

Arrester Manufacturer Expands HV Business

The town of Hermsdorf in the former East Germany has a rich history in the electro-technical field, being the site of a large HV test hall which at one time included the world's very first impulse generator, developed in the 1920s by Erwin Marx.

Until recently, Hermsdorf was also home to a once huge porcelain insulator manufacturing plant founded during the late 19th century. Indeed, the first porcelain insulator used on HV lines in Germany was manufactured in this town as was the country's first porcelain long rod.

Although both these facilities have since disappeared, the electrical components tradition of this community continues today in Tridelta Surge Arresters (Tridelta), one of the surviving businesses of the former huge government-controlled Tridelta Concern. Now under new ownership, this relatively small company in the arrester industry has in recent years been establishing a growing presence in this business.

INMR visits Tridelta and reports on developments in its manufacturing and marketing of both MV and HV arresters.



Matthias. Sees core competence in HV arresters.

Hans Matthias, Tridelta's Managing Director, has several explanations for the nearly threefold increase in the firm's production of HV arresters realized over the past five years. One of these involves what he claims is a strategic cost advantage enjoyed by the firm as a result of being comparatively small as well as being located in the Eastern portion of Germany.

"If we compare ourselves against our peer group of competitors," he says, "we feel we enjoy a definite cost advantage due to our lower overhead structure. Being a relatively small company in this field also gives us greater flexibility."

Another factor behind this growth, notes Matthias, is the firm's

relatively long experience in this business, particularly in regard to HV arresters which he says make up the firm's core competence and about 80 per cent of its revenues. "Our surge arresters have a history going back some 50 years. To many customers, this is important since it shows that we have developed a profound knowledge in this field and also that our products have already demonstrated long-term field experience."

Matthias and Senior Sales Manager, Karsten Laue, also indicate that Tridelta's strategy of maintaining a strong focus on the special needs of customers has already provided concrete results in terms of sales growth. For example, they explain that arresters, particularly those for

the medium voltage range, are today increasingly perceived as somewhat of a commodity. In such a case, they point out that what really tends to distinguish one supplier from the next is good after-sales service.

Says Matthias, "we asked our sales representatives in the various countries what was most important in this case. What came out is that a supplier in this business has to be customer-oriented. Basically, customers value that they can come to their supplier to help them find the best solution."

From a technical standpoint, Matthias and Laue confirm what is increasingly a major trend in the surge arrester industry worldwide, namely the growing acceptance and even preference for polymeric housings. This transition is virtually complete at the MV range and is apparently now moving decisively in that direction within the HV range as well.

For example, Laue estimates that in 2000, some 90 per cent of Tridelta's sales of HV surge arresters involved units with porcelain housings. By 2005, this proportion had decreased to 60 per cent while, over the next several years he predicts that that the reverse will likely be true, namely that most HV arresters sold by Tridelta will be equipped with polymeric housings in place of porcelain.

Driving this trend, says Laue, is the cost advantage enjoyed especially by certain new designs of polymeric arresters in relation to classical

designs involving porcelain. Other considerations, although often of lower importance, are lower weight, improved safety and superior performance under pollution.

At the same time, Laue admits that the built-in conservatism of the utility industry and the fact that silicone-housed HV arresters have not yet demonstrated service lifetimes approaching 25 years will act to slow this changeover in technology. Another factor which he believes will influence this transition is the fact that for applications where high mechanical strength is required, the solution proposed for polymeric equivalents typically must involve tube-type designs which, for the moment at least, are still higher in price than porcelain.

Yet another consideration, notes Laue is the issue of long-term stability, which he feels may favour porcelain since it is completely resistant to any leakage of moisture into the unit through the housing.

The historical cost advantage in favour of porcelain when it comes to tube type arrester designs, however, is apparently now narrowing and may to some extent be further offset by delivery considerations. Laue and Production

Cementing flanges onto HV arrester.



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Clear trend among HV units toward composite housings.

While in 2000, some 90 per cent of Tridelta's sales of HV surge arresters involved units with porcelain housings, by 2005, this ratio had decreased to 60 per cent.

(from left) Klaube, Bauer and Laue at station for testing sealing of tube design arresters.



Manager, Dieter Bauer state that delivery times for standard porcelain housings have almost doubled during the past year, from about 3 months to 6 months - a development which is causing them growing concern, especially since they expect this trend to continue.

Generally-speaking, modern zinc oxide arresters can be grouped into one of three major categories based

on design: wrap-type units, whereby an epoxy-impregnated fabric is wound around the block assembly and then cured; cage-type units, where fiberglass rods or loops linked to the end fittings hold the blocks tightly in place; or the classical tube-type where the assembly of blocks is inserted into a hollow housing (whether porcelain or composite tube) and the space between typically filled with nitrogen and other gases.

The manufacturing of arresters at Tridelta's Hermsdorf plant is divided principally by type of design being offered, which currently consist only of the wrap and tube types. Wrap type units are for both MV and HV applications and all have polymeric housings while the tube types are for HV applications only.

The zinc oxide blocks are currently purchased from suppliers in the U.S. and Japan and, according to R&D Head, Hartmut Klaube, are purchased based mainly on quality as well as technical characteristics.

The blocks for each production lot are segregated in advance by individual order. In the case of manufacture of the MV wrap design, these blocks are then mounted into modules around which successive layers of an epoxy-impregnated glass fiber fabric are wound on specially-designed machines.

This step is followed by curing in nearby ovens, where the temperature of the wrapped units is raised in a controlled cycle to a maximum of 125° C for a duration of about four hours, including time for cooling. Once the wrapped modules exit from this step, their mechanical strength is already determined.

At the moment, no molding is performed at the Hermsdorf plant and all silicone components are purchased from an external European supplier. Silicone tubes are expanded under vacuum and the cured metal oxide cylinder is inserted while liquid silicone is injected into the interface. The special technique used to switch off the vacuum is designed to guarantee no trapped air, while the liquid silicone vulcanizes in about one day and also ensure good bonding and the absence of any voids along the interface with the module.

Next, the silicone-covered module is placed into a machine which is pre-set to install the number

of sheds to be added as well as their relative spacing along the cylinder. The machine takes the sheds, expands them mechanically and brings them to their required positions. The final step in the production process then consists of adding end fittings and hardware.

This same type of basic process also applies to the production of wrap designs of HV arresters, typically used in applications such as line arresters. The only differences are in the diameters of the blocks and thereby wrapped modules as well as the colour of the silicone material, which in the case of HV units is grey.

Manufacturing of porcelain or composite tube-housed HV arresters is performed in a separate area of the plant and involves assembly of the zinc oxide module, whose dimensions basically determine the surge handling capabilities of the unit. Once assembled, this module is inserted into the hollow housing and the air between evacuated and replaced with a mixture consisting mainly of nitrogen and a small amount of helium.

According to Klaube, Tridelta purchases its porcelains only from European sources - a policy which he says originates mainly from the demands of customers who often specify in advance which suppliers are acceptable to them. He notes, for example, that customers even located in developing countries will often insist that the porcelains come only from these approved suppliers, especially as the voltages exceed 220 kV.

One of the key variables in the case of porcelain housings is that the surfaces at both ends have no tiny cracks or any roughness whatsoever. To demonstrate how important this requirement is, Klaube remarks that even a tiny

Cured moules (foreground) inserted into silicone tubes under vacuum.



Machine allows for flexibility in determining number and spacing of sheds along the arrester.



Installation of end fittings onto MV wrapped type arresters.

Zinc oxide block assembly and epoxy-impregnated wrap (background).



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hair placed onto these surfaces prior to sealing the porcelain can eventually result in leakage of the helium gas inserted into the inner space between module and housing.

Klaube and Bauer emphasize that sealing is one of the most important technical considerations during production of tube type arrester designs and that Tridelta still uses the improved sealing system

developed at the factory during the late 1970s. Once sealed, every single unit is tested under vacuum to detect the presence of any escaping helium.

The production of tube-type arresters is basically similar for both porcelain and composite-housed designs with the exception that cementing is performed only in the case of porcelain. Composite tubes are supplied with flanges already in place using an epoxy gluing method at the supplier's factory and all that needs to be done is to attach any additional connecting hardware using screws.

The Tridelta facility is equipped with its own HV test hall where most of the required testing as per IEC requirements can be performed. These include lightning and switching impulse tests as well as dielectric testing. There is also an area where 1000-hour



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Sealed arrester placed into vacuum chamber to detect presence of any escaped helium gas.

accelerated ageing tests are conducted on all purchased zinc oxide blocks. This includes power loss, operating duty and long wave testing.

Given the growing proportion of its business which involves units having polymeric housings, Tridelta has invested in quite a sophisticated research laboratory where it conducts its own 5000-hour accelerated ageing cycle on silicone-housed arresters.

Klaube explains that all required performance parameters, such as leakage current and resistance to tracking, are being recorded on a daily basis as the test unit is successively exposed to conditions of dry heat, moisture, salt fog and UV. Says Klaube, "while we are not really required to do this type of research in-house, we see it as a way to show customers that we have a good understanding of how our arresters will perform under different types of service conditions.

Laue also notes that part of the firm's basic philosophy today is to perform as many tests as possible internally so as to better appreciate exactly how their products will perform in the field. "When we bring customers to our factory," he says, "they can see that we know what we are talking about. They like to see that we do not just assemble the arresters but also have actual test experience for both blocks and housings."

In terms of future developments, Tridelta has recently purchased equipment to be used in production of its next generation of arresters. These investments are part of ongoing work aimed at expanding the range and also possibly modifying the process by which these products are manufactured in Hermsdorf.

Today, with growing competition in this sector coming from countries with low labour costs, Tridelta management appear quite confident both in their current production set-up and in their ability to remain

competitive, especially in term of the HV end of this business. They note that the firm has successfully type-tested arresters up to 800 kV and already supplied units up to 550 kV. "Some firms are re-locating production to China," acknowledges Matthias, "and of course we see this trend. But, more and more we hear customers asking: *where is my technical counterpart here?* Basically, they still want to have someone they can talk to, especially when it comes to arresters which will find application at high voltages." ☒

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Key parameters measured (inset) as 24 kV arrester undergoes 5000-hour accelerated ageing.