The Plastics Experts.

# AGRU liner pipes

## MADE OF PVDF, ECTFE, FEP, PFA

EN

# The Plastics Experts.

The AGRU success story already spans seven decades. Founded in 1948 by Alois Gruber Sen., the company is now counted among the most important comprehensive suppliers for piping systems, semi-finished products, protective liners for concrete and geomembranes made of engineering plastics. The fact that we provide everything as a single source supplier distinguishes us from many competitors. We process exclusively high-quality thermoplastic materials. And when it comes to problem-solving expertise for material selection and installation, we are your best partner.

AGRU semi-finished products made of thermoplastics are an excellent and durable solution for modern, premium apparatus and tank construction, and for manufacturing wear-resistant products. In the chemical and heavy industries, and in plant construction, a variety of requirements exist for semi-finished products in terms of acid and alkali resistance, application temperature and low static charge in areas with a risk of explosion.

Within the semi-finished product group, AGRU also offers liner pipes that are used for the inside lining of FRP pipes.
While the FRP pipe provides the necessary stiffness, the liner pipe provides the chemical resistance for the application. For the latter, all liner pipes are surface-modified to achive an excellent bonding strength to the FRP, which exceeds relevant industry standards.

## Quality

AGRU maintains a quality management system according to the ISO 9001:2015 standard, as well as an environmental management system according to the ISO 14001:2015 standard. Thus the products comply with international standards and are monitored and evaluated by independent testing agencies on a regular basis.

Bonding strength of AGRU liner pipes

- Requirement of DIN 16964 (PVDF) : ≥ 5 N/mm²
- Test method sement shear test according to DIN 53769

# AGRU liner pipes made of PVDF, ECTFE, FEP and PFA

## The liner pipe system

An FRP-reinforced liner pipe consists of the inner liner pipe, the outer FRP-reinforcement and the interface in between, where the bonded connection between the materials is established. FRP reinforced liner pipes have an equal constructive setup of the FRP-dualaminates used to build tanks, scrubbers, columns, reactors and other equipment, for example in the chemical and power industry.

The liner pipe serves for the protection against chemical attack and permeation, the outer FRP reinforcement is responsible for the mechanical strength and bears all loads. Typical wall thicknesses for liner pipes made of melt-extruded fluoroplastics are between 2.3 mm and 5 mm (depends on the material and the diameter). This is in contrast to the thermoplastic pressure pipes, which usually have greater wall thicknesses. Pressure pipes are used without reinforcement, suitable for pressures defined by the relevant pressure classification.

## Advantages of AGRU FRP liner pipe system

**Comprehensive product portfolio**
**and extensive stock-keeping of different materials and components**

Everything from one source

- PVDF HV-Liner pipes are available in diameter between OD 20 – 400 mm
- Different fittings (bends, tees, reducers) can be produced with the unique HV-Liner surface
- To minimize the installation costs, fabric backed ECTFE, FEP and PFA pipes are available in 5 m and 1 m lengths (tank inlets, nozzles and pipes)

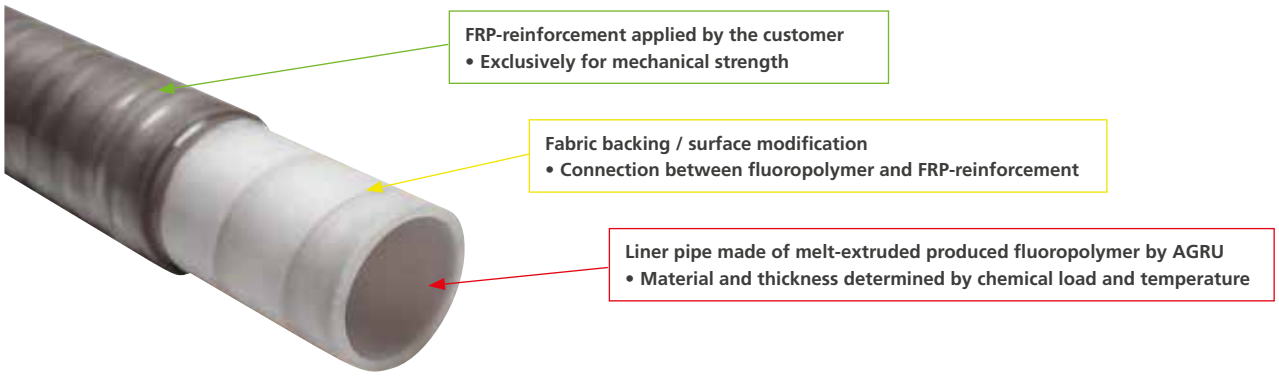
## Easy and cost-efficient installation

**Because of "thermoplastic material" behaviour welding and thermoforming can be done easily**

Time- and cost-saving installation

- Well known welding technologies
- Lightweight pipelines for easy handling
- Tailor-made, flangeless (welded) connections ensure minimized maintenance costs
- Less permeation-caused damages than with steel-based pipes

**STRUCTURE OF A LINER PIPE BY USING A LINER PIPE SYSTEM**



# HV-Liners and fabric backing systems

## PVDF HV-Liner

PVDF HV-Liner are an economical alternative to the traditional fabric backed pipe. The surface-treated PVDF pipe has a three-dimensional surface structure that provides an optimal bonding to the FRP pipe. The piping systems are available in PVDF, PVDF-FLEX and PVDF-el ESD. The pipes can be produced in diameters OD 20 – 400 mm, as well as injection-moulded HV-Liner parts from OD 20 mm – 250 mm.

Main application:
Mostly neutral and acidic media, up to approx. 120 °C, anti-static applications.

## SK+ laminated ECTFE pipes

SK+ laminated ECTFE pipes are characterised by outstanding resistance to chemicals and hydrolysis, even at high temperatures. Due to the high resistance of the SK+ laminate, it is the preferred system for applications with hydro-chloric acid (HCl) or hydrofluoric acid (HF) up to approx 120 °C.

## GGS glass knitted fabric backing

GGS glass knitted fabric backing is still the industrial standard for a remarkable wide selection of media also in the hottest and most aggressive environments. AGRU GGS is state of the art for fabric backed pipes made of high temperature fluoropolymers.

Main application:
Highly corrosive media, up to approx. 180 °C for PFA and FEP liner pipes.

# High-end materials product range

## PVDF HV-Liner system

AGRU PVDF is a highly crystalline non-reinforced plastic that combines good mechanical, thermal and electrical properties with excellent chemical resistance. In addition, it possesses good radiation resistance, which makes it ideal for high-end applications in the chemical, semiconductor, pharmaceutical and photovoltaic industries.

PVDF can be equipped with electrically conductive particles especially for the electrical industry and explosion proof areas. The conductive PVDF-el ESD (electrostatic discharge or electrically conductive) can be manufactured in sheets, rods, pipes and welding rods and has a lower surface resistance, which in turn prevents electrostatic charging. PVDF-el ESD and PVDF-Flex HV-Liner pipes can be produced on request.

New in the AGRU product portfolio are HV-Liner fittings. AGRU is now producing injection-moulded HV-Liner parts from OD 20 mm – 250 mm. Standard fittings are 90° bends, tees and reducers. Other parts are available on request.

| Liner pipe (5 m length) [mm] | Bend 90 ° [mm] | Tee [mm] | Reducer [mm] |
|---|---|---|---|
| 20 x 1.9 | 20 x 1.9 | 20 x 1.9 | |
| 25 x 1.9 | 25 x 1.9 | 25 x 1.9 | |
| 32 x 2.4 | 32 x 2.4 | 32 x 2.4 | |
| 40 x 2.4 | 40 x 2.4 | 40 x 2.4 | |
| 50 x 3.0 | 50 x 3.0 | 50 x 3.0 | |
| 63 x 3.0 | 63 x 3.0 | 63 x 3.0 | 110 x 3.4 – 63 x 2.5 |
| 75 x 3.0 | 75 x 3.6 | 75 x 3.6 | |
| 90 x 2.8 | 90 x 2.8 | 90 x 2.8 | |
| 110 x 3.0 | 110 x 3.4 | 110 x 3.4 | 160 x 4.9 – 110 x 3.4 |
| 125 x 3.0 | | | |
| 140 x 3.0 | 140 x 3.0 | 140 x 3.0 | |
| 160 x 3.0 | 160 x 3.0 | 160 x 3.0 | |
| 200 x 3.0 | 200 x 3.0 | 200 x 3.0 | |
| 250 x 3.0 | 250 x 3.0 | | |
| 315 x 4.0 | | | |
| 355 x 4.0 | | | |
| 400 x 5.0 | | | |

# High-end materials product range

## ECTFE natural / SK + fabric backed

ECTFE possesses a unique combination of properties that are the result of its chemical structure, which consists of a copolymer with ethylene and chloro-trifluoroethylene arranged alternately. ECTFE demonstrates excellent resistance to the corrosive influence of heat, strong radiation and weathering. The material has high impact resistance and shows almost no property changes in a wide temperature range, making it particularly well-suited for demanding industrial applications. Compared to PVDF, ECTFE has a better chemical resistance, especially when exposed to lyes. Fabric backed pipes are available in 1 m and 5 m length.

| SK+ liner pipe (5 m length) [mm] | SK+ liner pipe (1 m length) [mm] |
|---|---|
| 20 x 1.9 | 20 x 1.9 |
| 25 x 1.9 | 25 x 1.9 |
| 32 x 2.4 | 32 x 2.4 |
| 40 x 2.4 | 40 x 2.4 |
| 50 x 3.0 | 50 x 3.0 |
| 63 x 3.0 | 63 x 3.0 |
| 90 x 2.8 | 90 x 2.8 |
| 110 x 3.0 | 110 x 3.0 |
| 160 x 3.0 | 160 x 3.0 |

## FEP natural / GGS fabric backed

FEP, which is a fully fluorinated polymer, offers an outstanding corrosion and abrasion resistance. Flexibility, thermo-formability and optimum welding properties allow the cost-effective and reliable processing of AGRU FEP products. Fabric backed pipes are available in 1 m and 5 m length.

| Pipe plane (5 m length) [mm] | GGS liner pipe (5 m length) [mm] | GGS liner pipe (1 m length) [mm] |
|---|---|---|
| 32 x 2.3 | 32 x 2.3 | 32 x 2.3 |
| 50 x 2.3 | 50 x 2.3 | 50 x 2.3 |
| 63 x 2.3 | 63 x 2.3 | 63 x 2.3 |
| 90 x 2.3 | 90 x 2.3 | 90 x 2.3 |
| 110 x 2.3 | 110 x 2.3 | 110 x 2.3 |
| 160 x 2.3 | 160 x 2.3 | 160 x 2.3 |

## PFA natural / GGS fabric backed

PFA is the highest grade plastic in the AGRU portfolio. It is suitable for an extremely broad spectrum of applications thanks to its resistance to almost any medium and its high temperature resistance, meaning it can be offered as a solution even for extreme chemicals at high temperatures. Fabric backed pipes are available in 1 m and 5 m length.

| Pipe plane (5 m length) [mm] | GGS liner pipe (5 m length) [mm] | GGS liner pipe (1 m length) [mm] |
|---|---|---|
| 32 x 2.3 | 32 x 2.3 | 32 x 2.3 |
| 50 x 2.3 | 50 x 2.3 | 50 x 2.3 |
| 63 x 2.3 | 63 x 2.3 | 63 x 2.3 |
| 90 x 2.3 | 90 x 2.3 | 90 x 2.3 |
| 110 x 2.3 | 110 x 2.3 | 110 x 2.3 |

# Fabrication of AGRU liner pipes

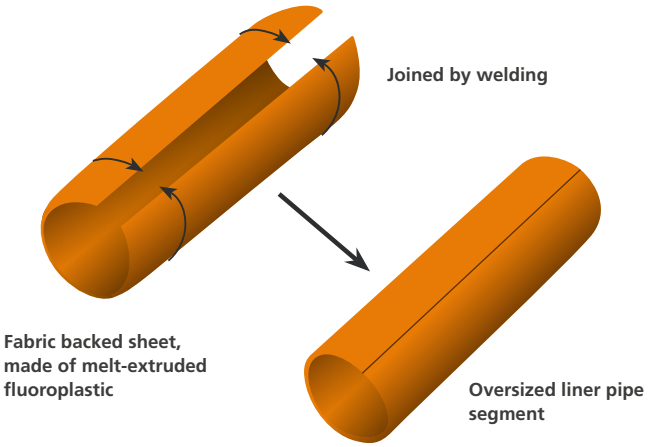
**The fluoropolymer liner pipe segments are connected by hot gas welding. For high quality and repeatable welds AGRU recommends the IR–welding technology which can be used for PVDF, ECTFE, FEP and PFA liner pipes.**

The advantages of IR welds can be shown as follows:

- Infrared technology for fully automatic, contact free welding
- Highest purity & reproducibility are ensured
- The bead is reduced to a minimum
- Up to 70 % shorter welding times in comparison to conventional heated element butt welding / hot gas welding technologies


## Oversized pipes

For manufacture of oversized pipes fabric backed sheet materials can be used. Knitted fabric backed lining laminates are cut in length, corresponding to the outline of the pipe. The lining laminate pieces are closed by welding in order to create the oversized liner pipe segments. Afterwards the oversized liner pipe can be supported with FRP.




The Plastics Experts.

Your distributor

Subject to errors of typesetting, misprints and modifications.
Illustrations are generic and for reference only.

1017

**AGRU Kunststofftechnik GmbH**
Ing.-Pesendorfer-Strasse 31
4540 Bad Hall, Austria

T. +43 7258 7900
F. +43 7258 790 - 2850
office@agru.at

www.agru.at