



Automation for a Changing World

# Delta Hybrid Energy Saving System

## HES Series



[www.deltaww.com](http://www.deltaww.com)

 **DELTA**  
Smarter. Greener. Together.

# Delta Hybrid Energy Saving System HES Series

Delta Electronics' mission is "to provide innovative, clean and efficient energy solutions for a better tomorrow". With this goal always in mind, we are committed to developing AC motor drives and technologies that ensure greater energy-savings for our customers.

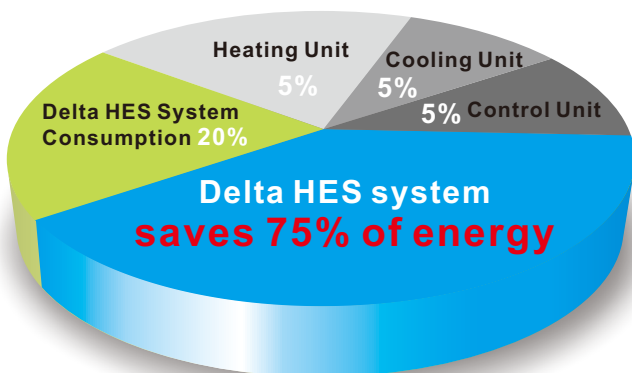
Plastic products are around us everywhere, from electronic devices to personal care items to auto accessories and countless more. These products are all made with injection molding machines using a series of injection and molding processes.

There are four major energy consuming units in a traditional injection machine: the hydraulic pump, the heating unit, the cooling system, and the system & components control unit. Among these the hydraulic pump consumes the most energy; it accounts for more than 75% of an injection molding machine's total energy consumption.

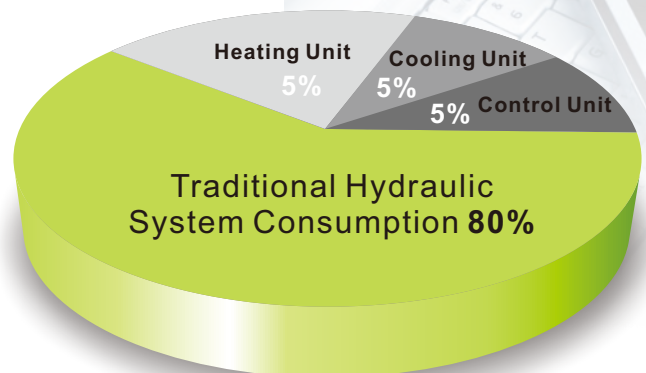
The amount of pressure and flow required for clamping, injection, holding pressure, cooling and ejection stages are all different. However the motor runs only at a steady speed providing an equal amount of flow and pressure. The overflow valve and the ratio valve adjust the excess pressure and flow that occurs at each stage. This process is also known as "high-pressure throttle" and it accounts for 40%~75% of the energy lost. To address this problem, Delta introduces an integrated solution that features outstanding pressure and flow control, low energy consumption, precision molding, and increased productivity: the Hybrid Energy System (HES).



### Energy Consumption Analysis of the Delta HES System



### Energy Consumption Analysis of Traditional Hydraulic Systems





## System Features

### (1) Superior Energy-Saving Results:

- Lower energy consumption rate at the clamping and cooling stage while maintaining high productivity and high precision,
- 40% less energy consumption than variable displacement pump hydraulic systems.
- 60% less energy consumption than traditional fixed displacement pump hydraulic systems.

**(2) Low Oil Temperature:** Oil temperature reduced by 5~10°C; oil usage reduced by 50~60%; 50% less oil tank volume; lower cooler specifications required or even no cooler required.

### (3) High Duplication Accuracy:

Precise flow and pressure control featuring duplication of products with less than 0.09% difference.

**(4) Long Holding Pressure:** Keeps mold halves securely closed for a longer period for thick plastic products formation.

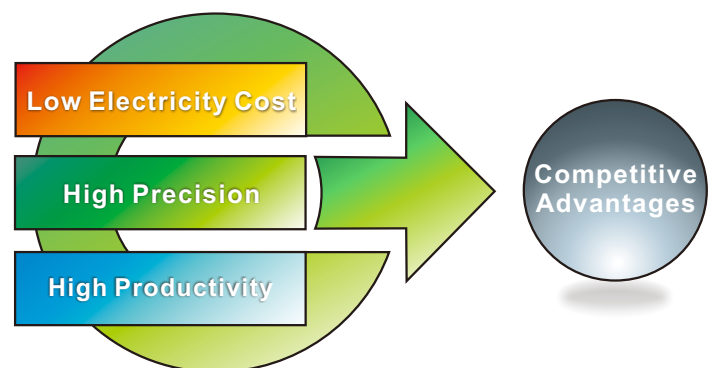
### (5) Fast Frequency Response:

Delta HES with permanent magnetic servo motor (PMSM) speeds up frequency response to 50ms.

**(6) Suitable for Harsh Environments:** Resolver is resistant to vibration, oil and dust.

**(7) Old Machine Replenishment:** Supports analog command 0~10V and 3-point adjustment for analog inputs. The computer in the injection molding machine does not need to be replaced.

**(8) Flow Convergence:** Saves cost on tubes, large flow capacity, enhances energy-savings.





## Energy-saving Comparison

- The Delta HES system attains an outstanding energy savings of up to **79%**
- 6375 kW-hr of electricity are saved per year for one injection molding machine
- Saves NT\$44,625 (US\$1485) for lowering electricity consumption by 6375kW-hr
- Wide use of Delta HES systems in a plant with 60 injection molding machines saves up to **NT\$2,677,500** annually (**US\$ 89,250**) in electricity costs

Every injection molding machine in the Delta Thailand Plant produces an average of **211,000** power supply components a month.



### Before



**Traditional System**  
 Max. Flow: 63L/min  
 Motor: Induction motor  
 15kw  
 Oil Pump: Yuken 65cc/rev  
 Max. Revolutions: 978 rpm

### After



**Delta HES System**  
 Max. Flow: 100L/min  
 Max. Pressure: 140bar  
 Control Mode: Built-in  
 PQC control

## Power Consumption Test Results

### Power consumption of traditional system(kWh)

Starting Time	End Time	Average Power Consumption	Total Time (Hour)	Total Watts in 4 Hours	kWh
16:51	20:50	2092W	4	8368	2.09

Implementation of Delta HES system saves 1.66 kW of power per hour

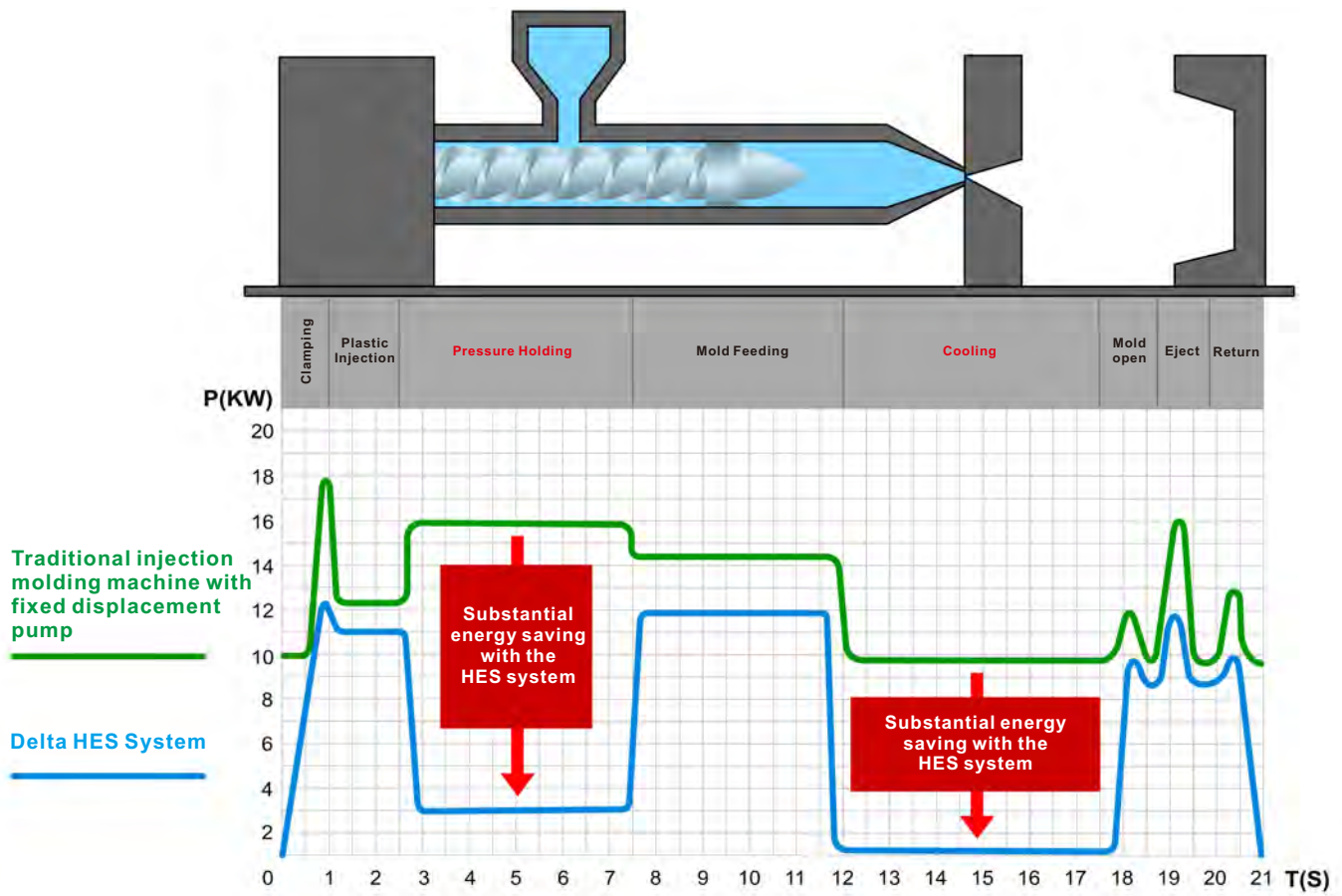


### Power consumption of Delta HES system(kWh)

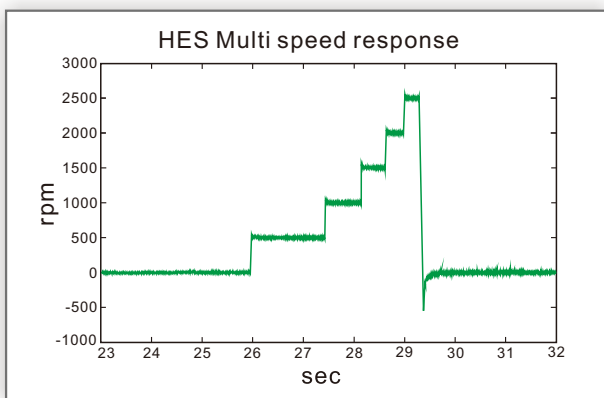
Starting Time	End Time	Average Power Consumption	Total Time (Hour)	Total Watts in 4 Hours	KWh
17:30	21:29	431W	4	1724	0.43



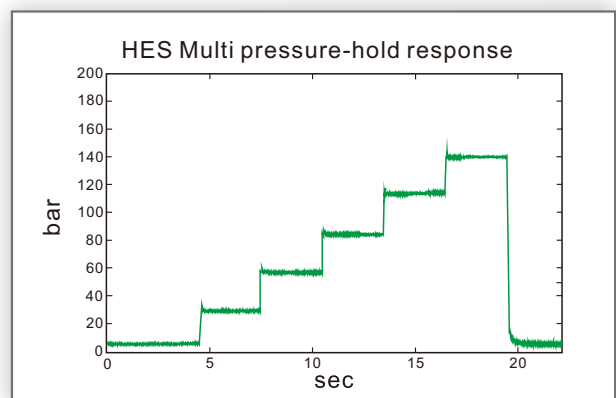
## Energy Consumption Curve of the Injection Molding Machine



**A: HES Multi-step Speed Response Curve**

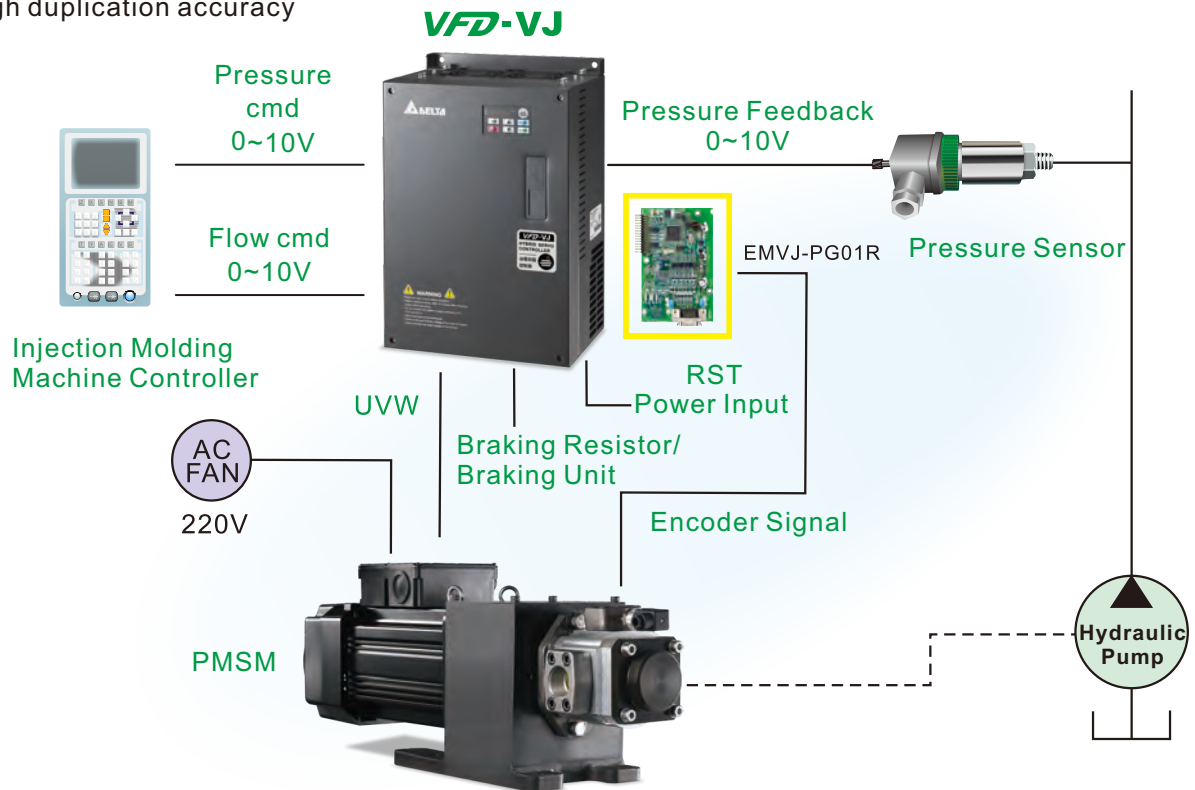


**B: HES Multi-step Holding Pressure Response Curve**

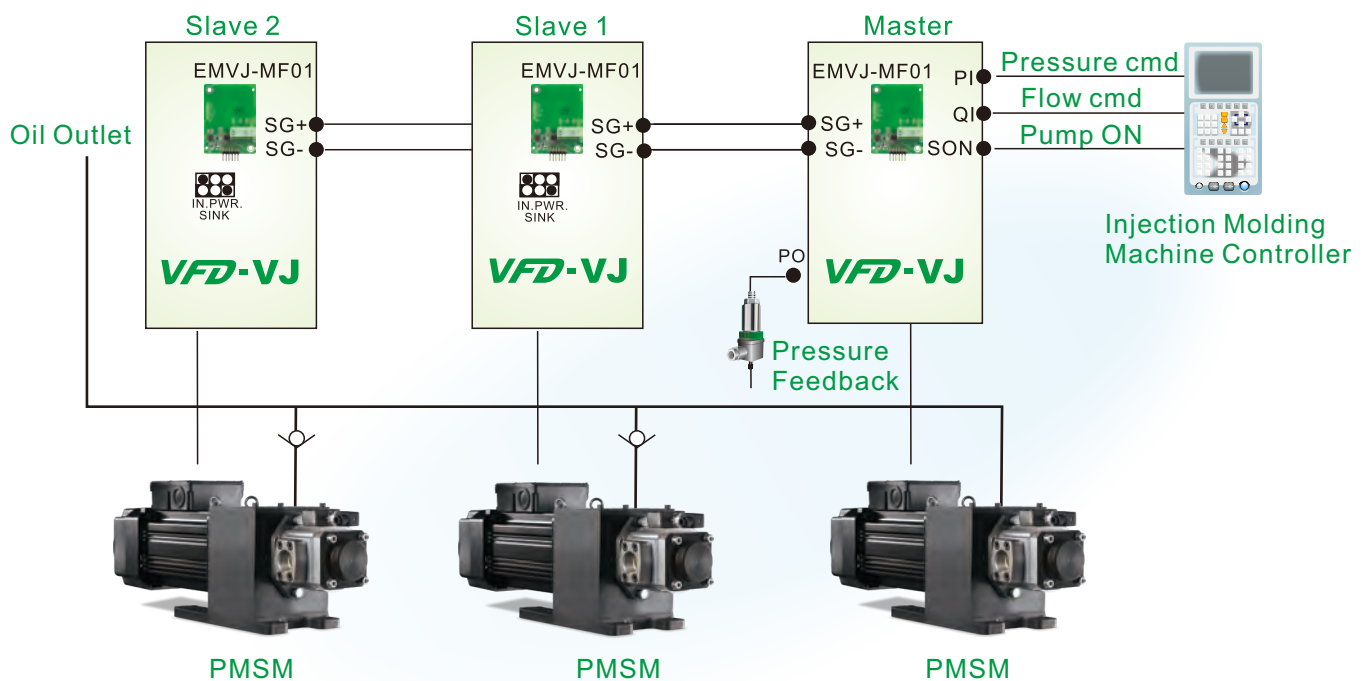


## System Structure

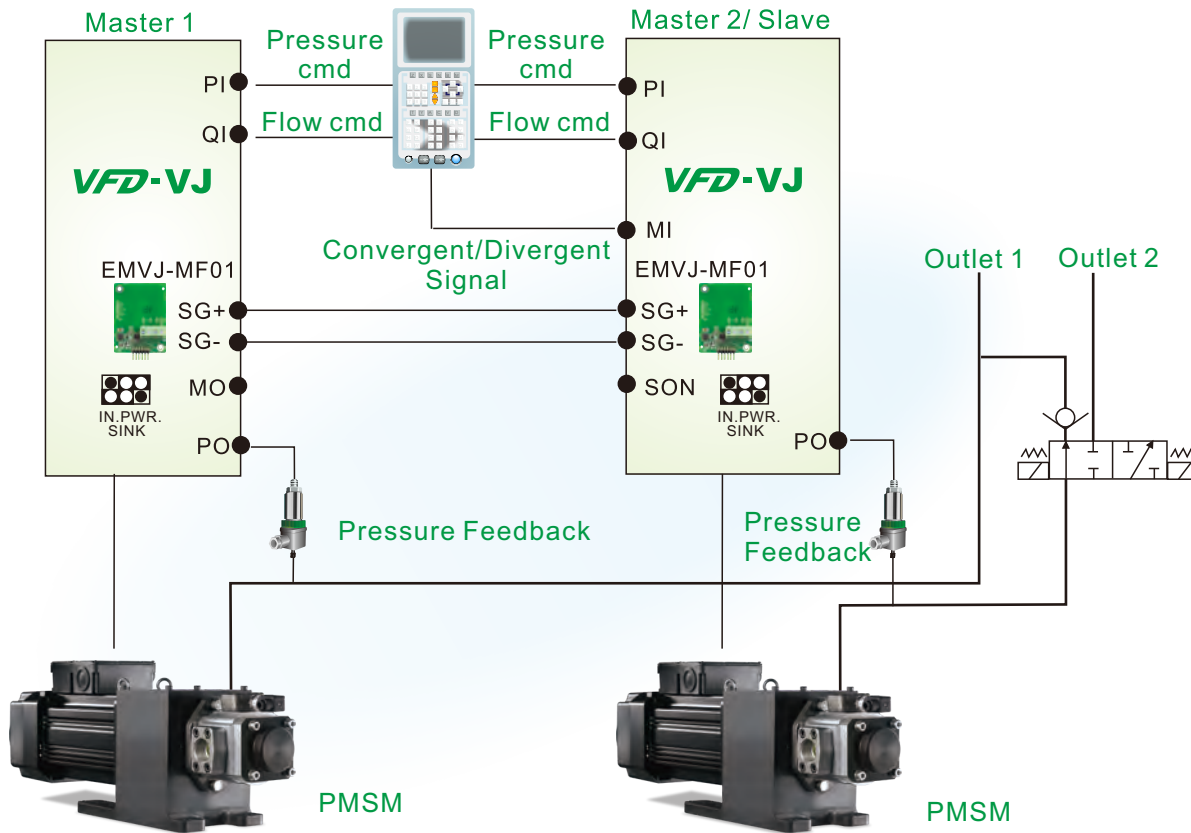
Hybrid control AC servo drive + AC servo motor+ fixed displacement pump + pressure sensor With PID control mode, this system provides you with precise pressure and speed control to enable fast response and high duplication accuracy



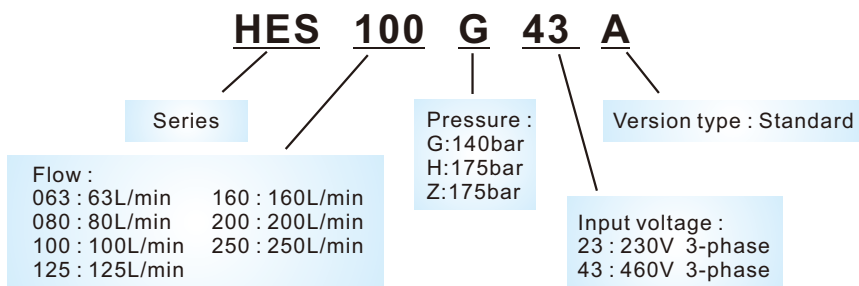
## Multiple Pumps Convergent Flow Control



## Convergent Flow/ Divergent Flow



## Hybrid Energy Saving System



# System Specifications

230V		Model HES____23A		HES____23A										
		063H	080G	080H	100G	100H	100Z	125G	125H	160G	160H	200G		
Flow	Pump Capacity	cc/rev	25	32		40			50		64		80	
	Flow	L/min	63	80		100			125		160		200	
	Linearity	%	Lower than 1% F.S.											
	Hysteresis	%	Lower than 1% F.S.											
Pressure	Max. Pressure	Mpa	18	14	18	14	18	18	14	18	14	18	14	
	Min. Pressure	Mpa	0.1											
	Linearity	%	Lower than 1% F.S.											
	Hysteresis	%	Lower than 1% F.S.											
Motor	Power	kW	11				15				20			
	Insulation Class		UL: Class A											
	Cooling Method		Fan cooling											
	Ambient Temperature		0 ~ 40 °C											
	Ambient Humidity		20 ~ 90 RH (Non-condensation)											
	Weight of Pump and Motor	kg	82			83		95	108		110		144	
AC Motor Drive	Model VFD-___VL23A-J		110 (06HA)	110 (08GA)	150 (08HA)	150 (10GA)	185 (10HA)	220 (10ZA)	220 (12GA)	300 (12HA)	300 (16GA)	370 (16HA)	370 (20GA)	
	Operation Voltage		3-phase voltage: 200~240V, 50/60Hz											
	Rated Output Capacity	KVA	19	25		29	34		46		56			
	Weight	kg	10	13				36						
	Braking Unit		Built-in						External: VFDB2022					
	Brake Resistor	W	1000						1500					
		Ω	8.3	5.8										
	Speed Detector		Resolver											
	Pressure Input		0~10V support 3-point adjustment for analog inputs											
	Flow Input		0~10V support 3-point adjustment for analog inputs											
	Multi-function Input Terminal		5 ch DC24V 8mA											
	Multi-function Output Terminal		2 ch DC24V 50mA, 1 ch relay output											
	Analog Output Voltage		1 ch dc 0~10V											
	Cooling Method		Fan cooling											
	Ambient Temperature		-10 ~ 45 °C											
Ambient Humidity		Lower than 90RH (Non-condensation)												
Protections		Over current, over voltage, low current, overload or overheating of AC drive, overload or overheating of motor, operation speed error												
Oil	Working Fluid		HL-HLP DIN51 524 Part1/2 R68,R46											
	Operation Temperature	C °	-20 to 100											
	Viscosity	@40 °C	67.83											
@100 °C		8.62												
Others		Available upon purchase: safety valve, reactor and EMI filters												





# System Specifications

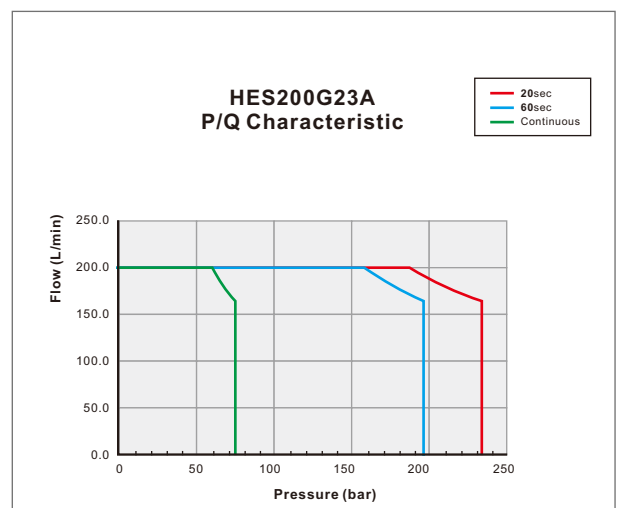
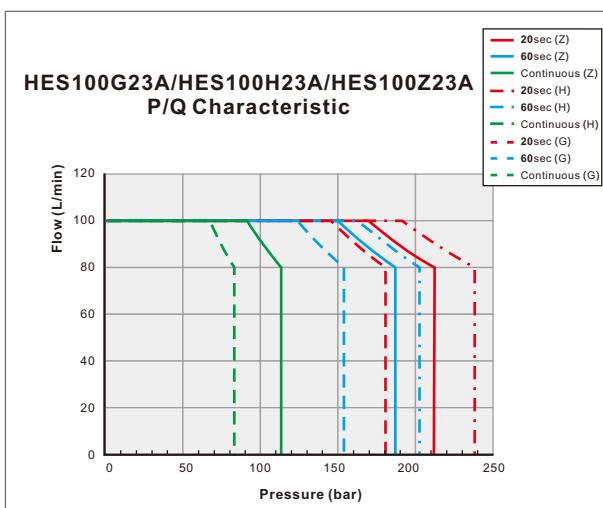
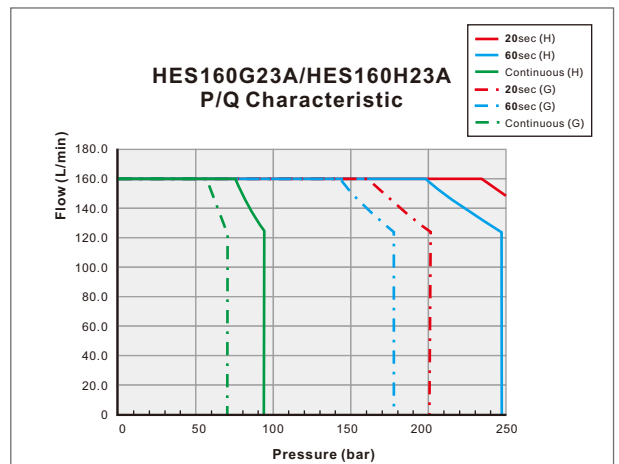
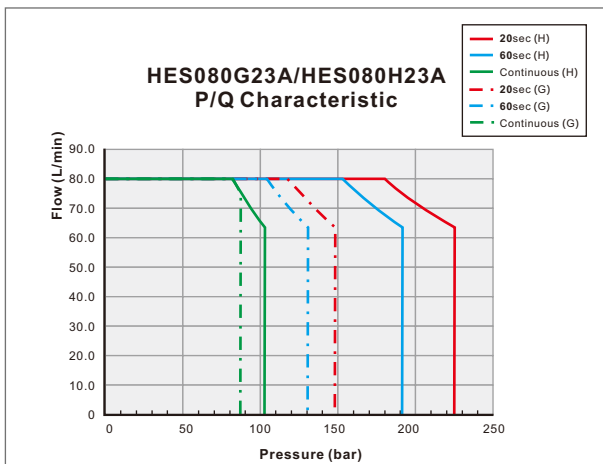
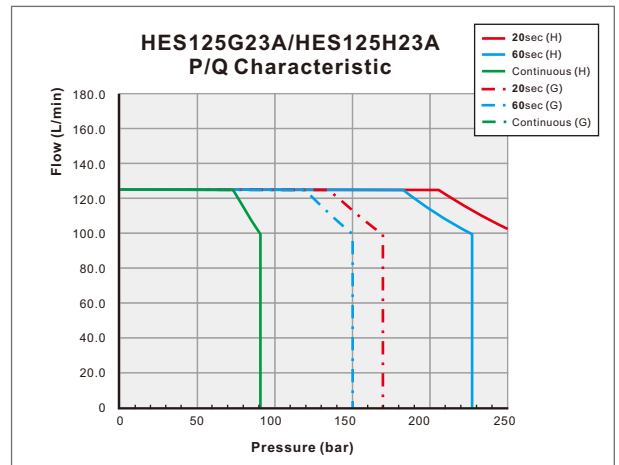
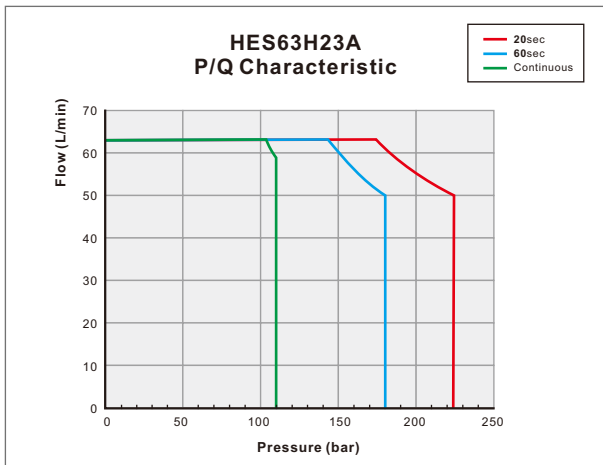
460V		Model HES___43A		HES___43A											
		063G	063H	080G	080H	100G	100H	100Z	125G	125H	160G	160H	200G		
Flow	Pump Capacity	cc/rev		25		32		40		50		64		80	
	Flow	L/min		63		80		100		125		160		200	
	Linearity	%		Lower than 1% F.S.											
	Hysteresis	%		Lower than 1% F.S.											
	Max. Pressure	Mpa		14	18	14	18	14	18	14	18	14	18	14	
Min. Pressure	Mpa		0.1												
Linearity	%		Lower than 1% F.S.												
Hysteresis	%		Lower than 1% F.S.												
Pressure	Power	kW		11				15				20			
	Insulation Class	UL: Class A													
	Cooling Method	Fan cooling													
	Ambient Temperature	0 ~ 40 °C													
	Ambient Humidity	20 ~ 90 RH (Non-condensation)													
Weight of Pump and Motor	kg		82			83		95		108		110		144	
AC Motor Drive	Model VFD-___VL43A ( )	110[A] (06GA)	150[B] (06HA)	150[B] (08GA)	185[B] (08HA)	185[B] (10GA)	220[A] (10HA)	220[A] (10ZA)	220[A] (12GA)	300[B] (12HA)	300[B] (16GA)	370[B] (16HA)	370[B] (20GA)		
	Operation Voltage	3-phase voltage: 380~460V, 50/60Hz													
	Rated Output Capacity	KVA		19	25	29	34	46	56						
	Weight	kg		10	13	13	13	36	36						
	Braking Unit	Built-in										External: VFDB4045			
	Brake Resistor	W		1000										1500	
		Ω		25				20		14		13			
	Speed Detector	Resolver													
	Pressure Input	0~10V support 3-point adjustment for analog inputs													
	Flow Input	0~10V support 3-point adjustment for analog inputs													
	Multi-function Input Terminal	5 ch DC24V 8mA													
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	Analog Output Voltage	1 ch dc 0~10V													
	Cooling Method	Fan cooling													
	Ambient Temperature	0~10-10 ~ 45 °C													
Ambient Humidity	Lower than 90RH (Non-condensation)														
Protections	Over current, over voltage, low current, overload or overheating of AC drive, overload or overheating of motor, operation speed error														
Oil	Working Fluid	HL-HLP DIN51 524 Part1/2 R68,R46													
	Operation Temperature	C °		-20 to 100											
	Viscosity	@40 °C		67.83											
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Others	Available upon purchase: safety valve, reactor and EMI filters														



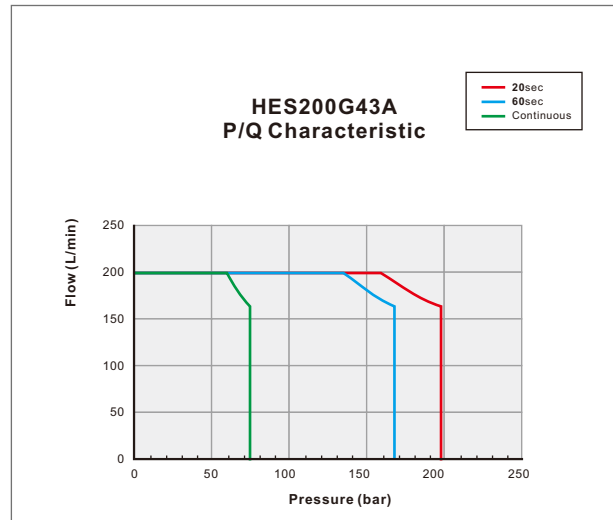
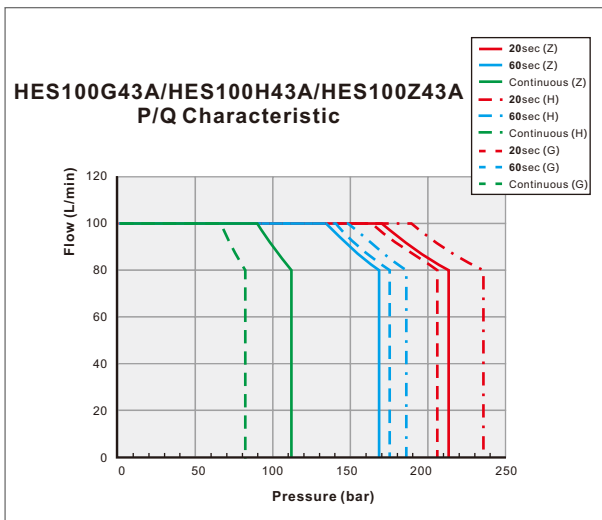
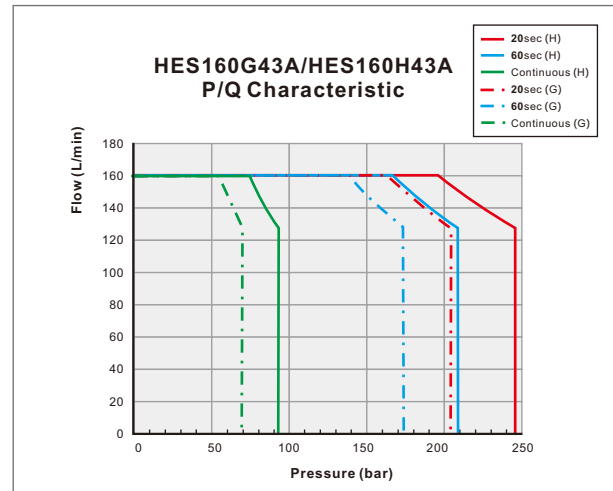
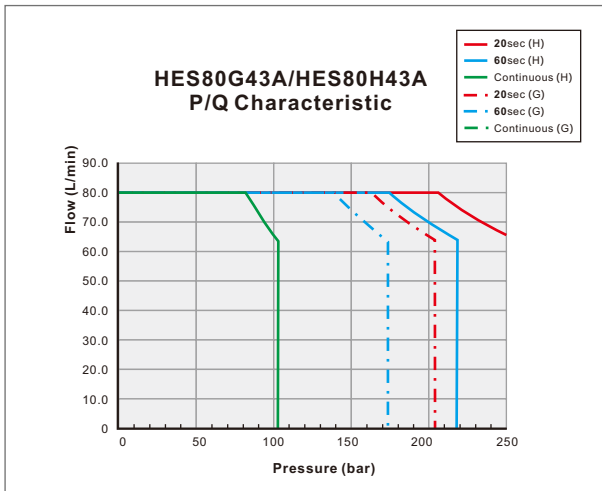
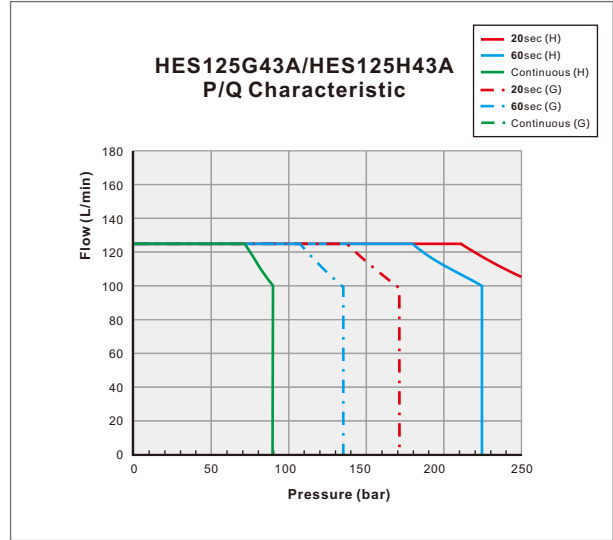
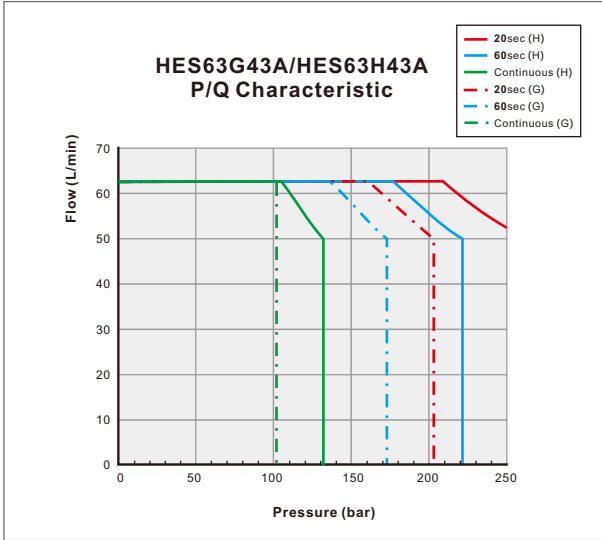
# System Overload Capability

High overload capability fulfills all kinds of production requirements

## Hybrid Energy Saving System HES\_\_\_23A



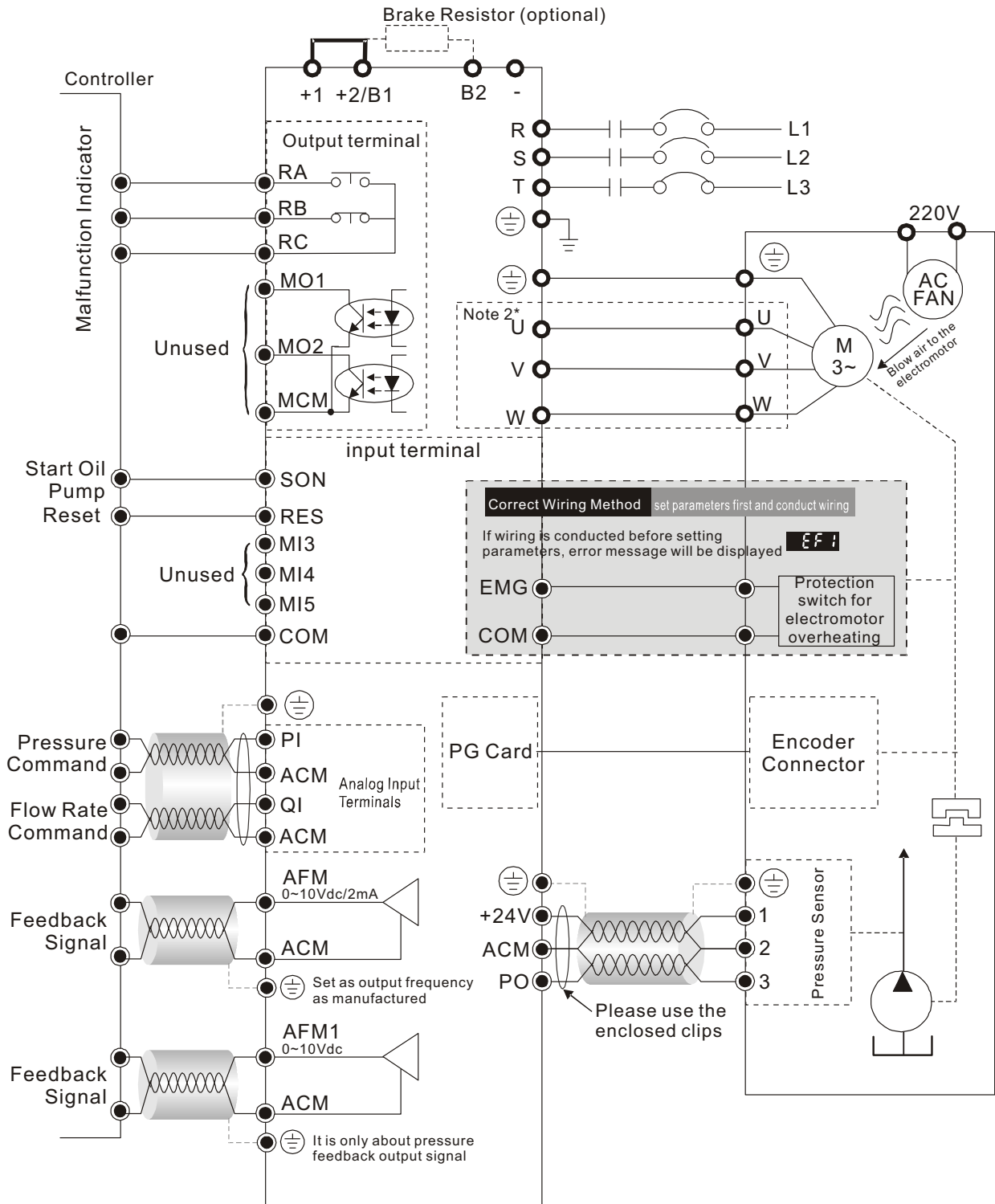
# Hybrid Energy Saving System HES\_\_\_43A



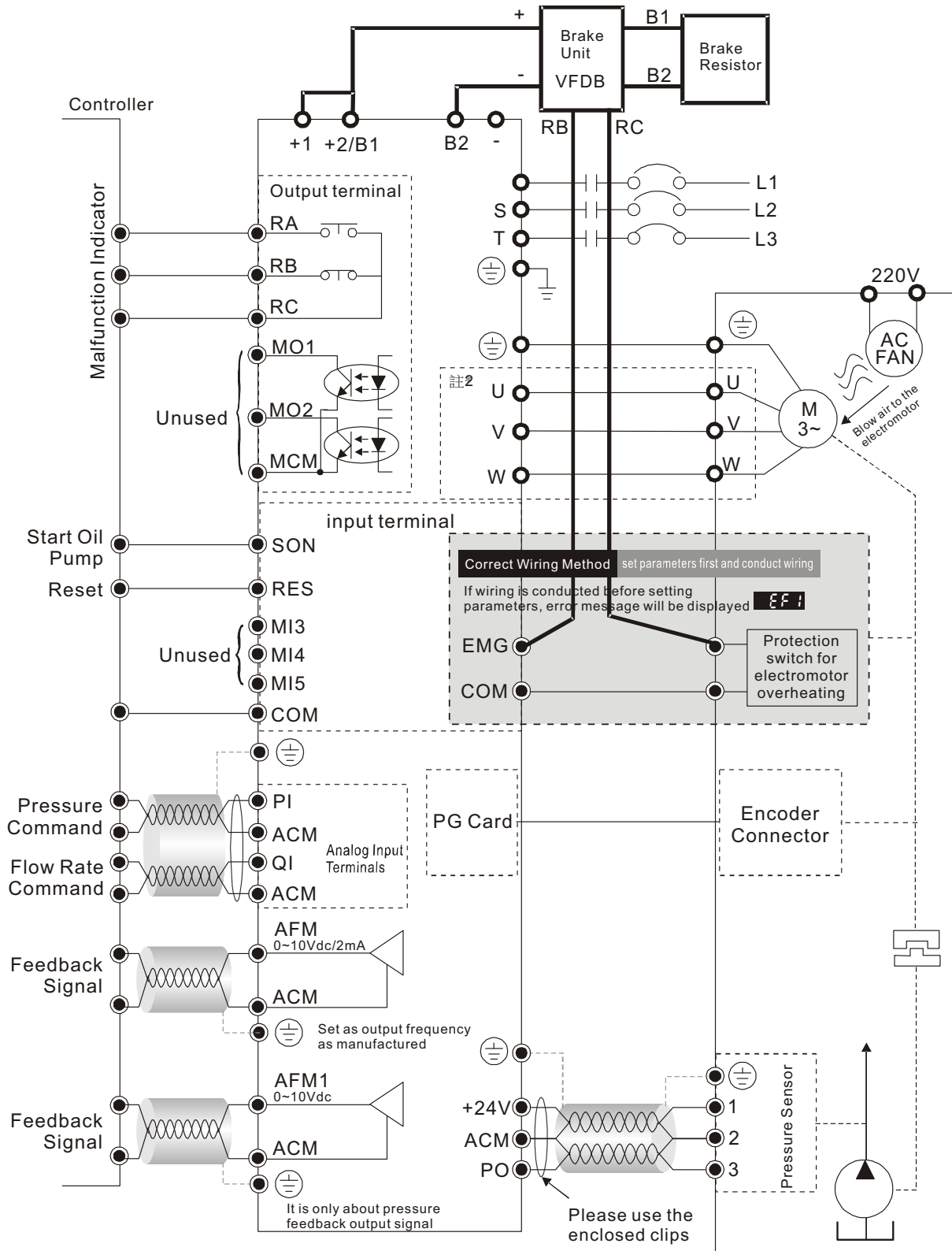
1. The recommended safety coefficient for the green line (continuous) is 95%, the blue line (60sec) is 90% and the red line (20sec) is 85%.
2. Model selection: a) Verify the system flow requirement. b) Verify the maximum system pressure requirement, for example the holding pressure time. c) Verify the injection molding operation requirement, calculate the average pressure by using the equation:  $\text{actual pressure} \times \text{work time}(\text{sec}) / \text{total cycle time}$ ; if the average pressure lies within the green line, the drive or the motor is in the normal operation zone and there will not be an overheating or over load problem.
3. For more detailed information, please contact Delta personnel.

# Wiring

HES063H23A ~ HES125G23A  
 HES063G43A ~ HES160G43A



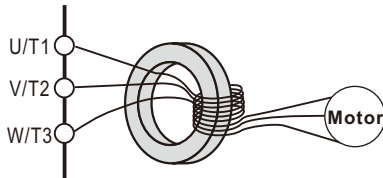
HES125H23A ~ HES200G23A  
 HES160H43A ~ HES200G43A



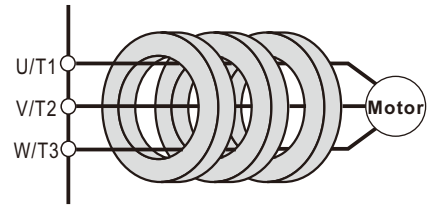
# Wiring

**Note\*1** The RC and RB wiring terminals are for overheating protection.

**Note\*2.** Applicable to drive models with capacity of 22kW or below. Please wrap the wire through the zero phase reactor at least three times before connecting to the motor.



Applicable to drive models that are **30kW** or above.



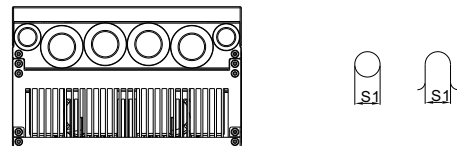
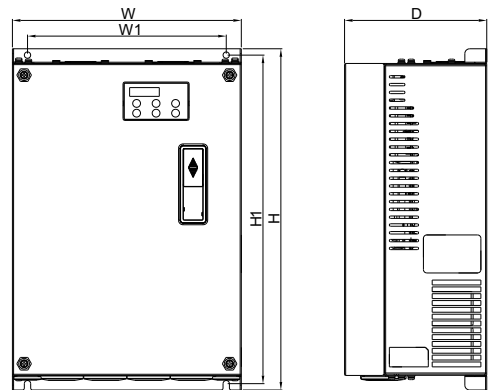
# Hybrid Controller Dimensions

## ■ Frame C

- VFD110VL23Axxxx
- VFD110VL43Axxxx
- VFD150VL43Bxxxx
- VFD185VL43Bxxxx

Dimensions UNIT:mm[inch]

Frame	W	W1	H	H1	D	S1	
C	mm	235	204	350	337	146	6.5
	inch	9.25	8.03	13.78	13.27	5.75	0.26

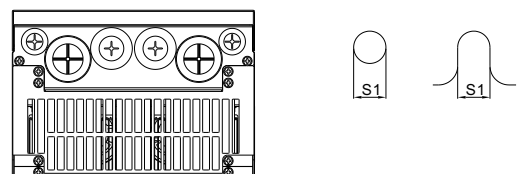
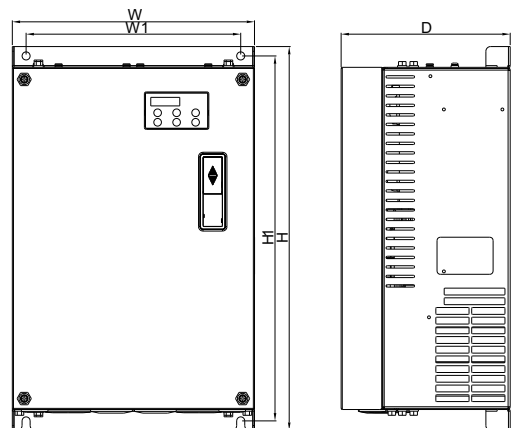


## ■ Frame D

- VFD150VL23Axxxx
- VFD185VL23Axxxx
- VFD220VL23Axxxx
- VFD220VL43Axxxx
- VFD300VL43Bxxxx

Dimensions UNIT:mm[inch]

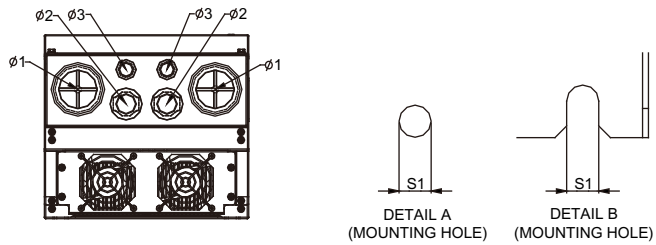
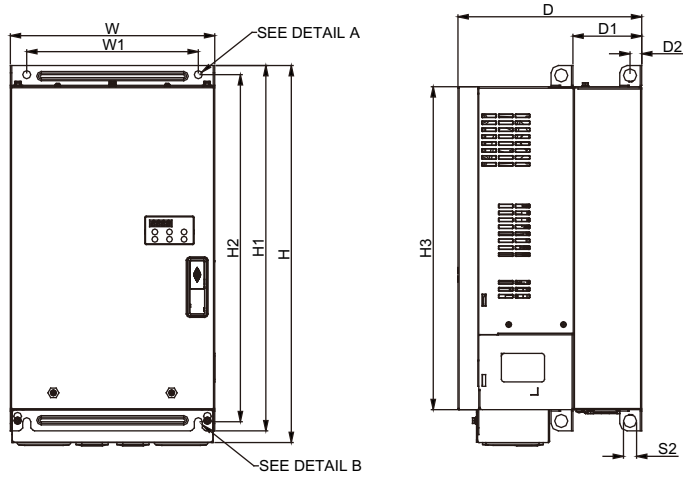
Frame	W	W1	H	H1	D	S1	
D	mm	255	226.0	403.8	384	168.0	8.5
	inch	10.04	8.90	15.90	15.12	6.61	0.33



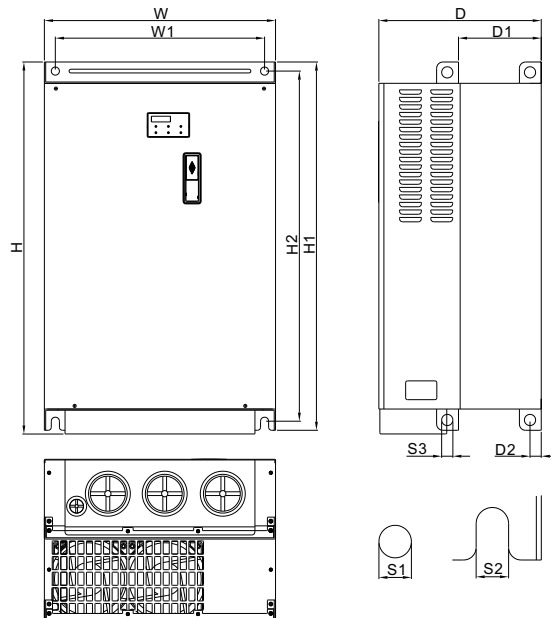
# Hybrid Controller Dimensions

## ■ Frame E

E0:  
VFD370VL43Bxxxx



E2:  
VFD300VL23Axxxx  
VFD370VL23Axxxx



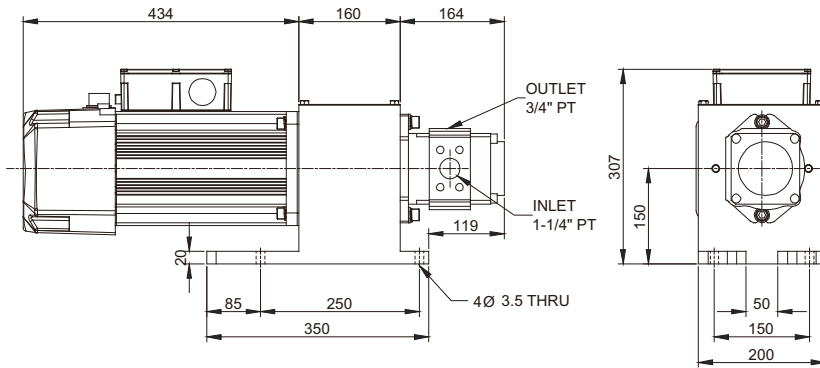
Dimensions

UNIT:mm[inch]

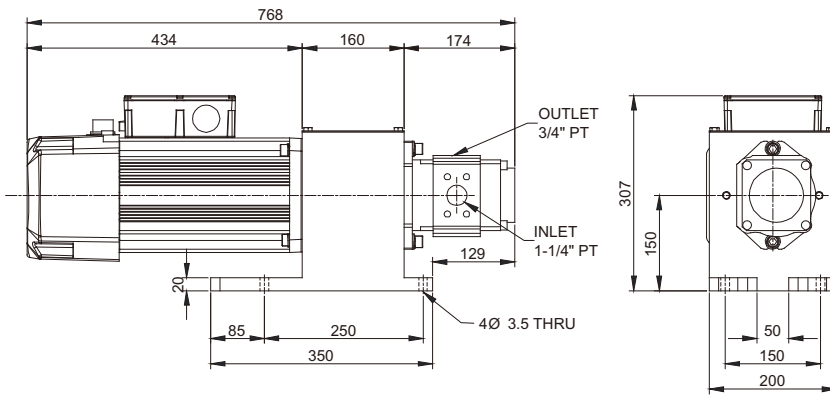
Frame		W	W1	H	H1	H2	H3	D	D1	D2	S1	S2	S3	Ø1	Ø2	Ø3
E0	mm	280.0	235.0	516.0	500.0	475.0	442.0	251.7	94.2	16.0	11.0	18.0	-	62.7	34.0	22.0
	inch	11.02	9.25	20.31	19.69	18.70	17.40	9.91	3.71	0.63	0.43	0.71	-	2.47	1.34	0.87
E2	mm	370.0	335.0	595.0	589.0	560.0	-	260	132.5	18.0	13.0	13.0	18.0	-	-	-
	inch	14.57	13.19	23.43	23.19	22.05	-	10.24	5.22	0.71	0.51	0.51	0.71	-	-	-

# Pump Dimensions

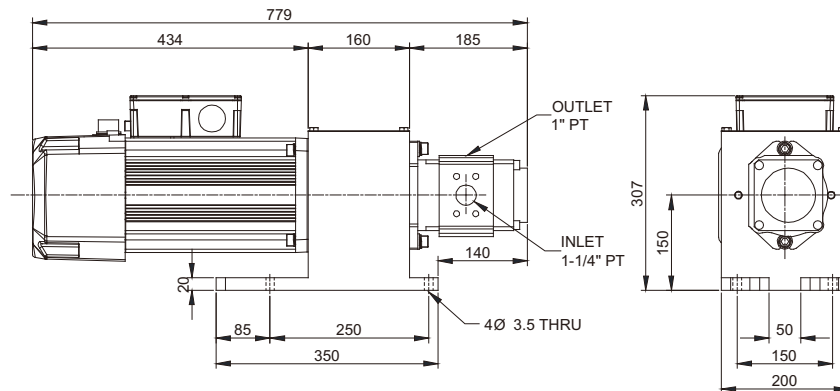
- HES063H23A
- HES063G43A
- HES063H43A



- HES080G23A
- HES080H23A
- HES080G43A
- HES080H43A

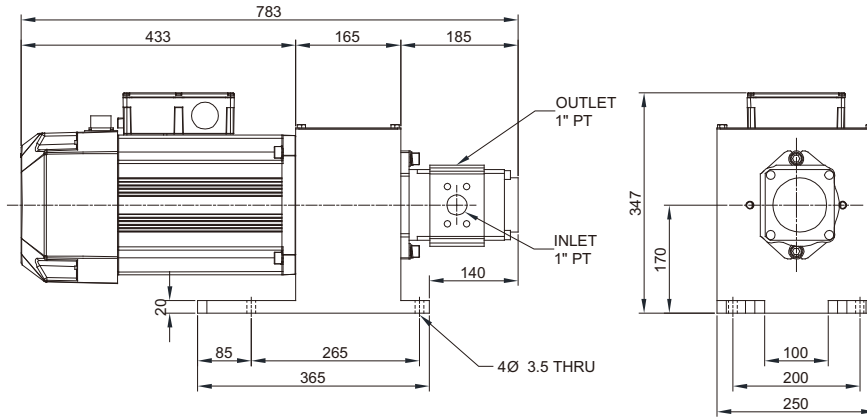


- HES100G23A
- HES100H23A
- HES100G43A
- HES100H43A

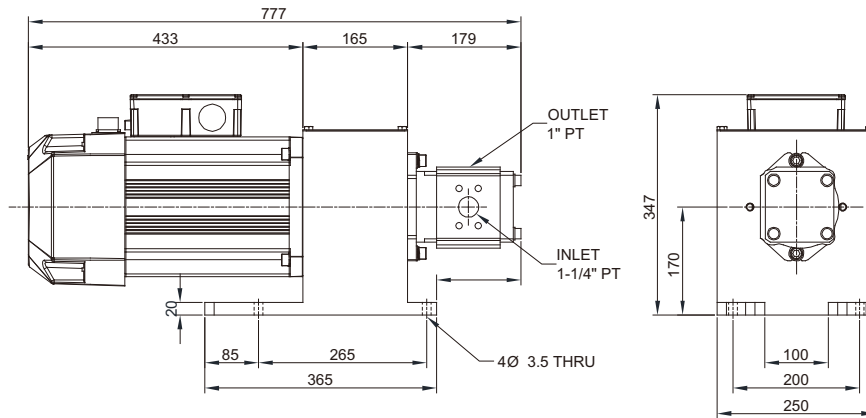




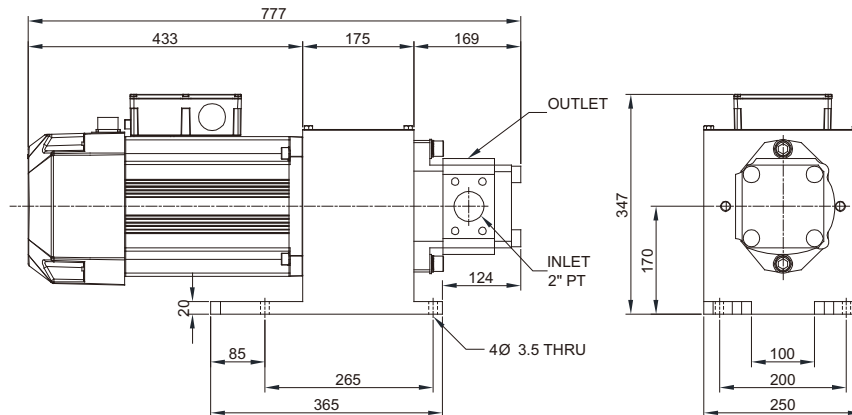
■ HES100Z43A



■ HES125G23A  
HES125H23A  
HES125G43A  
HES125H43A

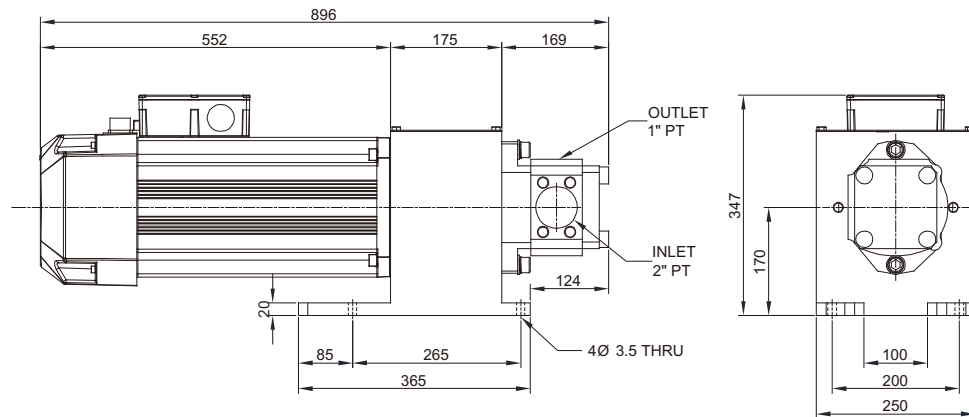


■ HES160G23A  
HES160G43A

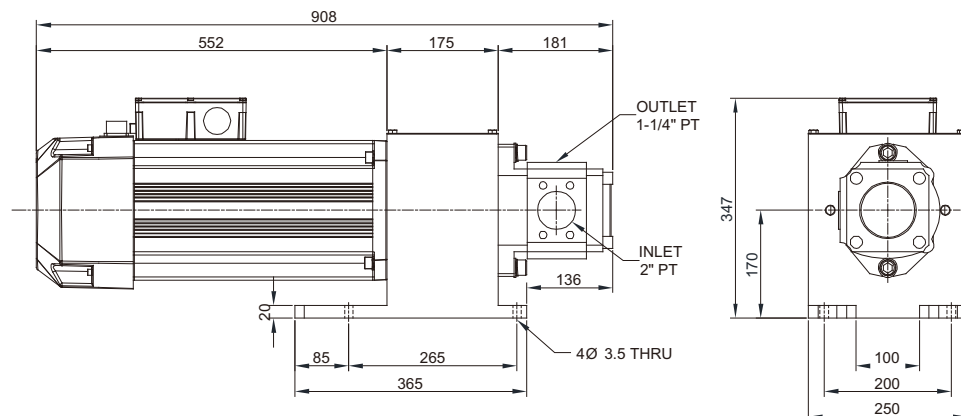


## Pump Dimensions

■ HES160H23A  
HES160H43A



■ HES200G23A  
HES200G43A

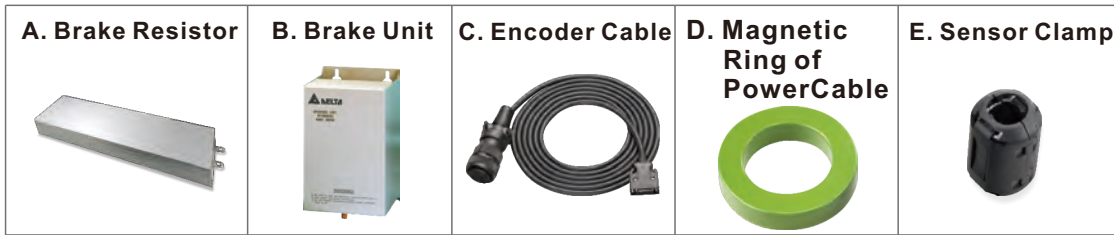


### Installation Precautions

1. Properly fix the motor and hydraulic unit onto the machine to prevent shifting.
2. Check that the hydraulic oil, inlet/outlet oil tube size and filter all conform with specifications.
3. Check that the AC motor drive and servo motor are properly installed.
4. Check if oil leakage occurs at low pressure, low displacement, open/close mold and injection/ejection stages.
5. Extract all air from inside the system so pressure can be released.

# Product Packaging

## Accessories



Please refer to HES user manual for accessories specifications.

Model	Package Items		
	Hybrid Controller	Pump	Accessories
HES063H23A	VFD110VL23A06HA Spec: please refer to frame C	HSP-025-110-23A Spec: refer to frame 1	HESP-063-H-N-23 Items: A,C,D*1,E
HES080G23A	VFD110VL23A08GA Spec: please refer to frame C	HSP-032-110-23A Spec: refer to frame 2	HESP-080-G-N-23 Items: A,C,D*1,E
HES080H23A	VFD150VL23A08HA Spec: please refer to frame D	HSP-032-110-23A Spec: refer to frame 2	HESP-080-H-N-23 Items: A,C,D*1,E
HES100G23A	VFD150VL23A10GA Spec: please refer to frame D	HSP-040-110-23A Spec: refer to frame 3	HESP-100-G-N-23 Items: A,C,D*1,E
HES100H23A	VFD185VL23A10HA Spec: please refer to frame D	HSP-040-110-23A Spec: refer to frame 3	HESP-100-H-N-23 Items: A,C,D*1,E
HES100Z23A	VFD220VL23A10ZA Spec: please refer to frame D	HSP-040-150-23A Spec: refer to frame 4	HESP-100-Z-N-23 Items: A,C,D*1,E
HES125G23A	VFD220VL23A12GA Spec: please refer to frame D	HSP-050-150-23A Spec: refer to frame 5	HESP-125-G-N-23 Items: A,C,D*1,E
HES125H23A	VFD300VL23A12HA Spec: please refer to frame E	HSP-050-150-23A Spec: refer to frame 5	HESP-125-H-B-23 Items: A,B,C,D*3,E
HES160G23A	VFD300VL23A16GA Spec: please refer to frame E	HSP-064-150-23A Spec: refer to frame 6	HESP-160-G-B-23 Items: A,B,C,D*3,E
HES160H23A	VFD370VL23A16HA Spec: please refer to frame E	HSP-064-200-23A Spec: refer to frame 7	HESP-160-H-B-23 Items: A,B,C,D*3,E
HES200G23A	VFD370VL23A20GA Spec: please refer to frame E	HSP-080-200-23A Spec: refer to frame 8	HESP-200-G-B-23 Items: A,B,C,D*3,E
HES063G43A	VFD110VL43A06GA Spec: please refer to frame C	HSP-025-110-43A Spec: refer to frame 1	HESP-063-G-N-43 Items: A,C,D*1,E
HES063H43A	VFD150VL43B06HA Spec: please refer to frame D	HSP-025-110-43A Spec: refer to frame 1	HESP-063-H-N-43 Items: A,C,D*1,E
HES080G43A	VFD150VL43B08GA Spec: please refer to frame C	HSP-032-110-43A Spec: refer to frame 2	HESP-080-G-N-43 Items: A,C,D*1,E
HES080H43A	VFD185VL43B08HA Spec: please refer to frame C	HSP-032-110-43A Spec: refer to frame 2	HESP-080-H-N-43 Items: A,C,D*1,E
HES100G43A	VFD185VL43B10GA Spec: please refer to frame C	HSP-040-110-43A Spec: refer to frame 3	HESP-100-G-N-43 Items: A,C,D*1,E
HES100H43A	VFD220VL43A10HA Spec: please refer to frame D	HSP-040-110-43A Spec: refer to frame 3	HESP-100-H-N-43 Items: A,C,D*1,E
HES100Z43A	VFD220VL43A10ZA Spec: please refer to frame D	HSP-040-150-43A Spec: refer to frame 4	HESP-100-Z-N-43 Items: A,C,D*1,E
HES125G43A	VFD220VL43A12GA Spec: please refer to frame D	HSP-050-150-43A Spec: refer to frame 5	HESP-125-G-N-43 Items: A,C,D*1,E
HES125H43A	VFD300VL43B12HA Spec: please refer to frame E	HSP-050-150-43A Spec: refer to frame 5	HESP-125-H-N-43 Items: A,C,D*3,E
HES160G43A	VFD300VL43B16GA Spec: please refer to frame E	HSP-064-150-43A Spec: refer to frame 6	HESP-160-G-N-43 Items: A,C,D*3,E
HES160H43A	VFD370VL43B16HA Spec: please refer to frame E	HSP-064-200-43A Spec: refer to frame 7	HESP-160-H-B-43 Items: A,B,C,D*3,E
HES200G43A	VFD370VL43B20GA Spec: please refer to frame E	HSP-080-200-43A Spec: refer to frame 8	HESP-200-G-B-43 Items: A,B,C,D*3,E



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