PASS - Plug And Switch System
High-voltage hybrid switchgear for digital substations
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ABB is a global leader in power and automation technologies that enable utility and industry customers to improve their performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs about 150,000 people.

In 1999, ABB launched the PASS (Plug And Switch System) a compact hybrid switchgear fully assembled and high-voltage tested in factory, for rapid installation and energization.

The PASS product family covers voltages from 72.5 kV to 420 kV with breaking current capability ranging from 31.5 to 63 kA. In addition to standard modules a special solution called the PASS M0 H offers a complete high voltage switchyard with an ‘H’ configuration as a single product.

PASS encloses all functions of a complete switchgear bay in a single module. The hybrid design makes use of traditional air-insulated busbar to connect with other equipment in the substation, while enclosing all high-voltage bay functions in a single-phase gas-insulated housing where they remain protected, allowing to place the item outdoors in any weather condition.

PASS with more than 8,000 bays is the most widely installed hybrid switchgear worldwide, protecting networks in many different climates and applications.
The digitally-enabled switchgear

**Combined disconnector / Earthing switch**
PASS is equipped with combined disconnector/earthing switches.

**Bushings**
The insulator consists of an epoxy impregnated fiber-glass tube with silicon rubber sheds.

**Circuit-breaker**
The PASS circuit-breaker is a single-pressure interrupter that operates by means of the well-known self-blast principle.

**Current transformer**
Non-conventional current transformers for metering and protection.

**Circuit-breaker drive**
The PASS is operated by Motor Drive, a digitally controlled servomotor that drives the contacts of a high-voltage circuit-breaker with the highest precision.

**Local control Cabinet (LCC)**
Electronic LCC which enables the high voltage switching bay to be operated digitally with a Human Machine Interface. It integrates self-monitoring and switchgear diagnostics.

**Voltage transformer**
PASS for digital substations can be equipped with conventional or non-conventional voltage transformers.
ABB's Digital Substation stands for a break-through innovation in substation technology. It is based on a seamless integration of state of the art IEC 61850 based control and protection Intelligent Electronic Devices (IEDs) with all relevant primary components and sensors of a modern substation.

Traditional substations have always relied on copper cables wiring together primary equipment like circuit breakers, conventional current and voltage transformers and protection relays to control of the electricity.

Interconnecting substation components with optical fiber replaces wiring them up with hundreds of individual copper cables. Not only are digital systems easier to install, they've proven to be safer, more reliable, and can reduce the quantity of copper in a substation by about 80 percent, a substantial cost saving.

As an innovative substation concept PASS can leverage digital substation features. ABB's hybrid switchgear can be equipped with Motor Drive, non-conventional instrument transformers (NCIT), and an intelligent local control cabinet for smooth integration into substation automation systems using IEC 61850, bringing the technology to continuously monitor the functions of the switchyard, whilst performing real-time simulation and diagnostics, allowing pro-active management of the life-cycle of the asset and remote service intervention.
The digital system is able to perform advanced self-diagnostic and complete circuit breaker monitoring; it embeds configurable logic needed to integrate typical local control cabinet components (e.g. interlocking) and to control auxiliary devices.

A typical high-voltage switchgear traditionally employs spring or hydraulic drives. However, given the trend towards a digital and smart grid, ABB developed a modern drive to best fit into the needs of such an intelligent grid: the Motor Drive.

Motor drive 1.4 is a digitally controlled servomotor that drives the contacts of a high-voltage circuit-breaker contacts with the highest precision, while the energy necessary to enable the operations is stored in capacitors.

The input/output (I/O) and interlocking of the PASS module are managed by electronic boards, which can be easily configured at any stage of the project.

The switchgear is equipped with an electronic local control cabinet which enables the high voltage switching bay to be operated digitally with a Human Machine Interface.

Diagnostic
Motor Drive collects and stores a wide array of data that can be downloaded and analyzed. Stored events of the circuit breaker’s activities and detailed information about the latest operations are available. Supervisor and diagnostic module of Motor Drive verifies that the system is working correctly; it continuously monitors:

- the functioning of all boards and internal supplies
- the integrity of interlocking
- the functionality of motor control chain

The auto-monitoring functionality, together with the dramatic reduction of mechanically moving parts, gives outstanding reliability, confirmed by the achievement of 30000 close/open operations.

Enabling components
Motor Drive and Intelligent local control cabinet
Following the concept of digital substations with functional integration and digital instrument transformers, ABB has developed the following technologies:

- Fiber Optic Current Sensors (FOCS), based on the Faraday effect principle, whereby light is used to deduce the precise magnitude of current that is creating the magnetic field.
- CP Sensor, based on the Rogowski coil principle and on voltage capacitive dividers for metering, protection and control accuracy in a single device.
- In case of use of traditional cast-resin type transformers, a SAM600 will be used to convert analog to digital signals and integrate it in the process bus.
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