SOLAR PV TILES

Installation Instructions for Redland Slate 10 Range Solar PV Tiles

Version: 3

Date: July 2012

Author: Kevin Ley / Michael McHugh / Graham Faulkner

Department: Redland Technical Solutions / Marketing

TABLE OF CONTENTS

1 INTRODUCTION

It is highly recommended that you read all the guidance and installation notes before starting the installation to ensure that the Redland Solar PV tiles and system are installed safely.

1.1 HEALTH & SAFETY

1.1.1 GENERAL GUIDANCE

- Ensure most up to date Construction (Design and Management) Regulations (CDM) and general construction site training are followed.
- Any person handling PV tiles should be trained in correct manual handling practice. Please note also that PV tiles can have sharp edges and so appropriate safety gloves should be worn when handling panels.
- All appropriate Health and Safety regulations should be followed correctly.
- Avoid installing the system in poor weather conditions, including strong wind, rain, ice or snow.
- Do NOT walk on the PV tiles at any time.
- The slating and tiling should be carried out in accordance with the current version of British Standard BS 5534, Code of practice for slating and tiling (including shingles) and current Redland Solar PV tile fixing instructions.
- Install all components as specified within this guide to ensure weather-tightness and wind uplift security.

1.1.2 ELECTRICAL HAZARDS

Photovoltaic (PV) tiles do not present a risk as long as appropriate safety practices are followed at all times during installation. In particular, you must be aware of the following:

- PV tiles produce a DC voltage whenever exposed to light. This voltage cannot be switched off.
- All work must be carried out with the system disconnected from the main electrical supply.
- PV tiles are pre-wired with insulated connectors to prevent an electrical shock during general handling. However, care must be taken not to cut or damage PV tile cable insulation or expose bare wire.
- Ensure all PV tile cable connectors are dry and free of dirt before making connections.
- Ensure no PV tile cable ends are left exposed to the weather during pauses in the work schedule or after completion of the works.

1.1.3 INSTALLATION PREPARATION

Follow the guidance below to ensure the Redland PV tiles are installed and handled correctly:

- Use this installation guide alongside your PV tile layout and circuit diagram to determine the location and layout of the Redland Solar PV tiles and associated PV tile cables on the roof.

- Keep the Redland PV tiles in a weatherproof environment prior to installation.
- Carry the Redland PV tiles with both hands by the frame, avoiding touching or scratching the face of the panels.
- Only load as many Redland PV tiles onto the roof as you expect to install during the work session.
- Secure or remove any uninstalled PV tiles before leaving the roof to avoid possible wind damage or theft.
- Do not leave tools or unsecured materials above the Redland PV tile installation area, to avoid potential damage to the PV tiles.

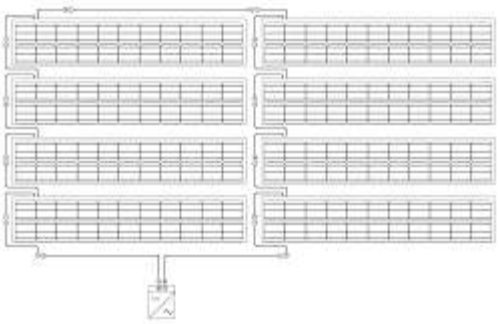
1.2 EQUIPMENT REQUIRED

- Screwdriver or hand-held power screwdriver with pozi-drive head.
- Voltmeter to check PV tile cable connections (Note: It is recommended to test the voltage across every 4 connected PV tiles as the installation proceeds to check the integrity of the PV tiles and their electrical connections).

2 PRELIMINARIES

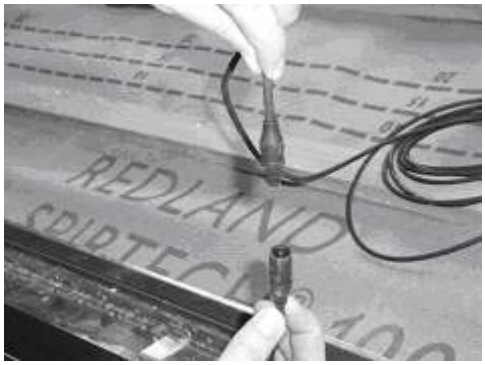
2.1 CIRCUIT DIAGRAM & LAYOUT

Before starting please check the circuit diagram to confirm the required layout of the PV tile array and the associated electrical connections between PV tiles and also back to the DC to AC Inverter. Redland Solar PV tiles are connected in electrical series in strings with each string having its own connections back to the inverter. The PV tile connectors and cables provided must be used for the series connection of the PV tile columns. PV tiles come with pre-wired connectors for tile-to-tile connections within a PV column. Additional PV tile cables are available in two lengths – 2 m cables for tile-to-tile connections between columns and 10 m cables for tile-to-inverter connections. A circuit diagram showing the recommended cabling plan (not to scale) for a single string array of 8 PV tiles is shown below.



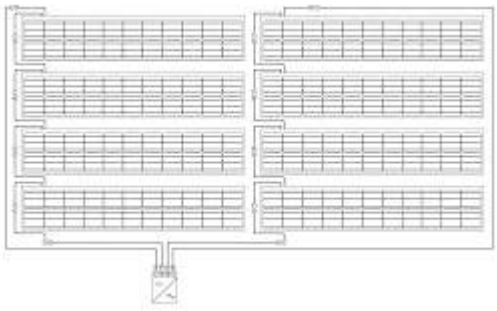
For Redland Solar PV tiles, the recommended direction of cabling within a string is in column fashion, from bottom to top, then top to bottom in adjacent column, and then bottom to top again, and so on as you work across the PV array with the PV tile columns running from right to left. The pre-wired connectors attached to the PV tiles should be used for all the electrical connections up or down a column. 2 m cables should be used for connecting PV tile columns to each other; connections between adjacent PV tile columns should be made top-to-top, then bottom-to-bottom, then top-to-top, and so on as you work across the PV array. The 10 m cables should be used to connect the first and last PV tiles in the string to the inverter. As a rule of thumb, the 10m cables should be long enough for the connections to the inverter for PV tile arrays up to 4 columns of PV tiles wide; for wider PV tile arrays it may be necessary to use longer inverter cables. Monier Limited can also supply 25m inverter cables if required.

Note that for all electrical connections the pre-wired connectors and cables are used to connect from the + terminal to the - terminal in electrical series.



Additional strings of PV tiles connected in electrical series can be connected to the inverter using the other sets of + and – inputs available on the inverter box. Note the maximum number of PV tiles that can be connected to the inverter is only limited by the capacity of the inverter. Check that the inverter has sufficient capacity for the size of the array being connected. For large projects more than one inverter may be required.

The circuit diagram below shows the recommended cabling plan (not to scale) for 2 strings of 4 PV tiles each connected to a single inverter.



2.2 FELT & BATTENS

Felt and batten the roof in the normal manner ensuring the roofing underlay is laid with an approximate 10mm drape between rafters and that the tiling battens are laid at the appropriate gauge for the PV tile type to be used (see relevant section to follow for the specific PV tile being installed).

2.3 MARKING POSITION

To make sure the PV tile array is installed in the correct position of the roof, it is recommended that you first mark out the area where the PV tiles are to go before you begin. It is also recommended that the position of the inverter(s) within the building in relation to the PV array is (are) identified.

2.4 RAFTER PITCHES & LENGTHS

For Cambrian Slate, Mini Stonewold, Mockbond Mini Stonewold, Landmark Double Pantile, Grovebury, Landmark Double Roman, 50 Double Roman, DuoPlain, Richmond 10, Saxon 10, Landmark Slate 10, MockBond Richmond 10, Natural Slate and Plain Tiles (including Rosemary Clay Plain Tiles) follow the appropriate PV tile installation instructions in following sections. The maximum rafter length for flat interlocking tiles and slates at minimum rafter pitch is 10 m (9 m for Natural Slate in moderate exposure areas, 6 m in severe). Please contact Technical Solutions for further advice on rafter lengths. Note that the minimum and maximum rafter pitch for use of each of the Redland Solar PV tiles is shown in the table below:

REDLAND SOLAR PV TILE	RAFTER PITCH° (MIN - MAX)
Natural Slate (500 x 250 mm)	25 - 69
Cambrian	25 - 69
Richmond 10	22.5 - 69
Saxon 10	22.5 - 69
Landmark Slate 10	22.5 - 69
MockBond Richmond 10	27.5 - 69
Mini Stonewold	22.5 - 69
Mockbond Mini Stonewold	22.5 - 69
Landmark Double Pantile	20 - 69
Grovebury	20 - 69
Landmark Double Roman	20 - 69
50 Double Roman	20 - 69
DuoPlain	25 - 69
Plain Tiles (incl. Rosemary Clay Plain Tiles)	35 - 69

2.5 FIXING

The fixing instructions in the following sections are those that apply where the supporting rafters/frame or tiling batten supports are spaced at no more than 600mm centres and the tiling battens used are 50 x 25 mm (38 x 25 mm for Plain Tiles (incl. Rosemary Clay Plain Tiles)) in dimension. For other configurations please contact Redland Technical Solutions (Tel. 08708 702595) for advice before proceeding.

Please note that in all cases the perimeter slates/tiles adjacent to the PV tile array must as a minimum be screw-fixed in all the available nail-holes using the screw specified for the

slate/tile. The only exception is centre-nailed Natural Slate which can be fixed in the standard way with two nail fixings, apart from the cut slate course directly below the bottom course PV tiles, which must be secured using slate hooks. Slate hooks can also be used around the sides and top of the PV tile array if so required .

2.6 INSTALLATION

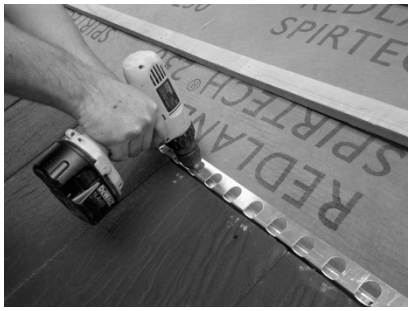
Note that all Redland Solar PV tiles are fully integrated with the slates/tiles and as such are designed to be installed from right to left (see instructions below). Redland Solar PV tiles are designed to integrate with at least one slate or tile at the perimeter of the PV tile array to ensure weather-tightness of the installation; this integration is achieved either directly by interlocking with the slate/tile in the case of interlocking roof slates/tiles, or indirectly via special proprietary soakers in the case of double lapped natural slates or plain tiles. Information on the layout and positioning of the proprietary soakers for the Natural Slate and Plain Tile PV tiles respectively is given at the start of the relevant sections that follow.

3 RICHMOND 10 / SAXON 10 / LANDMARK SLATE 10 / MOCKBOND RICHMOND 10 (“SLATE 10” TILES)

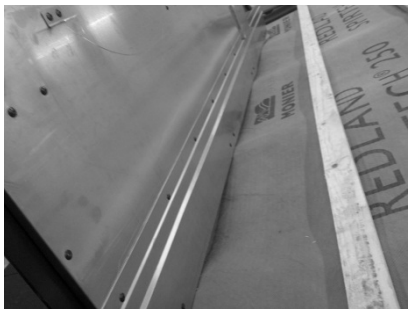
Each Slate 10 PV tile replaces 6 “Slate 10” tiles. It is important to note that the instructions below relate to the PV tile array and any special detailing required around the array. Everywhere else on the roof the standard fixing instructions for Richmond 10/Saxon 10/Landmark Slate 10/MockBond Richmond 10 should be followed. For all Slate 10 range tiles when installing Redland Solar PV tiles the tiling battens should first be set out with spacing (gauge) of 343 mm (+0 mm, -5 mm) only. If the PV tiles are set out at a gauge less than this it is possible that some PV cells will be partially covered or shaded by the PV tiles in the course above.

i. Install the slates in the course below the bottom PV tile course ensuring that the slates adjacent to the PV tiles are screw fixed using 38 x 4.2 mm stainless steel countersunk pozi-drive screws (9104) and tail-clipped using either Slate 10 eave (9293) or slate clips (9294) as appropriate.

ii. Before installing the bottom course PV tiles screw-fix the fixing bracket provided (one for each PV tile column) as shown into each rafter using the screws supplied. The fixing bracket is located flush against the top of the tiling batten (for the Slate 10 course below) with its right edge lined up approximately against the edge of the Slate 10 tile adjacent to the PV tile.

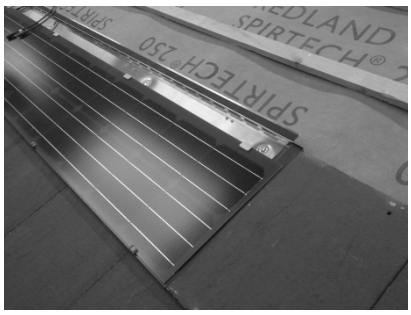


iii. The fixing bracket allows each bottom course PV tile to be mechanically fixed at its tail via the hook on the underside of the PV tile preventing the PV tile from lifting under windy conditions.



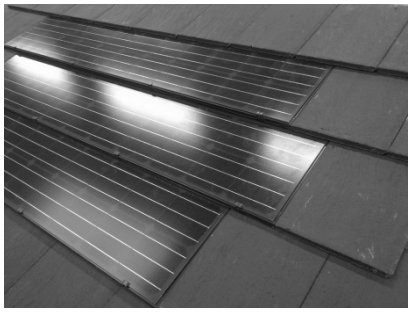
iv. The bottom course PV tile is now ready to be installed. Slide the PV tile down so that the fixing hooks on the underside locate under the fixing bracket shown in (ii) and that the metal nibs at the top of the PV tile (on the underside) hang on the tiling batten as shown. Screw-fix the PV tile to the tiling batten below using the PV tile screws supplied (4 per PV tile). Depending on the width (number of PV columns) of the PV tile array install further PV tiles as required in the same course working right to left. The PV tiles interlock with each other.

v. In the course where the first PV tile is positioned lay the slates half bond (quarter/three quarter bond for MockBond Richmond 10) in the normal manner working from right to left ensuring the slate adjacent to the PV tile is screw-fixed. With the first PV tile and slating course completed you are now ready to proceed with the installation of the PV tiles and slating in the course above. First ensure that the pre-wired connectors from the PV tile below are pushed up between the tiling batten and roofing underlay and are connected to the correct pre-wired connectors of the PV tile above.



vi. Position the PV tile above at the correct bond in relation to the PV tile below and slide it down until the fixing hooks on the underside of the PV tile locate under the head of the PV tile below. For the “Slate 10” range of tiles the standard configuration is to lay the PV tiles at half-bond (quarter/three quarter bond for MockBond Richmond 10), the same bond as that of the roof tiles. Continue laying the PV tiles (following the cabling plan) and slates from right to left until the PV tile column height required is achieved as per circuit diagram.

vii. In the slate course directly above the top PV tile course ensure each slate adjacent to the panels are screw-fixed. Ensure the pre-wired connector from the top PV tile is connected to correct pre-wired connector of top PV tile in adjacent PV tile column to left (if there is one) using 2 m cable as per circuit diagram. Complete PV tile array and slating installation as per cabling plan and these fixing instructions.

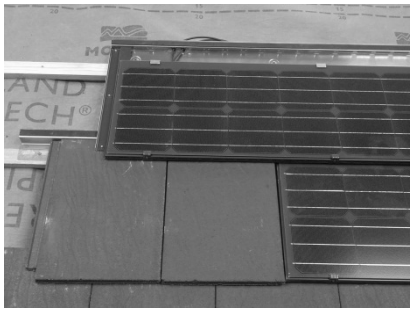


3.1 OFFSETTING SLATE “10” TILES

In some circumstances it may be advantageous to offset the Slate 10 PV tiles by more than half the bond of a Slate 10 tile to maximise the PV area on a roof slope with hips and valleys, or with dormer windows. Allowable offsets must be a multiple of the 300 mm cover width of a Slate 10 range roof tile to ensure the roof tiling maintains the correct half-bond laying pattern. The maximum offset allowed is 600 mm (or two tile cover widths)

i. An extension bracket (with foam attached) is supplied for those situations where you want to offset the PV tiles in the course above the PV tile course below by more than the standard configuration (of half a tile cover width). Depending on the degree of offset (up to maximum of two tile cover widths) the extension bracket is located at the necessary distance away from the primary fixing bracket. The bracket is screw-fixed to the tiling batten rather than the rafter as shown above.

ii. Once the extension bracket is fixed in the correct position the PV tile in the course above can be slid into position so that its reverse-side hook is engaged on both the primary fixing bracket at one end and on the extension bracket at the other end.



4 CONNECTIONS TO INVERTER

For safety reasons it is very important that the electrical connections from the inverter to the PV tile array are made as per the following instructions.

Normally the inverter is located within the roof sub-structure (e.g. loft space) in the immediate proximity of the PV tile array so as to keep the length of cable on the DC side of the system to a minimum. The cabling from the inverter to the PV tile array inside the roof structure must be properly secured throughout its length using clips or cable ties as appropriate. The inverter should always be mounted vertically on the wall on a non-combustible base or board fixed to the roof structure and in a location that is easily accessible for servicing and testing.

A DC switch should always be installed between the PV tile array and the inverter. Many inverters contain an integrated DC switch but it is possible that your inverter may not have an integrated switch. Check the technical specifications of the inverter and local regulations before installation.

As per the circuit diagram at either end of each string of PV tiles (connected in series) the + and – pre-wired connections must be connected to the correct inputs of the DC to AC inverter. These electrical connections are made as follows:

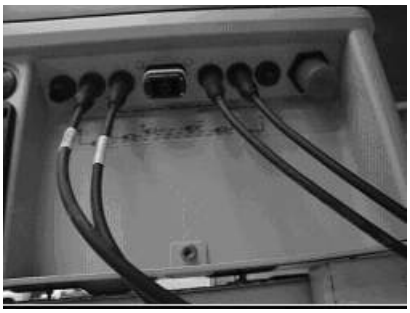
i. The 10 m cables supplied are used to make the electrical connections from the first and last PV tiles in each string back to the inverter. It is recommended that these cables are routed between the underlay and tiling battens and fed through a horizontal lap in the underlay near the apex of the roof into the roof space below (and ultimately to where inverter is located).

ii. Before the cables from the inverter are connected to the pre-wired connectors of the PV tile array it is essential that they are first properly secured by wrapping around a batten-rafter junction as shown above. This relieves any strain on the connectors and prevents the inverter cables detaching from the PV tile connectors.

iii. Once the inverter cable has been secured as in step (ii) then it can be connected to the pre-wired connectors of the PV tile array as shown.

iv. The + and – connections from each end of the string of PV tiles are connected to the + and – inputs of the inverter as per the circuit diagram.

v. Additional strings of PV tiles connected in electrical series can be connected to the inverter using the other sets of + and – inputs available on the box. Note the maximum number of PV tiles that can be connected to the inverter is only limited by the capacity of the inverter. Check that the inverter has sufficient capacity for the size of the PV tile array being connected. For large projects more than one inverter may be required.



5 REPLACING A PV LAMINATE

If a Redland Solar PV tile becomes damaged due to vandalism or for any other reason it will need to be replaced. It is possible to replace individual PV tile laminates for Natural Slate, Richmond 10, Saxon 10, Landmark Slate 10, MockBond Richmond 10, Mini Stonewold / Mockbond Mini Stonewold, Landmark Double Pantile / Grovebury, Landmark Double Roman / 50 Double Roman, Plain Tiles (inc Rosemary Clay) and DuoPlain without stripping off the installed PV tile array as follows.

i. First remove the damaged laminate by unscrewing the small brackets at the leading edge of the damaged PV tile and sliding the laminate out of the frame.
ii. Cut the pre-wired connector of the PV tile above the damaged PV tile so that the plug connection is removed.
iii. Wire a new plug to the pre-wired cable of the PV tile above.
iv. Insert new PV laminate into frame securing with screwed brackets at leading edge.
v. Connect new PV laminate pre-wired connector to new plug of PV tile above.

FIXING INSTRUCTIONS ISSUED BY REDLAND TECHNICAL SOLUTIONS:
ADDRESS: **MONIER LTD, BROADWAY LANE, SOUTH CERNEY, CIRENCESTER, GLOUCESTERSHIRE, GL7 5UH, UNITED KINGDOM.**
EMAIL: **TECHNICAL.REDLAND@MONIER.COM**
TELEPHONE: **08708 702595**
FAX: **08708 702596**