

Basic knowledge of GIS equipment (B/T/F type)

Réf. X0031E



Destinated for

Technician/Project Manager with a basic knowledge of electricity and mechanics



Required knowledge

None



Méthod

100% theory
Lecture-based presentation, video screenings



Duration

1 day



Place

TIA



Number of participants

10 max



Objectives

- Distinguish between GIS substations in the F/B/T series
- Describe the operating principles of the equipment
- Comply with and apply the safety rules specific to the equipment



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants expectation

Concept of a substation in a metal enclosure (B/T/F type)

- General overview
- Presentation of the GE product range
- Technical stages of GIS development
- Compartmentalization
- Switchgear unit diagrams
- Induced currents in GIS
- Sealing system
- Gaskets and greases

Service Module and Accessories

- The SF6 Densistat
- The rupture disk
- The molecular sieve
- The filling valves

Apparatus technology (B/T/F type)

- The circuit breaker
- The transfer disconnecter
- The earthing switch
- Busbars and removable elements
- Current transformers
- Voltage transformers
- Cable boxes
- Transformer connections
- Characteristics of the metal-enclosed switchgear
- Operating sequences

FK 3-X spring mechanism

- General Overview and History
- Product Range
- Optical Indicators
- Operating Principle

Design of F, B, and T type switchgear

- Single-line diagram
- Component location
- Gas monitoring devices
- Safety



Trainer

Experienced trainer with a strong field experience



Evaluation

At the beginning of the training, participants will be invited to express their expectations in order to confirm the alignment between their knowledge, individual objectives, and those of the training (positioning grid).

These expectations will be reviewed during a roundtable discussion to refine, if necessary, the content and the course flow.

Assessment of knowledge and skills will be conducted through a theoretical multiple-choice questionnaire (MCQ) and a practical work checklist, if applicable.

At the end of the training, each trainee will be asked to complete a satisfaction survey (hot evaluation). Upon completion of the session, a certificate of attendance will be issued.

Operation and maintenance – Gas insulated substation B/T/F type

Réf. X4442E/X5242E/X6142E



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical and mechanicals



Required knowledge

None



Method

Theory: 80% /Practice: 20%



Duration

5 days



Number of participants

5 to 8 (for better efficiency and safety on application)



Place

TIA



Objectives

The participants will be able to know the G.I.S. B/T/F type, the O&M philosophy and according to procedures, they will get knowledge on routine maintenance and simple inspections.



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants expectations

Handling procedures for SF6 and its mixtures according to IEC62271-4

Module A: Awareness

- Basic knowledge of environmental issues
- Environmental relevance of SF6 emissions and mitigation approaches
- Physical, chemical and environmental characteristics of SF6 and its mixtures
- Use of SF6 and its mixtures in HV electric power equipment
- International and local standards
- Personnel safety and suitable PPE
- Design of HV electric power equipment

Module B1: Maintenance not implying gas recovery.

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GE GRID Solutions range
- GIS bay design
- Partitioning
- Standard legend of single line diagram
- Busbar dilatation system
- Induced current.
- Sealing system
- Greases in GIS

Apparatus technology

- Circuit-breaker
- Disconnectors
- Operating mechanism
- Earthing switches
- Driving rod system
- Current transformer
- Voltage transformer
- GIS Surge Arrester
- Coupling elements
- Cable boxes
- Outdoor bushings

- SF6 quality according to 60376 and 60480 IEC standards
- Types of SF6 filled compartments.
- Item Instruments and procedures for checking SF6 quality.
- Procedures for re-filling (topping-up operation after leaks)
- Storage and transportation

Monitoring of the gas and protection of compartments

- Components and location
- SF6 densimeter
- Digital monitoring BWatch3 (if applicable)
- Moisture absorbers
- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK 3-X spring mechanism

- Optical indicators
- Safety rules
- Operating principle
- Simple inspections

Bay design (practice)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manual safety operation

SF6 compartments (practice)

- Pressure with permanent manometer
- Pressure with tools
- SF6 percentage
- Density check Theory
- Leaks localization
- SO2 contents

- GIS substation characteristics
- MID (maintenance isolating device)

High voltage tests for apparatus

- Definition
- Types of tests
- Presentation
- Lightning and switching impulse test.
- Power frequency test on site
- Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts

Apparatus maintenance- circuit-breaker and spring mechanism(practice)

- Damping device
- Operating time theory

Apparatus maintenance- Disconnecter and Earthing switches (practice)

- Mechanical operation
- Electrical operation
- Optical Indicator

Miscellaneous inspections

- Labeling operating mechanisms and filling valves
- Cubicle heating
- Connection's wiring
- Counters
- Alarm operations (if applicable)
- Earthing circuit



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.

Knowledge of old-generation GIS substations Type C/S/T

Ref. X0031E-Legacy1



Audience

Project manager with a background in electricity and mechanics



Prerequisites

None



Method

100% theory
Master presentation, video visualizations.



Duration

1 day



Capacity

Max. 10 trainees



Location

TIA



Objectives

- Distinguish GIS from C/S/T generations (Architectures and Concept) and their specificities
- Describe hydraulic controls associated with older generations and how they work
- List maintenance rules
- Describe specific safety regulations



Program

Presentation of the session

Concept of stations in metal envelopes

Generalities
GE range overview
GIS technical levels
Compartmentalization
Bay diagrams
Induced currents in GIS
Sealing system
Gaskets and greases
Isolated interfaces

Substation architectures: C/S/T

Single line diagram
Location of components
Gas monitoring devices
Safety

Maintenance plan for older generations

Manufacturer maintenance plan
General maintenance description
Description of maintenance operations

GIS equipment technology

The circuit breaker
The line disconnector
The earthing switch
Conductors and demountable elements
Current transformers
Voltage transformers
Cable boxes
Transformer connections
Characteristics of the GIS
Breaker sequences

Gas module and accessories

The SF₆ densimeter
The rupture disc
The molecular sieve
The filler valves

Hydraulic control

Presentation
Principle of rams
Valve system
Accumulators
Single and double-acting rams, differential
CI command, CH control



Trainer

Experienced trainer
Strong experience in the field



Assessment of achievements

At the beginning of the training, participants will be invited to express their expectations to confirm the adequacy between their knowledge, their individual objectives and those of the training (positioning grid).

These expectations will be taken up during a round table discussion in order to refine, if necessary, the content and the course of the training.

The evaluation of achievements and skills is carried out via a theoretical multiple-choice question and a Practical Work grid, (*if applicable.*)

At the end of the training, a hot evaluation must be completed by each of the trainees. At the end of the session, a certificate of attendance will be given.

Knowledge of old-generation substations Type C/S/T

Ref. X0031E-Legacy2



Audience

Service department technician with electrical and mechanical basics



Prerequisites

None



Method

100% theory. Lecture and videos



Duration

2 days



Capacity

Maximum 6 trainees



Location

TIA, Aix-les-Bains



Objectives

- Distinguish GIS from C/S/T generations (Architectures and Concept) and their specificities
- Distinguish hydraulic controls associated with older generations and their operating principle
- Describe maintenance rules and specificities
- Describe specific safety regulations



Program

Concept of stations in metal envelopes

Generalities
GE range overview
GIS technical levels
Compartmentalization
Bay diagrams
Induced currents in GIS
Sealing system
Gaskets and greases
Isolated interfaces

C/S/T substation architectures

Single line diagram
Location of components
Gas monitoring devices
Safety

Maintenance plan for older generations

Manufacturer maintenance plan
General maintenance description
Description of maintenance operations

PSEM equipment technology

The circuit breaker
The line disconnector
The earthing switch
Conductors and demountable elements
Current transformers
Voltage transformers
Cable boxes
Transformer connections
GIS position characteristics
Breaker sequences

Service module and accessories

The SF₆ densimeter
The rupture disc
The molecular sieve
The filler valves

Hydraulic control

Presentation
Principle of rams
Valve system
Accumulators
Single and double-acting rams, differential
CI command, CH control



Trainer

Experienced trainer
Strong field experience



Assessment of achievements

At the beginning of the training, participants will be invited to express their expectations in order to confirm the adequacy between their knowledge, their individual objectives and those of the training (positioning grid).

These expectations will be taken up during a round table discussion to refine, if necessary, the content and the course of the training.

The evaluation of achievements and skills is carried out via a theoretical multiple-choice question and a Practical Work grid, (**if applicable**).

At the end of the training, a hot evaluation must be completed by each of the trainees. At the end of the session, a certificate of attendance will be given.

Operation and maintenance – Gas insulated substation T155 type

Réf. X6141E



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical and mechanicals



Required knowledge

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Method

Theory: 80% /Practice: 20%



Duration

3 days



Number of participants

5 to 8 (for better efficiency and safety on application)



Place

Factory/Site



Objectives

The participants will be able to know the G.I.S. T155 type, the O&M philosophy and according to procedures, they will get knowledge on routine maintenance and simple inspections.



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants expectations

Handling procedures for SF6 and its mixtures according to IEC62271-4

Module A: Awareness

- Basic knowledge of environmental issues
- Environmental relevance of SF6 emissions and mitigation approaches
- Physical, chemical and environmental characteristics of SF6 and its mixtures
- Use of SF6 and its mixtures in HV electric power equipment
- International and local standards
- Personnel safety and suitable PPE
- Design of HV electric power equipment

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GE GRID Solutions range
- GIS bay design
- Partitioning
- Standard legend of single line diagram
- Busbar dilatation system
- Induced current
- Sealing system
- Greases in GIS

Apparatus technology

- Circuit-breaker
- Disconnectors
- Operating mechanism
- Earthing switches
- Driving rod system
- Current transformer
- Voltage transformer
- GIS Surge Arrester
- Coupling elements
- Cable boxes
- Outdoor bushings
- GIS substation characteristics
- MID (maintenance isolating device)

Module B1: Maintenance not implying gas recovery

- SF6 quality according to 60376 and 60480 IEC standards
- Types of SF6 filled compartments
- Instruments and procedures for checking SF6 quality
- Procedures for re-filling (topping-up operation after leaks)
- Storage and transportation

Monitoring of the gas and protection of compartments

- Components and location
- SF6 densimeter
- Digital monitoring BWatch3 (if applicable)
- Moisture absorbers
- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK 3-X spring mechanism

- Optical indicators
- Safety rules
- Operating principle
- Simple inspections

Bay design (practice)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manual safety operation

SF6 compartments (practice)

- Pressure with permanent manometer
- Pressure with tools
- SF6 percentage
- Density check Theory
- Leaks localization
- SO2 contents

High voltage tests for apparatus

- Definition
- Types of tests
- Presentation
- Lightning and switching impulse test
- Power frequency test on site
- Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts

Apparatus maintenance- circuit-breaker and spring mechanism(practice)

- Damping device
- Operating time theory

Apparatus maintenance- Disconnecter and Earthing switches (practice)

- Mechanical operation
- Electrical operation
- Optical Indicator

Miscellaneous inspections

- Labeling operating mechanisms and filling valves
- Cubicle heating
- Connection's wiring
- Counters
- Alarm operations (if applicable)
- Earthing circuit



Practice conditions

In Factory: an apparatus similar to your own equipment – a cell in dead conditions with gas will be at your disposal for the practical works.

On site: customer must put at disposal a bay of the referenced GIS in dead conditions with gas for the practical works with the necessary tools. And provide safety access to the site and equipment.



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.

Operation and maintenance – Gas insulated substation T155-7 type g3

Réf. X6141-7Eg³



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical, mechanicals and gas handling



Required knowledge.

None



Method

Theory: 80% Practice: 20%



Duration

3 days



Number of participants

6 maxima (for better efficiency and safety on application)



Place

Factory/site



Objectives

The participants will be able to know the G.I.S. T155-7 type g³, the O&M philosophy and according to procedures, they will get knowledge on routine maintenance and simple inspections.



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants expectations

Greenhouse gases and global warning

- Regulation in Europe/world
- Environment impact
- g³ versus other technologies
- g³: the sustainable alternative to SF₆

Physical and chemical characteristics

- Liquid versus gaseous
- Vapor pressure
- Breakdown voltage
- Standards gas mixtures
- g³ standard quality

g³ gas handling

- Handling processes for filling and recovery
- g³ quality analysis

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GE GRID Solutions range
- GIS bay design
- Partitioning
- Standard legend of single line diagram
- Busbar dilatation system
- Induced current.
- Sealing system
- Greases in GIS

Apparatus technology

- Circuit-breaker
- Disconnectors
- Operating mechanism
- Earthing switches
- Driving rod system
- Current transformer
- Voltage transformer
- GIS Surge Arrester
- Coupling elements
- Cable boxes
- Outdoor bushings

- Gas handling rules and recommendations
- Specific g3 components
- Storage and transportation

Safety with g³

- Mandatory safety devices
- Risks analysis according to the different situations

Monitoring of the gas and protection of compartments

- Components and location
- SF6 densimeter
- Digital monitoring BWatch3 (if applicable)
- Moisture absorbers
- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK 3-X spring mechanism

- Optical indicators
- Safety rules
- Operating principle
- Simple inspections

Bay design (practice)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manual safety operation

g³ compartments (practice)

- Pressure measurement
- Topping up (if applicable)
- Gas quality analysis
- Leaks localization (if applicable)
- PPE use

- GIS substation characteristics
- MID (maintenance isolating device)

High voltage tests for apparatus

- Definition
- Types of tests
- Presentation
- Lightning and switching impulse test.
- Power frequency test on site
- Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts

Apparatus maintenance- circuit-breaker and spring mechanism(practice)

- Damping device
- Operating time theory

Apparatus maintenance- Disconnecter and Earthing switches (practice)

- Mechanical operation
- Electrical operation
- Optical Indicator

Miscellaneous inspections

- Labeling operating mechanisms and filling valves
- Cubicle heating
- Connection's wiring
- Counters
- Alarm operations (if applicable)
- Earthing circuit



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.

Operation and maintenance – Gas insulated substation T155-7 type with SF₆ / g³ (bi-gas)

Réf. X6141E-g3SF₆



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical, mechanicals and gas handling



Required knowledge

None



Method

Theory: 80% /Practice: 20%



Duration

3,5 days



Number of participants

6 maxima (for better efficiency and safety on application)



Place

Aix Les Bains Factory/customer site



Objectives

The participants will be able to know the G.I.S. T155 type with SF₆/g³ (bi-gas), the O&M philosophy and according to procedures, they will get knowledge on routine maintenance and simple inspections.



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants expectations

Greenhouse gases and global warning

- Regulation in Europe/world
- Environment impact
- g³ versus other technologies
- g³ : the sustainable alternative to SF₆

Physical and chemical characteristics

- Liquid versus gaseous
- Vapor pressure
- Breakdown voltage
- Standards gas mixtures
- SF₆ & g³ standard quality

SF₆ & g³ gas handling

- Handling processes for filling and recovery
- SF₆ & g³ quality analysis
- Gas handling rules and recommendations

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GE Solutions range
- GIS bay design
- Partitioning
- Standard legend of single line diagram
- Busbar dilatation system
- Induced current.
- Sealing system
- Greases in GIS

Apparatus technology

- Circuit-breaker
- Disconnectors
- Operating mechanism
- Earthing switches
- Driving rod system
- Current transformer
- Voltage transformer
- GIS Surge Arrester
- Coupling elements
- Cable boxes
- Outdoor bushings

- Specific g³ components
- Storage and transportation

Safety with g³

- Mandatory safety devices
- Risks analysis according to the different situations

Monitoring of the gas and protection of compartments

- Components and location
- SF₆ & g³ densimeter
- Digital monitoring BWatch3
- Moisture absorbers
- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK 3-X spring mechanism

- Optical indicators
- Safety rules
- Operating principle
- Simple inspections

Bay design (practice)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manual safety operation

SF₆ & g³ compartments (practice)

- Pressure measurement
- Topping up (if applicable)
- Gas quality analysis
- Leaks localization (if applicable)
- PPE use

- GIS substation characteristics
- MID (maintenance isolating device)

High voltage tests for apparatus

- Definition
- Types of tests
- Presentation
- Lightning and switching impulse test.
- Power frequency test on site
- Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts

Apparatus maintenance- circuit-breaker and spring mechanism(practice)

- Damping device
- Operating time theory

Apparatus maintenance- Disconnecter and Earthing switches (practice)

- Mechanical operation
- Electrical operation
- Optical Indicator

Miscellaneous inspections

- Labeling operating mechanisms and filling valves
- Cubicle heating
- Connection's wiring
- Counters
- Alarm operations (if applicable)



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.

Gas insulated substation with g³

- g³ Gas handling
- Fundamentals for installation in T155-7 g³

Réf. V0053E + X6141-7Eg³



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical, mechanicals and gas handling



Required knowledge

None



Method

Theory: 75% / Practice: 25%



Duration

4 days



Number of participants

5 (for better efficiency and safety on application)



Place

On site



Objectives

The participants will be able to know the G.I.S. T155-7 type, the O&M philosophy and according to procedures, they will get knowledge on routine maintenance and simple inspections.

Fundamentals of the g³ and master the tools/management of the g³



Program

Presentation of the session

Reception and welcome
Confirmation of participants expectations

Presentation of the session

Reception and welcome
Confirmation of participants expectations

Greenhouse gases and global warning

Regulation in Europe/world
Environment impact
g³ versus other technologies
g³: the sustainable alternative

Physical and chemical characteristics

Liquid versus gaseous
Vapor pressure
Breakdown voltage
Standards gas mixtures
g³ standard quality

Concept of a substation in a metal enclosure in T155-7

Generalities
Technical steps
GE GRID Solutions range
GIS bay design
Partitioning
Standard legend of single line diagram
Busbar dilatation system
Induced current.
Sealing system
Greases in GIS

T155-7 - Apparatus technology

Circuit-breaker
Disconnectors
Operating mechanism
Earthing switches
Driving rod system
Current transformer
Voltage transformer
GIS Surge Arrester

g³ gas handling (practice)

Gas handling rules and recommendations
PPE use
Leaks detection
Handling processes for filling and recovery
g³ quality analysis
Specific g³ components
Storage and transportation

Safety with g³

Mandatory safety devices
Risks analysis according to the different situations

Monitoring of the gas and protection of compartments

Components and location
g³ densimeter
Digital monitoring BWatch3
Moisture absorbers
Maintenance module
Bursting disk
Valves
UHF sensors

FK 3-X spring mechanism

Optical indicators
Safety rules
Operating principle
Simple inspections

Bay design (presentation)

Single line layout
Single line diagram
Apparatus location
Monitoring device

Coupling elements
Cable boxes
Outdoor bushings
GIS substation characteristics
MID (maintenance isolating device)
Site requirements, pre-start checklists.
Cleanliness and environmental considerations.
Theory about the assembly principles.

High voltage tests for apparatus

Definition
Types of tests
Presentation
Lightning and switching impulse test.
Power frequency test on site
Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

General maintenance description
Maintenance operation description and spare parts
Theory about the commissioning and site acceptance tests.



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.

Operation and maintenance – Gas insulated substation T155 type

Réf. X6142E



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical and mechanicals



Required knowledge

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Method

Theory : 60% /Practice : 40%



Duration

5 days



Number of participants

5 maximum (for better efficiency and safety on application)



Place

Factory/Site



Objectives

The participants will be able to know the G.I.S. T155 type, the O&M philosophy and according to procedures, they will get practice on routine Operation & Maintenance.



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants' expectations

Handling procedures for SF6 and its mixtures according to IEC62271-4

Module A: Awareness

- Basic knowledge of environmental issues
- Environmental relevance of SF6 emissions and mitigation approaches
- Physical, chemical, and environmental characteristics of SF6 and its mixtures
- Use of SF6 and its mixtures in HV electric power equipment
- International and local standards
- Personnel safety and suitable PPE
- Design of HV electric power equipment

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GE GRID Solutions range
- GIS bay design
- Partitioning
- Standard legend of single line diagram
- Busbar dilatation system
- Induced current
- Sealing system
- Greases in GIS

Apparatus technology

- Circuit-breaker
- Disconnectors
- Operating mechanism
- Earthing switches
- Driving rod system
- Current transformer
- Voltage transformer
- GIS Surge Arrester
- Coupling elements
- Cable boxes
- Outdoor bushings
- GIS substation characteristics
- MID (maintenance isolating device)

Module B1: Maintenance not implying gas recovery

- SF6 quality according to 60376 and 60480 IEC standards
- Types of SF6 filled compartments
- Instruments and procedures for checking SF6 quality
- Procedures for re-filling (topping-up operation after leaks)
- Storage and transportation
- Monitoring of SF6 gas and recording of data

Monitoring of the gas and protection of compartments

- Components and location
- SF6 densimeter
- Digital monitoring BWatch3 (if applicable)
- Moisture absorbers
- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK 3-X spring mechanism

- Optical indicators
- Safety rules
- Operating principle
- Breakdown repair methodology

Bay design (practice)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manual safety operation

SF6 compartments (practice)

- Pressure with permanent manometer
- Pressure with tools
- SF6 percentage
- Density check (if applicable)
- Leaks localization
- SO2 contents

High voltage tests for apparatus

- Definition
- Types of tests
- Presentation
- Lightning and switching impulse test
- Power frequency test on site
- Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts

Apparatus maintenance- circuit-breaker and spring mechanism(practice)

- Damping device
- Operating time

Apparatus maintenance- Disconnecter and Earthing switches (practice)

- Mechanical operation
- Electrical operation
- Optical Indicator

Miscellaneous inspections (practice)

- Labeling operating mechanisms and filling valves
- Cubicle heating
- Connection's wiring
- Counters
- Alarm operations (if applicable)
- Gas handling device
- Earthing circuit



Practice conditions

In Factory: an apparatus similar to your own equipment – a cell in dead conditions with gas will be at your disposal for the practical works.

On site: customer must put at disposal a bay of the referenced GIS in dead conditions with gas for the practical works with the necessary tools. And provide safety access to the site and equipment.



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.

Operation and Maintenance – Gas insulated substation T155-7 g3

Réf. X6142E-7g³

	Destinated for Technical team involved in operation and maintenance of HV installations. Normal experience in HV Switchgear, basics in electrical and mechanicals		Required knowledge Knowledge of the T155 product
	Method Theory: 75% / Practice: 25% Lecture, videos, practical workshop on GIS and handling of DIL0 equipment.		Duration 5 days
	Number of participants 6 maxima (for better efficiency and safety on application)		Place Training centre Aix-les-Bains / site

Objectives

- The participants will be able to know the G.I.S T155-7 g3 product. They will be able to the operation and maintenance philosophy and according to procedures.
- They will get practice one routine operation and maintenance
- Apply specific safety rules on the G.I.S.

Program

Presentation of the session

- Reception and welcome
- Confirmation of participants expectation

Greenhouse gases

- Rules in Europe/World
- Environmental impact
- g³ compared to other technologies
- g³: the sustainable alternative to SF₆

Physical and chemical characteristics

- Liquid et Gas
- Gas liquefaction
- Breakdown resistance
- Standardized Gas Mixtures
- SF₆ & g³ standards

Manipulation of g³ gas

- Handling during filling and recovery processes
- Quality of the analysed gas
- Rules and recommendations for gas handing
- Specific g³ components
- Storage and transport

Safety with the g³

- Mandatory safety equipment
- Risk analysis across different situations

Gas monitoring and compartment protection

- Components and location
- Densimeter
- BWatch3 (if applicable)
- Moisture absorbers

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GE GRID solutions range
- GIS bay design
- Particularity T155-7
- Partitioning
- Standard legend of single line diagram
- Dilatation system
- Induced current
- Sealing system
- Greases and seal in G.I.S

Apparatus Technology

- Circuit-Breaker
- Disconnectors and Earthing switches
- Operating mechanism
- Driving rod system
- Current transformer
- Voltage transformer
- GIS Surge Arrester
- Coupling elements
- Cable box
- Outdoor bushings
- Transformer connection
- GIS characteristics
- MID (Maintenance Isolating Device)
- TID (Temporary Isolating Device)

- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK3-X spring mechanism

- General information and product range
- Operating principle
- Optical indicators
- Safety rules

Bay design (Practice)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manuel safety operation

Travaux gas (practice)

- Pressure with permanent manometer
- Pressure with tools (gas-to-gas)
- Gas analysis
- Density check (if applicable)
- Leaks localization

High voltage tests for apparatus

- Definition
- Types of tests
- Presentation
- Lightning and switching impulse test
- Power frequency test on site
- Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts

Switchgear maintenance (Pratique)

- Disconnectors and Earthing switches
- Mechanical operation
- Electrical operation
- Optical indicator

Circuit-breaker maintenance (Pratique)

- Checking circuit-breaker operating times
- Optical indicator

Miscellaneous inspections (Pratique)

- Labelling operating mechanisms and filling valves
- Cubicle heating
- Connection's wiring
- Counters
- Alarm operations (if applicable)
- Gas handling device
- Earthing circuit



Trainer

Experienced trainer with a strong field experience.



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.



Practice conditions

In Factory: an apparatus similar to your own equipment – a cell in dead conditions with gas will be at your disposal for the practical works.

On site: customer must put at disposal a bay of the referenced GIS in dead conditions with gas for the practical works with the necessary tools. And provide safety access to the site and equipment.

Operation and maintenance – Gas insulated substation B105 type

Réf. X4441E



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical and mechanicals



Required knowledge

Ø



Method

Theory: 80% /Practice: 20%



Duration

3 days



Number of participants

5 to 8 (for better efficiency and safety on application)



Place

Factory/Site



Objectives

The participants will be able to know the G.I.S. B105 type, the O&M philosophy and according to procedures, they will get knowledge on routine maintenance and simple inspections.



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants expectations

Handling procedures for SF6 and its mixtures according to IEC62271-4

Module A: Awareness

- Basic knowledge of environmental issues
- Environmental relevance of SF6 emissions and mitigation approaches
- Physical, chemical, and environmental characteristics of SF6 and its mixtures
- Use of SF6 and its mixtures in HV electric power equipment
- International and local standards
- Personnel safety and suitable PPE
- Design of HV electric power equipment

Module B1: Maintenance not implying gas recovery

- SF6 quality according to 60376 and 60480 IEC standards
- Types of SF6 filled compartments
- Instruments and procedures for checking SF6 quality
- Procedures for re-filling (topping-up operation after leaks)
- Storage and transportation

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GE GRID Solutions range
- GIS bay design
- Partitioning
- Standard legend of single line diagram
- Busbar dilatation system
- Induced current
- Sealing system
- Greases in GIS

Monitoring of the gas and protection of compartments

- Components and location
- SF6 densimeter
- Digital monitoring BWatch3 (if applicable)
- Moisture absorbers
- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK 3-X spring mechanism

- Optical indicators
- Safety rules
- Operating principle
- Simple inspections

Bay design (practice)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manual safety operation

SF6 compartments (practice)

- Pressure with permanent manometer
- Pressure with tools
- SF6 percentage
- Density check Theory
- Leaks localization
- SO2 contents

Apparatus maintenance- Disconnecter and Earthing switches (practice)

- Mechanical operation
- Electrical operation
- Optical Indicator

Apparatus technology

- Circuit-breaker
- Disconnectors
- Operating mechanism
- Earthing switches
- Driving rod system
- Current transformer
- Voltage transformer
- GIS Surge Arrester
- Coupling elements
- Cable boxes
- Outdoor bushings
- GIS substation characteristics
- MID (maintenance isolating device)

High voltage tests for apparatus

- Definition
- Types of tests
- Presentation
- Lightning and switching impulse test
- Power frequency test on site
- Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts

Apparatus maintenance- circuit-breaker and spring mechanism(practice)

- Damping device
- Operating time theory

Miscellaneous inspections

- Labeling operating mechanisms and filling valves
- Cubicle heating
- Connection's wiring
- Counters
- Alarm operations (if applicable)
- Earthing circuit



Practice conditions

In Factory: an apparatus similar to your own equipment – a cell in dead conditions with gas will be at your disposal for the practical works.

On site: customer must put at disposal a bay of the referenced GIS in dead conditions with gas for the practical works with the necessary tools and provide safety access to the site and equipment.



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.

Operation and maintenance – Gas insulated substation B105 type

Ref. X4442E



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical and mechanicals



Required knowledge

Ø



Method

Theory: 60% /Practice: 40%



Duration

5 days



Number of participants

5 maximum (for better efficiency and safety on application)



Place

Factory/Site



Objectives

The participants will be able to know the G.I.S. B105 type, the O&M philosophy and according to procedures, they will get practice on routine Operation & Maintenance.



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants' expectations

Handling procedures for SF6 and its mixtures according to IEC62271-4

Module A: Awareness

- Basic knowledge of environmental issues
- Environmental relevance of SF6 emissions and mitigation approaches
- Physical, chemical, and environmental characteristics of SF6 and its mixtures
- Use of SF6 and its mixtures in HV electric power equipment
- International and local standards
- Personnel safety and suitable PPE
- Design of HV electric power equipment

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GE GRID Solutions range
- GIS bay design
- Partitioning
- Standard legend of single line diagram
- Busbar dilatation system
- Induced current
- Sealing system
- Greases in GIS

Module B1: Maintenance not implying gas recovery

- SF6 quality according to 60376 and 60480 IEC standards
- Types of SF6 filled compartments
- Instruments and procedures for checking SF6 quality
- Procedures for re-filling (topping-up operation after leaks)
- Storage and transportation
- Monitoring of SF6 gas and recording of data

Monitoring of the gas and protection of compartments

- Components and location
- SF6 densimeter
- Digital monitoring BWatch3 (if applicable)
- Moisture absorbers
- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK 3-X spring mechanism

- Optical indicators
- Safety rules
- Operating principle
- Breakdown repair methodology

Bay design (practice)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manual safety operation

SF6 compartments (practice)

- Pressure with permanent manometer
- Pressure with tools
- SF6 percentage
- Density check (if applicable)
- Leaks localization
- SO2 contents

Apparatus technology

- Circuit-breaker
- Disconnectors
- Operating mechanism
- Earthing switches
- Driving rod system
- Current transformer
- Voltage transformer
- GIS Surge Arrester
- Coupling elements
- Cable boxes
- Outdoor bushings
- GIS substation characteristics
- MID (maintenance isolating device)

High voltage tests for apparatus

- Definition
- Types of tests
- Presentation
- Lightning and switching impulse test
- Power frequency test on site
- Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts

Apparatus maintenance- circuit-breaker and spring mechanism(practice)

- Damping device
- Operating time

Apparatus maintenance- Disconnector and Earthing switches (practice)

- Mechanical operation
- Electrical operation
- Optical Indicator

Miscellaneous inspections (practice)

- Labeling operating mechanisms and filling valves
- Cubicle heating
- Connection's wiring
- Counters
- Alarm operations (if applicable)
- Gas handling device
- Earthing circuit



Practice conditions

In Factory: an apparatus similar to your own equipment – a cell in dead conditions with gas will be at your disposal for the practical works.

On site: customer must put at disposal a bay of the referenced GIS in dead conditions with gas for the practical works with the necessary tools. And provide safety access to the site and equipment.



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.

Operation and maintenance – Gas insulated substation F35 type

Réf. X5241E



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical and mechanicals



Required knowledge

Ø



Method

Theory: 80% /Practice: 20%



Duration

3 days



Number of participants

5 to 8 (for better efficiency and safety on application)



Place

Factory/Site



Objectives

The participants will be able to know the G.I.S. F35 type, the O&M philosophy and according to procedures, they will get knowledge on routine maintenance and simple inspections.



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants expectations

Handling procedures for SF6 and its mixtures according to IEC62271-4

Module A: Awareness

- Basic knowledge of environmental issues
- Environmental relevance of SF6 emissions and mitigation approaches
- Physical, chemical, and environmental characteristics of SF6 and its mixtures
- Use of SF6 and its mixtures in HV electric power equipment
- International and local standards
- Personnel safety and suitable PPE
- Design of HV electric power equipment

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GE GRID Solutions range
- GIS bay design
- Partitioning
- Standard legend of single line diagram
- Busbar dilatation system
- Sealing system
- Greases in GIS

Apparatus technology

- Circuit-breaker
- Disconnectors
- Operating mechanism
- Earthing switches
- Driving rod system
- Current transformer
- Voltage transformer
- GIS Surge Arrester
- Coupling elements
- Cable boxes
- Outdoor bushings
- GIS substation characteristics

Module B1: Maintenance not implying gas recovery

- SF6 quality according to 60376 and 60480 IEC standards
- Types of SF6 filled compartments
- Instruments and procedures for checking SF6 quality
- Procedures for re-filling (topping-up operation after leaks)
- Storage and transportation

Monitoring of the gas and protection of compartments

- Components and location
- SF6 densimeter
- Digital monitoring BWatch3 (if applicable)
- Moisture absorbers
- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK 3-X spring mechanism

- Optical indicators
- Safety rules
- Operating principle
- Simple inspections

Bay design (practice)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manual safety operation

SF6 compartments (practice)

- Pressure with permanent manometer
- Pressure with tools
- SF6 percentage
- Density check Theory
- Leaks localization
- SO2 contents

High voltage tests for apparatus

- Definition
- Types of tests
- Presentation
- Lightning and switching impulse test
- Power frequency test on site
- Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts

Apparatus maintenance- circuit-breaker and spring mechanism(practice)

- Damping device
- Operating time theory

Apparatus maintenance- Disconnecter and Earthing switches (practice)

- Mechanical operation
- Electrical operation
- Optical Indicator

Miscellaneous inspections

- Labeling operating mechanisms and filling valves
- Cubicle heating
- Connection's wiring
- Counters
- Alarm operations (if applicable)
- Earthing circuit



Practice conditions

In Factory: an apparatus similar to your own equipment – a cell in dead conditions with gas will be at your disposal for the practical works.

On site: customer must put at disposal a bay of the referenced GIS in dead conditions with gas for the practical works with the necessary tools. And provide safety access to the site and equipment.



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.

Operation and maintenance – Gas insulated substation F35 g³ type

Réf. X5241E g³



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical, mechanicals and gas handling



Required knowledge

Ø



Method

Theory: 80% /Practice: 20%



Duration

3 days



Number of participants

5 to 8 (for better efficiency and safety on application)



Place

Factory/Site



Objectives

The participants will be able to know the G.I.S. F35 g³ type, the O&M philosophy and according to procedures, they will get knowledge on routine maintenance and simple inspections.



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants expectations

Greenhouse gases and global warning

- Regulation in Europe/world
- Environment impact
- g³ versus other technologies
- g³: the sustainable alternative to SF₆

Physical and chemical characteristics

- Liquid versus gaseous
- Vapor pressure
- Breakdown voltage
- Standards gas mixtures
- g³ standard quality

g³ gas handling

- Handling processes for filling and recovery
- g³ quality analysis
- Gas handling rules and recommendations
- Specific g³ components
- Storage and transportation

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GIS range
- GIS bay design
- Partitioning
- Standard legend of single line diagram
- Busbar dilatation system
- Sealing system
- Greases in GIS

Apparatus technology

- Circuit-breaker
- Disconnectors
- Operating mechanism
- Earthing switches
- Driving rod system
- Current and voltage transformer (LPIT if applicable)
- GIS Surge Arrester
- Coupling elements
- Cable boxes
- Outdoor bushings
- GIS substation characteristics

Safety with g³

- Mandatory safety devices
- Risks analysis according to the different situations

Monitoring of the gas and protection of compartments

- Components and location
- Densimeter
- Digital monitoring BWatch3 (if applicable)
- Moisture absorbers
- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK 3-X spring mechanism

- Optical indicators
- Safety rules
- Operating principle
- Simple inspections

Bay design (practice)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manual safety operation

g³ compartments (practice)

- Pressure measurement
- Topping up (if applicable)
- Gas quality analysis
- Leaks localization (if applicable)
- PPE use

High voltage tests for apparatus

- Definition
- Types of tests
- Presentation
- Lightning and switching impulse test
- Power frequency test on site
- Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts

Apparatus maintenance- circuit-breaker and spring mechanism(practice)

- Damping device
- Operating time theory

Apparatus maintenance- Disconnecter and Earthing switches (practice)

- Mechanical operation
- Electrical operation
- Optical Indicator

Miscellaneous inspections

- Labeling operating mechanisms and filling valves
- Cubicle heating
- Connection's wiring
- Counters
- Alarm operations (if applicable)
- Earthing circuit



Practice conditions

In Factory: an apparatus similar to your own equipment – a cell in dead conditions with gas will be at your disposal for the practical works.

On site: customer must put at disposal a bay of the referenced GIS in dead conditions with gas for the practical works with the necessary tools. And provide safety access to the site and equipment.



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.

Gas insulated substation with g³ Gas handling + Fundamentals for installation F35g³

Ref. V0053E + X5241E g³



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical, mechanicals and gas handling



Required knowledge

Ø



Method

Theory: 25% /Practice: 75%



Duration

4 days



Number of participants

5 maximum (for better efficiency and safety on application)



Place

TIA Aix-Les-Bains



Objectives

The participants will be able to know the G.I.S. F35 g³ type, the O&M philosophy and according

to procedures, they will be informed on routine Operation & Maintenance.

The participants will be able to use dedicated g³ cart to master the management of the gas.

Master the safety rules related to g³.



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants' expectations

Greenhouse gases and global warning

- Regulation in Europe/world
- Environment impact
- g³ versus other technologies
- g³: the sustainable alternative to SF₆

Physical and chemical characteristics

- Liquid versus gaseous
- Vapor pressure
- Standards gas mixtures
- g³ standard quality

g³ gas handling

- Handling processes for filling and recovery
- g³ quality analysis
- Gas handling rules and recommendations
- Specific g³ components
- Storage and transportation

Safety with g³

- Mandatory safety devices
- Risks analysis according to the different situations
- PPE use

g³ gas handling (practice)

- Preparation of g³ from liquid to gaseous
- GIS compartment filling or topping up
- Gas quality measurement
- Gas recovery to gaseous or liquid state
- Gas balance and report

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GIS range
- GIS bay design
- Partitioning
- Standard legend of single line diagram
- Busbar dilatation system
- Sealing system

Monitoring of the gas and protection of compartments

- Components and location
- Gas densimeter
- Digital monitoring BWatch3 (if applicable)
- Moisture absorbers
- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK 3-X spring mechanism

- Optical indicators
- Safety rules
- Operating principle
- Breakdown repair methodology

Bay design (presentation)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manual safety operation
- Theory about the assembly principles.
- Cleanliness and environmental considerations. Site requirements, pre-start checklists.

- Greases in GIS

Apparatus technology in F35g³

- Circuit-breaker
- Disconnectors
- Operating mechanism
- Earthing switches
- Driving rod system
- Current and voltage transformer
- GIS Surge Arrester
- Coupling elements
- Cable boxes
- Outdoor bushings
- GIS substation characteristics

High voltage tests for apparatus

- Definition
- Types of tests
- Presentation
- Lightning and switching impulse test
- Power frequency test on site
- Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts
- Theory about the commissioning and site acceptance tests.



Practice conditions

In Factory: a g3 cart and safety devices will be available for the practices – a cell in demonstration -without gas will be at your disposal.



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.

Operation and maintenance – Gas insulated substation F35 type

Réf. X5242E



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical and mechanicals



Required knowledge

Ø



Method

Theory: 60% /Practice: 40%



Duration

5 days



Number of participants

5 maximum (for better efficiency and safety on application)



Place

Factory/Site



Objectives

The participants will be able to know the G.I.S. F35 type, the O&M philosophy and according to procedures, they will get practice on routine Operation & Maintenance.



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants' expectations

Handling procedures for SF6 and its mixtures according to IEC62271-4

Module A: Awareness

- Basic knowledge of environmental issues
- Environmental relevance of SF6 emissions and mitigation approaches
- Physical, chemical and environmental characteristics of SF6 and its mixtures
- Use of SF6 and its mixtures in HV electric power equipment
- International and local standards
- Personnel safety and suitable PPE
- Design of HV electric power equipment

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GE GRID Solutions range
- GIS bay design
- Partitioning
- Standard legend of single line diagram
- Busbar dilatation system
- Sealing system
- Greases in GIS

Apparatus technology

- Circuit-breaker
- Disconnectors
- Operating mechanism
- Earthing switches
- Driving rod system
- Current transformer
- Voltage transformer
- GIS Surge Arrester
- Coupling elements
- Cable boxes
- Outdoor bushings
- GIS substation characteristics

Module B1: Maintenance not implying gas recovery

- SF6 quality according to 60376 and 60480 IEC standards
- Types of SF6 filled compartments
- Instruments and procedures for checking SF6 quality
- Procedures for re-filling (topping-up operation after leaks)
- Storage and transportation
- Monitoring of SF6 gas and recording of data

Monitoring of the gas and protection of compartments

- Components and location
- SF6 densimeter
- Digital monitoring BWatch3 (if applicable)
- Moisture absorbers
- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK 3-X spring mechanism

- Optical indicators
- Safety rules
- Operating principle
- Breakdown repair methodology

Bay design (practice)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manual safety operation

SF6 compartments (practice)

- Pressure with permanent manometer
- Pressure with tools
- SF6 percentage
- Density check (if applicable)
- Leaks localization
- SO2 contents

High voltage tests for apparatus

- Definition
- Types of tests
- Presentation
- Lightning and switching impulse test
- Power frequency test on site
- Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts

Apparatus maintenance- circuit-breaker and spring mechanism(practice)

- Damping device
- Operating time

Apparatus maintenance- Disconnecter and Earthing switches (practice)

- Mechanical operation
- Electrical operation
- Optical Indicator

Miscellaneous inspections (practice)

- Labeling operating mechanisms and filling valves
- Cubicle heating
- Connection's wiring
- Counters
- Alarm operations (if applicable)
- Gas handling device
- Earthing circuit



Practice conditions

In Factory: an apparatus similar to your own equipment – a cell in dead conditions with gas will be at your disposal for the practical works.

On site: customer must put at disposal a bay of the referenced GIS in dead conditions with gas for the practical works with the necessary tools. And provide safety access to the site and equipment.



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.

Operation and maintenance – Gas insulated substation F35 g³ type

Ref. X5242E g³



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical, mechanicals and gas handling



Required knowledge

Ø



Method

Theory: 60% /Practice: 40%



Duration

5 days



Number of participants

5 maximum (for better efficiency and safety on application)



Place

Factory/Site



Objectives

The participants will be able to know the G.I.S. F35 g³ type, the O&M philosophy and according to procedures, they will get practice on routine Operation & Maintenance.



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants' expectations

Greenhouse gases and global warning

- Regulation in Europe/world
- Environment impact
- g³ versus other technologies
- g³: the sustainable alternative to SF₆

Physical and chemical characteristics

- Liquid versus gaseous
- Vapor pressure
- Breakdown voltage
- Standards gas mixtures
- g³ standard quality

g³ gas handling

- Handling processes for filling and recovery
- g³ quality analysis
- Gas handling rules and recommendations
- Specific g³ components
- Storage and transportation

Safety with g³

- Mandatory safety devices
- Risks analysis according to the different situations
- PPE use

g³ gas handling (practice)

- Preparation of g³ from liquid to gaseous
- GIS compartment filling or topping up
- Gas quality measurement
- Gas recovery to gaseous or liquid state
- Gas balance and report

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GIS range
- GIS bay design
- Partitioning
- Standard legend of single line diagram
- Busbar dilatation system
- Sealing system
- Greases in GIS

Monitoring of the gas and protection of compartments

- Components and location
- SF6 densimeter
- Digital monitoring BWatch3 (if applicable)
- Moisture absorbers
- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK 3-X spring mechanism

- Optical indicators
- Safety rules
- Operating principle
- Breakdown repair methodology

Bay design (practice)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manual safety operation

Apparatus maintenance- circuit-breaker and spring mechanism(practice)

- Damping device
- Operating time

Apparatus maintenance- Disconnector and Earthing switches (practice)

- Mechanical operation
- Electrical operation
- Optical Indicator

Apparatus technology

- Circuit-breaker
- Disconnectors
- Operating mechanism
- Earthing switches
- Driving rod system
- Current and voltage transformer (LPIT if applicable)
- GIS Surge Arrester
- Coupling elements
- Cable boxes
- Outdoor bushings
- GIS substation characteristics

High voltage tests for apparatus

- Definition
- Types of tests
- Presentation
- Lightning and switching impulse test
- Power frequency test on site
- Partial discharge measurement

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts

Miscellaneous inspections (practice)

- Labeling operating mechanisms and filling valves
- Cubicle heating
- Connection's wiring
- Counters
- Alarm operations (if applicable)
- Gas handling device
- Earthing circuit



Practice conditions

In Factory: an apparatus similar to your own equipment – a cell in dead conditions with gas will be at your disposal for the practical works.

On site: customer must put at disposal a bay of the referenced GIS in dead conditions with gas for the practical works with the necessary tools. And provide safety access to the site and equipment.



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.

Operation and maintenance – Gas insulated substation B105 and F35 type

Ref. X4442E/X5242E



Destinated for

Technical team involved in operation and maintenance of HV installations. Normal experience in H.V. switchgear, basics in electrical and mechanicals



Required knowledge

Ø



Method

Theory: 60% / Practice: 40%



Duration

5 days



Number of participants

5 maximum (for better efficiency and safety on application)



Place

Factory



Objectives

The participants will be able to know the G.I.S. B105 and F35 type, the O&M philosophy and according to procedures, they will get practice on routine Operation & Maintenance.



Program

Presentation of the session

- Reception and welcome
- Confirmation of participants' expectations

Handling procedures for SF6 and its mixtures according to IEC62271-4 (Reminder)

Module A: Awareness

- Basic knowledge of environmental issues
- Environmental relevance of SF6 emissions and mitigation approaches
- Physical, chemical, and environmental characteristics of SF6 and its mixtures
- Use of SF6 and its mixtures in HV electric power equipment
- International and local standards
- Personnel safety and suitable PPE
- Design of HV electric power equipment

Concept of a substation in a metal enclosure

- Generalities
- Technical steps
- GE GRID Solutions range
- GIS bay design
- Partitioning
- Standard legend of single line diagram
- Busbar dilatation system
- Induced current
- Sealing system
- Greases in GIS

Apparatus technology

- Circuit-breaker
- Disconnectors
- Operating mechanism
- Earthing switches
- Driving rod system
- Current transformer
- Voltage transformer
- GIS Surge Arrester
- Coupling elements
- Cable boxes
- Outdoor bushings
- GIS substation characteristics

Module B1: Maintenance not implying gas recovery (Reminder)

- SF6 quality according to 60376 and 60480 IEC standards
- Types of SF6 filled compartments
- Instruments and procedures for checking SF6 quality
- Procedures for re-filling (topping-up operation after leaks)
- Storage and transportation
- Monitoring of SF6 gas and recording of data

Monitoring of the gas and protection of compartments

- Components and location
- SF6 densimeter
- Digital monitoring BWatch3 (if applicable)
- Moisture absorbers
- Maintenance module
- Bursting disk
- Valves
- UHF sensors

FK 3-X spring mechanism

- Optical indicators
- Safety rules
- Operating principle
- Breakdown repair methodology

Bay design (practice)

- Single line layout
- Single line diagram
- Apparatus location
- Monitoring device
- Manual safety operation

- MID (maintenance isolating device)

Manufacturer maintenance schedule for GIS apparatus

- General maintenance description
- Maintenance operation description and spare parts

SF6 compartments (practice)

- Pressure with permanent manometer
- Pressure with tools
- SF6 percentage
- Density check
- Leaks localization
- SO2 contents

Apparatus maintenance- circuit-breaker and spring mechanism(practice)

- Damping device
- Operating time

Apparatus maintenance- Disconnecter and Earthing switches (practice)

- Mechanical operation
- Electrical operation
- Optical Indicator

Miscellaneous inspections (practice)

- Labeling operating mechanisms and filling valves
- Cubicle heating
- Connection's wiring
- Counters
- Alarm operations (if applicable)
- Gas handling device
- Earthing circuit



Practice conditions

In Factory: an apparatus similar to your own equipment – a cell in dead conditions with gas will be at your disposal for the practical works.

On site: customer must put at disposal a bay of the referenced GIS in dead conditions with gas for the practical works with the necessary tools. And provide safety access to the site and equipment.



Trainer

Experienced trainer with a strong field experience



Evaluation

As part of our quality improvement policy, an evaluation sheet is submitted to trainees at the end of the training with the purpose of improving our programs through their comments.
