Important Notice: This document has been compiled to provide general technical information and advice on GRP Permadec® Panels. The installation information given is provided only as general guidance for trade contractors. This document does not form a specification. The responsibility for the installation of the panels rests wholly with the contractor and not with EMJ Plastics.

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EMJ Permadec® Formwork Panels are primarily used as permanent bridge beam infill shuttering.

In addition the many advantages of the strong, lightweight, durable, steel reinforced glass fibre panels extend its range of uses to include the construction of:-

- Platforms
- Ramps
- Floors
- Sewage Treatment Plants
- Culvert’s
- Jetty’s
- Tanks
- Capping Slab/Roof

AND MANY OTHER APPLICATIONS

The ease of installation and lightweight nature of Permadec® enables customers to make savings on site labour from reduced handling costs. As the panels are custom built and delivered ready for use, minimal on-site cutting is required.

Access to the underside of the panel is unnecessary, eliminating the need for expensive scaffolding or staging. As the panels are a permanent fixture, the requirement for stripping after casting is eliminated.

EMJ has supplied Permadec® Panels to over 4,500 structures in the UK alone. EMJ has exported panels across the world, and has supplied projects to Czech Republic, Poland, Trinidad, Cayman Islands, Jamaica, Sri Lanka, and others. The makeup of the panels lends itself ideally to international shipping as it is relatively light in weight and stackable, therefore maximising the use of available space on container loads.
EMJ Plastics has been manufacturing GRP products for the construction industry for over 40 years and is long established as the UK’s leading manufacturer of GRP Permanent Bridge Deck Formwork.

2.1 ADVANTAGES

If you are constructing or designing a concrete deck you may save time and money with the EMJ Permadec® formwork system.

Permadec® offers all the advantages of a lightweight, versatile permanent formwork system, some of which are listed below. It is capable of spanning up to 5.7 metres with loads in excess of a 700mm concrete deck. EMJ Permadec® Panels comply with all relevant design standards including Department of Transport Advice Note BA 36/90. Further information is available online at: www.emjplastics.com

Safe Working Platforms
When panels have been laid they are safe to use as a working platform.

Time Saving
• Panels are manufactured to size to suit standard, skewed or tapered decks, minimising on cutting, reducing expensive site labour time.
• Manufacture and curing period is relatively short allowing extra panels to be ordered at short notice.
• Incredibly fast to lay. Laying rates, including sealing joints between panels and beams vary between 9 to 20m² per man per hour. (This installation rate compared with traditional temporary plywood decking of 0.4 to 0.5m² per man per hour is a significant advantage).
• EMJ Permadec® can be laid up to 6 times quicker than Concrete panel systems, and has the added advantage of being easily cut on site to suit, for example splice/connection plates.
• Possession times can be reduced further by installing panels to braced pairs of steel beams either at the steel fabricators yard ready to ship installed directly to site or perhaps at ground level on site prior to lifting into position.

Cost Saving
• Minimum craning is required as two men can handle panels up to 2m in length
• Lifting holes can be incorporated through the panel ribs for easier cranage (please advise of this requirement when ordering)
• No intermediate support or under bridge access is required
• No Silane or other treatment necessary (as required with concrete formwork system)
• No further requirements after casting of deck
• Reduced lane rental costs and shorter possession periods.

FURTHER BENEFITS
• Specially designed Butyl Sealant System prevents grout loss and enables concrete pours outside possession times and prevents ingress of moisture during bridge usage.
• Safe to handle with no associated hazards or risk – MSDS Available upon request
• Resistant to chemicals (Full listing can be provided upon request)
• Resistant to salt attack
• Zero water absorption. Impermeable GRP gives a very good protection layer to the concrete and rebar (0.5mm GRP equivalent to 50mm of concrete cover to rebar)
• Capable of withstanding high amplitude vibrations
• High resistance to climate variation
• Good impact and abrasion resistance
• High strength to weight ratio
• Extremely versatile, numerous variations can be produced including, pre-cambered, notched ends, trough and haunched shaped, cantilever etc.
• Rib depths and centres can be varied to suit concrete loads, span reinforcing steel centres and the cover requirements. Hundreds of variations are available.
• Fatigue tested for a 120 year lifespan
• It is the creep deflection of formwork only between completion of concreting and 4 hours later which should not exceed 1 in 300 of the span. EMJ Permadec® panels fully meet this criteria as they do deflect during concrete pour but do not creep during concrete setting.
2.2 TABLE 1: STANDARD PANELS

EMJ’s Permadec® range includes panel sizes each of which are specifically designed for different spans and deck thicknesses.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>3A</th>
<th>3B</th>
<th>3C</th>
<th>4</th>
<th>4A</th>
<th>4B</th>
<th>4C</th>
<th>5A</th>
<th>5B</th>
<th>5C</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T</strong> = Soffit Thickness (mm)</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
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<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td><strong>H</strong> = Overall Height inc. rib (mm)</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td>50</td>
<td>63</td>
<td>75</td>
<td>38</td>
<td>50</td>
<td>63</td>
<td>75</td>
<td>63</td>
<td>75</td>
<td>105</td>
<td>90</td>
</tr>
<tr>
<td><strong>L</strong> = Length (maximum) (mm)</td>
<td>1200</td>
<td>1300</td>
<td>1400</td>
<td>2100</td>
<td>2800</td>
<td>3700</td>
<td>1500</td>
<td>2300</td>
<td>3100</td>
<td>3800</td>
<td>3300</td>
<td>4200</td>
<td>5300</td>
<td>5100</td>
</tr>
<tr>
<td><strong>Cs</strong> = Clear Span (maximum) (mm)</td>
<td>1100</td>
<td>1200</td>
<td>1300</td>
<td>2000</td>
<td>2700</td>
<td>3600</td>
<td>1400</td>
<td>2200</td>
<td>3000</td>
<td>3700</td>
<td>3200</td>
<td>4100</td>
<td>5200</td>
<td>5000</td>
</tr>
<tr>
<td><strong>B</strong> = Breadth (mm)</td>
<td>1220</td>
<td>1220</td>
<td>750</td>
<td>750</td>
<td>750</td>
<td>750</td>
<td>750</td>
<td>875</td>
<td>875</td>
<td>875</td>
<td>875</td>
<td>700</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td><strong>W</strong> = Weight (kg/m²)</td>
<td>16-20</td>
<td>17-22</td>
<td>24-29</td>
<td>29-40</td>
<td>37-57</td>
<td>43-64</td>
<td>26-33</td>
<td>32-46</td>
<td>42-65</td>
<td>49-74</td>
<td>53-82</td>
<td>58-89</td>
<td>94-116</td>
<td>97-108</td>
</tr>
<tr>
<td><strong>C</strong> = Centre of Ribs (mm)</td>
<td>229</td>
<td>190</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>125</td>
<td>125</td>
<td>125</td>
<td>125</td>
<td>125</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>P</strong> = Position of End Ribs (mm)</td>
<td>38</td>
<td>38</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>62</td>
<td>62</td>
<td>62</td>
<td>62</td>
<td>62</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td><strong>N</strong> = Number of Ribs</td>
<td>6</td>
<td>7</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
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<td>7</td>
<td>7</td>
<td>7</td>
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<td>7</td>
</tr>
<tr>
<td>Max Span Def @ 200mm Deck (mm)</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>11</td>
<td>20</td>
<td>27</td>
<td>9</td>
<td>14</td>
<td>25</td>
<td>29</td>
<td>20</td>
<td>35</td>
<td>35</td>
<td>33</td>
</tr>
</tbody>
</table>

**Note:** The maximum panel length quoted above is based on carrying 200mm deck depth only, we can manufacture to any length required. We can also design and manufacture to produce bespoke panels outside the information provided above.

EMJ offers a free bespoke design service, available upon request.

**GRP Composite Panels**

If you are constructing or designing a concrete deck with short span requirements between beams our Value Engineered GRP Composite Permadec Panel will save you even more time and money. Permadec Composite panels offer all the advantages of a lightweight, versatile permanent formwork system, capable of spanning up to 1.5 metres with loads in excess of a 400mm concrete deck thickness.
2.3 PANEL CHARACTERISTICS

Low in weight: Varies from 15 to 104kg/m² dependent on span

Large span: EMJ has supplied panels to span 5.7m carrying 1.2m of wet concrete and has the capability to handle much greater spans.

Design: EMJ offers a full design service for its Permadec® panels which can extend to the design of panels which are special, skewed, haunched etc.

Finish: May be supplied with a variety of permanent finishes to soffit, such as standard textured, smooth matt or smooth high gloss with various colours upon request. Standard panels are supplied in Light Grey to British Standard 4800 10-A-03.

Fig.2 Typical EMJ Permadec® Standard panel installed on steel beams.

Fig.3 Typical EMJ Permadec® Standard panel installed on concrete beams.

Fig.4 Typical EMJ Permadec® Haunched panel installed on steel beams.

Fig.5 Typical EMJ Permadec® Cantilever panel installed on steel beams.

EMJ can offer panels not only to suit the soffit but also the diaphragm, bottom flange and vertical elements as shown. Saving time and cost on site when compared to traditional temporary methods. Off-site installation is also possible in certain scenarios.

For further information please visit our Permadec website to review case studies relating to the above applications.

www.permadec.co.uk
3.0 USING GRP PERMADEC® PANELS

3.1 HANDLING

Prior to lifting, the contractor is advised to check the weight of a typical panel against its company policy for the maximum weight any one operative is permitted to lift. This will then indicate the number of general operatives required to lay any one panel. This is generally limited to 25kg per man lift in the UK.

Formwork is generally palletised as convenient for laying as possible. Pallets should be moved close to the laying area, this will reduce the amount of physical lifting required. On contracts where formwork dimensions vary, please check the locality of the formwork immediately before applying sealants.

3.2 SEALANT / INSTALLATION GUIDANCE

EMJ Butyl 2 x 6mm Ø Twin-track adhesive butyl bead x 8mtr this provides the seal between the panel and the bearing component i.e. concrete/steel beam. This sealant arrives on a roll of 8m in length and is applied to the bearing surface; the backing is then removed prior to laying of panel (fig 6).

This sealant has been specially designed to stop ingress of water during the life of the structure and also to prevent any grout loss when pouring. It has being tested to prove excellent adhesion against two substrates, the maximum force required to remove the panel after sealing is equivalent to 6.15kN/m run of panels.

EMJ Grey adhesive butyl tape with polyester backing 50mm wide x 35mtr length this is used to seal the adjacent panels. This arrives on a 35m roll and is applied firmly to the butt joint between panels on the top side surface prior to fixing rebars and pouring concrete (fig 7).

Sealants should be applied to steel soffits or concrete rebates once the formwork has been made available locally. EMJ recommends 10 to 20 linear metres to be laid at once, depending on conditions applicable at the time of laying. This can be increased once fluency has been established from the repetitive nature of the work. The formwork panels are to be lifted into position and rested on the sealant. Care should be taken to ensure the adequate bearing to the ends of the formwork panel.

The sealant positioned between the panels at the point where the panels butt up against each other should be applied at any point prior to pouring concrete and after positioning. It should be noted that a nominal gap of an average 2mm may appear between the panels, this is anticipated.

Once the panel is correctly positioned it is capable of supporting the live weight of the operative and can be walked upon. Caution should be observed working near the edges of panels, especially at heights.

Important Note: The installation information given is provided only as general guidance for trade contractors. This document does not form a specification. The responsibility for the installation of the panels rests wholly with the contractor and not with EMJ Plastics.

www.permadec.co.uk
3.3 CUTTING OF PANELS

Permadec® panels can be cut using a standard Stihl saw (or similar). A steel blade should be used; bearing in mind the panel has a stone like texture with steel content.

For personal safety, please ensure suitable protective clothing, goggles, respiratory mask, leather gloves etc. as standard to be worn for all cutting operations.

Should you cut though the ribs of the panels for ‘skew’ ends, please note that both ends of each rib still need to be supported prior to concreting. On the cut edges this can normally be supported either off the diaphragm shutter, alternatively by using the shutter to cast a rebate into the concrete to provide a supporting edge. Cutting through a rib will also expose the steel inserts; these should be painted with cold zinc metal paint such as ‘Galvafroid’ or others for protection prior to pouring concrete.

If you are cutting more than 2 ribs from a panel or plan to cut for openings, then please check with EMJ that this is suitable.

PLEASE NOTE: The responsibility for the implementation of health and safety regulations lies solely with the Contractor once the formwork has been delivered.

Panels should be free of all traces of oil and grease at the time of concreting. Any damaged panels should be rejected prior to installation. When placing panels, ensure that the bearing cover is equal on both sides. A minimum bearing of 30mm must be achieved on the bearing surface of the concrete rebate or the steel beam flange.

Concrete should be placed and compacted in accordance with the requirements of local codes and should not accumulate in heaps or be dropped from heights greater than the code allows.

3.4 DESIGN CODE GUIDANCE

In 1994 The Department of Transport issued further guidance on BA 36/90 The Use of Permanent Formwork with Interim Advice Note 13/11 as it was sometimes misinterpreted with regard to deflection of formwork panels. i.e It is the creep deflection of formwork only between completion of concreting and 4 hours later which should not exceed 1 in 300 of the span.

EMJ Permadec® panels fully meet this criteria as they do deflect during concrete pour but do not creep during concrete setting.

For safety reasons panels are recommended to be made long enough so that they can never drop out, if accidentally dislodged during rebar fixing. This can be done by specifying a panel length which if dislodged will butt up to the shear studs on a steel beam, but still have the minimum recommended bearing at the opposing end, therefore preventing possible dislodgement. In 2006 BS8500 was updated with regard to rebar cover, minimum cover between GRP interface and nearest reinforcement bars was reduced to only 20mm. This now makes it much easier to accommodate the GRP panels into the deck design.

Spacer blocks can be used supported from bearing beam or GRP Permadec® panels themselves. Typical spacer block information is available upon request.
4.0 HEALTH & SAFETY

EMJ stress the enforcement of Contractor Health & Safety Policy in respect to:-

• Manual Lifting
• COSHH
• Working with hand held tools
• First Aid at work
• Working Around Dust
• Working at Heights
• Good Housekeeping practices

EMJ recommends the use of hard hats, safety boots, quality rigger gloves and safety vests for general work with formwork. With work involved cutting or drilling of the formwork, please see notes above.

5.0 TRANSPORT & PACKAGING

EMJ offers various packaging methods to suit our client requirements. Our Permadec® panels are typically loaded on standard pallets, as individual packs. Each of these packs is clearly marked with panel type and dimensions.

They are banded and shrink wrapped ready for transportation. We apply a stick on label formwork pack to state as follows:

• Receiving Contractor
• Reference Number
• Project Name
• Project Address

Permadec panels are packed singularly with soffit face down to avoid the requirement turning during installation. The bottom panel in all packs has the rib face down.

EMJ work closely with site to ensure the top panel is the first to be installed, to save valuable time on site. Formwork packs can be mounted and banded to pallets for UK / European network distribution.

We also offer a crating service that allows containers for shipping worldwide.

For distribution overseas EMJ use pallets which meet the International Standards for Phytosanitary Measures No. 15 (ISPM 15) for exporting.
6.0 DESIGN PRINCIPLES

Engineering Theory of Bending:
The design of the panels is based on Engineering Elastic Theory of Bending where the plane of the section will remain plane after bending.

Design Standard
An appropriate standard for the design of permanent formwork does not exist. By default, the industry has adopted the advice note recommendation provided by HA to design permanent formwork (BA 36/90). Whilst this advice note offers very useful information and guidance to design and installation of the formwork, it does not extend its scope and falls short of being a code of practice thus engineering judgment sometimes is necessary to finalise the design.

Design Load
The loads have been taken from recommendation of BA36/90 with view that they are higher than the limits stipulated by Eurocode.

Loads to be considered in the design are as follows:
- Self-weight of the panels
- Wet concrete of the in situ deck
- Live load

BA 36/90- Clause: 4.1.1 (iii) recommends that the formwork shall be capable of resisting a live load of 1.5kN/m².
Table 4.1 of EN 1991 part 1.6 recommends a value of 1kN/m² to be considered as a representative value of construction load over the area of panel.

Section Design
Stress analysis of the section is carried out with a view that the stresses shall remain within the linear elastic limit of the material. We also utilise the advantages of composite section in our design. Thus in stress analysis, a converted section based on their relative modulus of elasticity (GRP & Steel) is used.

The section will then be designed based on the ultimate capacity with the aim of a minimum of 1.5 safety factor to allow for any unforeseen events. The permanent formwork is designed, executed and maintained with application of appropriate degrees of reliability to:

• Perform adequately under all expected loads
• Withstand all loads with adequate durability

Level of reliability has direct relationship with certainty of the design. With an accurate approach reflecting a realistic execution situation, an appropriate safety factor is used. The validity of use of the design principles are assured because:

• Panels are designed by appropriately qualified and experienced personnel.
• We ensure that the execution is carried out by personnel having necessary skill and experience.
• Products are produced under a highly monitored and controlled environment. EMJ employ and maintain a Quality Management System which is BE EN ISO9001 Certified.
• A quality control policy is in place to ensure the products are checked prior to delivery.

Taking all the above facts into account, with the use of the technical guidance of the advice note, reviewing all available relevant codes of practice and our engineering judgment, we are confident that our design with allowance for appropriate degrees of safety factor, results in the production of a high quality product suitable for use in the project. As an additional step, at request we can carry out a load test on a panel to demonstrate the site condition.
7.0 SEALANT DATA

EMJ Butyl 2 x 6mm Ø Twin-track adhesive butyl bead x 8mtr for sealing between EMJ Permadec® panel and steel beam flange, or concrete rebate. This acts as a long term seal to stop moisture travelling from the soffit of the panels to the beam flange, therefore cannot reach past this to concrete or onto studs/rebar.

EMJ Grey Adhesive Butyl Tape with polyester backing 50mm wide x 35mtr strips with clear polyester backing to one side for sealing joints between butt joints of panels. This stops grout loss and also acts as a long term seal to stop moisture ingress to concrete or rebar.

Description

High performance strip-bead sealants based on new technology which includes high strength rubber compounded with selected fillers and plasticisers to give very good movement accommodation and adhesion to most building materials.

For use where strong jointing sealants is required which offers good bonding characteristics. Good joint performance requires good initial contact between the strip and both surfaces of the joint.


Performance: Quality Assured to ISO9001:2000
Movement accommodation +/- 15%
Tensile Strength: 98 kPa
Shear Strength: 46 kPa
Outdoor service temperature: -40°C to +90°C

Application

Surface preparation: All surfaces should be clean, dry and free from frost, grease and loose materials. Apply directly from the reel onto one surface pressing to give adequate initial adhesion. Push firmly to ensure good contact with full area of strip along the length of the joint.

Application temperature: +5°C to +30°C