

YOSHIKAWA 분·입체 공급장치

# CIRCLE FEEDER<sup>®</sup>

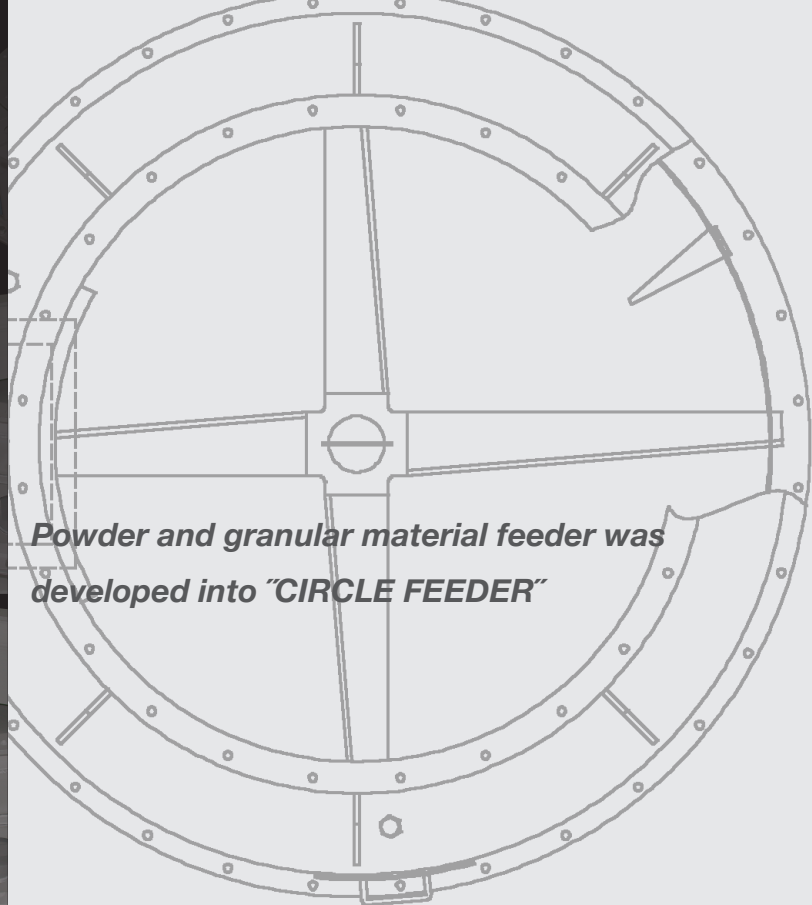
종합 카 다 로 그

Comprehensive catalog



*Powder & Granular Material Feeder by YOSHIKAWA*

분입체 공급장치  
CIRCLE  
FEEDER  
가 해결합니다



*Powder and granular material feeder was developed into "CIRCLE FEEDER"*

**브릿지 · 입도분리 방지**

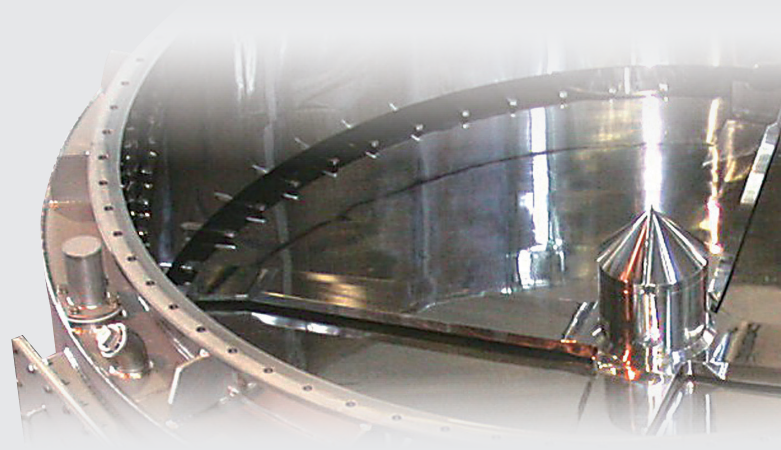
*Bridge and segregation of materials is prevented.*

**Mass-Flow 와 정량공급 실현**

*Mass-flow and uniform-rate feeding are realized.*

**적은 동력으로 에너지 절감**

*Energy saving by low power.*



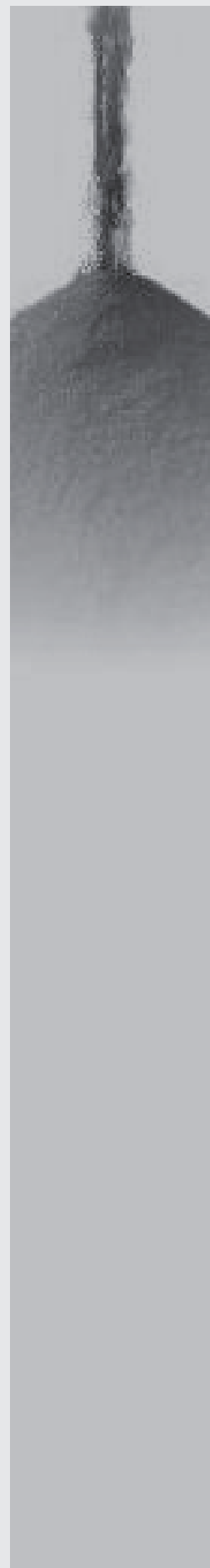
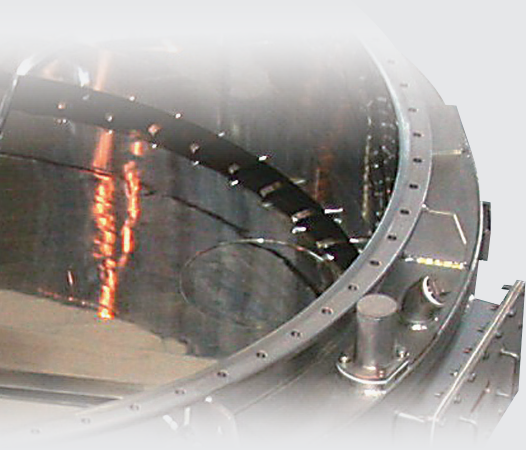
# Contents

## CIRCLE FEEDER

배출원리 및 구조 / 배출량 조절방법 / 사양 / 형식기호 Principles of the Discharge System and Construction Drawing / Adjustment of Discharge Rate / Specification List / Explanation of model code	4
선입선출 / 입도분리 개선사례 Mass-Flow / Segregation improvement case	5
특수사양 / 중량식 제어시스템 Special specification / Measuring system	6

## 응용기기

고정도 (高精度) 형 High accuracy type	CF-Sigma C F - $\Sigma$	7
산업폐기물, 과상 (塊狀) 전용 Dedicated feeder for industrial waste and massive form	Loop Feeder L F	
맥동 저감형 Pulsation reduction type	Disk Feeder D S	
식품 · 의약품용 Sanitary type	Sanitary Type C S	8
집진장치용 Dedicated feeder for duct collector	C F D	
공기이송장치용 Pneumatic conveying type	Pneuma Circle P T C	
컨테이너형 Unit-separating type	Container Unit C U	9
미량 소형기종 Compact size unit	Mini Ace MA	
	Micro Discharge MD	
	Delta D F	
응집제 용해장치 Powder dissolution unit	Y P D	10
Slide gate Slide gate	Yoshikawa Gate Y G	
Batch 식 전자동 스팀장치 Batch type auto steamer	Auto Steamer A S T	
연속식 고구마 찜 & 냉각장치 Continuous sweet-potato steaming and cooling system	S T M A C	
물성별 적용기종 사례 / 실적 분체 사례 Application by powder property / Powder reference list of Yoshikawa		11





# CIRCLE FEEDER

분 · 입체 공급장치

Powder & Granular Material Feeder

## 배출원리 및 구조

Principles of the Discharge System and Construction Drawing

## 사양

Specification List

## 배출량 조절방법

Adjustment of Discharge Rate

## 형식기호

Explanation of model code

분체 · 입체 공급의 모든 문제점을 CIRCLE FEEDER 로 한번에 해결 !!

CIRCLE FEEDER solves every problem with powder and granular materials once and for all.

### 구조

Construction



### 배출원리

- CIRCLE FEEDER 는 Hopper, Silo 하부에 설치합니다.
- 밀판 위를 얇고 평평한 날개가 회전합니다.
- 평평한 날개에 의해 원통 외부로 배출됩니다.
- 외주 회전날개에 의해 배출구로 운반됩니다.

### Construction and Principles of the Discharge System

- CIRCLE FEEDER is to be attached to the bottom of a hopper or silo.
- On the bottom panel of the CIRCLE FEEDER, thin, flat vanes rotate.
- The vanes spread out and move the powder materials to the periphery of the cylinder.
- At the periphery, the powder materials are introduced to the exhaust port by peripheral vanes and discharged.

- ①호퍼 Hopper (Silo)    ②유량조절볼트 Flow adjustment bolt    ③서클피더 CIRCLE FEEDER    ④전동기 Motor

### 배출량 조절방법

- 유량조절링 간격조정 (표준)  
유량조절볼트로 조절링을 위아래로 움직여 배출범위를 조절합니다.
- 회전날개의 회전속도 조정 (옵션 -VVVF)  
회전속도를 올리면 배출량이 증대되고 내리면 감소됩니다.

### Adjustment of Discharge Rate

- Clearance Adjustment of Flow Adjusting Ring (Standard)  
The feed rate is controlled with raising and lowering the height of flow adjusting bolts on the casing by turning the flow adjusting bolts.
- Rotation Speed Adjustment of Rotary Vanes(Optional)  
increases the discharging rate and lower r.p.m. decreases it.  
Mechanical type (Beier Variator Disco, etc.) Electrical type (Inverter, etc.)

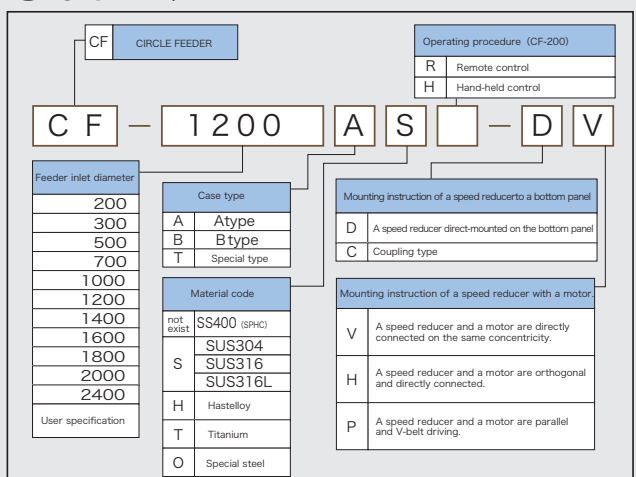
## 사양 Specification

Item	Model	CF-200		CF-300		CF-500		CF-700		CF-1000		CF-1200		CF-1400		CF-1600		CF-1800		CF-2000		CF-2400	
		A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Max. Capability (m <sup>3</sup> /h)	50Hz	0.13	0.66	0.38	0.89	0.92	2.4	4.9	13	10	20	13	29	18	35	20	38	27	48	30	59	40	86
	60Hz	0.15	0.80	0.46	1.1	1.1	2.9	5.9	15	12	24	16	35	22	42	24	46	32	58	36	71	48	104
Min. Capability (m <sup>3</sup> /h)	50Hz	0.05	0.37	0.21	0.49	0.51	1.1	1.9	5.6	3.2	7.4	3.9	9.1	5.3	14	5.9	15	6.8	17	8.6	18	11	32
	60Hz	0.06	0.44	0.26	0.59	0.62	1.3	2.3	6.8	3.9	8.9	4.8	11	6.4	16	7.1	18	8.2	20	10	22	13	38

- 사양은 분체 물성에 따라 달라질 수 있습니다.
- 배출구 표준은 1 개소 입니다. (2 개소 이상 취부도 가능합니다.)
- 표준 이외의 특수사양도 제작하고 있습니다.
  - 재질 (표준 SS400, SUS304) (기타 SUS316, 316L, Titan, Hastelloy, Resin-coating 등)
  - 수밀 (水密) 구조 · 기밀 (氣密) 구조 490.3kPa (5kg/cm<sup>2</sup>) 등 · 내열 사양 (분체온도 700℃ 등) · 내마모 사양 (회전날개 등)
  - 방폭사양 (Exia II B T4, Exd II B T4) · Sanitary 사양 · 회전제어 (인버터)
- CF-200 은 회전제어용 인버터 포함이 표준입니다.
- 대형 CIRCLE FEEDER CF-2400 이상의 대형기종도 제작가능합니다.

- Specifications may vary in accordance with the characteristics of the powder material.
- One exhaust port is provided as a standard feature.  
(Additional ports can be attached as required, e.g. two ports.)
- Additionally, special specification models are also available.
  - Standard materials: SS400, and SUS304  
Optional materials : SUS316,316L, titanium, hastelloy, resin-coating, and etc
  - Watertight construction
  - Airtight 490.3kPa (5kg/cm<sup>2</sup>) for example.
  - Heat-resistant specifications (700℃ of powder material temperature, etc.)
  - Wear-resistant specifications (rotary vanes, etc.) and many more.
  - Explosion-proof specifications (eG3, d2G4)
  - Sanitary specifications.
  - Revolution speed control optionally by Beier, disco, or inverter.
- CF-200 with revolution speed control unit as a standard.
- Large-sized Circle Feeder Equipment larger than CF-2400 is also available.  
Inquiries are invited.

## 형식기호 explanation of model code





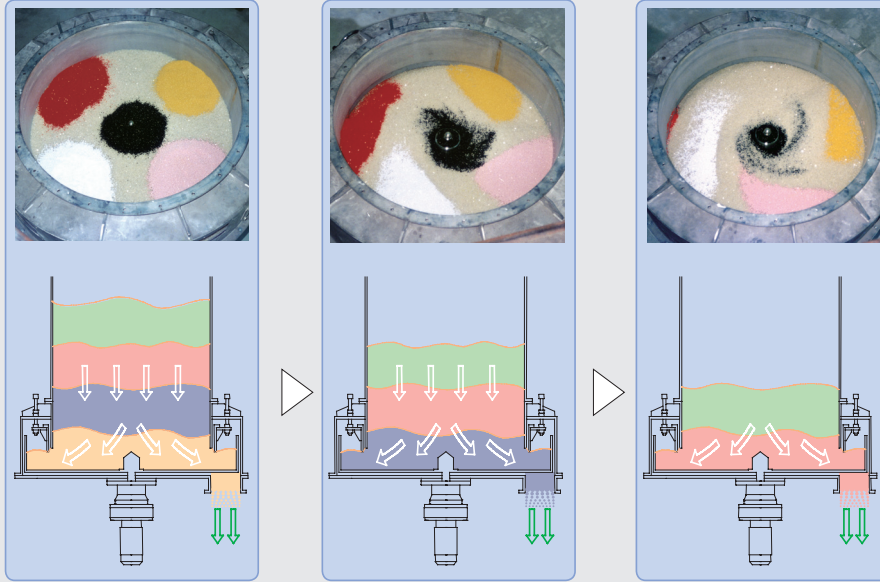
## 선입선출

Mass-Flow

## 입도분리 개선사례

Segregation improvement case

### ① 선입선출 Mass-Flow



### Mass-Flow 란 ? What Is Mass-Flow?

저장조 내의 분체, 입체 전체가 순차적으로 배출되는 것을 Mass-Flow 라고 합니다. CIRCLE FEEDER에서는 분체, 입체가 방사상으로 움직이며, 외주부로 배출하게 됨으로써 Mass-Flow(선입선출)가 가능하게 됩니다.

- Mass-flow is the movement where the entire powder and granular material in a storage tank flows in streams to be smoothly discharged. The Circle Feeder enables mass-flow (first-in first-out) as it allows the powder and granular material to flow radially toward the periphery where it is discharged.

### 입도분리란 ? What Is Segregation?

물성이 다른 혼합된 분체, 입체가 유동할 때, 물리적 성질의 차이에 의해 성분이 분리되는 현상입니다. CIRCLE FEEDER는 Mass-Flow를 통하여 이와 같은 입도분리를 방지할 수 있습니다.

- Segregation is the uneven distribution of components in a powder or granular material that occur during flows of the material due to differences in physical properties of its components. The mass-flow mechanism of the Circle Feeder prevents segregation of powder and granular materials.

### ② 입도분리 개선사례 Segregation improvement case

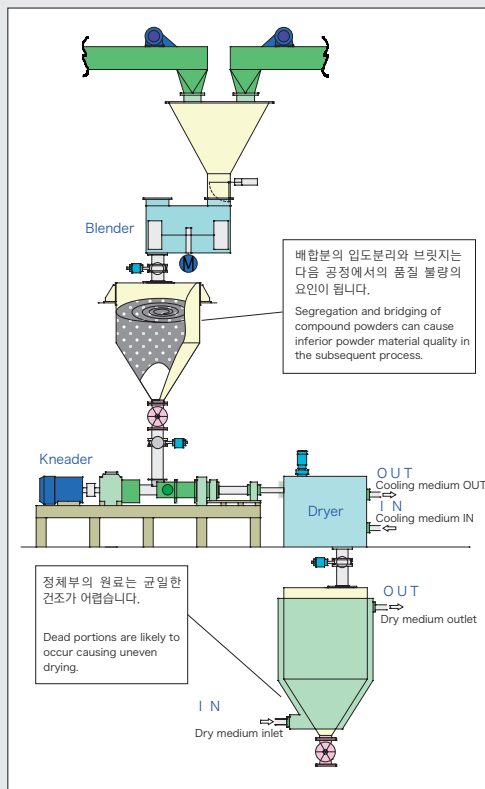
#### ※입도분리방지 Segregation deterrence

입도분리는 육안으로 확인이 어려우며, 분체의 저장, 취급상에서 발생하는 문제는 다양합니다.

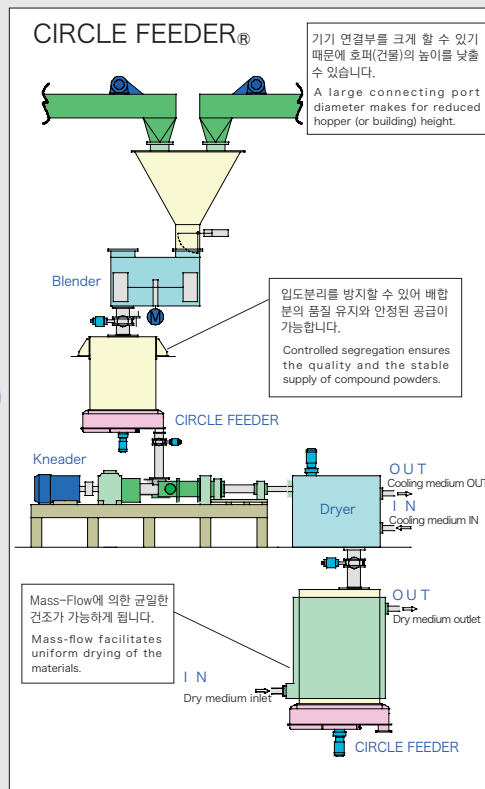
특히 의약, 식품업계에서의 입도분리는 품질저하의 큰 원인이 됩니다.

CIRCLE FEEDER는 Mass-Flow 배출로 입도분리를 방지할 수 있는 세계 유일의 공급장치입니다.

- Segregation is difficult to check visually, and the adverse effects resulting from segregation during storage and handling of powder and granular materials are diverse. For the pharmaceutical and food industries, in particular, segregation is a significant factor in lowered product quality. The Circle Feeder is the one and only feeder in the world that can prevent segregation via mass-flow discharging. Employment of the Circle Feeder will prevent segregation and help improve the stability of product quality.



CIRCLE FEEDER 도입사례



#### 혼합공정

##### Mixing process

입도분리를 억제함으로써 배합 비율을 일정하게 유지하여, 품질 저하를 방지합니다.  
By controlling segregation, the compound ratio can be kept constant, and thereby quality degradation can be prevented.

#### 건조공정

##### Drying process

Mass-Flow 배출로 건조 시간을 일정하게 유지함으로써, 균일한 품질을 얻을 수 있습니다. 가열, 냉각공정에서도 마찬가지로 덩어리(물침)가 발생하지 않습니다. Mass-flow of materials maintains the constant drying time and realizes the uniform material quality. Consistency in materials can be achieved even during the heating or cooling process.

#### 저장공정

##### Storing process

장기간 저장 후 배출하는 경우에도 입도분리와 브릿지가 발생되지 않으며, 안정된 배출이 가능합니다. Segregation and bridging of materials do not easily occur even after a long storage period, whereby stable discharging can be realized.

# CIRCLE FEEDER

분 · 입체 공급장치

Powder & Granular Material Feeder

## 특수사양

Special specification

## 중량식 제어시스템

Measuring system

### ① 특수사양 Special specification

#### Sanitary 사양 Sanitary Specification Models

Hand truck type



Open/close hinge type



Manual lift type



Electric lift type



#### 특수사양 Special Specification Models

Heat resistant type



Pressure-resistant type



Cassette type

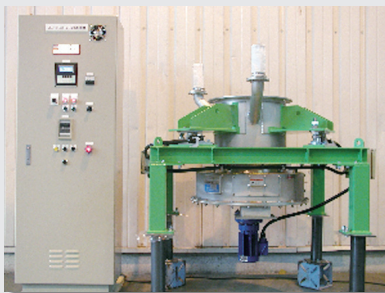


Special coating specifications

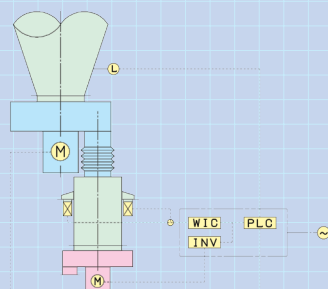


### ② 중량식 제어시스템 Measuring system

#### 구성 예 Composite Examples



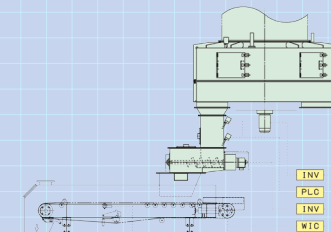
Continuous Uniform-Rate Feeding



High precision measurement

Conveyor Scale과 조합한 계량시스템

계량신호에 의해 CIRCLE FEEDER 를 회전제어하므로, 고정도 공급이 가능합니다.



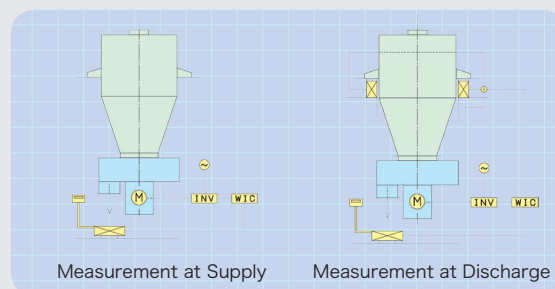
Measuring system with conveyor scale. Rotation of the Feeder is controlled by the signal from the conveyor scale. A combined use with a flow leveler brings about even higher precision feeding.

#### 계량제어장치

로드셀과 조합한 Loss-in Weight 시스템이나 Batch 계량시스템에 의한 고정도 계량 공급이 가능합니다. 또한 다품종 소량의 계량포장 장치나 다수의 공급장치를 조합한 배합계량장치도 구축할 수 있습니다.

#### Simple Measuring Unit

The loss-in-weight system combined with a load cell and the batch-weighing system offer high-precision measurement and feeding. Compound measuring units in combination with a high-mix low-volume measuring & packaging device or multiple feeders can also be constructed.



## CF- Σ

CIRCLE FEEDER와 용적식 공급기의 조합구성으로 높은 공급정도 실현

High accuracy is achieved with a combination of a Circle Feeder and a unique volumetric feeder.

### 특징 Feature

충진부는 브릿지 억제효과가 높은 CIRCLE FEEDER 로 안정공급

Discharger, Circle Feeder, prevents bridging with stable feeding.

독특한 구조에 의한 높은 정량 공급정도 실현

Its unique mechanism realizes highly accurate and uniform-rate feeding.

복수 라인에 각기 다른 능력의 고정도 공급 가능

More than one down-stream is possible with additional discharge ports, each with a different and accurate feed rate.

유지 보수 · 청소 용이

Easy cleaning and maintenance.

물성에 따라, 공급기 (Blade/Disk) 타입선택 가능

Blade type / Disc type (The both types are available)

### 사양

Specification table

#### ◆ Feeder

Model	a	b	c	d	e	f	g	h
Feeding capability	10~60 (Lit/h)	20~120 (Lit/h)	40~250 (Lit/h)	80~500 (Lit/h)	0.15~1.0 (m³/h)	0.4~2.5 (m³/h)	0.85~5.0 (m³/h)	2.0~10.0 (m³/h)
Power supply	AC200/220V 50/60Hz Three-phase AC200/220V 50/60Hz							

#### ◆ Discharger

Model	Σ-300	Σ-500	Σ-700	Σ-1000
Corresponding feeders	a~g	a~g	a~h	b~h
Approximate weight	275	345	480	610



## LF

선상(線狀)으로 엉키기 쉬운 원료나 괴상(塊狀)도 안정 배출

Stable feeding the string materials that are likely to twine around

### 특징 Feature

산업폐기물, 기타 부정형물의 안정공급

Stable supply of industrial waste and other amorphous material.

브릿지 · 입도분리 방지

Bridge and segregation of materials is prevented.

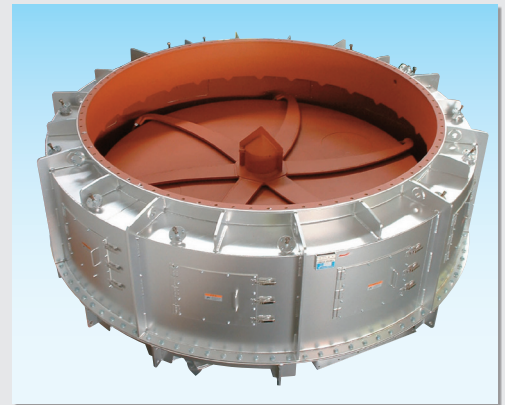
Mass-Flow 로 안정 공급

Mass-flow and uniform-rate feeding are realized.

### 사양

Specification table

Model	LF-1600	LF-2000	LF-2400	LF-3000	LF-3600
Feeding capability	By adjusting the inverter from 6 to 60 Hz, a 1-10 control range of the feeding capability is possible.				
Power supply	Three-Phase AC 200/220V 50/60Hz				
Approximate weight (Kg)	2000	3000	4000	7000	9000



## DS

파손이 적고 안정된 품질로 높은 공급정도 실현

High accuracy is possible with less breakup and stable quality.

### 특징 Feature

입도분리, 파손없이 품질안정

Stable quality with no breakup and segregation.

잔량이 거의 없어 원료 손실 최소화

Reduced the loss of product material of the almost non residual material.

분체, 입체, 괴상 (塊狀) 에 폭넓게 대응

Handle a wide variety of powder, granular, and lump.

맥동이 없는 높은 공급정도

No pulsation with high accuracy.

### 사양

Specification table

Model	DS-300	DS-500	DS-700	DS-1000	DS-1200	DS-1400	DS-1600	DS-1800	DS-2000
Capacity ( m³ /h)	0.6~1.6	1.1~3.3	2.7~8	5~15	7~21	10~30	13~39	17~50	23~67
Approximate weight (kg)	110	280	540	1070	1390	2070	2540	3350	4200





## CS

### 식품·의약품용

For pharmaceutical and food industry

#### 특징 Feature

##### Mass-Flow 로 정량 공급

Mass-flow and uniform-rate feeding are realized.

##### 브릿지 · 입도분리 방지

Prevention of bridging and segregation.

##### 분해, 조립, 청소 용이

Easy to disassemble and assemble.

##### 패킹없는 구조

No packings used.

#### 사양

Specification table

Model	CS-300	CS-500	CS-700
Feeding capability (ℓ / h)	960 ~ 96	2280 ~ 228	5620 ~ 562
Materials	SUS 304 (접분부 Buff #400 외면 Buff #300) SUS304(Powder-contacting section: Buff #400, Outer surface: Buff #300)		
Approximate weight (kg)	140	270	400



## CFD

### 집진장치용

Dust collector of Circle Feeder type

#### 특징 Feature

CFD 는 CIRCLE FEEDER 배출원리에 의한 브릿지 억제효과를 가지며, 집진 더스트를 안정배출합니다.

( 특수사양 / 실적최고온도는 900℃ )

CFD, utilizing the feeding principle of the Circle Feeder, has a bridge preventing effect with a stable discharge of the collected dust. (Max. proven temperature 900 degrees Celsius with special specification units)

#### 표준사양

standard specification

N type

( 더스트온도 :80℃이하 )

#### 내열 공냉사양

Heat-resistant and air-cooled specification

HA type

( 더스트온도 :250℃이하 )

#### 내열 수냉사양

Heat-resistant and water-cooled specification

HW type

( 더스트온도 :360℃이하 )

#### 사양

Specification table

Model	CFD-1000	CFD-1200	CFD-1400	CFD-1600	CFD-1800	CFD-2000	CFD-2200	CFD-2400
	N	N	N	N	HA/HW	N	HA/HW	N
Designed feed rate (m³/h)	6.0	8.0	10.0	10.0	12.0	12.0	12.0	12.0
Approximate weight (kg)	300	370	430	600	700	780	850	900



## PTC

### 공기이송장치용

Ejector installed! Highly accurate feeder for pneumatic conveying

#### 특징 Feature

미량 (0.2 ℓ / h) 공급, 공기이송 가능

Small amount feeding and pneumatic conveying are possible.

정량공급기구에 의한 공급의 안정성 극대화

Stable feeding with highly accurate structure.

Ejector 방식으로 공기누설 (Air leaking) 없음

No air leakage by applying ejector system.

#### 사양

Specification table

Model	Feed rate with 1 port (L / H)					Number of port
	A	B	C	D	E	
PTC- 300	0.2~1.4	1.0~7.0	6.0~4.0	30~200	70~400	1~3
PTC- 500	0.2~1.4	1.0~7.0	6.0~4.0	30~200	70~400	1~4
PTC- 700	—	1.0~7.0	6.0~4.0	30~200	70~400	1~4
PTC-1000	—	—	6.0~4.0	30~200	70~400	1~4



# CU

## 컨테이너형

Container having feeding capability

### 특징 Feature

컨테이너에 의한 저장, 이동 가능

It permits storage and transportation of materials by container.

다품종 소량생산에 최적

It is suitable for various kinds of high-mix, low-volume production.

노동력 절감에 최적

It is designed to reduce labor.

### 사양 Specification table

Model	CU 002	CU 05	CU 10	CU 15
Effective capacity	20L	0.5m <sup>3</sup>	1.0m <sup>3</sup>	1.5m <sup>3</sup>
Feeding capability	0.6m <sup>3</sup> /h	10m <sup>3</sup> /h		
Power supply	Single-Phase AC100/110V 50/60Hz	3 φ AC200/220V 50/60Hz Three-phase AC200/220V 50/60Hz		
Approximate weight(Kg)	45	500	750	950



# MA

## 분체·입체 소형 정량공급기

Powder and granular material and small size feeder

### 특징 Feature

유동성이 나쁜 분체의 미량공급 가능

Feeder that can feed, at a very low rate and small quantity, powder materials that are usually difficult to discharge.

### 사양 Specification table

Model	MA-120	MA-180	MA-260
Feeding capability (ml/min)	40 ~ 400	70 ~ 700	100 ~ 1000
Power	Single-Phase 100V 50/60Hz		
Contact Materials	SUS 304		
Attachments	Speed controller · Tachometer		
Optionnal Parts	Remote control(Separate type),etc.		
Weight (kg)	16	20	30



# MD

## 고정도 소형 정량공급기

High accuracy and small size feeder

### 특징 Feature

CIRCLE FEEDER 원리를 응용하여 유동성이 나쁜 분체의 미량 고정도 공급 실현

With the Circle Feeder principle applied, high-precision feeding is realized even for powders of poor fluidity.

1g/h 미량공급 가능

a small amount of feeding with 1g/hr

분해 · 청소 용이

Easy disassembly and cleaning

### 사양 Specification table

Model	MD-120	MD-180
Capacity (cc/min)	0.52 ~ 166.7	5.2 ~ 1667
Power supply	Single-Phase 100 / 200V 50 / 60Hz Three-Phase 200 / 220V 50 / 60Hz	
Option	Scraper	



# DF

## 분체, 입체 소형 정량공급기

Compact, Uniform ratio powder feeder

### 특징 Feature

계량기를 사용하지 않고, 0.5% 의 고정도를 실현

1 ml /min 부터 넓은 범위의 공급 가능

Without using a scale, high precision of ±0.5% was realized in widely ranged feeding rates, 1ml per minute at minimum.

### 사양 Specification table

Model	DF-100
Capacity	12 ~ 120 ml/min
Feed Accuracy	± 0.5% 이하
Contact Materials	SUS303
Power Source	Single-Phase 100V 50/60Hz



## YPD

응집제 용해장치(응집제 이외의 분체의 용해에도 이용 가능)

Polymer Dissolution System(applicable to the other powder dissolution than polymer)

### 특징

Feature

독자적인 초기 용해방식에 의한 완전 용해 실현 (특허)

The unique initial dissolution system achieves thorough dissolution of the flocculant.

응결방지 슈트 적용으로 안정공급 가능 (특허)

Stable feeding is possible with applying chute of dew condensation prevention.

표준사양의 N 타입과 고기능 사양의 P 타입을 라인업

The lineup of standard N type and high-function P type.

### 사양

Specification table

Model	YPD-05	YPD-10	YPD-20	YPD-30
Dissolver capacity	0.5 m <sup>3</sup>	1.0 m <sup>3</sup>	2.0 m <sup>3</sup>	3.0 m <sup>3</sup>
Dissolved oxygen concentration	0.1 ~ 0.2 wt%			
Hopper volume	50 L (option 70 • 90 L)			
Supply-water specification	Quantity of water supply : 20L / min Over • Pressure of water supply : 0.15 ~ 0.7MPa			
Supply-air specification	Air pressure : 0.4 ~ 0.7MPa			



## YG

분체·입체 전용 Slide gate

Slide gate for especially powder and granular

### 특징

Feature

부드러운 동작으로 분체를 확실하게 차단

Shut off the material by smooth performance.

그랜드패킹으로 분말 Sealing

Sealed with gland packing to protect powder leakage.



## AST

Batch식 전자동 스팀장치 (곡물, 고구마 이외에도 적용가능)

Batch type auto steamer (applicable to the other than cereals, sweet potato)

### 특징

Feature

자동제어에 의한 증기 손실 감소

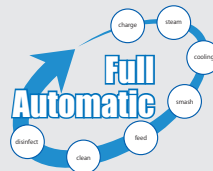
Reduced the loss of steam by automated control

수냉식 냉각실에 의한 냉각시간 단축

Shorten the cooling time by cooling and water room

냉동 고구마 해동, 스팀 가능

Thaw frozen sweet potato, steam is possible



### 사양

Specification table

Model	AST 30	AST 50	AST 100
Power supply	Three-Phase AC 200 / 220 V 50 / 60 Hz		
Feed Rate	1.5 ~ 3.0 t / Batch	3.5 ~ 5.0 t / Batch	~ 10 t / Batch
Materials	C/S • SUS304		
Setting Place	Indoor		
Safety device	safety valve • pressure sensor		
other	Include the control panel		

## STMAC

연속식 고구마 스팀, 냉각장치

Continuous sweet-potato steaming and cooling system

### 특징

Feature

고구마 쌓이는 높이를 일정하게 하여, 고른 증기·냉각가능

Sweet potatoes maintained at a constant height level in the processing tank ensure uniform steaming and cooling.

일일 100 톤까지 처리 가능 (특수사양)

Capable of processing up to 100 tons per day (Non-standard specifications)

자동세척, 살균기능

Features automatic cleaning and sterilizing functions.

### 사양

Specification table

Model	STMAC-20	STMAC-40	STMAC-80
Power supply	Three-Phase AC 200 / 220 V 50 / 60 Hz		
Feed Rate	20 t / Day	40 t / Day	80 t / Day
Materials	C/S • SUS 304		
Setting Place	Indoor		





# 물성별 적용기종 사례

Application by powder property

## 적용실적 분체 · 입체

Powder reference list of Yoshikawa

### ① 물성별 적용기종 사례 Application by powder property

	Powder			Flake		Lump	
	Flowability Large	Flowability Midium	Flowability Small	weak	strong	weak	strong
C F							
C F - Σ							
L F							
D S							
C S							
P T C							
C U							
C F D							
M D							
D F							
M A							

### ② 적용실적 분체 · 입체 Powder reference list of Yoshikawa

#### ● 화학관련

탄산칼슘, 배합비료, 목분, 소다회, 가루비누, 산화티탄, 염료, 염화칼륨, 안료, 수지, 건조오니, 화학섬유, 코크스, 석탄, 고로슬러그, 펄프슬러지 등

#### ● 식품

옥수수녹말, 커피검질, 찐고구마, 차, 밀가루, 콩가루, 전분, 우롱차, 고탄수율 케익, 아미노산 + 가쓰오부시, 맥주찌꺼기 등

#### ● 곡물사료

쌀겨, 대두, 맥당, 소맥배아, 계분 등

#### ● 기타

알루미늄, 안티몬, 해면펠프, 주물사, 에폭시 수지, 소각재, 소석회, 과상 셀룰로즈유도체, 카본블랙, 함침펠프칩, 오일코크스, 톱밥, 오니 등

#### Powdery Substance Examples(Applicability Proven)

##### ● Chemical Substances

Calcium carbonate, mixed fertilizer, charcoal, soda ash, sodium phosphate, soap powder, titanium oxide, dyes, potassium chloride, strontium carbonate, pigment, resin, dry sludge, chemical fiber, coke, coal, blast furnace slag, pulp sludge, etc.

##### ● Food

Corn starch, coffee grounds, steamed sweet potato, tea, flour, soy bean flour, starch dogtooth violet starch, oolong-tea, amino + dried bonito, ground hydrangea tea, etc.

##### ● Feed

Rice husk, wheat bran, bran, coconut pulp, rape seed pulp, soy bean residue, wheat germ, fish meal, fowl drippings, minced chicken/pork, etc.

##### ● Others

Adipic acid, alumina, antimony, sponge pulp, foundry sand, epoxy resin, mica, incineration ash, lump cellulose derivative, carbon black, impregnated pulp chip, oil coke, sawdust, sludge, etc.



pigment



silica · dehydrated cake



coke sludge



ceramic related powder



resin cake, food cake



Coal



plastic waste



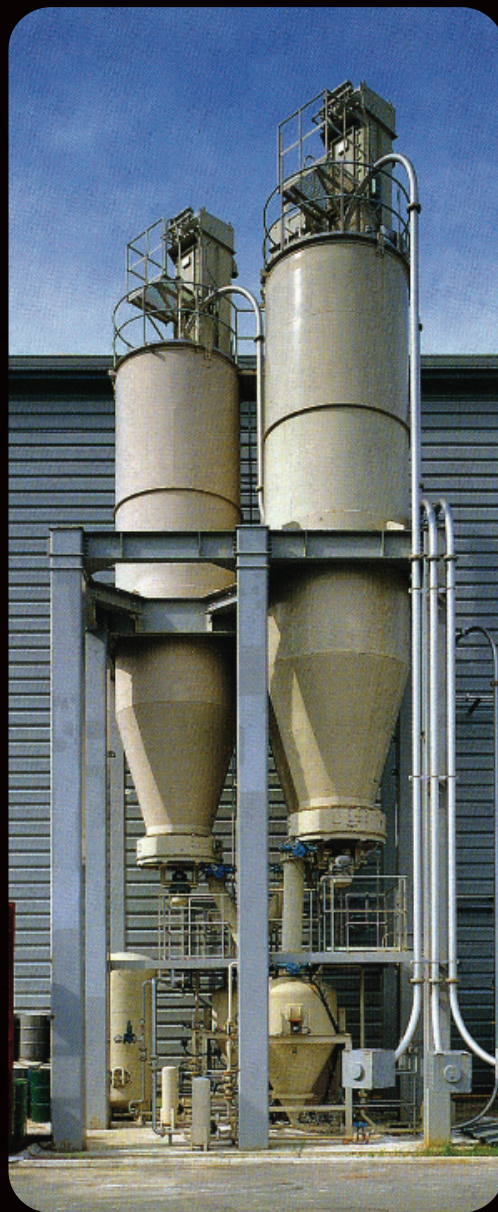
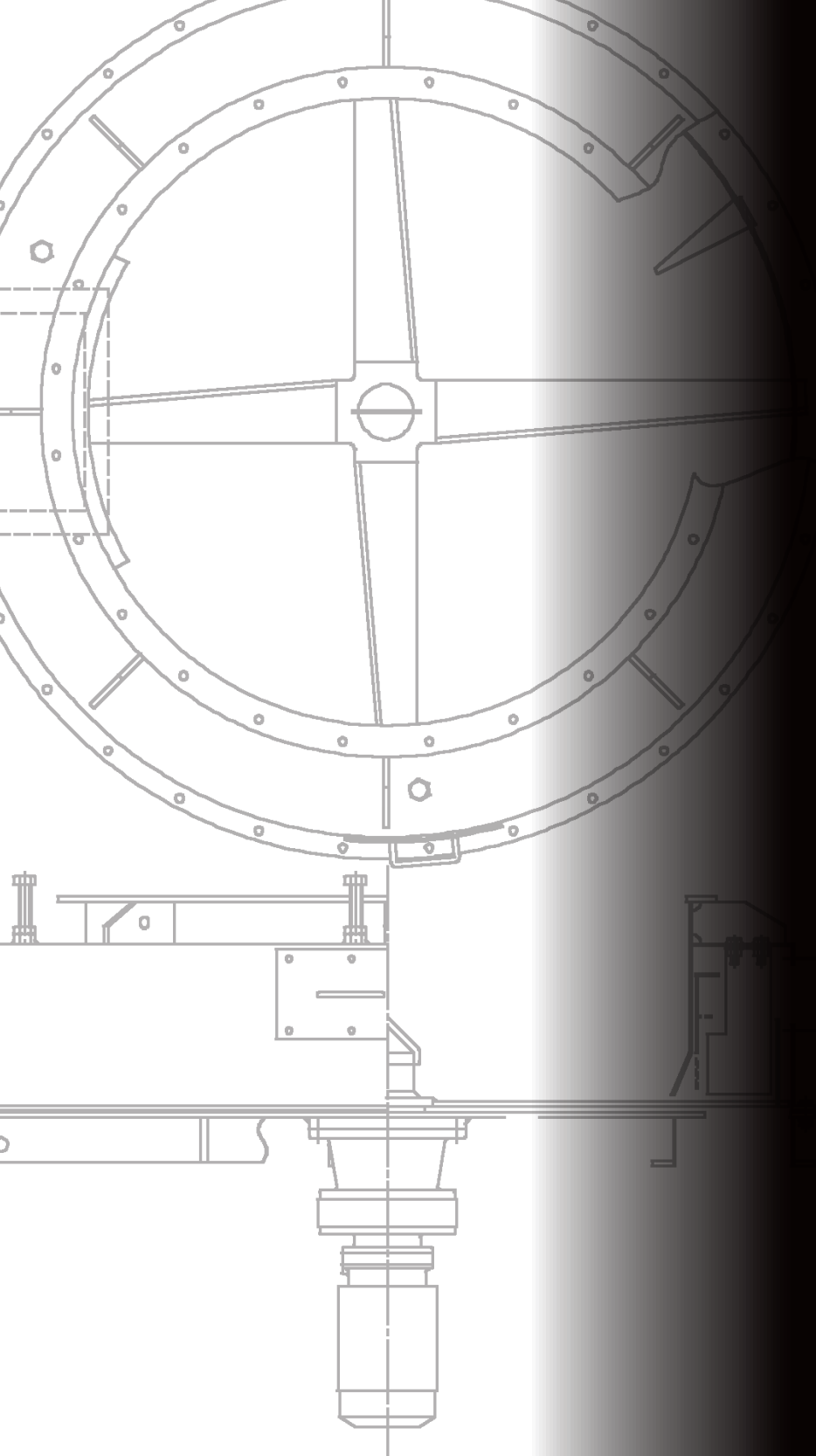
tire chip



R P F



wood chip



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