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35kA Test Stand for Surge Current Tests

The close partnership between GvA Leistungselektronik GmbH in Mannheim and IRS Systemtechnik GmbH in Brennberg near Regensburg is currently producing very successful different versions of test benches for surge current tests.

By Erik Rehmann, Manager Marketing & Quality, GvA Leistungselektronik

The latest joint development is a test stand for surge current tests up to 35kA for the IPH Institute "Prüffeld für elektrische Hochleistungstechnik" GmbH in Berlin. IPH is part of KEMA Labs, the Testing Inspection and Certification Division of CESI S.p.A., the worldwide leading service provider of independent tests of power components with headquarters in Milan.

Especially well-known automotive suppliers increasingly use IPH's test facilities with the surge current generator to test switching elements and fuses in vehicles with high currents for several milliseconds. GvA's scope of services included the design of all electrical components, the preparation of circuit diagrams, the construction of the switch cabinets and the assembly of the entire system. The development as well as the construction of the control system of the surge current system including the measurement value acquisition and the safety concept came from IRS.

Figure 1: Not quite commonplace: the new 35kA surge current system of IPH in Berlin.

"In the partnership with IRS, both contribute a great deal of know-how, which ideally complements each other," explains GvA Managing Director Thomas Schneider. "This is added value that our clients appreciate. And if, in addition, the personal chemistry between all those involved is right, then, as in our case, a very trusting cooperation develops, which is not commonplace these days".

Reinhard Schiegl, IRS Managing Director, confirms: "With GvA, we have gained a top developer for power electronics who can also take responsibility for large complete systems. Coupled with our many years of expertise in measurement and testing technology as well as control and software solutions, this is for me a real partnership with future potential".

IPH Managing Director and KEMA Labs Division Executive Vice President Domenico Villani is excited about his new test facility: "Surge current tests up to 35kA is an impressive rating. It cannot be offered by many. The new facility further expands the opportunities for our customers and partners at the Berlin location and consolidates our market position at the cutting edge of innovative technologies. We have decided in favour of GvA and IRS due to the great experience with such competences and we are more than satisfied with the project progress".

The surge current system in detail

The system consists of a total of 14 cabinets: a control cabinet with a bi-directional DC power supply unit for charging and discharging to a maximum of 1500Vdc, a capacitor bank consisting of 10 cabinets with a total capacity of 2.0F to provide the necessary energy for a "shot", an impulse current cabinet for switching the test voltage on and off, an disconnecting cabinet for system safety and a resistance cabinet for setting the target current.

The challenge of such a surge current system is to provide a high current (up to 35kA) at a constant voltage (up to 1500Vdc) for several milliseconds. A low internal resistance and a low inductance of the system play a major role in this. If a large part of the voltage already drops within the system, the target voltage would not be present on the device under test and high overvoltages would occur when the load current is switched off. With the internal resistance of <4mΩ achieved by GvA and the system inductance of <6µH, negative effects could be reduced as much as possible.

A special feature of this system was also the requirement to be able to switch the output current not only on but also off again in a reproducible manner. On the one hand, this was required for certain tests and, on the other hand, offers the advantage of being able to repeat current pulses in extremely short cycles. Thyristors are generally the preferred semiconductor element for switching such high currents. However, due to the physical properties of a thyristor, it is not possible to switch off the current again. With the IGBT switch developed by GvA for the new surge current system, IPH is able to switch the full current of 35kA on and off several times without completely discharging the capacitor bank and converting the entire energy of the capacitor bank into heat. When switching off, high switch-off voltages are generated above the IGBTs, which are reduced by a specially developed circuit network to such an extent that they cannot pose a danger to the IGBT modules.

Furthermore, it is quite possible that a test object may fail at some point during such tests of new components. In this case the entire energy of the capacitor bank must be able to be absorbed by the sys-

tem, which is not exactly trivial due to the rather large capacitor bank. Therefore the resistor cabinet, which has resistor plates in different configurations for setting the target current, is designed to be able to absorb the complete energy in case of a failure.

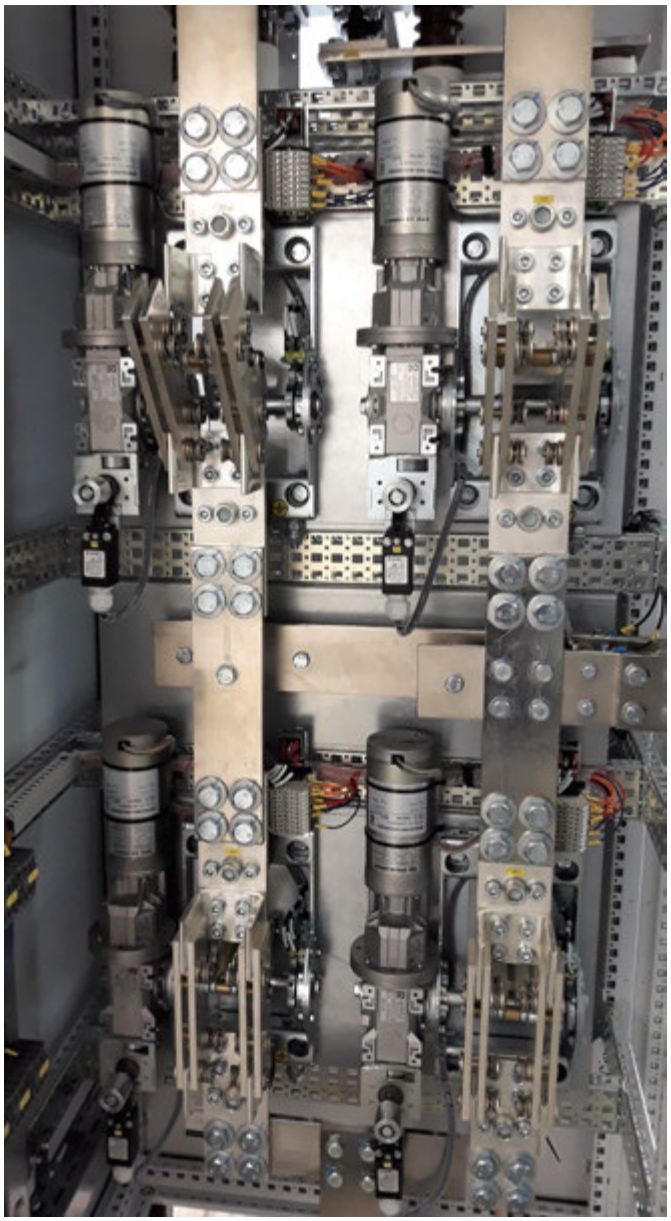

Figure 2: Four disconnectors are used for galvanic isolation of the system and grounding of the test object.

Due to the enormous energy content of the system of 2.25MWs, a special focus was placed on plant safety together with IRS. The software takes over the safety functions such as emergency discharges in case of malfunction or power failure, insulation monitoring, voltage and current monitoring as well as mechanical protection barriers and prevents incorrect operation by the operator.

This newly developed surge current test bench enables IPH and therefore the whole KEMA Labs Division of CESI SpA to contribute to further increasing the safety of future generations of electric vehicles by testing and qualifying components.

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