

General Information

Domestic Waste Water Treatment Plant



Turns WASTE WATER into DOMESTIC WATER

Germany's first certified small-scale waste water
treatment plant on a biological sludge basis



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1 General Remarks

BUSSEMF is

developed by: BUSSE GmbH, Zaucheweg 6, 04316 Leipzig
and

produced by: BUSSE Innovative Systeme GmbH, Zaucheweg 6, 04316 Leipzig

BUSSEMF is a small-scale sewage treatment facility operating on the basis of submerged microfiltration membranes (membrane bioreactor technology). The one-year testing period necessary for obtaining the general permission by German construction authorities according to DIN 4261 Part 2 was completed on November 11, 2000. The permission (Z-55.3-60) was obtained on June 13, 2001.

The **BUSSEMF** membrane bioreactor technology guarantees hygienically safe outflow (filtrate) free of floating matter with high COD and BOD5 degradation rates.

Currently, three types of **BUSSEMF** plants are available:

BUSSEMF Standard: for indoor use in frost-proof locations. It is available for 4 and 8 inhabitant equivalents.

BUSSEMF & existing septic tank: An existing multiple cell septic tank according to DIN 4261 Part 1 is upgraded with a **BUSSEMF** plant.

BUSSEMF Multiple: Compact solution for multiple-family houses, hotels and small settlements.

The purification performance of sewage treatment facilities operating with submerged microfiltration membranes is a qualitative leap in the treatment of domestic waste water. The outflow is characterized by high organic matter degradation rates and meets high hygienic standards.

With its system technology, **BUSSEMF** facilities reach the high quality of central treatment plants i.e. substantially better purification performance and easy maintenance, if the producer's guidelines concerning state-of-the-art maintenance are considered.

After 6 years of experience with operating small-scale treatment facilities with membrane technology in Germany, it is safe to say that all inflow parameter are met. Internationally, experience with this technology even exceeds ten years.

The high hygienic level of domestic water reached with this technology allows the effective use of treated sewage for watering the garden or flushing the toilet and thus preserves natural resources. Maintenance contracts with customers provide for ongoing high performance levels. External maintenance is necessary to warrant efficient functioning and the regeneration of the membranes.

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2 Scope of Use

BUSSEMF facilities have been designed for the biological treatment of all kinds of domestic waste water (not rain water) in frost-proof indoor locations according to DIN 4261 part 2.

3 Structure

The waste water enters the plant via a drainpipe or a pump. It is then conveyed from the coarse matter separation / intermediate storage tank to the activation stage by a mammoth pump. The treated waste water leaves the facility in free fall either to percolate or to enter a pump system. The waste water entering the plant is treated in the plant's odour-tight, modularly arranged tanks made of galvanised sheets of polyethylene/metal. The individual tanks are easily accessible for maintenance. The state of the membranes (filtration performance) can be monitored, without coming into contact with the waste water, by means of a counter showing the number of hours of operation.

4 How BUSSE-MF Plants Work

BUSSEMF plants operate using a combination of biological sludge processes, submerged membranes and particulate matter separation in a preliminary treatment tank which also serves as an intermediate storage tank for waste water and sludge. The facility is controlled by an adjustable time switching unit and a float switch. The individual tanks have the following functions:

4.1 Coarse Matter Separation & Waste Water Storage

Waste water first enters the coarse matter separation tank. Here, non-dissolved coarse matter is separated from the water. The tank also serves as intermediate storage for larger amounts of water (e.g. from bathtubs). The coarse-matter free waste water is subsequently conveyed to the activation stage by means of a mammoth pump. This solution guarantees the removal of floating sludge and coarse matter with a diameter of more than 7 mm.

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4.2 Biological Stage

In the biological treatment stage, the waste water is treated biologically on the basis of the membrane bioreactor technology. The oxygen necessary for the biological decomposition processes is introduced by an aeration system using a very quietly operating compressor. The air is passed through a filtration module and limits the secondary layer on the microfiltration plates (pore size 0.4 µm) installed in the module. The treated waste water is then drained via the microfiltration plates by static overpressure and gravity flow.

In the energy saving mode (no sewage inflow) the time switching device controls aeration intermittently, prevents putrefaction and allows for proper function even after prolonged periods without inflow.

The water leaving the microfilters is free of floating matter. Additional purification of the treated waste water is not necessary.

5 Technical Data

Domestic treatment plant BUSSE MF	Model	MF-HKA4 (for 4 inhabitants)	MF-HKA8 (for 8 inhabitants)
Performance volume (inhabitants)		4	8
Daily quantity of waste water	[m ³ /d]	0,60	1,20
Daily pollution load	[kg BSB5/d]	0,24	0,48
Energy consumption, 230V alternating current (min-max)	[kWh/d]	1,8 - 3,0	3,1 - 5,0
Total height	[m]	2,0	2,0
Space required (standard version, incl. control unit)	[m x m]	1,10 x 1,50	1,10 x 2,30
COD-concentration in outflow	[mg/l]	< 50	< 50
BOD5-concentration in outflow	[mg/l]	< 10	< 10
Deposit matter	[ml/l]	< 0,1	< 0,1
EU Directive on bathing water (76/160/EWG)	[KBE/ml]	Limit and optimum are safely met	
Irrigation water (acc. DIN 19650)	[KBE/ml]	Suitability classes 2,3 and 4	

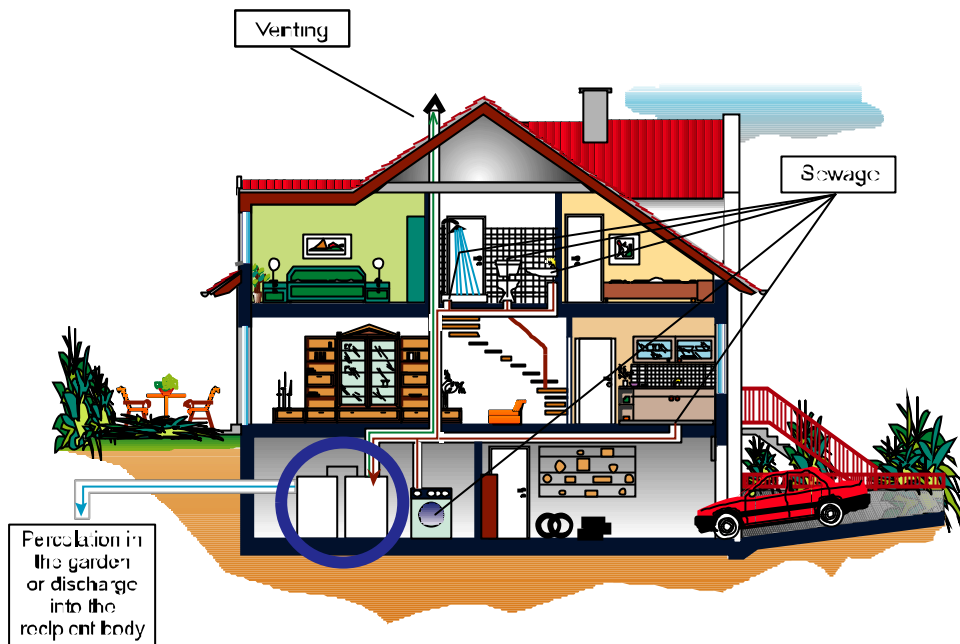
Table 1: Technical Data for HKA 4 and HKA 8

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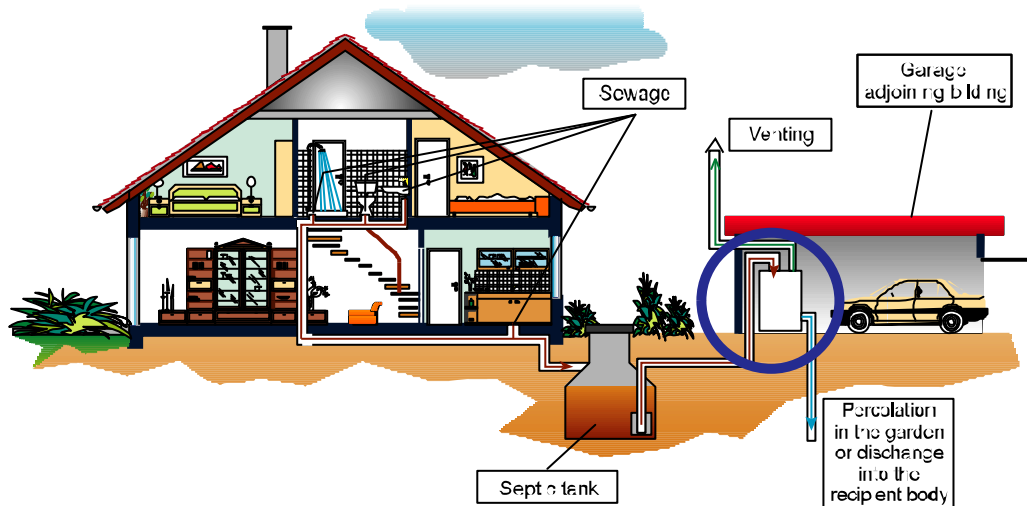


Type 1: **BUSSEMF** Standard



Graphic 1: Standard **BUSSEMF** Typ MF-HKA4

Type 2: **BUSSEMF** & Existing Septic Tank



Graphic 2: **BUSSEMF** & Existing Septic Tank

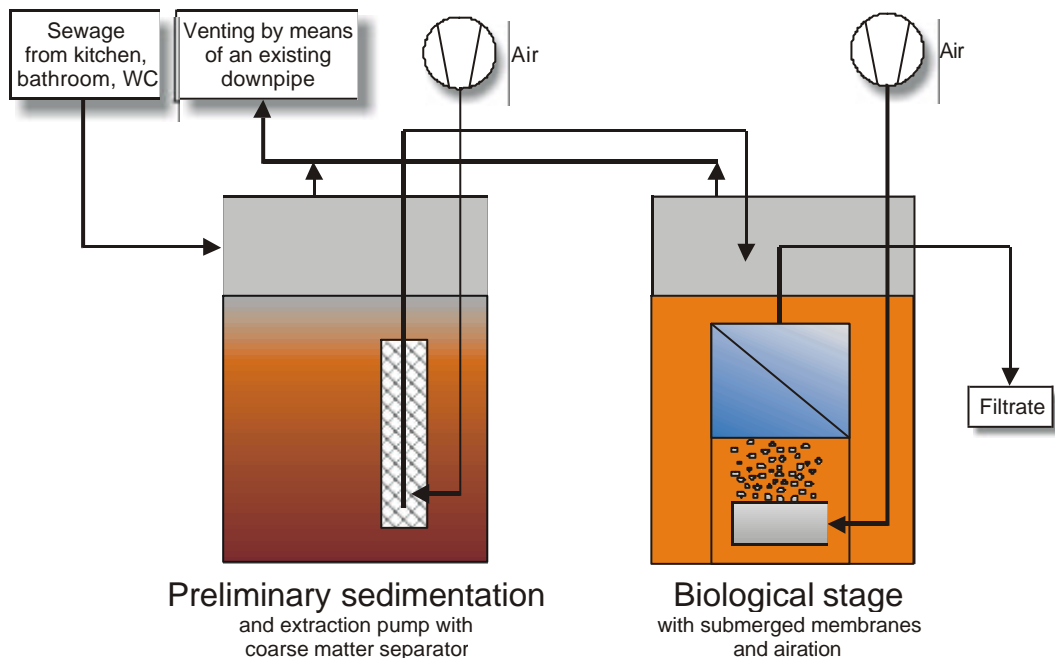
BUSSEMF facilities allow for the efficient upgrading of existing septic tanks. In this case, the septic tank serves as coarse matter separator and intermediate storage tank.

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Graphic 3: BUSSEMF plant type MF-HKA4, installed in a cellar



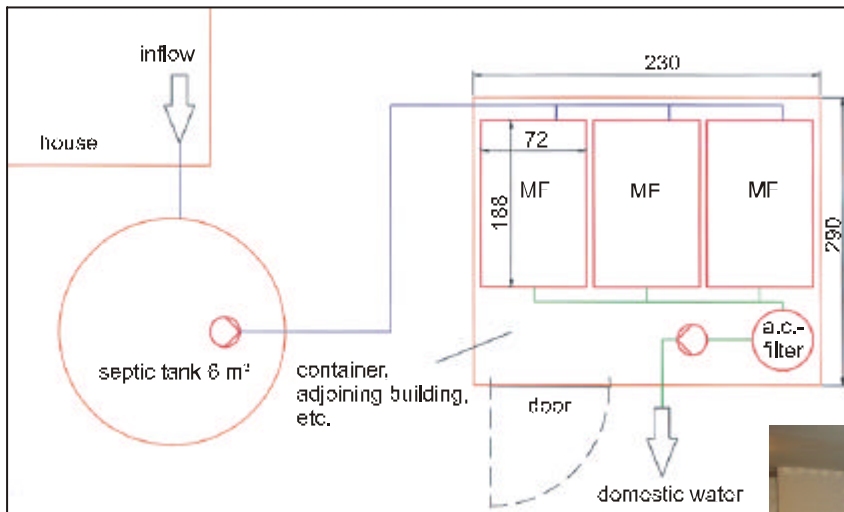
Graphic 4: How BUSSEMF Plants Work

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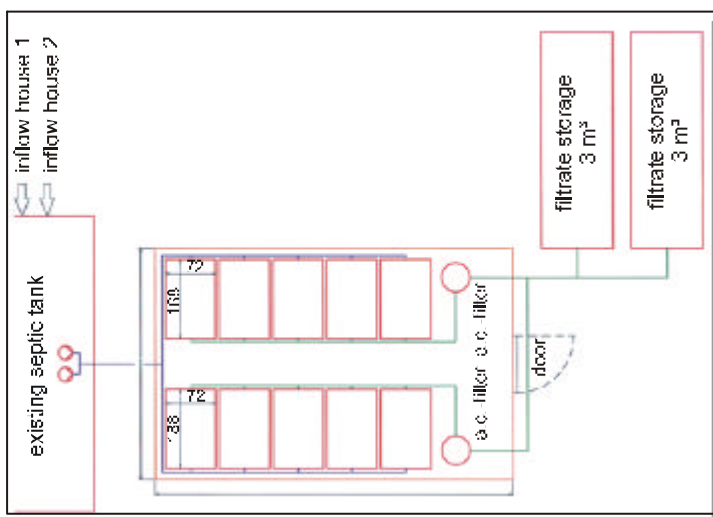
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Type 3: **BUSSEMF** Multiple (8-50 inhabitant equivalents)



Combined septic tank with free positioned bio-reactors for 25 equivalent inhabitants



Example of use in a hotel with 100 equivalent inhabitants

Graphic 5: **BUSSEMF** Multiple

Due to their modular structure, **BUSSEMF** small-scale treatment plants can be easily adapted to existing systems and guarantee a high level of stable purification performance by using microfiltration membrane technology.

This technology also meets the requirements set out in the European Council's directives on the quality of bathing water (76/160/EWG) and DIN 19650 (hygienic requirements for irrigation water, February 1999).

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6 DIN Test Mark

The **BUSSEMF**-type domestic treatment facility was granted general permission by the German construction authorities on June 13, 2001. The testing period had been completed on November, 15, 2000. The University of Hanover was designated to conduct the test by the German Institute for Structural Engineering in Berlin.

7 References

BUSSEMF facilities have been produced since autumn 1999. Presently more than 160 **BUSSEMF** plants are in use in decentralised waste water treatment in Germany.

8 Third-party Maintenance

Maintenance intervals are fixed by the municipal water authority in accordance with DIN 4162 part 4, and to these ends, a maintenance contract must be signed with the system manufacturers or with an expert trained by them. The manufacturer's guidelines are to be closely respected.

9 Monitoring by the Operator

The operator is responsible for maintaining a logbook registering monthly controls and any malfunctions which occur, in which case it is necessary to provide for repair.

The logbook includes the following data: Date, hours of operation, malfunctions if occurred, repair measures taken and signature.

Daily operational check:	Is the plant working? Has there been an alarm signal?
Weekly functional check:	Registration in the logbook
Monthly visual check:	The registrations in the logbook are handed over to the maintenance company

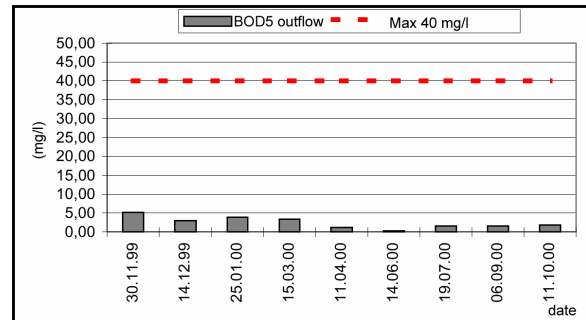
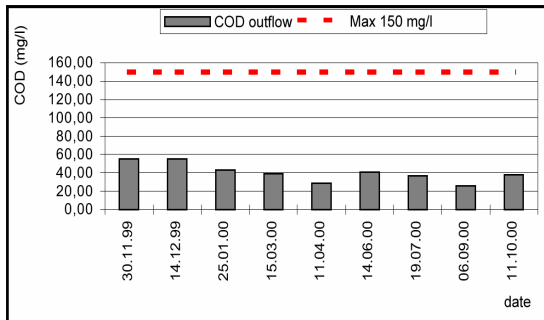
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10 Process Stability in Case of Loading Interruptions

The process stability of **BUSSEMF** facilities was tested in a research paper submitted at Berlin Technical University and in operational testing by the ISAH Institute of Water Quality and Waste Management at the University of Hanover. Elimination rates exceeded 95% for COD and 99% for BOD5. Our own tests with pilot plants yielded a stable purification performance even after a 4-week interruption of the inflow.



Graphic 6: Results of the COD and BOD5 sample test conducted by ISAH at Hanover University

11 Costs

Prices of **BUSSEMF** plants

Purchasing price (+ VAT 16%)	
BUSSEMF 4 inhabitants	BUSSEMF 8 inhabitants
on request	on request

Operating Costs (in Germany)

Model	Maintenance costs per visit	Energy costs per year	Operating costs per m ³ waste water
BUSSEMF 4 inhabitants	265,00 €	95,00 €	1,85 €
BUSSEMF 8 inhabitants	385,00 €	150,00 €	1,40 €