

Technical specification

Hand Lay Up fiberglass (GRP) fittings

Product code: HLU

Manufacturing process: Hand Lay Up

Application field: Civil / Industry / Marine

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1. Scope

The present document describes the main characteristics of hand lay up fiberglass (GRP) fittings manufactured by Nuova Sguassero.

2. References

Standards:

- UNI 9032
- EN 1796, EN 14364
- ASTM D5685, ASTM D5421
- AWWA C950, AWWA M45
- ISO 14692

Documents:

- Technical/commercial offer (contains specific information concerning the proposed pipes as resin type, rating, length, thickness, weight and joining systems).

3. Product certifications

- FM (Factory Mutual);
- KIWA (certification for drinking water also available).

4. Application field

HLU series fittings are used in civil, industrial and marine fields for many applications such as: thermoelectric and hydroelectric power plants, chemical and petrochemical industry, civil works (sewage systems, waterworks, drainages, irrigation plants), waters treatment, fumes treatment, fire fighting systems and desalination plants, shipbuilding.

These piping systems convey pressure or gravity fluids and can be installed aboveground, underground and submerged.

5. Product description

5.1 Pipe wall structure

HLU fittings wall consists of three layers: inner liner, structural wall and external liner (figure 1).

- The inner liner provides chemical corrosion resistance properties and acts as an anti-diffusion barrier towards the conveyed fluid.
This resin rich layer is manufactured with “C” glass *surfacing mat* and “E” glass *mat* as reinforcements and has a nominal thickness of 1,3 mm (higher thickness and different glass or synthetic tissues are available for specific applications).

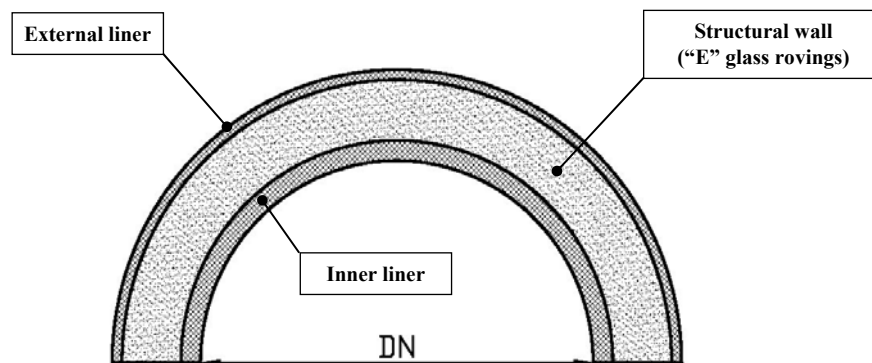


Figure 1: FW pipes wall section.

- The structural wall provides the mechanical resistance to withstand the stresses acting on the pipe (internal and external pressure, thermal loads, dead weight, external static and dynamics loads, etc.). The

reinforcing material consists of specific weight “E” glass Mats and Woven rovings. Wall thickness is function of diameter and design data.

- The external liner is the superficial finishing layer and protects the pipe from external agents and U.V. rays. It consists of a low weight synthetic veil and it is particularly rich of resin.

5.2 Manufacturing process

Fittings are manufactured by the “*hand lay up*” process where “E” glass Mats and Woven rovings, impregnated with resin, are wound or stratified on a rotating or fixed mould, up to reach the required thickness.

5.3 Impregnating resin

Glass fibers impregnating resin (orthophthalic, isophthalic, bisphenolic, vinylester or epoxy) depends on the composite material chemical and physical resistance required (conveyed fluid and temperature).

5.4 Raw materials

	<i>Inner liner</i> (anti-corrosion)	<i>Inner liner</i> (anti-diffusion)	<i>Structural wall</i>	<i>External liner</i> ⁽¹⁾
Impregnating resin	orthophthalic, isophthalic, bisphenolic, vinylester or epoxy			
Resin characteristics	standard, anti-abrasive, fire resistant or electrical conductive			
Pigments / Additives	--		--	U.V. protection ⁽²⁾
Type of reinforcing tissue	surfacing mat ⁽⁴⁾	mat	rovings	superficial veil ⁽³⁾
Materials	"C" glass ⁽⁴⁾	"E" glass	"E" glass	synthetic tissue ⁽³⁾
Weight	33 g/m ²	375 - 450 g/m ²	900 g/m ²	10 g/m ²
Nominal resin content	70%		60%	90%
Nominal reinforcement content	30%		40%	10%
Nominal thickness	1,3 mm ⁽⁵⁾		note (6)	0,2 mm ⁽⁵⁾
Notes:	⁽¹⁾ the indicated data are referred to standard external liner (see also par. 5.1); ⁽²⁾ if required; ⁽³⁾ external liner can be reinforced with glass tissues; ⁽⁴⁾ inner liner can be reinforced with synthetic tissues; ⁽⁵⁾ liners can be manufactured with different thickness; ⁽⁶⁾ wall thickness is function of design data (DN and PN).			

5.5 Rating and dimensions

Fittings are identified by a set of parameters (rating) such as nominal diameter (DN) and nominal pressure (PN).

Standard products range available is indicated in table 1.

<i>Parameter</i>	<i>Symbol [Unit]</i>	<i>Value</i>
Nominal (inner) diameter	DN [mm]	DN25 ÷ DN2400
Nominal pressure	PN [bar]	PN4 ÷ PN20

Table 1: HLU fittings standard product range.

For intermediate values of the indicated parameters reference can be made to the applicable product standards. Different or higher diameters, pressure and stiffness classes are available on demand.

Fittings thickness is calculated on the basis of the design data using the main dimensioning criteria stated in the applicable standards (UNI, EN, ASTM, AWWA, ISO, etc..).

5.6 Joining systems

The proposed joining systems for HLU fittings can be divided in two categories:

- Axial restrained joint: bell & spigot with double O-ring gasket and key-lock, flanged, butt & strap welding and glued conical;
- Non axial restrained joint: bell & spigot with double O-ring gasket and sleeve with double lip gasket.

Fittings can be joined also with mechanical coupling such as Helden, Reka, Straub, Teekay, Gibault, etc..

Joint type selection depends on design data, technical specifications, installation requirements and customer requests.

5.7 Physical and mechanical properties

GRP laminate has exceptional chemical resistance, mechanical strength values similar to steel but with a specific weight about 4 times lower, low electrical conductivity, low thermal conductivity, optimal abrasion resistance and low surface roughness that reduces pressure losses.

Table 2 reports values of some physical and mechanical properties.

<i>Characteristics</i>	<i>Mean nominal value</i>
Superficial roughness	30 μ m / 150 HW
Tensile elastic modulus axial (E_a) / hoop (E_h)	11000 / 11000 Mpa
Allowable tensile axial stress	2,2 ÷ 2,5
Allowable tensile hoop stress	2,2 ÷ 2,5
Poisson coefficient in case of hoop stress (ν_{hl})	0,3 ÷ 0,4
Poisson coefficient in case of axial stress (ν_{lh})	$\nu_{lh} = \nu_{hl} \times (E_a/E_c)$
Thermal expansion coefficient	18 ÷ 20 $\times 10^{-6}$ 1/°C
Thermal conductivity	0,26 W/mK
Specific heat	1,26 J/gK
Electrical resistivity	1000 M Ω /m
Specific weight	1,6 kg/dm ³

Table 2: HLU fittings physical and mechanical properties.