Dry --type transformer specification

0HB.469.008.5

NEWONDER SPECIAL ELECTRIC CO., LTD.

January, 2011

After-sale service hotline: 400-030-6566
summarize

This specification include installation & application specification & maintenance. Before installation and use equipment take care to read whole operating specification please!

⚠️ When operate the equipment, need eligible electrician enforce.

1. usage

At present, dry-type transformer of our company produced have 3 series: dry-type transformer and distribution series, dry-type rectifier transformer series; dry-type transformer for variable frequency drive series all is Non-sealed, the winding use copper lead wire, heat-resistant class is B or H of insulation material, insulation of B winding circle is twin fiberglass, insulation of H winding circle adopt NOMEX paper. Voltage class is 10kV and below. The products are widely used in high building, airports, stations, docks, subways, power plants, metallurgy, petrochemical companies, shopping centers, and residential quarters they are also installed in various controlling apparatus such as conversion distribution devices rectification devices and converter adjustable speed devices.

2. type description: 2.1 dry-type distribution and power transformer
Example:  a. SG9-100/6: 100kVA/6kV three phase dry-type distribution transformers
   b. SG10-630/6: 630kVA/6kV three phase dry-type distribution transformers.
   The insulation class of Our SGN10 series product is H-class.

2.2 dry-type rectifier transformer

<table>
<thead>
<tr>
<th>Z</th>
<th>S</th>
<th>G</th>
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<tbody>
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</tbody>
</table>

- Voltage class KV
- Rated capacity KVA
- Insulation structure (B-class omitted, N for H-class)
- Try-type transformer (Non-sealed)
- Cooling mode (AN omitted, F-AF)
- Phase (D-single, S-3phase)
- Rectifier transformer

Example:  a. ZSG-500/6: 500kVA/6kV, Three-phase dry-type rectifier transformers
   b. ZSFGN-1000/10: 1000kVA/10kV three phase dry-type rectifier duty transformers.
   Insulation of H-class made of NOMEX paper

2.3 Dry-type transformer for variable frequency drive

<table>
<thead>
<tr>
<th>ZT</th>
<th>S</th>
<th>G</th>
</tr>
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<tbody>
<tr>
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</tbody>
</table>

- Voltage class KV
- Rated capacity KVA
- Insulation structure (B-class omitted, N for H-class)
- Try-type transformer (Non-sealed)
- Cooling mode (AN omitted, F-AF)
- Phase S-3phase
- Transformer for inverter

Example:  a. ZTSG-500/6: 500kVA/6kV three phase dry-type transformer for inverter
   b. ZTSFGN-1000/10: 1000kVA/10kV three phase dry-type rectifier duty transformers.
   Insulation of H-class is made of NOMEX paper

3. Normal service conditions:

3.1 altitude of 1000m below sea level

3.2 Ambient temperature:

| Temperature max   | +40°C |
| Average daily temperature max | +30°C |
| Average yearly temperature max | +20°C |
| Temperature mini | −5°C (suitable for outdoor dry-type transformer.) |
3.3 In the use environment there should be no harmful smog, steam, the transformer avoid weltering for water, rain and snow.

3.4 The rated supply voltage oscillogram is just like the sine wave. Multi-phase dry type transformer should be connected to the seemly symmetrical supply voltage.

3.5 Protect shell with window shade distance keep out object 1 meter above, ensure airiness all right. Special usage condition should be pointed out when ordering the products, and the products are put out according to the technical specification made by the two sides.

4. Transportation and storage:

4.1 In the transportation, measures should be taken to keep transformers from rain and dampness and leave factory documentation should be carefully packed for the same reason.

4.2 In the process of handling and transportation, the dry type transformer should not be seriously struck or shaken.

4.3 When it reaches the site, a thorough inspection should be made to disclose whether there was mechanic damage, all the accessories are present and whether leave factory documentation suffered from dampness.

4.4 When the dry type transformer reaches the site, it should be installed immediately. If not, store it in the house and take effective measure for rain and dampness.

5. General inspection before installation

5.1 After long distance transportation and storage, a thorough external inspection should be made. Examine and check tightness of accessible bolted electric joints. Then remove
the dust collection with dry compressed air and screw tight the loose part.

5.2 Inspect the core

— The iron core should not be deformed and the insulation mat between the iron yoke and the clamp should remain in a good state.

— The core should not be multiply grounded;

— If it is necessary, you can further open the clamp and the iron yoke ground strip and measure the insulation of the core against the ground (≥5MΩ when leave the factory) and the iron York screw against the core and the claps with 2500v mega meter. They all should be in a good state.

5.3 Inspect the winding:

— The windings’ insulation layer should remain perfect without any damage and deposition.

— The windings should stand in order with the same gap.

— The pressure plate of the winding should be tight and firm and the lock nuts should be fastened.

5.4 Lead-out wires’ insulation should be in good state and firmly packed without damage, transposition, break down and distortion. Lead-out wires should be firmly fixed and has tight and firm fixed bolster and good insulation base.

5.5 Each joint of non-magnetization voltage regulating patch board or apparatus should be correctly and tightly connected with the coil. The connection position and turn should stand in its own place and agree with the indicated position by the mark label or indicating device.
5.6 Before DTT is connected to the outside wire, measure the insulator resistance of the DTT against the ground. If it is lower than the lowest permitted insulation resistance value (on-site) listed below. It should be dried, referring to the appendix to choose the proper measure.

<table>
<thead>
<tr>
<th>Winding voltage class(kV)</th>
<th>0.4</th>
<th>3.0</th>
<th>6.0</th>
<th>10</th>
<th>35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test condition</td>
<td>Room temperature 10-40℃, humidity &lt; 85%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation Resistance (MΩ)</td>
<td>≥50</td>
<td>96.6</td>
<td>≥200</td>
<td>≥300</td>
<td>≥1000</td>
</tr>
<tr>
<td>On-site test</td>
<td>humidity (%)</td>
<td>≤85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>temperature (℃)</td>
<td>5</td>
<td>15</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Insulation Resistance (MΩ)</td>
<td>11.5</td>
<td>7.5</td>
<td>5.0</td>
<td>45</td>
</tr>
</tbody>
</table>

6. The assembly of the Dry-type transformer and its accessories

6.1 Dry-type transformer should be installed steady with tight and firm foundation bolt to the base; if there is roller, the wheelbase and the gauge should agree with each other. When all parts are put in place, fasten it with arresting gear.

6.2 Fan installation

It should be installed according to the operation insulation of the DTT and cooling fan. Make sure it is the side-blown or top-blown type. Generally fan is installed at the lower side of the DTT (sometimes, on the top of the outer casing where the hot air is pulled out), according to the optimum position diagram of the side-blown or top-blown fan, in order that the air steam can flow through the core radiation air duct, low tension coil air duct, high and low tension coil air duct. The rated supply voltage and phases should match the normal mode voltage and phases. The fans of the same transformer should be
<table>
<thead>
<tr>
<th>NEWONDER SPECIAL ELECTRIC CO., LTD.</th>
<th>specification</th>
<th>0HB.469.008.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry-type transformer</td>
<td>Total 14 page 6</td>
<td></td>
</tr>
</tbody>
</table>

shunted, and then connected to the temperature controller. The larger capacity fan should be installed with an intermediate relay. After the preliminary installation of the fan, a power on test should be performed to check whether the leads are correctly connected and the steering diversion agrees with the label of the fan, air stream flow through suitable radiation duct, the three phases are equally set. The insulator resistance should not be lower than $0.5 \, M\Omega$.

6.3 Installation of the temperature controller (when the transformer operate, must be ensured temperature control normal power source, otherwise the transformer can burn out):

It should be installed and shakedown tested exactly following the operating instruction. B-class transformer uses 3 glass epoxy tubes $\Phi 11/\Phi 8 \times 300$, while H-class uses 3 biphenyl oxide tubes $\Phi 10/\Phi 8 \times 300$. All these should be fastened separately on the top of the upper side of the high and low-tension coil air duct. The sensing cable is installed in the trunking of upper clap and three platinum resistance are insert in the tube with the same depth (250mm) and are firmly locked. The wiring diagram on the back casing control run and close of the fan, trip for over temperature and fault warning. Try to check the connection point and the movement is right or wrong.

6.4 The wire splices of the temperature controller and cooling fan should be installed up to the insulation standard of low voltage electric apparatus.

6.5 Earthing

Dry-type transformer and its shell, fan and temperature controller must be safely and correctly grounded. Required earthing resistance is $\leq 2\Omega$. 
# Acceptance test and test run of Dry-type transformer

## The item and standard of acceptance test; follow the content of the list below

<table>
<thead>
<tr>
<th>Item of test</th>
<th>application</th>
<th>quality characteristic requirement and allowable deviation</th>
<th>note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 winding DC resistance</td>
<td>capacity (kVA)</td>
<td>unbalance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>distribution transformer ≤ 2500</td>
<td>≤4%</td>
<td>wire</td>
</tr>
<tr>
<td></td>
<td>power transformer ≥ 630</td>
<td>≤2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>rectiformer, conversion transformer</td>
<td></td>
<td>(not lead out in the center)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(lead out in the center)</td>
</tr>
<tr>
<td></td>
<td>give no specification but offer factory practical measured value and tested temperature.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 connection symbol</td>
<td>all kinds of transformers</td>
<td>Accord with nameplate</td>
<td></td>
</tr>
<tr>
<td>3 Core earthing</td>
<td>all kinds of transformers</td>
<td>only one point is grounded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core insulator resistance</td>
<td>megameter lasts for 1 min. There should be no flashover or breakdown</td>
<td>10-40°C humidity ≤ 85%</td>
</tr>
<tr>
<td>4 insulator resistance (not lower than)</td>
<td>all kinds of transformers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>switch off the outer connection wire</td>
<td>kV</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MΩ</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>2500V</td>
<td>$R_2 = R_1 \times 1.5^7$</td>
<td></td>
</tr>
<tr>
<td>5 ratio of transformer</td>
<td>distribution transformer</td>
<td>Rated tap</td>
<td></td>
</tr>
<tr>
<td></td>
<td>power transformer</td>
<td>≤±0.5% or ≤ fact measure impedance ± 10%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>rectiformer, conversion transformer</td>
<td>Rated tap</td>
<td>≤±%</td>
</tr>
<tr>
<td></td>
<td>Devoltage &lt; 250V</td>
<td></td>
<td>or according to the technique protocol</td>
</tr>
<tr>
<td></td>
<td>Devoltage &gt; 250V</td>
<td>Rated tap</td>
<td>≤±1%</td>
</tr>
<tr>
<td>6 check and test of the voltage regulation apparatus</td>
<td>Off-circuit tap</td>
<td>Type of connection lug plate</td>
<td>agree with the indicating label and firmly and correctly connected</td>
</tr>
<tr>
<td></td>
<td>Changing transformer</td>
<td>Tap switch</td>
<td>rotating smoothly</td>
</tr>
<tr>
<td>7 alternating current pressurization (switch off the out leads and pull out the thermometric searching unit)</td>
<td>distribution transformer</td>
<td>Voltage class kV</td>
<td>≤1</td>
</tr>
<tr>
<td></td>
<td>power transformer</td>
<td>Withstand voltage kV/1 min</td>
<td>2.6</td>
</tr>
<tr>
<td>8 Phase check</td>
<td>All kinds of transformer</td>
<td></td>
<td>the first side matches the network phase</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the second side agrees with the designation requirement of the user.</td>
<td></td>
</tr>
</tbody>
</table>
7.2: Inspection before operate

A thorough external inspection should be made to verify that it has had operating condition.

The body and cooling device and all the accessories should be assembled correctly.

There is no foreign substance left on the transformer.

The position of the tap is up to the requirement.

The phase of transformer and the link group should be up to the running requirement and the phase color is correctly marked.

Earthing leads and earthing net is correctly and safely grounded, according to the design requirement.

Temperature measurement device indicates correctly and the integer limited value is up to the requirement.

Temperature measurement device indicates correctly and the integer limited value is up to the requirement.

All the items of acceptance test should be acceptable and linkage test is correct.

7.3 On the situation of open circuit voltage ratting, impulse the switch to break off the second side wire and activate the switch for 5 times, with the first time for not less than 10 minutes’ intervals. There should be no sign of normality and the magnetizing in rush currents hold not cause the wrong moving of the protection device.

7.4 Test operate of transformer
After 5 times qualified impulse on the switch, DTT can no-load run for 30 minutes. If there is no sign of abnormality, it can take on some load gradually till it has reached the nominal load. Then keep it running for 24 hours. No abnormality, the test is completed. After the acceptance check according to some related regulations, the transformer device can be put into normal running.

8. Operate and should be noticed problem of dry-type transformer

8.1 Operate of the transformer should follow DL/T572-95《the regulation of power transformer》and GB/T17211-1998《on-load regulation of dry type power transformer》

8.2 magnetizing in rush current of on-load switching:
the size of magnetizing in rush current depend on the phase of the line voltage when the transformer is switched on and the state of core residual magnetism can reach 80-100 times of the stable no-load current or 6-8 times of rated current. After several periodical waves, its value become weak in several scores of seconds, so the rush current could not bring much damage to the transformer. But if proper measures are not taken, it is possible to cause wrong protection action, which could cause over current or wrong running in the transformer. So take care when you operate the transformer. The peak value of magnetizing in rush current (ip) should be exchanged with the virtual value IΦ = \( \frac{0.6}{\sqrt{2}} \) ip (A)

8.3 According to the temperature class of the insulator material, B-class .F-class
and H-class’ winding temperature rise limited value and performance parameter shows in the diagram below;

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>B-class</th>
<th>F-class</th>
<th>H-class</th>
</tr>
</thead>
<tbody>
<tr>
<td>The highest permitted temperature for the insulator material</td>
<td>130</td>
<td>155</td>
<td>180</td>
</tr>
<tr>
<td>limited value of winding temperature rise</td>
<td>80</td>
<td>100</td>
<td>125</td>
</tr>
</tbody>
</table>

Running under the normal use situation, wire temperature rise of the transformer should not surpass the limited value in the list. (resistance method) because the pt hot resistance of the dry type transformer temperature controller is fixed into the protecting tube on the top of the air flue, the indicating temperature is the air flue’s. Usually it is lower than the wire’s practical temperature by about 10. The user should choose appropriate integral constant value towards the control of the fan, warning and brake trip, according to the specific environmental situation and running regulations. You also can refer to the list below:

<table>
<thead>
<tr>
<th>temperature (气道温度)℃</th>
<th>Over temperature warning℃</th>
<th>Over temperature trip℃</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-class</td>
<td>105</td>
<td>120</td>
</tr>
<tr>
<td>H-class</td>
<td>150</td>
<td>160</td>
</tr>
</tbody>
</table>

8.4 In the process of operating, you should always monitor and check it

——Monitor the sound and temperature while it is running.

——Monitor the coil, core and the outlook of the seal wire, to see if there is any damage、color change、dust collection and dirty situation.
find out if the accessories are in a good state like the cooling device, tap changer and temperature test device.

It must be protected from dripping water and protect the coils from direct exposure to the sunlight.

Keep a duty record on running of the transformer.

9. periodic maintenance

9.1 periodic maintenance should follow the DL/T 596-1996 《precautionary test regulation of the power apparatus》

9.2 Running for about 1 year, off circuit maintenance should be performed on dry transformer for these items below.

Check the coil, core, seal wire, shunting terminal and fastening pieces on every section to disclose any damage, deformation, color change, loose, sign of overheat and corrosion. If there is something abnormal, verify the causes and make necessary measures.

Remove the dust from the transformer. It should be wiped with dry cloth instead of voltage cleaner. The part that cannot be wiped should be blown clean by the dry compressed air.

Clean the inner dust of the fan and check and refill or change bearing grease.

On-load or off-load tap changer should be checked and maintained according to the regulation of the operating instruction.

9.3 if it is possible, it should be tested according to 《preventive test rule》. Among
them, the resistance must be tested and its value should not be lower than the 5.6th rule of this operation instruction.

9.4 With the qualified inspection, maintenance and test, it can be put into use again.

9.5 Intake air shutter Of the transformer have dust screen, dust screen should be cleaned time visual environment case . dust screen clean after dry up install

Intake air shutter take down as follow (next page)

10. appendix dry up after the dry-type transformer suffers from dampness.

10.1 Dry up method choice: according to the insulation dampness situation and the on-site situation, choose from infrared light, oven, hot wind, short circuit or other methods to dry the transformer. For example:

10.1.1 Infrared light dry method: exposure outer coat to the large power infrared light.

10.1.2 Oven drying method: it is used for the small capacity DTT. Hang it into the oven and control the inner temperature ≤100°C. Measure their insulator resistance every hour. There should be no air gap on the top of the oven, through which the dampness can go out.

10.1.3 Hot wind-dry up method: set up a drying room with wall panel according to the size of the DTT. The inner side of the wall panel should be laid on the asbestos sheet and fireproof solution immersed domino hemp cloth. Transformer is hung into the room, with a minimum distance of 200mm to the walls. It can be heated by electric furnace or steam s-shaped tube and so on. The amount of the hot wind through the drying room should be 1.5 times drying-room containment/minute. The hot wind which is no higher
specification

1. louvre should lifting, it can dismount;

2. then dust screen should upward movement, take out;

3. according to various data of transformer, top fan have 1-3 dais. (look at packing list)

4. install top fan should be noticed concert with fan and else parts, avoid damaging fan and else parts.

than 100°C should be blown upward from the lower side of the machine, and the damp is let out through the upper air hole.
10.1.4 Low voltage windings short circuit heating method: Make low voltage winding short-circuit, using generator set or shifting coil voltage regulator to supply power and control voltage to the high voltage winding from 0. Then keep the current in high voltage winding equal to the rated current, till it is dry.

10.2 The temperature control of dry up. While drying the dry-type transformer, the platinum resistance thermometer should be installed in every part to monitor the transformer. Be sure to heat regularly at the temperature rise speed of $10\text{–}15{}^\circ\text{C} / \text{hn}$. Especially the winding, should not overpass the highest permitted temperature for the insulator grade. For B-class insulator transformer, the air hole temperature should not pass $80{}^\circ\text{C}$ and H-class $100{}^\circ\text{C}$. Measure high, low coil resistance and each part’s temperature every hour.

10.3 Judge the end of the dry up: under the same temperature, insulator resistance of the winding starts to decline, then rise and keep steady for 6 hours. then it shows the end of dry up and the temperature descent at the speed of $10\text{–}15{}^\circ\text{C} / \text{hn}$. 

10.4 When dry up the transformer, fire security measures should be made. Avoid heating System fault or the winding overheat damage transformer

10.5 After dry up, should be made a thorough check of the machine. All bolts pressing section should not be loose and there should not be abnormality like overheat on the appearance of the insulator.