



Automation for a Changing World

# Delta Hybrid Energy Saving System

## HES Series



[www.delta.com.tw/ia](http://www.delta.com.tw/ia)



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.

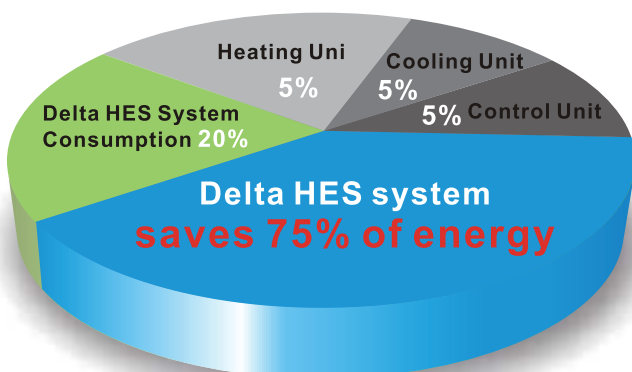
Plastic products are around us everywhere, from electronic devices to personal care items to auto accessories and countless more. These products are all made with injection molding machines using a series of injection and molding processes.

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.

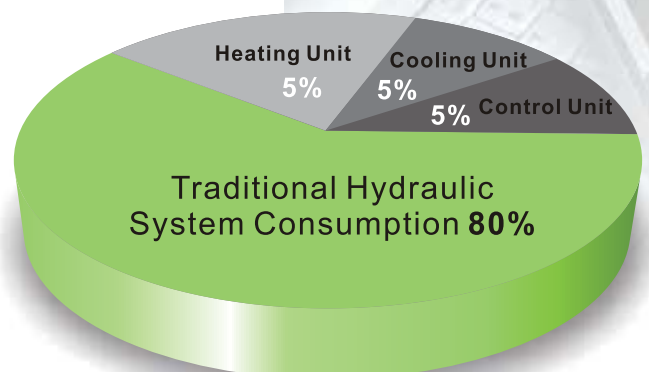
The amount of pressure and flow required for clamping, injection, holding pressure, cooling and ejection stages are all different. However the motor runs only at a steady speed providing an equal amount of flow and pressure. The overflow valve and the ratio valve adjust the excess pressure and flow that 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 Degree of Repeat 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.

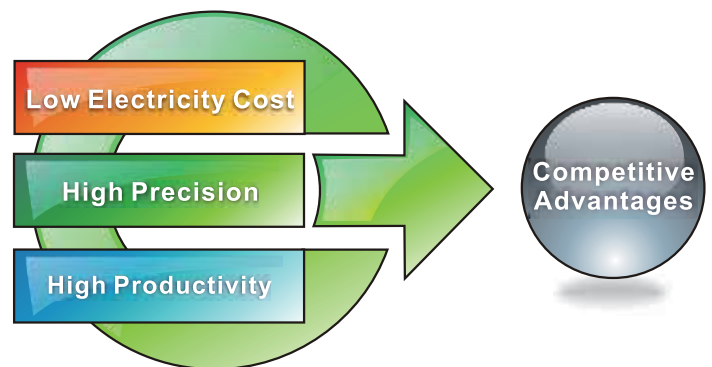
### (5) Good Frequency Response:

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 injection molding machine does not need to be replaced.

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





## 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

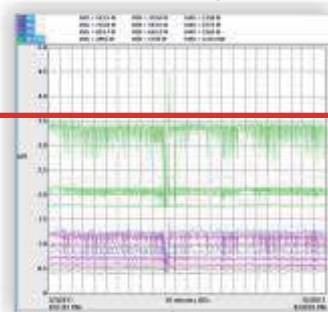
### After



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

## Power Consumption Test Results

Injection Molding Machine  
Traditional System



Injection Molding Machine  
Delta HES



### 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



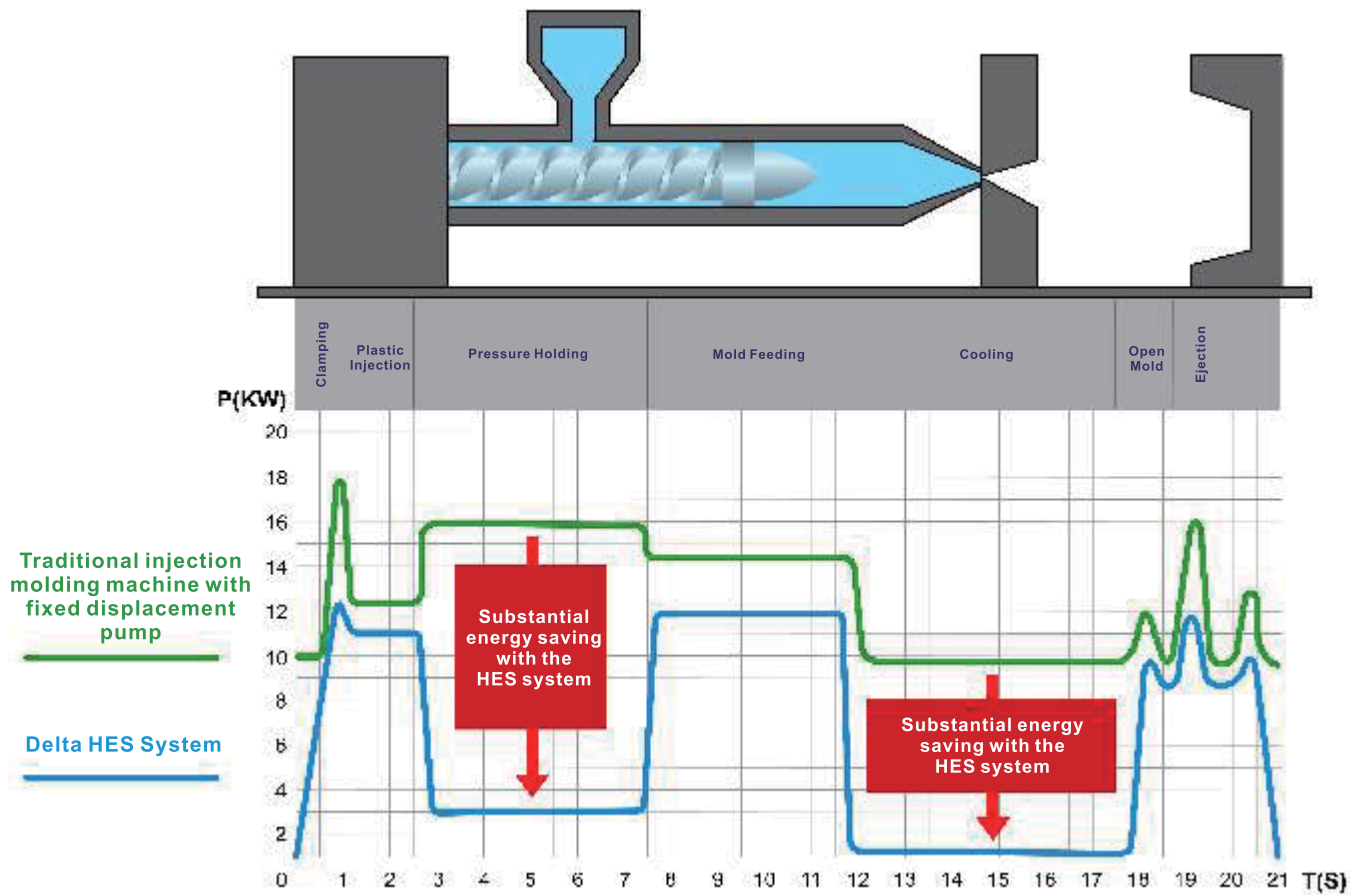
### Power consumption of Delta HES system(kWh)

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

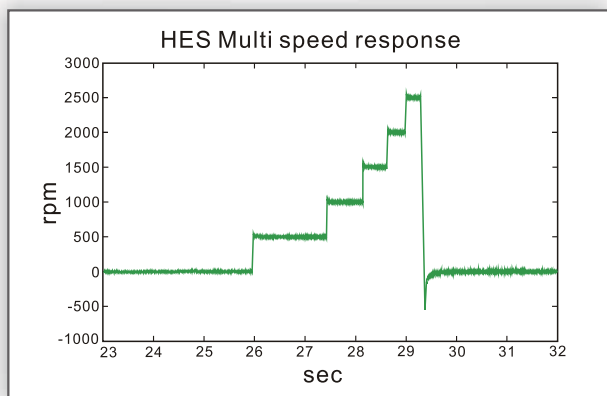
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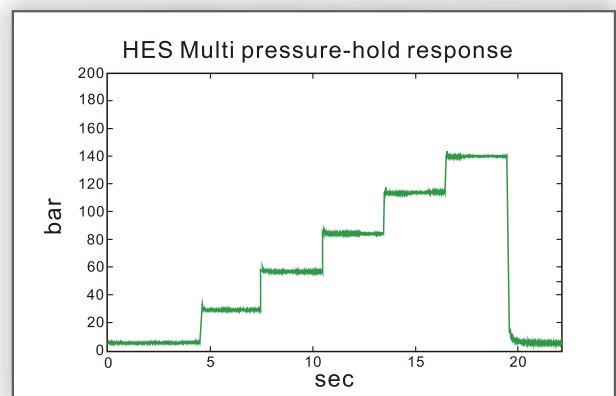
## Energy Consumption Curve of the Injection Molding Machine



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

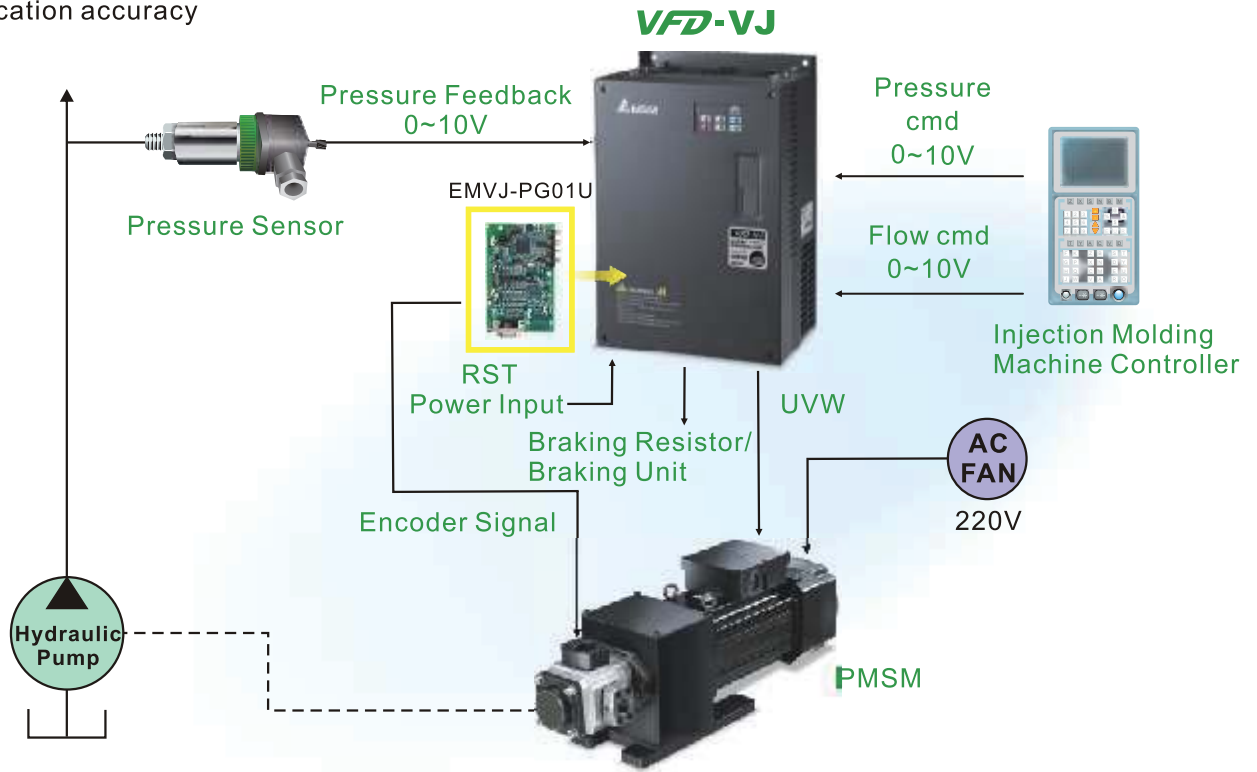


**B: HES Multi-step Holding Pressure Response Curve**

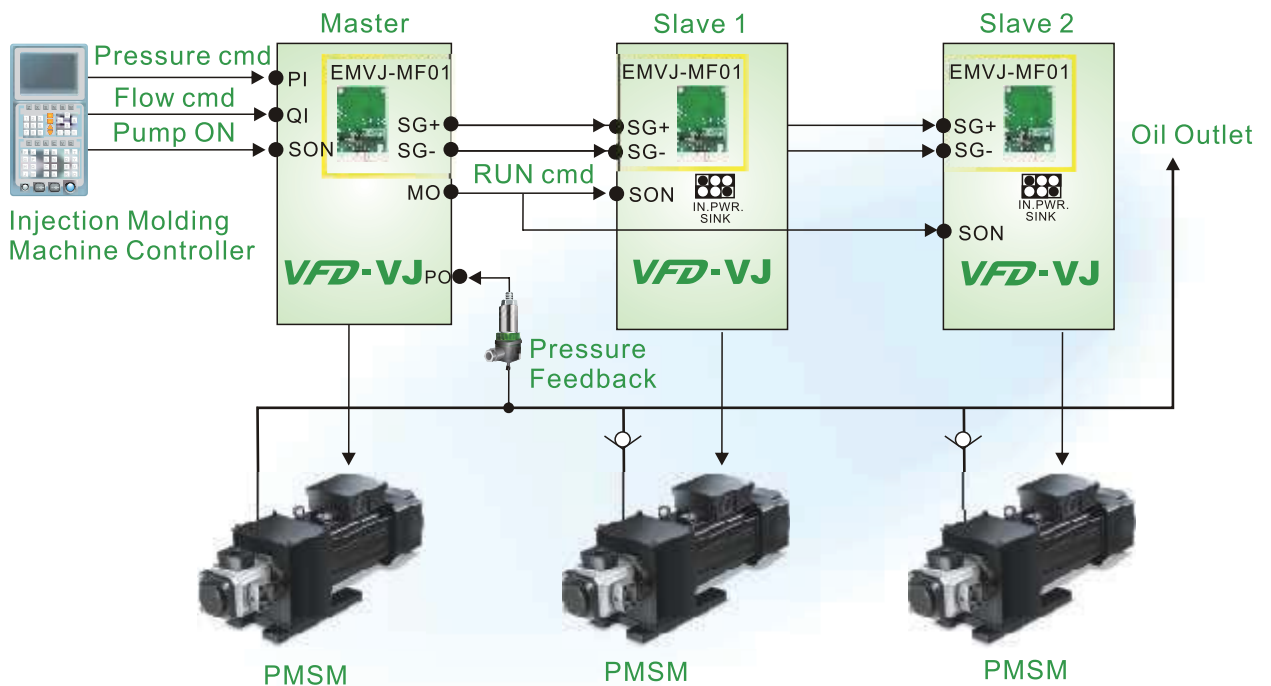


# System Structure

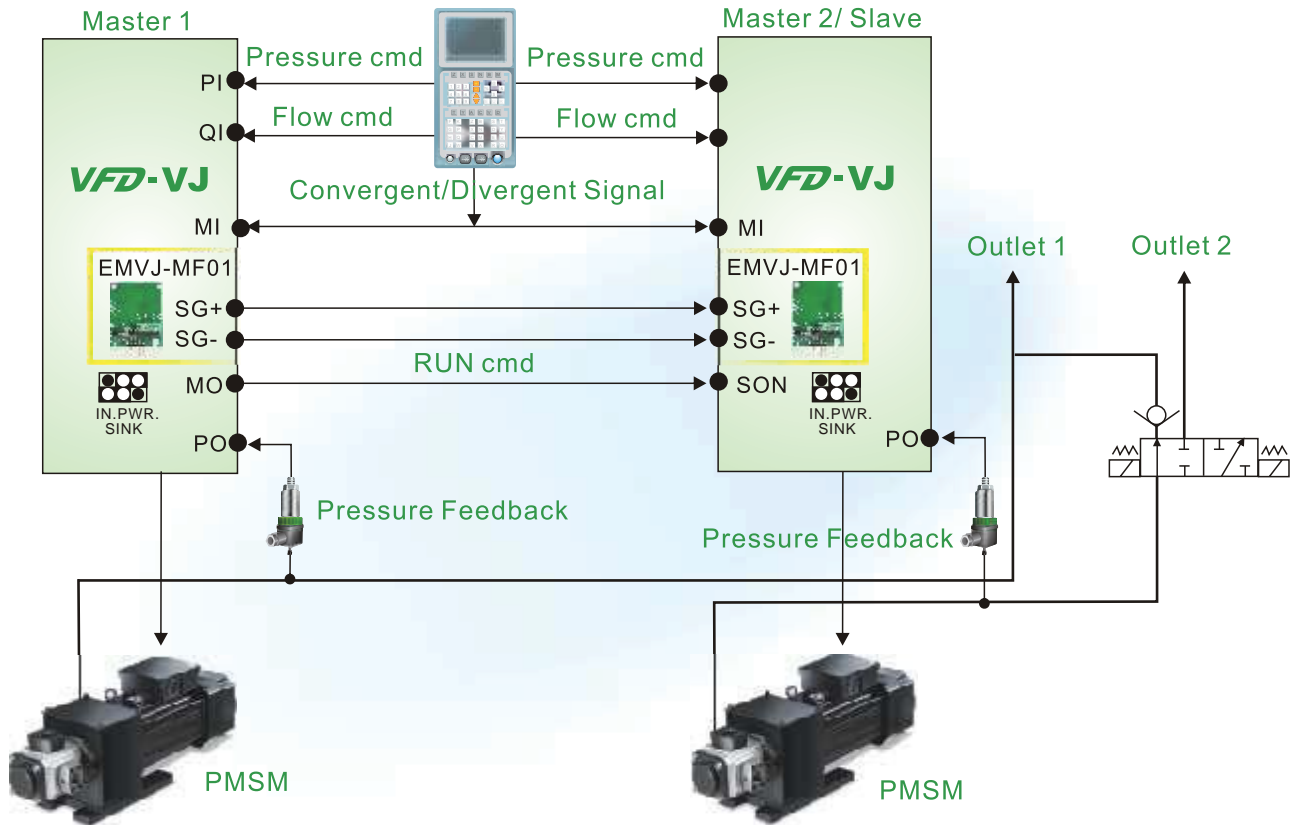
AC servo drive + AC servo motor+ fixed displacement pump + pressure sensor With PID control mode, this system provides you with precise pressure and speed control to enable quick response and high duplication accuracy



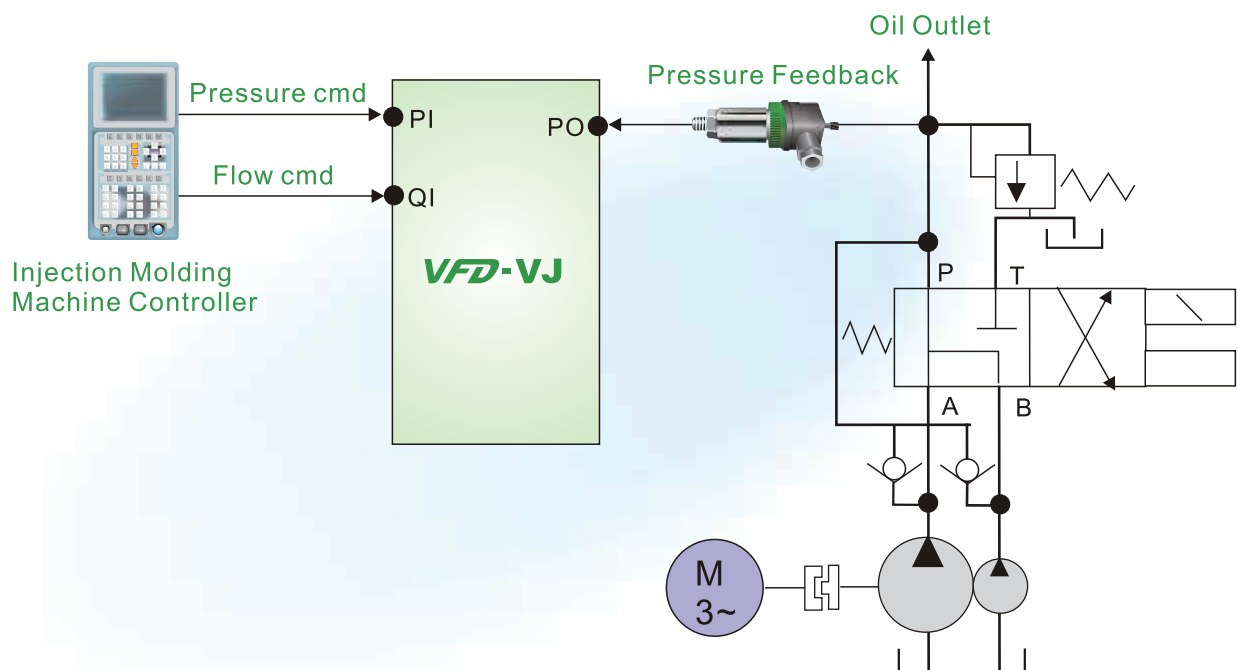
# Covergent Flow Multiple Pumps



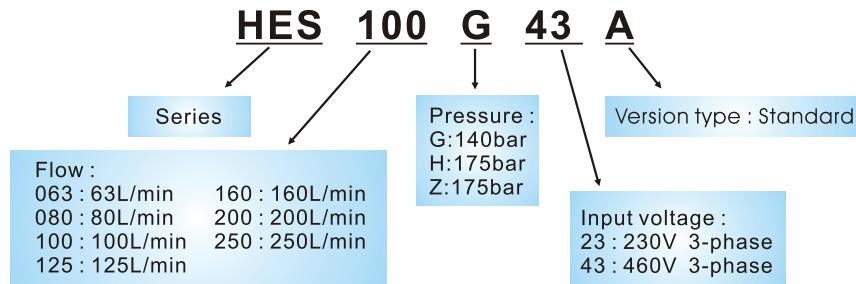
## Convergent Flow/ Divergent Flow



## Flow Capacity Switch \*(Optional Accessory)



# Hybrid Energy Saving System



## System Specifications

230V Model HES___23A		HES___23A									
		063H	080G	080H	100G	100H	100Z	125G	125H	160G	
Flow	Pump Capacity	cc/rev	25	32		40			50		64
	Flow	L/min	63	80		100			125		160
	Max. Flow	L/min	75	96		120			150		192
	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
	Min. Pressure	Mpa	0.1								
	Linearity	%	Lower than 1% F.S.								
	Hysteresis	%	Lower than 1% F.S.								
Motor	Power	kW	11				15				
	Insulation Class		UL: Class A								
	Cooling Method		Force Cooling								
	Ambient Temperature		0 ~ 40 °C								
	Ambient Humidity		20 ~ 90 RH (Non-condensation)								
	Weight of Pump and Motor	kg	82			83		95	108		110
AC Motor Drive	Model VFD-___VL23A-J		110		150		185		220		300
	Operation Voltage		3-phase voltage: 220~240V, 50/60Hz								
	Rated Output Capacity	KVA	19		25		29		34		46
	Weight	kg	10		13		13		13		36
	Braking Unit		Built-in								External
	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		5ch DC24V 8mA								
	Multi-function Output Terminal		2 ch DC24V 50mA, 1 ch Relay output								
	Analog Output Voltage		1 ch dc 0~10V								
	Cooling System		Force 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								

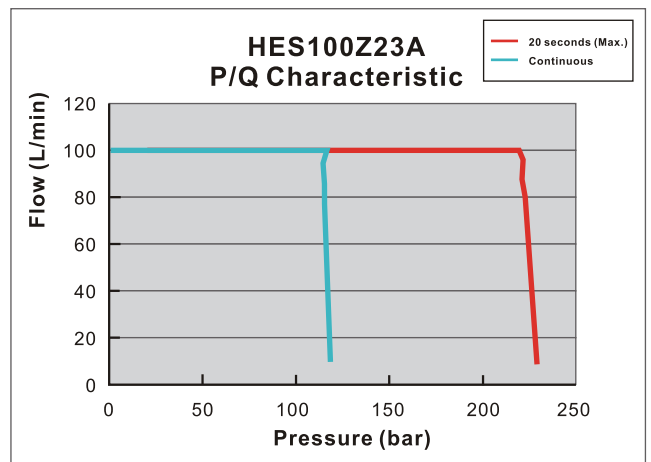
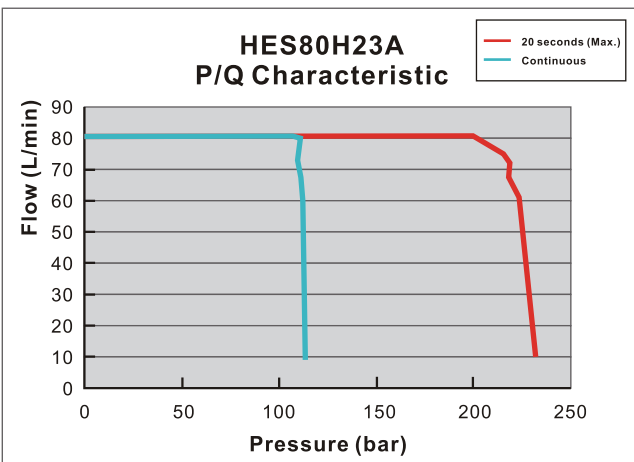
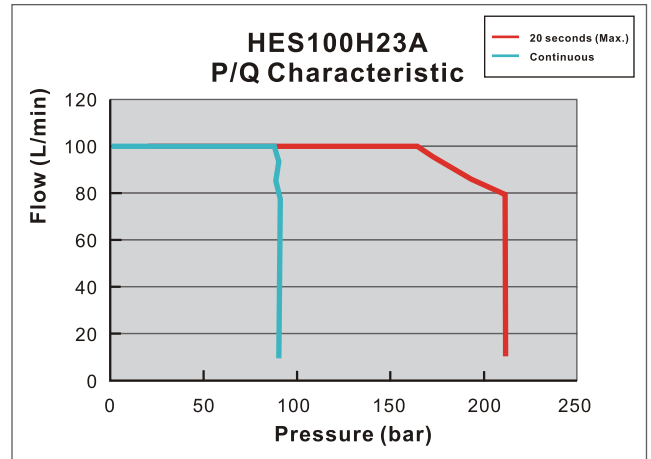
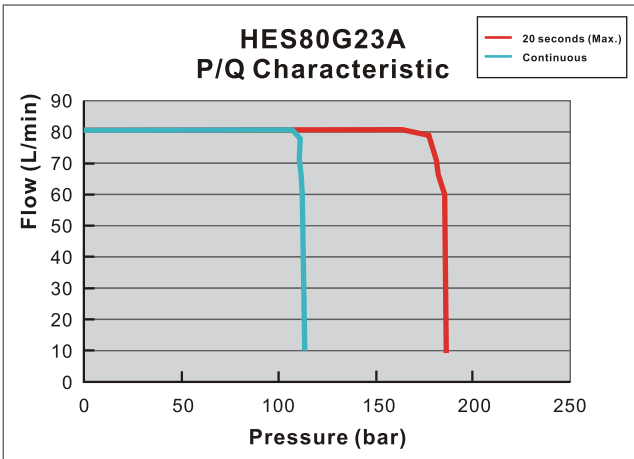
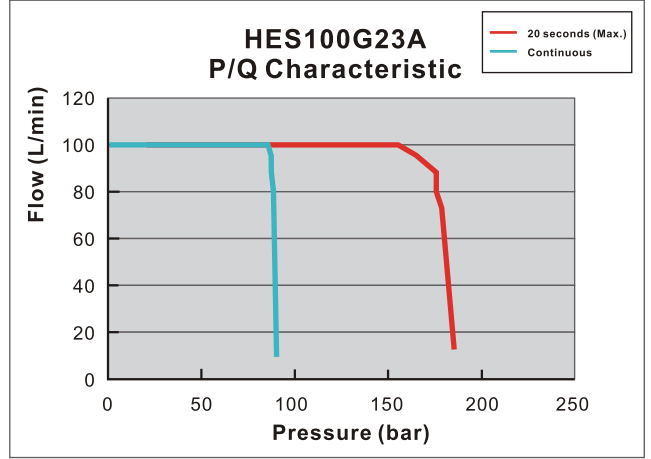
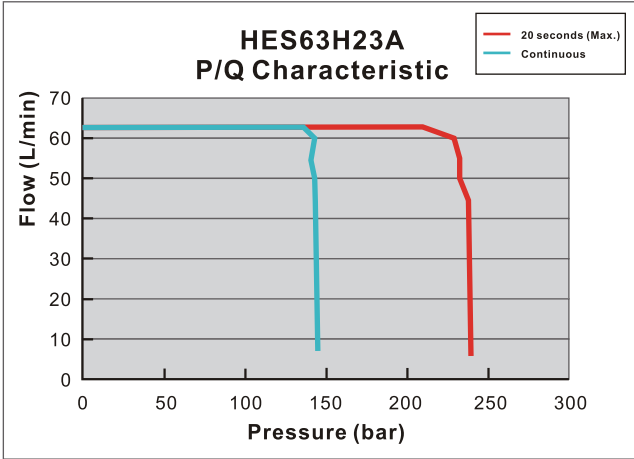


# System Specifications

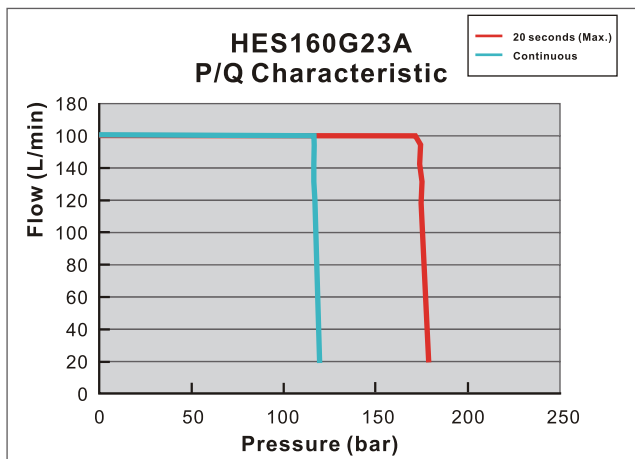
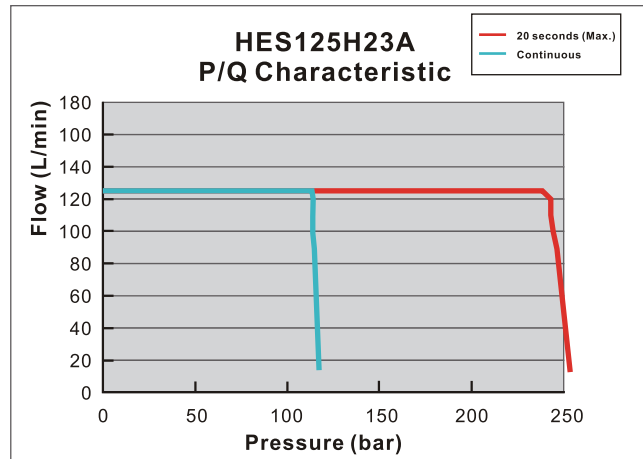
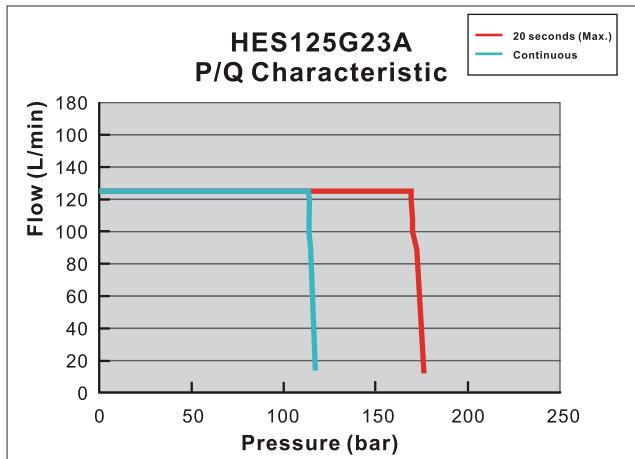
460V		Model HES___43A		HES___43A										
		063G	063H	080G	080H	100G	100H	100Z	125G	125H	160G	160H	200G	
Flow	Pump Capacity	cc/rev	25		32		40			50		64		80
	Flow	L/min	63		80		100			125		160		200
	Max. Flow	L/min	75		96		120			150		192		240
	Linearity	%	Lower than 1% F.S.											
	Hysteresis	%	Lower than 1% F.S.											
Pressure	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.											
Motor	Power	kW	11				15				20			
	Insulation Class		UL: Class A											
	Cooling Method		Force 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-J		110	150		185		200		300		370		
	Operation Voltage		3-phase voltage: 380 ~ 480V, 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					
	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											
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	Cooling System		Force Cooling											
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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											
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Others		Available upon purchase: safety valve, reactor and EMI filters												



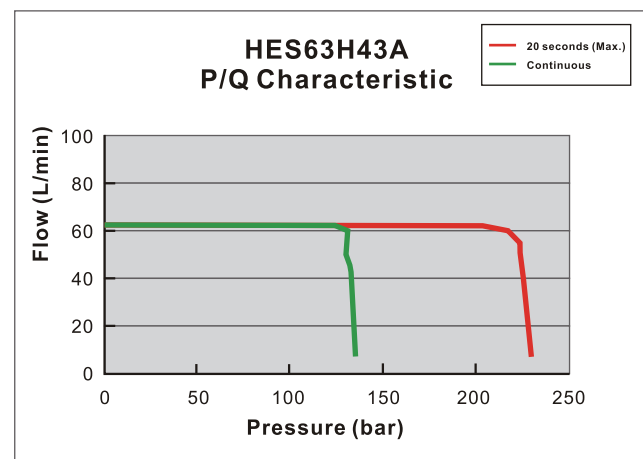
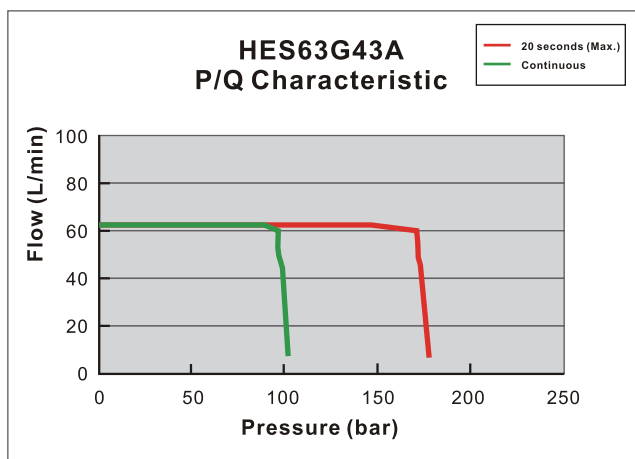
# System Overload Capacity HES \_\_\_\_23A Model



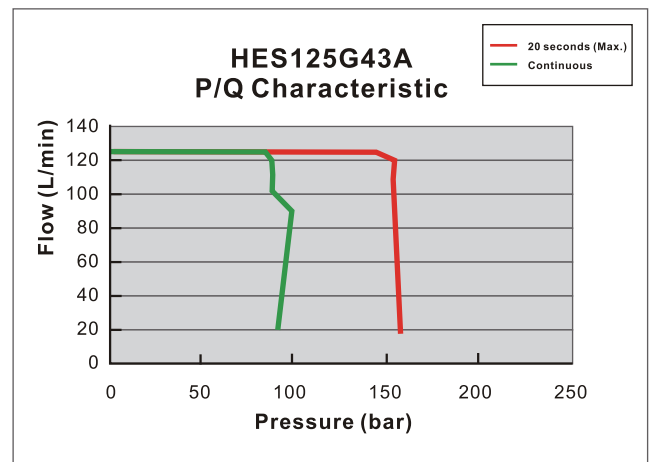
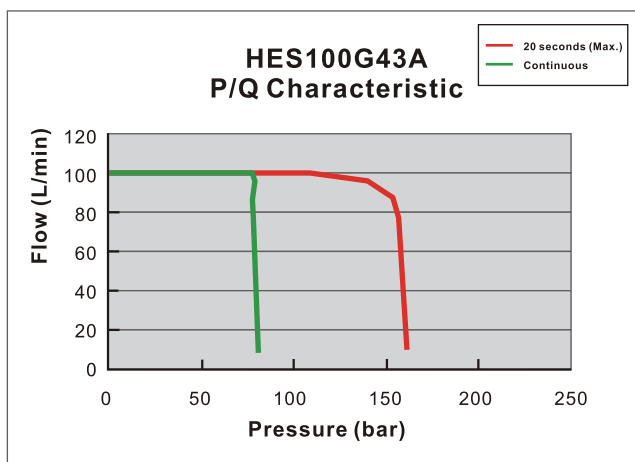
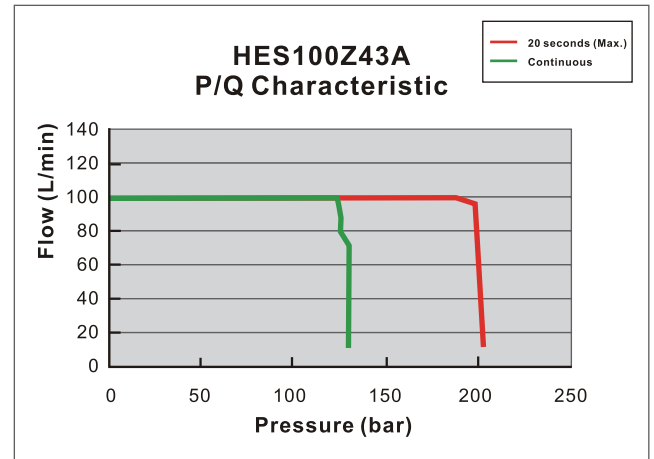
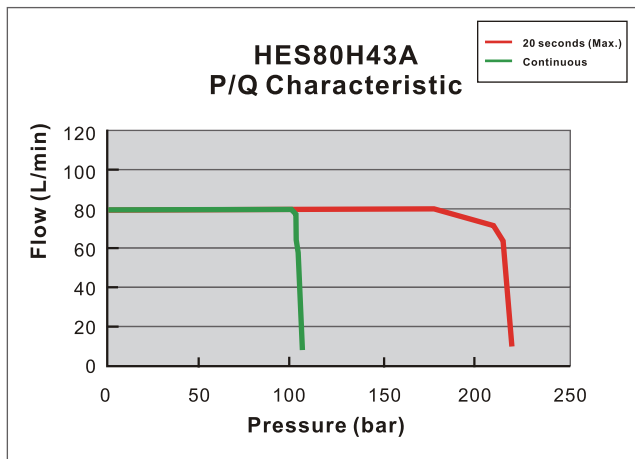
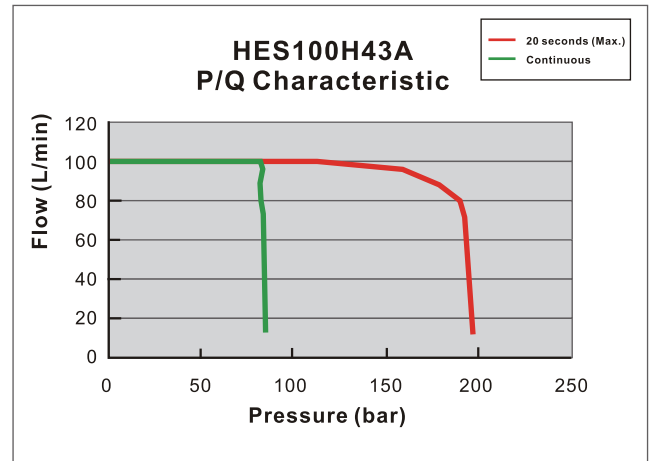
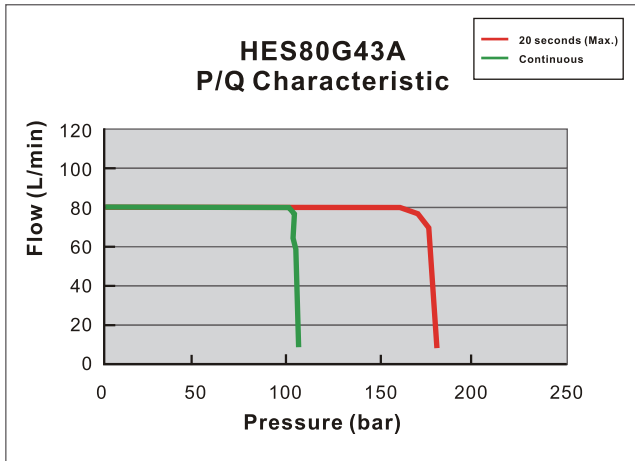
## System Overload Capacity HES\_\_\_\_23A Model



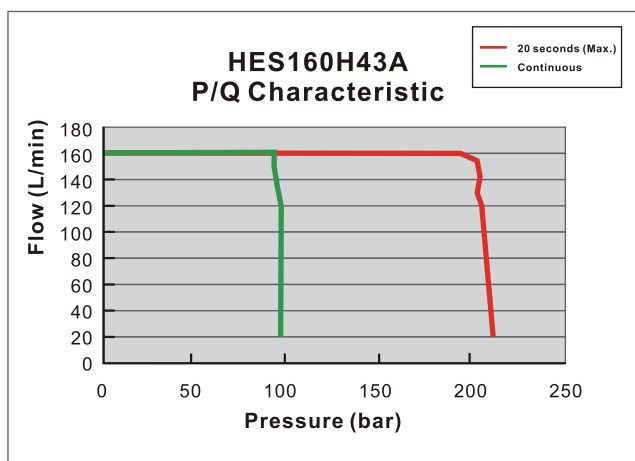
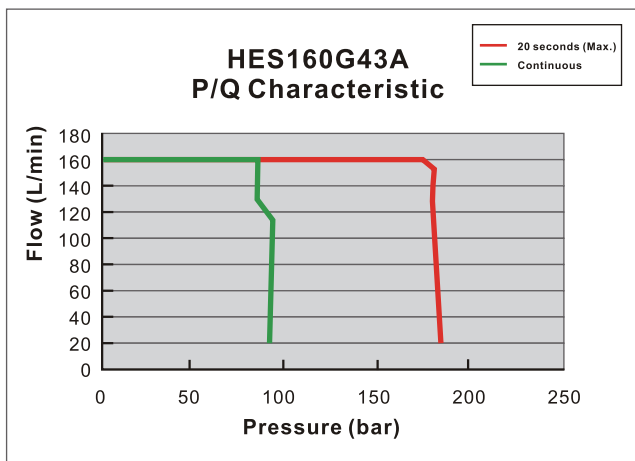
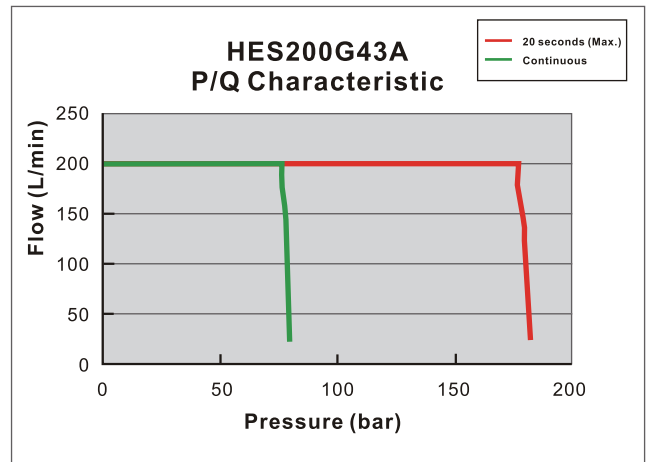
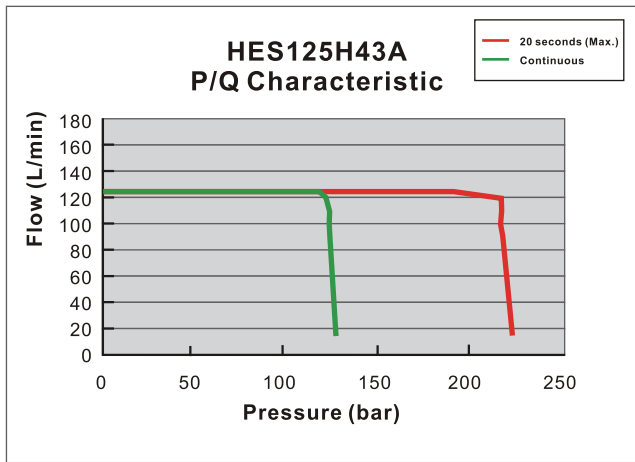
## System Overload Capacity HES\_\_\_\_43A Model



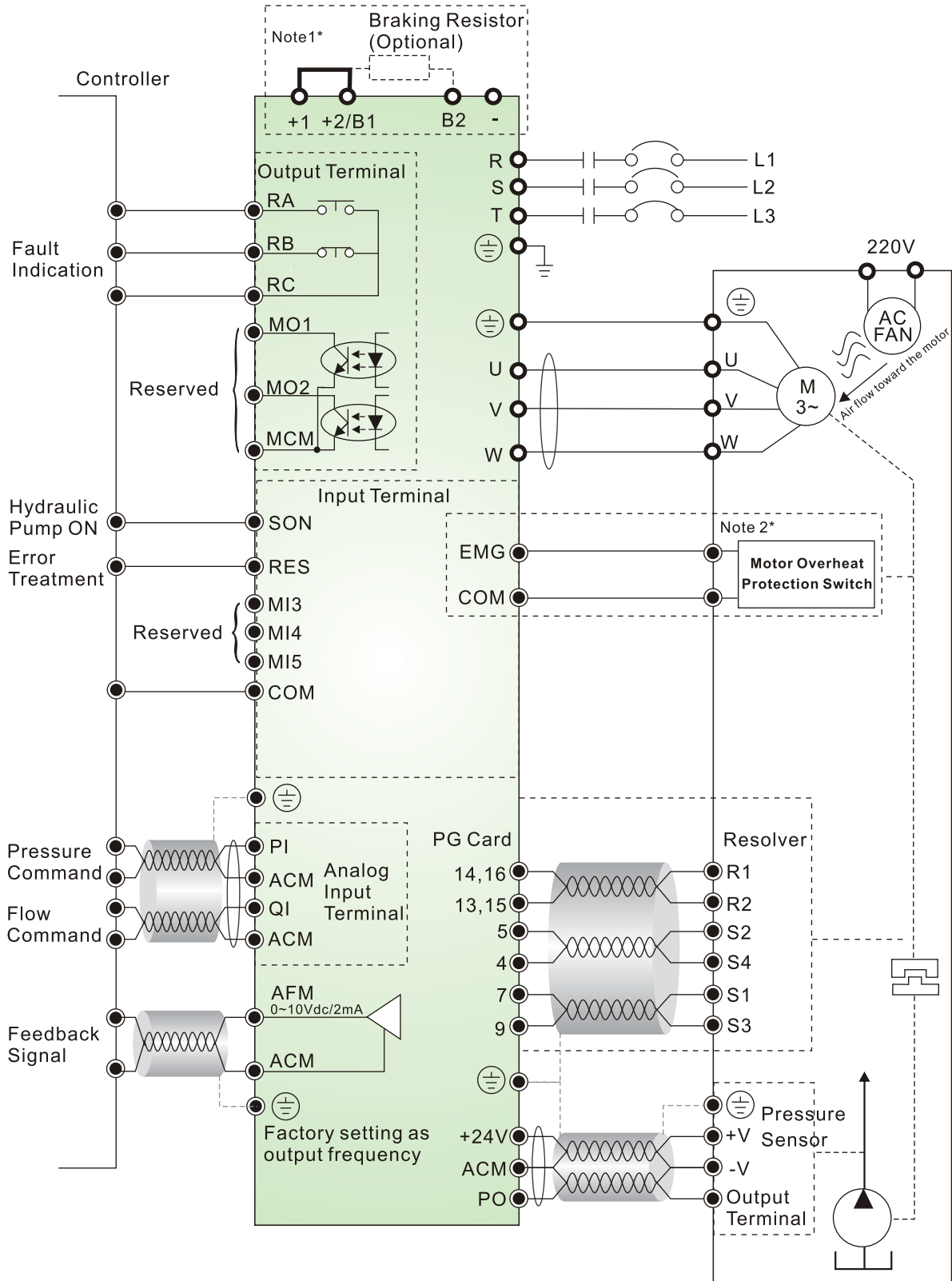
# System Overload Capacity HES \_\_\_\_43A Model



# System Overload Capacity HES\_\_\_\_43A Model

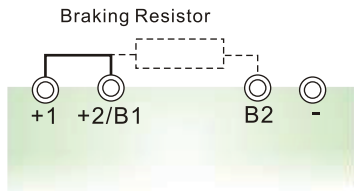


# Wiring

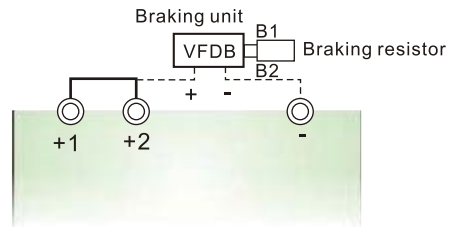


## Wiring

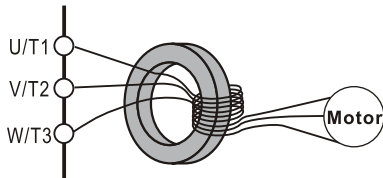
**\*1** Applicable to drive models that are 22kW or below (built-in brake unit).



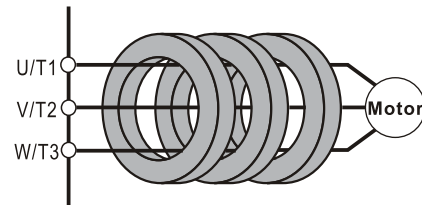
Applicable to drive models that are 30kW or above (built-in brake resistor).



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



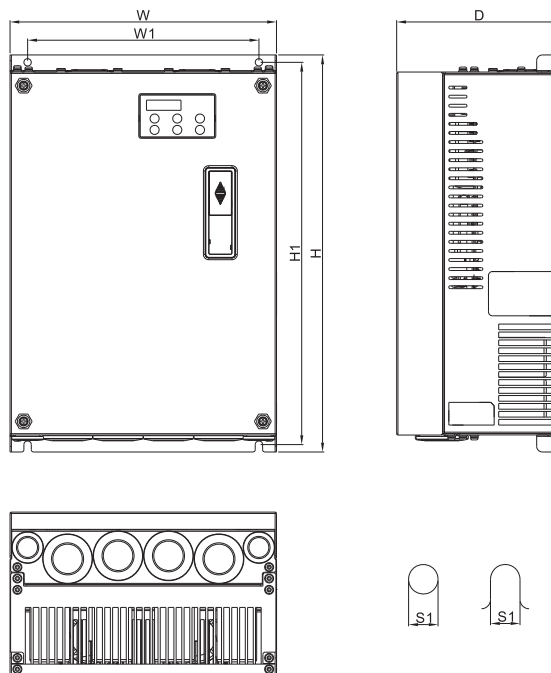
Applicable to drive models that are **30kW** or above.



## Hybrid Controller Dimensions

### ■ Frame C

VFD110VL23A/43A-J



DIMENSIONS

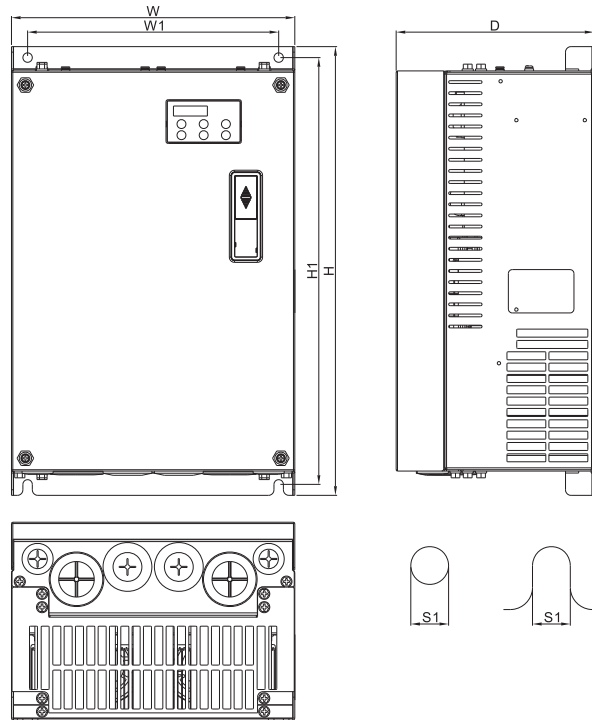
UNIT:mm[inch]

Frame	W	W1	H	H1	H2	H3	D	Ø	Ø1	Ø2	Ø3
C	mm	235	204	350	337	320	136	6.5	-	34	22
	inch	9.25	8.03	13.78	13.27	12.60	5.35	0.26	-	1.34	0.87

# Hybrid Controller Dimensions

## ■ Frame D

VFD150VL23A/43A-J  
 VFD185VL23A/43A-J  
 VFD220VL23A/43A-J



DIMENSIONS

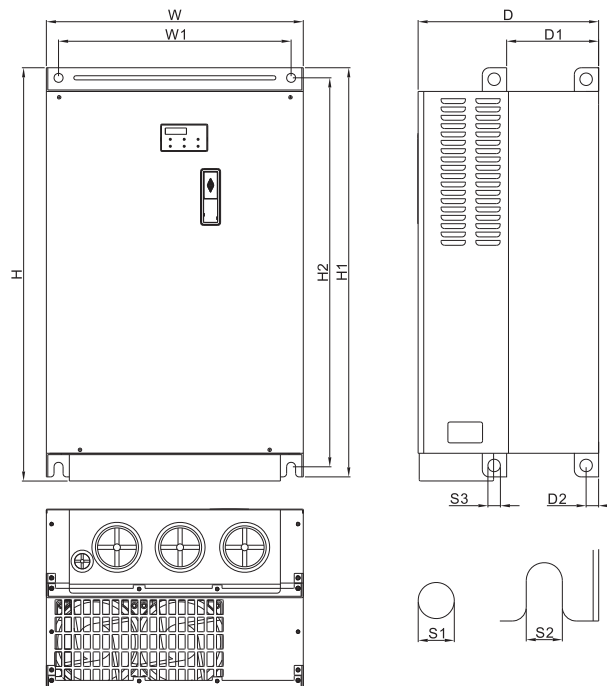
UNIT:mm[inch]

Frame	W	W1	H	H1	H2	H3	D	Ø	Ø1	Ø2	Ø3	
D	mm	255	226.0	403.8	384	360	21.9	168.0	8.5	44	34	22
	inch	10.04	8.90	15.90	15.12	14.17	0.86	6.61	0.33	1.73	1.34	0.87

## ■ Frame E

E1:  
 VFD300VL43A-J  
 VFD370VL43A-J  
 VFD450VL43A-J

E2:  
 VFD300VL23A-J  
 VFD370VL23A-J



DIMENSIONS

UNIT:mm[inch]

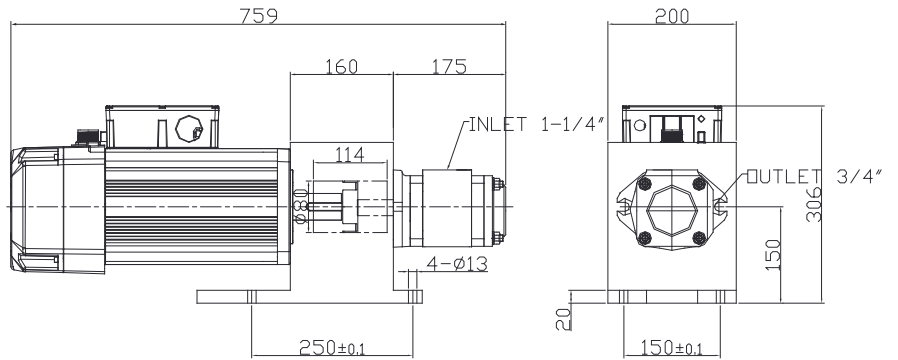
Frame	W	W1	H	H1	H2	D	D1	D2	S1	S2	S3	
E1	mm	370.0	335.0	-	589.0	560.0	260	132.5	18.0	13.0	13.0	18.0
	inch	14.57	13.19	-	23.19	22.05	10.24	5.22	0.71	0.51	0.51	0.71
E2	mm	370.0	335.0	595.0	589.0	560.0	260	132.5	18.0	13.0	13.0	18.0
	inch	14.57	13.19	23.43	23.19	22.05	10.24	5.22	0.71	0.51	0.51	0.71



# Pump Dimensions

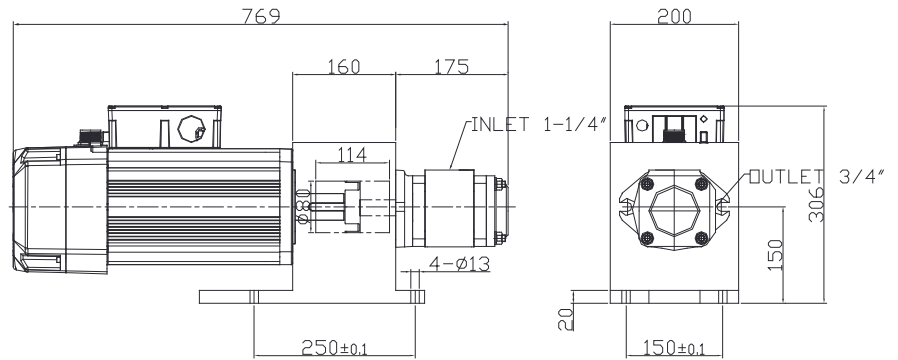
## Frame 1

- HES063H23A, HES063G43A, HES063H43A



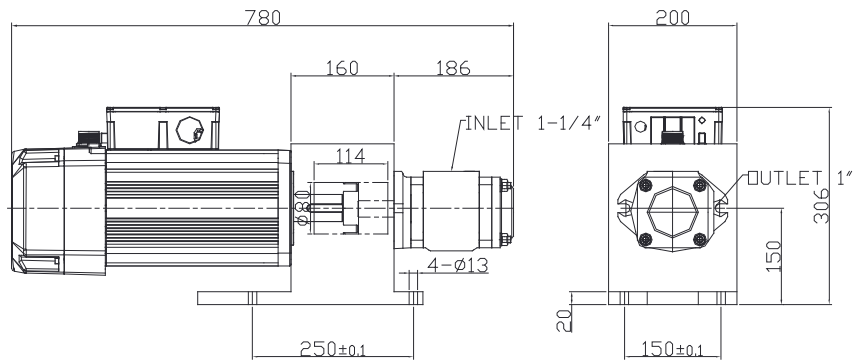
## Frame 2

- HES080G23A, HES080H23A, HES080G43A, HES080H43A



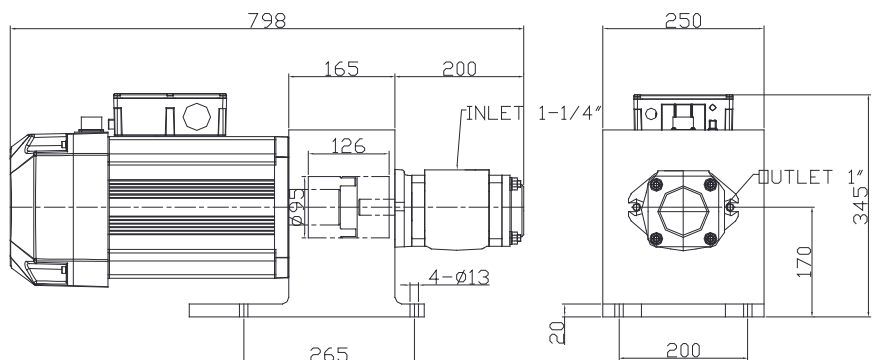
## Frame 3

- HES100G23A, HES100H23A, HES100G43A, HES100H43A



## Frame 4

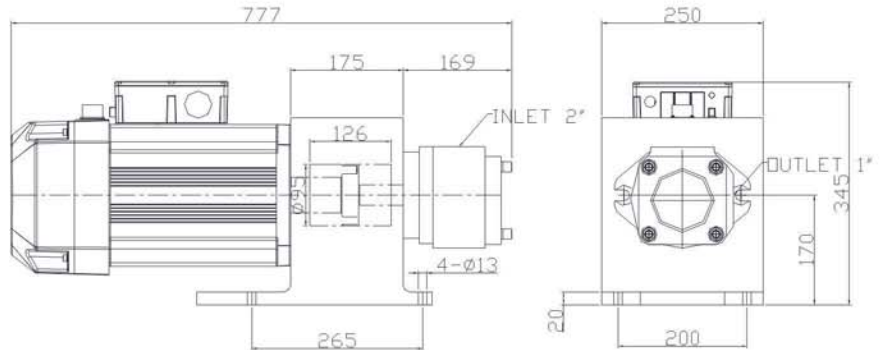
- HES125G23A, HES125H23A, HES125G43A, HES125H43A



## Pump Dimensions

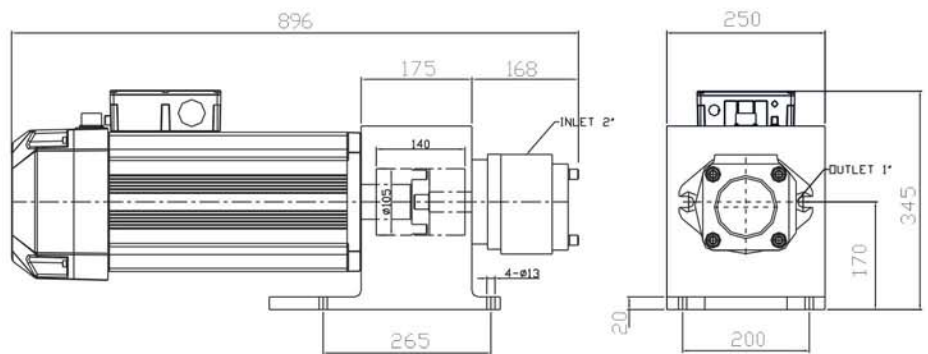
### Frame 5

- HES160G23A, HES160G43A



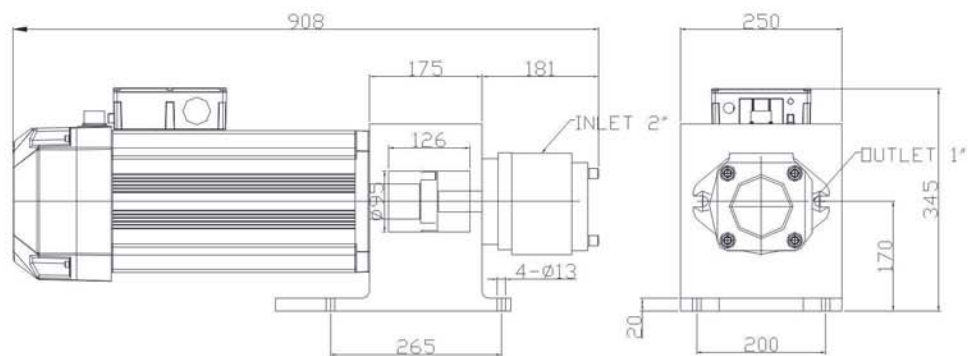
### Frame 6

- HES160H43A



### Frame 7

- 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	VFD110VL23A-J Spec: please refer to frame C	HSP-025-110-23A Spec: refer to frame 1	HESP-063-H-N-23 Items: A,B,D,E,F*1
HES080G23A	VFD110VL23A-J Spec: please refer to frame C	HSP-032-110-23A Spec: refer to frame 2	HESP-080-G-N-23 Items: A,B,D,E,F*1
HES080H23A	VFD150VL23A-J Spec: please refer to frame D	HSP-032-110-23A Spec: refer to frame 2	HESP-080-H-N-23 Items: A,B,D,E,F*1
HES100G23A	VFD150VL23A-J Spec: please refer to frame D	HSP-040-110-23A Spec: refer to frame 3	HESP-100-G-N-23 Items: A,B,D,E,F*1
HES100H23A	VFD185VL23A-J Spec: please refer to frame D	HSP-040-110-23A Spec: refer to frame 3	HESP-100-H-N-23 Items: A,B,D,E,F*1
HES125G23A	VFD220VL23A-J Spec: please refer to frame D	HSP-050-150-23A Spec: refer to frame 4	HESP-125-G-N-23 Items: A,B,D,E,F*1
HES125H23A	VFD300VL23A-J Spec: please refer to frame E	HSP-050-150-23A Spec: refer to frame 4	HESP-125-H-B-23 Items: A,B,D,E,F*1,E*3
HES160G23A	VFD300VL23A-J Spec: please refer to frame E	HSP-064-150-23A Spec: refer to frame 5	HESP-160-G-B-23 Items: A,B,D,E,F*1,E*3
HES063G43A	VFD110VL43A-J Spec: please refer to frame C	HSP-025-110-43A Spec: refer to frame 1	HESP-063-G-N-43 Items: A,B,D,E,F*1
HES063H43A	VFD150VL43A-J Spec: please refer to frame D	HSP-025-110-43A Spec: refer to frame 1	HESP-063-H-N-43 Items: A,B,D,E,F*1
HES080G43A	VFD150VL43A-J Spec: please refer to frame D	HSP-032-110-43A Spec: refer to frame 2	HESP-080-G-N-43 Items: A,B,D,E,F*1
HES080H43A	VFD185VL43A-J Spec: please refer to frame D	HSP-032-110-43A Spec: refer to frame 2	HESP-080-H-N-43 Items: A,B,D,E,F*1
HES100G43A	VFD185VL43A-J Spec: please refer to frame D	HSP-040-110-43A Spec: refer to frame 3	HESP-100-G-N-43 Items: A,B,D,E,F*1
HES100H43A	VFD220VL43A-J Spec: please refer to frame D	HSP-040-110-43A Spec: refer to frame 3	HESP-100-H-N-43 Items: A,B,D,E,F*1
HES125G43A	VFD220VL43A-J Spec: please refer to frame D	HSP-050-150-43A Spec: refer to frame 4	HESP-125-G-N-43 Items: A,B,D,E,F*1
HES125H43A	VFD300VL43A-J Spec: please refer to frame E	HSP-050-150-43A Spec: refer to frame 4	HESP-125-H-B-43 Items: A,B,D,E,F*1,E*3
HES160G43A	VFD300VL43A-J Spec: please refer to frame E	HSP-064-150-43B Spec: refer to frame 5	HESP-160-G-B-43 Items: A,B,D,E,F*1,E*3
HES160H43A	VFD370VL43A-J Spec: please refer to frame E	HSP-064-150-43A Spec: refer to frame 6	HESP-160-H-B-43 Items: A,B,D,E,F*1,E*3
HES200G43A	VFD370VL43A-J Spec: please refer to frame E	HSP-080-200-43A Spec: refer to frame 7	HESP-200-G-B-43 Items: A,B,D,E,F*1,E*3



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