

Transformer, On Load Tap Changer, Oil Cable Box Explosion and Fire Prevention

TRANSFORMER PROTECTOR

The Only Proven Solution Against Transformer Explosion

SERGI CONSERVATOR SHUTTER
TL24: Diameter DN50
TL34: Diameter DN80

**Transformer, On Load Tap Changer, Oil Cable Box
Explosion and Fire Prevention, from 0.1 MVA**

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SERGI CONSERVATOR SHUTTER TL24: Diameter DN50 TL34: Diameter DN80

Document revisions

Ref.	Date	Done	Checked	Approved	Revision Subject
FtTLda33e	02/08/14	FrCa Aecs140206FrCa2	DiHa Ppcs131213DiHa04	PhMa Amcc140208PhMa6	Illustrations update, torque values update, warnings of installation
AtTLda160817Fe	08/17/16	BrBr Aecs160719BrBr05	DiHa Aecs160816DiHa11	PhMa Amcc160816PhMa33	Content update
AtTLda160929Fe	29/SEP/16	AdRa Aecs160916AdRa06	DiHa Aecs160922DiHa10	PhMa Amcc160929PhMa14	Section 4 update

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1 INTRODUCTION

In cases where a transformer has exploded or caught fire, the tank is often damaged. The explosive gas created by the electric arc, being in contact with oxygen causes a fire. Unfortunately when the transformer tank has ruptured, the conservator oil produces an overflow into the transformer tank which causes the fire to spread to the surrounding equipment and then to the whole plant.

The purpose of the SERGI CONSERVATOR SHUTTER is to isolate the conservator tank when an abnormal flow is detected. This prevents the conservator oil from feeding the fire.

The SERGI CONSERVATOR SHUTTER *Illustration 1*:

1. Is a flow sensitive shutter valve that will quickly and effectively isolate the oil in the conservator tank, as soon as it detects an abnormally high oil flow. This abnormal oil flow may be caused by a ruptured transformer tank (in the event of tank explosion), pipe or radiator etc.
2. Is designed to permit a residual oil flow through to the transformer which allows the conservator tank to keep the transformer oil at its correct operating level.
3. Can be used with the TRANSFORMER PROTECTOR to prevent a draining of the conservator tank when the TRANSFORMER PROTECTOR is activated.

The SERGI CONSERVATOR SHUTTER can be installed on either new or existing transformers without major modification to the transformer or the conservator tank it is available in two different sized models, to fit two inch (TL24) and three inch (TL34) conservator piping. The two inch (TL24) is available with standard 4-hole pattern. The three inch (TL34) is available with standard 8-hole pattern or 4-hole upon specific request.

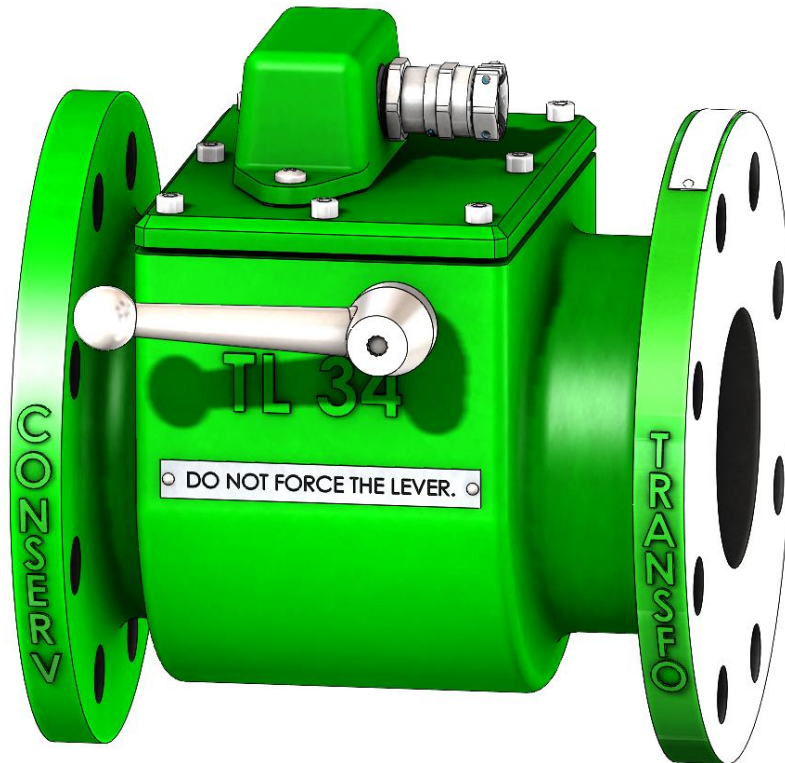


Illustration 1: SERGI CONSERVATOR SHUTTER model TL34

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2 OPERATION PRINCIPLE

2.1 GENERAL

The SERGI CONSERVATOR SHUTTER operation is based on flow rate. It allows a normal flow to keep the transformer oil level correct. If there is a sudden and abnormally high flow of oil from the conservator tank to the transformer then the valve will close and remain closed. This prevents the conservator tank from draining.

The SERGI CONSERVATOR SHUTTER is self-contained and entirely mechanical in operation, which makes it very reliable. It is insensitive to shock waves and vibration (which may be generated by the transformer).

It is equipped with an integrated magnetic contact switch. The signal generated by the magnetic switch can be used for:

- Remote indication of the valve position (open or closed)
- Input to other additional safety systems.

2.1.1 NORMAL OPERATION

The SERGI CONSERVATOR SHUTTER is designed to remain open during normal transformer operation allowing normal oil flow between the conservator and the transformer tank. With the valve open, there will be no continuity across the terminals. The electrical contact is **Normally Open**; see Illustration 2.

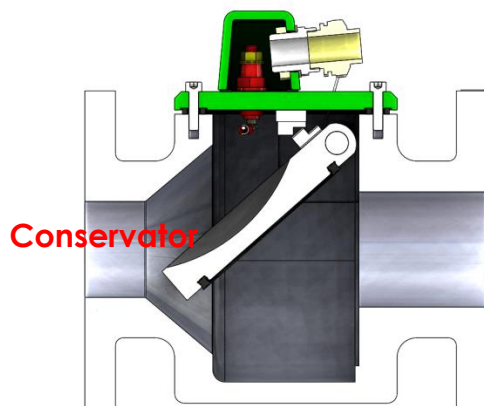


Illustration 2: SERGI CONSERVATOR SHUTTER is open because the oil flow is normal

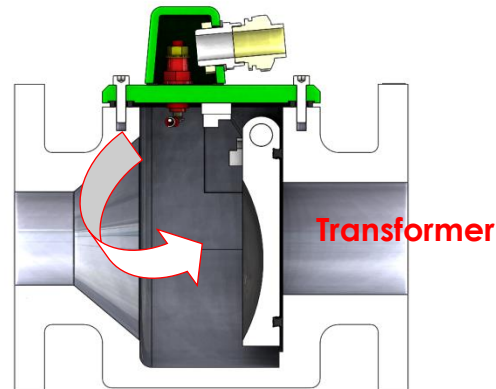


Illustration 3: SERGI CONSERVATOR SHUTTER is closed

2.1.2 CLOSURE DUE TO ABNORMALLY HIGH FLOW RATE

The SERGI CONSERVATOR SHUTTER is closed because of the high flow rate between the conservator and the transformer tank. When the valve closes and there will be continuity across the terminals.

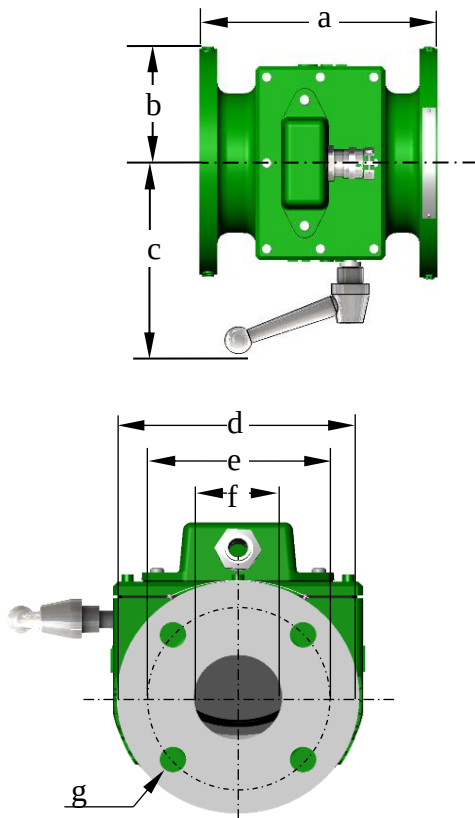
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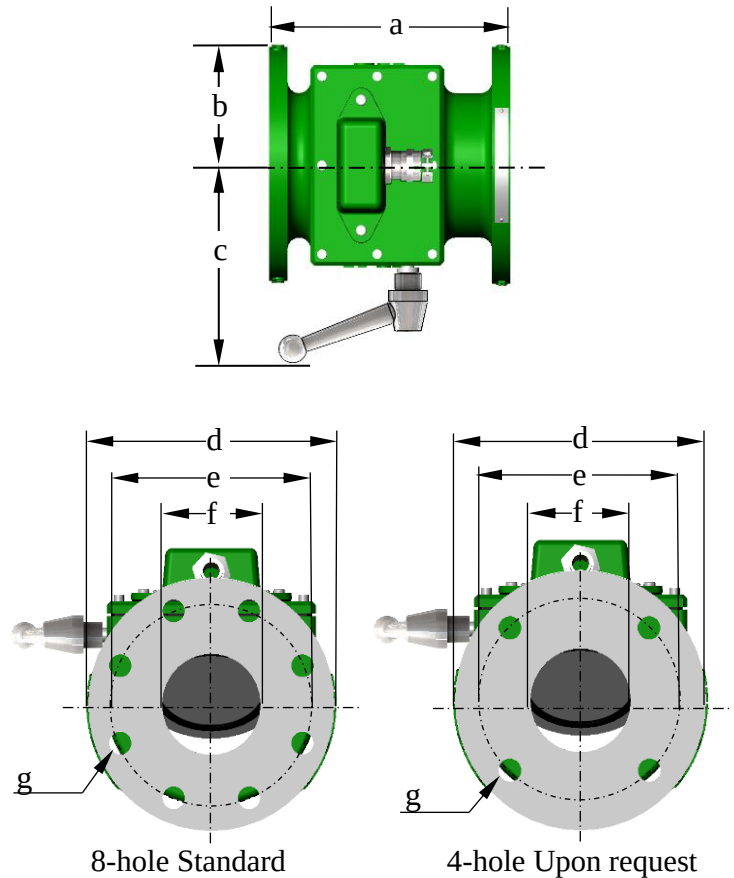
3 SERGI CONSERVATOR SHUTTER MODELS

The SERGI CONSERVATOR SHUTTER has two designs TL24 and TL34. The TL24 is designed to fit DN50 (2-inch) conservator pipe and the TL34 is designed to fit DN80 (3-inch) pipe. The flanges are ISO standard. The TL34 comes standard with 8-hole flanges. The 4-hole flanges remain available upon special request. The gaskets are included but the fasteners and flanges are in the client's scope of supply. SERGI can provide flange and fasteners upon specific option purchase.

TL24 – Top and Side View



TL34 – Top and Side View



Dimensions	a	b	c	d	e	f	g
TL24 DN 50 in mm (2-inch)	210.5 (8.3)	83 (3.3)	158 (6.2)	165 (6.5)	125 (4.9)	61.5 (2.4)	4 x Ø18 (4 x Ø0.71)
TL34 8-hole DN 80 in mm (3-inch)	210.5 (8.3)	100 (3.9)	158 (6.2)	200 (7.9)	160 (6.3)	80 (3.15)	8 x Ø18 (8 x Ø0.71)
TL34 4-hole DN 80 in mm (3-inch)	210.5 (8.3)	100 (3.9)	158 (6.2)	200 (7.9)	160 (6.3)	80 (3.15)	4 x Ø18 (4 x Ø0.71)

Illustration 4: SERGI CONSERVATOR SHUTTER dimensions

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4 SPECIFICATIONS

4.1 BODY MATERIAL

The body material is made of AlSi7Mg0.6 S T6 85 HBS, which is an aluminum alloy.

4.2 TEMPERATURE RANGE

The shutter can handle temperatures ranging from -40°C to 100°C (-40°F to 212°F)

4.3 PRESSURE

The service pressure for the shutter is up to 2 bar (29psi)

4.4 ELECTRICAL CHARACTERISTICS

4.4.1 DEGREE OF PROTECTION

The Electrical Terminal box is rated at IP 66.

4.4.2 SWITCH CHARACTERISTICS

The switch characteristics are:

• Maximum switching voltage:	250 VDC
• Maximum switching current:	400 mA
• Carrying current:	1 A
• Initial contact resistance (excluding cable):	$\leq 150 \text{ m}\Omega$
• Insulation resistance:	$10^{11} \Omega$
• Capacitance:	0.5 pF
• Maximum frequency:	200 Hz
• Resonant frequency:	2300 Hz
• Operate time:	1 ms
• Release time:	0.1 ms

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5 OPERATING LEVER



Do not exert undue force when handling the operating lever or attempt to turn it beyond its limits of movement.

5.1 GENERAL

The SERGI CONSERVATOR SHUTTER is equipped with an operating lever. This operating lever is **only designed to open** the shutter:

- After an incident has been normalized the SERGI CONSERVATOR SHUTTER has to be reset by moving the lever.
- To fill the transformer with oil: If the transformer filling is to be carried out via the conservator tank, then the shutter must be kept in an **open position**.

The design of the lever does not allow the manual closing of the SERGI CONSERVATOR SHUTTER.

The limit of travel of the valve lever is controlled by an unlocking pin, mounted internally, which allows it to move through 45 degrees in order to open the SERGI CONSERVATOR SHUTTER, see Illustration 5. The unlocking pin is secured to the pivot shaft and it controls the flap when turned.



After transformer filling has been completed, it is absolutely essential to remove any securing device that was used to hold the valve open. Failure to observe this procedure will render the valve completely inoperative.

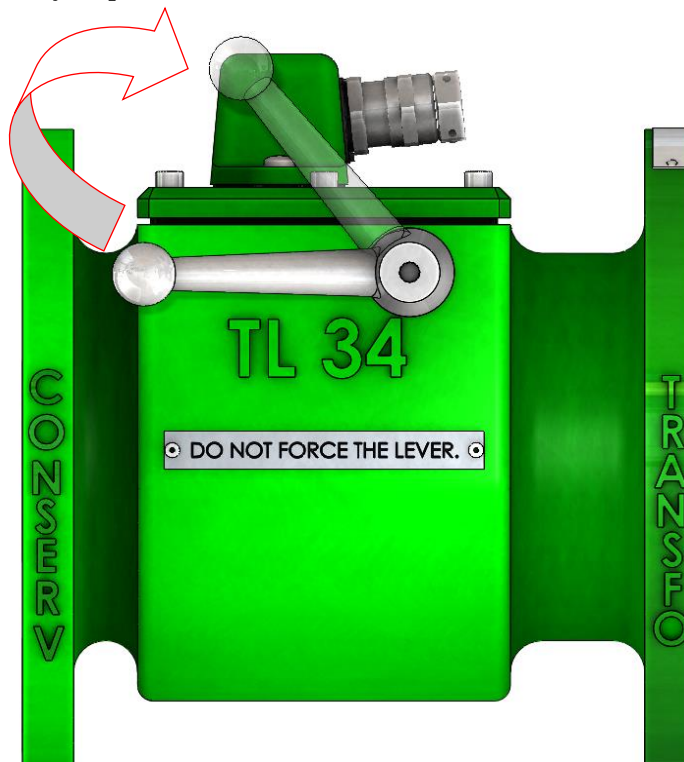


Illustration 5: Maximum movement of the SERGI CONSERVATOR SHUTTER lever.

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5.2 OPERATING LEVER POSITIONS

The operating lever is normally left in the horizontal position. However, if the standard position is not suitable for an operator, it can be adjusted to an alternative position by following these steps.

- 1) Pull the lever at its center.
- 2) The operating lever handle can now be turned through 360 degrees, without affecting the SERGI CONSERVATOR SHUTTER pivot.
- 3) After an alternative position is found, the handle can be released, and it will automatically re-engage to the pivot shaft via spring tension, and it will start acting within its original 45 degrees travel limit.

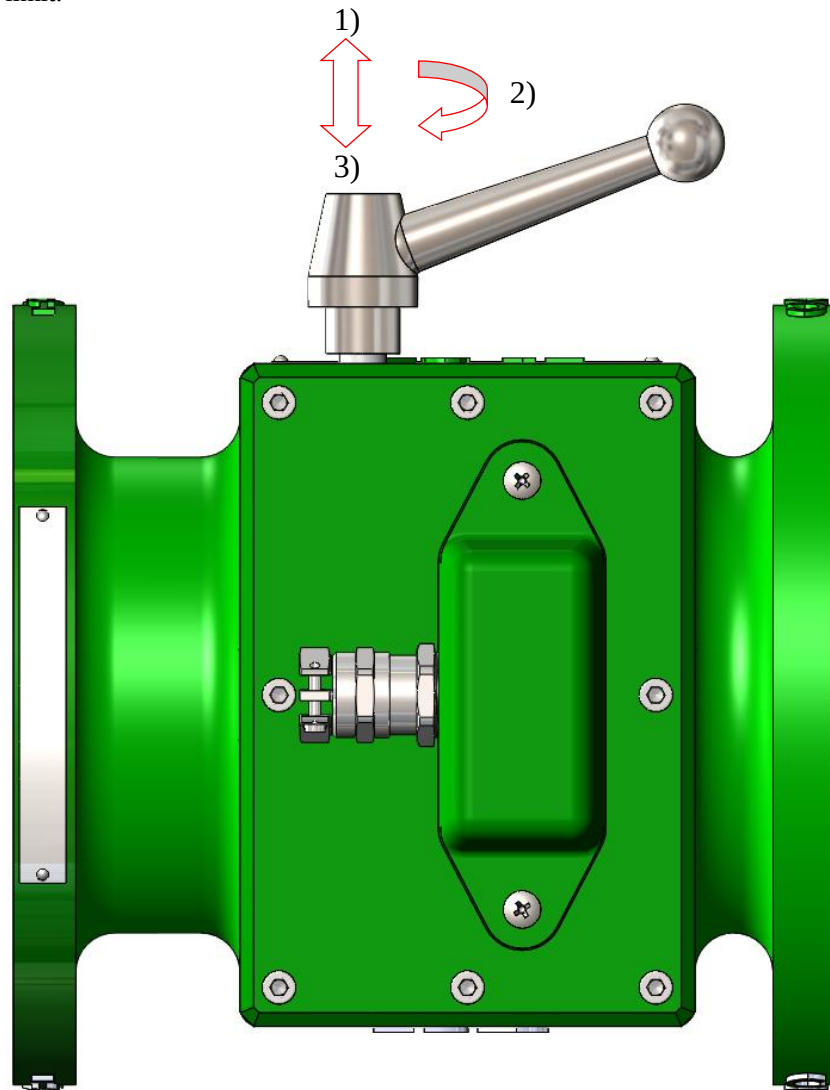


Illustration 6: Disengage of the Lever from the Pivot Shaft on the TL34 SERGI CONSERVATOR SHUTTER.

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6 INSTALLATION

6.1 MECHANICAL INSTALLATION

The SERGI CONSERVATOR SHUTTER can be installed on new and existing transformers without major modification to the transformer or the conservator tank. It must always be installed on a horizontal section of piping. Small slopes with a maximum of 5 degrees are permitted, between the conservator shutter and the Buchholz Relay. It is recommended to install two manual valves (for maintenance and replacement purposes) on the conservator pipe; one between the conservator tank and the Conservator Shutter, and the second between the Buchholz Relay and the transformer tank.

The Conservator Shutter must be installed at least 200 mm below the minimum oil level in the Conservator Tank. The inscriptions on the Conservator Shutter flanges indicate where the flanges should be connected.

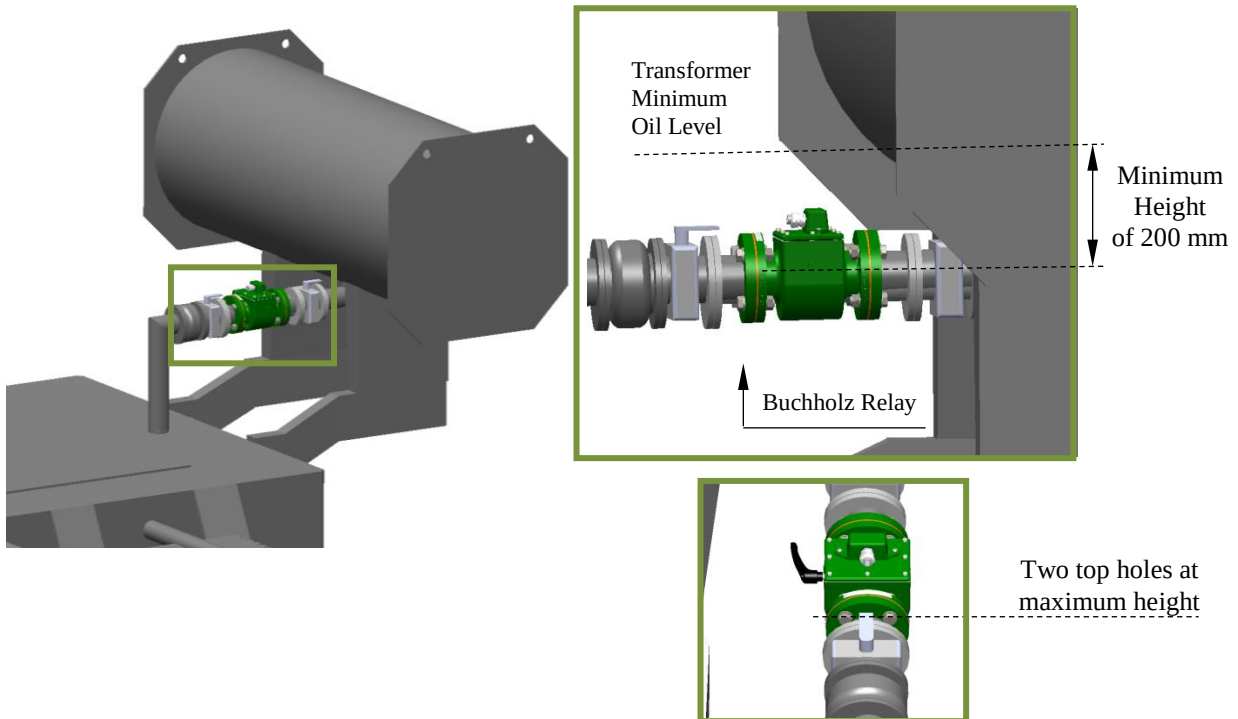


Illustration 7: SERGI CONSERVATOR SHUTTER Location

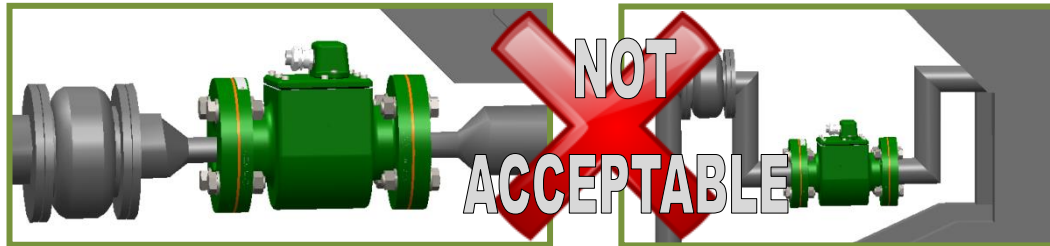


Illustration 8: Incorrect Installation



WARNING: The conservator diameter must not be reduced to match SERGI CONSERVATOR SHUTTER Diameter. Extra elbows should not be added to accomplish the minimum height of 200mm.



WARNING: DO NOT do any machining on SERGI CONSERVATOR SHUTTER

WARNING: Do not touch hex screws on the top cover.

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6.2 GASKETS AND FLANGES

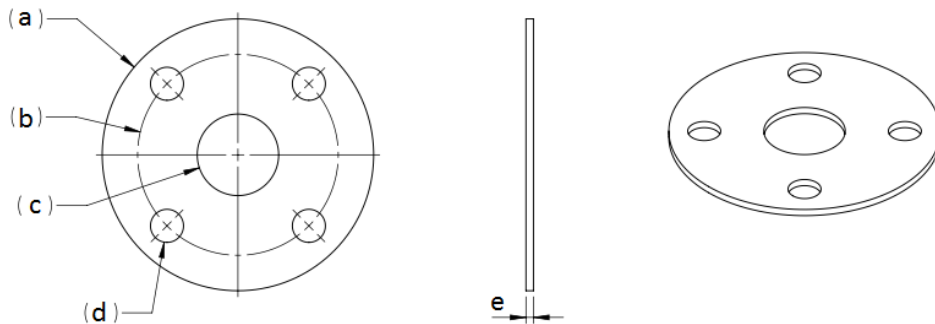
6.2.1 TL24 AND TL34 SERGI CONSERVATOR SHUTTER GASKETS

With the SERGI CONSERVATOR SHUTTER, gaskets are included which are necessary for correct installation of the system. One gasket should be placed on each side of the SERGI CONSERVATOR SHUTTER.

The TL24 SERGI CONSERVATOR SHUTTER uses a DN50 (2-inch) gasket.

The TL34 SERGI CONSERVATOR SHUTTER uses a DN80 (3-inch) gasket.

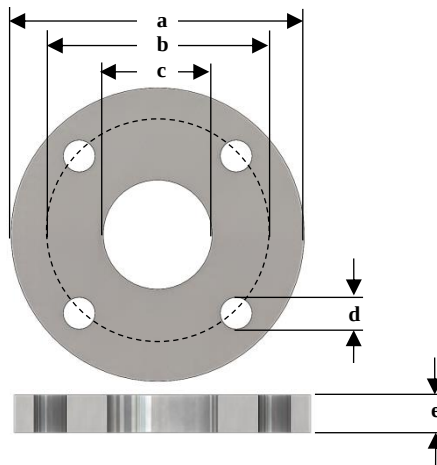
The table below shows the gasket dimensions for the SERGI CONSERVATOR SHUTTER



Dimension of gasket (inches)	DN	a (mm)	b (mm)	c (mm)	d (mm)	e (mm)	Hole	Quantity of holes
2	DN 50	165	125	65	18	3	M16	4
3	DN 80	200	160	93	18	3	M16	8
3	DN 80	200	160	93	18	3	M16	4

Illustration 9: NC80 Gasket for the TL24 & TL34, dimensions in mm.

6.2.2 TL24 AND TL34 SERGI CONSERVATOR SHUTTER FLANGES



Dimension of flange (inches)	DN	a (mm)	b (mm)	c (mm)	d (mm)	e (mm)	Hole	Quantity of holes
2	DN 50	165	125	61.5	18	19	M16	4
3	DN 80	200	160	90.5	18	20	M16	8
3	DN 80	200	160	90.5	18	20	M16	4

Illustration 10: ISO Flange for the TL24 & TL34, dimensions in mm.

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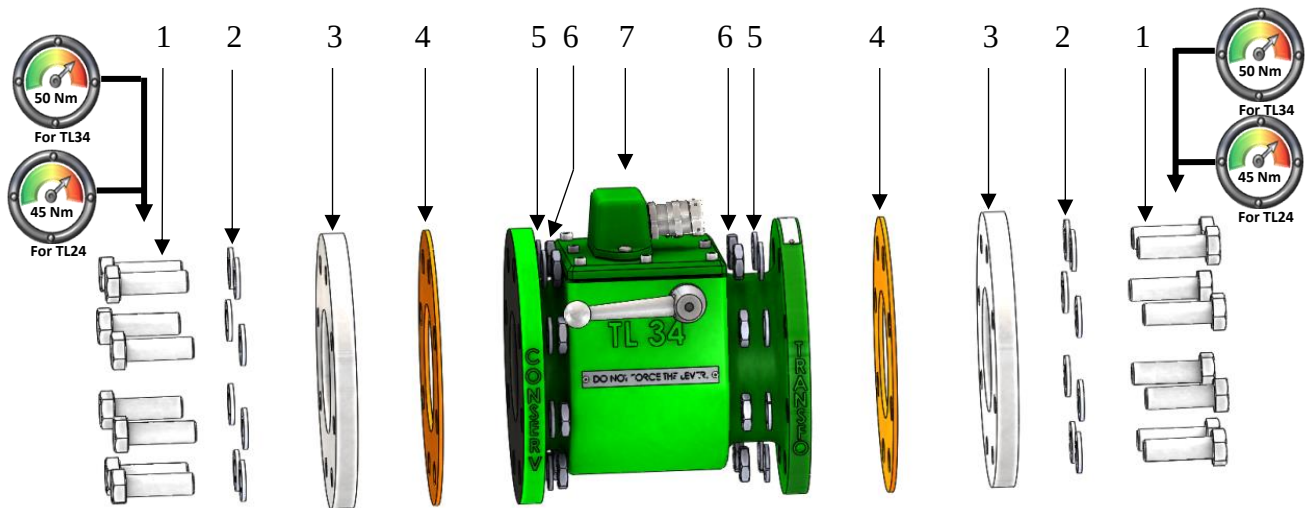
6.2.3 FASTENERS AND TORQUE

The torque applied to the M16 bolts on the flanges should be 45 Nm (33ft-lb) for the TL24 SERGI CONSERVATOR SHUTTER and 50 Nm (37ft-lb) for the TL34 SERGI CONSERVATOR SHUTTER model.

The standard SERGI CONSERVATOR SHUTTER does not come with fasteners or flanges. These components can be purchased as an option. Do not touch the 5mm hex screws on the cover.

For the connection between the SERGI CONSERVATOR SHUTTER flanges and the piping flanges M16 bolts, nuts, flat washers and WZ16 split lock washers will be necessary:

TL24	TL34 8-hole	TL34 4-hole
• Eight M16 bolts.	• Sixteen M16 bolts.	• Eight M16 bolts.
• Eight M16 nuts.	• Sixteen M16 jam nuts.	• Eight M16 jam nuts.
• Eight M16 flat washers.	• Sixteen M16 flat washers.	• Eight M16 flat washers.
• Eight WZ16 split lock washers.	• Sixteen WZ16 split lock washers.	• Eight WZ16 split lock washers.



1	M16 bolt	5	WZ 16split lock washer
2	M16 flat washer	6	M16 nut*
3	ISO flange	7	SERGI CONSERVATOR SHUTTER
4	NC80 full faced gasket	*Use Jam Nuts for TL34 (DIN 439B)	

Illustration 11: TL24 & TL34 Fasteners

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6.3 ORIENTATION OF THE SERGI CONSERVATOR SHUTTER

The inscriptions on the SERGI CONSERVATOR SHUTTER flanges indicate where the flanges should be connected. The flange with the “TRANSFO” inscription must be connected to the flange closer to the transformer. The flange with the “CONSERV” inscription should be connected to the flange that is closer to the conservator; see Illustration 12. The oil flow from the conservator tank to the transformer should go from the flange with the “CONSERV” inscription to the flange with the “TRANSFO” inscription.



Illustration 12: Orientation of the SERGI CONSERVATOR SHUTTER

The electrical connection must be placed so that they are in the upper most position as shown. The flat cover of the SERGI CONSERVATOR SHUTTER is level with the horizon. This will ensure that the SERGI CONSERVATOR SHUTTER will operate efficiently and correctly. To do so, two of the holes in the flanges should be placed in the highest position, see Illustration 13.

**Two Holes at
Maximum High**

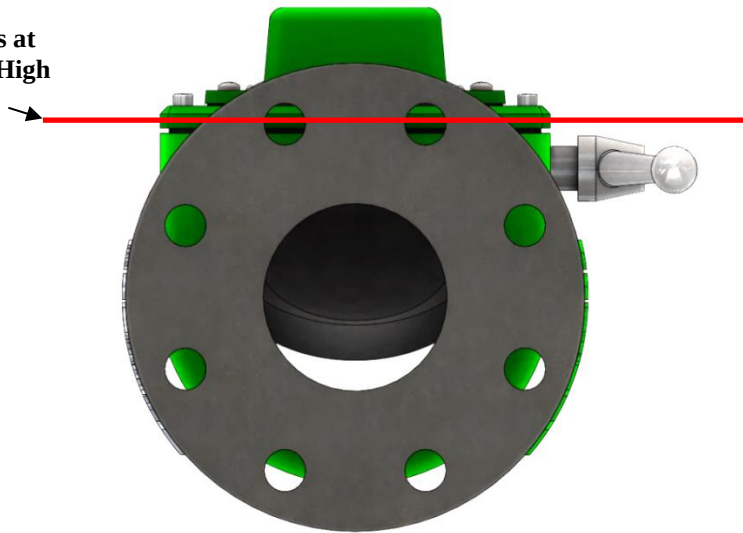


Illustration 13: Correct Position of the SERGI CONSERVATOR SHUTTER flanges.

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6.4 ELECTRICAL INSTALLATION

To perform the electrical installation, the terminal cover (Illustration 14) on the SERGI CONSERVATOR SHUTTER, must be taken off by removing the two screws. Once the terminal cover has been removed, the 2-core electric cable can be introduced through the metallic cable gland PG13.5. Two terminals are provided for the connection of the cable. Each terminal has an M6 threaded section with a nut for the electrical connection. Once the terminals have been attached, the terminal cover can be replaced in its original position by screwing both screws to a 5.5 N-m (4.1ft-lb) torque.

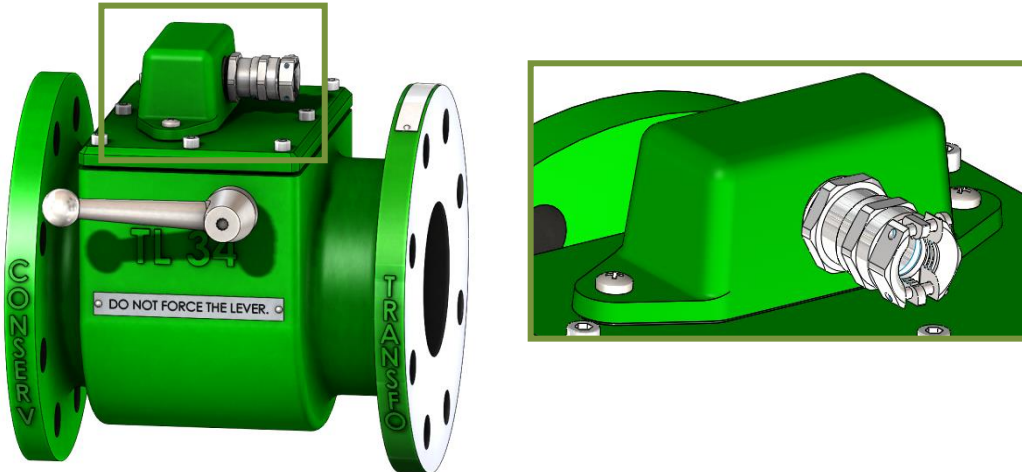


Illustration 14: Terminal Cover.



Important Note: Electrical Terminals are installed and torqued by manufacturer and cannot be re-torqued by customer. This will lead to oil leakage.

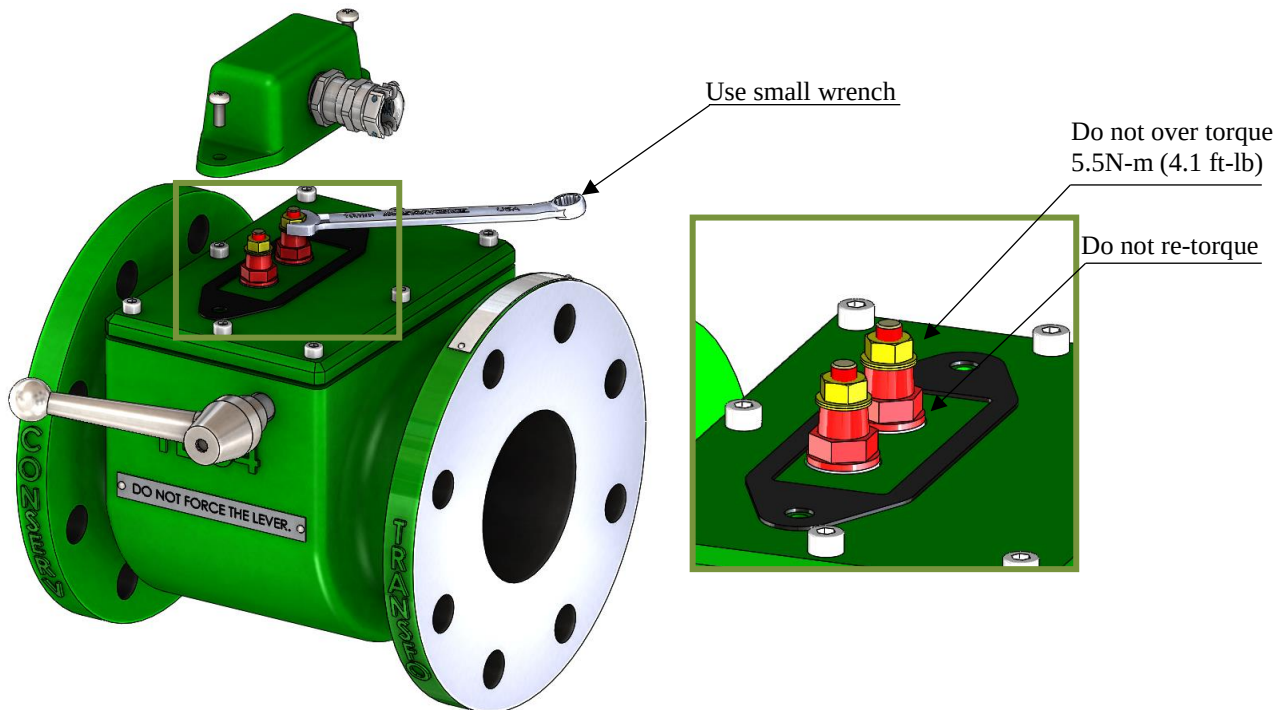


Illustration 15: Electrical Terminals.

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7 TESTING

7.1 TESTS IN THE WORKSHOP

Before the SERGI CONSERVATOR SHUTTER is installed on the transformer, it can be tested in the workshop.

The steps that should be taken for the test are:

- Place the SERGI CONSERVATOR SHUTTER in a horizontal position with its terminal cover upper-most and connect a continuity tester to the two terminals.
- The SERGI CONSERVATOR SHUTTER flap can now be moved to the close position by using a rod or similar. Continuity should be registered when the valve is closed.
- When the SERGI CONSERVATOR SHUTTER flap is released it should return automatically to its open position. The continuity tester should register no continuity when the SERGI CONSERVATOR SHUTTER flap is opened.

7.2 TESTS ON THE TRANSFORMER

The SERGI CONSERVATOR SHUTTER can be tested for automatic closure and contact operation once it has been installed on the transformer.



WARNING: Before testing, the transformer must be de-energized.

The steps that should be taken for the test are:

- At a suitable oil exit valve (DN50, 2 inches minimum), place a large enough container to collect the drained oil.
- Connect up a continuity tester to the SERGI CONSERVATOR SHUTTER terminals.
- Ensure that the operating lever is at its normal position so as not to interfere the SERGI CONSERVATOR SHUTTER flap movement.
- Open the oil exit valve fully.
- After a short period of time, check the tester for continuity.
- As soon as continuity is verified (the SERGI CONSERVATOR SHUTTER is closed), shut the oil exit valve.
- After testing, disconnect the continuity tester.

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8 MAINTENANCE

The design of the SERGI CONSERVATOR SHUTTER takes into account simplicity of maintenance for the operator as well as cost efficiency.

Maintenance inspection of the valve should be carried out every year or when usual transformer maintenance is done:

- Proceed with a visual check of the SERGI CONSERVATOR SHUTTER to check for any oil leaks.
- Check that the operating lever is not stuck. The lever should return to its original position without undue force.
- Check the wires and condition of the terminals and connections.
- Apply a jumper to the terminals. Verify that the control box indicates conservator shutter closed. To clear the signal, remove the jumper.
- Verify that the conduit is securely connected to the gland.
- Make sure that the SERGI CONSERVATOR SHUTTER is clean, that the paint is in good condition and there is no rust.

The SERGI CONSERVATOR SHUTTER should be replaced every 5 years.

8.1 MAINTENANCE AND REPLACE TIMELINE

CONSERVATOR SHUTTER Maintenance Inspection Timeline while “In Service”

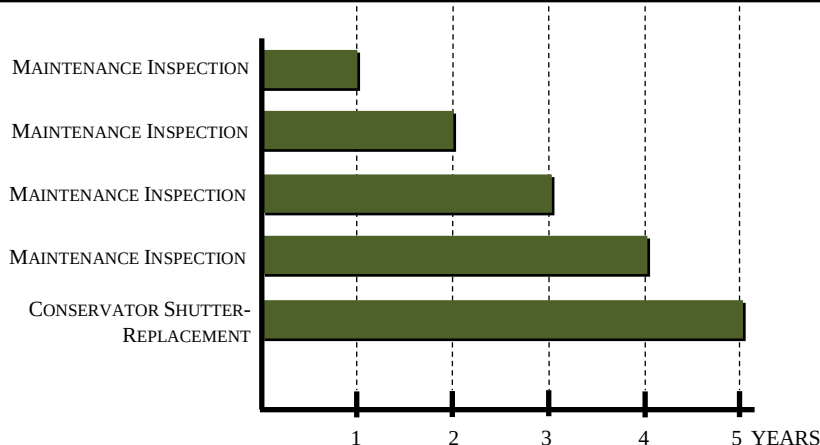


Illustration 18: Maintenance and Replacement Timeline on a yearly basis.

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8.2 APPENDIX 1

MAINTENANCE INSPECTION

PLANT / SUB-STATION NAME:

TRANSFORMER MANUFACTURER:

TRANSFORMER MVA:

TRANSFORMER SERIAL NUMBER:

SIGNAL VERIFICATION:

APPLY A JUMPER TO THE TERMINALS. VERIFY THAT THE CONSERVATOR LIGHT/ALARM ON THE MONITORING SYSTEM IS LIT.

TO CLEAR THE SIGNAL, REMOVE THE JUMPER AND HIT THE RESET BUTTON ON THE CONTROL BOX. (IF NEEDED)

FIRST ANNUAL MAINTENANCE INSPECTION	SECOND ANNUAL MAINTENANCE INSPECTION	THIRD ANNUAL MAINTENANCE INSPECTION	FOURTH ANNUAL MAINTENANCE INSPECTION
CONSERVATOR SHUTTER: ☐ SIGNAL VERIFICATION ☐ NO LEAKS ☐ GASKETS ☐ HANDLE ☐ ELECTRICAL CONNECTIONS ☐ CABLE GLANDS ☐ FASTENERS	CONSERVATOR SHUTTER: ☐ SIGNAL VERIFICATION ☐ NO LEAKS ☐ GASKETS ☐ HANDLE ☐ ELECTRICAL CONNECTIONS ☐ CABLE GLANDS ☐ FASTENERS	CONSERVATOR SHUTTER: ☐ SIGNAL VERIFICATION ☐ NO LEAKS ☐ GASKETS ☐ HANDLE ☐ ELECTRICAL CONNECTIONS ☐ CABLE GLANDS ☐ FASTENERS	CONSERVATOR SHUTTER: ☐ SIGNAL VERIFICATION ☐ NO LEAKS ☐ GASKETS ☐ HANDLE ☐ ELECTRICAL CONNECTIONS ☐ CABLE GLANDS ☐ FASTENERS
MAINTENANCE PERSONNEL: DATE: NAME: SIGNATURE:	MAINTENANCE PERSONNEL: DATE: NAME: SIGNATURE:	MAINTENANCE PERSONNEL: DATE: NAME: SIGNATURE:	MAINTENANCE PERSONNEL: DATE: NAME: SIGNATURE:

Note: SERGI is intended to receive a copy of this form for our own records and quality procedure.
Form can be faxed to : + (33) 1 39 22 11 11or after.sales@sergi-tp.com

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