

RUBBER BELLOWS USE HISTORY LIFE CYCLE ON PUMPS & HEVAC PLANT

SUPAFLEX AGENCIES

I first got involved in Building Services Engineering in 1969, after firstly working at Bechtel in the Petrochemical industry, then in M&E Contracting and for a short while with M&E Consultants. At the end of 1974 beginning of 1975 I joined the Tube Investments Engineering Group (Powerflex Division) near Finsbury Park North London dealing with all aspects of rubber and metallic bellows application engineering for London and the South East and also International Projects. After more than 5 decades doing this, very few, if anyone, can match my back history. The early use of rubber bellows in Building Services Engineering in the 1960's had consisted of Neoprene bodied units with a steel wire reinforcing in the collar and Nylon Cord Reinforcing in the body. The life cycle of Neoprene at 80 or 80 + degrees C constant temperature flow was quite poor, not so bad on CHW F&R at 6/12 Centigrade.

The introduction, during the late 60's and early 70's, of bellows using EPDM (Ethylene Propylene Diene Monomer), a synthetic rubber, with Nylon Reinforced bodies was much better on LPHW. In the prominent days of Engineering Appliances Ltd. Val Westermann who'd founded it in the 50's thought up the bright idea of EPDM on LPHW and Neoprene (being cheaper) on CHW. This turned out to be a disaster, with fitters mixing them up and getting the Neoprene on LPHW and EPDM on CHW. Fortunately, it did not last very long. With EPDM with nylon reinforcing on LPHW the nylon goes brittle with age, but so does the EPDM. Neoprene above 70 C CT is likely to fail very quickly. Neither the TI Group or Engineering Appliances exist today.

When the HEVAC Exhibitions moved from London to the then new NEC Birmingham in 1976 Val Westermann was filled with excitement to show the new EPDM Rubber Bellows with Steel Cord reinforcing in the body only to find that TI Powerflex were also introducing the Elaflex EPDM Rotex Double Red Band Steel Cord Reinforced unit at the same time. These were produced by Continental but marketed under other German Brand names, not under Continental's own brand name. Most will be aware from vehicle tyres that Continental is Europe's biggest producer. With the development of Aramid Fibre use (better known as Kevlar - the Trade Name of the Dupont Company) the Double Red Band was changed over to Aramid Fibre (Kevlar) reinforcing for 25 years or more. Continental's R&D found how much stronger Kevlar is, it has greater life cycle than any other. So, the steel cord EPDM was dropped in favour of Kevlar. I have been involved with the complete replacement of all rubber bellows to High Grade units on some very well-known

buildings - THE LIVER BUILDING LIVERPOOL - WELLCOME FOUNDATION HEADQUARTERS IN EUSTON RD LONDON - PART OF THE ROYAL VICTORIA HOSPITAL BELFAST and THE BANK OF ENGLAND. All of these buildings suffered immense damage to plant, equipment and building fabric when Nylon Reinforced EPDM Bellows failed without warning. On the Wellcome HQ even a few steel cord reinforced units were removed and replaced with Kevlar reinforced. The Client insisted on the use of Kevlar. Some UK Consulting Engineers refer to the DIN 4809 Spec. Only the Steel Cord Reinforced and most certainly the Kevlar Reinforced comply with this standard.

You can still purchase steel cord EPDM reinforced Rubber Bellows today from a few sources only, a couple of German and one French - the German units being more readily available. They still work, with just a warning leak but do not burst fail. R&D work at Continental on Steel Cord Bodied EPDM Bellows, also as a result of failures in the field, found that it gradually breaks and frets through the EPDM body of the bellows.

Today the latest material used Polyester Ether Ketone (PEEK) has replaced the use of Aramid Fibre (Kevlar) this just shows tiny leak signs when the EPDM body starts to age and deteriorate. Many clients and their FM contractors do not pick up on the fact early enough that the bellows on their pumps and plants are too old and the consequences of failure can be very very expensive.

ARAMID FIBRE (KEVLAR)

Aramid Fibre (Kevlar) was discovered by Stephanie Kwolek, a Chemist, the daughter of a Hungarian couple who had emigrated to the USA. Working for the Dupont Company in their laboratories in the USA in the mid 1960's, she discovered its merits and the Dupont Company owns the tradename Kevlar. Eventually, it was used Worldwide in Military and Police bullet proof vests, Space Suits, the Concorde's fuel tanks, after the fatal Air France crash, also in EPDM Rubber Bellows and many other options. Stephanie Kwolek died in her early 90's in 2014, leaving a great legacy

behind, so you can no longer ask her about it.

STEPHANIE KWOLEK

- Stephanie Kwolek was an American chemist, whose career at DuPont company covered over 40 years
- Inventor of Kevlar 1965
- Born July 31st 1923
- Died June 18, 2014
- Carnegie Mellon College of Engineering...
- Awarded with National Medal of Technology and Innovation, Perkin Medal

HIGH TEMPERATURE & PRESSURE REINFORCED - 25 bar WP @ 80 C, 15 bar @ 120 C and 10 bar @ 130 C are also available for the out of the ordinary application

Other Polymers are also available for many applications including oils, food and potable water. To prevent your clients suffering the kind of FM nightmare as some of the buildings mentioned above) always specify Hugh Grade reinforced bellows on LPHW in particular.

LATEST TECHNOLOGY PEEK

Most producers of high-grade rubber bellows now use this body reinforcing which like Aramid Fibre (Kevlar) conforms to the requirements of DIN 4809. This is a piece of British innovation, a material called PEEK (Polyester Ether Ketone). This was developed originally back in the days of Imperial Chemical Industries (ICI). If Sir John Harvey Jones (Former Chairman/Chief Executive of ICI) was alive today, he would be highly delighted. Sir John, who died in 2008, once famously, told Morgan Cars that they were doing it all wrong. PEEK is produced in Britain today, with a vast percentage of the production going to Export for many applications in a variety of different industries.

PROBLEMS IN THE LAST 40 YEARS WITH FAILURES

In the 1980's and to the present day an ever increasing number of poorly produced rubber bellows have been entering Britain from the Far East (Mainly China) by Merchants. They come under no QA control whatsoever, may not even be made from EPDM and at best just nylon reinforced. DIN4809 Standards are Tested by TUV SUD – they would have no chance of meeting this. A DIN4809 tested unit has an expected life cycle of a minimum of 10 years.

In December 2018 a serious incident occurred with a Chinese made unit being used way over temperature (100 c +) bursting and flashing to steam over a young fitter, seriously injuring him. He was lucky not to have been killed. In March 2021 on a CT Heating pump at a USAF/RAF Military base one split splashing LPHW over a fitter. In September 2021 there is now a Defence Infrastructure Organisation (DIO) safety alert.

The HSE, BSI, CIBSE, BSRIA, BESA plus DIN STANDARDS and TUV SUD in Germany are all aware of this. Currently there is still no BS Standard matching DIN4809. Clients are footing the bill for the short life and damage these units cause.

For those old enough to remember the Flixborough Disaster of 1974 it took 7 years for the BSI to introduce a Metallic Bellows Standard.