

THALETEC

Innovative Mixing Technology for glass-lined reactors



Process Engineering by THALETEC

Glass-lined reactors enable a wide range of chemical processes under the most aggressive conditions. In addition to single processes (crystallisation, suspension, dispersion, gassing etc.), the focus is often on the versatility («multipurpose») of the reactor. This requires a compromise when determining the suitable mixing technology. Other requirements demand the mixing of residuals, high heat transfer, high wear resistance against Hydroabrasion or the prevention of electrostatic charges. THALETEC offers a wide range of specially developed turbines, baffles, additional components and glass-linings to meet all requirements. To enable a numerical or analytical design of the required mixing technology, we recommend that you complete and send us the process questionnaire (F001 [📄](#)). You will find these and other support options from THALETEC during your project planning phase for glass-lined apparatus in the product flyer (K164 [📄](#)).

Simply contact us via e-mail at process@thaletec.com

Glass-lined Turbines from THALETEC

The characteristics of a turbine are essentially defined by its power input, its pumping or circulating power and its shearing effect. The power input in turbulent operation conditions depends on the dimensionless Newton Number or Power Number (characteristic parameter of mixing technology, i.e. type and number of turbines and type and number of baffles), the product density, the rotational speed and the turbine diameter. The other characteristics are determined by the Pumping Number, which is also dimensionless, and the energy dissipation. THALETEC offers the right turbine for every requirement, which in combination with a THALETEC baffle represents the ideal mixing technology for your mixing task. The turbines can be designed as single-stage or multi-stage systems. In general, the turbines are divided into radial flow turbines, axial flow turbines, radial/axial flow turbines and special turbines. Axial flow turbines and radial/axial flow turbine are mostly used as the upper stage(s) of a multi-stage system.



① CFD simulation of a BE6300 with a 3-stage TAR/TAF agitator system. Visualisation of the flow velocity and injection of a second substance (yellow).

Radial Flow Turbines

CXU (Curved X-shaped Universal)
CXR (Curved X-shaped Residual) K024 



Power input medium
Pumping power high
Shear stress medium
Viscosity range low to medium

Processes: Homogenisation,
 Gases, Suspension,
 Dispersion,
Multipurpose,
 Heat transfer,
Residual (CXR)

FBT (Flat-Blade-Turbine)



Power input high
Pumping power high
Shear stress medium to high
Viscosity range low to medium

Processes: Homogenisation,
 Gases, Dispersion,
 Heat transfer

RCI (Retreat Curved Impeller)
One-piece impeller or splitted Impeller



Power input low to medium
Pumping power medium
Shear stress medium
Viscosity range low to medium

Processes: Homogenisation,
 Gases, Dispersion,
 Heat transfer

Axial Flow Turbines

RCleco (Retreat Curved Impeller eco)



Power input low
Pumping power low
Shear stress low
Viscosity range low to medium

Processes: Homogenisation,
 Suspension,
 Dispersion, Gases,
 Residual, Heat transfer

UFT (UltraFlow Turbine)
UFX (UltraFlow X-shaped) K173 



Power input low
Pumping power medium
Shear stress medium
Viscosity range low to medium

Processes: Homogenisation,
 Suspension,
 Crystallisation,
 Heat transfer

TAR (Turbo-Axial-Residual) K024 



Power input low
Pumping power medium
Shear stress medium
Viscosity range low to medium

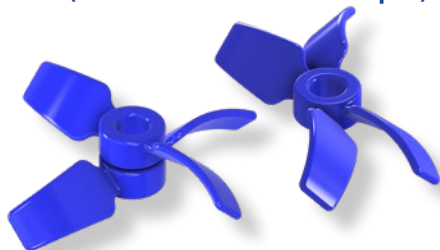
Processes: Homogenisation,
 Suspension,
 Crystallisation,
 Heat transfer, Residual

Radial/Axial Flow Turbines

DCT (Diffusor-Concentrator-Turbine)

K030 

DCX (Diffusor-Concentrator-X-shaped)

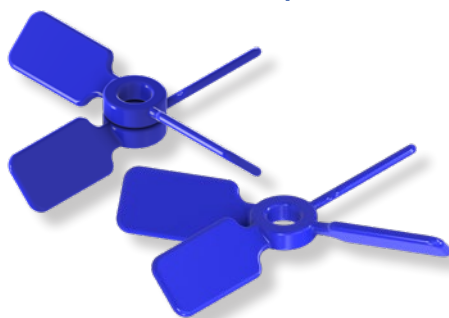


Power input	medium
Pumping power	medium
Shear stress	medium
Viscosity range	low to medium

Processes: Homogenisation, Gases, Suspension, Dispersion, Multipurpose, Heat transfer

PBT (Pitched-Blade-Turbine)

PBX (Pitched-Blade X-shaped)

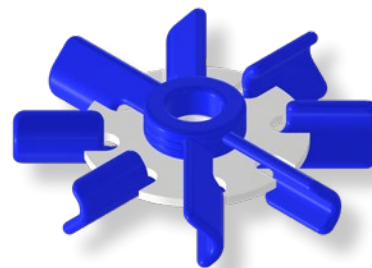


Power input	medium
Pumping power	high
Shear stress	medium
Viscosity range	low to medium

Processes: Homogenisation, Suspension, Crystallisation, Multipurpose, Dispersion, Heat transfer

Special Turbines

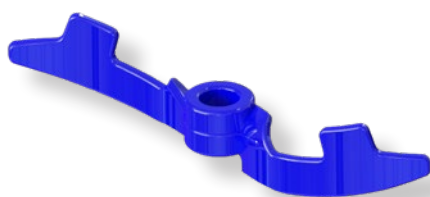
SGT (Smith-Gassing-Turbine) K084



Power input	very high
Pumping power	high
Shear stress	very high
Viscosity range	low to medium

Processes: Homogenisation, **Dispersion, Gases**, Heat transfer

SoliSus (Solid Suspension) K189



Power input	low
Pumping power	very high
Shear stress	low
Viscosity range	low to medium

Processes: Homogenisation, **Suspension**, Crystallisation, **Hydroabrasion**, Heat transfer

ANC (Anchor)

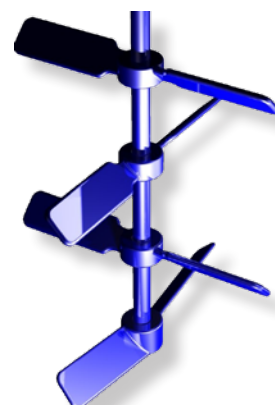


Power input	low
Pumping power	low
Shear stress	low
Viscosity range	medium to high

Processes: **High viscosity media**, Heat transfer, Crystallisation, Residual

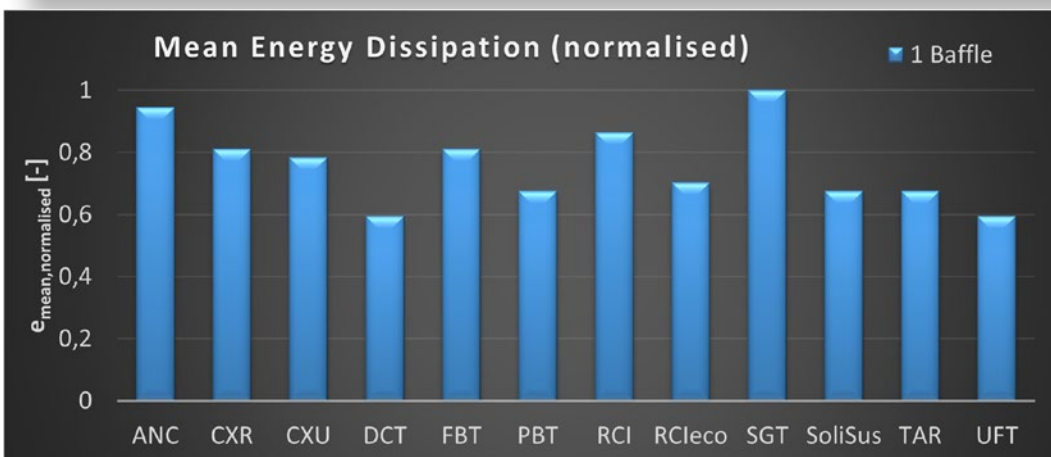
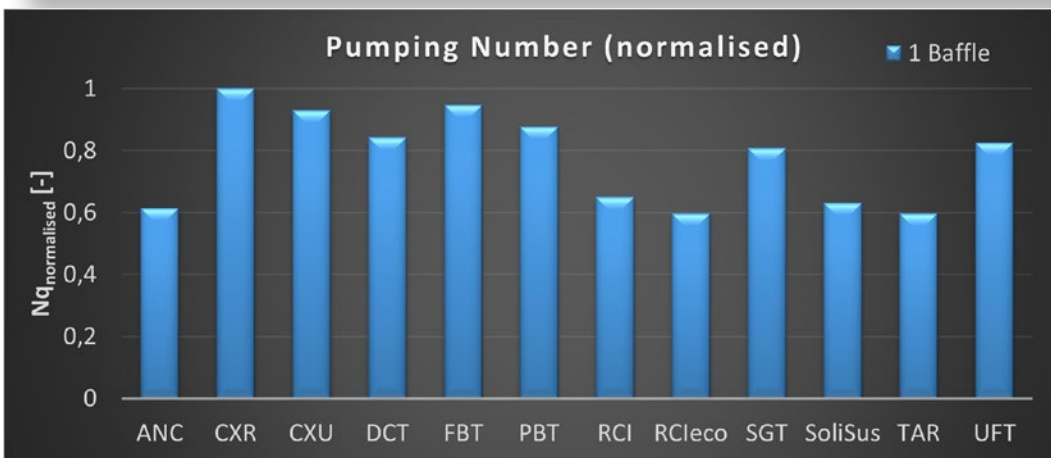
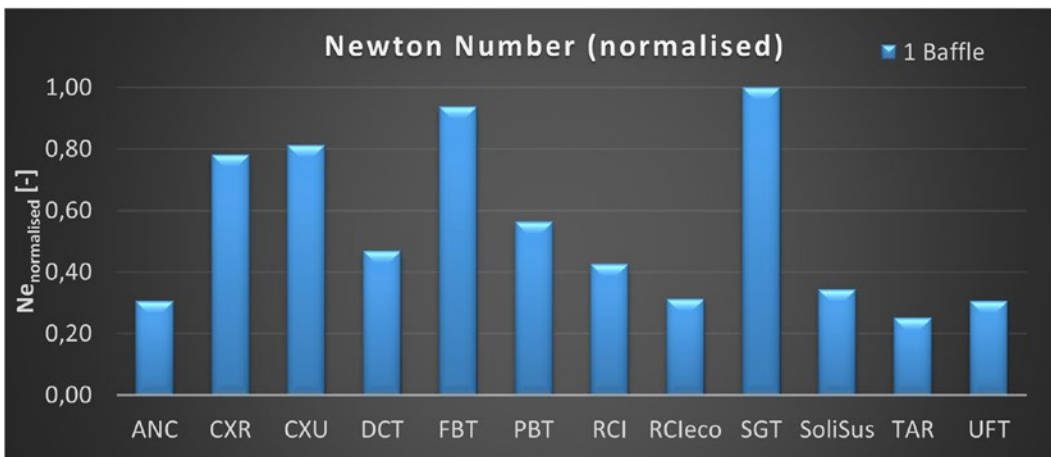
CAT (Cross Arm Turbine) K072

CFT (Counter Flow Turbine)

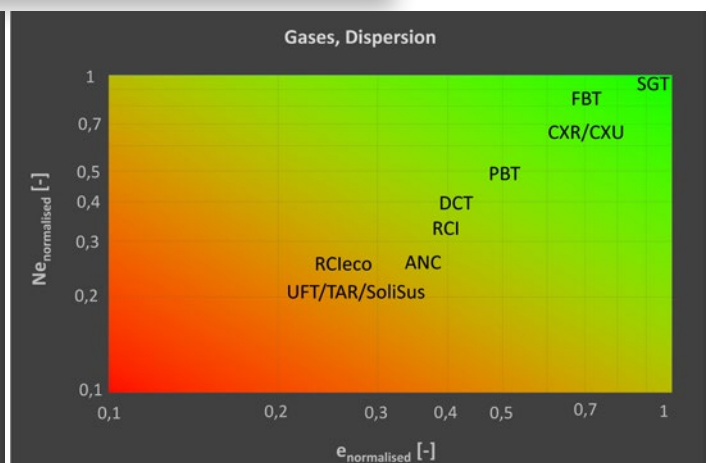
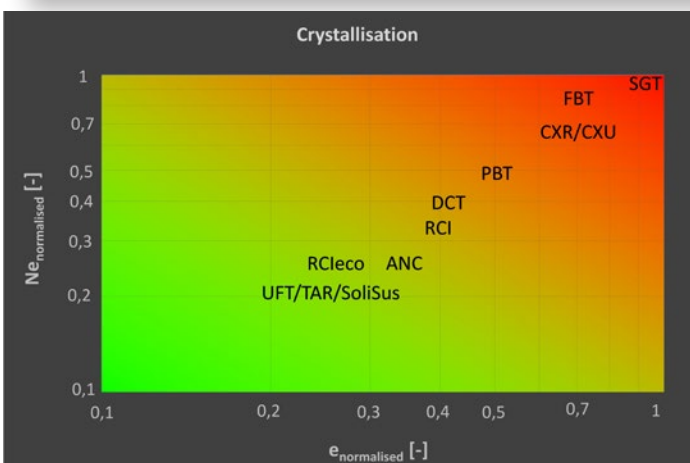


Power input	medium to high
Pumping power	high
Shear stress	medium (CFT high)
Viscosity range	low to medium (high)

Processes: Homogenisation, Suspension, Dispersion, Heat transfer



The process diagrams help you to categorise the THALETEC turbines according to your individual process. The process diagrams classify the turbines in a normalised comparison with regard to their power input and energy dissipation. The green areas represent suitable and the red areas rather unsuitable turbines for the processes. However, the process diagrams only serve as a general orientation. Especially for multipurpose applications, the mixing technology must be designed with compromises between the different processes. Moreover, the influence of the rotational speed and especially the turbine diameter must be taken into account.



Shaft/Hub connection (MultiFlex and CryoTec)

Nowadays, split agitator systems are the standard in the glass-lined industry, i.e. the turbine shaft and the turbine itself represent two separate components. The two components are connected via a shrunk connection by cooling the hollow shaft internally with liquid nitrogen and shrinking on the turbine. This simple procedure takes place inside the reactor and is one of the main reasons why the reactor type BE is so popular. The turbines are easy to replace. The BE reactor also has a significantly smaller sealing surfaces compared to the AE and CE reactors, which increases safety.

Both the MultiFlex (tapered design) and the CryoTec (cylindrical design) connection are suitable for assembling split agitator systems.

The turbine can be changed quickly via the manhole and it is not necessary to dismantle the shaft. Both connection systems allow multi-stage agitator systems.

Additional advantages are offered by the innovative THALETEC connection MultiFlex (K073 [↗](#)). With the help of a special tool, the turbine is placed on the shaft and is pretensioned in a defined manner. Due to the tool, no technician needs to be inside the reactor during shaft cooling with liquid nitrogen, so safety is increased during assembly. The turbine hub and shaft are tapered to prevent a jam during assembly and during disassembly with product residues.



⤴ MultiFlex with tapered shaft (left) and CryoTec with cylindrical shaft (centre). Special tool for easy and safe assembly of a MultiFlex connection (right).

Glass-lined Baffles from THALETEC

Baffles are essential components of mixing technology for achieving a high power input and short mixing times. Without baffles, the fluid would only perform a tangential movement with an extremely low mixing effect. Due to the high functional integration of THALETEC baffles, they offer a multitude of functions in one assembly (S013 [↗](#)). In addition to acting as baffle, an additional inlet nozzle, a dip pipe or a fast-reacting temperature measuring

system (QuickTip K061 [↗](#) and K114 [↗](#)) can be implemented in the glass-lined assembly. Of course, all types of baffles can be combined with all THALETEC glass-linings, so that the problems of hydroabrasion or electrostatics can be countered. In addition, THALETEC offers the DeltaBaffle (K057 [↗](#)) which has a greater baffle effect due to its special shape and thus increases the power input of the installed turbine by up to 15 % in the reactor.



Standard Stromstörer
Standard Baffle



PremiumBaffle
PremiumBaffle



DeltaBaffle
DeltaBaffle



QuickTip
Temperatursensor
Temperature Sensor



TS Temperatursensor
TS Temperature Sensor



QuickTip Tandem
Temperatursensor
Temperature Sensor



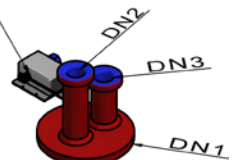
MultiTube



PremiumTube

Abmessungen *Dimensions*

flexsens 100




NL

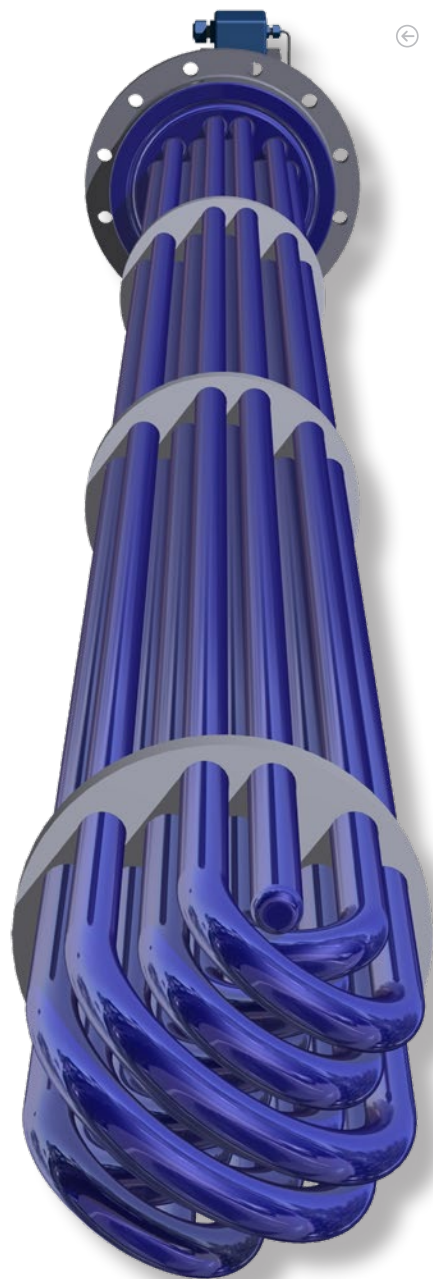
TS: 75 mm
QuickTip: 25 mm



Temperatursensor
Temperature Sensor

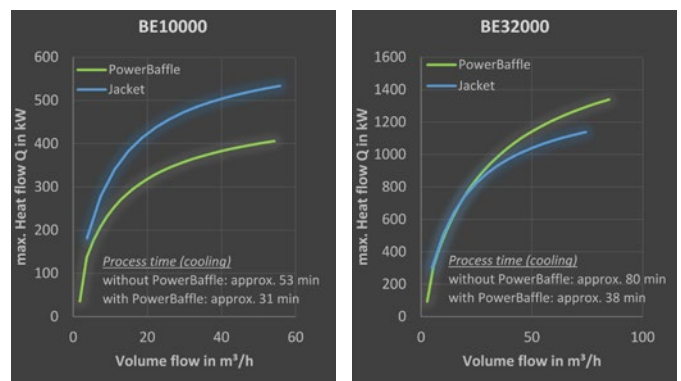
The PowerBaffle - More Performance and Safety as well as shorter Process Times

A worldwide unique baffle system is the PowerBaffle, which acts both as a baffle and as a heat exchanger (K014 ). The PowerBaffle is a glass-lined tube bundle heat exchanger that is available for reactor sizes BE/CE2500 to BE/CE40000 and for nozzle diameters DN200 to DN400. In addition, the PowerBaffle can be equipped with a temperature probe, which is positioned at the lowest point in the direction of flow. One or more PowerBaffles in the reactor significantly increase the heat exchange surface and thus increase the safety with regard to the available heat flow or significantly reduce the process times. In this context,




⊖ Glass-lined tube bundle heat exchanger PowerBaffle for significantly increasing the heat exchange surface in reactors

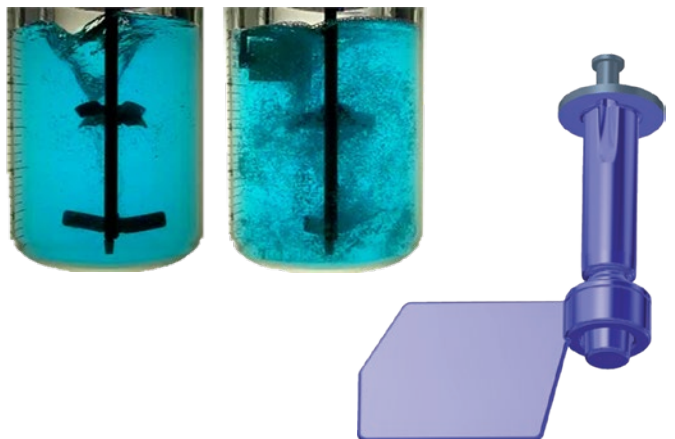
a PowerBaffle provides high-quality heat exchange surfaces. The k-value is 2.5 to 3 times higher compared to the glass-lined reactor wall (jacket/half-pipe coil) with the same chemical resistance. Compared to a jacket or a half-pipe coil, a PowerBaffle results in lower operating costs because it generates a smaller pressure drop. Consequently, less pumping power is required for the service medium. From a BE32000 reactor size upwards, one PowerBaffle even provides a greater heat flow than the jacket/half pipe coil at nominal volume.



⊕ Comparison of the heat flows in a BE10000 and a BE32000 each with a jacket and one PowerBaffle at nominal volume. For the total heat flow of the reactors, both heat flows must be added in each case. (Product H₂O with 80°C to 50°C at nominal volume; service medium H₂O with 20°C; CXR/DCT agitator system with 60 min⁻¹)

Further Baffle systems

A SegTec (K054 ) can be used to significantly improve the gas distribution (e.g. hydrogen, chlorine gas) inside the reactor. Due to its weir effect on the liquid surface, the gas intake from the upper gas section of the reactor is significantly improved and gases already present in the product medium circulate longer. The same applies to floating solids. Gases have to be introduced close to or ideally below the turbine. The introduction close to the turbine can be implemented with the help of specially shaped dip pipes. A charge

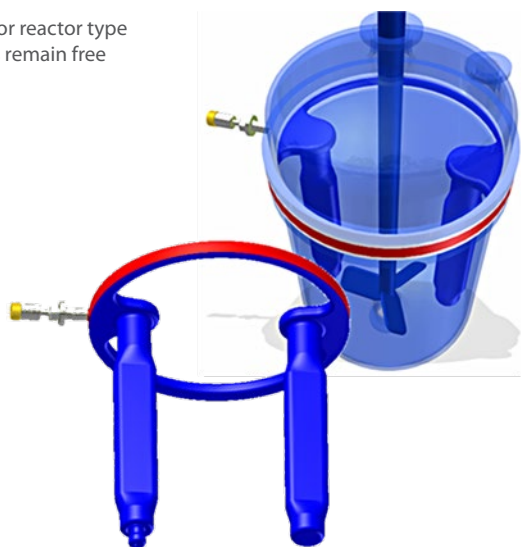


⊕ Patented SegTec for better gas distribution in the product

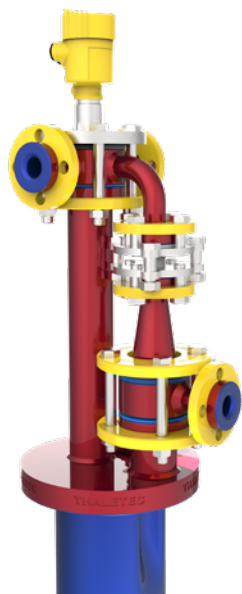
below the turbine is possible via the GassingValve (K083 [↗](#))(integrated in the bottom outlet valve) or a SpargerValve.

The typically small AE reactor types have only limited design options for the nozzle pattern at the top. A RingBaffle (K167 [↗](#)) keeps the nozzles free for the injection of different media and at the same time integrates the required baffle system. The RingBaffle can be equipped with standard baffles or with DeltaBaffles. In addition, a combination with the SegTec system and/or temperature sensor is possible.

⊕ RingBaffle for reactor type AE - nozzles remain free



The THALETEC HexaTube System (K154 [↗](#)) features an extremely high level of functional integration. A HexaTube combines the following 6 functions in one assembly:



- ⊖ 1) Baffle
- 2) Temperature probe
- 3) Dip pipe
- 4) Inlet nozzle
- 5) Filling level measurement
- 6) CIP-Connection

Only one nozzle is required and the entire system is cleanable with the help of the integrated CIP connection.

We protect your glass-lined reactor – the right technical glass-lining

Further issues regarding mixing technology results from the effects of the used product. Generally, glass-lined equipment is used under the most aggressive conditions (Iso-corrosion graphs K003 [↗](#)) and is easy to clean. Our product flyer EmSelect (K139 [↗](#)) will help you to easily select the right glass-lining. We would also be happy to advise you in a meeting or via e-mail (process@thaletec.com). Technical glass-linings have very good chemical resistance to acidic media and can be used in the alkaline range to a limited range. To extend the permissible pH range, ALKASIST (K129 [↗](#)) is the choice to achieve a higher chemical resistance under alkaline conditions.

When media with low electrical conductivity are stirred (e.g. toluene), electrostatic charges are generated locally as a result of the relative movements between the product and the reactor (turbines, baffles, vessel wall, etc.). Similar to a capacitor, an electrical voltage occurs between the product and the steel components. The glass-lining acts as a dielectric. High electrical voltages lead to typical punctual breakdowns through the glass-lining and inevitably to the destruction of the steel wall behind it by the aggressive media. This can be effectively countered with CONDUSIST (K098 [↗](#)), an electrically conductive glass-lining over the entire layer-thickness. In addition, CONDUSIST creates a conductive connection between the turbine and the shaft.

Some chemical processes require solids in the form of powders. If hard and/or larger particles strike against the glass-lined components during the mixing process, hydroabrasive wear is the result. To increase the wear resistance, THALETEC offers the glass-lining ABRISIST (K028 [↗](#)).

Services around the glass-lined mixing technology

- Product overview K035 [↗](#)
- Maintenance, repair and replacement of the mechanical seal K106 [↗](#)
- Reglassing K060 [↗](#)
- Fast shaft K116 [↗](#)
- LocaRep K112 [↗](#) and repair techniques K097 [↗](#)
- Process Engineering (Mixing Technology and Heat Transfer) K164 [↗](#)

Spare parts and accessories

- Impeller S006 [↗](#)
- Multiflex Turbines and Shafts S009 [↗](#)
- Glass-lined Baffles S013 [↗](#)
- Glass-lined Dip pipes S014 [↗](#)
- PTFE Feed pipes S015 [↗](#)
- CryoTec Turbines and Shafts S020 [↗](#)

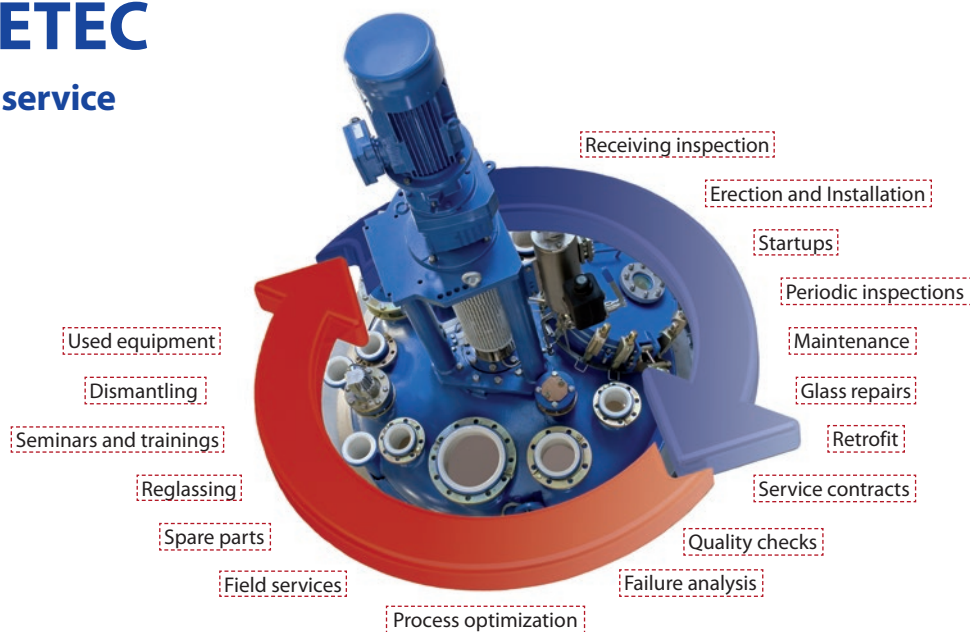
We would like to advise you regarding the advantages of glass-lined equipment like:

- Glass-lined reactors acc. to DIN 28136
- Glass-lined Pharma Reactors
- Components for pharmaceutical and high purity applications
- Mixing technology for pharmaceutical and chemical industry
- Reactors for Polymerization
- Storage Tanks and Receivers
- Columns
- Heat Exchangers
- Sensor technology
- Accessories

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