

Overview of development of the large-capacity hybrid superheated steam and hot-air oven

[1] Development setup

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[2] Oven specifications



Fig. 1 Exterior view of oven

Table 1 Specifications of oven

Item	Unit	Oven
Model	-	DFC-560A-2R/L-CE
External dimensions	W x D x H mm	2,880 x 950 x 1,225
Power supply capacity	kW(A)	32.3 (93.4)
Cooking oven dimensions	W x D x H mm	1,510 x 560 x (50 to 80) (Height adjustable)
Weight	kg	500 for body, 115 for control panel
Maximum volume of steam	kg/h	80 (adjustable)
Maximum volume of hot air	L/min	300 (adjustable)
Superheated steam temperature	°C	120 to 400
Price (excl. taxes; cost of installation separate)	¥	26 million
Power supply	-	AC 200V, 3-phase

[3] Key development points

<1> Use of superheated steam

Superheated steam has been spotlighted in recent years as a new heat source to replace the hot air used in the past, and it has the following advantages:

- High-speed baking: The baking time is about two-thirds compared with hot air.
- Improved taste and texture: Taste is improved, and juicy and tender textures are produced.
- Deodorization effects: The odors of some types of fish, for example, can be eliminated.

<2> Mixture of superheated steam and hot air

Mixing superheated steam and hot air yields the kind of flavors that are between what is produced by the use of superheated steam only and what is produced by the use of hot air only. For instance, when carrots are heated using superheated steam only, the smell inherent to the carrots is removed, making them non-offensive to children who do not like carrots. In contrast, when hot air is mixed in with the superheated steam, a faint smell of carrots is left, and tender food full of the flavor of carrots is produced.

<3> Function for adjusting the cooking oven height

The superheated steam outlets are at the top of the oven. This means that the more the position of the conveyor on which the food is placed is raised so that the food is brought closer to the outlets, the more the food is exposed to the high-temperature superheated steam and the more energy is conserved. When, for example, heating thinly shaped food such as bread, the conveyor is raised as shown in (a) of Fig. 2.



(a) Conveyor height adjusted to 5 cm



(b) Conveyor height adjusted to 8 cm

Fig. 2 Conveyor height adjustments

(Figures represent the height of superheated steam outlets from the conveyor)

[4] Evaluation by food industry professionals

Takashi Matsumura, head of the product development office of IDEAPLUS Inc., which is a Japanese restaurant franchise, kindly cooperated in tasting some foodstuffs cooked by the Aero-Steam Oven, and his assessment is quoted below.

<1> Effects of superheated steam

“Both tastes and textures are considerably improved by using this oven. To take the example of hamburgers, when they are cooked in a conventional hot-air oven, they always have the odor that’s peculiar to them and tend to have a somewhat dried-up texture. However, they don’t have these odors and are bursting with all the juices of the meat and are filled out nicely when they are cooked in the Aero-Steam Oven.”

<2> Effects of combining superheated steam and hot air

“The foodstuff industry is always a place of stiff competition. All the companies involved are focused on incorporating what their customers need, what the current trends are and what’s in season, and they are always busy developing new products and dishes. The fact that this oven uses the new technique of combining superheated steam and hot air makes me feel it has opened the door to new possibilities for tastes, textures and other aspects of the foods cooked. I expect this oven to be a powerful force in future product development.”

<3> Improved yield for food ingredients

“This oven has a better yield (by approx. 1% to 5%) compared with the conventional hot air system. Increasing the yield for the food ingredients translates into cost reductions when the same quantities of the ingredients are purchased and also into a sharper competitive edge for companies and restaurants.”