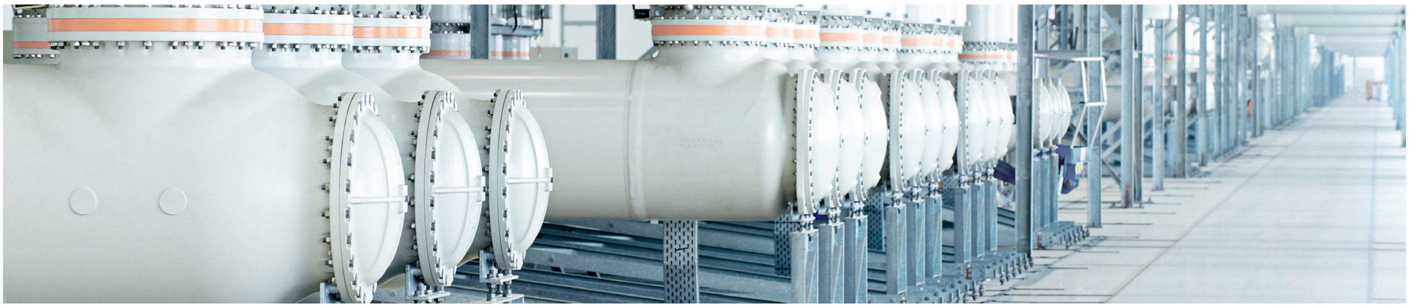
Service High Voltage Products

CSA – Customer Support Agreement
Detailed Analysis of Strategic Spare components and Tools (DASST)



Putting the customer in the driver's seat to plan substation availability

As the requirements to more power and more reliability within the energy networks increased in recent decades, we at ABB believe that it is our duty to encourage our customers to embrace new ways of maintaining gas insulated switchgear (GIS) availability in the long term. The "detailed analysis of strategic spare components and tools" (DASST) is a service product designed to identify possible failure cases and reveal indispensable purchase decisions regarding strategic spare components and tools. As a result, our customers can make a qualified decision based on this report to ensure that the most important potential failures in their GIS are covered in the form of availability of spare components and tools.

Customer Advantage – Decision basis for purchase of strategic spare components and tools

The GIS is very reliable equipment with a minimal rate of failure, but it is not possible to rule them out completely. With more and more energy transported in even more complex network systems, a major failure can result in feeder lines or in extreme cases complete substations being out of order with the possible consequence of energy black out. Depending on the network, this result in financial losses. Within the DASST we are mainly focusing on major failures that are putting the station out of service, as this is what is really the worst case for the GIS. Therefore whenever facing such a major failure event, it is crucial to have the needed spare components at hand to speed up the repair, and thereby keep the downtime as short as possible. This is why they are called Strategic Spare Components. The total failure repair time until re-energizing increases exorbitantly in the absence of strategic spare components and necessary tools, as their production time and shipment to the site depends on many substation-specific variants. Depending on the age of the product, the complexity and the degree of customization of the failed component the delivery time can up many months.

The most crucial question is not how often such failures could occur in a particular component, but how sensitive the system is to an unexpected long-term outage of a section. This information needs to be considered by the customer, and provides the basis for any purchase decision. The station-specific analysis provides a customer with the background information needed to make qualified purchase decisions. This insight puts the customer in the driver's seat to plan substation availability and minimize the downtime of the most crucial equipment, should a failure occur.

The sensitivity of the system to long-term outage of a section is more crucial than the statistical possibility of a failure event.

Deliverables of the DASST – Explained through an example case

Station-specific DASST deliverables

A – Localization of possible failures

B – Corresponding strategic components

C – Complementary spare parts

D – Repair-related tools

E – Spare component minimization

Customer benefits

- First step into highest availability
- Basis for purchase decision
- Cost optimization
- Deployment overview for each componentand supplier

A – Localization of possible failures

As the first step of the station-specific DASST, our experts look into the complete GIS layout and point possible failure sources, and mark them with numbers. All cases that need the same spare components are marked with the same number. This will make it easy in a failure event to identify the needed spare components. Within this exercise, we assume that a failure is caused by a flashover or any other incident that affects a feeder line, a busbar, or the coupler in way that it causes a shutdown. The results of such an analysis are graphically illustrated for a sample configuration as seen in Figure 1.

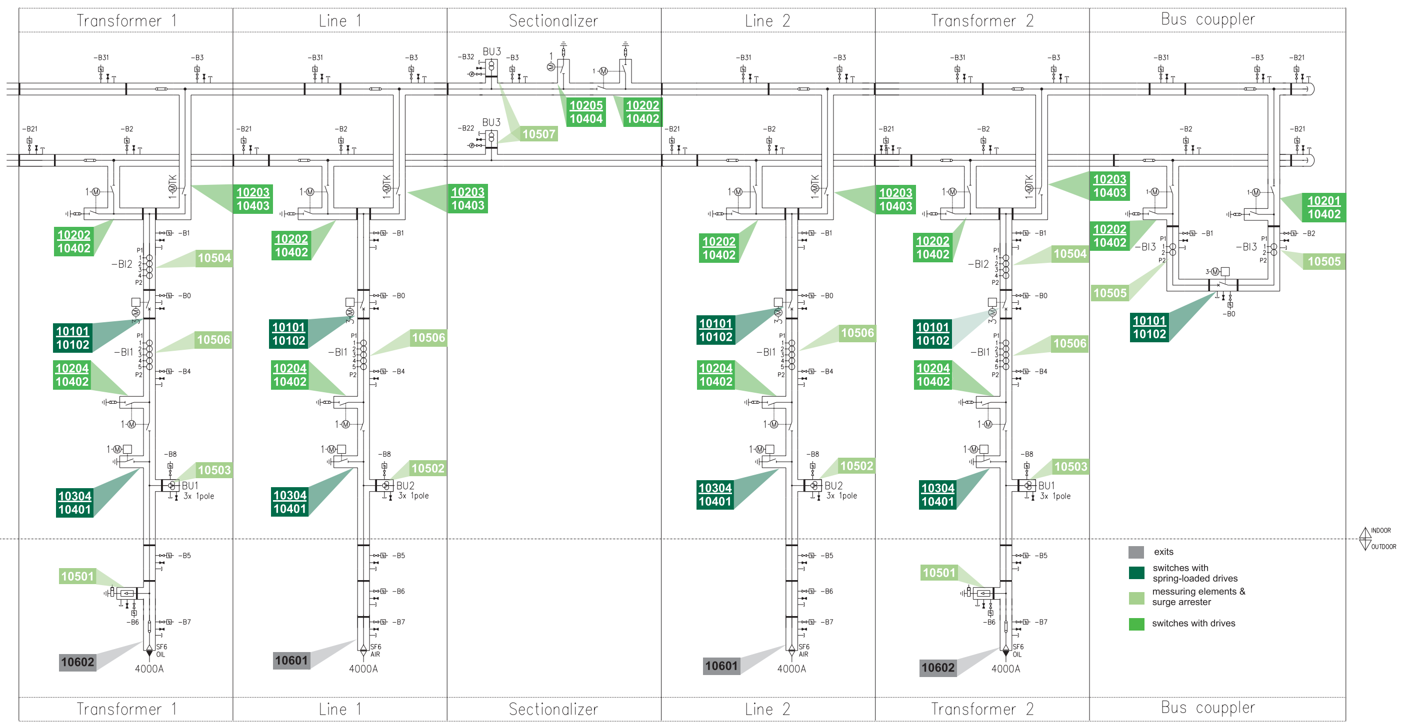


Figure 1: Example of a GIS gas layout with numbered failure locations

B – Corresponding strategic components

Strategic spare components are fully factory tested equipment that can be used for the replacement of failed equipment mentioned in the above cases. Due to the fact that many components in a substation are customized and can even differ within the different bays, it is important to look into the configuration detail of each component to ensure that one-to-one replacement is possible.

In Table 1 you see an extract of a consolidated list of spare components that corresponds with the failure cases evaluated in the first step above. The matrix view links the different strategic components with their location within the GIS layout.

	Strategic component	Transf. 1	Line 1	Section-alizer	Line 2	Transf. 2	Coupler
10100	**Circuit breaker**						
10101	Circuit breaker pole	■	■		■	■	■
10102	Operating mechanism for circuit breaker	■	■		■	■	■
10200	**Disconnector/earthing switch**						
10201	Disconnector/earthing switch type 1						■
10202	Disconnector/earthing switch type 2	■	■	■	■	■	■
10203	Disconnector	■	■		■	■	
10204	Disconnector/earthing switch type 3	■	■		■	■	
10205	Earthing switch			■			
10300	**Fast acting earthing switch**						
10304	Fast acting earthing switch	■	■		■	■	
10400	**Drives**						
10401	Drive for fast acting earthing switch	■	■		■	■	
10402	Drive for disconnector/earthing switch	■	■	■	■	■	■
10403	Drive for disconnector drive	■	■		■	■	
10404	Drive for earthing switch			■			
10500	**Voltage/current transformer and surge arrester**						
10501	Surge arrester	■				■	
10502	Voltage transformer type 1		■		■		
10503	Voltage transformer type 2	■				■	
10504	Current transformer type 1	■				■	
10505	Current transformer type 2						■
10506	Current transformer type 3	■	■		■	■	
10507	Voltage transformer type 3			■			
10600	**Exits**						
10601	SF6 bushing		■		■		
10602	Transformer connection	■				■	

Table 1 – Corresponding Spare Components

C – Complementary spare parts

Additional to the strategic spare components, there are complementary spare parts that might be needed to:

- replace a spare part instead of a complete component, or
- complete the replacement of the above-listed components.

Complementary Spare Parts

Pressure relief device	Support Insulator (IO)
Gas density monitor	Barrier Insulator (IG)

D – Repair-related tools

For efficient and fast repair procedures an adequate pool of tools must be available on site. Factors like difficult portability, sensitivity and the size of certain tools tend to complicate quick repair procedures. Additionally can customs prolong the delivery times even more. These problems can easily be overcome by having adequate tools stored on site and ready for use at anytime. Table 3 gives an overview of basic GIS tools.

Repair related tools and equipment

Installation tools	Pre-filter unit
Gas measuring and gas handling equipment	Leakage detector
Vacuum cleaner	Crane
Specific tools for different GIS types	Consumables

E – Spare component minimization – Optimizing the investment

... within one station

Within one station, there can be different components with the same function (e.g., disconnectors) that cannot be replaced with just one spare component. The details of differentiation depend very much on the type of equipment, production year and also customer-specific configurations of different parameters. As a result, some customers may have many different combinations of components, and that calls for the same amount of spare components if you want to be able to perform a one-to-one replacement.

Within the DASST, it is possible to go into a deep analysis of each component and its configuration, and define the minimal amount of needed components. For some components this can mean, that they fully factory tested equipment can be used for one-to-one replacement in some cases, but needs to be adjusted with a modification kit for order failure locations. The advantage for the customer is lower investment costs, with the consequence of certain cases that require a modification. Such possibilities will be evaluated in detail and the positive and negative impacts listed to provide the customer with the needed possible insights.

... across different stations of the same GIS model

Customers with several substations within short distances, allowing for quick transportation, should seek the possibility of pooling their spare components. Depending on the production years and corresponding technological advances, there can be large or small numbers of spare components that may be shared among different stations. A combined analysis of all stations at the same time will allow for comparison of all recommended spare components and tools for all stations, which can be merged to one list with a minimal amount of components recommended.

Example: Purchase decision taken by the customer is based on strategic station availability

Based on the background information about the GIS and the station-specific analysis, each customer can easily see what spare components are needed to repair all analyzed failures. It is now up to the customer to decide how many of these failures should be covered with spare components.

Strategic decisions regarding substation availability can obviously be made for each substation in the network. But it can even be done on a bay or diameter level if needed. In Figure 1 you see a substation with two line feeders, two transformer feeders and one bus coupler. For each of these bays, the failures and the needed spare components for repair are listed individually in the matrix of table 1.

Let us assume that the transformers are redundant, so that the full capacity can be handled through one transformer connection. But each of the outgoing lines is crucial, since there are large, important consumers at the end of each line. This means that the customer can decide in a first step to buy the required strategic components for the line feeder bays only. In a second step, the customer can buy the rest of the recommended components in order to have the highest possible availability for the complete substation, including some puffers for scheduled maintenance.

The DASST allows our customers to prioritize the GIS failure risks and prepare for the possibility of failures by purchasing those strategic components required to keep down-time to an absolute minimum and thereby increasing the availability of the station

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