

# Variable Frequency Resonance System

IEC840,  
IEC60840/FDIS,  
IEC62067.CD, IEC  
60885-2 :1985

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**HFRS-C 60800/400kV**

**(400kV, 152A)**

(Cylinder Type, for power cable on-site testing)

Himalayal Corporation Limited



### Operating Conditions:

#### Outdoor use

Altitude ≤1000m

Ambient Temperature: -10℃~+50℃

Max. Daily Temp. Difference ≤25℃

Relative Humidity: ≤95% (at 20℃)

Anti Earthquake: ≤ Class 8

Geoclimatic Horizontal Acceleration: 3.0m/s<sup>2</sup>

Geoclimatic Vertical Acceleration: 1.5m/s<sup>2</sup>

Waveform of power supply voltage is sine actually, and the waveform distortion rate is <3%

Set a reliable earthing section, and its earthing resistance is <0.5 ohm

### System Configuration:

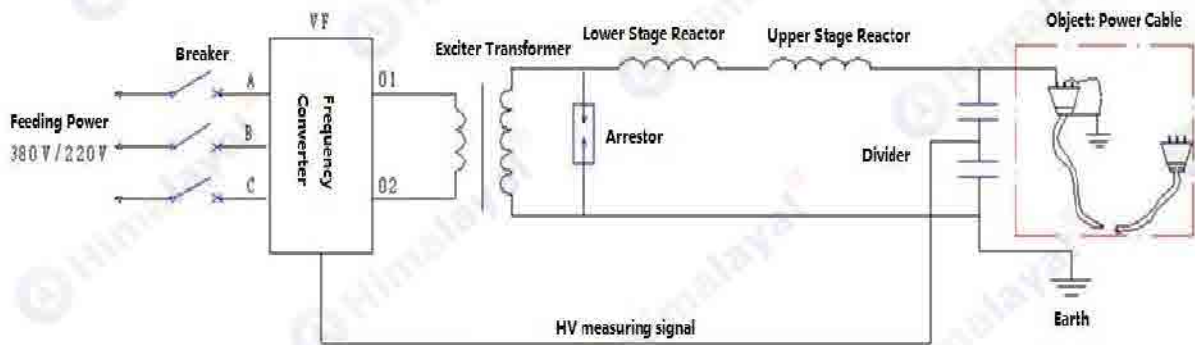
No.	Mode	Name	Qty.
1	HFC-450kW	Frequency Converter (Square wave)	2 sets
2	HET-900/5.9, 11.8	Exciter transformer	1 set
3	HFRS-C 7600kVA/200kV	Cylinder Type Resonant Reactor	8 sets
4	HVF 4000/400	Capacitance Voltage Divider	1 set

### Specification

Item	Name	Type	Qty.
Frequency Converter	Optical fiber	20meter	1 pcs
	Measuring termination	Include Optical fiber 20meter, for HV signal collecting.	1 unit
	Transport binder		1 set
	Special tools	295transistor checker,	1 set
Exciter transformer	Output wire	25mm <sup>2</sup> 5meter	1 pcs
	Basement insulation 40kV		4 units
	Corona ring 400kV 200kV		4 units 4 units
HV Reactor	Serial Lifting device		1 set
	Transport binder		2 sets
	HV lead wire	Φ200mm10meter/Φ300mm 10 meter	1 pcs each
	Serial connection wire	15mm <sup>2</sup> /2.5meter	4 pcs
	Parallel connection wire	50mm <sup>2</sup> /2.5meter	3 pcs
Capacitance Divider	Iron basement	2stage serial connection	1 set
	Measuring shielding wire	Measuring cable 15meter	1 set

Aluminum packing case		1 set
Low voltage wire	195mm <sup>2</sup> 15m	6 pcs
Wire/cable	185mm <sup>2</sup> /150m	6 pcs
	Earth cable	25mm <sup>2</sup> /8meter
	LV cable drum	9 units
	Packing case	Short cable and accessory
		1 set
Rainproof, dustproof cover	Frequency converter, Capacitance voltage divider, Compensation Reactor	10 units
Socket head wrench and others	\	1 set
Whole set documents	User Manual, Packing List, Calibrating Certificate	2 sets

### System Principle Diagram



SYFS - Frequency Converter

L - HV Reactor

C2 - Capacitance Voltage Divider (LV arm)

Tp - Exciter Transformer

C1 - Capacitance Voltage Divider (HV arm)

CX - GIS or Capacitance Object Load

### Main Equipment Data:



### System configuration performance index

Rated input voltage:  $380V \pm 10\% \pm 20\%$  (Three phase)

Feeding frequency: 50Hz/60Hz

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Rated output voltage adjusting range: 0~250kV (All parallel connection)

0~400kV (Two reactor serial connection, four parallel connection)

Rated output current: 304A (All parallel connection)

152A (Two reactor serial connection, four parallel connection)

Overall capacitance: 60800kVar

System voltage adjusting maximum resolution:  $\leq 0.05\%$

Output voltage instability:  $\leq 1\%$

Output frequency range: 15~300Hz

Output frequency resolution: 0.01Hz

Output frequency instability:  $\leq 0.05\%$

**System quality factor:  $Q \geq 80$**

**System protection function (Please check frequency converter part.)**

### System component parameter

#### Frequency Converter (Square wave) 2sets

Item	Qty.	Description
1	2	<p>Mode: <b>HFC-450kW</b></p> <p>Rated input voltage: 380V<math>\pm 10\%</math> (three phase); 50-60Hz</p> <p>Rated output power: 450kW</p> <p>Rated output voltage: single phase, 0-480V continuous adjustable</p> <p>Rated output current: 937.5A</p> <p>Output waveform: square wave</p> <p>Output voltage instability: <math>\leq 1.0\%</math></p> <p>Frequency adjusting range: 20Hz~300Hz</p> <p>Frequency adjusting sensitivity: <math>\leq 0.01\text{Hz}</math>, output frequency instability <math>\leq 0.05\%</math></p> <p>Sound level <math>\leq 65\text{dB}</math></p> <p>Working time: continuous working 180min under rated output capacitance;</p> <p>Frequency adjusts within setting range, voltage output stable.</p> <p>Variable frequency power source and control cabinet, voltage divider and control cabinet are connected by optical cable, making sure no damage to control cabinet when test object breakdown.</p> <p>Main body is separated from control, display, protection parts. Main body and protection are in one. Display is in one (separate). Control and display are portable.</p> <p>Variable frequency power source has the ability of anti anti-electromagnetic interference. Under high field interference, Its measuring accuracy and control protection can meet requirement. It equips with excellent magnetic shielding component. All lead wire are made of high permeability magnetic alloy , no space radiation.</p>

#### Variable frequency power source dedicated cable and lead wire:

Item	Qty.	Description
2	1	<p>Variable frequency power source equips with dedicated lead wire and socket to connected with other devices.</p> <p>Equips oscilloscope power socket, Partial discharge tester dedicated synchro source: 100V,</p>

100W

Optical wire and photoelectric converter for the connection among variable frequency power source control cabinet, Variable frequency power source main body and voltage divider connection, one set each, length of the optical cable 20m.



#### Exciter transformer 1set

Item	Qty.	Description
3	1	<p>Mode: <b>HET-900/5.9, 11.8</b></p> <p>Rated frequency: 20~300Hz</p> <p>Rated capacitance: 900kVA</p> <p>HV winding rated voltage/current: 5.9kV/152A; 11.8kV/76A</p> <p>Cooling methods: ONAN</p> <p>Heat-resistance: A grade, 25# transformer oil</p> <p>Working time: one hour on, two hour off, three cycle per day, winding<math>\leq</math>65K, oil surface<math>\leq</math>55K;</p> <p>Sound level: 65dB</p> <p>insulation endurance class: A class</p> <p>Impedance level: <math>\leq</math>6%</p> <p>Insulation level: LV winding to earth 3kV/1mm; HV winding to earth 20kV/1min</p> <p>HV winding adopt full insulation structure, and output with 15kV bushing.</p> <p>Structure requirement: oil immersed shell type; silicon steel plate is DQ130-30 high quality cooling rolling silicon steel plate, Bm value very low; Transformer has double coils, cooper lead wire, Low voltage winding and HV winding, adopt electrostatic shielding between two windings which has the function of isolation filter; equips measuring coil, used to measure HV side voltage; there are oil expansion tank and moister absorber on transformer; Oil temperature thermograph and oil level indicator are set on oil expansion tank; Transformer's spare part and component, e.g. bushing, valve and oil conservator's structure and layout will not affect the transportation. There are also enough safety distance between transformer HV and LV winding, will not cause partial discharge and corona when testing.</p>

Dimension and weight:

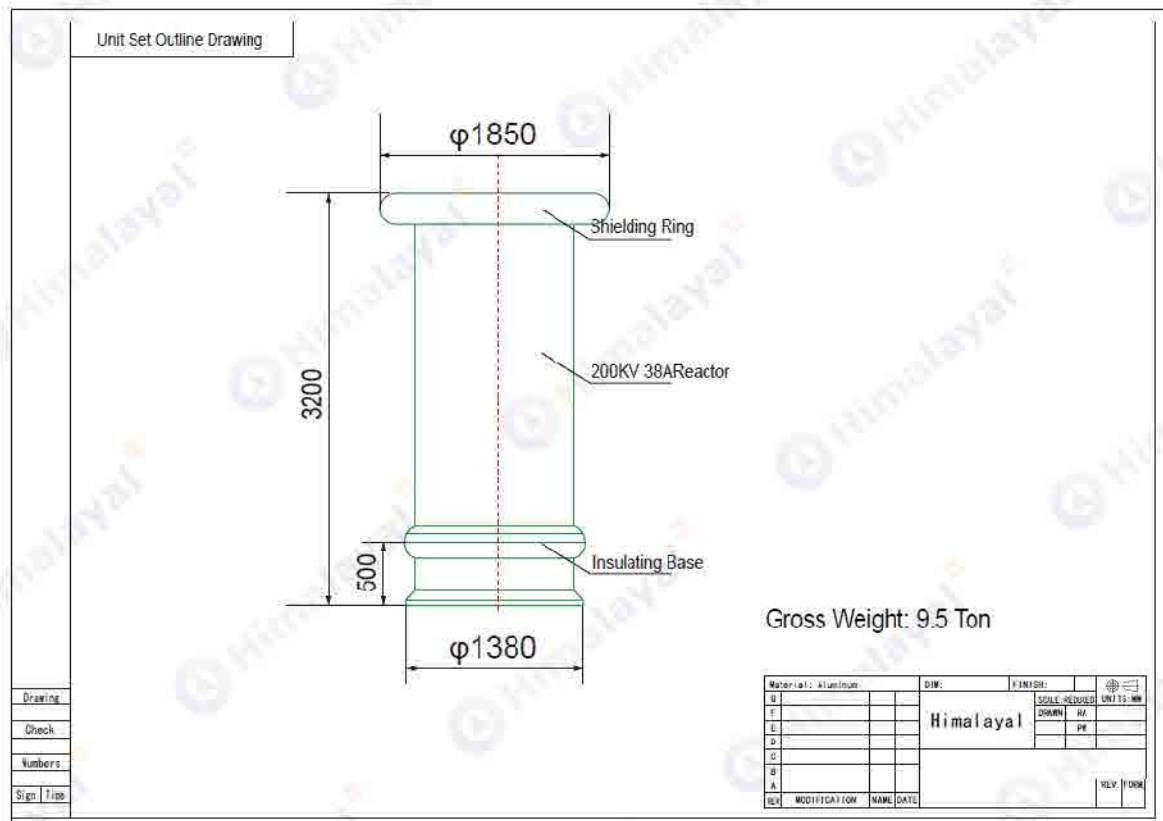
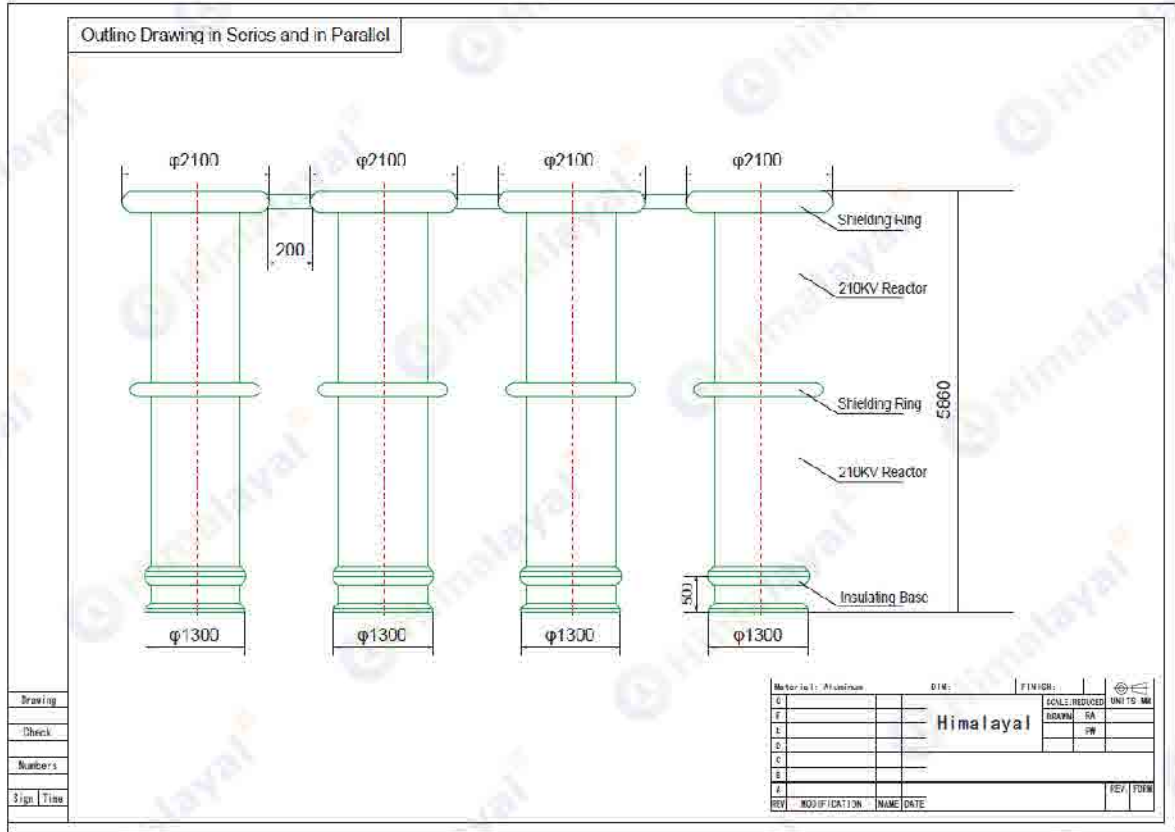
2550 x 1600 x 1900 (L x W x H), weight: 5000kg

### Cylinder Type Resonant Reactor 8sets

Item	Qty.	Description
4	8	<p>Reactor parameter:</p> <p>Mode: <b>HFRS-C 7600/200</b></p> <p><b>Single Module</b></p> <p>Rated voltage: 200kV</p> <p>Rated current: 38A</p> <p>Rated capacitance: 7600kVA</p> <p>Rated inductance: 41.9H±2%</p> <p>Insulation level: 220kV/1min, insulation basement to earth: 137kV/1min</p> <p>Rated frequency: 20-300Hz</p> <p><b>Quality factor: Q&gt;100 (20Hz)</b></p> <p>Working time: one hour on, two hour off, under rated output capacitance, not surpass 3 cycles every day. Temperature raise: winding≤80K, transformer oil≤55K;</p> <p><b>Structure requirement:</b></p> <p>The system adopts iron coil subsection air gap and copper winding structure, reactor adopts copper lead-wire winding, oil immerse self-cooling, and equips with breathe capsule for transformer oil expanding when testing. Reactor equips reliable hook for suspending. The inner structure of the reactor is special designed for long distance railway, highway transportation. The system suitable for on-site test.</p> <p>Reactor has nameplate for single unit and serial connection: the parameter on nameplate are: Rated voltage, inductance, working frequency, weight, and so on.</p>

### Capacitive Voltage Divider

Item	Qty.	Description
5	1	<p>Mode: <b>HVF 4000/400</b></p> <p>Single phase</p> <p>Rated Voltage:400kV</p> <p>Frequency: 20~300Hz</p> <p>Rated capacity: 4000pF±5%</p> <p>Nominal dividing ratio: 1000:1 (400kV)</p> <p>Voltage ratio error: ≤1% (effective value)</p> <p>Insulation level: withstand 60s under 110% rated voltage</p> <p><b>Dielectric Loss &lt; 0.3%</b></p> <p>Working time: one hour on, two hour off, under rated output capacitance,</p> <p>Corona ring: aluminum alloy material, convenient for packing and transportation.</p> <p>Pedestal: has enough stability, removable; voltage is measured via special measuring lead-wire to variable frequency power source; can measure single stage and two stage serial connection voltage; HV connection adopts HV corona-free connection, scalable.</p>



## Delivery and Final Test Items

**Complete sets of equipment shall be carried out following the factory test and final acceptance:**

The following items, unless noted, the factory test and final acceptance shall be done, and its standards in accordance with the relevant professional standards and the implementation of the agreement. the factory test and final acceptance results should be no substantive difference.

### Frequency Converter

Item	Qty.	Description
1	1	Test items: (1) Continuous working 60min under full load, and measure below items Measure input, output voltage and current Measure input, output power and efficiency Measure wind cooling inlet and outlet wind temperature Measure frequency adjusting range Inspect each high current connect point heating state (2) Over-voltage setting test (3) Breakdown protection test (4) Emergency shutdown test (5) Auto tune and auto raise voltage test (6) Variable frequency power source outlet short-circuit test: the variable frequency power source fast protection device should act reliable when variable frequency power source bear full load and short-circuit variable frequency power source output end with insulation rod. Repeat the test three times, no abnormal phenomenon.

### Exciter transformer

Item	Qty.	Description
2	1	Test items: (1) Measuring winding DC resistance and insulation resistance test (2) Measure voltage ratio (3) Impedance test (4) Withstand test

### Frequency Resonant Reactor (Cylinder type)

Item	Qty.	Description
3	1	Test items: (1) Winding resistance measurement (2) Withstand test (3) Inductance measurement (4) Rated load test



**Capacitance voltage divider**

Item	Qty.	Description
4	1	Test items: (1) Measure dielectric loss angle (2) Capacitance measurement, compared with designed value, not surpass $\pm 1\%$ (3) Withstand test (4) Voltage ratio inspection

**On-site test:**

Withstanding test at 380kV for 3uF capacitance load object – power cable.