A New Lighting Experience

Energy-Efficient Street Lighting with VS Components

Vossloh-Schwabe Solutions for EuP Directive

Saving the Planet, Reducing Costs – Sustainable Energy Efficiency with Vossloh-Schwabe

Climate changes resulting from the CO_2 emitted by burning fossil fuels pose a major challenge for the planet.

The lighting solutions provided by Vossloh-Schwabe ensure that local authorities everywhere can save energy, achieve sustainable cost reductions and at the same time make a valuable contribution to reducing CO_2 output.

As a result of street lighting having become such a design feature of cityscapes in recent years, the volume of urban lighting has increased, but also the associated energy requirements. More importantly, though: existing facilities, operating components and the underlying lamp technology are outdated.

Many street lighting facilities are outdated and are therefore highly inefficient.

This not only results in higher energy requirements, but also more maintenance work and higher investment costs. All this adds up to street lighting accounting for approx. 30–50% of the entire power consumption recorded by municipal and other types of local authority – which amounts to a huge cost factor for public budgets to cover.

Using various lighting situations as examples, energy savings of 30–50% can be achieved if efficient technology is used in the right place.

The European Union's new EuP Directive also demands that considerably more efficient use be made of energy. Vossloh-Schwabe is supporting the implementation of this directive with efficient components for street and facility lighting.

Expected Energy Savings Potential in EU-27

Annual Energy Savings Potential*				
Area of Application	Million KWh	Billion Euro***	Euro/KWh***	CO_2 (Million Tons)**
Home Lighting	62.2	12.4	0.20	23
Office Lighting	21.6	2.2	0.10	8
Industrial Lighting	21.6	2.2	0.10	8
Street Lighting	9.5	0.9	0.10	3.5
Total	**114.9**	**17.7**	**–**	**42.5**

* According to a conservative estimate, these figures are expected for EU-27 among industrial companies when all lighting systems are converted to provide energy-efficient lighting.

** The conversion is carried out according to data provided by the International Energy Agency (0.37kg CO_2/KWh) – CO_2 Emissions From Fuel Combustion (2006 Edition) – II. 61.

*** Assumed average values for price per KWh

Clever and Efficient Use of Light – European Directives and their Meaning

European Directives for Energy-Efficient Lighting

Product Level	Existing Systems	New Buildings or Refurbishments
EuP Directive	**ES Directive**	**EPB Directive**
General Lighting Part 1: Light Sources Part 2: Directional Lighting and Luminaires	National Energy Action Plan of the Member States (NEAP – ROMS)	EPB Directive National Requirements Germany: Energy Saving Ordinance (EnEV), Meseberg Decision –30%
General Service Lighting (excluding residential lighting) [Tertiary Lighting]		

EuP specifies requirements regarding the eco-compliant design of energy-using products.

Also known as the eco-design directive, "2005/32/EC Energy using Products Directive (EuPD)" lays down eco-design requirements for energy-using products. The directive covers the entire product cycle including production, transport, scrapping and recycling. In Germany, the directive was enacted by the Energy Using Products Act (EBPG), which took effect on 6 March 2008.

The EuP Directive includes implementing measures for lighting that define energy-efficiency requirements for lamps, ballasts and luminaires.

The above chart shows the applicability of the "General Lighting Part 1 (non-directional lighting) and Part 2 (directional lighting)" and the "Tertiary Lighting" implementing measures. All kinds of lighting system involving fluorescent and high-pressure discharge lamps (for office space, industrial facilities, street lighting, hotels and shops etc.) are covered.

The implementing measures governing "Tertiary Lighting" specify requirements for lamps and ballasts as well as fundamental requirements for luminaires. These measures lay down provisions concerning obligations to provide energy-efficiency information in three steps. Minimum energy efficiency is laid down in lm/W for the various lamp types. For ballasts (magnetic and electronic), minimum energy efficiency depends on the specific lamp type (output-to-power intake ratio).

Energy efficiency classes are converted into minimum energy efficiency requirements for magnetic and electronic ballasts.

Timeline – "Tertiary Lighting" Implementing Measures for Ballasts

Early 2009: the implementing measures will take effect 20 days after publication in the Official Journal of the European Union.

	Step One as of 2010	**Step Two** as of 2012	**Step Three** as of 2017
Luminaires	• Obligation to provide information about the energy efficiency of the components used (lamps, ballasts etc.). • The sum of standby losses of a luminaire must not exceed the sum value of the ballasts used. (Example: a luminaire with two ballasts must not exceed a value of 2 Watt.)	• Luminaires must be constructed in such a way as to also enable the use of third-step ballasts, i.e. luminaires basically have to be retailed for operation with all types of ballast. Luminaires with a protection class of ≥ IP4X are exempt; in this case, the third ballast step will not yet have to be taken into consideration. • The sum of standby losses of a luminaire must not exceed the sum value of the ballasts used.	• Luminaires must be equipped with third-step ballasts.
Ballasts for Discharge Lamps	• No special requirements yet.	• Introduction of minimum energy efficiency and power loss requirements as are already found in good ballasts today. • Requirement to label ballasts with minimum energy efficiency levels.	• Improvement of minimum energy efficiency values. See yellow box on the right (all ballast technologies are allowed).
Ballasts for Fluorescent Lamps	• EEI labelling provisions based on minimum energy efficiency levels; these will be calculated in accordance with the specifications of the max. permissible total power input values found in the CELMA EEI Tables. • Minimum energy classification EEI = B2 (minimum energy efficiency) • Minimum energy classification EEI = A3 (minimum energy efficiency) for ballasts used with new lamp systems. • Standby losses of ballasts must not exceed a value of 1 Watt per ballast.	• Standby losses of ballasts must not exceed a value of 0.5 Watt per ballast.	• Introduction of minimum energy efficiency requirements in accordance with calculation formulae dependent on the lamp rating (all ballast technologies are allowed). • The need for labelling with CELMA EEI classes will be removed because only one limiting value will have to be complied with. • The calculated max. permissible value will constitute the minimum energy efficiency level of a ballast that must be observed and will not be specific to any particular ballast technology, i.e. a magnetic ballast can be used if it meets the requirements. The requirements can, however, only be met by magnetic ballasts given higher lamp ratings (> 30 W). The power loss of this ballast type will roughly correspond to the values typical of today's EEI = B1 classification.

Minimum energy efficiency requirements for ballasts used with third-step high-pressure discharge lamps as of 2017

Nominal Lamp Output	Minimum Energy Efficiency of the Ballast
< 30 W	78%
≥ 30 ≤ 75 W	85%
> 75 ≤ 105 W	87%
> 105 ≤ 405 W	90%
> 405 W	92%

40% Energy Savings – Made Easy by VS

With lessons learned from the first oil crisis in the 1970s, Vossloh-Schwabe already began developing low-loss ballasts for fluorescent lamps 30 years ago. The company numbers among the pioneers of energy-efficient lighting solutions – then and above all now.

VS is a pioneer – but not just when it comes to developing energy-efficient lighting solutions.

This unique tradition was continued in the form of consistent technological enhancements in the fields of magnetic ballasts for high-pressure discharge lamps and fluorescent lamps, which has resulted in numerous variations of the most diverse components for all manner of applications.

In addition, power reduction technology was presented for the field of high-pressure discharge lamps, which is particularly useful for reducing the output of street lighting during off-peak times and thus promises to yield further substantial savings potential.

Considerable savings potential can be achieved by reducing the output of street lighting, for instance during off-peak times.

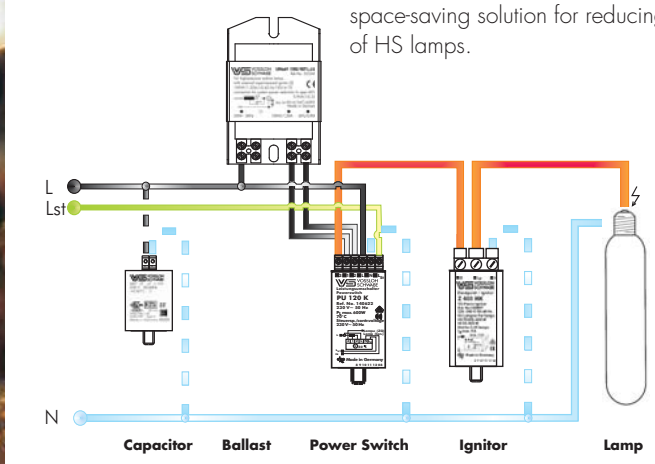
Replacing mercury vapour lamps (HM) with high-pressure sodium lamps (HS) in existing lighting systems provides an effective solution for saving energy since HS lamps require far less energy due to their much higher luminous efficiency.
As a result, energy savings of 30–40% can be attained.

Cleverly Reducing Output – For All the Light You Need

Vossloh-Schwabe provides an impressive range of power reduction products that function by increasing the ballast's impedance value within an extremely narrow tolerance range that is achieved by individually adjusting each air gap during the production process.

Increasing impedance results in a reduction of the lamp current at unchanging supply voltage. It is therefore guaranteed that the re-ignition voltage is high enough to not allow the lamp to go out – always under observation of the given lamp manufacturer's specifications. This VS system has been approved by leading lamp manufacturers.

Having ensured power reduction functionality for many years, Vossloh-Schwabe provides all required components, perfectly matched and of the highest quality: magnetic ballasts, power reduction switches, ignitors and capacitors. VS ignitors with an integrated power reduction switch are a further space-saving solution for reducing the output of HS lamps.

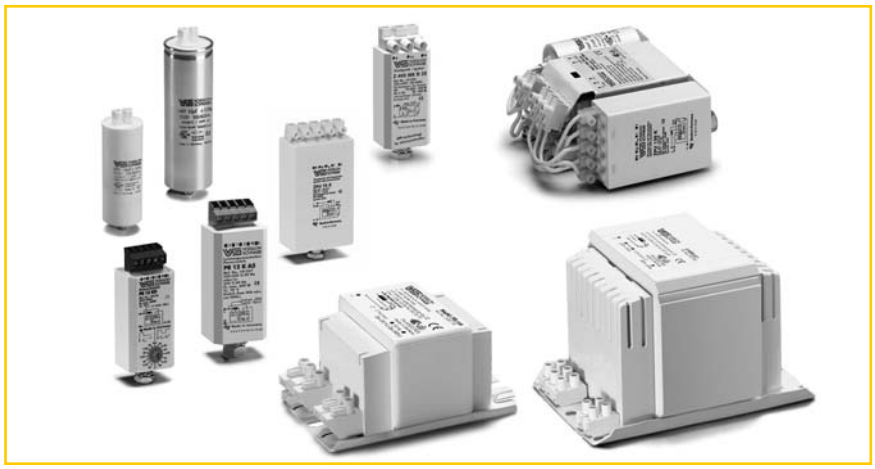


At Vossloh-Schwabe, the change in impedance is achieved by using switchable ballasts. The actual switch-down is carried out by using modern, time-controlled electronic power reduction switches that are addressed via an additional control conductor or a power reduction switch with a constant incentive rate setting (but no control conductor). With regard to their internal loss values, the standard version of magnetic VS ballasts already comply with the second step of the EuP implementing measure applicable as of 2012. Beyond that, VS even provides low-loss ballasts that meet the minimum energy efficiency requirements of step 3 – effective as of 2017 – across almost all power ratings. As a result of further optimisation work, the internal losses of VS ballasts remain well below the demanded EuP values.

Many VS products already satisfy EuP requirements effective as of 2017

Lamp Output W	Energy Efficiency VS Magnetic Standard	Low-loss	EuP Minimum Energy Efficiency Step 2 2012	Step 3 2017
0–50	79.00%	85%	75%	85%
50–70	78.50%	84%	75%	85%
70–125	80.50%	84%	75%	85%
125–400	87.50%	90%	85%	90%
400–1000	90.50%	93%	85%	90%
1000–2000	94%	–	90%	92%

VS' product range is rounded off by a power reduction unit in which the individual components are already pre-wired, which additionally reduces installation and assembly costs.



Targeted Control for New Savings Potential – VS Lixos

Lixos is a Vossloh-Schwabe system to permit targeted, time-sensitive power control and monitoring of individual luminaires and/or luminaire groups in outdoor lighting systems featuring separate lighting grids. Lixos is based on a power reduction circuit and is combined with various monitoring tools for effective operation of a lighting system.

By enabling control and targeted operation of each individual luminaire group, energy savings of up to 40% can be achieved. As Lixos needs neither a control conductor nor a ripple control transmitter, this modern method of lighting control can both be used in new systems as well as in existing systems undergoing refurbishment.

In the basic version of Lixos, each luminaire is equipped with a slave module, which is housed either in the base of the lighting column or directly within the luminaire. A coding switch is used to program the switching time of the slave module, which thus solely functions as a power reduction switch. Depending on the programmed switching time, the slave module switches the luminaire from nominal operation down to reduced operation. This naturally requires using a suitable ballast designed to permit power reduction.

Lixos Advanced functions on the master-slave principle, which means that the master is interconnected with the lighting cable in a central junction box and then uses the power line to send signals to the slave modules integrated into each column or luminaire. The slave modules convert the received signals into equivalent actions.

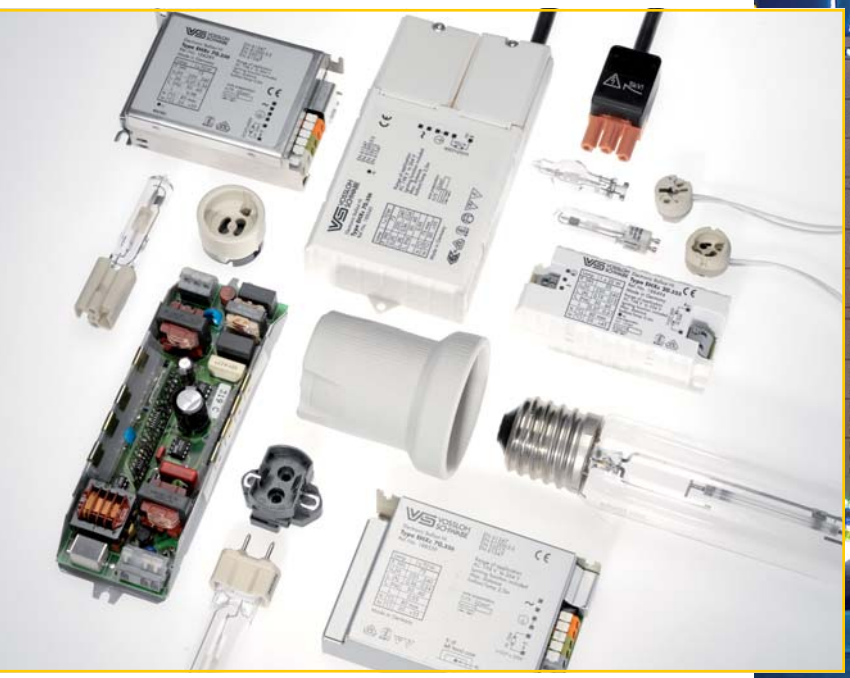
Service addresses are allocated to the luminaires within a lighting system. Prior to operation of a lighting system it must be defined which luminaires are meant to enable certain lighting situations (e.g. at pedestrian crossings or junctions, on main and secondary roads, along school routes as well as facility lighting etc.) at defined time intervals. Each master can be used to control and address 15 different groups. Each slave components is allocated to such a group address.

Lixos enables targeted control and remote monitoring of the individual luminaires.

VS Shapes the Future – Electronic Operating Devices

Supplementary to the technological improvement of magnetic ballasts, Vossloh-Schwabe has also focused on developing electronic ballasts. Appropriate to the various lamp families, high-quality and long-life electronic ballasts are available for fluorescent lamps and high-pressure discharge lamps in standard and dimmable versions. In combination with intelligent control systems, this ballast technology also spells additional savings potential for street lighting.

For street lighting, Vossloh-Schwabe is working on future-compliant electronic solutions that go beyond simply switching a device on and off. Current development work is targeting electronic ballasts for street lighting using metal halide lamps and high-pressure sodium lamps with ratings of 70 W, 100 W, 150 W and 250 W.



The Road to Marketability – Vossloh-Schwabe LED Technology

LED technology constitutes a further building block of future-proof lighting systems. Vossloh-Schwabe provides a comprehensive LED product range that enables the most diverse lighting concepts. Furthermore, especially when using LED lighting, system solutions are needed that result in optimised energy consumption when modified to suit the specific application. With particular regard to street lighting, local authorities can reap the long-term benefits associated with semi-conductor technology.

As a sales partner of Cree Inc. Vossloh-Schwabe has access to the brightest LEDs in the world. Thanks to the American specialist company, the success story of these high-performance LEDs for street lighting has already begun. In Germany, Vossloh-Schwabe has started a number of highly promising pilot projects involving LEDs and provides support for its customers for producing optimum LED luminaire designs. In this case, electrical, optical and thermal challenges are jointly mastered by the LED specialists at VS.

LED technology is characterised by two main benefits: energy efficiency and long service life. Requiring neither any chemical nor strong electrical stimulation to produce light within the semi-conductor itself, LED systems can operate without needing either an ignitor or any sophisticated monitoring technology. Furthermore, LEDs make very efficient use of the supplied energy and a system efficiency value of up to 62 lm/W can be achieved at present, which clearly outperforms the energy efficiency of conventional lighting technology.

The second decisive advantage of LEDs is their extremely long service life of up to 50,000 hours – the longest service life of all light sources currently on the market. The only factor limiting LED service life is the considerable heat generated within the semi-conductor, as a result of which the thermal design of an LED luminaire must be modified to suit. These two outstanding LED properties combine to ensure huge savings potential with regard to energy and maintenance over a long service life.

Light Source	**LED** (30 pcs.)	**HI**	**HS**	**T5**	**CFL**
Luminous Flux (lm)	3,000	20,000	5,600	3,300	3,200
Lamp/Module Rating (W)	36	250	70	35	42
Efficiency of Lamp/Module (lm/W)	77	80	80	94	76
Efficiency of Operating Device (%)	90	90	90	90	90
Typical Lamp Efficiency (%)	90	68	64	68	56
System Efficiency incl. Luminaire (lm/W)	62	49	46	58	38

Road-Testing Street Lighting

Three good reasons speak for modern street lighting

- Road safety:
  Good lighting prevents accidents by ensuring good visibility in the dark for motorists, cyclists and pedestrians. Consequently, possible hazards can already be seen from afar. In addition, LEDs are ideal for ensuring safe traffic routing.
- Personal safety:
  Light at night not only serves personal protection, but also makes your property more secure.
- Design feature:
  Modern street lighting enhances the appeal of any city, town or community, draws people to high-street shops and can also be used to accentuate attractive local landmarks.

Payback Period of the Higher Price of Power Reduction Components if Purchasing a New Lighting System with High-pressure Discharge Lamps

		High-pressure Sodium Lamps (HS)					Mercury Vapour Lamps (HM)			
Nominal Lamp Output	W	70	100	150	250	400	80	125	250	400
Ballast	Type	U-NaH 70/40%	U-NaH 100/40%	U-NaH 150/40%	U-NaH 250/40%	U-NaH 400/40%	Q 80/50	Q 125/80	U-Q 250/150	U-Q 400/250
System Output during Normal Operation	W	83	114	160	271	421	90	134	274	422
System Output during Reduced Operation	W	50	67	98	150	253	55	89	164	267
Energy Savings per Lamp	W	33	47	62	121	168	35	45	110	155
No. of Luminaires	pcs.	100	100	100	100	100	100	100	100	100
Power-reduced Operation/Year	h	2190	2190	2190	2190	2190	2190	2190	2190	2190
Energy Savings per Year	kWh	72.27	102.93	135.78	264.99	367.92	76.65	98.55	240.90	339.45
Savings in Energy Costs per Year	EUR	722.70	1029.30	1357.80	2649.90	3679.20	766.50	985.50	2409.00	3394.50
Additional Costs for Operating Devices*	EUR	1100	1100	1100	1100	1100	1100	1100	1100	1100
Total First-Year Cost Savings	EUR	–377.30	–70.70	257.80	1549.90	2579.20	–333.50	–114.50	1309.00	2294.50
Payback Period	**Years**	**1.52**	**1.07**	**0.81**	**0.42**	**0.30**	**1.44**	**1.12**	**0.46**	**0.32**

Energy costs are based on a power price of 0.10 Euro/kWh; Output reduction is based on an assumed period of 6 hours per day, 365 days a year.

* Extra price for 100 ballasts including voltage tapping for power reduction and investment costs for 100 electronic power reduction switches capable of start-up under full load (PU 120 K).

Vossloh-Schwabe – 90 Years of Efficient, Safe and Top-Quality Lighting Technology

Vossloh-Schwabe was founded in 1919 and currently numbers among the world's largest manufacturers of innovative lighting technology. In 2002, Vossloh-Schwabe became a member company of the Japanese Panasonic Electric Works Group, whose range of products includes global brands such as Panasonic. This integration into the Japanese group also paved the way for Vossloh-Schwabe to achieve further international growth.

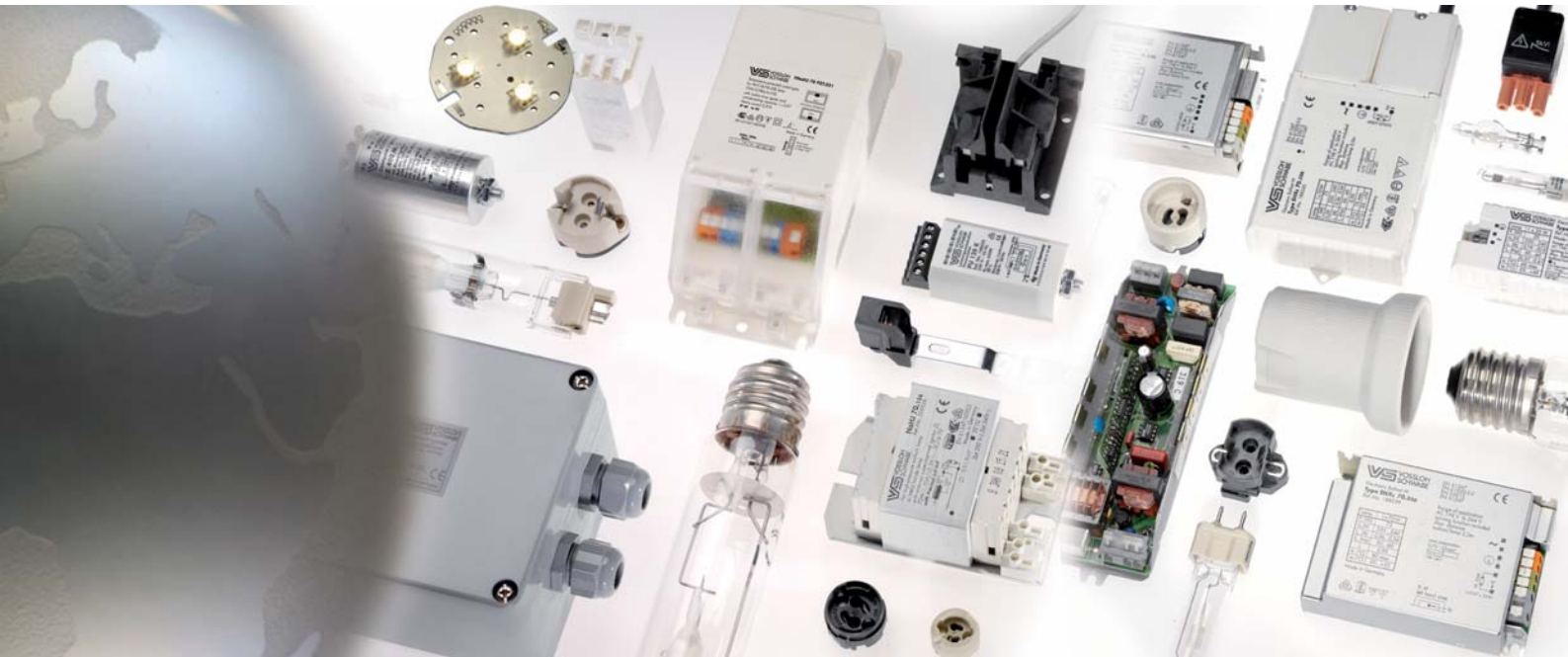
With its broad product range, Vossloh-Schwabe provides a future-orientated component structure that satisfies the requirements of energy-efficient lighting and the provisions of EU Directives and laws: from magnetic and electronic ballasts, through modern control systems (Lixos or DALI) to LED lighting and perfectly matched operating devices.

The high quality of VS components is also reflected by a three-year product warranty, which can even be extended to five years.

Are you looking to make lasting energy-efficiency improvements?

Please speak to our experts – the earlier, the better. VS has the know-how and capacity to support your projects from the outset.

Your local VS contact will be happy to provide you with further information at any time.



Vossloh-Schwabe
Deutschland GmbH

P.O. Box 28 69
58478 Lüdenscheid, Germany

Phone: +49 23 51/10 10
Fax: +49 23 51/10 12 17
+49 23 51/10 13 84

www.vossloh-schwabe.com

01/2009