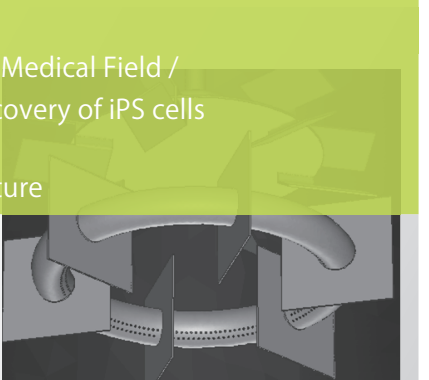


# SATAKE BIOREACTOR SERIES

Satake Cell Culture Device General Catalogue



Animal Cell Culture  
Regenerative Medical Field /  
Medicine Discovery of iPS cells  
Microbial Culture

# The key word is “Industrialization”. Satake proposes the most optimal “Cell Culture” from laboratory scale to production.

For 30 years since the establishment of our Mixing Technology Laboratory, Satake has been put endless efforts in mixing research and development, mainly focusing on “Flow and its Effect”. By applying these technologies to cell culture field, we succeeded in developing novel bioreactor that can create the most optimal environment for cell culture. As the top manufacturer of mixer with extensive knowledge and experience in mixing technology, we confident that our products will satisfy our customers. In addition, we have also built schemes to customize order-made bioreactor and cell culture systems by working together hand-in-hand with customers. Try it out as we are looking forward to serve you!



## Lineup

Animal Cell Culture  
MRF Reactor P.4-5

Rotating Type

Animal Cell Culture  
VMF Reactor P.6-7

Vertical Motion Type

Animal Cell Culture  
VerSus Reactor P.8-9

Vertical Motion Type/SPG Membrane Sparger

Animal cell culture /  
Regenerative medicine For production P.10-11

Single-Use Bioreactor

Rotating Type / Vertical Motion Type

Regenerative Medical /  
Medicine Discovery of iP5 cells P.12-13

HiD 4×4

Vertical Motion Type

Microbial Culture P.14-15

HS100 Turbine /SATAKE Sparger

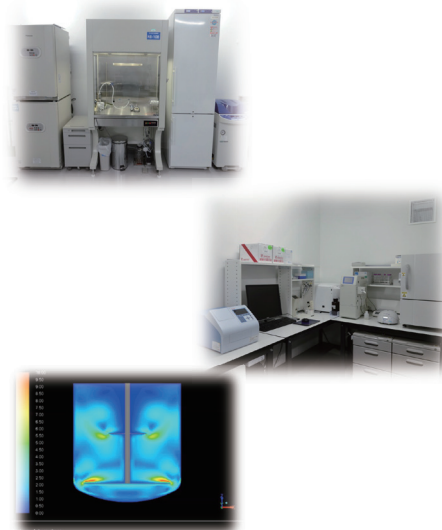
High Efficient Turbine / Aeration Mixing System

# Outsourcing Service for Cell Culture

## Outsourcing Service for Numerical Calculation using CFD

### ■ Feature of Satake Outsourcing Service for Cell Culture

“Laboratory results cannot be reproduced at scale-up scale”  
 “We want to optimize production, however we have no idea how to do it”  
 “We interested in trying the new bioreactor, however we may want to confirm whether it is really effective or not before purchasing it”...etc.  
 To meet such requirements from our customers, SATAKE Mixing Technology Laboratory is equipped with a clean room (culture room) which is specialized for outsourcing service for cell culture. By cooperation with our partner companies, our clean room is well-equipped with devices for scaling-up purpose, with maximum volume up to 200L and evaluating analysis for inducing differentiation of iPS cells. Additionally, we also offer outsourcing service for numerical calculation using computational fluid dynamics (CFD). With long term of knowledge and experience in mixing technology, we are able to offer to our customers the most ideal service to meet their needs and requirements.



### ■ Possession equipment introduction

#### 【Culturing device】

- VMF Reactor Volume : about 200ml ~ 8L
- MRF Reactor Volume : about 1L ~ 2.4L  
Driving 2Run is possible at the same time
- S-BOX (Control device)  
Dissolved oxygen concentration(DO) , pH Control
- Ventilation method  
Shirasu porous glass(SPG) membrane / Sintered metal

#### 【Other equipment】

- CO<sub>2</sub> Incubator(2 devices) with shaking machine
- Centrifuge separator
- Clean bench
- Autoclave
- Freezing refrigerator (-20°C、5°C)
- Deep Freezer (-80°C)
- Liquid nitrogen preserving container
- Digital microscope (Magnification 20 ~ 200times)

#### 【Cell counting method】

- Blood cell counting plate
- Cell counter (TC20)

#### 【Component analysis in the culture supernatant】

- Multifunctional bio sensor (BF-7)  
glucose • latic acid • glutamine • glutamic acid • ammonia etc.  
※ Consultation is necessary for other components
- Absorptivity plate leader (Multiskan GO)  
Lactate dehydrogenase  
※ Consultation is necessary for fixed-quantity of the antibody

### ■ The cell handling achievements

#### 【Culture of floating cells】

- CHO cells (Chinese hamster ovary cell)  
CHO-S、CHO-K1、CHO-DG44、CHO 1-15500
- HL60 cells (Human acute myelogenous leukemia)
- U937 cells (Human histiocytic lymphomas)

#### 【Culture of adherent cells】

- HeLa cells (Human uterine cervix cancer)
- Vero cells (African green monkey kidney)
- MDCK cells (Dog kidney)

#### Process of Outsourcing Culture Service

- ① Pre-meeting
  - Confirmation of customer' s purpose, cell and culture method
  - Explanation of laboratory facilities
- ② Quotation/Proposal
- ③ NDA(Non-Disclosure Agreement) Contract
  - Disclosure of detail information such as protocol and etc.
  - Conversation about culture condition
- ④ Borrowing of Cell Line
- ⑤ Culture Examination
  - Cell Number Counting and Culture Fluid Component Analysis from sampling
  - Delivery of Cell and culture supernatant after the examination if necessary
- ⑥ Result Report
  - Issue of Result Report and Conversation for subsequent action

Please contact our Bio project team for more information.

Contact number +81-48-444-7721

# MRF Reactor

Rotating Mixing Type of Bioreactor equipped with SuperMix MR210Bio Impeller

Exclusive type developed for required specifications, custom order-made and single-use.



MRF Reactor is a bioreactor for the laboratory scale, which is practically use for the purpose of scaling up and production. This reactor is equipped with a standard type of special impeller, so called the “MR210Bio”, which enables to reproduce similar laboratory results at scale-up. This impeller has high performance in mixing and easy-to-clean due to its simple design. Furthermore, this impeller can also corresponds to liquid level changes (Fed-batch) and exhibits good mixing performance at any liquid level from small volume of 1.5L up to large volume of 20,000L.

This reactor is dedicated with a special controller of “S-BOX X10 α”, which makes it easier to change each parameters, including the PI control.

**Option** Simplified controllers **S-BOX X10 Simple**  
SATYAKE INSTRUMENT SYSTEM

Net sales limited only controller  
 Simple control of DO · pH is possible.

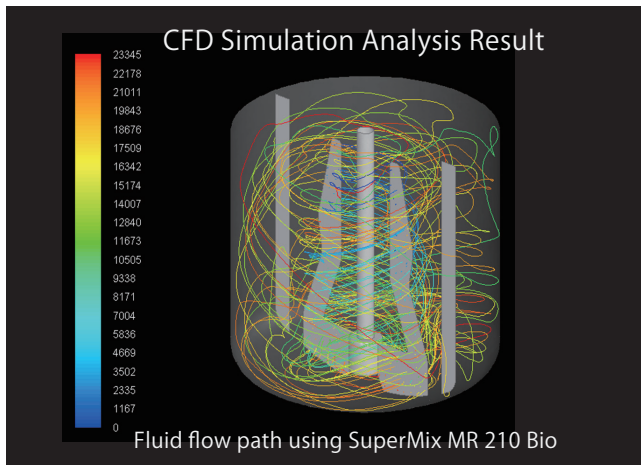
**MRFReactor**

Item		Specification	
Product name		MRF Reactor	
Model		MRF-3000	MRF-10000
Temp. control method		Band heater method(PID Controller) with over-temperature control function(MAX 80°C)	
Rotation method		Seal less magnetic drive	
Ventilation method		Shirasu porous glass(SPG) membrane / Sintered metal	
Performance	Temp. range	Room temp. +5~20°C (Standard setting:37°C)	
	Temp. precision	±0.3°C (37°C)	
	Rotation speed range	5~200min <sup>-1</sup>	
Function	Temp. setting	Digital	
	Rotation speed setting	Touch panel input	
Configuration	Band heater	150W	
	Motor	MAX output 100W	
	Impeller	Standard MR210Bio impeller	
Standard	Reactor size	I.D.140×203 Height [mm]	I.D.200×360 Height [mm]
	Reactor full volume	3L	10L
Ambient temperature range		10~35°C	
Outer size		300W×485D×890H [mm] (360W with overturning prevention metal)	
Weight		Approx. 30kg	Approx. 34kg
Rated power		AC 100V、50/60Hz	

\* The reactor performance is the value operated at no-load operation at 20°C (room temp.) with rated power of AC100V 50Hz.

# The most optimal cell culture environment is created by high mixing performance of SuperMix MR210Bio impeller.

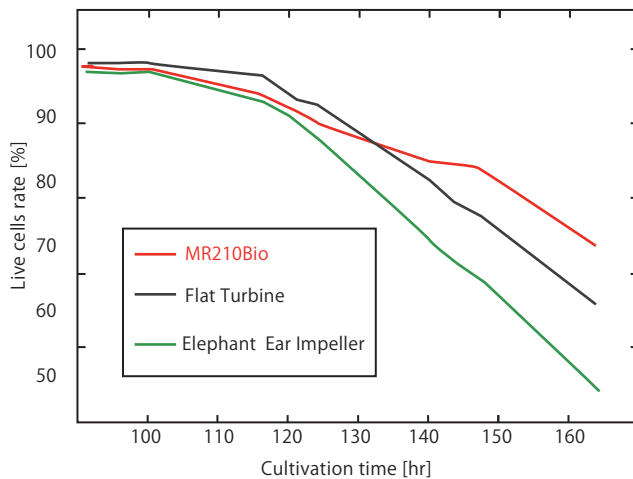
## Fluid flow in a bioreactor



## CFD Simulation Analysis Result

The SuperMix MR210Bio impeller, which is particularly developed for cell culture, generates large circulation flows to promote high uniformity in a stirred tank. This flow characteristic ensures high uniformity and good flow thoroughly in a stirred tank at low power consumption and impeller speed, even with varying liquid level. This is because, the main fluid flow pattern is keep steady even with changes of liquid level. Hence, this impeller is sufficient to be used for the fed-batch cell culture, of which liquid level significantly changing in such operation. The applicability of this impeller in such unsteady condition certainly make it a special impeller for cell culture which has not been reported. It is clearly shown from the CFD simulation analysis result that, high performance in fluid flow circulation can be obtained using the SuperMix MR210Bio impeller.

## Case study of cell culture



## Comparison of cells survival rate at the later stage of cell culture using CHO cells

The graph on the left shows the cells survival rate at the later stage in bioreactor using conventional impeller designs of flat turbine impeller and elephant ear impeller, in comparison with SATAKE MRF reactor with novel SuperMix MR210Bio impeller. It is clearly shown that higher survival rate of cells at the later stage of the cell culture is obtained with SATAKE MRF reactor compared to the conventional bioreactors. This implies the characteristics of the novel SuperMix MR210Bio impeller which has low shear effect and high uniformity in a stirred tank. Subsequently, with the combination of using the CFD, it is enables to perform scaling-up using large scale reactor.

## S-BOX × 10 α

Item	Specification									
Product name	Cultivation controller			Cultivation controller						
Model	S-BOX × 10 α			S-BOX × 10 Simple						
Display range • Precision	pH (Hydrogen ion conc.)	0.00~14.00 [pH]		Display precision : F.S. ± 0.5%	pH (Hydrogen ion conc.)	0.00~14.00 [pH]				
	DO (Dissolved oxygen)	0.00~10.00 [mg/L]			DO (Dissolved oxygen)	0.00~10.00 [mg/L]				
	FL (O <sub>2</sub> Flow rate)	0.00~20.00 [mL/min]			F.S. ± 0.5%					
Control setting range	pH (Hydrogen ion conc.)	0.00~14.00 [pH]		pH (Hydrogen ion conc.)	0.00~14.00 [pH]					
	DO (Dissolved oxygen)	0.00~10.00 [mg/L]		DO (Dissolved oxygen)	0.00~10.00 [mg/L]					
	FL (O <sub>2</sub> Flow rate)	0.10~20.00 [mL/min]								
Control output	pH (Hydrogen ion conc.)	ON/OFF Control		pH (Hydrogen ion conc.)	ON/OFF Control					
	DO (Dissolved oxygen)	Flow rate step control		DO (Dissolved oxygen)	ON/OFF Control					
	FL (O <sub>2</sub> Flow rate)	PI control (Slope set method Time, %)								
Recording output	pH (Hydrogen ion conc.)	Data logger included	Output precision : F.S. ± 0.5%	pH (Hydrogen ion conc.)	Data logger included	Output precision : F.S. ± 0.5%				
	DO (Dissolved oxygen)	DC 0~5 [V]		DO (Dissolved oxygen)	DC 0~5 [V]					
	FL (O <sub>2</sub> Flow rate)									
Power	AC100V、50/60Hz			AC100V、50/60Hz						
Casing material	SUS304 (without painting), Indoor type, Non drip proof, Non explosion proof			SUS304 (without painting), Indoor type, Non drip proof, Non explosion proof						
Installation method	Desk-top indoor type			Desk-top indoor type						
Outer size	W260 × H350 × D300 [mm]			W260 × H350 × D300 [mm]						
Ambient environmental condition	Temp.	5~45 °C	RH	20~85 % (No condensation)	Temp.	5~45 °C	RH	20~85 % (No condensation)		
Utility	Power	AC100V plug × 2 ports (for controller body and recorder)				Power	AC100V plug × 2 ports (for controller body and recorder)			
	O <sub>2</sub>	Flow rate 20mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube				O <sub>2</sub>	Flow rate 20mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube			
	CO <sub>2</sub>	Flow rate 50mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube				CO <sub>2</sub>	Flow rate 50mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube			
	AIR	Flow rate 150mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube				AIR	Flow rate 150mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube			
	※All gases must be dried gas excluding corrosive component, dust and oil mist including O <sub>2</sub> , CO <sub>2</sub> , AIR				※All gases must be dried gas excluding corrosive component, dust and oil mist including O <sub>2</sub> , CO <sub>2</sub> , AIR					

System development and customization for demand specification are also possible.  
Please contact our Bio project team below for more information.  
Contact number +81-48-444-7721

# VMF Reactor

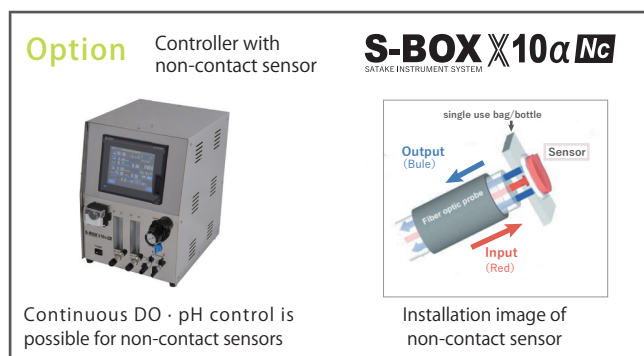
## Vertical Motion Mixing Type of Bioreactor

Exclusive type developed for required specifications, custom order-made and single-use.



JPN Pat. No.4316251  
Other patents pending or patented in japan and abroad

VMF Reactor is a next-generation type of bioreactor using vertical motion mixing. This reactor can perform high mixing performance and mild mixing as well. Furthermore, this reactor is also superior in controlling severe shear force compared to the conventional rotating type impeller. Additionally, "complete seal structure" is realized as complicated rotating seal is unnecessary. This secures high cleanliness and germ-free, as well also free from the risks of contamination and leakage. This reactor is dedicated with a special controller of "S-BOX×10α", which makes it easier to change each parameters, including the PI control. Additionally, this reactor can also be customized up to 8 bioreactors by demands.



Continuous DO · pH control is possible for non-contact sensors

Installation image of non-contact sensor

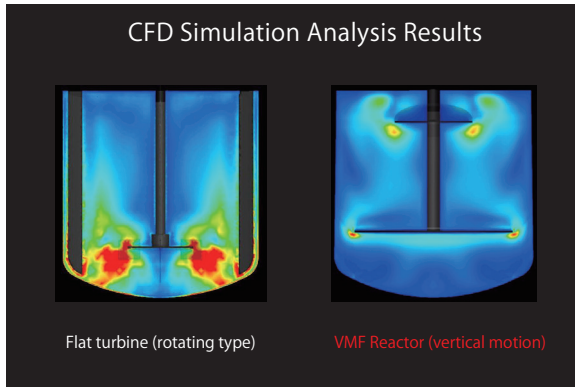
### VMF Reactor

Item		Specification			
Product name		VMF Reactor			
Model		VMF-500	VMF-1500	VMF-3000	VMF-10000
Temp. control method		Band heater method(PID Controller) with over-temperature control function(MAX 80°C)			
Linear transmission method		Seal less linear shaft drive			
Ventilating method		Sintered metal			
Performance	Temp. range	Room temp. +5~20°C (Standard setting:37°C)			
	Temp. precision	±0.3°C (37°C)			
	MAX Vertical motion stroke	40mm			
	MAX impeller speed	300mm/s			
Function	Temp. setting	Digital			
	Vertical motion setting	Touch panel input			
Configuration	Band heater	150W			
	Motor	MAX output 800W			
	Impeller	Standard VM200	Standard VM100 + VM200		
Standard	Reactor size	I.D.90×200 Height [mm]	I.D.110×169 Height [mm]	I.D.140×203 Height [mm]	I.D.200×360 Height [mm]
	Reactor full volume	0.5L	1.5L	3L	10L
Ambient temperature range		10~35°C			
Outer size		300W×485D×890H [mm] (360W with overturning prevention metal)			
Weight		Approx. 28kg	Approx. 28kg	Approx. 30kg	Approx. 34kg
Rated power		AC 100V、50/60Hz			

\* The reactor performance is the value operated at no-load operation at 20°C (room temp.) with rated power of AC100V 50Hz.

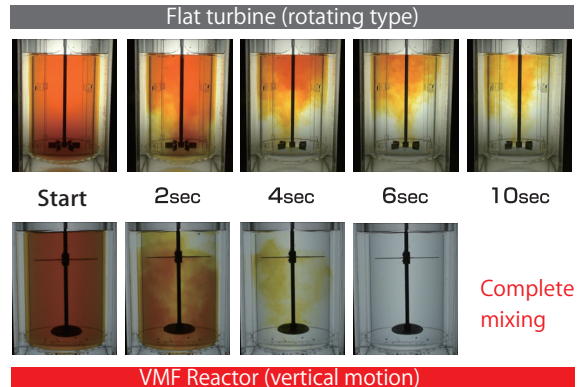
# Less shear and good mixing performance are realized to create optimal cell culture environment!!

## Comparison of shear stress

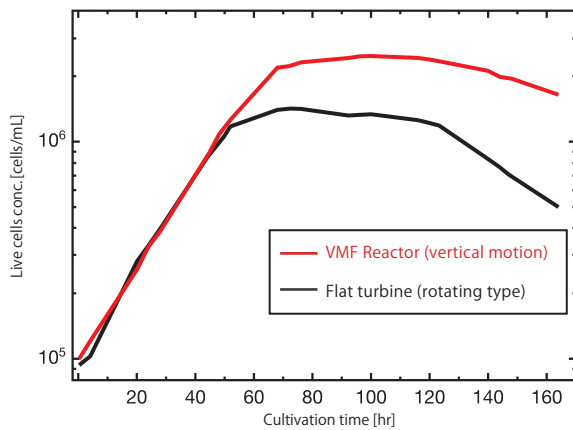


From the CFD simulation analysis results, it is clearly shown that, shear stress is more uniform in VMF reactor using novel vertical motion impeller, compared to the conventional reactor using the rotating type of flat turbine impeller. Furthermore, comparison of mixing performance at similar power consumption showed that, complete mixing also can be reached

## Comparison of mixing performance (Pv = const.)



## Case study of cell culture



## Cell culture comparison using CHO cells

VMF Reactor creates optimal cell culture environment compared to the conventional reactor using the rotating type impeller, by providing the most ideal physical environment for cell culture in a stirred tank. This eventually results in high survival cells rate using the VMF reactor than the MRF reactor. The superior performance of the VMF reactor is more significant, if the cells used are sensitive to the shear stress, compared with less-shear stress-sensitive cells. Consequently, this will eventually increase the production of products.

## S-BOX × 10 α

Item	Specification								
Product name	Cultivation controller				Cultivation controller				
Model	S-BOX × 10 α				S-BOX × 10 α Nc				
Display range · Precision	pH (Hydrogen ion conc.)	0.00~14.00 [pH]	Display precision : F.S. ± 0.5%	pH (Hydrogen ion conc.)	5.00~8.00 [pH]	Display precision : F.S. ± 0.5%	pH (Hydrogen ion conc.)	0.00~10.00 [mg/L]	
	DO (Dissolved oxygen)	0.00~10.00 [mg/L]		DO (Dissolved oxygen)	0.00~10.00 [mg/L]				
	FL (O <sub>2</sub> Flow rate)	0.00~20.00 [mL/min]		FL (O <sub>2</sub> Flow rate)	0.00~20.00 [mL/min]				
Control setting range	pH (Hydrogen ion conc.)	0.00~14.00 [pH]	Data logger included DC 0~5 [V]	pH (Hydrogen ion conc.)	0.00~14.00 [pH]	Output precision : F.S. ± 0.5%	pH (Hydrogen ion conc.)	0.00~14.00 [pH]	
	DO (Dissolved oxygen)	0.00~10.00 [mg/L]		DO (Dissolved oxygen)	0.00~10.00 [mg/L]				
	FL (O <sub>2</sub> Flow rate)	0.10~20.00 [mL/min]		FL (O <sub>2</sub> Flow rate)	0.10~20.00 [mL/min]				
Control output	pH (Hydrogen ion conc.)	ON/OFF Control		pH (Hydrogen ion conc.)	ON/OFF Control		pH (Hydrogen ion conc.)	ON/OFF Control	
	DO (Dissolved oxygen)	Flow rate step control		DO (Dissolved oxygen)	Flow rate step control		DO (Dissolved oxygen)	Flow rate step control	
	FL (O <sub>2</sub> Flow rate)	PI control (Slope set method Time, %)		FL (O <sub>2</sub> Flow rate)	PI control (Slope set method Time, %)		FL (O <sub>2</sub> Flow rate)	PI control (Slope set method Time, %)	
Recording output	pH (Hydrogen ion conc.)	Data logger included DC 0~5 [V]	Output precision : F.S. ± 0.5%	pH (Hydrogen ion conc.)	Data logger included DC 0~5 [V]	Output precision : F.S. ± 0.5%	pH (Hydrogen ion conc.)	Data logger included DC 0~5 [V]	Output precision : F.S. ± 0.5%
	DO (Dissolved oxygen)			DO (Dissolved oxygen)					
	FL (O <sub>2</sub> Flow rate)			FL (O <sub>2</sub> Flow rate)					
Power	AC100V, 50/60Hz				AC100V, 50/60Hz				
Casing material	SUS304 (without painting), Indoor type, Non drip proof, Non explosion proof				SUS304 (without painting), Indoor type, Non drip proof, Non explosion proof				
Installation method	Desk-top indoor type				Desk-top indoor type				
Outer size	W260 × H350 × D300 [mm]				W260 × H350 × D300 [mm]				
Ambient environmental condition	Temp.	5~45 °C	RH	20~85 % (No condensation)	Temp.	5~45 °C	RH	20~85 % (No condensation)	
	Power	AC100V plug × 2 ports (for controller body and recorder)			Power	AC100V plug × 2 ports (for controller body and recorder)			
	O <sub>2</sub>	Flow rate 20mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube			O <sub>2</sub>	Flow rate 20mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube			
	CO <sub>2</sub>	Flow rate 50mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube			CO <sub>2</sub>	Flow rate 50mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube			
Utility	AIR	Flow rate 150mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube			AIR	Flow rate 150mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube			
	※All gases must be dried gas excluding corrosive component, dust and oil mist including O <sub>2</sub> , CO <sub>2</sub> , AIR				※All gases must be dried gas excluding corrosive component, dust and oil mist including O <sub>2</sub> , CO <sub>2</sub> , AIR				

System development and customization for demand specification are also possible.  
Please contact our Bio project team below for more information.  
Contact number +81-48-444-7721

# VerSus Reactor

Collaboration of VMF Reactor and SPG Membrane Sparger

Exclusive type developed for required specifications, custom order-made and single-use.



VerSus Reactor is an innovative bioreactor for animal cell culture. It is composed of VMF Reactor and “SPG Membrane Sparger※” which generates extremely high uniformity of microbubbles. The “SPG Membrane Sparger” enables to provide less-shear stress damage to the animal cells in bioreactor by supply oxygen sufficiently. Furthermore, excessive formation of bubbles are also controlled by reducing the flow rate aeration of dissolved oxygen (DO). This reactor is dedicated with a special controller of “S-BOX x10 $\alpha$ ”, which makes it easier to change each parameters, including the PI control.

※ The “SPG Membrane Sparger” is developed with collaboration between Miyazaki Prefecture Industrial Technology Center and JGC Corporation.

**Option** Controller with non-contact sensor

Continuous DO - pH control is possible for non-contact sensors

**S-BOX x10 $\alpha$  Nc**

Installation image of non-contact sensor

## VerSus Reactor

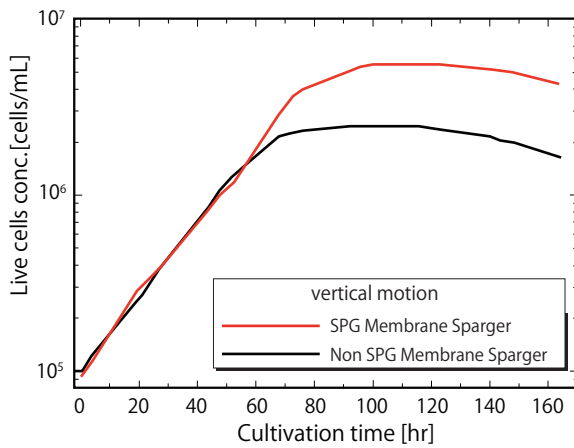
Item		Specification			
Product name		VerSus Reactor			
Model		VSR-500	VSR-1500	VSR-3000	VSR-10000
Temp. control method		Band heater method(PID Controller) with over-temperature control function(MAX 80°C)			
Linear transmission method		Seal less linear shaft drive			
Ventilating method		Shirasu porous glass(SPG) membrane			
Performance	Temp. range	Room temp. +5~20°C (Standard setting:37°C)			
	Temp. precision	±0.3°C (37°C)			
	MAX Vertical motion stroke	40mm			
	MAX impeller speed	300mm/s			
Function	Temp. setting	Digital			
	Vertical motion setting	Touch panel input			
Configuration	Band heater	150W			
	Motor	MAX output 800W			
	Impeller	Standard VM200	Standard VM100 + VM200		
Standard	Reactor size	I.D.90×200 Height [mm]	I.D.110×169 Height [mm]	I.D.140×203 Height [mm]	I.D.200×360 Height [mm]
	Reactor full volume	0.5L	1.5L	3L	10L
Ambient temperature range		10~35°C			
Outer size		300W×485D×890H [mm] (360W with overturning prevention metal)			
Weight		Approx. 28kg	Approx. 28kg	Approx. 30kg	Approx. 34kg
Rated power		AC 100V、50/60Hz			

\* The reactor performance is the value operated at no-load operation at 20°C (room temp.) with rated power of AC100V 50Hz.



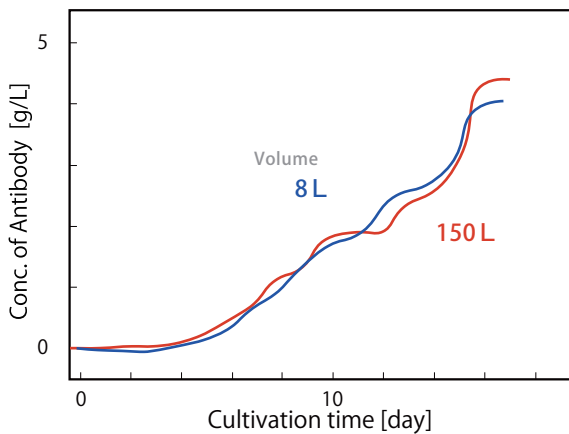
We promise further enhancement of “efficient production” by using the “VerSus Reactor” which combines the collaboration of “VMF Reactor” to controls physical effect inside a bioreactor and efficient microbubbles technology of “SPG Membrane Sparger”.

Case study of cell culture



Cell culture comparison using CHO cells

The graph on the left indicates the growth curves of CHO cells in a VMF reactor equipped with and without the SPG membrane sparger. It is well observed that, the CHO cells grow remarkably, under the condition of using the SPG membrane sparger. This reveals the outstanding performance of the VerSus reactor which implied that, weak flows are unaffected by the highly uniform microbubbles. Additionally, the high performance of gas absorption can significantly reduce the flow rate of DO aeration, which cause the formation of layers of bubbles.



Antibody production comparison using CHO Cells

The graph on the left indicates the scaling-up results※ from 8L to 150L using shear sensitive of CHO cells. These tests are conducted at the actual production of antibodies at market. The results demonstrate that, concentration of antibody in 150L scale is comparatively equal, or more than the 8L scale. Similar performance was also obtained using the CFD simulation under similar experimental conditions at fixed shear stress factor.

※ Results obtained with collaboration between JGC Corporation.

S-BOX × 10 α

Item	Specification									
Product name	Cultivation controller				Cultivation controller					
Model	S-BOX × 10 α				S-BOX × 10 α Nc					
Display range • Precision	pH (Hydrogen ion conc.)	0.00~14.00 [pH]	Display precision : F.S. ± 0.5%	pH (Hydrogen ion conc.)	5.00~8.00 [pH]	Display precision : F.S. ± 0.5%	DO (Dissolved oxygen)	0.00~10.00 [mg/L]		
	DO (Dissolved oxygen)	0.00~10.00 [mg/L]		DO (Dissolved oxygen)	0.00~10.00 [mg/L]		FL (O <sub>2</sub> Flow rate)	0.00~20.00 [mL/min]	FL (O <sub>2</sub> Flow rate)	0.00~20.00 [mL/min]
	FL (O <sub>2</sub> Flow rate)	0.00~20.00 [mL/min]		FL (O <sub>2</sub> Flow rate)	0.00~20.00 [mL/min]		FL (O <sub>2</sub> Flow rate)	0.00~20.00 [mL/min]	FL (O <sub>2</sub> Flow rate)	0.00~20.00 [mL/min]
Control setting range	pH (Hydrogen ion conc.)	0.00~14.00 [pH]		pH (Hydrogen ion conc.)	0.00~14.00 [pH]		DO (Dissolved oxygen)	0.00~10.00 [mg/L]		
	DO (Dissolved oxygen)	0.00~10.00 [mg/L]		DO (Dissolved oxygen)	0.00~10.00 [mg/L]		FL (O <sub>2</sub> Flow rate)	0.10~20.00 [mL/min]		
	FL (O <sub>2</sub> Flow rate)	0.10~20.00 [mL/min]		FL (O <sub>2</sub> Flow rate)	0.10~20.00 [mL/min]		FL (O <sub>2</sub> Flow rate)	0.10~20.00 [mL/min]		
Control output	pH (Hydrogen ion conc.)	ON/OFF Control		pH (Hydrogen ion conc.)	ON/OFF Control		DO (Dissolved oxygen)	Flow rate step control		
	DO (Dissolved oxygen)	Flow rate step control		DO (Dissolved oxygen)	Flow rate step control		FL (O <sub>2</sub> Flow rate)	PI control (Slope set method Time, %)		
	FL (O <sub>2</sub> Flow rate)	PI control (Slope set method Time, %)		FL (O <sub>2</sub> Flow rate)	PI control (Slope set method Time, %)		FL (O <sub>2</sub> Flow rate)	PI control (Slope set method Time, %)		
Recording output	pH (Hydrogen ion conc.)	Data logger included	Output precision : F.S. ± 0.5%	pH (Hydrogen ion conc.)	Data logger included	Output precision : F.S. ± 0.5%	DO (Dissolved oxygen)	DC 0~5 [V]		
	DO (Dissolved oxygen)	DC 0~5 [V]		DO (Dissolved oxygen)	DC 0~5 [V]		FL (O <sub>2</sub> Flow rate)	DC 0~5 [V]	FL (O <sub>2</sub> Flow rate)	DC 0~5 [V]
	FL (O <sub>2</sub> Flow rate)	DC 0~5 [V]		FL (O <sub>2</sub> Flow rate)	DC 0~5 [V]		FL (O <sub>2</sub> Flow rate)	DC 0~5 [V]	FL (O <sub>2</sub> Flow rate)	DC 0~5 [V]
Power	AC100V, 50/60Hz				AC100V, 50/60Hz					
Casing material	SUS304 (without painting), Indoor type, Non drip proof, Non explosion proof				SUS304 (without painting), Indoor type, Non drip proof, Non explosion proof					
Installation method	Desk-top indoor type				Desk-top indoor type					
Outer size	W260×H350×D300 [mm]				W260×H350×D300 [mm]					
Ambient environmental condition	Temp.	5~45 °C	RH	20~85 % (No condensation)	Temp.	5~45 °C	RH	20~85 % (No condensation)		
Utility	Power	AC100V plug × 2 ports (for controller body and recorder)						Power	AC100V plug × 2 ports (for controller body and recorder)	
	O <sub>2</sub>	Flow rate 20mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube						O <sub>2</sub>	Flow rate 20mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube	
	CO <sub>2</sub>	Flow rate 50mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube						CO <sub>2</sub>	Flow rate 50mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube	
	AIR	Flow rate 150mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube						AIR	Flow rate 150mL/min or less, Supply pressure 0.3MPa One-touch joint of connecting port φ6mm tube	
	※All gases must be dried gas excluding corrosive component, dust and oil mist including O <sub>2</sub> , CO <sub>2</sub> , AIR				※All gases must be dried gas excluding corrosive component, dust and oil mist including O <sub>2</sub> , CO <sub>2</sub> , AIR					

System development and Control for demand specification are also possible.  
Please contact our Bio project team below for more information.  
Contact number +81-48-444-7721

# Single-Use Bioreactor

## 50L/200L-SUB VMF Reactor

Exclusive type developed for required specifications, custom order-made and single-use.



JPN Pat. No.4316251  
Other patents pending or patented in japan and abroad

50L/200L-SUB VMF Reactor is a single-use bioreactors for commercial production. This reactor are line-up from 50L to 200L (maximum volume all the way until 1000L for future development). This reactor employed single-use hard bottle or bag that can be used to validate sterilization. We promise just-in-time supply regardless of small bag lot, as it is the product made in Japan.

This reactor is dedicated with a special controller of "S-BOX×200", which makes it easier to change each parameters, including the PI control.

### Single-use bag



- Consistent supply at any time, even in a small lot as it is made in Japan.
- Ready-to-use design as  $\gamma$  sterilization is performed beforehand.
- Materials adopted for the bag, impeller, shaft, tube, etc. meet the USP Class VI standard.

### 50L/200L-SUB VMF Reactor

Item	Specification	
Product name	VMF Reactor	
Model	50L-SUB *	
Temp. control method	Clamp heater method (PID Controller) with over-temperature control function	
Linear transmission method	Seal less linear shaft drive	
Ventilating method	Shirasu porous glass (SPG) membrane / Sintered metal	
Performance	Temp. range	Room temp. +5~20°C (Standard setting:37°C)
	Temp. precision	±0.3°C (37°C)
	MAX Vertical motion stroke	100mm
	MAX impeller speed	800mm/s
Function	Temp. setting	Digital
	Vertical motion setting	Touch panel input
Configuration	Band heater	1.5kW
	Motor	MAX output 800W
	Impeller	Standard VM100 + VM200
Standard	Reactor size	I.D.369×650 Height [mm]
	Reactor full volume	75L
Ambient temperature range	10~35°C	
Outer size	780W×800D×2000H [mm]	
Weight	Reactor body Approx. 135kg, Vessel unit Approx. 42kg	
Rated power	Power supply from S-BOX×200	

\* The reactor performance is the value operated at no-load operation at 20°C (room temp.) with rated power of AC100V 50Hz.

## SUB Series for scalable cell culture.

Single-use to enhance production and prevent contamination for biopharmaceuticals and regenerative medicines. Satake provides an extensive line-up of single-use products from 200mL up to 200L to deal with various cases (maximum volume all the way until 1000L for future development). We realized the scalable cell culture from laboratory scale to actual scale production.



※ 200mL single-use bottle is for the "VMF Reactor VMF-500 and HiD4×4".

※ 3L single-use bottle is for the "VMF Reactor VMF-3000" and multi-bioreactors option from 2 up to 8 bioreactors.

※ 50L single-use bottle or bag is for the "50L/ 200L-SUB VMF Reactor"

※ Please contact our Bio project team below for more information.

### Materials for Impeller, Bottle, Bag

Materials adopted for the bottle, impeller, shaft, tube, etc. meet the USP Class VI standard. Completely developed in collaboration with Japan maker. Consistent supply at any time even in a small lot as it is made in Japan.

### Standard Sterilized Bottle / Bag

Hard bottle or bag are available from 200mL up to 200L. The bottle has been EOG sterilized, The bag is already  $\gamma$  sterilized. As a result, immediate operation is possible after delivery. Certificate can be issued for each lot.

### S-BOX × 200

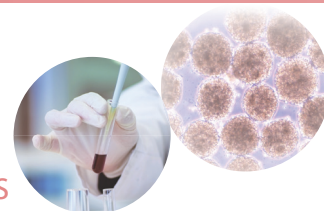
Item	Specification			
Product name	Cultivation controller			
Model	S-BOX × 200			
Display range	TH (Temp.)	0.0~150.0 [°C]	DO (Dissolved oxygen)	0.00~10.00 [mg/L]
	Linear shaft (Mixing)	Stroke 0~100 [mm] Speed setting 0~800 [mm/s]	FL (O <sub>2</sub> Flow rate)	0.0~200.0 [mL/min]
	pH (Hydrogen ion conc.)	0.00~14.00 [pH]	Electronic weight scale (For culture medium supply)	0.1 [g] ~61 [kg]
Control setting range	TH (Temp.)	0.0~60.0 [°C]	DO (Dissolved oxygen)	0.00~10.00 [mg/L]
	Linear shaft (Mixing)	Stroke 0~100 [mm] Speed setting 0~300 [mm/s]	FL (O <sub>2</sub> Flow rate)	1.0~200.0 [mL/min]
	pH (Hydrogen ion conc.)	0.00~14.00 [pH]	Electronic weight scale (For culture medium supply)	0.1 [g] ~61 [kg]
Control output	TH (Temp.)	PI control (Slope set method Time, %)		
	Linear shaft (Mixing)	Set-point control by shaft driver		
	pH (Hydrogen ion conc.)	On/OFF control by adding CO <sub>2</sub> gas and ON/OFF by alkali pump selection system		
	DO (Dissolved oxygen)	PI control (Slope set method Time, %) By mass flow controller		
	FL (O <sub>2</sub> Flow rate)	PI control (Slope set method Time, %)		
	FEED	ON/OFF addition by feed pump		
Recording output	Culture medium supply / discharge By electronic balance and pump			
Power	Data logger 10ch			
Casing material	1 $\phi$ 200V 30A 50/60Hz (2P+E, With hook type plug)			
Installation method	SSUS304 #300 buffed finish Indoor type, Non drip proof, Non explosion proof			
Outer size	Indoor self standing type			
Ambient environmental condition	W550×D550×H1000 [mm] ※Excluding protruding portion			
Utility	Temp.	Room temp.	RH	20~90 % (No condensation)
	Power	1 $\phi$ 200V 30A (2P+E, Hook type plug 30A×1 port)		
	O <sub>2</sub> · CO <sub>2</sub> · AIR	Flow rate 5L/min or less, Supply pressure 0.3MPa, One-touch joint of connecting port $\phi$ 6mm tube		
※All gases must be dried gas excluding corrosive component, dust and oil mist including O <sub>2</sub> , CO <sub>2</sub> , AIR				

System development and customization for demand specification are also possible.  
Please contact our Bio project team below for more information.

Contact number +81-48-444-7721

# HiD 4×4

Commercial use bioreactor for inducing differentiation of iPS cells



Exclusive type developed for required specifications, custom order-made and single-use.

## HiD 4×4

SATAKE VMOVE MIXER® Single-Use Bioreactor



JPN Pat. No.4316251  
Other patents pending or patented in japan and abroad



HiD4×4 is a “single-use-3D suspension-bioreactor”, the world’ s first developed device, particularly for inducing differentiation of iPS cells. In order to meet the requirement of industry and commercial production of “medicine discovery using human iPS cells” for the regenerative medicine, it is essential to develop a bioreactor that can mix the iPS cells, uniformly and homogeneously, in a large-scale production. Therefore, we at Satake took this as a challenge by carried-out extensive research in this field, in collaboration with leading research organization and companies in Japan. This has successfully led us in developed a world’ s leading commercial use bioreactor for inducing differentiation of iPS cells. This device can be connected and controlled by multi-bioreactors of 4, 8, 12, 16 (and more), and applicable for screening also. Further, we are motivated to utilize this device for the ES cells as well.

This reactor is dedicated with a special controller of “S-BOX×02”, which makes it easier to change each parameters and/or to meet demand depending on production control, including the PID control.

### ■ HiD4×4

Item		Specification
Product name		HiD 4×4
Model		HiD 4-4
Temp. control method		Hot plate + Cooling chiller heating / cooling system (PID Controller) with over-temperature control function
Linear transmission method		Seal less linear shaft drive
Performance	Temp. range	Room temp. +5~20°C (Standard setting:37°C)
	Temp. precision	±0.3°C (37°C)
	MAX Vertical motion stroke	40mm
	MAX impeller speed	500mm/s
Function	Temp. setting	Digital
	Vertical motion setting	Touch panel input
Configuration	Hot plate	235W×4
	Cooling chiller	Air-cooled type, 450W, HFC, R-404A
	Motor	MAX output 800W
Standard	Impeller	Standard VM200
	Reactor size	I.D.86(94)×107 Height [mm]
Reactor full volume		0.7L
Ambient temperature range		10~35°C
Outer size	Reactor body (HiD4×4)	680W×480D×914H [mm]
	Cooling chiller (SCA-32)	205W×405D×545H [mm]
Weight	Reactor body (HiD4×4)	Approx. 70kg
	Cooling chiller (SCA-32)	Approx. 28kg
Rated power		AC 100V、50/60Hz

\*The reactor performance is the value operated at no-load operation at 20°C (room temp.) with rated power of AC100V 50Hz.

## 200mL Single-use Bottle

Satake bioreactor are equipped with a 200mL single-use bottle as a standard accessory, which is customized for variable use, such as scale-up, commercial production, and industrial use. This bottle is designed by giving careful consideration not only on safety, but also easy-to-use as well, so that cell culture can be conducted sufficiently.



### Materials for Impeller, Bottle

Materials adopted for the bottle, impeller, shaft, tube, etc. meet the USP Class VI standard. Completely developed in collaboration with Japan maker. Consistent supply at any time, even in a small lot as it is made in Japan.

Mitigate risks associated with foreign supplier, thereby avoiding excessive stocks holding.

### Standard Sterilized Bottle

Ready-to-use design as EOG sterilization is performed beforehand. Certificate can be issued for each lot.

## Option

Satake single-use bottle is generally equipped with tubes only. pH sensor and DO sensor shall be stored in a clean bench. Please contact us, if contactless sensor is required. Various options are also available, such as continuous-cell culture medium-supply system, cell culture medium-temperature control (37°C) system, accessories glass vessel, gas humidity control system for cell culture in a stirred tank, etc. Please contact us, as we also comply with particular specifications as well.

### ■ S-BOX × 02

Item	Specification		
Product name	Quadruplex 200mL cultivation controller		
Model	S-BOX × 02		
Display range	pH (Hydrogen ion conc.)	0.00~14.00 [pH]	
	DO (Dissolved oxygen)	0.0~130.0 [%]	
Control setting range	pH (Hydrogen ion conc.)	0.00~14.00 [pH]	
	DO (Dissolved oxygen)	0.0~130.0 [%]	
Control output	pH (Hydrogen ion conc.)	ON/OFF control by adding CO <sub>2</sub> gas	
	DO (Dissolved oxygen)	ON/OFF control by adding O <sub>2</sub> gas	
Recording output	Data logger 20ch		
Power	AC100~230V、50/60Hz		
Casing material	SSUS304 #300 buffed finish Indoor type, Non drip proof, Non explosion proof		
Installation method	Indoor self standing type		
Outer size	W600×D500×H914 [mm] ※Excluding protruding portion		
Ambient environmental condition	Temp.	Room temp.	RH 20~90 % (No condensation)
	Power	AC100V plug × 2 (for controller body and recorder)	
Utility	O <sub>2</sub> · CO <sub>2</sub> · AIR	Flow rate 1L/min or less, Supply pressure 0.2MPa, One-touch joint of connecting port φ6mm tube	
	※All gases must be dried gas excluding corrosive component, dust and oil mist including O <sub>2</sub> , CO <sub>2</sub> , AIR		

System development and customization for demand specification are also possible.  
Please contact our Bio project team below for more information.  
Contact number +81-48-444-7721

# High Efficient Turbine / Aeration Mixing System

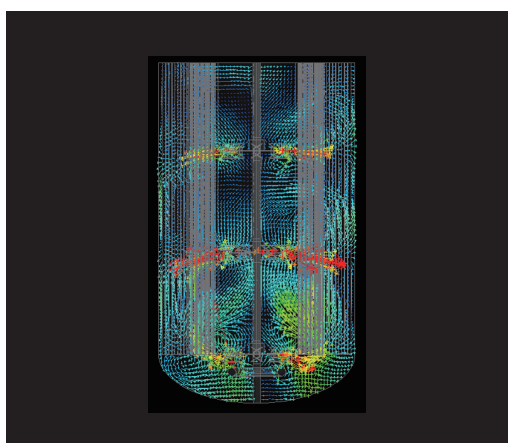
## SuperMix HS100 Turbine

Practicable to supply efficient oxygen for mass-cell culture of plant cell and microbial.



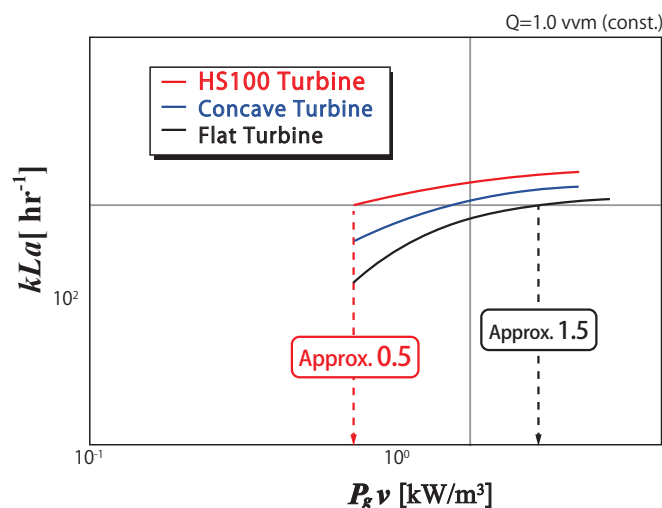
SuperMix HS100 Turbine is a special impeller, particularly employ for gas-liquid mixing. We investigated the best way to obtain good flow condition by applying these two effects, efficiently; the impeller's flow effect and, shear and break effects correspond to high discharge flow effect, which were evaluated separately. As an outcome, this impeller can generate high shear and break effect by using the pressure difference and fluctuations at the discharge field, and flow is concentrated by the lift force of the impeller as well, at low power consumption. By these effects, high performance of gas absorption and OTR requirement are obtained. The maximum volume we've worked for this impeller is 300kL.

### Fluid flow in a stirred tank



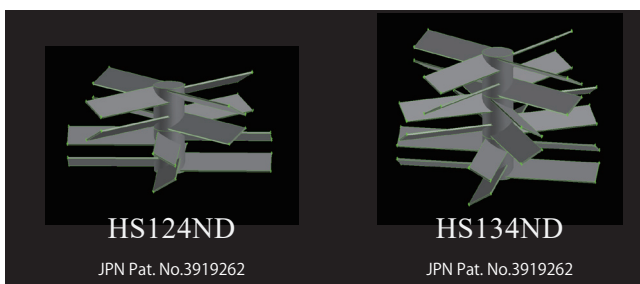
Simulation results of 200kL-F bioreactor  
Two-phase (gas-liquid) fluid flow analysis

### Comparison of Gas Absorption Performance (KLa)



## SuperMix HS124ND, 134ND Turbine

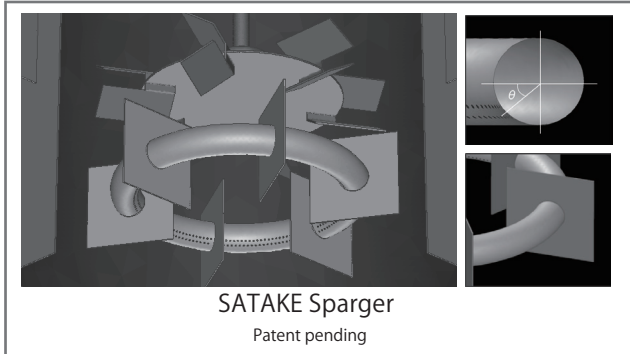
Impellers to enhance the performance of gas



The high performance-gas absorption-turbine impellers of SuperMix HS124ND and 134ND Turbine were developed, particularly to enhance the performance of gas absorption. Each of these impellers with its upper and lower part has sufficient flow discharge effect, thereby resulting in high performance of gas absorption and required OTR. The maximum volume we've worked for these impellers are 200kL.

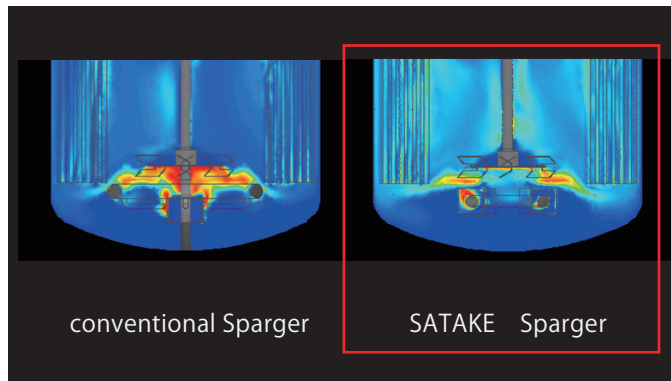
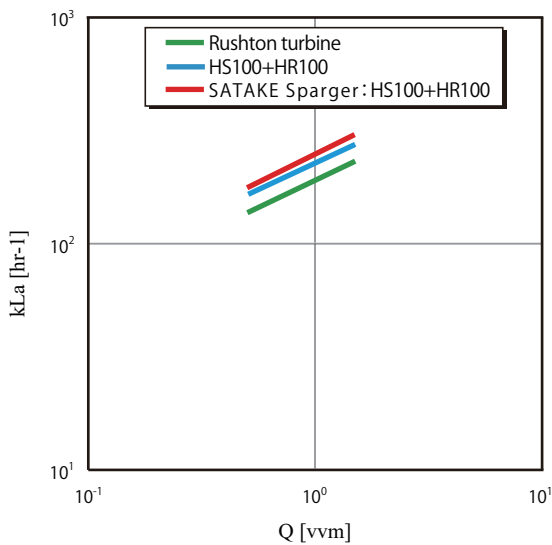
# SATAKE Sparger

Further achievement on high mixing efficiency by considering various aspects of a mixer



SATAKE Sparger is designed by giving focus on gas discharge direction, so that gas flow can pass the vicinity of impeller blade, of which shear region exists. Additionally, shear and break effects are enhanced by increasing the gradient of fluid flow. This is made possible by locating the stationary impeller blade to the ring. Furthermore, discharge fluid flow effect is also enhanced by the stationary impeller blade as well. Subsequently, gas can be effectively dispersed in a stirred tank by these effects.

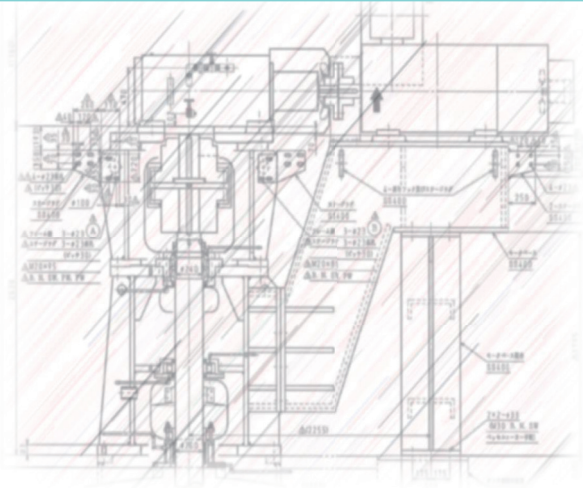
SATAKE Sparger delivers superior performance by the combination of SuperMix HS100 Turbine impeller. The gas dispersion effect is enhanced by the multiple affects associated with the optimized impeller, thereby increased the performance of gas absorption.



Simulation results of 200kL-F bioreactor  
Two-phase (gas-liquid) fluid flow analysis

## Achievement on large scale bioreactor

In Satake, we have experienced a great deal of supplying bioreactors from small scale, up to a large scale. The figure on the right indicates our recent achievement of supplied large scale bioreactor, with the liquid volume of 100kL ~ 300kL. By collaboration with our partner, we are also able to provide tank as well, if there is bioreactor tank on demand, concurrently.



**【Motor power】**

- 600kW     • 480kW     • 130kW
- 490kW     • 470kW     • 110kW
- 485kW     • 430kW     • 90 kW

etc.

Making every effort to develop and manufacture products that satisfy customer needs and the demand for safety.



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