INSTALLATION MANUAL
FOR
MODULAR EXPANSION JOINT
(LG SYSTEM)
TABLE OF CONTENTS

1. INTRODUCTION TO THE MODULAR EXPANSION JOINT
   1.1 Purpose
   1.2 How They Work
   1.3 Movement Capacity
      1.3.1 Longitudinal Direction - ex:
      1.3.2 Transverse Direction - ey:
      1.3.3 Vertical Direction - ez:
      1.3.4 Rotation \( \Phi_X, \Phi_Y, \Phi_Z \)
   1.4 Design Drawing

2. TRANSPORTATION AND STORAGE
   2.1 Transportation and Handling
   2.2 Storage

3. INSTALLATION
   3.1 Inspection
   3.2 Preparation of the Recess
   3.3 Shuttering
   3.4 Placing in the Recess
   3.5 Connecting
      3.5.1. The 1st Side
      3.5.2. The 2nd Side
   3.6 Concreting
   3.7 Asphalt Surfacing

APPENDIX – INSTALLATION RECORD SHEET
1. INTRODUCTION TO THE MODULAR EXPANSION JOINT

1.1 Purpose

A modular expansion joint forms the load-carrying link between the abutment and the deck or between individual decks of a bridge. Their purpose is to create a transition that maintains a high level of riding comfort for the vehicles and limits noise output from this traditionally problematic part of a bridge structure. To achieve this the expansion joint accommodates movements resulting from settlement of piers and abutments, temperature variation, traffic load and from creep and shrinkage of the concrete.

1.2 How They Work

The total longitudinal movement capacity is divided into individual, smaller gaps by the lamellas. These gaps are made watertight with locked in elastomeric profiles (lock seal).

Absorbing Impact:

1. The Connection Between our center beam & support beam is an elastic connection
2. Therefore impact energy is dampened by the connection

The lamellas are connected to joists (support beams) via a pre-stressed free-sliding system. The joists themselves are supported by a similar system in the joist boxes. The elastomeric control springs coordinate individual movements (spacing) of the lamellas in conjunction with the elastomeric profiles. This forms a dynamic system that can absorb any combination of braking or accelerating forces applied by the traffic. This elastic system heavily reduces the forces acting directly on the other expansion joint components and also on the adjacent bridge structure, thus extending the life span of the entire system.
The residual horizontal loads are transmitted through the L-shaped edge profile and anchorage system into the bridge deck. Vertical loads are transmitted from the lamellas and sliding bearings to the joist beams and from there through sliding bearings (situated in the joist box) into the adjacent bridge structure.

1.3 Movement Capacity

The advantage given by the elastic support system and the free-sliding lamellas is the 3-dimensional movement and rotational capacity of the expansion joint. Combinations of any translations ($e_x$, $e_y$, $e_z$) and rotations ($\varphi_x$, $\varphi_y$, $\varphi_z$) around all 3 axes are possible.

The Modular Expansion Joint is especially suited to accept movement in longitudinal direction. The total movement capacity depends on the number of lamellas.

<table>
<thead>
<tr>
<th>Type</th>
<th>$b_1$</th>
<th>$b_2$</th>
<th>$h$</th>
<th>$f_{min}$</th>
<th>$f_{50}$</th>
<th>$f_{70}$</th>
<th>$f_{90}$</th>
<th>$G$(Wt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LG2</td>
<td>400</td>
<td>15.7</td>
<td>400</td>
<td>15.7 5.9</td>
<td>260 10.2</td>
<td>280 11.0</td>
<td>300 11.8</td>
<td>150 99</td>
</tr>
<tr>
<td>LG3</td>
<td>480</td>
<td>18.9</td>
<td>400</td>
<td>15.7 10.2</td>
<td>400 15.7</td>
<td>430 16.9</td>
<td>460 18.1</td>
<td>210 139</td>
</tr>
<tr>
<td>LG4</td>
<td>560</td>
<td>22</td>
<td>400</td>
<td>15.7 11.8</td>
<td>540 21.3</td>
<td>580 22.8</td>
<td>620 24.4</td>
<td>250 165</td>
</tr>
<tr>
<td>LG5</td>
<td>640</td>
<td>25.2</td>
<td>400</td>
<td>15.7 15.0</td>
<td>680 26.8</td>
<td>730 28.7</td>
<td>780 30.7</td>
<td>290 195</td>
</tr>
<tr>
<td>LG6</td>
<td>720</td>
<td>28.3</td>
<td>400</td>
<td>15.7 18.1</td>
<td>820 32.3</td>
<td>880 34.6</td>
<td>940 37.0</td>
<td>410 275</td>
</tr>
<tr>
<td>LG7</td>
<td>800</td>
<td>31.5</td>
<td>420</td>
<td>16.5 21.2</td>
<td>960 37.8</td>
<td>1030 40.5</td>
<td>1100 43.3</td>
<td>500 335</td>
</tr>
<tr>
<td>LG8</td>
<td>880</td>
<td>34.6</td>
<td>440</td>
<td>17.3 24.4</td>
<td>1100 43.3</td>
<td>1180 46.5</td>
<td>1260 49.6</td>
<td>596 400</td>
</tr>
<tr>
<td>LG9</td>
<td>960</td>
<td>37.08</td>
<td>450</td>
<td>17.7 27.5</td>
<td>1240 48.8</td>
<td>1330 52.4</td>
<td>1420 55.9</td>
<td>745 500</td>
</tr>
<tr>
<td>LG10</td>
<td>1040</td>
<td>41.0</td>
<td>460</td>
<td>18.1 30.7</td>
<td>1380 54.3</td>
<td>1480 58.26</td>
<td>1580 62.2</td>
<td>1060 713</td>
</tr>
<tr>
<td>LG12</td>
<td>1200</td>
<td>47.2</td>
<td>500</td>
<td>19.7 37.0</td>
<td>1660 65.4</td>
<td>1780 70.0</td>
<td>1900 74.8</td>
<td>1340 900</td>
</tr>
</tbody>
</table>

Standard Dimensional Details of Modular Expansion Joint
1.3.1 Longitudinal Direction ($e_x$):

<table>
<thead>
<tr>
<th>Joint type</th>
<th>Movement capacity $e_x$ (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNITARY</td>
<td>1x80 = 80 mm</td>
</tr>
<tr>
<td>LG2</td>
<td>2x80 = 160 mm</td>
</tr>
<tr>
<td>LG3</td>
<td>3x80 = 240 mm</td>
</tr>
<tr>
<td>LG4</td>
<td>4x80 = 320 mm</td>
</tr>
<tr>
<td>LG5</td>
<td>5x80 = 400 mm</td>
</tr>
<tr>
<td>LG6</td>
<td>6x80 = 480 mm</td>
</tr>
</tbody>
</table>

1.3.2 Transverse Direction ($e_y$):

Condition: Max rotation angle of the joist relative to the x-axis;

$\varphi_2 = <3\%$)

1.3.3 Vertical Direction ($e_z$):

Condition $\varphi_y = < 3\%$)

1.3.4 Rotations ($\varphi_x, \varphi_y, \varphi_z$):

$\varphi_x$: determined by $\varphi_y$ max.

$\varphi_y$: $\varphi_y < 3\%$

$\varphi_2$: determined by the degree of expansion/contraction of the bridge.
1.4 Design Drawing

Typical Cross section at Stirrup Box:
2. TRANSPORTATION AND STORAGE

2.1 Transportation and Handling

Expansion joints are long and relatively slim steel constructions with a considerable weight and require careful handling to avoid damages at unloading.

Lifting points for straps and chains are generally marked in yellow. If a single crane only is used for lifting and lowering into position, then the angles between the two straps must not exceed 45°. Otherwise, the use of a lifting-beam is recommended.

N.B. *Never use the pre-setting brackets as lifting points.*

2.2 Storage

The expansion joint must be stored on wooden beams (approx. 12 cm x 12 cm) placed under the joist boxes, if installation is not immediately made after unloading. The wooden beams must be laid horizontally to avoid tensions and torsion within the expansion joint.
3. INSTALLATION

3.1 Inspection

The modular expansion joint should be thoroughly inspected to see if damage occurred during shipment.

In case of damage, silicone caulk is applied to seal any gaps between the bulkhead and joint, or in the support bar boxes to ensure that no concrete can enter the joints during the pour.

Cold galvanizing paint is applied to any blemishes that may occur during the shipment of the joint.
3.2 Preparation of the Recess/Block-out.

The recess must suit in size and form to the geometry of the expansion joint. In order to avoid difficulties during installation, the following points must be checked and considered.

- Dimension check of recess/Block-out
- Check of the levels
- Check of the skew and slope
- Check of the designed gap between bridge deck and abutment and/or between adjoining decks.
- Checking of the existing structural reinforcement according to the drawings.

Usually, the rebars should be placed at 150 mm intervals. Missing rebars must be replaced by insertion bars penetrating sufficiently deep into the concrete. Otherwise make drill holes in the block-out and fix by epoxy short weldable reinforcement bars to fix the anchor lugs of MEJS.

Rebars that would obstruct the installation of the expansion joint should be bent to accommodate the expansion joint anchorages. Larger diameter rebars should be heated prior bending to avoid fractures.

If required, removing or cutting off interfering reinforcing shall only be done after consultation with the engineer-in-charge.

The recess must be cleaned thoroughly. If necessary the surface should be roughened. All loose debris must be removed with pressurized air.
3.3 Shuttering

Shuttering plates must be used to seal the space between the undersides of the joint and the vertical face of the recess.

The expansion joint is laid on transversally placed wooden beams approx. 40 - 60 cm above the recess. Shuttering plates of 3 mm thickness are then welded to the underside of the joint. Gaps, resulting from the wooden beams, are to be sealed prior lowering the joint into the recess.

The shuttering must be fitted in such a way that it forms an appropriate seal against the edge of the recess. If required, the shuttering plates can be tensioned by connecting to the reinforcement bars with fixing wires. Otherwise props can be also used between two shuttering plates.

3.4 Placing in the Recess/Block-out

Level marks must be set next to the recess by the installation engineer. This enables a controlled leveling of the expansion joint.

Lowering the expansion joint into the recess with a crane alone is not recommended. With hand-operated jacks, the entire length of the joint can be evenly lowered into the recess. (The number of jacks depends on the joint length).

As soon as the joint is accurately placed, the engineer in charge shall provide a written confirmation of the correct placement of the joint.
3.5 Connecting

3.5.1 The 1st Side
The side where the least longitudinal movement is expected (either the abutment of the bridge deck side) is designated the 1st side for connecting the joint. If required, the preliminary fixing is made by evenly placing then welding of rebars over the entire length between the stud and the deck reinforcement. Otherwise make drill holes in the block-out and fix by epoxy short weldable reinforcement bars to fix the anchor lugs of MEJS.

To facilitate concreting, it is recommended that the gap between recess and shuttering sealed by a grout seam of approx 80 X 80 mm. The seam must be left to dry prior to final concreting.

After this, if required, additional rebars are welded until all studs are firmly connected to the deck reinforcement. The expansion joint is sufficiently fixed when no vibrations are noted when lightly bouncing on the joint.

N.B. The extent of the fixing of the expansion joint described above is not designed to accept dynamic loads from traffic. It serves only to firmly pin the expansion joint in the recess until the concrete has been poured and sufficiently cured. It is, therefore, vital that the expansion joint is not subject to any loads that could in any way displace the precise location of this fixing.

3.5.2 The 2nd Side
Depending on the size of the expansion joint and the expected movement during the installation, the most suitable time must be determines for the fixing of the 2nd (opposite) side (Please refer to the gap setting chart as mentioned in the particular drawing of MEJS). Usually this is the early morning hours with the smallest temperature deviations.

The procedure is identical to that at the 1st side. As fast as possible, preferably with several fitters at the same time, the joint is provisionally fixed to the reinforcement.

N.B. Immediately afterwards, the fixation brackets must be removed. The expansion joint can now follow the longitudinal movement of the bridge.

Thereafter, seal the gap between recess and shuttering with an 80 mm x 80 mm grout seam and weld the remaining rebars, as described previously.

Thereafter, the joint is precisely and adjusted in the longitudinal, transverse and vertical planes. If required, the joint must also be adjusted to the gradient of the final surface level.
3.6 Concreting

**Reinforcement**
Once the modular expansion joint is placed in the block-out, the remainder of the reinforcing steel can be inserted. The rebar needs to be high enough in the block-out, close to the top of the anchorage.

**Joint Release**
Once the joint is deemed to be straight and at the right grade the joint can be released. Please refer the specific shop drawing of MEJS regarding gap-presets. This is done by welding the edges of the joint to the reinforcement bars and removal of the gap width bars on top of the joint. Otherwise make drill holes in the block-out and fix by epoxy short weldable reinforcement bars to fix the anchor lugs of MEJS.

**Concrete Protection**
After all reinforcing steel is in place, the top surface of the modular expansion joint should be protected. This can be accomplished by placing plywood, bit board, Masonite or plastic across the top and secured with duct tape.

Gaps in the bulkhead should be filled with foam or bit board.
Prior to the concrete pour, the contractor must check to determine that no concrete can protrude into the support bar boxes.

**Concrete Pour**
The concrete must be poured to the exact level surface of the roadway to assure a smooth transition between the roadway and the modular expansion joint.

A vibrator should be used to ensure that concrete is sufficiently placed underneath the support bar boxes.

The concrete should be leveled out at least 3mm above grade to protect the expansion joint and allow for the setting of the concrete which reduces the total height.
3.7 **Asphalt Surfacing**

If required, an insulation sheet is clued to the horizontal flange of the edge profile prior to asphalting.

In order to get a smooth transition, the asphalt must be leveled precisely to the joint. It is common that the top surface of the asphalt is approx. 2 -4 mm higher than the edge profile of the joint.

As the connecting surface to the joint is subject to heavy load impact it is recommended to install a transition strip of mastic asphalt on both sides of the joint.
## Appendix – Installation Record Sheet

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Place of Installation (Abutment, Piers)</td>
</tr>
<tr>
<td>2</td>
<td>Date of Delivery</td>
</tr>
<tr>
<td>3</td>
<td>Presetting brackets firm and fixed</td>
</tr>
<tr>
<td>4</td>
<td>Presetting value acc. Drawings or instruction</td>
</tr>
<tr>
<td>5</td>
<td>Corrosion protection and cleanliness</td>
</tr>
<tr>
<td>6</td>
<td>Regularly unloaded, stored, protected</td>
</tr>
<tr>
<td>7</td>
<td>Installation manual available, complete</td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Temperature Air / Structure (°C)</td>
</tr>
<tr>
<td>12</td>
<td>Presetting value changed / corrected</td>
</tr>
<tr>
<td>13</td>
<td>Presetting brackets released, removed</td>
</tr>
<tr>
<td>14</td>
<td>Distance between inner side of edge profile after connecting with the structure</td>
</tr>
<tr>
<td>15</td>
<td>Installation levels, directions, checked</td>
</tr>
<tr>
<td>16</td>
<td>Approved for concreting, Date</td>
</tr>
<tr>
<td>17</td>
<td>Delivery Sheet No. of the concrete</td>
</tr>
<tr>
<td>18</td>
<td>Concreting done, Date</td>
</tr>
<tr>
<td>19</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Remarks, Notes</td>
</tr>
</tbody>
</table>

Recorded: ________________________  Signature: ________________________

Place: ________________________  Date: ________________________

Place: ________________________  Date: ________________________

________________________  __________________________
Contractor                      Client