SF6 Insulated
Test Transformer

HGTS-900/1200

(900kVA/1200kV)

Himalayal Corporation Limited

Himalayal®

Operating Conditions:

Altitude ≤1000m

Ambient Temperature: -10℃～＋50℃

Max. Daily Temp. Difference ≤25℃

Relative Humidity:≤85%（at 20℃）

Anti Earthquake: ≤ Class 8

Indoor use.

Geoclimatic Horizontal Acceleration: 3.0m/s^2

Geoclimatic Vertical Acceleration: 1.5m/s^2

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

Background PD level of our factory: 3pC.

System Configuration:

Item	Qty	Type
1	1	HGTS-900kVA/1200kV SF6 insulated Test Transformer
2	1	SF6-1200-0.00015 SF6 Capacitance Voltage Divider also Coupling Capacitor
3	1	TYDZ-250/0.4/0~6.3 Voltage Regulator
4	1	HDR 1200-5-0.75 Damping Resistance
5	1	PGL-1 Primary Stage HV Switchgear Cabinet
6	1	LNF-250/2x625 Power Supply Noise Filter
7	1	HCR-150x6/6 HV Compensation Reactor
8	1	ACS-2000 Digital Control and Measuring System
9	1	PV2-1 Digital Peak Voltmeter
10	1	Accessories Measurement and Control Cable, earthing bar

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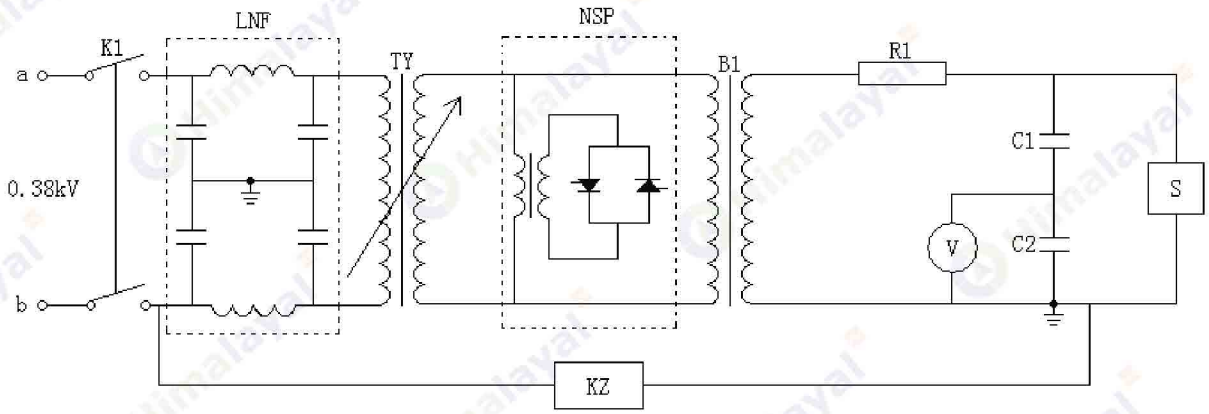
Main circuit diagram of the system



K1: Primary switchgear **TY**: Voltage regulator **LNF**: Power noiser filter

B1:Test transformer **R1**:Damping resitance **C1,C2**:Capacitance voltage divider

KZ: Control system **V** Peakvolt Meter **S**: Test object

NSP: Fast Protection Device

HCTT 600/1200 Power Frequency SF6 Insulated Test Transformer

Item	Qty	Description
1.1	1	Casing, Stationary type
		Single phase
		Frequency: 50Hz
		Rated Capacity: 1200kVA
		Rated Voltage: excitation winding: 2x6kV; HV winding: 1200kV
		Rated Current: excitation current: 2x75A HV Current: 0.75A
		Low voltage winding can be serial connection and parallel connection:
		When serial connection: HV output is 600kV/0.75A
		When parallel connection: HV output is 1200kV/0.75A
		(HV terminal of the transformer will be earthed through a current transformer 5/5 so as to check the
		current value of HV side and ensure safety of the operators and equipment.)
		Waveform deviation ≤3%

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Unload Current: IO ＜10%

Impedance voltage ≤12%

Voltage Ratio of Measurement Windings: 1000:1

Over Current Ability: Continuous working for 180S under 120% rated current (0.9A), then thermal damage

or distortion of the winding shall not be occurred.

Over Voltage Ablity: Overvoltage at 105% UH (1260kV) for 60s., then it shall not happened any insulation

damage for the testing transformer.

Short-circuit Discharge Test: under 900kV short-circuit discharge three times via damping resistor, not

cause any damage on the system.

Insulation Level: 20kV/1min (low voltage winding to earth)

5kV/1min (HV terminal to earth)

Winding Insulation level to earth:

HV winding to LV winding, measuring winding and earth >1500MΩ

LV winding to HV winding, measuring winding and earth >1500MΩ

Partial discharge level: ≤5pC, under 100% rate voltage

≤3pC, under 80% rate voltage

Noise: ≤60dB

Dielectric loss: <0.5%

Operating Time: test at 900kV, with load 1000pF, working 5min, 30min off, everyday not less than 20cycle;

Protection: Equip with 6kV surge arrestors.

SF6 Capacitance Voltage Divider (also coupling capacitor)

Item	Qty	Description
2.1	1	Mode: SF6-1200-0.00015
		Frequency: 50Hz

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Rated voltage: 1200kV

Rated capacity: 150pF

Dielectric Loss <0.3%

Temperature coefficient: <0.0005

Voltage ratio: 3000/1

Measuring Accuracy: ≤±1%

Insulation level: SF6 capacitance voltage divider can withstand under 105% rated voltage (1260kV) 60S, and nor abnormal phenomenon.

Partial discharge level: ≤5pC, under 100% rate voltage

≤3pC, under 80% rate voltage

Structure type: insulated by SF6 gas, form gas capacitor with conducting rod.

Allowed Operating Time:same with the transformer.

pV1-2 Digital Peak Voltmeter

Item	Qty	Description
3.1	1	Function:the peak voltmeter is used to measure AC withstand test voltage and real effective value

1)Input voltage measuring range: 700V, the voltage is peak value /$\sqrt{2}$ or real effective value

2)The voltage is real voltage of the meter, input voltage= test voltage/ voltage ratio

3)Peak value reproduction: peak value/effective value display selection

4)Voltage display: is 4.5 digit digital meter. Display test voltage's real effective value or peak volt/$\sqrt{2}$, Reading is Kv.

5)Voltage ratio setting switch, the switch is 4 digit. Max ratio is 9999. Set the value to real ratio enable more accuracy data.

6.)Accuracy grade not less than 1 grade. Can measure effective value, peak value, peak value/$\sqrt{2}$, and record flashover voltage value, measuring error meet the requirement of IEC60060-2

7. Self-holding over-voltage value when flashover.

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TYDZ-250/0.4/0~6.3 Voltage Transformer

Item	Qty	Description
4.1	1	Single phase,Frequency: 50Hz Single phase Frequency: 50Hz Cooling methods: ONAN Rated Capacity: 250kVA Regulating methods: Motor drive Rated Input Voltage: 0.4kV Rated Input Current: 625A Rated Output Voltage: 0~6.3kV Rated Output Current: 0~40A Aberration Ration of Waveform:≤3% Starting Voltage ≤1.5% Short-circuit Impedance:≤7.5%(in range of 50%～ 100%,impedance is being linearity) Mode of Regulation: electrical drive Operation Time: same with the transformer Short-circuit capability: When test transformer discharge to the test object via damping resistance under transient state, short-circuit current reach 2 times of rated value. The discharge last 8 circle will no damage regulator's winding or mechanical distortion. Over-load ability: withstand 30min at 1.2UH, withstand 15min at 1.4UH, withstand 5min at 1.5UH. Temperature raise: temperature rise of oil surface is less than 55K., winding less than 65K Product structure: ① there are upper and lower position limited, oil drain valve, oil level indicator ②Regulating unit and raise voltage raising units are set together.

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HDR 325-5-0.31 Damping Resistor

Item	Qty	Description
5.1	1	Mode: HDR 1200-5-0.75
		Rated Frequency: 50Hz
		Rated Voltage: 1200kV
		Rated Current: 0.75A
		Nominal Resistance: 5kΩ
		Rated Power: 2.8kW
		Partial discharge level: ≤5pC, under 100% rate voltage
		≤3pC, under 80% rate voltage
		Operating Time: same with the transformer
		Temperature raise: Resistor surface temperature raise less than 40K under 100% IH

PLG-1 Pre-stage Swithgear Cabinet (Regulator input cabinet)

Item	Qty	Description
6.1	1	Mode: PLG-1
		Rated frequency: 50Hz
		Rated voltage: 0.4kV
		Rated current: 625A
		Short time current: 8kA
		Grade of protection: IP20
		Time delay: 5s
		Winding voltage: 220V (Switch on and off)
		Switching time: 10000times
		On the surface-panel, there are voltmeter, amperemeter, power supply switch-off indicating lamp, Power supply switch-on indicating lamp, remote function switch.

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LNF-250/2x625 Power Noise Filter

Item	Qty	Description
7.1	1	Rated capacitance: 250kVA
		Rated Voltage: input voltage: 0.4kV, output voltage:0.4kV
		Rated Current: input current: 625A, output current:625A
		Frequency: 50Hz
		Single phase
		Cooling methods: ONAN
		Line number: 2 lines
		AttenuationCharacter:
		40KHz-100KHz>40dB; 100KHz-2MHz>60dB
		Allowed Operating Time:same with the transformer
		PD level, background noise < 5pC
		Insulation level: 20kV/1min, no abnormal discharge.
		Install inside the Pre-stage Cabinet

Compensation Reactor

Item	Qty	Description
8.1	1	Mode: HCR-150x6/6
		Structure: Iron shell, stationary type iron core
		Rated capacitance: 6x150kVar
		(Six grade: 150, 300, 450, 600, 750, 900 output with bushing)
		Rated frequency: 50Hz
		Rated voltage: 6kV
		Rated current: 25, 50, 75, 100, 125, 150A
		Reactor equip compensation current transformer, install inside compensation reactor.
		Single phase
		Degree of linearity:＜±1%
		Sound level:＜70dB (measured in 4 meters distance)

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Over-current capacity: the over-current will not cause thermal damage or winding distortion to the compensation reactor, when the reactor working under 120% In continuous 3 mintues.

Over-voltage capacity: the over-voltage will not cause any insulation damage of the compansation reactor when the reactor working under 110%UH 1 mintues.

Working time: same as transformer;

Temperature raise ≤65K, oil surface temperature raise ≤55K,

Attention:

The winding is mutistrand copper wire parallel wound, which reducing reactor winding eddy-current loss.

Copper wire density ≤2.5A/mm2

Insulation level: all insulation, all terminal insulation withstand to ground 10kV/min , no abnormaldischarge.

Structure: adjustable reactor iron coil pass through single phase motor, which realize stepless reactance regulation. At the same time, we will equip moisture absorber and oil drain valve for the reactor.

NSP-2010 Over Voltage Fast Protection Device

Item	Qty	Description
9.1	1	Rated voltage: 6kV,Maximum voltage: 6.6V Instant maximum current:5kA,Inhibition protection time：>200ms (turnable) Former ordering time:<100nS,Protection response time:<100us Sensitivity:10％～100%turnable,Operating time: same with transformer Fast controlled silicon will be touched when the test object is breakdown, that the input voltage of transformer will pump into the minimum in 10ms, and the magnetic

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field in transformer will be absorbed thus making the over voltage attenuated within 10ms. The electric switch-off cannot be established on the test object.

Because of fiber communication adopted, the environmental interference to protection device is weakened.

The device is made up of test circuit, logic judging control amplifying circuit, strong touching circuit, fast thyristor and reactor, automatic control, designation and pre-protective circuit , each of which is connected by fiber so as to develop the anti-interference function and reliability, raising the response speed as well.

ACS-2000 Digital Automatic Control And Measuring System

Item	Qty	Description
10.1	1	Structure: PLC control, Adjusting Accuracy: 0.1kV Voltage Withstand Time: Setting Range: 1S-9999S, Adjusting Accuracy: 1S Adjusting Accuracy: 0.1kV Voltage Withstand Time: Setting Range: 1S-9999S Adjusting Accuracy: 1S Input Power Supply: 380V, 3-phase, 10A, AC±10%

Item	Qty	Description
10.1	1	**System Introduction**
10.1.1		The control table will be connected with its switch cabinet through optical fiber so as to isolate the main system equipment from the control unit and prove safety control of the system.
10.1.2		The key components and control panel are used of high quality imported parts.
10.1.3		Control, program writing, software update is available.
10.1.4		With functions of control, measurement, protection and interlocks, and can realize automatically control.

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10.2. **Main Structure of System**

The system is composed by operating interface and PLC control unit.

10.2.1 The operating interface is mounted on the control table which is located in control room. So the test transformer can be controlled at site. To different test requirements, data of control and measurement will be transmitted via 2-core optical fiber.

10.2.2 The PLC control unit is mounted at switch cabinet side which connected with the interface via 2-core optical fiber.

10.3. **System Functions:**

10.3.1 Separated sub-interface for different control of the transformer.

10.3.2 Emergency stop buttons of each interface are available for cut off power supply of the system and shut down the test. The functions can be set and operated through touch screen.

10.4 **Control Functions:**

Open/Close of Primary side of the regulator

Open/Close of Secondary side of the regulator

Step-up/Step-down

Step-up time setting; Step-down time setting

Speed Adjustable

Setting of Timer

Turn Ratio Setting of the Divider;

Setting of Current Protection Value

Setting of Voltage Protection Vaule

Reset of Protection State

Operation of Alarming Bell & Lights;

Timing Operation: timing will be driven automatically after push down start button. When arrived the setting time point, the alarming will start and keep for 2 min, then the system will step down.

Automatic Control:Preset of voltage value, step-up/step-down speed and timing data, then push down start button for realizing of the whole process.

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10..5 **Measurement Display**

Secondary voltage of regulator (i.e. Primary winding voltage of testing transformer) : accuracy 1%

Secondary current of regulator (i.e. Primary winding current of testing transformer) : accuracy 1%

Voltage of Divider (i.e. Secondary winding voltage of testing transformer): accuracy 1%

Secondary winding current of testing transformer: accuracy 1%

The high voltage value of discharge can be recorded.

10.6 **State Display and Indication:**

Correctness of phase sequence;

Close or open state indication of regulator primary switch;

Cose or open state indication of regulator secondary switch

Position Limit indication of regulator step-up / step-down;

Overvoltage Protection;

Overcurrent Protection;

Protective device action of switch cabinet;

Interlock/Indication between test field door and switch-on operation;

Interlock/Indication of non-release of emergency button;

Interlock/Indication of operation when the regulator set not at lowest position;

The reactor is stepless adjustable unit and controlled manually of the motor for adjustment of air-gap. The relevant current value will be indicated and with showing of capacitive current compensated.

10.7 **Interlock:**

Interlock of isolating switch ON and vacuum circuit breaker ON;

Interlock of vacuum circuit breaker OFF and isolating switch OFF;

Interlock of vacuum circuit breaker Close and failure set lowest position of regulator;

Test field door opened, vacuum circuit breaker can not be closed;

Emergency stop button not released, vacuum circuit breaker can not be closed;

Circuit breaker closed, tripping off automatically when the door opened;

Only regulator primary closed first, the secondary can be closed;

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When the primary tripped off, the secondary do same action automatically;

Circuit breaker tripped off, the regulator will go down to the lowest position;

When the regulator is live, if the control power suddenly cut off, the vacuum breaker will trip off. After the system be switched on again, the regulator will return to Zero Limit Position. Otherwise, the breaker could not be turned on again.

In test process, if test object is breakdown, overcurrent protection will act and the front pole switch and rear pole circuit breaker will trip off and the regulator will return to Zero Position. Otherwise, the close operation of front pole switch and vacuum breaker can not be carried out.

10.8 Protection

The switch cabinet has current and voltage protection components which separated away from the control system. When set protection value reached, the protective actions work accordingly and its action will be indicated on the interface of control system.

The current protective value of regulator primary and secondary can be set through control system. When the set value reached, the system trip off automatically.

Control Functions:Change-over between auto and manual control as per operator order input. Close /open of switch is under control; automatic step-up / step-down and emergency open while being failure; the speed of step-up can be controlled automatically, that means high speed of step-up is done before 75% test voltage and the speed slow down beyond 75% test voltage.

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