

KaeMix Student 2025 User Guide

KaeMix Documentation

May 27, 2025

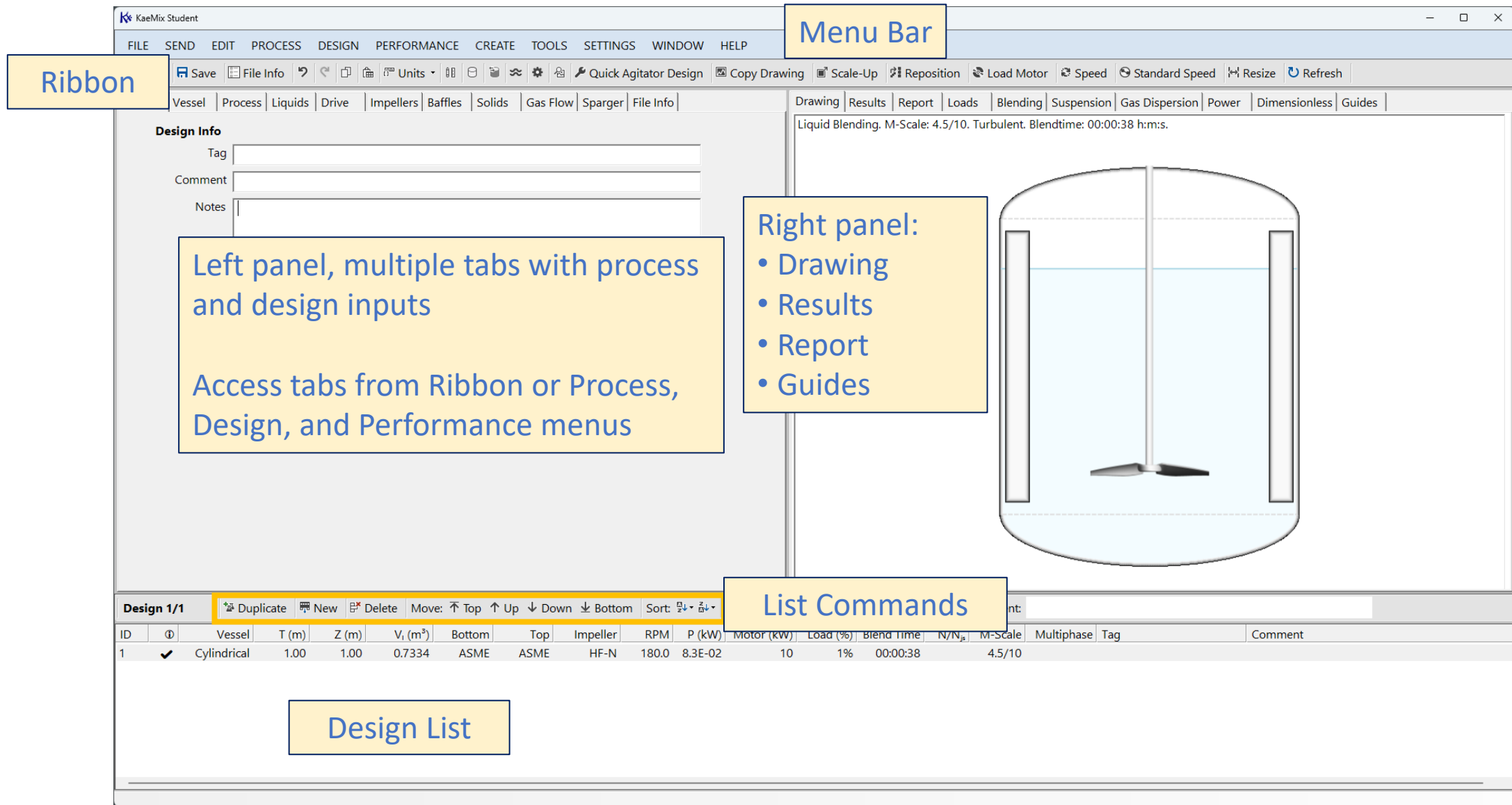
www.kaemixllc.com

support@kaemixllc.com

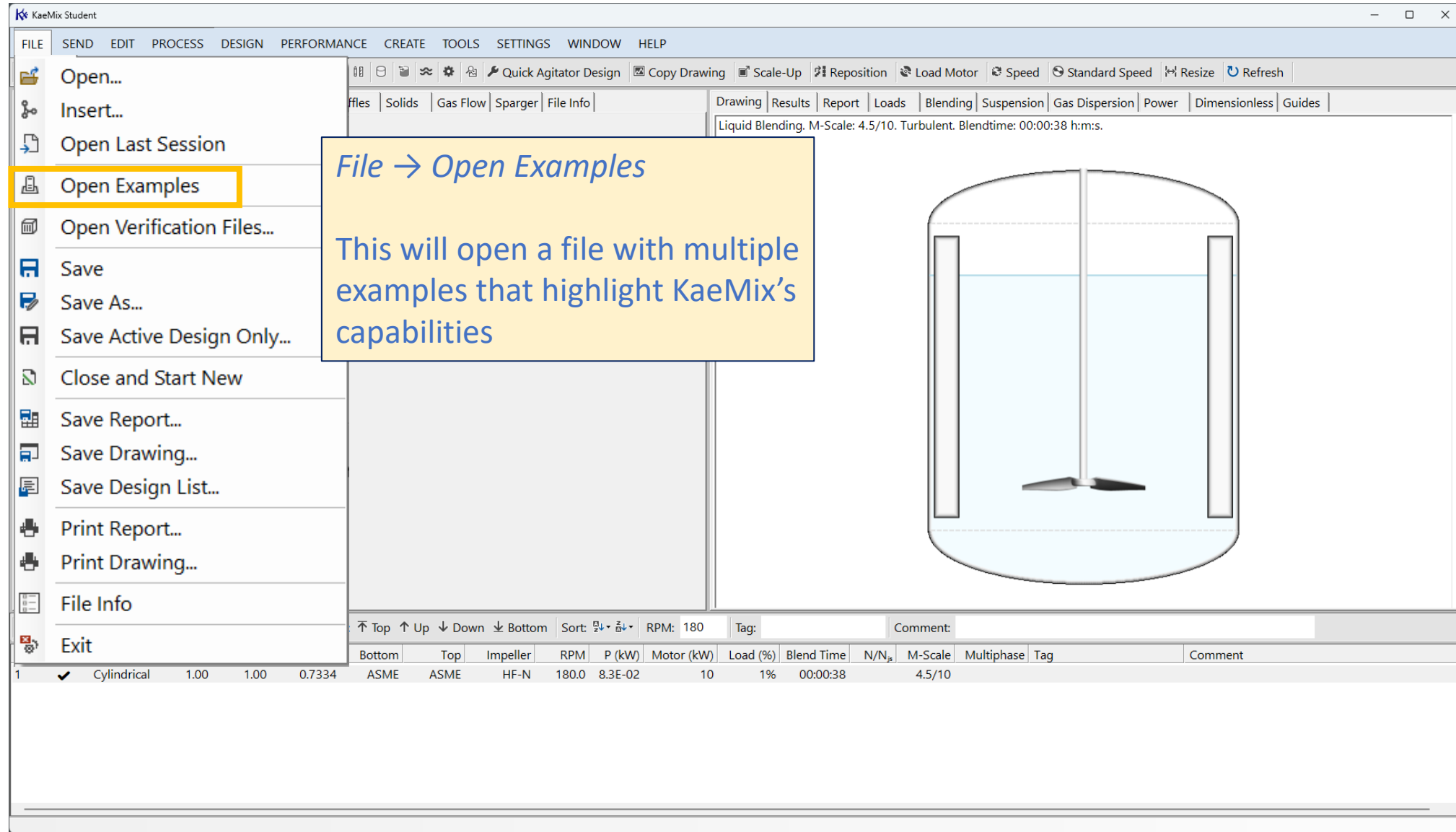
Summary

- This document describes KaeMix Student's features, user interface, and how to use the program
- For instructions on how to install KaeMix Student, see the installation guide

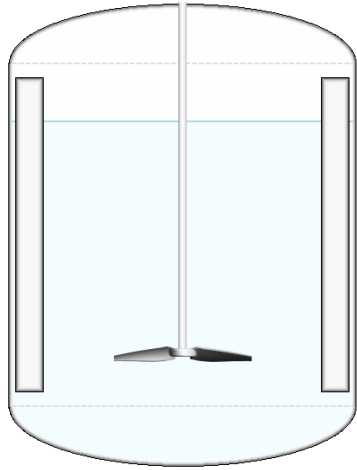
Screen Layout



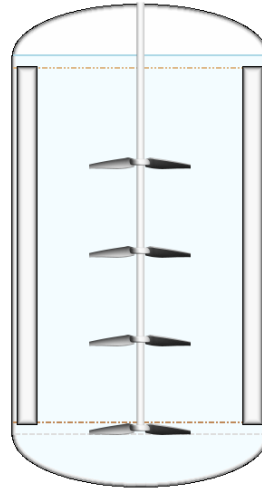
Built In Examples



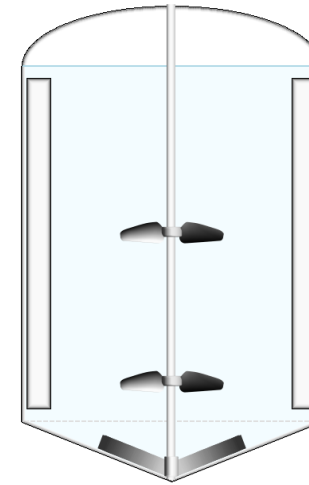
Design Examples



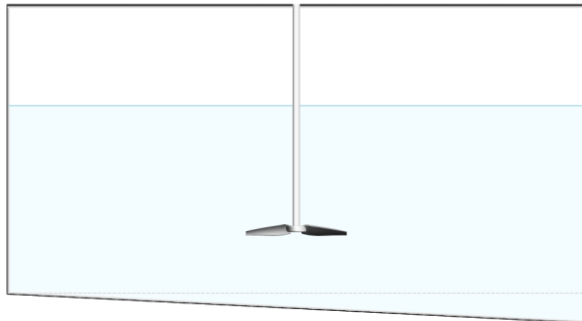
Default design:
single hydrofoil



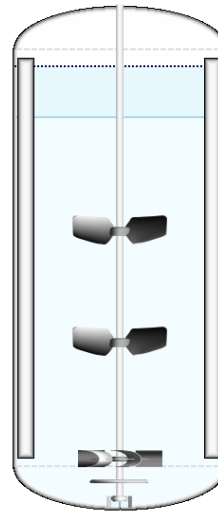
Multiple hydrofoils



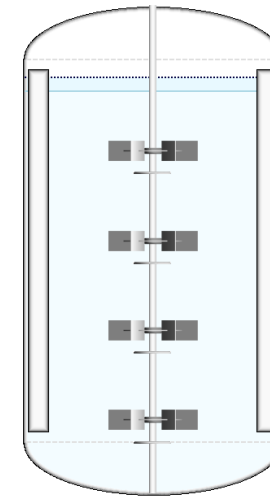
Hydrofoils and a sweeper



Rectangular vessel with
sloped bottom



Hydrofoils, a disk
turbine, and gas sparger



Multiple impellers and
spargers

Multiple Design Capability

KaeMix Student

FILE SEND EDIT PROCESS DESIGN PERFORMANCE CREATE TOOLS SETTINGS WINDOW HELP

Open Save File Info Units Quick Agitator Design Copy Drawing Scale-Up Reposition Load Motor Speed Standard Speed Resize Refresh

Design Vessel Process Liquids Drive Impellers Baffles Solids Gas Flow Sparger File Info

Impellers Edit Sets 1-4 Edit Sets 5-8

Set 1 Set 2 Set 3 Set 4

Connected To Main Drive Main Drive

Style Disk Turbine General

Type Bakker HFOil-Wide

Pump Direction Radial Up

Diameter (m) 0.8131 0.9147

Blade Width (m) 0.1626

Number of Blades 6 4

Blade Angle (degrees)

Liquid Blending. M-Scale: 9.1/10. Turbulent. Blendtime: 00:00:24 h:m:s.
Gas Dispersion. Complete Dispersion (3/4). k_a : 0.073 1/s

KaeMix allows multiple designs in one file. These are shown in the Design List. These can be moved, sorted, duplicated, etc. You can also tag them and add comments. Select designs by clicking in the list.

Design 5/8 Duplicate New Delete Move: Top Up Down Bottom Sort: RPM: 78 Tag: Gas Dispersion Comment: Turbine + 2 Up Pumping Impellers

ID	Φ	Vessel	T (m)	Z (m)	V_L (m³)	Bottom	Top	Impeller	RPM	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N_c	M-Scale	Multiphase	Tag	Comment
1	✓	Cylindrical	1.00	1.00	0.7334	ASME	ASME	HF-N	300.0	0.38	10	4%	00:00:23		7.6/10		Single Hydrofoil - Narrow	
2	✓	Cylindrical	2.03	3.45	10.759	Ellipse	Ellipse	HF-N	114.0	3	4.0	75%	00:00:20	1.15	10.1/10	★★★★	Suspension	Fully suspended
3	✓	Cylindrical	1.78	2.80	6.6577	Ellipse	Ellipse	RDT	60.0	1.67	4.0	42%	00:00:19		4.3/10	★★★☆☆	Multiple spargers	Multiple Rushton
4	✓	Cylindrical	2.03	2.84	8.3443	Conical	Ellipse	SWPS	72.0	6.19	7.89	78%	00:00:21		8.0/10		Sweeper	Conical bottom
5	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	78.0	4.29	10	43%	00:00:23		9.1/10	★★★☆☆	Gas Dispersion	Turbine + 2 Up Pumping Impellers
6	✓	Rectangular	1.00	0.75	1.4042	Angled	Flat	HF-N	240.0	0.1	0.40	25%	00:00:54		2.6/10		Angled Bottom	Rectangular vessel
7	✗	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	190.0	0.31	3.0	10%			0.0/10		Cavern Size	Yield stress fluid

Unit Systems: Metric and USA

KaeMix Student

FILE SEND EDIT PROCESS DESIGN PERFORMANCE CREATE TOOLS SETTINGS WINDOW HELP

Open Save File Info Units Quick Agitator Design Copy Drawing Scale-Up Reposition Load Motor Speed Standard Speed Resize Refresh

Design Vessel Process Liquids Drive

Impellers Edit Sets 1-4

Set 1

Connected To Main Drive

Style Disk Turbine

Type Bakker

Pump Direction Radial Up

Diameter (m) 0.8131 0.9147

Blade Width (m) 0.1626

Number of Blades 6 4

Blade Angle (degrees)

Number of Impellers 1 2

First Bottom Clearance (m) 0.4064 1.484

Last Bottom Clearance (m)

Note

Impeller Power Number 2.33 0.771

Diameter / Tank Ratio (D/T) 0.4 0.45

Blade Width Ratio (W/D) 0.2

Clearance / Tank Ratio (C/T) 0.2 0.73

Blade Pitch / Diameter (P/D)

☒ Metric

☐ US Customary

Select your preferred units

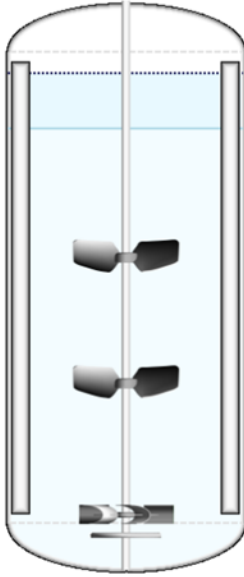
Keyboard shortcuts are:

ctrl-m → Metric units

ctrl-u → USA Customary units

Liquid Blending. M-Scale: 9.1/10. Turbulent. Blendtime: 00:00:24 h:m:s.

Gas Dispersion. Complete Dispersion (3/4). k_a : 0.073 1/s



Design 5/8 Duplicate New Delete Move: ↑ Top ↑ Up ↓ Down ↓ Bottom Sort: 1 2 3 RPM: 78 Tag: Gas Dispersion Comment: Turbine + 2 Up Pumping Impellers

ID	Φ	Vessel	T (m)	Z (m)	V_t (m³)	Bottom	Top	Impeller	RPM	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N_c	M-Scale	Multiphase	Tag	Comment
1	✓	Cylindrical	1.00	1.00	0.7334	ASME	ASME	HF-N	300.0	0.38	10	4%	00:00:23		7.6/10		Single Hydrofoil - Narrow	
2	✓	Cylindrical	2.03	3.45	10.759	Ellipse	Ellipse	HF-N	114.0	3	4.0	75%	00:00:20	1.15	10.1/10	★★★★	Suspension	Fully suspended
3	✓	Cylindrical	1.78	2.80	6.6577	Ellipse	Ellipse	RDT	60.0	1.67	4.0	42%	00:00:19		4.3/10	★★★☆☆	Multiple spargers	Multiple Rushton
4	✓	Cylindrical	2.03	2.84	8.3443	Conical	Ellipse	SWPS	72.0	6.19	7.89	78%	00:00:21		8.0/10		Sweeper	Conical bottom
5	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	78.0	4.29	10	43%	00:00:23		9.1/10	★★★☆☆	Gas Dispersion	Turbine + 2 Up Pumping Impellers
6	✓	Rectangular	1.00	0.75	1.4042	Angled	Flat	HF-N	240.0	0.1	0.40	25%	00:00:54		2.6/10		Angled Bottom	Rectangular vessel
7	✗	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	190.0	0.31	3.0	10%			0.0/10		Cavern Size	Yield stress fluid

Workflow

Workflow

KaeMix Student

FILE EDIT PROCESS DESIGN PERFORMANCE TOOLS SETTINGS WINDOW HELP

Open Save File Info Units Quick Agitator Design Copy Drawing Scale-Up Reposition Load Motor Speed Standard Speed Resize Refresh

Design Vessel Process Liquids Drive Impellers Baffles Gas Flow Sparger Solids Particles File Info

Vessel Design

Vessel Style: Cylindrical

Diameter (m): 2.032

Width (m):

Vessel Material: Stainless Steel

Wall Thickness (m):

Bottom Thickness (m):

Wetted Parts Material: Stainless Steel

Sealing: Mechanical Seal - Double

Power Draw

Total P_v (kW): 4.7889

Total P_s (kW): 4.2918

P_g/P_v : 0.8962

Main Impeller 1: Bakker

% Power Draw: 45.7

Reynolds Re: 13752

Description: Turbulent

Power P_o : 2.33

Shear Rate (1/s): 15.6

Eff. Visc. (mPa.s): 75

M-Scale 7.9/10 (Strong)

Blend Time (h:m:s): 00:00:24

Cavern Volume:

M-Phase 3.0/10 (Moderate)

Particle Suspension:

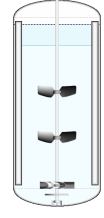
Impeller Speed / N_p :

Cloud H/Z:

Gas Dispersion: Dispersing

Gas Holdup: 13.1%

$k_L a$ (1/s): 0.0729



Design 5/8 Duplicate New Delete Move: Top Up Down Bottom Sort: rev/s 1.3 Tag: Gas Dispersion Comment: Turbine + 2 Up Pumping Impellers

ID	✓	Vessel	T (m)	Z (m)	V_L (m³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N_p	M-Scale	M-Phase	Tag	Comment
1	✓	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	5.0	0.38	2.0	19%	00:00:23		7.6/10		Single Hydrofoil - Narrow	
2	✓	Cylindrical	2.03	3.45	10.759	Ellipse	Ellipse	HF-N	1.9	3.0	4.0	75%	00:00:19	1.19	9.2/10	3.0/10	Suspension	Fully suspended
3		Cylindrical	1.78	3.02	7.2114	Ellipse	Ellipse	RDT	1.0	2.35	4.0	59%	00:00:20		4.1/10		Multiple spargers	Multiple Rushton
4		Cylindrical	2.03	2.84	8.2344	Conical	Ellipse	SWPS	1.2	6.36	7.9	81%	00:00:21		7.3/10		Sweeper	Conical bottom
5	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	1.3	4.29	10.0	43%	00:00:24		7.9/10	3.0/10	Gas Dispersion	Turbine + 2 Up Pumping Impeller
6	✓	Rectangular	1.60	0.75	1.4042	Angled	Flat	HF-N	4.0	0.3	0.4	76%	00:00:18		5.1/10		Angled Bottom	Rectangular vessel
7	X	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	7.0	2.18	25.0	9%	00:12:13		0.0/10		Cavern Size	Yield stress fluid

C:\KaeMix\Examples\KMS.kaemix

Typically start in the left panel with the design information or vessel design, and then move through the tabs from left to right: vessel, process, liquids, gas, solids, drive, impellers, baffles, etc.

In the right panel you can view your progress from either the Drawing or Results tab

Drawing

Drawing Results Report Loads Blending Suspension Gas Dispersion

Liquid Blending. M-Scale: 10/10. Turbulent. Blendtime: 00:00:17 h:m:s.

Gas/Solids. M-Phase: 3/10. Dispersing. k_a : 0.102 1/s. 100% Suspended. CH/Z: 100%

Caption with summary of results

Gassed operating level
(calculated by KaeMix)

Operating level (includes liquid and
solids, not gas, specified by user)

Baffles

Shaft

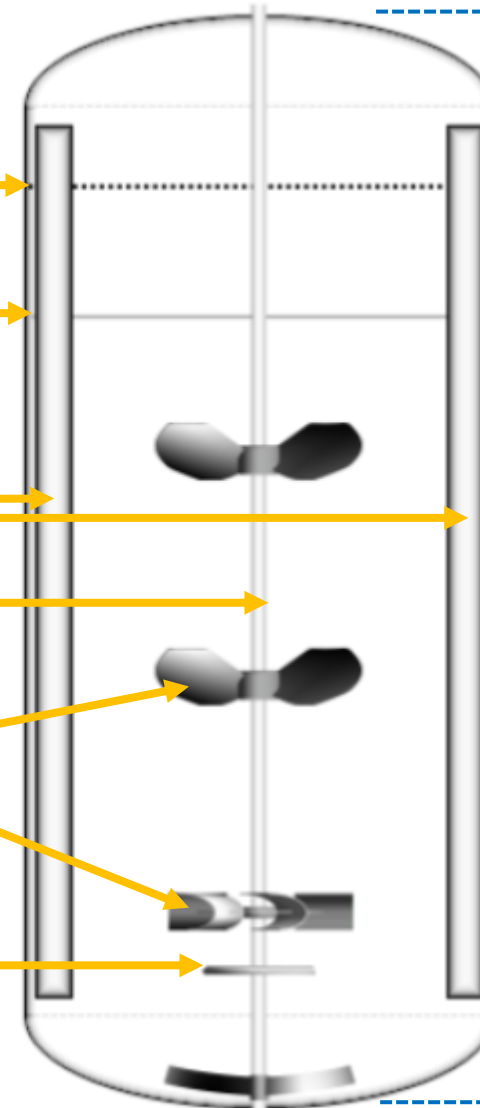
Impellers

Gas sparger

Top head depth

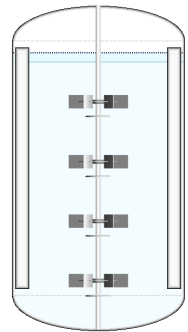
Straight side

Bottom depth



Results

- P_u : total power draw of all submerged impellers, ungassed
- P_g : total power draw of all submerged impellers, gassed
- P_g/P_u : ratio between gassed and ungassed power draw
- Main Impeller: name of the impeller with the highest power draw
- % Power Draw: main impeller power draw as percentage of total
- Reynolds Re: Reynolds number of main impeller
- Description: if flow is turbulent or laminar
- Power Po: main impeller power number
- Shear Rate: shear rate in region of main impeller
- Eff. Visc.: effective viscosity based on main impeller shear rate
- M-Scale: a 1 to 10 scale of agitation for liquid mixing
- Blend time: time to reach 100% uniformity in liquid
- Cavern volume: volume of caverns around impellers for yield stress fluids
- M-Phase: a 1 to 10 scale of agitation for the gas and/or solids phases
- Particle Suspension: percentage of the solids suspended into the liquid
- Impeller Speed / N_{js} : ratio between impeller speed and the just-suspended speed for the impeller that contributes the most to the off-bottom suspension
- Cloud H/Z: ratio between the height of the solids cloud and the operating level
- Gas Dispersion: if the gas is being dispersed or the impeller is flooded
- Gas Holdup: volume of gas divided by total volume (liquid + solid + gas)
- K_a : gas-liquid mass transfer coefficient

Drawing	Results	Report	Loads	Blending	Suspension	Gas Dispersion	Power	Dimensionless
Power Draw					M-Scale 8/10			
Total P_u (kW)		4.8056			Blend Time (h:m:s)		00:00:24	
Total P_g (kW)		3.6888			Cavern Volume			
P_g/P_u		0.7676						
Main Impeller		1: Bakker			M-Phase 3/10			
% Power Draw		45.5			Particle Suspension			
Reynolds Re		13752			Impeller Speed / N_{js}			
Description		Turbulent			Cloud H/Z			
Power Po		2.33			Gas Dispersion		Dispersing	
Shear Rate (1/s)		15.6			Gas Holdup		12.5%	
Eff. Visc. (mPa.s)		75			k_a (1/s)		0.0665	
								

M-Scale

- Originally, a 1 to 10 Scale of Agitation* for blending applications, described in:

“How to design agitators for desired process response”

Hicks et al., Chemical Engineering, April 1976

- Scale of 1 to 10:

- M-Scale 1-2 are for applications requiring minimum fluid velocities to achieve the process result.
- M-Scale 2 will blend miscible liquids to uniformity if specific gravity differences are less than 0.1; blend miscible fluids to uniformity if the viscosity of the most viscous is less than 100 times that of the other; establish complete fluid-batch control; and produce a flat, but moving, fluid-batch surface.
- M-Scale 3-6 are characteristic of fluid velocities in most chemical process industries agitated batches.
- M-Scale 6 will blend miscible liquids to uniformity if specific gravity differences are less than 0.6; blend miscible fluids to uniformity if the viscosity of the most viscous is less than 10000 times that of the other; and produce surface rippling at lower viscosities.
- M-Scale 7-10 are characteristic of applications requiring high fluid velocity for the process result, such as in critical reactors.
- M-Scale 10 will blend miscible liquids to uniformity if specific gravity differences are less than 1.0; blend miscible fluids to uniformity if the viscosity of the most viscous is less than 100,000 times that of the other; and produce surging surfaces at low viscosities.

M-Scale Descriptions

1: Slow
2: Mild
3: Moderate
4: Intermediate
5: Medium
6: Medium-Strong
7: Strong
8: Very Strong
9: Powerful
10: Very Powerful*

** In KaeMix the scale has been extended to a maximum of 14*

Report

You can view a report from the right panel.

To print it, right click in the report to get the print menu or use *File → Print*.

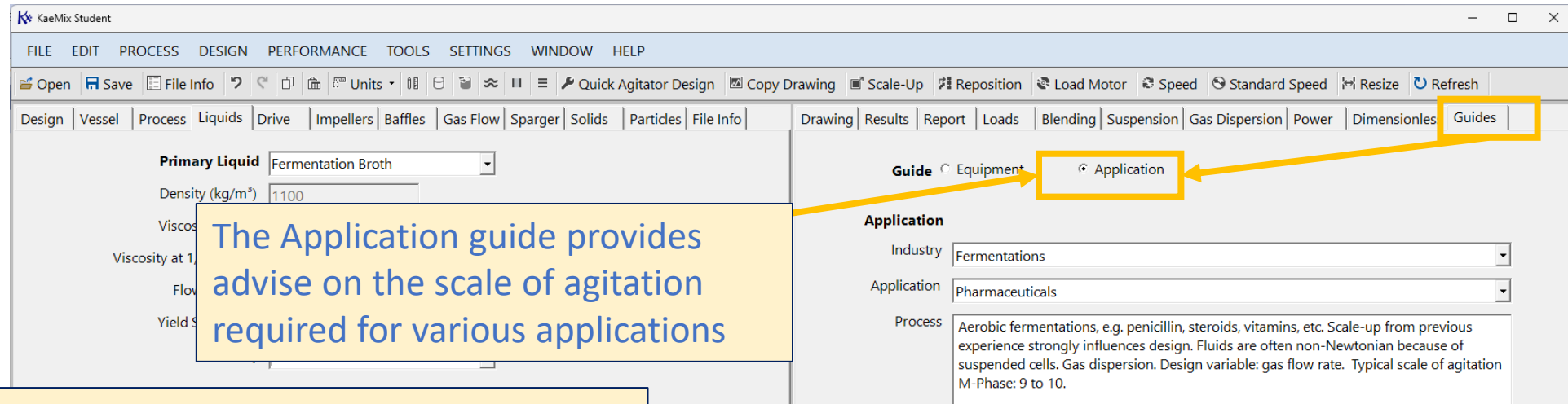
You can save the report or send it to MS-Office or LibreOffice from the File menu.

The screenshot shows the KaeMix software interface. The top menu bar includes FILE, EDIT, PROCESS, DESIGN, PERFORMANCE, TOOLS, SETTINGS, WINDOW, and HELP. Below the menu is a toolbar with various icons. The main window is divided into two panels. The left panel, titled 'Process Operating Conditions', contains a list of process parameters: Process, Liquids, Drive, Impellers, Baffles, Heat, Gas Flow, Sparger, Solids, Particles, Draft Tube, and Stage. The right panel, titled 'Report', contains three sections: 'File Info', 'Design Info', and 'Program Messages'. The 'File Info' section lists project details: Project Name (KaeMix Examples Project), Company (KaeMix LLC), Location (Atlantis), Customer (Imagineering Inc), Designer (Orca Doe), and Manufacturer (AMCE). The 'Design Info' section lists design parameters: Design (8 ✓), Tag (Gas Dispersion), Comment (Turbine + 2 Up Pumping Impellers), Liquid Flows (Batch System), Gas Dispersion (✓), Solid Suspension (X), Liquid Dispersion (X), and Heat Transfer (X). The 'Program Messages' section displays two messages: 'Liquid Blending. M-Scale: 7.9/10. Turbulent. Blendtime: 00:00:25 h:m:s.' and 'Gas Dispersion. M-Phase: 3.0/10. Dispersing. k_{ga}: 0.073 1/s'. Below the report panel is a table titled 'Design 8/11' with columns for ID, Vessel, T (m), Z (m), V_L (m³), Bottom, Top, Impeller, rev/s, P (kW), Motor (kW), Load (%), Blend Time, N/N_{ph}, M-Scale, M-Phase, Tag, and Comment. The table contains 11 rows of data, with the last row (ID 11) highlighted in grey.

ID	①	Vessel	T (m)	Z (m)	V _L (m³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _{ph}	M-Scale	M-Phase	Tag	Comment
5		Cylindrical	2.03	2.84	8.7836	Ellipse	Ellipse	SWPS	1.2	6.36	7.9	81%	00:00:21		7.0/10		HTR Coils	
6	✓	Rectangular	5.17	3.50	71.4	Angled	Flat	HF-W	2.0	10.4	16.0	65%	00:01:08		4.3/10		Side Entering	
7		Cylindrical	1.78	2.27	5.3617	ASME	ASME	PUMPS	2.0	5.44	24.6	22%	00:00:26		2.4/10		Pumper	
8	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	1.3	3.94	33.5	12%	00:00:24		7.9/10	3.0/10	Gas Dispersion	Turbine + 2 Up Pumping Impeller
9	✓	Cylindrical	2.54	4.49	21.967	ASME	ASME	SWPS	1.5	10.15	57.7	18%	00:00:29	0.59	9.8/10	1.0/10	Draft Tube	
10	✓	Horizontal	1.00	0.75	1.1529	Ellipse	Ellipse	HF-N	4.0	0.3	0.9	34%	00:00:10		5.8/10		Horizontal	
11	✓	Cylindrical	2.00	2.00	6.2832	Flat	Flat	RDT	0.63	1.36	10.0	14%	00:00:46		4.9/10		Droplet Size	

Guides

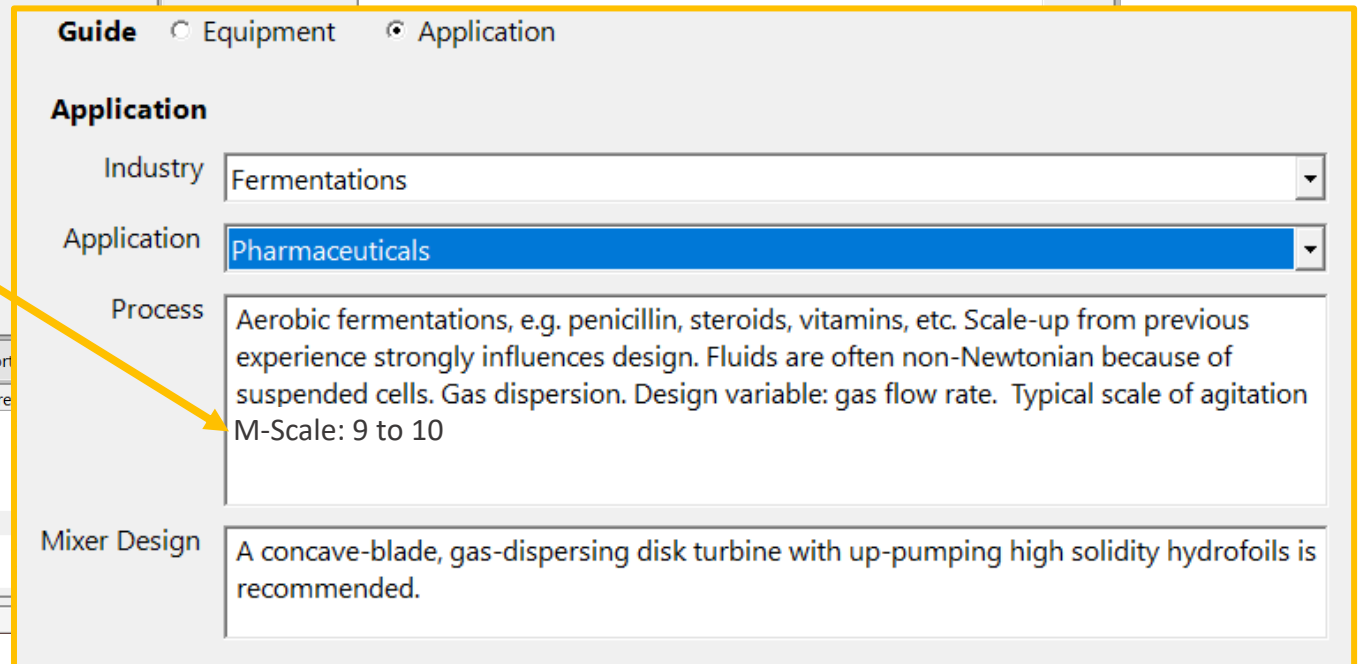
Guides: Applications



The Application guide provides advise on the scale of agitation required for various applications

Scale of Agitation: a 1 to 10 mixing scale indicating agitation intensity: *M-Scale*

Source: Gates, Hicks, Dickey. *Application guidelines for turbine agitators*. Chemical Engineering. Dec. 1976. pp. 165-170



Guides: Equipment

KaeMix

FILE EDIT PROCESS DESIGN PERFORMANCE TOOLS SETTINGS WINDOW HELP

Open Save File Info Units Quick Agitator Design Copy Drawing Scale-Up Reposition Load Motor Speed Standard Speed Resize Refresh

Design Vessel Process Liquids Drive Impellers Baffles Heat Gas Flow Sparger Solids Particles Drawing Results Report Loads Blending Suspension Gas Dispersion HT Rate Power Dimensionless **Guides**

Primary Liquid Fermentation Broth

Density (kg/m³) 1100

Viscosity (cP) 100

Viscosity at 100°C (cP) 100

Flow Rate (m³/h) 100

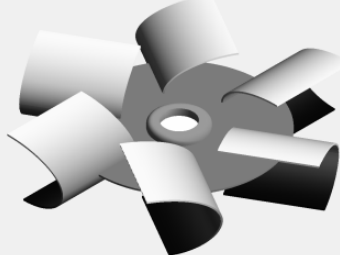
Yield Stress (Pa) 100


☐ Secondary Liquid

Equipment Disk Turbine

Type Bakker

Vertically asymmetric, deep concave blades. Used for demanding gas dispersion applications such as fermentation.

 Clockwise rotation

 Counter clockwise rotation

Design 8/11 Duplicate New Delete Move: Top Up Down Bottom Sort: rev/s 1.3 Tag: Gas Dispersion Comment: Turbine + 2 Up Pumping Impellers

ID	Ⓢ	Vessel	T (m)	Z (m)	V _L (m ³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _p	M-Scale	M-Phase	Tag	Comment
5		Cylindrical	2.03	2.84	8.7836	Ellipse	Ellipse	SWPS	1.2	6.36	7.9	81%	00:00:21		7.0/10		HTR Coils	
6	✓	Rectangular	5.17	3.50	71.4	Angled	Flat	HF-W	2.0	10.4	16.0	65%	00:01:08		4.3/10		Side Entering	
7		Cylindrical	1.78	2.27	5.3617	ASME	ASME	PUMPS	2.0	5.44	24.6	22%	00:00:26		2.4/10		Pumper	
8	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	1.3	3.94	33.5	12%	00:00:24		7.9/10	3.0/10	Gas Dispersion	Turbine + 2 Up Pumping Impeller
9	✓	Cylindrical	2.54	4.49	21.967	ASME	ASME	SWPS	1.5	10.15	57.7	18%	00:00:29	0.59	9.8/10	1.0/10	Draft Tube	
10	✓	Horizontal	1.00	0.75	1.1529	Ellipse	Ellipse	HF-N	4.0	0.3	0.9	34%	00:00:10		5.8/10		Horizontal	
11	✓	Cylindrical	2.00	2.00	6.2832	Flat	Flat	RDT	0.63	1.36	10.0	14%	00:00:46		4.9/10		Droplet Size	

C:\KaeMix\Examples.kaemix

File and Design Info

File Info

The screenshot displays the KaeMix software interface. The 'File Info' tab is selected in the top menu bar. A dropdown menu is open, showing options like 'Open...', 'Insert...', 'Open Last Session', 'Open Examples', 'Open Verification Files...', 'Save', 'Save As...', 'Save Active Design Only...', 'Close and Start New', 'Save Report...', 'Save Drawing...', 'Save Design List...', 'Print Report...', 'Print Drawing...', 'File Info', and 'Exit'. The 'File Info' option is highlighted. A yellow box highlights the 'File Info' tab in the top menu bar. Another yellow box highlights the 'File Info' option in the dropdown menu. A yellow box highlights the 'Project Name' field in the 'File Info' tab. A yellow box highlights the 'Enter the file information here' text. A yellow box highlights the 'Enter notes here' text. A yellow box highlights the 'In the File Info tab you can enter relevant information about the contents of this file.' text. The 'Project Name' field contains 'KaeMix Examples Project'. The 'Company' field contains 'KaeMix LLC'. The 'Location' field contains 'Atlantis'. The 'Customer' field contains 'Imagineering Inc.'. The 'Designer' field contains 'Orca Doe'. The 'Manufacturer' field contains 'AMCE'. The 'Project Notes' field is empty. The 'File Info' tab contains a table with 7 rows and 18 columns. The table is titled 'Design Log' and contains the following data:

ID	①	Vessel	T (m)	Z (m)	V _i (m³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _g	M-Scale	M-Phase	Tag	Comment
1	✓	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	5.0	0.38	10.0	4%	00:00:23		7.6/10		Default Design	
2	✓	Cylindrical	1.52	2.31	4.0193	Ellipse	Ellipse	COW	0.1	16.89	30.0	56%	00:23:03		2.3/10		Helical	
3	✓	Cylindrical	2.03	2.84	8.7836	Ellipse	Ellipse	SWPS	1.2	6.31	8.0	79%	00:00:22		7.0/10		HTR Coils	
4	✓	Cylindrical	2.03	3.45	10.759	Ellipse	Ellipse	HF-N	2.0	3.5	5.0	70%	00:00:19	1.25	9.7/10	3.5/10	Suspension	Fully Suspended
5	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	1.3	4.29	33.5	13%	00:00:24		7.9/10	3.0/10	Gas Dispersion	Turbine + 2 Up Pumping Impellers
6	✓	Rectangular	5.17	3.50	71.4	Angled	Flat	HF-W	2.0	10.4	16.0	65%	00:01:09		4.3/10		Side Entering	
7	✓	Horizontal	1.18	0.75	1.1529	Ellipse	Ellipse	HF-N	4.0	0.3	0.9	34%	00:00:13		5.8/10		Horizontal	

Design Info

KaeMix

FILE EDIT PROCESS DESIGN PERFORMANCE TOOLS SETTINGS WINDOW HELP

Open Save File Info Quick Agitator Design Copy Drawing Scale-Up Reposition Load Motor Speed Standard Speed Resize Refresh

Design Vessel Process Liquids Drive Impellers Baffles Heat Gas Flow Sparger Solids Particles Drawing Results Report Loads Blending Suspension Gas Dispersion HT Rate Power Dimensionless Guides

Design Info

Tag: Gas Dispersion

Comment: Turbine + 2 Up Pumping Impellers

Notes

In this tab you can enter design related information and notes.

Additional Phenomena

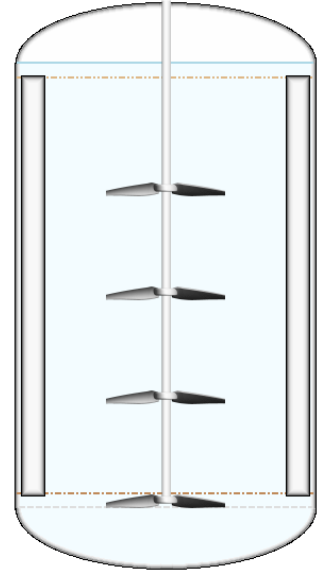
☒ Gas Dispersion ☐ Solids Suspension

☐ Heat Transfer ☐ Liquid Dispersion

Additional Components

☐ Draft Tube ☐ Stage Dividers

Liquid Blending. M-Scale: 7.9/10. Turbulent. Blendtime: 00:00:25 h:m:s.
Gas Dispersion. M-Phase: 3.0/10. Dispersing. k_a : 0.073 1/s



Note: whereas the File Info applies to the whole file, the Design Info is separate for each design in the file.

Design 8/11 Duplicate New Delete Move: Top Up Down Bottom Sort: rev/s 1.3 Tag: Gas Dispersion Comment: Turbine + 2 Up Pumping Impellers

ID	①	Vessel	T (m)	Z (m)	V_t (m³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N_p	M-Scale	M-Phase	Tag	Comment
5		Cylindrical	2.03	2.84	8.7836	Ellipse	Ellipse	SWPS	1.2	6.36	7.9	81%	00:00:21		7.0/10		HTR Coils	
6	✓	Rectangular	5.17	3.50	71.4	Angled	Flat	HF-W	2.0	10.4	16.0	65%	00:01:08		4.3/10		Side Entering	
7		Cylindrical	1.78	2.27	5.3617	ASME	ASME	PUMPS	2.0	5.44	24.6	22%	00:00:26		2.4/10		Pumper	
8	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	1.3	3.94	33.5	12%	00:00:24		7.9/10	3.0/10	Gas Dispersion	Turbine + 2 Up Pumping Impeller
9	✓	Cylindrical	2.54	4.49	21.967	ASME	ASME	SWPS	1.5	10.15	57.7	18%	00:00:29	0.59	9.8/10	1.0/10	Draft Tube	
10	✓	Horizontal	1.00	0.75	1.1529	Ellipse	Ellipse	HF-N	4.0	0.3	0.9	34%	00:00:10		5.8/10		Horizontal	
11	✓	Cylindrical	2.00	2.00	6.2832	Flat	Flat	RDT	0.63	1.36	10.0	14%	00:00:46		4.9/10		Droplet Size	

C:\KaeMix\Examples.kaemix

Vessel Design

Vessel Design (1/3)

Application Vessel Process Liquids Gas Flow Solids

Vessel Design

Vessel Style Cylindrical

Straight Side (m) 4.064

Diameter (m) 2.032

Width (m)

Bottom Style Elliptical

Bottom Depth (m) 0.4064

Bottom Volume (m³) 0.8786

Top Head Style Elliptical

Top Head Depth (m) 0.4064

Top Head Volume (m³) 0.8786

Total Volume (m³) 14.06

Vessel Material Stainless Steel

Wall Thickness (m)

Bottom Thickness (m)

Wetted Parts Material Stainless Steel

Sealing Mechanical Seal - Double

Vessel Styles

Vessel Design

Vessel Style Cylindrical

Straight Side (m) Cylindrical

Rectangular

Sealing Options

Bottom Depth (m)

Bottom Volume (m³)

Top Head Style

Top Head Depth (m)

Top Head Volume (m³)

Total Volume (m³)

Vessel Material

Wall Thickness (m)

Bottom Thickness (m)

Wetted Parts Material

Sealing Mechanical Seal - Double

Bottom Styles

Bottom Style ASME

Bottom Depth (m) Flat

Bottom Volume (m³) ASME

Top Head Style Conical

Top Head Depth (m) Dish

Top Head Volume (m³) Elliptical

Total Volume (m³) Hemispherical

Vessel Material ASME F&D (6%)

Wall Thickness (m) ASME F&D (10%)

Bottom Thickness (m) ASME 80:10

Wetted Parts Material ASME 80:6

Sealing DIN 28011

Angled Left to Right

Angled Right to Left

Angled Back to Front

Angled Front to Back

Materials

Vessel Material Stainless Steel

Wall Thickness (m) Composite

Bottom Thickness (m) Concrete

Wetted Parts Material Glass

Sealing Perspex

Stainless Steel

Stainless Steel 304LSS

Stainless Steel 304SS

Stainless Steel 316LSS

Stainless Steel 316SS

Stainless Steel 317LSS

Titanium

Titanium - Grade 2

Vessel Design (2/3)

Settings | Equipment Preview **OFF**
Standard dropdown when clicking
Bottom Style

Vessel Design

Vessel Style: Cylindrical

Diameter (m): 2.032

Width (m):

Straight Side (m): 2.438

Bottom Style: ASME

Bottom Depth (m): Flat

Bottom Volume (m³): ASME

Top Head Style: Conical

Top Head Depth (m): Dish

Top Head Volume (m³): Elliptical

Total Volume (m³): Hemispherical

Sealing: ASME F&D (6%)

Vessel Material: ASME F&D (10%)

Wall Thickness (m): ASME 80:10

Bottom Thickness (m): ASME 80:6

Wetted Parts Material: DIN 28011

Note: DIN 28013

Settings | Equipment Preview **ON**
opens graphical selection panel
when clicking Bottom Style

Vessel Design

Vessel Style: Cylindrical

Diameter (m): 2.032

Width (m):

Straight Side (m): 4.064

Bottom Style: ASME

Bottom Depth (m): 0.3441

Bottom Volume (m³): 0.6796

Top Head Style: Elliptical

Top Head Depth (m): 0.4064

Top Head Volume (m³): 0.8786

Total Volume (m³): 13.859

Sealing: Mechanical Seal

Vessel Material: Stainless Steel

Wall Thickness (m): 0.003

Bottom Thickness (m): 0.003

Wetted Parts Material: Stainless Steel

Note:

Bottom Style

Flat

Conical

Dish

Elliptical

2:1 Elliptical

1.9:1 Elliptical

Hemispherical

Angled Left to Right

Angled Back to Front

ASME

ASME F&D (6%)

ASME F&D (10%)

ASME 80:10

ASME 80:6

DIN 28011

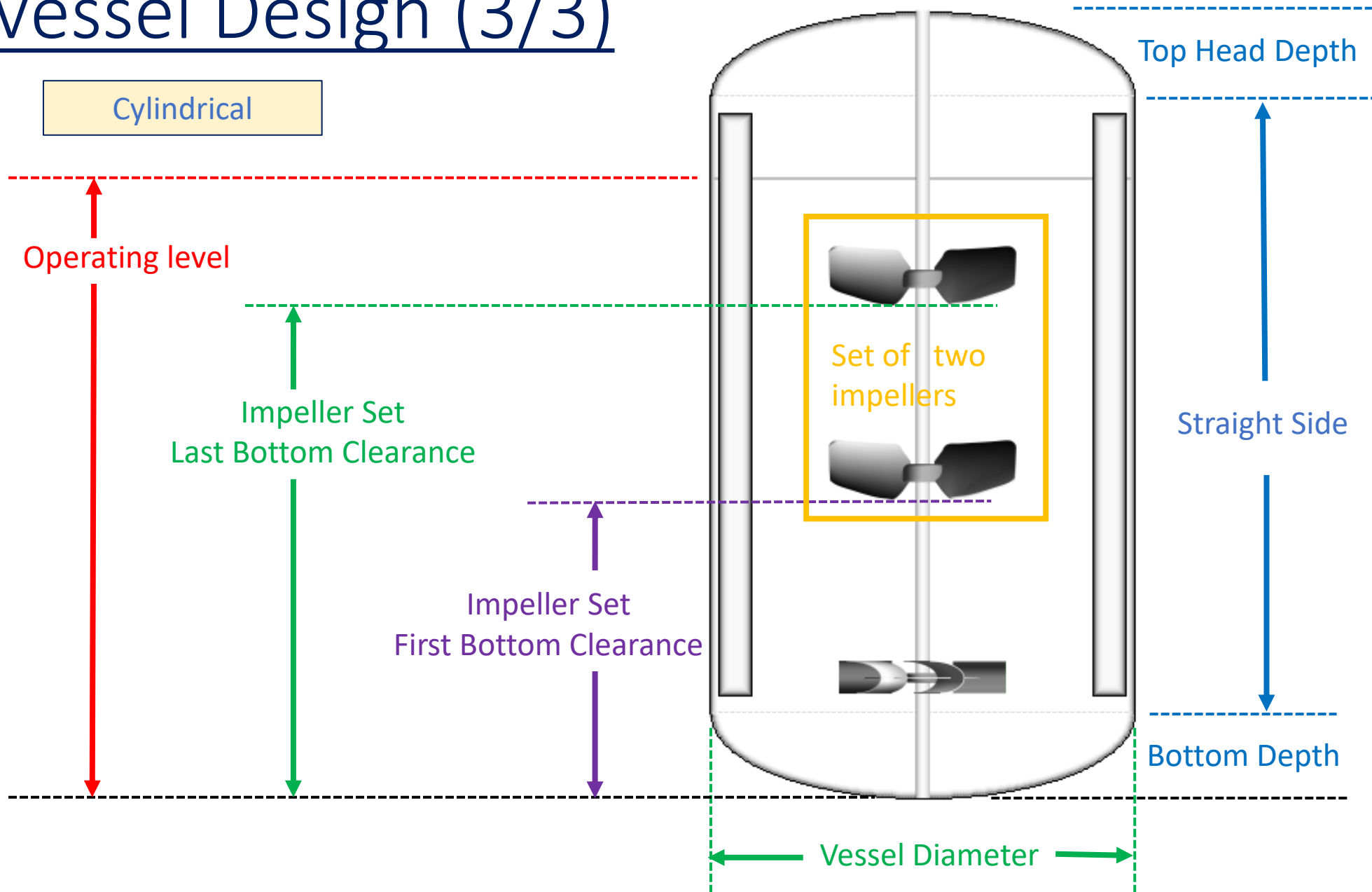
DIN 28013

Angled Right to Left

Angled Front to Back

Close the panel
by clicking x-box
or press Enter or
Esc on keyboard

Vessel Design (3/3)



Process

Process Operating Conditions

Design	Vessel	Process	Liquids	Drive	Mechanical	Impellers	Baffles	Solids
Process Operating Conditions								
Operating Level (m)	1		<p>Operating level includes liquid and solids but excludes gas. Measured vertically from the deepest point in the bottom. Minimum level is the bottom depth. Maximum level is to the top of the straight side</p> <p>Gassed operating level includes gas and is calculated by KaeMix</p> <p>Operating volume corresponding to operating level. You can specify either volume or level and the other is calculated</p> <p>Operating temperature</p> <p>Operating pressure (in the head space)</p> <p>Average pressure in the liquid, and pressure at the deepest point at the bottom, in Atmosphere (or Bar depending on settings), calculated by KaeMix</p> <p>Specify an additional level for in the drawing</p> <p>If you specify continuous flow and a flow rate, KaeMix will calculate the residence time</p>					
Gassed Operating Level (m)								
Operating Volume (m ³)	0.7303							
Operating Temperature (°C)	15							
Operating Pressure (Atm)	1							
Average Pressure (Atm)	1.048							
Pressure at Bottom (Atm)	1.097							
Liquid Weight (kg)	730.3							
Mixture Weight (kg)	730.3							
Additional Level Indicator (m)	0.4							
Liquid Flows <input type="radio"/> Batch System <input checked="" type="radio"/> Continuous Flow								
Continuous Flow Rate (m ³ /s)	0.01							
Residence Time (h:m:s)	00:01:13							
Residence Time / Blend Time	2.48							

Liquids (1/3)

Primary Liquid	Water (T-dependent)
Density (kg/m ³)	Water
Viscosity Model	Water (T-dependent)
Viscosity at 1/s (mPa.s)	Fermentation Broth
Flow Index n"	Acetic Acid (C ₂ H ₄ O ₂)
Yield Stress (Pa)	Acetone ((CH ₃) ₂ CO)
Safety	Benzene (C ₆ H ₆)
	Carbon Disulfide (CS ₂)
	Carbon Tetrachloride (CCl ₄)
	Castor Oil
	Chloroform (CHCl ₃)
	Decane (C ₁₀ H ₂₂)
	Dodecane (C ₁₂ H ₂₆)
	Ethanol (C ₂ H ₅ OH)
	Ethylene Glycol ((CH ₂ OH) ₂)
	Glycerol (C ₃ H ₈ O ₃)
	Heptane (C ₇ H ₁₆)
	Hexane (C ₆ H ₁₄)
	Kerosene
	Linseed Oil
	Methanol (CH ₃ OH)
	Octane (C ₈ H ₁₈)
	Phenol (C ₆ H ₅ OH)
	Propanol (C ₃ H ₈ O)
	Propylene Glycol (C ₃ H ₈ O ₂)
	Toluene (C ₇ H ₈)
	Turpentine (C ₁₀ H ₁₆)

If you select a liquid from the dropdown list the physical properties will be set automatically. The properties are constant, except for *Water (T-dependent)* in which case density and viscosity vary with temperature.

Important: To specify your own liquid with your own physical properties, first enter a name that does not appear in the dropdown list!

Liquids (2/3)

Primary Liquid Goopy Fluid

Density (kg/m³) 1000

Viscosity Model Newtonian

Consistency (mPa.sⁿ) Newtonian

Flow Index n" Power Law

Yield Stress

Newtonian, Power Law ("pseudo-plastic"), and Yield Stress ("Herschel-Bulkley") viscosity models are available

Newtonian Fluid: $\mu_\gamma = \text{constant}$ (enter in mPa.s = cP)

Power Law Fluid: $\mu_\gamma = \mu_{\gamma=1/s} \gamma^{(n-1)} = k \gamma^{(n-1)}$

Yield Stress Fluid: $\mu_\gamma = \tau_{\text{yield}}/\gamma + k \gamma^{(n-1)}$

Fluid is stagnant if $\tau < \tau_{\text{yield}}$

μ_γ	Viscosity at shear rate γ (1/s)
$\mu_{\gamma=1/s}$	Viscosity at shear rate $\gamma = 1$ (1/s)
k	Consistency (enter in mPa.s ⁿ = cP.s ⁽ⁿ⁻¹⁾)
n	Flow Index
τ_{yield}	Yield Stress (enter in Pa or Dyne/cm ²)
τ	Shear Stress (Pa)

Primary Liquid Goopy Fluid

Density (kg/m³) 1000

Viscosity Model Yield Stress

Consistency (mPa.sⁿ) 12

Flow Index n" 0.8

Yield Stress (Pa) 3.4

Safety

No Safety Concerns

Acid (Low pH)

Base (High pH)

Biohazard

Controlled Substance

Corrosive

Environmental Hazard

Explosive

Flammable

Health Hazard

Neurotoxic

Poisonous

Safety Hazard

Toxic

You can select safety information from the dropdown list or enter your own text

Volume Percentage 2nd Liquid

Droplet Diameter (m)

Dispersion Time (h:m:s)

Liquids (3/3)

If there is insufficient agitation with a yield stress fluid, a cavern may form around the impeller in which fluid moves, while fluid outside the cavern remains stagnant. KaeMix calculates the approximate cavern size

Yield stress fluid specified

Primary Liquid goop

Density (kg/m³) 1000

Viscosity Model Yield Stress

Consistency (mPa.sⁿ) 10000

Flow Index n 1

Yield Stress (Pa) 10

Effective Viscosity (mPa.s) 10316

Safety No Safety Concerns

Power Draw

Total Power (kW) 0.3098

Main Drive 3kW @ 190RPM

% Loaded 10.3%

Main Impeller 1: HFOil-Narrow

% Total Power 100.0

Reynolds Re 49.5

Flow Regime Laminar

Power Po 0.93

Shear Rate (1/s) 31.67

Eff. Visc. (mPa.s) 10316

Blending M-Scale 0/10 (None)

Bulk Fluid Vel. (m/s) 2.94E-03

Total Flow (m³/s) 0.0512

Turnovers / Minute 4.19

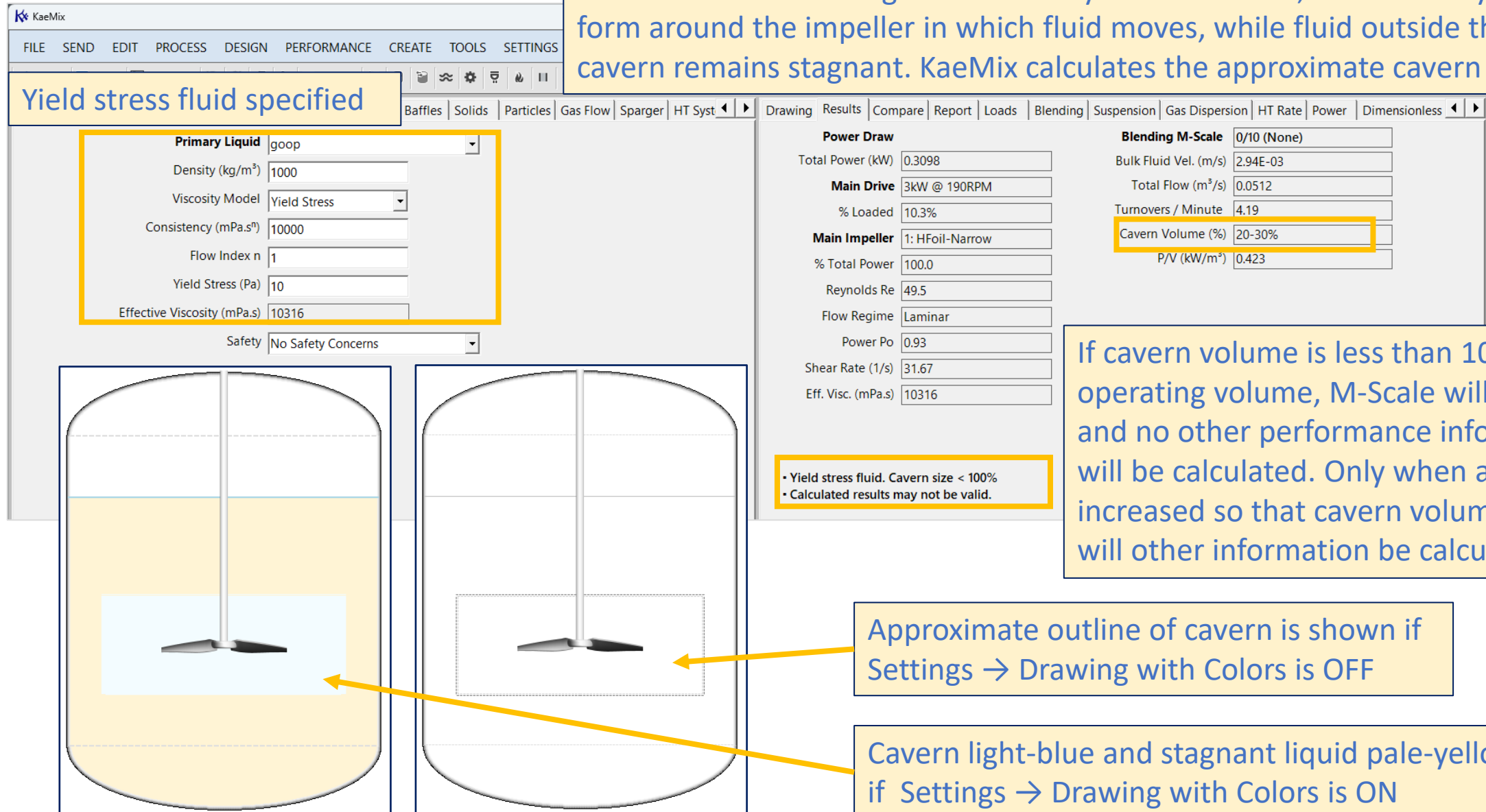
Cavern Volume (%) 20-30%

P/V (kW/m³) 0.423

• Yield stress fluid. Cavern size < 100%
• Calculated results may not be valid.

Approximate outline of cavern is shown if Settings → Drawing with Colors is OFF

Cavern light-blue and stagnant liquid pale-yellow if Settings → Drawing with Colors is ON



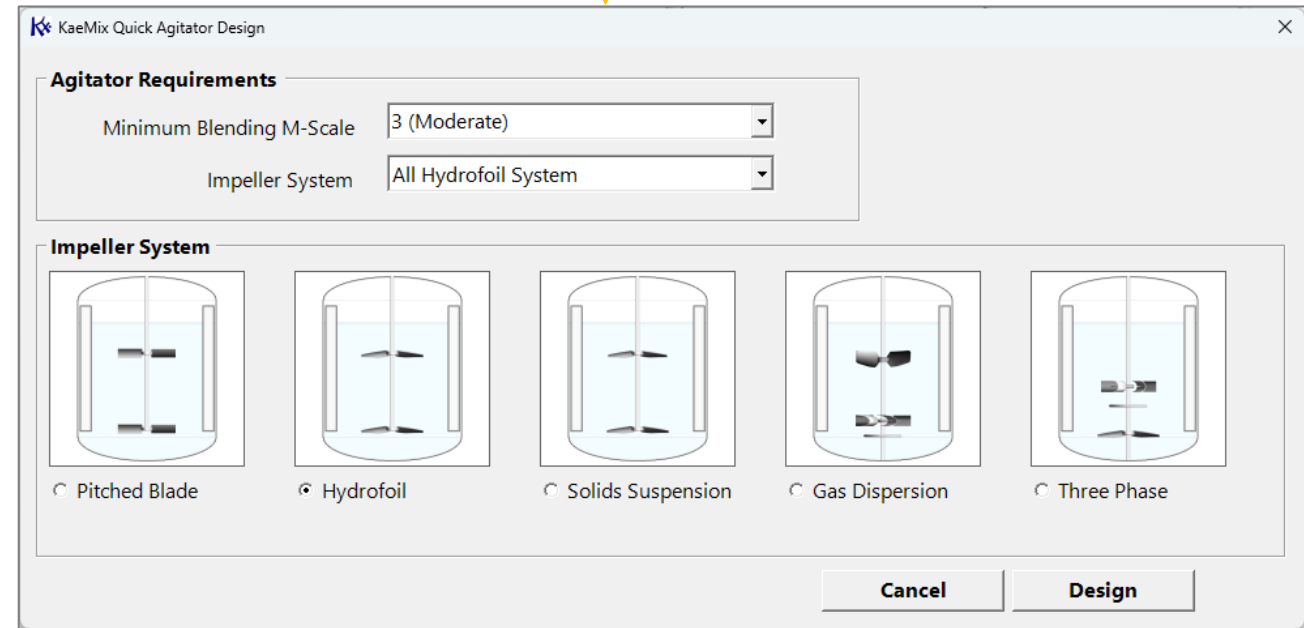
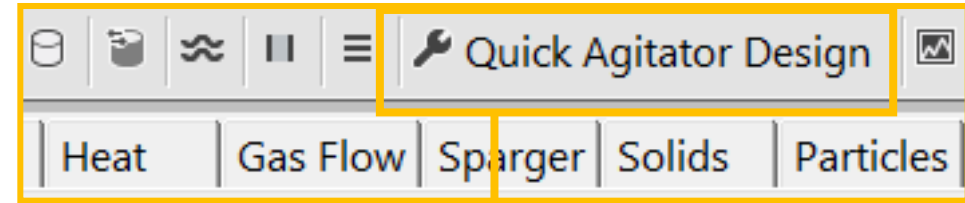
If cavern volume is less than 100% of the operating volume, M-Scale will be 0/10 and no other performance information will be calculated. Only when agitation is increased so that cavern volume = 100% will other information be calculated

Design Tools



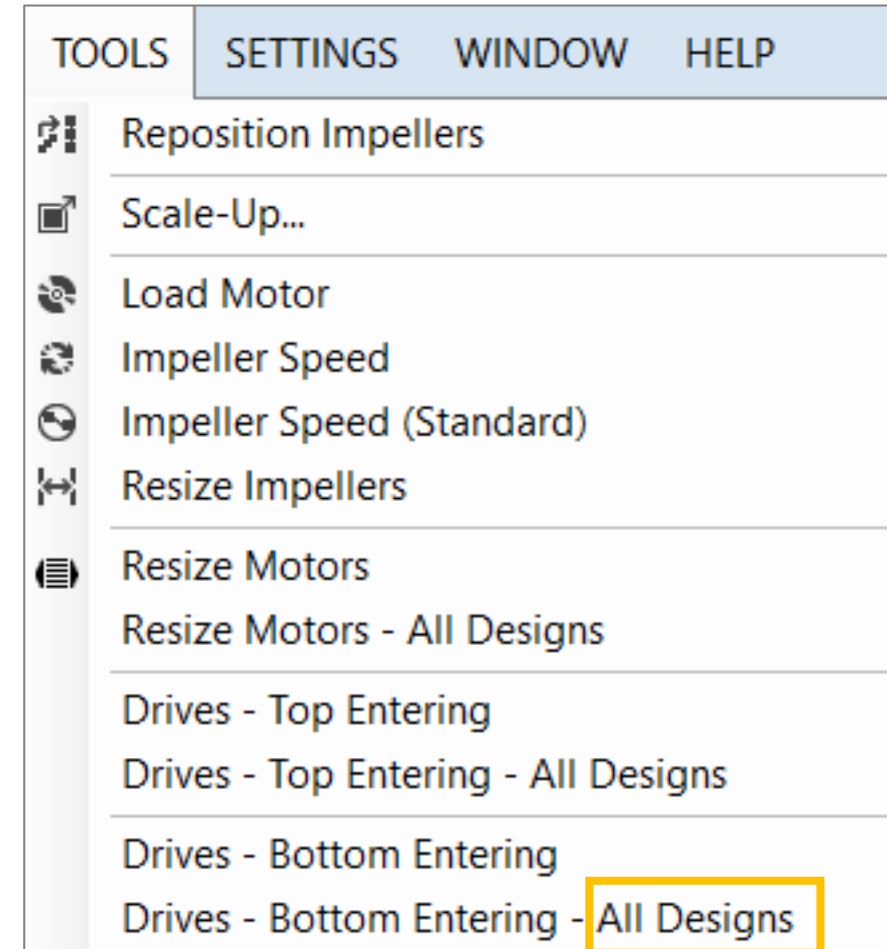
Quick Agitator Design

- After specifying the vessel, process, and liquids, the fastest way to create an initial agitator design is using the Quick Agitator Design panel
- Specify the impeller system and required M-Scale, click Design, and KaeMix will design the agitator



Tools Menu

- *Reposition Impellers*: spaces impellers over vessel height
- *Scale-Up*: opens the Scale-Up panel
- *Load Motor*: adjust speed and diameter to load motor
- *Impeller Speed*: adjusts speed only to load the motor
- *Impeller Speed (Standard)*: sets the highest standard RPM that does not overload the motor
- *Resize Impellers*: adjusts diameters to load motor
- *Resize Motors*: changes motor size to match impeller power draw
- *Drives – Top Entering*: changes bottom entering drive to top entering
- *Drives – Bottom Entering*: changes top entering drive to bottom entering



“All Designs” means that this change is applied to all designs in the file, not just to the active design. It is recommended to save your file before issuing these commands

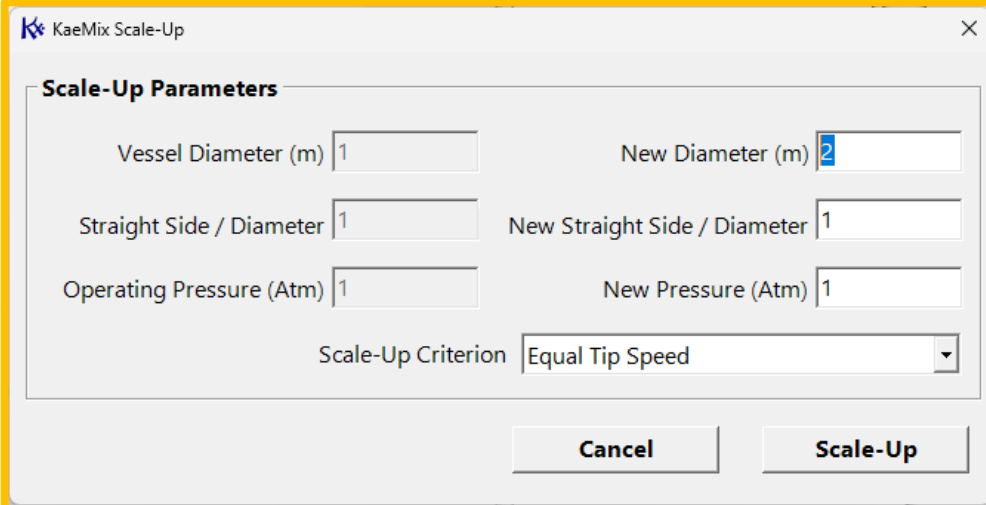
Create Menu

- Create menu: useful to quickly create an impeller system before manually refining the design
- These commands duplicate the active design and replace the impeller and baffle system with the system selected from the list

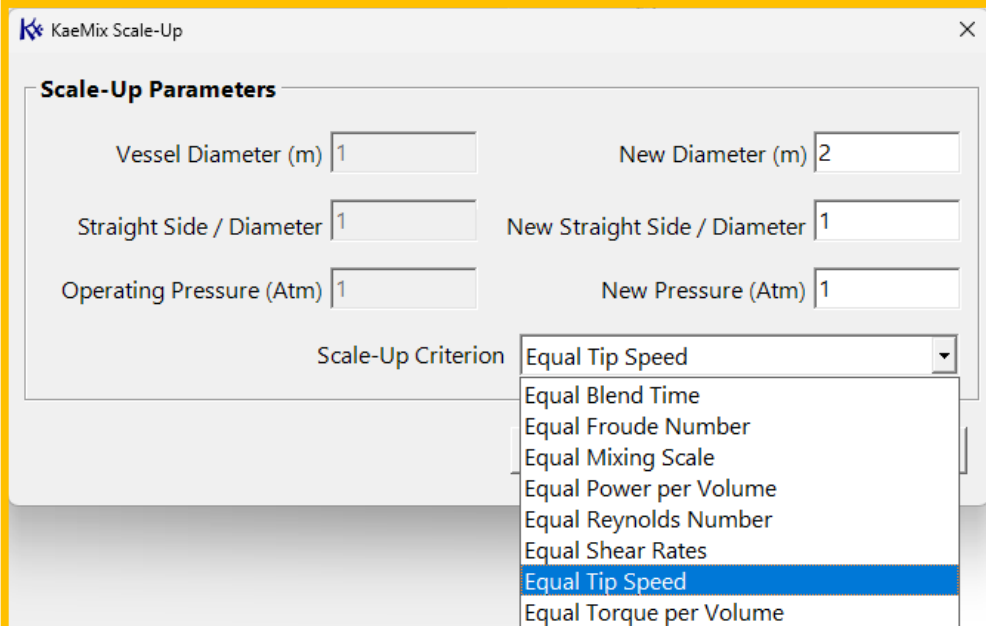
CREATE	TOOLS	SETTINGS
	Quick Agitator Design...	
	Pitched Blade System	
	Hydrofoil System	
	Solids Suspension System	
	Gas Dispersion System	
	Three Phase System	

Scale-Up

- *Tools* → *Scale-Up*
- You can scale up or down
- You can change the aspect ratio of the vessel by modifying the ratio between Straight Side and Vessel Diameter
- Available Scale Up criteria:
 - Equal Blend Time
 - Equal Froude Number
 - Equal Mixing Scale (M-Scale)
 - Equal Power per Volume
 - Equal Reynolds Number
 - Equal Shear Rates
 - Equal Tip Speed
 - Equal Torque per Volume
- Clicking *Scale-Up* adds a new design



The image shows the 'KaeMix Scale-Up' dialog box. It contains a 'Scale-Up Parameters' section with the following fields: 'Vessel Diameter (m)' set to 1, 'New Diameter (m)' set to 2, 'Straight Side / Diameter' set to 1, 'New Straight Side / Diameter' set to 1, 'Operating Pressure (Atm)' set to 1, and 'New Pressure (Atm)' set to 1. The 'Scale-Up Criterion' is set to 'Equal Tip Speed'. At the bottom right, there are two buttons: 'Cancel' and 'Scale-Up'. The 'Scale-Up' button is highlighted with a yellow border.



The image shows the 'KaeMix Scale-Up' dialog box with the 'Scale-Up Criterion' dropdown menu open. The menu lists the following options: 'Equal Tip Speed', 'Equal Blend Time', 'Equal Froude Number', 'Equal Mixing Scale', 'Equal Power per Volume', 'Equal Reynolds Number', 'Equal Shear Rates', 'Equal Tip Speed' (highlighted in blue), and 'Equal Torque per Volume'. The 'Scale-Up' button is highlighted with a yellow border.



Drives and Shafts



Drives

A drive consists of a motor-gearbox and a shaft

Drives Main Drive

Style: Top Entering

Drive Name:

Motor (kW): 10 **Enter motor power here**

Maximum Load (%): 80

Speed (RPM): 78 **Enter shaft rotational speed here**

Speed (rev/s): 1.3

Rotation: Clockwise

Shaft Design Method: Specify

Shaft Support: ☒ Steady Bearing

Shaft Length: ☒ Automatic

Shaft Length (m): 4.8768

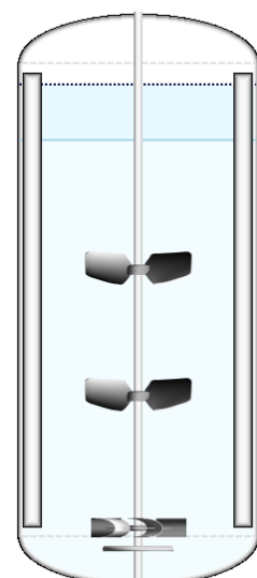
Shaft Off Bottom (m): 0

Shaft Type: Solid

Shaft Diameter (m): 0.0711

Shaft Inside Diameter (m):

Liquid Blending. M-Scale: 9.1/10. Turbulent. Blendtime: 00:00:24 h:m:s.
Gas Dispersion. Complete Dispersion (3/4). k_a: 0.073 1/s



Design 5/8 Duplicate New Delete Move: ↑ Top ↑ Up ↓ Down ↓ Bottom Sort: RPM: 78 Tag: Gas Dispersion Comment: Turbine + 2 Up Pumping Impellers

ID	Φ	Vessel	T (m)	Z (m)	V _L (m³)	Bottom	Top	Impeller	RPM	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _p	M-Scale	Multiphase	Tag	Comment
1	✓	Cylindrical	1.00	1.00	0.7334	ASME	ASME	HF-N	300.0	0.38	10	4%	00:00:23	1.15	7.6/10		Single Hydrofoil - Narrow	
2	✓	Cylindrical	2.03	3.45	10.759	Ellipse	Ellipse	HF-N	114.0	3	4.0	75%	00:00:20		10.1/10	★★★★	Suspension	Fully suspended
3	✓	Cylindrical	1.78	2.80	6.6577	Ellipse	Ellipse	RDT	60.0	1.67	4.0	42%	00:00:19		4.3/10	★★★☆	Multiple spargers	Multiple Rushton
4	✓	Cylindrical	2.03	2.84	8.3443	Conical	Ellipse	SWPS	72.0	6.19	7.89	78%	00:00:21		8.0/10		Sweeper	Conical bottom
5	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	78.0	4.29	10	43%	00:00:23		9.1/10	★★★☆	Gas Dispersion	Turbine + 2 Up Pumping Impellers
6	✓	Rectangular	1.00	0.75	1.4042	Angled	Flat	HF-N	240.0	0.1	0.40	25%	00:00:54		2.6/10		Angled Bottom	Rectangular vessel
7	✗	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	190.0	0.31	3.0	10%			0.0/10		Cavern Size	Yield stress fluid

Drives – Shaft Design

KaeMix Student

FILE SEND EDIT PROCESS DESIGN PERFORMANCE

Open Save File Info Units

Design Vessel Process Liquids Drive Impellers Baffles

Drives Main Drive

Style Top Entering

Drive Name

Motor (kW) 10

Maximum Load (%) 80

Speed (RPM) 180

Speed (rev/s) 3

Rotation Clockwise

Shaft Design ☐ Automatic

Shaft Support ☒ Steady Bearing

Shaft Length ☒ Automatic

Shaft Length (m) 1.3387

Shaft Off Bottom (m) 0

Shaft Type Solid

Shaft Diameter (m) 0.027

Shaft Inside Diameter (m)

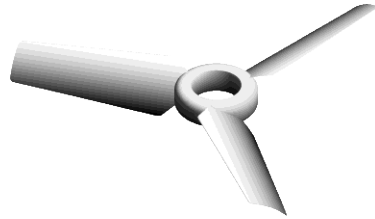
Shaft Design can be set to Automatic or the shaft can be specified by the user.
Shafts can be solid or hollow.

Shaft Length is calculated as follows:
Length = Top Head Depth
+ Vessel Straight Side
+ Bottom Depth
- Shaft Off Bottom

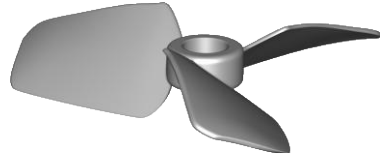
Impellers



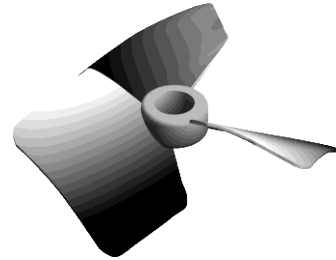
Available Impellers



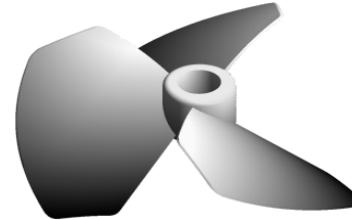
Hydrofoil Narrow



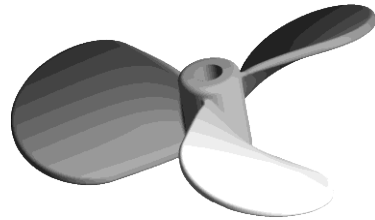
Hydrofoil Medium



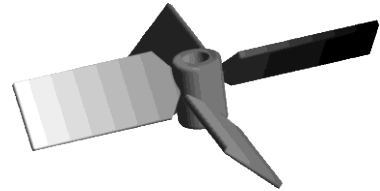
Hydrofoil Wide



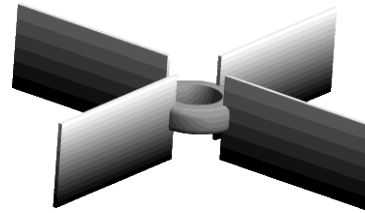
HF Extra Wide



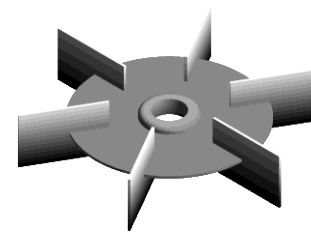
Propeller



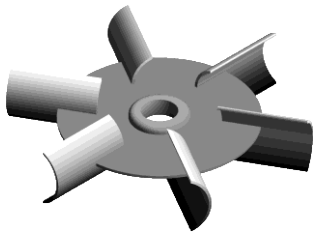
Pitched Blade



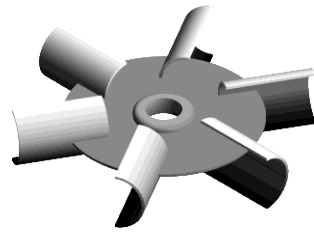
Straight Blade



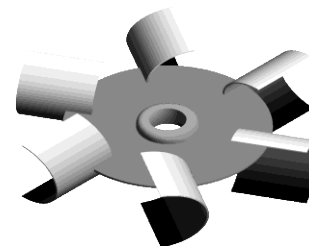
Rushton Turbine



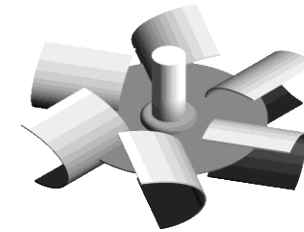
Van't Riet Turbine



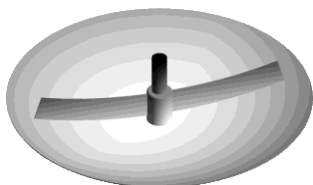
Smith Turbine



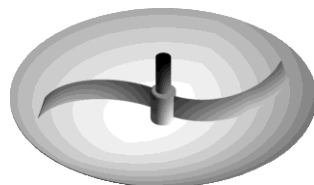
Middleton Turbine



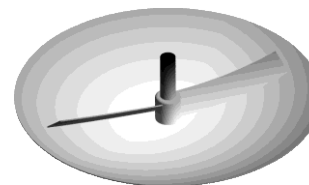
Bakker Turbine



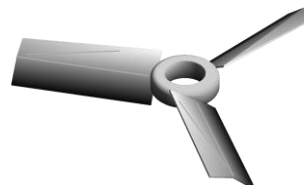
Sweeper Straight



Sweeper Curved



Sweeper Angled



High-Efficiency

Select Impeller Type

Settings | Impeller Preview **OFF**
Standard dropdown when clicking
Impeller Type

Set 2

Main Drive

General

HFOil-Wide

High Efficiency

Extra Efficiency

HFOil-Narrow

HFOil-Intermediate

HFOil-Medium

HFOil-Wide

HFOil-X-Wide

Hydrofoil

Pitched Blade

Propeller

Straight Blade

Sweeper Curved

Sweeper Pitched

Sweeper Straight

Settings | Impeller Preview **ON**
opens graphical selection panel
when clicking Impeller Type

Set 2

Main Drive

General

HFOil-Wide

High Efficiency

Extra Efficiency

HFOil-Narrow

HFOil-Intermediate

HFOil-Medium

HFOil-Wide

HFOil-X-Wide

Hydrofoil

Pitched Blade

Propeller

Straight Blade

Sweeper Curved

Sweeper Pitched

Sweeper Straight

Style: Disk Turbine

Type: Bakker

Pump Direction: Radial

Diameter (m): 0.8131

Blade Width (m): 0.1626

Number of Blades: 6

Blade Angle (degrees):

Number of Impellers: 1

First Bottom Clearance (m): 0.4064

Last Bottom Clearance (m):

Note:

Diameter / Tank Ratio (D/T): 0.4

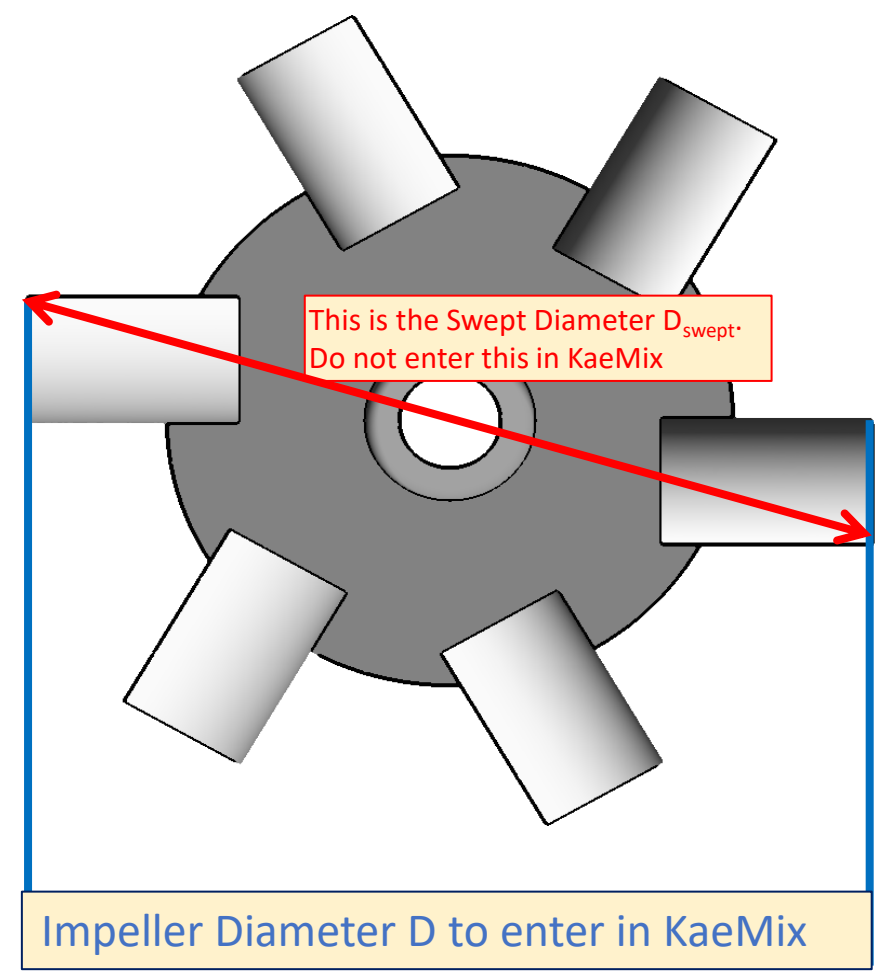
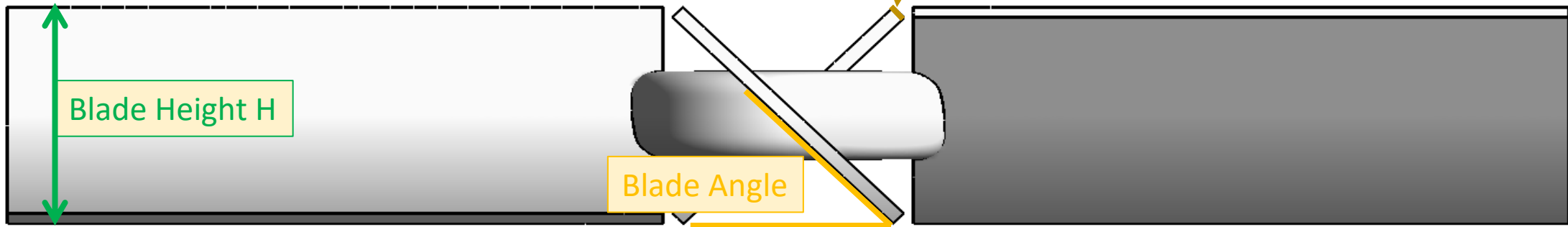
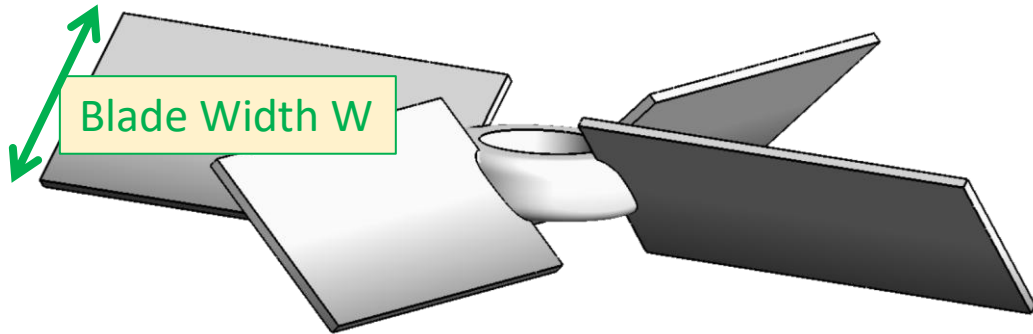
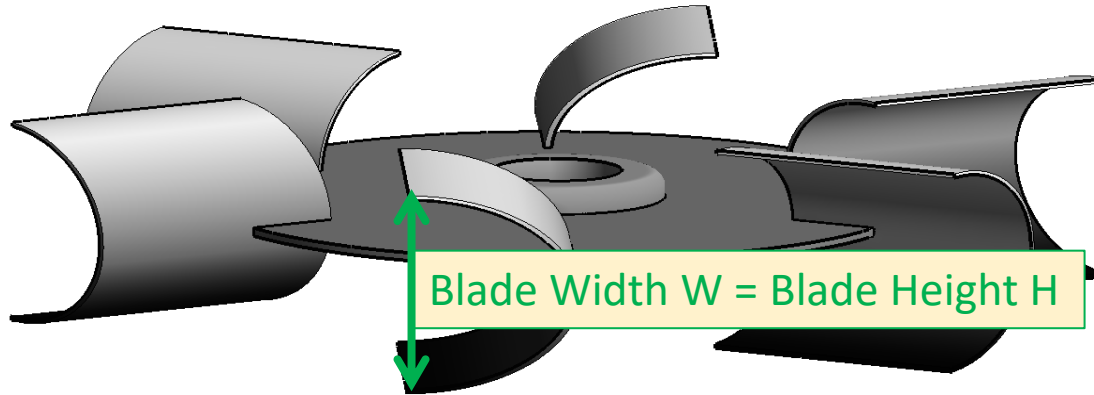
Clearance / Tank Ratio (C/T): 0.2

Blade Width Ratio (W/D): 0.2

Blade Pitch / Diameter (P/D):

Close the panel by clicking x-box or press Enter or Esc on keyboard

Impeller Dimensions



Multiple Impellers of Different Type

Impellers | Edit Sets 1-4 | Edit Sets 5-8

Set 1 ☒ Set 2 ☒

Connected To: Main Drive | Main Drive

Style: Disk Turbine | General

Type: Bakke | HFOil-Wide

Pump Direction: Radial | Up

Diameter (m): 0.8131 | 0.9147

Blade Width (m): 0.1626

Number of Blades: 6 | 4

Blade Angle (degrees):

Number of Impellers: 1 | 2

First Bottom Clearance (m): 0.4064 | 1.484

Last Bottom Clearance (m): | 2.563

Note:

Impeller Power Number: 2.33 | 0.771

Diameter / Tank Ratio (D/T): 0.4 | 0.45

Blade Width Ratio (W/D): 0.2


Clearance / Tank Ratio (C/T): 0.2 | 0.73

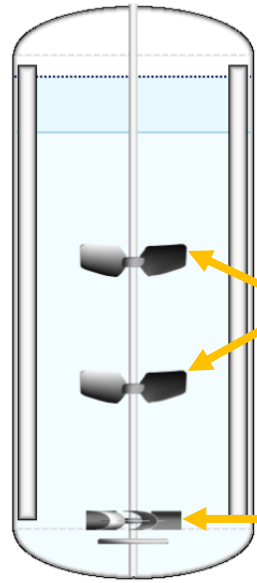
Blade Pitch / Diameter (P/D):

You can have up to eight different impeller sets.

Enable or disable sets using the check boxes.

To specify an impeller, select Style first, then Type.

You can swap /order impeller sets with the  buttons.



Set 2

Set 1

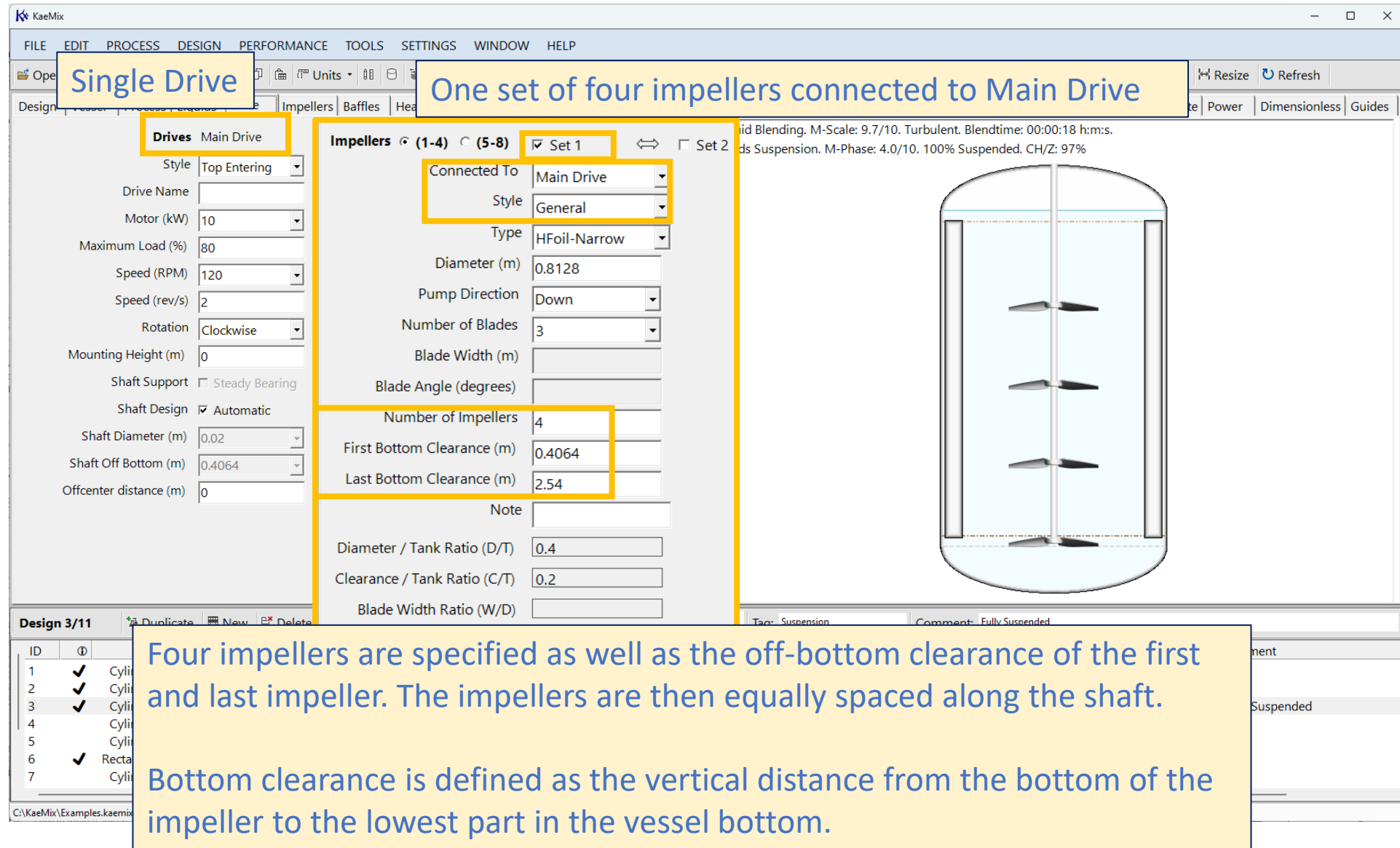
Design 5/8

ID	①																	
1	✓																	
2	✓	Cylindrical	2.03	3.45	10.759	Ellipse	Ellipse	HF-N	114.0	3	4.0	75%	00:00:20	1.15	10.1/10	★★★★	Suspension	Fully suspended
3	✓	Cylindrical	1.78	2.80	6.6577	Ellipse	Ellipse	RDT	60.0	1.67	4.0	42%	00:00:19		4.3/10	★★★☆	Multiple spargers	Multiple Rushton
4	✓	Cylindrical	2.03	2.84	8.3443	Conical	Ellipse	SWPS	72.0	6.19	7.89	78%	00:00:21		8.0/10		Sweeper	Conical bottom
5	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	78.0	4.29	10	43%	00:00:23		9.1/10	★★★☆	Gas Dispersion	Turbine + 2 Up Pumping Impellers
6	✓	Rectangular	1.00	0.75	1.4042	Angled	Flat	HF-N	240.0	0.1	0.40	25%	00:00:54		2.6/10		Angled Bottom	Rectangular vessel
7	X	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	190.0	0.31	3.0	10%			0.0/10		Cavern Size	Yield stress fluid

A single drive and shaft with multiple different impellers.

Impeller Set 1 is a disk turbine. Impeller Set 2 consists of two wide-blade hydrofoils.

Multiple Impellers of Same Type



Baffles

Baffle Design

In the Baffles tab you can choose Automatic design or Manual design. Here Automatic is selected, and this follows these rules in this order:

- Rectangular → no baffles
- All impellers $Re < 100$ → no baffles
- All impellers $Re < 300$ → two flat baffles (T/12 at T/72)
- All other configurations → four flat baffles (T/12 at T/72)

Baffle Design Automatic Manual

Baffle Geometry ☒ Baffles

Baffle Style: Standard Flat

Number of Baffles: 4

Baffle Width (m): 0.1693

Baffle Thickness (m): 0.0051

Baffle to Wall (m): 0.0282

Baffle to Bottom Straight Side (m): 0.0847

Baffle to Top Straight Side (m): 0.0847

Design 4/7 Duplicate New Delete Move: Top Up Down Bottom Sort: rev/s: 1.2 Tag: Sweeper Comment: Conical bottom

ID	(i)	Vessel	T (m)	Z (m)	V _i (m ³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _p	M-Scale	M-Phase	Tag
1	✓	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	5.0	0.38	2.0	19%	00:00:23		6/10		Single Hydrof
2	✓	Cylindrical	2.03	3.45	10.759	Ellipse	Ellipse	HF-N	1.9	3.0	4.0	75%	00:00:19	1.01	10/10	3/10	Suspension
3	✓	Cylindrical	1.78	3.02	7.2114	Ellipse	Ellipse	RDT	1.0	2.35	4.0	59%	00:00:20		5/10		Multiple sparg
4	✓	Cylindrical	2.03	2.84	8.2344	Conical	Ellipse	SWPV	1.2	4.02	7.9	51%	00:00:23		7/10		Sweeper
5	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	1.3	3.69	10.0	37%	00:00:24		8/10	3/10	Gas Dispersio
6	✓	Rectangular	1.60	0.75	1.4042	Angled	Flat	HF-N	4.0	0.24	0.4	61%	00:00:18		5/10		Angled Bottom
7	✗	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	5.0	1.15	10.0	11%			0/10		Cavern Size

A sweeper is an impeller that matches the shape of the bottom and is close to it. Blades can be vertical / straight, pitched, or curved.

Baffle Design – Manual

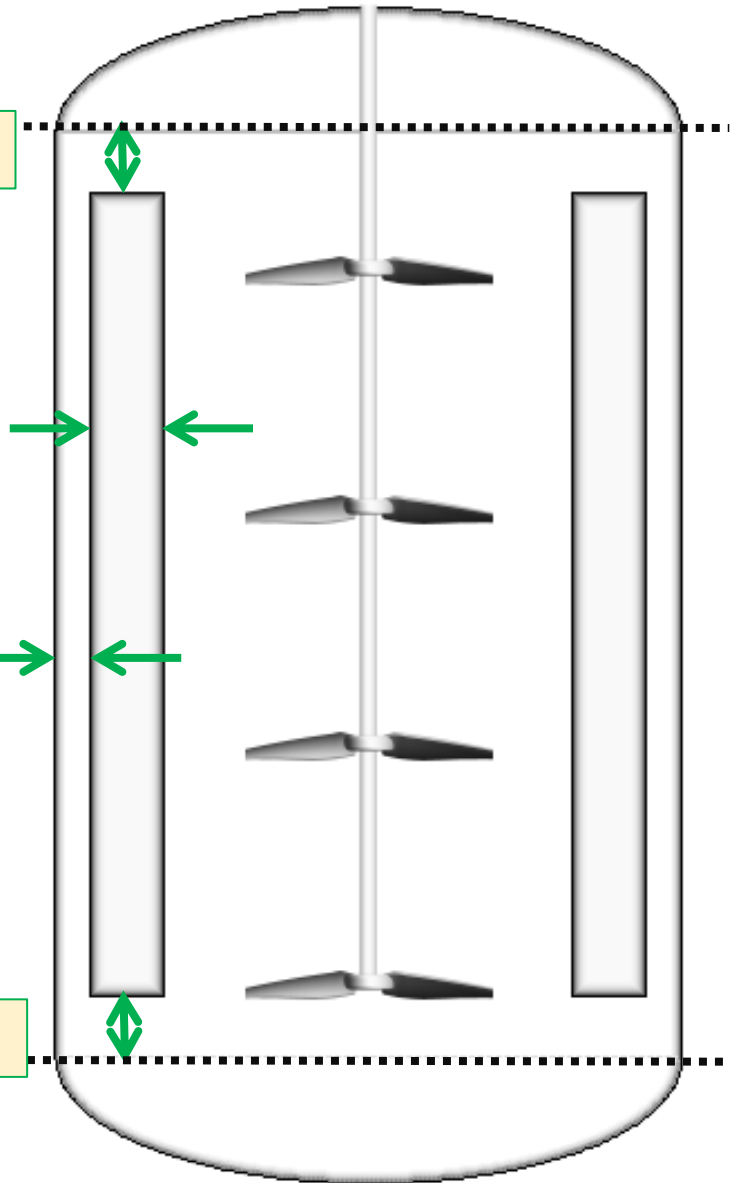
*Baffle type
“Standard – Flat”
allows you to
prescribe the
location and size of
the baffles in detail*

Baffle to Top Straight Side

Baffle Width

Baffle to Wall

Baffle to Bottom Straight Side

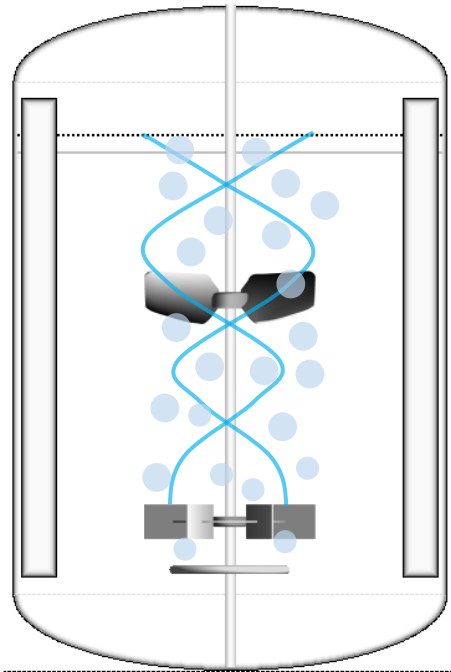


Gas Dispersion

Gas Dispersion – Flow Regimes

Rated from zero stars ☆☆☆☆
to four stars ★★★★★

Increasing impeller speed N →

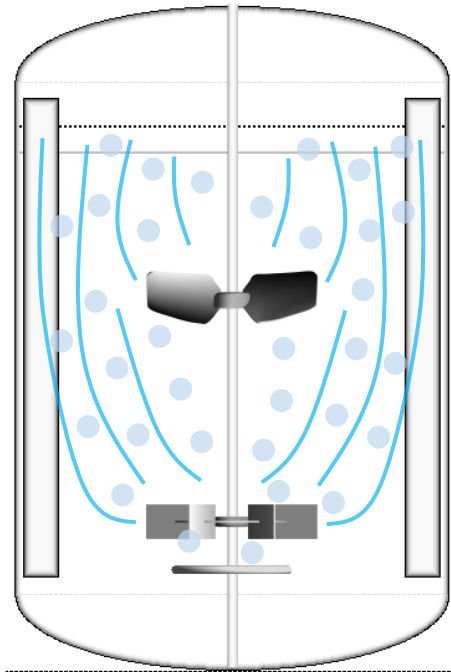


☆☆☆☆

Flooded (0/4)

Gas rises straight through
the impellers

Avoid this flow regime

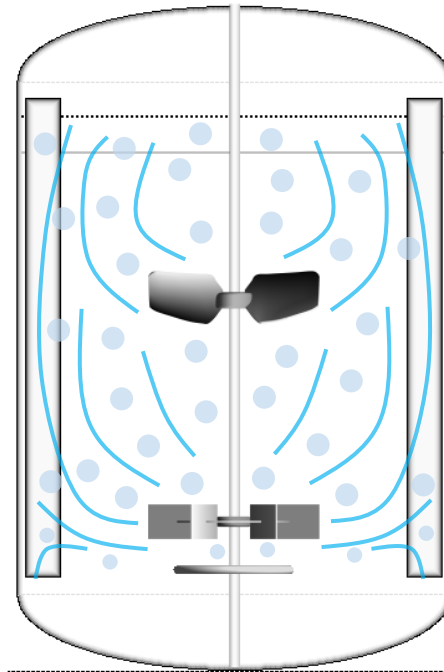


★★★★

Coarse Dispersion (1/4)

Impellers not flooded. Some
gas reaches vessel walls,
especially near upper impellers

Applications that are not mass
transfer limited

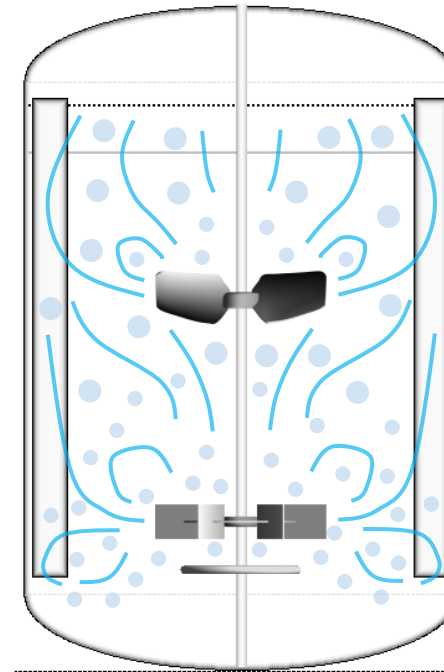


★★★☆☆

Dispersing (2/4)

Gas is dispersed towards the
vessel wall, but there is little
or no recirculation

Reactors requiring moderate
degree of mass transfer

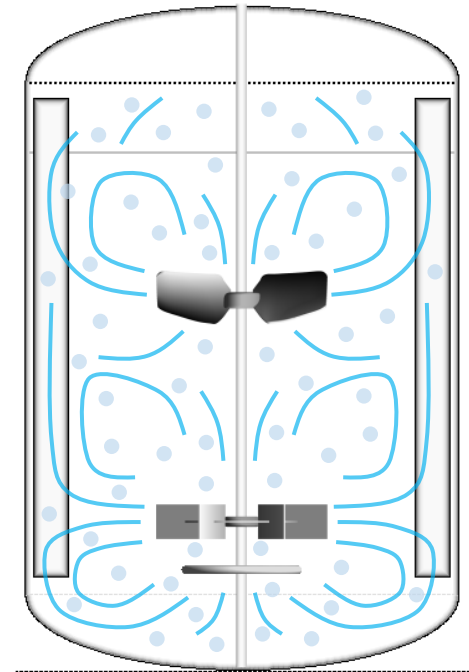


★★★★☆

Complete Dispersion (3/4)

Gas is dispersed and there is
gas recirculation

Suitable for critical gas-liquid reactors where
rapid mass transfer is required



★★★★★

Fine Dispersion (4/4)

Gas dispersed and substantial
recirculation. Small bubble
size aids mass transfer

Gas Dispersion

Enable gas dispersion here

☒ Gas Dispersion

Process Gas Air

Gas Flow Unit Vol/Vol/Minute (VVM)

Gas Flow 1

Gas C_p/C_v ratio 1.4

Coalescence Behavior Non-Coalescing

Viscosity model (k_a) Liquid ($k_a \propto \text{viscosity}^{-1/2}$)

Safety No Safety Concerns

Mole Fraction O_2 0.2095

Molecular Weight 28.97

Diffusion Coeff. (m^2/s) 2.05E-09

Gas Flow Rate

Mass Flow (kg/s) 0.2912

Mass Flow (kg/hr) 1048.3

Actual Conditions (m^3/s) 0.1677

Standard Conditions (m^3/s) 0.2377

Open the Gas Flow tab to enter the gas dispersion related information. Here you can also access the Sparger Design and Gas Dispersion Results tab.

Gas Flow

Sparger Design

☒ Gas Dispersion

Sparger Design Automatic Manual

Gas Spargers ☒ Set 1 ☐ Set 2

Style Ringsparger

Fraction of Gas Flow 1

Sparger Diameter (m) 0.6096

Number of Holes

Hole Diameter (m)

Direction Down

Number of Spargers 1

Off Bottom First Sparger (m) 0.2845

Off Bottom Last Sparger (m)

Offcenter Distance (m)

Gas Dispersion Results

Gas Dispersion

Main Gas Dispersion Impeller 1: Bakker

Flow Regime Dispersing

Gas Holdup

Process / Actual Conditions 12.5%

Water / Standard Conditions 12.4%

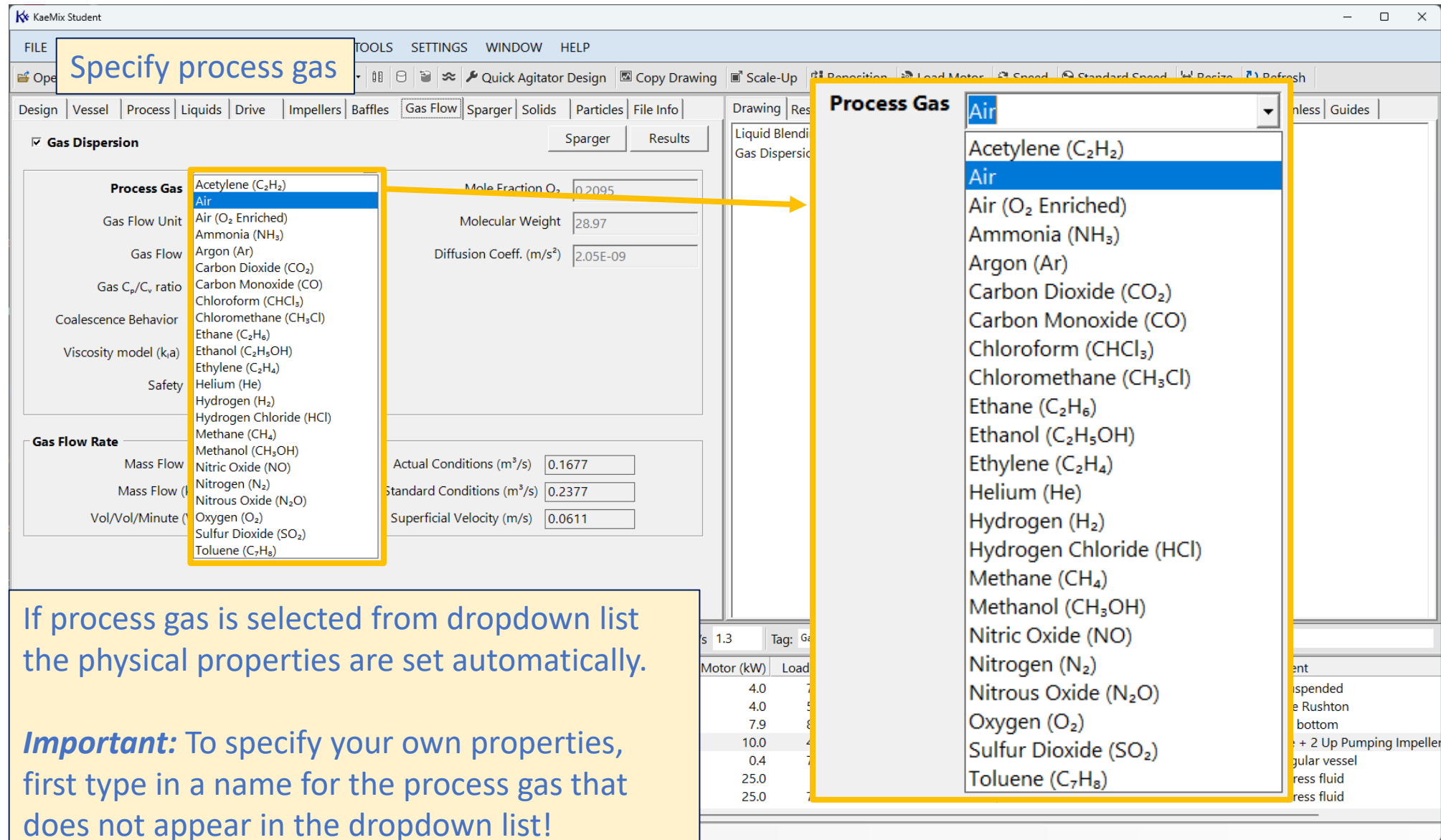
Mass Transfer Coefficient (1/s)

k_a Process / Actual Conditions 0.0665

k_a Water / Standard Conditions 0.0774

ID	Des	Impeller	Flow	Power	Time	Efficiency	Notes
2		Cylindrical	1.78	3.02	7.2114	Ellipse	Ellipse
3		Cylindrical	2.03	2.84	8.2344	Conical	Ellipse
4		Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse
5	✓	Cylindrical	1.60	0.75	1.4042	Angled	Flat
6	✓	Rectangular	1.00	1.00	0.733	Ellipse	Ellipse
7	✗	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse
8	✓	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse

Gas Dispersion – Process Gas



Specify process gas

Process Gas

Acetylene (C₂H₂)
Air
Air (O₂ Enriched)
Ammonia (NH₃)
Argon (Ar)
Carbon Dioxide (CO₂)
Carbon Monoxide (CO)
Chloroform (CHCl₃)
Chloromethane (CH₃Cl)
Ethane (C₂H₆)
Ethanol (C₂H₅OH)
Ethylene (C₂H₄)
Helium (He)
Hydrogen (H₂)
Hydrogen Chloride (HCl)
Methane (CH₄)
Methanol (CH₃OH)
Nitric Oxide (NO)
Nitrogen (N₂)
Nitrous Oxide (N₂O)
Oxygen (O₂)
Sulfur Dioxide (SO₂)
Toluene (C₇H₈)

Gas Flow Unit
Gas Flow
Gas C_p/C_v ratio
Coalescence Behavior
Viscosity model (k_a)
Safety

Gas Flow Rate
Mass Flow
Mass Flow (l/min)
Vol/Vol/Minute (l/min)

Mole Fraction O₂ 0.2095
Molecular Weight 28.97
Diffusion Coeff. (m²/s) 2.05E-09

Actual Conditions (m³/s) 0.1677
Standard Conditions (m³/s) 0.2377
Superficial Velocity (m/s) 0.0611

Process Gas

Air
Acetylene (C₂H₂)
Air
Air (O₂ Enriched)
Ammonia (NH₃)
Argon (Ar)
Carbon Dioxide (CO₂)
Carbon Monoxide (CO)
Chloroform (CHCl₃)
Chloromethane (CH₃Cl)
Ethane (C₂H₆)
Ethanol (C₂H₅OH)
Ethylene (C₂H₄)
Helium (He)
Hydrogen (H₂)
Hydrogen Chloride (HCl)
Methane (CH₄)
Methanol (CH₃OH)
Nitric Oxide (NO)
Nitrogen (N₂)
Nitrous Oxide (N₂O)
Oxygen (O₂)
Sulfur Dioxide (SO₂)
Toluene (C₇H₈)

If process gas is selected from dropdown list the physical properties are set automatically.

Important: To specify your own properties, first type in a name for the process gas that does not appear in the dropdown list!

Gas Dispersion – Flow Rate (1/2)

Specify gas flow

PERFORMANCE TOOLS SETTINGS WINDOW HELP

Open Save File Info Units Quick Agitator Design Copy Drawing Scale-Up Reposition Load Motor Speed Standard Speed Resize Refresh

Design Vessel Process Liquids Drive Impellers Baffles Gas Flow Sparger Solids Particles File Info Drawing Results Report Loads Blending Suspension Gas Dispersion Power Dimensionless Guides

☒ **Gas Dispersion**

Process Gas: Air

Gas Flow Unit: Vol/Vol/Minute (VVM)

Gas Flow: 1

Coalescence Behavior: Non-Coalescing

Viscosity model ($k_L a$): Liquid ($k_L a \propto \text{viscosity}^{-1/2}$)

Safety: No Safety Concerns

Gas Flow Rate

Mass Flow (kg/s): 0.2912 Actual Conditions (m^3/s): 0.1577

To enter the gas flow rate, first select the Gas Flow Unit, then enter the Gas Flow in that unit

Specify bubble coalescence behavior. If unsure, select *coalescing*.

For viscosity model select *Liquid, Fermentation Broth, or Fine Suspension* as appropriate. *None* is for situations where you specified the value of the diffusion coefficient that you want to be used without additional corrections. Note: if both the process liquid and the process gas are selected from the dropdown lists then the viscosity model setting is disabled and KaeMix automatically selects the best model

Coalescence Behavior

- Coalescing
- Clean Water
- Coalescing
- Non-Coalescing
- Electrolyte-Water

Viscosity model ($k_L a$)

- Liquid ($k_L a \propto \text{viscosity}^{-1/2}$)
- Liquid ($k_L a \propto \text{viscosity}^{-1/2}$)
- Fine Suspension
- Fermentation Broth
- None (Diff. Coeff. effect only)

Gas Dispersion - Flow Rate (2/2)

Gas Flow Rate

Mass Flow (kg/s)	0.2824	Actual Conditions (m ³ /s)	0.1714
Mass Flow (kg/hr)	1016.7	Standard Conditions (m ³ /s)	0.2305
Vol/Vol/Minute (VVM)	1	Superficial Velocity (m/s)	0.0611

VVM and superficial gas velocities are calculated based on average gas temperature and average pressure

VVM is gas volumetric flow rate / operating volume per minute

Gas flow rates in USA units are shown if KaeMix is set to USA units

Actual Conditions are defined as the temperature and the pressure at the bottom

Standard Conditions mean the *International Standard Metric Conditions*: 15°C / 59°F at 1 Atm

Here, CFM is Cubic Feet per Minute. Standard is 59°F at 1 Atm

Tip: it is best to enter gas flow as a mass flow rate because not everyone uses the same definitions for standard or actual conditions used in volumetric flow rate calculations

Gas Flow Rate

Mass Flow (lb/s)	0.6226	Actual CFM	363.25
Mass Flow (lb/hr)	2241.4	Standard CFM	488.41
Vol/Vol/Minute (VVM)	1	Superficial Velocity (ft/s)	0.2004

Gas Dispersion - Results

Main impeller: the lowest impeller that is directly gassed

Flow Regime: *Flooded* means the gas rises through the impeller system without being driven to the wall. *Coarse Dispersion* means gas is driven direction vessel wall but may not completely reach it and there is no recirculation. *Dispersing* means that gas is driven to the vessel wall and some smaller bubbles may recirculate. *Complete dispersion* means that gas is also driven down at the vessel wall and part of the gas recirculates through the impeller system

Gas holdup and mass transfer coefficient k_La are shown for the process / actual conditions; for water / standard conditions (15°C/ 59°F and atmospheric pressure); and for the custom correlations

The following is not included in holdup and k_La calculations:

- o Power input by impellers below the lowest sparger
- o Gas input from spargers above the highest impeller
- o Impellers and spargers located above the user specified operating level (which is ungassed)

Dip tube spargers work less well than other spargers and a reduced efficiency is assigned to them

Gas Dispersion

Main Gas Dispersion Impeller 1: Bakker

Flow Regime Dispersing

Gas Holdup

Holdup α (Process / Actual Conditions) 13.1%

Holdup α (Water / Standard Conditions) 13.0%

Mass Transfer Coefficient (1/s)

k_La (Process / Actual Conditions) 0.0294

k_La (Water / Standard Conditions) 0.0844

Sparger Design

FILE

EDIT

PROCESS

DESIGN

PERFORMANCE

TOOLS

SETTINGS

WINDOW

HELP

Save

File Info

Units

Design Info

Vessel

Process

Liquids

Impellers

Reposition

Drive

Load Motor

Scale-Up

Clipboard

Refresh

Design

Vessel

Process

Liquids

Drive

Impellers

Baffles

Gas Flow

Sparger

Solids

Particles

File Info

Drawing

Results

Report

Loads

Blending

Suspension

Gas Dispersion

Power

Dimensionless

Guides

Gas Dispersion

Sparger Design

Automatic

Manual

Gas Spargers

Style

Ringsparger

Sparger Diameter (m)

0.2667

Number of Holes

Hole Diameter (m)

Direction

Down

Number of Spargers

4

Off Bottom First Sparger (m)

0.35

Off Bottom Last Sparger (m)

2.223

Here a set of four spargers is specified

Liquid Blending. M-Scale: 5/10. Turbulent. Blendtime: 00:00:20 h:m:s.

Spargers

Design 3/7

Duplicate

New

Delete

Move: Top Up Down Bottom

Sort: 1 2 3

rev/s: 1

Tag: Multiple spargers

Comment: Multiple Rushton

ID	(i)	Vessel	T (m)	Z (m)	V _L (m ³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _{js}	M-Scale	M-Phase	Tag	Comment
1	✓	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	5.0	0.38	2.0	19%	00:00:23		6/10		Single Hydrofoil - Narrow	
2	✓	Cylindrical	2.03	3.45	10.759	Ellipse	Ellipse	HF-N	1.9	3.0	4.0	75%	00:00:19	1.01	10/10	3/10	Suspension	Fully suspended
3	✓	Cylindrical	1.78	3.02	7.2114	Ellipse	Ellipse	RDT	1.0	2.35	4.0	59%	00:00:20		5/10		Multiple spargers	Multiple Rushton
4	✓	Cylindrical	2.03	2.84	8.2344	Conical	Ellipse	SWPV	1.2	4.02	7.9	51%	00:00:23		7/10		Sweeper	Conical bottom
5	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	1.3	3.69	10.0	37%	00:00:24		8/10	3/10	Gas Dispersion	Turbine + 2 Up Pump
6	✓	Rectangular	1.60	0.75	1.4042	Angled	Flat	HF-N	4.0	0.24	0.4	61%	00:00:18		5/10		Angled Bottom	Rectangular vessel
7	X	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	5.0	1.15	10.0	11%			0/10		Cavern Size	Yield stress fluid

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KaeMix Student User Guide

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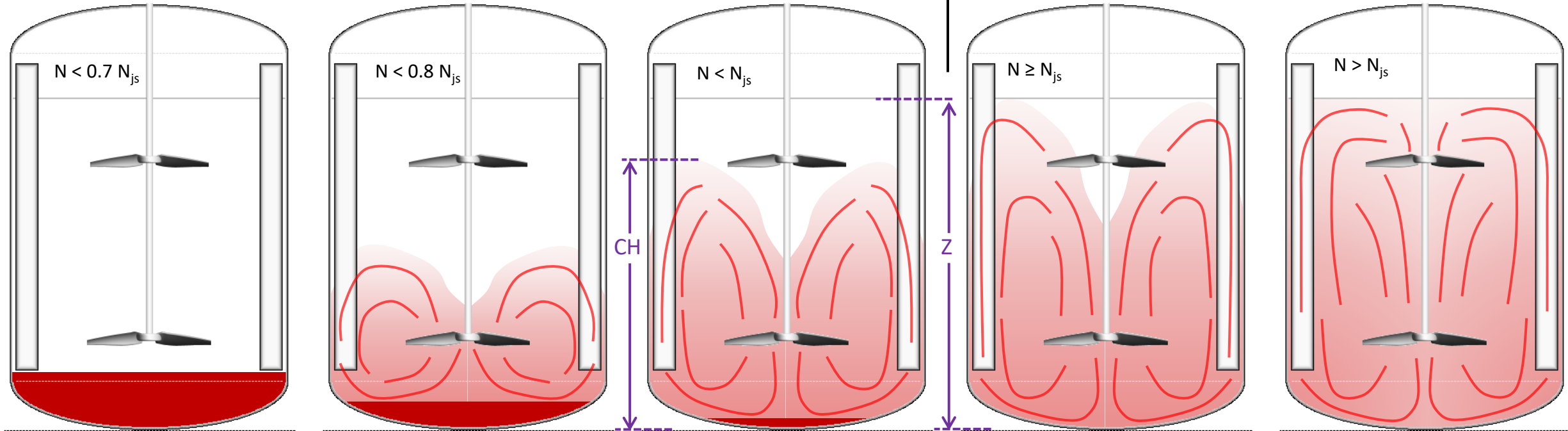
Solids Suspension

Solids Suspension – Flow Regimes

Rated from zero stars ☆☆☆☆
to four stars ★★★★★

Increasing impeller speed N →

The point at which this transition occurs is called just-suspended and the impeller speed is denoted as N_{js}



☆☆☆☆

Settled Solids ($0/4$)

All or most solid particles are settled on the bottom

☆☆☆☆

Partial Motion ($1/4$)

Most particles are in motion. There are still some stagnant solids on the bottom

☆☆☆☆

Solids Motion ($2/4$)

All solids are in motion. Some solids are moving around on the bottom

☆☆☆☆

Complete Suspension ($3/4$)

All solids are in motion. When deposited on the bottom, solids stay there only briefly

☆☆☆☆

Fine Suspension ($4/4$)

All solids are distributed throughout the vessel

KaeMix warning: Operating at $N < 0.8N_{js}$ is not recommended

KaeMix reports percentage of solids that are unsuspended

KaeMix reports cloud height CH/Z . Cloud height depends on impeller placement, especially in tall vessels

Solids Suspension

Enable solids suspension here

Solids Description

Solid Particles

Solids Material: PET

Solids Density (kg/m³): 1380

Particle Diameter (m): 1.73E-03

Settling Velocity: Specify

Particle Free Settling Velocity (m/s): 0.0905

Hindered Settling Velocity (m/s): 0.0719

Solids Weight / Mixture Weight (%): 10

Solids Weight / Liquid Weight (%): 11.111

Solids Volume / Operating Volume (%): 7.45

Mixture Density (kg/m³): 1028.3

Solids Weight (kg): 1106.3

Safety: No Safety Concerns

Open the Solids tab to enter the solids suspension related information. Here you can also access the Suspension Results tab.

Tip: particle diameter can be:

- entered directly,
- or calculated from mesh, e.g., enter size as “100 mesh” or “1/4 mesh”

Liquid Blending. M-Scale: 9.2/10. Turbulent. Blendtime: 00:00:20 h:m:s.
Solids Suspension. M-Phase: 4.0/10. 100% Suspended. CH/Z: 97%

Design 2/8

ID	Φ	Vessel	T (m)	Z (m)	V _L (m³)	Bottom	Top	Impeller	RPM	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _s	M-Scale	M-Phase	Tag	Comment
1	✓	Cylindrical	1.00	1.00	0.7303	ASME	ASME	HF-N	300.0	0.38	10.0	4%	00:00:23		7.6/10		Single Hydrofoil - Narrow	
2	✓	Cylindrical	2.03	3.45	10.759	Ellipse	Ellipse	HF-N	114.0	3.0	4.0	75%	00:00:20	1.15	9.2/10	4.0/10	Suspension	Fully suspended
3	✓	Cylindrical	1.78	2.80	6.6577	Ellipse	Ellipse	RDT	60.0	1.67	4.0	42%	00:00:19		3.8/10	3.8/10	Multiple spargers	Multiple Rushton
4	✓	Cylindrical	2.03	2.84	8.2344	Conical	Ellipse	SWPS	72.0	6.19	7.9	78%	00:00:22		7.2/10		Sweeper	Conical bottom
5	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	78.0	4.29	10.0	43%	00:00:24		7.9/10	3.0/10	Gas Dispersion	Turbine + 2 Up Pumping Impellers
6	✓	Rectangular	1.60	0.75	1.4042	Angled	Flat	HF-N	240.0	0.1	0.4	25%	00:00:54		2.6/10		Angled Bottom	Rectangular vessel

Solids Suspension Results (1/3)

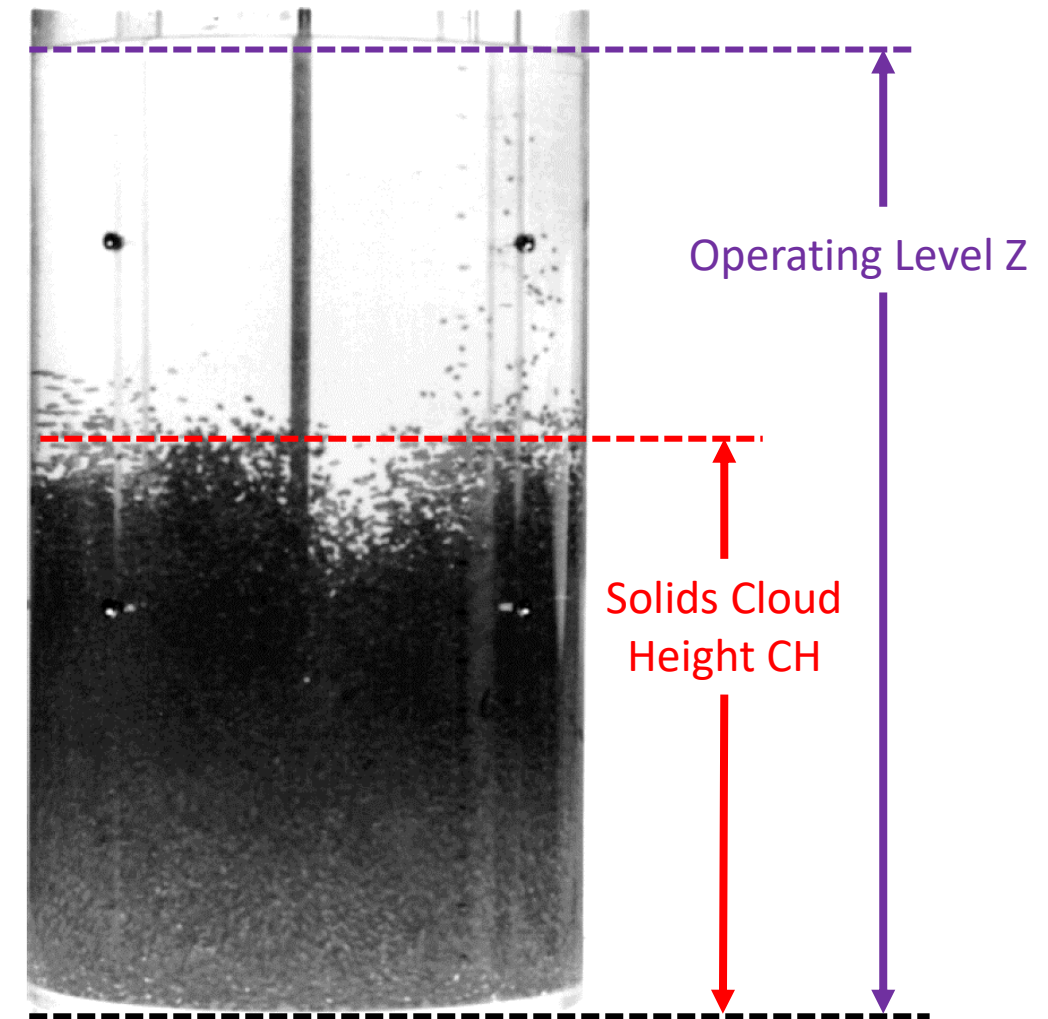
- N_{js} is the just-suspended speed
- Main impeller is name of impeller that contributes most to the off-bottom suspension process
- Three methods are used to calculate this:
 1. N_{js} GMB: Grenville-Mak-Brown (2015). Down pumping axial flow impellers. Scaleup exponent is -0.67
 2. N_{js} CFM: Corpstein-Fasano-Myers (1994). Both down and up pumping axial flow impellers. Scaleup exponent depends on particle properties.
 3. N_{js} Zwietering: Zwietering (1958). Radial and axial flow impellers. Scaleup exponent is -0.85.
- N_{js} is reported as the average of these calculations
- The percentage of unsuspended (settled on the bottom) solids, the percentage of suspended solids, and the Cloud Height / Z (operating level) ratio are reported also for conditions where these can be calculated

Solids Suspension Results

Ungassed	
Main Suspension Impeller	1: HFoil-Narrow
N_{js} (RPM)	99.1
N_{js} (rev/s)	1.65
N/N_{js}	1.21
N (RPM)	120
N (rev/s)	2.00
P_{js} (kW)	1.9708
Unsuspended	0%
Suspended	100%
Cloud Height / Z	97%

Solids Suspension Results (2/3)

- The Cloud Height / Z (operating level) ratio is reported also for conditions where this can be calculated
- A cloud height CH/Z of 100% means that the solids cloud reaches the liquid surface
 - Note that this does not mean that the solids are 100% uniformly distributed throughout the liquid: there may still be concentration gradients
- Cloud height calculations are based on Hicks M.T., Myers K.J., Bakker A. (1997) *Cloud Height in Solids Suspension Agitation*, Chem. Eng. Comm., Vol. 160, pp 137-155.

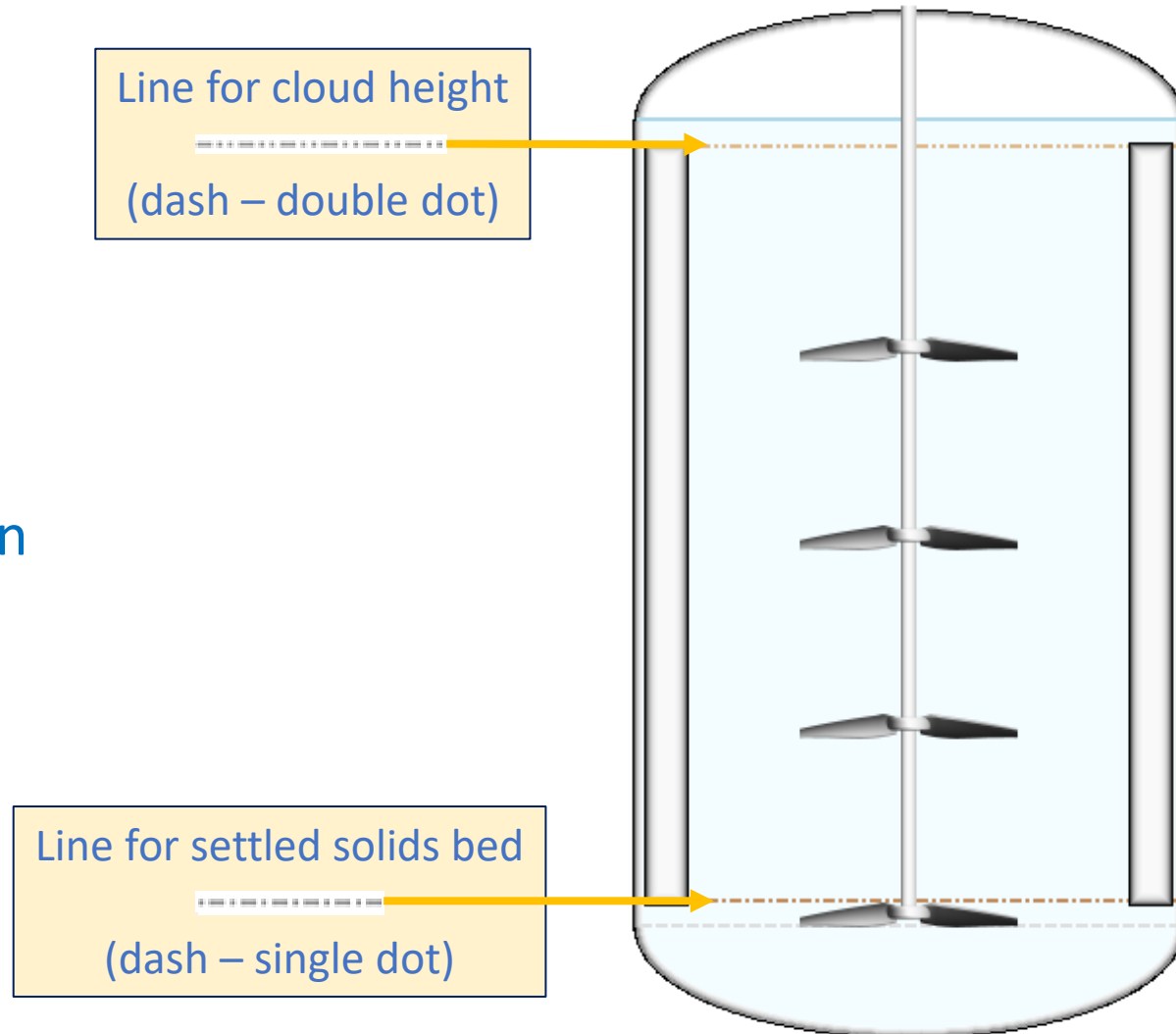


In this experiment, cloud height CH / Z \approx 60%

Solids Suspension Results (3/3)

- If Settings | Draw Solids Levels is On then KaeMix will draw lines at the predicted cloud height and at the height of the solids bed if all solids were settled
- Limitations: only for cylindrical and rectangular vessels for which solids suspension calculations can be performed. Cloud height only drawn if able to be calculated. If $CH/Z = 100\%$ then operating level and cloud height are the same and line for cloud height may not be visible

Liquid Blending. M-Scale: 8.2/10. Turbulent. Blendtime: 00:00:25 h:m:s.
Solids Suspension. M-Phase: 4.0/10. 100% Suspended. CH/Z: 97%



Results



Blend Time

KaeMix

FILE EDIT PROCESS DESIGN PERFORMANCE TOOLS SETTINGS WINDOW HELP

Save File Info Units Design Info Vessel Process Liquids Impellers Reposition Drive Load Motor Scale-Up Clipboard Refresh

Design Vessel Process Liquids Drive Impellers Baffles Gas Flow Sparger Solids Particles File Info Drawing Results Report Loads **Blending** Suspension Gas Dispersion Power Dimensionless Guides

Primary Liquid Fermentation Broth

Density (kg/m³) 1200

Viscosity Model Newtonian

Viscosity at 1/s (mPa.s) 75

Blend times required to reach a certain degree of uniformity are presented. Both ungassed and gassed blend times are shown.

Blend Time (h:m:s)

Uniformity	Ungassed	Gassed
80%	00:00:05	00:00:06
85%	00:00:06	00:00:07
90%	00:00:08	00:00:09
95%	00:00:10	00:00:11
96%	00:00:11	00:00:12
97%	00:00:12	00:00:13
98%	00:00:13	00:00:15
99%	00:00:16	00:00:18
100%	00:00:24	00:00:27

Design 5/7 Duplicate New Delete Move: ↑ Top ↑ Up ↓ Down ↓ Bottom Sort: rev/s: 1.3 Tag: Gas Dispersion Comment: Turbine + 2 Up Pumping Impellers

ID	(i)	Vessel	T (m)	Z (m)	V _L (m ³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _{js}	M-Scale	M-Phase	Tag	Comment
1	✓	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	5.0	0.38	2.0	19%	00:00:23		6/10		Single Hydrofoil - Narrow	
2	✓	Cylindrical	2.03	3.45	10.759	Ellipse	Ellipse	HF-N	1.9	3.0	4.0	75%	00:00:19	1.01	10/10	3/10	Suspension	Fully suspended
3	✓	Cylindrical	1.78	3.02	7.2114	Ellipse	Ellipse	RDT	1.0	2.35	4.0	59%	00:00:20		5/10		Multiple spargers	Multiple Rushton
4	✓	Cylindrical	2.03	2.84	8.2344	Conical	Ellipse	SWPV	1.2	4.02	7.9	51%	00:00:23		7/10		Sweeper	Conical bottom
5	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	1.3	3.69	10.0	37%	00:00:24		8/10	3/10	Gas Dispersion	Turbine + 2 Up Pump
6	✓	Rectangular	1.60	0.75	1.4042	Angled	Flat	HF-N	4.0	0.24	0.4	61%	00:00:18		5/10		Angled Bottom	Rectangular vessel
7	✗	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	5.0	1.15	10.0	11%			0/10		Cavern Size	Yield stress fluid

Drive Loads

KaeMix Student

FILE SEND EDIT PROCESS DESIGN PERFORMANCE TOOLS SETTINGS WINDOW HELP

Open Save File Info Units Quick Agitator Design Copy Drawing Scale-Up Reposition Load Motor Speed Standard Speed Resize Refresh

Design Vessel Process Liquids **Drive** Impellers Baffles Solids Gas Flow Sparger File Info

Drawing Results Report **Loads** Blending Suspension Gas Dispersion Power Dimensionless Guides

Drives Main Drive

Style: Top Entering

Drive Name:

Motor (kW): 10

Maximum Load (%): 80

Speed (RPM): 480

Speed (rev/s): 8

Rotation: Clockwise

Shaft Design: ☒ Automatic

Shaft Support: ☐ Steady Bearing

Shaft Length: ☒ Automatic

Shaft Length (m): 0.45

Shaft Off Bottom (m): 0.1

Shaft Type: Solid

Shaft Diameter (m): 0.01

Shaft Inside Diameter (m):

Power draw and motor load are shown

Drive Loads

	Ungassed	Gassed
Total Power Draw (kW)	0.0027	
P_g/P_u		
P/V (kW/m ³)	0.0796	
P/Mass (W/kg)	0.0783	
Total Flow Rate (m ³ /s)	0.0079	
Motor Load		
Main Drive (10kW)	0.0%	

The design list shows for each design, for the main drive: the speed, the power draw, the motor capacity, and the motor load

Design 3/3 Duplicate New Delete Move: ↑ Top ↑ Up ↓ Down ↓ Bottom Sort: RPM: 480 Tag: Two Impellers S/D = 3.7 Comment: CH/Z = 46%

ID	✓	Vessel	T (m)	Z (m)	V_t (m ³)	Bottom	Top	Impeller	RPM	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _s	M-Scale	M-Phase	Tag	Comment
1	✓	Cylindrical	0.29	0.51	0.0337	Flat	Flat	HF-N	480.0	1.3E-03	10.0	0%	00:00:26	1.01	1.3/10	3.0/10	Single Impeller	CH/Z = 46%
2	✓	Cylindrical	0.29	0.51	0.0337	Flat	Flat	HF-N	480.0	2.7E-03	10.0	0%	00:00:13	1.01	2.0/10	3.0/10	Two Impellers S/D = 3.0	CH/Z = 95%
3	✓	Cylindrical	0.29	0.51	0.0337	Flat	Flat	HF-N	480.0	2.7E-03	10.0	0%	00:00:13	1.01	2.0/10	3.0/10	Two Impellers S/D = 3.7	CH/Z = 46%

Power Draw Details

KaeMix

FILE EDIT PROCESS DESIGN PERFORMANCE TOOLS SETTINGS WINDOW HELP

Open Save File Info Units Quick Agitator Design Copy Drawing Scale-Up Reposition Load Motor Speed Standard Speed Resize Refresh

Design Vessel Process Liquids Drive Impellers Baffles Heat Gas Flow Sparger Solids Particles Drawing Results Report Loads Blending Suspension Gas Dispersion HT Rat Power Dimensionless Guides

Impellers (1-4) (5-8) Set 1 Set 2 Set 3 Set 4

Connected To Main Drive Main Drive

Style Disk Turbine General

Type Bakker HFOil-Wide

Ungassed torque M, flow / pumping rate Q, and power P per impeller

Blade Angle (degrees)

Number of Impellers

First Bottom Clearance

Last Bottom Clearance (m) 0.4064 2.563

Note

Diameter / Tank Ratio (D/T) 0.4

Clearance / Tank Ratio (C/T) 0.2 0.73

Blade Width Ratio (W/D)

Blade Pitch / Diameter (P/D)

Ungassed totals for the impeller set

Gassed values per impeller

Gassed totals for the impeller set

Power Draw	Set 1	Set 2	Set 3	Set 4	Set 5	Set 6	Set 7	Set 8
Type	BDT	HF-W						
Nr Blades	6	4						
Drive	1	1						
Speed N (rev/s)	1.3	1.3						
Torque M (Nm)	268	159						
Flow Q (m³/s)	0.475	0.746						
Power P (kW)	2.19	1.3						
Nr Impellers	1	2						
Total M (Nm)	268	319						
Total Q (m³/s)	0.475	1.49						
Total P (kW)	2.19	2.6						
Gassed M _g (Nm)	250	137						
Gassed Q _g (m³/s)	0.465	0.711						
Gassed P _g (kW)	2.05	1.12						
Total M _g (Nm)	250	275						
Total Q _g (m³/s)	0.465	1.42						
Total P _g (kW)	2.05	2.25						

Design 8/11 Duplicate New Delete Move: Top Up Down Bottom Sort: rev/s 1.3 Tag: Gas Dispersion Comment: Turbine + 2 Up Pumping Impellers

ID	①	Vessel	T (m)	Z (m)	V _L (m³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _p	M-Scale	M-Phase	Tag	Comment
5	✓	Cylindrical	2.03	2.84	8.7836	Ellipse	Ellipse	HF-N	1.2	0.34	7.9	4%	00:00:58		4.2/10		HTR Coils	
6	✓	Rectangular	5.17	3.50	71.4	Angled	Flat	HF-W	2.0	10.4	16.0	65%	00:01:08		4.3/10		Side Entering	
7		Cylindrical	1.78	2.27	5.3617	ASME	ASME	PUMPS	2.0	5.44	24.6	22%	00:00:26		2.4/10		Pumper	
8	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	1.3	4.29	33.5	13%	00:00:24		7.9/10	3.0/10	Gas Dispersion	Turbine + 2 Up Pumping Impeller
9	✓	Cylindrical	2.54	4.49	21.967	ASME	ASME	SWPS	1.5	10.15	57.7	18%	00:00:29	0.59	9.8/10	1.0/10	Draft Tube	
10	✓	Horizontal	1.00	0.75	1.1529	Ellipse	Ellipse	HF-N	4.0	0.3	0.9	34%	00:00:10		5.8/10		Horizontal	
11	✓	Cylindrical	2.00	2.00	6.2832	Flat	Flat	RDT	0.63	1.36	10.0	14%	00:00:46		4.9/10		Droplet Size	

C:\KaeMix\Examples\kaemix

Dimensionless Numbers

KaeMix

FILE EDIT PROCESS DESIGN PERFORMANCE TOOLS SETTINGS WINDOW HELP

Open Save File Info Units Quick Agitator Design Copy Drawing Scale-Up Reposition Load Motor Speed Standard Speed Resize Refresh

Design Vessel Process Liquids Drive Impellers Baffles Heat Gas Flow Sparger Solids Particles Drawing Results Report Loads Blending Suspension Gas Dispersion HT Rate Power **Dimensionless** Guides

Impellers (1-4) (5-8) Set 1 Set 2 Set 3 Set 4

Connected To Main Drive Main Drive

Style Disk Turbine General

Type Bakker

Diameter (m) 0.8131

Pump Direction Radial

Number of Blades 6

Blade Width (m) 0.1626

Blade Angle (degrees)

Number

First Bottom C

Last Bottom C

Diameter / Tank

Clearance / Tank

Blade Width

Blade Pitch / Dia

Dimensionless numbers are shown for each impeller set

Reynolds $Re = \rho N D^2 / \mu$

Froude $Fr = N^2 D / g$

Power Number $Po = P / (\rho N^3 D^5)$

Pumping Number $N_q = Q_{\text{impeller}} / (N D^3)$

Gas Flow Number $Fl = Q_{\text{gas}} / (N D^3)$

Dimensionless	Set 1	Set 2	Set 3	Set 4	Set 5	Set 6	Set 7	Set 8
Type	BDT	HF-W						
Nr Blades	6	4						
Reynolds Re	1.38E+04	1.74E+04						
Froude Fr	0.14	0.158						
Power Po	2.33	0.771						
Pumping Nq	0.68	0.75						
Gas Flow Fl	0.248	0.202						
P _g /P _u	0.935	0.863						
Po _g	2.18	0.665						
Nq _g	0.665	0.714						
D/T	0.4	0.45						
W/D								
Pitch/D								
C ₁ /T	0.2	0.73						
C ₂ /T	0.2	1.26						
Nr Impellers	1	2						
Cavern D/T								

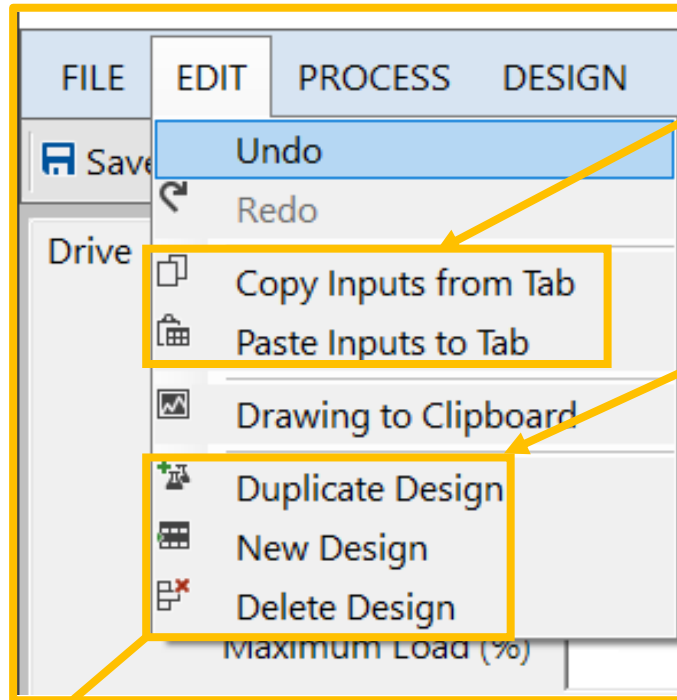
Design 8/11 Duplicate New Delete Move: Top Up Down Bottom Sort: rev/s 1.3 Tag: Gas Dispersion Comment: Turbine + 2 Up Pumping Impellers

ID	Φ	Vessel	T (m)	Z (m)	V _L (m³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _p	M-Scale	M-Phase	Tag	Comment
5	✓	Cylindrical	2.03	2.84	8.7836	Ellipse	Ellipse	HF-N	1.2	0.34	7.9	4%	00:00:58		4.2/10		HTR Coils	
6	✓	Rectangular	5.17	3.50	71.4	Angled	Flat	HF-W	2.0	10.4	16.0	65%	00:01:08		4.3/10		Side Entering	
7		Cylindrical	1.78	2.27	5.3617	ASME	ASME	PUMPS	2.0	5.44	24.6	22%	00:00:26		2.4/10		Pumper	
8	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	1.3	4.29	33.5	13%	00:00:24		7.9/10	3.0/10	Gas Dispersion	Turbine + 2 Up Pumping Impeller
9	✓	Cylindrical	2.54	4.49	21.967	ASME	ASME	SWPS	1.5	10.15	57.7	18%	00:00:29	0.59	9.8/10	1.0/10	Draft Tube	
10	✓	Horizontal	1.00	0.75	1.1529	Ellipse	Ellipse	HF-N	4.0	0.3	0.9	34%	00:00:10		5.8/10		Horizontal	
11	✓	Cylindrical	2.00	2.00	6.2832	Flat	Flat	RDT	0.63	1.36	10.0	14%	00:00:46		4.9/10		Droplet Size	

C:\KaeMix\Examples\kaemix

Managing Designs

Managing Designs – Design List



Use Copy and Paste to Tab if you want to copy inputs from one design to another. In the first design, click on Copy Inputs from Tab and the inputs from the active tab will be stored. Go to the second design, and click Paste Inputs to Tab and the inputs will be pasted in this design

To add another design, click New or Duplicate. New will add a default design. Duplicate creates a copy of the active design. You can also delete designs you no longer need

The ✓ and ✗ indicate if a design passed or failed basic design checks

You can edit the speed for the Main Drive here

You can add a Tag (e.g., a name, label, or keyword) and a Comment to each design

Design 8/11		Duplicate	New	Delete	Move: ↑ Top ↑ Up ↓ Down ↓ Bottom				Sort: ↕ ↕	rev/s: 1.3	Tag: Gas Dispersion	Comment: Turbine + 2 Up Pumping Impellers						
ID	(i)	Vessel	T (m)	Z (m)	V _i (m ³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _p	M-Scale	M-Phase	Tag	Comment
4		Cylindrical	1.78	3.02	7.211	Ellipse	Ellipse	RDT	1.0	2.35	2.4	97%	00:00:20		5/10		Stages	
5	✓	Cylindrical	2.03	2.84	8.784	Ellipse	Ellipse	SWPV	1.2	3.97	7.9	50%	00:00:23		7/10		HTR Coils	
6		Rectangular	5.17	3.50	71.4	Angled	Flat	HF-W	2.0	6.4	3.0	213%	00:01:12		3/10		Side Entering	
7	✓	Cylindrical	1.78	2.27	5.362	ASME	ASME	PUMPS	1.4	7.65	24.6	31%	00:00:21		7/10		Pumper	
8	✓	Cylindrical	2.03	3.80	11.88	Ellipse	Ellipse	BDT	1.3	3.76	33.5	9%	00:00:25		8/10	3/10	Gas Dispersion	Turbine + 2 Up P
9	✓	Cylindrical	2.54	4.49	21.97	ASME	ASME	SWPV	1.5	6.35	57.7	11%	00:00:31	0.44	7/10	1/10	Draft Tube	
10	✓	Horizontal	1.00	0.75	1.153	Ellipse	Ellipse	HF-N	4.0	0.3	0.9	34%	00:00:10		7/10		Horizontal	

Managing Designs - Sorting

You can reorder the design list by moving designs up, down, to the top, or the bottom

To sort the whole list, click on the Sort A→Z or Z→A buttons in the list commands. This will bring up the list of variables that you can use to sort

Move: ⬆ Top ⬆ Up ⬇ Down ⬇ Bottom

Sort: A↕ Z↕

Tag
M-Scale
Blend Time
Motor Load
Motor Size
Power Draw
Rotation Speed
Volume
Liquid Level
Vessel Diameter
M-Phase
N/N_{js}
Mass Transfer k_{1a}

Design 8/11		Duplicate	New	Delete	Move: ⬆ Top ⬆ Up ⬇ Down ⬇ Bottom				Sort: A↕ Z↕		Tag: Gas Dispersion	Comment: Turbine + 2 Up Pumping Impellers							
ID	(i)	Vessel	T (m)	Z (m)	V ₁ (m ³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _{js}	M-Scale	M-Phase	Tag	Comment	
1	✓	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	5.0	0.38	10.0	4%	00:00:23		6/10			Fully Suspended	
2		Cylindrical	1.52	2.31	4.019	Ellipse	Ellipse	COW	0.1	16.06	2.7	605%	02:07:26		2/10		Helical		
3	✓	Cylindrical	2.03	3.45	10.76	Ellipse	Ellipse	HF-N	1.67	1.97	3.6	55%	00:00:22	0.96	10/10	3/10	Suspension		
4		Cylindrical	1.78	3.02	7.211	Ellipse	Ellipse	RDT	1.0	2.35	2.4	97%	00:00:20		5/10		Stages		
5	✓	Cylindrical	2.03	2.84	8.784	Ellipse	Ellipse	SWPV	1.2	3.97	7.9	50%	00:00:23		7/10		HTR Coils		
6		Rectangular	5.17	3.50	71.4	Angled	Flat	HF-W	2.0	6.4	3.0	213%	00:01:12		3/10		Side Entering		
7	✓	Cylindrical	1.78	2.27	5.362	ASME	ASME	PUMPS	1.4	7.65	24.6	31%	00:00:21		7/10		Pumper		
8	✗	Cylindrical	2.03	3.00	9.289	Ellipse	Ellipse	BDT	1.3	3.76	33.5	11%			0/10	0/10	Gas Dispersion	Turbine + 2 Up Pumping Impellers	
9	✓	Cylindrical	2.54	4.49	21.97	ASME	ASME	SWPV	1.5	6.11	57.7	11%	00:00:31	0.41	7/10	1/10	Draft Tube		

Managing Designs - Undo and Redo

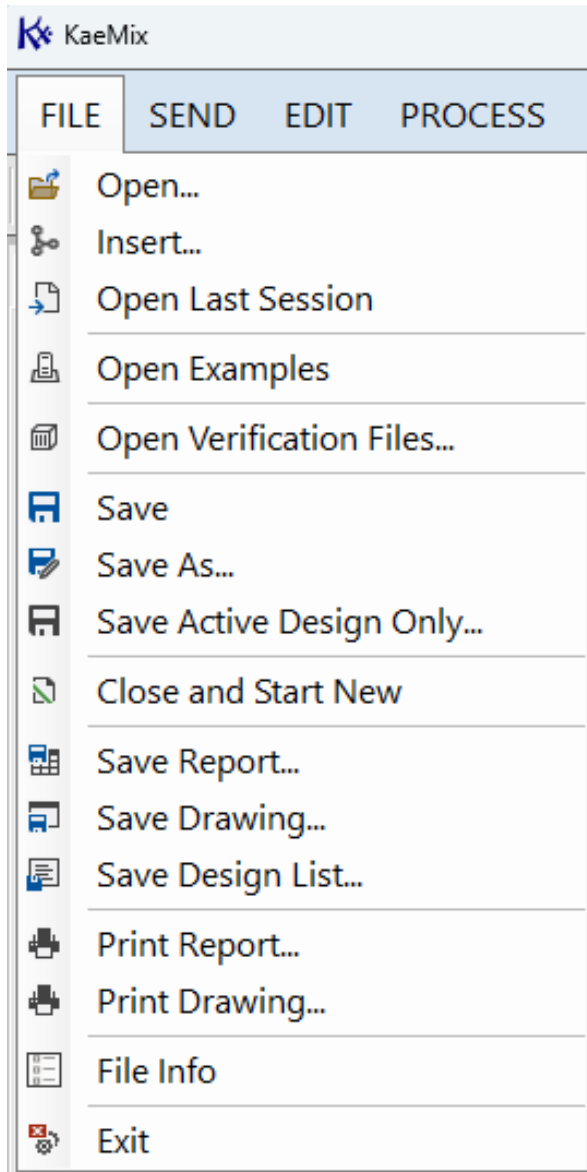
Undo and Redo can be accessed from the ribbon and the Edit menu. There is one Undo level

If you are going to make a lot of changes, it's a good idea to first Duplicate Design so that you still have a copy from before the changes

ID	(i)	Vessel	T (m)	Z (m)	V ₁ (m³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _s	M-Scale	M-Phase	Tag	Comment
1	✓	Cylindrical	1.00	1.00	0.733	Ellipse	Ellipse	HF-N	5.0	0.38	10.0	4%	00:00:23		6/10			
2		Cylindrical	1.52	2.31	4.019	Ellipse	Ellipse	COW	0.1	16.06	2.7	605%	02:07:26		2/10		Helical	
3	✓	Cylindrical	2.03	3.45	10.76	Ellipse	Ellipse	HF-N	1.67	1.97	3.6	55%	00:00:22	0.96	10/10	3/10	Suspension	Fully Suspended
4		Cylindrical	1.78	3.02	7.211	Ellipse	Ellipse	RDT	1.0	2.35	2.4	97%	00:00:20		5/10		Stages	
5	✓	Cylindrical	2.03	2.84	8.784	Ellipse	Ellipse	SWPV	1.2	3.97	7.9	50%	00:00:23		7/10		HTR Coils	
6		Rectangular	5.17	3.50	71.4	Angled	Flat	HF-W	2.0	6.4	3.0	213%	00:01:12		3/10		Side Entering	
7	✓	Cylindrical	1.78	2.27	5.362	ASME	ASME	PUMPS	1.4	7.65	24.6	31%	00:00:21		7/10		Pumper	
8	✗	Cylindrical	2.03	3.00	9.289	Ellipse	Ellipse	BDT	1.3	3.76	33.5	11%			0/10	0/10	Gas Dispersion	Turbine + 2 Up Pumping Impellers
9	✓	Cylindrical	2.54	4.49	21.97	ASME	ASME	SWPV	1.5	6.11	57.7	11%	00:00:31	0.41	7/10	1/10	Draft Tube	

Menus

File Menu



Only one file can be open at a time. So, if you *Open* a file, it will close the current file and then open the new file

If you *Insert* a file, the current file will stay open, and all the designs from the file you select will be copied into the current file

Open Last Session opens the file that was automatically saved when you exited KaeMix previously

Open Examples opens a file with several helpful examples

Save and *Save As* save all the designs in the file

Save Active Design Only saves a new file with only the active design (the design selected in the Design List). Then if you open another existing file and insert the file you just saved you have in effect copied that design into your existing file

Close and Start New closes the open file and starts a new file

Save Report saves the HTML report for the active design. *Tip: the HTML report can also be read into Excel, Word, Calc, and Writer*

Help Menu

The screenshot displays the KaeMix software interface. The 'HELP' menu is open, showing options: 'About KaeMix', 'License Key', 'License Agreement', 'KaeMix Overview', 'KaeMix Installation Guide', 'KaeMix User Guide', and 'KaeMix Verification Guide'. A yellow box labeled 'Documentation' points to the 'KaeMix Overview' through 'KaeMix Verification Guide' items. Another yellow box labeled 'About KaeMix' points to the 'About KaeMix' window, which contains the following text:

KaeMix™ 2025
Author: Andre Bakker
E-mail: support@kaemixllc.com
© 2023-2025 KaeMix LLC
KaeMix™ is a trademark of KaeMix LLC

The main interface shows a 3D visualization of a mixing process. Below the visualization, there are checkboxes for 'Personal Phenomena' (Gas Dispersion, Heat Transfer) and 'Additional Components' (Draft Tube, Solids Suspension, Stage Dividers). At the bottom, there is a table with 11 columns: ID, Vessel, T (m), Z (m), V_i (m³), Bottom, Top, Impeller, rev/s, P (kW), Motor (kW), and Lo. The table contains 8 rows of data.

A 'Clickwrap License Agreement' window is open, displaying the following text:

Clickwrap License Agreement

DISCLAIMER OF WARRANTY

THIS SOFTWARE IS PROVIDED "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL LICENSOR AND IT'S CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE. IN NO EVENT WILL LICENSOR'S AND IT'S CONTRIBUTORS' AGGREGATE LIABILITY TO LICENSEE EXCEED THE GREATER OF \$1,000 OR THE TOTAL OF LICENSE FEES PAID BY LICENSEE TO LICENSOR DURING THE PRECEDING TWELVE MONTHS.

LICENSE

Licensor is not conveying to Licensee any title, ownership, copyright or any other intellectual property rights in or related to this Software.

RESTRICTIONS ON USE

This Software is not allowed to be resold.

This Software is not allowed to be decompiled, disassembled, reverse engineered or otherwise modified.

At the bottom of the license agreement window, there are two buttons: 'Not accepting License Agreement. Exit' and 'Accepting License Agreement. Continue'.

License Agreement: Important!

Window Menu

The screenshot displays the KaeMix software interface. The 'WINDOW' menu is open, showing options: 'Refresh' (with a circular arrow icon) and 'Standard Layout' (with a grid icon). A yellow box highlights the 'WINDOW' menu and its options. Another yellow box highlights the 'Refresh' button in the top toolbar. A third yellow box highlights the 'Standard Layout' button in the bottom toolbar. A callout box points to the 'Refresh' button in the toolbar, stating: 'Refresh recalculates everything and redraws the screen'. Another callout box points to the 'Standard Layout' button in the bottom toolbar, stating: 'Standard Layout restores the KaeMix window layout to its default'. The main window shows a design of a vessel with two up-pumping impellers. The bottom of the interface features a table with design parameters.

ID	①	Vessel	T (m)	Z (m)	V _i (m ³)	Bottom	Top	Impeller	rev/s	P (kW)	Motor (kW)	Load (%)	Blend Time	N/N _s	M-Scale	M-Phase	Tag	Comment
2	✓	Cylindrical	1.52	2.31	4.0193	Ellipse	Ellipse	COW	0.1	16.89	30.0	56%	00:23:03		2.3/10		Helical	
3	✓	Cylindrical	2.03	3.45	10.759	Ellipse	Ellipse	HF-N	2.0	3.5	5.0	70%	00:00:18	1.21	9.7/10	4.0/10	Suspension	Fully Suspended
4		Cylindrical	1.78	3.02	7.2114	Ellipse	Ellipse	RDT	1.0	2.35	3.0	78%	00:00:20		4.1/10		Stages	
5	✓	Cylindrical	2.03	2.84	8.7836	Ellipse	Ellipse	HF-N	1.2	0.34	7.9	4%	00:00:58		4.2/10		HTR Coils	
6	✓	Rectangular	5.17	3.50	71.4	Angled	Flat	HF-W	2.0	10.4	16.0	65%	00:01:08		4.3/10		Side Entering	
7	✓	Cylindrical	1.78	2.27	5.3617	ASME	ASME	PUMPS	2.0	5.44	24.6	22%	00:00:26		2.4/10		Pumper	
8	✓	Cylindrical	2.03	3.80	11.884	Ellipse	Ellipse	BDT	1.3	4.29	33.5	13%	00:00:24		7.9/10	3.0/10	Gas Dispersion	Turbine + 2 Up Pumping Impeller

Send



Send to Office Applications

The KaeMix application window is shown with the 'SEND' menu open. The menu options are:

- Report to Excel
- Report to Word
- Report to Calc
- Report to Writer
- Report to Browser
- Drawing to Paint.Net
- Design List to Excel
- Design List to Calc

The background shows a report in Excel with the following sections:

Vessel Design

Parameter	Value	Unit
Vessel Style	Cylindrical	
Straight Side	3	(m)
Diameter	2.032	(m)
Bottom Style	Elliptical	
Bottom Depth	0.4064	(m)
Bottom Volume	0.8786	(m ³)
Top Head Style	Elliptical	
Top Head Depth	0.4064	(m)
Top Head Volume	0.8786	(m ³)
Vessel Material	Stainless Steel	
Wall Thickness		(m)
Bottom Thickness		(m)
Wetted Parts Material	Stainless Steel	
Sealing	Mechanical Seal - Double	

Operating Conditions

Parameter	Value	Unit
Operating Temperature	20	(°C)
Operating Pressure	100000	(N/m ²)
Operating Level	3	(m)
Gassed Operating Level	3.328	(m)
Operating Volume	9.289	(m ³)
Operating Pressure	0.987	Atm
Average Pressure	1.147	Atm
Bottom Pressure	1.306	Atm
Flow Rate		(m ³ /s)
Residence Time		(h:m:s)

Liquids

Parameter	Value	Unit
Primary Liquid	Fermentation Broth	
Density	1100	(kg/m ³)
Viscosity Model	Newtonian	
Viscosity	2	(mPa.s)
Safety	No Safety Concerns	

Drives

Parameter	Value	Unit
Primary Liquid	Fermentation Broth	
Density	1100	(kg/m ³)
Viscosity Model	Newtonian	
Viscosity	2	(mPa.s)
Safety	No Safety Concerns	

KaeMix Report in Excel

KaeMix checks if these applications are installed, and if so, enables Send To functionality:

- Microsoft Office ("C:\Program Files\Microsoft Office")
- LibreOffice ("C:\Program Files\LibreOffice\program")
- Paint.Net ("C:\Program Files\paint.net"). If Paint.Net is not found it will enable Microsoft Paint instead

The KaeMix application window is shown with a report in Word. The report content is as follows:

File Info

KaeMix™
August 13, 2022 - Build 0023
8/13/2022 7:50:36 PM

Project Name
Location
Customer
Designer
Vessel Manufacturer
Mixer Manufacturer
Project Description
Design
Tag
Comment

Gas Dispersion
Turbine + 2 Up Pumping Impellers

Application

Industry Fermentations
Application Pharmaceuticals
Process Aerobic fermentations, e.g. penicillin, steroids, vitamins, etc. Scale-up from previous experience strongly influences design. Fluids are often non-Newtonian because of suspended cells. Gas dispersion. Design variable: gas flow rate. Typical scale of agitation: 9 to 10.
A concave-blade, gas-dispersing disk turbine with up-pumping high solidity hydrofoils is recommended.

Mixer Design
Liquid Flow Batch System
Gas Dispersion
Solid Suspension
Heat Transfer

Vessel Design

Parameter	Value	Unit
Vessel Style	Cylindrical	(m)
Straight Side	3	(m)
Diameter	2.032	(m)
Bottom Style	Elliptical	(m)
Bottom Depth	0.4064	(m)
Bottom Volume	0.8786	(m ³)

Operating Conditions

Parameter	Value	Unit
Operating Temperature	20	(°C)
Operating Pressure	100000	(N/m ²)
Operating Level	3	(m)
Gassed Operating Level	3.328	(m)
Operating Volume	9.289	(m ³)
Operating Pressure	0.987	Atm
Average Pressure	1.147	Atm
Bottom Pressure	1.306	Atm
Flow Rate		(m ³ /s)
Residence Time		(h:m:s)

Liquids

Parameter	Value	Unit
Primary Liquid	Fermentation Broth	
Density	1100	(kg/m ³)
Viscosity Model	Newtonian	
Viscosity	2	(mPa.s)
Safety	No Safety Concerns	

Drives

Parameter	Value	Unit
Set 1 Style	Top Entering	
Drive Name	Motor	
Maximum Load	33.46	(kW)
Speed	80	(%)
Speed	78	(RPM)
Speed	1.3	(rev/s)
Rotation	Clockwise	
Mounting Height	0	(m)
Steady Bearing	✓	

KaeMix Report in Word

Send Drawing to Paint or Paint.Net

SEND FILE EDIT PROCESS DESIGN

- Report to Excel
- Report to Word
- Report to Calc
- Report to Writer
- Report to Browser
- Drawing to Paint.Net**
- Design List to Excel
- Design List to Calc
- Comparison Table to Excel
- Comparison Table to Calc
- CSV File to Excel
- CSV File to Calc

PERFORMANCE TOOLS SETTINGS WINDOW HELP

Units Quick Agitator Design Copy Drawing Scale-Up Reposition Load Motor Speed Standard Speed Resize Refresh

Gas Flow Sparger Solids Particles Draft Tube Stages File Info Drawing Results Report Loads Blending Suspension Gas Dispersion HT Rate

Liquid Blending. M-Scale: 7.9/10. Turbulent. Blendtime: 00:00:25 h:m:s.
Gas Dispersion. M-Phase: 3.0/10. Dispersing. ka: 0.073 1/s

KaeMixDrawing.png - paint.net 4.3.11

File Edit View Image Layers Adjustments Effects

Brush width: 2 Hardness: 75% Fill: Solid Color

To... x

Colors

Primary More >>

Left click to draw with primary color, right click to draw with secondary color

KaeMix drawing in Paint.Net

To edit or print the drawing send it to Paint.Net (or Paint)

You can also click the Copy Drawing button or Edit → Drawing to Clipboard. This will copy the drawing to the Windows clipboard. You can then paste it into other programs (e.g., PowerPoint)

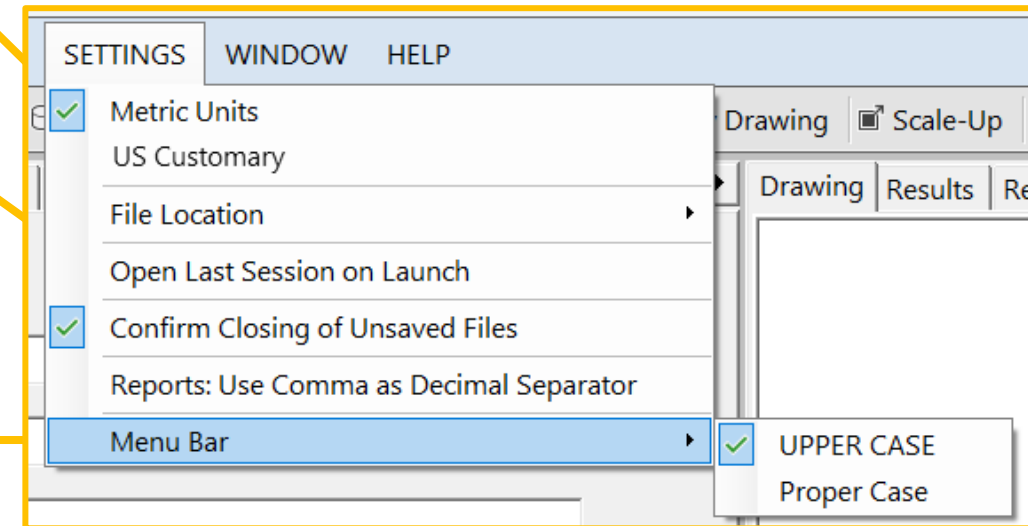
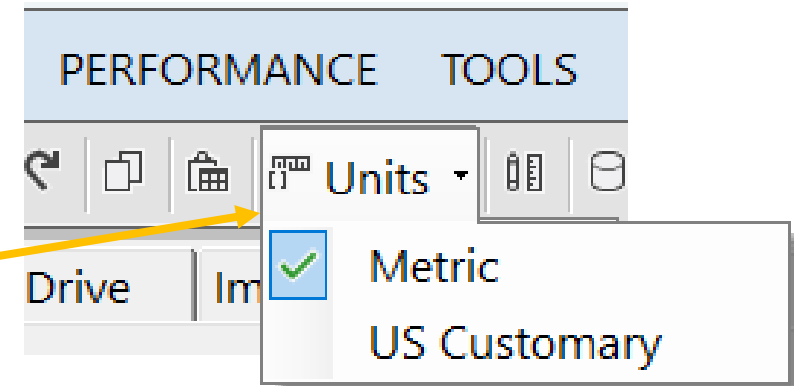
ID	①	Vessel	T (m)	Z (m)
2	✓	Cylindrical	1.52	2.31
3	✓	Cylindrical	2.03	3.45
4	✓	Cylindrical	1.78	3.02
5	✓	Cylindrical	2.03	2.84
6	✓	Rectangular	5.17	3.50
7	✓	Cylindrical	1.78	2.27
8	✓	Cylindrical	2.03	3.80

1-Phase	Tag	Comment
4.0/10	Helical	Fully Suspended
	Suspension	
	Stages	
	HTR Coils	
	Side Entering	
	Pumper	
	Gas Dispersion	Turbine + 2 Up Pumping Impellers

Settings

Settings

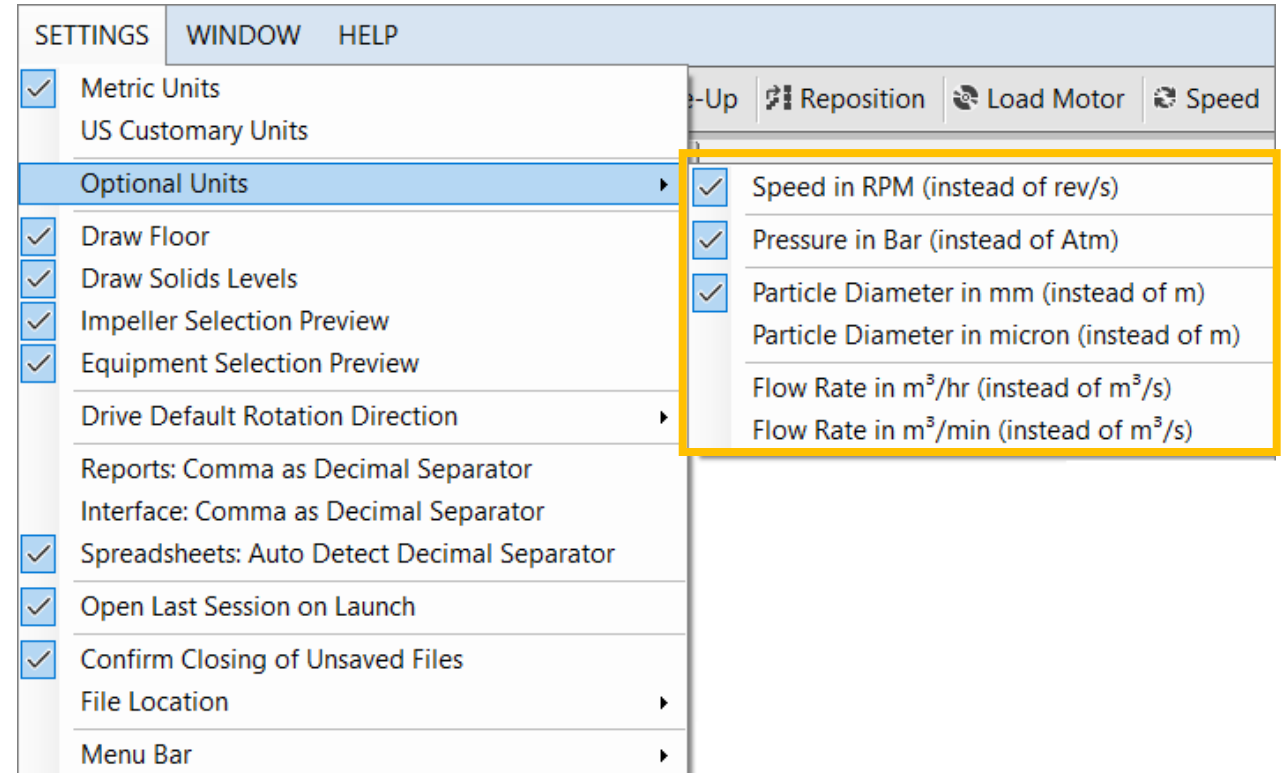
- You can easily switch between Metric and USA units using the Units button in the ribbon or the Settings menu
- If you want your last session automatically restored when you launch KaeMix then select the *Open Last Session on Launch* setting
 - Note, you can also do this manually from *File* → *Open Last Session*
- The text in the menu bar is by default in upper case font. If you prefer proper case, you can select this in the Settings menu



Settings – Optional Units

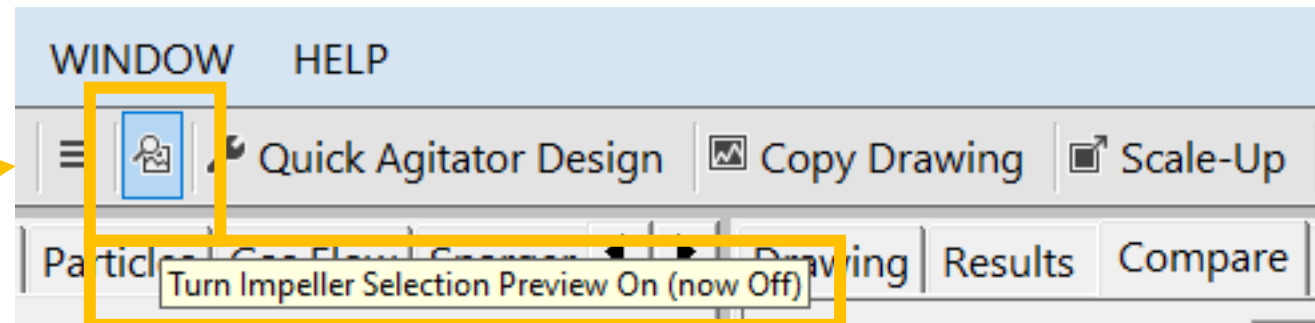
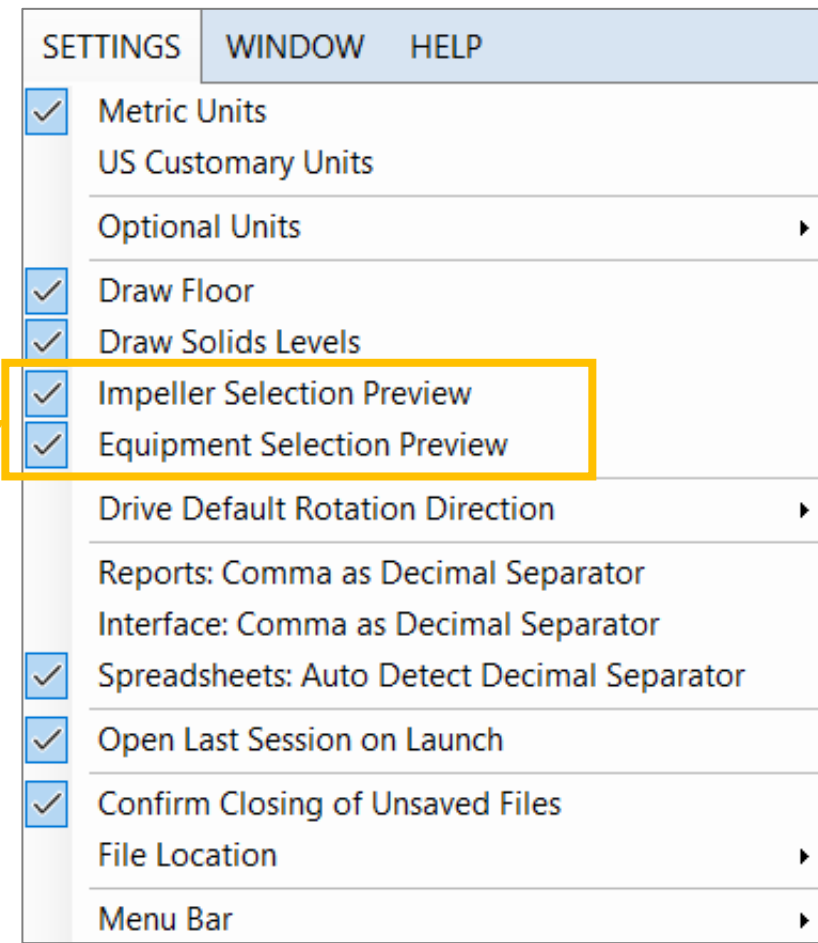
- Settings → Optional Units

- Speed in RPM (instead of rev/s)
- Pressure in Bar (instead of Atm)
- Particle diameter in mm
- Particle diameter in micron
- Flow rate in m³/hr (instead of m³/s)
- Flow rate in m³/min (instead of m³/s)



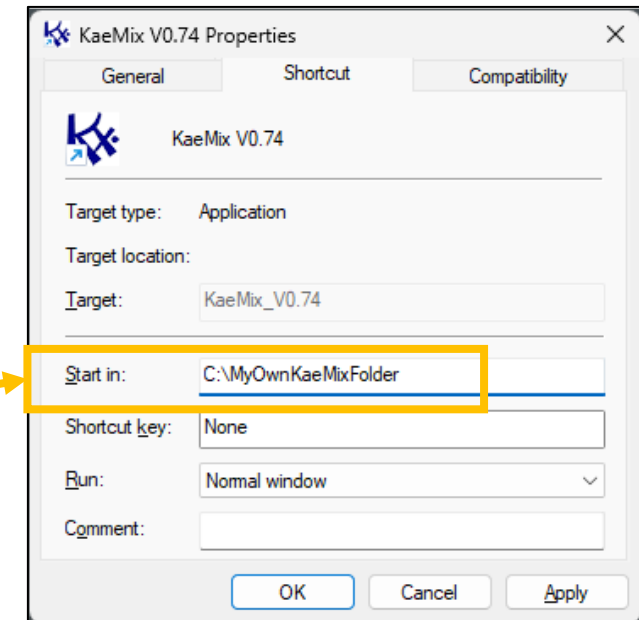
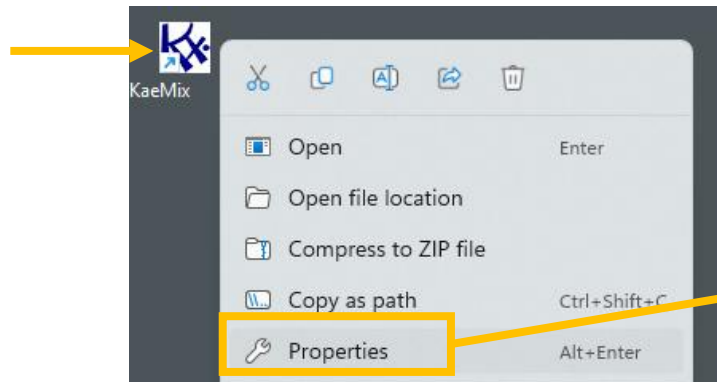
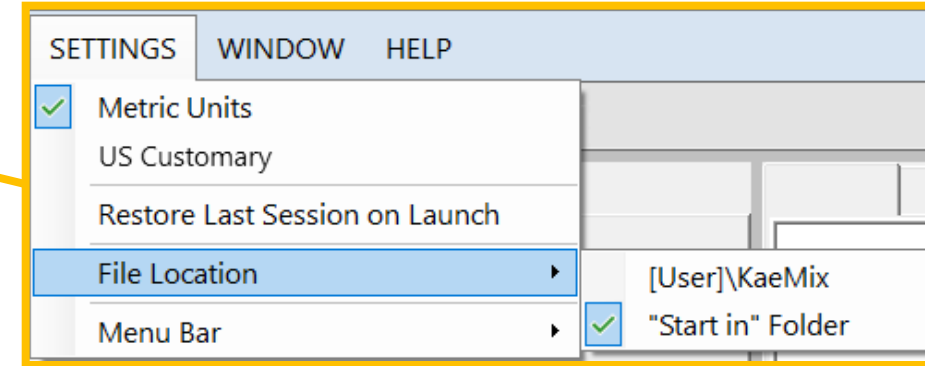
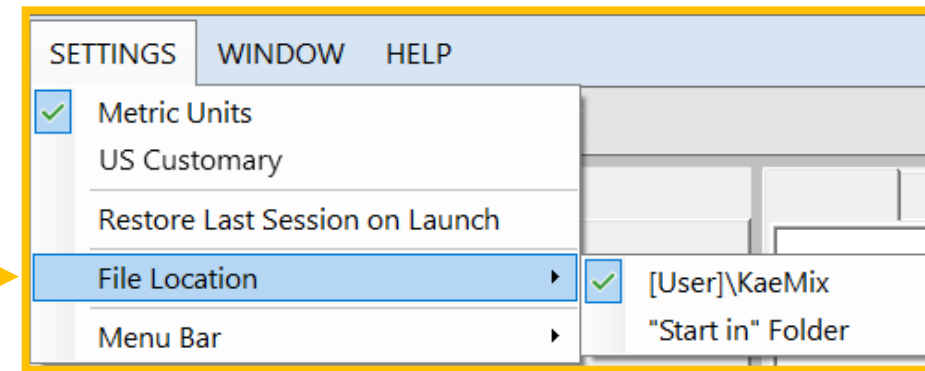
Settings - Previews

- Equipment and impeller selections can be made graphically using Previews or using standard text dropdowns
- This feature is enabled from the Settings menu. There is one setting for Equipment (bottoms, heads, baffles, spargers) and one for impellers
- Previews can also be enabled or disabled from the corresponding icon in the ribbon



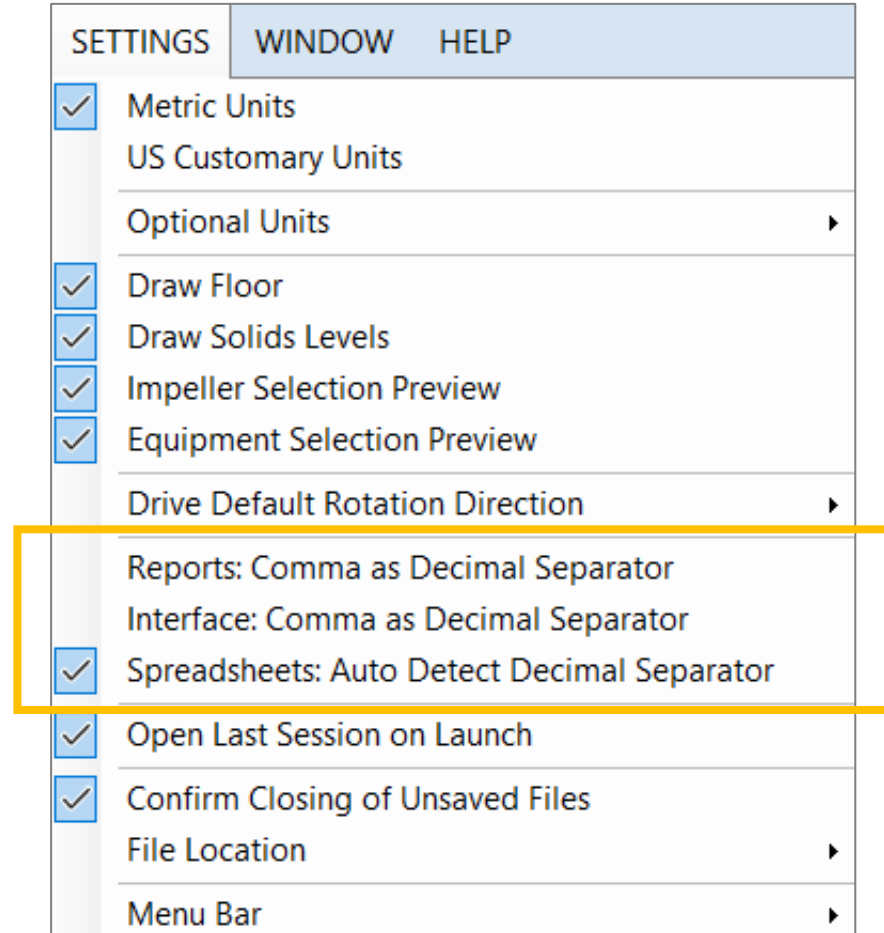
Settings – File Location

- You can control where KaeMix files are saved by default
- Default is [User]\KaeMix folder and usually looks like this: “C:\Users\yourname\KaeMix”
- To change the default, select “*Start in*” Folder instead
- Specify the “*Start in*” Folder as follows
 - Right click on the KaeMix icon on the desktop and then click on Properties
 - Then specify the “Start In” folder and click Apply. Next time you launch KaeMix it will default to the “Start In” folder that you specified here



Settings: Decimal Separator

- By default, KaeMix uses the decimal point as the decimal separator, e.g. “3.14”
- This can be changed to the decimal comma, e.g. “3,14” from the Settings menu



END