



**KERAJAAN MALAYSIA
JABATAN KERJA RAYA MALAYSIA
STANDARD SPECIFICATION
FOR ROAD WORKS**

Section 14 : Expansion Joints



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FOREWORD

As practices in road construction change over time, it is imperative for Jabatan Kerja Raya (JKR) to continuously update and improve their standard specifications. These new specifications are not only aimed at keeping abreast with current technologies but also helping in improving the quality of constructed product. In unison, these new specifications have a significant positive impact on the construction industry especially with the incorporation of new products and technologies.

Standard Specification for Road Works is an essential component in the road infrastructure construction industry. This specification provides an improved guidance in the material selection and the production of good quality workmanship and products, based on current best practices. The purpose of this standard specification is to establish uniformity in road works to be used by road designers, road authorities, manufacturers and suppliers of road related products.

This document "Standard Specification for Road Works - Section 14: Expansion Joints" is a part of a series of improved specifications in the Standard Specification for Road Works. The compilation of this document was carried out through many discussions by the technical committee members. Additionally it has been presented at a technical workshop held on 11th – 12th May 2009. Feedbacks and comments received were carefully considered and incorporated in the specification where appropriate.

This Specification had also been presented in the *Mesyuarat Jawatankuasa Spesifikasi Piawai JKR bagi Kerja-kerja Jalan* Bil. 2/2012 on 12th April 2012 and finally approved in the *Mesyuarat Jawatankuasa Pemandu Pengurusan* Bil. 7/2013 on 19th March 2013.

This document will be reviewed and updated from time to time to cater for any changes on policies and current requirements. In this respect, any comments and feedback regarding this specification should be forwarded to Unit Standard & Spesifikasi, Cawangan Kejuruteraan Jalan & Geoteknik.

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SECTION 14 – EXPANSION JOINTS

	PAGE
14.1 DESCRIPTION	S14-1
14.2 MATERIALS	S14-1
14.2.1 General	S14-1
14.2.2 Metals	S14-1
14.2.3 Elastomer	S14-2
14.2.4 Epoxies	S14-2
14.2.5 Epoxy Mortar Nosings	S14-3
14.2.6 Joint Filler	S14-3
14.2.7 Joint Sealing Compound	S14-3
14.2.8 Waterstops	S14-4
14.3 CONSTRUCTION	S14-4
14.3.1 General	S14-4
14.3.2 Prevention of Damage	S14-5
14.3.3 Epoxy Mortar Nosing	S14-5
14.3.4 Sealing	S14-6
14.4 PROPRIETARY JOINTS	S14-6
14.5 WATERSTOPS	S14-7

APPENDIX

<i>APPENDIX A:</i>	S14-8
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TABLE 14.1: PHYSICAL PROPERTIES OF NEOPRENE

SECTION 14 : EXPANSION JOINTS

SECTION 14 – EXPANSION JOINTS

14.1 DESCRIPTION

The Works shall consist of the supply and installing the expansion joints at position shown on the Drawings. All Works shall be done in accordance with this Specification and in conforming with the design, and the lines, grades, dimensions and notes shown on the Drawings and as directed by the S.O.

For the purpose of this Specification, the following terms and definition apply: -

(a) Expansion Joint

A movement joint mainly to allow expansion cause by cyclic and long term structure movement. Expansion joint devices must prevent water and debris infiltration to substructure element below and provide a relatively smooth riding surface over a long service life.

(b) Neoprene

A synthetic rubber which is flexible, oil-resistant and has the other excellent properties of non-flammability and durability when exposed to ultraviolet rays or ozone.

14.2 MATERIALS

14.2.1 General

All parts and element shall be as specified in the Specification and on the Drawings and shall comply with the manufacturer's requirement.

The use of materials for expansion joints other than those on the Drawings shall be to the approval of the S.O. who will require the Contractor to submit samples as soon as possible before the commencement of the Works. The materials used shall conform to the S.O.'s approval and shall be of the same type and quality as the sample submitted for approval.

14.2.2 Metals

End welded studs shall conform to the requirement of Cold Finished Carbon Steel Bars and Shafting ASTM A280. The tensile properties, determined in accordance with ASTM A3370, shall conform to the following minimum requirements: -

Tensile strength	415 N/mm ²
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Yield strength	345 N/mm ²
Elongation	20% in 50mm
Reduction of area	50%

Anchors shall be fabricated from hot rolled mild steel deformed bars conforming to BS 4449 and shall be of weldable quality.

All other steel plates, bars and shapes shall be fabricated from high strength low alloy steel conforming to the requirements of BS 4360 grade 50B, with the additional requirements that the steel shall contain 0.33/0.50 copper.

Bolts, nuts and washers shall be high strength conforming to the requirements of BS 4395: Part 1 General Grade or ASTM 4325, Type 3.

All metallic components (other than stainless steel surfaces, bearing areas and area in contact with the neoprene seal concrete) shall be shop and field painted in accordance with the requirements of BS 5493. Paint System shall be to the approval of the S.O.

The metal surfaces in direct contact with the neoprene seal elements, shall be sandblasted and treated as recommended by the manufacturer so as to provide a high strength bond between the neoprene seal and the mating metal surfaces.

14.2.3 Elastomer

The elastomer portion of the elastomeric expansion joint shall be of the compound known as neoprene which shall have the following physical properties as per Table 14.1 in Appendix A.

14.2.4 Epoxies

Epoxy for bonding the neoprene seals in place shall be one-point moisture curing, polyurethane and hydrocarbon solvent mixture equal to Bon-Lastic Adhesive and meeting the following properties: -

Average Weight per litre	1.2 kgs +10%
Solids Contents by Weight	65%
Material to be fluid	from -15°C to 49°C
Film Strength N/mm ² ,min	14
Elongation	250%

Low temperature 60°F

Tensile - OK

Elongation - Not Brittle

Epoxy for use in coating concrete surfaces and for filling the joint blockout in the concrete after installing and adjusting the expansion joints shall be a two-components epoxy resin adhesive meeting the requirement of AASHTO M235.

Neat epoxy adhesive, or epoxy grout shall be used in filling the gap below bottom of the expansion joint dam.

14.2.5 Epoxy Mortar Nosings

Nosing shall comply with the requirements of BD 33/94 on Expansion Joints for Uses in Highway Bridge Decks.

14.2.6 Joint Filler

Nonextruding and resilient type shall conform to the Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) AASHTO M213 (ASTM D1751).

Bituminous type filler shall conform to the Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) AASHTO M213 (ASTM D1751).

Preformed Joint Fillers shall conform to the Specification for Preformed Expansion Joint Fillers and Concrete (Bituminous Type) AASHTO M33 (ASTM D994).

Preformed Elastomeric Compression Joint Seals shall conform to the Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements AASHTO M220.

14.2.7 Joint Sealing Compound

Poured joint sealing compound shall consist of hot poured materials as described in this Specification.

Rubber bitumen sealant shall consist of hot poured material complying with the requirements of BS 2499.

14.2.8 Waterstops

Adequate waterstops of metals, rubber or plastic shall be placed as shown on the Drawings. Where movement at the joint is provided for, the waterstops shall be of type permitting such movement without injury. They shall be spliced, welded or soldered, to form continuous watertight joints.

Rubber waterstops shall be formed from synthetic rubber, made exclusively from neoprene, reinforcing carbon black, zinc oxide, polymerization agents and softener. This compound shall contain not less than 70% by volume of neoprene. The tensile strength shall not be less than 18.96 N/mm^2 with an elongation at breaking of 600%. The shore Durometer indication (hardness) shall be between 50 and 60 points. After 7 days in air ($70^\circ\text{C}\pm 1$) or after 4 days in oxygen at ($70^\circ\text{C}\pm 1$) and 2.05 N/mm^2 pressure, the tensile strength shall not be less than 65% of the original.

Polyvinylchloride waterstops shall be manufactured by the extrusion process from an elastomeric plastic compound, the basic resin of which shall be polyvinylchloride (PVC). The compound shall contain any additional resins, plasticizers, stabilizers, or other materials needed to ensure that, when the materials is compounded, it will meet the performance requirements given in this Specification. No reclaimed PVC or other material shall be used.

The material shall comply with the following physical requirements when tested under the indicated ASTM test method: -

Specific Gravity	ASTM D 792	1.35Max.
Durometer Hardness	ASTM D 2240	75 \pm 5
Tensile Strength	ASTM D 412	12.4N/mm ² .Min
Elongation	ASTM D 412	350%
Cold Brittleness	ASTM D 746	0°C
Stiffness in Flexure	ASTM D 747	2.4N/mm ² .Min.

14.3 CONSTRUCTION

14.3.1 General

The Contractor shall supply shop drawings indicating all materials specification and dimensions and any additional details not shown on the Drawings.

All Works shall be formed under direction of a competent supervisor experienced in the construction of expansion joint. The Works shall be carried out preferably in a dry weather.

The mixing, application and curing of all proprietary materials shall comply with the manufacturer's requirements.

The same joint system, seal or sealant shall continue across the full width of the deck including footway, verge, hard strip, hard shoulder and central reserve.

The position of all bolts cast into concrete and holes drilled in plates shall be accurately determined from templates.

The Contractor shall ensure that any surface designed to be filled with a compressible materials or which is shown on the Drawings as void, is kept clean of any materials likely to impair the efficiency of the joint and shall provide such means as approved by the S.O. for sealing the joint until such time as a permanent seal can be formed.

14.3.2 Prevention of Damage

The expansion joint during installation shall be adequately protected to ensure that it is not damaged during the placement and finishing of the concrete, asphaltic surfacing, the parapets and any other subsequent construction.

During the placing and hardening of concrete or mortar under expansion joint components, relative movement shall be prevented between them and the supports to which they are being fixed.

When one half of the joint is being set, the other half shall be completely free from longitudinal strain. In particular where strong backs or templates are used to locate the two sides of a joint, they shall not be fixed simultaneously to both sides.

Screw threads shall be kept clean, free from dust and protected from rust. Ramps shall be provided and maintained to protect all expansion joints from vehicular loading. Vehicles shall cross the joints only by means of the ramps until the S.O. permits removal.

14.3.3 Epoxy Mortar Nosing

Nosing should only be applied to sound concrete and if the concrete having crack width greater than 0.1mm or deteriorated, it shall be repaired and making good. Concrete surfaces shall be dry, clean and free from laitance. Before application of the priming coat, loose materials and dust shall be removed by air jet, tested to ensure that no oil is carried over from the compressor.

Unless otherwise specified, surfacing shall be carried across the joint and then cut back to accommodate the nosing. The cutting shall be done with a

diamond saw to give a clean edge throughout the depth of the materials provide to be removed. Masking materials provided to prevent surfacing materials adhering to concrete surface at the joint shall be properly located to prevent displacement by the paving machine.

A priming coat of unfilled epoxy resin composition shall be well worked in by brush to all surfaces with which the nosing are permanently in contact at a uniform rate not less than 0.27 kg/m^2 . The mortar shall then be applied as quickly as possible while the priming coat is still tacky.

The composition and mix proportion of the epoxy mortar shall be submitted for the S.O approval. Aggregate shall either be silica sand, calcined bauxite or other approved synthetic or natural aggregate of suitable grading. The particle size distribution shall be that which produces a mortar with adequate workability and minimum void volume. Aggregate shall be clean and completely dry.

Whichever type of aggregate is used, the epoxy mortar components shall be thoroughly mixed in a suitable mechanical mixer. The sequence, duration and temperature of mixing shall be in accordance with the compounder's instruction.

The mortar shall be placed in position within the time recommended by the compounder. It shall be well worked against the primed surfaces and trowelled flush with the adjacent road surface to form a dense mortar to the profile described on the Drawings.

Epoxy mortar shall generally be compacted in courses of thickness not exceeding 50mm. Where an underlying course is more than 1 hour old it shall, unless otherwise agreed by the S.O., be primed with an unfilled epoxy resin priming coat before placing the mix course.

Traffic shall not be permitted to run the mortar until the S.O. agreement has been obtained.

14.3.4 Sealing

A poured sealant, where specified, shall only be placed when the mean bridge temperature is between 21°C and 38°C in one continuous length.

Joints shall be clean and dry before sealing. Sealant shall not be over-applied. Any excess shall be removed.

14.4 PROPRIETARY JOINTS

Proprietary expansion joints shall be installed by specialist workmen who have been trained and approved by the joint's manufacturer.

The joints shall be installed strictly in accordance with the manufacturer's recommendations and approved by the S.O. The manufacturer shall furnish a two (2) years warranty of satisfactory performance including free non-binding joint movements and water tightness of the joint assembly.

14.5 WATERSTOPS

The waterstops shall be formed with an integral cross section in suitable mould, so as to produce a uniform section with a permissible variation in dimension of 0.8mm. No splices will be permitted in straight strips and special connection pieces shall be well cured in a manner such that any free special connection pieces shall be full moulded. During the vulcanization period the joints shall be securely held by suitable clamps. The material at the splices shall be dense and homogenous throughout the cross section.

The waterstop shall be of the size and shape shown on the Drawings. They shall be dense, homogenous, and without holes or other defect.

The manufacturer shall be responsible for the testing, either in his own or in a recognized commercial laboratory, and shall submit three (3) certified copies of test results to the S.O.

APPENDIX A**Table 14.1 - PHYSICAL PROPERTIES OF NEOPRENE**

Physical Properties	Requirement	ASTM
Tensile strength, min N/mm ²	14	D412
Elongation at break Hardness, Type A	250	D412
Durometer, points	55± 5	D2240 (modified)
Compression set, 70hr at 100°C max	40%	D395 method B (modified)
Oven aging, 70hr at 100% Tensile strength, loss, max	20%	-
Elongation, loss, max	20%	D412
Hardness, Type A durometer (points change)	0 to +10	-
Oil Swell, ASTM oil 3.7hr at 100% Weight change, max	45%	D471
20% strain, 300pphm, in air 70 hours at 40°C (wiped with Toulene to remove contamination)	No cracks	-
Low temperature recovery, 72hrs at - 10°C 50% deflection, min	88%	D2628
Low temperature recovery, 22hrs at -29°C 50% deflection	83%	D2628
High temperature recovery, 72 hours at 100°C min 50% deflection	85%	D2628

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