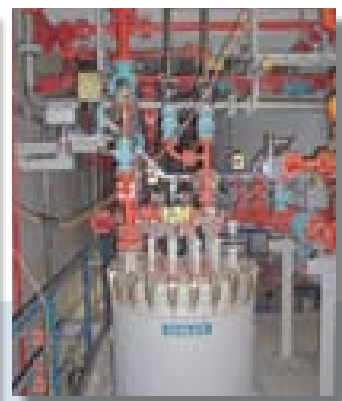


# estrella



**PROFESSIONAL SOLUTIONS IN GLASS LINING**

Committed to a 100% certified quality and ability to supply worldwide





Professional Solutions in Glass Lining

Estrella has been established in 1946 in Basel, as a steel work company and supplier of glass lined home products. In the mid sixties the company developed a glass lining technology for the production of chemical process equipment, glass lined pipes and fittings. In the first years Estrella's supplies were for the Swiss market only, but soon expanded serving the German chemistry. In 1976 Estrella went overseas and established an organization, covering the North American Markets. In early seventies the production capacity was extended to mid size vessels up to a capacity of 8000 liters. In 1989 Estrella invested in modern technology with a furnace, that allows to manufacture vessels up to a nominal capacity of 25 m<sup>3</sup>. In the late nineties Estrella invested a large amount of resources in the research of a piping system that could meet the demand of GMP conformity and developed a fitting with a reduced void in the gasketing area. The new flange system not only reduced the void but could also allow the use of gaskets other than PTFE envelope type ones, reducing by far the leakage rates. In 1999 the new flanging system has been patented and is so far the safest system present on the market. The system is not just safe but also easy to install and reduces the maintenance costs. The glass lined piping for pharmaceutical, food and fine chemical industry has become a reliable system.

#### Product range:

Glass lined pipes and fittings with Estrella's Safety Flange

Glass lined transportable receivers

Glass lined filters

Glass lined process vessels up to a nominal capacity of 25000 liters

Agitators baffles and temperature probes for glass lined reactors

Covers and accessories for glass lined process equipment, standard or custom designed

Glass lined mushroom type bottom outlet valves

Glass lined dip pipes

Glass lined columns

Glass lined reactors with nominal capacity 63 – 630 liters

#### Service range:

Reglassing of glass lined process vessels and accessories

Field service, glass inspection and repairs



## Glass

Glass lined vessels, accessories and pipings are frequently used in chemical and pharmaceutical plants for their chemical and physical properties. The excellent chemical resistance of glass against acid, basic and neutral organics allows a wide range of applications. The very smooth surface of glass (Ra 0.05) facilitates cleaning of systems. The hardness of the glass surface (600 Vickers) is a good protection in case of abrasive mediums. Compared to plastic linings, the allowable working limits of glasslining regarding pressure (-1/+25 bar) as well as temperature (-60/ +250°C) are remarkable higher. The absolute unpermeability of the glasslining gives also great advantages for multi-purpose plants compared to the permeable plastic linings. Glasslined steel is much more resistant against mechanical and thermal shocks than pure glass, due to his resistant steel wall. This high quality compound material is the result of years of experience and specific know-how regarding to glass receipt, application techniques, materials selection and construction details, as well as firing technology.

## The steel construction

Steel pieces, built for glasslining, have to be specifically designed and manufactured. Uniform thicknesses must be used to avoid un-homogenous heating up and cooling down during firing process of glasslining. Oversized wall thickness of vessels are made, not to withstand the final working conditions, but to pass several heat treatments at over 800°C without important deformations. Selection of raw materials, under consideration of limited chemical composition, is done for controlled hydrogen diffusion and best adherence of the lining on his steel support. Welding procedures and specifications have to be strictly considered. Items to be glass lined must have minimum radius and an absolutely smooth surface, all nozzles have to be extruded at temperature to avoid stress and disturb the good progress of lining. After a classical way of manufacturing, assembly and welding, all welds have to be grinded so that the surface to be lined is absolutely flat: imperfections in the steel surface must be grinded and smoothed out to avoid any kind of step. Condition for a perfect glass lining is an absolutely perfect steel fabrication, including welds without any defect. The final steel construction has to be normalized at 920°C. After this treatment the whole pieces have to be sandblasted once to clean the surfaces and also to give a certain roughness in order to improve the mechanical adherence of the glass.

Of course the steel construction is submitted to constant quality controls:

- Check of material certificates as well as control analysis.
- Survey of welding preparation, welding datas and operations.
- Nondestructive testing by LPT, US, or RX.

## Glass production

Estrella has his own glass receipt and produces his own glass frits.

The process of glass production is as follows:

After mixing of the raw materials, (Quartz, Soda, Borax, Feldspar, adhesive oxiders and fluidisers) these are melted in a furnace at 1500°C.

The frit is finally obtained by crushing in cold water.

By milling the frit in a ceramic ball mill, including additional set up salts and water, after a final filtration, we obtain a slurry ready to be used for pouring out or spraying.

Here also, constant quality checks are absolutely necessary:

- Control of raw materials by analysis and test melting.
- Check of fluidity and expansion for each batch.
- Production of test plates to check the mechanical and thermal limits.
- Checking viscosity, grain size and distribution of the slurry.

## Glass lining

Now the slurry and the steel pieces can go into the enameling area to be worked up. The glass lining consists in several application and firing operations during which the whole layer does always fuse completely. The first layers (1 to 2 times) are made of ground enamel. This enamel is specifically prepared to ensure the requested adherence on the steel, first on a mechanical basis due to the roughness of the steel support, second on a chemical basis due to the oxide film built up during firing. The composition of the ground enamel will determine the admissible temperature difference ( $\Delta T$ ) due to his buffer function between steel and cover coating. Since the ground enamel is chemically less resistant than the cover coats, it is very important to limit its thickness at 0.4 to 0.5 mm. The next layers (5 to 8 times) are made of cover enamel.

This is the real acid / alkali resistant enamel. The total thickness according usual standards should be 1.0 to 2.2 mm for vessels and 0.8 to 2.0 mm for pipings.

The technical delivery conditions are precisely given in DIN EN15159-1 ÷ 3 for vessels and accessories, in DIN 2876 for pipings. Appropriated technologies and extended know-how are necessary to match the high level of quality requested for these specific products.

Hereby some of the most important working and control steps:

Application of the slurry by spraying on (for easy reachable surfaces ) or pouring out (in worse reachable areas)

Complete drying of the applied layer.

Wiping off the surplus, and finalizing the edges before firing.

Loading the pieces on heat resistant firing supports.

Firing the applied layer at approx. 900°C for ground coats and approx. 800°C for cover enamel, using specific firing parameters adjusted to the type and size of the pieces.

Cooling down to ambient temperature (at quiet air or in closed cabins)

Intermediate controls after each firing:

Visual checks (for inclusions, cracks, firing aspect, surface image)

as well as thickness measurements at different areas of the pieces.

Corrections of unacceptable defaults on the surface after each firing:

Scale, fire clay and other inclusions have to be removed.

Steps in the thickness of the lining have to be smoothed out before the next application.

Checking the deformations after each layer allows a correction from one firing to the next and improves a good final result.

From a thickness of 1.0mm (0.8 for pipings) a Sparktesting will be done at 20Kv DC.

This process will be repeated as much as necessary to obtain a product fulfilling the requests of the standards.

These controls are made on 100% of the produced pieces.

Produced carefully and with adequate competences glass lined articles are safe and high quality products and the end users can match all needs regarding: chemical, mechanical, abrasion, temperature and pressure requirements.







## Estrella's 2000® Glass

Estrella's 2000® Enamel is the result of research and experience, collected serving the European and Overseas chemical industry. It has been specially formulated to get the same quality in glassing pipings and process equipment. The glass is consistently homogeneous and it has a very thin bubble structure.

### Chemical resistance

HCL 20% condensating	(DIN ISO 2743)	mm/year	0,04
NaOH 0,4% 80°C	(DIN ISO 2745)	mm/year	0,22
H2O vapor	(DIN ISO 2744)	mm/year	0,01
Thermoshock resistance		150°C*	

### Colors

Blue



Light blue



White



For more information please download from our website the bulletins:  
 Chapter 01 : Corrosion table.  
 Chapter 10 : Heat transfer.

\*see download

## Glass lined pipes and fittings with Estrella's Safety Flange

### Features

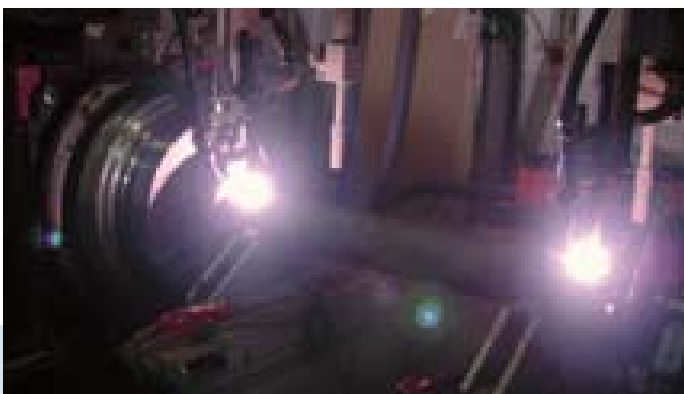
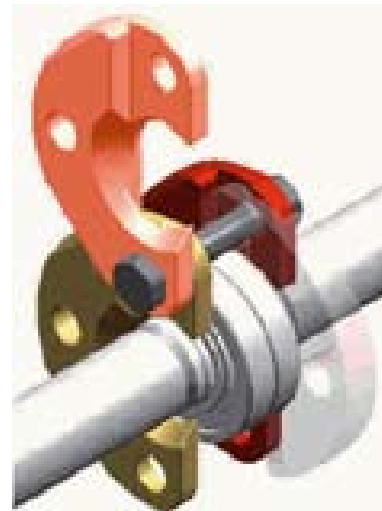
Our fittings up to ND 200 can be equipped with the Estrella Safty Flange, that ensures an optimal distribution of the tightening forces. It has only main assembly bolts and does not have secondary assembly screws, ensuring a higher mechanical stability. The flange is fitted on the pipes with a click in a second.

The safety flange system allows the use of every type of gasket and not PTFE envelope type only. Loss of tightening after thermal cycles is lower.

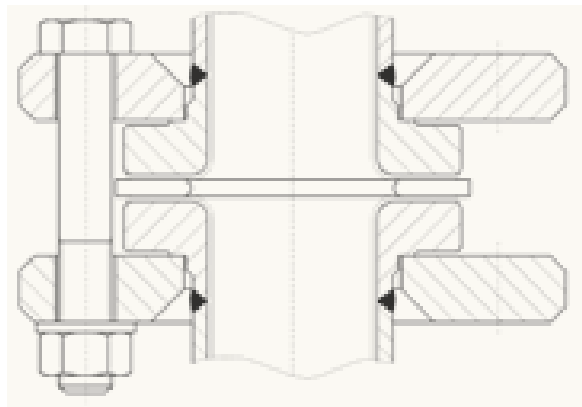
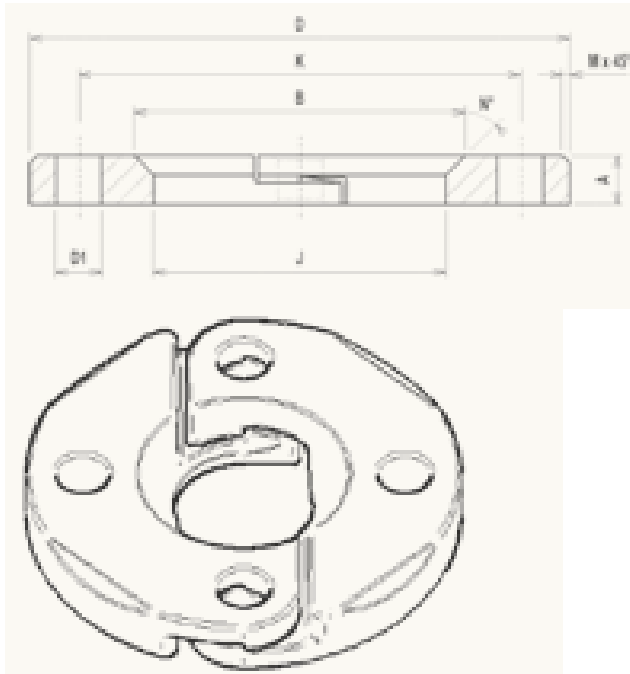
The inner glass lined radius has been minimized to reduce the void. The safety flange is designed for dual use: as safety flange and as standard DIN flange, you need just to reverse it. Glass lined with Estrella 2000®.

### Benefits

- Compatible with all type of gaskets
- Fast, safe and precise installation
- Stable long lasting connection
- Void poor connection
- Best GMP conformity
- 100% less leakage in comparison to common split flanges
- Best price/value ratio
- TA Luft conformity
- 100% compatible with DIN std. pipes



### Glass lined pipes and fittings with Estrella's Safety Flange



DN	15	20	25	32	40	50	65	80	100	125	150	200
A+/- 0,25	14	14	16	16	20	17	21	20	20	24	26	35
B	37.5	42	50	62	74	80	94.6	110	135	168	195	251
J	26	31	37	50	54	65.5	82.5	94	119	144	174	226
D	95	105	115	140	150	165	185	200	220	250	285	340
K	65	75	85	100	110	125	145	160	180	210	240	295
M	6	6	2.5	6	10	14	10	8	3	5	3	2
N°	30	45	45	45	45	45	30	45	45	45	45	45
D1	4 x Ø 14	4 x Ø 14	4 x Ø 14	4 x Ø 18	4 x Ø 18	4 x Ø 18	4 x Ø 18	8 x Ø 18	8 x Ø 18	8 x Ø 18	8 x Ø 23	8 x Ø 23
Gew. (Kg)	0.6	0,7	1.0	1.4	2.1	2.4	2.7	3.3	3.9	5.0	7.4	12.6

For engineering information please download from our website the following bulletins:

For the DIN standard.

Chapter 03 : pipes and fittings (DN 350 - DN 700).

Chapter 05 : pipes and fittings (DIN 2873 PN10).

Chapter 5a : jacketed pipes and fittings.

For the ANSI standard.

Pipes & fittings connections ANSI 150PSI.

Pipes & fittings connections ANSI 300PSI.



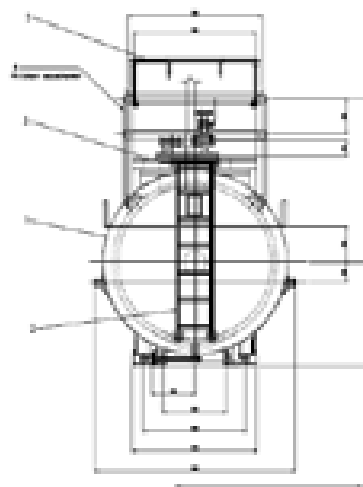
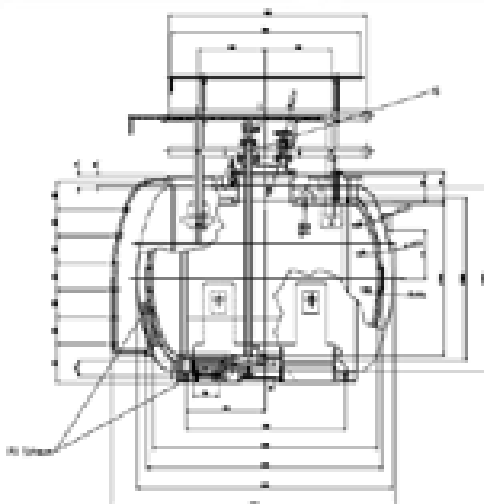
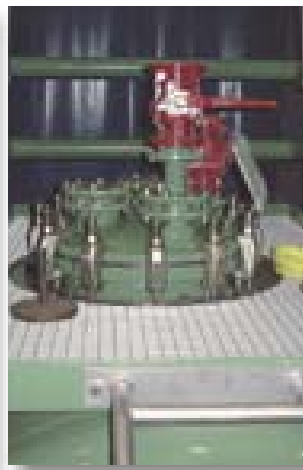
## Glass lined transportable receivers

### Features

The Estrella's transportable vessels are glass lined inside with Estrella 2000®. The external cladding is made of carbon steel and has an epoxy corrosion protection. The inner space is foam filled to protect the glass lined vessel. A jacket is provided to maintain the product temperature. The platform, the ladder, the valves and blind flanges are in the scope of supply. Upon request customer specified components can be used. The unit has the EU conformity certification for the transport of chemicals.

### Technical data

Capacity 3370 l  
 Design temperature: -10/+160°C  
 Design pressure: -1/+6 bar  
 Construction code AD-2000 / PED Module.  
 Certification according ADR/GGVS.  
 Empty weight 4600 Kg.  
 BAM approval no. D/BAM/171434/TC.  
 Dimensional tolerances DIN 28005-2.  
 Glass DIN ISO 2746, 11.02 spark tested, plug free.  
 External finish 2 components zink dust primer and RAL 6011 finish.



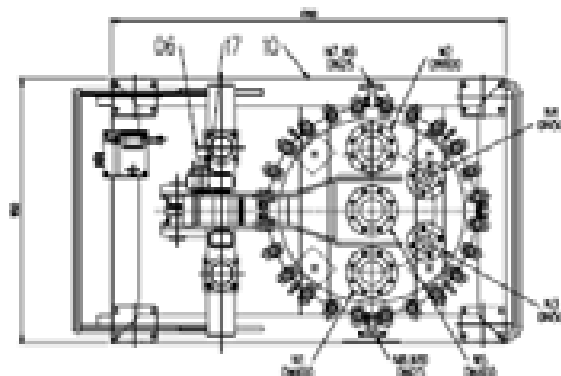
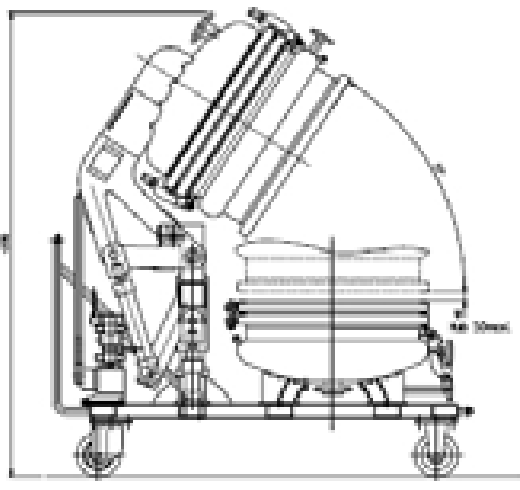
## Glass lined filters

### Features

Estrella's nutsche filters are glass lined with Estrella 2000®.  
The filter can be supplied with 2 or 3 sections.  
The opening assist is a hydraulic hand operated pump.

### Technical data

Design temperature: -10/+200°C.  
Design pressure: -1/+6 bar.  
Construction code AD-2000 / PED.  
Available also with ASME, Chinese and Korean stamp.



For engineering information please download from our website the bulletin:  
Chapter 8 - 010 : Filters.

## Glass lined process vessels up to a nominal capacity of 25000 liters

### Features

The Estrella's glass lined process. Vessels can be supplied as per DIN 28018/9 or custom made. The vessels are with or without jacket. Reaction vessels as per DIN 28136 1, 3 type AE up to 6300 l type CE and BE up to 20000 l. Estrella 2000® glass inside.

### Technical data

Design temperature: -10/+200°C.  
Design pressure: -1/+6 bar.  
Construction code AD-2000 / PED.  
Available also with ASME, Chinese and Korean stamp.  
Other dimension and design data available on request.



For engineering information please download from our website the bulletin:  
Chapter 02 : Vessels.

## Agitators, baffles and temperature probes for glass lined reactors

### Features

The Estrella's glass agitators and baffles can be supplied as per the DIN standard or custom made. Stirrers shaft terminal acc. DIN 28159. Baffle according to DIN 28146 and temperature guide pipe acc. DIN 28149. Retreat blades impeller acc. DIN 28157. Anchor agitator acc. DIN 28158. Multifunction baffle (dip pipe + baffle function).

### Technical data

Design temperature:  $-10/+200^{\circ}\text{C}$ .  
Design pressure:  $-1/+6$  bar.  
Construction code AD-2000 / PED.  
Available also with ASME, Chinese and Korean stamp.  
Other design data available upon request.



For engineering information please download from our website the bulletins:  
Chapter 4 - 001 ÷ 002: Mixers.  
Chapter 4 - 003 : Baffles.  
Chapter 4 - 006 : Thermo wells.

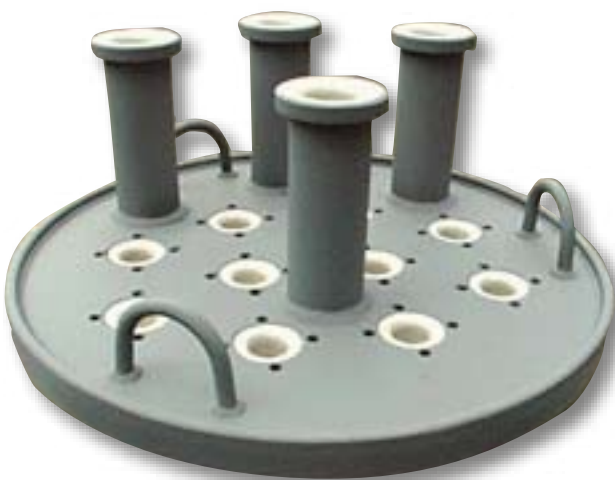
## Custom designed covers and accessories for glass lined process equipment

### Features

Glass lined with Estrella 2000®.  
Standard cover acc. DIN 28153 1 - 2.  
With sight glass acc. DIN 28121  
Special design with quick opening.  
Custom designs.

### Technical data

Design temperature:  $-10/+200^{\circ}\text{C}$ .  
Design pressure:  $-1/+6$  bar.  
Construction code AD-2000 / PED.  
Available also with ASME, Chinese  
and Korean stamp.  
Other design data available upon request.



## Sanitary design glass lined mushroom type bottom outlet valves

### Features

Sizes DN 50/80 80/100 150/100.  
Optional 2xPt 100 temperature probe.  
Manually operated.  
With pneumatic actuator.  
Sanitary design short shaft mushroom.  
Glass lined with Estrella 2000®.

### Technical data

Design temperature: -10/+200°C.  
Design pressure: -1/+6 bar.  
Construction code AD-2000 / PED.



For engineering information please download from our website the bulletin:  
Chapter 6 - 004 ÷ 005: Bottom outlet valves.



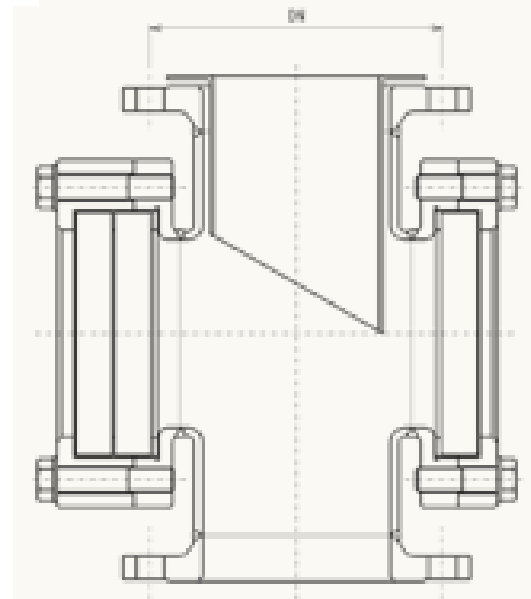
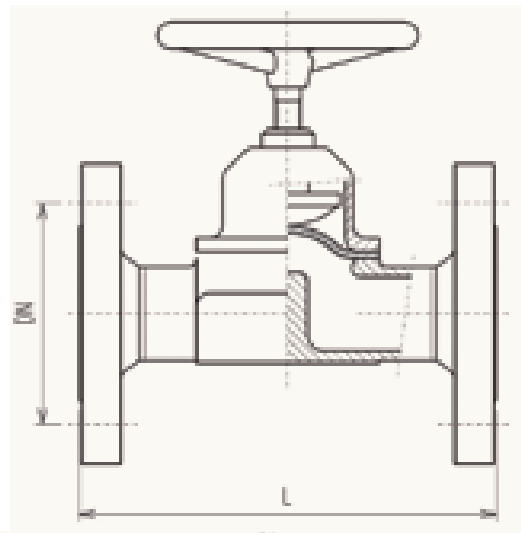
## Diaphragm valves and sight glasses

### Features

Range DN 25 – DN 200  
 100% made in Switzerland.  
 Manually operated.  
 With pneumatic actuator.  
 Glass lined with Estrella 2000®.

### Technical data

Working temperature range: - 20 / +200°C\*.  
 Working pressure up to 13 bar\*.  
 Construction code AD-2000 / PED.



For engineering information please download from our website the bulletin:  
 Chapter 6 - 001 ÷ 003: Diaphragm valves.  
 Chapter 6 - 014 : Sight flow indicator.  
 Chapter 6 - 016 : Sight glass armature.

\*depending on the size see download

## Glass lined dip pipes and collectors

### Features

Glass lined with Estrella 2000®.  
Standard flange size range DN 50 – DN 200.  
Length up to 3000 mm.  
Special design upon request.

### Technical data

Design temperature: -10/+200°C.  
Design pressure: -1/+6 bar.  
Construction code AD-2000 / PED.  
Available also with ASME, Chinese  
and Korean stamp.  
Other design data available upon request.



For engineering information please download from our website the bulletin:  
Chapter 4 - 005 : Dip pipes.

## Glass lined columns

### Features

Glass lined with Estrella 2000®.  
Range DN 80 – DN 2000.  
Construction tolerances acc. DIN 28007-2.  
½ DIN tolerance available on request.

### Technical data

Design temperature: -10/+200°C.  
Design pressure: -1/+6 bar.  
Construction code AD-2000 / PED.  
Available also with ASME, Chinese  
and Korean stamp.  
Other design data available upon request.



For engineering information please download from our website the bulletin:  
Chapter 3 - 110 ÷ 111: Columns.

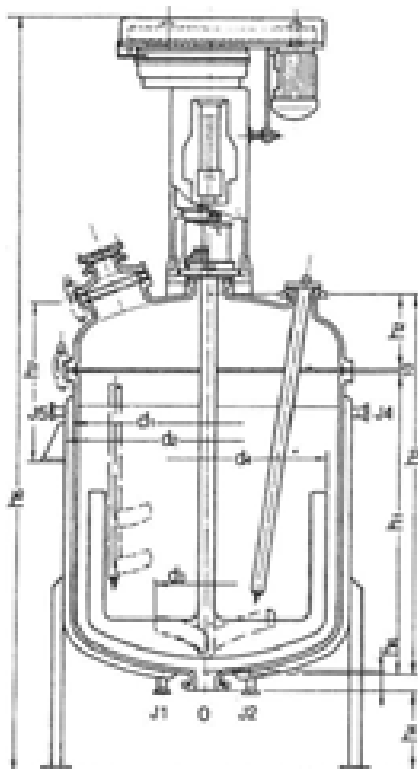
## Glass lined reactors with nominal capacity 63 – 630 liters

### Features

Dimensions acc. DIN 28136 1, 3 AE.  
 Pedestal acc. DIN 28162.  
 Drive flange acc. DIN 28137 2.  
 Mechanical seal acc. DIN 28138 2, 3.  
 Stirrers shaft terminal acc. DIN 28159.  
 Baffle according to DIN 28146 and  
 temperature guide pipe acc. DIN 28149.  
 Retreat blades impeller acc. DIN 28157.  
 Anchor agitator acc. DIN 28158.  
 Thermo well acc. DIN 28147.  
 Jacket nozzles acc. DIN 28151.  
 Supports types.  
 Brackets 28145 7.  
 Legs 28145 8.

### Technical data

Design temperature: -25/+200°C.  
 Design pressure: -1/+6 bar.  
 Construction code AD-2000 / PED.  
 Available also with ASME, Chinese  
 or Korean stamp.  
 Other design data available upon request.



<b>a</b> Nenninhalt	63	100	160	250	400	630
<b>h1</b> Ges. Inhalt	97	135	218	334	544	865
<b>h2</b> Mantelinhalt	32	46	70	93	130	151
<b>h3</b> Heiz- / Kühlfläche	0,60	0,90	1,30	1,70	2,50	3,30
<b>DNd1</b>	508	508	600	700	800	1000
<b>d2</b>	600	600	700	800	900	1100
<b>d4</b>	420	420	500	600	700	880
<b>h1</b>	400	600	700	800	1000	1000
<b>h2</b>	180	180	200	230	250	300
<b>h3</b>	590	790	910	1030	1260	1310
<b>h6</b>	80	80	80	80	90	90
<b>h5</b> $\approx$	2460	2660	2780	3110	3340	3340
<b>h4</b>	500	500	500	500	500	500
<b>h7 min</b>	500	500	550	600	650	700

For engineering information please download from our website the bulletin : AE reactors.

## Reglassing of glass lined process vessels and its accessories

### Descripton

We reglass with Estrella 2000®. We cover all construction codes. In case of larger damage, part of the shell or nozzles can be replaced. Estrella QA manages the approval procedures with the notified bodies. Estrella reglasses reaction vessels and any type of glass lined process equipment.

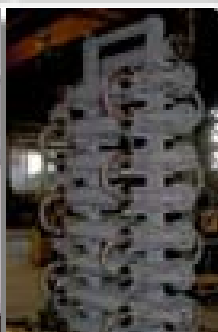
### Benefits

- 100% comparable with a brand new vessel.
- No engineering work needed due to replacement. with a vessel having different standard design
- Cost and budget saving.
- Short delivery time.



# estrella

Professional Solutions in Glass Lining



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