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No.RW/NH-34059/1/96-S&R *Dated, the 30th November, 2000*

To

The Chief Engineers of States/UT PWDs (Dealing with National Highways and other Centrally Financed Schemes); Director General Border Roads; Chairman, National Highways Authority of India; Engineer-in-Chief, Municipal Corporation of Delhi

Subject: Revised Interim Specifications for Expansion Joints

In supersession of this Ministry's Circular letters of even number dated March 31, and July 21, 1997 on the above subject, please find enclosed herewith revised interim specifications for expansion joints for adoption on all National Highway and other Centrally sponsored bridge projects. Salient points of revised interim specifications are mentioned below:

1.1. **Criteria for Adoption**

1.1.1. Suitability criteria for adoption of different types of expansion joints is given in *Annexure-I.*

It may be noted that some provisions pertaining to single strip seal and modular joints have since been revised in the modified interim specification placed below for further adoption.

1.1.2. Special type of modular expansion joint should be provided for bridges having wide deck and large span length involving complex movements/rotations in different directions/planes, with prior approval of the Ministry.

1.1.3. Dynamic/fatigue testing under simulated conditions shall be done for modular joints to be installed on bridges located in Seismic Zones IV & V.

1.1.4. Specification for strip seal joints contained in Clause 2607 of this Ministry's "Specifications for Roads & Bridge Works" stands substituted by those given herein.

2. While arranging supply of expansion joints, a warranty of trouble-free performance for at least ten years and free rectification of defects/replacement, if any, during this period may be insisted upon from the contractor/suppliers for all types of joints except for buried joints, filler joints and asphaltic plug joint.

3. The performance of the expansion joints shall be observed regularly by the client particularly during the warranty period. The joints showing any defect during this period shall be got repaired/replaced by the respective firms at their own cost failing which the particular supplier may be debarred from supplying their expansion joint system for National Highway works and other Centrally sponsored schemes.

4. It is requested that the contents of this circular be brought to the notice of all officers in your department concerned with National Highways and other Centrally sponsored schemes.

5. It may be noted that a Committee of IRC is already working on a draft code for expansion joints. These interim specifications will be in force till the code is finalised by the Committee and made applicable by the Ministry.

6. You are also requested to send your comments/suggestions, if any, for further improvement of the interim specifications.

7. Please acknowledge receipt of this letter.

[Enclosure to Ministry's Circular No.RW/NH-34059/1/96-S&R dated 30th Nov. 2000]

GOVERNMENT OF INDIA

MINISTRY OF ROAD TRANSPORT AND HIGHWAYS

REVISED

INTERIM SPECIFICATIONS

FOR

EXPANSION JOINTS

I. BURRIED JOINT

Clause 2604 of MOST's Specification for Road & Bridge Works (Third Revision) may be deemed modified as under:

1. This joint shall consist of continuously laid bituminous/asphaltic surfacing over the joint gap bridged by a steel plate resting freely over the top surface of the deck concrete.

2. The width of the joint gap shall be kept as 20 mm.

3. The steel plate shall conform to weldable structural steel as per IS:2062. The plate shall be 12 mm thick and 200 mm wide. The plate shall be made of minimum number of pieces (not exceeding two pieces per traffic lane width) welded together to form the required length.

4. 2 mm dia, 100 mm long nails, spaced at 300 mm centres along the centre line of the plate shall be welded to the bottom surface of the steel plate to protrude vertically into the joint gap in order to prevent dislodging of the plate.

5. The plate and the nails shall be protected against corrosion by galvanising or any other approved anti-corrosive coating with a minimum thickness of 100 micron. These shall be completely free of oil, rust, loose paint or other similar material before application of anti-corrosive coating.

6. The concrete surface shall be free from any loose material and cleared of any grease, oil, paint, etc. and the surface shall be sand blasted, clean of all laitance and level true, prior to placement of the steel plate.

7. The plate shall be placed symmetrical to the centre line of the joint and it shall be ensured that the plate does not get displaced from its position while laying the wearing course.

II. ASPHALTIC PLUG JOINT

1. Asphaltic plug joint shall consist of a polymer modified bitumen binder, carefully selected single size aggregate, closure/bridging metallic plate and heat resistant foam caulking /backer rod.

2. GENERAL REQUIREMENTS

2.1. The joint shall extend to the full depth of the wearing course down to structural concrete. Where needed, a recess may be cut into the deck slab concrete to accommodate the minimum required depth of the joints.

2.2. The joint shall be provided in the entire width of the structure including kerb and/or footpath. A recess in the kerb and/or footpath shall be made to allow the joint to pass beneath them. The expansion gap in the adjoining kerbs and/or footpaths shall be sealed with a suitable sealant, such as, polysulphide sealant

2.3. Expansion joint shall cater for a horizontal movement of 25 mm and vertical movement of 2 mm. This shall be certified by the manufacturer/supplier of the joint.

2.4. The minimum width (in traffic direction) of the joint shall be 500 mm and maximum width shall be 750 mm.

2.5. Minimum depth of joint shall be 75 mm and maximum depth shall not exceed 100 mm.

2.6. The joint shall be capable of performing satisfactorily, within the temperature (ambient) range of -5 to +50 degree C.

3. MATERIAL

3.1. **Binder:** The polymer modified bitumen binder shall have the capacity to fill the gaps and voids between single size aggregate and to impart flexibility to accommodate various design movements. It shall be a patented blend of bitumen, synthetic polymer, fillers and surface active agent and shall be so formulated as to combine necessary fludity for the installation process, low temperature flexibility and flow resistance at high ambient temperatures. The binder shall satisfy following requirement:

Softening point	100 deg. C minimum
Core penetration at 25 deg. C. 0.1 mm (BS:2499)	: 100 mm max.
Flow resistance at 70 deg.C, 5 hours (BS:2499)	: 3 mm max.
Extension Test	: 5 cycle of extension to
(blocks prepared to ASTMD 1190	: 50 per cent at a rate of
and tested to limits BS2499)	: 3.2 mm/hour at 25 deg.C
Safe heating temperature	: 210 deg.C.

3.2. **Aggregates:** The aggregate shall be single size aggregate chosen from basalt granite, grit stone or gabro group. The nominal size of aggregate shall be 12.5 mm for depths of joints upto 75 mm and 20 mm for joints of more depths of joint. The aggregate shall not be flaky and the Flakiness Index shall not be more than 25 per cent. The aggregate shall satisfy following grading requirements:

IS Sieve Designation	Nominal size of aggregate	
	20 mm	12.5 mm
	percentage by weight passing the sieve	
26.5 mm	100	—
19.9 mm	85-100	100
13.2 mm	0-35	85-100
09.5 mm	0-7	0-35
06.3 mm	——	0-7
02.3 mm	0-2	——2
600 micron	——	———
75 micron	0-1	0-1

The aggregate should have good (i) Polished Stone Value (PSV), (ii) Aggregate Abrasion Value (AAV), (iii) Aggregate Impact Value (AIV) and (iv) Aggregate Crush Value (ACV). In addition surface characteristics should promote proper adhesion. The following are the required values:

PSV>60
AAV<05
AIV<18
ACV=10-25

3.3. **Closure Plate:** The closure plate shall be weldable structural steel conforming to IS:2062. The minimum thickness of steel plate shall be 6mm and the width shall not be less than 200 mm. Closure plate shall be provided with as large length as possible and welded together to form the required length. The number of pieces shall not be more than two per traffic lane width. It shall be provided with equidistant holes at a maximum spacing of 300 mm centres for anchorage to the caulking/backer rod along the longitudinal centre line of the plate. The plate shall be protected against corrosion by galvanising or any other approved anti-corrosive coating paint with a minimum thickness of 100 micron.

3.4. **Foam caulking/Backer Rod:** A closed-cell polyolefine or open cell polyurethane foam cylinderical caulking or backer rod having diameter equal to 150 per cent of the joint opening shall be provided. It shall be heat resistant and possess good flexibility and recovery characteristics with density of 25 to 30 kg/cu.m.

4. INSTALLATION

4.1. The expansion joint shall be installed by the manufacturer/supplier.

4.2. The block out for the joint shall be marked and constructed to the dimensions as indicated in the drawing or recommended by manufacturer/supplier.

4.3. The recess for the block out shall be thoroughly cleaned of any loose or foreign material by wire brushing and air blowing and dried with hot compressed air.

4.4. The recess in the deck slab, if required shall be repaired with epoxy mortar and cleaned and dried again.

4.5. The foam caulking/backing rod shall be placed about 25 mm down into the joint opening.

4.6. The aggregate shall be washed, cleaned and heated to a temperature between 120-180 deg. C. prior to placement

4.7. The binder shall be preheated to temperature of 170-190 deg. C before application.

4.8. While sealing the joint opening with preheated binder, care shall be taken that the binder does not spill on to the joint surface of the deck.

4.9. The joint shall not be installed when the ambient temperature goes below +5°C. or above +35°C. or while it is raining/snowing (Planning for installation must take into account the weather condition).

4.10. When element weather resumes, the joint installation may be continued after the upper layer and/or exposed surface of the partially completed joint has been re-prepared by heating and/or coating with binder as necessary.

5. HANDLING AND STORAGE

All the aggregates and binder shall be pre-bagged and clearly marked. All the material shall be stored on concrete platform at 150 mm above the ground in covered enclosures to avoid contamination.

6. TESTS AND STANDARD OF ACCEPTANCE

The material shall be tested in accordance with these specifications and shall meet prescribed criteria. The manufacturer/supplier shall furnish the requisite certificate from the recognised testing laboratory of India or abroad.

The work shall conform to these specifications and shall meet the prescribed standards of acceptance.

III. COMPRESSION SEAL JOINT

1. Compression seal joint shall consist of steel armoured nosing at two edges of the joint gap suitably anchored to the deck concrete and a preformed ehloroprene elastomer or closed cell foam joint sealer compressed and fixed into the joint gap with special adhesive binder.

2. MATERIAL

2.1. **Steel Nosing:** The steel nosing shall be of angle section ISA 100x100 conforming to weldable structural steel as per IS:2062. The thickness of legs shall not be less than 12 mm. The top face of the angle shall be provided with bleeder holes of 12 mm diameter spaced at maximum 100 mm centres so as to ensure that there are no voids in the concrete beneath the angle.

2.2. **Anchorage:** The anchorage steel shall conform to IS:2062 or equivalent.

The steel nosing shall be anchored to the deck by reinforcing bars or anchor plates cast in concrete or a combination of anchor plates and reinforcing bars. Anchor bars shall engage the main structural reinforcement of the deck and in case of anchor plates and anchor loops, this shall be achieved by passing transverse bars through the loops or plates.

The minimum thickness of anchor plates shall be 12 mm. Total cross sectional area of bars on each side of the joint shall not be less than 1600 sq. mm per m length of the joint and the centre-to-centre spacing shall not exceed 250 mm. The ultimate resistance of each anchorage shall not be less than 600 KN/m in any direction.

2.3. Corrosion protection: All steel section shall be protected against corrosion by hot dip galvanising or any other approved anti-corrosive coating with a minimum thickness of 100 microns.

2.4. **Joint Seal**

2.4.1. The sealing element shall be a preformed continuous chloroprene or closed cell foam seal with high tear strength, insensitive to soil, gasoline and ozone. It shall have high resistance to ageing and ensure water tightness. The seal should be vulcanised in a single operation for the full length of the joint required for carriageway, kerbs and footpaths, if any. The seal shall cater for a horizontal movement upto 40 mm and vertical movement of 3 mm.

2.4.2. The physical properties of chloroprene/closed cell foam sealing element shall conform to the following:

(a) Chloroprene seal:

Shall be preformed extruded multi-web cellular section of chloroprene of such a shape as to promote self removal of foreign material during normal service operations. Chloroprene of joint seal shall conform to Clause 915.1 of IRC:83(Part II) and satisfy the properties stipulated in Table 2- strip seal element specifications of these specifications except in respect of the working movement range of the sealing element which shall be as specified in Clause 2.4.1 above.

(b) Closed Cell Foam Seal:

Shall be of preformed non-extruded non-cellular section made from low density closed cell, cross linked ethylene vinyl acetate, polyethylene copolymer that is physically blown using nitrogen. The material shall possess properties as indicated in the Table 1.

TABLE-1

	Property	Special Value.
(i)	Density	41.7-51.3 kg/cu.m.
(ii)	Compression Set on 25 mm	50 per cent compression samples (ASTMD 3575) for 22 hours at 23 degree Celcius, 2 hour recovery; 13 per cent set
(iii)	Working temperature	-70 to+70 deg. C.
(iv)	Water absorption (total immersion for 3 months) (ASTM 3575)	0.09766 kg/sq.m
(v)	Tensile strength	0.8 Mpa.
(vi)	Elongation at break (ASTMD 3575)	195+/- 20 per cent

2.5. **Lubricant-cum-Adhesive:** The type and application of material used in bending the preformed joint seal to the steel nosing and concrete shall be as recommended by the manufacturer/supplier of the seal system.

3. HANDLING AND STORAGE

(i) The expansion joint materials shall be handled with care and stored undercover.

(ii) All joint material and assemblies shall be protected from damage and assemblies shall be supported to maintain true shape and alignment during transportation and storage.

4. INSTALLATION

4.1. The expansion joint shall be installed by the manufacturer/supplier or their authorised representative, who will ensure compliance of installation procedure and instructions.

4.2. The dimension of the joint recess and the width of the gap shall conform to the approved drawing.

4.3. Anchoring steel shall be welded to the main reinforcement in the deck maintaining the level and alignment of the joint.

4.4. Concreting of pocket/recess shall be done with great care using proper mix conforming to same grade as that of the deck concrete but no less man M30 grade in any case. The water-cement ratio shall not be more than 0.40. If needed, suitable admixtures may be used to achieve the workability. The width of pocket shall not be less than 300 mm on either side of the joint. Care shall also be taken to ensure efficient bonding between already cast/ existing deck concrete and the concrete in the joint recess.

4.5. At the time of installation, joint shall be clean and dry and free from spalls and irregularities which might impair a proper joint seal.

4.6. Concrete or metal surfaces shall be clean, free of rust, laitance, oils, dirt, dust or other deleterious materials.

4.7. The lubricant-cum-adhesive shall be applied to both faces of the joint and joint seal prior to installation in accordance with the manufacturer's instructions.

4.8. The joint seal shall be compressed to the specified thickness for the rated joint opening and ambient temperature at the time of installation which shall be between +05 to +35°C.

4.9. The joint seal shall be installed without damage to the seal. Loose fitting or open joints shall not be permitted.

5. ACCEPTANCE CRITERIA

5.1. All steel elements shall be furnished with corrosion protection system.

5.2. For the joint seal the acceptance test shall conform to the requirements stipulated in para 2.4 above. The manufacturer/supplier of this type of joint shall produce a test certificate to this effect conducted in a recognised laboratory in India or abroad.

5.3. Prior to acceptance 25 per cent of the completed and installed joints, subject to a minimum of one joint, shall be subjected to water tightness test. Water shall be continuously ponded along the entire length for a minimum period of 4 hours for a depth of 25 mm above the highest point of deck. The width of ponding shall be atleast 50 mm beyond the anchorage block of the joint on either side. The depth of water shall not fall below 25 mm anytime during the test. A close inspection of the underside of the joint shall not reveal any leakage.

6. TESTS AND STANDARDS OF ACCEPTANCE

The materials shall be tested in accordance with these specifications and shall meet the prescribed criteria. The manufacturer/supplier shall furnish the requisite certificates from the recognised testing laboratory of India or abroad.

The work shall conform to these specifications and shall meet the prescribed standards of acceptance.

IV. STRIP/BOX SEAL EXPANSION JOINT

1. COMPONENTS

Strip seal expansion joint shall comprise the following items:

(a) **Edge Beam**

This shall be either extruded or hot rolled steel section or cold rolled cellular steel section with suitable profile to mechanically lock the sealing element in place throughout the normal movement cycle. Further, the configuration shall be such that the section has a minimum thickness of 10 mm all along its cross-section (flange & web). Thickness of lips holding the seal shall not be less man 6 mm. The minimum height of the edge beam section shall be 80 mm. The minimum cross-sectional area of the edge beam shall be 1500 mm^2.

(b) **Anchorage**

Edge beams shall be anchored to the deck by reinforcing bars, or anchor plates cast in concrete or a combination of anchor plate and reinforcing bars. Anchor bars, shall engage the main structural reinforcement of the deck and in case of anchor plates or loops, this shall be achieved by passing transverse bars through the loops or plates.

The minimum thickness of anchor plate shall be 12 mm. Total cross-sectional area of bar on each side of the Joint shall not be less than 1600 mm sq. per metre length of the joint and the centre-to-centre spacing shall not exceed 250mm. The ultimate resistance of each anchorage shall not be less than 600 kN/m in any direction.

2. MATERIAL

(a) The steel for edge beams shall conform to any of the steel grade corresponding to RST 37-2 OR 37-3 (DIN), ASTM A36 or A588, CAN/CSA Standard G40.21 Grade 300 W or equivalent.

(b) Anchorage steel shall conform to IS:2062 or equivalent

(c) All steel sections shall be protected against corrosion by hot dip galvanising or any other approved anti-corrosive coating with a minimum thickness of 100 micron.

(d) Chloroprene of strip seal element shall conform to Clause 915.1 of IRC:83 (Part II). The properties of chloroprene shall be as specified in Table-2 : strip seal element specifications.

3. FABRICATION (Pre-Installation)

(a) The strip seal joint system and all it's component parts including anchorages shall be supplied by the manufacturer/ system supplier.

(b) The width of the gap to cater for movement due to thermal effect, prestress, shrinkage and creep, superstructure deformations (if any) and sub-structure deformations (if any) shall be determined and intimated to the manufacturer. Depending upon the temperature at which the joint is to be installed, the gap dimension shall be preset.

TABLE 2. STRIP SEAL ELEMENT SPECIFICATION

PROPERTY	SPECIFIED VALUE
Hardness* DIN 53505 ASTM D 2240(Modified)	63±5 Shore A 55 ± 5 Shore A
Tensile strength* DIN 53504 ASTM D412	Min. 11 Mpa Min. 13.8 Mpa
Elongation at fracture* DIN 53504 ASTM D412	 Min. 350 per cent Min. 250 per cent
Tear Propagation Strength Longitudinal Transverse Shock Elasticity Abrasion	Min. 10 N/mm Min. 10N/mm Min. 25 per cent Min. 220 cu.mm.

Residual Compressive Strain (22 h/70°C/30 per cent strain) Ageing in hot air (14 days/70°C)	Max. 28 per cent
Change in hardness	Max. +7 Shore A
Change in tensile strength	Max. -20 per cent
Change in elongation at fracture	Max. -20 per cent
Ageing in ozone (24 h/50 pphm/25°C/20 per cent elongation)	No cracks
Swelling behaviour in Oil (168h/25°C) ASTM oil No. 1 Volume Change Change in hardness	Max. + 5 per cent Max. -10 Shore A
ASTM Oil No.3	
Volume change	Max. + 25 per cent
Change in hardness	Max. -20 Shore A
Cold Hardening Point	Max. -35°C

*Only one set of specifications, viz, ASTM or DIN shall be followed depending on the source of supply.

(c) Each strip seal expansion joint system shall be fabricated as a single entity unless stage construction or excessive length prohibits monolithic fabrication. It shall fit the full width of the structure as indicated on the approved drawing. The system shall be preset by the manufacturer prior to transportation. Presetting shall be done in accordance with the Joint opening indicated on the drawing.

(d) The finally assembled joint shall then be clamped and transported to the work site.

4. HANDLING AND STORAGE

(a) For transportation and storage, auxiliary brackets shall be provided to hold the joint assembly together.

(b) The manufacturer/supplier shall supply either directly to the Engineer or to the Bridge Contractor all the materials of strip seal joints including sealants and all other accessories for the effective installation of the joints.

(c) Expansion joint material shall be handled with care. It shall be stored under cover on suitable lumber padding.

5. INSTALLATION

5.1. The joint shall be installed by the manufacturer/supplier or their authorised representative who will ensure compliance to the manufacturer's instructions for installation.

5.2. Taking the width of gap for movement of the joint into account the dimensions of the recess in the decking shall be established in accordance with the drawings or design data of the manufacturer. The surfaces of the recess shall be thoroughly cleaned and all dirt and debris removed. The exposed reinforcement shall be suitably adjusted to permit unobstructed lowering of the joint into the recess.

5.3. The recess shall be shuttered in such a way that dimensions in the joint drawing are maintained. The formwork shall be rigid and firm.

5.4. Immediately, prior to placing the joint, the presetting shall be inspected. Should the actual temperature of the structure be different from the temperature provided for presetting correction of the presetting shall be done. After adjustment, the brackets shall be tightened again.

5.5. The joint shall be lowered in a pre-determined position. Following placement of the joint in the prepared recess, the joint shall be levelled and finally aligned and the anchorage steel on one side of the joint welded to the exposed reinforcement bars of the structure. Upon completion, the same procedure shall be followed for the other side of the joint. With the expansion joint finally held at both sides, die auxiliary brackets shall be released, allowing the joint to take up the movement of the structure.

5.6. High quality concrete shall then be filled into the recess. The packing concrete must feature low shrinkage and have the same strength as that of the superstructure, but in any case not less than M 35 grade. Good compaction and careful curing of concrete is particularly important. After the concrete has cured, the movable installation brackets and shuttering still in place shall be removed.

5.7. The neoprene seal shall be filled installed in continuous length spanning the entire roadway width. To ensure proper fit of the seal and enhance the ease of installation, dirt, spatter or standing water shall be removed from the steel cavity using a brush, scrapper or compressed air. The seal shall be installed without any damage to the seal by suitable hand method or machine tools.

5.8. As soon as the concrete in the recess has become initially set, a sturdy ramp shall be placed over the joint to protect the exposed steel beams and neoprene seals from the site traffic. Expansion joint shall not be exposed to traffic before the carriageway surfacing is placed.

5.9. The carriageway surfacing shall be finished flush with the top of the steel sections. The actual junction of the surfacing/wearing coat with the steel edge section shall be formed by a wedge shaped joint with a sealing compound. The horizontal leg of the edge beam shall be cleaned beforehand. It is particularly important to ensure thorough and careful compaction of the surfacmg in order to prevent any premature depression forming in it.

6. ACCEPTANCE CRITERIA

(i) All steel elements shall be finished with corrosion protection system.

(ii) For neoprene seal, the acceptance test shall conform to the requirements in Table 1. The manufacturer/supplier shall produce a test certificate accordingly, conducted in a recognised independent laboratory, in India or abroad.

(iii) The manufacturer shall produce test certificates indicating that anchorage system had been tested in a recognised laboratory to determine optimum configuration of anchorage assembly under dynamic loading.

(iv) Prior to acceptance 25 per cent of the completed and installed joints, subject to a minimum of one joint, shall be subjected to water tightness test. Water shall be continuously ponded along the entire length for a minimum period of 4 hours for a depth of 25 mm above the highest point of deck. The width of ponding shall be atleast 50 mm beyond the anchorage block of the joint on either side. The depth of water shall not fall below 25 mm anytime during the test. A close inspection of the underside of the joint shall not reveal any leakage.

(v) Investigation of fatigue strength of the edge beam section with anchorages to withstand 2×10^6 load change cycles of 85 kN vertical load and 10 kN of horizontal load without showing sign of distress shall be required. The supplier shall produce a test certificate in this regard conducted in a recognized laboratory, in India or abroad.

(vi) As strip seal type of joint is specialised in nature, generally of the proprietary type, the manufacturer shall be required to produce evidence of satisfactory performance of this type of joint.

7. TESTS STANDARDS OF ACCEPTANCE

The materials shall be tested in accordance with these specifications and shall meet the prescribed criteria. The manufacturer/supplier shall furnish the requisite certificates from the recognised testing laboratory of India or abroad.

V. MODULAR STRIP/BOX SEAL JOINT

1. A modular expansion joint shall consist of two or more modules/cells to cater to a horizontal movement in excess of 70 mm. It shall allow movements in all 3 directions and rotation about all 3 axes as per the design requirements. It shall ensure that during all movements cycles of the joint, opening and closing (gaps) of all modules are equal.

2. COMPONENT

2.1. The structural system consisting of two edge beams, one or more central/separation beams or lamellas

and cross support bars supporting individuals or multiple central beams to transfer the loads to the bridge deck through the anchorage system.

2.2. Resilient or shock absorption support system for central beams as well as support bars to dampen dynamic loading, thus, reducing the forces transmitted to the substructure and anchorages as also to accommodate vertical and transverse movements apart from longitudinal movement.

2.3. Sliding or control system which allows closing and opening of the joint and also ensures that all modules open and close equally.

2.4. Mechanically locked sealing system of chloroprene which provides watertight, noiseless and easy replacement system.

3. MATERIALS

3.1. **Edge and Central Beams:** These shall be either extruded or hot rolled steel sections or cold rolled cellular steel sections including continuously shop welded sections for central beams with suitable profile to mechanically lock the sealing element in place throughout the normal movement cycle. Further, the configuration shall be such that the section has a minimum thickness of 10 mm all along the cross-section (Flange and Web). The thickness of lips holding the seal shall not be less than 6 mm. The cold rolled cellular sections shall be relieved of any locked in stresses through annealing process. These shall be closed at both ends and be air tight after installation of seal to prevent ingress of moisture in the hollow portion. The minimum height of edge beams and central beam sections shall be 80 mm. Minimum cross-sectional area of edge beam shall be 1500 sq.mm. The material shall conform to any of the steel grade corresponding to RST 37-2 or 37-3 or 52-3(DIN), ASTM A558,CAN/CSA standard G-40.21 Grade 300W or equivalent. The material for support bars may be same as that of edge/central beams or as per manufacturer's recommendations.

3.2. **Chloroprene Seal:** This shall be a preformed extruded single strip or cellular section of chloroprene of such a shape as to promote self removal of foreign material during normal joint operation. The seal shall possess high tear strength and be insensitive to oil, gasoline and ozone. It shall have high resistance to ageing and ensure water tightness.

Chloroprene seal shall conform to Clause 915.1 of IRC:83(Part II). The properties of chloroprene shall conform to Table 2-strip seal element specification of these specifications.

3.3. **Anchorage:** The anchorage steel shall conform to IS:2062 or equivalent.

3.3.1. Edge beams shall be anchored to the deck by anchor plates cast in concrete or a combination of anchor plate and reinforcing bars. Anchor plates or loops shall be anchored by passing transverse bars through the loops or plates.

3.3.2. The minimum thickness of anchor plate shall be 12 mm. Anchor bars on each side of the joint shall not be less than 1600 mm sq.per metre length of the joint and the centre anchor bars to centre spacing shall not exceed 250 mm. The ultimate resistance of each anchorage shall not be less man 600 kN/m in any direction. The anchor loop at the edge profiles should be at a right angle to the joint. Planned deviations of this direction are allowable only for the range of 90° +/- 20°. (The anchoring reinforcement of the construction must lie parallel to the anchor loops).

3.4. **Support and Control System:** The overall system and components of the resilient/shock absorption system and sliding/control system shall conform to the specifications recommended by the manufacturer. The centre-to-centre spacing of transverse support bar shall not exceed 1.75 m.

3.5. **Corrosion Protection:** All steel sections shall be protected against corrosion by hot dip galvanising or any other approved anti-corrosive coating with a minimum thickness of 100 micron.

4. FABRICATION (pre-installation)

4.1. The modular expansion joint system and all its component parts including anchorages shall be supplied by the manufacturer.

4.2. The width of the gap to cater for movement due to thermal effect, prestress, shrinkage and creep, superstructure deformations (if any) and sub-structure deformations (if any) shall be determined and intimated to the manufacturer. Depending upon the range of temperature at which the joint is likely to be installed, the gap dimension shall be present.

4.3. Each modular expansion joint system shall be fabricated as a single entity free from any joint in the longitudinal direction unless stage construction or excessive length prohibits monolithic system shall be preset by the manufacturer prior to transportation. Pre-setting shall be done in accordance with the joint opening indicated on the drawing.

4.4. The finally assembled joint shall then be clamped and transported to the work site.

5. HANDLING AND STORAGE

5.1. For transportation and storage, auxiliary brackets shall be provided to hold the joint assembly together.

5.2. The manufacturer/supplier shall supply either directly to the Engineer or to the Bridge Contractor entire assembly of Modular Strip/Box Seal joints including sealants and all other accessories for the effective installation of the joints.

5.3. Expansion joint material shall be handled with care. It shall be stored under cover on suitable lumber padding.

6. INSTALLATION

6.1. The joint shall be installed by the manufacturer/supplier only.

6.2. Taking the width of gap for movement of the joint into account, the dimensions of the recess in the decking shall be established in accordance with the drawings or design data of the manufacturer. The surface of the recess shall be thoroughly cleaned and all dirt and debris removed. The exposed reinforcement shall be suitably adjusted to permit unobstructed lowering of the joint into the recess.

6.3. The recess shall be shuttered in such a way that dimensions in the drawing are maintained. The formwork shall be rigid and firm.

6.4. Immediately prior to placing the joint, the presetting shall be inspected. Should the actual temperature of the structure be different from the temperature provided for presetting, correction of the presetting shall be done. After adjustment, the brackets shall be tightened again.

6.5. The joint shall be lowered in a pre-determined position. Following placement of the joint in the prepared recess, the joint shall be levelled and finally aligned and the anchorage steel on one side of the joint welded to the exposed reinforcement bars of the structure. Upon completion, the same procedure shall be followed for the other side of the joint. With the expansion joint finally held at both sides, the auxiliary brackets shall be released, allowing the joint to take up the movement of the structure.

6.6. Controlled concrete having strength not less than that in superstructure subject to the minimum of M35 shall be filled into the recess. The packing concrete must feature low shrinkage. Good compaction and careful curing of concrete is particularly important. After the concrete has cured; the movable installation brackets and shuttering still in place shall be removed.

6.7. The chloroprene seal shall be field installed in continuous lengths spanning the entire roadway-width. To ensure proper fit of the seal and increase the ease of installation, dirt, spatter or standing water shall be removed from the steel cavity using a brush, scrapper or compressed air. The seal shall be installed without damage to the seal by suitable hand method or machine tools.

6.8. As soon as the concrete in the recess has become initially set, a sturdy ramp shall be placed over the joint to protect the exposed steel beams and neoprene seals from site traffic. Expansion joint shall not be exposed to traffic loading before the carriageway surfacing is placed.

6.9. The carriageway surfacing shall be finished flush with the top of the steel sections. The actual junction of the surfacing/wearing coat with the steel edge section shall be cleaned beforehand. It is particularly important to ensure thorough and careful compaction of the surfacing in order to prevent any premature depression forming in it.

7. ACCEPTANCE CRITERIA

7.1. All steel elements shall be finished with corrosion protection system.

7.2. For chloroprene seal, the acceptance test shall conform to the requirements stipulated in para 2(d) under strip/ box seal expansion joints.

7.3. The manufacturer/supplier shall produce a test certificate accordingly, conducted in a recognised laboratory, in India or abroad.

7.4. Fatigue strength of internal beams and support connections shall be investigated to withstand 2 million cycles of vertical load of 85 kN and a horizontal load of 10 kN without showing signs of distress. The supplier shall have to produce a test certificate in this regard conducted by a recognised laboratory from India or abroad.

7.5. The manufacturer/supplier shall produce test certificates indicating that anchorage system had been tested in a recognised laboratory to determine optimum configuration of anchorage assembly under dynamic loading.

7.6. Prior to acceptance 25 per cent of the completed and installed joints, subject to a minimum of one joint, shall be subjected to water tightness test. Water shall be continuously ponded along the entire length for a minimum period of 4 hours for a depth of 25 mm above the highest point of deck. The width of ponding shall be atleast 50 mm beyond the anchorage block of the joint on either side. The depth of water shall just fall below 25 mm anytime during the test. A close inspection of the underside of the joint shall not reveal any leakage.

7.7. As modular strip/box seal type of joint is specialised in nature, generally of the proprietary type, the manufacturer shall be required to produce evidence of satisfactory performance of his product.

8. TESTS AND STANDARDS OF ACCEPTANCE

The materials shall be tested in accordance with these specifications and shall meet the prescribed criteria. The manufacturer/supplier shall furnish the requisite certificates from the recognised testing laboratory in India or abroad. The work shall conform to these specifications and shall meet the prescribed acceptance.

VI. CRITERIA FOR PERMITTING FOR LOCAL MANUFACTURING OF EXPANSION JOINTS BY INDIAN FIRMS/JOINT VENTURES

1. Manufacturing of expansion joint system by Indian firms/joint venture shall be allowed under appropriate license of and with technical collaboration of the foreign principal manufacturer of repute under the following conditions:-

(i) The materials and the finished products for unitary/modular strip seal expansion joints shall be of the similar specification and quality as of those used for the expansion joints being manufactured by the principal company abroad.

(ii) The foreign principal shall have direct participation in the quality assurance system both in regard to manufacture and testing of the joints in India through their engineers who shall make periodic visits to India for imparting training and expertise in the manufacture and testing as well as to supervise the quality control and testing procedure of the joints to be manufactured by the Indian firm to ensure full technology transfer to the Indian firms. The manufacturing process, facilities available for manufacture and testing of the joints with the Indian firm and the testing procedure are required to be certified by the foreign principal before the joints are manufactured on regular basis in India.

(iii) The foreign principal manufacturer along with the Indian firm shall furnish a joint guarantee against the defective materials used in manufacture, workmanship as well as a guarantee for quality assurance at various stages of manufacture of the strip seal/modular seal expansion joints in India. This guarantee shall remain valid for a period of 10 years from the date of supply of the joints to the client except for the defects arising out of the force majeure situations.

(iv) The firm shall arrange for all testing of the joints to be carried out in India at their establishment or at an independent laboratory. Tests such as dynamic testing which cannot be performed for want of facilities in India at present shall be got done through the foreign principal who shall furnish the necessary certificate for acceptance.

(v) There should be clear stipulation in the technical collaboration agreement that the foreign manufacture will have "buy back" arrangement of the Indian product manufactured in India under their license for marketing in other countries. This will ensure that the foreign collaborator accepts the Indian product as equivalent to their original product in use abroad.

(vi) An original sample of the foreign manufacturer's joints shall be kept at the Indian manufacturer's works factory for comparing the quality, dimensions, finish, etc. of the Indian products while inspecting these products by the client against specific orders for supply.

2. The firm seeking permission to manufacture the joints in India shall submit the relevant supporting documents to ensure compliance to the stipulations contained in paras (i) to (vi) above and to prove that the joints shall be manufactured by them as per the Revised Interim Specifications.

Annexure-I

SUITABILITY CRITERIA

FOR

ADOPTION OF DIFFERENT TYPES OF EXPANSION JOINTS

Sl. No.	Type of Expansion joints	Suitability for adoption of joint	Expected Service life	Special Consideration
(1)	(2)	(3)	(4)	(5)
1.	Buried Joint	Simply supported spans upto 10 m	10 years	Only for decks with bituminous/ asphaltic wearing coat. Steel plate may need replacement if found corroded or distorted at the time of relaying/renewal of wearing coat
2.	Filler Joint	Fixed end of simply supported spans with insignificant movement of simply supported spans not exceeding 10 m.	10 years	The sealant and joint filler would need replacement if found damaged.
3.	Asphaltic Plug Joint	Simply supported spans for right or skew (upto 20 degree) moderately curved or wide deck with maximum horizontal movement not exceeding 25 mm. Ambient temperature should be in the range of 5 degree to 50 degree celcius.	10 years	Only for decks with bituminous/ asphaltic wearing coat. Not suitable for bridge with longitudinal gradient more than 2 per cent and cross camber/super-elevation exceeding 3 per cent. Not suitable for curved spans and spans resting on yielding supports.
4.	Compression Seal Joint* (Chloroprene/ Seal & Closed Cell Foam Seal)	Simply supported or continuous spans right or skew (upto 30 degree), moderately curved with maximum horizontal movement not exceeding 40 mm)	10 years	Chloroprene/Closed Foam Seal may need replacement during service.
5.	Elastomeric Slab Seal Joint*	Simply supported or continuous spans. Right or skew (less than 20 degree), moderately curved with maximum horizontal movement upto 50 mm	10 years	Liable to excessive wear and tear under high traffic intensity. Not suitable for bridges located in heavy rainfall area and spans resting on yielding supports.

(1)	(2)	(3)	(4)	(5)
6.	Single Strip Seal joint*	Moderate to large simply supported cantilever/ continuous construction having right skew or curved deck with maximum horizontal movement upto 70 mm	25 years	Elastomeric seal may need replacement during service.
7.	Modular Strip/ Box Seal Joint*	Large to very large continuous/ cantilever construction with right deck having maximum horizontal movement in excess of 70 mm	25 years	Elastomeric seals may need replacement during service.
8.	Special* joints for special conditions	For bridges having wide deck and large span length involving complex movements/rotations in different directions/planes, provision of special type of modular expansion joints, such as, Swivel Joists joints may be made	25 years	Elastomeric seal may need replacement during service. Provision of these joints may be made with prior approval of the Ministry.

*These are proprietary items for which 10 years warranty shall be insisted upon