

# Fuse Recycling in Germany supports research and education in the field of electrical power distribution

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## Abstract

Verein zur Förderung des umweltgerechten Recycling von abgeschalteten NH/HH-Sicherungseinsätzen e.V. (Association for the promotion of environmentally-compatible recycling of disused LV HRC/HV HRC fuse-links)

The association is officially accredited as a non-profit association. It was founded in 1995 and since then the association is busy with the recycling of LV and HV HRC fuse-links in Germany and that on a non-profit basis. The association was founded by fuse manufacturers with the aim to return utilizable raw materials from LV and HV fuse links to the cycle of resources again. In addition the target is, that only those fuses will be produced in future, which can be recycled without any problems.

LV and HV HRC fuses are collected in Euro grid box pallets (GBP) and smelted down in a copper converter. Compared with disassembling or shredding of fuses, the smelting procedure offers the most environment-friendly way of recycling. Material, which could cause troubles, for example like asbestos, are gathered in the slag.

The system has proved itself for more than 15 years and is running in German utilities and big industrial companies.

From the start of the association till today around 410 tons of copper and around 5 tons of silver had been recycled. As a result, it was possible to save approximately more than 43.000 tons crude ore. And we disburdened the world by tons of CO<sub>2</sub>.

Our recycling system is user-friendly as well as free of charge. The recycling system and the logistics are financed by the sales of copper and silver.

Surplus is sponsored for the engineering research in the field of fuse links carried out at universities and colleges. So there will be different topics presented at ICEFA 2011 have been sponsored and supported by our association, such as:

- Theoretical and experimental investigation of fault currents to be interrupted by PV fuses
- The influence of fuses on arcing fault energy and personnel protective clothing required
- The influence of current frequencies up to 1.000 Hz on power dissipation and time-current-characteristics of NH fuse-links

Additionally and as a new and future aim of our association universities and colleges will be sponsored encouraging the education of electrical engineers in Germany. Those engineers are the future guarantors for save and efficient power distribution systems including high-sophisticated modules as photovoltaic and wind power plants, smart grids, DC-networks and so on. Those engineers will safe the future application of fuses in a wide range of applications.

We want to close the gap of missing engineers in the field of electrical power distribution and we improve the general conditions by financial and professional support.

The adoption of the European Directive and Environment Regulations such as WEEE, ROHS and EuP have effects on the fuse-link industry. Our association offers the most practicable and efficient return system of the world.

**Keywords:** NH-HRC-Fuses, HH-HRC-Fuses, Low Voltage and high Voltage Fuses Recycling, NH/HH-Recycling, European Directive, WEEE, ROHS, EuP, Association for the promotion of environmentally-compatible recycling of disused LV HRC/HV HRC fuse-links, Application of Fuses.

*The association NH-HH-Recycling e.V. is officially accredited as a non-profit association. It was founded in 1995 and since then the association is busy with the recycling of LV and HV HRC fuse-links in Germany and that on a non-profit basis.*

*The association was founded by German fuse manufacturers with the aim to return utilizable raw materials from LV and HV fuse links to the cycle of resources again.*

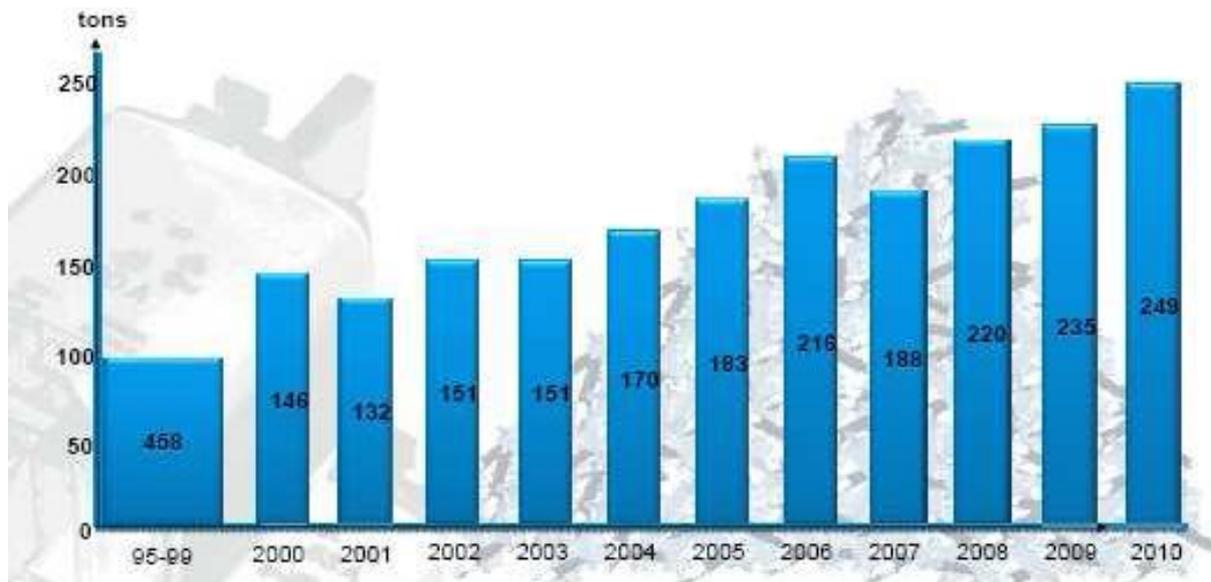
*In addition, the target is that only those fuses will be produced in future, which can be recycled without any problems.*

*Surplus is sponsored for the engineering research in the field of fuse links and their application carried out at universities and colleges.*

The task of the Verein zur Förderung des umweltgerechten Recycling von abgeschalteten NH/HH-Sicherungseinsätzen e.V. is to process the various materials of which fuse links are made so that they can be returned to the cycle of manufacture for further use. Those materials are much too valuable for putting into normal waste. In 2010, for example, our association collected and recycled 249 tons of fuses.

From the start of the association till today around 410 tons of copper and around 5 tons of silver had been recycled. As a result, it was possible to save approximately more than 43.000 tons crude ore. And we disburdened the world by tons of CO<sub>2</sub>.

Next figure shows the collected tons of LV and HV fuses over the years. It illustrates the steady increasing acceptance of our recycling system.



**Fuses include valuable materials**

Fig. 1 shows a cross section through an LV HRC fuse link and lists the other materials used in its construction; similarly Fig. 2 illustrates an HV HRC fuse link.

**Structure of an HV HCR fuse link**

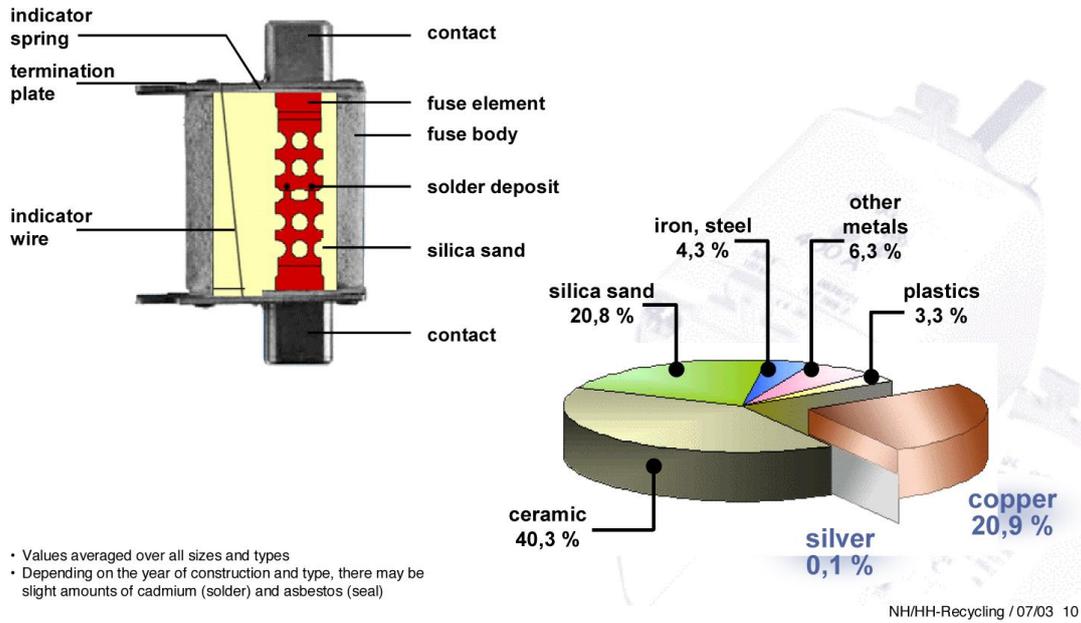


Fig. 1

**Structure of an LV HRC fuse link**

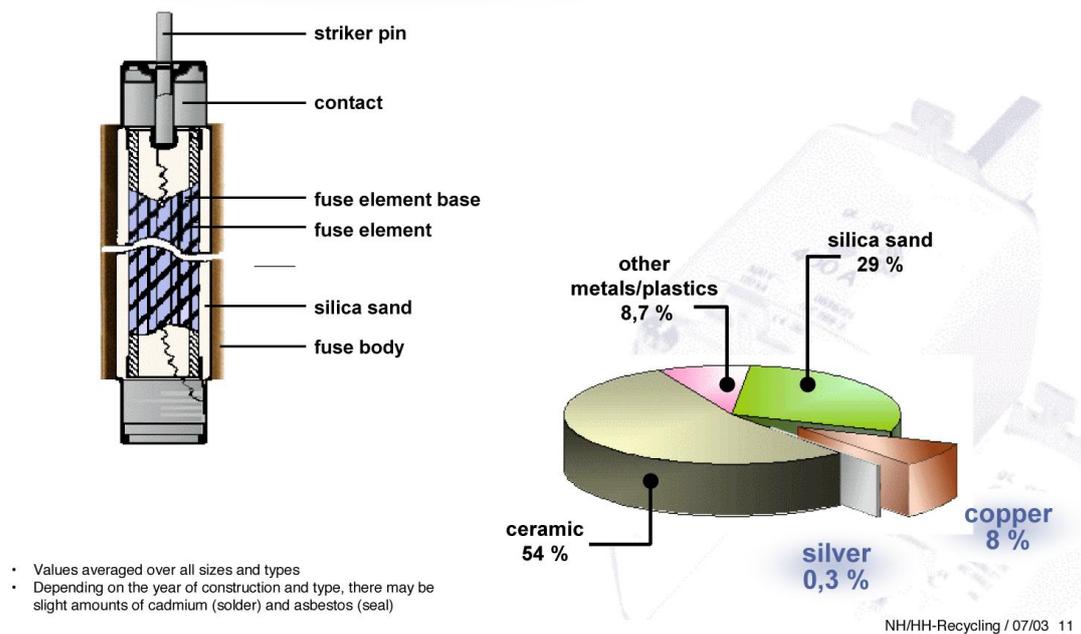


Fig. 2

## Our successful fuse recycling system is user-friendly and free of charge

LV and HV HRC fuses are collected in Euro grid box pallets (GBP) and transported to a collection place (buffer store) organized by our association. The collecting customer has to send a telefax or an e-mail to our office. That's all. The rest is organized by our logistic partner. He picks up the box pallets with fuses and delivers empty ones. The collected fuses are smelted down in a copper converter without any preprocessing.



Our partner AURUBIS AG in Hamburg, one of the leading copper producers worldwide and the biggest one in Europe provides us easy handling and optimum conditions for our fuse recycling process. AURUBIS produces row copper from the copper converter and copper of highest purity in an electrolyze process.



Beside the valuable components copper and silver from the ceramic and the quartz sand of the fuses we get slag which can be used in street and dike construction.

Compared with disassembling or shredding of fuses, the smelting procedure offers the safest and

most environment-friendly way of recycling. Materials which could cause troubles, for example like asbestos, are gathered in the slag. The strict rules that apply when working with asbestos make disassembly a complex and costly process - as also is shredding or processing by pan grinder (a crushing process producing coarser results than a shredder) with subsequent melting down in the blast furnace.

Our recycling system has proved oneself for more than 15 years and is running successful in German power utilities and big industrial companies. Currently, in total we have 455 collecting places in Germany.

Following only a few of our collecting customers:

VORWEG GEHEN

e-on | Bayern

EnBW

VATTENFALL

ABB



VDE

Mainova

For small collectors who are not able to fill a complete Euro grid box pallet (GBP) we are able to provide so called "open" collecting places on request.

The association is financing the recycling-system and the logistics by the sales of copper and silver from the recycled fuses. For the collecting customers our recycling system is user-friendly as well free of charge.

### Research benefits from the surplus

Surplus is sponsored for the engineering research in the field of fuse links and their application carried out at universities and colleges. So there will be different topics presented at ICEFA 2011 have been sponsored and supported by our association, such as:

1. Theoretical and experimental investigation of fault currents to be interrupted by PV fuses
2. The influence of fuses on arcing fault energy and personnel protective clothing required
3. The influence of current frequencies up to 1.000 Hz on power dissipation and time-current characteristics of NH fuse-links

### Our new aim – to support education of electrical engineers

Additionally and as a new and future aim of our association universities and colleges will be sponsored encouraging the education of electrical engineers in Germany.



Those engineers are the future guarantors for save and efficient power distribution systems including high-sophisticated modules as photovoltaic and wind power plants, smart grids, DC-networks and so on. Those engineers will safe the future application of fuses in a wide range of applications.

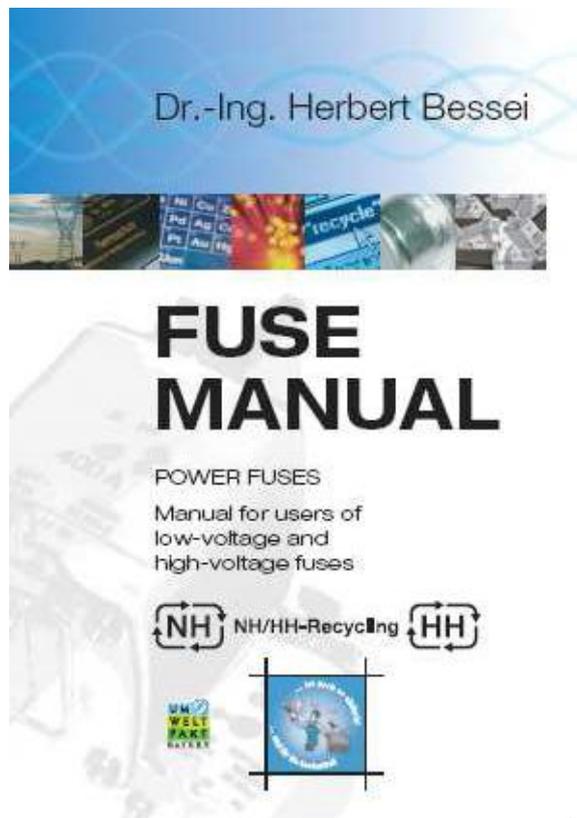
We want to close the gap of missing engineers in the field of electrical power distribution and we improve the general conditions by financial and professional support.

How does it work? Universities and colleges are asked to show their research and educational structure, their actual and future activities and their concept or roadmap in a letter of intent. This letter of intent can be downloaded by everybody in German language from our homepage [nh-hh-recycling.de](http://nh-hh-recycling.de) under chapter Förderungen, key word Absichtserklärung.

After receipt of the letter of intent our association will check and evaluate the concept and decide the financial support paid in form of a donation. The donated money can be used to buy hardware, equipment or software, to finance R&D projects and to finance a dissertation, a practical or a student by a stipend.

Our main interest is to support those who are working in the field of fuses, fuse-switches and their applications which of course is a wide field from standard power distribution topics to special things as DC networks, photovoltaic, e-cars, high-frequency applications or reactive current compensation.

Professional support is given on demand, independent from the financial support: we provide information about fuses in form of a powerpoint presentation, further special data or samples can be given on request. Our fuse manual is available in four languages now. In Future we will offer it in nine languages.



### European Directives and Environment Regulations

The adoption of the European Directives and Environment Regulations such as WEEE, RoHS and EuP have effects on the fuse-link industry.

The WEEE – Directive, it stands for “Waste electrical and electronic equipment” which became into force in August 2004 is the core of a taking back and recycling system. The countries have to install a collection and take back system free of charge for consumers that ensure the return of the electronic equipment from August 2005. For fuses, WEEE does not require recycling systems. Our fuse-recycling system is offering a user-friendly solution on a voluntary base.

The “Restriction of use of certain hazardous substances in electrical and electronic equipment,” (RoHS) became into force in August 2004, valid in July 2006. For fuses the equipment RoHS category 9 “monitoring and control instruments” is relevant. Today, the category 9 is exempted from RoHS, but the reviews every 4 years may lead to the cancellation of all exemptions. European fuse-producers offer RoHS-conform products on a voluntary base.

The EuP directive (2009/125/EC) is requiring energy-friendly products.

Our association offers the most practicable and efficient recycling system of the world and provides excellent conditions to improve and support the application of fuses in the different markets. Our products and our recycling system comply with all European Directives and Environment Regulations.

### For the sake of environment and natural resources

... and we are always one step ahead the directives and regulations. This demonstrates the increased awareness of the members of our association but also of our collecting customers concerning the matters of environment and natural resources.

And we hope that more and more people in other countries are going to establish similar recycling systems. BENELUX and UK just did it.

Our association gave support in the starting phase of implementation and thus makes us proud.



Ask us if you are interested to get more information.

[www.nh-hh-recycling.de](http://www.nh-hh-recycling.de)



2011

**9th INTERNATIONAL CONFERENCE  
ON ELECTRICAL FUSES AND THEIR APPLICATIONS**

**A STUDY OF CHALLENGES FOR FUSE LINK  
PROTECTION IN THE NEW GENERATIONS OF  
ENVIRONMENTALLY FRIENDLY VEHICLES**

**Craig Rice, Nigel Nurse, Steffie Cheong**