PREFACE:

LEAKAGE CURRENTS, SHORT CIRCUITS & CURRENT INTERRUPTIONS

ARE FREQUENTLY CAUSED BY POLLUTED INSULATORS

CASE & COST STUDY:

230/33/11 KV STEEL MILL FACTORY - DISTRIBUTION SUBSTATION

SCOPE: Identify a preventive maintenance program to prevent the polluted insulators' side effects with a Cost-effective Preventive Maintenance Solution

WITHOUT POWER OUTAGE

Introduction, preliminary:

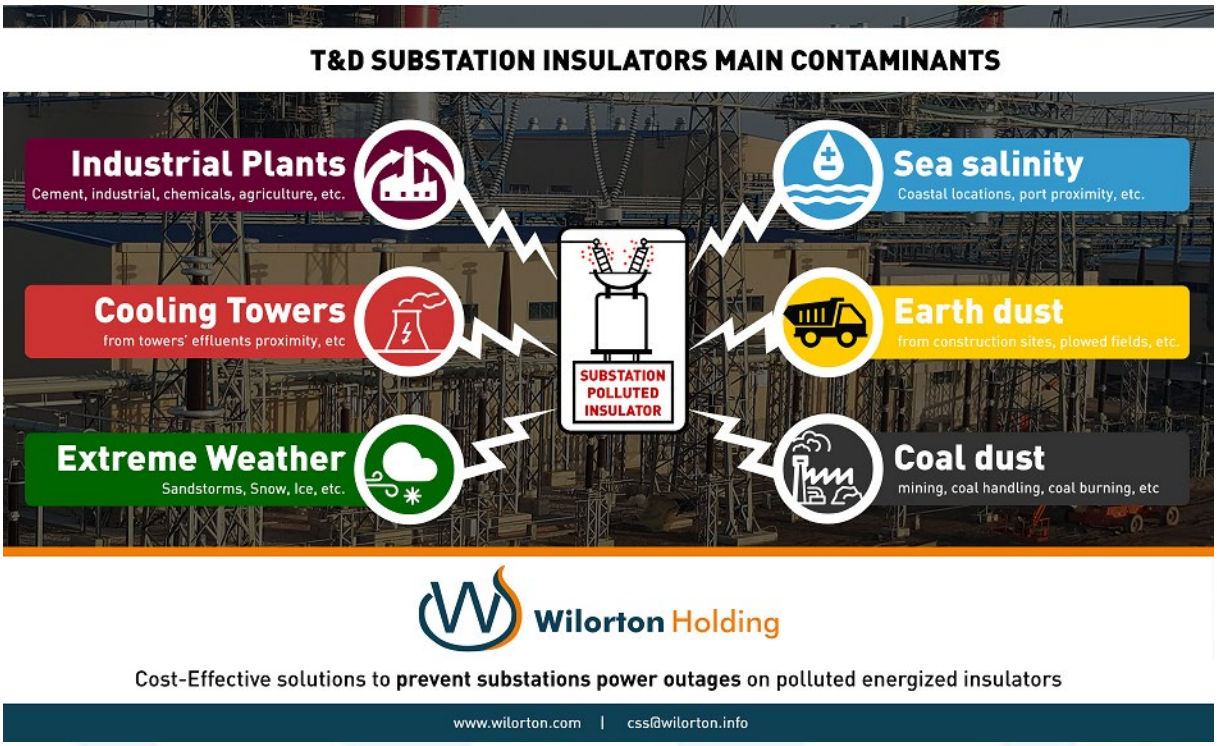
- In this location, the insulators are primarily subject to heavy contamination by metallic particles generated in a scrap plant installed outside the Substation's perimeter.
- When operating, the scrap plant disperses in the air micro-particles of metallic dust, which quickly settle on the insulator's surface.
- In addition to the metallic particle's pollution sticking to the insulators' surface, industrial pollutants generated by the nearby steel mill plant and desert dust increase flashovers and outage risk.

Quick summary (Pollution effects):

- When the scrapping plant is in production, the pollution is particularly severe; the insulators' surface is quickly covered with metal particles dust's layer.
- The pollutants builds-up gradually daily.
- Even during dry and hot weather seasons, the insulation strength does decrease quickly when light mist occurs (Early morning and evening time).
- Fog, mist, or light rain usually creates conditions that produce a conducting film on the dirty insulator surface without washing its impurities.

- When the polluted insulators become wet, a conductive layer forms on the contaminated insulator surface, initiating leakage current.
- Outdoor bushings/insulators are subject to surface dirt deposits to some degree and in all Substation operating areas.

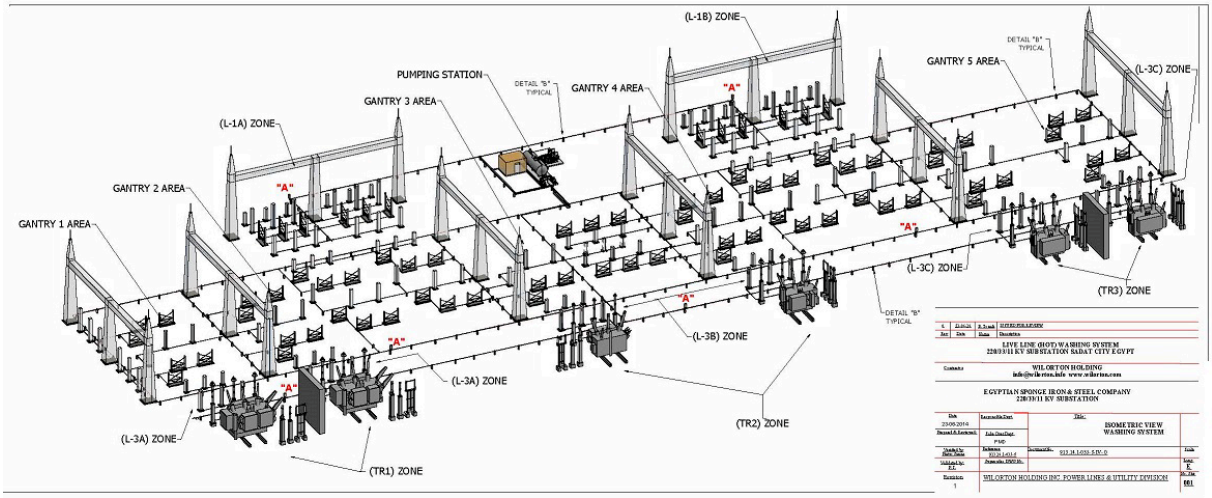
Quick summary (Pollution effects):



Polluted Insulators. Sample pic.



230/33/11 kV Substation (Overall nos. 405 ABB Insulators) switchyard layout



LEGEND:	CB	CIRCUIT BREAKER
	SF6	SF6
	CT	CURRENT TRANSFORMER
	CVT + LT	CAPACITIVE VOLTAGE TRANSFORMER + LINE TRAP
	SA	SURGE ARRESTER
	PI	POST INSULATOR
	TI	TENSION INSULATOR
	TI DOUBLE	DOUBLE TENSION INSULATOR
	TRAFO	TRANSFORMER

Washing zone(s), Insulators/Bushings summary:

USER: EGYPTIAN SPONGE IRON & STEEL COMPANY (ESISCO) 220/33/11 KV SUBSTATION											
WASHING ZONE LIST DETAIL											
SUBSTATION AREA CODE	**WASHING ZONE NOS.**	INSULATOR TYPES & QUANTITIES									
		CB	**SF6**	**CT**	**CVT + LT**	**SA**	**PI**	**TI**	**TI DOUBLE**	**TRAFO 220/33kV**	**TRAFO 220/11kV**
L1A	**10**	12		6	6	6			6		
L1B	**10**	12		6	6	6			6		
L2A	**7**	12	3				6	6			
L2B	**12**	36	9				6	12			
L2C	**11**	24	6	6			3	12			
L2D	**13**	36	9				9	12			
L2E	**11**	24	6				6	18			
L3A	**8**			6		6				12	
L3B	**8**			6		6				6	6
L3C	**8**			6		6					12
TOTAL	**98**	**156**	**33**	**36**	**12**	**30**	**30**	**60**	**12**	**18**	**18**
		TOT. INSULATORS 405									

To prevent "power outages" when a contaminant-related failure takes out a line, rather than running the risk of having multiple flashovers, repeated relay operations that are hard on the circuit breakers and substation equipment.

We have proposed an energized (hotline) insulators AUTOMATED washing system (AWS-DS) to increase the power supply reliability for uninterrupted performance.

As standard procedure, the AUTOMATED washing system cleans the energized polluted insulators with a customized maintenance program, seasonally adjusted.

The seasonally adjusted customized maintenance program, general details:

- Summertime:
    - The entire Substation – nos. 405 insulators – is washed every two days.
    - The washing operation is scheduled to start at midnight (Fresher).
    - The whole washing system cycle is completed in 3 hours.
- Wintertime:
    - The entire Substation – nos. 405 insulators – is washed every two days.
    - The washing operation is scheduled to start at midday (Warmer).
    - The whole washing system cycle is completed in 3 hours.

The "Automated" washing system controls the entire substation washing cycle; washing cycles are defined according to each location's environmental and specific needs.

The parameters automatically managed to include daily, weekly, or monthly washing schedules.

Once the required parameters have been set, the washing cycles are automatically managed and executed without operator(s) assistance.

The installation of the "**Automated"** washing system in 2015 eliminated the power outages due to metallic particle pollution to zero. In December 2020, the Substation's insulators were automatically washed every two days. **Overall washing time: approx. Three hours (Entire Substation).**

A seasonally adjusted maintenance program focused on washing energized and POLLUTED insulators to prevent leakage currents, flashovers, and power outages.

Preventing T&D power interruption with AUTOMATED Washing Systems (AWS-DS), attaining operational excellence, reducing downtime risk, ensuring personnel safety, achieving financial efficiency, optimizing maintenance budget.

Automated Washing System Design Overview, General:

Location design conditions:

- Ambient temperature: °C 45
- Elevation above sea level: m 12
- Average pressure: Mb 1.020
- Relative humidity: % 80

Automated Washing System Design Overview, General:

- Special precautions are applied in selecting and protecting materials and equipment against deterioration because of humidity and temperature, **dust, industrial and metallic particles laden atmosphere**.

- Attention must also be paid to selecting and protecting AWS electronic components, protection relays, instrumentation, and temperature and humidity-sensitive equipment.

- The AWS design ensures a minimum requirement of manual intervention in case of an individual plant component or system failure. To achieve this, AWS is required to provide the necessary redundancies. This redundancy concept is applied to AWS-sensitive parts.

- All AWS-selected equipment and components have undergone not less than five continuous years of proven successful operation.

- PRELIMINARY: The User defines/selects the automatic washing cycle(s) on daily/weekly/monthly or customized parameters. User-defined design maximum number of cleaning cycles: once daily.

- The design, material, equipment, construction, manufacture, inspection, testing, and performance of the AWS GIS Insulator Washing System and accessories conform with all currently applicable statutes, regulations, and safety codes in the locality where the equipment will be installed to the latest relevant International Standards.

The Automated Washing System (AWS) Control System, before starting washing, preliminarily checks that all pre-conditions are met, i.e.:

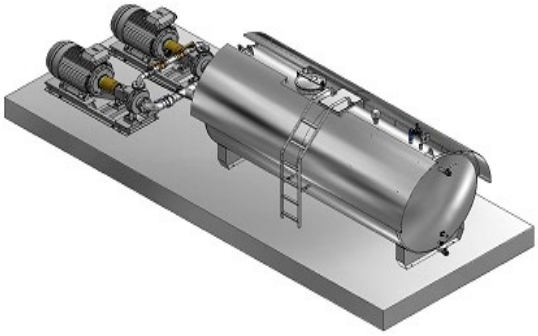
- Water level
- Water conductivity parameters
- Wind speed
- Wind direction
- Electrical system functionality
- Water system pressure

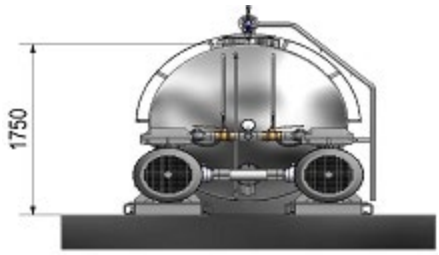
Our ref. No.: 2021-02-24 CASE STUDY: 230/33/11 kV Outdoor Distribution Substation

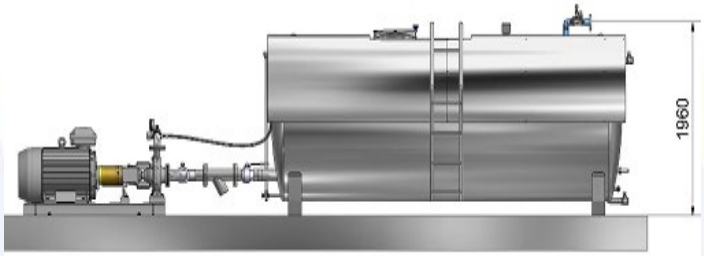
Basic AWS equipment includes:

- One pumping station, with one stainless steel horizontal, round shape, demi-water storage water tank complete with filter, stainless steel valves, magnetic water level switch, backflow by-pass, two centrifugal pumps (100% redundancy), two continuous water conductivity monitors (100% redundancy), etc.

Automated Washing System, typical Pumping Station outline







Control System includes:

- One control panel complete with HMI panel SIMANTIC TP2200 (22") touch screen.
- One CPU Siemens S7-1500, or higher CPU, for indoor installation (Substation control room),
- Electrical system, cables, junction boxed, solenoid valves, controlling system, etc.
- Manual washing control system

Nos. 98 Wash zones Control panel Front View (Sample) -



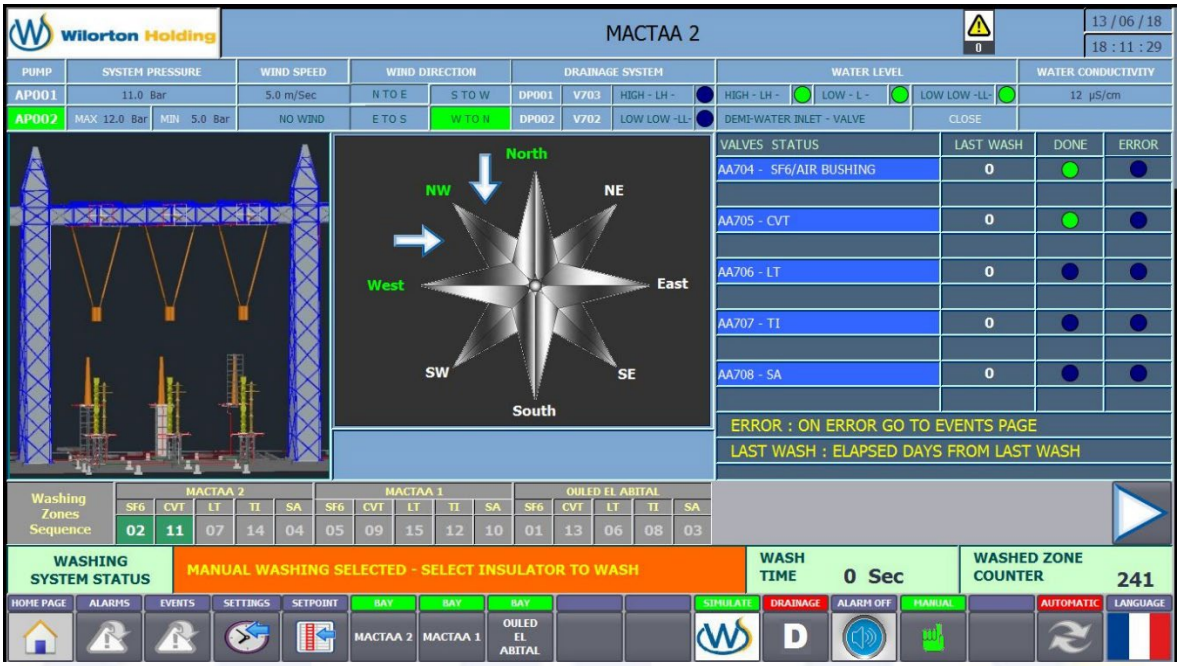




Junction Boxes (Sample)

- Weather station – Anemometers (Redundancy: 100%):
- Detects the wind direction and speed. The system is designed to provide an effective washing cycle without the danger of over-spraying in the wind up to max. Seven m/sec from any direction.
- The monitor should be in a position where it is unaffected by any nearby buildings.

CONTROL PANEL SCREEN EVIDENCING WIND CONTROLS AND PARAMETERS (SAMPLE)



Wind speed:

- The AWS continuously checks the wind speed.
- With wind speed exceeding design parameters, the AWS Control System automatically puts on hold the washing cycles.

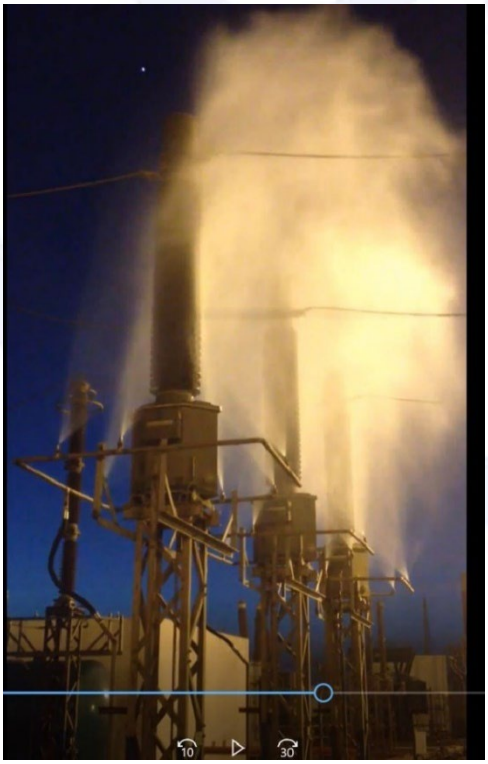
AWS Water piping system:

- Main water distribution piping system with fittings. Piping specification: API-5L/ASTM A106 Gr. B, SCH. 40 HDG. Fitting's specification: A 105 HDG.
- Washing zones piping branches with fittings, Stainless Steel Flex. pipes
- Stainless Steel spraying nozzles (Nozzle's quantity vary depending on the insulator type)
- Ball valve, inox lever, SS-304/316 material grade, PN-64, dia. 2"/1-1/2"/1", NPT thread
- Piping specification: API-5L/ASTM A106 Gr. B, SCH. 40 HDG, Fitting's specification: A 105 HDG.
- Automatic piping system vent valves
- Piping clamps, spacers, etc.
- Automatic drainage station (Optional equipment)

Substation Automated Washing System. Sample pic.



Substation "Automated" Washing System (Night view)





Live video https://youtu.be/pT-Qz9nVbbY *Live video* https://youtu.be/Lrfzb3ocers

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230/33/11 kV Substation (Overall nos. 405 ABB insulator) Substation's sample photos











230/33/11 KV Distribution Substation Case study (ACTUAL)

BUDGETARY PRICE

Our scope includes:

- AWS Engineering.
- Construction and installation drawings.
- Electro-mechanical equipment/materials Bill of materials (*)
- Supply of Control System equipment management software.
- Supply of particular components (Spraying nozzles, resistivity monitors).
- Site installation supervision
- AWS site test
- AWS site commissioning
- User training

(*) NOTE: Unless otherwise required and conveniently available in the USER local market, the supply of materials/equipment, in compliance with specifications, is procured locally directly by the Client's procurement office. Our office must approve local equipment/materials specifications.

The Automated Energized Polluted Insulator Cleaning System for the entire Substation, with nos. Ninety-eight washing zones, **budgetary price starting from > On request**

Including:

- AWS Design & Engineering.
- Construction and installation drawings.
- Supply of electro-mechanical equipment/materials.
- Supply of Control System equipment management software.
- Supply of special components (Spraying nozzles, resistivity monitors, etc.).
- Electro-mechanical site installation supervision.
- AWS site test
- AWS site commissioning

- User training (*)
- Customized seasonally adjusted preventive maintenance washing program. (For existing and operational PP Substations, interruptions history report, if any, is helpful**).**

Excluding:

- Pipes and fittings
- Local installation

SUPPLY GENERAL TERMS & CONDITIONS

Payment:	By irrevocable and confirmed L/C, payable by negotiation against presentation of standard shipping documents
Estimated Time of Delivery:	Starting from 6/10 weeks from receipt and confirmation of a clarified order and L/C. For a shorter delivery time, pls. apply
(*) Job Site Training:	For eight people, five workdays. Excluding air tickets, inland transportation and lodging, visa charges, if any, for our Trainer(s)
Technical package:	O&M manuals & documentation - English language
Warranty period:	24 months from FOB date
After-sales guarantee:	Spare parts availability and technical support, ten years from delivery
Goods Origin:	Italy
Validity:	Until 31-06-2022

Wilorton Holding Inc.