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Styrene butadiene styrene (SBS) modified bituminous sheet materials

(Draft for Approval)

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Foreword

Articles 5.3 and 8.1 of this Standard are mandatory, whilst the rest are recommended.

This Standard is identical but non-equivalent to EN 13707 – 2004 “Flexible sheets for waterproofing. Reinforced bitumen sheets for roof waterproofing – Definitions and characteristics.”

This Standard replaces GB 18242 – 2000 “Styrene butadiene styrene (SBS) modified bituminous sheet materials).”

The main changes to this Standard when compared with GB 18242 – 2000 are as follows:

- Glass fibre enhanced felt is added in the padding (3.1.1 in version 2000; 3.1.1 in this version);
- Products with a thickness of 5mm have been added; products with a thickness of 2mm have been removed (3.2.2 in version 2000; 3.2 in this version);
- Product application suggestion has been revised (3.4 in version 2000; 3.4 in this version);
- Roll weight has been replaced by mass per unit area (4.1 in version 2000; 4.1 in this version);
- Raw material requirements have been added (Article 4 of this version);
- Sub-peak pull, second peak elongation, mass increase after water permeation, heat aging, oil permeability, seam peeling strength, nail shank tearing strength, mineral granule adhesion, lower sheet bituminous coating thickness of sheet surface are added in Material Characteristics (Table 3 in version 2000; Table 2 in this version);
- Pull has been revised and tearing strength removed (Table 3 in version 2000; Table 2 in this version);
- Test methods have been modified, tests are conducted according to GB/T 328-2007 (Article 5 in version 2000; Article 6 in this version);
- Final factory inspection items have been revised, type inspection period has been modified (6.1 in version 2000; 7.1 in this version);

This Standard is proposed by the Chinese Federation of Construction Materials.

This Standard is under the jurisdiction of the National Standardisation Technical Committee of Light and Decoration Materials (SAC / TC 195).

The units responsible for drafting this Standard are: Chinese Construction Industry Association of Waterproof Materials, Construction Material Industry Technical Supervision and Research Centre, Suzhou Waterproof Material Research and Design Institute of China Chemical Construction Material Corporation.

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The interpretation of this Standard is assigned to Suzhou Waterproof Materials Research Institute.

This Standard was first issued in 2000.

Styrene butadiene styrene (SBS) modified bituminous sheet materials

1 Scope

This Standard sets the classifications, technical requirements, test methods, inspection rules, markings and user manual requirements for styrene butadiene styrene modified bituminous sheet materials (abbreviated as SBS waterproof sheet).

This Standard applies to waterproof sheets made from the padding of polyester felt, glass fibre felt or enhanced glass fibre polyester felt, by the bitumen modifier of styrene butadiene styrene (SBS) thermoplastic elastomer and coated on both sides with insulation materials.

2 Normative References

The provisions of the following documents become provisions of this Standard after being referenced. For dated reference documents, all later amendments (excluding corrigenda) and revised versions do not apply to this Standard. However, the parties to the agreement are encouraged to study whether the latest version of these documents applies. For undated reference documents, the latest versions apply.

GB/T 328.2	Test methods for building sheets for waterproofing – Part 2: bitumen sheets for waterproofing - Visible defects
GB/T 328.4	Test methods for building sheets for waterproofing – Part 4: bitumen sheets for waterproofing – Thickness and mass per unit area
GB/T 328.6	Test methods for building sheets for waterproofing – Part 6: bitumen sheets for waterproofing – Length, width and straightness
GB/T 328.8	Test methods for building sheets for waterproofing – Part 8: bitumen sheets for waterproofing – Tensile properties
GB/T 328.10 - 2007	Test methods for building sheets for waterproofing – Part 10: bitumen, plastic and rubber sheets for waterproofing – Watertightness
GB/T 328.11 - 2007	Test methods for building sheets for waterproofing – Part 11: bitumen sheets for waterproofing – Flow resistance at elevated temperature
GB/T 328.14	Test methods for building sheets for waterproofing – Part 14: bitumen sheets for waterproofing – Flexibility at low temperature
GB/T 328.17 - 2007	Test methods for building sheets for waterproofing – Part 17: bitumen sheets for waterproofing –Adhesion of granules
GB/T 328.18	Test methods for building sheets for waterproofing – Part 18: bitumen sheets for waterproofing – Resistance t tearing (nail shank)
GB/T 328.20	Test methods for building sheets for waterproofing – Part 20: bitumen sheets for waterproofing – resistance of peeling of joints

GB/T 328.26	Test methods for building sheets for waterproofing – Part 26: bitumen sheets for waterproofing – Dissoluble content (coating material content)
GB/T 18244	Test methods for resistance to weathering of building waterproof materials
GB/T 18840	Padding for bituminous waterproof sheets
JC/T 904	Elastomer modified bitumen

3 Classification and Labelling

3.1 Type

3.1.1 Padding is classified as polyester felt (PY), glass fibre felt (G) and glass fibre enhanced polyester felt (PYG).

3.1.2 Upper surface insulating material is classified as polyethylene coating (PE), fine sand coating (S) and mineral granule coating (M); lower surface insulating material is classified as fine sand (S) and polyethylene coating (PE).

Note: fine sand coating is coating by mineral granules with a diameter of less than 0.60mm.

3.1.3 The products are classified as Type I and Type II according to the characteristics of their material.

3.2 Specification

The nominal sheet width is 1000 mm.
The nominal thickness of polyester felt sheet is 3 mm, 4mm, 5mm.
The nominal thickness of glass fibre felt sheet is 3 mm, 4mm.
The nominal thickness of glass fibre enhanced polyester felt is 5 mm.
The nominal sheet size is 7.5 m^2, 10m^2, 15m^2.

3.3 Labelling

The product is labelled in the following sequence: name, model, padding, upper surface material, lower surface material, thickness, size and code of Standard.

Example: Type I elastomer modified bituminous waterproof sheet with a size of 10m^2, thickness of 3 mm, upper surface of mineral granules and lower surface of polyethylene coating polyester felt is labelled as:

SBS I PY M PE 3 10 GB 18242 – 200X

3.4 Application

3.4.1 Elastomer modified bituminous waterproof sheets are mainly suitable for industrial and civil roofing, and underground waterproof engineering work.

3.4.2 Glass fibre enhanced polyester felt sheets can be used in machinery fixed single layer waterproof sheets subject to wind load resistance testing.

3.4.3 The glass fibre sheets are suitable for the bottom layer in multi-layer waterproof work.

3.4.4 The waterproof sheets with the upper surface insulating material of opaque mineral granules are suitable for exposed application.

3.4.5 The waterproof sheets with the surface insulation material of fine sand are used in underground waterproof work.

4 Raw materials

4.1 Modified bitumen

Modified bitumen should conform to the requirements of JC/T 905.

4.2 Padding

4.2.1 Only polyester felt, glass fibre felt and glass fibre enhanced polyester felt are used as padding.

4.2.2 The application of polyester felt and glass fibre felt should conform to the requirements set out in GB/T 18840. The specification and characteristics of glass fibre enhanced polyester felt should meet the requirements for waterproof sheet production as set out in this Standard.

4.3 Surface insulation materials

Polyester (PET) coating and heat resistant polyethylene coating may not be used as surface insulation materials.

5 Requirements

5.1 Mass per unit area, size and thickness

The mass per area, size and thickness should conform to the requirements set out in Table 1.

Table 1 - Mass per unit area, Size and Thickness

Specs (nominal thickness) mm		3			4			5		
Upper surface materials		PE	S	M	PE	S	M	PE	S	M
Lower surface materials		PE	PE, S		PE	PE, S		PE	PE, S	
Area (m^2/sheet)	Nominal area	10, 15			10, 7.5			7.5		
	Deviation	± 0.10			± 0.10			± 0.10		
Mass per unit area (kg/ m^2)		3.3	3.5	4.0	4.3	4.5	5.0	5.3	5.5	6.0
Thickness mm	Average value •	3.0			4.0			5.0		

	Minimum unit value	2.7	3.7	4.7

5.2 Appearance

5.2.1 The sheet should be rolled up tightly and neatly. Inward and outward unevenness at the roll ends should not exceed 10 mm.

5.2.2 When the sheet is unwound at 4 to 50 • , cracks should be no more than 10 mm long and there should be no bonded spots within 1000 mm from the roll core.

5.2.3 The padding should be thoroughly permeated without any non-permeated spots.

5.2.4 The surface of sheet should be smooth and free from any holes, nicks edges, cracks or lumps. The mineral granules should be even and consistent and firmly bonded with the sheet surface.

5.2.5 Each sheet roll should not have more than one seam. The shorter side should not be less than 1000 mm long. The seam should be neatly cut with an added length of 150 mm.

5.3 Material characteristics

The material characteristics should conform to the requirements set out in Table 2.

Table 2 - Material Characteristics

Serial No	Item		Specs				
			I		II		
			PY	G	PY	G	PYG
1	Soluble (g/m^2) •	3 mm	2100				/
		4 mm	2900				/
		5 mm	3500				
		Test phenomenon	/	Non-flammable padding	/	Non-flammable padding	/
2	Heat resistance	•	90		105		
		• mm	2				
		Test phenomenon	No dripping or dropping				
3	Low temperature flexibility - •		-20		-25		
			No cracking				
4	Permeability - 30 min		0.3 MPa	0.2 MPa	0.3 MPa		
5	Pull	Maximum peak pull (N/50mm) •	500	350	800	500	900
		Sub-peak pull (N/50mm) •	/	/	/	/	800
		Test phenomenon	During the pull test there is no bituminous coating crack or padding peeling in the middle area of the sheet.				

6	Elongation	Maximum peak elongation % •	30	/	40	/	/
		Sub-peak elongation % •	/		/		15
7	Mass increase after permeation % •	PE, S	1.0				
		M	2.0				
8	Heat aging	Pull retainability % •	90				
		Elongation retainability - % •	80				
		Low temperature flexibility - •	-15		-20		
			No cracking				
		Size change - % •	0.7	/	0.7	/	0.3
		Mass loss - % •	1.0				
9	Oil permeability	Number of sheet •	2				
10	Seam peeling strength (N/mm) •		1.5				
11	Nail shank tearing strength [a] N •		/				300
12	Mineral granule adhesion [b] g •		2.0				
13	Lower sheet surface bituminous coating thickness [c] mm •		1.0				
14	Artificial climate accelerated aging	Appearance	No slippage, dripping or dropping				
		Pull retainability - % •	80				
		Low temperature flexibility - •	-15		-20		
			No cracking				

a. Only applicable to single layer sheet for machinery fixed engineering work.
b. Only applicable to sheet with mineral granule surface.
c. Only applicable to sheet for heat melting engineering work.

6 Test method

6.1 Standard test conditions

The standard test conditions are 23±2 • .

6.2 Size

Measure the length and width in accordance with GB/T 328.6l; multiply the average values to obtain the sheet size.

6.3 Thickness

Measure the thickness in accordance with GB/T 328.4. For fine sand waterproof sheets, remove the sand granules before measuring the sheet thickness; for mineral granule waterproof sheets, remove the granules and measure the sheet thickness at 60 mm from the edge and using an area of 1 m in length.

6.4 Mass per unit area

Measure the weight of the sheet and calculate the mass per unit area (kg/m^2) with the size obtained in 6.2.

6.5 Appearance

The test should be conducted according to GB/T 328.2.

6.6 Test sample preparation

Cut off the first 2500 mm of the sheet and take the samples evenly from 1 m long sheets according to the method in GB/T 328.4. The size and quantity of the samples for the sheet characteristics test are taken according to Table 3.

Table 3 – Size and Quantity of Samples

Serial No	Test Item		Sample size (lengthwise x width-wise) mm	Quantity Unit
1	Soluble content		100 × 100	3
2	Heat resistance		125 × 100	3 lengthwise
3	Low temperature flexibility		150 × 25	10 lengthwise
4	Water impermeability		150 × 150	3
5	Pull and elongation		(250 ~ 320) × 50	5 each lengthwise and width-wise
6	Mass increase after water permeation		(250 ~ 320) × 50	5 lengthwise
7	Heat aging	Pull and elongation retainability	(250 ~ 320) × 50	5 each lengthwise and width-wise
		Lowe temperature flexibility	150 × 25	10 lengthwise
		Size change and mass loss	(250 ~ 320) × 50	5 lengthwise
8	Oil permeability		50 × 50	3
9	Seam peeling strength		400 × 200 (overlapping side)	2 lengthwise
10	Nail shank tearing strength		200 × 100	5 lengthwise
11	Mineral granule adhesion		265 × 50	3 lengthwise
12	Lower sheet surface bituminous coating thickness		200 × 50	3 lengthwise
13	Artificial climate accelerated aging	Pull retainability	120 × 25	5 each lengthwise and width-wise
		Low temperature flexibility	120 × 25	10 lengthwise

6.7 Soluble content

The test should be conducted according to GB/T 328.26.
For glass fibre felt products, after the soluble content test, place the padding on a flame and observe the result.

6.8 Heat resistance

The test is conducted according to Method A of GB/T 328.11-2007. There should be no dripping or dropping.

6.9 Low temperature flexibility

The test should be conducted according to GB/T 328.14. The curving diameter is30 mm for 3 mm thick sheet and 50 mm for the 4 mm thick sheet and 5 mm thick sheet.

6.10 Water impermeability

The test should be conducted according to Method B of GB/T 328.10-2007. Use a 7-hole tray. The water is taken on the upper surface. For sheets with fine sand or mineral granules on the upper surface, the water is taken on the lower surface. For sheets with fine sand on both surfaces, remove the fine sand along the sealing ring and apply No 60 to 100 hot bitumen evenly along the ring; test the water impermeability after one hour's cooling.

6.11 Pull and elongation

The test should be conducted according to GB/T 328.8. The clamp spacing is 200 mm. Take the average value of 5 samples lengthwise and width-wise. During the test, observe whether there is any peeling between the bituminous coating and padding or cracking on the bituminous coating in the middle of the sample.

6.12 Mass increase after permeation

6.12.1 Test equipment

6.12.1.1 A sink with lid
6.12.1.2 A balance with an accuracy of 0.1g
6.12.1.3 A brush
6.12.1.4 A ventilating oven with a control accuracy of ±2 •
6.12.1.5 A device for hanging the samples

6.12.2 Sample processing

For samples to be tested for mass increase after permeation, brush any loosened sand granules away from the surface, place the sample in an oven (50 ± 2 •), dry for 24 h ± 30 min, place the sample in standard conditions for one hour and then weigh the mass (m_1). There should be no contact between the samples during the drying and placing. Completely immerse the sample in water (23 ± 2 •) for 7 d ± 1h. To prevent sand granules from falling, it is better to place each set of samples separately.

6.12.3 Test procedure

After immersing in water for 7 d ± 1h, remove the sample and fallen sand granules, place them under temperature conditions of 23 ± 2 • and relative humidity at 50 ± 5% for 5 h ± 5min. The samples should be hung vertically with at least 20 mm spacing between each other. Weigh the mass of the sample and the fallen sand granules (m_2).

6.12.4 Result calculation

The mass increase after permeation should be calculated according to formula (1):

$$W = \frac{m_1 - m_2}{m} \times 100 \qquad \text{..... (1)}$$

In the formula:
W – mass increase after the sample processing, %;
m_1 – mass before the sample processing, unit g;
m_2 – mass after the sample processing, unit g.

The arithmetic average value from 5 samples is taken as the test result.

6.13 Heat aging

6.13.1 Test equipment

6.13.1.1 A balance with an accuracy of 0.1g

6.13.1.2 An oven with a control accuracy of ±2 •

6.13.1.3 A vernier calliper with an accuracy of ± 0.02mm

6.13.2 Sample processing

After the size change and mass loss tests the samples can be used in the width-wise pull retainability test and elongation at maximum pull test. New samples may be used if there are any disputes.

For the pull retainability test, elongation retainability test, size change test and low temperature flexibility test, place the samples horizontally on a glass plate spread with talcum power and then place the samples horizontally in an oven set at 80 ± 2 • to be kept at this temperature for 10 d ± 1h.

For samples to be tested for mass loss, cut the sample according to 6.6 and then brush any loosened sand granules away from the surface; place the sample in an oven (50 ± 2 •), drying for 24 h ± 30 min, place the sample under standard conditions for one hour and then weigh the mass (m_1).

The change in size of the sample is tested by measuring the length of the sample (L_1) using a vernier calliper.

There should be no contact between the samples during the drying and placing of them. The mass loss test sample should be placed on separation paper and other samples should be placed horizontally on a glass plate spread with talcum power, then put the samples horizontally in an oven adjusted at 80 ± 2 • , to be kept at this temperature for 10 d ± 1h.

6.13.3 Test procedures

After the heating process for 10 d ± 1h, remove the samples and place them under standard conditions for 2 h ± 5min.

For the pull retainability test sample, conduct the pull test immediately according to 6.11.

For the low temperature flexibility test sample, conduct the test immediately, according to 6.9.

For the size change test sample, measure the length of the sample (L_2) at the original position of measuring L_1 immediately.

For the mass loss test sample, weigh the mass of the sample (m_2) immediately.

6.13.4 Result calculation

6.13.4.1 Pull retainability and elongation retainability

The pull retainability should be calculated according to formula (2):

$$Rt = TS' / TS \times 100 \quad \text{..... (2)}$$

In the formula:
Rt – sample's pull retainability after processing, %,
TS – sample's average value before processing, unit N/50mm;
TS' - sample's average value after processing, unit N/50mm.

The pull retainability is calculated with the average value of 5 samples.

The elongation retainability is calculated according to formula (2).

For PYG padding products, the pull retainability is calculated by the maximum peak value.

For PYG padding products, elongation retainability is calculated by the second peak elongation.

6.13.4.2 Low temperature flexibility

Record if there are any cracks.

6.13.4.3 Size change

The size change of each sample is calculated according to formula (3):

$$D = \left|\frac{L_1 - L_2}{L_1}\right| \times 100 \quad \text{..... (3)}$$

In the formula:
D – the sample's size change after processing (%);

L_1 – the sample's length before processing, unit (mm);
L_2 – the sample's length after processing, unit (mm).

The arithmetic average value of 5 samples is used as the test result.

6.13.4.4 Mass loss

The mass loss is calculated according to formula (4):

$$w = \frac{m_1 - m_2}{m} \times 100 \qquad \text{..... (4)}$$

In the formula:
w – the sample's mass loss after processing, %;
m_1 – the sample's mass before processing, unit g;
m_2 – the sample's mass after processing, unit g.

The arithmetic average value from 5 samples issued as the test result.

6.14 Oil permeability

6.14.1 Equipment

6.14.1.1 An oven with a control accuracy of ±2 •
6.14.1.2 Filter paper – medium speed qualitative filter paper

6.14.2 Sample preparation

Remove the PE coating or find sand on the lower surface from the samples, refer to GB/T 328.11 for the removal method.

6.14.3 Test procedure

Place the processed samples separately on five-layer filter paper larger than the samples, which is placed on glazed tiles, put a weight of 1 kg on each sample and place them horizontally in an oven adjusted to the specified heat resistance temperature for 5 h ± 15min. Then place them under standard test conditions for 1 h, checking how many layers have been permeated.

6.14.4 Calculation of results

Filter paper with any stains will be treated as permeated. The highest permeated layer from 3 tests will be used as the test result.

6.15 Seam peeling strength

The test is conducted according to GB/T 328.20. Use the heat melting method to join the sheet lengthwise at the overlapping area. Take the average peeling strength from 5 samples as the test result.

6.16 Nail shank tearing strength

The test is conducted according to GB/T 328.18. Take the average value from 3 samples as the test result.

6.17 Mineral granule adhesion

The test is conducted according to Method B in GB/T 328.17 - 2007. Take the average value from 5 samples as the test result.

6.18 Lower sheet surface bituminous coating thickness

Cut the samples according to 6.6 and measure the sample's thickness in line with GB/T 328.4. Measure two points, 50 mm from the centre of each sample and take the average value of these two points. Use a hot scraper to remove the lower coating in order to reveal the padding, and leave it to cool down to standard test conditions. Measure the thickness of the original two points of each sample again and take the average value of these two points. The difference between the two measured average thicknesses is the bituminous coating thickness of the lower sheet surface of this sample. Take the average value from 3 samples as the bituminous coating thickness of the lower sheet surface.

6.19 Artificial climate accelerated aging

The test is conducted according to GB/T 18244. Use the xenon arc lamp method. The cumulative radiation energy is 1500 MJ/m^2 (illuminating time about 720 h).

Check the appearance of the sample after aging; the pull retainability is tested according to 6.11 with clamp spacing of 70 mm and calculated according to 6.13.4.1; the low temperature flexibility is tested according to 6.9.

7 Inspection rules

7.1 Inspection classification

The inspection is classified as final factory inspection, periodic inspection and type inspection.

7.2 Final factory inspection

The items of final factory inspection include: mass per unit area, size, thickness, appearance, soluble content, water impermeability, heat resistance, low temperature flexibility, pull, elongation, oil permeability and lower sheet surface bituminous coating thickness.

7.3 Periodic inspection

The periodic inspection item is aging. The inspection should be conducted at least once every 3 months.

7.4 Type inspection

The type inspection items include all requirements stipulated in Article 5. The type inspection is conducted in the following circumstances:

a) New product in production or type appraisal;
b) Annually in normal production;
c) Change of materials or process that could noticeably affect the product performance;
d) Considerable difference found between the final factory inspection and the last type inspection;
e) Restarting production after more than 3 months' suspension of the product;
f) National quality supervision and inspection authorities request a type inspection.

7.5 Batch

Sheets of 10000 m^2 of the same type and specs can be a batch. Sheets of less than 10000 m^2 can also be a batch.

7.6 Sampling

Take 5 rolls of sheet at random from each batch to conduct the tests of mass per unit area, size, thickness and appearance.

7.7 Qualification rules

7.7.1 Single item qualification

7.7.1.1 Mass per unit area, size, thickness and appearance

If all samples from the 5 rolls of sheet meet the requirements set out in 5.1 and 5.2, the mass per unit area, size, thickness and appearance are qualified. If any one item fails to meet the requirements, the samples from another 5 rolls of the same batch can be taken to repeat the failed test. If all tests meet the requirements specified by the standard, this batch is qualified; otherwise this batch fails.

7.7.1.2 Material characteristics

Take one roll of sheet at random from the rolls passed the mass per unit area, size, thickness and appearance qualification tests to conduct the material characteristics test.

7.7.1.2.1 If the soluble content, pull, elongation, water impermeability, heat resistance, seam peeling strength, nail shank tearing strength, mineral granule adhesion, lower sheet surface bituminous coating thickness and its arithmetic average value meet the requirements specified by the standard, this item qualifies.

7.7.1.2.2 If all 3 samples meet the water impermeability requirement specified by the standard, this item qualifies.

7.7.1.2.3 If both sides of the sheet meet the low temperature flexibility requirement specified by the standard, this item qualifies.

7.7.1.2.4 If the maximum value of oil permeability meets the requirement specified by the standard, this item qualifies.

7.7.1.2.5 If all results from the heat aging, artificial climate accelerated aging tests meet the requirement in Table 2, this item qualifies.

7.7.1.2.6 If the test results of all items meet the requirements set out in Table 2, the material characteristics of this product batch qualify. If any one item fails to meet the requirement, randomly take another 5 rolls of sheet from this batch and repeat the failed item test on one of these 5 rolls. If the test meets the requirement specified by the standard, the material characteristics of this batch qualify.

7.7.2 General qualification

If the test results meet all requirements specified in Article 5, this product batch qualifies.

8 Markings, packaging, storage and transportation

8.1 Markings

The outer package of the sheet material should include:

- Name and address of manufacturer;
- Trademark;
- Product label;
- Applicable for heat melting process or not;
- Date of production or batch number;
- Qualification logo;
- Production licence number and its logo.

8.2 Packaging

The sheet materials can be packed using paper, plastic tape, box or plastic bag. The roll should be cylindrically wrapped with both of the unpacked ends measuring less than 100 mm in total. Storage and transportation notes should be marked on the packaging or included in the product leaflet.

8.3 Storage and transportation

8.3.1 Storage

During storage and transportation, products of different types and different specifications should be stored separately without mixing. Avoid exposure to direct sunlight and do not leave in rain. Attention should be paid to ventilation. The storage

temperature should not be higher than 50 •. Vertical storage should only be in single layers and during transportation should only be stacked in double layers.

8.3.2 Transportation

Pressure on the roll or against the roll should be avoided during transportation and, if necessary, the tilt should be used.

8.3.3 Storage shelf life

Under normal storage and transportation conditions, the storage shelf life is one year from the production date.