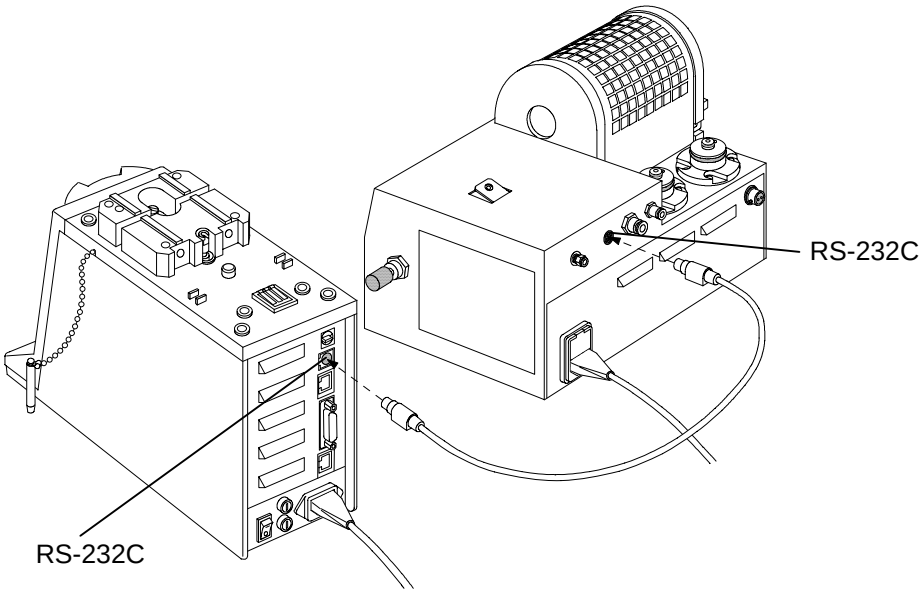
Attach an adapter for power connector to the plug and ground the green wire to the earth terminal.

⚠ Warning!

The earth wire must be grounded. If not, there exists a danger of electric shock.

2-2-2. Connecting cable to a measuring unit

The evaporator ADP-611 and the moisture titration unit are connected with the supplied cable, which is plugged in RS232C port on the rear panel of both units as shown below.

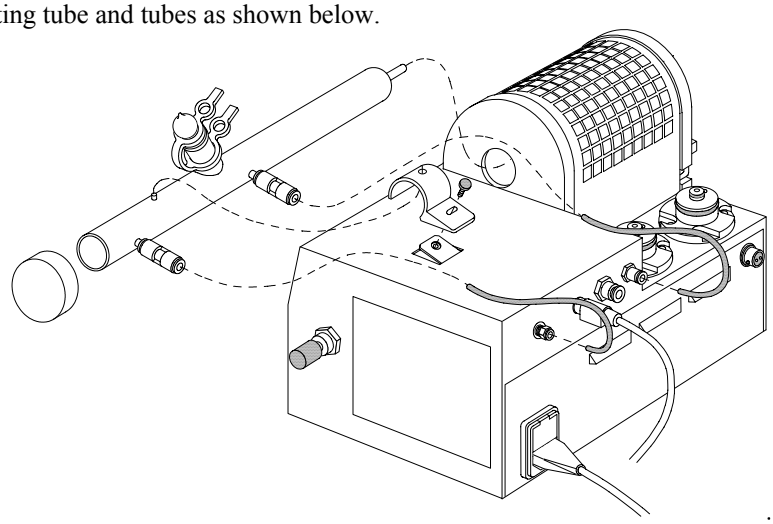


⚠ Warning!

Before connecting to the measuring unit, make sure to see the power of measuring unit is tuned off. If connected with the power turned on, it may cause malfunction of both units.

2-2-3. Installation of Heating tube and tube lines

Install the heating tube and tubes as shown below.

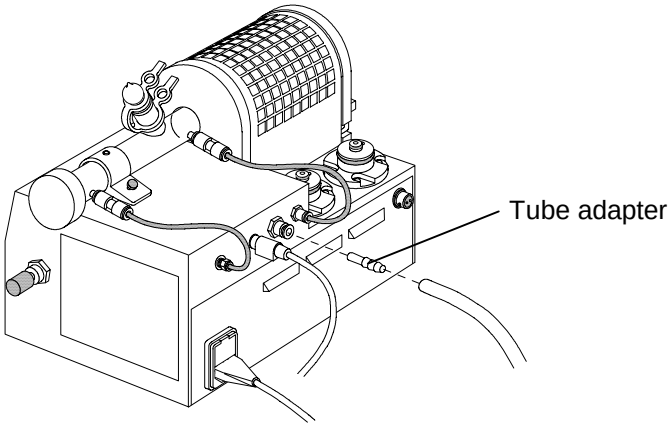


⚠ Caution!

The heating tube is made of glass. Handle with care. Do not give excessive force to the joint and tube lines. Any broken joint may cause leak and other kinds of troubles.

2-2-4. Installation of carrier gas tube

Fix the tube adapter in the carrier gas flow inlet on the rear panel, and connect the tube line from the tank (nitrogen gas container). If the outside diameter of gas line is ϕ6mm, the tube can be inserted without a tube adapter.

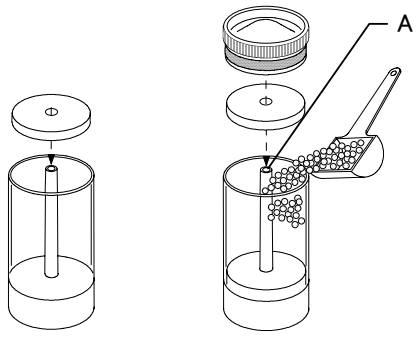


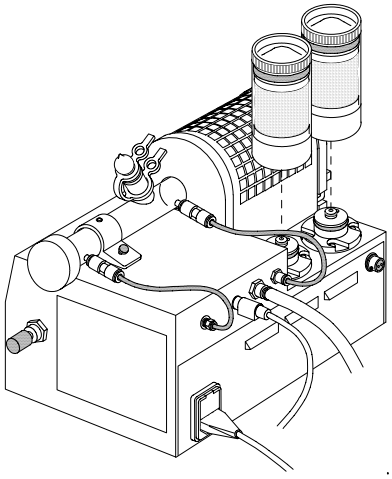
Note:

Supply the nitrogen gas under secondary pressure below 0.5kg/cm^2. Also, fasten the jointed Tube adapter and gas tube securely with a wire winded around it. Use a gas tube made of copper, stainless or 4-fluoride ethylene, which does not absorb moisture.

2-2-5. Installation of desiccant tube

1) First, place a sponge at the bottom of tube, and fill it with Zeolyte. At this point, put your finger on top of the hole (as illustrated A) to prevent clogging.
2) After filling, place another sponge on top of it, and cap the tube. The cap must securely seal the tube top by squeezing.
3) Place the two desiccant tubes (zeolite filled in) in position as shown below.



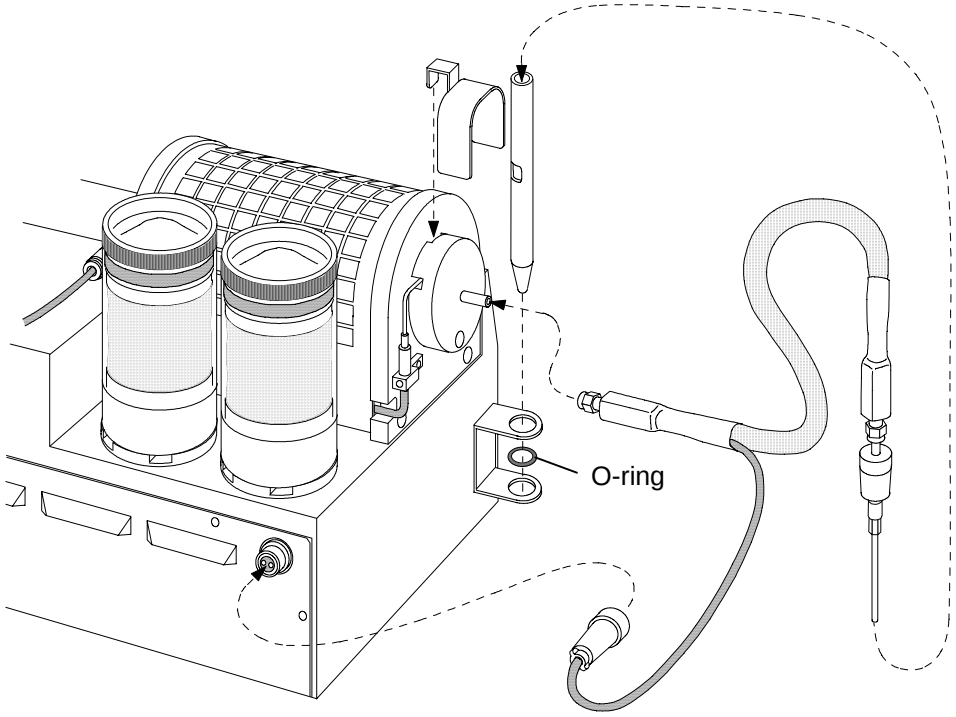


⚠ Warning!

When filling Zeolite, leave a few mm gap in between its top and tube lid. Too much Zeolite if pushed into the tube, may cause unstable carrier gas flow.

2-2-6. Installation of heater tube and bubbler tube

Install the nozzle holder, heater tube, bubbler tube and protect cover as shown below. When installing the nozzle holder, be sure to attach the O-ring to it as shown below.

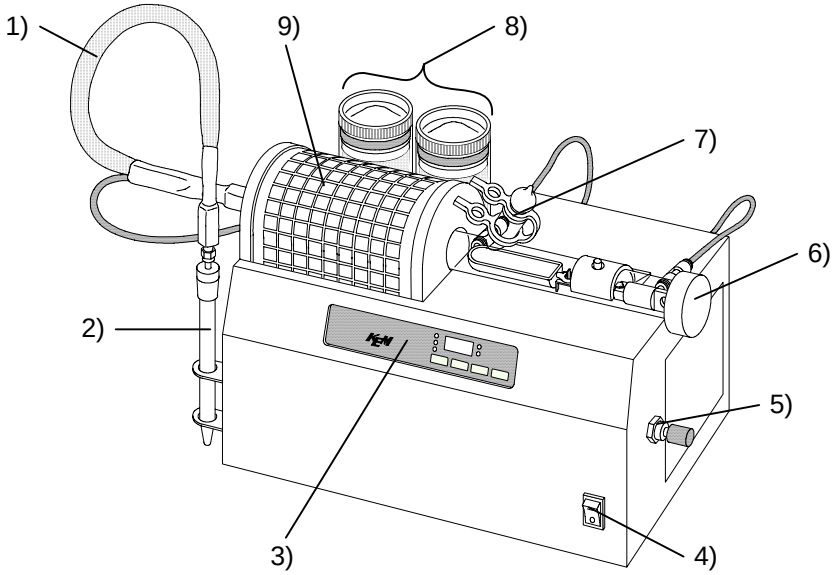


Note:

When connect a heater tube to a bubbler, tighten them with fingers. Never use any tools such as a plier or a wrench which might become them deformed.

2-3. Parts configuration

2-3-1. Front view



1) Heater tube
The gas containing evaporated moisture is introduced to the Karl Fischer moisture titrator through this tube. Temperature of heater tube is maintained at above 105°C.

2) Nozzle holder
This is the rest for bubbler tube when it is not in use.

3) Operating panel
Display screen and keys are arranged here.

4) Power switch
Main switch for the unit.

5) Flow control knob
Carrier gas flow is controlled with this knob. Range: 100 ~ 300mL/min.

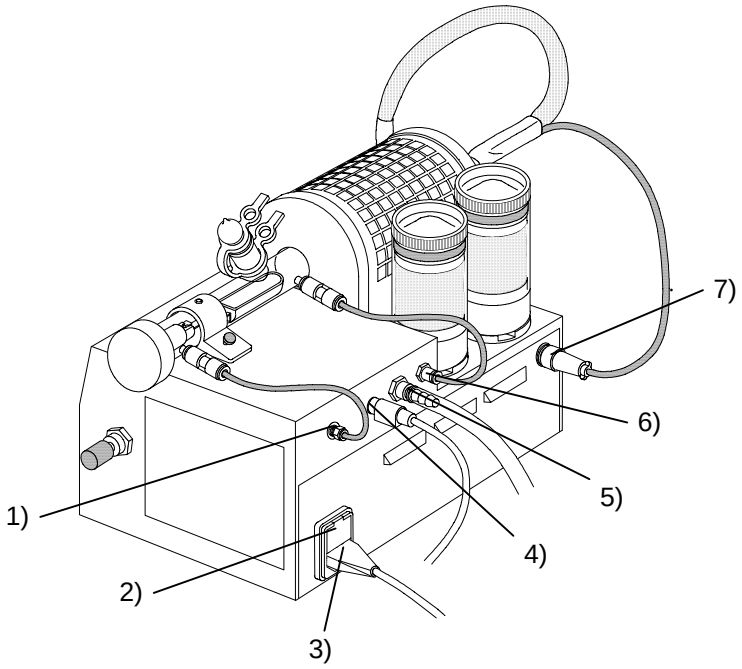
6) Heating unit cap
The sample boat is loaded or unloaded though this hole.

7) Sample inlet
The sample is discharged through this inlet.

8) Desiccant tube
The moisture in carrier gas introduced into the unit is removed with desiccant.

9) Oven
This is an electric oven to heat the loaded sample. Range: 50 ~ 300°C.

2-3-2. Rear view



1) Back purge outlet (Back Purge)
   This outlet is connected with the back purge drain outlet of the heating tube.

2) Power fuse box
   The power fuse is housed here.

3) Power receptacle (~ LINE)
   The power cord is connected here.

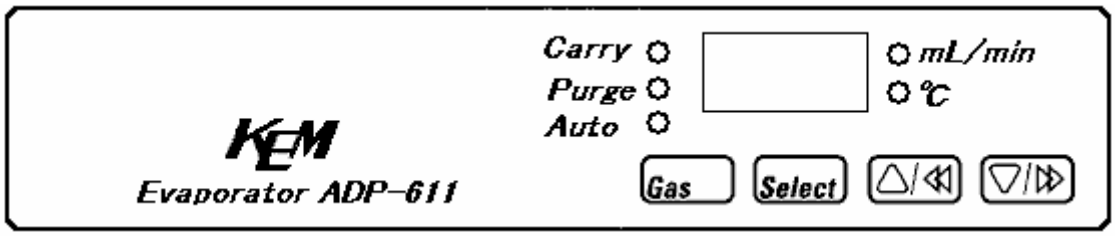
4) RS-232C port
   The cable from the measuring unit is connected to this port.

5) Carrier gas inlet (Gas In)
   The carrier gas tube line comes to this inlet. Pressure range: below 0.5kg/cm^2.

6) Purge gas inlet (Carrier)
   This inlet is connected with the carrier gas inlet of the heating tube.

7) Heater tube connecting port (Warming tube)
   The power for heater tube is supplied from this connector.

2-3-3. Operating panel



Gas This switch makes a changeover of gas line between Carry and Purge:

Carry line : LED "Carry" turns on, and the carrier gas flows into titration cell.
Purge line : LED "Purge" turns on, and the gas goes to the back purge line.

Select This switch changes the display (oven temperature, gas flow rate and selection of oven temperature).

Temperature : LED "°C" turns on, and the display shows present temperature of the heating tube. LO appears when the temperature is below 40°C.

Flow rate : LED "mL/min" turns on, and shows present gas flow rate. LO appears when flow rate is below 60mL/min.

Select : LED "°C" blinks. Select a temperature of heating unit for manual operation. When this button is pressed again, it is confirmed and stored in memory. When LED "Auto" is off, the heating goes up to preset degree of temperature.

△/◁◁ The sample boat moves into the oven.
This key also works in selection of temperature in manual operation.

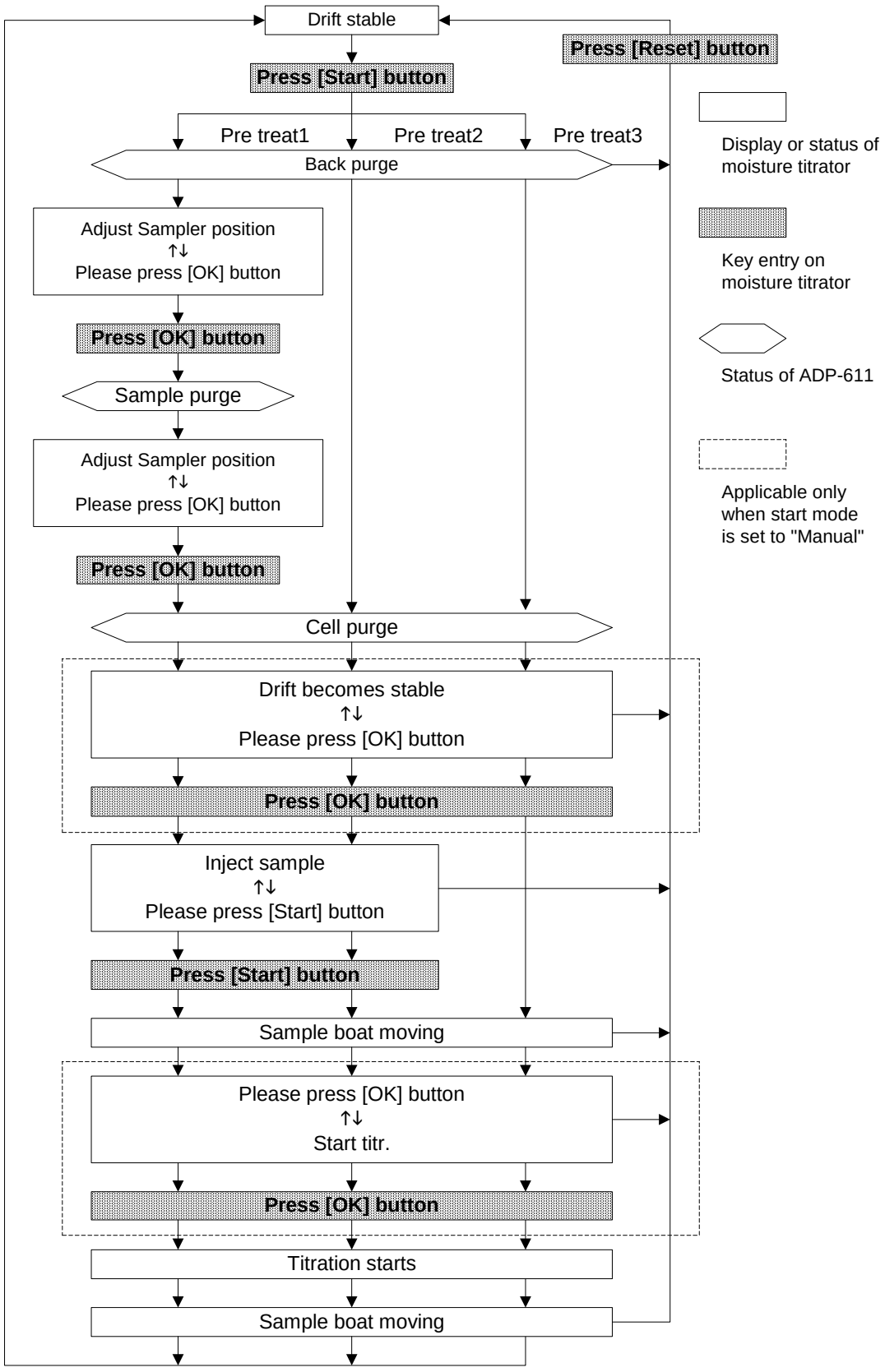
▽/▷▷ The sample boat moves into the oven.
This key also works in selection of temperature in manual operation.

"Auto" When this is turned lit, it means the evaporator is communicating with the measuring unit.

3. Measuring procedure

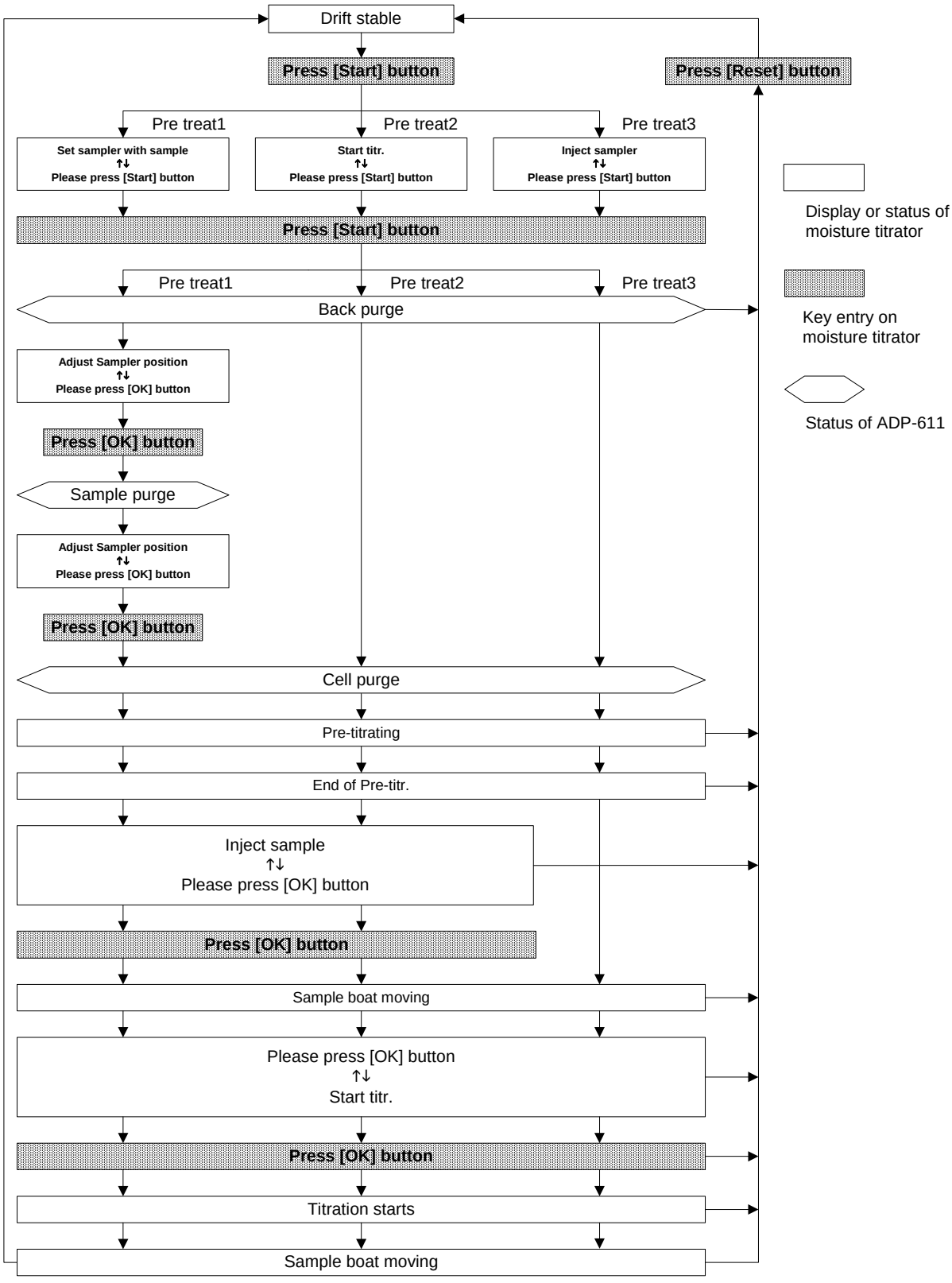
3-1. Sequence of measurement

< MKC-610 >

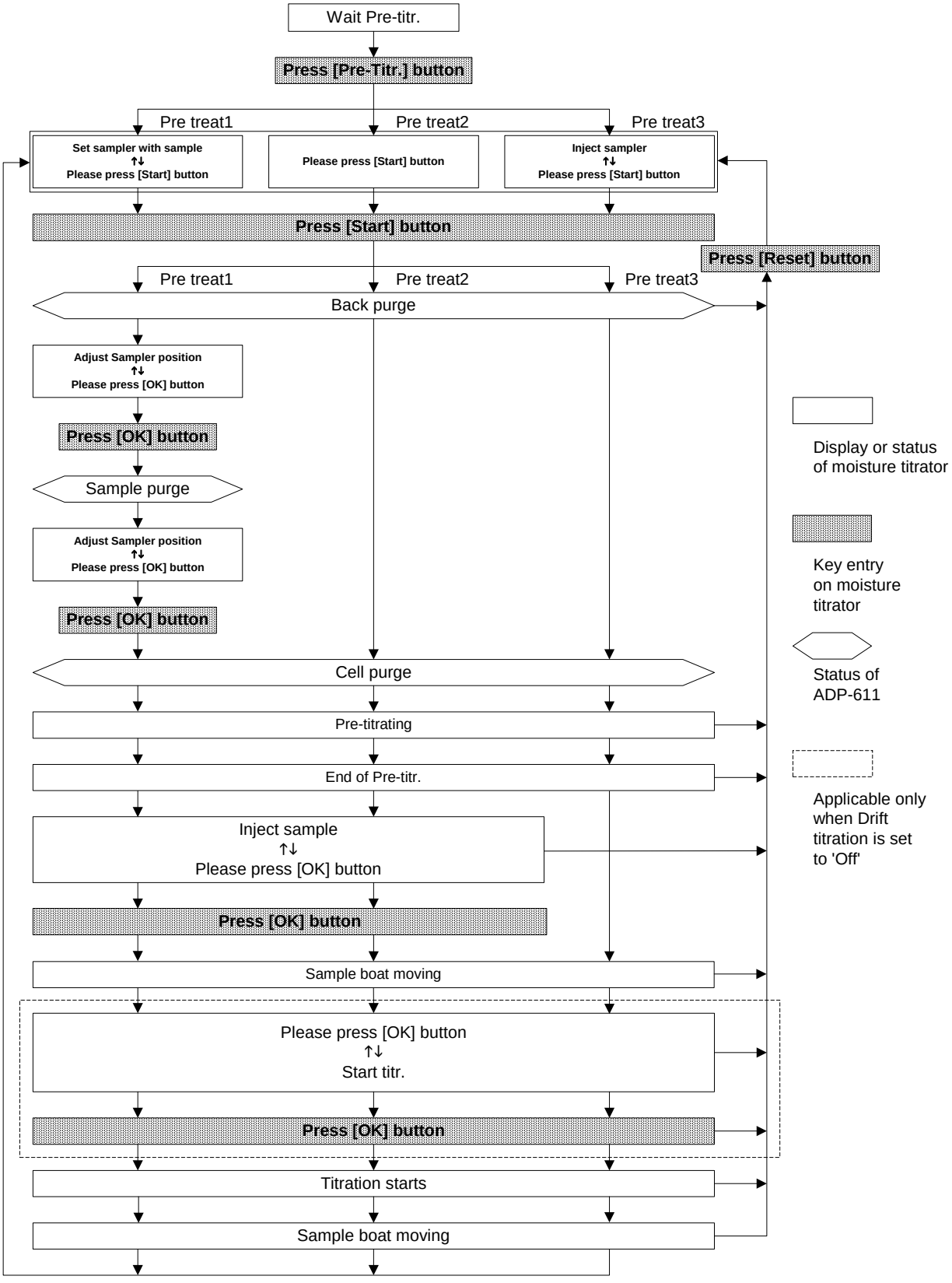


< MKA-610 >

1) When ‘On’ for Drift titr. and ‘Manual’ for Start mode is selected



2) When ‘On’ for Drift titr. and ‘Auto’ for Start mode or when ‘Off’ for drift titration is selected



3-2. Preparation of Karl Fischer moisture titrator

3-2-1. Method parameter setup

It is necessary to set up Method parameters on Karl Fischer moisture titration unit in order to measure water content in solids evaporated in the oven. Below descriptions are selected only for those parameters necessary in making settings for such measurements.

< Method parameter >

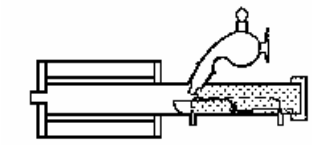
Below chart shows Method parameters:

Parameter	Item	Standard	Remarks
[Titration parameter]	t(max)	1800s	Selection of evaporation time
[Control parameter]	Start mode	Auto	For a sample of little amount of water in it, it is necessary to make manual setup and start titration after the sample moves into the oven.
[Option parameter]	Pre treat	1 - 3	Select according to sample type
	Back purge	180s	Depends on sample and environment
	Cell purge	120s	
	Sample purge	180s	
	Heating mode	Set	Typically, use the fixed mode. Scan mode is described later in this manual.
	Heating speed	***°C	Select temperature for evaporation.

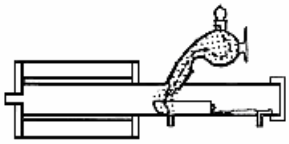
Pre treat 1 : An optional eggplant shape sampler and an optional heating tube TS19/25 is used for sampling and discharge into the sample inlet. It begins with back purge, sample purge and cell purge, and then, starts measurement process when the drift level becomes stable while carrier gas is flowing through the system.

Pre treat 2 : This is direct discharge of sample into the oven. It begins with back purge and cell purge, and then, starts measurement process when the drift level becomes stable while carrier gas is flowing through the system.

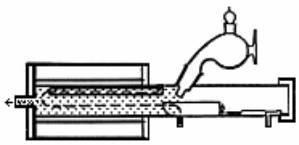
Pre treat 3 : Use the sample boat. Weigh the dried sample boat with a sample on it, and weigh it, and then, move it into the oven. It begins with back purge and cell purge, and then, starts measurement process when the drift level becomes stable while carrier gas is flowing through the system.



Back purge



Sample purge



Cell purge

* Put a port plug onto the eggplant sampler for Pre treat 2 or 3.

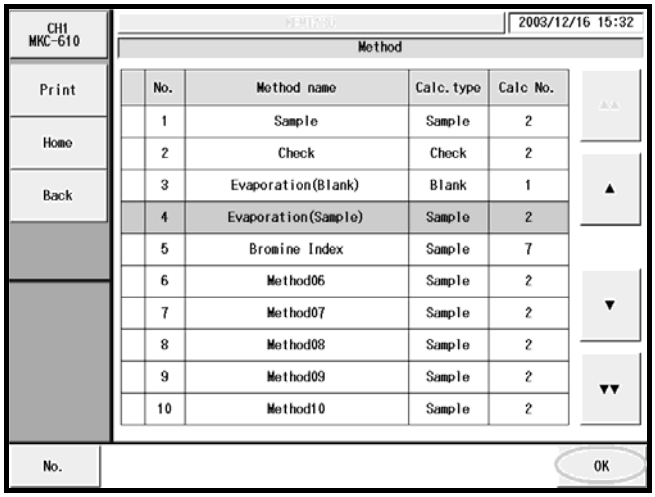
Note:

How to edit Method parameters is described in the manual for the connected measuring unit.

3-2-2. Changing the Method

Press [Method] button on Main display of KF moisture titrator. Select the Method that you have selected previously for evaporation unit, and then, press [OK] button.

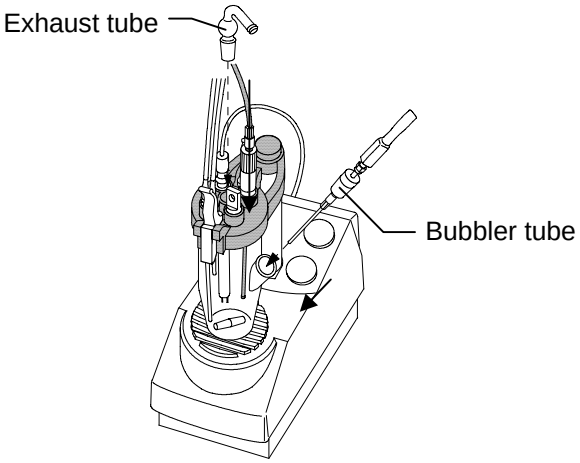
< Example of display on MKC-610 >



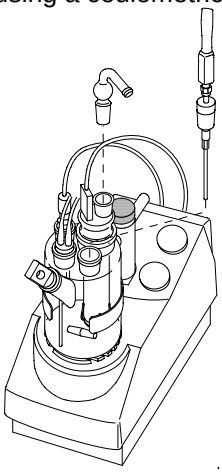
3-2-3. Preparation of titration cell (flask)

1) Remove the plug at the sample inlet, and fix the bubbler tube instead, which is connected to the heater tube and housed in nozzle holder of ADP-611.
2) Remove the desiccant tube, and put on the exhaust tube.
3) For coulometric titration, fill the titration cell with KF reagent (for evaporator or a reagent made by blending the KF reagent for general use with Ethylene glycol 25%), and for volumetric titration, fill the flask with dehydrated solvent (for gas).
4) Press [Pre-Titr.] button on Main display to start pre-titration.

< when using a volumetric titrator >



< when using a coulometric titrator >



⚠ Caution!

When the exhaust tube is extended with a tube to exhaust gas out of the room, the extension tube must not be bent or clogged. If bent or clogged, the KF reagent flows back to the unit, and may break the system.

< Example of Method parameters for KF-Oven with MKC-610 coulometry with water standard >

	Parameter	Example
Titration parameter	Titration mode	H2O
	t(stir)	0s
	t(wait)	15s
	t(max)	1200s
	Drift stop	Rel.
	Rel.	0.1ug/s
	Abs.	–
Control parameter	Cell type	2-Comp.
	Stable	0.1
	Control gain	5.0
	Electrolysis speed	Standard
	Start mode	Auto
	End level	200mV
	Data sampling time	10s
	Stirrer speed	3
Report parameter	Report format	GLP
	Graph printing	On
	Data list printing	On
Reagent parameter	Anolyte	
	Catholyte	

	Parameter	Example
Calculation parameter	Calc. type	Sample
	Blank No.	1
	Calc. No.	2
	Unit	%
	Decimal	2
	Fraction	Half adjust
	Drift comp.	Auto
	Drift	–
	Evaluation	On
	Standard value	5.55
	Permit.error	0.5
Option parameter	Pre treat	2
	Cell purge	120s
	Back purge	180s
	Sample purge	–
	Heating mode	Set
	Oven temp.	220°C
	Heating speed	–
	Start temp.	–
	End temp.	–

< Example of Method parameters for KF-Oven with MKA-610 volumetry with water standard >

	Parameter	Example
Titration parameter	Titration mode	Normal
	t(stir)	0s
	t(wait)	15s
	t(max)	1200s
	t(interval)	0s
	Max. volume	10mL
	Titr.burette No.	1
	Dose mode	Off
	Dose burette No.	–
	Titration mode	–
Control parameter	End time	30s
	Final volume	0.01mL
	Titration speed	3
	Detector mode	1
	Drift titr.	On
	Start mode	Manual
	End level	75mV
	Data sampling time	10s
	Stirrer speed	4
Report parameter	Report format	GLP
	Graph printing	On
	Data list printing	On
Reagent parameter	Titration unit	
	Dose unit	

	Parameter	Example
Calculation parameter	Calc. type	Sample
	Blank No.	1
	Calc. No.	2
	Unit	%
	Decimal	2
	Fraction	Half adjust
	Drift comp.	Auto
	Drift	–
	Evaluation	On
	Standard value	5.55
	Permit.error	0.5
Option parameter	Pre treat	2
	Cell purge	120s
	Back purge	180s
	Sample purge	–
	Heating mode	Set
	Oven temp.	220°C
	Heating speed	–
	Start temp.	–
	End temp.	–
Repeat meas. parameter	Repeat measurement	Off
	Repeat times	–

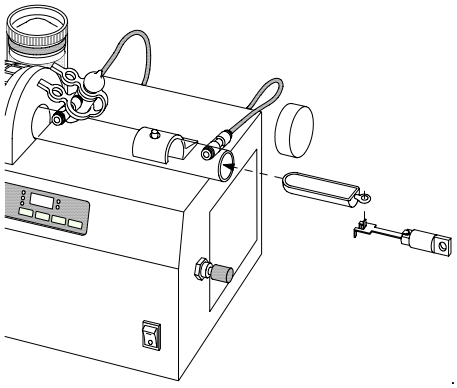
3-3. Operating procedures

3-3-1. Preheat of sample boat

Note:

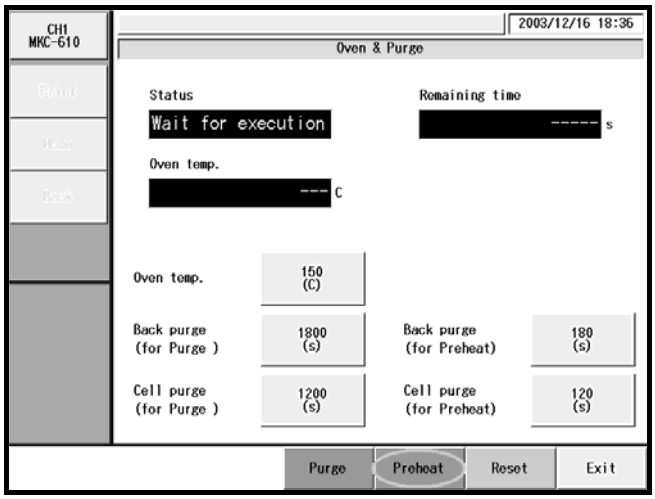
Make sure the carrier gas is flowing at the rate of 200mL/min and the oven temperature has reached preset degrees. Also, the connected KF moisture titrator shows on display either "Drift Stable" or "Drift" message.

1) Remove the cap of heating tube.
2) Hook the dried boat with the boat push rod, and insert it into the heating tube. Place the boat at sample drop position under the sample inlet.
3) Cap the heating tube.



4) Press [Option] button on Main display to show "Oven&Purge" dialog box.
5) Enter heating temperature (Oven temp.) and purge time (for Preheat).
6) Press "Preheat" button. The sample boat will move into the oven, and return back to the original position after the time for back purge and cell purge (both preset for Preheat) elapsed.

(Example of display on MKC-610)



7) Wait until the sample boat cools off, usually for 10 minutes.
8) Press [Exit] button to return to Main display.

3-3-2. Sample measurement procedure

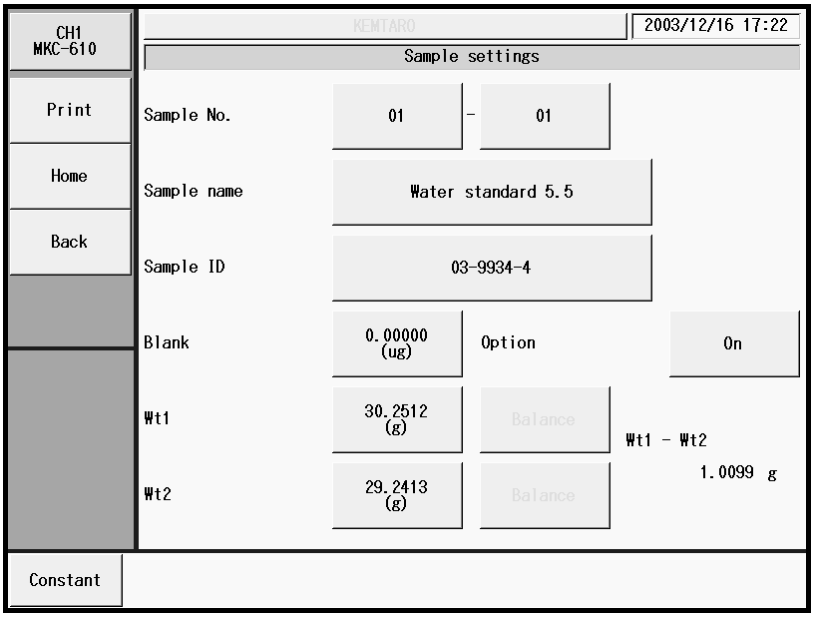
Note:

Make sure the carrier gas is flowing at the rate of 200mL/min and the oven temperature has reached preset degrees. Also, the connected KF moisture titrator shows on display either "Drift Stable" or "Drift" message.

< Conditions setup >

1) Press [Sample] button on Main display of KF moisture titrator. Enter sample name and ID on "Sample settings" dialog box.

(Example of display on MKC-610)



< Sample parameter setup >

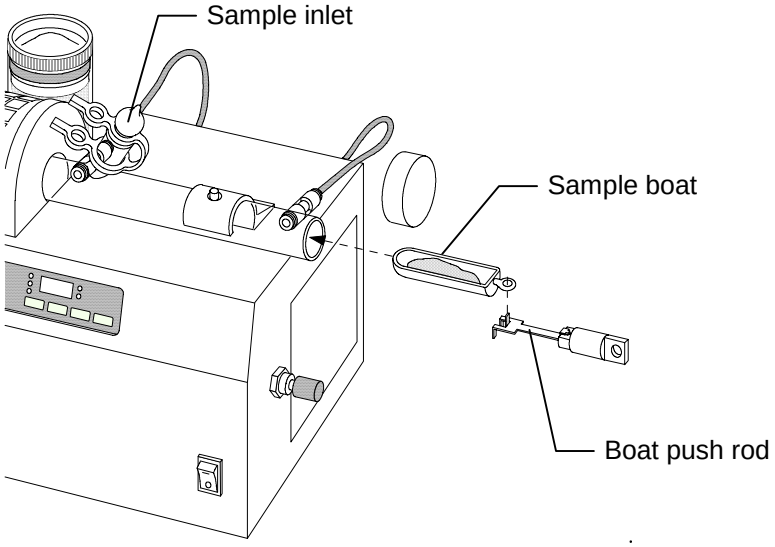
Press [Sample] button to show "Sample settings" dialog box, and enter the following parameters:

Parameter	Selection	Remarks
Option	On	Selection of use of optional peripherals. Turn it "On" when an oven is used.

3-3-3. Weigh the sample and load it into heating tube for measurement (Pre treat 3)

Select Pre treat “3” for Option parameter on KF moisture titrator.

1) Weigh the sample on an electronic balance. Press [Sample] key on KF moisture titrator, and enter the weight Wt1(g). For Wt2(g), enter zero (0).
2) Put the weighted sample onto sample boat, and hook it with boat push rod to insert it into heating unit. Place the boat at sample drop position under the sample inlet.



3) Wait until KF moisture titrator shows on display either “Drift Stable” or “Drift” message.
4) Press [Start] button on KF moisture titrator. After back purge and cell purge are finished in the oven, it will start measurement.
5) After measurement, the results are calculated according to preset calculation No. and printed out.
6) Leave the sample boat within heating tube for more than 10 minutes, and then, take it out of the heating tube. To continue measurement, repeat the steps starting from 1).

⚠ Caution!

The sample boat is very hot right after measurement is over. Leave it for more than 10 minutes within heating tube after coming out of the oven. Otherwise, you may burn your fingers with it.

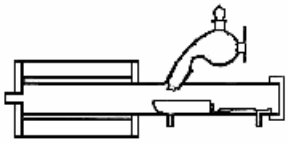
⚠ Caution!

Fix the port plug at sample inlet with a rubber band. Otherwise, it may pop up when the sample boat comes out of the oven back to the heating tube.

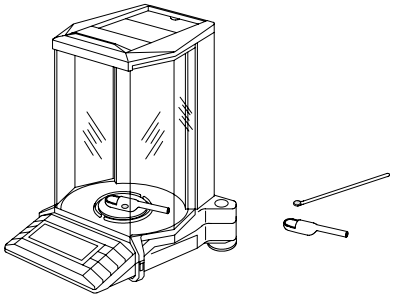
3-3-4. Use a finger shaped sampler for measurement (Pre treat 2)

Select Pre treat "2" for Option parameter on KF moisture titrator.

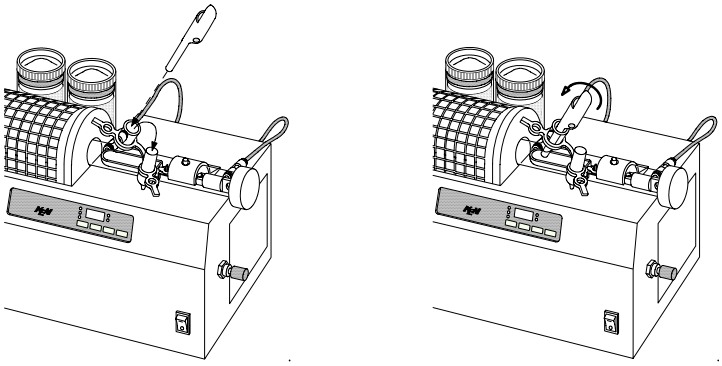
1) Remove the cap of heating cap, and hook the sample boat with the boat push rod, and then, load it into heating tube. Place the boat at sample drop position under the sample inlet. Fix the cap back to heating tube.



2) Wait until KF moisture titrator shows on display either "Drift Stable" or "Drift" message.
3) Take the sample into the sampler. Weigh the sample + sampler on a balance. Press [Sample] key on KF moisture titrator, and enter the weight Wt1(g).



4) Press [Start] button on Main display of KF moisture titrator.
5) After back purge and cell purge are finished in the oven, the message will appear to prompt "Inject sample ⇔ Please press [Start] button". Remove the port plug and insert the sampler into the inlet. Turn round the sampler and discharge the sample onto the boat.



6) Remove the sampler and fix the port plug with a rubber band, and press [Start] button or [OK] button on KF moisture titrator.
7) Weigh the sampler after sample is discharged, and enter Wt2 on KF moisture titrator.
8) After measurement, the results are calculated according to preset calculation No. and printed out.
9) Leave the sample boat within heating tube for more than 10 minutes, and then, take it out of the unit. To continue measurement, repeat the steps starting from 1).

⚠ Caution!

The sample boat is very hot right after measurement is over. Leave it for more than 10 minutes within heating tube after coming out of the oven. Otherwise, you may burn your fingers with it.

3-3-5. After-measurement procedure

1) Remove the cap of heating tube and take out the sample boat.
2) Remove the bubbler tube and put on the port plug.
3) Close the nitrogen gas valve to stop carrier gas flow.
4) Remove the exhaust tube, and put back the desiccant tube on KF moisture titrator.
5) Turn off the power.
6) Clean the sample boat or sampler, and store in a desiccator after dried.

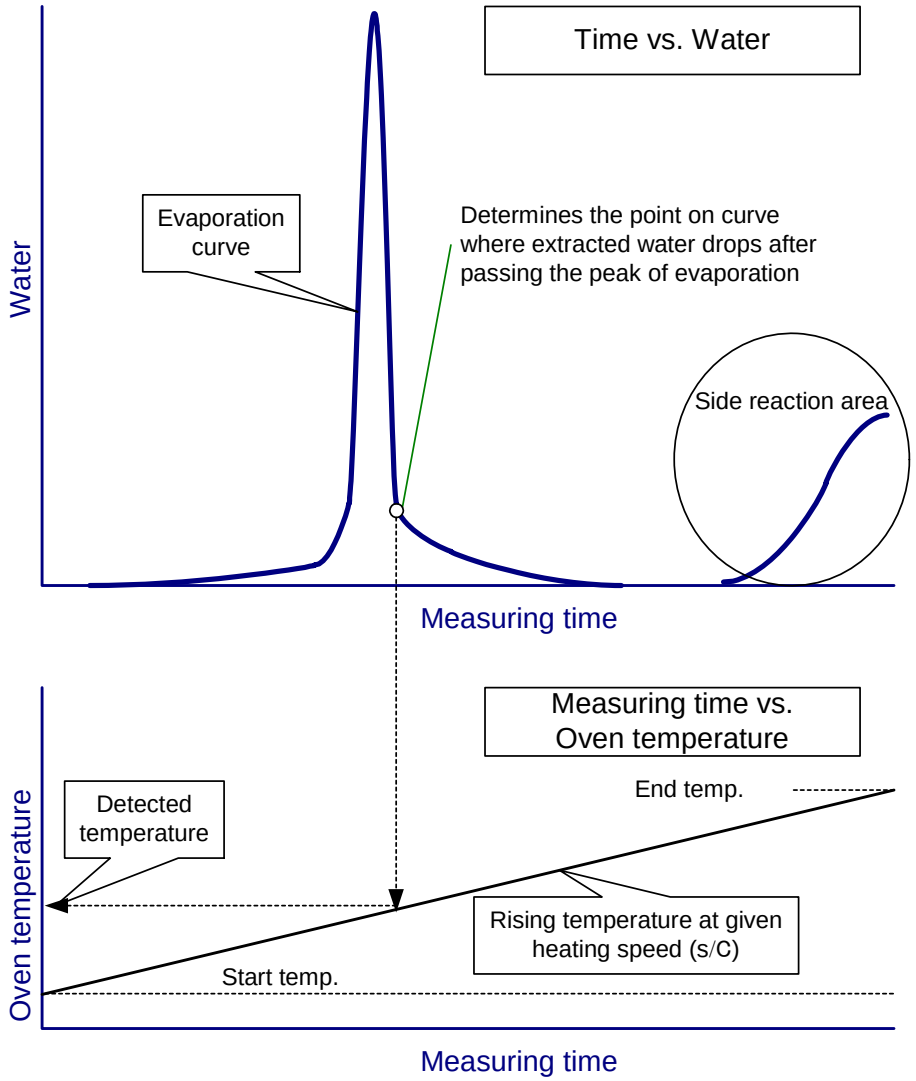
> ⚠ **Caution!**
>
> **The above post treatment must be ensured. Otherwise, KF reagent may flow back and breaks the system.**

3-4. Scan mode for optimal evaporation

3-4-1. Outline of scan mode

This mode, when connected to KEM's MKA-610 or MKC-610 moisture titrator, is useful in measurement of a sample of which evaporation temperature is unknown or when you want to check temperature effect on the sample.

The scan mode determines optimal oven temperature by plotting evaporation curve based on the relation between extracted water and heating temperature rising consecutively in the oven.



Note:

Please note the scan mode determines the point of degrees as an optimal evaporation temperature for reference purpose only, and does not guarantee the measurement results obtained from its computation.

3-4-2. Parameter setup

The scan mode requires Method parameters setup on KF moisture titrator as shown below. As for Method parameter setup, refer to the manual for the titration unit.

< Example of Method parameters for MKC-610 Coulometry >

	Parameter	Example
Titration parameter	Titration mode	H2O
	t(stir)	0s
	t(wait)	15s
	t(max)	4500s(*1)
	Drift stop	Off
	Rel.	–
	Abs.	–
Control parameter	Cell type	2-Comp.
	Stable	0.1
	Control gain	5.0
	Electrolysis speed	Standard
	Start mode	Manual
	End level	200mV
	Data sampling time	10s
	Stirrer speed	3

	Parameter	Example
Option parameter	Pre treat	2
	Cell purge	120s
	Back purge	180s
	Sample purge	–
	Heating mode	Scan
	Oven temp.	–
	Heating speed	20s/°C
	Start temp.	100°C
	End temp.	300°C

< Example of Method parameters for MKA-610 Volumetry >

	Parameter	Example
Titration parameter	Titration mode	Normal
	t(stir)	0s
	t(wait)	0s
	t(max)	4500s(*1)
	t(interval)	0s
	Max. volume	10mL
	Titr.burette No.	1
	Dose mode	Off
	Dose burette No.	–
	Dose volume	–
Control parameter	End time	0s
	Final volume	0.01mL
	Titration speed	3
	Detector mode	1
	Drift titr.	On
	Start mode	Manual
	End level	75mV
	Data sampling time	10s
	Stirrer speed	4

	Parameter	Example
Option parameter	Pre treat	2
	Cell purge	120s
	Back purge	180s
	Sample purge	–
	Heating mode	Scan
	Oven temp.	–
	Heating speed	20s/°C
	Start temp.	100°C
	End temp.	300°C

(*1) t(max) (s) = (End temp. – Start temp.) × Heating speed

3-4-3. Measurement in scan mode

Measurement in scan mode is processed in the same way as in ordinary sample measurement. Measurement procedure is described in “3-3. Operating procedures”, and parameter setup is in “3-4-2. Parameter setup”.

< Example of scan mode >

Below printout is an example of measurement results in scan mode:

[Data list]

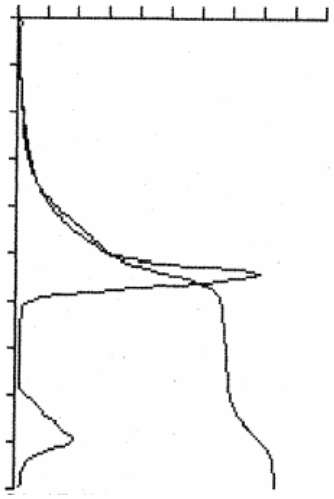
Time	Unit	Total
00:00:30	7.8	7.8
00:01:00	7.3	15.1
00:01:30	6.2	21.3
00:02:30	6.0	27.3
	:	
	:	
00:39:00	222.9	3222.2
00:39:30	291.2	3513.4
00:40:00	351.6	3865.0
00:40:30	381.9	4246.9
00:41:00	373.4	4620.3
00:41:30	343.6	4963.9
00:42:00	297.7	5261.6
00:42:30	245.4	5507.0
00:43:00	186.8	5693.8
00:43:30	126.7	5820.5
00:44:00	74.7	5895.2
00:44:30	41.4	5936.6
00:45:00	24.0	5960.6
00:45:30	16.7	5977.3
00:46:00	13.7	5991.0
00:46:30	12.3	6003.3
00:47:00	11.0	6014.3
00:47:30	10.3	6024.6
	:	
	:	
01:13:00	12.0	7516.0
01:13:30	11.5	7527.5
01:14:00	10.8	7538.3
01:14:30	10.5	7548.8
01:15:00	10.0	7558.9

[Sacn Data]

Time	Unit	Temp.
00:00:30	7.8	100
00:01:00	7.3	100
00:01:30	6.2	101
00:02:30	6.0	102
	:	
	:	
00:39:00	222.9	210
00:39:30	291.2	212
00:40:00	351.6	213
00:40:30	381.9	214
00:41:00	373.4	216
00:41:30	343.6	217
00:42:00	297.7	219
00:42:30	245.4	220
00:43:00	186.8	222
00:43:30	126.7	223
00:44:00	74.7	224
00:44:30	41.4	226
00:45:00	24.0	227
00:45:30	16.7	229
00:46:00	13.7	230
00:46:30	12.3	232
00:47:00	11.0	233
00:47:30	10.3	234
	:	
	:	
01:13:00	12.0	302
01:13:30	11.5	302
01:14:00	10.8	302
01:14:30	10.5	301
01:15:00	10.0	301

Detected by scan mode →

T:0.0 ug 8900.0
U:0.0 ug 480.0
00:00:00



01:15:30

Model : MKC-610
Serial No. : XXX99999

Print : 2003/10/22 11:32

*** R e s u l t ***
Method No./Name :
04/Evaporation(Sample)

Sample No. : 27-01
Sample name:
Water standard 5.5
Sample ID :
03-99-2563
Date : 2003/10/22 11:32

Moisture 6796.2 ug
Result :
6.78 %
D.Temp : 226C
Titr.time : 01:15:15
Wt1 : 10.2330 g
Wt2 : 10.1327 g
Net : 0.1003 g

4. Other usage

4-1. Ageing heating tube

Before sample measurement, the heating tube and titration cell (flask) are conditioned by ageing as follows:

Note:
Make sure the carrier gas is flowing at the rate of 200mL/min, and the oven temperature has reached preset degrees.

1) Press [Option] button on Main display to show the dialog box for Oven&Purge.
2) Select an oven temperature and purge time length.
3) Press [Purge] button. The sample boat moves into the oven, and returns back to the original position after the time for back purge and cell purge (both preset for purge), and the purge time elapsed.
4) Wait until the sample boat cools off, usually for 10 minutes.
5) Press [Exit] button, and return to Main display.

4-2. Blank test

When pre treat "2" was chosen on [Option parameter] for KF titration method, a blank test before measurement is recommended by removing moisture, which permeates into heating tube at time of direct sample discharge, thus more precise measurement results can be obtained.

1) Select "Blank" for calc. type in [Calculation parameter], which was previously configured for sample measurement.
2) Hook the dried boat with the boat push rod, and insert it into the heating tube. Place the boat at sample drop position under the sample inlet. Cap the heating tube.
3) Wait until KF moisture titrator shows on display either "Drift Stable" or "Drift" message.
4) Press [Start] button on KF moisture titrator.
5) After back purge and cell purge are finished in the oven, the message will appear to prompt "Inject sample ⇔ Please press [Start] button". Remove the port plug and insert an empty sampler into the inlet. Turn round the sampler.
6) After a given time (same time length as for sample discharge) elapsed, remove the sampler, and fix the port plug into the inlet winded with a rubber band, and press [Start] button or [OK] button on KF moisture titrator.
7) After the test is over, the results will appear on display.
8) Leave the sample boat within heating tube for more than 10 minutes, and then, take it out of the unit. Repeat these steps for a few times. When "Auto" for mean value setup on [Function] – [Other settings] is set to "On", the average blank value is automatically set in for blank test method.

⚠ Caution!
The sample boat is very hot right after measurement is over. Leave it for more than 10 minutes within heating unit after coming out of the oven. Otherwise, you may burn your fingers with it.

4-3. Measurement in manual operation

< Selection of oven temperature >

1) Press [Select] key and LED "°C" blinks.
2) Select desired oven temperature with [△/⏪], [▽/⏩] key.
3) Press again [Select] key to start heating the oven.

< Ageing heating tube >

1) When Heating tube reaches preset temperature, turn "PURGE" LED on by [GAS] key.
2) Back purge for more than 30 minutes by carrier gas.
3) Turn "CARRY" LED on by [GAS] key.
4) Cell purge for about 10 minutes by carrier gas.
5) Wait for drift to be stale during 4). When the drift stable, it is ready for measurement.

< Measuring procedure >

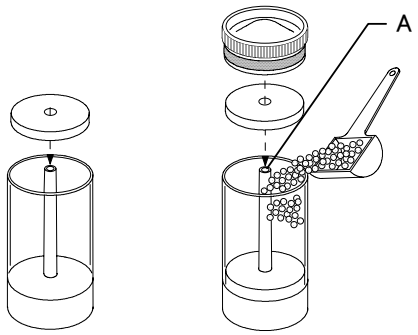
1) Place the dried sample boat in heating tube.
2) Press [GAS] key to turn LED "Purge" for about 3 minutes back purge with carrier gas.
3) Press [GAS] key to turn LED "Carry" for about 2 minutes cell purge with carrier gas.
4) Press [Start] key or the Start key on KF moisture titrator to start titration.
5) Discharge the sample through sample inlet.
6) The moisture from evaporating gas flows into the titration cell, and measurement goes on.

5. Maintenance

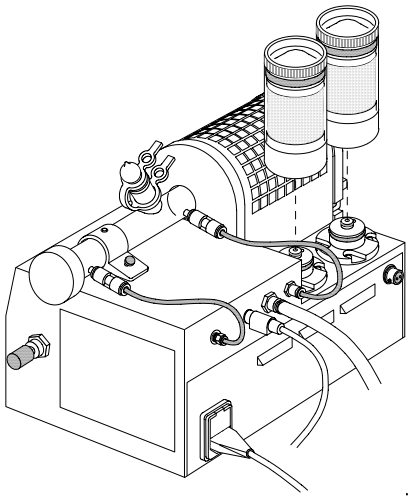
5-1. Daily checkup

5-1-1. Replacement of desiccator

When the drift of carrier gas (200mL/min N_2) goes up 2 to 3 times, replace desiccator (zeolite).



1) First, place a sponge at the bottom of tube, and fill it with Zeolyte. At this point, put your finger on top of the hole (as illustrated A) to prevent clogging.
2) After filling, place another sponge on top of it, and cap the tube. The cap must securely seal the tube top by squeezing.



Note:

Make sure the higher drift is not caused by overdue reagent life or any leaking of tube connection.

⚠ Warning!

When filling Zeolite, leave a few mm gap in between its top and tube lid. Too much Zeolite if pushed into the tube, may cause unstable carrier gas flow.

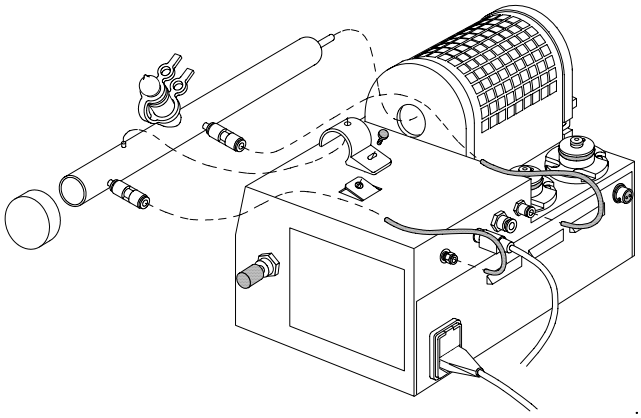
5-1-2. Cleaning the sample boat

When the boat is stained with solid, remove it by a brush, and after rinsing, dry it in a dryer.

5-2. Other Maintenance

5-2-1. Cleaning and replacing Heating tube

When Heating tube is stained with solid, remove it disconnecting carrier gas tube line and heating tube holder. After removing the solidified dirt, rinse and dry in a dryer. After cooling off the dried heating tube in a desiccant container, install to Main unit.

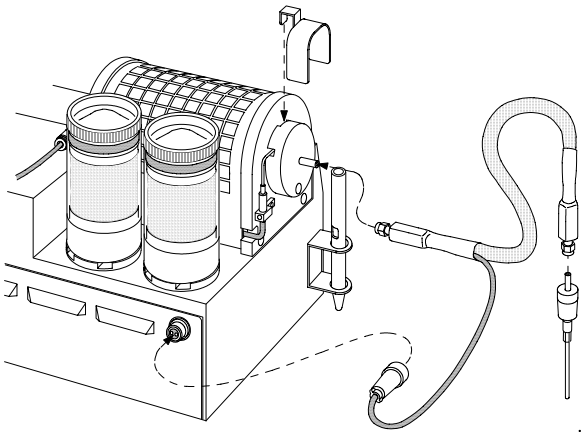


⚠ Caution!

Remove the heating tube only after its temperature goes down. You may burn your fingers if it is still hot.

5-2-2. Cleaning Heater tube

When a sample contained sublimated substance or KF reagent back washed, rinse it chemically, and then, rinse with water and finally with alcohol. Dry it well by carrier gas.



⚠ Caution!

Remove the heater tube only after its temperature goes down. You may burn your fingers if it is still hot.

5-2-3. Storage of the instrument

When the ADP is not going to be used for a long period of time, remove Heater unit, Heater tube, tube lines and desiccant containers.

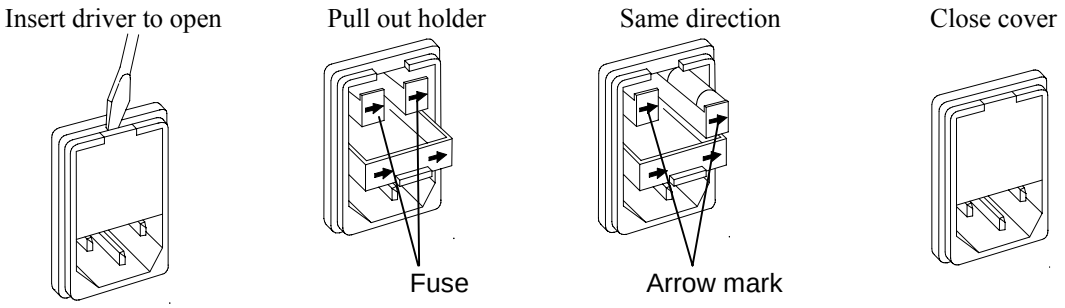
Keep Heater unit and tubing in desiccator.

Store Main unit and other components in a dry and dark place without vibration. Use the carton box in which the instrument was first delivered.

5-2-4. Replace of power fuse

If the power fuse is broken, replace it according to below instruction.

1) Turn off power switch and remove power cord.
2) Open the upper cover on power inlet using a flat head driver.
3) Pull out both fuse holders using the screwdriver.
4) Replace the fuse and close the cover to the same direction.



Type and rating of fuse is T4A/250V.

⚠ Caution!

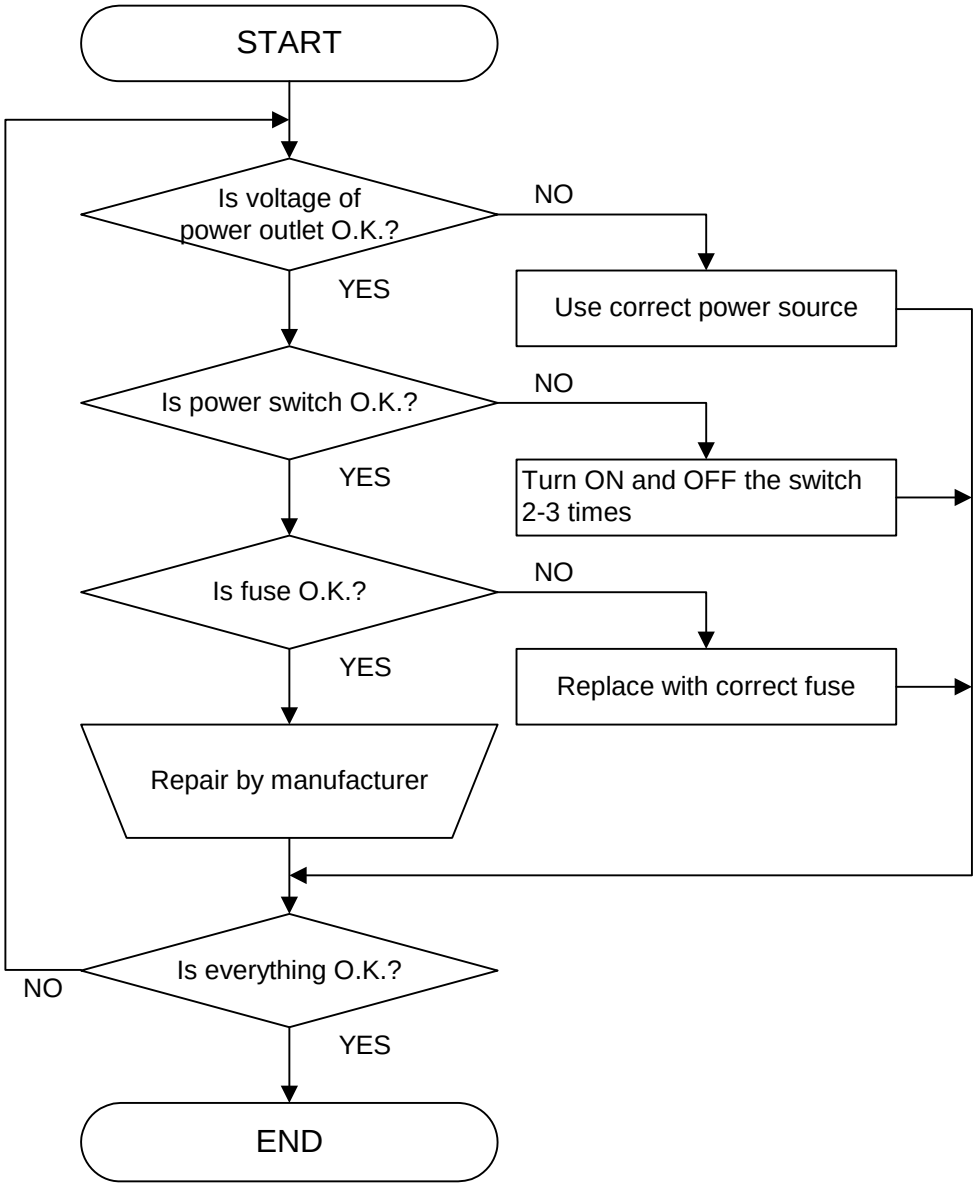
There are two fuses. It is recommended to change them all at a time.

6. Troubleshooting

6-1. Error messages and remedies

Message	Trouble	Remedy
E-1	Difference in temperature between heating tube and set value exceeds 10°C.	See measures taken when oven temperature does not rise.
E-2	Temperature detected by thermocouple exceeds 350°C.	Replace K-thermo couple.
E-3	Sample boat does not come to programmed position.	Contact your local dealer.
E-5	Heater is under no control due to lost data of its resistance.	Contact your local dealer.
E-6	Temperature cannot be displayed due to the loss of memory of temperature parameter for heating tube.	Contact your local dealer.
E-7	Flow rate cannot be displayed due to the loss of memory of calibration parameter for flow rate.	Contact your local dealer.

6-2. Power source

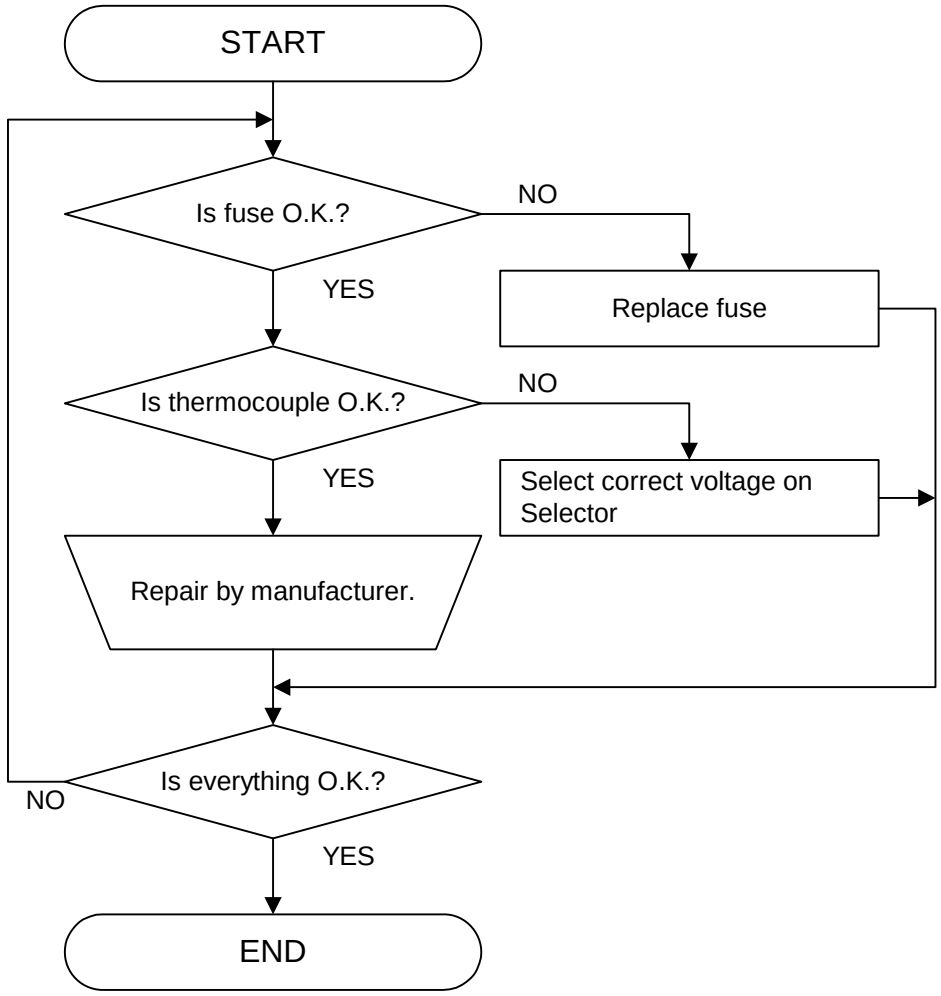


AC	LINE VOLTAGE	FUSE	Hz
100V ~ 120V	90 ~ 132V	T4A/250V	50/60
220V ~ 240V	198 ~ 264V	T4A/250V	50/60

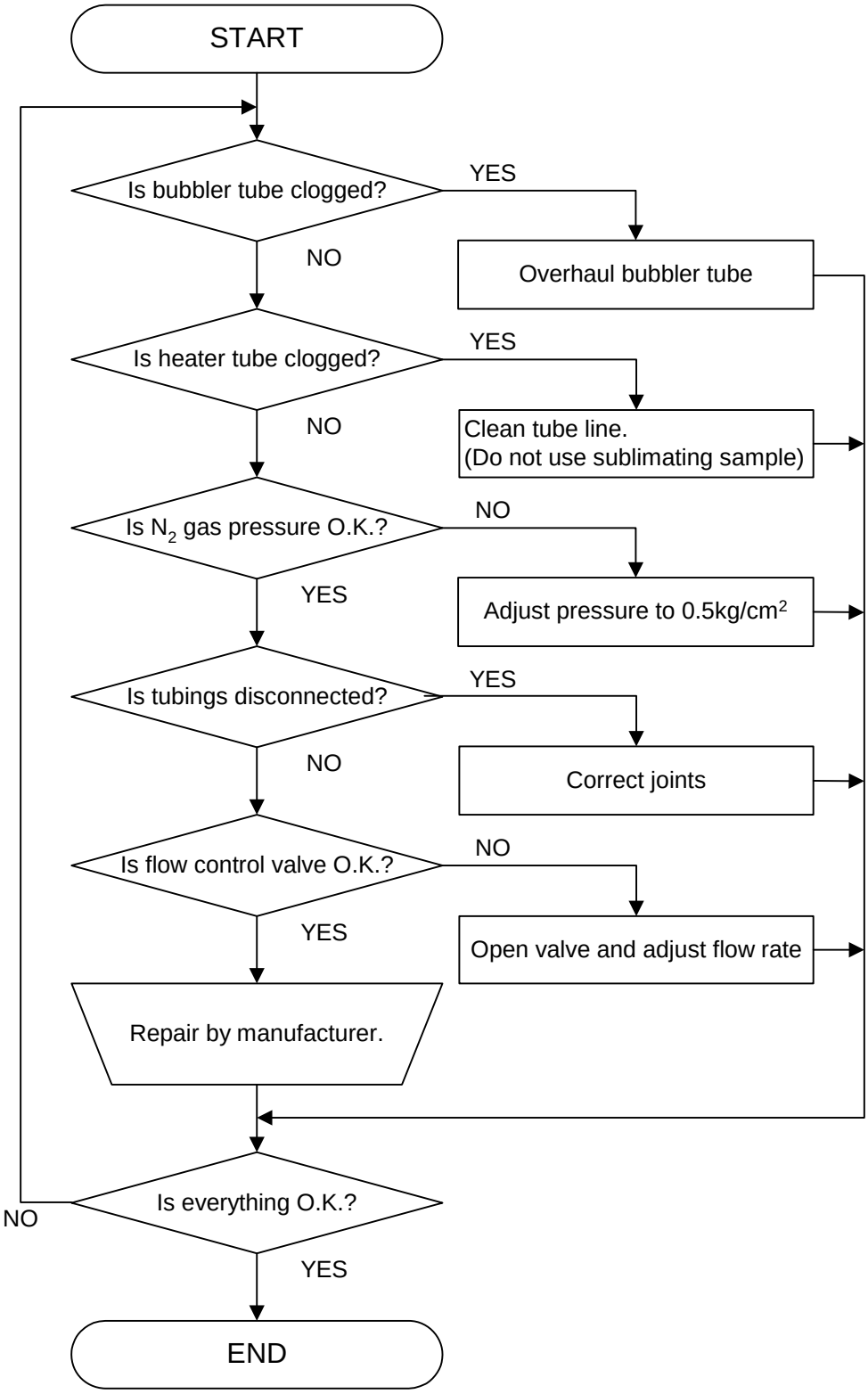
⚠ Warning!

The warranty does not apply to any troubles on the electric circuit when input voltage is applied improperly.

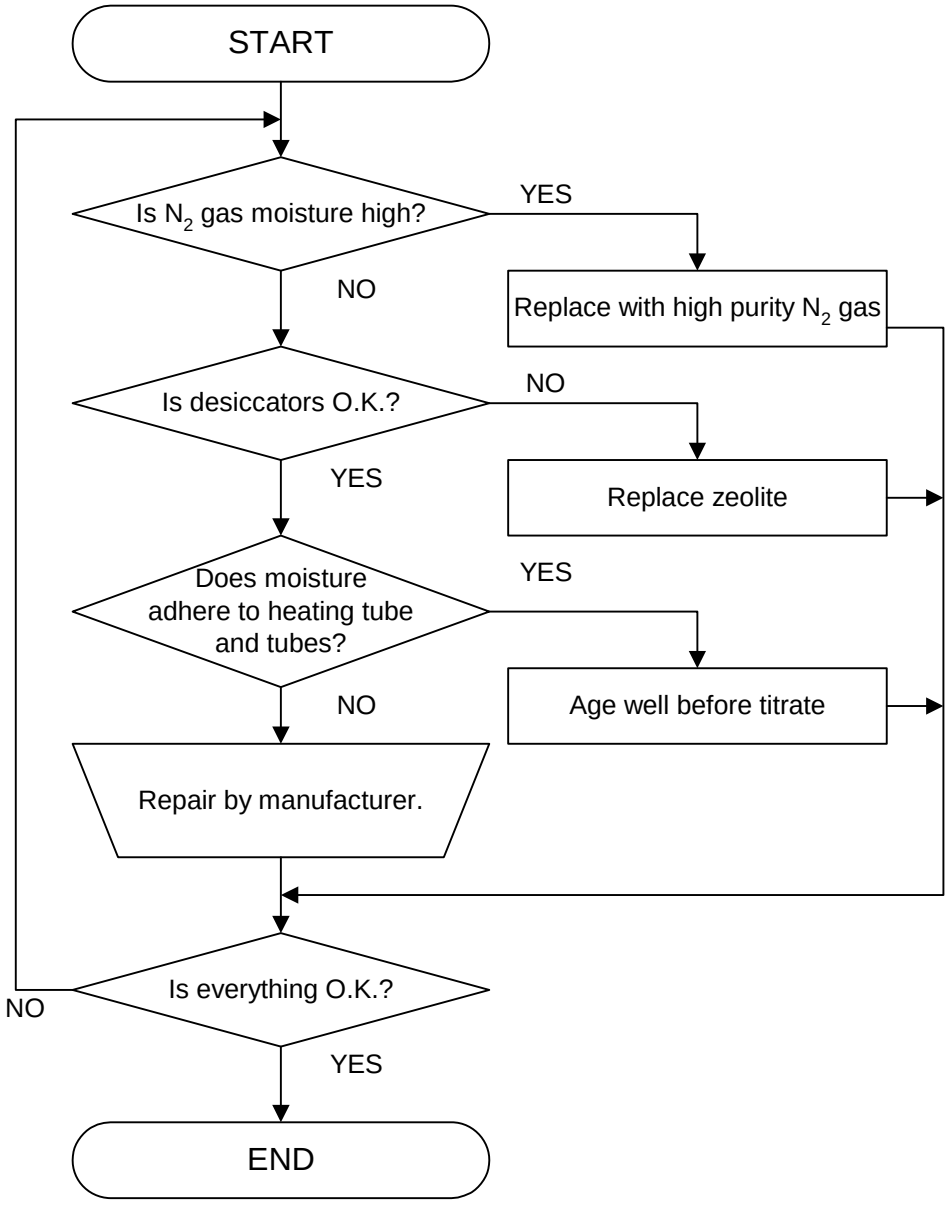
6-3. When Heater temperature does not rise



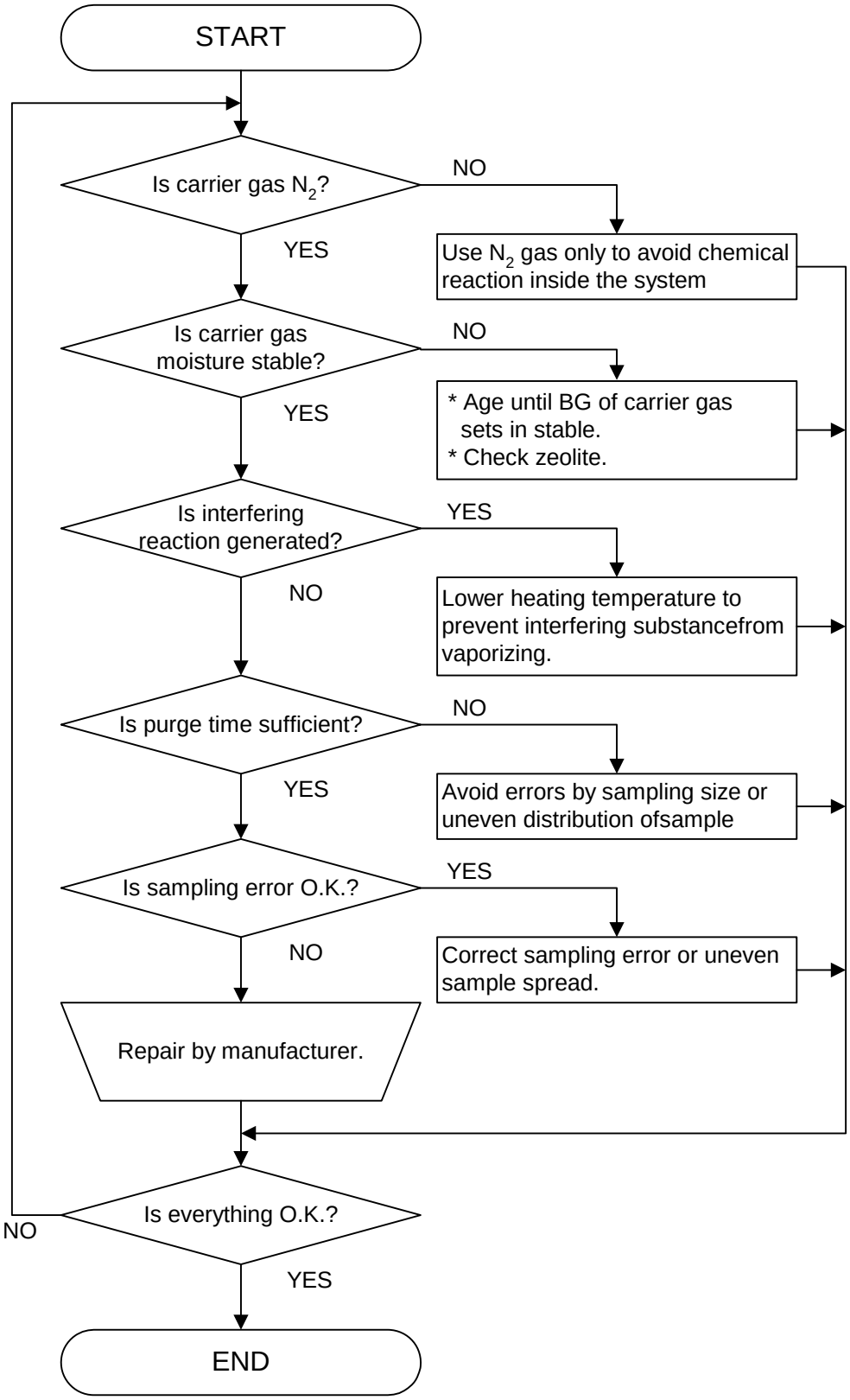
6-4. When carrier gas does not flow



6-5. When carrier gas is moist



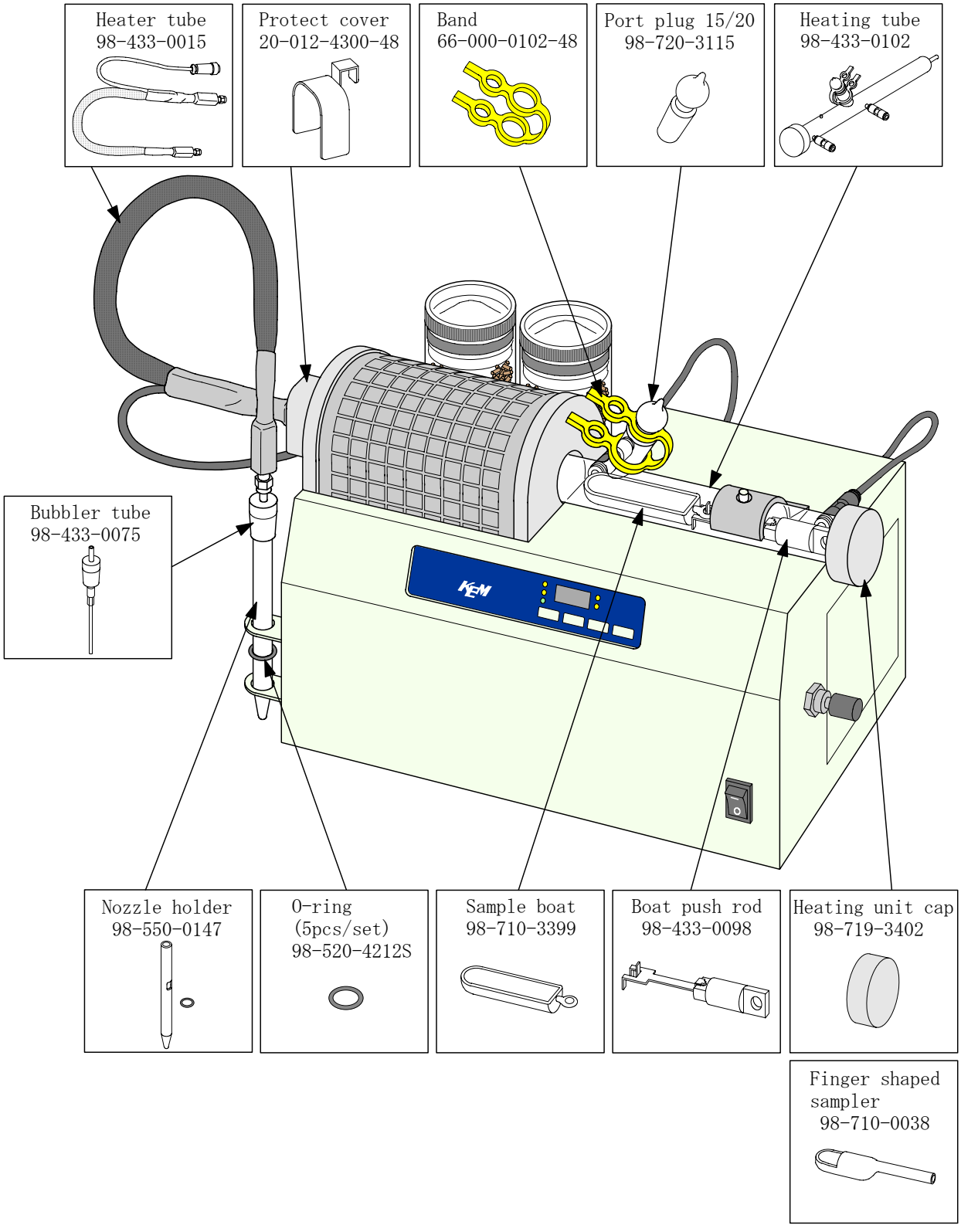
6-6. When reproducibility of measurement is poor

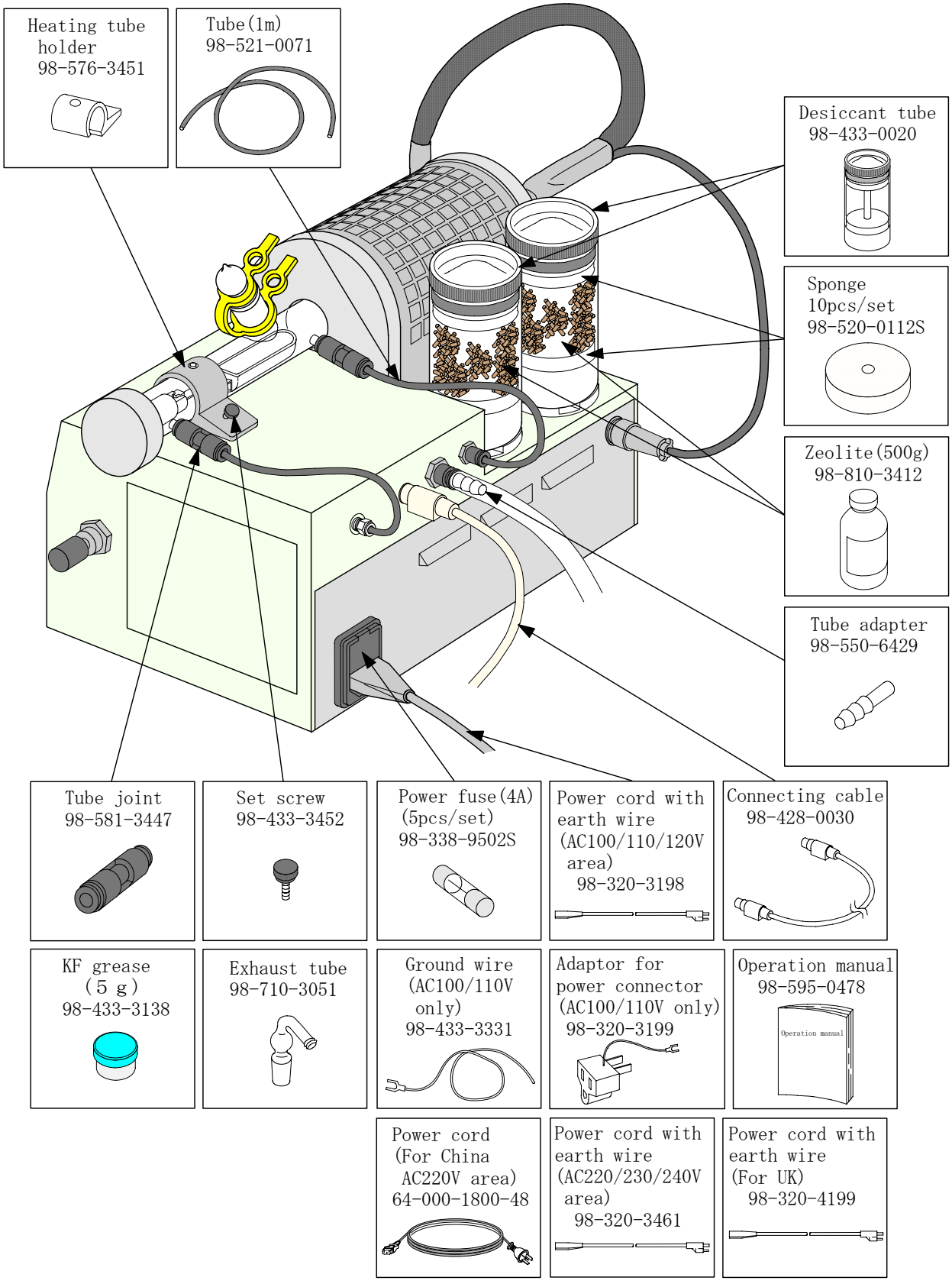


7. Reference

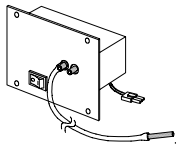
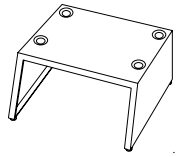
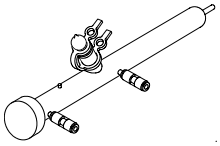
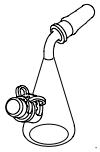
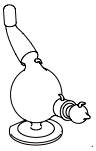
7-1. Part list

– Maintenance parts –



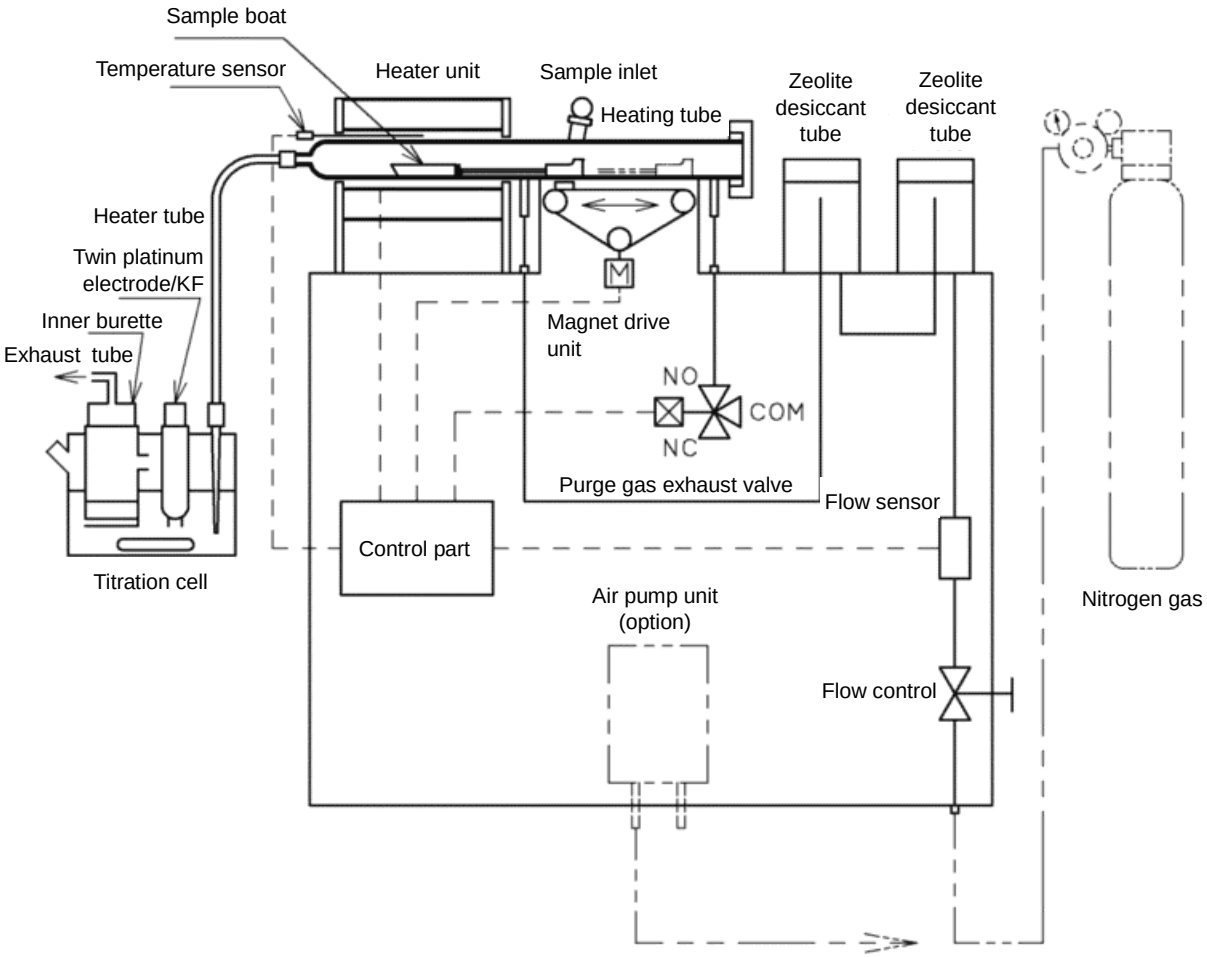

Heating tube holder 98-576-3451
Tube(1m) 98-521-0071
Desiccant tube 98-433-0020
Sponge 10pcs/set 98-520-0112S
Zeolite(500g) 98-810-3412
Tube adapter 98-550-6429
Tube joint 98-581-3447
Set screw 98-433-3452
Power fuse(4A) (5pcs/set) 98-338-9502S
Power cord with earth wire (AC100/110/120V area) 98-320-3198
Connecting cable 98-428-0030
KF grease (5 g) 98-433-3138
Exhaust tube 98-710-3051
Ground wire (AC100/110V only) 98-433-3331
Adaptor for power connector (AC100/110V only) 98-320-3199
Operation manual 98-595-0478
Operation manual
Power cord (For China AC220V area) 64-000-1800-48
Power cord with earth wire (AC220/230/240V area) 98-320-3461
Power cord with earth wire (For UK) 98-320-4199

– Option –

Part code	Part name	Remarks	Sketch
98-433-0096	Air pump unit	Built-in type	
98-433-0100	Stand		
98-433-0103	Heating tube	Wide-mouthed sample inlet Bore: TS19/25	
98-710-0042	Pellet sampler	For heating tube with bore of TS19/25	
98-740-3020	C-type sampler	For heating tube with bore of TS19/25	
98-740-3024	Eggplant-type sampler	For heating tube with bore of TS19/25	
98-720-3130	Port plug 19/25	For heating tube with bore of TS19/25	

7-2. Tube lines flow chart

(Example: MKC-610)



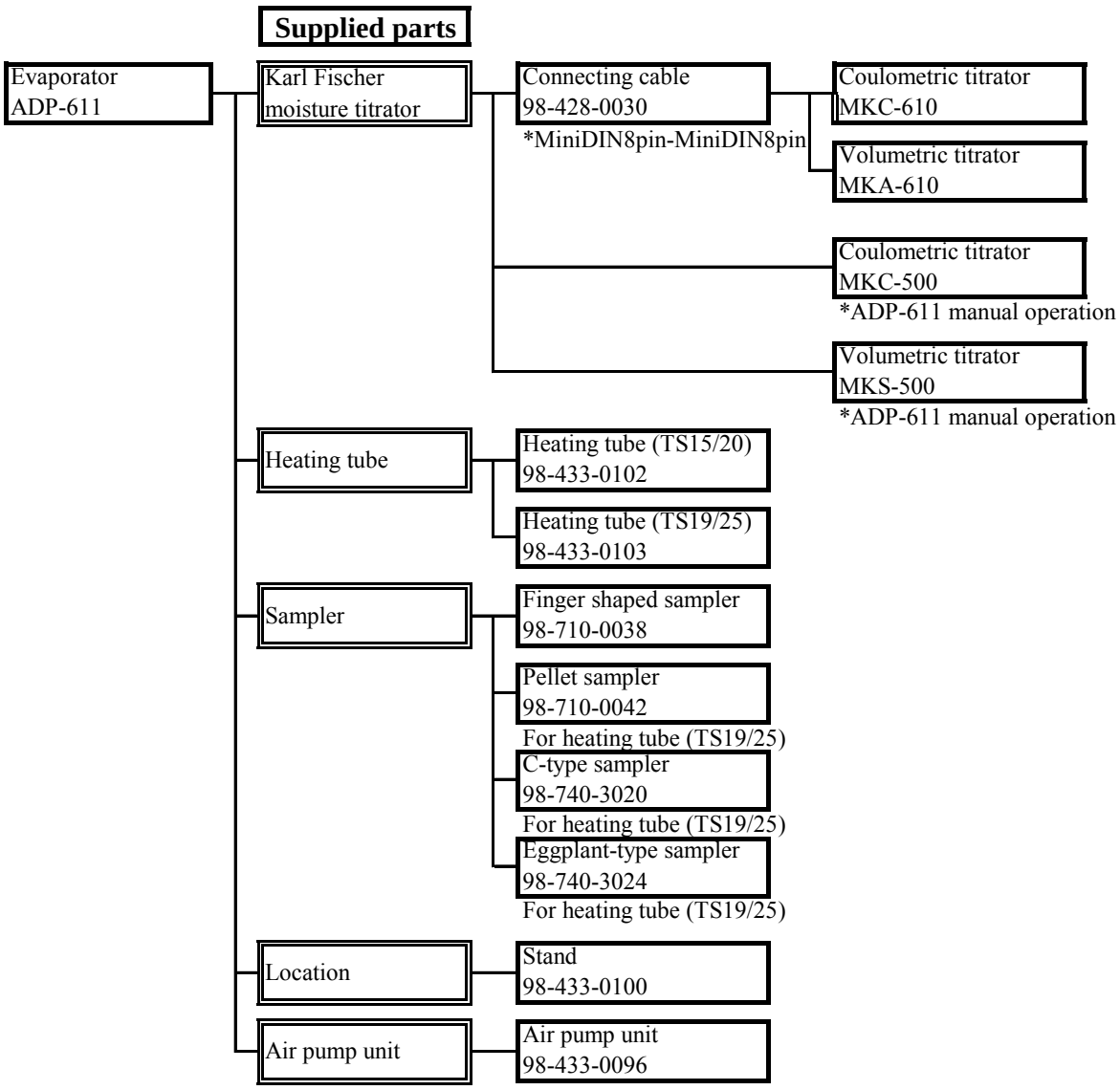
7-3. Examples of heating temperature for samples

Category	Sample	Heating temperature (°C)
Plastics, Rubber	Phenol resin	110
	Polyvinyl chloride	130
	Styrene form	130
	Nylon-6	150
	Polyethylene	150
	Polycarbonate	150
	Polyvinyl alcohol	150
	Synthetic paper	150
	ABS resin	180
	Polypropylene	180
	Polyester	180
	Acetyl cellulose resin	180
	α-polyoxymethylene	180
	Polyacetal	200
	Nylon-66	230
	Polystyrene	230
	Polyethylene terephthalate	230
	Epoxy resin	230
	Rubber compound	150
	Carbon black	200
Pigment	Calcium carbonate	100
	Zinc white	300
	Antimony oxide	300
Rocks Non-organics	Sodium nitrite	150
	Sodium sulfate	150
	Coal	180
	Ferrite	200
	Copper sulfate	250
	Titanium oxide	300
	Zinc oxide	300
	Iron oxide	300
	Manganese carbonate	300
	Calcium carbonate	300
Grains, Starch	Soybean flour	135
	Wheat starch	140
	Brown rice flour	150
	Wheat flour	150

⚠ Warning!

The above heating temperatures represent only typical values for corresponding substances and should not be applicable to substances similar to them.
Therefore, you should check the heating temperature on actually measured samples.

7-4. System Configuration



7-5. Specification

Type and model	Model ADP-611 Evaporator	
Heating method	Electrically conductive clear heater glass	
Temperature range	Control method: proportional Setting range : 50 ~ 300°C Minimum temperature setting: 1°C Temperature precision : ± 2°C Temperature sensor : K-thermocouple	
Temperature display	LED digital 3 characters	
Heater unit Sample boat	Pyrex glass tube ϕ 30 × 335mm Pyrex glass 68 L × 25 W × 15 H mm Capacity 16mL	
Carrier gas	Nitrogen: not included in supplied parts. Nitrogen gas, governor and tubing have to be prepared by user. Air pump is not included in supplied parts.	
Gas dryer	Zeolite 100g 2 pcs	
Gas flow	100 ~ 300 mL/min	
Dimension	370 (W) × 195 (D) × 217 (H) mm	
Power	AC100 ~ 120V± 10% 50Hz/60Hz	AC220 ~ 240V± 10% 50Hz/60Hz (Pre-adjusted before shipment from the factory)
Power consumption	Approx. 300W	Approx. 300W
Weight	Approx. 5kg	Approx. 7kg

7-6. Warranty and After-Sale Service

1. The product you have purchased passed factory inspection and testing prior to shipment, and its quality is guaranteed by free of charge replacement during warranty period except consumable parts provided the instrument has been under normal use and operation, however, depending on operational and environmental condition under which the instrument has been in use may require chargeable service work.

2. For service during and after warranty period, please contact your local dealer or distributor.

3. Read the manual thoroughly before you decide to call for service.
   When you should need servicing, please provide with the following information:

   Production number of unit
   Description of the trouble
   Person to contact

4. Parts and spares can be purchased separately and will be available for seven (7) years after termination of production of the model.

5. This warranty does not cover claims due to any of the following conditions:

   1) Any modification or specification change by an unauthorized person
   2) Damage by splashed water (the instrument is not water-proof)
   3) Use in range or condition other than specified
   4) Operated in other way than specified in the manual or negligence of maintenance
   5) Physical force given to the instrument during transportation or move
   6) Use of parts or reagent other than specified
   7) Caused by use under extreme ambient or environmental condition
   8) By fire, riots, earthquake, lightning, or Act of God in any form or manner

6. Escape clause
   Under no circumstances will Manufacturer be liable for any damage, whether incidental, consequential or other, or for any other remedy arising from any loss, damage, expenses or inquiry in connection with use of the article.

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