

Variable Frequency Serial Resonant System for Cable On site Testing

IEC840,
IEC60840/FDIS,
IEC62067.CD

HFRS T 44200/2*260

(520kV 85A or 260KV 170A, Tank Type, Two Reactors)

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 | HFC-600kW | Variable Frequency Power Source(Square Wave) | 1 set |
| 2 | HET-600/1.75, 2.5,3.6,4.5, 6 | Exciter transformer | 1 set |
| 3 | HFRS-T 22100kVA/260kV | Variable Frequency Resonant Reactor | 2 sets |
| 4 | HVF 3000/520 | Capacitive Voltage Divider | 1 set |
| 5 | HCC 520-0.06 | Compensation capacitor (Using when no-load test) | 1 set |
| 6 | HDR 520-0.01 | Current Limiting Resistor | 1 set |

Specification

| No. | Name | Mode and specification | Qty. |
|-----|--|--|-------------------------|
| 1 | Measuring cable and optical cable | / | 1 set |
| 2 | HV Bushing | 260KV/300A | 1 set |
| 3 | Divider pedestal and compensation capacitor pedestal | / | 2 sets |
| 4 | Divider top electrode and compensation capacitor top electrode | 520KV, 260KV Corona ring | 2 sets |
| 5 | Divider, reactor top electrode | 520KV | 2 sets |
| 6 | Variable frequency cabinet lead-in cable | 180mm ² *30m | 3 pcs |
| 7 | Variable frequency cabinet lead-out cable | 300mm ² *10m | 2 pcs |
| 8 | Packing case | Dividing packing case Compensation capacitor packing case Cable packing case | 1 set 1 set 1 set |
| 9 | HV Lead wire | Flexible metal sylphon bellows (each | 1 set |

section striction length: 1m, extend to 10m), diameter ϕ 100mm, each section has two connector.

Main Equipment Data:

System configuration performance index

| Item | Qty. | Description |
|------|------|--|
| 1 | 1 | Rated input voltage: 380V \pm 10% (three phase); 50Hz Rated output capacitance: 44200kVA Variable frequency power source output capacity: 600kW Rated voltage: 520kV Rated current: 170A Single phase Frequency adjust range: 20-300Hz Frequency adjust sensitivity: \leq 0.1Hz Frequency instability: \leq 0.05% Resonant voltage waveform is sin wave, waveform deviation \leq 1% Test voltage stability \leq 1% Insulation level: 120% rated voltage, withstand 1 minutes Sound level: 65dB Working time: one hour on, one hour off under rated output capacitance, not surpass 3 cycles every day. 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. Quality factor: Q>65 ~120 |

System component parameter

Variable frequency power source (Square wave)

| Item | Qty | Description |
|------|-----|---|
| 2 | 1 | Mode: HRC-600kW Rated input voltage: 380V \pm 15% (three phase); 50Hz Rated output power: 600kW Rated output voltage: single phase, 0-500V continuous adjustable Rated output current: 1200A Output waveform: square wave Output voltage instability: \leq 1.0% Output voltage stability: UN \pm 1% Output voltage frequency stability: $f_0\pm$ 0.01% Frequency adjusting range: 20Hz~300Hz Frequency adjusting sensitivity: \leq 0.1Hz, output frequency instability \leq 0.05% Insulation level: input, output terminal to ground \geq 2kV/AC/1min |

Cooling type: forced air cooling

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 180min under rated output capacitance;

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 |

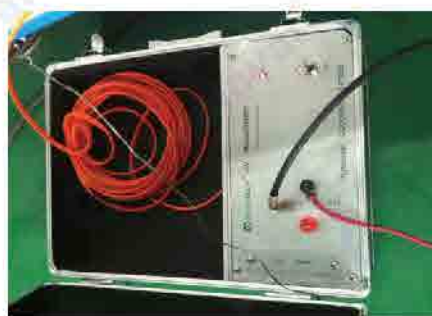
voltage. Manual test methods also has the selection of auto tune and auto timing;
 Equips output voltage, over-voltage protection and over-current protection setting value adjusting function;
 Equips testing time setting function, time setting range:0-99min, timing accuracy±0.1second, end of setting 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-600/1.75, 2.5, 3.6, 4.5, 6 Rated frequency: 25Hz Working frequency: 25~300Hz Rated capacitance: 600kVA HV winding is independent winding: HV winding voltage: 1.75kV, 2.5kV, 3.6kV,4.5kV,6kV |

HV winding current: 171A,171A,171A,133A,100A

LV winding voltage: 2x450V, 2x500, 2x550V

LV winding current: 2x600A

Cooling methods: ONAN

Heat-resistance: A grade, 25# transformer oil

Working time: continuous working 60 min under rated output capacitance, winding \leq 65K, oil surface \leq 55K;

Sound level: 60dB

Impedance level: \leq 5%

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.

Tank Type Resonant Reactor

| Item | Qty. | Description |
|------|------|--|
| 5 | 1 | <p>Single Reactor parameter: Mode: HFRS-T 22100/260 Single Module Rated voltage: 260kV Rated current: 85A Rated capacitance: 25800kVA Rated inductance: 16H\pm1% Error: <1% Insulation level: withstand 60s under 110% rated voltage Rated frequency: 20-300Hz Quality factor: Q>65 ~ 120 Working time: one hour one, one hour off, under rated output capacitance, not surpass 3cycles every day. Temperature raise: winding\leq80K, transformer oil\leq55K; Surface of epoxy tube temperature raise \leq40K</p> <p>Two Reactors parallel connection parameter: Mode: HFRS-T 44200/260 Two reactors parallel connection Rated voltage: 260kV Rated current: 170A</p> |

Rated capacitance: 44200kVA

Rated inductance: 8H±1%

Error: <1%

Insulation level: withstand 60s under 110% rated voltage

Rated frequency: 20-300Hz

Quality factor: Q>65 ~ 120

Working time: one hour one, one hour off, under rated output capacitance, not surpass 3 cycles every day. Temperature raise: winding≤80K, transformer oil≤55K; Surface of epoxy tube temperature raise ≤40K

Two Reactors serial connection parameter:

Mode: **HFRS-T 44200/520**

Two reactors serial connection

Rated voltage: 520kV

Rated current: 85A

Rated capacitance: 44200kVA

Rated inductance: 32H±1%

Error: <1%

Insulation level: withstand 60s under 110% rated voltage

Rated frequency: 20-300Hz

Quality factor: Q>65 ~ 120

Working time: one hour one, one hour off, under rated output capacitance, not surpass 3 cycles every day. Temperature raise: winding≤80K, transformer oil≤55K; Surface of epoxy tube temperature raise ≤40K



Capacitive Voltage Divider

| Item | Qty. | Description |
|------|------|---|
| 6 | 1 | Mode: HVF 3000/520 Single phase |

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Rated Voltage: 520kV
Frequency: 20~300Hz
Rated capacity: 3000pF (Two stages)
Single stage capacitance: 6000pF (Use for object up to 260kV)
Two stage serial connection capacitance: 3000pF (For object voltage between 260kV and 520kV)
Nominal dividing ratio: 6000:1
Voltage ratio error: ≤1% (effective value)
Insulation level: withstand 60s under 110% rated voltage
Dielectric Loss <0.5%
Cooling: ONAN
Measuring accuracy: ≤±1.5%
Working time: one hour on, 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.

Compensation Capacitor (Using when no-load testing)

| Item | Qty. | Description |
|------|------|---|
| 7 | 1 | Mode: HCC 520-0.006 Single phase Rated Voltage: 520kV Frequency: 20~300Hz Rated capacity: 6000pF (Two stages) Single stage capacitance: 12000pF Two stage serial connection capacitance: 6000pF Nominal dividing ratio: 6000:1 Voltage ratio error: ≤1% (effective value) Insulation level: withstand 60s under 110% rated voltage Dielectric Loss <0.5% Cooling: ONAN Measuring accuracy: ≤±1.5% Working time: one hour on, one hour off, under rated output capacitance Corona ring: aluminum alloy material, convenient for packing and transportation. |

HV Bushing

| Item | Qty. | Description |
|------|------|--|
| 8 | 1 | Mode: GY260-300 Single phase |

Rated frequency: 20-300Hz

Rated voltage: 260kV

Rated current: 300A

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

Current Limiting Resistor

| Item | Qty. | Description |
|------|------|---|
| 9 | 1 | Mode: HDR 520-0.01 Single phase Rated frequency: 20-300Hz Rated voltage: 520kV Rated current: 170A Rated inductance: 10mH Working time: one hour one, one hour off, under rated output capacitance |

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 |
|------|------|-------------|
|------|------|-------------|

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|---|---|--|
| 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 |

Current Limiting Resistor test

- | Item | Qty. | Description |
|------|------|---|
| 5 | 1 | Test items: (1) Appearance inspection (2) Inductance measurement, compared with designed value, not surpass $\pm 1\%$ (3) Withstand test |

On-site test:

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