

Variable Frequency Serial Resonant System for 150KV Power Cable and GIS On

IEC840,
IEC60840/FDIS,
IEC62067.CD

HFRS-C 16000/4*200

(800KV 20A, Cylinder Type)

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/s²

 Geoclimatic Vertical Acceleration: 1.5m/s²

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	HRC-400kW	Variable Frequency Power Source (Square wave)	1 set
2	HET-400/5, 10, 20, 30	Exciter transformer	1 set
3	HFRS-C 16000kVA/200kV	Cylinder Type Resonant Reactor	4 sets
4	HVF 2000/800	Capacitive Voltage Divider	1 set

Specification

No.	Name	Mode and Specification	Qty.
1	Measuring cable and optical cable	/	2 sets
2	30KV pedestal	/	1 set
3	Divider pedestal and compensation capacitor pedestal	/	2 sets
4	Divider top electrode	800KV Corona ring	1 set
5	Reactor top electrode	800KV	1 set
6	Variable frequency cabinet lead-in cable	120mm ² 3*10m	3 pcs
7	Variable frequency cabinet lead-out cable	150mm ² 2*10m	2 pcs
8	Packing case	Divider packing case	1 set
		Compensation capacitor packing case	1 set
		Cable packing case	1 set
9	HV Lead wire	Flexiable metal sylphon bellows (each section striction length: 1m, extend to 10m), diameter φ 100mm, each section has two connector.	1 set

Main Equipment Data:**System configuration performance index**

Item	Qty	Description
1	1	<p>Rated input voltage: 380V \pm 10% (three phase); 50Hz</p> <p>Rated output capacitance: 16000kVA</p> <p>Variable frequency power source output capacity: 400kW</p> <p>Rated voltage: 800kV</p> <p>Rated current: 20A</p> <p>Single phase</p> <p>Frequency adjust range: 20~300Hz</p> <p>Frequency adjust sensitivity: \leq0.1Hz</p> <p>Frequency instability: \leq0.05%</p> <p>Frequency converter waveform is square wave.</p> <p>Resonant voltage (HV) waveform is sin wave, waveform deviation \leq1%</p> <p>Test voltage stability \leq1%</p> <p>Insulation level: 120% rated voltage, withstand 1 minutes</p> <p>Sound level: 65dB</p> <p>Working time: one hour @ rated voltage and rated current.</p> <p>Short-circuit resistance ability: under rated capacitance, when reactor output terminal discharge to test object, discharge last 5 cycles, no damage to frequency converter winding.</p> <p>Quality factor: Q>40</p>

System component parameter**Variable frequency power source (Square wave)**

Item	Qty	Description
2	1	<p>Mode: HFC-400kW</p> <p>Rated input voltage: 380V\pm15% (three phase); 50Hz</p> <p>Rated output power: 400kW</p> <p>Rated output voltage: single phase, 0-460V continuous adjustable</p> <p>Rated output current: 869.6A</p> <p>Output waveform: square wave</p> <p>Output voltage instability: \leq1.0%</p> <p>Output voltage stability: UN\pm1%</p> <p>Output voltage frequency stability: f\pm0.01%</p> <p>Frequency adjusting range: 20Hz~300Hz</p> <p>Frequency adjusting sensitivity: \leq0.1Hz, output frequency instability \leq0.05%</p> <p>Insulation level: input, output terminal to ground \geq2kV/AC/1min</p> <p>Cooling type: forced air cooling</p>

Sound level ≤ 75 dB

Temperature raise: bridge arm temperature raise < 40 K, electric circuit temperature < 40 K, main circuit hottest point < 50 K;

Working time: continuous working 60min under rated output capacitance; three cycles per day.

Frequency adjusts within setting range, voltage output stable.

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.

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.

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.



Variable frequency power source

Variable frequency power source control cabinet:

Item	Qty	Description
3	1	Equips starting, stop and emergency switch - off button; Equips raise voltage and reduce voltage rough adjustment and fine control button(voltage raise and down speed are settable); Equips frequency rough adjustment and fine control button (Adjusting speed is settable); Cooling fan direction automatically selection; Automatic and manual test selection (Auto tune, automatic raise and reduce voltage); Equip test methods auto selection function, automatic test methods: setting test voltage, test time, auto tune -- auto raise voltage --- auto constant voltage and timing --- auto reduce

voltage. Manual test methods also has the selection of auto tune and auto timing;
 Equips output voltage, over-voltage protection and over-current protection setting value adjusting function;

Equips testing time setting function, time setting range:0-99min, timing accuracy±0.1second, end of setting time has sound reminding.

Variable frequency power source control cabinet display function:

Bridge arm voltage display;

Variable frequency power source input voltage, current, phase position display;

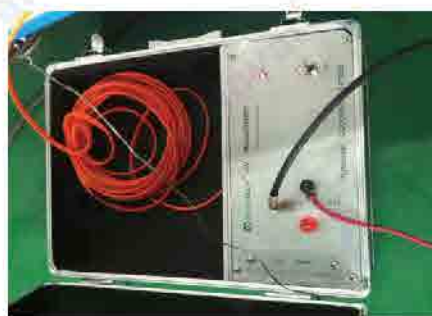
Variable frequency power source output voltage, current, frequency voltage, phase position and output waveform display;

Gateway wind temperature display;

All kinds of protection actions display;



Remote controller



Signal transit case (Volt. Signal -Optical signal)



Accessory case

Exciter transformer

Item	Qty	Description
4	1	Mode: HET- 400/5,10,20, 30 Working frequency: 20~300Hz Rated capacitance: 400kVA HV winding is independent winding: HV winding voltage: 5kV, 10kV, 20kV, 30kV HV winding current: 80A, 40A, 20A, 16.6A

LV winding voltage: 2x400V, 2x460, 2x500V

LV winding current: 2x434.8A

Non-load current: <8%

Impedance voltage: <6%

Cooling methods: ONAN

Heat-resistance: A grade, 25# transformer oil

Working time: half hour one, one hour off, under rated output capacitance

Temperature raise: winding $\leq 65K$, oil surface $\leq 55K$;

Sound level: 60dB

Insulation level: LV winding 3kV/1mn; HV winding 110% rated voltage withstand 60s.

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.

Cylinder Type Resonant Reactor

Item	Qty	Description
5	4	Reactor parameter: Mode: HFRS-C 16000/4x200 Four stages. Single reactor Rated voltage: 200kV Two reactors serial connected: 400kV Three reactors serial connected: 600kV Four reactors serial connected: 800kV Single reactor rated capacitance: 4000kVar Two reactors serial connected capacitance: 8000kVar; Three reactors serial connected capacitance: 12000kVar; Four reactors serial connected capacitance: 16000kVar; Single reactor inductance: 50H Two reactors serial connected inductance: 100H Three reactors serial connected inductance: 150H Four reactors serial connected inductance: 200H Single Reactor rated current: 20A Two reactors serial connected current: 40A Three reactors serial connected current: 60A Four reactors serial connected current: 80A Insulation level: Single Reactor withstand voltage: 220kV/1min

Two reactors serial connected withstand voltage: 440kV/1min

Three reactors serial connected withstand voltage: 660kV/1min

Four reactors serial connected withstand voltage: 880kV/1min

Error: <1%

Rated frequency: 20~300Hz

Quality factor: Q>40

Working time: half hour one, one hour off, under rated output capacitance, not surpass 3cycles every day. Temperature raise: winding≤65K, transformer oil≤55K; Surface of epoxy tube temperature raise ≤40K



Capacitive Voltage Divider

Item	Qty	Description
6	1	Mode: HVF 2000/800 Single phase, 4stages Rated Voltage: 800kV Frequency: 20~300Hz Rated capacity: 2000pF Single stage rated voltage: 200kV Two stages serial connected: 400kV Three stage serial connected: 600kV Four stages serial connected: 800kV Single stage capacitance: 8000pF (Use for object up to 200kV) Two stage serial connection capacitance: 4000pF Three stage serial connected capacitance: 2666pF Four stage serial connected capacitance: 2000pF Nominal dividing ratio: 8000:1 (supply the calibrating certificate from Nation Calibrating center) Voltage ratio error: ≤1% (effective value) Insulation level: withstand 60s under 110% rated voltage 880kV

Dielectric Loss <0.2%

Cooling: ONAN

Measuring accuracy: $\leq \pm 1.5\%$

Working time: half hour one, one hour off, under rated output capacitance

Corona ring: aluminum alloy material, convenient for packing and transportation.

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.

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.

Variable frequency power source

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

Serial Resonant Reactor

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

Capacitance voltage divider, Resonant Capacitor

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:

Do every test you want to do on power cable and GIS after the system successful installed, inspect the whole system's quality on-site.