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0845-12d RALF (Type 2017)

RALF – At a glance

Bioengineering RALF essentials

General

- Autoclavable small benchtop glass reactor
- Versatile reactor system for numerous different applications
- Single as well as multiple systems
- Wide variety of options available
- Installation, training and IQ/OQ service package available

Bioengineering RALF Basic for microbial cultivation

- Single wall vessel with heating pad and cooling finger
- 1 gas channel, pulsed
- 2 fixed speed peristaltic pumps
- With agitation control, temperature control, pH control and DO control
- Incl. BioSCADA RALF for complete process automation and data acquisition, analysis and export

Bioengineering RALF Basic for cell culture

- Single wall vessel with heating pad and cooling finger
- 3 gas channels, pulsed
- 2 fixed speed peristaltic pumps
- With agitation control, temperature control, pH control and DO control
- Incl. BioSCADA RALF for complete process automation and data acquisition, analysis and export

Bioengineering RALF Advanced for microbial cultivation

- Single wall vessel with perfused baffles and heating circuit
- 1 gas channel, pulsed
- 2 fixed and 1 variable speed peristaltic pumps
- With agitation control, temperature control, pH control, DO control and foam/level control
- Incl. BioSCADA RALF for complete process automation and data acquisition, analysis and export

Bioengineering RALF Advanced for cell culture

- Double wall vessel with heating circuit
- 3 gas channels, pulsed
- 2 fixed and 1 variable speed peristaltic pumps
- With agitation control, temperature control, pH control, DO control and foam/level control
- Incl. BioSCADA RALF for complete process automation and data acquisition, analysis and export

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Overview

	RALF for microbial cultivation		RALF for cell culture	
Standard models	**RALF Basic**	**RALF Advanced**	**RALF Basic**	**RALF Advanced**
Total volume [L]	2 | 3.7 | 5 | 6.7			
Geometry D_i:H_i 2 L | 3.7 L | 5 L | 6.7 L [mm]	96:300 | 125:300 | 150:300 | 150:400			
Dimensions of sterilizable unit for autoclaving w × h [mm]	307–440 × 507–607			
Footprint w × d [mm]	512 × 679–723			
Ports (vessel lid) 2 L | 3.7 L | 5 L | 6.7 L	15 | 18 | 19 | 19 DN04 connection tubes: 6 | 5 | 5 | 5 DN12 lid ports: 8 | 12 | 12 | 12 DN19 lid ports: 0 | 0 | 1 | 1 Agitator port: 1 | 1 | 1 | 1			
Vessel	Single wall vessel		Single wall vessel	Double wall vessel
Controllers	Agitator speed, temperature, pH, DO	Agitator speed, temperature, pH, DO, foam	Agitator speed, temperature, pH, DO	Agitator speed, temperature, pH, DO, level
Drive	Top drive mechanical seal, 20–1500 rpm			
Agitators	2 flat-blade disc agitator		1 propeller agitator	
Temperature control	Electrical heating jacket and cooling finger with solenoid valve for temperature control	Heating and cooling by per-fused stainless steel baffles connected to heating circuit with circulation pump, electrical heater and cooling water valve for temperature control	Electrical heating jacket and cooling finger with solenoid valve for temperature control	Heating circuit connected to double wall; with circulation pump, electrical heater and cooling water valve
Aeration	Ring sparger, 1 pulsed gas line (Air), condenser		Sinter sparger, 3 pulsed gas lines (Air, O_2, CO_2), condenser	
Pumps	2 fixed speed	2 fixed speed, 1 variable	2 fixed speed	2 fixed speed, 1 variable
Dosing	2x bottle, immersion tube, cap and filter	3x bottle, immersion tube, cap and filter	2x bottle, immersion tube, cap and filter	3x bottle, immersion tube, cap and filter
Sampling/harvest	Sampling system with glass tube			
Configurable ports for external devices	1x RS232, 4x analog input with controllers, freely configurable; 1x digital input; 4x analog output; 1x digital output; 1 USB connection			
Software/control	BioSCADA RALF			

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Technical data

General	2 L	3.7 L	5 L	6.7 L
Ambient temperature [°C]	5–40			
Relative humidity (non-condensing) [%]	85			
Operating temperature (cultivation) [°C]	Max. 80			
Operating temperature (sterilization in autoclave) [°C]	Max. 130			
Operating pressure (sterilization in autoclave) [barg | psig]	Max. 1.5 | 21			
Net weight RALF Basic [kg | lbs]	73 | 161.0	74 | 163.1	75 | 165.4	76 | 167.6
Gross weight RALF Basic wrapped [kg | lbs]	96 | 211.7	97 | 213.9	98| 216.1	99 | 218.3
Net weight RALF Advanced [kg | lbs]	82 | 180.8	83 | 183.0	84 | 185.2	85 | 187.4
Gross weight RALF Advanced wrapped [kg | lbs]	105 | 231.5	106 | 233.7	107 | 235.9	108 | 238.1
Weight autoclavable unit (empty) [kg | lbs]	17 | 37.5	19 | 41.9	21 | 46.3	23 | 50.7
Utility requirements				
Power supply	CEE 7/7, 1x 230 V (110 V to 264 V), 50/60 Hz, 10 A fused | NEMA 5–12, 1x 110 V, 50/60 Hz, 16 A fused			
Max. power consumption (110 V) | (230 V) [W]	800 | 1400			
Cooling water supply: connection | flow | pressure	Hose nipples 6/1 mm | 2–4 L/min | 0.6–2 bar (8.7-29.0 psig)			
Cooling water return: connection | flow | pressure	Hose nipples 6/1 mm | 2–4 L/min | pressureless			
Peak water consumption during cooling at 2 bar, with exhaust cooler [L/h]	Max. 250			
Average water consumption during cultivation mode [L/h]	Approx. 60			
Gas (dry, particle- and oil-free): connection | flow | pressure	Pneumatic plug connection 8/1 mm | 2–500 L/h | 2.5–10 barg (36.3–145.0 psig)			
Gas consumption	Depending on process parameters			
Recommended working volume [L], max.	1.3	2.5	3.3	4.5
Recommended working volume [L], min.	0.65	0.9	1.2	1.2
Lid process connections				
DN04 connection tubes	6	5	5	5
DN12 lid ports	8	12	12	12
DN19 lid ports	-	-	1	1
Agitator port	1	1	1	1
Motor type	BLDC			
Motor torque [Nm]	1.6			
Motor power [W]	230			
Agitator diameter, standard [mm]				
Flat-blade disc agitator (2x)	40	48	60	60
Propeller agitator (1x)	48	66	66	66
Segment pitched blade agitator (1x)	48	66	66	66
Material vessel (in contact with medium)	Borosilicate glass			
Material steel parts (in contact with medium)	316L			
Steel parts surface roughness (in contact with medium) [µm]	Ra 0.8			
Material polymer (in contact with medium)	EPDM, PTFE, silicone			

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Temperature control	2 L	3.7 L	5 L	6.7 L
Temperature control range with cooling water (chilled) [°C]	4–80			
Double jacketed vessel: electrical heater [W]	800			
Single wall vessel: heating blankets [W]	300	400	400	500
Heating-up time	Approx. 1 min/°C			
Max. cooling-down time from 60 to 25 °C (at 15 °C cooling water temperature, double wall, 500 rpm agitator speed, no aeration) [min]	50	50	50	50

Requirements for external chiller	
Cooling water supply: connection | pressure	Hose to nipples 6/1 mm | 0.6–2 bar (8.7–29.0 psig)
Cooling water return: connection | pressure	Hose to nipples 6/1 mm | pressureless
Cooling capacity up to 3 RALF | up to 6 RALF	400 W, 30 L water tank capacity | 600 W, 50 L water tank capacity

Rotameter Air for microbial cultivation [Ln/h] *	0–250	0–250	0–500	0–500
Rotameter Air | O_2 | CO_2 for cell cultivation [Ln/h] *	0–8 | 8 | 5	0–16 | 16 | 8	0–16 | 16 | 8	0–40 | 40 | 8
Rotameter N_2 [Ln/h] *	0–100	0–100	0–250	0–250
Mass flow controller Air for microbial cultivation [Ln/h] *	0–250 [±1.0 %, 1:50]		0–500 [±1.0 %, 1:50]	
Mass flow controller Air | O_2 | CO_2 for cell cultivation [Ln/h] *	0–8 | 8 | 5 [±1.0 %, 1:50]	0–16 | 16 | 8 [±1.0 %, 1:50]	0–16 | 16 | 8 [±1.0 %, 1:50]	0–40 | 40 | 8 [±1.0 %, 1:50]
Mass flow controller N_2 [Ln/h] *	0–100 [±1.0 %, 1:50]		0–250 [±1.0 %, 1:50]	
Inlet filter and outlet filter	0.2 µm pore size			

* Other maximal flow rates available for each gas line: 2, 5 8, 16, 40, 100, 250 or 500 Ln/min

Peristaltic pumps	
Pump head	BioE/Oina
Fixed rpm | flow rate hose D_i 2.0 mm | flow rate hose D_i 3.5 mm	130 rpm | 35 mL/min | 60 mL/min
Variable rpm | flow rate hose D_i 2.0 mm | flow rate hose D_i 3.5 mm	0–130 rpm | 0–35 mL/min | 0–60 mL/min

Storage bottles, volume [mL]	250

Communication to PC	RJ45 (TCP/IP)
Agitator speed [rpm]	20–1500
Temperature [°C]	0–150 ± 0.1
pH, gel electrode [pH]	2–12 ± 0.05
DO, amperometric	6 ppb to saturation ± [1 % + 6 ppb]
Foam and level, conductive on / off	On/off, reaction time
Free I/Os: RS232 in | USB in | 4–20 mA in | 4–20 mA out | 24 V out	1 | 1 | 4 | 4 | 1

Minimum requirements for external PC	
Processor | RAM | HD | ports | OS	PIII, 1.2 GHz | 512 MB | 20 GB | USB 2.0 | Windows XP, 7, 8.1, 10
Screen	Min. 15" | color

Material tower	Stainless steel AISI 304 + steel 37, varnished

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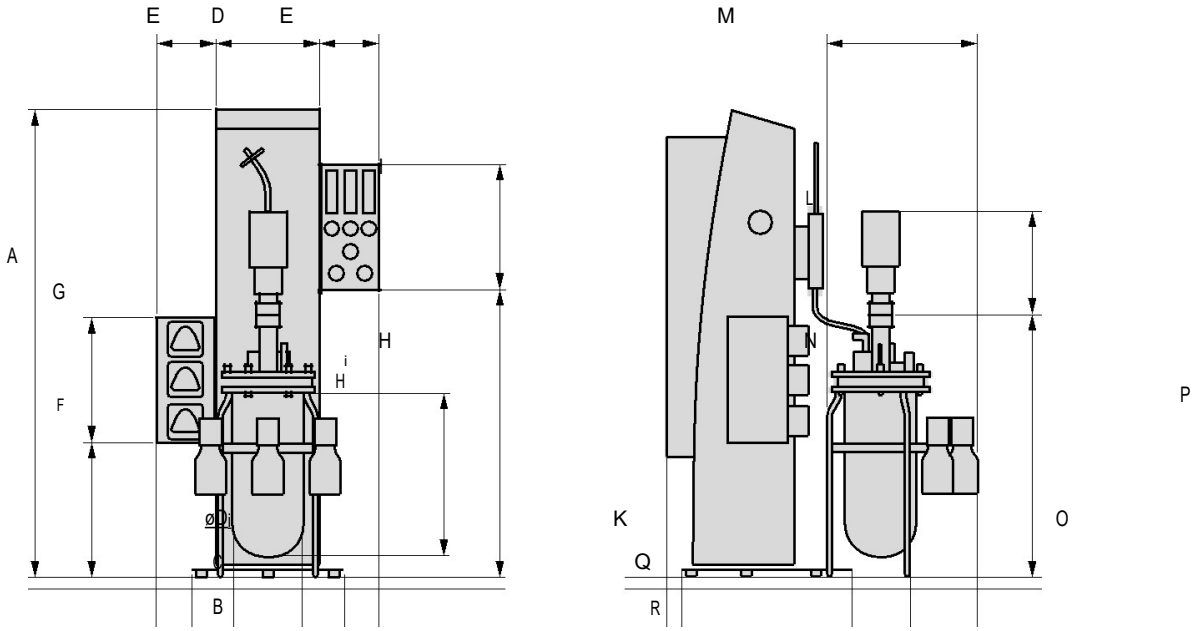
Dimensions



Front view Side view Top view

A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]	K [mm]	L [mm]
1065	512	342	240	136	309	285	652	285	390	246

	M* [mm]	N* [mm]	O* [mm]	P [mm]	Q [mm]	R [mm]	D_i [mm]	H_i [mm]
RALF 2 L	307	507	400	222	489	679	96	300
RALF 3.7 L	325	509	417	239	502	690	125	300
RALF 5 L	349	607	440	264	521	721	150	300
RALF 6.7 L	349	607	440	264	521	723	150	400

A [inch]	B [inch]	C [inch]	D [inch]	E [inch]	F [inch]	G [inch]	H [inch]	I [inch]	K [inch]	L [inch]
41.93	20.16	13.46	9.45	5.35	12.17	11.22	25.67	11.22	15.35	9.69

	M* [inch]	N* [inch]	O* [inch]	P [inch]	Q [inch]	R [inch]	D_i [inch]	H_i [inch]
RALF 2 L	12.09	19.96	15.75	8.74	19.25	26.73	3.78	11.81
RALF 3.7 L	12.80	20.04	16.42	9.41	19.76	27.17	4.92	11.81
RALF 5 L	13.74	23.89	17.32	10.39	20.51	28.38	5.90	11.81
RALF 6.7 L	13.74	23.89	17.32	10.39	20.51	28.46	5.91	15.75

* Maximum dimension for autoclaving

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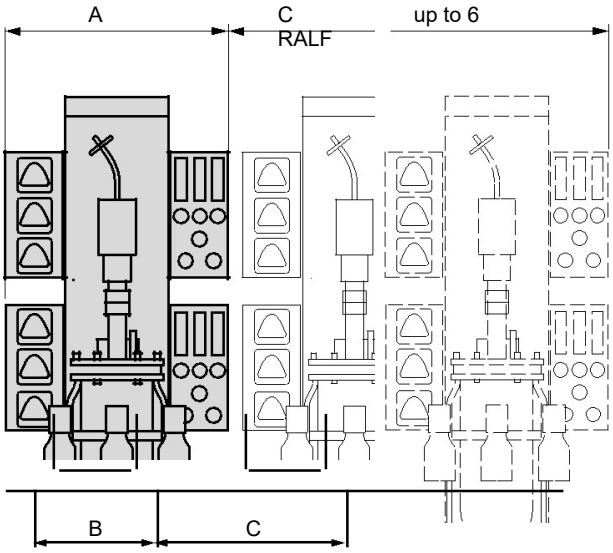
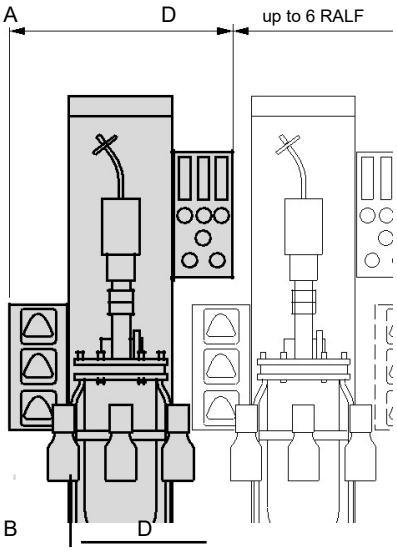
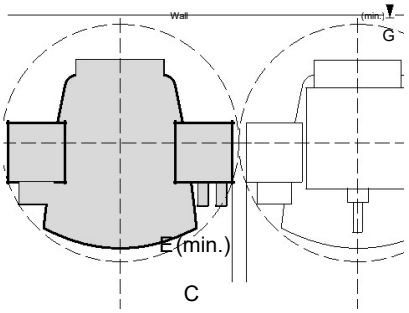
Arrangement type 1

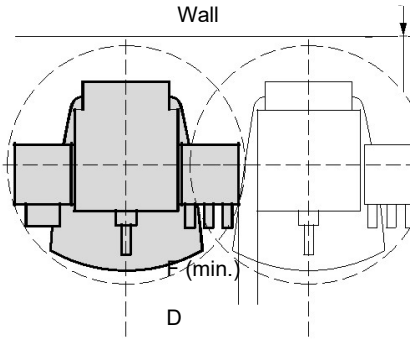


Arrangement type 2





Top view (Arrangement type 1)



Top view (installation type 2)

A [mm]	B [mm]	C [mm]	D [mm]	E* [mm]	F* [mm]	G* [mm]
512	342	550	426	35	50	130

A [inch]	B [inch]	C [inch]	D [inch]	E* [inch]	F* [inch]	G* [inch]
20.157	13.464	21.653	16.771	1.378	1.968	5.118

* Minimum dimension for maintenance