

Sieyuan®

Oil-Immersed Arc-Suppression Coil and Earthing Transformer

Operating Instructions

SIEYUAN ELECTRIC CO.,LTD

1 Application Scope

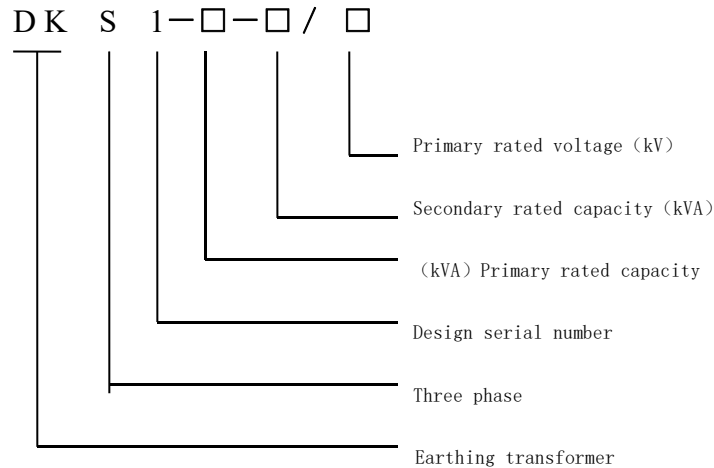
The Operating Instructions are applicable to the transportation, the storage, the installation, the operation and the maintenance of oil-immersed arc-suppression coils with the nominal capacity of 5000kVA and below and the voltage class of 66kV and below (hereafter referred to as “arc-suppression coils” for short) and excitation-free voltage-regulation oil-immersed earthing transformers with the nominal capacity of 5000kVA and below and the voltage class of 35kV and below (hereafter referred to as “earthing transformer” for short).

1.1 The arc-suppression coils are used for compensating single-phase reactors generating condenser current when fault occurs between the neutral point insulation system and the ground. The product is connected between the neutral point of the power transformer or the earthing transformer and the ground in the three-phase system. At the nominal grade, the voltage and the current of the supplementary coils P1 and P2 are 10V and 10A.

1.2 The earthing transformer (the coupler of the neutral point) is a three-phase transformer (or three-phase reactor), which is generally used for providing a manual neutral point which can be loaded manually for unearthed points of the system and is used for earthing the system. The neutral point of the product is connected to the arc-suppression coil or resistor before it is earthed. It can be provided with secondary coil with continuously nominal capacity and is used as a station-used power supply.

If after the arc-suppression coil and the earthing transformer are normally transported, they do not need center-suspension check, the disassembled components and parts can be assembled. After they are inspected and accepted, they can be used.

2 Executive Standards



4 Use Conditions

4.1 Height above sea level $\leq 1000\text{m}$

4.2 Environmental temperature

The maximum temperature $+40^{\circ}\text{C}$

Maximum annual average temperature 20°C

The average temperature of the hottest month 30°C

The minimum temperature -25°C

4.3 Relative humidity $\leq 95\%$

4.4 There shall be no obvious dirt in the installation environment

4.5 The ground acceleration caused by earthquake a_g

Below 3m/s^2 in the horizontal direction;

Below 1.5m/s^2 in the vertical direction.

4.6 If the above conditions are exceeded, the rating shall be properly regulated according to related provisions of GB1094.

5 Transportation

5.1 The products can be transported to the installation place by road or railway. The products are transported with oil, and shall be attached with accessories, fittings and documents, and the packaging boxes shall be delivered together with the products.

5.2 The products shall be lifted through the four lifting handles on the wall of the box, and all of the four lifting handles can bear the total

weight of the products. The lifting loops or hanging handles are just for lifting the products; when the products are lifted, the included angles between the ropes and the vertical lines are less than 30 degrees. Attention shall be paid to riggings such as rope clamps, strippers and so on which shall not squeeze porcelain sleeves and other fittings.

5.3 During transportation the products shall be put horizontally as far as possible with the maximum gradient less than 10 degrees, and shall not be impacted violently.

6 Inspection and acceptance

After the user unit receives the products, he shall immediately check the specification, the model and the technical parameters of the products according to the purchase contracts for conformance. Subsequently, it shall check the technological documents, the products and the annexes according to the check list of documents for fullness and check for the following items.

6.1 Check the products for oil leakage or oil impregnation.

6.2 Check the products for damaged parts and the oil tanks for deformation and depression.

6.3 Check whether such easily worn parts as the electric point pressure type thermometers (unless specially specified, the capacity of the products is more than or equal to 800kVA), the sleeves, the air relays (unless specially specified, the capacity of the products is more than or equal to 800kVA), the moisture absorbers and so on are damaged.

7 Storage

When the products are stored, moisture absorbers shall be installed; the oil level shall be often kept above the tank cap to reduce the contact surface between oil and air; the stored products shall be inspected periodically; the products that have been transported with the oil conservators removed must be stored with oil conservators and moisture

absorbers installed to ensure certain oil pressure and oil quantity and to be adapted to the temperature fluctuation.

8 Installation

8.1 When the product is installed on the field, no position of the product is allowed to be welded (welding components and parts). If the product needs welding in an exceptional case, cooling measures must be taken around the welded points to prevent the transformer oil from being decomposed into gas, or else, the transformer oil is incorrect.

8.2 Before the product is put into running test, all of fastening bolts in the product shall be fastened again.

8.3 When the mercury thermometer and the signaling thermometer are installed, the water in the thermometer sockets shall be removed first and then transformer oil is injected into the sockets before the signaling thermometer is installed. The gap between the bulb of the signaling thermometer and the plug screw of M27*2 shall be sealed with silicone jelly to prevent rainwater from entering the gap.

8.4 When the moisture absorber is installed, transformer oil (suspended moisture absorber) shall be filled in the lower part of the moisture absorber. See the Operating Manual of the moisture absorber for details.

8.5 When an air relay is installed, it shall be noted that the relay shall be installed in the connecting tube between the transformer oil tank and the oil conservator, and the arrowhead on the air relay shall point to one side of the oil conservator. See the Operating Manual of the air relay for the details.

8.6 Assembling other components and parts

8.7 Injecting oil into products which have been transported when they are disassembled with oil discharged:

8.8.1 For the products in the structure other than full-sealed corrugated tank structure and capsule-type oil conservator structure, the rotary

cover on the top of the oil conservator shall be opened to inject correct transformer oil to the normal oil level in the oil conservator (the oil level depends on the ambient temperature). During oil injection, all of air relief cocks must be opened until the oil bleeds out when the cocks shall be closed.

8.8.2 For the products in full-sealed corrugated tank structure, the oil level read on the top tube-type oil level gauge on the tank cover shall be checked. In case the oil is not full, it shall be injected. When oil is injected, all of air relief cocks and the rotary cover on the top of the top tube-type oil level gauge on the cover of the tank shall be opened to inject correct transformer oil until oil bleeds out when the air relief cocks and the rotary cover are closed and screwed down.

8.9 After oil is injected into the product, the air relief cocks of the air relay, the sleeves and so on are sealed and all of sealing surfaces are checked. After the product is left still for 24 hours, it shall be checked for oil leakage; and air in the air relay, the sleeves and so on is drained. When transformer oil is re-injected, the model, the producing area or the oil base of the transformer oil re-injected must be noted; transformer oil of different models shall not be mixed for use; if mixture is needed, the mixture must pass the test before it is used.

8.10 Transformer oil is sampled, tested and analyzed.

8.11 On completion of oil injection, leakage test starts: air static pressure test (leak test of air pressure). The test method is as follows: the mouth piece of the moisture absorber on the oil conservator and clean dry compressed air of 25kpa are used for static pressure test, and the state is kept for 3 hours; and no oil is impregnated.

8.12 Attentions for test

8.12.1 During static pressure test, heavy objects above 5kg must be used for pressing the signal masts (the topmost end) of the pressure relief

valves (unless specially specified, it is present for arc-suppression coil with the capacity of more than 630kVA; it is present for the earthing transformer with the capacity of more than or equal to 800kVA).

8.12.2 Transformer oil is filled in the sleeves.

8.12.3 Air is drained from the air relay.

8.13 In case the product is provided with the air relay, after it is installed on the basal plane, one end of the oil conservator shall be blocked up by 10 to 15mm so that the product is slightly inclined to increase the action sensitivity of the air relay.

8.14 On completion of the installation, all of fastening bolts of the product shall be re-fastened; and then test can be conducted before it is put into operation.

9 Test before it is put into operation

9.1 On completion of the installation of the product, it shall pass the following tests before it is put into operation:

9.1.1 Measurement of insulation resistance.

9.1.2 Measurement of DC resistance

9.1.3 In the externally applied power frequency withstand test, the repetitive test voltage is 85% of the delivery test voltage (see the records on the test reports of the product), and the test lasts for one minute. The testing voltage of the arc-suppression coils which are insulated in grades shall be executed according to the provisions on the nameplate. Be sure to disassemble the coils which are of different insulation levels before the test (cores must be suspended before they are disassembled).

9.1.4 Arc-suppression coils

9.1.4.1 For the products regulated by means of turn regulation, the loaded tapping switch is regulated to the maximum current grade (the eleventh grade, for instance) for measurement of the reactance. If permitted by

the conditions, the rating shall be achieved as far as possible; pay attention to the sound of the product and the change in instruments during the test.

9.1.4.2

The circuits of the product regulated by regulating the capacity and the high impedance shall be connected according to relevant requirements.

9.1.4.3 The impedance value of the product shall not be significantly different from the delivery test results (see the corresponding test values on the test reports of the product). The voltage is regulated to a nominal value (depending on the test conditions), and the switch is regulated to the maximum grade from the first grade, and then from the maximum grade back to the first grade. The impedance value of each grade of the product is measured for the discrepancy from the changes in grade and any fault of the action of the switch.

9.1.4.4 The loaded switch test is conducted according to the test procedures; see the delivery test reports of the loaded switch for the data.

9.1.5 Earthing transformer

9.1.5.1 No-load test is conducted under the nominal voltage for 30 seconds. The sound of the product and the change in the instruments during the test shall be noted.

9.1.5.2 The no-load current and the open circuit losses of the product are measured; the results shall not be significantly from the test results (refer to the corresponding test values on the test report of the product).

9.1.5.3 The single-phase method shall be adopted for no-load voltage ratio measurement. Low-voltage coils which are not involved in the test shall be short-circuited to reduce error brought by the leakage reactance to the no-load voltage ratio measurement. The test method: when the group of joining is ZNyn11: A0/ac (short-circuited to bo) , B0/ba

(short-circuited to co) , CO/cb (short-circuited to ao) ; when the group of joining is ZNyn1: A0/ab(short-circuited to co), B0/bc(short-circuited to ao) , CO/ac (short-circuited to bo) .

In the test in 9.1.3 and the tests below, after the product is injected with oil, it must be left still for some time (at the level 6kV, for three hours; at the level 10kV, for 8 hours; at the level 35kV, for 24 hours; at the level 66kV, for 36 hours). During the tests, the precedence of the above items must be kept.

9.2 The following checks shall follow after the product passes the test in clause 7.1,

9.2.1 Calibrating and testing the protectors such as the air relay, the automatic control device and so on.

9.2.2 The oil level of the oil conservator is checked; the butterfly valves (when the arrowhead on the valve handle points to the flow direction of the pipeline, it is open) between the oil conservator, the gas relay and the product must be open.

9.2.3 Calibrating the reading of the thermometer

9.2.4 Check every position of the product for other foreign matters.

9.2.5 Check if the oil tanks are well earthed.

9.2.6 Check the oil tanks for oil leakage.

9.3 Before the product provided with the air relay is put into operation, the air relay shall be removed; the rope used for fixing baffle plates is clipped off for calibration before it is installed. When it is installed, the arrowhead on the air relay points to one side of the oil conservator. When the product is put into operation, the signal contact of the air relay is connected to the overcurrent tripping circuit of the product; the overcurrent protection action is set to be instantaneous action; after the product is powered on with nominal voltage for 30 seconds, listen to the sound of the transformer. If possible, the voltage on the product is

increased gradually from zero so as to find out the fault early.

9.4 For arc-suppression coils, if PT and CT used for measurement are not used, the circuit of PT shall be open with one end earthed; after CT is short-circuited, it is earthed.

9.5 For the excitation-free tapping switch, when the locating pin on the top of the regulation handle of the switch is put in position, the number next to it is the grade of the switch. During the grade regulation, it must be powered off, and then the switch is turned to the grade required (the guide pin must be clamped in the clamping groove) before the direct-current resistance is measured. The measured direct-current resistance is compared with the direct current resistance at the same grade and the same temperature in the delivery test reports to determine whether the switch is in proper position; or else, it shall not be powered on.

9.6 After the test is completed, it is switched off; the overcurrent protection setting value is regulated again; the signal contact of the air relay is connected to the warning circuit; the stripping contact is connected to the tripping circuit for protection of the relay; the product is switched on under no load at the nominal voltage for three to five times to check the action of the relay protection under the impact effect of exciting surge.

9.6 If the test result of powering on the product is good, it can be put into operation.

10 Putting into operation

10.1 During the operation of the product, the devices for indication of temperature, oil level and so on and the protectors (such as the air relay and so on) shall be frequently checked to ensure it to act reliably; the sealed positions shall be checked frequently for oil leakage.

10.2 The arc-suppression coils run at the maximum current grade, and the

running period is subject to the provisions on the nameplate. The voltage measurement coils provide load capacity of about 110V and 10A.

10.3 Earthing transformer:

10.3.1 After the neutral point of the earthing transformer is connected with the arc-suppression coil, single-phase switching-on is not allowed. Accordingly, it would be best that three-phase synchronizing switch shall be adopted on the high pressure side (for instance, three-phase oil switch, three-phase SF6 switch and so on);

10.3.2 On the primary side of the product the arc-suppression coil provides rated zero-sequence current; the period is subject to the provision on the nameplate; continuously nominal capacity is provided on the secondary side;

10.3.3 For the products of 10kV and below, permanent asymmetry of 1% exists in phase B. See the product testing reports or the nameplate of the product for the details.

10.3.4 The primary tapping of product with secondary coil is $\pm 5\%$; The voltage is regulated in five grades; the first grade is grade +5%; the third grade is nominal; the fifth grade is -5%. In order to meet the control requirement, the second grade and the fourth grade are used for providing unsymmetrical voltage for neutral points, and are not adopted when not needed;

10.3.5 As the group of the earthing transformer is approximate, angular error occurs. It can not be connected with transformers of the same group in parallel to prevent circulating current;

10.3.6 The outer coil of the post B of primary coil for the earthing transformer without secondary coil is provided with pig tail of -2.5%; a disk-type switch is adopted; the first grade and the second grade are nominal; the third grade is -2.5%, and is to provide unbalanced voltage for neutral points for control use. If users put forward special

requirements when placing orders, the requirements under the contract shall be followed; and shall be indicated in the tapping grades on the nameplate.

11 Maintenance

The product shall be maintained according to the operating standards of the product issued by the Ministry of Water Resources and Power Industry. All of screws on the body of the arc-suppression coil are sealed with glue 504 or other jamming measures are taken to them; they shall not be screwed by force. The four 1Cr18Ni9Ti non-magnetic screws between the upper pressing plate and the lower pressing plate are used for regulating and fixing the air gaps. Once they become loose, the inductance will be reduced and the coil will be burnt. When the product is delivered, it shall have been adjusted well, and locked with locknuts; the locknuts shall not become loose at discretion.
