

SINCE 1889



RCF Free

RCF Free

Electric Furnace/Muffle Furnace

FO/FP series

A new RCF-free series that does not contain any refractory ceramic fiber.*1



*1 RCF (Refractory Ceramic Fiber)

In November 2015, it was added to Class 3 substances under Japanese Law.

It is also classified as 2B (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).



Electric Furnace

FO
series



Muffle Furnace

FP
series

Under the slogan of safety and security, our company has switched to RCF-free alumina fiber as the material for the furnace body.

Yamato Scientific Co., Ltd.

What will you choose? Electric Furnace? or Muffle Furnace?

You can choose from a wide range of products to find the perfect one for you.

Although the applications of electric furnaces and muffle furnaces are the same, we recommend that you understand the structure and characteristics of each type of furnace before selecting one, because the difference in structure can cause a significant difference in the results.

Applications of Electric / Muffle Furnaces

<p>Ash treatment (removal of organic matter)</p> <p>Analysis of metals, ash content, asbestos, etc.</p>	<p>Baking</p> <p>Development of materials such as ceramics, porcelain</p>	<p>Development of new materials such as super-conducting materials</p>	<p>Melting and heat treatment of glass</p>	<p>Degreasing of metals and ceramics</p>
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* If temperature accuracy, risk of contamination, and heater life are your priorities, we recommend selecting a muffle furnace.

Structural differences between electric and muffle furnaces

The muffle furnace belongs to the electric furnace in a broad sense. (Figure 1)

An electric furnace with no exposed heater is called a muffle furnace. The word "muffle" means to wrap around, because the outside of the furnace is covered with a heater.

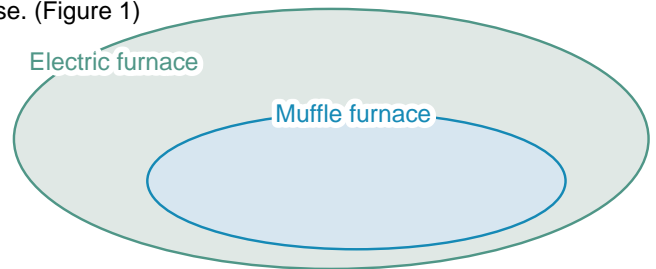
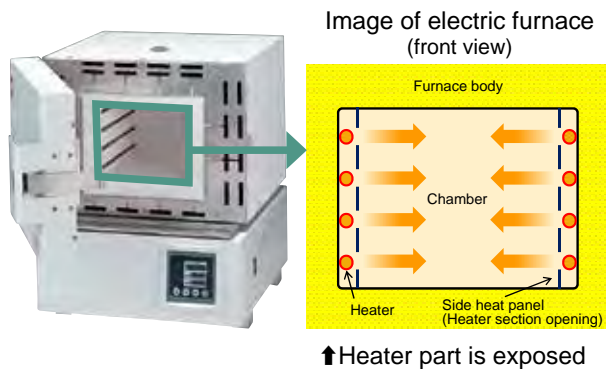
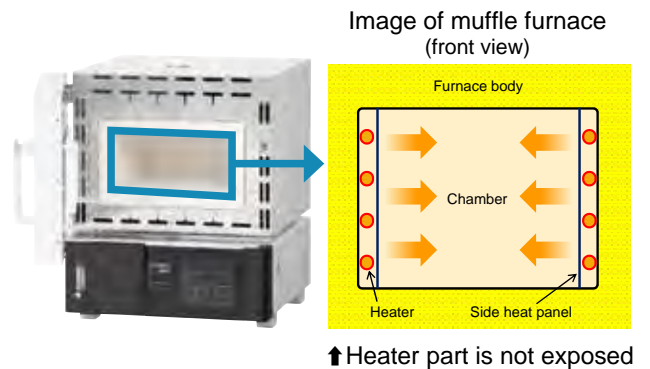


Figure 1

Structure of Electric Furnace



Structure of Muffle Furnace



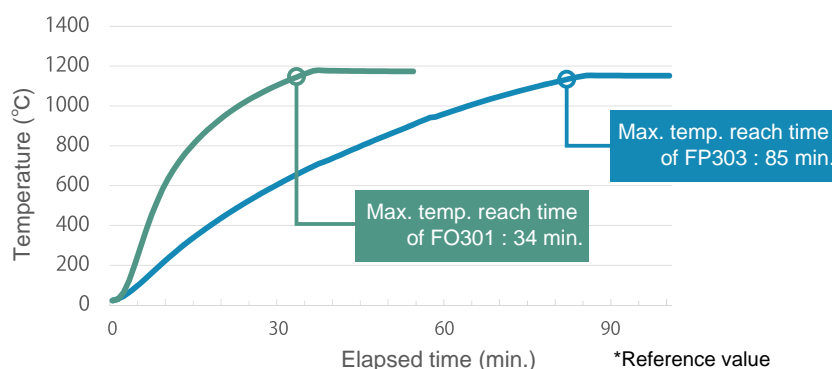


Features of Electric Furnace

Directly heated by a heater, the temperature rise time is fast and the sample can be processed in a short time.



Temperature rise data Comparison of FO 301 and FP 303



Features of Muffle Furnace

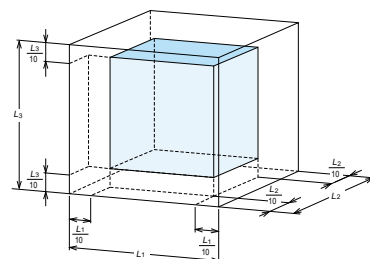
1. Indirect heating from the outside of the furnace body provides high temperature uniformity, making it ideal for baking that requires precise temperature control.

●9-point distribution reference data (no load)

	Upper back right	Upper back left	Upper front right	Upper front left	Lower back right	Lower back left	Lower front right	Lower front left	Center
FP303	1151.5	1154.6	1151.1	1153.5	1150.0	1148.4	1147.8	1150.4	1151.3

Conditions

- The measurement points are at 1/10 (minimum 50mm) of the distance to the relative wall surface in the chamber internal dimensions and at 9 points in the center. (JIS/JTMK07 compliant)
 - Average temperature at room temperature of 23°C, AC200V, 50Hz, setting of 1150°C. This data is for reference only.
 - no load.
- It is suitable for pretreatment of microanalysis because it can reduce contamination risk of substances that repeatedly adsorb and transpire on the heater.
 - Since the material scattered from the sample does not deteriorate the heater, the heater life can be extended.



Why the Muffle Furnace Is Selected



Reduction or prevention of contamination and heater deterioration



- It is suitable for cases where outgas components from the sample may be adsorbed and released on the heater surface, and for trace analysis where evaporation of heater material is a contamination risk.
- It is also suitable for cases where outgas from the sample adversely affects the heater life. If you are currently using an exposed heater and the heater is frequently deteriorated, try using a muffle furnace.

Electric furnace

A standard type electric furnace with a program operation function that can be used in various situations.

Available in 9 different lineups from small quantity (1.5 L) to large quantity (30 L)



Uses material without RCF (alumina fiber).
Excellent thermal insulation effect with low thermal conductivity.



FO101

Internal capacity
1.5L

FO311

Internal capacity
7.5L

FO611

Internal capacity
17.5L

FO811

Internal capacity
30L

Specifications

Model	FO101	FO201	FO301	FO311	FO411	FO511	FO611	FO711	FO811
Product code	214136	214137	214138	214139	214140	214141	214142	214143	214144
Performance*	Operating temp. range								
	100 to 1150°C								
	Temp. control accuracy								
±2.0°C (at 1150)°C									
Structure	Max. temp. reaching time								
	Approx. 60min.			Approx. 70min.			Approx. 80min.		
	Exterior material								
Chrome-free electrogalvanized steel sheet Baked finish									
Furnace									
Alumina fiber									
Sensor									
R-thermocouple (for temperature control, for independent overheat protection)									
Heater									
1kW	1.5kW	2kW	2kW	2.2kW	2.5kW	3kW	3.5kW	4kW	
Exhaust port									
Internal diameter 20mm (top)									
Cooling Fan									
Axial fan motor									
Temp. control method									
PID controll									
Overheat protector									
Integrated controller									
Operation functions									
Fix temperature operation, programmed operation (6 patterns of 30 steps x 1, or 15 steps x 2, or 10 steps x 3)									
Additional functions									
Calibration offset function, power failure compensation function									
Timer									
Auto Start, Auto Stop, Quick Auto Stop, 1 min. to 99 hrs. 59 min. and 999 hrs. 50 min.									
Safety Devices									
Self-diagnostic function (memory error, sensor error, heater disconnection, SSR short circuit, automatic overheat protection), overcurrent leakage breaker, overheat protector									
Standards	Internal capacity								
	1.5L	3.75L	7.5L	7.5L	9L	11.3L	17.5L	23.6L	30L
	Accessories								
	Exhaust capx1, Thermal fusex1								
	Internal dimensions*2 (WxDxHmm)								
100×150×105	100×250×155	200×250×155	200×250×155	200×300×155	300×250×155	250×350×205	270×350×255	300×400×255	
External dimensions*2 (WxDxHmm)									
346×405×517	346×505×567	446×505×567	446×505×567	446×554×567	507×504×627	507×604×677	507×605×727	507×655×727	
Power source*3 (50/60Hz)									
AC115/220V Single phase with step down transformer				AC220V Single phase					
Weight									
24kg	30kg	37kg	37kg	38kg	44kg	52kg	58kg	62kg	

*1 Performance is based on rated power supply voltage, single phase 100V/200V±5%, room temperature 23°C±5%, humidity 65%RH±20%, no load.

*2 Protruding parts are not included.

*3 Length of power cord : 2 m outside the unit, Power plug not included.

Features

The operation is simple and easy.

The controller is equipped with a controller with excellent operability, and various settings can be made with simple operations using the up and down keys.

It will soon reach the maximum temperature.

Since the heater is exposed, the maximum temperature (1150°C) is reached quickly. (Compared with our conventional muffle furnace)

Programmed operation and timer functions are also provided.

In addition to programmed operation with 6 patterns and 30 steps, there are auto-start, auto-stop and quick auto-stop (to set the off timer during continuous operation) functions.

Exhausting moisture and gases generated from samples

The upper part of the body is equipped with an exhaust port as standard. The opening can be adjusted according to the hazardous gas or moisture condition generated from the sample.

Equipped with various safety functions.

It is equipped with a self-diagnostic function, an overheat prevention function, and an overcurrent leakage breaker as standard.

No power supply work required (when using FO101)

The FO101 can use a regular wall outlet. No power supply work is required.

It is also effective for samples that dislike oxygen (when using the option).

Options are available to prevent oxidation of inside the furnace and sample. A flowmeter is also provided to adjust the flow rate when introducing N₂ gas.

Corrosive gas emissions are also supported (when using options).

A device that can be attached to the top of the exhaust port to exhaust gases generated from inside the furnace is also available as an option. Use this product when corrosive or other dangerous gases are emitted.

Optional Items

No.	Product name	Model	Applicable models	Product code
①	Exhaust fan unit (for 100V)	OFF36	FO101/201/301	214160
②	Exhaust fan unit (for 200V)	OFF38	FO311/411/511/611/711/811	214161
③	Time up output terminal	OFO30	FO for all models	281301
④	Temp. output terminal (4-20mA)	OFO40	FO for all models	281302
⑤	N ₂ gas inlet device (with flowmeter 10 to 50 L/min) Gas inlet RC (PT) 1/2 female screw	OFF12	FO for all models	281303
⑥	Sample tray 200×150mm Load capacity 2kg or less	OFF22	FO for all models	281310

*Please specify when you place your order. ③ to ⑤

Control panel



Exhaust fan unit (①/②)

It is possible to quickly exhaust the gas generated by the rise in temperature inside the furnace.

- Duct : Flexible duct, made of aluminum
Length 1.5m, Diameter 50mm
- Power supply :
AC100V 0.27A, 200V 0.15A Single phase

*The original performance may not be obtained during use.

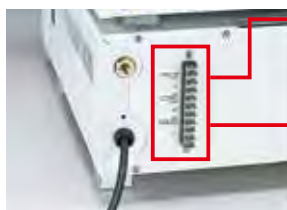


N₂ gas inlet device (⑤)



Sample tray (⑥)

Used as a temporary place to cool hot samples. Used to temporarily cool hot samples.



Time up output terminal (③)

- Time-up output
Output at auto stop and program end

Temp. output terminal (④)

- Measured temp. transmission output
Used to record and monitor the temp. inside the furnace
Temp. output: 4-20mA

Learn more about FO Series ▶



Muffle Furnace

The structure that does not expose the heater reduces contamination and deterioration of the heater. Since it is heated by radiant heat from the heat plate, a highly accurate and stable temperature distribution can be obtained.



Uses a material (alumina fiber) that does not contain RCF. It has low thermal conductivity and excellent insulation effect.



FP103

Internal capacity
1.5L



FP313

Internal capacity
7.5L



FP413

Internal capacity
11.3L

Specifications

Model	FP103	FP303	FP313	FP413	
Product code	214145	214146	214147	214148	
Performance ^{*1}	Operating temp. range	100 to 1150°C			
	Temp. control accuracy (JTM K05)	±1.0°C (at 1150°C)			
	Temp. fluctuation (JIS)	2.0°C (at 1150°C)			
	Temp. distribution accuracy (JTM K05)	±4.0°C (at 1150°C)			
	Temp. gradient (JIS)	14°C (at 1150°C)			
	Temp. rise time (when passing 1150°C)	Approx. 90 min.		Approx. 80 min.	
Structure	Exterior material	Chrome-free electrogalvanized steel sheet Baked finish			
	Furnace	Alumina fiber			
	Sensor	R-thermocouple (for temperature control, for independent overheat protection)			
	Heater	1.1kW	2.4kW	2.4kW	3.25kW
	Exhaust port	Internal diameter 20mm (top)			
	Cooling fan	19/16W(50/60Hz)			
Controller	Temp. control method	PID controll			
	Timer display range	0 min. to 99 hrs. 59 min. (1 min. or 1 hr. timer resolution)			
	Operation functions	Fix temp. operation, quick auto-stop operation, auto-start operation, auto-stop operation, programmed operation : up to 99 steps, up to 99 patterns, repetitive operation function			
	Additional functions	Accumulation function of energization/operation time (up to 65535 hrs.), calendar timer (24 hrs.) time (24-hour display), calibration offset, monitor display of power consumption, CO ₂ emissions, heater operation volume, power failure recovery mode selection, saving and recalling user setting information			
Safety device	Self-diagnostic functions (sensor abnormal detection, heater disconnection detection, triac short-circuit detection, main relay failure detection, automatic overheat protection), key lock function, independent overheat protection, overcurrent leakage breaker, thermal fuse				
Standards	Internal capacity	1.5L	7.5L	7.5L	11.3L
	Accessories	Exhaust port cap, thermal fuse, Hearth board			
	Internal dimensions* ²	W100xD150xH100mm	W200xD250xH150mm	W200xD250xH150mm	W300xD250xH150mm
	External dimensions* ²	W376xD404xH515mm	W446xD504xH565mm	W446xD504xH565mm	W506xD504xH625mm
	Power source* ³ (50/60Hz)	External step-down transformer for AC220V	AC115V Single phase 21.5A	AC220V Single phase 12A	AC220V Single phase 15A
	Weight	29kg	43kg	43kg	51kg

*1 Performance is based on rated power supply voltage, single phase 100V/200V±5%, room temperature 23°C±5%, humidity 65%RH±20%, no load.

*2 Protruding parts are not included.

*3 Length of power cord : 2 m outside the unit, Power plug not included.

Features

Ideal structure for trace analysis and contamination prevention.

Since the heater is not exposed in the furnace, this structure is effective when gas components generated from the sample are repeatedly adsorbed and released by the heater, or when evaporation of the heater material becomes a contamination risk.

Well temperature distribution.

Since the heater is partitioned by a heat plate and heated by radiation heat, the temperature distribution is better than that of an electric furnace where the heater is exposed.

Equipped with programmed operation and various operation functions.

In addition to programmed operation with 99 steps and 99 patterns, there are various operation modes such as auto start operation, auto stop operation, and repetitive operation.

Power failure compensation can be selected.

It is possible to select whether the unit will automatically recover or go into standby mode after power failure recovery.

Equipped with various safety functions.

In addition to the independent overheat prevention, it is equipped with a self-diagnostic function and a key lock function to enhance the maintenance ability and preventing from accidental operation.

No power supply work required (when using FP103)

The FP103 can use a regular wall outlet. No power supply work is required.

It is also effective for samples that dislike oxygen (when using the option).

Options are available to prevent oxidation of inside the furnace and sample. A flowmeter is also provided to adjust the flow rate when introducing N₂ gas.

Corrosive gas emissions are also supported (when using options).

A device that can be attached to the top of the exhaust port to exhaust gases generated from inside the furnace is also available as an option. Use this product when corrosive or other dangerous gases are emitted.

Optional Items

No.	Product name	Model	Applicable models	Product code
①	Exhaust fan unit (for 100V)	OFP36	FP103/303	214160
②	Exhaust fan unit (for 200V)	OFP38	FP313/413	214161
③	Time up output terminal	OFP58	FP103/303/313/413	214168
④	External alarm output terminal	OFP56	FP103/303/313/413	214167
⑤	Temp. output terminal (4-20mA)	OFP48	FP103/303/313/413	214166
⑥	N ₂ gas inlet device (with flowmeter 10 to 50L/min for N ₂)	OFP24	FP103	214162
⑦		OFP26	FP303/313	214163
⑧		OFP28	FP413	214164
⑨	External communication terminal (RS485)	OFP46	FP103/303/313/413	214165
⑩	External communication adapter set (RS485)	OIN90	FP103/303/313/413	211880
⑪	Operation signal output terminal	OFP62	FP103/303/313/413	214169
⑫	Event output terminal	OFP64	FP103/303/313/413	214170
⑬	Sample tray 200×150mm Load capacity 2kg or less	OFP22	FP103/303/313/413	281310
⑭	Alumina hearth board 90×145×6mm 5 pcs.	OFP68	FP103	214157
⑮	Alumina hearth board 190×245×8mm, 5 pcs.	OFP70	FP303/313	214158
⑯	Alumina hearth board 290×245×8mm, 5 pcs.	OFP72	FP413	214159

*Please specify when you place your order. ③ to ⑫

Control panel



Display and operability are divided into upper and lower parts, and operation status display, setting display, setting display and operation keys are arranged.



Exhaust fan unit (①/②)

It is possible to quickly exhaust the gas generated by the rise in temperature inside the furnace.

- Duct : Flexible duct, made of aluminum
Length 1.5m, Diameter 50mm
- Power supply :
AC100V 0.27A, 200V 0.15A Single phase

*The original performance may not be obtained during use.



N₂ gas inlet device (⑥⑦⑧)



Sample tray (⑬)

Used as a temporary place to cool hot samples. Used to temporarily cool hot samples.

Learn more about FP Series ▶



Related Products

We collected related products necessary for using electric furnaces and muffle furnaces. Please consider it together with the main body.

●Crucible

Product name	Standard / Quantity	Dimensions (mm)	Product code
Crucible	SSA-H B1 / 1 pc.	O.D.46xH36	214204
	SSA-H B2 / 1 pc.	O.D.54xH43	214205
	SSA-H B3 / 1 pc.	O.D.66xH54	214206
	SSA-H B4 / 1 pc.	O.D.73xH59	214207
	SSA-H B5 / 1 pc.	O.D.88xH72	214208
Crucible lid	SSA-H / 1 pc.	For Crucible B1	214209
		For Crucible B2	214210
		For Crucible B3	214211
		For Crucible B4	214212
		For Crucible B5	214213
Crucible tong	1 pc.	180	214220
		210	214221
		240	214222
		300	214223
		360	214224
		450	214225
		500	214226
	600	214227	

●Hearth board for FP series

Product name	Quantity	Dimensions (mm)	Product code
Alumina hearth board	5 pc.	90×145	214157
		190×245	214158
		290×245	214159

●Combustion boat

Product name	Standard / Quantity	Dimensions (mm)	Product code
Combustion boat	#01/50 pc.	W6×H4×D30	214228
	#10/10 pc.	W14×H12×D140	214229
	#8/50 pc.	W15×H13×D90	214230

●Hearth board

Product name	Standard / Quantity	Dimensions (mm)	Product code
Hearth board Square	SSA-S/1 pc.	50 square x 2.5t	214238
		100 square x 2.5t	214239
		150 square x 2.5t	214240



Crucible / Crucible lid Crucible tong Alumina hearth board Combustion boat hearth board Square

Q & A FO/FP Series

Q I would like to use a gas other than N₂ for the optional N₂ gas inlet device, is there a problem?

In addition to N₂ inert gases such as Ar and He can be used, but the flowmeter attached to the optional inlet device is for N₂, so if Ar or He is used, flow-rate conversion is required. The conversion formula is described in the instruction manual of the flowmeter.

Q What is about the heat resistance of alumina fiber, the material of the new furnace material.

The maximum heat resistance temperature of the material is approximately 1600°C. It is sufficiently heat resistant to withstand the maximum temperature of 1150°C.

Q We are using the old products including RCF, are they subject to regulation?

The current special regulations require appropriate measures to be taken in manufacturing and processing where dust may be emitted, but the use in a non-scattering environment is exempted, so we decide that the RCF-containing parts incorporated in our old products also fall under the exemption from the regulations under normal usage.

Q We need a temperature monitor. Is there an easy and inexpensive way to do this?

By combining the optional temperature output terminal (4-20mA) with a shunt resistor and a data logger, temperature recording can be easily performed. The data can be imported to a PC, and the software can be downloaded free of charge.

Example of arrangement

- Temperature output terminal (4-20mA)
- Data logger
Model: GL 240 Product code : 535762
- Shunt resistance
Model : B 551 Product code : 535787



Caution The specifications and performance figures of the products listed in this catalog are presented as a user guide under general operating conditions. When using the product, please understand the contents of the instruction manual and use the product correctly. Please note that we cannot be held responsible for any damage to persons or property caused by using the product outside the conditions of use described in the instruction manual.

●Specifications and appearance are subject to change for improvement without prior notice. ●The product colors may appear different from the actual colors due to the shooting and printing inks. ●Company names, product names, and logos are trademarks or registered trademarks of our company Corporation or of their respective owners.

SINCE 1889



For the development of scientific technologies

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