

**BE
SERIES**

Anaerobic Tank Reactor – BE4

BE4 Anaerobic Tank Reactor

(shown with optional Settler BE4-1)

The reactor on the BE4 is a cylindrical glass vessel with a water jacket for heating. The vessel is supplied with baffles and a variable-speed stirrer for use as a continuous stirred tank reactor (CSTR).

Multi configurable and extremely versatile for both educational and research purposes.

It has a self-contained, floor-standing anaerobic tank reactor of 20 litre volume. The stirrer, motor and baffles are removable for non-stirred configurations.

**CONTINUOUS STIRRED TANK REACTOR (CSTR)
PACKED BED REACTOR (PBR)
UPFLOW ANAEROBIC SLUDGE BLANKET REACTOR (UASB)**

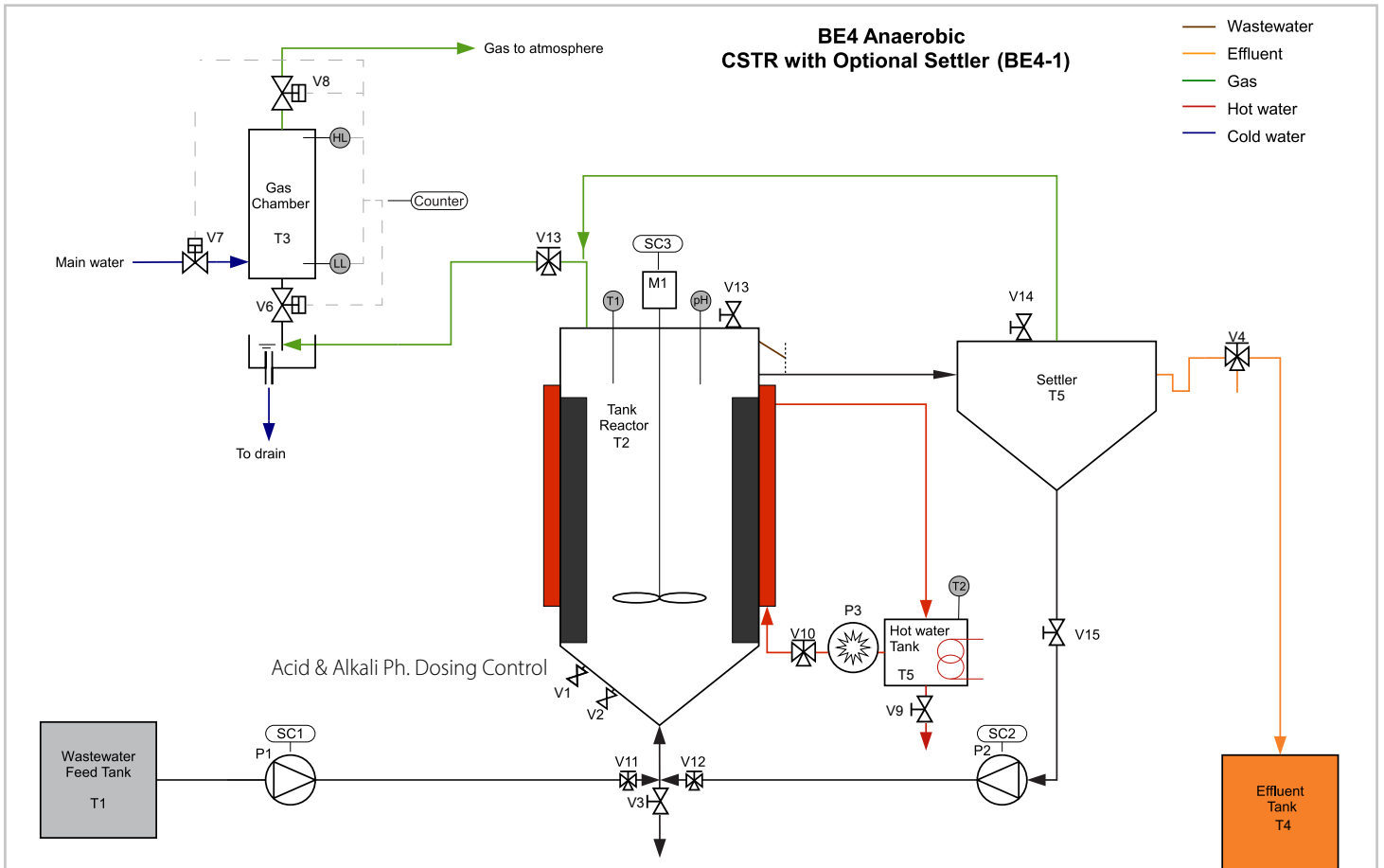
Tank reactor showing detail with bio-balls



BE4: Anaerobic tank reactor

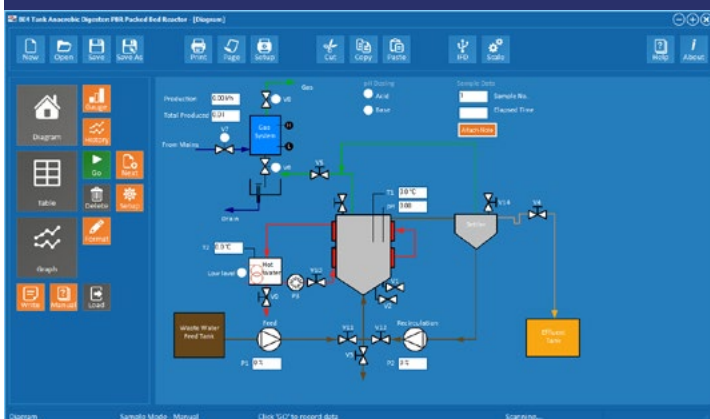
Features

- ▶ Continuous stirred tank reactor (CSTR)
- ▶ Packed bed reactor (PBR)
- ▶ Upflow anaerobic sludge blanket reactor (UASB)
- ▶ Measures reactor temperature, jacket temperature and vessel pH
- ▶ Programmable logic controller (PLC) provides temperature control, pH control and gas collection (rate and totalisation) calculations
- ▶ Jacket heating system with pump and hot water vessel. Temperature is PID controlled room temperature to 55°C
- ▶ Automated volumetric gas collection system measures, which adds less than 10 mbar back pressure to the reactor
- ▶ Complete with automated pH dosing system to maintain the vessel pH within a predetermined range (user programmable)
- ▶ User calibration of pH and gas collection system
- ▶ Feed flow rates from 0.06-4.8 l/hr (using interchangeable peristaltic hoses)
- ▶ Gas sample point
- ▶ Data logger and software as standard (requires PC, not supplied)



BE4-1 Process flow diagram

armSOFT Software: Screen showing BE4 (diagram)

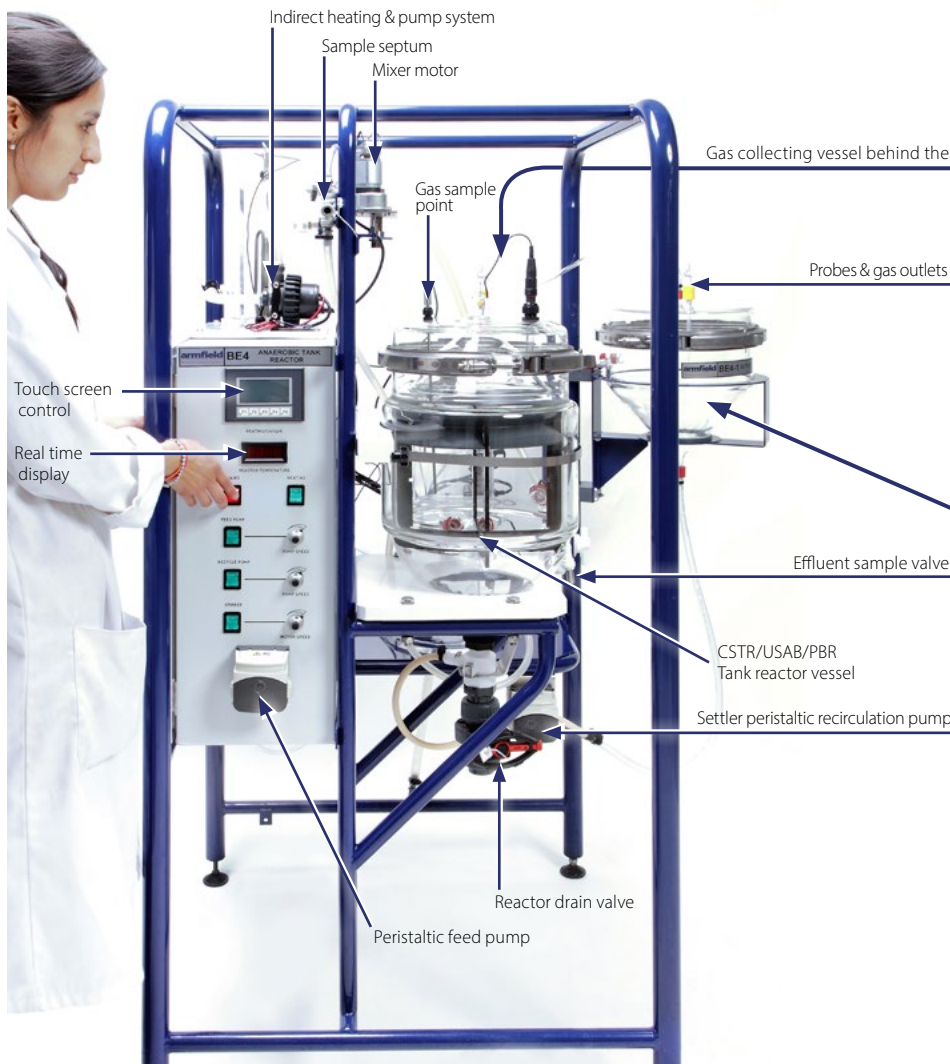


2kW Heating element with indirect heating (hot water circulation unit)



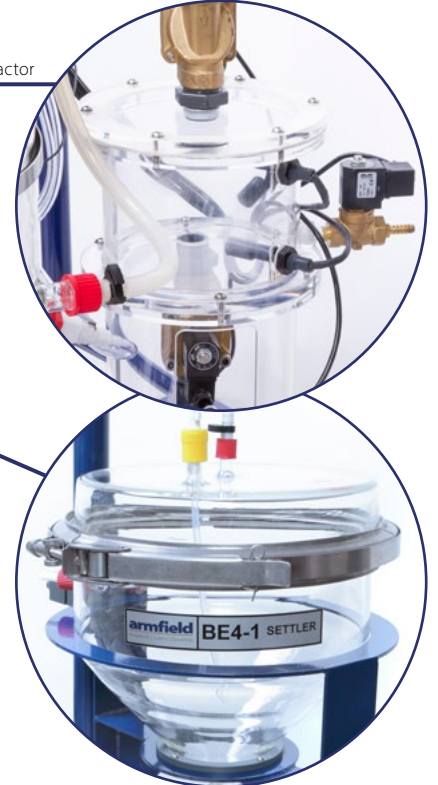
Anatomy of the BE4 anaerobic tank reactor

This annotated diagram shows the layout of the Armfield BE4, these units can be operated in different configurations making them extremely versatile and suitable for both educational and research purposes.



Gas Collection System

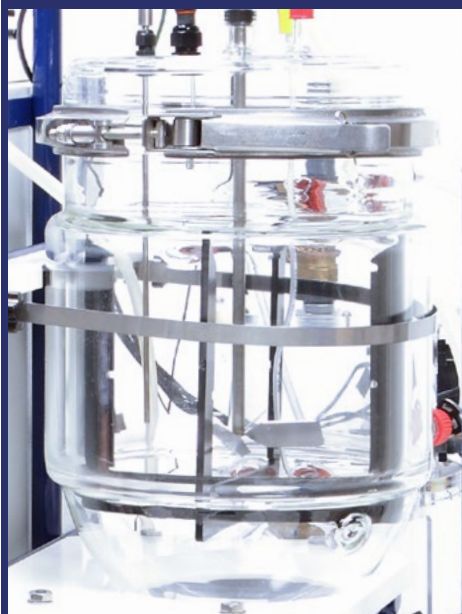
Gas produced in the reactor during the bacterial digestion process is collected in the gas collection chamber (T3) using a water displacement system which has been designed to impart a small and constant back pressure on the reactor.



Settler Reactor BE4-1

An optional Settler (BE4-1) is also available for the Anaerobic Tank Reactor BE4. Its function is to collect solid particles of biomass at the exit from the reactor for return to the reactor in BE4. This biomass would otherwise be lost to the system.

BE4 configured as CSTR (continuous stirred tank reactor)



Tank reactor showing detail of bio-balls and supports, configured as PBR (packed bed reactor)



Tank reactor showing detail of baffles, deflector and lid configured as UASB (upflow anaerobic sludge blanket reactor)



Description - BE4 Anaerobic tank reactor

The reactor on the BE4 is a cylindrical glass vessel with a water jacket for heating. The vessel is supplied with baffles and a variable speed stirrer for use as a continuous stirred tank reactor (CSTR).

The baffles and stirrer are removable to enable the reactor to be filled with bio-balls and a support grill, to reconfigure the unit as a packed bed reactor.

An alternative reactor lid complete with deflector and tri-phase separator is also supplied. This enables the reactor to also be configured as an upflow anaerobic sludge blanket reactor (UASB).

The feed into the reactor is provided by a variable-speed peristaltic pump. The lid of the reactor is fitted with a sampling station, which includes ports for instrumentation probes (both temperature and pH) and permits liquid samples to be taken from the reactor at different depths.

The reactor temperature is controlled by a recirculating water system in the same way as the BE3 and the same novel system for collecting and measuring the emitted gas is used. Similarly the pH dosing system is identical in concept and the data can be recorded on a PC using the data logger.

Requirements

Scale



Electrical supply: 220-240V / 1ph / 50Hz / 10 amp
120v/1ph/60 Hz 20A
220V / 1ph / 60Hz / 10 amp

Water and drain: The reactors need to be connected to a supply of water (>1 bar) and to a suitable drain. The amount of fresh water used during the operation of the BE4 will be the same as that of the gas produced.

Ventilation: The gas produced can be collected (vessel not provided) or can be vented to atmosphere. In any case the reactors should be positioned in a well ventilated area and an outlet provided to vent the emitted gases outdoors.

Computer: The user must have a PC with a USB port, running Windows 7 or above is required if running the data logging software.

Complementary equipment

BE1:	Batch Enzyme Reactor
CEU:	Catalytic Reactors
UOP12:	Filtration Unit
W8:	Anaerobic Digester
W11:	Aerobic Digester

Overall dimensions

Length	0.738m
Width	0.696m
Height	1.50m

Packed and crated shipping specifications

Volume	1.5m ³
Gross weight	150Kg

Ordering specification

- ▶ Anaerobic Tank Reactor
- ▶ A self-contained, floor-standing anaerobic tank reactor, volume 20l
- ▶ Configurable as:
 - Continuous stirred tank reactor (CSTR)
 - Packed bed reactor (PBR)
 - Upflow anaerobic sludge blanket reactor (UASB)
- ▶ Stirrer, motor and baffles are removable for non-stirred configurations
- ▶ Variable-depth liquid sampling point
- ▶ Common points to both reactors
- ▶ Measures reactor temperature, jacket temperature and vessel pH
- ▶ Programmable logic controller (PLC) provides temperature control, pH control and gas collection (rate and totalisation) calculations
- ▶ Jacket heating system with pump and hot water vessel. Temperature is PID controlled room temperature to 55°C
- ▶ Automated volumetric gas collection system measures, which adds less than 10 mbar back pressure to the reactor
- ▶ Complete with automated pH dosing system to maintain the vessel pH within a predetermined range (user programmable)
- ▶ User calibration of pH and gas collection system
- ▶ Feed flow rates 0.06-4.8 l/hr (using interchangeable peristaltic hoses)
- ▶ Gas sample point
- ▶ Data logger and software as standard (requires PC, not supplied)

Experimental capabilities

- ▶ Optimising reactor start-up (acclimation of biomass)
- ▶ Effect of temperature, pH, residence time etc.
- ▶ Investigation of hydraulic loading (feed rate)
- ▶ Effect of effluent strength and nutrient deficiency
- ▶ Effect of recirculation ratio and fluidisation
- ▶ Comparing efficiency of different configurations (BE4)
- ▶ Investigation of bacteria type
- ▶ Acidogenesis and methanogenesis process demonstrations

Specifications

Reactor volume	20l
Heater power	2kW
Jacket temperature	< 60°C
Flow rate (Recycle)	55 l/min
Feed flow rate	0.06 to 4.81 l/hr
Settler volume	11l (BE4-1)

Ordering codes

- ▶ BE4-A: 220-240V / 1ph / 50Hz / 10 amp
- ▶ BE4-B: 120v/1ph/60 Hz 20A
- ▶ BE4-G: 220V / 1ph / 60Hz / 10 amp

Armfield standard warranty applies with this product

Knowledge base

- > 28 years expertise in research & development technology
- > 50 years providing engaging engineering teaching equipment

Benefit from our experience, just call or email to discuss your laboratory needs, latest project or application.

An ISO 9001:2015 Company



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