

# SOLUTIONS FOR RENEWABLE ENERGY

LIGHTNING PROTECTION  
TRANSFORMER MAINTENANCE  
OVERHEATING & FIRE PROTECTION



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# THE RENEWABLE ENERGY

Renewable energies are extremely important in today's power generation scheme. Replacing fossil fuel-reliant power stations with renewable energy sources, such as wind and solar, is a vital part of stabilizing climate change and achieving net zero carbon emissions.

Streamar Electric AG strives to provide the best innovative technology solutions for renewable energy projects in order to increase productivity and reliability, making operating more efficient.

# GLOSSARY

LLPD

Line Lightning Protection  
Device

rFPT

remote Fire Prevention  
Thermolabels

FPC

Fire Prevention Concentrator

DLS

Direct Lightning Strike

Lightning striking a component of the network such as the conductor, tower or substation equipment

CFO

Critical Flashover Voltage

The voltage amplitude of a given waveshape that, under specified conditions, causes flashover through the surrounding medium on 50% of the voltage applications

PPM

Parts Per Million

vFPT

visual Fire Prevention  
Thermolabels

FPA

Fire Prevention Alarm

IOV

Induced Overvoltage

An overvoltage in the network that is induced by a lightning strike that does not strike directly at any component of the network

BFO

Back Flashover

A flashover of phase-to-earth insulation resulting from a lightning strike to that part of the system which is normally at earth potential

## ICON LEGENDS:



IOV



DLS

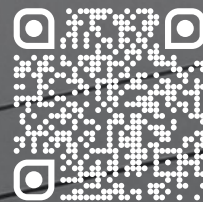


BFO





# LLPD



## LINE LIGHTNING PROTECTION UP TO 69 KV

A unique lightning protection solution for overhead lines: Line Lightning Protection Devices (LLPDs) with EasyQuench (EQ) technology have been invented and patented by Streamer.

More than 2 million LLPDs have been installed worldwide (China, Indonesia, Malaysia, Brazil, UAE, Vietnam, Switzerland, Germany and elsewhere).

# INTRODUCTION

## THE ISSUES

Lightning poses a severe threat to the safety and productivity and safety hazard for different industries.

The consequences of lightning can be production losses for energy companies (estimate to millions of USD per year).

Losses are caused by lack of electricity for a few hours and therefore downtime of all electrical equipment.

## THE SOLUTION

For lightning protection of overhead lines we offer Line Lightning Protection Devices (LLPD) that will drastically reduce lightning outages by preventing flashovers of insulator caused by direct and indirect lightning strikes and will then break the following short circuit in less than 10ms. These LLPDs are easily retrofitted on any line shape. Moreover, special grounding and low soil resistivity are not required for this type of device, hence it can be implemented literally everywhere.

## THE RESULT

As result of installing LLPDs on the medium voltage lines, the lightning trips are avoided which means:

- no production loss;
- no safety hazard.





# INSTALLED WORLDWIDE

## Indonesia

- Perusahaan Listrik Negara
- VALE
- Pertamina
- Medco Energy (Indonesia)

## Vietnam

- VietNam Electricity

## Malaysia

- Tenaga Nasional Berhad

## Philippines

- Dagupan Electric
- NGCP

## China

- China Railway First Group co
- China Southern Power Grid
- State Grid Corporation of China
- Zhinu Spring phase 4 Wind Power
- Electric power branch D plant

## Brazil

- Celesc
- CPFL Energia
- Rio Grande Energia

## Colombia

- EPM
- Mineros

## Peru

- ElectroSur

## Jamaica

- JPSCo

## Botswana

- Botswana Power Corporation

## South Africa

- AngloAmerican
- Seriti (south Africa)

## Saudi Arabia

- Saudi Aramco

## Switzerland

- BKW
- Groupe E
- Repower

## Germany

- Westnetz

## Ecuador

- EERSA

## New Zealand

- Electronet

## Laos

- EDL

## Italy

- ENEL

## Croatia

- HEP



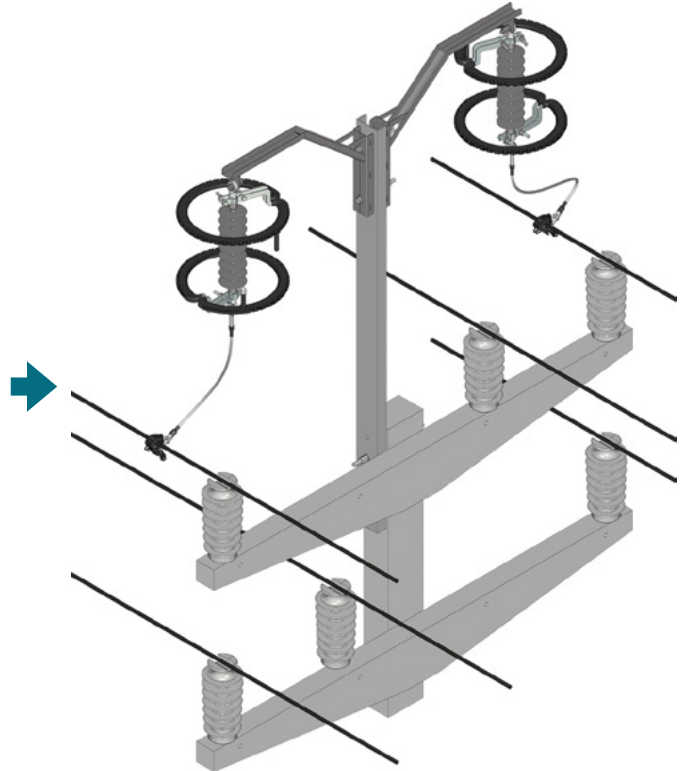
# INSTALLATION EXAMPLES: WIND FARMS

Brazil	
Rated voltage of overhead lines	34.5 kV
Quantity of installed LLPDs	850 sets

Pole without LLPDs



Pole with LLPDs



# INSTALLATION EXAMPLES: WIND FARMS

China, Shanxi province	
Zhinu Spring phase 4 Wind Power	
Rated voltage of overhead lines	35 kV
Quantity of installed LLPDs	54 sets



China, Neimenggu Province	
Electric power branch D plant	
Rated voltage of overhead lines	35 kV
Quantity of installed LLPDs	99 sets



LINE LIGHTNING PROTECTION DEVICES

# EASYQUENCH



## EASYQUENCH BENEFITS

- Prevents outages on the line
- Protects overhead lines from direct lightning strike and induced overvoltage
- No dedicated grounding to be arranged;
- No maintenance required
- Works perfectly in areas with high soil resistivity
- Works under extreme climatic conditions and high-altitude landscape
- Quenches follow current (short circuit current) in less than one semiperiod of industrial power frequency
- 20 years life expectancy
- Fix and forget



# EASYQUENCH



## A UNIQUE & EFFICIENT TECHNOLOGY FOR LINE LIGHTNING PROTECTION

EasyQuench is a unique technology, developed and being improved since 1996 by Streamer. Products featuring the EasyQuench technology protect overhead lines against direct and indirect lightning strikes, thus helping to prevent breakage of conductors, insulators and power outages.

Due to their operating principle, line lightning protection devices (LLPDs) do not require any special grounding (e.g. a ground lead). Therefore, these devices are especially efficient in areas with high soil resistivity.

The Operating principle of LLPDs with the EasyQuench system is based on the following concepts:

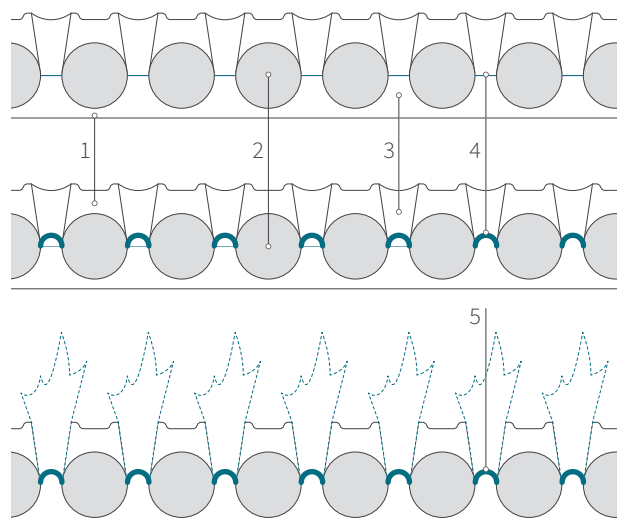
1. Insulation coordination. Coordination of lightning protection devices with line insulation is necessary to ensure proper operation and is achieved by adjusting BIL (CFO) of LLPD so that it is lower than those of the protected insulator. By fulfilling this requirement, it can be guaranteed that in case of a direct or an indirect lightning strike, the LLPD will operate correctly and prevent flashovers of the protected insulator.
2. Follow current interruption. Since all power lines are connected to transformers, when there's a flashover of LLPD somewhere on the line, a power frequency short-circuit current (or follow current) starts flowing immediately through it. Thanks to the EasyQuench system, LLPD can interrupt the fault current within one half of the period.

The EasyQuench system consists of a series of small discharge/ arcing chambers, being formed by two adjacent metal electrodes placed in a silicone rubber body. Electrodes are separated from each other with tiny air gaps, that break down as soon as the LLPD is subjected to lightning overvoltage.

When a follow current starts flowing through the EasyQuench system, it immediately gets split into a series of small power arcs located inside the device. Each of the miniature arcs is then quenched individually.





When power frequency follow current crosses zero, it is eliminated. The line then immediately gets back to normal operation, therefore no short circuit will be sensed by protection relays and there will be no outage or power supply interruption.

Diagram of discharge initiation:






- |                            |               |
|----------------------------|---------------|
| 1. Silicone rubber body    | 4. Arc        |
| 2. Intermediate electrodes | 5. Plasma jet |
| 3. Arc quenching chamber   |               |

# TECHNICAL DATA

	d10z	i20z	dC20z	d24z
				
Reference	LL.PD.D012.E0.WW	SAI.020.Z.WW/820	SAD.C20.Z.WW/920	LLPD.D024.B0.WW
Highest voltage of equipment, kV	12	24	24	24
Protection from	DLS	IOV	DLS	DLS
Maximum prospective fault current/effective current, kA	5/ 3.5	1.5/ 1.2	5/ 3.5	5/ 3.5
External air gap, mm	50–70	60–80	60–80	60–80
50% flashover voltage, kV	<115	<110	<185	<150
Power frequency withstand voltage, kV (wet/dry)	28/38	30/40	40/50	40/50
Lightning discharge capability (200 µs), C	2.8	2.4	2.8	2.8
High current impulse (4/10 µs), kA	65	65	65	65
Maximum quenching lightning current, kA	20 (8/50µs)	3 (1/50µs)	20 (8/50µs)	20 (8/50µs)
Minimum withstand amounts of operations	10	10	10	10
Average expected lifespan, years	30	30	30	30
Weight, kg	1.1	0.43	2.6	2.8
Maintenance	1 visual verification/ year	1 visual verification/ year	1 visual verification/ year	1 visual verification/ year

# TECHNICAL DATA

	dM35z	d45z	d69z
			
Reference	SAD.M35.Z.WW/920	SAD.045.Z.WW/930	SAD.069.Z.WW/920
Highest voltage of equipment, kV	40.5	52	72.2
Protection from	DLS	DLS	DLS
Maximum prospective fault current, kA	5/ 3.5	5/ 3.5	5/ 3.5
External air gap, mm	115–180	80+80	80+80+120
50% flashover voltage, kV	<200	<280	<440
Power frequency withstand voltage, kV (wet/dry)	65/80	95/95	140/140
Lightning discharge capability (200 µs), C	2.8	2.8	2.8
High current impulse (4/10 µs), kA	65	65	65
Maximum quenching lightning current, kA	20 (8/50µs)	20 (8/50µs)	20 (8/50µs)
Minimum withstand amounts of operations	10	10	10
Average expected lifespan, years	30	30	30
Weight, kg	6.2	7	9.3
Maintenance	1 visual verification/ year	1 visual verification/ year	1 visual verification/ year

# ACCESSORIES

Reference		Description
LL.CL.BA04.1B.WW	Conductor clamp (non-insulated)	For bare/covered conductors with diameter 8-25 mm; material: stainless steel
LL.CL.CA04.1B.WW		
LL.CC.0837.LA.WW	Shear head conductor clamp (piercing)	For covered conductors with diameter 16-37 mm; pierce insulation up to 8 mm of thickness; provides optimal torque; can be installed on live-line
LL.CC.0837.OA.WW		
LL.CC.0837.OO.WW		
LL.CB.0037.LA.WW	Shear head conductor clamp (non-piercing)	For bare conductors with diameter 6-24 mm; provides optimal torque; can be installed on live-line
LL.CB.0037.OA.WW		
LL.CB.0037.OO.WW		
LL.JU.FL27.1A.WW	Jumper	For connection LLPD with conductor through conductor clamp. Length 2.5/3 m; for LLPD d24z, dM35z; d45z; d69z
LL.JU.LL25.1A.WW		
LL.IN.BA3B.11.TH	Insulator	Grey, clevis/tongue, 24 kV; creepage distance 686 mm, for LLPD d24z
LL.IN.BA3A.11.TH		Grey, tongue/tongue, 24 kV; creepage distance 686 mm; for LLPD d24z
LL.IN.CA3B.11.TH		Grey, clevis/tongue, 40,5 kV; creepage distance 914 mm, for LLPD dM35z
LL.IN.CA3A.11.TH		Grey, tongue/tongue, 40,5 kV; creepage distance 914 mm, for LLPD dM35z
LL.IN.CA3B.12.TH		Grey, clevis/tongue, 40,5 kV; creepage distance 1137 mm, for LLPD dM35z
LL.IN.CA3A.12.TH		Grey, tongue/tongue, 40,5 kV; creepage distance 1130 mm, for LLPD d45z
LL.IN.DB3A.11.CN		Grey, tongue/tongue, 50kV; creepage distance 1130 mm, for LLPD d45z
LL.IN.EB3A.11.CN		Grey, tongue/tongue, 72.5kV; creepage distance 1730 mm, for LLPD d69z
LL.HR.BH10.1B.WW	Horn electrode	Steel, max. ext. diam. of insulator end fitting: 40 mm; for LLPD d10z
LL.HR.BH11.1B.WW		Steel, max. ext. diam. of insulator end fitting: 40 mm; for LLPD i20z
LL.HR.BH12.1B.WW		Steel, max. ext. diam. of insulator end fitting: 40 mm; for LLPD i24z
LL.BR.CLAA.1B.WW	Bracket	Steel; for L-bar 60x60 mm - 90x90 mm; for LLPD i20z inst.
LL.BR.CLBA.1B.WW		Steel; for L-bar 60x60 mm, for LLPD i20z inst.
LL.BR.CLBA.2B.WW		Steel; for L-bar 90x90 mm, for LLPD i20z inst.
LL.BR.CLCB.1B.WW		Steel; for Г/L-bar 70x70 - 80x80 mm; for LLPD d24z, dM35z, d45z, d69z inst.
LL.BR.CRBA.1B.WW		Steel; permissible diameter of cross-arm 140-180 mm; for LLPD dC20z inst.
LL.BR.CRCA.1B.WW		Steel; for LLPD d24z, dM35z installing
LL.BR.CUAA.1B.WW		Steel; permissible size of cross-arm 150*130 mm;for LLPD i20z inst.
LL.BR.CUBA.1B.WW		Steel; permissible size of cross-arm 150*130 mm; for LLPD dC20z inst.
LL.BR.CUCA.1B.WW		Steel; perm.size of cross-arm 150*130 mm;for LLPD d24z, dM35z, d45z, d69z
LL.BR.IDAA.1B.WW		Steel; max. diam. of insulator's pin: 40 mm; for LLPD i20z, d10z inst.
LL.BR.IDAB.1B.WW		Steel; max. diam. of insulator's pin: 24 mm ; for LLPD i20z inst.
LL.BR.PRBA.1B.WW		Steel; permissible diam. of pole: 150-200 mm; for LLPD dC20z inst.
LL.AC.BH01.AB.WW	Additional cross-arm	Steel; for LLPD d24z, dM35z inst.
LL.AC.BH02.AB.WW		Steel; for LLPD d45z, d69z inst.
LL.ID.0001.SA.WW	Indicator	One-time indication of LLPD operation
LL.ID.0001.BA.WW		





# MOISTURE MONITORING AND EXTRACTION FOR POWER TRANSFORMERS

Moisture is one of the primary causes of failures for power transformers and one of the main degradation factors for insulation paper. Therefore, it increases the risks of operation failures and shortens the life expectancy of the asset. After several years of service operation, moisture can appear in a transformer from several sources which are external or internal and it has a complex dynamic between the oil and paper within the transformer.

Also it is difficult to evaluate the moisture situation of a transformer without thorough monitoring.

TRANSEC offers an efficient solution for both moisture monitoring and extraction which is online and does not require any operator.

# INTRODUCTION

## THE ISSUE: MOISTURE THREATENING THE TRANSFORMER

Moisture is one of the primary causes of failures for power transformers and one of the main degradation factors for the insulation paper. It, therefore, increases the risks of operation failures and shortens the life expectancy of the asset.

Unfortunately, moisture can appear in a transformer from several sources, which are external or internal and it has a complex dynamic between the oil and paper within the transformer.

## THE SOLUTION: MAINTAINING A DRY TRANSFORMER BY CONTINUOUS FILTRATION

Maintaining a low level of moisture in a transformer provides significant benefits in terms of operations and risk as it carries a constant high insulation level. It is therefore possible to load the transformer at a higher level and to make this load vary without risk of damaging the transformer.

Also, it has consequent financial benefits since it elongates the asset's life by slowing down the paper degradation. This degradation creates particles or even sludges. Finally, moisture is also responsible for the creation of acids in the oil. Hence keeping a low level of moisture will lower the maintenance costs.

## FINANCIAL BENEFIT EXAMPLE OF USING TRANSEC

By extending the life expectancy of the transformer, TRANSEC contribute to generating financial benefits to its user.

We considered an Interest Rate (IR) of 5% and a price of new transformer (C) constant of the years.

The table below shows concrete examples of what these savings can represent, where n is the number of years of transformer life extension.

Cost of a new transformer — 40 MVA	400 000 \$
Saving calculation formula	$C * [(1 + IR)^n - 1]$
TRANSEC life extension on old transformer	5 years
Savings	110 512 \$
TRANSEC life extension on new transformer	15 years
Savings	431 571 \$

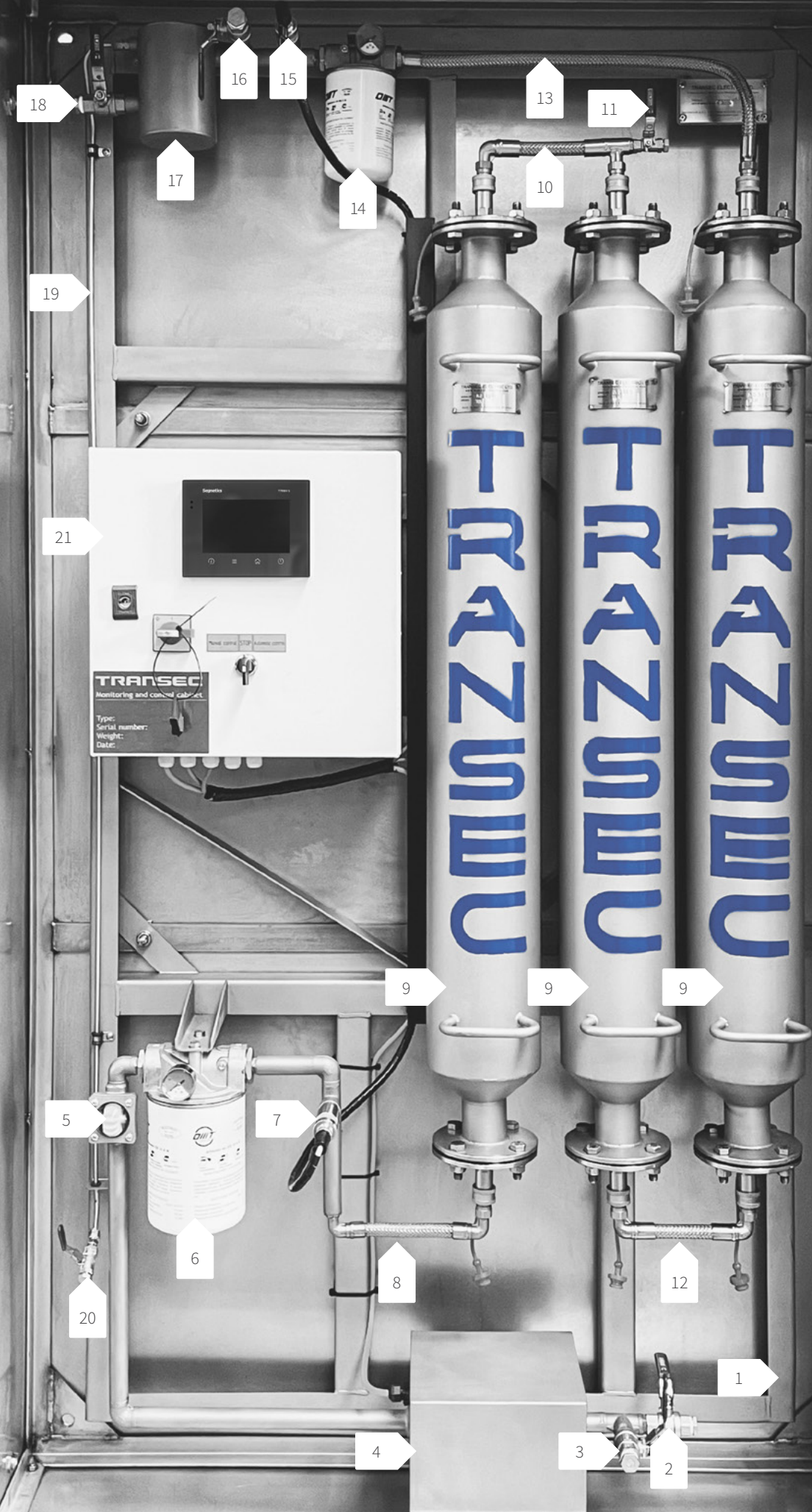
## MOISTURE AND TEMPERATURE SENSORS WITHIN THE OIL

[illegible]

Thanks to the constant sampling from the TRANSEC sensors, the relative saturation, the moisture PPM and temperature can be followed remotely on the webserver which allows assessment of the moisture level in the transformer and to observe the effect of the TRANSEC filtration.



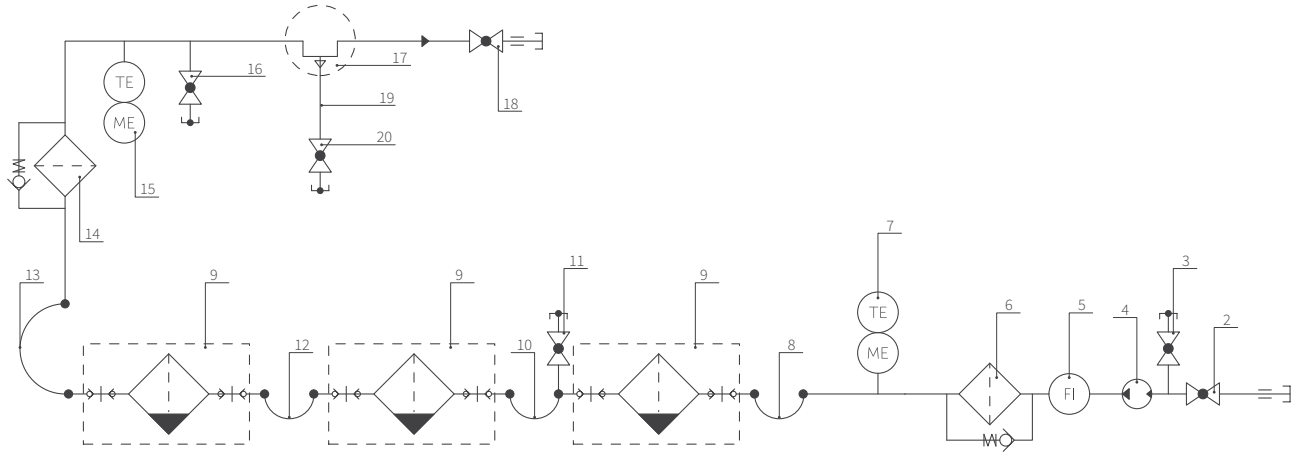






# TRANSEC CL1i, CL2i, CL3i. ONLINE DRYING SYSTEM

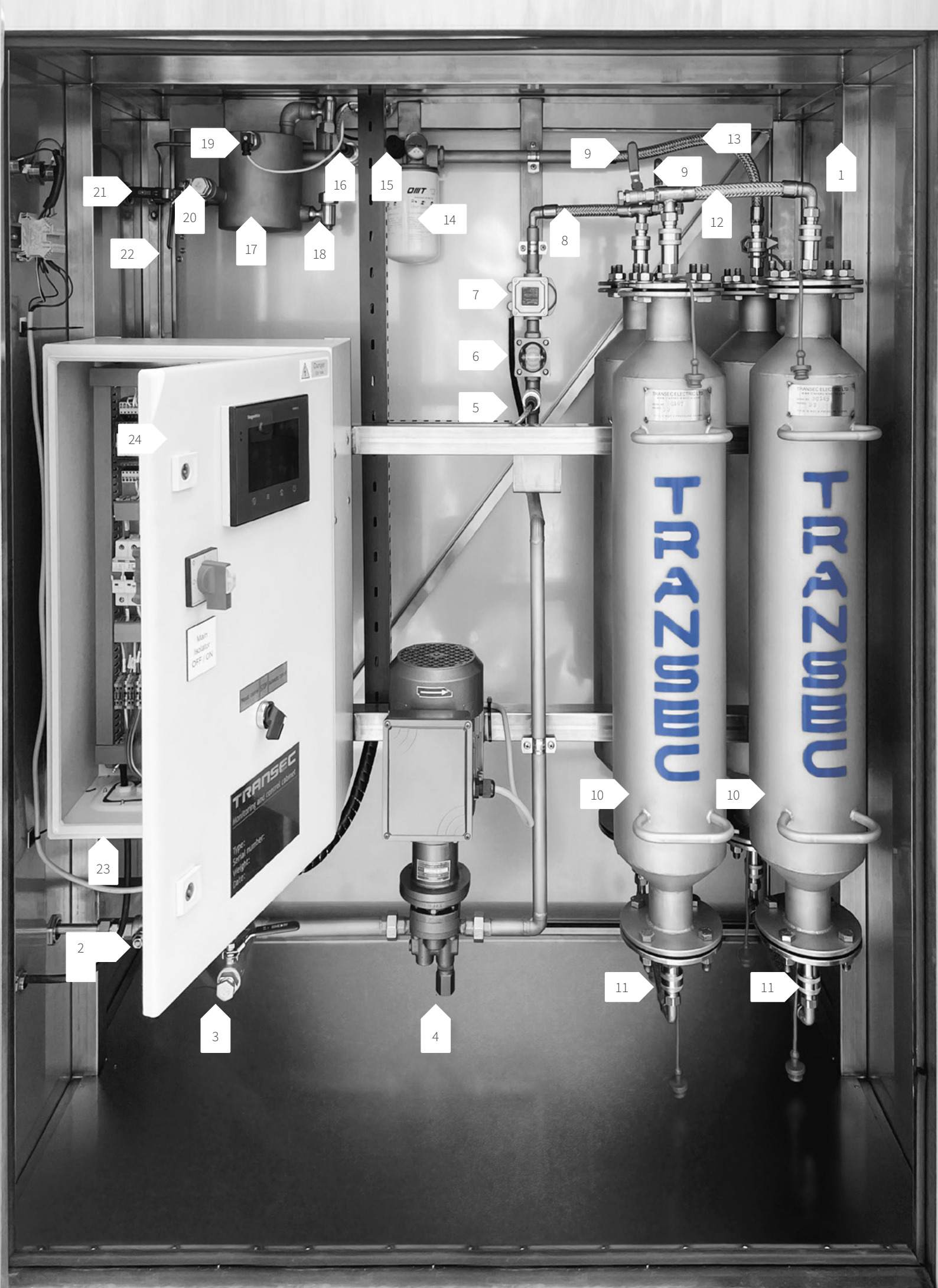
## PRINCIPLE OF OPERATION



Oil from the transformer tank through inlet ball valve 2 enters the unit. Pump 4 pushes the oil through inlet filter 6 and put it into cylinders 9. While the oil flows through the cylinder,

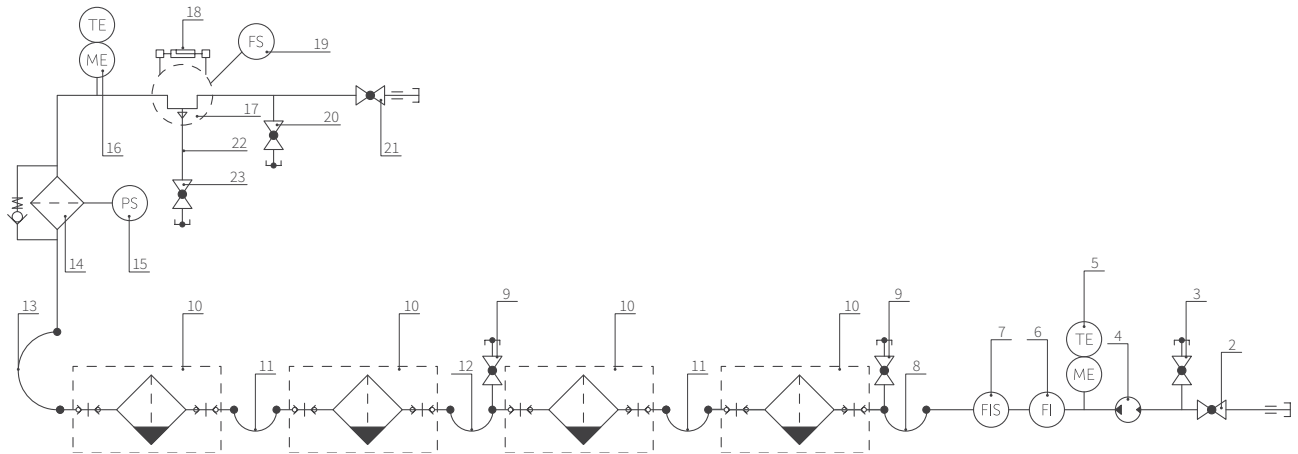
the adsorption process takes place, moisture is adsorbed by zeolite. The oil is returned to the main tank of the transformer through outlet filter 14, deaerator 17 and outlet ball valve 18.

1. Frame
2. Inlet ball valve
3. Inlet sampling valve
4. Pump
5. Flow indicator
6. Inlet filter
7. Inlet moisture and temperature sensor
8. Bottom interconnection pipeline between cylinder and sensor/inlet filter
9. Cylinders
10. Top interconnection pipeline between cylinders
11. Air bleed valve between cylinders
12. Bottom interconnection pipeline between cylinders
13. Top interconnection pipeline between cylinder and outlet filter
14. Outlet filter
15. Outlet moisture and temperature sensor
16. Outlet sampling valve
17. Deaerator
18. Outlet ball valve
19. Bleed pipe
20. Deaerator air bleed valve
21. AMi monitoring and control cabinet (MCC)



# TRANSEC CL4. ONLINE DRYING SYSTEM

## PRINCIPLE OF OPERATION



Oil from the transformer tank through inlet ball valve 2 enters the unit. Pump 4 pushes the oil through the pipelines into cylinders 10. While the oil flows through the cylinder,

the adsorption process takes place, moisture is adsorbed by zeolite. The oil is returned to the main tank of the transformer through outlet filter 14, deaerator 17 and outlet ball valve 21.

- |   |  |
|---|--|
| 1. External enclosure   | 22. Bleed pipe                               |
| 2. Inlet ball valve   | 23. Deaerator air bleed valve                |
| 3. Inlet sampling valve   | 24. WSi monitoring and control cabinet (MCC) |
| 4. Pump   |  |
| 5. Inlet moisture and temperature sensor  |  |
| 6. Flow indicator   |  |
| 7. Flow meter   |  |
| 8. Top interconnection pipeline between cylinder and sensor                                     |  |
| 9. Air bleed valve on the first cylinder and air bleed valve between second and third cylinders |  |
| 10. Cylinders   |  |
| 11. Bottom interconnection pipelines between cylinders  |  |
| 12. Top interconnection pipeline between cylinders  |  |
| 13. Top interconnection pipeline between cylinder and outlet filter                             |  |
| 14. Outlet filter   |  |
| 15. Particle filter sensor  |  |
| 16. Outlet moisture and temperature sensor  |  |
| 17. Deaerator   |  |
| 18. Glass gauge   |  |
| 19. Float switch  |  |
| 20. Outlet sampling valve   |  |
| 21. Outlet ball valve   |  |

# TRANSEC CL1i, CL2i, CL3i.

## TECHNICAL DATA

Parameter	CL1	CL2	CL3
Water extraction capacity before cylinder change	3 to 4 litres	6 to 8 litres	10 to 12 litres
Flow rate with Grundfos UPS2 pump	70 to 90 litres per hour		
Flow rate with TC500 pump	400 to 500 litres per hour		
Particle filter	10 microns on inlet & outlet; optionally the unit can be fitted with an additional 3 microns pre-filter; optionally the unit can be fitted with an additional 5 microns pre-filter for heavily sludged transformers		
Material	Stainless steel 304 Grade		
Oil temperature range	0°C to 105°C		
Acceptable environment condition	-40°C to +60°C		
Altitude	Up to 2000 m		
Protection class of the unit enclosure	IP55		
Protection class of the MCC enclosure	IP65		
Power Supply	240 V 50 Hz or 110V 60 Hz		
Pump Grundfos UPS2 Power	140 W		
Pump Midland TC500 Power	250 W		
Number of cylinders	1	2	3
Oil drying adsorbent	Zeolite with 3 Angstrom bead size		
Monitoring	Available in option		
Size	1940 x 1000 x 300		
Installation weight without MCC	128 kg	164 kg	200 kg
MCC weight	00	AMi	WSi
	0.4 kg	12 kg	20 kg
Installation time	5 to 6 hours with 2 people		
Manufacturing type test	3 bar pressure at 110°C for 1 hour		
Manufacturing routine test	Cyclic 3 bar pressure at 60°C for 24 hours		
Enclosure	Optional. In stainless steel		
Fixation	On the wall or the ground		



# TRANSEC CL1i, CL2i, CL3i.

## PRODUCT SELECTION GUIDE

TRANSEC unit	TR. CL.	X	X	X	X	X	X	X	.i
Number of Cylinders	1 cylinder (4 litres of water extraction)	1							
	2 cylinder (8 litres of water extraction)	2							
	3 cylinders (12 litres of water extraction)	3							
Monitoring	No Monitoring		0						
	Monitoring with local display; PPM, Temp & %RS; Alarms		A						
	Monitoring with local display; PPM, Temp & %RS; Alarms; Analytics; Cylinder Saturation; automation		W						
Pump type	Grundfos UPS2 70 to 90 litres per hour			U					
	Midland TC500 400 to 500 litres per hour			T					
Mounting	Mounting on wall or on transformer; no standing frame				0				
	Standing frame v1 to be bolted on the ground				1				
	Standing frame v2 self standing				2				
	Enclosed in Stainless Steel IP55 fixed on the ground or on a wall				3				
Pump/Power Supply	50Hz 240VAC					5			
	60Hz 120VAC					6			
Oil inside cylinders	Un-inhibited naphthynic oil IEC 60296						U		
	Inhibited naphthynic oil IEC 60296						I		
	Other (please specify)						O		
Filters	2x standard filters: inlet & outlet 10 microns							0	
	Inlet 3 microns & outlet 10 microns							1	
	Inlet & outlet 3 microns							2	
	Inline stainless steel 5 microns							3	
	Prefilter Pall 5 microns & outlet 10 microns							4	
	Prefilter Pall 5 microns & Inline stainless steel 5 microns							5	
Version									i

# TRANSEC CL1i, CL2i, CL3i.

## SPARE PARTS & SERVICES

Monitoring unit	
TR.MT.00AM.0i.WW	Monitoring with local display; PPM, Temp & %RS; Alarms
TR.MT.00WS.0i.WW	Monitoring with local display; PPM, Temp & %RS; Alarms; Analytics; Cylinder Saturation; automation
TR.SR.MONI.UP.WW	Service for Monitoring box installation
Communication option	
TR.MT.RTGS.00.WW	GSM Router (2G,3G and 4G(LTE))
TR.AC.GTW.61850	IEC 61850 Gateway added in Monitoring cabinet (MODBUS TCP Converting to IEC - TCP ETHERNET & FIBER OPTIC OUTPUT)
Accessories	
TR.AC.NCYL.03.0i	3 new cylinders iVersion + 2x replacement particle filters (10 microns)
TR.AC.IKIT.00.WW	Installation kit: 2x Male Stud Couplings, 1x Reducing tee, 1x Brass stud coupling, 3m copper tube, 1x Non return valve, 2x 2m tube SS 15mm cold annealed
TR.AC.IKIT.01.WW	Installation kit with flexible pipes stainless steel braided (7m & 10m)
TR.AC.ENCL.S1.0i	Stainless Steel Enclosure with insulation for CL1
TR.AC.ENCL.S3.0i	Stainless Steel Enclosure with insulation for CL3
TR.AC.ENCL.P3.0i	Powder Coated Enclosure with insulation for CL3
TR.AC.FLAN.15.WW	Flanges for installation DN15
TR.AC.FLAN.25.WW	Flanges for installation DN25
TR.AC.FLAN.50.WW	Flanges for installation DN50
TR.AC.FLAN.00.WW	Flanges for installation (size to be specify)
TR.AC.LEAK.00.WW	Leak tray & sensor*
TR.AC.GGAU.00.WW	Glass Gauge on dearator
TR.AC.RLVL.00.WW	Dearator level alarm switch*
TR.AC.SLSV.0i.WW	1x inflow controllable solenoid valves *
TR.AC.HTCA.00.WW	Heater for monitoring cabinet
*Only available for the WSi version	
Services	
TR.SR.REGE.03.WW	Regeneration of 3 cylinders (EXW UK)
TR.SR.SINS.00.WW	Installation Supervision
TR.SR.INSF.00.WW	Transformer inspection
TR.SR.MONI.UP.WW	Service for Monitoring box installation
TR.SR.MODI.00.WW	Product modification service

# TRANSEC CL4.

## TECHNICAL DATA

Parameter	CL4
Water extraction capacity before cylinder change	6.5 litres
Flow rate with TC500 pump	400 to 500 litres per hour
Particle filter	10 microns on inlet & outlet; optionally the unit can be fitted with an additional 3 microns pre-filter; optionally the unit can be fitted with an additional 5 microns pre-filter for heavily sludged transformers.
Material	Stainless steel 304 Grade
Oil temperature range	0°C to 105°C
Acceptable environment condition	-40°C to +60°C
Altitude	Up to 2000 m
Protection class of the unit enclosure	IP56
Power Supply	240 V 50 Hz
Pump Midland TC500 Power	250 W
Number of cylinders	4
Oil drying adsorbent	Zeolite with 3 Angstrom bead size
Monitoring	WSi only
Size	1443 x 1200 x 747
Installation weight	350 kg
Installation time	5 to 6 hours with 2 people
Manufacturing type test	3 bar pressure at 110°C for 1 hour
Manufacturing routine test	Cyclic 3 bar pressure at 60°C for 24 hours
Enclosure	304 Grade Stainless steel
Fixation	Self-standing

# TRANSEC CL4.

## PRODUCT SELECTION GUIDE

TRANSEC unit	TR. CL.	X	X	X	X	X	X	X	.i
Amount of Cylinders	4 cylinders (6.5 litres of water extraction)	4							
Monitoring	Monitoring with local display; PPM, Temp & %RS; Alarms; Analytics; Cylinder Saturation; automation		W						
Pump type	Midland TC500 400 to 500 litres per hour			T					
Mounting	Enclosed in stainless steel IP55; self standing				3				
Pump/Power Supply	50Hz 240VAC					5			
	60Hz 120VAC					6			
Oil inside cylinders	Un-inhibited naphthynic oil IEC 60296						U		
	Inhibited naphthynic oil IEC 60296						I		
	Other (please specify)						O		
Filters	2x standard filters: inlet & outlet 10 microns							0	
Version									i



# TRANSEC CL4.

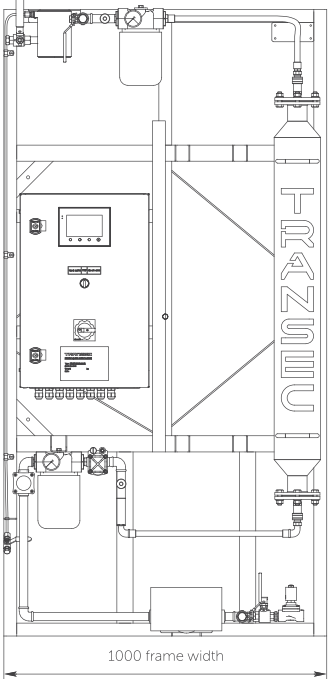
## SPARE PARTS & SERVICES

Communication option	
TR.MT.RTGS.00.WW	GSM Router (2G,3G and 4G (LTE))
TR.AC.GTW.61850	IEC 61850 Gateway added in Monitoring cabinet (MODBUS TCP Converting to IEC - TCP ETHERNET & FIBER OPTIC OUTPUT)
Accessories	
TR.AC.NCYL.04.0i	4 new cylinders short iVersion for CL4
TR.AC.IKIT.00.WW	Installation kit: 2x Male Stud Couplings, 1x Reducing tee, 1x Brass stud coupling, 3m copper tube, 1x Non return valve, 2x 2m tube SS 15mm cold annealed
TR.AC.IKIT.01.WW	Installation kit with flexible pipes stainless steel braided (7 m & 10 m)
TR.AC.FLAN.15.WW	Flanges for installation DN15
TR.AC.FLAN.25.WW	Flanges for installation DN25
TR.AC.FLAN.50.WW	Flanges for installation DN50
TR.AC.FLAN.00.WW	Flanges for installation (size to be specify)
TR.AC.LEAK.00.WW	Leak tray & sensor
TR.AC.GGAU.00.WW	Glass Gauge on dearator & level switch
TR.AC.SLSV.0i.WW	1x inflow controllable solenoid valves
Services	
TR.SR.REGE.03.WW	Regeneration of 4 cylinders short iVersion (EXW UK)
TR.SR.SINS.00.WW	Installation Supervision
TR.SR.INSPE.00.WW	Transformer inspection
TR.SR.MONI.UP.WW	Service for Monitoring box installation
TR.SR.MODI.00.WW	Product modification service

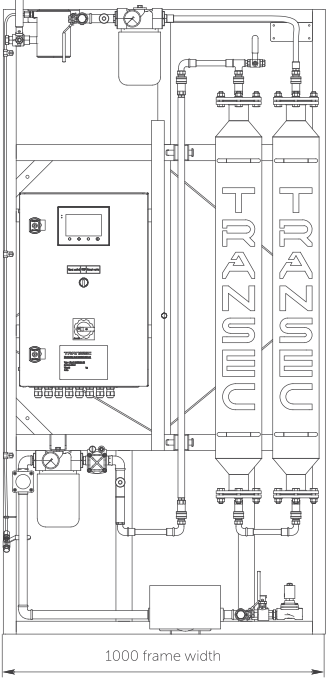


# DIMENSIONS

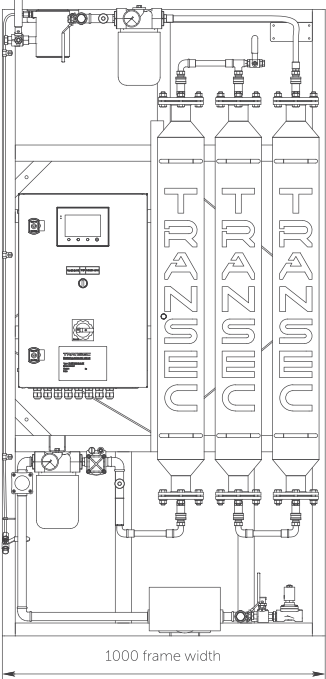
CL1 WSi



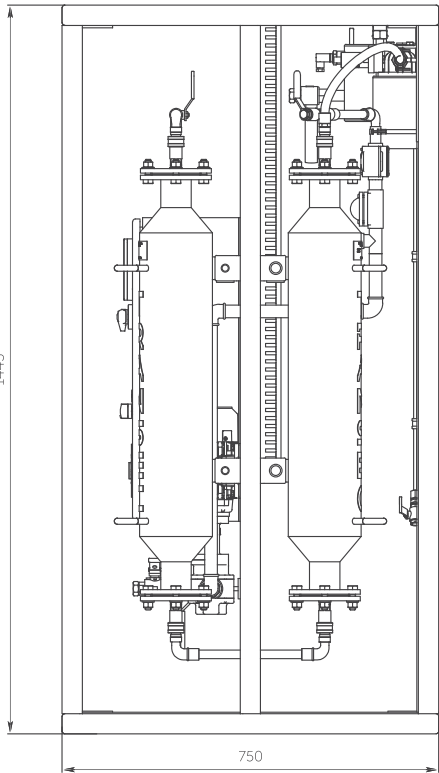
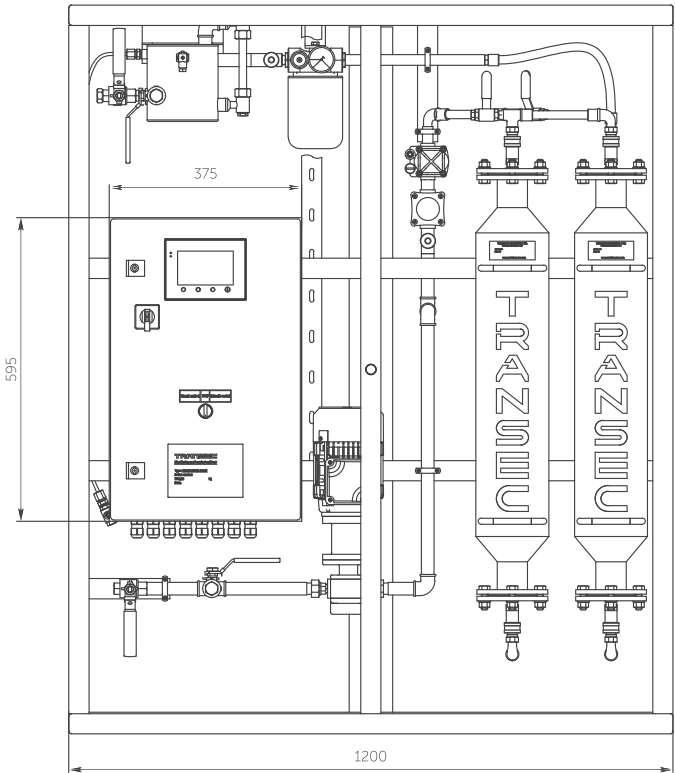
CL2 WSi



CL3 WSi



CL4 WSi



# MONITORING CABINET. TECHNICAL DATA

Parameter	AMi	WSi
Local display	<ul style="list-style-type: none"> <li>Oil temperature IN&amp;OUT</li> <li>PPM Moisture IN&amp;OUT</li> <li>Relative Saturation in</li> <li>Pump and sensor status or alarm</li> <li>Settings</li> <li>Reports</li> <li>Trends</li> </ul>	<ul style="list-style-type: none"> <li>Oil temperature IN&amp;OUT</li> <li>PPM Moisture IN&amp;OUT</li> <li>Relative Saturation IN&amp;OUT</li> <li>Water content in paper</li> <li>Pump and sensor status or alarm</li> <li>Settings</li> <li>Reports</li> <li>Trends</li> <li>Cylinder saturation level</li> <li>Total water volume extracted</li> </ul>
Data logging	<ul style="list-style-type: none"> <li>Temperature IN&amp;OUT</li> <li>PPM IN&amp;OUT</li> <li>Relative saturation IN</li> <li>Alarms</li> </ul>	<ul style="list-style-type: none"> <li>Temperature IN&amp;OUT</li> <li>PPM IN&amp;OUT</li> <li>Relative saturation IN&amp;OUT</li> <li>Water content in paper</li> <li>Cylinder Saturation</li> <li>Alarms</li> </ul>
Alarms	<ul style="list-style-type: none"> <li>SensorInDown</li> <li>SensorOutDown</li> <li>Overheat</li> <li>% RS Alarm</li> <li>AlarmReset</li> <li>% Capacity Alarm</li> <li>T°C IN</li> <li>T°C OUT</li> <li>PPM IN</li> <li>PPM OUT</li> </ul>	<ul style="list-style-type: none"> <li>Pump status</li> <li>SensorInDown</li> <li>SensorOutDown</li> <li>OverheatCab</li> <li>LowFlow — Oil flow rate, l/h</li> <li>Leakage</li> <li>OverheatOil</li> <li>Paper overdry</li> <li>Alarm reset</li> <li>FreezeOil — Oil temperature below the setpoint</li> <li>% Capacity Alarm</li> <li>% RS Alarm</li> <li>T°C IN</li> <li>T°C OUT</li> <li>PPM IN</li> <li>PPM OUT</li> <li>Water Content — %WC alarm setpoint</li> </ul>
Cylinders saturation	Saturation estimated based on the PPM IN&OUT difference	Calculated based on PPM and oil flow
Sensors	2x high accuracy moisture and temperature sensors	
Remote control	Alarm settings	Alarm settings, Pump stop & restart conditions
Communication	Via 3G/4G network or Ethernet: TCP/IP (VNC, HTTP, FTP/SFTP, MODBUS), USB stick	

# INSTALLATIONS

## UK



EDF Energy

Nuclear power plant

80 units in operation

## UK



NNG

Wind farm offshore generation

6 units in operation

## ARGENTINA



**SALTO GRANDE**  
ARGENTINA - URUGUAY

Salto Grande

Hydroelectric power plant

20 units in operation

## TEXAS (USA)



Covanta

Power Generation Waste to Energy

1 unit

## ZAMBIA



ZESCO

Kafue gorge hydroelectric power station

11 units in operation

## UAE



EGA

50 units in operation

## CAMBODIA



EDC Transmission

9 units in operation



TRANSFORMER MAINTENANCE. INSTALLATION EXAMPLE

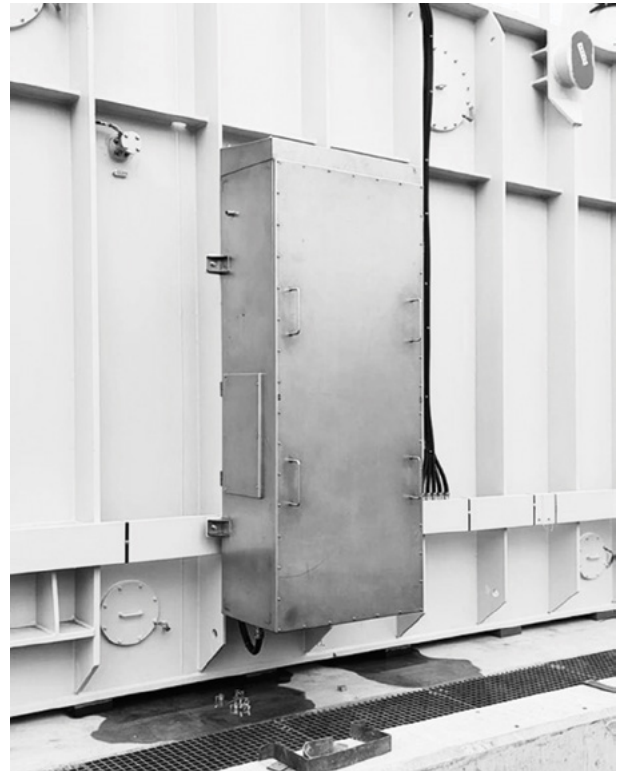
# OFFSHORE AND ONSHORE WIND TURBINE STATIONS

NNG PROJECT. UK

• 2 TRANSEC units offshore

• 2 TRANSEC units onshore

• 6 Transformers





# ONSHORE WIND TURBINE STATIONS

## EDF DORENELL. SCOTLAND

- Transformer 132/33 kV 120 MVA



## EDP RENEWABLES.SPAIN

- Transformer 66/20 kV 50 MVA







# FIPRES



## ELECTRICAL FIRE PREVENTION & OVERHEATING CONTROL SYSTEM

FIPRES detects abnormal overheating of electrical equipment, thus avoiding material damage from fire, loss of profit and life threatening situations. In a nutshell, the system consists of thermolabels (rFPT), a special gas sensor (FPA), and a concentrator unit (FPC). rFPT is a sticker made of composite material with encapsulated gas inside.

These stickers are glued at the contact connections (CB inputs/outputs, bus-bars, cable terminations, etc.).

Should the contact become heated up to the activation temperature of the sticker, rFPT releases a safe and non-toxic signal gas. This gas is detected by FPA, which in turn sends an ALARM signal to maintenance personnel through Modbus, dry contact relay.

FIPRES offers a new and unique solution at an affordable price that takes utility and industrial companies to a new level of safety and maintenance efficiency.

# INTRODUCTION

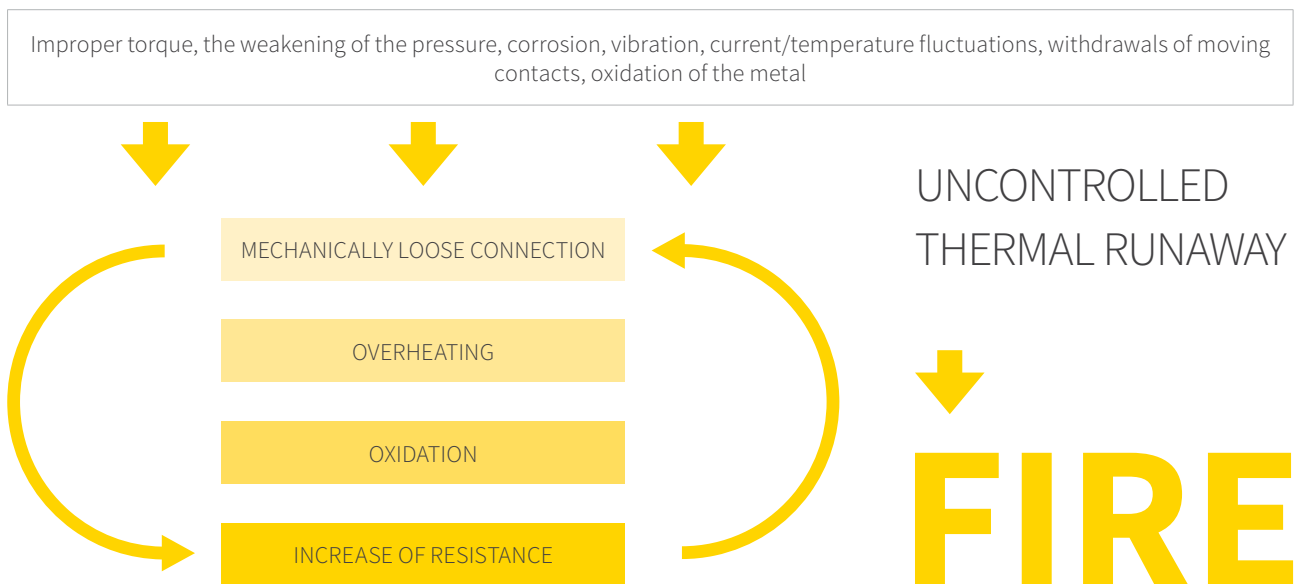
## THE ISSUE: ELECTRICAL EQUIPMENT DAMAGE DUE TO FIRE.

When considering the causes of electrical fires, it must be highlighted that there are many causes that cannot be prevented by standard solutions such as overcurrent protection, Arc Fault Detection Device or Ground Fault Protection devices.

In practice, the most common cause of fire and damage to equipment in electrical panels are loose connections,

especially those made on site. Loose connection have a higher resistance, which leads to overheating of such contact.

This process can be exaggerated by oxidation process of contact surfaces, which happens faster at high temperatures.



## THE SOLUTION: FIPRES – OVERHEATING AND FIRE PROTECTION

To prevent all possible negative outcomes consequences of overheating and resulting fire, electrical panels require a solution that continuously monitors all critical points and,

if overheating is detected, immediately provides information about this to the maintenance personnel. And Streamer Electric AG is glad to provide such solution — FIPRES.

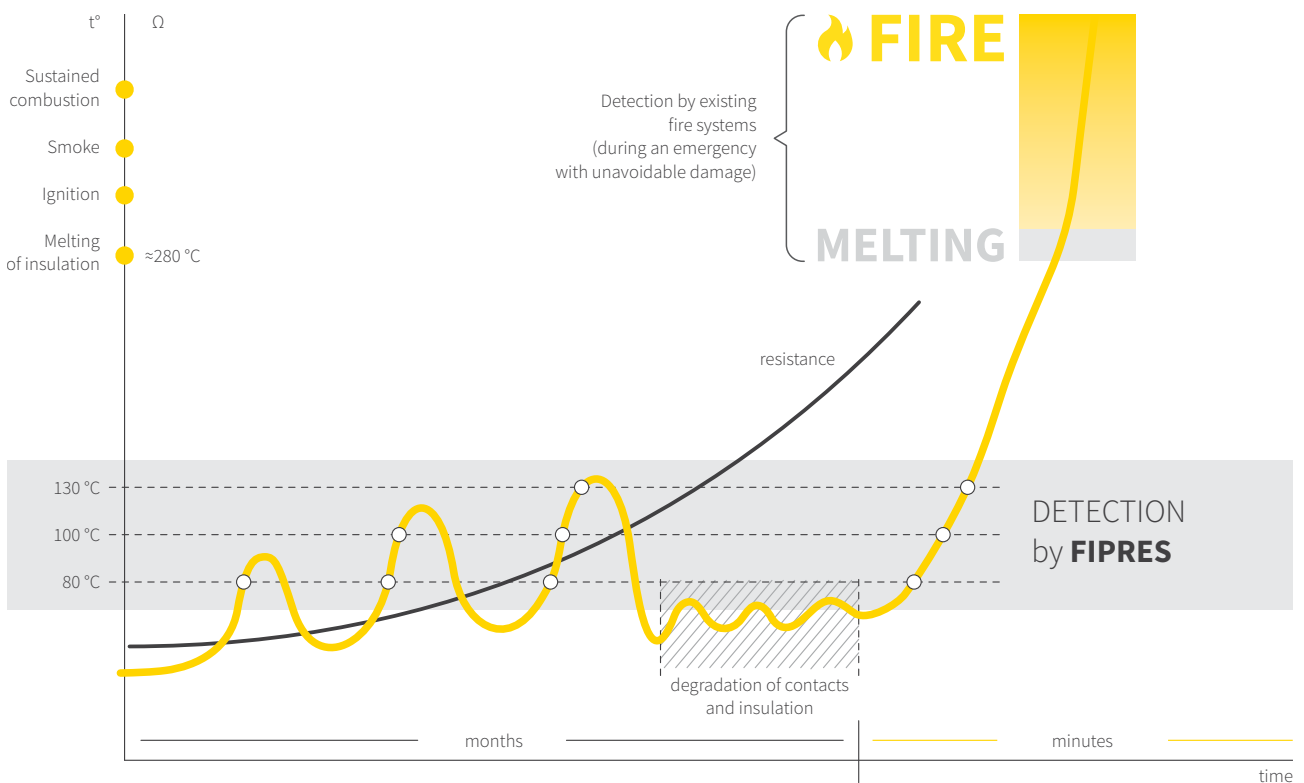
# FIPRES TECHNOLOGY

FIPRES – Electrical Fire Prevention and Overheating Control System is a new and unique technology that allows finding dangerous overheating of loose contacts long before a fire hazard occurs.

FIPRES is a preventive system that works 24/7 and controls all critical connections without human intervention in LV and MV electrical panels.

FIPRES works on principle of early detection. Indeed, usually fire starts with melting of cable insulation, which is the weakest point in terms of withstanding temperature.

Depending on the material and thickness, generally there are 2 critical temperatures for cable insulation: 200 °C, when insulation starts to deteriorate and 280°C, when insulation material starts to melt and smoke. FIPRES works way below these temperatures, providing detection of overheating in a range 80...130 °C, which are abnormal temperatures for electrical equipment, but still months before any dangerous situation.



# FIPRES TECHNOLOGY. HOW IT WORKS

**rFPT.** Remote fire prevention thermolabel

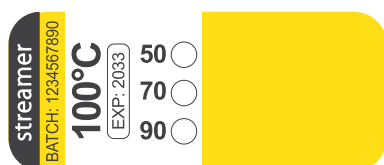
**FPA.** Fire prevention alarm.  
FPA 24/X – FP.AL.00SB.01.WW  
FPA 24(4S) – FP.AL.004S.02.WW

**FPC.** Fire prevention concentrator.  
FPC 220S – FP.CU.S000.01.WW

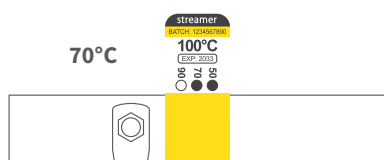
**1** rFPT must be wrapped around cables/ busbars close to the contact points.  
A gas sensor (FPA) should be installed into the same volume

**4** FPA transmits alarm signals to SCADA or BMS system through Modbus RTU, or to local alarm systems using dry contact output

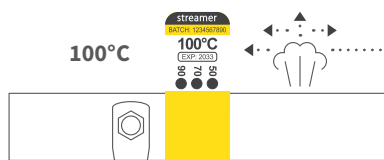
**5** FPC monitors the status of up to 32 FPA, displays and records Alarm signals. When FPA is triggered, the FPC transmits information to the central fire alarm system, SCADA or BMS. FPC has a speaker for audible notification



**2** When a contact is heated above 50°/70°/90°C thermoindication dots irreversibly change their colors to black



**3** In emergency situations when the temperature rises above 80°C/100°C/130°C the sticker releases signal gas which is detected by the gas sensor FPA



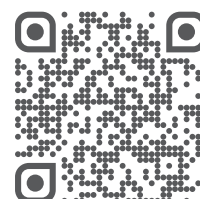
Signal gas (non-toxic and non-flammable)

VIA RS 485 MODBUS



You can use a similar device which supports RS 485 Modbus instead of FPC (or even use light version of FIPRES: only rFPT + FPA. In this case FPA transmits signal directly to SCADA/BMS)

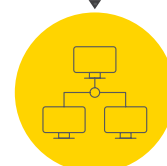
Learn more:



SCADA or BMS system



Fire alarm system

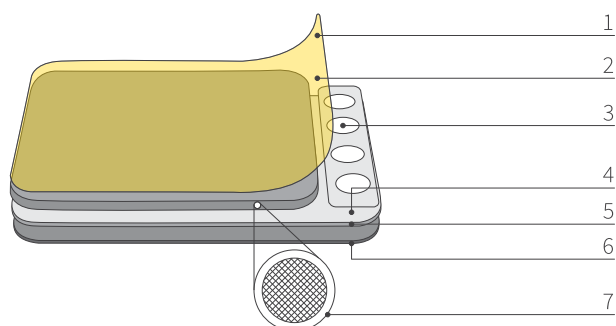


Local computer Network

# remote FIRE PREVENTION THERMOLABELS (rFPT)

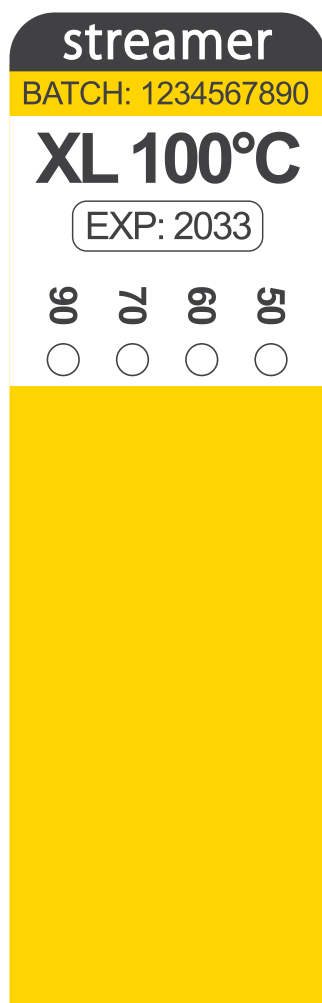
rFPTs are installed at the contact connection points, on electrical wires or some parts of electrical equipment which are potentially prone to overheating. When heated to activation temperature, a signal gas is emitted from rFPT and is detected by FPA.

- Innovative system of gas encapsulation
- Validity period is 10 years
- Safe, non-toxic and non-flammable gas inside
- Easy installation without additional accessories



1. Protective film
2. Composition material
3. Thermosensitive dot
4. Polymer film
5. Adhesive layer
6. Backing layer
7. Microcapsules

rFPT 100/XL



rFPT 130/1



rFPT 100/0,3



rFPT 80/0,1





# remote FIRE PREVENTION THERMOLABELS (rFPT)

Activation temperature	Item name	Conductor cross-section, mm <sup>2</sup>	Volume of compartment, m <sup>3</sup>	Reference (box with 10x rFPT inside)
80°C	rFPT 80/0.1	<10	0.1	FP.RT.080A.Y1.WW
	rFPT 80/0.3	10–35	0.3	FP.RT.080B.Y1.WW
	rFPT 80/1	35–120	1	FP.RT.080C.Y1.WW
	rFPT 80/XL	>120	1–4	FP.RT.080D.Y1.WW
100°C	rFPT 100/0.1	<10	0.1	FP.RT.100A.Y1.WW
	rFPT 100/0.3	10–35	0.3	FP.RT.100B.Y1.WW
	rFPT 100/1	35–120	1	FP.RT.100C.Y1.WW
	rFPT 100/XL	>120	1–4	FP.RT.100D.Y1.WW
130°C	rFPT 130/0.1	<10	0.1	FP.RT.130A.Y1.WW
	rFPT 130/0.3	10–35	0.3	FP.RT.130B.Y1.WW
	rFPT 130/1	35–120	1	FP.RT.130C.Y1.WW
	rFPT 130/XL	>120	1–4	FP.RT.130D.Y1.WW
Operating temperature of all rFPTs is from –60°C to +50 °C. Validity period of rFPT is 10 years.				
	0.1	0.3	1	XL
Length, mm	50	80	138	210
Width, mm	20	20	20	35
Thickness, mm	1.75	1.75	1.75	1.75
Weight, g	1.1	2.2	4.3	11

# FIRE PREVENTION ALARM (FPA)

- Highly sensitive gas sensor inside (metal-oxide semiconductor sensor).
- Continuous auto-calibration for the best adjustment for environment.
- Modbus interface and dry contact output to connect to SCADA, BMS or local alarm system.
- Can be used in environment up to 36 kV.

FPA constantly checks the ambient air for the presence of rFPT signal gas. In case of signal gas detection FPA goes into ALARM mode and transmits ALARM signal via Modbus RS-485 to SCADA or BMS. Dry contact output closes.

FPA has 2 versions: single body FPA (FPA 24/X) and FPA with 4 corded sensors FPA 24(4S). FPA has a display showing the current Modbus address.

FPA 24/X  
FP.AL.00SB.01.WW



- For single compartment with up to 1 m<sup>3</sup> of volume

FPA 24(4S)  
FP.AL.004S.02.WW



- For several separate compartments up to 1 m<sup>3</sup> each;
- For a large compartment with a volume of up to 4 m<sup>3</sup>

Technical data	FPA 24/X	FPA 24(4S)
Protected volume	Up to 1 m <sup>3</sup>	Up to 4 m <sup>3</sup>
Supply voltage	12–28V DC (24 V DC is nominal)	
Type of connection	RS-485 Modbus RTU	
Modbus connection type	9600 bps, 8 data bits, 1 stop bit, none-parity	
Discrete outputs	Dry contact output (max. power 60 W)	
Mounting type	On DIN-rail	
Dimensions, mm	52x86x56	Main body: 52x86x56; corded sensor: 46x66x28
Lifetime	10 years	
EMC protection according to	EN 61000-6-5:2015; EN 61000-6-4:2007/A1:2011	
Other features	Reverse polarity protection; auto-calibration based on environment conditions	

# FIRE PREVENTION CONCENTRATOR (FPC)

- Gather information from up to 32 FPAs.
- LCD display for easy access by maintenance personnel.
- Events log, speaker and powerful dry contact output.
- Can transmit information to SCADA/BMS.



FPC is a hub which gather information from up to 32 FPAs. It monitors the status of all connected FPAs and displays current operation mode. FPC has a log, stored in non-volatile memory with all events.

FPC has an LCD display with backlight, status indicators, a speaker for audible warning and a three-button keyboard.

Modbus interface, dry contact output are available for communication.

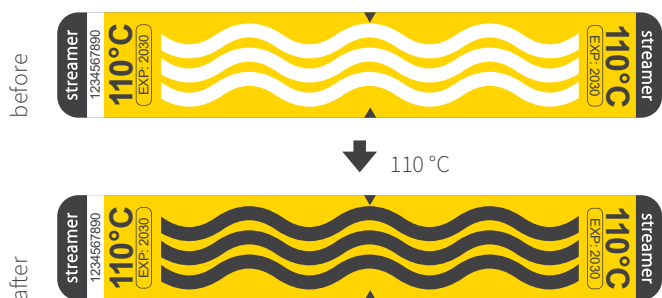
Technical data		
Supply voltage	100–240 V AC (220 V AC is nominal)	
Type of connection	RS-485 Modbus RTU	
Outputs	RS-485 Modbus RTU	
Modbus connection type	9600 bps, 8 data bits, 1 stop bit, none-parity	
Number of connected FPA	Up to 32	
Discrete outputs	Dry contact output (220 V AC, 7 A)	
Dimensions	200x270x48 mm	
Lifetime	10 years	
Item name	Reference	Description
FPC 220S	FP.CU.S000.01.WW	Basic version

# visual FIRE PREVENTION THERMOLABELS (vFPT)

vFPTs are self-adhesive thermal indicator stickers made of composite material that irreversibly change color when the threshold temperature is reached. The thermolabels continuously monitor the temperature, allowing register the fact of exceeding one or more temperatures by a contact or contact connection during the operation of the electrical installation.

vFPT helps maintenance personnel understand the condition of the equipment, not only at the time of inspection, but can also see if the equipment has reached a certain temperature in the past. Unlike using a thermal imager, vFPT provides a clear picture of what has happened since the last check. These labels are extremely easy to install for any configuration of electrical equipment.

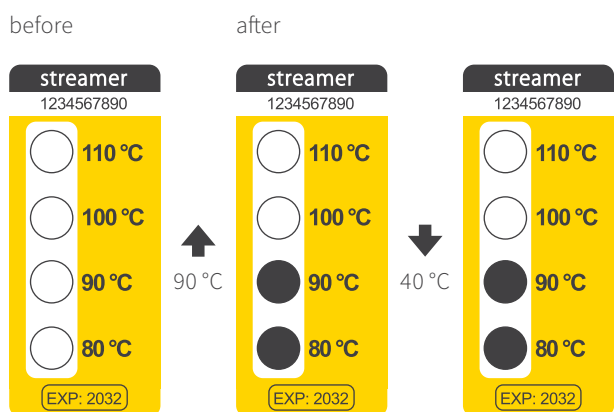
## ONE-TEMPERATURE THERMOLABELS



The principle of operation is simple: at the activation temperature (70, 90 or 110 °C ) the white strips irreversibly change color to black.

One-temperature vFPT thermal indicators detect overheating above the set maximum allowable temperature.

## FOUR-TEMPERATURE THERMOLABELS

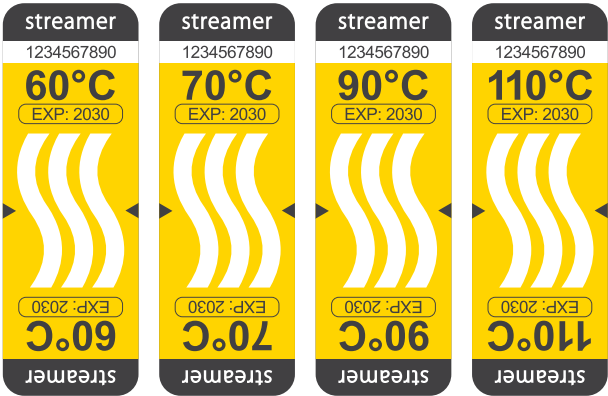


Four vFPT temperature indicators allow to determine the maximum temperature to which overheating occurred and detect differences in heating of identical units (phases, motors, mechanical devices), allowing to understand the exact reason of the overheating.



# vFPT. 1-TEMPERATURE

- vFPT provides information on overheating occurred between 2 checks.
- More effective way of tracking contact connections temperature than traditional visual inspection and infrared thermography (IRT).
- Long strips allow to get 360° angle of observation.
- Specially designed for installation on electrical equipment
- 10 years of validity period.
- Single-temperature vFPT allows to determine the maximum exceeded temperature during operation of electrical equipment.
- Control hard-to-reach or inaccessible elements for the thermal imager (MV switchgear, explosion-proof electrical equipment).



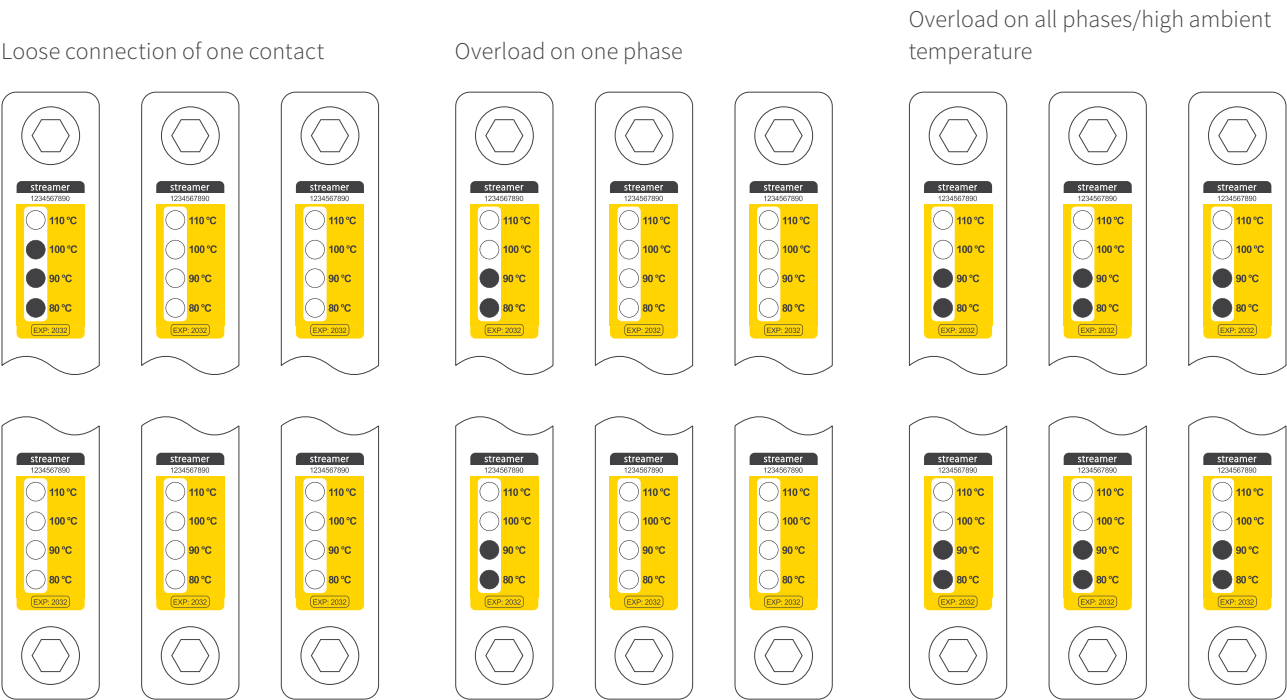
	S	M	L
Length, mm	40	50	75
Width, mm	15	15	15
Activation temperature	Item name	Conductor cross-section, mm <sup>2</sup>	Reference
70 °C	vFPT 70S	Up to 10	FP.VT.070A.Y1.WW
	vFPT 70M	10–35	FP.VT.070B.Y1.WW
	vFPT 70L	35–120	FP.VT.070C.Y1.WW
90 °C	vFPT 90S	Up to 10	FP.VT.090A.Y1.WW
	vFPT 90M	10–35	FP.VT.090B.Y2.WW
	vFPT 90L	35–120	FP.VT.090C.Y2.WW
110 °C	vFPT 110S	Up to 10	FP.VT.110A.Y1.WW
	vFPT 110M	10–35	FP.VT.110B.Y1.WW
	vFPT 110L	35–120	FP.VT.110C.Y2.WW
Other temperature vFPT can be created on request with a minimum order quantity			



# vFPT. 4-TEMPERATURES

- Shows if the contacts is ok, concerning or emergency.
- Detect defects at early stages.
- 4-temperatures vFPT allows you to understand not only if the contact has reached highest permissible temperature but also to see how defect evolves and understand the reasons of overheating.
- Reduce the risk of fires in electrical installations.
- 10 years of validity period.
- Control hard-to-reach or inaccessible elements for the thermal imager (MV switchgear, explosion-proof electrical equipment).

## EXAMPLES OF CONTACT CONNECTION CONDITION EVALUATION USING THERMOLABELS



Length, mm	50							
Width, mm	20							
Conductor cross-section, mm <sup>2</sup>	10–120							
Standard range vFPT	FP.VT.058C.Y1.WW — 50–60–70–80 °C FP.VT.811C.Y1.WW — 80–90–100–110 °C  Other set of temperatures can be created on request with a minimum order quantity							
Possible temperature range, °C	50	60	70	80	90	100	110	120

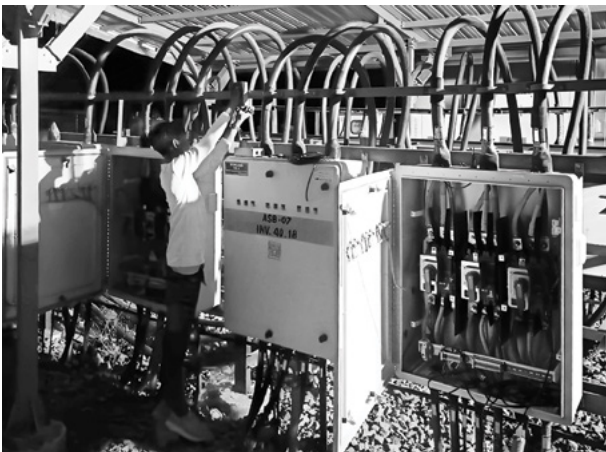
# INSTALLATION EXAMPLE: SOLAR POWER PLANT

FIPRES INSTALLATION IN RAJASTHAN, INDIA, PHOTOVOLTAIC  
PLANTS OF POWER 350 MW, 250 MW, 390 MW, 300 MW



Company	Industry	Country	Protected object
Adani solar	Solar power plant	Rajasthan, India	Combiner boxes of photovoltaic plants of power 350 MW, 250 MW, 390 MW, 300 MW

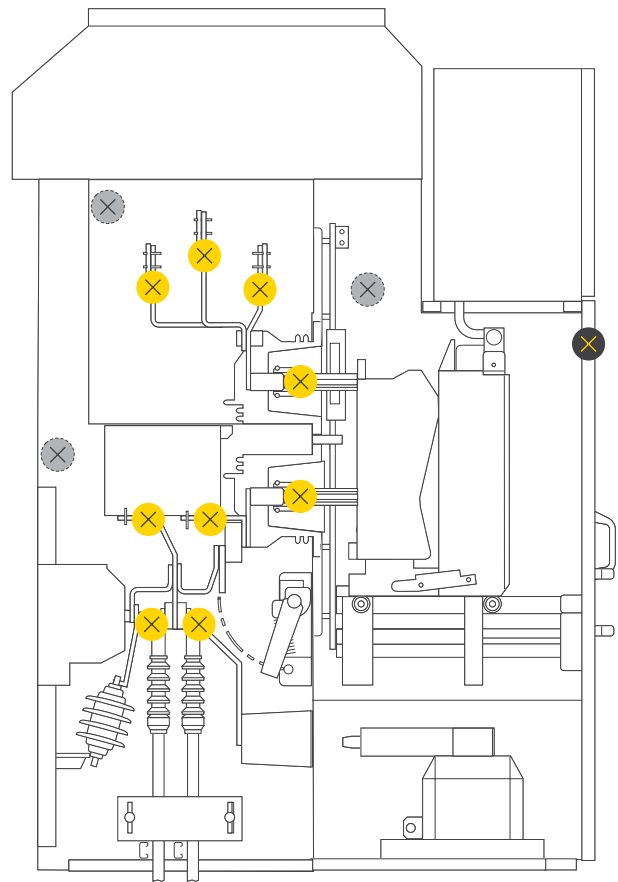
FIPRES IS INSTALLED IN COMBINER BOXES OF 5 PV PLANTS  
USING FPA 24(4S) AND RFPT 130XL.  
A TOTAL OF 54 PANELS ARE EQUIPPED WITH FIPRES



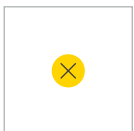
# INSTALLATION

## EXAMPLES OF FIPRES INSTALLATION. SWITCHGEARS 6–35KV

- Each closed protected volume (compartment) where are rFPTs, should be equipped with corded sensor of FPA 24(4S).
- Maximum volume of compartment to be equipped with one corded sensor is 1 m<sup>3</sup>. In case of volume of compartment exceed 1 m<sup>3</sup> two or more corded sensors are required.
- Corded sensors of FPA 24(4S) should be placed at the top part of a compartment.
- Corded sensors of FPA 24(4S) shouldn't be blocked by obstacles, which prevent spreading gas into it.
- It's recommended to install corded sensors near and above to rFPT spots.



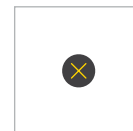
### ICON LEGENDS:



rFPT



Corded sensor of FPA 24(4S)



Main body of FPA 24(4S)

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## WEBSITE



## LINKEDIN



## YOUTUBE

