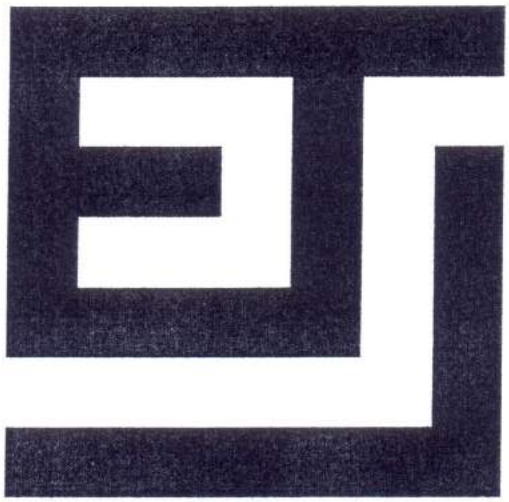

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Pressure Relief Valves Series VS

Cat: 10VSCATR06-E Rev: 06 - 10/2011

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Function, features, operation and assembly		06 – 10/10/11

1.0 Contents of specification

The specification concerns the function, the main features and the operation of the pressure relief valves Series VS and VST, as well as the admitted environmental and operating condition for the different executions. Operating conditions depend generally from the compatibility of the materials, components, surface finish, and, for the electric contacts and circuits, their degree of protection, with the operating conditions of the transformer.

2.0 Function

The pressure relief valve opens when the pressure inside the transformer's tank increases over the set operating value, following for example a failure or a short circuit, and by releasing oil reduces the pressure in the tank. By means of the electric contact, if present, and the optical indication the pressure relief valve indicates that a fault has taken place.

The pressure relief valves Series VST have been specially designed for use on transformers where an oil spillage is absolutely to be avoided; typical installation are on trains or ships or where environmental or safety standard are particularly exacting.

The oil-tight cover contains the oil released by the valve when opening and provides a flanged connection on which a pipe can be attached that ducts the oil in the desired direction

3.0 Construction features

The pressure relief valves Series VS are in accordance with standard EN 50216

3.1.0 Materials and components

- Flange, obturator, cover and electric contact's casing are of cast aluminium;
- Fittings are of stainless steel or nickel coated brass;
- Gasket materials as specified for the different executions;
- Splash diverter of Series VS is made of stainless steel;
- Springs are of spring steel, sandblasted and painted with epoxy powders;
- External screws are of stainless steel.

3.2.0 Reference drawings

Overall dimensions:

Pressure relief valves with contact type K

- Type VSQI 050 NKP - nominal diameter 50 mm — N° 10.050.40
- Type VS 080 NKP - nominal diameter 80 mm — N° 10.080.40
- Type VS 100 NKP - nominal diameter 100 mm — N° 10.100.40
- Type VS 150 NKP - nominal diameter 150 mm — N° 10.150.40

Pressure relief valves with contact type C

- Type VS 080 NCP - nominal diameter 80 mm — N° 10.080.30
- Type VS 100 NCP- nominal diameter 100 mm — N° 10.100.30
- Type VS 150 NCP - nominal diameter 150 mm — N° 10.150.30

Pressure relief valves without contact

- Type VSQI 050 NP - nominal diameter 50 mm — N° 10.050.30
- Type VS 080 NP - nominal diameter 80 mm — N° 10.080.40
- Type VS 100 NP- nominal diameter 100 mm — N° 10.100.40

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- Type VS 150 NP - nominal diameter 150 mm — N° 10.150.30

Reference part list — 10VSNOMR00

The drawings show the valves complete with splash diverter.

Pressure relief valves with oil tight cover

- Type VST 080 N – VST 080 NK – nominal diameter 80 mm — N° 10.T80.40
- Type VST-2 150 NK – VQT-2 150 NK – nominal diameter 150 mm — N° 10.T15.40

Reference part list — 10VSNOMR00

3.3.0 Construction

The pressure relief valves Series VS and VST are spring operated safety valves, consisting of a mounting flange with the central opening closed by a spring loaded obturator; the springs are compressed between obturator and cover or obturator and pressure ring for the valves with oil tight cover, which are assembled to the flange by columns.

No part of the pressure relief valve reaches inside the transformer tank. A specially designed gasket assures the oil-tightness between flange and obturator when the valve is closed.

The oil-tight cover of Series VST encases the valve completely and provides the flanged connection on which a pipe can be attached.

3.4.0 Pressure setting and springs

The setting of the pressure relief valves Series VS and VST is effected by choosing a different spring - for valve diameter 150 mm a double spring set – for every operating pressure value; therefore the setting of the pressure relief valve can be changed only at the factory, thus eliminating possible misuses.

The springs are of the compression type, designed so as to have a low force gain with the stroke.

Specification N° 10VSTARRxx indicates the tolerance of the setting and the minimum operating pressure for the different pressure settings as well as the minimum pressure at which the valve closes after operation. To avoid oil leakage or undue operation of the valve, the operating pressure must be chosen so that in normal operation the corresponding maximum operating pressure is never reached.

3.5.0 Operation indicators

3.5.1.0 Optical indicator

The pressure relief valves Series VS and VST have as a standard feature an optical indicator showing that the valve has operated; the optical indicator consists of a red pin showing about 30 mm over the top of the valve cover when the valve has operated because of an internal overpressure. The pin is spring loaded so that even after a partial opening of the valve due to limited or short-duration overpressures the pin is nevertheless expelled completely.

For Types VSQI 050, VST-2 150 and VQT-2 150 the optical indication operates also the electric contact, if present.

3.5.2.0 Electric contact

The operation of the pressure relief valve can be indicated also by electric contact, which can be of the "C" type, according to specification N° 10VSSCHCRxx or of the "K" type according to specification N° 10VSSCHKRxx.

3.6.0 Splash diverter and oil tight protection

To avoid that during the operation of the valve hot oil is shot in all directions, thus increasing the

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danger to man and machine, the valves type VS 080, VS 100 e VS 150 can be fitted with a splash diverter, which diverts the out-flowing oil in a determined direction. Valves type VSQI 050 are always supplied with a splash diverter.

Valves type VST 080, VST-2 150 and VST-2 150 have a complete oil tight cover with a flange, where an oil drain pipe can be connected; the oil ejected by the valve can be picked up.

3.7.0 Oil-tightness and resistance to pressure

The pressure relief valves Series VS and VST:

- are oil tight to oil at 100°C up to pressure Pt, which depends on the setting pressure;
- are mechanically and electrically resistant to vacuum (10 torr);
- have a mechanical resistance to pressures up to 4 bars.

3.8.0 Resistance to dynamical stress

The pressure relief valves Series VS can operate without undue operation in following conditions:

- Sinus vibrations with frequency <= 120 Hz and amplitude <= 250 µ;
- Dynamical conditions causing following accelerations:
  - ◊ Max 3g in all directions, sinus vibration, amplitude <= 20 mm;
  - ◊ Shock condition with max 10 g in all directions.

3.9.0 Surface protection

Flange, obturator, cover and contact's casing are painted internally and externally with one primer coat of epoxy paint and externally with a finishing coat of polyurethane paint colour RAL 7031. The primer coat on the internal surfaces in contact is compatible with transformer mineral oil up to temperatures of 120°C.

The painting procedure is accepted by the Italian electricity authority ENEL.

The specification N° 00VERRxx describes in details all the features of the painting procedure.

4.0 Operation and installation

4.1.0 Operation

Should an overpressure inside the transformer tank build up due to short circuit or else, higher than the set operation pressure of the pressure relief valve, the obturator lifts from the flange propelled by the pressure, thus opening the discharge opening. The oil can flow out thus reducing the overpressure; at the same time the optical indication and if installed the electric contact show that the valve has operated. When the overpressure has been discharged the valve shuts again automatically to complete oil-tightness.

With the valves with oil tight cover the oil discharged remains inside the cover and can be ducted to an appropriate container by a pipe flanged to the cover, thus reducing the danger to persons or things as well as the pollution.

Thanks to the design of the pressure relief valves Series VS and their springs, the full opening is reached even for small overpressures in a very short time, so as to reduce immediately the resistance to the oil flow.

4.2.0 Importance of the electric contact

Real life tests have shown that failures of the transformer followed by sudden pressure increases, such as for instance short circuits, induce the operation of the pressure relief valve in time spans which are considerably shorter than that of other safety devices, such as the Buchholz Relay. To

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exploit this rapid operation for the safety of the transformer we strongly advice to fit out the pressure relief valve with electric contacts, which should be connected to the trip circuit of the transformer.

4.3.0 Installation

The pressure relief valve should be installed, either in horizontal or vertical position, on the transformer tank, as near as possible to possible failure sources or in a central position to such sources. The size of the pressure relief valve should be chosen considering the available space and the oil quantity to be vented in case of failure.

For a higher safety standard and to increase the rapidity of operation it can be preferable to install more than one pressure relief valve eventually of a smaller size.

4.4.0 Choice of nominal pressure

To avoid oil leakage or undue operation of the valve, the operating pressure should be chosen so that in normal operation the corresponding maximum operating pressure is never reached. Furthermore, to reduce oil loss after operation, the minimum pressure at which the valve closes after operation should be always higher than the oil head insisting on the valve.

5.0 Compatibility

The installation compatibility of the pressure relief valves Series VS depend mainly from the material used for the gaskets; therefore the executions differ because of the used gaskets.

5.1.0 Standard execution – nitrile rubber gaskets (N)

Admitted operating conditions are:

Environmental conditions:

Ambient temperature	-20°C to +50°C
Relative humidity	95% to 20°C - 80% to 40°C - 50% to 50°C

Insulating liquid: transformer mineral or silicon oil

Temperature	- 20°C to + 110°C

5.2.0 Execution Nf - nitrile rubber gaskets for low temperatures (Nf)

Admitted operating conditions are:

Environmental conditions:

Ambient temperature	-40°C to +50°C
Relative humidity	95% to 20°C - 80% to 40°C - 50% to 50°C

Insulating liquid: transformer mineral or silicon oil

Temperature	- 40°C to + 120°C

5.3.0 Execution V – Fluor rubber gaskets (Viton V)

Admitted operating conditions are:

Environmental conditions:

Ambient temperature	-15°C to +50°C
Relative humidity	95% to 20°C - 80% to 40°C - 50% to 50°C

Insulating liquid: transformer mineral or silicon oil

Temperature	- 15°C to + 150°C

5.4.0 Special executions

For other environmental and/or operating conditions to be examined individually.

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6.0 Identification of types

Taking for example pressure relief valve Type **VS 080 NCP 0,5**, which indicates:

- pressure relief valve series VS;
- nominal diameter 80 mm;
- with nitrile rubber gaskets N;
- with one contact type C;
- with splash diverter P
- with operating pressure 0,5 bars,

the pressure relief valves Series VS are identified as follows:

VS	080	N	C	P	0,5

	Series identification:
VS	Pressure relief valve Series VS, types VS 080, VS 100, VS 150
VSQI	Only for pressure relief valve type VSQI 050
VST	Pressure relief valve Series VS with oil tight cover – DN 80 mm
VST-2	Pressure relief valve Series VS with oil tight cover – DN 150 mm
VQT-2	Pressure relief valve Series VS with oil tight cover and flange with 6 holes – DN 150 mm

	Identification of nominal diameter:
050	Nominal diameter 50 mm
080	Nominal diameter 80 mm
100	Nominal diameter 100 mm
150	Nominal diameter 150 mm

	Identification of gasket type:
N	Nitrile rubber gaskets
Nf	Nitrile rubber gaskets for low temperatures
V	Fluor rubber gaskets (Viton)

	Identification of contact – see contacts specifications
...	Contact type ...

	Optional splash diverter:
-	Without splash diverter or series VST valves
P	With splash diverter

	Operating pressure:
0,5	Operating pressure 0,5 bars

7.0 Reference specifications

- Setting tolerance N° 10VSTARRxx
- Wiring diagrams and contacts
  Contacts type C N° 10VSSCHCRxx
  Contacts type K N° 10VSSCHKRxx
- Painting N° /00VERRxx