

# 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

and

**in Ireland exclusively**

**distributed by:** **Bioflow Watercare**, Stephen Reynolds, 8 Goatstown Ave., Dundrum, Dublin 14  
[info@bioflowwatercare.com](mailto:info@bioflowwatercare.com), [www.bioflowwatercare.com](http://www.bioflowwatercare.com)

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

The permission (Z-55.3-60) was obtained on June 13, 2001. Additional tests to prolong the permission Z-55.3-60 and to get the permission according to the EN 12566-3 for decentralized wastewater treatment systems have been run by the Institute for Wastewater Technology PIA in Aachen. The **BUSSEMF** has successfully surpassed the certification process and has met all demands for the reduction standards C, N, D, H + P. The BusseMF achieved a removal rate of 96.8% COD, 99.7% BOD5, 99.5% SS, 97.9% NH4-N, 99.99% Fecal Coli-forms, and with extra Phosphor treatment it remove 98.1% of the Phosphor. The **BUSSEMF** has successfully surpassed the certification process of NSF International Standard 40 and 245 for USA and North America in 2008.

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 <b>BUSSEMF</b>	Model	MF-HKA4 (for 4 inhabitants)	MF-HKA8 (for 8 inhabitants)
Performance volume (inhabitants)		4	8
Daily quantity of waste water	[m <sup>3</sup> /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
NH4-N	[mg/l]	< 10	
Sedimentable Solids	[ml/l]	< 0,1	< 0,1
Coliform bacteria	[KBE/ml]	< 100	
EU Directive on bathing water (76/160/EWG)		Limit and optimum are safely met	
Irrigation water (acc. DIN 19650)		Suitability classes 2,3 and 4	

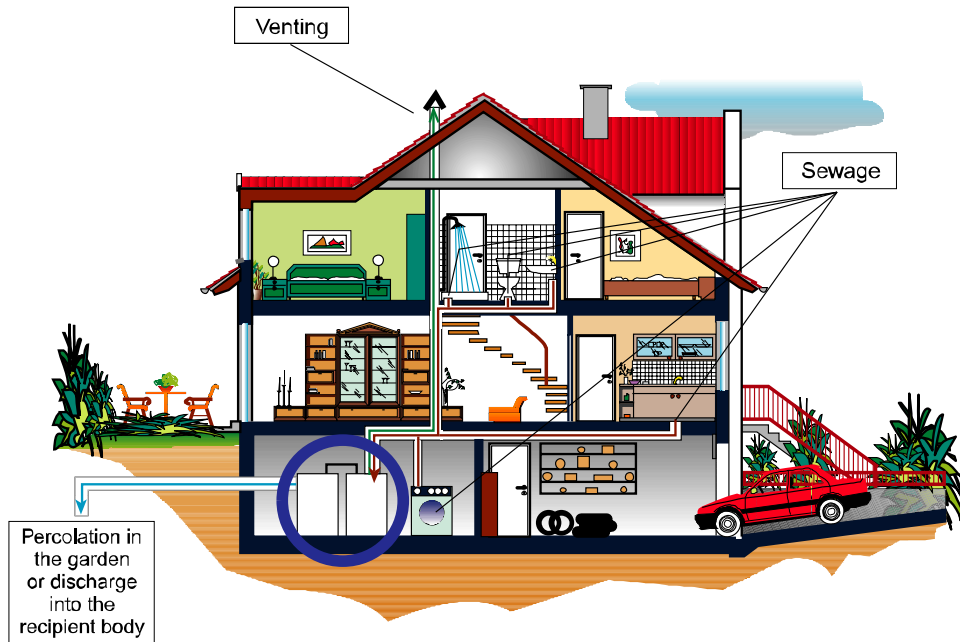
Table 1: Technical Data for HKA 4 and HKA 8

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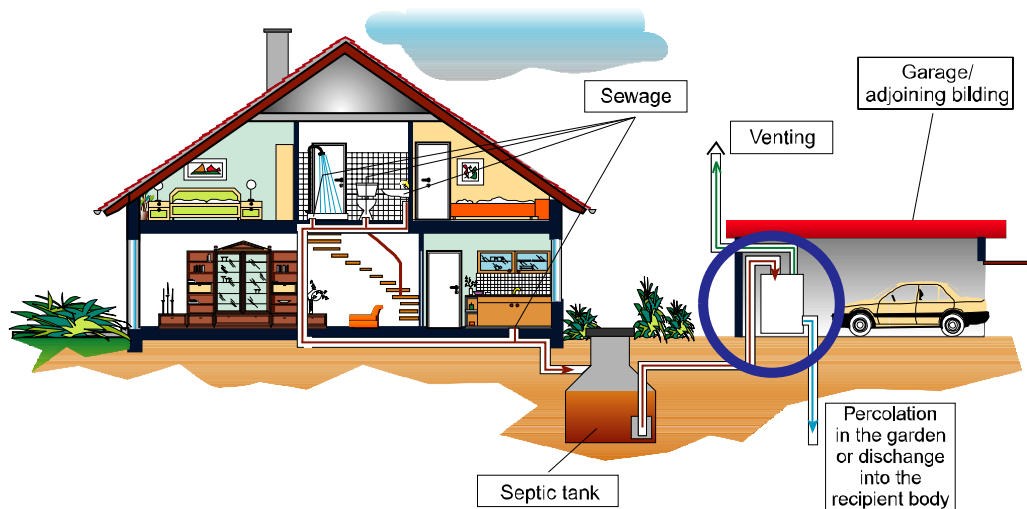


## Type 1: BUSSEMF Standard



Graphic 1: Standard BUSSEMF Typ MF-HKA4

## Type 2: BUSSEMF & Existing Septic Tank



Graphic 2: BUSSEMF & Existing Septic Tank

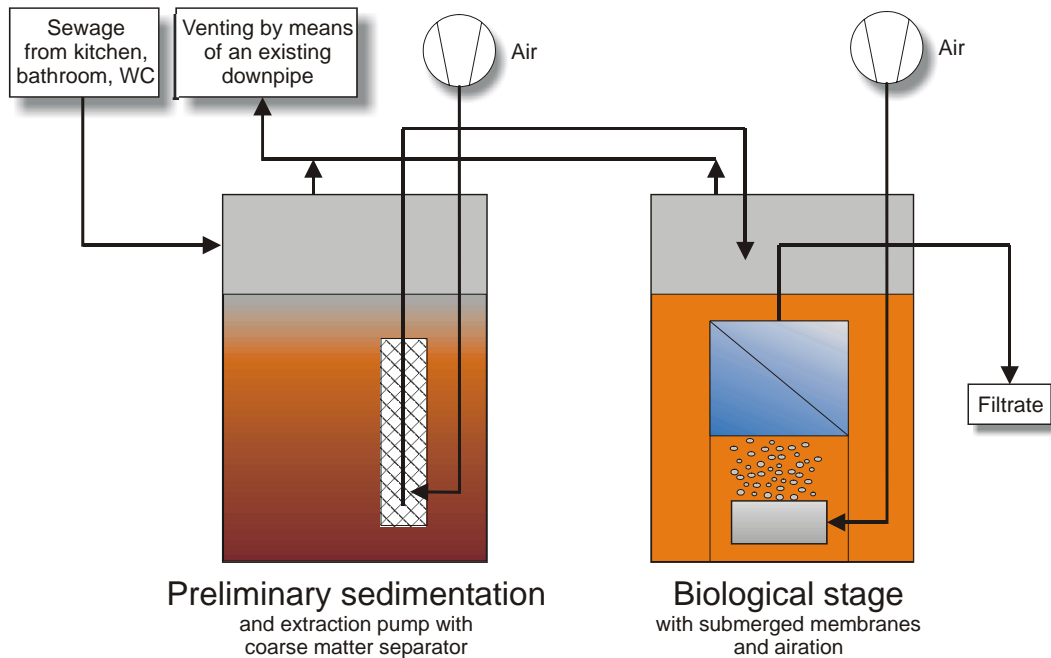
BUSSEMF facilities allow for the efficient upgrading of existing septic tanks. In this case, the septic tank serves as coarse matter separator and intermediate storage tank.

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



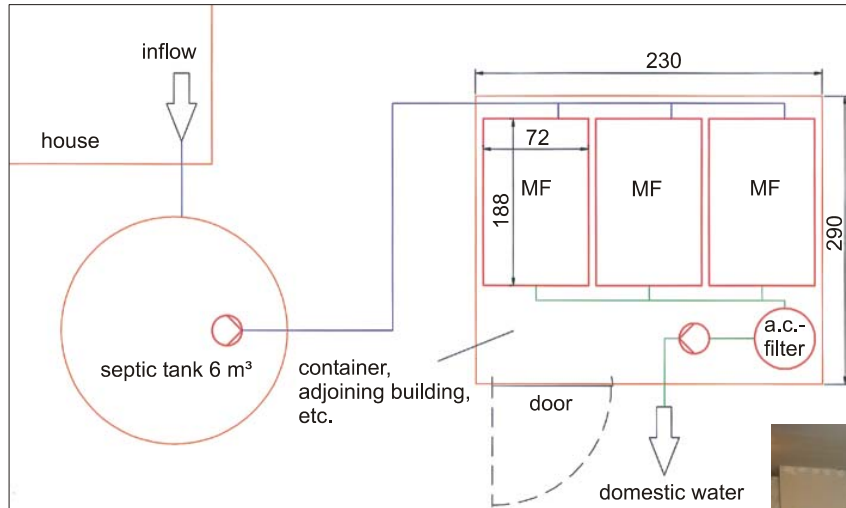
Graphic 4: How **BUSSEMF** Plants Work

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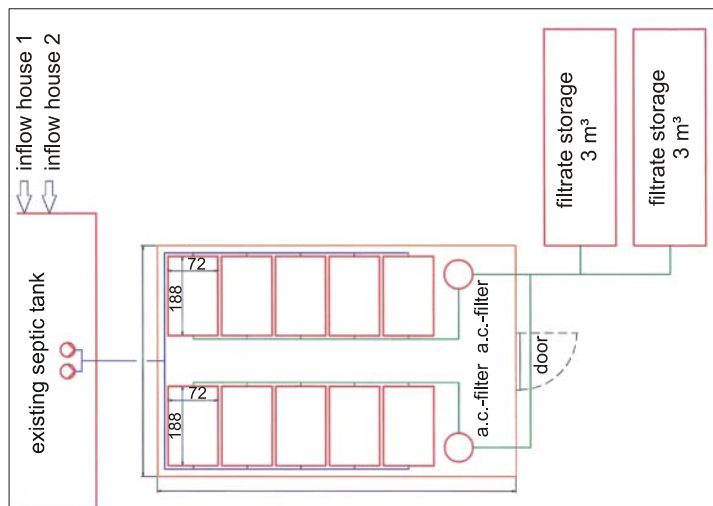
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## Type 3: BUSSEMF Multiple (8-50 inhabitant equivalents)



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 400 **BUSSEMF** plants are in use in decentralised waste water treatment in Germany and 11 other countries.

## 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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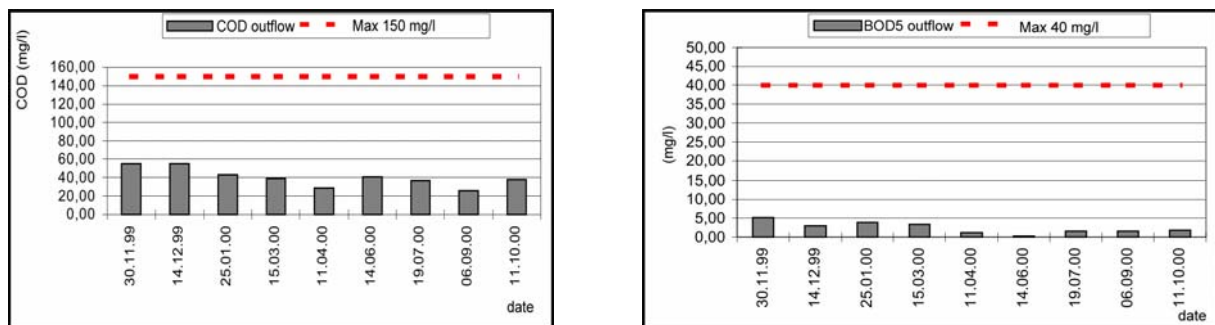
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## 10 Process Stability in Case of Loading Interruptions

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

The **BUSSEMF** Membrane Sewage Treatment System has been tested to European Standard EN 12566-3 for wastewater treatment and by NSF international Standard 40/245 and achieved a removal rate of 96.8% COD, 99.7% BOD5, 99.5% SS, 97.9% NH<sub>4</sub>-N, 99.99% Fecal Coli-forms, and with extra Phosphor treatment it remove 98.1% of the Phosphor.

### NSF Standard 40 & 245 DIN 4261-3 & EN 12566-3 Classes C+N+D+H+P+

Parameter	Measure	Inlet	Outlet	Limit: 246-272 WAC*/ class H+
fecal coliforms	/100 ml	6 – 7 10 <sup>6</sup>	< 1	200/100

\* Washington State Department of Health: Chapter 246-272A WAC

\*\* German class for water disinfection

Parameter	Measure	Inlet	Outlet	Limit*: Standard 40/245/class D+
cBOD <sub>5</sub>	mg/l	170 / 307	< 2	30 / 25 / 15
NH <sub>4</sub> -N	mg/l	39 / 34	< 1	n. l. / n. l. / 10
N <sub>TOTAL</sub>	mg/l	37 / 52	15 / 16	n. l. / ** / 25***
TSS	mg/l	180 / 389	2	30 / 30 / 50*

\* 30 day average/average of all samples/24h composite sample (TSS random)

\*\* <50% average TKN influent samples

\*\*\* N<sub>anorg.</sub>

**Tested and certified by NSF International 2008, PIA Aachen 2008, TU-Berlin 1999**