



Applications for Galfan galvanised wire-ropes in the Gottlieb Daimler stadium in Stuttgart and at the Nuage Léger (Grande Arche) in Paris



Long-term experience with Galfan

Review of 20 years experience with this improved corrosion protection for steel wires

Almost 20 years after the idea arose of transferring the so-called Galfan method (patent ILZRO, Zn/5% Al alloy) from wide strip to steel wire, a retrospective review of the success of wire coating using this alloying system is appropriate. In this context, the long-term experience is particularly interesting.

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After thorough preliminary investigations and discussions with the International Lead Zinc Research Organisation (ILZRO) in North Carolina, USA, and the Centre de Recherches Metalurgique (CRM) in Liège, Belgium, the University of Wuppertal (Institute for Materials and Corrosion Protection), together with TrefilArbed Bissen, Luxembourg (now a part of the Arcelor Group), began initial tests on an investigation installation. In contrast to wide strip (Sendzimir method), the attempts to apply Galfan coatings by a single dip in a Zn/5% Al bath failed in the case of wire, because no suitable flux was available.

A second immersion produced the breakthrough

A production plant was built which, by immersing the wire in a zinc bath and

subsequently in a Zn/5% Al bath, permitted the satisfactory generation of thick, adhesive and corrosion-resistant Zn/5% Al coatings. The method developed by the author was given the designation "double-dip" method [1] (trademark of the TrefilArbed Bissen: Crapal). The method was ready for production in 1984 for low-carbon steels and was soon also adopted by Drahtwerk Köln for high-carbon steels.

The "double-dip" method produced a breakthrough – perfect quality, heavy coatings (50 – 60 microns) and excellent adhesion of the Zn/5% Al coating, together with substantially improved corrosion protection.

Various publications demonstrate the advantages of, and the scientific basis for, the Zn/5% Al alloys [1, 2, 3]. The corrosion mechanism of Zn Al coatings was

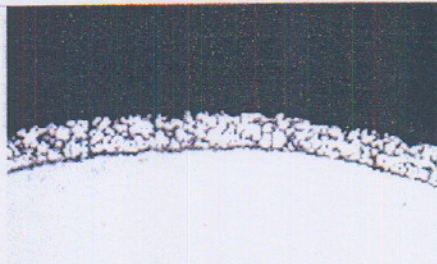
investigated for the first time and the particularly important diffusion processes during Galfan galvanising were recognised and described [4, 5].

The substantially improved corrosion protection, as compared with a pure zinc coating, was recognised right from the beginning of production. In this connection, reference may be made to numerous short-term corrosion investigations at various institutes throughout the world [6, 7, 8]. For example, the salt spray test and the Kesternich (SO₂) test both show approximately three-times higher life for Zn/5% Al alloys as compared with pure zinc. For this reason, TrefilArbed Bissen in Luxembourg was giving a triple life guarantee for Galfan wires, as compared with heavy-galvanised wires, under the same conditions.

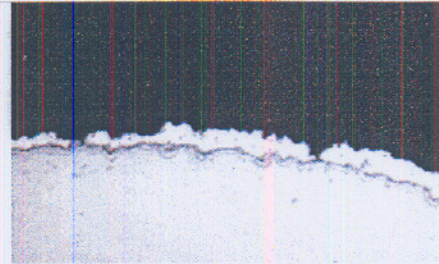
Long-term investigations in a vineyard

In the meantime, long-term investigations of zinc and Zn/5% Al surfaces have been evaluated after 10 and 14 years. The wires were installed in 1985 in a vineyard near Würzburg, Germany, for a long-term comparison.

The results were astonishing. In comparison with zinc coatings of the same thickness, the Galfan coatings behave substantially better in these long-term tests than the short-term corrosion tests would suggest. Another noteworthy feature, however, is the uniformity and smoothness of the Galfan coating. In the case of the pure zinc coating, on the other hand, an extremely uneven corrosive attack is found. In consequence, the heavy-galvanised wire already exhibits red rust locally after 14 years, even though there was still 100g/m² of residual zinc present. In the case of a Galfan coating, short-term investigations would suggest initial red rust only at a residual coating of approximately 20g/m². Because of the substantially better results during the long-term tests, the TrefilArbed Bissen life guarantee for Galfan was increased to four times as



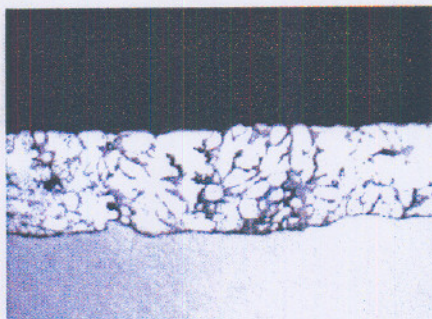
Galfan after 10 years (magnification 200)



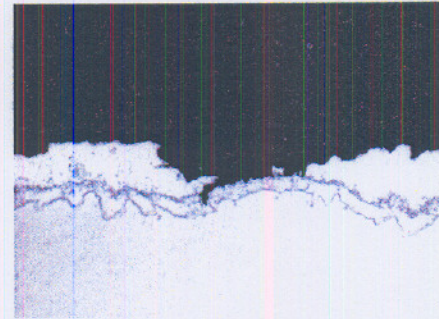
Heavy galvanising after 10 years (magnification 200)

Residual coating and loss of mass after 10 and 14 years of weathering

	Initial coating 1985	Residual coating 1994	Residual coating 1999	Loss of mass after 9 years	Loss of mass after 14 years
Galfan	330g/m ²	300g/m ²	275g/m ²	30 g/m ²	55g/m ²
Heavy galvanising	330g/m ²	190g/m ²	99g/m ²	140g/m ²	221g/m ²



Galfan after 14 years (magnification 500)



Heavy galvanising after 14 years (magnification 500)

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compared with a zinc coating of the same thickness.

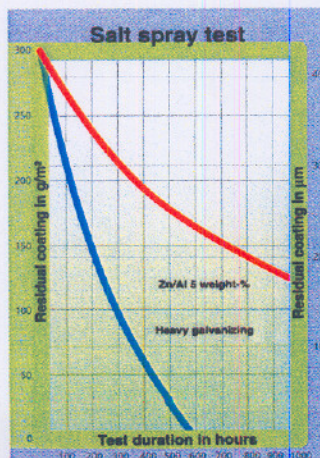
Wide spectrum of applications

The use of Galfan products has been continuously extended in the intervening period. As an example, approximately 70% of the total galvanisation produc-

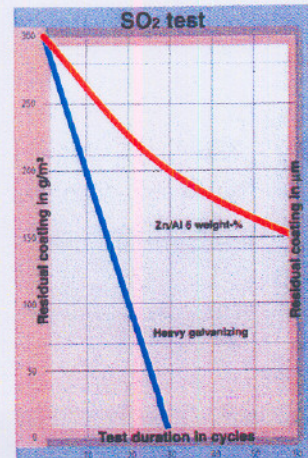
tion at TrefilArbed in Bissen is currently effected in Galfan type quality.

The use of Galfan wires encompasses more and more new applications. There is a particular demand for spot-welded mesh material because, in contrast to a zinc coating, the weld locations do not rust in the case of Galfan wires. The for-

Salt spray test according to DIN 50 021 and ASTM - B 117



SO₂ atmosphere according to DIN 50 018



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With welding the corrosion protection is maintained: Advantageous when welded mesh material is employed in greenhouses and gabions.

mation of Fe/Al layers within the steel has been recognised as the reason for this [9].

Some illustrations show, as examples, the wide application fields of Galfan products. After almost 20 years of Galfan production, it may be expected that Zn/5% Al coatings will displace zinc coatings on steel wire in the medium-term.

The process has, in the meantime, also been employed in the case of wide strip ("double-dip" quality from the Agozal company). In this case also, the Galfan double-dip strip with its thick coatings, excellent adhesion and very good workability will probably replace Sendzimir galvanised and Galfan single-dip strip for components endangered by corrosion. Particularly where wire and strip are combined (for example greenhouses, among other applications), a thick Galfan coating is absolutely necessary for all the structural parts.

Summarising, it can be stated that the high level of expectation for the new and improved corrosion protection for steel wires has, after twenty years, been more than fully satisfied.

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The use as wire in the vineyard served as the basis for long-term corrosion tests.

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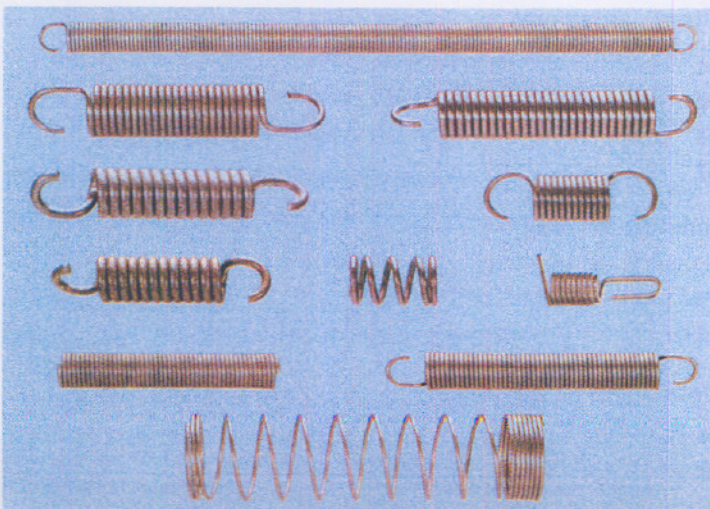
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Galfan coated wires are also used in spring production.