SOUTH AFRICAN BUREAU OF STANDARDS

STANDARDIZED SPECIFICATION

for

CIVIL ENGINEERING CONSTRUCTION

LB : BEDDING (PIPES)

Approved by the COUNCIL OF THE SOUTH AFRICAN BUREAU OF STANDARDS on 2 March 1983

Obtainable from the SA BUREAU OF STANDARDS Private Bag X191 Pretoria 0001 Republic of South Africa

Telegrams : Comparator, Pretoria

Published and printed in the Republic of South Africa by the South African Bureau of Standards

1. SCOPE

1.1 This specification covers the bedding (bedding cradle and selected fill blanket) for buried pipes carrying fluids under pressure or gravity.

NOTE: The standards referred to in the specification are listed in Appendix A.

2. INTERPRETATIONS

2.1 SUPPORTING SPECIFICATIONS

2.1.1 Where this specification is required for a project, the following specifications shall, inter alia, form part of the contract document:

a) Project specification;

b) SABS 1200 A or SABS 1200 AA, as applicable;

c) SABS 1200 D or SABS 1200 DA, as applicable;

d) SABS 1200 DB.

2.1.2 In addition to the specifications referred to in 2.1.1 the following specifications, inter alia, may be required:

a) SABS 1200 G or SABS 1200 GA, as applicable, to cover Class A bedding;

b) SABS 1200 L, SABS 1200 LA, SABS 1200 LD, or SABS 1200 LE, as appropriate, to cover the relevant type(s) of pipeline to be bedded.

2.2 APPLICATION. This specification contains clauses that are generally applicable to the bedding of pipes. Interpretations and variations of the specification are set out in Portion 2 of the project specification which precedes this specification in a contract document.

2.3 DEFINITIONS. For the purposes of this specification the definitions and abbreviations given in the applicable of the specifications listed in 2.1 and the following definitions shall apply:

**Bedding**

a) The material in the bedding cradle and fill blanket up to the underside of the main fill.

b) The operation of placing and compacting bedding in the manner specified.

**Bedding cradle.** The zone in which bedding is placed firmly and without voids under and up the sides of a pipe, a duct, or a cable in such a manner that for all practical purposes the pipe, duct, or cable cannot move or deflect.

**Compactibility factor.** A number (determined by means of the test given in Subclause 4.2 of Section LB of Part 3 of SABS 0120) representing the extent to which a particulate material will compact.

**Evenly graded.** Descriptive of a particulate material that is such that the sizes of approximately 90% by mass of the grains are evenly distributed between stated limits (see Drawing LB-6).

**Expansion joint.** A joint in concrete bedding in which two concrete surfaces are separated by resilient filler of thickness at least 15 mm.

**Flexible pipe.** A pipe of which the diameter is reduced by more than 1% under an external radial force before the appearance of cracks.

**Joint hole.** A depression formed in the bedding cradle to accommodate a joint in a pipeline.

**Main fill.** The approved filling material placed in a pipe trench after the pipe has been laid, bedded, and surrounded by selected fill blanket up to 150 mm or other specified cover above the top of the pipe.

**Rigid pipe.** A pipe of which the diameter is reduced by not more than 1% under an external radial force before the appearance of cracks.

**Selected fill blanket.** Material placed and compacted to form a blanket on or from the top of the bedding cradle up the sides and over the top of a pipe, duct, or cable, in such a manner that the barrel of the pipe, duct, or cable is supported continuously and firmly on the sides and protected over the top by a dense cushion of material.

**Selected fill material.** Material that complies with the requirements of 3.2.

**Selected granular material.** Material that complies with the requirements of 3.1.

**Singularly graded.** Descriptive of a particulate material in which over 90% by mass of the grains is retained on a single sieve of any specified size aperture between stated limits (see Drawing LB-6).

3. MATERIALS

3.1 SELECTED GRANULAR MATERIAL. Selected granular material shall be material of a granular, non-cohesive nature that is singularly graded between 0.6 mm and 19 mm, is free-draining, and has a compactibility factor (as determined by the test given in Section LB of Part 3 of SABS 0120) not exceeding 0.4 or such other value as is laid down in the project specification.

3.2 SELECTED FILL MATERIAL. Selected fill material shall be material that has a PI not exceeding 6 and that is free from vegetation and from lumps and stones of diameter exceeding 30 mm.

3.3 BEDDING. Bedding for rigid pipes shall be of Class A, B, C, or D (see Drawing LB-1) and bedding for flexible pipes shall be selected granular material and selected fill material (see Drawing LB-2). The bedding cradle for Class A bedding shall be concrete (see 5.2.1(a)). Bedding cradles for Classes B, C, and D bedding shall be of selected granular material (see 3.1). The material for the selected fill blanket shall in all cases comply with the requirements of 3.2.
3.4 SELECTION

3.4.1 Suitable Material Available from Trench Excavation (See also 8.1.2). The excavation of a pipe trench shall comply with the requirements of Subclause 5.4 of SABS 1200 DB, and the provisions of Subclause 3.7 of SABS 1200 DB. In terms of which, for the purpose of providing bedding materials, the Contractor is not required to use selective methods of excavating shall apply. The Contractor will be permitted (but is not required) to screen, wash, or otherwise treat excavated material in order to produce material suitable for bedding or covering the pipeline. The Contractor shall take every reasonable precaution to avoid burying or contaminating material that is suitable and is required for bedding or covering the pipeline.

3.4.2 Suitable Material not Available from Trench Excavation (See also 8.1.2). When material suitable for use as selected fill material or selected granular material is not readily available from trench excavation within a distance not exceeding 0.5 km, the Contractor shall, subject to the Engineer's approval for each material, obtain suitable material to replace the shortfall from other necessary excavations on the Site; or by opening up borrow pits at approved areas located at intervals along the route of the pipeline; or by importing from commercial or other sources.

4. PLANT

4.1 PLACING, COMPACTING, AND TESTING EQUIPMENT

4.1.1 Placing and Compacting. Adequate equipment shall be provided for the placing and compaction of bedding as specified in 5.1.3 and 5.1.4.

4.1.2 Testing. The Contractor shall provide the necessary test equipment for performing on Site the tests referred to in 7.1 and 7.2.

5. CONSTRUCTION

5.1 GENERAL

5.1.1 Trench

5.1.1.1 Width. The Contractor shall so excavate each trench that the width conforms to the requirements of Subclause 5.2 of SABS 1200 DB.

5.1.1.2 Bottom. The Contractor shall prepare the trench bottom in accordance with the requirements of Subclause 5.5 of SABS 1200 DB.

5.1.2 Details of Bedding. Pipes shall be bedded and protected in accordance with the details shown on:

a) Drawing LB-1, appropriate to the class of bedding scheduled or ordered for rigid pipes; and
b) Drawing LB-2 for flexible pipes.

5.1.3 Placing

5.1.3.1 No bedding shall be laid until the Engineer has approved the trench, measured the depth if necessary, and authorised pipelaying to proceed.

5.1.3.2 Except in the case of Class A bedding, the joint holes shall be refilled with fine granular material and lightly compacted to prevent the migration of adjacent pipe bedding material into the holes and to obviate the production of hard spots under joints (see Drawing LB-2).

5.1.3.3 In the placing of bedding, all voids under the overhang of the pipes shall be filled and the compaction shall be carried out uniformly on each side of the pipe so as not to cause any lateral or vertical displacement of the pipe.

5.1.3.4 Bedding shall be carried out as pipelaying proceeds, and shall be completed before the acceptance test is carried out.

5.1.4 Compacting. The degree of compaction attained for bedding (other than concrete and the material over the top of the pipeline) shall be 90% of modified AASHTO maximum density (see 6.1).

5.2 PLACING AND COMPACTING OF RIGID PIPES

5.2.1 Class A Bedding. In addition to complying with the applicable requirements of 5.1, the Contractor shall construct Class A bedding in accordance with the following requirements:

a) The pipes shall be supported on a continuous cradle of concrete having a 28 d compressive strength of at least 20 MPa.

During pipelaying and before the placing of the concrete bedding, the pipes shall be suitably supported as shown on Drawing LB-3(a).

Care shall be taken during the placing of the concrete to prevent movement or flotation of the line. In the case of pipes with flexible joints, concrete shall not be allowed to enter the joints during construction of the bedding and a positive vertical expansion joint in the bedding cradle shall be formed at each pipe joint.

b) The selected fill blanket shall not be placed in any section until a period of 24 hours has elapsed after placement of the bedding cradle in that section.

c) The main fill shall not be placed in any section until the bedding cradle in that section has achieved a compressive strength of at least 15 MPa.

5.2.2 Class B and Class C Beddings. In addition to complying with the applicable requirements of 5.1, the Contractor shall construct Class B and Class C beddings in accordance with the following requirements:

The pipes shall be bedded on a continuous bed of selected granular material, the material being placed in accordance with the details shown on Drawing LB-3(b) or (c), as relevant, and the bedding constructed in the manner shown on Drawing LB-3(b) or (c), as relevant. To ensure that each pipe will be fully supported throughout the length of its barrel on the bedding cradle, joint holes shall be formed in the bedding cradle for pipe sockets and couplings.

5.2.3 Class D Bedding. In addition to complying with the applicable requirements of 5.1, the Contractor shall construct Class D bedding in accordance with the following requirements:

The pipes shall be placed directly on the trench bottom after this has been hand-trimmed to ensure that each pipe will be fully supported throughout the length of its barrel. Joint holes shall be formed in the trench bottom for pipe sockets and couplings.

5.2.4 Temporary Support Material (Class B, C, and D Beddings). Any material that is used to support a pipeline temporarily during construction or that does not comply with the requirements for bedding cradle shall be removed before the selected fill blanket for Class B, C, or D bedding is placed.
5.3 PLACING AND COMPACTING OF FLEXIBLE PIPES. In addition to complying with the applicable requirements of 5.1, the Contractor shall construct bedding for flexible pipes in accordance with the following requirements:

a) Bedding cradle. Flexible pipes shall be supported on a continuous bed of selected granular material of compacted depth at least 100 mm and covering the full width of the trench. The granular material shall be compacted to the density specified in 5.1.4. Additional selected granular material shall then be placed carefully and evenly between the sides of the trench and the pipeline, in layers of uncompacted thickness approximately 100 mm, as shown on Drawing LB-2 and in accordance with the construction details shown for flexible pipes on Drawing LB-3(d). Each layer shall be compacted individually to the density specified in 5.1.4. Particular care shall be exercised to prevent damage, deflection, or displacement of the pipeline.

b) 200 mm selected fill blanket. After completion of the bedding cradle, selected fill blanket shall be placed carefully in layers of 100 mm uncompacted thickness over the full width of the trench and shall be compacted to the density specified in 5.1.4 up to a height of at least 300 mm above the crown of the pipeline. Special care shall be taken when compacting over the pipeline.

5.4 CONCRETE CASING TO PIPES. Where ordered or where required in terms of the project specification or the drawings, pipes shall be encased in concrete of the specified grade. The lower part of the encasement shall be constructed first in the manner specified for Class A bedding in 5.2.1(a). Once the pipeline has been tested and approved, the pipes shall be covered with concrete to the specified depth and expansion joints shall be constructed in the upper part to coincide with those in the lower part. No earthfill over the cradle shall be commenced until at least 2 d after the concrete has been placed or until the concrete has attained a strength of at least 15 MPa.

5.5 TOLERANCES

TOLERANCES TO PIPELINES. Material displaced by the pipeline and by importation of material from sources other than trench excavation, shall be disposed of along the pipeline servitude within a distance of 0.5 km from source unless otherwise required in terms of the project specification.

6. MOISTURE CONTENT AND DENSITY. The permissible deviations from OMC and density shall, except where otherwise specified, be as given below, appropriate to the particular class of work:

<table>
<thead>
<tr>
<th>Permissible deviation, %</th>
<th>Degree of accuracy</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>III</td>
</tr>
<tr>
<td>1) OMC in field during compaction</td>
<td>±2</td>
</tr>
<tr>
<td>2) Specified density when bedding rigid pipes</td>
<td>±</td>
</tr>
<tr>
<td>3) Specified density when bedding flexible pipes</td>
<td>±</td>
</tr>
</tbody>
</table>

* As stated in the project specification.

7. TESTING

7.1 DENSITY. The Engineer may order density tests to be carried out to determine the density and grading of the bedding. The tests may be carried out by the sand replacement method or, where the grading of the bedding is such that the particle size is not less than 0,075 mm and not more than 2 mm, by use of a dynamic cone penetrometer.

If the density is below that specified, the Engineer may order removal and recompression.

7.2 COMPATIBILITY. The Engineer may order the compatibility test given in Subclause 4.2 of Section LB of Part 3 of SABS 0120 to be carried out on any material used or to be used in the bedding cradle.

8. MEASUREMENT AND PAYMENT

8.1 PRINCIPLES

8.1.1 Supply of Bedding Materials Measured Separately. The operation of bedding (see 2.3) will not be measured separately, but the provision alongside the trench of bedding materials that comply with the relevant requirements of the specification will be measured separately. The rate for laying a pipeline shall cover the cost of handling, placing, and compacting the bedding materials up to the underside of the main fill, in addition to any other cost associated with laying the pipeline.

8.1.2 Sources of Bedding Materials. The provision of bedding materials shall be in accordance with 3.4.1 and 3.4.2, and the relevant terms of 8.2 shall apply to such materials.

8.1.3 Volume of Bedding Materials. The volume of bedding materials will be computed from:

a) the dimensions of the pipe and the side allowance determined in accordance with Subclause 8.2.3 of SABS 1200 DB and as shown on Drawing LB-4; and
b) the depth of each bedding section as shown on Drawing LB-1 or Drawing LB-2, as applicable.

No allowance will be made for bulking of material.

8.1.4 Separate Items for Cradle and Blanket. Separate items are scheduled for material for the bedding cradle and for the selected fill blanket to provide for the probability that the excavated material from the trench is more likely to comply with the requirements for the latter than for the former.

8.1.5 Disposal of Displaced Material. Material displaced by the pipeline and by importation of material from sources other than trench excavation, shall be disposed of along the pipeline servitude within a distance of 0.5 km from source unless otherwise required in terms of the project specification. Freehaul, if ordered, of such displaced material shall be covered as specified in Subclause 8.1.3.4 of SABS 1200 DB.

8.1.6 Freehaul. Except as provided for in 8.2.2.2 and 8.2.2.3, the freehaul of 0.5 km specified in Subclause 5.2.5.1 of SABS 1200 D or Subclause 5.2.6.1 of SABS 1200 DA, as relevant, shall be applicable to selected granular material and to selected fill material.
8.2 SCHEDULED ITEMS

8.2.1 Provision of Bedding from Trench Excavation

a) Selected granular material ................................................................. Unit: m³
b) Selected fill material ......................................................................... Unit: m³

The rates shall cover the cost of acquiring, from within 0.5 km, bedding that complies with the relevant requirements of the specification, of delivering it to points alongside the trench spaced to suit the Contractor's methods of working, and of disposing of displaced material within a freehaul distance of 0.5 km.

NOTE: In terms of the standardized specifications covering pipelines, the rate for the supply and laying of pipelines covers the cost of handling bedding material from alongside the trench and placing it under and around the pipeline.

8.2.2 Supply only of Bedding by Importation

8.2.2.1 From necessary excavations (Provisional)

a) Selected granular material ................................................................. Unit: m³
b) Selected fill material ......................................................................... Unit: m³

The rate shall cover the operations specified in 8.2.1.

8.2.2.2 From borrow pits (Provisional)

a) Selected granular material ................................................................. Unit: m³
b) Selected fill material ......................................................................... Unit: m³

The rate shall cover the cost of acquiring (including the cost of opening up, and subsequently spreading surplus material, overburden, and topsoil in the manner specified in Subclause 5.2.2 of SABS 1200 D or Subclause 5.2.2 of SABS 1200 DA, as applicable), regardless of distance, the required bedding from borrow pits (see Subclause 8.3.4 of SABS 1200 D or Subclause 8.3.4 of SABS 1200 DA, as relevant), of delivering it to points alongside the trench spaced to suit the Contractor's methods of working, and of disposing of material displaced by such importation, within a freehaul distance of 0.5 km.

8.2.3 From commercial sources (Provisional)

a) Selected granular material ................................................................. Unit: m³
b) Selected fill material ......................................................................... Unit: m³

The rate shall cover the cost of acquiring, regardless of distance, the required bedding from commercial sources (see Subclause 8.3.4 of SABS 1200 D or Subclause 8.3.4 of SABS 1200 DA, as relevant), of delivering it to points alongside the trench spaced to suit the Contractor's methods of working, and of disposing of material displaced by such importation, within a freehaul distance of 0.5 km.

8.2.4 Concrete Bedding Cradle ................................................................. Unit: m³

The volume of concrete will be computed as specified in 8.1.3.

The rate shall cover the cost of providing and placing the concrete screed and cradle and, when relevant, formwork for pipes of all diameters regardless of the method of construction. (See Drawing LB-3(a).)

8.2.5 Encasing of Pipes in Concrete ........................................................ Unit: m³

Separate items will be scheduled for each size of pipe and for each grade of concrete specified.

The volume will be computed from the dimensions of the concrete as given on the drawing.

The rate shall cover the cost of dealing with any excavation (in all materials including disposal of surplus) that is additional to that measured under the item for pipe trench excavation, the cost of encasing the pipe in concrete including the cost of formwork (if any), etc., and the cost of formwork to form flexible joints at 4 m centres.

8.2.6 Overhaul of Material for Bedding Cradle and Selected Fill Blanket (see 8.2.1) ................................................................. Unit: m³ Km

This item will be applicable only to such bedding from trench and other necessary excavation as is hauled for distances in excess of 0.5 km with the written approval of the Engineer.

The volume will be computed as specified in 8.1.3 and the distance will be the distance (in excess of 0.5 km) by the shortest practicable route in one direction measured to the nearest 0.1 km.

The rate shall cover the cost of transporting and off-loading the bedding material, and of loading and disposing of material displaced by such bedding within a freehaul distance of 0.5 km.
COMPACTED SELECTED FILL BLANKET

MONOLITHIC 20 MPa CONCRETE BEDDING CRADLE

BASE WIDTH

(SEE DWG LB-3(a) & LB-4)

D = OUTSIDE BARREL DIMENSION

D/4 300mm MAX. WITH:
(a) 100 mm MIN. FOR TRENCH IN SOIL
(b) 50 mm MIN. FOR TRENCH IN ROCK

300 mm

COMPACTED SELECTED FILL BLANKET

BEDDING CRADLE OF COMPACTED SELECTED GRANULAR MATERIAL

300 mm

D/4 SUBJECT TO x BEING NOT LESS THAN 100 mm AND NOT MORE THAN 200 mm

x = D/6 SUBJECT TO x BEING NOT LESS THAN 100 mm AND NOT MORE THAN 200 mm

TRENCH BOTTOM HAND-TRIMMED TO SUPPORT PIPE THROUGHOUT THE LENGTH OF ITS BARREL. PIPES NOT TO REST ON THEIR SOCKETS OR COLLARS; JOINT HOLES TO BE CUT IN TRENCH BOTTOM

a) Rigid Pipe on Class A Bed

b) Rigid Pipe on Class B Bed

c) Rigid Pipe on Class C Bed

d) Rigid Pipe on Class D Bed

Drawing LB-1 — Pipe Bedding Details: Rigid Pipes
Bedding (pipes)

(a) Flexible Pipes

NOTE: See 5.2.2.

(b) Typical Joint Pockets

NOTE: See 5.2.3

Drawing LB - 2 - Pipe Bedding Details: Flexible Pipes and Typical Joint Pockets
PLACE EACH LENGTH OF BEDDING IN ONE CONTINUOUS OPERATION.
CONCRETE FULL WIDTH OF TRENCH.
Pipes above 600mm Ø:
USE FORMS FOR SIDES OF CONCRETE IF TRENCH BOTTOM EXCEEDS BASE WIDTH (SEE DRAWING LB-4).

\[ x = \frac{D}{4} \]

SUBJECT TO:
\[ x \text{ BEING NOT LESS THAN } 75 \text{mm} \]
\[ \text{AND NOT MORE THAN } 300 \text{mm} \]

\( x = \) 0

SELECTED FILL BLANKET NOT TO BE PLACED UNTIL 24h AFTER PLACING OF CONCRETE.

**a) Class A Bedding**

SELECTED FILL BLANKET COMPACTED UNIFORMLY IN LAYERS WITH LIGHT COMPACTION DIRECTLY OVER PIPE.

PRECAST CONCRETE BLOCK VEE-SHAPED ON UPPER SURFACE (AID TO ALIGNMENT ONLY).

SELECTED GRANULAR MATERIAL PLACED AND COMPACTED IN UNIFORM LAYERS ON BOTH SIDES OF PIPE FOR BEDDING CRADLE.

**b) Class B Bedding**

SELECTED FILL BLANKET COMPACTED UNIFORMLY IN LAYERS WITH LIGHT COMPACTION DIRECTLY OVER PIPE.

**c) Class C Bedding**

SELECTED GRANULAR MATERIAL PLACED AND COMPACTED IN UNIFORM LAYERS ON BOTH SIDES OF PIPE FOR BEDDING CRADLE.

**d) Flexible Pipe Supported on Selected Granular Material**

Drawing LB-3 — Construction of Pipe Bedding
W : BASE WIDTH OF THE TRENCH
(SEE SUBCLAUSE 8.2.3 OF SABS 1200 DB)

W, D1, AND D2 ARE THE DIMENSIONS TO BE USED FOR MEASUREMENT OF QUANTITIES

LEVEL REQUIRED TO OBTAIN SPECIFIED MINIMUM BEDDING CRADLE THICKNESS

TRENCH SUPPORTS, IF ANY
SELECTED FILL BLANKET
BEDDING CRADLE

SIDE ALLOWANCE (SEE SUBCLAUSE 8.2.3 OF SABS 1200 DB)

BASE WIDTH

Drawing LB-4 — Measurement of Bedding
a) Backfilling Over Rigid Pipeline

b) Backfilling Over Flexible Pipeline

Drawing LB-5 - Backfilling Details
PARTICLE SIZE DISTRIBUTION

SIEVE APERTURE (mm)

PERCENTAGE FINES (BY MASS)

PARTICLE SIZE (mm)

EVENLY GRADED ..............................................0.6 mm – 19 mm (a)
SINGULARLY GRADED OF ± 1.0 mm..0.6 mm – 19 mm (b)
± 4.5 mm..0.6 mm – 19 mm (c)
± 9.5 mm..0.6 mm – 19 mm (d)

Drawing LB-6 - Typical Grading of Bedding Material between 0.6 mm and 19.0 mm Limits
**APPENDIX A. APPLICABLE STANDARDS**

Reference is made to the latest issues of the following standards:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SABS 1200 A</td>
<td>Civil engineering construction: General</td>
</tr>
<tr>
<td>SABS 1200 AA</td>
<td>Civil engineering construction: General (small works)</td>
</tr>
<tr>
<td>SABS 1200 D</td>
<td>Civil engineering construction: Earthworks</td>
</tr>
<tr>
<td>SABS 1200 DA</td>
<td>Civil engineering construction: Earthworks (small works)</td>
</tr>
<tr>
<td>SABS 1200 DB</td>
<td>Civil engineering construction: Earthworks (pipe trenches)</td>
</tr>
<tr>
<td>SABS 1200 G</td>
<td>Civil engineering construction: Concrete (structural)</td>
</tr>
<tr>
<td>SABS 1200 GA</td>
<td>Civil engineering construction: Concrete (small works)</td>
</tr>
<tr>
<td>SABS 1200 J</td>
<td>Civil engineering construction: Medium-pressure pipelines</td>
</tr>
<tr>
<td>SABS 1200 LA</td>
<td>Civil engineering construction: Urban services (small works) (In course of preparation)</td>
</tr>
<tr>
<td>SABS 1200 LA</td>
<td>Civil engineering construction: Sheet</td>
</tr>
<tr>
<td>SABS 1200 LE</td>
<td>Civil engineering construction: Stormwater drainage</td>
</tr>
<tr>
<td>SABS 0120</td>
<td>Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 3 : Guidance for design : Section LE</td>
</tr>
</tbody>
</table>