

## 1. SCOPE

This schedule specifies requirements for the Berolina-Liner and Berolina-Liner HF systems as manufactured by BKP Berolina Polyester GmbH & Co. Both systems are applicable to the renovation of gravity sewers and drains.

The approval is not applicable to:

- leaktightness of end seals;
- reconnection of laterals

## 2. PRODUCT DESCRIPTION

### 2.1 Introduction

The systems comprise of a glass fibre reinforcement woven sleeve which is factory impregnated with an ultra violet (UV) light curing polyester or vinyl ester thermosetting resin. When installed and cured this forms a full length cured-in-place structural liner within the host pipe.

The Berolina-Liner and HF systems have a range of internal diameters from 150mm to 1600mm and egg shaped pipes between 200mm x 300mm (DN250 equivalent) and 1200mm x 1800mm (DN1600mm equivalent).

### 2.2 Relevant Standards

The following relevant standard was identified for cured-in-place pipe liners:

- BS EN ISO 11296-4:2011<sup>(1)</sup>

### 2.3 Approval History

The BKP Berolina-Liner System has been WRc Approved™ since 2007:

- PT/265/0407

- PT/331/0512

PT/331/0512 was revised July 2015 for an increase in diameter to 1600mm.

## 3. REQUIREMENTS AND TESTING

### 3.1 Product Design

The Berolina-Liner systems shall be structurally designed in accordance with DWA-A143-2<sup>(2)</sup> or ASTM F1216<sup>(3)</sup>.

### 3.2 Type Testing

The BKP Berolina-Liner systems shall comply with the following test requirements which are based upon BS EN ISO 11296-4.

Appearance: The internal surface of the liner shall be smooth, clean and free from scoring, cavities, wrinkling and other surface defects that would prevent the Berolina-Liner systems from meeting the general fitness for purpose requirement.

Mechanical Characteristics Testing: Mechanical testing requirements of BS EN ISO 11296-4 are listed in Table 1.

Table 1 Berolina-Liner system mechanical characteristics

Parameter	Requirement
Short-term flexural modulus	Minimum: 1,500 MPa Declared: 10,000 MPa
Long-term flexural modulus	Minimum: 300 MPa Declared: 6,800 MPa
Short-term stress at first break	Minimum: 25 MPa Declared: 150 MPa
Long-term flexural stress	No minimum value Declared: 105 MPa

Table 2 Berolina-Liner HF system mechanical characteristics

Parameter	Requirement
Short-term flexural modulus	Minimum: 1,500 MPa Declared: 17,500 MPa
Long-term flexural modulus	Minimum: 300 MPa Declared: 13,800 MPa
Short-term stress at first break	Minimum: 25MPa Declared 350 MPa
Long-term flexural stress	No minimum value Declared: 267 MPa

Table 3 Berolina-Liner and HF systems long term strain corrosion

Parameter	Requirement
Long term strain corrosion test	Minimum extrapolated failure strain at 50 years $> = 0.45\%$ Declared: 0.713%

Quality control tests

Samples are taken each day or from each batch of impregnated linings and cured. The cured sample is tested in accordance with BS EN ISO 11296-4 as detailed in Table 4.

Table 4 Quality control tests

Parameter	Requirement
Wall structure	Clause 8.4.1
Wall thickness	Clause 8.4.2
Initial specific ring stiffness or short term flexural modulus	Clause 8.5 Table 5
Flexural stress at first break	Clause 8.5 Table 5
Flexural strain at first break	Clause 8.5 Table 5

**3.3 Manufacture**

To ensure the quality and performance of the Berolina-Liner and Berolina-Liner HF systems, the manufacturing process shall include appropriate systems for:

- Verification that component materials received are to specification
- Handling and storage of all component materials and finished linings
- Records of manufacture
- Inspection and maintenance of manufacturing equipment

The production of the Berolina-Liner and Berolina-Liner HF systems and related Quality Control procedures shall comply with requirements to ensure the stated performance of the product is reliably achieved.

**3.4 Installation**

When installed in accordance with the installation documentation<sup>(4)</sup>, the installation shall be practicable and suitable for

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**Assessment Schedule for the Berolina-Liner  
and Berolina-Liner HF liner systems as  
manufactured by BKP Berolina Polyester  
GmbH & Co.**



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conditions that could reasonably be expected on site.

#### **4. APPROVAL**

The Berolina-Liner and Berolina-Liner HF systems have been audited and have successfully met all of the requirements stated within this assessment schedule.

Signed: .

A handwritten signature in black ink, appearing to read 'K.A. Adams'.

#### **5. REFERENCES**

1. BS EN ISO 11296 Part 4 Plastic piping systems for renovation of underground non-pressure drainage and sewerage networks. Part 4 Cured-in-place-pipes, 2011
2. DWA-A 143.2- Rehabilitation of drainage systems outside buildings - Part 2: Static calculation for the rehabilitation of wastewater pipes and pipes with lining and assembly methods (July 2015)
3. ASTM F1216 – 09 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
4. Berolina-Liner System installation manual, Version 13-12-02 (English), 22-5-2015