ADI AUTOCLAVABLE GLASS BIOREACTORS

1 - 20L

SALES INFORMATION

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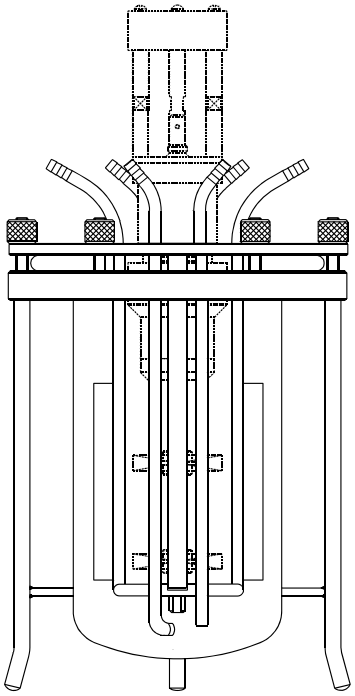
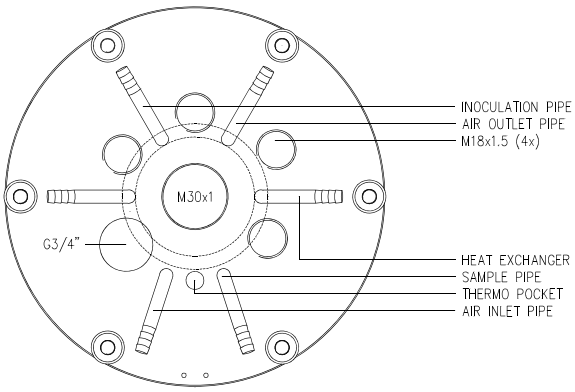
THE 1 LITER DISHED REACTOR WITH HEAD PLATE:



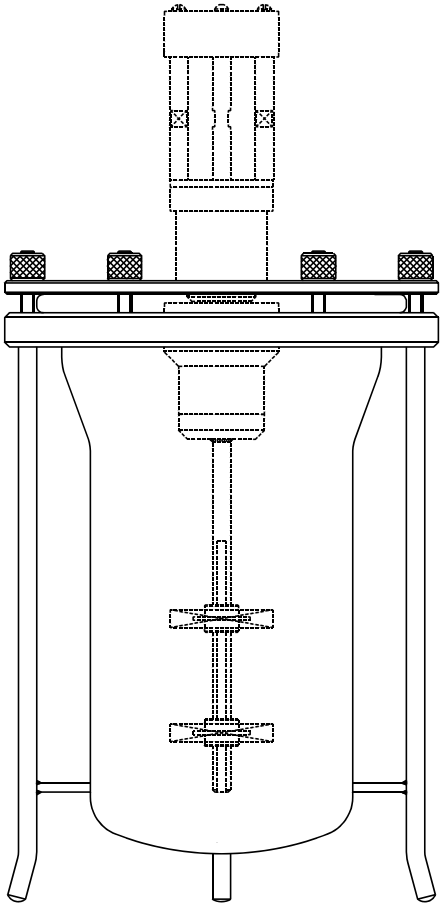


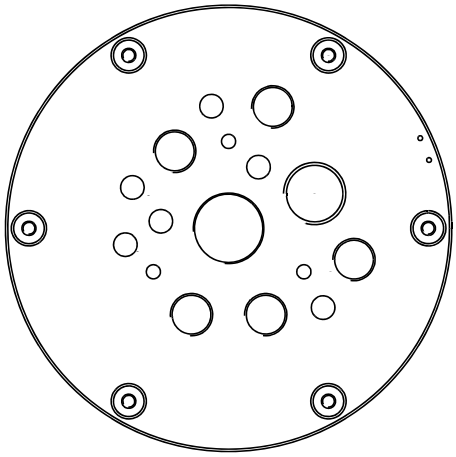
Z61101C004 1 Liter dished bottom reactor

Reactor type	1 liter dished bottom		
Inner Diameter	95 mm	Autoclave Space (HxD)	400 x 200 mm
Inner Height (max.)	200 mm	Overall height reactor	290 mm
Liquid Height (working vol.)	150 mm	Total Volume	2.2 liter
Welded Connections in Head Plate	Water in-/outlet (heat exchanger)	Working Volume	1.7 liter
	Sample Pipe	Min. Working Volume	0.5 liter
	Air inlet Pipe	H/D Total	2.3
	Inocculation Pipe	H/D Work Vol.	1.9
	Air Outlet Pipe		
	Thermometer pocket		
Ports in Head Plate	1 x M30 x 1		
	1 x G3/4"		
	4 x M18 x 1.5		

Materials in contact with the medium: borosilcate glass
stainless steel
silicone rubber
viton & EPDM

THE 2 LITER DISHED REACTOR WITH HEAD PLATE:



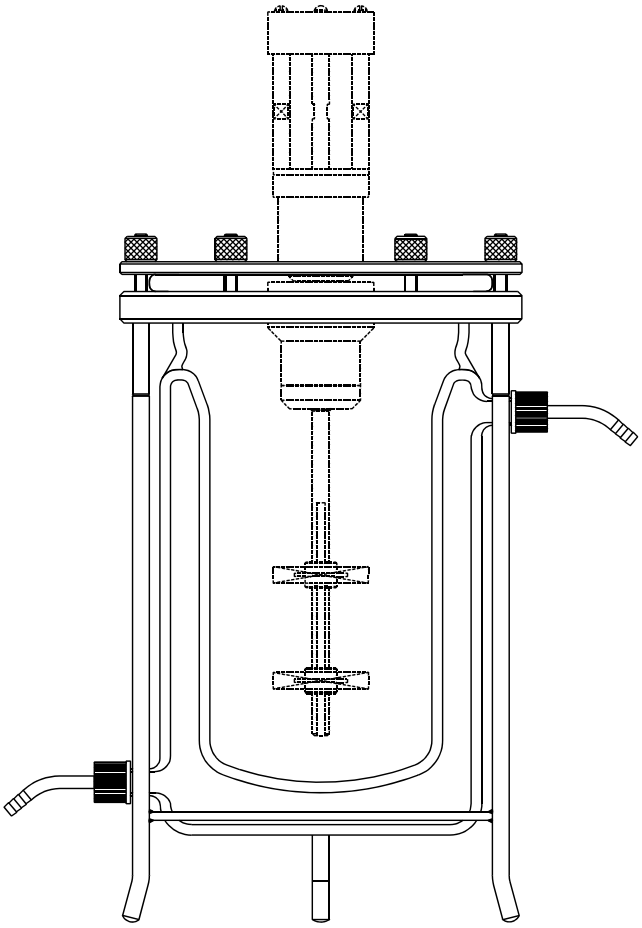


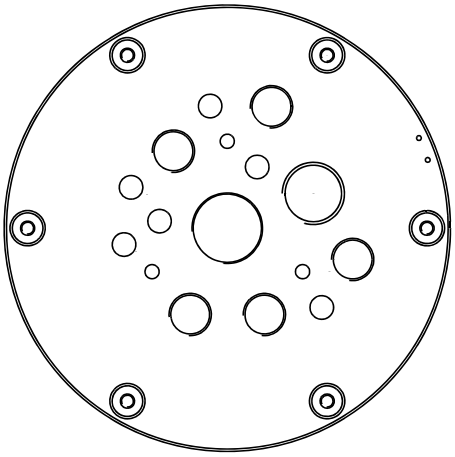
Z611020002 2 Liter dished bottom reactor

Reactor type	2 liter dished bottom		
Inner Diameter	105 mm	Autoclave Space (HxD)	400 x 200 mm
Inner Height (max.)	240 mm	Overall height reactor	290 mm
Liquid Height (working vol.)	156 mm	Total Volume	2.2 liter
Ports Head Plate	1 x M30 x 1	Working Volume	1.7 liter
	1 x G3/4"	Min. Working Volume	0.5 liter
	5 x M18 x 1.5	H/D Total	2.3
	3 x 6 mm	H/D Work Vol.	1.9
	6 x 10 mm		

Materials in contact with the medium: borosilcate glass
stainless steel
silicone rubber
viton & EPDM

THE 2 LITER JACKETED REACTOR WITH HEAD PLATE:



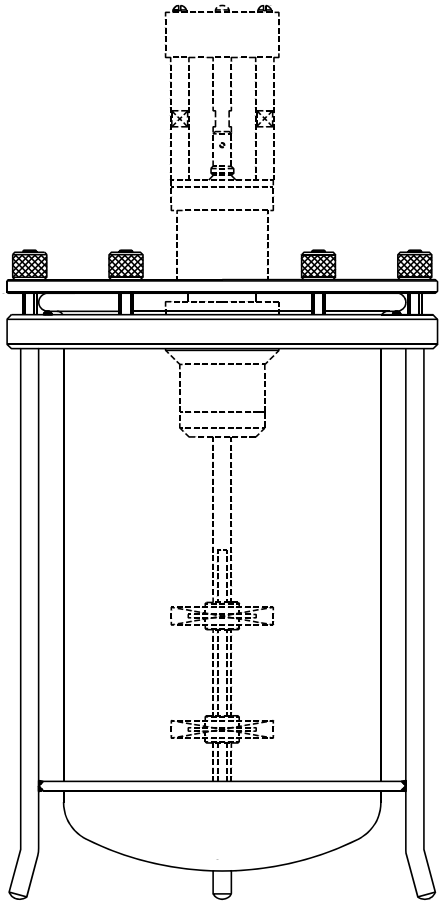


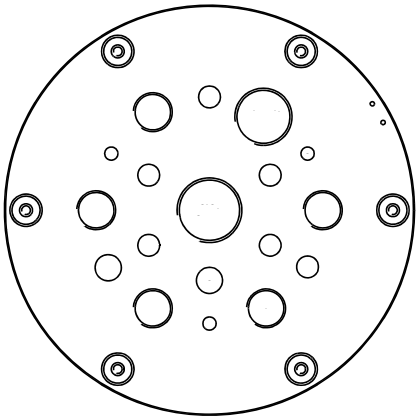
Z61104CT04 2 Liter jacketed reactor

Reactor type	2 liter jacketed		
Inner Diameter	105 mm	Autoclave Space (HxD)	400 x 200 mm
Inner Height (max.)	240 mm	Overall height reactor	290 mm
Liquid Height (working vol.)	156 mm	Total Volume	2.2 liter
Ports Head Plate	1 x M30 x 1	Working Volume	1.7 liter
	1 x G3/4"	Min. Working Volume	0.5 liter
	5 x M18 x 1.5	H/D Total	2.3
	3 x 6 mm	H/D Work Vol.	1.9
	6 x 10 mm	Jacket Volume	1.4 liter

Materials in contact with the medium: borosilcate glass
stainless steel
silicone rubber
viton & EPDM

THE 3 LITER DISHED BOTTOM REACTOR WITH HEAD PLATE:



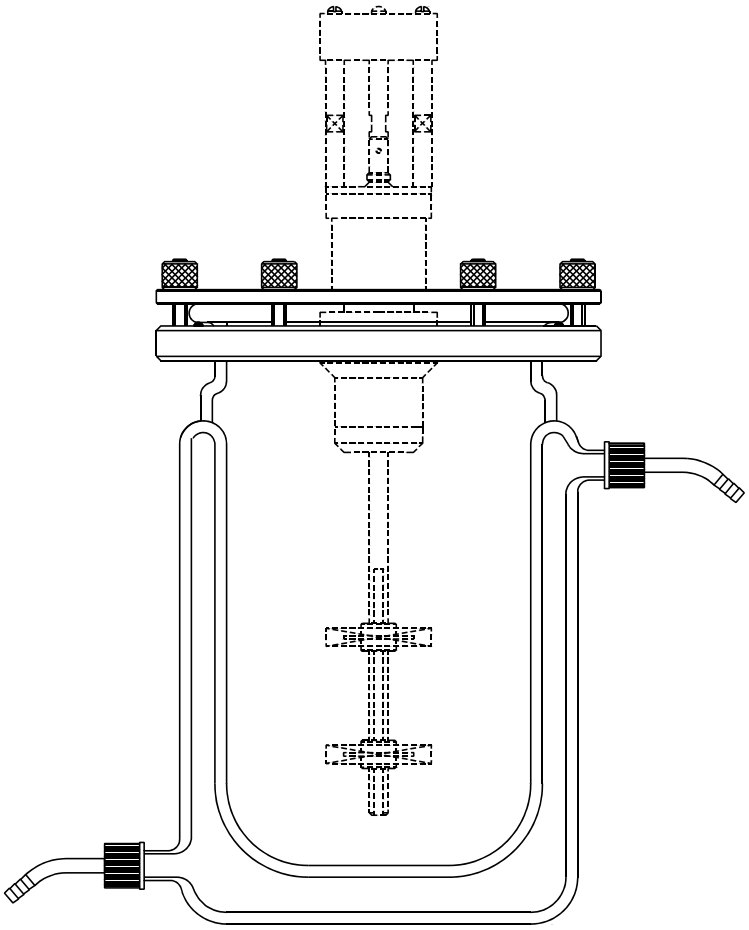


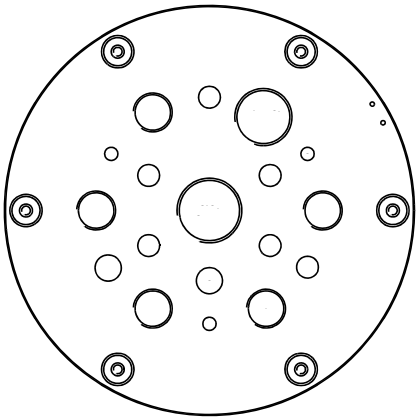
Z61101C006 3 Liter dished bottom reactor

Reactor type	3 liter dished bottom		
Inner Diameter	130 mm	Autoclave Space (HxD)	400 x 200 mm
Inner Height (max.)	250 mm	Overall height reactor	290 mm
Liquid Height (working vol.)	200 mm	Total Volume	3.1 liter
Ports Head Plate	1 x M30 x 1	Working Volume	2.7 liter
	1 x G3/4"	Min. Working Volume	0.47 liter
	5 x M18 x 1.5	H/D Total	1.9
	3 x 6 mm	H/D Work Vol.	1.5
	6 x 10 mm		
	2 x 12 mm		

Materials in contact with the medium: borosilcate glass
stainless steel
silicone rubber
viton & EPDM

THE 3 LITER JACKETED REACTOR WITH HEAD PLATE:



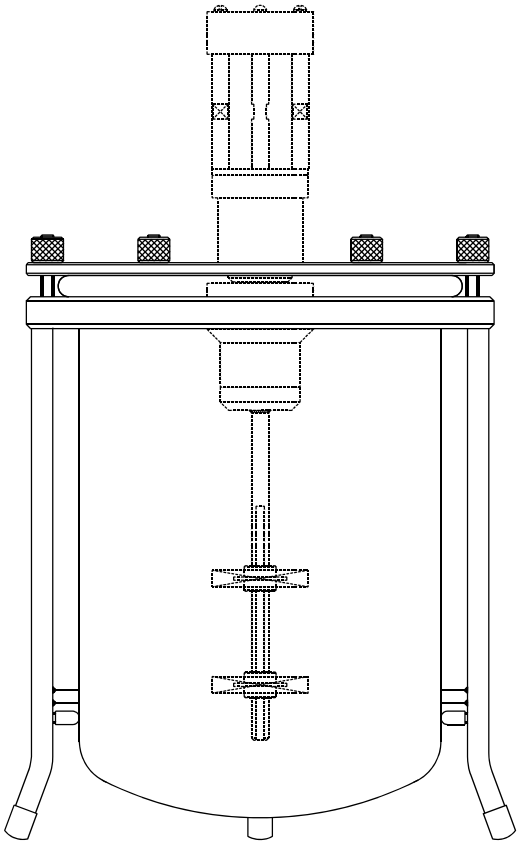


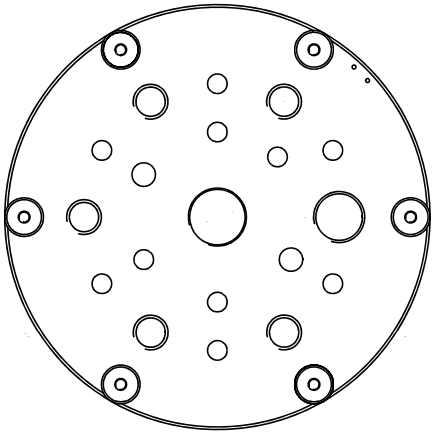
Z61103CT04 3 Liter jacketed reactor

Reactor type	3 liter dished bottom		
Inner Diameter	130 mm	Autoclave Space (HxD)	400 x 230 mm
Inner Height (max.)	250 mm	Overall height reactor	290 mm
Liquid Height (working vol.)	200 mm	Total Volume	3.1 liter
Ports Head Plate	1 x M30 x 1	Working Volume	2.7 liter
	1 x G3/4"	Min. Working Volume	0.47 liter
	5 x M18 x 1.5	H/D Total	1.9
	3 x 6 mm	H/D Work Vol.	1.5
	6 x 10 mm	Jacket Volume	1.2 liter
	2 x 12 mm		

Materials in contact with the medium: borosilcate glass
stainless steel
silicone rubber
viton & EPDM

THE 5 LITER DISHED BOTTOM REACTOR WITH HEAD PLATE:



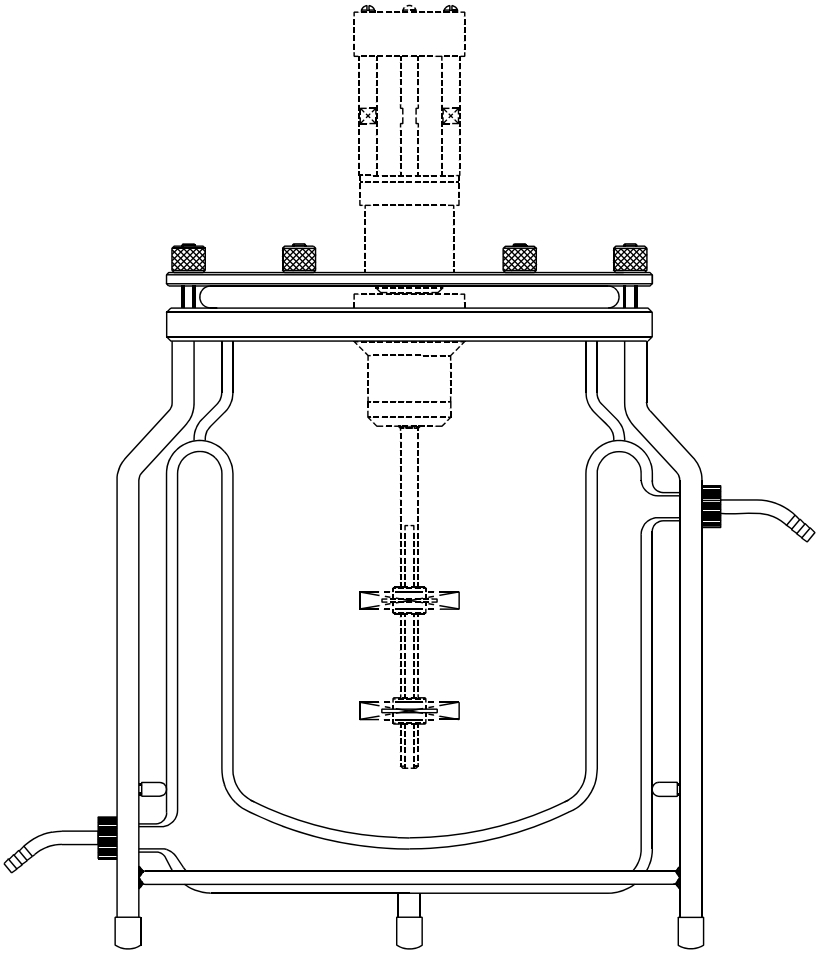


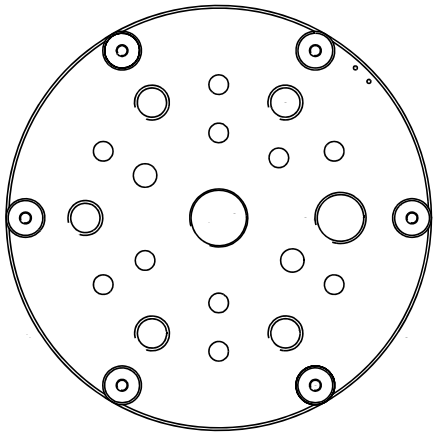
Z611000005 5 Liter dished bottom reactor

Reactor type	5 liter dished bottom		
Inner Diameter	160 mm	Autoclave Space (HxD)	400 x 200 mm
Inner Height (max.)	250 mm	Overall height reactor	290 mm
Liquid Height (working vol.)	180 mm	Total Volume	4.8 liter
Ports Head Plate	1 x M30 x 1	Working Volume	3.4 liter
	1 x G3/4"	Min. Working Volume	1.5 liter
	5 x M18 x 1.5	H/D Total	1.6
	10 x 10 mm	H/D Work Vol.	1.1
	2 x 12 mm		

Materials in contact with the medium: borosilcate glass
stainless steel
silicone rubber
viton & EPDM

THE 5 LITER JACKETED REACTOR WITH HEAD PLATE:



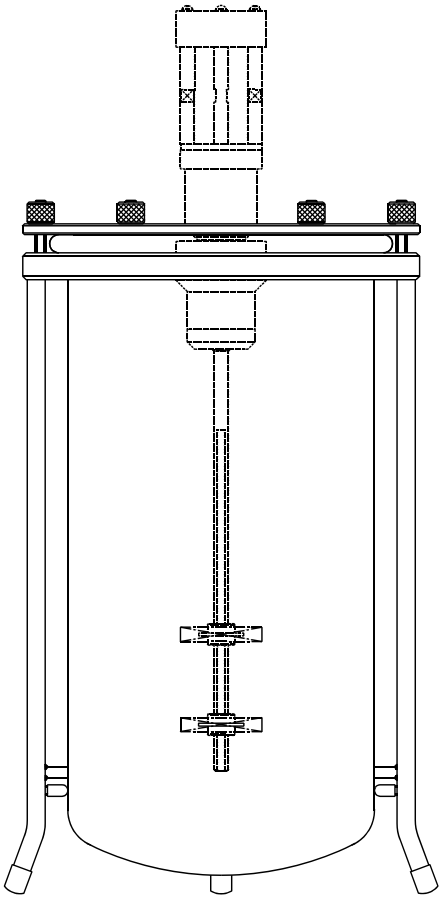


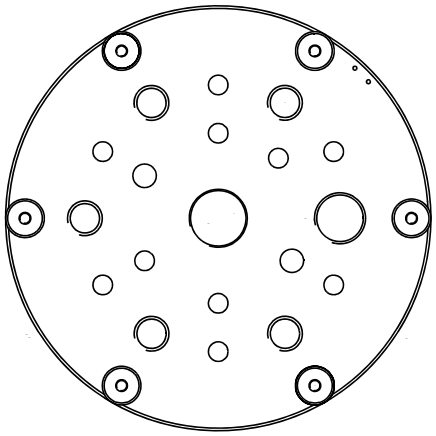
Z61104CT05 5 Liter jacketed reactor

Reactor type	5 liter jacketed		
Inner Diameter	160 mm	Autoclave Space (HxD)	450 x 260 mm
Inner Height (max.)	250 mm	Overall height reactor	330 mm
Liquid Height (working vol.)	180 mm	Total Volume	4.8 liter
Ports Head Plate	1 x M30 x 1	Working Volume	3.4 liter
	1 x G3/4"	Min. Working Volume	1.5 liter
	5 x M18 x 1.5	H/D Total	1.6
	10 x 10 mm	H/D Work Vol.	1.1
	2 x 12 mm	Jacket Volume	1.8 liter

Materials in contact with the medium: borosilcate glass
stainless steel
silicone rubber
viton & EPDM

THE 7 LITER DISHED BOTTOM REACTOR WITH HEAD PLATE:



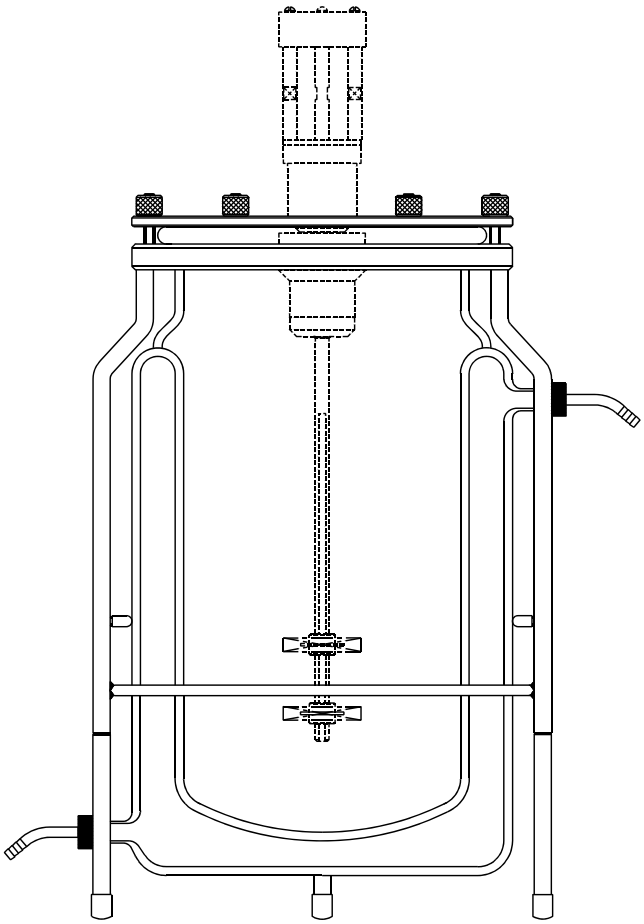


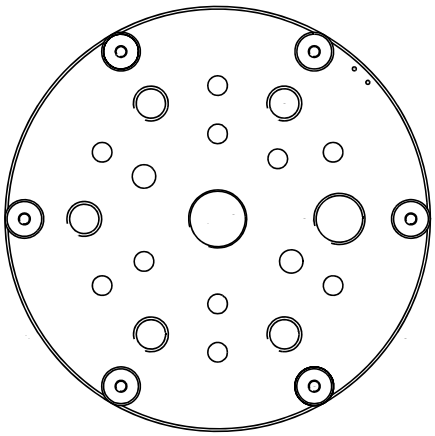
Z611000007 7 Liter dished bottom reactor

Reactor type	7 liter dished bottom		
Inner Diameter	160 mm	Autoclave Space (HxD)	510 x 260 mm
Inner Height (max.)	350 mm	Overall height reactor	390 mm
Liquid Height (working vol.)	270 mm	Total Volume	6.8 liter
Ports Head Plate	1 x M30 x 1	Working Volume	5.4 liter
	1 x G3/4"	Min. Working Volume	2.0 liter
	5 x M18 x 1.5	H/D Total	2.2
	10 x 10 mm	H/D Work Vol.	1.8
	2 x 12 mm		

Materials in contact with the medium: borosilcate glass
stainless steel
silicone rubber
viton & EPDM

THE 7 LITER JACKETED REACTOR WITH HEAD PLATE:



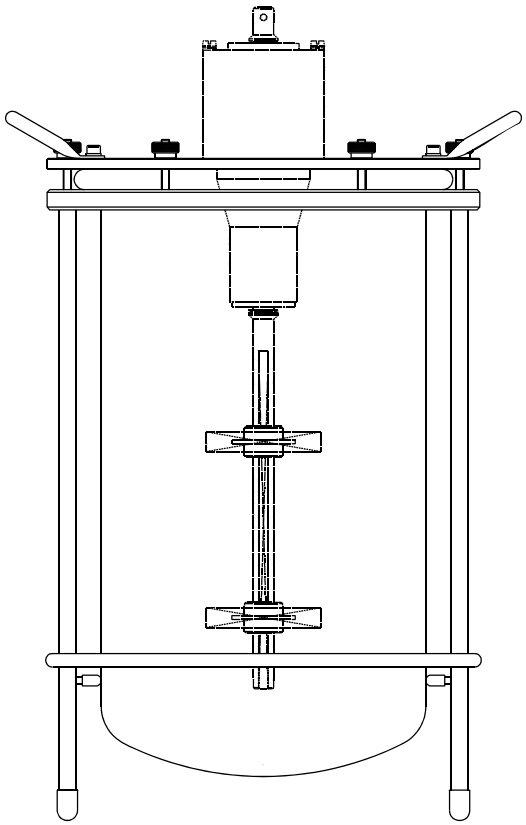


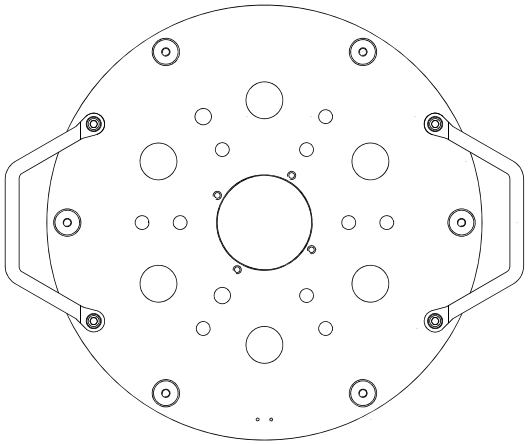
Z61103CT07 7 Liter jacketed reactor

Reactor type	7 liter jacketed		
Inner Diameter	160 mm	Autoclave Space (HxD)	540 x 260 mm
Inner Height (max.)	350 mm	Overall height reactor	425 mm
Liquid Height (working vol.)	270 mm	Total Volume	6.8 liter
Ports Head Plate	1 x M30 x 1	Working Volume	5.4 liter
	1 x G3/4"	Min. Working Volume	2.0 liter
	5 x M18 x 1.5	H/D Total	2.2
	10 x 10 mm	H/D Work Vol.	1.8
	2 x 12 mm	Jacket Volume	2.4 liter

Materials in contact with the medium: borosilcate glass
stainless steel
silicone rubber
viton & EPDM

THE 15 LITER DISHED BOTTOM REACTOR WITH HEAD PLATE:



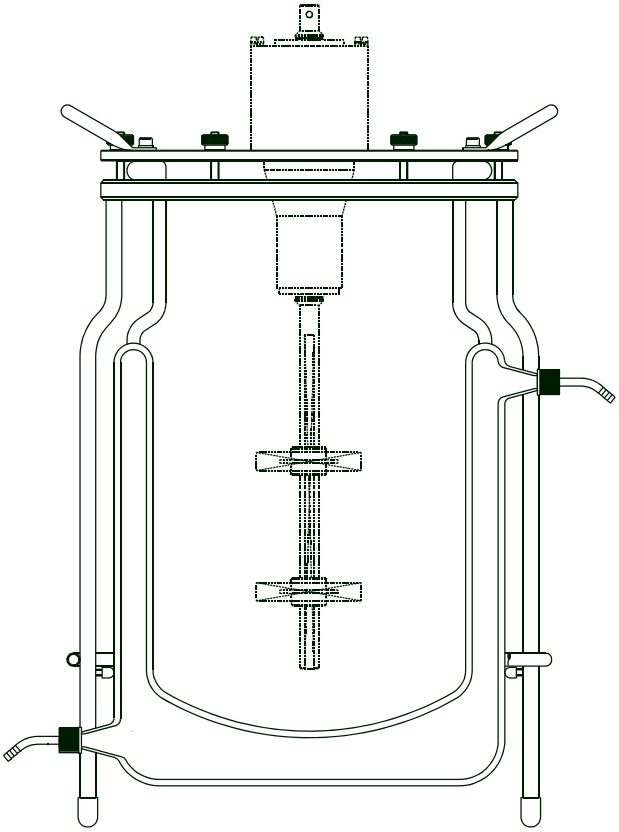


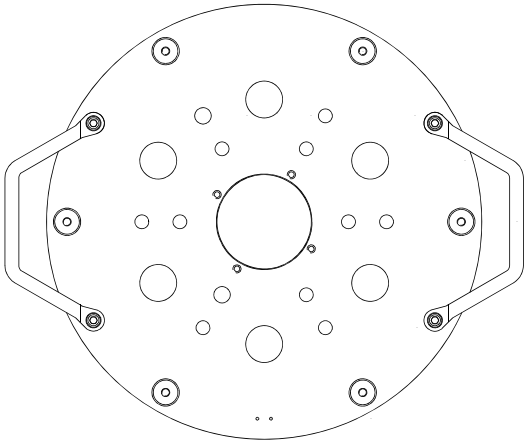
Z611000010 15 Liter dished bottom reactor

Reactor type	15 liter dished bottom		
Inner Diameter	220 mm	Autoclave Space (HxD)	620 x 400 mm
Inner Height (max.)	440 mm	Overall height reactor	510 mm
Liquid Height (working vol.)	274 mm	Total Volume	16.5 liter
Ports Head Plate	1 x 69 mm	Working Volume	12 liter
	6 x 27 mm	Min. Working Volume	2.5 liter
	2 x 12 mm	H/D Total	1.7
	10 x 10 mm	H/D Work Vol.	1.5

Materials in contact with the medium: borosilcate glass
stainless steel
silicone rubber
viton & EPDM

THE 15 LITER JACKETED REACTOR WITH HEAD PLATE:



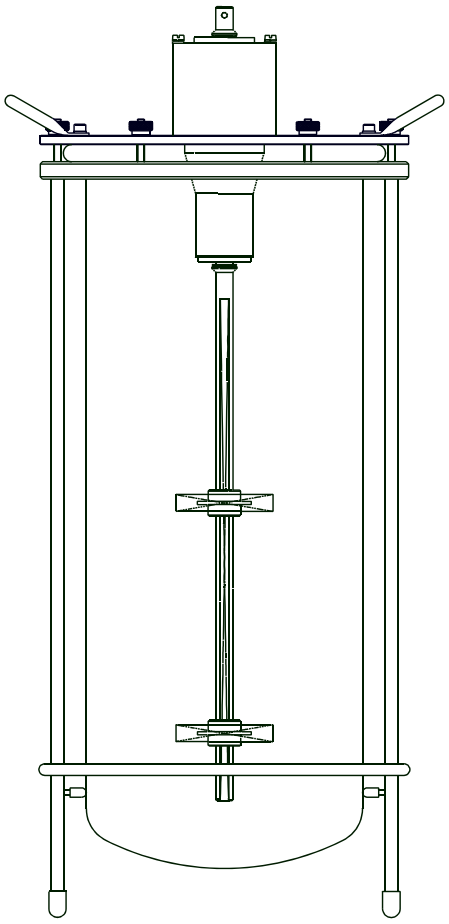


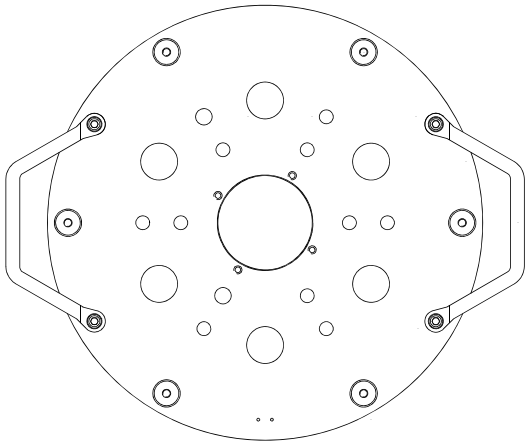
Z61103CT10 15 Liter jacketed reactor

Reactor type	15 liter jacketed		
Inner Diameter	240 mm	Autoclave Space (HxD)	650 x 400 mm
Inner Height (max.)	438 mm	Overall height reactor	510 mm
Liquid Height (working vol.)	274 mm	Total Volume	18.2 liter
Ports Head Plate	1 x 69 mm	Working Volume	12 liter
	6 x 27 mm	Min. Working Volume	2.5 liter
	2 x 12 mm	H/D Total	1.4
	10 x 10 mm	H/D Work Vol.	1.2
		Jacket Volume	7.4 liter

Materials in contact with the medium: borosilcate glass
stainless steel
silicone rubber
viton & EPDM

THE 20 LITER DISHED BOTTOM REACTOR WITH HEAD PLATE:





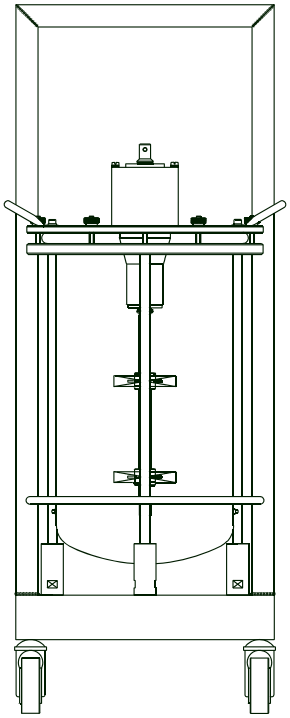
Z611000020 20 Liter dished bottom reactor

Reactor type	20 liter dished bottom		
Inner Diameter	220 mm	Autoclave Space (HxD)	850 x 400 mm
Inner Height (max.)	620 mm	Overall height reactor	715 mm
Liquid Height (working vol.)	475 mm	Total Volume	23 liter
Ports Head Plate	1 x 69 mm	Working Volume	16 liter
	6 x 27 mm	Min. Working Volume	2.5 liter
	2 x 12 mm	H/D Total	2.4
	10 x 10 mm	H/D Work Vol.	2

Materials in contact with the medium: borosilcate glass
stainless steel
silicone rubber
viton & EPDM

CART FOR THE 15 AND 20 LITER BIOREACTOR:

Since moving a filled 15 or 20 liter bioreactor is not an easy job, a special cart is available; it is developed to fit both the tripod of the 15/20 liter and the jacketed 15 liter reactor (inner holes are used to fit the 15 and 20 liter reactor, outer holes are used to fit the 15 liter jacketed reactor).



Z811110001 Cart for the 15 and 20 liter bioreactors

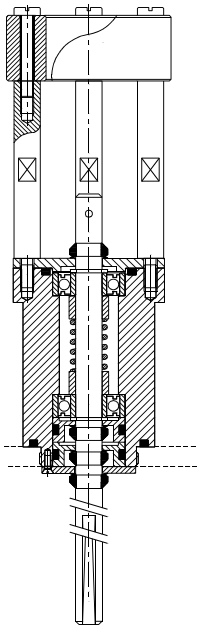
Dimensions (mm):	h = 960	
	w = 350	
	d = 460	
Material:	Frame:	stainless steel 316
	Wheels:	Duro-plastic (autoclavable)

AGITATION: TOP STIRRER ASSEMBLY:

Lipseal Stirrer Assemblies:

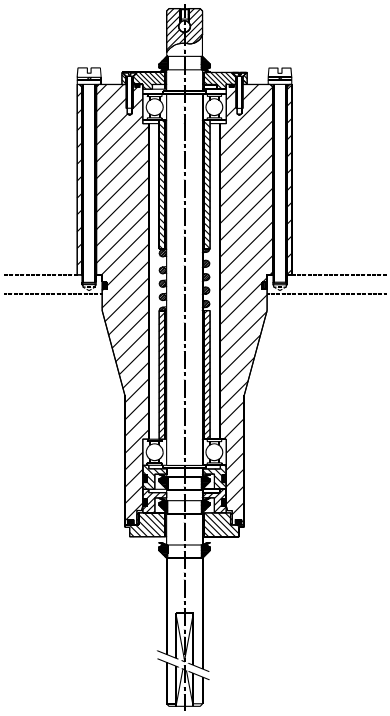
Z81315R002 Lipseal stirrer assembly 1 liter
Z81315R003 Lipseal stirrer assembly 2, 3, 5 liter
Z81315R007 Lipseal stirrer assembly 7 liter

The stirrer assembly is mounted at the central stirrer port in the head plate.



Z81315R010 Lipseal stirrer assembly 15 liter
Z81315R020 Lipseal stirrer assembly 20 liter

The stirrer assembly is mounted at the central stirrer port in the head plate.

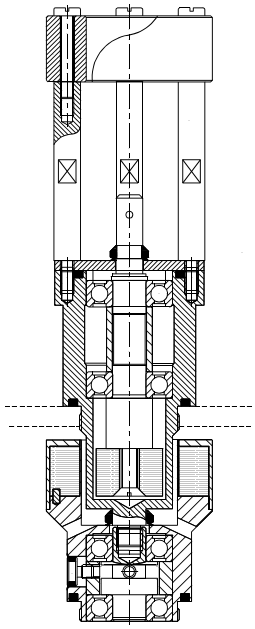


Magnetically coupled stirrer assemblies:.

Z81315MG02 Top stirrer assembly for 1 liter reactor
Z81315MG03 Top stirrer assembly for 2, 3, 5 liter reactor
Z81315MG07 Top stirrer assembly for 7 liter reactor

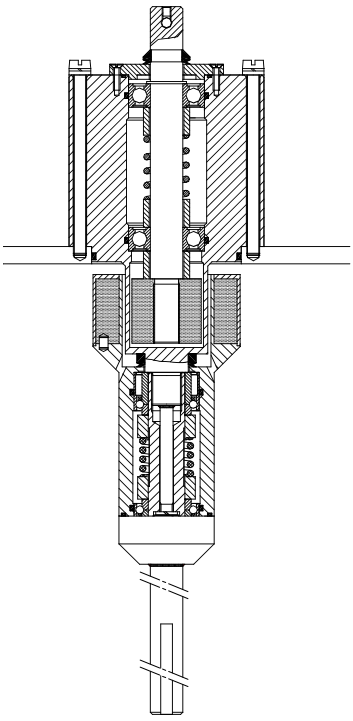
The stirrer assembly is presented exclusive stirrer shaft.

The stirrer assembly is mounted at the central stirrer port in the head plate.



Z81315MG10 Top stirrer assembly for 15L reactor
Z81315MG20 Top stirrer assembly for 20L reactor

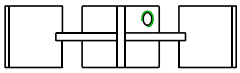
The stirrer assembly is mounted at the central stirrer port in the head plate.



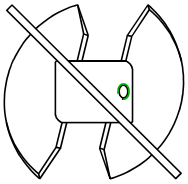
AGITATION: IMPELLERS:

The impellers fit to the ⌀ 15 mm shaft of the stirrer assembly.

Turbine impellers (6 bladed):



Z81312RS02 - Rushton impeller, 4 bladed, 1, 2 and 3 liter reactor
Z81313R602 - Rushton impeller, 6 bladed, 1, 2 and 3 liter reactor
Z81313R645 - Rushton impeller, 6 bladed (vortex), 2 and 3 liter reactor
Z81313R607 - Rushton impeller, 6 bladed, 5 and 7 liter reactor
Z81313R610 - Rushton impeller, 6 bladed, 15 and 20 liter reactor
Z81313R611 - Rushton impeller, 6 bladed, vortex 15 and 20 liter reactor



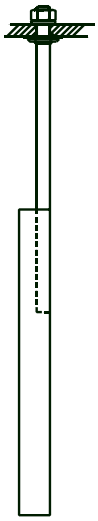
Marine impellers:

Z81314RC02 - Marine impeller (vortex), 1, 2 and 3 liter reactor
Z81314RC03 - Marine impeller (scoping), 1, 2 and 3 liter reactor
Z81314RC07 - Marine impeller (vortex), 5 and 7 liter
Z81314RC08 - Marine impeller (scoping), 5 and 7 liter
Z81314RC10 - Marine impeller (vortex), 15 and 20 liter
Z81314RC11 - Marine impeller (scoping) 15 and 20 liter

Note:
A combination of Turbine and Marine impellers may also be applied.

AGITATION: BAFFLES:

Baffle assembly:



Note:
The 1 liter reactor comes with 2 baffles that are fixed to the heat exchanger!

Baffles are used to increase the mixing efficiency (without baffles, the medium flow can become laminar, causing poor mixing efficiency and mass transfer). The baffles are mounted near the reactor wall for optimum mixing performance.
The baffle assembly consists of one baffle and mounting material.

Z81326KS03	2 and 3 liter reactor, 6 mm port
Z81326KS05	5 liter reactor, 10 mm port
Z81326KS07	7 liter reactor, 10 mm port
Z81326KS10	15 liter reactor, 10 mm port
Z81326KS20	20 liter reactor, 10 mm port

Applicable number of baffles: 1 - 3

AGITATION: STIRRER MOTORS:

The table below contains information about applicable stirrer motors:

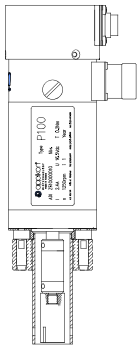
Order nbr.	Motor type	Top / Bottom	Speed range (rpm)	Max. torque (Nm)	For reactors (l)
Z510000010	P100	Top	0 - 1250	0.2	1 - 7
Z510000020	P140	Top	0 - 1250	0.3	1 - 7
Z510000030	P310	Top	0 - 1500	0.55	1 - 7
Z510000011	P100 i=6	Top	0 - 200	1	15, 20
Z510000040	P1000	Top	0 - 1000	3	15, 20

The following motor cable is available:

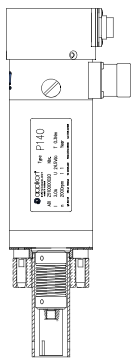
Z510121011 Motor cable for stirrers P100 and P140
Z510121012 Motor cable for stirrers P100 and P310 and P1000
Z510121020 Encoder cable

The ***ez***-Control comes with an internal Stirrer Speed Controller that covers the range motors from P100 to P1000!

MOTOR DESCRIPTION:

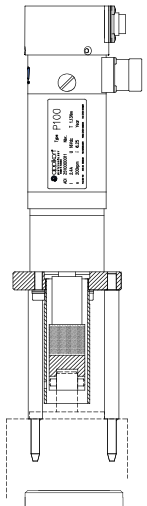


Z510000010: Stirrer Motor Assembly P100
Motor P100 including motor studs and flexible coupling; standard motor for the Applikon 2 and 3 liter bioreactors with low viscous media and a stirrer speed range of 0 - 1250 rpm.
The motor can also be used with the 1 - 7 liter cell culture applications with a stirrer speed range of 0 - 500 rpm.
Maximum torque: 0.20 Nm.
Weight: 1.6 kg.
The motor studs fit in the Top Stirrer Assemblies of the 1 - 7 liter reactors.

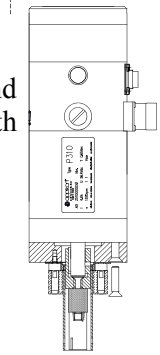


Z510000020: Stirrer Motor Assembly P140
Motor P140 including motor studs and flexible coupling; heavy duty motor for the Applikon 5 and 7 liter bioreactors, used in tough applications with viscous media and stirrer speeds up to 1250 rpm.
Maximum torque: 0.30 Nm.
Weight: 1.9 kg.
The motor studs fit in the Top Stirrer Assemblies of the 1 - 7 liter reactors.

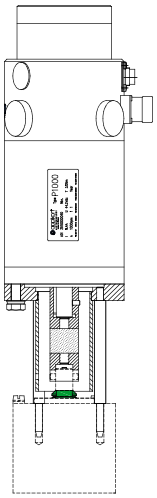
Z510000011: Stirrer Motor Assembly P100 i=6
Motor P100, i=6, including motor studs and coupling; (stirrer speed is reduced 6.25 times by a planetary gear box).
Standard motor for cell culture bioreactors and a standard stirrer speed range of 0 - 200 rpm.
Maximum torque: 1.0 Nm.
Weight: 2.4 kg.
The motor studs fit in the Top Stirrer Assemblies of the 15 and 20 liter reactors.



Z510000030: Stirrer Motor Assembly P310
Motor P310 including motor studs and flexible coupling; upgrade motor for the 5 and 7 liter Applikon autoclavable bioreactors, to be used in normal applications with stirrer speeds up to 1500 rpm.
Maximum torque: 0.55 Nm.
Weight: 3.9 kg.
The motor studs fit in the Top Stirrer Assemblies of the 1 - 7 liter reactors.



Z510000040: Stirrer Motor Assembly P1000
Motor P1000, including motor studs and coupling; standard motor for the Applikon autoclavable 15 and 20 liter bioreactors with a stirrer speed range of 0 - 1000 rpm.
The motor can also be used in the in-situ sterilizable bioreactors as a top-drive stirrer.
Maximum torque: 3.0 Nm.
Weight = 8.1 kg.
The motor studs fit in the Top Stirrer Assemblies of the 15 and 20 liter reactors.

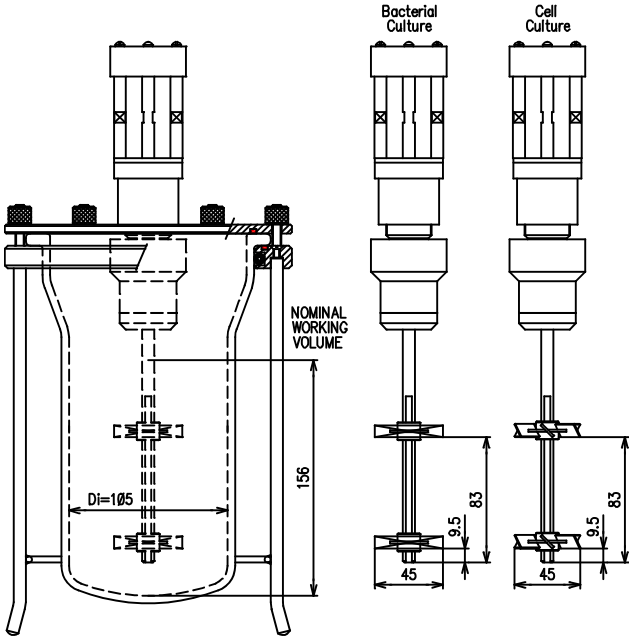


Z310110050 Power upgrade P1000 motor

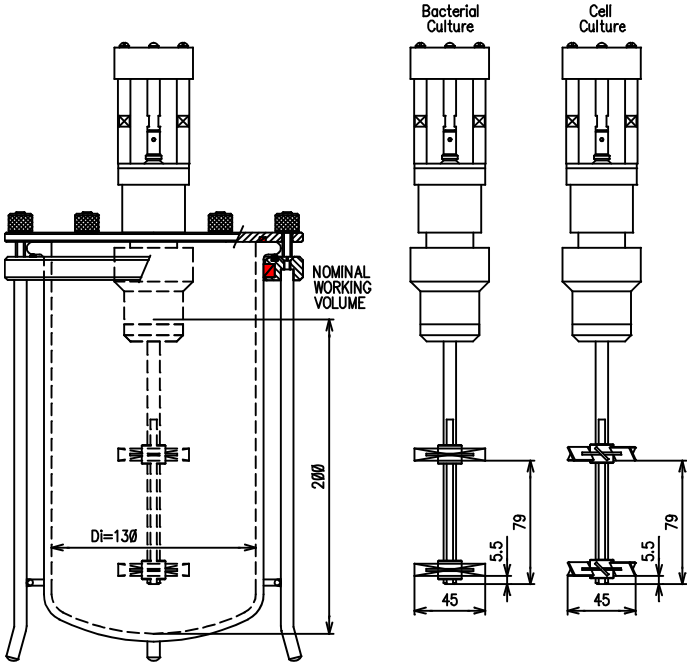
AGITATION: IMPELLER CONFIGURATION:

The following images show the advised impeller configuration (position and diameter) for the glass autoclavable bioreactors:

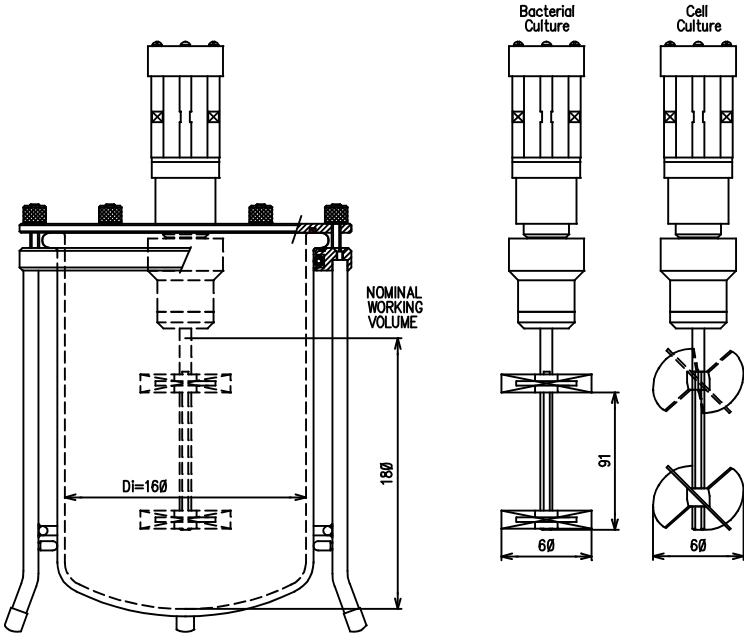
2 liter reactor:



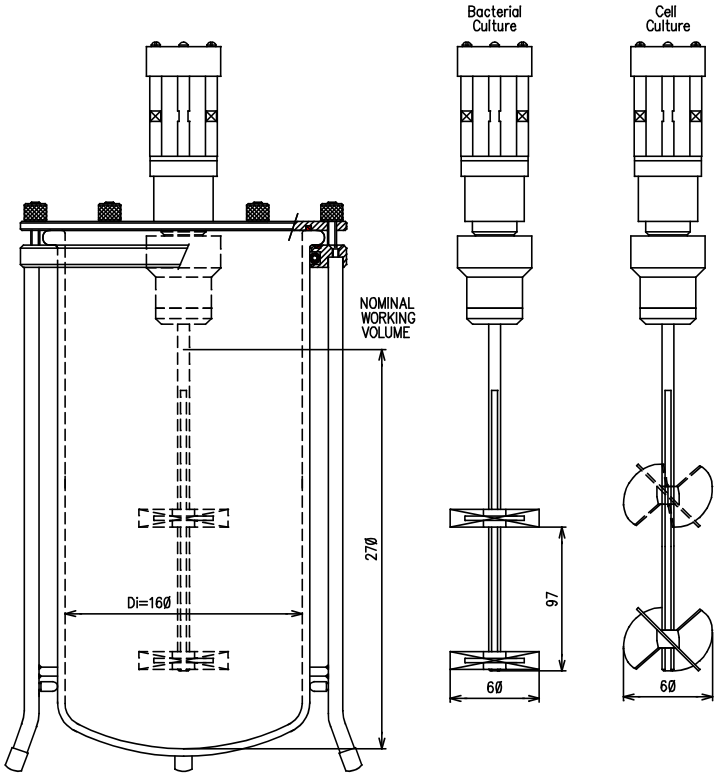
3 liter reactor:



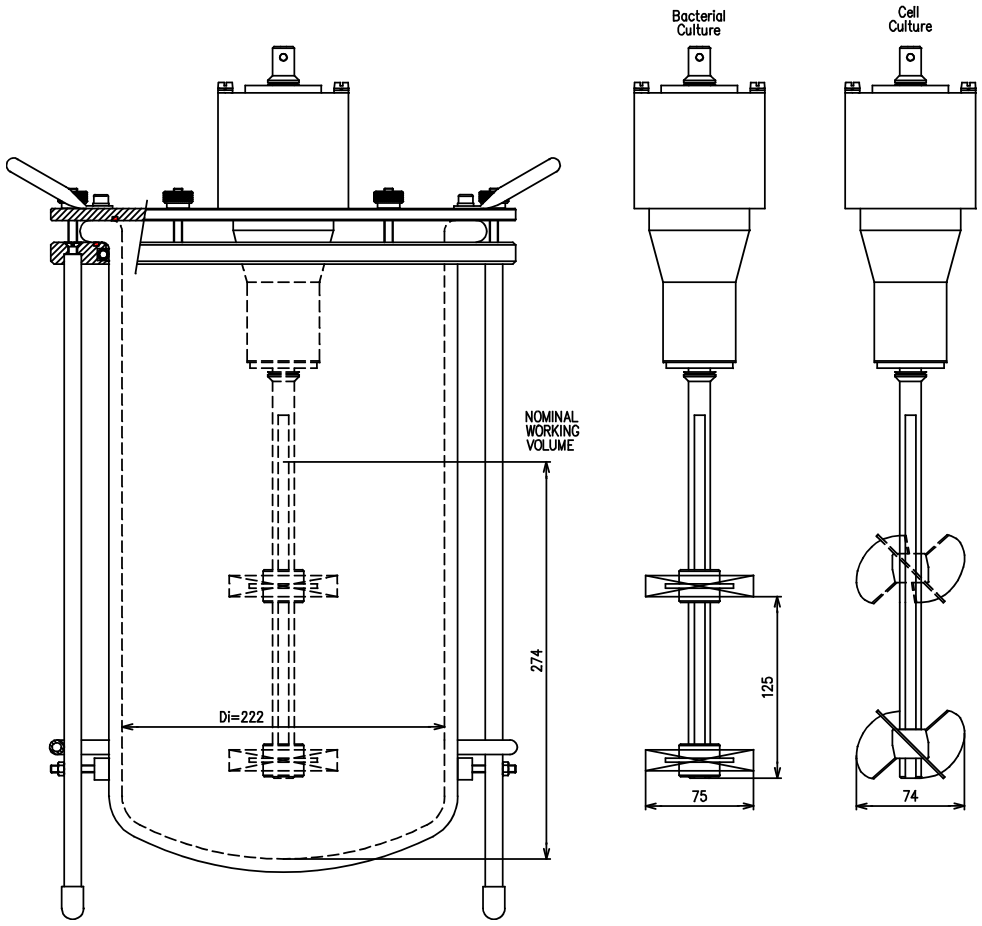
5 liter reactor:



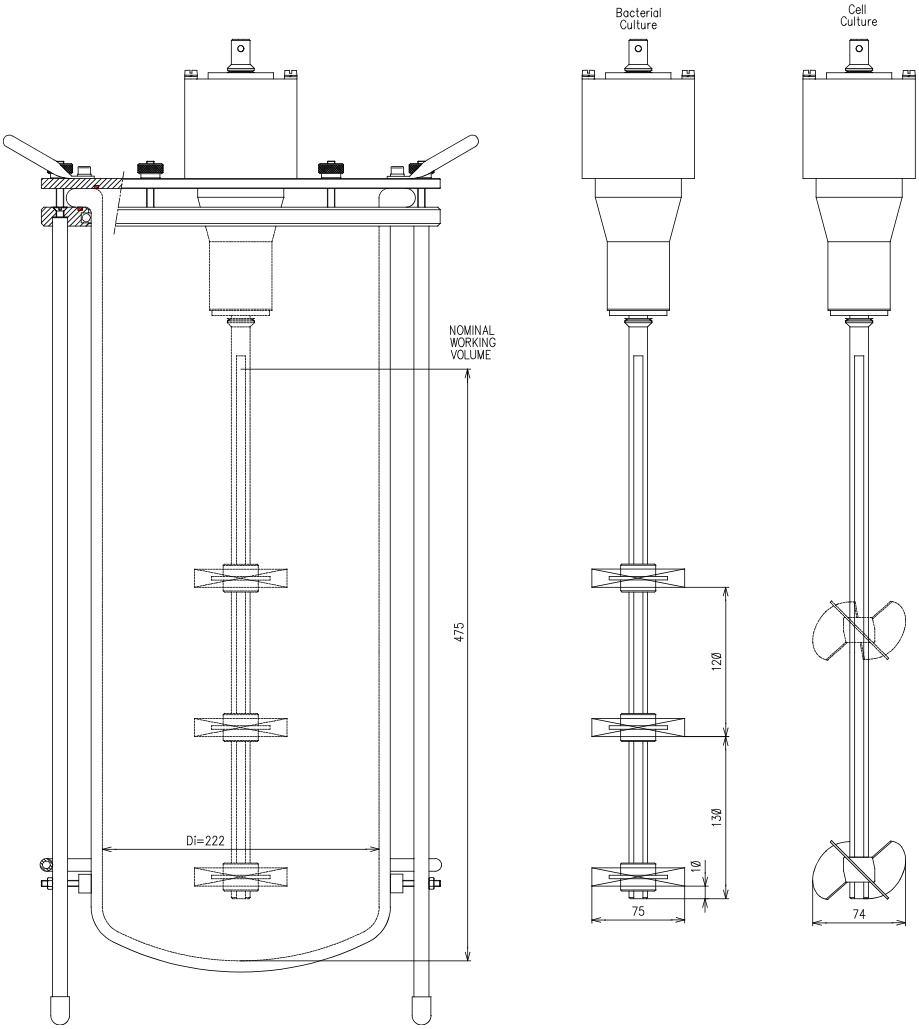
7 liter reactor:



15 liter reactor:



20 liter reactor:



AGITATION: POWER REQUIRED FOR STIRRING:

The power (Watt) of the stirrer motor that is required depends ond the number, type and diameter of the impellers, density of the medium and the stirrer speed. The required power per impeller of a stirrer motor in **non aerated** media is given by the equation:

$$P = \rho \times (N/60)^3 \times D^5 \times Np$$

where: P = the required power of the stirrer motor (W)
ρ = the density of the medium (kg/m^3)
N = the stirrer speed (rpm)
D = the impeller diameter (m)
Np = the power number of the impeller type:
Rushton turbine impellers: Np = 6
ADI marine impellers: Np = 1.5

Note:
When mounted according to the given configuration, a second or a third impeller on a shaft requires only 90% of the power of the first impeller. This means that the equation above is multiplied with the factor 1.9 for the second impeller and with a factor 2.8 for a third impeller.

The required torque of the stirrer motor is related to its power according to the following equation:

$$M = P \times 60 / (2 \pi N)$$

where: M = the required torque of the stirrer motor (Nm)
P = the required power of the stirrer motor (W)
N = the stirrer speed (rpm)

The Tip Speed (m/s) of an impeller at a certain stirrer speed is given by the equation:

$$\text{Tip speed} = (N / 60) \times \pi \times D$$

where: N = the stirrer speed (rpm)
D = the impeller diameter (m)

Below some examples are given of required stirrer power, torque and corresponding tip speed for non-aerated media with a density of 1100 kg/m^3:

7 liter reactor with 2 turbine impellers of 60 mm:
required power at 800 rpm: $P = 1100 \times (800/60)^3 \times (0.060)^5 \times 6 \times 1.9$ = approx. 23 W
required torque: $M = 23 \times 60 / (2 \pi 800)$ = approx. 0.28 Nm
tip speed: approx. 2.5 m/s

15 liter reactor with 2 turbine impellers of 75 mm:
required power at 800 rpm: $P = 1100 \times (800/60)^3 \times (0.075)^5 \times 6 \times 1.9$ = approx. 70 W
required torque: $M = 70 \times 60 / (2 \pi 800)$ = approx. 0.85 Nm
tip speed: approx. 3.1 m/s

20 liter reactor with 3 turbine impellers of 75 mm:
required power at 800 rpm: $P = 1100 \times (800/60)^3 \times (0.075)^5 \times 6 \times 2.8$ = approx. 105 W
required torque: $M = 105 \times 60 / (2 \pi 800)$ = approx. 1.25 Nm
tip speed: approx. 3.1 m/s

15 liter reactor with 1 marine impeller of 74 mm:
required power at 200 rpm: $P = 1100 \times (200/60)^3 \times (0.15)^5 \times 1.5$ = approx. 0.14 W
required torque: $M = 0.14 \times 60 / (2 \pi 200)$ = approx. 0.065 Nm
tip speed: approx. 0.8 m/s

Note:
- In bacterial cultures, when aeration is approx. 2 VVM (2 gas volumes per reactor (working) volume per minute) the required motor power and torque will show a substantial decrease in relation to the calculated value.
- Friction in the (ball) bearings may cause power losses of 10 . . 20 %.

AERATION:

The gas supply section supports (a combination of) four rotameters and four mass flow controllers.

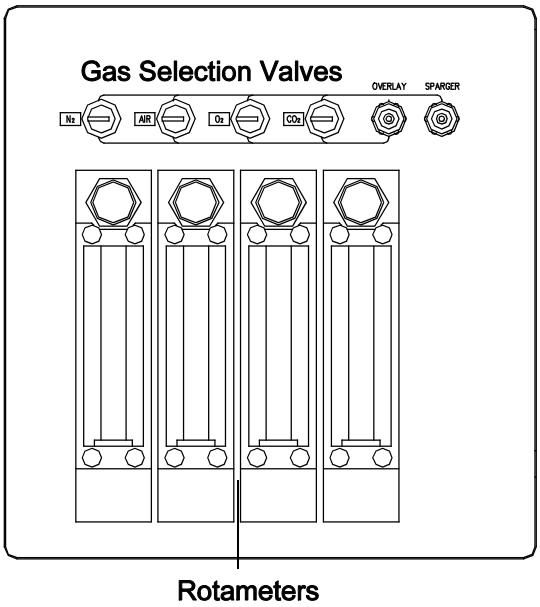
The gas selection block module offers easy switching (per gas) between gas overlay and sparging (upward position = sparging; downward position = overlay).

Z311302020 Gas Selection Block

In case no Gas Selection Block is applied, for each individual gas outlet a bulkhead union is mounted in the front! Spare holes are blinded.

Z310112040: Gas Outlet Bulkhead Connector Set

Inside the gas supply section, four mass flow controllers can be installed.

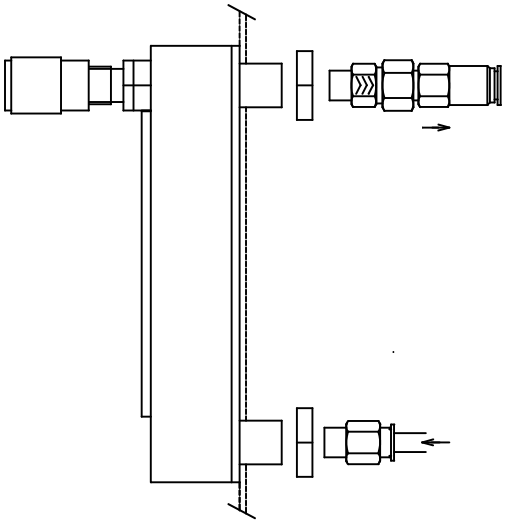


Rules of Thumb: Gas flow rates for sparger and overlay:

Gas	Cell culture	Microbial culture	Cell culture	Microbial culture
	Sparging		Overlay	
Air	approx. 0.1 vvm	1 - 2 vvm	0.1 vvm	10% of “air to sparger”
O_2	10% of “air”	20 - 30% of “air”	NA	NA
CO_2	10 - 25% of “air”	20 - 30% of “air”	10% of “air to sparger”	NA
N_2	10 - 25% of “air”	20 - 30% of “air”	NA	NA

Where: vvm = volume per (working) volume per minute

Available rotameters for the *ez*-Control (60 mm, direct reading scales):



Z3RM002006 Rotameter 50 ml/min O_2, N_2, air
Z3RM002011 Rotameter 100 ml/min O_2, N_2, air
Z3RM002016 Rotameter 500 ml/min O_2, N_2, air
Z3RM002020 Rotameter 1 l/min O_2, N_2, air
Z3RM002025 Rotameter 5 l/min O_2, N_2, air
Z3RM002030 Rotameter 10 l/min O_2, N_2, air
Z3RM002035 Rotameter 50 l/min O_2, N_2, air

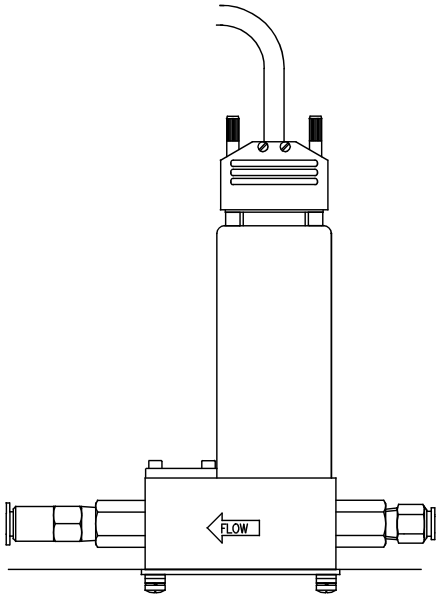
Z3RM002041 Rotameter 50 ml/min CO_2
Z3RM002046 Rotameter 100 ml/min CO_2
Z3RM002051 Rotameter 500 ml/min CO_2
Z3RM002055 Rotameter 1 l/min CO_2
Z3RM002060 Rotameter 5 l/min CO_2
Z3RM002065 Rotameter 10 l/min CO_2

Each rotameter contains a non-return valve at the gas-outlet. As a result, pressure differences cannot cause back-flow through the rotameter.

Available mass flow controllers

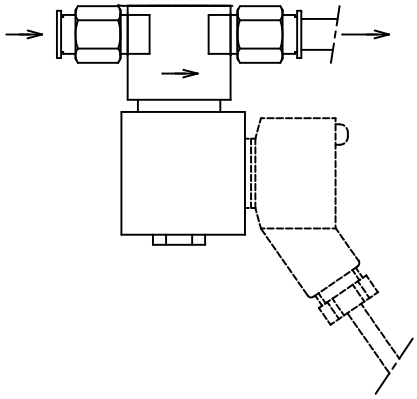
Behind the rotameter panel, four mass flow controllers can be mounted.
The mass flow controller comes with a mounting set (mounting material, connectors and tubing); it also contains a non-return valve at the gas-outlet. As a result, pressure differences cannot cause back-flow through the mass flow controller.

The Controller Output to the mass flow controller is communicated digitally (RS485-protocol)



Z310112020 Mass Flow Controller 0 - 30 SL/min

Valves in the gas supply lines:



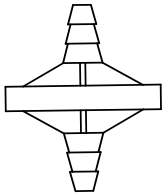
At the inner rear side of the gas-supply box, solenoid valves can be mounted in the gas supply line (before the rotameter or mass flow controller).

Z310112010 Solenoid Valve Assembly 24V

Specifications for the gas inlet lines:
Gas inlet connections: bulkhead union 6 mm
Gas outlet connections: bulkhead union 6 mm
Required inlet pressure: 2 barg

GAS IN-/OUTLET FILTER:

The bacterial air filter is an economical depth filter for sterile gas delivery and venting applications. The hydrofobic PTFE filter membrane excludes the risk of contamination. Housing material: polypropylene. The filter is autoclavable.



Specifications:

Effective filtration area:	25 cm^2
Pore size:	0.2 µm
Typical flow rate:	40 Lpm at 0.4 barg (6 psig)
Hose barb connection:	Stepped hose barbs: 7 / 9.5 mm
Maximum temp.	132 °C

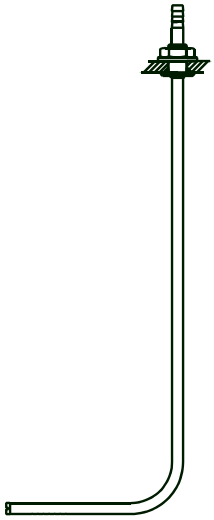
Z811302030 Disposable air filter

Note: for venting applications, a condenser must be applied in order to prevent the filter to be clogged with water.

SPARGERS:

Spargers or gas inlet pipes are tubes that are immersed in the medium. Consequently gas that is added is sparged in the medium.

L-TYPE SPARGER:



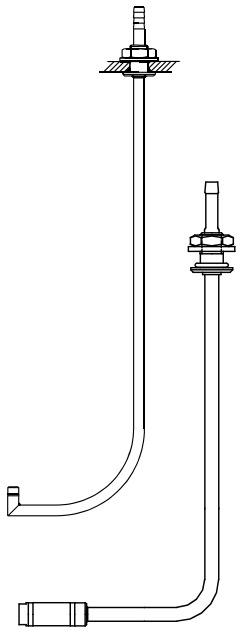
To meet the oxygen demand of a culture, a sterile gas stream can be sparged through the culture, using an
air-inlet pipe.
This pipe can be applied when high gas flow rates are
required, since this pipe causes hardly any pressure drop.

The holes in this pipe are located at the bottom to make sure that medium will be driven out by the gas stream.

Z81318L002	2 liter reactor, 10 mm port
Z81318L003	3 liter reactor, 10 mm port
Z81318L005	5 liter reactor, 10 mm port
Z81318L007	7 liter reactor, 10 mm port
Z81318L010	15 liter reactor, 10 mm port
Z81318L020	20 liter reactor, 10 mm port

POROUS-TYPE SPARGER:

In cell culture cultivations high gas-flow will damage the cells due to shear forces. To meet the oxygen demand of the cells at lower gas-flows the exchange-surface must be high. This is achieved by using a porous sparger. This sparger produces tiny gas bubbles for optimum gas distribution.
Use the Ceramic Sparger to increase the Oxygen Transfer Rate (OTR); oxygen transfer (k_La-value) of the ceramic sparger is approx. 3 times higher than the transfer with the porous sparger.
The ceramic sparger must not be used with serum-containing media (foam formation)!



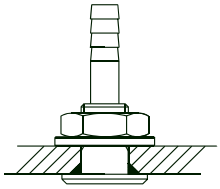
Sintered Metal Tip:

Z81318L004	2 liter reactor, 10 mm port
Z811303005	3 liter reactor, 10 mm port
Z81318L006	5 liter reactor, 10 mm port
Z81318L008	7 liter reactor, 10 mm port
Z81318L011	15 liter reactor, 10 mm port
Z811303008	Porous sparger for air-inlet pipe

Ceramic Tip:

Z81318CS03	Gas Inlet pipe + ceramic sparger 3L
Z81318CS07	Gas Inlet pipe + ceramic sparger 7L
Z81318CS15	Gas Inlet pipe + ceramic sparger 15L
Z81318CS00	Ceramic tip for sparger 3L/7L/15L

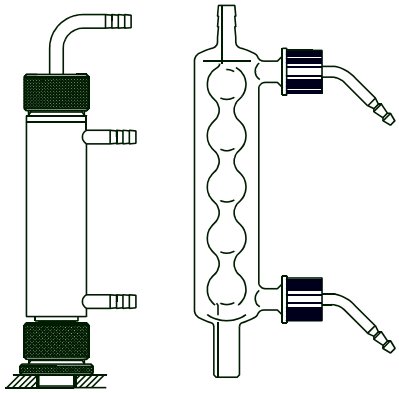
AIR OVERLAY ASSEMBLY:



This assembly can be used for either gas overlay or gas outlet.
Air overlay means head space aeration (separate from or in combination with sparging gas through the culture).

Z81308LU02 2 - 20 liter reactor, 10 mm port

AIR OUTLET CONDENSER:

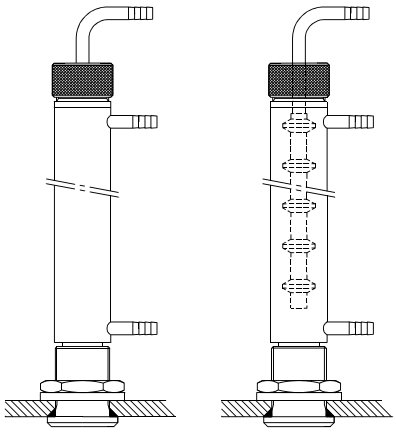


Working at elevated temperature and using aeration of the culture might cause too much evaporation during fermentation (increase of nutrient concentration and decrease in volume); this can be prevented by using an air-outlet condenser.

- glass condenser, fits into the pH/mV nipple.

- stainl. steel condenser, fits into the M18 x 1.5 port

Z81308L003 glass condenser for 2 - 5 liter reactor, pH/mV nipple
Z81308L002 SS condenser for 2 - 5 liter reactor, M18 x 1.5 port
Z81308L007 SS condenser for 7 liter reactor, M18 x 1.5 port

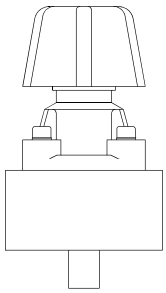


- stainl. steel condenser, fits in a 27 mm port

- baffled stainl. steel condenser, fits in a 27 mm port

Z81308L010 SS condenser for 15 and 20 liter reactor, 27 mm port
Z81308L011 baffled SS condenser for 15 and 20 l. reactor, 27 mm port

TUNING VALVE:

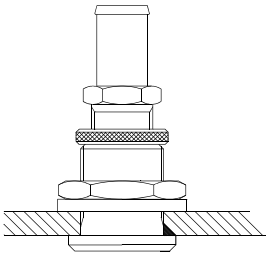


The tuning valve can be installed on top of the stainless steel air-outlet condenser in order to create a small over-pressure in the reactor.
This has the following advantages:
- risk of contamination is reduced,
- oxygen transfer to the medium is increased,
- sampling the culture is eased.

For safety reasons it is strongly advised to use this tuning valve in combination with the pressure relief valve (listed below).

Z811302020 2 . . 20 liter reactor

PRESSURE RELIEF VALVE:



When over-pressure is applied in the (glass) Applikon bio-reactors, it is advised to install a relief valve.
The relief valve opens at 0.5 barg.

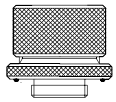
Z811302050 2 - 7 liter reactor, M18 x 1.5 port
Z811302060 15 and 20 liter reactor, 27 mm port

ADDITIONS:

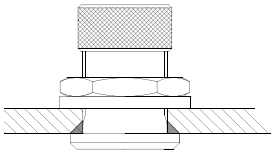
During preparation and while running a process, fluids will be added to the reactor (medium addition, inoculation, pH and level control, perfusion, etc.).

Septum holder:

The septum holder is equipped with a silicone rubber septum and can be used as a universal addition port by piercing it with one or more needles.



Z81302PD02 2 - 7 liter reactor, M18 x 1.5 port



Z81302PD10 15 and 20 liter reactor, 27 mm port

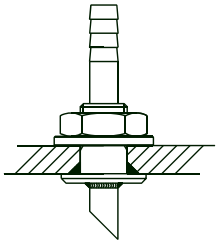
Needle for septum:

The needle is used to pierce the septum and to add a fluid or gas to the culture.

Z81309IN02 Needle for septum

Addition pipe 10 mm port:

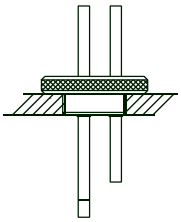
This addition pipe can be used to add fluids or gasses to the reactor.



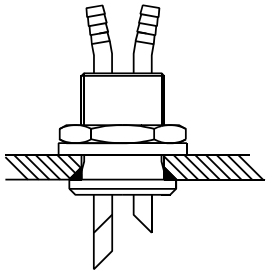
Z81324MT02 Addition pipe ID = 4 mm, 10 mm port

Medium inlet triple:

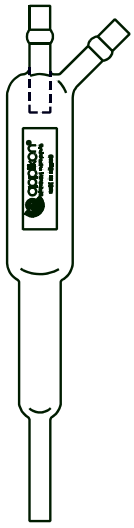
The medium inlet triple allows you to equip one head plate port with three additions (e.g. for acid, alkali and anti-foam addition). This device can be used to expand the number of entries beyond the number of ports in the head plate.



Z81324MT03 2 - 7 liter reactor, M18 x 1.5 port



Z81324MT10 15 and 20 liter reactor, 27 mm port



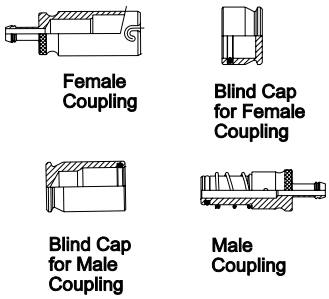
Liquid entry system:

When running a continuous culture, backgrowth of organisms into the medium container must be prevented.
The liquid entry system uses a sterile gas flow to transfer the fresh medium to the reactor; in this way, direct contact between the culture and the medium storage container does not exist.
The liquid entry system fits into the pH/mV nipple (Z81300N002).

Z81309IN03 Liquid entry system, pH/mV nipple

Rapi-Lok Sterile Connector:

The autoclavable Rapi-Loks are a fast and reliable way to make or break tubing connections during a fermentation or cell culture process.



Materials: Body and blind caps: SS 316L
O-rings: silicone

Z81324MT50 Rapi-Lok male coupling, bore size (ID) 2mm
Z81324MT51 Rapi-Lok female coupling, bore size (ID) 2mm
Z81324MT52 Rapi-Lok male coupling, bore size (ID) 4mm
Z81324MT53 Rapi-Lok female coupling, bore size (ID) 4mm
Z81324MT54 Rapi-Lok male coupling, bore size (ID) 6mm
Z81324MT55 Rapi-Lok female coupling, bore size (ID) 6mm
Z81324MT56 Rapi-Lok blind cap for male coupling
Z81324MT57 Rapi-Lok blind cap for female coupling

Liquid addition bottle:

The liquid addition bottles are available in the following sizes:

0.5 liter	Z811302009
1.0 liter	Z811302010
2.0 liter	Z811302011
5.0 liter	Z811302012
10 liter	Z811302013
20 liter	Z811302014

The liquid addition bottle comes with an air-inlet filter.

The Pump Section of the ***ez***-Control contains three positions for pumps:

At the Pump Section upto three tubing pump drives with “Easy Load” pump heads may be installed.

Z310116010 Fixed speed pump drive *ez*-Control 20 rpm

Z310116030 Pump head package 102R (standard)
Z310116020 Pump head package 313D (advanced)
Z310116040 Blind Plate Pump Position

Available tubing:

Type:	13	ID = 0.8 mm	flow = 0.06 ml/rev (thin-wall tubing)
Type:	14	ID = 1.6 mm	flow = 0.2 ml/rev (thin-wall tubing)
Type:	15	ID = 4.8 mm	flow = 1.67 ml/rev (thick-wall tubing)
Type:	16	ID = 3.1 mm	flow = 0.8 ml/rev (thin-wall tubing)
Type:	18	ID = 7.9 mm	flow = 3.8 ml/rev (thin-wall tubing)

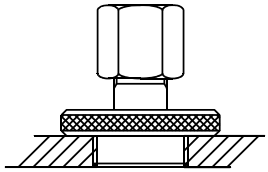
Z364111300 Silicone tubing type 13, 7.5 m (thin-wall tubing)
Z364111400 Silicone tubing type 14, 7.5 m (thin-wall tubing)
Z364111500 Silicone tubing type 15, 7.5 m (thick-wall tubing)
Z364111600 Silicone tubing type 16, 7.5 m (thin-wall tubing)
Z364111800 Silicone tubing type 18, 7.5 m (thin-wall tubing)

Z364021300 Norprene food tubing type 13, 15 m (thin wall tubing)
Z364021400 Norprene food tubing type 14, 15 m (thin wall tubing)
Z364021500 Norprene food tubing type 15, 15 m (thick wall tubing)
Z364021600 Norprene food tubing type 16, 15 m (thin wall tubing)
Z364021800 Norprene food tubing type 18, 15 m (thin wall tubing)

Stand alone pumps:
Z375548500 Eco Drive (var. speed) for short term operations. 7 - 200 rpm, 230Vac
Z377521570 Uni Drive; variable speed drive for continuous operation. 1 - 100 rpm
Z375237000 Variable speed drive with digital display. 1 - 100 rpm

SAMPLING:

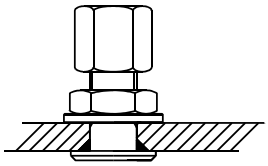
Assembly holder 6 mm tube for M18 x 1.5 port:



This device fits into a M18 x 1.5 port and can be used to hold any 6 mm (O.D.) tube. The insertion length of this tube can be varied; additions to or sampling from the culture fluid can take place at any level inside the reactor.

Z811302015 2 - 7 liter reactor, M18 x 1.5 port

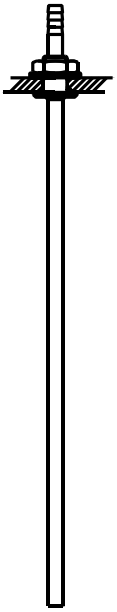
Assembly holder 6 mm tube for 10 mm port:



This device can be inserted into a 10 mm port and can be used to hold any 6 mm (O.D.) tube. The insertion length of this tube can be varied; additions to or sampling from the culture fluid can take place at any level inside the reactor.

Z81320AH00 2 - 20 liter reactor, 10 mm port

Sample pipe (fixed length):

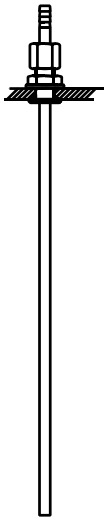


This assembly is used to sample the culture fluid.

Tube diameter (O.D.): 6 mm (to fit in a 10 mm port)
9.5 mm (to fit in a 12 mm port)

Z81319MB03 2 - 5 liter reactor, 10 mm port
Z81319MB05 2 - 5 liter reactor, 12 mm port
Z81319MB07 7 liter reactor, 10 mm port
Z81319MB08 7 liter reactor, 12 mm port
Z81319MB10 15 liter reactor, 10 mm port
Z81319MB12 15 liter reactor, 12 mm port
Z81319MB20 20 liter reactor, 10 mm port

Sample pipe (height adjustable):



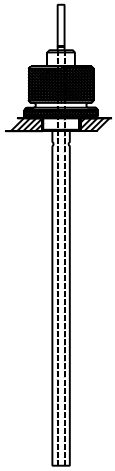
The height adjustable sample pipe assembly consists of:
- an assembly holder for 6 mm tubes and
- a O.D. 6 mm sample tube.

Tube diameter (I.D.): 4 mm.

With this device, the culture fluid can be sampled at any desired level.

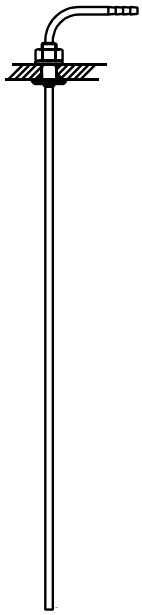
Z81319MB04 2 - 5 liter reactor, 10 mm port
Z81319MB06 7 liter reactor, 10 mm port
Z81319MB21 15 liter reactor, 10 mm port
Z81319MB25 20 liter reactor, 10 mm port

Chemostat tube:



The chemostat tube is used in continuous fermentation.
This device is designed to achieve a constant level in the reactor.
Liquid is taken out of the reactor through the height adjustable inner tube.
This inner tube is shielded from the reactor by an outer tube to avoid the influence of foam and surface irregularities on the liquid level.

Diameter outer tube:	O.D. = 8 mm
	I.D. = 6 mm
Diameter inner tube:	O.D. = 3.18 mm
	I.D. = 1.4 mm



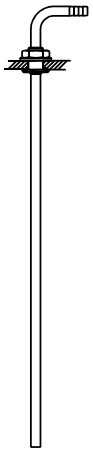
Z81206CH03 2 - 5 liter reactor, M18 x 1.5 port
Z81206CH07 7 liter reactor, M18 x 1.5 port
Z811310005 15 liter reactor, 27 mm port

Sample pipe (I.D. = 1.56 mm):

This sample pipe is designed for the sampling of small volumes.
The internal diameter of the pipe guaranties a minimum dead volume. The sample pipe fits into a 6 mm (baffle) port or into a 10 mm port, depending on type number.

Z81319MB13 2 and 3 liter reactor, 6 mm port
Z81319MB15 2 - 7 liter reactor, 10 mm port

Drain tube:

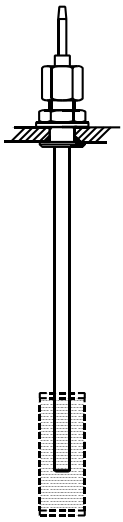


The drain tube is used to take relatively large samples from the culture and to drain bio-reactor after finishing the process.

Diameter: O.D. = 6.35 mm
I.D. = 4.53 mm

Z81319MB14 2 - 5 liter reactor, 10 mm port

Sample pipe for screens:

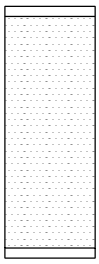


The sample pipe for screens has a very small dead volume. The height adjustable sample pipe can be used with or without a sample screen.
If it is used without sample screen, the small dead volume of the pipe guarantees samples from the culture that are representative for the reactor contents.

If a sample screen is used at the end of this pipe, cell free samples can be drawn from the culture. Sample screens are available in several pore sizes (see below).

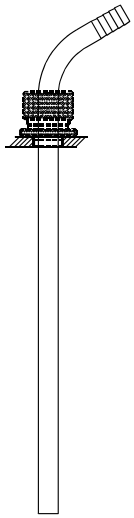
Z81319MB09 2 - 5 liter reactor, 10 mm port
Z81319MB11 7 - 20 liter reactor, 10 mm port

Sample screen:



Available pore sizes:
Z811303010 13 µ sample screen
Z811303011 25 µ sample screen
Z811303012 76 µ sample screen
Z811303013 105 µ sample screen

Sample pipe I.D. 10 mm:



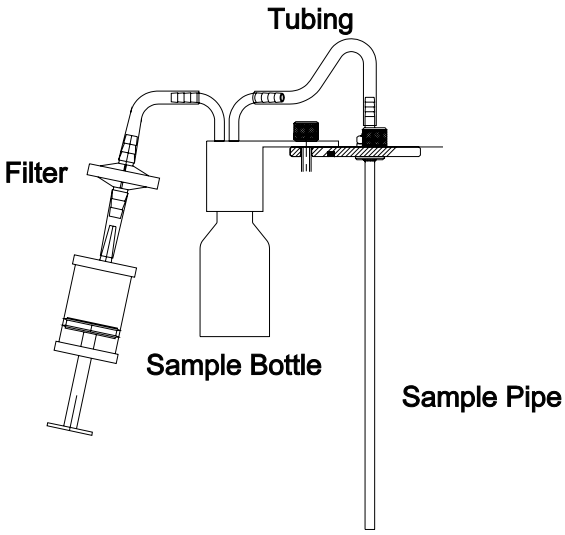
This sample pipe is designed for sampling cultures with flocculating organisms (in this case a sample pipe with a small diameter will ruin the flocks and the pipe will be clogged).
The shear forces inside this sample pipe are nearly negligible.

The sample pipe can be fitted in a 12 mm I.D. pH/mV nipple.

Z81319MB22 2 - 5 liter reactor, pH/mV nipple
Z81319MB23 7 liter reactor, pH/mV nipple
Z81319MB24 15 and 20 liter reactor, pH/mV nipple

Sample system:

The sample system with a 60 (or 30) ml glass bottle can be mounted onto the head plate of the bio-reactor.
This system, completed with a syringe and connected to the sample pipe (tubing), provides your bio-reactor with an easily operated sampling device.

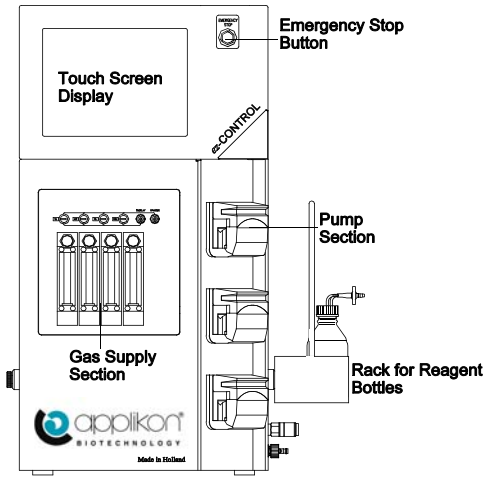


Z81207SS02 2 - 20 liter reactor

Z81207BT30 Sample bottle 30 ml
Z81207BT60 Sample bottle 60 ml

CONTROL:

Z310110010: ***ez***-Control: Z310110010:

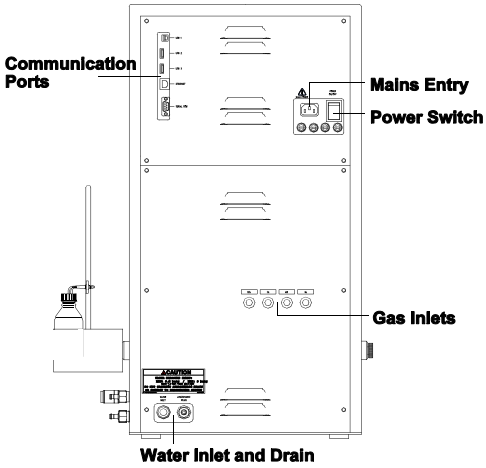


Controlled parameters:
- pH (PID-control)
- DO (PID-control)
-Temperature (PID-control)
- Level / anti foam (contact / no contact)
- Stirrer speed (stirrer motors: P100 . . P1000)

Maximum actuator lay-out:

- pH:	2 pumps for alkali and acid; 1 rotameter (+solenoid) and/or MFC for CO_2
- DO:	3 rotameters (+ solenoids) and/or MFC's for nitrogen, air and oxygen
- Temp.:	Heating by Heating Blanket or Thermo-Circulator
	Cooling by Cold Water Valve or Thermo-Circulator
- Level:	1 pump for level / anti-foam control
- Stirrer speed:	Internal Stirrer Speed Controller

Power Supply:
115/230 VAC (+15%/-20%), 50/60Hz,



Communication Ports:
an alarm output (2 x 3 pins)
- a RJ-45 Ethernet connection
- two USB ports
- a mini USB port

Utility Requirements:
- Gasses at inlet pressure of 2 barg
- Water at inlet pressure of 0.5 . . 2.0 barg
- Atmospheric drain

Optional Racks for Reagent Bottles:
At both sides of the ***ez***-Control a rack for reagent bottles can be mounted. Available rackrs:

Z310113010	Bottle Rack for ***ez***-Control; 3 x 0.5 liter bottles for 1 - 7 liter reactors
Z310113020	Bottle Rack for ***ez***-Control; 1 x 0.5 & 2 x 1 liter bottles for 15 - 20 liter reactors

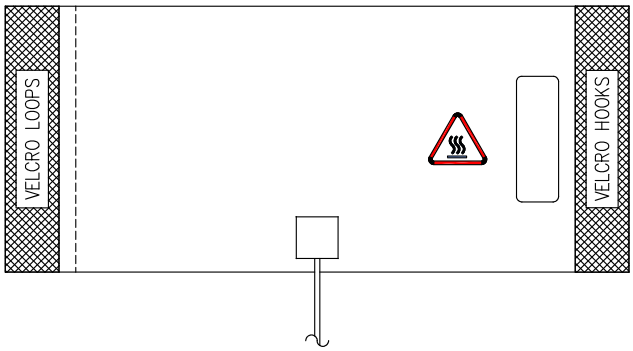
TEMPERATURE CONTROL:

For temperature control different actuator configurations can be used; the table below presents the options:

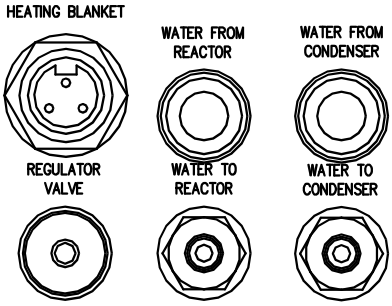
Option #:	Actuator for Heating:	Actuator for Cooling:
1	Heating Blanket	None (temperature loss to environment)
2	Heating Blanket	Cold Water Valve
3	Thermo Circulator	Thermo Circulator

A heating blanket is wrapped around the glass bio reactor (no jacket).
Power consumption:

1L:	73 W
2L:	100 W
3L:	110 W
5/7L:	178 W
15/20L:	383 W



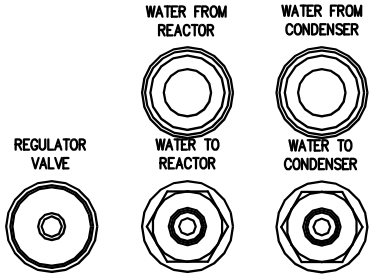
Maximum temperature of the heating blankets is limited to 80 °C.



The heating blanket is connected to the 3-pins connector at the right hand side of the cabinet!

The liquid connections to/from reactor and condenser are in use for the cold water valve assembly. Since this assembly supplies a continuous flow of cooling water to the condenser, a tuning valve is used to prevent too much loss of cooling water; the tuning valve does not obstruct cooling water to the reactor.

In case a Thermo Circulator is used for both heating and cooling, the connection for the heating blanket is blinded:



The water to the condenser has no temperature control; it flows directly from the water inlet (through the tuning valve) to the condenser.

The temperature of water that is directed to the (jacket or heat exchanger of the) reactor is controlled by the ***ez***-Control.

Available Heating Blankets:

Z311020010	Heating blanket 230 VAC for 1 liter dished bio reactor
Z311020022	Heating blanket 230 VAC for 2 liter dished bio reactor
Z311020030	Heating blanket 230 VAC for 3 liter dished bio reactor
Z311020072	Heating blanket 230 VAC for 5 and 7 liter dished bio reactor
Z311020150	Heating blanket 230 VAC for 15 and 20 liter dished bio reactor

Additional Power Supply for Heating Blankets (inside the ***ez***-Control)

Z310111020	Heating Blanket Supply:	115VAC - 200W;	230VAC - 400W
Z310111050	Heating Blanket Supply:	115VAC - 400W	

Cold Water Valve:

Z310111030	Cold Water Valve Assembly (24 VDC)
Z310111040	Condenser Regulation Valve

Thermo Circulator:

Z310111010	Thermo Circulator Module 230VAC
Z310111015	Thermo Circulator Module 115VAC

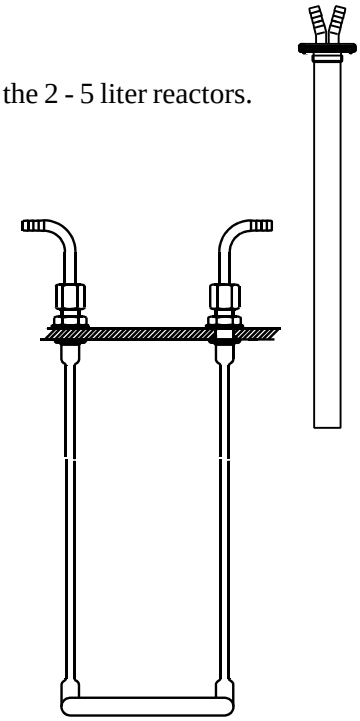
Heat transfer between cold water valve / thermo circulator and the reactor is achieved through a jacketed vessel or a heat exchanger. The jacketed vessels are described in chapter 1.

Heat exchangers:

Two different types of heat exchangers are available.

Fitting into a M18 x 1.5 port. This heat exchanger can be used in the 2 - 5 liter reactors.

Z81317KV03 2 - 5 liter reactor, M18 x 1.5 port



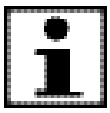
Fitting two 10 mm ports. This type of heat exchanger is available for the 5 - 20 liter reactors.

Z81317HE05	5 liter reactor, two 10 mm ports
Z81317HE07	7 liter reactor, two 10 mm ports
Z81317HE10	15 liter reactor, two 10 mm ports
Z81317HE20	20 liter reactor, two 10 mm ports

SCADA SYSTEM SOFTWARE:

Supervisory control and data acquisition:

(Z590007200	BioXpert Lite (Windows 2000, XP)
(Z590007120	BioXpert V2 software (Windows, 2000, XP)
Z590007401	BioXpert XP (Windows XP), license for 1 process
Z590007402	BioXpert XP (Windows XP), license for 2 processes
Z590007404	BioXpert XP (Windows XP), license for 4 processes
Z590007408	BioXpert XP (Windows XP), license for 8 processes
Z590007416	BioXpert XP (Windows XP), license for 16 processes
Z590007472	Report Generator for BioXpert XP
Z590007474	Remote Access for BioXpert XP



The ***ez***-Control can be connected 1-to-1 with a PC through a “cross-linked” network cable (2 x RJ45). In case a Switch (Hub) is used, a network of ***ez***-Controls and a PC can be established. The ***ez***-Control is identified by its IP-address.

AD/DA CONVERTOR:

The AD/DA Convertor is used to import data from third party devices into BioXpert.

Z310114010 AD/DA convertor card + adapter box

MOUNTING BOX FOR ACTUATORS:

Z310114020 Mounting Box for actuators