Forward-looking technology and challenge to the world

OPERON
∞ INFINITE POTENTIAL

Operon Co., Ltd. / Operon Cryogenic Research Institute

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Ultralow temperature and cryogenic freezer, freeze dryer, centrifugal speed vacuum concentrator, chiller, cold trap & test chamber, etc

www.operon.co.kr

OPERON
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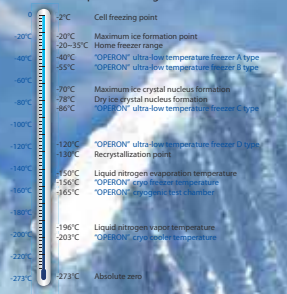
Only Operon!

Original Technology of cryogenic cooling system and ultra-high vacuum registered as the international patent (U.S.A, Germany, China & Korea)

Cryogenic technology only by OPERON!

- -203°C Water vapor cryo pump / Cryo cooler
- -165°C Cryogenic Test chamber
- Cryogenic freezer below -156°C
- -137°C freeze dryer for organic solvent
- -120°C Cold trap, Vapor trap, Centrifugal speed vacuum concentrator, Ultralow temperature chiller, Immersion cooler
- -90°C Ultra safe(Twin heart) freezer
- -86°C ~ -40°C Shelf cooling type freezer, independent control type double door freezer, power plus freezer

Ultra-Low Temperature Range



USA patent | Germany patent | China patent | Korea patent | ISO 9001 / ISO 14001 | CE certification

OPERON

OPERON Co., Ltd. is a research and development company which has focused on cryogenic & ultralow temperature and ultra-high vacuum field since 1991.

OPERON registered international patents of the unique cryogenic cooling system, -156°C in U.S.A, Germany and China, etc, and it has exported directly to around 30 countries. About 3000 local and overseas companies, research centers, universities and hospitals have used OPERON's products. Based on the original cooling technology, the cooling technology has been applied to all industries such as macromolecule, semiconductor, petro-chemistry and vacuum evaporation coating as well as biotechnology, microorganism, pharmaceutics and pharmacy. Especially, "Cryogenic Research Institute", an affiliated with a research center of OPERON Co., Ltd., was established in 2011 to study only cryogenic and ultra-high vacuum, which is the first time among domestic companies.

History

1991~1999

1991. 08 Established OPERON engineering
1991. 09 Developed -40°C and -86°C ultralow freezers
1991. 10 Developed -120°C ultralow freezer
1991. 10 Developed 30,000 RPM centrifuge
1991. 11 Developed -70°C and -86°C freeze dryers
1991. 12 Developed -120°C freeze dryer
1998. 06 Developed PCR Thermal Cycler
1998. 12 Developed CFC-free refrigerant cooling system
1999. 11 Registered own Brand OPERON no. 0459435 [the Korean Intellectual Property Office]

2000~2005

2000. 03 Conversed OPERON to a corporation
2000. 06 Developed -156°C cryogenic cooling system and -165°C Cryo cooler system
2000. 12 Utility model registration of the freezer with double freezer compartments no. 0214717 [the Korean Intellectual Property Office]
2001. 03 The test report on -156°C cryogenic freezer, test no. 2001056210 [Korea Institute of Machinery & Materials]
2001. 08 Technology assessment venture business confirmation no. 2001162471-3510 [Small and Medium Business Association]
Assessment organization Small & Medium Business Corporation
2001. 10 Applied the patent on cryogenic cooling system (U.S.A, Japan, China & Germany) [the Korean Intellectual Property Office]
PCT/KR01/01667 10/05/2001
2002. 03 Registered the patent on rotary centrifugal vacuum concentrator no. 0330734 the Korean Intellectual Property Office]
2002. 03 Utility model registration of the vacuum oven [the Korean Intellectual Property Office]
2002. 05 Registered the patent on -156°C Cryogenic cooling system no. 0337791 [the Korean Intellectual Property Office]
2002. 09 Brand registration of CONQUEROR no. 0529948 [the Korean Intellectual Property Office]
2002. 07 European Community quality certification of -86°C & -156°C CE plasma freezer [DNV]
2003. 04 Chosen as A Man of Merit for Science Advancement on 36th Day of Science and won the prize of Prime Minister [Ministry of Government Administration and Home Affairs]
2003. 09 Won the prize of technology innovation [Small & Medium Business Corporation]
2003. 11 Won the second prize of Ministry of Commerce, Industry and Energy in 11th Korean Technology Fair [Ministry of Commerce, Industry and Energy]
2003. 11 Registered the Chinese patent on -156°C cryogenic cooling system no. 4263462 [the Chinese Intellectual Property Office]
2003. 11 Registered the United States patent on -156°C cryogenic cooling system no. US 6,622,518 B2 [the United States Intellectual Property Office]
2003. 11 KFDA certification of Ministry of Food and Drug Safety's medical equipment permission (Plasma freezer) [Ministry of Food and Drug Safety]
2005. 01 Registered the patent on 70K(Kelvin)-203°C cryogenic multi refrigerated system using compression cycle no. 0469537 [the Korean Intellectual Property Office]

2007~2008

2007. 08 New technology venture business confirmation [Gyeonggi-do]
2007. 08 INNOBIZ business certification [Gyeonggi Credit Guarantee Foundation]
2007. 11 Development of plate freezer and quality certification CE certificate [TUV]
2007. 11 Registered the international patent on -156°C cryogenic cooling system no. 101 94 530 [the German Intellectual Property Office]
2008. 11 Chosen as new growth power industry by advanced convergence industry [New Growth Power Association]

2010~2015

2010. 10 The groundbreaking ceremony for headquarters and cryogenic technology research center of OPERON [Gimpo gold valley]
2010. 10 Won the Minister prize of Ministry of Knowledge Economy of 2010 A Man of Merit for Excellent Capital Goods Development [Ministry of Knowledge Economy]
2010. 10 Developed -165°C cryogenic test chamber
2011. 03 Contracted on international joint research for energy technology development business (Korean Institute of Machinery & Materials) [Korea Institute of Energy Technology Evaluation and Planning]
2011. 07 Chosen for Small and Medium Business Association business support for Biznavi technology development – Development completed [Small and Medium Business Support Center]
Chosen for Small and Medium Business Association business support for metallic mold technology development – development completed
2011. 07 Building and relocating headquarters of OPERON and establishment of cryogenic technology research center
2011. 07 Chosen as strategic industry nurturing business [Gimpo-si]
2011. 10 Contracted on cooperation for cryogenic test chamber of Posco technology research center [Posco]
2011. 11 Developed 350 liters Aircraft fuel chiller
2012. 06 Design development support business (Development of freeze dryer design for fine pharmaceutics) [Small and Medium Business Association]
2012. 08 Chosen for 2012 Regional Specialized Business (Development of stoppering freeze dryer) [Small and Medium Business Corporation]
2013. 03 Developed -90°C Ultra Safe (Twin Heart) freezer system
Patent number: 10-2013-0027941 [the Korean Intellectual Property Office]
2013. 04 The patent on developing -120°C freeze dryer for manufacturing organic solvent no. 10-1303656 (cooling system) [the Korean Intellectual Property Office]
2014. 04 KIMM family company listed [KIMM-Korea Institute of Machinary & Materials]
2014. 10 Certificate of Patent registration for Pre-freezing and Drying system : Patent no. : 20-0474748 [KIPO]
2014. 10 Certificate of Patent registration for Mini tray Design Patent no. 30-0767789[KIPO]
2014. 10 Certificate of Patent registration for Mini tray loading system Patent no. : 30-0767787[KIPO]
2014. 11 Certificate of Patent registration for the Cooled & Heated plate applied the Heat-pipe principle Patent no. :10-1463853 [KIPO]
2014. 11 Good Design Certification for the production scale of Freeze dryer [KIDP]
2015. 04 Certificate of Patent Chemical-free registration no. : 10-1514319 [KIPO]

Contents

Ultralow temperature and Cryogenic freezer

The representative product of OPERON Co., Ltd., -156°C cryogenic freezer for preserving stem cell is the compression freezer which is used to preserve samples for a long time without deterioration and does never use liquid nitrogen. OPERON cryogenic freezer which overcame high cost, high risk, inconvenience and sample contamination occurring when using liquid nitrogen is registered to the international patent (the United States, Germany, China and Korea).

OPERON cryogenic freezer is applied with cryogenic cooling system, and it is an innovative cryogenic product with electric method replacing liquid nitrogen tank. The temperature range in which ice is not formed is called "AMORPHOUS", and the approximate range is -135°C~ -150°C. If the samples go through this temperature range rapidly, it is able to preserve the samples without deterioration from several years to maximum several decades because ice crystals are not formed. Other than this, we have various products like independent control type freezer with separate chambers, shelf-cooling type freezer which has powerful freezing and temperature uniformity, power plus freezer which is appropriate for surrounding temperature +40°C and ultra safe (Twin Heart) freezer which has 2 compressors which maintain -90°C during the operation, and when one compressor is broken down, another compressor maintains -80°C.

■ Cryogenic freezer (CFQ) ■ Ultralow-upright (DFU) ■ Chest (DFC) ■ Double door (DFUD)
■ Shelf-cooling type (DFU-V/DFUD-V) ■ Power plus (DFU-P/DFUD-P) ■ Ultra safe-Twin Heart(DFU-CUS/DFC-CUS)

Cryogenic Freezer-CFQ

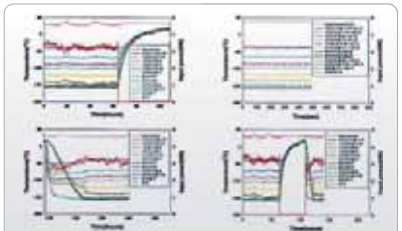
Cryo Freezer conqueror -156℃

Product features and specifications

- The world first freezer which makes maximum cryogenic -156°C without liquid nitrogen
- Application of cryogenic cooling system (Auto cascade system) registered to the international patent
- Use of CFC-free special mixed refrigerants which OPERON Co., Ltd developed
- Application of aerodynamically designed pan wings equipped with huge capacity and high performance
- Hermetic compressor for LBP with excellent performance
- CE certification product for preserving cell
- Non scaling stainless chamber and round corner design for easy cleaning
- Use of 200mm high density urethane insulating materials to minimize cold air loss
- Chamber mold and double door with elegant design
- Strong structure frame and impact resistant powder coating finishing
- Filter cover for easy cleaning
- Chest type cabinet structure
- Temperature for hard condition resistant test +32°C
- Temperature measuring sensor: platinum PT-100Ω(Class A 0.15 grade)
- Prevention of frost with Rim Heating system
- RS-232 Data port and Interface which is available for store, control and monitor temperature data via user's PC

Comparison

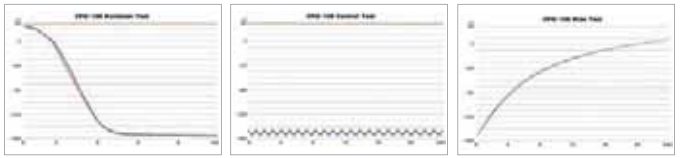
Items	OPERON ELECTRIC FREEZER	LIQUID NITROGEN FREEZER
Economic efficiency	It is available only with the lower cost electronic connection.	Expensive liquid nitrogen tank and the liquid nitrogen should be supplemented consistently.
Safety	It is safer from pollutants. When blackout, it secures safety with BACK UP SYSTEM if the temperature goes up.	It has a risk to be contaminated by bacteria or fungi inside the tank
Accuracy	Temperature difference between the upper part and the lower part inside is ±3°C, so the temperature is more even.	The temperature of the lower part inside the tank is -196°C, and the upper part is -70°C. The temperature difference is huge. This has a significant impact on viability of stem cell.
Convenience	Internal space can be used efficiently for keeping samples, and it is simple to perform work.	Rack for keeping samples is very inconvenient for sample work because of the liquid nitrogen tank's structure, and it is difficult to use the space inside the tank efficiently.



[References for reliability evaluation of Korean Institute of Machinery & Materials]

Stem cell needs long-term preservation for 10~20 years.

It's been stated on various papers that cell preservation using liquid nitrogen has lots of problems. OPERON products resolved the above problems perfectly.



[References for reliability evaluation of cryogenic technology research center affiliated to OPERON]

Control system

- Micro processer control system /Digital temperature indicator which adjust the temperature by 0.1°C
- Functions for setting double passwords to prevent access or control except administrators
- Data locking function

Alarm system and safety devices

- Alarm for filter cleaning period (Warm Condenser alarm)
- Alarm for high/low temperature of sight and auditory
- Equipped with pressure switch
- Equipped with overheating prevention switch
- Auto return system after blackout

Cryogenic Freezer (Mechanical Cryo)

Model	CFQ-150	CFQ-152	CFQ-156	CFQ-232	CFQ-300
External size(mm)	W1614 x D890 x H1105	W1614 x D890 x H1105	W1614 x D890 x H1105	W1676 x D890 x H1105	W2170 x D900 x H1065
Internal size(mm)	W600 x D400 x H600	W600 x D400 x H600	W600 x D400 x H600	W770 x D460 x H665	W1050 x D470 x H610
Range for usage	-90°C ~ -150°C	-95°C ~ -152°C	-100°C ~ -156°C	-90°C ~ -156°C	-80°C ~ -140°C
Inside measurement	144L			235L	300L
Electric capacity	Capacity necessary for installment AC220V 380V 3ph (50/60Hz)				
Weight	380Kg				450Kg

Options Rack / Box / LN2 Backup system / LCD touch screen with SD card(or USB) - Basic -1channel (sensor 3channel, 6channel options) / U-system (remote alarm system and wireless control system – telecommunication subscription needed / Automatic voltage regulator / Cryogenic gloves / Battery backup (Control panel and alarm) / Recorder / VIP

Ultralow temperature freezer-DFC/DFC-P

Chest Type

Product features and specifications

- Realization of powerful and stable -86°C freezing performance with application of Two stage Auto cascade system
- Use of CFC-free special mixed refrigerants
- Application of aerodynamically designed pan wings equipped with huge capacity and high performance
- Hermetic compressor for LBP with excellent performance
- Use of 130mm high density urethane insulating materials to minimize cold air loss
- Non scaling stainless chamber
- Strong structure frame and impact resistant powder coating finishing
- Round corner design for easy cleaning
- Prevention of condensation and the chill loss with two-layered packing
- Filter cover for easy cleaning and washable filter
- Chest type cabinet structure
- Temperature for hard condition resistant test +32°C
- Temperature measuring sensor: platinum PT-100Ω(Class A 0.15 grade)
- Prevention of frost with Rim Heating system
- RS-232 Data port and Interface which is available for store, control and monitor temperature data via user's PC

Control system

- Micro processer control system /Digital temperature indicator which adjust the temperature by 0.1°C
- Functions for setting double passwords to prevent access or control except administrators
- Data locking function

Alarm system and safety devices

- Alarm for filter cleaning period (Warm Condenser alarm)
- Alarm for high/low temperature of sight and auditory
- Equipped with pressure switch
- Equipped with overheating prevention switch
- Auto return system after blackout

Ultralow temperature freezer (Chest freezer)

Model	DFC-37			DFC-84			DFC-200			DFC-300			DFC-400			DFC-500			DFC-600		
Temperature range	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE
	-40°C	-55°C	-75°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C
External size	W430 x D560 x H920			W700 x D653 x H1125			W1365 x D720 x H1101			W1665 x D720 x H1101			W1965 x D720 x H1101			W2265 x D720 x H1101			W2565 x D720 x H1101		
Internal size	W235 x D365 x H425			W437 x D387 x H500			W600 x D470 x H710			W900 x D470 x H710			W1200 x D470 x H710			W1500 x D470 x H710			W1800 x D470 x H710		
Inside measurement	37L			84L			200L			300L			400L			500L			600L		
Electric capacity	Capacity necessary for installment AC220V 1ph (50/60Hz)																				
Weight	40kg			150Kg			255Kg			290Kg			315Kg			340Kg			365Kg		

Ultralow temperature freezer (Power Plus model-Chest type) for Tropical climate

- Chest type Power Plus model- the freezer appropriate for the surrounding temperature +40°C and over

Model	DFC-200P			DFC-300P			DFC-400P			DFC-500P			DFC-600P		
Temperature range	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE
	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C
External size	W1365 x D720 x H1101			W1665 x D720 x H1101			W1965 x D720 x H1101			W2265 x D720 x H1101			W2565 x D720 x H1101		
Internal size	W600 x D470 x H710			W900 x D470 x H710			W1200 x D470 x H710			W1500 x D470 x H710			W1800 x D470 x H710		
Inside measurement	200L			300L			400L			500L			600L		
Electric capacity	Capacity necessary for installment AC220V 1ph (50/60Hz)														
Weight	255Kg			290Kg			315Kg			340Kg			365Kg		

Options Rack / Box / CO2 Backup system / LCD touch screen with SD card(or USB) - Basic -1channel (sensor 3channel, 6channel options) / U-system (remote alarm system and wireless control system – telecommunication subscription needed / Automatic voltage regulator / Cryogenic gloves / Battery backup (Control panel and alarm) / Recorder / VIP / ※**The minimum temperature of ultralow temperature freezer(C-type) is supplied with -91°C performance if the customer requests.**

Ultralow temperature freezer-DFU/DFU-P

Upright type Single door

Product features and specifications

- Realization of powerful and stable -86°C freezing performance with application of Two stage Auto cascade system
- The controller attached at the user's eye level
- Use of CFC-free special mixed refrigerants
- Application of aerodynamically designed pan wings equipped with huge capacity and high performance
- Hermetic compressor for LBP with excellent performance
- Use of 130mm high density urethane insulating materials to minimize cold air loss
- Non scaling stainless chamber and 1 or 2 stainless doors inside
- Strong structure frame and impact resistant powder coating finishing
- Round corner design for easy cleaning
- Prevention of condensation and the chill loss with three-layered wrinkle packing
- Filter cover for easy cleaning and washable filter
- Chest type cabinet structure
- Temperature for hard condition resistant test +32°C
- Temperature measuring sensor: platinum PT-100Ω(Class A 0.15 grade)
- Prevention of frost with Rim Heating system
- RS-232 Data port and Interface which is available for store, control and monitor temperature data via user's PC
- Equipped with the port for auto vacuum release

Control system

- Micro processer control system /Digital temperature indicator which adjust the temperature by 0.1°C
- Functions for setting double passwords to prevent access or control except administrators
- Data locking function

Alarm system and safety devices

- Alarm for filter cleaning period (Warm Condenser alarm)
- Alarm for high/low temperature of sight and auditory
- Equipped with pressure switch
- Equipped with overheating prevention switch
- Auto return system after blackout

Ultralow temperature freezer (Upright freezer)

Model	DFU-128			DFU-256			DFU-374			DFU-446			DFU-558			DFU-657			DFU-740			DFU-800			DFU-868		
Temperature range	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE
	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C
External size	W710 x D750 x H1390			W710 x D750 x H1990			W860 x D800 x H1951			W860 x D900 x H1951			W1010 x D900 x H1901			W1010 x D990 x H1901			W1010 x D1010 x H2001			W1010 x D1080 x H2001			W1010 x D1151 x H2001		
Internal size	W450 x D475 x H600			W450 x D475 x H1200			W600 x D520 x H1200			W600 x D620 x H1200			W750 x D620 x H1200			W750 x D730 x H1200			W750 x D750 x H1300			W750 x D820 x H1300			W750 x D891 x H1300		
Inside measurement	128L			256L			374L			446L			558L			657L			731L			800L			868L		
Electric capacity	Capacity necessary for installment AC220V 1ph (50/60Hz)																										
Weight	210kg			300kg			370kg			380kg			400kg			420kg			450kg			470kg			500kg		

Ultralow temperature freezer (Power Plus model-Upright type) for Tropical climate

- Upright type Power Plus model- the freezer appropriate for the surrounding temperature +40°C and over

Model	DFU-128P			DFU-256P			DFU-374P			DFU-446P			DFU-558P			DFU-657P			DFU-740P			DFU-800P			DFU-868P		
Temperature range	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE
	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C	-40°C	-55°C	-86°C
External size	W710 x D750 x H1390			W710 x D750 x H1990			W860 x D800 x H1951			W860 x D900 x H1951			W1010 x D900 x H1901			W1010 x D990 x H1901			W1010 x D1010 x H2001			W1010 x D1080 x H2001			W1010 x D1151 x H2001		
Internal size	W450 x D475 x H600			W450 x D475 x H1200			W600 x D520 x H1200			W600 x D620 x H1200			W750 x D620 x H1200			W750 x D730 x H1200			W750 x D750 x H1300			W750 x D820 x H1300			W750 x D891 x H1300		
Inside measurement	128L			256L			347L			446L			558L			657L			731L			800L			868L		
Electric capacity	Capacity necessary for installment AC220V 1ph (50/60Hz)																										
Weight	220kg			310kg			380kg			390kg			410kg			430kg			460kg			470kg			510kg		

Options Rack / Box / CO2 Backup system / LCD touch screen with SD card(or USB) - Basic -1channel (sensor 3channel, 6channel options) / U-system (remote alarm system and wireless control system – telecommunication subscription needed / Automatic voltage regulator / Cryogenic gloves / Battery backup (Control panel and alarm) / Recorder / VIP / ※**The minimum temperature of ultralow temperature freezer(C-type) is supplied with -91°C performance if the customer requests.**

Product features and specifications

- Realization of -90℃ freezing performance with application of patented Single Stage Auto Cascade Two compressor systems
- When one compressor is broken down, another compressor maintains -80℃ (with amb. +25℃ / +32℃)
- When exchanging or repairing the compressor, it does not need to cut off the power, and the samples do not have to be moved to another freezer, Also, welding is not necessary, so welding equipment is not needed. Vacuuming is not necessary, and the user can exchange the compressor within 30 minutes without trained engineers or special tools, so it can reduce the repair cost by 30~70% comparing to the previous product.
- The controller attached at the user's eye level
- Use of CFC-free special mixed refrigerants
- Application of aerodynamically designed pan wings equipped with huge capacity and high performance
- Hermetic compressor for LBP with excellent performance
- Use of 130mm high density urethane insulating materials to minimize cold air loss
- Non scaling stainless chamber and 2 stainless doors inside
- Strong structure frame and impact resistant powder coating finishing
- Round corner design for easy cleaning
- Prevention of condensation and the chill loss with three-layered wrinkle packing
- Filter cover for easy cleaning and washable filter
- Upright type canbinet structure
- Temperature for hard condition resistant test +32℃
- Temperature measuring sensor: platinum PT-100Ω(Class A 0.15 grade)
- Prevention of frost with Rim Heating system
- RS-232 Data port and Interface which is available for store, control and monitor temperature data via user's PC
- Equipped with the port for auto vacuum release

Control system

- Micro processer control system /Digital temperature indicator which adjust the temperature by 0.1℃
- Functions for setting double passwords to prevent access or control except administrators
- Data locking function

Alarm system and safety devices

- Alarm for filter cleaning period (Warm Condenser alarm)
- Alarm for high/low temperature of sight and auditory
- Equipped with pressure switch
- Equipped with overheating prevention switch
- Auto return system after blackout

ULT freezer - CUS(Ultra Safe(Twin Heart)® freezer - (Standard model))

Model	DFU-446CUS(S)	DFU-558CUS(S)	DFU-657CUS(S)	DFU-740CUS(S)	DFU-800CUS(S)	DFU-868CUS(S)
Temperature	2 compressor : -90℃					
	1 compressor Run when event : -80℃~ -65℃		1 compressor Run when event : -80℃~ -65℃		1 compressor Run when event : -80℃~ -65℃	
Outer dimension (mm)	W860 x D900 x H1951	W1010 x D900 x H1901	W1010 x D990 x H1951	W1010 x D990 x H2001	W1010 x D1080 x H2001	W1010 x D1151 x H2001
Inner dimension (mm)	W600 x D620 x H1200	W750 x D620 x H1200	W750 x D730 x H1200	W750 x D750 x H1300	W750 x D820 x H1300	W750 x D891 x H1300
Volume	446L	558L	657L	740L	800L	868L
Electrical power	AC220V 1ph (50/60Hz)					
Weight	380Kg	400kg	420kg	450kg	470Kg	500kg

Model	DFC-200CUS(S)	DFC-300CUS(S)	DFC-400CUS(S)	DFC-500CUS(S)	DFC-600CUS(S)
Temperature	2 compressor : -90℃				
	1 compressor Run when event : -80℃~ -65℃				
Outer dimension (mm)	W1365 x D720 x H1101	W1665x D720 x H1101	W1965 x D720 x H1101	W2265 x D720 x H1101	W2565 x D720 x H1101
Inner dimension (mm)	W600 x D470 x H710	W900 x D470 x H710	W1200 x D470 x H710	W1500 x D470 x H710	W1800 x D470 x H710
Volume	200L	300L	400L	500L	600L
Electrical power	AC220V 1ph (50/60Hz)				
Weight	255kg	290kg	315Kg	340kg	365Kg

Model	DFUD-446CUS(S)	DFUD-558CUS(S)	DFUD-657CUS(S)	DFUD-740CUS(S)	DFUD-800CUS(S)	DFUD-868CUS(S)
Temperature	2 compressor : -90℃					
	1 compressor Run when event : -80℃~ -65℃		1 compressor Run when event : -80℃~ -65℃		1 compressor Run when event : -80℃~ -65℃	
Outer dimension (mm)	W860 x D900 x H1951	W1010 x D900 x H1901	W1010 x D990 x H1951	W1010 x D990 x H2001	W1010 x D1080 x H2001	W1010 x D1151 x H2001
Inner dimension (mm)	W600 x D620 x H1	W750 x D620 x H1200	W750 x D730 x H1200	W750 x D750 x H1300	W750 x D820 x H1300	W750 x D891 x H1300
Volume	446L	558L	657L	740L	800L	868L
Electrical power	AC220V 1ph (50/60Hz)					
Weight	380Kg	400kg	420kg	450kg	470Kg	500kg

ULT freezer - CUS(Ultra Safe(Twin Heart)® freezer - (Premium model))

Model		DFUD-446CUS(P)	DFUD-558CUS(P)	DFUD-657CUS(P)	DFUD-740CUS(P)	DFUD-800CUS(P)	DFUD-868CUS(P)
Major specification	Temperature	2 compressor Run when event : -90℃					
		1 compressor Run when event : -80℃~ -65℃					
	Outer dimension (mm)	W860 x D900 x H1951	W1010 x D900 x H1901	W1010 x D990 x H1951	W1010 x D990 x H2001	W1010 x D1151 x H2001	W1010 x D1151 x H2001
	Inner dimension (mm)	W600 x D620 x H1200	W750 x D620 x H1200	W750 x D730 x H1200	W750 x D750 x H1300	W750 x D891 x H1300	W750 x D891 x H1300
	Volume	446L	558L	657L	740L	800L	868L
	Electrical power	AC220V 1Ph (50Hz/60Hz)					
	Weight	380kg	400kg	420kg	450kg	470kg	500kg
Feathers	When compressor replacement (Maker's standard parts)	Equipped 2 x Valve and 4 x Union					
		2 x Compressor, 1 x Heat Exchanger, 1 x Copper tube (1 x Evaporation coil)					
		Oil separator is not required					
		No switch-off is required					
		No move the samples are required					
		No gas discharge is required					
		This does not require welding work					
		No pressure test is required					
		No Gas re-charging is required					
		No special tool is required					
		No Specially trained engineer is required					
		No freezer stop is required and User can be replace the compressor by theselves within 30-40min					
		Shorten the Service lead time					
		Cost saveing more than 30% ~ 70% of compressor replacement					
	Energy saving	Eco mode operation can make 30% of Energy saving					

Model		DFU-446CUS(P)	DFU-558CUS(P)	DFU-657CUS(P)	DFU-740CUS(P)	DFU-800CUS(P)	DFU-868CUS(P)	DFU-800CUS(P)	DFU-868CUS(P)	DFC-200CUS(P)	DFC-300CUS(P)	DFC-400CUS(P)	DFC-500CUS(P)	DFC-600CUS(P)
Major specification	Temperature	2 compressor Run when event : -90℃												
		1 compressor Run when event : -80℃~ -65℃												
	Outer dimension (mm)	W860 x D900 x H1951	W1010 x D900 x H1901	W1010 x D990 x H1951	W1010 x D990 x H2001	W1010 x D1151 x H2001	W1010 x D1151 x H2001	W1010 x D1151 x H2001	W1010 x D1151 x H2001	W1365 x D720 x H1101	W1665 x D720 x H1101	W1965 x D720 x H1101	W2265 x D720 x H1101	W2565 x D720 x H1101
	Inner dimension (mm)	W600 x D620 x H1200	W750 x D620 x H1200	W750 x D730 x H1200	W750 x D750 x H1300	W750 x D891 x H1300	W750 x D891 x H1300	W750 x D891 x H1300	W750 x D891 x H1300	W600 x D470 x H710	W900 x D470 x H710	W1200 x D470 x H710	W1500 x D470 x H710	W1800 x D470 x H710
	Volume	446L	558L	657L	740L	800L	868L	800L	868L	200L	300L	400L	500L	600L
	Electrical power	AC220V 1ph (50/60Hz)												
	Weight	380kg	400kg	420kg	450kg	470kg	500kg	470kg	500kg	255kg	290Kg	315kg	340kg	365Kg
Feathers	When compressor replacement (Maker's standard parts)	Equipped 2 x Valve and 4 x Union												
		2 x Compressor, 1 x Heat Exchanger, 1 x Copper tube (1 x Evaporation coil)												
		Oil separator is not required												
		No switch-off is required												
		No move the samples are required												
		No gas discharge is required												
		This does not require welding work												
		No pressure test is required												
		No Gas re-charging is required												
		No special tool is required												
		No Specially trained engineer is required												
		No freezer stop is required and User can be replace the compressor by theselves within 30-40min												
		Shorten the Service lead time												
		Cost saveing more than 30% ~ 70% of compressor replacement												
	Energy saving	Eco mode operation can make 30% of Energy saving												

Options Rack / Box / CO2 Backup system / LCD touch screen with SD card(or USB) - Basic -1channel (sensor 3channel, 6channel options) / U-system (remote alarm system and wireless control system – telecommunication subscription needed / Automatic voltage regulator / Cryogenic gloves / Battery backup (Control panel and alarm) / Recorder / VIP

Ultralow temperature freezer-DFUD

Upright type double door with double controller

Product features and specifications

- Creative upright type double door freezer by OPERON which is independently controlled
- Independent temperature adjustment and space usage according to the characteristics of samples
- To keep samples which are used frequently in the upper chamber, and to keep samples which need long-term preservation in the lower chamber
- More stable temperature with triple silicon gasket of the upper and the lower chambers
- Four inner doors which are two in the upper chamber and two in the lower chamber and two outer doors in the upper and the lower chamber

Ultralow temperature freezer(Double door / Double controller freezer)

Model	DFUD-558						DFUD-657						DFUD-740					
	AA	BB	CC	AB	AC	BC	AA	BB	CC	AB	AC	BC	AA	BB	CC	AB	AC	BC
Temperature in the upper chamber	-40℃	-55℃	-86℃	-40℃	-40℃	-55℃	-40℃	-55℃	-86℃	-40℃	-40℃	-55℃	-40℃	-55℃	-86℃	-40℃	-40℃	-55℃
Temperature in the lower chamber	-40℃	-55℃	-86℃	-55℃	-86℃	-86℃	-40℃	-55℃	-86℃	-55℃	-86℃	-86℃	-40℃	-55℃	-86℃	-55℃	-86℃	-86℃
External size	W1010 x D900 x H1990						W1010 x D1030 x H1950						(OUT)W1010 x D1010 x H2047					
Internal size	(W750 x D620 x H550) x 2						(W750 x D770 x H530) x 2						(W750 x D880 x H535) x 2					
Inside measurement	511L						612L						706L					
Door (inside/outside)	4/2						4/2						4/2					
Electric capacity	Capacity necessary for installment AC220V 1ph (50/60Hz)																	
Weight	420kg						430kg						450kg					

Upright type double door with single controller

It is an upright type double door freezer to minimize the cold air loss when taking out samples. As samples which are used frequently are kept in the upper chamber and samples which need a long-term preservation are kept in the lower chamber, it affects the temperature of other samples less.

Control system

- Micro processer control system /Digital temperature indicator which adjust the temperature by 0.1℃
- Functions for setting double passwords to prevent access or control except administrators
- Data locking function

Alarm system and safety devices

- Alarm for filter cleaning period (Warm Condenser alarm)
- Alarm for high/low temperature of sight and auditory
- Equipped with pressure switch
- Equipped with overheating prevention switch
- Auto return system after blackout

Ultralow temperature freezer(Double door / Single controller freezer)

Model	DFUD-374			DFUD-446			DFUD-558			DFUD-657			DFUD-740		
Temperature range	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE
	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃
External size	W860 x D800 x H1951			W860 x D900 x H1951			W1010 x D900 x H1901			W1010 x D990 x H1901			W1010 x D1010 x H2001		
Internal size	W600 x D520 x H1200			W600 x D620 x H1200			W750 x D620 x H1200			W750 x D730 x H1200			W750 x D750 x H1300		
Inside measurement	374L			446L			558L			657L			731L		
Electric capacity	Capacity necessary for installment AC220V 1ph (50/60Hz)														
Weight	370kg			380kg			400kg			415kg			445kg		

Options Rack / Box / CO2 Backup system / LCD touch screen with SD card(or USB) - Basic -1channel (sensor 3channel, 6channel options) / U-system (remote alarm system and wireless control system – telecommunication subscription needed / Automatic voltage regulator / Cryogenic gloves / Battery backup (Control panel and alarm) / Recorder / VIP / ※**The minimum temperature of ultralow temperature freezer(C-type) is supplied with -91℃ performance if the customer requests.**

Ultralow temperature freezer

DFU-V / DFUD-V (shelf-cooling type)
DFU-P / DFUD-P (Power Plus model)

Upright type Validity(Shelf Cooling Type) – (DFU-V / DFUD-V)

Product features and specifications

- Realization of strong cooling power with installment of copper pipes in each shelf and accurate and even temperature profile inside

Ultralow temperature freezer (Shelf cooling type Validity freezer)-Single door

Model	DFU-128V			DFU-256V			DFU-374V			DFU-446V			DFU-558V			DFU-657V			DFU-740V			DFU-868V		
Temperature range	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE
	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃
External size	W710 x D750 x H1390			W710 x D750 x H1990			W860 x D800 x H1951			W860 x D900 x H1951			W1010 x D900 x H1901			W1010 x D990 x H1901			W1010 x D1010 x H2001			W1010 x D1151 x H2001		
Internal size	W450 x D475 x H600			W450 x D475 x H1200			W600 x D520 x H1200			W600 x D620 x H1200			W750 x D620 x H1200			W750 x D730 x H1200			W750 x D750 x H1300			W750 x D891 x H1300		
Inside measurement	128L			256L			347L			446L			558L			657L			731L			868L		
Electric capacity	Capacity necessary for installment AC220V 1ph (50/60Hz)																							
Weight	210kg			300kg			370kg			380kg			400kg			420kg			450kg			500kg		

Ultralow temperature freezer (Shelf cooling type Validity freezer)-Double door

Model	DFUD-374V			DFUD-446V			DFUD-558V			DFUD-657V			DFUD-740V			DFUD-1080V			DFUD-1215V		DFUD-1260V	
Temperature range	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	AE	BE
	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-40℃	-55℃
External size	W860 D800 H1951			W860 x D900 x H1951			W1010 x D900 x H1901			W1010 x D990 x H1901			W1010 x D1010 x H2001			W1460 x D1010 x H1990			W1610 x D1010 x H1990		W2260 x D1010 x H1583	
Internal size	W600 D520 H1200			W600 x D620 x H1200			W750 x D620 x H1200			W750 x D730 x H1200			W750 x D750 x H1300			W1200 x D750 x H1200			W1350 x D750 x H1200		W1400 x D750 x H1200	
Inside measurement	347L			446L			558L			657L			731L			1080L			1215L		1260L	
Electric capacity	Capacity necessary for installment AC220V 1ph (50/60Hz)																					
Weight	380kg			390kg			410kg			425kg			455kg			500kg			520kg		540kg	

Upright-Double door type Power plus model for Tropical climate

Product features and specifications

- The freezer appropriate for the surrounding temperature +40℃ and over

Ultralow temperature freezer (Power Plus model-Double door Upright type)

Model	DFUD-374P			DFUD-446P			DFUD-558P			DFUD-657P			DFUD-740P			DFUD-1080P			DFUD-1215P		DFUD-1260P	
Temperature range	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	CE	AE	BE	AE	BE
	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-86℃	-40℃	-55℃	-40℃	-55℃
External size	W860 x D800 x H1951			W860 x D900 x H1951			W1010 x D900 x H1901			W1010 x D990 x H1901			W1010 x D1010 x H2001			W1460 x D1010 x H1990			W1610 x D1010 x H1990		W2260 x D1010 x H1583	
Internal size	W600 x D520 x H1200			W600 x D620 x H1200			W750 x D620 x H1200			W750 x D730 x H1200			W750 x D750 x H1300			W1200 x D750 x H1200			W1350 x D750 x H1200		W1400 x D750 x H1200	
Inside measurement	347L			446L			558L			657L			731L			1080L			1215L		1260L	
Electric capacity	Capacity necessary for installment AC220V 1ph (50/60Hz)																					
Weight	380kg			390kg			410kg			425kg			455kg			500kg			520kg		540kg	

Control system

- Micro processer control system /Digital temperature indicator which adjust the temperature by 0.1℃
- Functions for setting double passwords to prevent access or control except administrators
- Data locking function

Alarm system and safety devices

- Alarm for filter cleaning period (Warm Condenser alarm)
- Alarm for high/low temperature of sight and auditory
- Equipped with pressure switch
- Equipped with overheating prevention switch
- Auto return system after blackout

Options Rack / Box / CO2 Backup system / LCD touch screen with SD card(or USB) - Basic -1channel (sensor 3channel, 6channel options) / U-system (remote alarm system and wireless control system – telecommunication subscription needed / Automatic voltage regulator / Cryogenic gloves / Battery backup (Control panel and alarm) / Recorder / VIP / ※**The minimum temperature of ultralow temperature freezer(C-type) is supplied with -91℃ performance if the customer requests.**

Accessory

Full Storage Capacity

Operon Chest freezer's Storage system(Rack & Box)

Model	Eight stage	The number of box	Ten stage	The number of box	Twelve stage	The number of box
DFC-84	6EA	48	-	-	-	-
DFC-200	12EA	96	12EA	120	12EA	144
DFC-300	18EA	144	18EA	180	18EA	216
DFC-400	24EA	192	24EA	240	24EA	288
DFC-500	30EA	240	30EA	300	30EA	360
DFC-600	36EA	288	36EA	360	36EA	432
CFQ-150	8EA	64	8EA	80	-	-
CFQ-152	8EA	64	8EA	80	-	-
CFQ-156	8EA	64	8EA	80	-	-
CFQ-232	15EA	120	15EA	150	-	-
CFQ-300	21EA	168	21EA	210	-	-

Operon Upright freezer's Storage system(Rack & Box)

Model	The number of shelf	Rack (stage X row)	2"box+Cell divider	Micro tube (81 hole)	Micro tube (100 hole)
DFU-128	3	9EA (3x3)	81	6561	8100
DFU-256	4	12EA (5x3)	180	14580	18000
DFU-374	4	16EA (5x3)	240	19440	24000
DFU-446	4	16EA (5x4)	320	25920	32000
DFU-558	4	20EA (5x4)	400	32400	40000
DFU-657	4	20EA (5x5)	500	40500	50000
DFU-740	4	15EA (5x5) + 5EA (6x5)	525	42525	52500
DFU-868	4	10EA (6x6) + 10EA (5x6)	660	53460	66000
DFUD-1080EV	4	24EA (5x5) + 8EA (5x4)	760	61560	76000

Operon Sliding freezer's Storage system(Rack & Box)

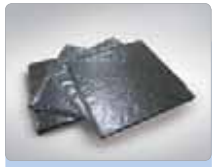
Model	The number of shelf	Rack (stage X row)	2"box+Cell divider	Micro tube (81 hole)	Micro tube (100 hole)
DFU-128	3	9EA (3x3)	81	6561	8100
DFU-256	4	12EA (4x3)	144	11664	14400
DFU-374	4	16EA (4x3)	192	15552	19200
DFU-446	4	16EA (4x4)	256	20736	25600
DFU-558	4	20EA (4x4)	320	25920	32000
DFU-657	4	20EA (4x5)	400	32400	40000
DFU-740	4	15EA (4x5) + 5EA (6x5)	450	36450	45000
DFU-800	4	15EA (4x5) + 5EA (6x5)	450	36450	45000
DFU-868	4	15EA (4x5) + 5EA (6x6)	480	38880	48000
DFUD-1080EV	4	32EA (4x5)	640	51840	64000


Upright rack


Sliding rack


Chest rack


Poly Carbonate Box (2")


Vacuum Insulation Panel (V.I.P)


U-System
(remote alarm, wireless control system)


Frost remover


Cryogenic gloves(Cryo gloves)


Circular 7 days chart recorder


Konics recorder(KRN-50)-2ch

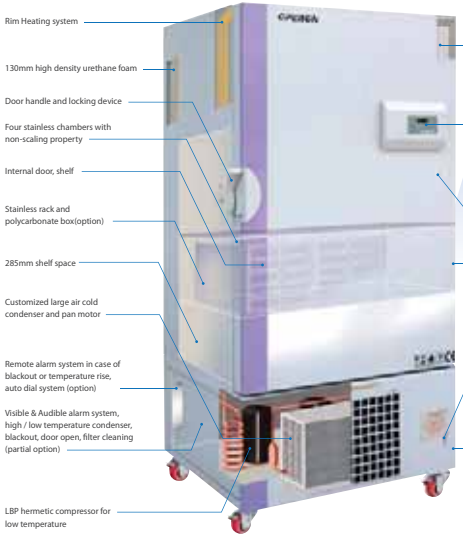

Paperless recorder(2ch~12ch)


Yokogawa recorder SR-10006(1~6ch)

Description

Controller 1 (LCD controller: option)

Dual cooling system which does not need an oil separator (Auto cascade system)



LED controller (standard)

- Data Lock function: Set-point security password
- The temperature is set by 0.1℃, and setting temperature and low/high temperature alarm can be entered. Control circuit chooses safety circuit when operated again after blackout to protect the device in case of auto power return.
- When choosing remote alarm system, alarm messages about abnormal temperature and blackout are sent to maximum four users.
- RS-232 PC communications program is available for monitoring and setting temperature such as accumulated time/temperature recording/graph presentation.
- Text description and LED flickering while sending auditory alarm are presented about abnormal temperature and abnormal condensation.

START/STOP	Start/stop
MODE	Save data or Move to the next stage
	High temperature alarm/Low temperature alarm/Remote alarm
	LN2.CO2 back up alarm
	Data lock, set point security
	Setting password etc
SHIFT	Move the digit
INC	Increase of numbers
ALARM ON/OFF	Alarm ON/OFF

New controller

- 7"Color TFT-LCD, Touch Screen Panel with SD card
- Setting the temperature by 0.1℃ and entering setting temperature and low/high temperature alarm, set-point security and password security
- Control section(Touch screen panel) includes data acquisition function, so additional recorder devices are not necessary.
- Data acquisition and backup of collected data using USB are easy, and save them as an excel file.
- Validation Support System presents maximum six temperature and graphs (including control sensor) at the same time and is available for setting save period from per a minute to per an hour recording maximum 3 years. Also, real-time monitoring is available performing the function of validator (OQ, PQ, Paperless Recorder, etc). (Deluxe Pack)
  (Option for additional sensors), 1-(Basic Pack control 1), 2-(Ice Crystal Pack control1, ice crystal temperature of samples monitoring 1, Abnormal condensation 1), 3-(Deluxe Pack control1, shelf3, abnormal condensation1, outdoor temperature1)
- Real-time graph can be checked on graph monitoring mode, so control state of products can be checked at a glance.
- Energy saving function is set to realize energy saving
- Visual alarm screen is made, so various alarm and warning messages are presented on Touch Screen Panel in the form of graphics or texts. Information on abnormal high temperature, low temperature or blackout is sent to the user.
- If UPS is chosen, it supplies the power to control section and sends information on blackout and various alarms to the user. Saving data during blackout is available. Automatic return to already saved set value in case of power return after blackout. (When choosing U-System, alarm messages are sent to the mobile)

LCD(7") touch screen controller (option)

(It may be different from the actual image)

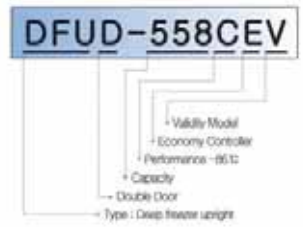
Controller & Alarm system – LCD touch screen control panel (option)

- Ultralow temperature freezer communicates with PC using U-system through RS-485 in the remote area which make monitoring, control and alarm available. One system controls maximum twelve ultralow temperature freezers.
- CDMA of U-system makes the user control twelve ultralow temperature freezers, monitor the current state of the device, receive alarm message(text message) and backup accumulated alarms with the mobile by wireless realizing safer sample management.

Code classification

Temperature Code

CODE	TEMPERATURE
A	-40℃
B	-55℃
C	-86 ℃
D	-120℃
CRYO	-150℃~-203℃



Model Code

Code	Model	REMARKS
DFU	Deep Freezer Upright type	DFU-128/256/374/446/558/657/740L
DFU-V	Deep Freezer Upright type with Validation	Plumbing each shelves
DFUD-V	Deep Freezer Upright type Double door with Validation	DFU-374/446/558/657/740/1080/1260L
DFUD-E	Deep Freezer Upright type Double door	Single controler(same as DFU)
DFUD	Deep Freezer Upright type Top chamber:-86℃/-55℃/-40℃ Bottom chamber:-86℃/-55℃/-40℃	Double controller DFUD-558CC/558AC/558BB/558BC/558AA DFUD-657CC/657AC/657BB/657BC/657AA
DFUP	Deep Freezer Upright Power plus up	Frequently door open or poor environment
DFC	Deep Freezer Chest type	DFC-84/200/300/400/500/600L
CFQ	Cryo Freezer Conqueror	CFQ-150/-152/-156/-300/-232
FDB	Freeze Dryer Bench top type	FDB-5503
FDU	Freeze Dryer Upright type	FDU-7003/7006/7012/7024/8603/8606/8612/8624
FDG	Freeze Dryer Glass type	FDG-120/105/90
FDS/FDTS	Freeze Dryer Stoppering type	FDS-12012/12006/8612/8606/7003/5503 , FDTS(For Production)
FDT	Freeze Dryer Bulk Tray type	FDT-86111/55111/8650/8632/8612/8606/12050/12032/12012/12006
FDCF	Freeze Dryer Chemical Free	FDCF-12012/12006/12003
SVQ	Speed Vacuum concentrator	SVQ-120/-95, MSVQ-20
IMC	Immersion Cooler	IMC-120/-86
SF	Shell Freezer-Cryo bath	SF-40/CB-80
VWCP	Water Vapor Cryo Pump	WVCP-1500/1650
CT	Cold Trap (Glass type/Coil type/Probe type)	CT-120/-90/-70/-55 , CTL/CTM/CTI
CH	Industrial Ultra Low Temp.of Chiller	CH-40/-55/-86/-120
CTC	Cryogenic Test Chamber	CTC-165 /MTC
GR	Gas Recycler	GR-120/86/40/20
CnH	Circulation Bath(cooling & heating)	CnH-2505/2510/2520/2530/2540/2550/4005/4010/4020/4030/4040/4050
HC	Circulation Bath (heating)	HC-20005/20010/20020/20030/20040/20050
IC	Industrial chiller	IC-4020/6020/9020/4035/6035/9035
FDUT	Freeze Dryer (Combi)	FDUT-12012/12006/12003/8612/7012/8606/7006/8603/7003
MPS	Multi Purpose System	MPS-55
CUS	Ultra Safe (twin heart) Freezers	DFU-CUS/DFUD-CUS/DFC-CUS
ATC/VTC	Altitude-Temperature-Vacuum test chamber	ATC-100/200/300 , VTC-100/200/300

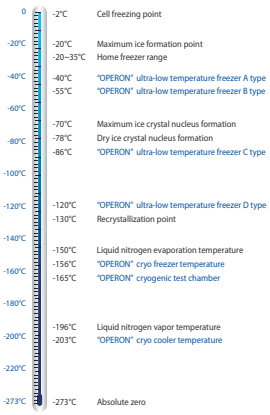
Controller Code

Code	Type	Model	Remarks
C/E	Compact/Economic	All kinds of freezer DFC-84/IMC/CT/SF-40	For freezer
E	Economic Standard	Basic control panel for freeze dryers	For Freeze Dryer
P	Programmable	FDT-additional drying program	
N	Premium Network	All Models(option), Touch screen with Memory card & Tele-communication	

Application Code

Classification	Model	Remarks
Freezer for sample preservation	DFC/DFU/DFUD/DFUV/DFUP/CUS	
Epoxy freezer / Ice pack freezer	DFUD-1080EV/1260EVtype	
Plasma Freezer	DFU-446/CFQ-156	
STEM CELL Freezer	CFQ	
Compact Freezer for personal use	DFC-84	
Freeze Dryer for laboratory	FDB/FDU/FDT/FDCF/FDG/FDS/MPS	
Freeze Dryer for food and medicines (Cooled & Heated shelf)	FDT, FDUT	
Freeze Dryer for collect of organic solvents like ethanol	FDG/FDCF	
Cryo pump for semiconductor/Sputtering/Coater	WVCP-1500/WVCP-1650	Order made
Concentrator for analysis of DNA/RNA/PROTEINS	SVQ, MSVQ-20	
Cooler for a partial cooling	IMC	
Ultra-low chiller for industrial use	CH-40/-55/-86/-120	Order made
Quick Freezer	LT-40	Order made
Ciyogenic test chamber(Strength)	CTC-165/150/130 , MTC-150/130	Order made
Circulation Bath for a reaction unit or distillation unit, chiller	CnH/HC/CH/IC	Order made
Collecting Vapor, Gas, Organic Solvent	CT-50/70/90/120, CTL/CTM/CTI	
Altitude-Temperature-Vacuum Test chamber	ATC-100/200/300, VTC-100/200/300	Order made

Ultra-Low Temperature Range



Vacuum Relief Port-Builtin
Rim Heating Systems-Builtin

Type	Data Setting								Alarm						MEMORY CARD
	MICRO PROCESSOR	TEMPERATURE	ALARM TEMP.	ACCESS PASSWORD	DATA RESET PASSWORD	DATALOC	PRINT SET	C.02 BACKUP SET	BUZZER& LED LAMP	POWER FAILURE	WARM CONDENSER	CLEAN FILTER	ROOM TEMP.	R.T.M.	
E-Type	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	OPTION	OPTION	OPTION	OPTION	OPTION	-
N-Type	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Freeze dryer

Freeze dryer freezes samples including aqueous solution or water at least below -40℃, reduces the pressure under water vapor pressure of the temperature and sublimates and dries ice.
Freeze dry for this is consist of a sample drying chamber for frozen (or self-frozen) samples, a vacuum pump for reduced pressure and a cold trap (or condenser) to capture vapor sublimated.
Freeze drying occurs at low temperature, so samples are not deteriorated well by heat. After drying, samples are resolvable well, so it is appropriate for the concentration of aqueous solution.
Original characteristics of samples such as taste, flavor, shape or substances are mostly remained after drying with this method.
Therefore, with freeze drying, samples which have unstable biological activities in moisture condition or aqueous solution can be preserved for a long time.
Recently, freeze drying is applied to the wide range from pharmaceutics, biology and food industry to petro-chemistry and semiconductor industry, and -120℃ ~ -130℃ freeze dryer is widely used for smooth drying of samples in accordance with freezing point of solvent to be diluted.

Considerations for choosing freeze dryer

The user should consider several details before choosing freeze dryer.
1. Decide the temperature of the capture section in accordance with samples to be dried or freezing point of solvent to be diluted.
2. Decide the capacity of the capture section considering the amount of samples to be tried once and the moisture content.
3. Decide the temperature range of the heat plate.
   Freeze dryer for production is designed to adjust the heat of sublimation when drying from -47℃ to +70℃ by circulation heating medium on the heat plate to increase productivity.
4. Recognizing samples' characteristics – whether samples after drying can be exposed to air temperature or air pressure.
5. Choose drying type considering the next processing stage after drying samples.
   Prepare appropriate accessories such as bulk tray, flask or vial, mini tray or acrylic drying chamber for drying type.
   This prevents budget waste caused by purchasing unnecessary accessories and helps to go to the next stage.
6. Consider the budget
   To decide the purpose of use and method is the wisest and important to purchase accessories with the best performance available within the budget. Also, it prevents to purchase unnecessary devices or accessories or inappropriate equipment for the purpose in advance.

Application

Freeze dryer can be used in all areas in which samples including aqueous solution and water are dried at low temperature to minimize the deterioration of the samples by heat.
In biotechnology field, it is applied to study or produce protein, microorganism or strain etc. Also, freeze dried powder is easy to dissolve in water, so it is frequently used in food and pharmaceutical industry, and it is necessary for injections, blood relative processing, vaccine relative research or production progress.
Recently, it is applied to petro-chemistry, semiconductor or macromolecule field.
Especially, FDT freeze dryer of OPERON can be applied as for optimizing production or process development.

※Specifications of freeze dryer may be partly different from standards.

Freeze dryer-FDT-(Bulk tray type)-for production

Bulk Tray type

[FDT-12012]

[FDT-8620]

Configuration

a. Dry section / b. Freezing section /
c. Vacuum section / d. Control section /
e. Options

Shelf & Tray

Trap Coil

Vacuum pump

Features and advantages

- Square-shaped drying chamber can reduce the installment area about over 30% by maximizing the effective area for drying compared to other company's circular chamber with the same capacity.
- -156℃ cryogenic cooling system registered to the international patent and Operon Auto Cascade System, the original technology for -203℃ cryogenic cooling system are combined to realize quick freezing and quick defrosting functions.
- Experiment data like sample temperature or degree of vacuum is stored on SD Card already equipped and is easily transferred to the user's PC to analyze.
- The user can choose automatic or manual function for the dry program, and when choosing automatic function, the user can program by choosing the temperature of the heat plate or drying time.
- Selected vacuum pump contains automatic Gas Ballasting function, so it releases gas which fills the pump to get better degree of vacuum.
- Embedded vacuum release valve automatically operates to prevent a back flow of contaminated oil and gas in the pump when blackout, cold trap temperature rise or pump operation stop by mishandling.
- It is equipped with automatic protection function for the vacuum pump which makes the vacuum pump operates automatically when the temperature of the cold trap decreases below the certain temperature which the user sets regarding the freezing point of samples and the vacuum pump automatically turns out when the temperature increases over the setting temperature.
- Transparent acryl chamber with a thickness of 40mm is safe for the user to see the drying process.
- The automatic defrosting device defrosts quickly after drying.

Options

1. Vacuum pump (range): 400LPM ~ 1600LPM
2. Option for changing the temperature of the heat plate (for FDT)
3. Option for additional shelves
4. Chemical trap
5. Oil mist trap
6. Activated carbon
7. Option for changing materials (SUS316)
8. Option for changing the temperature of the cold trap
9. CIP (Automatic cleaning device)
10. SIP (Automatic sterilization device)
11. Stoppering device

Freeze dryer-FDT-(Bulk tray type)-for production

Bulk Tray type

[FDT-86100(2CMB)]

[FDT-8650]

Freeze dryer (Bulk tray type) - Production scale

Model		Bulk Tray Type											
		FDT-86100	FDT-55100	FDT-12050	FDT-8650	FDT-12032	FDT-8632	FDT-12020	FDT-8620	FDT-12012	FDT-8612	FDT-12006	FDT-8606
Main Body	Cold Trap Temp	-86℃	-55℃	-120℃	-86℃	-120℃	-86℃	-120℃	-86℃	-120℃	-86℃	-120℃	-86℃
	Capacity	100L		50L		32L		20L		12L		6L	
	Shelf Temp	-47℃~+70℃(Standard) , -115℃~+70℃(Option)											
	Dimension	W2250 x D3400 x H2200		W1554 x D1311 x H2179		W1554 x D1311 x H2061		W1554 x D1311 x H2061		W1404 x D1211 x H1924		W1370 x D1211 x H1850	
	Chamber Size	(W505 x D890 x H690)x 2EA		W505 x D890 x H690		W505 x D890 x H550		W505 x D890 x H550		W370 x D600 x H430		W330 x D550 x H330	
	Trap Size	(Φ390 x L920) x 2EA		Φ390 x L920		Φ390 x L920		Φ340 x L730		Φ340 x L580		Φ310 x L260	
	Shelf/Tray	18EA/16EA		9EA/8EA		6EA/5EA		5EA/4EA		5EA/4EA		4EA/3EA	
		W470 x D740 x H40		W470 x D740 x H40		W470 x D740 x H40		W470 x D740 x H40		W320 x D450 x H40		W286 x D394 x H40	
	Programmable Controller	(LCD Controller – Korean, English / RS-232/RS-485 data port with interface - data acquisition via user's PC / Low & High alarm / Vacuum leak alarm / Event list / Thermal printer set / Remote alarm set / Vacuum control 2torr ~ 0.001torr / Vacuum display 10torr ~ 0.001torr) LCD Touch Screen + SD card 40 pattern 99 segment, 999 cycle											
	Sample Sensor	3port of display sensor & 1printer sensor											
	Pump Protection System	Built-in(Automatic pump start & stop control system for vacuum pump)											
	Defrost	Auto											
	Electric	220V/380V 3ph		220V/380V 3ph				220V/380V 3ph		220V/380V 3ph	220V/1ph	220V/380V 3ph	220V/1ph
	Weight	1500kg / 1400kg		780kg / 750kg / 730kg / 700kg				680kg	650kg	580kg	550kg	480kg	450kg

Freeze dryer-FDTI (Intergrated) - One type

Bulk Tray type

[FDTI-5050]

[FDTI-50100(2CMB)]

Freeze dryer (Bulk tray type) - Production scale

Model		Bulk Tray Type											
		FDT-86100	FDT-55100	FDTI-8650	FDTI-5050	FDTI-8632	FDTI-5032	FDTI-8620	FDTI-5020	FDTI-8612	FDTI-5012	FDTI-8606	FDTI-5006
Main Body	Cold Trap Temp	-86°C	-55°C	-86°C	-55°C	-86°C	-55°C	-86°C	-55°C	-86°C	-55°C	-86°C	-55°C
	Capacity	100L		50L		32L		20L		12L		6L	
	Shelf Temp	-47°C~+70°C(Standard)											
	Dimension	W3000 x D1600 x H2030		W1650 x D1311 x H1790		W1650 x D1311 x H1790		W1554 x D1311 x H1650		W1504 x D1311 x H1650		W1404 x D1211x H1500	
	Chamber Size	(W600 x D890 x H850) x 2EA		W600 x D890 x H850		W550 x D740 x H40		W505 x D890 x H690		W505 x D890 x H690		W360 x D600 x H550	
	Trap Size	Built-in one type											
	Shelf/Tray	16EA/14EA		8EA/7EA		6EA/5EA		5EA/4EA		5EA/4EA		4EA/3EA	
		W550 x D740 x H40		W550 x D740 x H40		W550 x D740 x H40		W470 x D740 x H40		W470 x D470 x H40		W300 x D400 x H40	
	Programmable Controller	(LCD Controller – Korean, English / RS-232/RS-485 data port with interface - data acquisition via user's PC / Low & High alarm / Vacuum leak alarm / Event list / Thermal printer set / Remote alarm set / Vacuum control 2torr ~ 0.001torr / Vacuum display 10torr ~ 0.001torr) LCD Touch Screen + SD card 40 pattern 99 segment, 999 cycle											
	Sample Sensor	3port of display sensor & 1printer sensor											
	Pump Protection System	Built-in(Automatic pump start & stop control system for vacuum pump)											
	Defrost	Auto											
	Electric	220V/380V 3ph		220V/380V 3ph		220V/380V 3ph		220V/380V 3ph		220V/380V3ph	220V/1ph	220V/380V3ph	220V/1ph
	Weight	1500kg /1400kg		780kg /750kg / 730kg /700kg				680kg	650kg	580kg	550kg	480kg	450kg

Freeze dryer-FDTA(All-In-One type)-Energy Saving/Cost Saving model

Bulk Tray type for Agriculture & foods

[FDTA-4508]

[FDTA-5020]

[FDTA-5035]

[FDTA-5050]

[FDTA-5070]

[FDTA-50100]

Freeze dryer (Bulk tray type - FDTA : Production scale-all-in-one type)

Model	Bulk Tray (Agriculture & foods)								
	FDTA-4504	FDTA-4508	FDTA-5006	FDTA-5012	FDTA-5020	FDTA-5035	FDTA-5050	FDTA-5070	FDTA-50100
Cold trap temperature	-60°C		-60°C						
Total ice capacity	4.5kg/4.5L	8kg/8L	6kg/6L	12kg/12L	20kg/20L	35kg/35L	50kg/50L	70kg/70L	100kg/100L
Shelf size/nos.	(W247 x D360mm) x 4ea	(W257 x D700mm) x 4ea	(W300 x D400mm) x 4ea	(W320 x D450mm) x 6ea	(W470 x D740mm) x 5ea	(W550 x D740mm) x 6ea	(W550 x D740mm) x 8ea	(W550 X D740mm) X (6ea X 2)	(W550 X D740mm) X (8ea X 2set)
Shelf temperature	-50°C(pre-freeze) ~ +50°C(Standard : Sublimation heat control)								
Outer dimension / System	W600 x D650 x H1213mm	W645 x D1000 x H1270mm	W1060 x D1060 x H1441mm	W1504 x D1136 x H1632mm	W1554 x D1312 x H1650mm	W1650 x D1312 x H1793mm	W1650 x D1312 x H1793mm	W2834 x D1312 x H1793mm	W2834 x D1312 x H1793mm
	1set	1set	1set	1set	1set	1set	1set	1set	1set
Drying chamber size / System	Ø345 x L550mm	Ø385 x L900mm	W360 x D600 x H550mm	W550 x D650 x H690mm	W550 x D890 x H690mm	W600 x D890 x H850mm	W600 x D890 x H850mm	(W670 x D890 x H850mm) x 2set	(W670 x D890 x H850mm) x 2set
	1set	1set	1set	1set	1set	1set	1set	1set	1set
Cooling system	Hermetic compressor 1set	Hermetic compressor 1set	Hermetic compressor 1set	Hermetic compressor 1set	Hermetic compressor 1set	Hermetic compressor 1set	Hermetic compressor 1set	Semi hermetic compressor 1set	Semi hermetic compressor 1set
Tray	3EA	3EA	4EA/3EA	5EA/4EA	4EA	5EA	7EA	5EA x 2	7EA x 2
	W247 x D360mm x H40mm	W255 x D700mm x H40mm	W300 x D400 x H40mm	W470 x D470 x H40mm	W470 x D740 x H40mm	W550 x D740 x H40mm	W550 x D740 x H40mm	W550 x D740 x H40mm	W550 x D740 x H40mm
Sublimation type	Sublimation heating by hotgas bypass with compressor instead of electrical heater, Minimized use of electrical heater, Maximized Energy saving about 50% compare to the silicone oil circulation type								
Loading type	Plate shelves (Manual type)								
Control system	On/Off switches - Vacuum, Pre-freezing, Drying, Compressor								
Display	1-Sample temperature(1°C) , 1-Vacuum pressure / Range : Vacuum degree(760torr ~ 0torr Full scale : 1torr Unit)								
Defrost	Manual defrost (Standard), Hot water/Steam (Option - User's Utility)		Auto defrost - Hot gas by pass(Standard) , Hot water/Steam (Option - User's Utility)						
Optional accessories	Two stage oil rotary vane Vacuum pump or Equvalent Screw pump (Different depending on the type, Volume , condition of samples)								
	200LPM	200LPM	200LPM	400LPM	400LPM	600LPM	800LPM	1500LPM	1500LPM
Electrical power requirement	AC220V +/-10% , 1ph 1.2kW(Run), 2kW(Peak)	AC220V +/-10% , 1ph 1.4kW(Run), 2.3kW(Peak)	AC220V +/-10% , 1ph 1.8kW(Run), 2.8kW(Peak)	AC220V +/-10% , 1ph 2.5kW(Run), 3.5kW(Peak)	AC380V +/-10% , 3ph 4line (R-S-T-N) + G 5.7kW(Run), 7.5kW(Peak)	AC380V +/-10% , 3ph 4line (R-S-T-N) + G 4kW(Run), 10kW(Peak)	AC380V +/-10% , 3ph 4line (R-S-T-N) + G 5kW(Run), 10kW(Peak)	AC380V +/-10% , 3ph 4line (R-S-T-N) + G 7kW(Run), 11kW(Peak)	AC380V +/-10% , 3ph 4line (R-S-T-N) + G 8kW(Run), 12kW(Peak)

(Electrical power to be changed depending on the type & capacity of pump applied)

Difference between FDTA vs FDTE

High Efficiency Energy 50% Saving type F/D

[FDTE-5050]

[FDTA-50100]

FDTE : 40pattern 99segment 99cycle Programmable

LCD touch screen Controller with SD card
LCD touch screen with SD card 6channel recorder
(Cold trap, Shelf, 3samples,Vacuum/760~0.001torr)) /
Shelf temp. control , Pre-freezing

FDTA : Simple type on/off switches ,

(Cold trap, Sample, Vacuum(AN)/0~ -0.1MPa) / Shelf temp. control , Pre-freezing

High Efficiency Energy 50% Saving type F/D

Model		Summary Specification(50kg)	Summary Specification(100kg)
Item		Main specifications(Energy 50% Saving type)	Main specifications(Energy 50% Saving type)
Frame	Out	About W1649 x D1312 x H1793mm	About W2834 x D1312 x H1793mm
	Structure	Chamber/Control/Engine/Trap/Vacuum	Chamber/Control/Engine/Trap/Vacuum
	Capacity	Total : 50kg (Water 100%) / Shelf area : 2.85m2	Total : 100kg (Water 100%) / Shelf area : 5.7m2
Drying chamber	In	((I) W600 x D890 x H850mm)	((I) W600 x D890 x H850mm) x 2set
	Shelf	((W550 x D740 x T18mm) x 8shelves(7+1))	((W550 x D740 x T18mm) x 8shelves(7+1)) x 2set
	Tray	((W548 x D748 x H40mm) x 7ea)	((W548 x D748 x H40mm) x 14ea
	Shelf temp.	Pre-freezing & Sublimation heat / -50°C ~ +50°C / Hot gases by pass	Pre-freezing & Sublimation heat / -50°C ~ +50°C / Hot gases by pass
Control	Controller	Pre-freezing , Shelf temp. control function included	Pre-freezing , Shelf temp. control function included
Sample Sensor		On/Off switches – Vacuum(760~0torr) , Pre-freezing , Drying , Compressor cooling	On/Off switches – Vacuum(760~0torr) , Pre-freezing , Drying , Compressor cooling
Cold trap	Temp./Capacity	-60°C / 50kg	-60°C / 100kg
Vacuum	Pump capacity	800LPM/Two stage Oil Rotary Vane Vacuum pump	800LPM/Two stage Oil Rotary Vane Vacuum pump x 2set
Vacuum	Pressure	1.5 x 10-3torr / Display : – 760torr ~ 0torr Full scale	1.5 x 10-3torr / Display : – 760torr ~ 0torr Full scale
Cooling system	Type	Air cooled condenser type	Air cooled condenser type
	System	Single(or Two stage auto cascade system)	Single(or Two stage auto cascade system)
	Compressor	Hermetic(or Semi hermetic) / 1set	Hermetic(or Semi hermetic) / 1 or 2set
	Defrost	Auto/Hotgas (Standard) , Hot water(or steam) – User's Utility	Auto/Hotgas (Standard) , Hot water(or steam) – User's Utility
Accessories		Vacuum pump(800L) + Oil, Tray(7), Sample sensor(2), Defrost Heater, Tray car	Vacuum pump(2 x 800L) + Oil, Tray(14), Sample sensor(4), Defrost Heater, Tray car
Power	Consumption	AC380V 3Ph, 4W (R-S-T-N) + G, Less 10A / 3.8kW(Run) / Comp. + Pump + Heater	AC380V 3Ph, 4W (R-S-T-N) + G, Less 20A / 7.6kW(Run) / Comp. + Pump + Heater

Difference between FDTA vs FDTE

High Efficiency Energy 50% Saving type F/D

Accessories(Standard)

Item	Description	Q'ty
Tray	Stainless steel (W550 x D740 x H40mm)	5set/7set/14set
Tray Car	For the size of W550 x D740 x H40mm Tray	1set
External Defrost heater	Electric heater type(Heat Cannon)	1set
Vacuum pump	2stage Oil rotary vane vacuum pump	1set/2set
Vacuum Oil	High Vacuum Oil – Spare	8L/16L
Probe type of Sample sensors	Spare sensor (PT-100 or J or K type)	2set/4set

Core Summary

- Product name : High degree of Efficiency Freeze dryer
- Application : Production & process of Foods/Agricultural products/Marine products
- Usages : F/D for Water base products
  - Pre-freezing
  - Shelf Temperature control & Sublimation heat
  - Vapor collecting with iced status
  - Ultimate Vacuum pressure 1.5 x 10-3torr for perfect dry
  - Energy 50% saving
  - Cost 50% saving for production & Air-conditioning
- Core technologies applied :
  - Patent : Simulaneous control system(Patent:10–1303656) : Energy recycling from the compressor to the Sublimation heat, Energy 50% saving
  - Patent : Cryogenic cooling system (Patent : USA(US6, 622, 518 B2), Germany(101 94 530), China(130411), Korea(PCT no.0337791)) Applied

Advantages & Features

- Energy consumption 50% level compare to the General F/D system
  (100KG capacity : 7.6kWh x 72h = 547kW x 9time = 4,923kW x @50KRW(Agricultural) = 246,150KRW / 1Month)
- Energy recycling (Compressor's hot gases to the sublimation heating)
- Cost saving of Air–conditioning & production
- 30~40% of cost down for the F/D system compare to the other competitors
- Simple ON/OFF control prevent user' s mistake
- Compact , rectangular type of chamber minimized installation space
- 2Chamber system controllable individually, It is very favorable when line power–cut or small volume of sample and breakdown of machine.

Comparison of Energy consumption & Energy costs

Model	Comparison of Energy consumption & Energy costs						
	FDTA-4504	FDTA-4508	FDTA-5012	FDTA-5020	FDTA-5035	FDTA-5050	FDTA-50100
Power	220V 1Ph			380V 3Ph 4W(R-S-T-N)+G			
Run(A)	5A	6A	8A	8A	9A	10A	20A
Run(kW)	1.2kW	1.4kW	2kW	3kW	3.4kW	3.8kW	7.6kW
Start(A)	10A	12A	16A	16A	18A	20A	40A
1day/24hr	28.8kW	33.6kW	48kW	72kW	81.6kW	91.2kW	182.4kW
3day/72hr	86.4kW	100.8kW	144kW	216kW	244.8kW	273.6kW	547.2kW
1M/9times	777.6kW	907.2kW	1296kW	1944kW	2203kW	2462kW	4925kW
Price@/kW	@50KRW/kW (Farmer electricity basis)						
Costs/Krw	38,880	45,360	64,800	97,200	110,150	123,100	246,250

Patented Technology/Energy 50% Saving

Freeze dryer-FDTE(Economy model)-Energy Saving/Cost Saving model

Bulk Tray type(Economy model)


[FDTE-8035]


[FDTE-50100]


[FDTE-8006]


[FDTE-8020]

Freeze dryer (Bulk tray type - FDTE (Economy model) Production scale - (all-in-one type))

Model	Bulk Tray (Economy type)															
	FDTE-4504	FDTE-4508	FDTE-5006	FDTE-8006	FDTE-5012	FDTE-8012	FDTE-5020	FDTE-8020	FDTE-5035	FDTE-8035	FDTE-5050	FDTE-8050	FDTE-5070	FDTE-8070	FDTE-50100	FDTE-80100
Cold trap temperature	-60℃		-60℃/-80℃													
Total ice capacity	4.5kg/4.5L	8kg/8L	6kg/6L		12kg/12L		20kg/20L		35kg/35L		50kg/50L		70kg/70L		100kg/100L	
Shelf size/nos.	(W247 x D360mm) x 4ea	(W257 x D700mm) x 4ea	(W300 x D400mm) x 4ea		(W320 x D450mm) x 6ea		(W470 x D740mm) x 5ea		(W550 x D740mm) x 6ea		(W550 x D740mm) x 8ea		W550 x D740 x (6EA X2)		W550 x D740 x 8-2set	
Shelf temperature	-50℃ ~ +50℃(Standard : Pre-freezing & Sublimation heat control), Customization available															
Outer dimension / System	W600 x D650 x H1213mm	W645 x D1000 x H1270mm	W1060 x D1060 x H1441mm		W1504 x D1136 x H1632mm		W1554 x D1300 x H1650mm		W1650 x D1312 x H1793mm		W1650 x D1312 x H1793mm		W2834 x D1312 x H1793mm		W2834 x D1312 x H1793mm	
	1set		1set		1set		1set		1set		1set		1set		1set	
Drying chamber size / System	Ø345 x L550mm	Ø385 x L900mm	W360 x D600 x H550mm		W550 x D650 x H690mm		W550 x D890 x H690mm		W600 x D890 x H850mm		W600 x D890 x H850mm		(W670 x D890 x H850mm) x 2set		W670 x D890 x H850mm) x 2set	
	1set		1set		1set		1set		1set		1set		1set		1set	
Cooling system	Hermetic compressor 1set		Hermetic compressor 1set		Hermetic compressor 1set		Hermetic compressor 1set		Hermetic compressor 1set		Hermetic compressor 1set		Semi hermetic compressor 20HP		Semi hermetic compressor 20HP	
Tray	3EA	3EA	3EA		5EA		4EA		5EA		7EA		5EA x 2		7EA x 2	
	W247 x D360mm x H40mm	W255 x D700mm x H40mm	W300 x D400mm x H40mm		W320 x D450mm x H40mm		W470 x L740 x H40mm		W550 x D740 x H40mm		W550 x D740 x H40mm		W550 x D740 x H40mm		W550 x D740 x H40mm	
Sublimation type	Sublimation heating by hotgas bypass with compressor instead of electrical heater, Minimized use of electrical heater, Maximized Energy saving about 50% compare to the silicone oil circulation type															
Loading type	Plate shelves (Manual type)															
Control system	On/Off switches - Vacuum, Pre-freezing, Drying, Compressor		(LCD Controller – Korean, English / RS-232/RS-485 data port with interface - data acquisition via user's PC / Low & High alarm / Vacuum leak alarm / Event list / Thermal printer set / Remote alarm set / Vacuum control 2torr ~ 0.001torr / Vacuum display 10torr ~ 0.001torr) LCD Touch Screen + SD card 40 pattern 99 segment, 999 cycle													
Display	1-Sample temperature(1℃), 1-Vacuum pressure / Range : Vacuum degree(760torr ~ 0torr Full scale : 1torr unit)		1-Sample temperature, 1-Cold trap temperature(-200.0 ~ +100.0℃ / 0.1℃ increment), 1-Vacuum pressure / Range : Vacuum degree(760torr ~ 0.001torr Full scale : 0.001torr Unit)													
Recorder	Option (LCD Touch Screen + SD card 6 channel graphic and storage)															
Safety device/ alarm	-		Built-in(Automatic pump start & stop control system for vacuum pump), (Automatic vacuum breaking system), (Low & High temperature safety alarm)													
Defrost	Manual defrost(Standard), Hot water/Steam (Option - User's Utility)		Auto defrost - Hot gas by pass(Standard), Hot water/Steam (Option - User's Utility)													
Optional accessories	Two stage oil rotary vane Vacuum pump or Equvalent Screw pump (Different depending on the type, Volume , condition of samples)															
	200LPM		200LPM		400LPM		400LPM		600LPM		800LPM		1500LPM		1500LPM	
Electrical power requirement	AC220V +/-10%, 1ph 1.2kW(Run), 2kW(Peak)	AC220V +/-10%, 1ph 1.4kW(Run), 2.3kW(Peak)	AC220V +/-10%, 1ph 1.8kW(Run), 2.8kW(Peak)		AC220V +/-10%, 1ph 2.5kW(Run), 3.5kW(Peak)		AC400V +/-10%, 3ph 4line (R-S-T-N) + G 4kW(Run), 7.5kW(Peak)		AC400V +/-10%, 3ph 4line (R-S-T-N) + G 5kW(Run), 10kW(Peak)		AC380V +/-10%, 3ph 4line (R-S-T-N) + G 5.5kW(Run), 10kW(Peak)		AC380V +/-10%, 3ph 4line (R-S-T-N) + G 7kW(Run), 11kW(Peak)		AC380V +/-10%, 3ph 4line (R-S-T-N) + G 8kW(Run), 12kW(Peak)	

(Electrical power to be changed depending on the type & capacity of pump applied)

Freeze dryer-FDTR(Circular Round type)

Bulk Tray type for Mass production scale

Freeze dryer (Bulk tray type - FDTR : Production scale - Circular Round type)

Model	Bulk Tray Type(Circular type)											
	FDTR-86100	FDTR-55100	FDTR-86200	FDTR-55200	FDTR-86300	FDTR-55300	FDTR-70500	FDTR-45500	FDTR-70700	FDTR-45700	FDTR-701000	FDTR-451000
Cold trap temperature	-86℃	-55℃	-86℃	-55℃	-86℃	-55℃	-86℃	-55℃	-70℃	-45℃	-70℃	-45℃
Total ice capacity	100kg/100L		200kg/200L		300kg/300L		500kg/500L		700kg/700L		1000kg/1000L	
Shelf size/nos.	W800 x D1000mm / 8EA		W1000 x D1200mm / 11EA		W1210 x D1510mm / 11EA		W1450 x D1524mm / 14EA		W650 x D3400mm / 24EA (Both side separation type)		W750 x D4100mm / 28EA (Both side separation type)	
Shelf temperature	-40℃ ~ +70℃(Standard) / Others optional											
Outer dimension	W1920 x D2450 x H2200mm		W2320 x D2850 x H2200mm		W2600 x D3400 x H2650mm		W2900 x D4100 x H2650mm		W3100 x D7500 x H2650mm		W3100 x D9500 x H2650mm	
Chamber dimension	Ø1200 x L1850mm		Ø1450 x L2645mm		Ø1750 x L3150mm		Ø2300 x L3500mm		Ø2600 x L7000mm		Ø2300 x L9150mm	
Cooling system	15HP x 2set		15HP x 4set or 30HP x 2set		15HP x 6set or 45HP x 2set		30HP x 4set(or equvalent)		100HP x 2set(or equvalent)		100HP x 2set	
Tray	32EA		44EA		99EA		126EA		192EA		224EA	
	W400 x D500 x H40mm		W500 x D600 x H40mm		W400 x D500 x H40mm		W483 x D508 x H40mm		W650 x D425 x H30mm		W650 x D508 x H30mm	
Type of sample loading	Plate shelves (Manual type)								Lift trolley (Auto lift) / Lift rail & trolley			
Programmable controller	(LCD Touch screen + SD Card(2Gb)-Programmable 40Pattern,99Segment,999Cycle)– Korean, English , Chinese / 999H 59M 59S pattern each segment, Pattern control(Pattern edit, Cycling set, File edit , Hold) and Manual mode											
Display	3-Sample sensor , 1-Cold trap sensor , 1-Vacuum sensor , 1-Shelf sensor / Range : Vacuum degree(760torr ~ 0.001torr Full scale) , Temperature(-199 ~ +199 / 0.1℃)											
Recorder	LCD Touch screen + SD Card(2Gb)- Korean , English , Chinese / 6Channel											
Safety device/ alarm	Built-in(Automatic pump start & stop control system for vacuum pump), (Automatic vacuum breaking system) , (Low & High temperature safety alarm)											
Defrost	Auto defrost - Hot gas by pass(Standard) , Hot water/Steam (Option - User's Utility)											
Optional accessories	Two stage oil rotary vane Vacuum pump or Equvalent Screw pump(Different depending on the type, Volume , condition of samples)											
	1500LPM		3000LPM		4500LPM		7500LPM		10500LPM		15000LPM	
	C.I.P.(Option)											
	S.I.P.(Option)											
	Vacuum control system between 10torr ~ 0.001torr - full scale (Option)											
	Isolation system(Option)											
	SUS-316L(Chamber , Coil , Shelves , Tray , Sanitary fitting) - (Option)											
	Cooling plant for pre-freezing and troley & Rail for automatic loading system(Option)											
Electrical Power requirement	AC400V +/-10% , 3ph 4line (R-S-T-N) + G 15kW(Run), 20kW(Peak)		AC400V +/-10% , 3ph 4line (R-S-T-N) + G 30kW(Run), 40kW(Peak)		AC400V +/-10% , 3ph 4line (R-S-T-N) + G 45kW(Run), 60kW(Peak)		AC400V +/-10% , 3ph 4line (R-S-T-N) + G 60kW(Run), 90kW(Peak)		AC400V +/-10% , 3ph 4line (R-S-T-N) + G 110kW(Run), 150kW(Peak)		AC400V +/-10% , 3ph 4line (R-S-T-N) + G 150kW(Run), 200kW(Peak)	

The Consultating is requird if you need the Cooling plant for Pre-freezing and Automatic loading system


[Drying chamber]


[Guide rail in drying chamber]


[Prefreezer and drying chamber]


[Shelves]

Freeze dryer-FDTC(Clean Room type)

Bulk Tray type for GMP / Clean Room model - Characteristic and Merit of Operon F/D

Standard : 300kg

Item	Standard	Case	Merit
Chamber Form	3Chamber / 3individual control	In case of Line breakdown and blackout	Unit of Non-power outage Line is possible to dry, Possible to run continuously without operation-stop in breakdown ==> Increase operation rate
		In case of A/S or inspection	In compressor exchange, immediate handling and transporting is possible with only one engineer. Separate type of cooling System allows convenient A/S maintenance without special appliances
		For small amount of sample	Separate operation of 100kg-Chamber is possible
		For different kinds of sample drying	The memorized drying patterns in different kinds of condition, individual drying is possible and allows reduction of time and cost
		Electricity Consumption	Reduction of over 20% of power consumption in comparison with competitor's (Power consumption :15kW /Including starting load25kW) x 3Unit
		Setting and maneuverability	Separate type of drying room and machine room with 3 cold trap Chamber allows immediate installation is possible
		Setting space	A design with 3 square Chamber eliminates all the Dead space occurs when using archetypes of Chamber . 30% of space is saved
Trap temperature	86degree/ Moisture, Vapor, Collecting	Temporary excess moisture / Vapor inflow / final process vacuum quality	With powerful cooling power (reach-86) allows perfect collecting, vacuum pump protecting, maintaining stable degree of vacuum, and smooth drying
Chamber	Square/4chamber		Loading capacity : 100kg(Based on moisture content 100%)
Surface	19.8m^2	Thin-walled sample	Sample thickness :15mm , Save Tray interval space
Lathe temperature	Concurrent control system of pre-freezing / re-cooling in drying	When Temporary sample Melting or heat sublimation and excessive Vapor	Dry room re-cooling is possible to control and maintain Lathe temperature or to prevent sample from Melting. A patented safety system aimed at such high-value sample damages as vacuum pump protection, prevention of sample Melting and cooler breakdown.
Tray	1Lathe1Tray	Loading/Unloading	When heat sublimation, with tightened Tray / Hot plate allow smooth heat supply and equal dry quality maintenance
Heating medium	Silicone oil	For precise control on lathe temperature and product safety	Heating medium(TMN) with safety certification from NSF(National Sanitation Foundation)
Vacuum pump	Over 4500LPM (1500LPM x 3set)	In case pump breakdown and power outage in Line	Separate operation for vacuum part of 100kg or 200kg (extra effort required) increases operation rate.
Control	LCD Touch screen+ SD card(2Gb) internal – 3set	Manual/Automatic dry pattern	RS-232/RS-485communication and internal interface allow the dry data to save (PC), control, and monitor
		Programmable pattern	40Pattern, 99Step , 999Cycle program editing and Graphic , multilingual operation(Korea, English , Chinese)
Control panel cover	Transparent acrylic cover	Prevention of Mal-operation and moisture permeation	Transparent acrylic cover prevents mal-operation and moisture or source of pollution during operation.
Recording system	LCD Touch screen+ SD card(2Gb) internal – 3set	For data saving and extract	Support multichannel such as 6channel, 3 sample temperature, lathe temperature , cold trap temperature, degree of vacuum, and Graphic

Freeze dryer-FDTC(Clean Room type)

Bulk Tray type for GMP / Clean Room model - Characteristic and Merit of Operon F/D

Item	Standard	Case	Merit
Wiring Maintenance	Rotary switch system in controlling	For Maintenance, inspection, and A/S of control panel or Wiring	Rotary-open structure of the controller of control panel and recorder to secure convenience in maintenance, inspection, and A/S
Sample Protection	Vacuum control	Temporal temperature rise, sample Melting and sample dispersal	Controlling degree of vacuum considering each characteristic and condition of sample allows sample dispersal prevention and its protection without operation-stop during dry process (option)
Cooling technical skills	Nationally patented cooling technology	Cooling technical skills /high efficient Reduction of energy consumption	High performance heat exchangers applied nationally patented cooling technology (Korea, America, German, China) allows Reduction of energy consumption over 20% in comparison with others
Usability	Separated Dry room and Cold trap	Sample inserting / defrosting / drain	Taking the sample out after drying and proceed separate defrosting and drain operation (Preventing pollution caused by Sample crossing over)
Sight glass	Sufficient Sight glass sufficient with Square chamber structure	Progress inspection of the dry and collecting process	Square chamber structure dry room (ø160 x 40T) – 3 set of 4 each, Cold trap with (Over ø160) – 3 set of sight glass
Sign of degree of vacuum	760torr ~ 0.001torr (1.5×10^{-3}torr)	Assuming progress of dry process	When combining vacuum Control system, vacuum control is available over 10torr to 0.001torr for safe dry operation without Sample disposal / Vacuum pump off / Sample melting
Defrosting and drain	Hot gas automatic defrosting (basic)+hot water/defrosting in a couple of hours when steam connecting	When immediate defrosting after drying	Vertical designed cold trap allows immediate defrosting and drain when connecting hot water or steam supply line after drying (User Utility : Steam or Hot water is required) In case of Clean Room, water treatment of defrosting and drain process is also required

[FDTE-86300]

Freeze dryer-FDTC(Clean Room type)

Clean Room

Clean Room – Freeze dryer for production appropriate for installment condition

(1 Chamber / 100kg) - Independent type



Freeze dryer (Bulk tray type - GMP/Clean room model : Production scale - Square type - Independent type)

Model	Bulk Tray Type (Clean Room Construction)											
	FDTC-86100	FDTC-55100	FDTC-86200	FDTC-55200	FDTC-86300	FDTC-55300	FDTC-86500	FDTC-55500	FDTC-70700	FDTC-45700	FDTC-701000	FDTC-451000
Cold trap temperature	-86℃	-55℃	-86℃	-55℃	-86℃	-55℃	-86℃	-55℃	-70℃	-45℃	-70℃	-45℃
Total ice capacity	100kg/100L		200kg/200L		300kg/300L		500kg/500L		700kg/700L		1000kg/1000L	
Shelf size/nos.	(W475 x D745mm) x 20ea		(W475 x D745mm) x 40ea		(W475 x D745mm) x 60ea		(W475 x D745mm) x 100ea		(W475 x D745mm) x 140ea		(W475 x D745mm) x 200ea	
Shelf temperature	-40℃ ~ +70℃(Standard) / Others optional											
Outer dimension / System	Drying chamber(Controller included):W1050 x D1130 x H1965mm / Cooling Unit:W2000 x D1300 x H1930mm / Cold trap : W800 x D800 H1800mm											
Chamber dimension / System	1set		2set		3set		5set		7set		10set	
	((I)W505 x D950 x H1500mm) x 1		((I)W505 x D950 x H1500mm) x 2		((I)W505 x D950 x H1500mm) x 3		((I)W505 x D950 x H1500mm) x 5		((I)W505 x D950 x H1500mm) x 7		((I)W505 x D950 x H1500mm) x 10	
	1set		2set or 1set		3set or 1set		5set or 1set		7set or 1set		10set or 1set	
Cooling system	15HP x 2set		15HP x 4set or 30HP x 2set		15HP x 6set or 45HP x 2set		30HP x 4set(or equvalent)		75HP x 2set(or equvalent)		100HP x 2set(or equvalent)	
Tray	19EA		38EA		57EA		95EA		133EA		190EA	
	W470 x D740 x H40mm		W470 x D740 x H40mm		W470 x D740 x H40mm		W470 x D740 x H40mm		W470 x D740 x H40mm		W470 x D740 x H40mm	
Type of sample loading	Plate shelves (Manual type)											
Programmable controller	(LCD Touch screen + SD Card(2Gb)-Programmable 40Pattern,99Segment,999Cycle)– Korean, English , Chinese / 999H 59M 59S pattern each segment, Pattern control(Pattern edit, Cycling set, File edit , Hold) and Manual mode											
Display	3-Sample sensor , 1-Cold trap sensor , 1-Vacuum sensor , 1-Shelf sensor / Range : Vacuum degree(760torr ~ 0.001torr Full scale) , Temperature(-199 ~ +199 / 0.1℃ Unit)											
Recorder	LCD Touch screen + SD Card(2Gb)- Korean , English , Chinese / 6Channel											
Safety device/alarm	Built-in(Automatic pump start & stop control system for vacuum pump), (Automatic vacuum breaking system) , (Low & High temperature safety alarm)											
Defrost	Auto defrost - Hot gas by pass(Standard) , Hot water/Steam (Option - User's Utility)											
Optional accessories	Two stage oil rotary vane Vacuum pump or Equvalent Screw pump (Different depending on the type, Volume , condition of samples)											
	1500LPM		3000LPM		4500LPM		7500LPM		10500LPM		15000LPM	
	C.I.P.(Option)											
	S.I.P.(Option)											
	Vacuum control system between 10torr ~ 0.001torr - full scale (Option)											
	Isolation system(Option)											
	SUS-316L(Chamber , Coil , Shelves , Tray , Sanitary fitting) - (Option)											
Electrical power requirement	AC400V +/-10% , 3ph 4line (R-S-T-N) + G 15kW(Run), 20kW(Peak)		AC400V +/-10% , 3ph 4line (R-S-T-N) + G 30kW(Run), 40kW(Peak)		AC400V +/-10% , 3ph 4line (R-S-T-N) + G 45kW(Run), 60kW(Peak)		AC400V +/-10% , 3ph 4line (R-S-T-N) + G 60kW(Run), 90kW(Peak)		AC400V +/-10% , 3ph 4line (R-S-T-N) + G 110kW(Run), 150kW(Peak)		AC400V +/-10% , 3ph 4line (R-S-T-N) + G 150kW(Run), 200kW(Peak)	

(Electrical power to be changed depending on the type & capacity of pump applied)

Freeze dryer-FDTS-(Stoppering type)

Stoppering type

Stoppering Program

Hydraulic Stoppering System (Bottom to top)

Freeze dryer(Bulk tray - Stoppering type) - Production scale

Model		Stoppering type									
		FDTS-12050	FDTS-8650	FDTS-12032	FDTS-8632	FDTS-12020	FDTS-8620	FDTS-12012	FDTS-8612	FDTS-12006	FDTS-8606
Main Body	Cold Trap Temp	-120℃	-86℃	-120℃	-86℃	-120℃	-86℃	-120℃	-86℃	-120℃	-86℃
	Capacity	50L		32L		20L		12L		6L	
	Shelf Temp	-47℃~+70℃(Basic) , -115℃~+70℃(Option)									
	Trap Size	Φ420 x L750		Φ350 x L750		Φ345 x L480		Φ315 x L450		Φ315 x L300	
	No. of tray / Shelf size	7EA		5EA		4EA		4EA		3EA	
		W660 x D660 x H22		W660 x D660 x H22		W500 x D500 x H22		W460 x D460 x H22		W460 x D460 x H22	
	Stoppering system	Hydraulic bottom to top stoppering system									
	Programmable Controller	(LCD Controller – Korean, English / RS-232/RS-485 data port with interface - data acquisition via user's PC / Low & High alarm / Vacuum leak alarm / Event list / Thermal printer set / Remote alarm set / Vacuum control 2torr ~ 0.001torr / Vacuum display 10torr ~ 0.001torr)									
	Sample Sensor	3port of display sensor & 1printer sensor									
	Pump Protection System	Built-in(Automatic pump start & stop control system for vacuum pump)									
	Defrost	Auto									
	Electric	220V/440V 3ph				220V/440V 3ph		220V/440V 3ph	220V/1ph	220V/440V 3ph	220V/1ph
	Weight	780kg / 750kg / 730kg / 700kg				680kg	650kg	580kg	550kg	480kg	450kg

Freeze dryer-FDB

Bench Top Model

Product features and specifications

- Choosing the wide temperature range from -86℃ to -55℃ available
- Compact freeze dryer for the laboratory table
- Installing manifold type or drying chamber available
- Strong structure frame and impact resistant powder coating finishing
- Filter cover for easy cleaning
- Bench-top type structure
- Temperature measuring sensor: platinum PT 100Ω(Class A 0.15 grade)
- Equipped with the valve for auto vacuum release to prevent a back flow of contaminated oil or gas

Control System

- Microprocessor control system
- One touch type automatic operation of freezing & vacuum function
- Buttons for choosing automatic & manual function
- Functions for automatic operating start and automatic setting temperature for stop to prevent the vacuum pump

[Optional items]

Tube holder | T-type manifold | Drying chamber+D-Type manfold+Mini tray | Pump table | Flask- 2L/3L (Compatible stoppering system : 5ml x 28ea) | Flask stoppering system

Freeze dryer(Bench top type) - Lab scale

Model		FDB-8603	FDB-7003	FDB-5503	FDB-5502	FDB-7002	FDB-8602
Main Body	Cold Trap Temp	-86℃	-70℃	-55℃	-55℃	-70℃	-86℃
	Capacity(total)	3L~4.5L	3L~4.5L	3L ~ 4.5L	2L ~ 3L	2L ~ 3L	2L ~ 3L
	Dimension	W480 x D570 x H480			W345 x D500 x H540		
	Trap Size	Φ315 x L180	Φ315 x L180	Φ315 x L180	Φ155 x 195		
	Controller	Microprocessor controlled LED digital display 0.1℃ increment & vacuum display 2000mTorr~0mTorr					
	Pump Protecteion System	Built-in					
	Defrost	Manual defrost					
	Electric	Capacity necessary for installment AC220V 1ph (50/60Hz)					
	Weight	70kg	60kg	50Kg	40kg	45kg	50kg

Options

1. Vacuum pump (100LPM ~ 200LPM)
2. Drying chamber (Small/Large)
3. Mini tray or three stage shelf
4. T-TYPE manifold
5. D-TYPE manifold
6. Vacuum valve + Cap + Adaptor
7. Flask (1000ml ~ 150ml)
8. Vacuum oil
9. Vacuum grease
10. Tube holder
11. Pump table
12. Stainless rack + Box
13. Oil mist trap
14. Chemical trap
15. Flask stoppering system (ø 22mm x 24Vials)

Freeze dryer-FDU

Upright type

Product features and specifications

- Choosing the wide capacity range from 24L to 3L available
- Choosing the wide temperature range from -90℃ to -55℃ available
- Powerful freezing performance to start drying within 15minutes ~ 30minutes
- Compact and movable upright type freeze dryer
- Installing manifold type or drying chamber available
- Strong structure frame and impact resistant powder coating finishing
- Filter cover for easy cleaning
- Upright type structure
- Temperature measuring sensor: platinum PT 100Ω(Class A 0.15 grade)
- Equipped with the valve for auto vacuum release to prevent a back flow of contaminated oil or gas

Control System

- Microprocessor control system
- One touch type automatic operation of freezing & vacuum function
- Buttons for choosing automatic & manual function
- Functions for automatic operating start and automatic setting temperature for stop to prevent the vacuum pump

[Optional Rotor when ordering the model equipped with the concentrator]

Freeze dryer(Upright type) - Lab scale

Model		Upright-type							
		FDU-8624	FDU-7024	FDU-8612	FDU-7012	FDU-8606	FDU-7006	FDU-8603	FDU-7003
Main Body	Cold Trap Temp	-90℃	-70℃	-90℃	-70℃	-90℃	-70℃	-90℃	-70℃
	Capacity(total)	24L ~ 28L		12L ~ 15L		6L ~ 8L		3L ~ 4.5L	
	Dimension	W890 x D846 x H1037		W850 x D796 x H987		W500 x D646 x H976			
	Trap Size	Φ345 x L580		Φ 345 x L380		Φ 315 x L300		Φ 315 x L180	
	Controller	Auto/Manual start-up controller, Display cold trap,Temperature & vacuum pressure(2000mTorr ~ 0mTorr), printer set							
	Pump Protecteion System	(Automatic vacuum pump start & Stop controller system)							
	Defrost	Auto				Manual			
	Electric	Capacity necessary for installment AC220V 1ph (50/60Hz)							
	Weight	180kg		155kg		115kg		110kg	

Options

1. Vacuum pump (100LPM ~ 200LPM)
2. Drying chamber (Large)
3. Mini tray or three stage shelf
4. T-TYPE manifold
5. D-TYPE manifold
6. Vacuum valve + Cap + Adaptor
7. Flask (1000ml ~ 150ml)
8. Vacuum oil
9. Vacuum grease
10. Oil mist trap
11. Chemical trap
12. Rotor for vacuum concentration (1.5ml X 210/ 1.5ml X 72/ 15ml X 12/ 50ml X 6/ swing rotor)
    (Concentrator equipped model is available for the large upper plate with 12L capacity)
13. Flask stoppering system (ø22mm x 24Vials)

Freeze dryer-FDCF

Chemical-free Upright type

Product Introduction : Only Operon,
-120°C Chemical free freeze dryer for organic solvents

Product features and specifications

-156°C cryogenic cooling system registered to the international patent and Operon Auto Cascade System, the original technology for -203°C cryogenic cooling system are combined to realize quick freezing and quick defrosting functions.

Technical Data sheet

Features and advantages

- Chemical free freeze dryer is -120°C ~ -135°C cold trap with powerful freezing power, and it can capture organic solvents whose freezing point is -115°C ~ -95°C like ethanol, methanol, acetone, hexane or Iso-Octane.
- In case of samples whose freezing point is below -100°C, an expensive cryogenic freezer or liquid nitrogen is needed for pre-freezing. That is expensive and inconvenient way, and especially, liquid nitrogen is risky to use and has a possibility to contaminate samples. Also, samples are not frozen well in the general -86°C freezer, or while moving frozen samples to the drying chamber, samples are melted, so the examination is likely to fail. Chemical free freeze dryer of OPERON uses stainless five stage mini tray for self-freezing (pre-freezer embedded) below -120°C, and it is appropriate for the quick, convenient and efficient experiment.

Freezing Section

- Freezing system: Duality cooling system applied with Auto Cascade Systems of OPERON registered to the international patent
- Concentrator capacity: 1.5HP x 2 Set
- Refrigerant: CFC-free eco-friendly mixed refrigerant
- Refrigerant oil: Polyester oil
- Cold trap size: Ø345 x L380mm
- Cold trap capacity: 12L
- Cold trap material: Stainless steel SUS-304(Teflon coating)
- Material for Cold trap lid: Transparent acryl
- Defrosting: Automatic defrosting

Control Section

- Presentation Section: STN-2Tone(Blue/White) LCD Display(128x64 Dot, 60x32mm) / 6Point LED Presentation of state)
- Entering Section: 6Point Touch Key.
- Entering the temperature sensor: 1ch (Extension to 6ch for monitoring – option)
- Entering the vacuum sensor: 1ch
- Range of degree of vacuum (degradability): 2000~0mTorr /1mTorr
- Sending monitoring data: Send temperature or monitoring data to PC or Konics data recorder, thermal printer.
- SMS sending function: Send SMS to the registered phone number when alarming

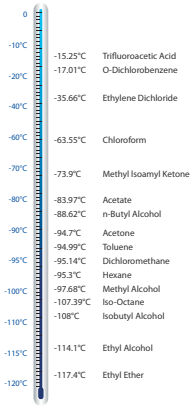
Vacuum Section

- Vacuum sensor (Varian)
- Valve for auto vacuum release

Drying section options and other options

- Vacuum pump: 100LPM ~ 1600LPM
- Manifold (T-type : 24P ~ 8P) / D-type : 12P ~ 8P)
- Five stage mini tray
- Flask (150ml ~ 1000ml)
- Vacuum valve + Cap + Adaptor
- Option for additional shelves
- Device for heating the heat plate (For FDCF, FDU, FDB, FDS)
- Chemical trap
- Oil mist trap
- Activated Carbon
- Torch
- Stoppering device
- Used as vacuum concentration
- Used as Shell freezer
- Drying chamber (transparent acryl, stainless square chamber)
- Three stage shelf

Freezing Points



Application

Chemical free freeze dryer is used to dry directly diluted solvents without other preprocessing in the samples such as ethanol, methanol, acetone, hexane or Iso-Octane whose freezing point is -115°C ~ -95°C. Especially, chemical free freeze dryer of OPERON is the world first below -120°C dryer for chemicals. This product is used by users who experiences frequent breakdown of the vacuum pump and experiment failures while using -85°C ~ -50°C freeze dryer from other companies.

Freeze dryer(Chemical free type) - Lab scale

Model		Chemical Free		
		FDCF-12012	FDCF-12006	FDCF-12003
Main Body	Cold Trap Temp	-120°C	-120°C	-120°C
	Capacity(total)	12L ~ 15L	6L ~ 8L	3L ~ 4.5L
	Dimension	W850 x D796 x H987		W500 x D646 x H976
	Trap Size	Φ 345 x L380	Φ 315 x L300	Φ 315 x L180
	Controller	Auto/Manual start-up controller, Display cold trap, Temperature & vacuum pressure(2000mTorr ~ 0mTorr), printer set		
	Pump Protecteion System	(Automatic vacuum pump start & Stop controller system)		
	Defrost	Auto		Manual
	Electric	220V/1Ph(50/60Hz)		
	Weight	210kg	190kg	180kg

Freeze dryer-FDUT (Compact Dryer)

Cooled & Heated Compact type (Combination type/all-in-one type)

When purchasing freeze dryer for production, FDUT combination type (COMBI) model is appropriate if the amount of samples to be dried once is below 6L, if the budget is limited or if the user has the cooling equipment like the cold trap or freeze dryer for experiment.
FDUT products are embedded with heated & cooled shelf in the dryer chamber like freeze dryer for production, and dry program is used with automatic/ manual settings, and it is connected with the cold trap or freeze dryer which the user already has with vacuum line to capture vapor or moisture from the dryer chamber.
The user can choose the dry chamber capacity from 3L to 6L, and all-in-one FDUT which is embedded with the dry chamber and the cold trap is from 2 to 4L.

Combination type(FDUT-8606) All-in-one type(FDUT-6002)

Features and advantages

- Square-shaped dry chamber can reduce the installment area about over 30% by maximizing the effective area for drying more compared to other company's circular chamber with the same capacity.
- -156°C cryogenic cooling system registered to the international patent and Operon Auto Cascade System, the original technology for -203°C cryogenic cooling system are combined to realize quick freezing and quick defrosting functions.
- The user can choose automatic or manual function for the dry program, and when choosing automatic function, the user can program by choosing the temperature of the heat place or drying time.

All-in-one type : Freeze dryer (Cooled & Heated - All-in-one type) - Pilot scale

Specification	FDUT-6002	FDUT-8602	FDUT-12002
Dimension(Overall)	W500 x D646 x H1468		
Chamber size	W300 x D360 x H352		
Shelf temp.	-47°C~+40°C		
Shelf Quantity	Standard-(W240 x D240) x 3EA		
Door	Tempered Glass door		
Controller(Drying Chamber)	LCD programmable & Manual drying controller		
Medium	Silicone oil(Dow corning 10cst)		
Circulation	Circulation pump(March pump)		
Cold trap temp	-60°C	-86°C	-120°C
Cold trap capacity(total)	2L ~ 4L		
Controller(Cold trap)	Microprocessor controlled LED digital 0.1°C increment display Cold trap./Vacuum pressure(2000mTorr~0mTorr)/Printer set/Auto&manual selection)		
Defrost	Manual		

Combination type : Freeze dryer (Cooled & Heated - Combination type) - Pilot scale

Part	Specification	FDUT-12012	FDUT-12006	FDUT-12003	FDUT-8612	FDUT-7012	FDUT-8606	FDUT-7006	FDUT-8603	FDUT-7003
Cooled & Heated Drying chamber	Dimension	(Overall) W500 x D646 x H1468 / (chamber) W300 x D360 x H352								
	Shelf Temp	-47°C~+40°C								
	Shelf Quantity	Standard-(W240 x D240) x 3EA								
	Door	Tempered Glass Door								
	Controller	Manual & Programmable drying controller(LCD)								
	Medium	Silicon oil(Dow Corning 10cst)								
	Circulation	Circulation Pump(March Pump)								
	Recorder	Square type Temperature recorder (Archived or Real time print)								
Cold Trap	Dimension	W850 x D800 x H1000					W850 x D650 x H980			
	Temp	-120°C			-90°C	-70°C	-90°C	-70°C	-90°C	-70°C
	Capacity(total)	12L ~ 15L	6L ~ 8L	3L ~ 4.5L	12L ~ 15L	12L ~ 15L	6L ~ 8L	6L ~ 8L	3L ~ 4.5L	3L ~ 4.5L
	Controller	Microprocessor controlled LED digital 0.1°C increment display Cold trap./Vacuum pressure(2000mTorr~0mTorr)/Printer set/Auto&manual selection)								
	Defrost	Auto(Hot gas by pass-12L이상) & Manual defrost-12L이하								
Chamber option	Stoppering system	Top to bottom								
Weight		350kg	340kg	330kg	320kg	310kg	295 kg	290kg	285 kg	280kg

Options RVacuum pump (range): 100LPM ~ 1600LPM / Option for the temperature change of the heat plate (for FDT) / Option for the additional shelves / Chemical trap / Oil mist strap / Stoppering system

Freeze dryer-FDS

Stoppering freeze Dryer

Stoppering type freeze dryer of OPERON is appropriate for samples which should be sealed into the Vial bottle in a vacuum after drying.
It can be simple to use for the small amount of samples less than 10ml x 140pieces

Features and advantages

- It has a wide range of options for various capacities from 24L to 3L and cold trap temperature from -90℃ to -55℃.
- It is compatible with any freeze dryer models for experiment of OPERON, and if the user already has OPERON products, it can be used interchangeably with an additional stoppering device.
- The lift device to lift and lower the stoppering device is used conveniently to put or take out samples. (only for 12L – option)
- After drying, it sealed the lid of glass bottle in a vacuum to prevent samples perfectly from moisture and external environment.
- Selected vacuum pump contains automatic Gas Ballasting function, so it releases gas which fills the pump to get better degree of vacuum.
- Embedded vacuum release valve automatically operates to prevent a back flow of contaminated oil and gas in the pump when blackout, cold trap temperature rise or pump operation stop by mishandling.
- It is equipped with automatic protection function for the vacuum pump which makes the vacuum pump operates automatically when the temperature of the cold trap decreases below the certain temperature which the user sets regarding the freezing point of samples and the vacuum pump automatically turns out when the temperature increases over the setting temperature.
- Transparent acryl chamber is safe for the user to see the drying process (option).

[Stoppering Device]

[Flask- 2L/3L]
(Compatible stoppering system : 5ml x 28ea)

[Flask stoppering system]
(ø22mm x 24Vials)

Freeze dryer(Stoppering type) - Lab scale

Model			FDS-12012	FDS-8612	FDS-7012	FDS-12006	FDS-8606	FDS-7006	FDS-12003	FDS-8603	FDS-7003	FDS-5503
Main Body	Cold Trap Temp		-120℃	-90℃	-70℃	-120℃	-90℃	-70℃	-120℃	-90℃	-70℃	-55℃
	Cold Trap Capacity(total)		12L ~ 15L			6L ~ 8L			3L ~ 4.5L			
	Dimension (mm)	Drying Chamber	Φ 300 x L330 (Transparent acrylic drying chamber -option)									
		Overall	W850 x D796 x H987			W500 x D646 x H976			W480 x D570 x H480			
	Cold Trap		Φ345 x L380			Φ315 x L300			Φ315 x L180			
	Controller		Auto/Manual start-up controller, Display cold trap temperature & vacuum pressure(2000mTorr~0mTorr) printer set									
	Stoppering System		Clear acrylic lid+3shelves+stoppering device (H:600)									
	Pump Protection System		(Automatic vacuum pump start & Stop control system)									
	Defrost		Auto			Manual						
	Electric		220V/1ph, 60hz/50hz									
	Weight		230kg	175kg	175 kg	210kg	135 kg	135 kg	200kg	130kg	130kg	70 kg

Options

1. Vacuum pump (range): 100LPM ~ 1600LPM
2. Manifold (D-type) 8Port ~ 12Port
3. Flask
4. Vacuum valve + Cap + Adaptor set
5. Option for additional shelves
6. Device for heating the heat plate (for FDCF, FDU, FDB, FDS)
7. Chemical trap
8. Oil mist trap
9. Activated carbon
10. TORCH
11. Used as vacuum concentrator (combination type)
12. Shell freezer (combination type)
13. Drying chamber
14. Flask stoppering system (ø 22mm x 24Vials)

Freeze dryer-FDG

Glass type freeze dryer (for acid)

It is highly recommended to use FDG (for acid) of OPERON. If samples or solvents to be diluted in samples contain sulfuric acid, hydrochloric acid or acetic acid.
The drying chamber and the cold trap of FDG is made with borosilicate glass.
Therefore, if the proper experiment or production is difficult because of corrosion of stainless or Teflon coated materials, the model for acid of OPERON is appropriate.

Glass drying chamber

Glass cold trap

Teflon Disc

[FDG-120]

Features and advantages

- The drying chamber and the cold trap of freeze dryer for acid is made with borosilicate glass, so it is appropriate to dry samples which contain toxic substances like sulfuric acid, hydrochloric acid or acetic acid.
- -156°C cryogenic cooling system registered to the international patent and Operon Auto Cascade System, the original technology for -203°C cryogenic cooling system are combined to realize quick freezing and quick defrosting functions.
- Selected vacuum pump contains automatic Gas Ballasting function, so it releases gas which fills the pump to get better degree of vacuum.
- Embedded vacuum release valve automatically operates to prevent a back flow of contaminated oil and gas in the pump when blackout, cold trap temperature rise or pump operation stop by mishandling.
- It is equipped with automatic protection function for the vacuum pump which makes the vacuum pump operates automatically when the temperature of the cold trap decreases below the certain temperature which the user sets regarding the freezing point of samples and the vacuum pump automatically turns out when the temperature increases over the setting temperature.
- Transparent borosilicate glass chamber is safe for the user to see the drying process (embedded).
- After drying, defrost water is easily separated to discharge into the special container.

Freeze dryer (Glass type - borosilicate type for acid) - Lab scale / Industrial scale

Model			FDG-120	FDG-105	FDG-90
Main Body	Cold Trap Temp		-120℃	-105℃	-90℃
	Cold Trap Capacity(total)		12L ~ 15L		
	Dimension(mm)	Drying Chamber	Φ300 x L230		
		Cold Trap	Φ300 x L250		
		Overall	W850 x D800 x H1410(Included drying chamber)		
	Materials	Drying Chamber	Borosilicate Glass A3.3		
		Cold Trap	Borosilicate Glass A3.3		
		External	Cold rolled steel with powder coated		
		Insulation	High density urethane foam		
	Controller		Auto/Manual start-up controller, Display cold trap temperature & vacuum pressure(2000mTorr~0mTorr), printer set		
	Pump Protection System		(Automatic vacuum pump start & Stop control system)		
	Defrost		Manual defrost		
	Electric		220V/1Ph, 60Hz/50Hz		
	Weight		230kg		

Options Vacuum pump (range): 100LPM ~ 1600LPM / Chemical trap / Oil mist trap / Activated carbon / Drain device

Freeze dryer-MPS

Multi purpose system

Features and advantages

- The size and weight of the device is very compact, and it can be used as both cold trap & freeze dryer and freeze dryer & mini concentrator, and it can be connected with vacuum oven or gel dryer to dry small amount of samples.
- Selected vacuum pump contains automatic Gas Ballasting function, so it releases gas which fills the pump to get better degree of vacuum.
- Embedded vacuum release valve automatically operates to prevent a back flow of contaminated oil and gas in the pump when blackout, cold trap temperature rise or pump operation stop by mishandling.
- It is equipped with automatic protection function for the vacuum pump which makes the vacuum pump operates automatically when the temperature of the cold trap decreases below the certain temperature which the user sets regarding the freezing point of samples and the vacuum pump automatically turns out when the temperature increases over the setting temperature.

[MPS-5502]

MPS-55 (Multi Purpose System)

Dimension(WxDxH)	W345 x D474 x H540	Chamber	Stainless steel
Lowest temperature	-55°C	Drain	Silicon hose
Cold trap lid	Clear acrylic lid	Vacuum connector	Id-10mm/od-19mm
Trap chamber volume(total)	2 ~ 3 L	Defrost	Manual
Optional manifold	6port with valve	Display	LED/0.1°C increment
Weight	about 29kg (optional manifold -4kg)		

MPS-70 (Multi Purpose System)

Dimension(WxDxH)	W345 x D474 x H540	Chamber	Stainless steel
Lowest temperature	-70°C	Drain	Silicon hose
Cold trap lid	Clear acrylic lid	Vacuum connector	Id-10mm/od-19mm
Trap chamber volume(total)	2 ~ 3 L	Defrost	Manual
Optional manifold	6port with valve	Display	LED/0.1°C increment
Weight	about 29kg (optional manifold -4kg)		

MPS-86 (Multi Purpose System)

Dimension(WxDxH)	W345 x D474 x H540	Chamber	Stainless steel
Lowest temperature	-86°C	Drain	Silicon hose
Cold trap lid	Clear acrylic lid	Vacuum connector	Id-10mm/od-19mm
Trap chamber volume(total)	2 ~ 3 L	Defrost	Manual
Optional manifold	6port with valve	Display	LED/0.1°C increment
Weight	about 29kg (optional manifold -4kg)		

MSVQ-20 (Mini Speed Vacuum Concentrator)

Dimension(WxDxH)	W213 x D335 x H223	Chamber	SUS with Teflon coating
Rotor	1.5ml x 20hole(Anodizing)	Lid	Clear acrylic lid
Speed control	0 - 2000rpm	Centrifuge	Max.2000 rpm
Heat control	Amb. +5°c ~ +65°c	Vacuum connector	id-10mm/od-19mm
Vacuum Gauge	0 ~ 76cmHg	Rotor safety	Speed control (0 = off)

Accessories for freeze dryer

T manifold (24port ~ 6port)

Drying Chamber + three stage shelf (heating type/ non-heating type)

Drying Chamber + five stage mini tray (heating type/ non-heating type)

Drying Chamber + three stage shelf (heating type/ non-heating type) + D-Type Manifold (6.8.12 Port)

Rotor used as the concentrator

Stainless square chamber (heating type/ non-heating type)

Five stage mini tray (heating type/ non-heating type)

Drying Chamber + five stage mini tray (heating type/ non-heating type) + D-Type Manifold (6.8.12 Port)

Chemical trap

Oil mist trap (small/large)

Adaptor & Cap, Flask (150ml ~ 3000ml)

Vacuum valve / Vacuum grease

Thermal printer

Oil rotary vacuum pump (1.5x10^{-3}Torr) 100LPM ~1600LPM

Shell freezer + flask rolling kit

Stoppering device

Pump table

Square chamber (large) – non-heating

Tube holder

D manifold + vacuum valve

Ampoule manifold (Ampoule and rubber tube)

Square type heated chamber

4branch glass adaptor

4tiers mini tray with cryo box

F/D Description

Controller 1 (LCD controller : option)

Basic

Controller

START/STOP	The first pump starts to operate 2 minutes after the refri lamp turns on.
MODE	Temperature setting for operation the vacuum pump 'Auto' or 'Manual' setting for the vacuum pump, printer setting
←↑	Push ↑ key to choose mode (Auto / Manual). Push ←↑ key to set the temperature and vacuum pump.
Vacuum	If the cold trap reaches the setting temperature, push 'VACUUM' key to operate the vacuum pump (Manual mode)
Enter	Push 'ENTER' key to settle setting temperature.
LED digital presentation of the cold trap temperature and vacuum pressure (2000 ~ 0 mTorr)	

Option (LCD touch key)

1. Temperature range can be -200.0°C to +100.0°C / 0.1°C
2. There are 6 user icons to indicate the status of compressor, vacuum pump, alarms, printer, U-System™, key lock.
3. Key lock function prevent all unauthorized access.
4. Full scale vacuum range from 760 Torr to 0.000Torr display. (2000mTorr - 0mTorr is indicated by 0.001 Torr).
5. Pump unit is furnished with an automatic & manual control.
6. Vacuum control in the range of 2000mTorr to 0mTorr is provided.
7. High/low temperature alarms in the condenser increase
8. Alarm signal transmission and automatic power off systems .
9. Vacuum leakage detector is also incorporated to transmit alarm signals and automatically turn off the vacuum pump that is working for at least 30 minutes after the detected leakage.
10. RS232 - rs and under the conditions encountered possible, and 485 - rs rs - 232 and 485 - rs pc by at the same time, run on and 232 - rs communications, using data acquisition system by utilizing his (private offering software)(basic) backup data for the product operation.
    RS-232 - 1. munication PC 2. Thermal Printer 3. U System
    RS-485 - 1. Voltage (voltage tester)more than 2. SD Card11. The inquiring function allows users to review alarm activation history.
11. The inquiring function allows users to review alarm activation history.

(It may be different from the actual image)

Special cooling equipment

Cryo Cooler-WVCP for Ultra High Vacuum (Cryo pump for ultra-high vacuum in vacuum evaporation coating field)
Centrifugal speed vacuum concentrator (SVQ)
Cold Trap (CT)/ Vacuum Vapor Trap (VT) / Immersion Cooler
Quick freezer (LT), Plate Contact freezer (PF) ,Blast freezer (BF)
Low & High Temperature Circulation Bath (CnH / HC)
Industrial Chiller (IC/CH)
Aircraft Fuel Test Chiller (CSA)/Altitude Test Chamber/Vacuum Test Chamber
Cryogenic Test Chamber (CTC)
Cryogenic Metal Treatment Chamber (MTC)/Cryogenic Material Tester (CMT)
Multi-purpose Cooling Unit system (CU)
Immersion Cooler(IMC)
Gas Recycler (GR)

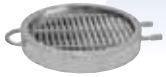
Cryo Cooler-WVCP for Ultra High Vacuum

Water Vapor Cryo Pump

Cryo Cooler - Only Operon!
Patent number 0469537

Specifications

- Application of Cryogenic Cooling System which is registered to the international patent
- Maximizing stability and reliability with the application of advanced production technology and mass-production technology of -156℃ cryo freezer
- Realization of cost effectiveness with standardized components and mass production technology
- Maintenance: Preparation and supply of standardized components (compressor, refrigerant and control device) for quick repair and realization of inexpensive maintenance cost with simple repair process



[Baffle]

Features

- High speed vacuum system
- Water Vapor cryo pump : $1x10^{-5Torr}$ ~ $1.5x10^{-10Torr}$
- Prevention of oil backflow
- Simple installment and maintenance
- Resolution of inconvenience / risky factors / high cost of using liquid nitrogen
- Cryogenic cooling system with low temperature difference in a high speed vacuum
- Provide high quality product production environment with the partial pressure of low water vapor

Control System

- Digital Controller

Application of the product

- Vacuum Evaporation Coating
- Film Deposition
- Semiconductor, LCD sputtering
- Optical Industry
- Various industries which need high speed ~ high degree vacuum

Option

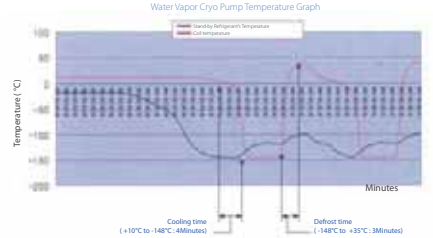
- Air cooling type
- Remote control system

Cryo cooler / Water vapor cryo pump

Model	WVCP-1500	WVCP-1650
Max. temperature	-150℃	-165℃
Operation temp. range	-90℃~-150℃	-90℃~165℃
Vacuum pressure	$1x10^{-5Torr}$ ~ $5x10^{-10Torr}$	
Size(Out)	W1204 x D804 x H1852	
Pre-cooling speed	80Mim.(Attm 25℃ ~ -120℃ Stand-by)	
Cryo-coil cooling	Cryo coil on (+10℃ to -140℃ : 4min.)	
Defrost time	Heatup (-140℃ to +10℃: 2min.)	
Defrost	Hot gas by pass	
Stand-by time	3Min. (Defrost off / Stand-by delay time)	
Operation	Cryo coil on — Defrost — Stand by — Cryo coil on	
Cooling water	25 L/Min.	
Heat removal capacity	Max. 3,600Watts at (-90℃) Min. 150Watts at(-150℃)	Max. 4,500Watts at (-90℃) Min. 150Watts at(-165℃)
Cryo coil	09.52mm or 012.7mm (Standard Capacity for 6m, Optional-9m)	
Refrigerants	CFC-free Mixed-Refrigerant (WVCP-MX7)	CFC-free Mixed-Refrigerant (WVCP-MX9)
Electric requirement	380V / 440V 3phase 50 /60 Hz or 220V 3phase 50 / 60 Hz	
Weight	480Kg	570Kg

Option ■ Air cooled condenser ■ Remote control system

WATER VAPOR CRYO COOLING & DEFROSTING GRAPH



Centrifugal speed vacuum concentrator(SVQ)

Speed Vacuum (Speed Vac) Concentrator (Centrifugal vacuum concentrator)

Features and advantages

- It is all-in-one type in which rotor, cold trap and vacuum line part are embedded. It does not need large installment area, and it has a low risk of vacuum leak through the connection part. Also, the base controls the vacuum pump to prevent a blackout occurring in the process of concentration and sample contamination caused by a pump halt.
- The temperature range of the cold trap is wide and various, so the user can choose the most appropriate model for the experiment. -70℃, -95℃ and -120℃ models are available, and the user can choose the rotor capacity. Especially, if the user has other cooling equipment like the cold trap or previous freeze dryer, MSVQ-20 model is highly appropriate. Anodizing processed high quality rotor and chamber with reasonable price and compact design make concentration experiment quick and simple.
- Indication of the degree of vacuum between 2000mmTorr to 0mmTorr and the temperature of the cold trap on the controller (except MSVQ-20) makes possible to observe the process of concentration and dry.
- The embedded heater transfers heat quickly and evenly and heat until ambient +5℃ ~ +65℃. (option for +90℃)
- Magnetic motor makes sure smooth rotation, and the centrifugal force prevents bumping and foaming of samples, and the samples can be collected in the bottom of a vial after the concentration without loss. (SVQ-120 model, Speed control available)
- When opening the door lid, the device blocks the rotor's rotation to secure the user's safety.

[SVQ-120]

[SVQ-95]

Swing rotor

50ml x 6

15ml x 12

1.5ml x 72

1.5ml x 210

[MSVQ-20]

Centrifugal vacuum concentrator

OPERON -120℃ Centrifugal Speed vacuum concentrator) - SVQ-120
(Centrifugal vacuum concentrator of OPRON contains the cooling equipment to concentrate unfrozen liquid samples quickly.
Especially, -120℃ cryogenic centrifugal vacuum concentrator can capture most of organic solvents in the cold trap, so it just uses the oil rotary pump which is used in the freeze dryer. Degree of concentration is 10^{-3}mTorr, and it can perform not only as a concentrator but also a freeze dryer.

Centrifugal vacuum concentrator (Speed vacuum concentrator)

Model	SVQ-120	SVQ-95	SVQ-70	MSVQ-20
Max.Temperature	-120℃	-95 ℃	-70℃	-
Dimension	W850 x D796 x H987	W500 x D646 x H976		W213 x D335 x H223
Rotor	1.5mlx210Hole built-in	1.5mlx72 Hole built-in		1.5mlx20Hole
Speed	1800rpm			2000rpm
Drive Motor	AC insuction 90W			
Heater	250W/(Amb.). + 5℃ to +90℃			+5℃ to +65℃
Defrost	Hot Water			
Vacuum Guage	10^{-3Torr}			0~76cmHg
Electric	16A	12A	8A	3A
	220V/1Ph			
Weight	190Kg	145Kg	110Kg	12Kg

Option

- Rotor free selection (15mlxl2hole, 50mlx6 hole, swing rotor for micro plate)
- Vacuum pump
- Heat control & Speed controler

Options

1. Vacuum pump (range): 100LPM ~ 1600LPM
2. Chemical trap
3. Oil mist trap
4. Activated carbon
5. T-type manifold (for freeze drying)
6. Vacuum valve + Cap + Adaptor (for freeze drying)
7. Rotor (1.5ml x 72hole / 210hole, 15ml x 12hole , 50ml x 6hole , Micro plate Swing Rotor)

Cold Trap (CT)/ Vacuum Vapor Trap (VT)

Cold Trap / Vapor Trap

Features and advantages

This product is designed to be appropriate for the purpose of the product with the technology registered to the international patent (Korea, the United State, Germany, China).
The cooling system with compact design and strong cooling power secures reliability and stability satisfying the users. According to use, it is classified into for moisture capture and for organic solvent capture. Also, trap chamber is categorized into three models such as the model in which borosilicate is put in the corrosion resistant stainless cooling container, and the model in which the cooling coil is installed in the vacuum chamber, and the model which is coated with Teflon to prevent the cold trap chamber from corrosive gas.
It is produced as standardized products from 1.8L for the laboratory to 50L for the industry. According to capture type like moisture, methanol, ethanol, solvent, acid or organic solvent etc, the user has various options with different freezing point (from -40℃ to -120℃)
For the laboratory, it is installed in the front of the vacuum pump to capture moisture and alcohol occurring from the vacuum oven, gel dryer, vacuum concentration, and for the industry, it is used for vacuum drying, vacuum furnace, vacuum concentration and solvent recovery and to capture harmful substances from the production process, anesthesia gas and rare gas.
Vacuum vapor trap and water vapor cryo pump are used to improve degree of vacuum and to maintain high degree vacuum in various vacuum industries.

[Coil type]

[Glass type] [stick type] [Glass]

Cold Trap (CT)

Specifications

- This cold trap prevents vapor flowing into the vacuum pump efficiently.
- The cooling coil with the lowest temperature -120℃ captures gas flowing into the vacuum pump efficiently.
- Powerful cooling function to reach -80℃ in 25 minutes
- It can be used as cryo bath.

Control System

- Microprocessor control system
- Digital temperature indicator which adjusts the temperature by 1℃

Application

- It is applied to food, medical, agricultural science, biochemistry, pharmaceutics, Korean medicine, petro-chemistry and semiconductor industries, and it is also applied to functions or equipment like gel drying, evaporators, dryers, protection of oil sealed vacuum pump, dehydration of gas steams.

[CT-70P] [CT-100P] [CT-50G] [CT-50B] [CT-50C]

Cold trap/ Vacuum vapor trap(Glass type)

Model	CT-120P	CT-90P	CT-70P	CT-50P	CT-90G	CT-70G	CT-50G
Trap Temperature	-120℃	-90℃	-70℃	-50℃	-90℃	-70℃	-50℃
Dimension	W500 x D646 x H976		W345 x D474 x H540		W345 x D474 x H540		
Cold Trap	Φ65 x 400mm		Φ65 x 400mm		Φ155 x 195mm		
Capacity	-		-		1.8L(water)		
Compressor	Hermetic compressor(1 or 2sets)						
Weight	80kg	70kg	50kg	40kg	50kg	40kg	35kg

Cold Trap (CT)/ Vacuum Vapor Trap (VT)/Immersion Cooler

Cold Trap / Vapor Trap

Cold trap/ Vacuum vapor trap - lab scale(Coil type)

Model	CTL-1.8			CTL-4.5				CTM-6.0				CTM-12			
Trap Temperature	-50℃	-70℃	-90℃	-50℃	-70℃	-90℃	-120℃	-50℃	-70℃	-90℃	-120℃	-50℃	-70℃	-90℃	-120℃
Dimension	W345 x D470 x H620			W500 x D650 x H950			W860 xD800 xH950	W500 x D650 x H950			W850 x D750 x H950	W850 x D750 x H950			W1300 xD1600 xH2000
Cold Trap	Φ155 x 195mm			Φ315 x 210mm				Φ315 x 300mm				Φ315 x 450mm			
Capacity	1.8L			4.5L				6L				12L			
Compressor	Hermetic compressor(1 or 2sets)														
Weight	35kg	40kg	50kg	40kg	45kg	110kg	140kg	110kg	120kg	150kg	190kg	170kg	180kg	190kg	210kg

CTI - Industrial scale Cold trap and Gas Liquefaction ststem(Cold trap / Vapor trap / Gas liquefaction system - Industrial scale)

Model	(Cold trap / Vapor trap / Gas liquefaction system) - Industrial scale															
	CTI-20				CTI-32				CTI-50				CTI-100			
Cold trap temperature	-50℃	-70℃	-90℃	-120℃	-50℃	-70℃	-90℃	-120℃	-50℃	-70℃	-90℃	-120℃	-50℃	-70℃	-90℃	-120℃
Dimension(Engine)	W850 x D1200 x H1350mm				W1000 x D1400 x H1750mm				W1200 x D1000 x H1200mm				W1300 x D1600 x H2000mm			
Trap size	(Φ345) x 480mm				(Φ420) x 750mm				(Φ770) x 1145mm				(Φ770) x 1145mm			
Capacity	20L				32L				50L				100L			
Compressor	Hermetic or Semi-hermetic Compressor 1 or 2set															
Electrical power requirement	AC380V or AC220V 3Ph 4line (R-S-T-N) + G															

(Electrical power to be changed depending on the type & capacity of pump applied)

Immersion Cooler (IMC)

Specifications

- The cooler which is able to be easily moved and installed in the water bath, trap or the place which needs local cooling
- It maintains the stable and steady temperature of samples in bath.
- Attached with the flexible cooling bar

Control System

- Freeze samples to the lowest temperature -120℃ only with the connection to the power without separate temperature control.

Option

- Microprocessor control system
- Digital temperature indicator which adjusts the temperature by 1℃

Application

It is applied to sample freezing, Vapor Trapping, Shell Freezing, Thermostatic baths, Aquariums, ASTM metal & plastic test, Reaction vessels, Flash & Rotary evaporators, parylene coating system and, chemical reaction cooling test, etc.

Immersion Cooler

Model	IMC-120	IMC-90	IMC-40
Min. Temperature	-120℃	-90℃	-40℃
Size	W500 x D550 x H850	W345 x D474 x H540	
Cooling coil/Probe	Φ12x1.2m (Flexible SUS)/Probe size & type selectable		
Temp. Accuracy	+/- 0.2℃		
Compressor	1set	1set	1set
Weight	110kg	70kg	38kg

※ The shape and size of Probe can be customized if the customer requests.

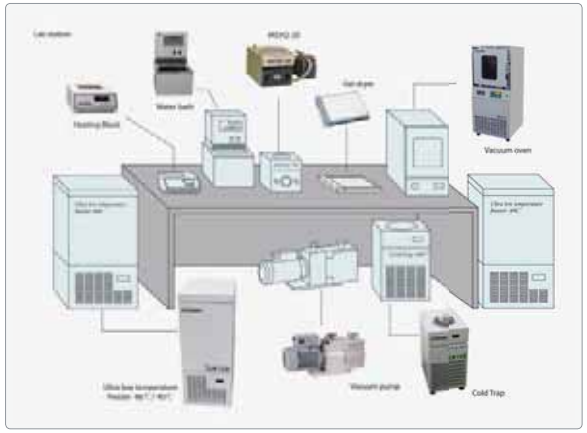
[Probe]

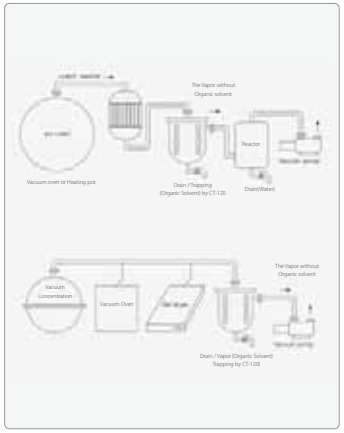
VOD-Vacuum oven with cold trap

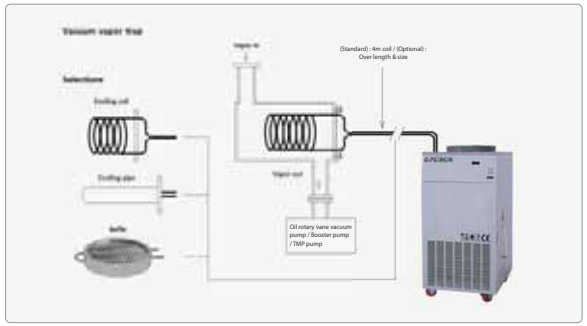
[VOD-7060(-70℃ / 60L)]

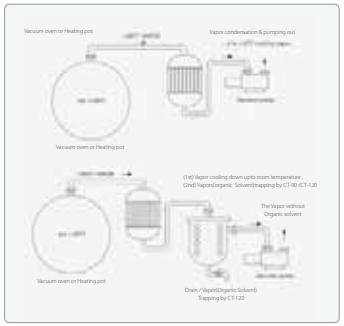
Cold Trap (CT) / Industrial Scale Cold trap / Vapor trap

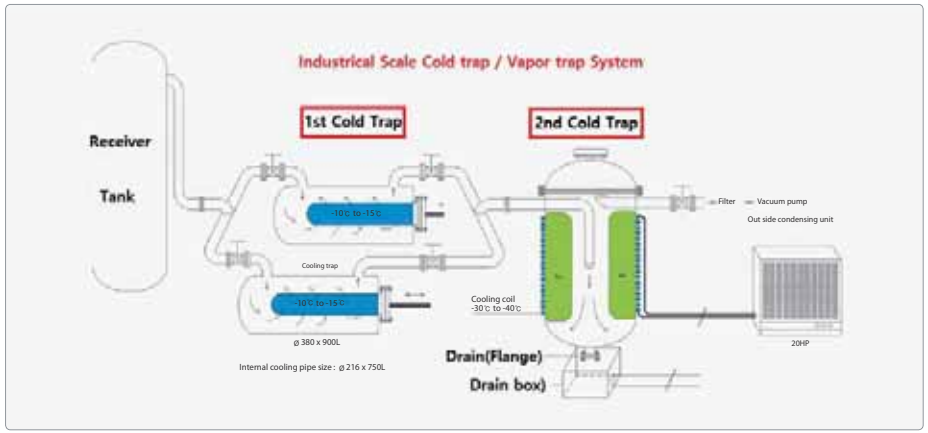
Cold trap / Vacpor trap solution











LT-40 / PF-40 / BF-3000

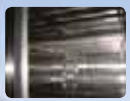
Blast freezer (Quick freezer) / Quick Plate Contact freezer (Plate cooler)

Blast freezer (Quick freezer)


[LT-40]


[PF-40]


[BF-3000]


[BF-3000(IN)]

Model	OPR-LT-40 (BLAST FREEZER)
Dimension	(In) W750 x D620 x H1200 (Out) W980 x D1105 x H1990
Materials	(In/Out) Stainless steel SUS-304
Capacity	558L
Temperature performance	-40°C(ambient temp. 30°C)
Core sample freezing range	0°C ~ -5°C/from 30°C to / 25 ~ 55MIN.
Defrost time	30min.(Heat up from -40°C to +30°C)
Heater	1.2Kw x 220V - 2 sets +30 °C fixed for defrost,+125°C cut-off
H.T.C.S	Over heat protector +50°C~+320°C
Insulation	High density poly urethane form 100mm~150mm
Refrigeration	Two stage cascade system, Non-CFC
Compressor FAN	Hermetic compressor 3HP x 3sets(or 2sets)
Compressor	16W x 3EA IS-4425YSB
Condenser	Water cold condenser
Evaporator	(1100 x 200 x 150) x 2set
Circulation Fan	16W x 3EA(외 250)IS-4425YSB
Water supply	18L/Min.
Temperature controller	3EA/DX-3
Temperature display	Digital LED out(Cooling water temp./Chamber temp./ Core sample temp./Defrost temp.)
Sensor	Two PT 100Ω for chamber temp, and Core sample temp. One sensor CA for water cold condenser
Alarm	Buzzer when door opened 5min./when reached at set temp. Core sample/when overheated the cooling water
Door	1door
Power	220V. (60hz) 18A, 200V(50hz) 20A, 5KW
Shipping size & Weight	W1300 x D1420 x H2260/620kg

Option ■ Tray - 8shelves(W740 x D620 x H4) x 8ea ■ Tray car ■ Air cold condenser

Model	BF-3000 (BLAST FREEZER)
Dimension	(in)W1600 x D1300 x H1500mm / (Out)W2500 x D1800 x H1750mm
Materials	(In/Out) : Stainless steel SUS-304
Capacity	3000L
Temperature performance	-45°C (at ambient temp. +30°C)
Core sample freezing range	0°C ~ -5°C / from 30°C to 60 ~ 120min.
Defrost time	30-50min.(Heat up from -40°C to +30°C)
Heater	1.5Kw x 220V ~ 6sets +30°C fixed for defrost , at +125°C cut-off
H.T.C.S	Over heat Protector +50°C ~ +320°C
Insulation	High Density Poly Urethane foam 100mm ~ 150mm
Refrigeration	Two stage Auto cascade systems, CFC-free refrigerants
Compressor Fan	Air cooled condenser (BCCI-0006 x 4)
Compressor	Hermetic compressors
Condenser	Air cooled condenser type
Evaporator	built in
Circulation Fan	(Alco) : 9 x NUT6B16PUN201 / FAN 9" Angle - 34degree / Air flow about 557CFM/unit
Air ventilation/Circulation	Required
Temperature controller	LED digital display (Ambient temp. /Chamber temp. / Core sample temp. /Defrost temp.)
Temperature display	3 x PT-100 for chamber temp. Core sample temp. and Ambient temp.
Sensor	Two PT-100Ω for chamber temp. and core sample temp. One sensor for warm condenser
Alarm	Buzzer when door opened 5min./when reached at set temp./ core sample/warm condenser/high room temperature
Door	Single
Power	AC380V 3ph, 4line (R-S-T-N) + G, 20A, 7.5Kw
Shipping size & Weight	about W2800 x D2100 x H2100mm / 1200kg

Option ■ Tray ■ Tray car ■ Trolley(W740 x D470 x H1100) ■ Water cooled condenser

Model		PF-40 (PLATE FREEZER)
Number of Bags		500ml bags x 12EA / 350ml bags x 15EA
Temperature	Max.	-80 °C
	Operation	-40 °C
Cooling time		40min. ~ 45min.
Refrigeration system		Two stage auto cascade systems(3hp x 2set)
Dimension	Plate	W740 x D470 x H70
	Overall	W1080 x D900 x H1010
Materials	Internal	Aluminum plate and SUS
	External	Cold rolled steel with powder coated
	Insulation	High density urethane foam
Sensor	Temperature control	PT-100Ω
	Chamber	PT-101S2
Caster		4ea of casters with stopper
Power sources		400V, 3ph, 60hz/50hz
Application		Quick freezing for fluid bags, Semiconductor, Metal etc..

Quick freezer (Blast freezer / Quick plate freezer)

Quick freezer of OPERON is widely used to food processing field like marine and agricultural products as well as fluid bags, metal and semiconductor industry.
It is applied to food processing industry or high quality agricultural or marine products because it can increase freshness by making them go through the ice crystal zone quickly within 30~50 minutes.
Also, Quick plate freezer is used to prevent the deterioration of samples by freezing fluid quickly which should be preserved under the low temperature for a long time.
OPERON quick freezer's advantages
1. Quick freezing (within 30~50minutes) and rapid defrosting system
2. Application of double safety system for fan motor rotation and prevention of cold damage when opening the door.
3. Convenient one touch processing system
4. Compact and simple structure and high efficient cooling system

Low & High Temperature Circulation Bath (CnH & HC)

Circulation bath (Cooling & Heating)-for reactor and distiller

- Circulation Bath(Cooling & Heating) for Reaction Unit and Distillation Unit
- Order made available for the Distillation unit and Reaction unit

- Compact design
- Options for the wide range of capacity and the temperature
- Powerful cooling and heating performances

Model		CnH-2505 / CnH-4005 / CnH-6005 / CnH-7005 / CnH-8005 / CnH-9005	CnH-2510 / CnH-4010 / CnH-6010 / CnH-7010 / CnH-8010 / CnH-9010	CnH-2520 / CnH-4020 / CnH-6020 / CnH-7020 / CnH-8020 / CnH-9020	CnH-2530 / CnH-4030 / CnH-6030 / CnH-7030 / CnH-8030 / CnH-9030	CnH-2540 / CnH-4040 / CnH-6040 / CnH-7040 / CnH-8030 / CnH-9040	CnH-2550 / CnH-4050 / CnH-6050 / CnH-7050 / CnH-8050 / CnH-9050
Volume Capacity		5L	10L	20L	30L	40L	50L
Temperature	Range	-25℃ / -40℃ / -60℃ / -70℃ / -80℃ / -90℃ ~ 0℃, +150℃(Option)					
	Accuracy	+/-0.1℃					
	Uniformity	+/-0.1℃					
	Controller	PID with digital setting & display(Micom. Soft touch key pad)					
Heater		1.2kW ~ 8kW (Option)					
Refrigeration unit		Single or Two stage cascade system					
Dimension (mm)	Bath	W340 x D240 x H160		W400 x D500 x H200		W400 x D500 x H400	
	Overall	W500 x D660 x H1360		W850 x D800 x H1360		W850 x D800 x H1700	
Materials	Internal	SUS-304					
	External	Cold rolled steel with powder coated					
	Insulation	High density urethane foam					
Sensor	Temperature control	PT-100Ω					
	Overheat protection	PT-100Ω					
Caster		4EA of casters with stopper					
Power sources		220V 1Ph or 380V 3Ph					
Pump		12L ~ 25L/min. , Head pressure(1m ~ 1.2m)					

* The size of cabinet & chamber colud be changed without notice

Circulation bath(Heating)-for reactor and distiller

- Circulation Bath(Cooling & Heating) for Reaction Unit and distillation Unit
- Order made available for the Distillation unit and Reaction unit

Model		HC-20005	HC-20010	HC-20020	HC-20030	HC-20040	HC-20050
Volume Capacity		5L	10L	20L	30L	40L	50L
Temperature	Range	Amb. ~ +200℃					
	Accuracy	+/-0.1℃					
	Uniformity	+/-0.1℃					
	Controller	PID with digital setting & display(Micom. Soft touch key pad)					
Heater		1.2kW~2.5kW					
Refrigeration unit		-					
Dimension (mm)	Bath	W340 x D240 x H160		W400 x D500 x H200		W400 x D500 x H250	
	Overall	W440 x D340 x H660		W500 x D600 x H700		W500 x D600 x H750	
Materials	Internal	SUS-304					
	External	Cold rolled steel with powder coated					
	Insulation	High density urethane foam					
Sensor	Temperature control	PT-100Ω					
	Overheat protection	PT-100Ω					
Caster		4EA of casters with stopper					
Power sources		220V, 60Hz					
Pump		12L ~ 25L/min. , Head pressure(1m ~ 1.2m)					

Low & High Temperature-Industrial chiller IC/CH

Industrial Chiller / Circulator

Industrial Chiller for Reactor / Distillation units

Industrial Chiller (IC) – for reactor and distiller

It is an industrial chiller to cover the wide range of the temperature from -120℃ to +250℃ with powerful cooling and heating which are needed for fluid process.
This product is applied with -156℃ cryogenic cooling system registered to the international patent (Korea, U.S.A, Germany and China), so cooling speed and the power is excellent and stable to operate the system.
It is completely different cooling system from general chillers regarding heat removal capacity and cooling temperature.
It is used for fluid management connected to jacket type industrial reactors or the distiller unit.

Industrial Chiller for Reactor / Distillation units

Item \ Type	IC-4020 IC-6020 IC-9020 IC-12020	IC-4035 IC-6035 IC-9035 IC12035	Item \ Type	IC-4020 IC-6020 IC-9020 IC-12020	IC-4035 IC-6035 IC-9035 IC12035
Operation temp.	-40~+250℃ -60~+250℃ -90~+200℃ -120~+100℃	-40~+250℃ -60~+250℃ -90~+200℃ -120~+100℃	Refrigeration	air-cooled, CFC-free	air-cooled, CFC-free
			Refrigerant	R507/R508B	R507/R508B
Temp, stability at -10℃	0.02℃	0.02℃	Pressure pump	28L/min	28L/min
Temp, adjustment	Digital	Digital	Head pressure	0.6bar	0.6bar
Temp, indication	Digital	Digital	Pump connection	13~16mm	13~16mm
Heating power	2kW	3.5kW	Bath volume	21.8L	21.8L
Cooling power			Expansion tank	8L	8L
at 200℃	1.8kW	2.5kW	bath size	Ø315 x L280mm	Ø315 x L280mm
at 100℃	1.8kW	2.5kW	Dimension	W850 x D780 x H1360	W950 x D800 x H1360
at 20℃	1.8kW	2.5kW	Height of bath opening	1000mm	1000mm
at 0℃	1.8kW	2.5kW	Net weight	140Kg	180Kg
at -20℃	1.5kW	2.3kW	Power supply	220V/1phase(50/60Hz)	400V/3-N 50Hz
at -40℃	1.3kW	2.0kW	Max. current	8A	16A
at -60℃	0.8kW	1.2kW	Fuse	25A	20A
at -80℃	0.25kW	0.5kW	Max. ambient temp.	40 ℃	40 ℃
at -90℃	0.11kW	0.23kW	Min. ambient temp.	5℃	5℃
at -120℃	0.1kW	0.2kW			

Industrial Ultra Low Temperature of Chiller (for production line)

Type	CH-90		
N-Hexan in N-hexane out	+30℃ -90℃	Refrigeration system	Two stage auto cascade system
Cooling Capacity	1.2L/Min -90℃	Compressor	15HP x 2set
Cooling Water	80L/Min +30℃	Refrigerant	First stage - R404A Second stage - Mixed Refrigerant
Temperature Accuracy	+/-0.5℃	Dimension	W1600 x D2300 x H2100mm
Power	380V/440V (20A/17A)	Weight	1650kg

Aircraft Fuel Test Chiller (CSA)/Altitude Test Chamber/Vacuum Test Chamber

Chilled Simulator for Aircraft Fuel / Circulator

Aircraft Fuel chiller

Chill Simulator for Aircraft Fuel of OPERON freezes the temperature of aircraft fuel inside the tank which stores 350L aircraft fuel from the room temperature to -60°C within five hours. The Aircraft Fuel Chiller controls accurately the setting temperature for the experiment, -50°C by +/- 1°C.

The temperature control is applied with PID control system, and it does not use the heating method by electric heat. The control system is installed separately from the chiller base and is provided with the software which controls the temperature on PC.

The monitoring sensor is installed over four points to check the temperature profile of aircraft fuel inside the tank, and values read on the sensor are presented on the monitoring screen and recorded/stored.

The refrigerant line is installed over 3m away from the chiller base and cooling tank using a special flexible tube, so it is easy to be moved and installed.

The chiller base and cooling tank and control devices are established with grounding and static electricity prevention measures to conduct safe experiments.

Altitude-Temperature Test Chamber (ATC)

Altitude/Temperature test chamber is used to perform the environmental test of products or components applied to aerospace and electric & electronic communication field, and it provides various similar environments with the extreme space environment.

Altitude-Temperature test chamber

Model	ATC-300	ATC-200	ATC-100
Chamber size	W500 x D900 x H700	W500 x D900 x H500	W360 x D700 x H400
Capacity	300L	200L	100L
Temperature range	-120°C ~ +180°C		
	-90°C ~ +180°C		
	-70°C ~ +180°C		
Altitude range	150000ft ~ 50000ft / 1mbar		
Controller	LCD touch screen controller with USB		

Vacuum-Temperature Test Chamber (VTC)

Vacuum/Temperature test chamber is used to perform the environmental test of products or components applied to aerospace and electric & electronic communication field, and it provides various similar environments with the extreme space environment.

Vacuum Temperature test chamber

Model	VTC-300	VTC-200	VTC-100
Chamber size	W500 x D900 x H700	W500 x D900 x H500	W360 x D700 x H400
Capacity	300L	200L	100L
Temperature range	-120°C ~ +180°C		
	-90°C ~ +180°C		
	-70°C ~ +180°C		
Vacuum range	1.5 x 10 $^{-3}$Torr		
Controller	LCD touch screen controller with USB		

CTC Cryogenic Test Chamber/ MTC Cryogenic Metal Treatment Chamber

Cryogenic Test Chamber (Upright-Combination type) for Strength test

OPERON -165°C Cryogenic Test Chamber - CTC-165

Cryogenic Test Chamber of OPERON is the cryogenic cooling device to test the strength of materials for an LNG carrier between -165°C to -10°C. It is a creative product of OPERON.

Previously in the most advanced countries, cryogenic test is available with continuous injection of liquid nitrogen connected to the tank lorry, but electronic concentrator operating method of OPERON Co., Ltd cryogenic cooling technology realizes -165°C, so the sample test can be performed with below half of cost comparing to the method using liquid nitrogen for a long time. Also, if the user wants rapid cooling, using it with liquid nitrogen method satisfies both quick freezing and low cost.

It is also used to test tensile strength or degree of fatigue of metals. There are two types of chambers, combination type with flexible fitting which makes it move up & down and back & forth and chest type all-in-one freezer chamber.

[MTC-130/MTC-150] [CTC-165]

Model		CTC-165	CTC-150	CTC-130
Items		Description	Description	Description
Overall (Engine)	Min. Temperature	-165 °C	-150 °C	-130 °C
	Operating temperature	-20 ~ -165 °C	-20 ~ -150 °C	-20 ~ -130 °C
	Dimension	W1000 x D900 x H1750		
	Compressor	7.5HP ~ 5HP x 2Set(Semi hermetic compressors)		
	Refrigeration system	Two stage auto cascade system		
	Condenser	Air cold condenser		
	Refrigerants	CFC-free mixed refrigerants		
	Caster	4EA of Heavy duty wheel-swivel casters(Put master 4")		
	Power requirement	380V 3Ph, 12Kw		
Chamber	Dimension	(In)W356 x D356 x H660		
		(Out)W616 x D866 x H990		
	Circulation fan motor	100W		
	Heater Capacity	1000W		
	Temperature control system	PC Monitoring & Controlling		
	Temperature Acuracy	+/-0.5 °C		
	Sensor	PT-I00(One for chamber, One for Sample)		
	Sensor port	36mm of hole		
	Insulation	150mm of High density urethane foam		
	Inside light	Halogen lamp		
	Viewing port	Triple tempered glass(T 10mm d 130mm)		
	Cylinder sealing	Special made housing seal		
	Rim-heating	Silicone rubber heater		
	Door packing	Special made packing		
	Drain hole	built-in		
	Caster	3"		
	Stabilizer	built-in		
	Power requirement	220V/1Ph , 1.5Kw		
Control system	PC Monitoring & Controlling	Temperature control unit - 1set		
		RS-232 cable - 1 set		
		Software Program CD - 1set		

Cryogenic Metal Treatment Chamber (MTC)

Mechanical Cryo and L.N2 Cryo system

MTC (Cryogenic Treatment / Metal Treatment Chamber)

Model	MTC-165	MTC-150	MTC-130	MTC-110	MTC-90
Overall size	(Out)W2438 x D1200 x H1305mm / W2170 x D900 x H1065mm / W1676 x D890 x H1105mm / W1614 x D890 x H1105mm / (Out)W1614 x D938 x H724mm				
Chamber size	(in)W800 x D800 x H800mm / W1050 x D470 x H610mm / W770 x D460 x H665mm / W600 x D400 xH600mm / W600 x D500 x H400mm				
Temperature range	-50°C ~ -165°C	-50°C ~ -150°C	-50°C ~ -130°C	-50°C ~ -110°C	-40°C ~ -90°C
Capacity	512L	300L	232L	144L	120L
Display	Microprocessor controlled LED digital display 0.1 degree C increment				
Electrical power	AC380V or AC220V 3Ph 4line (R-S-T-N) + G				

Cryogenic Processing, Cryogenic Treatment Chamber

Cryogenic processing or cryogenic treatment (or cryogenic tempering as it is sometimes incorrectly called) is a fascinating and truly spectacular means to increase wear resistance & life on all metals and some plastics.)
Cryogenic processing can be the factor that makes a product dominant in its field, that insures the victory of a racing vehicle, that cuts the production costs to increase profits. It may be the deciding factor in selecting the winner in racing, in production, in product design.
Our process has been verified by application done by the Automobile Company, Excavator Heavey industries, Jig industries, Audio cable industries and others.
We continue to aid researchers by working with corporate researchers and universities. We find that research into cryogenic treatment advances our ability to achieve our excellent results.
We invite you spend some time with us at this website and get a glimpse of what can be accomplished through the use of cold to enhance wear resistance, durability, and profits. See why companies come to us to improve product design and processing economy, why racers come to us to give them the edge to win and win consistently. See why the US Postal Service has found that cryogenically treated brakes last over five times as long as untreated brakes.
Opero's Cryogenic treatment technologies would help you to much improve the precesses , durability and strength.

We offer cryogenic tempering for a vast array of products ad industries including

Industry	Applied Industries example
Machining	lathes, drill bits, cutting and milling tools
Pulp and Paper	saws, chippers, millers and cutters
Oil and Gas	ldrilling, compression, pumps, pumpjack gears, valves and fittings
Mining	drill bits, drilling steel, slasher teeth and face cutters
Food Processing	grinders, knives and extruding dies
Textiles	scissors, needles, shears and cutting tools
Wood Fabricating	saws, drill bits, routing bits and planes
Dental and Surgical Instruments	-

Industry	Advantages & Benefits
Stamping	Increased die and punch performance. Less down time. Less die maintenance. Increased profits.
Forgin	Increased die performance. Less down time. Less die maintenance. Increased profits.
Steel Manufacturing (shearing and rolling)	Increases shear blade life and performance. reduces down time. Can be used on rolls, guides, slitters, bearings, weld dies. Increased profits.
Fleet Maintenance	Increase stopping power by up to 30%. Decrease brake temperature. Increase brake life. Decrease maintenance costs.
Machining Automated Industry	Extend the life of cutting tools. Increase production. Decrease down time.
High Performance Engines	Increase durability on cylinder heads and engine blocks, crank shafts, cam shafts. Everything from spark plugs to headers.
Aerospace and Aircraft Manufacturing	Increased tensile strength. Stress relieves alloys. Higher tolerance machining.
Drilling and Oil Industry	Reduced wear on drill heads and high wear maintenance items.
Firearms	Inprove accuracy. Dissipate heat more effectively. Extend barrel life.
Sporting Goods	Golf balls travel further & lasts longer. Golf clubs hit balls further. Aluminum softball bats are stronger with less vibration.

Industrial Applications Extended Life and Durability

- Machining : lathes, drill bits, cutting and milling tools
- Pulp and Paper : saws, chippers, millers and cutters
- Oil and Gas : drilling, compression, pumps, pumpjack gears, valves and fittings
- Mining : drill bits, drilling steel, slasher teeth and face cutters
- Food Processing : grinders, knives and extruding dies
- Textiles : scissors, needles, shears and cutting tools
- Wood Fabricating : saws, drill bits, routing bits and planes
- Dental and Surgical Instruments

[MTC-90]

[MTC-165]

[MTC-150]

Cryogenic Treatment (Enhance of Durability & Sensitivity, Exfoliation, Shrinkage)

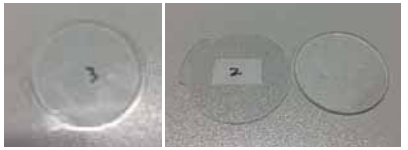
Cryogenic Treatment (Enhance of Durability & Sensitivity)

Diamond cutting tool

End mill

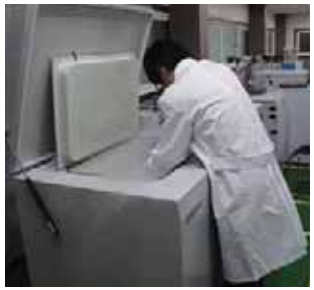
Cable & Rebroadcasting parts

Crygenic Treatment (Exfoliation)

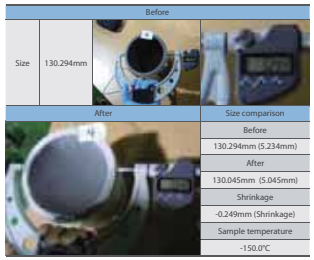


Exfoliation (TSP, LCD, LED, Sapphire Glass)

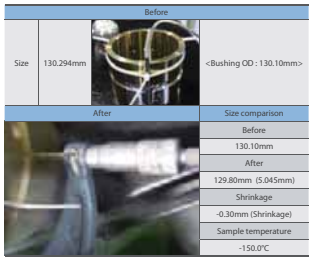
Cryogenic Treatment (Shrinkage)



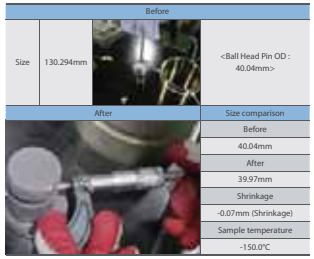
Precision assembling
(Bushing , Bearing , Ball pin , Guide post , Screw etc..,)



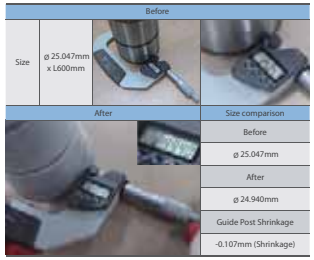
Vessel Engine Parts



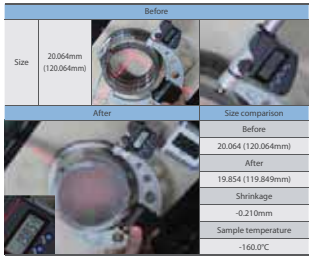
Ball Head Pin



Automobile Parts - Guide post



Bushing



Cryogenic Material Tester : -180°C ~ +180°C

Cooled & Heated
all-in-one type Material tester

CMT (Cryogenic Material Tester)

Model		Cryogenic Material Tester					
		CMT-180180	CMT-165165	CMT-150150	CMT-180	CMT-165	MTC-150
Major specification	Overall size	(Out)W850 x D800 x H980mm					
	Loading stage	(in)Ø80 x H100mm + Insulated lid					
	Temperature range	-180°C ~ +180°C	-165°C ~ +165°C	-150°C ~ +150°C	-180°C ~ -90°C	-165°C ~ -80°C	-150°C ~ -70°C
	Accuracy	+/-1 ~ 5°C					
	Cooling system	Two stage auto cascade system / 2set x 1.5HP hermetically sealed compressor					
	Display	Microprocessor controlled LED digital display 0.1 degree C increment					
	Electrical power	AC220V 1Ph					

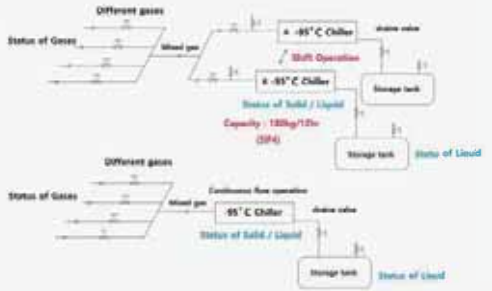
Multi-purpose Cooling Unit system (CU)

Cooling Unit for Gas Liquefaction system / Cold trap / Cryo cooler

High temperature gases Liquefaction

Cold trap system

Gas liquefaction system



Multi-purpose of Cooling Unit

Model		Multi-purpose of Cooling Unit				
		CU-70	CU-86	CU-130	CU-150	CU-165
Major specification	Overall size	About (Out)W2500 x D1500 x H1950mm				
	Cooling capacity(kW) at atmospheric pressure	6500W at -60°C	5500W at -70°C	4000W at -100°C	3000W at -110°C	2000W at -120°C
	Maximum temperature performance	-70°C	-86°C	-130°C	-150°C	-165°C
	Temperature accuracy	+/-2°C				
	Refrigeration system	Two stage auto cascade system				
	Type	Air cooled condenser type				
	Compressor	2set x 15HP(or Equivanent)				
	Display	Microprocessor controlled LED digital display 0.1 degree C increment				
	Monitoring & Controlling	Remote monitoring & controlling via RS-232/RS-485 communication port with interface				
	Electrical power	AC380V 3Ph 4line (R-S-T-N) + G , 30kW ~ 10kW				
Application field		Aerospace.Automobile.Telecommunication - Components test, LNG ship vessel , Pressure vessel test, Large capacity of Space environmetal test, Strength test, Cryogenic fuel tank test , LNG Liquefaction , Chiller for Reactor or Distillation system, Purification & Separation in Petrochemistry industries, Chiller etc.				
be used for various purposes		Connectable different size & shape of chamber depending on User's purpose of use				
Multi-purpose application with single cooling unit	Cooler	Cooling for 28m3 ~ 10m3 chamber				
	Water vapor Cryo pump	Cooling for multi-number of baffles (7ea x 2.5m) with jumpers(12.7mm)				
	Chiller	Circulation chiller (Industrial scale)				
	Test Chamber	Test chamber / Cryogenic Treatment chamber				
	Freezer	Ultra low temperature freezers (Multi-numbers)				
	Cold Trap	Cold trap / Vapor trap / Gas Liquefaction system				
	Thermal test	Thermal test				