Soil & Waste systems

Design and Installation Guide

MARLEY
PLUMBING & DRAINAGE
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Marley Plumbing & Drainage offer a complete range of soil & waste systems, with products available in a variety of colours and with either push-fit, solvent weld or compression joints. Recognising the potential of plastics in the development of sanitary pipework systems, Marley Plumbing & Drainage launched their first range of PVCu discharge pipes and fittings in 1963. Constant technical innovation and product development have served to keep Marley Plumbing & Drainage at the forefront in the field of sanitary plumbing ever since.

A wide range of systems have been developed to suit both the requirements of domestic above ground drainage and the particular needs of commercial, industrial and public buildings.

Products are manufactured at the Marley Plumbing & Drainage factory in Lenham, Kent. Marley soil & waste goods are manufactured under a quality assurance system from either unplasticised polyvinyl chloride (PVCu), polypropylene (PP) or acrylonitrile butadiene styrene (ABS). Products comply with the material and performance requirements of the relevant British and new European standards.
The Range

Marley Plumbing & Drainage offer a Solvent or Push-fit Soil and Waste system, complemented by a new range of high quality universal compression waste traps. A ‘Multi-Fit’ compression waste system is also available for connection to solvent or push-fit plastic pipe or copper waste pipe.

The **Soil system**, available in 82mm, 110mm & 160mm diameters consists of all the components necessary for a modern installation. Socketted or plain ended pipe is available as well as a wide range of ring seal and solvent socket fittings. The **pipe support system** in zinc electro-plated mild steel has been developed specifically to meet the requirements of supporting horizontally suspended PVCu sanitary pipework. A range of solvent and push-fit **WC connectors** and a **WC manifold system** allow connection in a variety of situations.

The **Waste ranges** are available with either push-fit, compression ‘multi-fit’ or solvent jointing and come in a full range of colours. The **Push-Fit range**, in 32mm and 40mm, is manufactured to BS 5254, from polypropylene. Two **Solvent systems** are available, ABS and MUPVC, both manufactured to BS 5255 and bear the British Standard Kitemark where applicable. Resistant to ultra violet attack, the MUPVC range is suitable for internal and external applications. Both solvent ranges are available in 32mm, 40mm and 50mm.

The new range of waste **Traps**, injection moulded in high temperature polypropylene, with a high gloss, wipe clean finish completes the range with easy to grasp compression fixing nuts and can be used in conjunction with any of the waste systems.

For situations where sanitary pipework is located on the external surface of buildings, 21.5mm solvent jointed overflow, 32 and 40mm MUPVC waste and 110mm soil pipework systems are available in a variety of colours, enabling exterior colour co-ordination of soil and waste pipes with rainwater gutters and downpipes.
Installation

The different elements of the Marley Plumbing and Drainage Soil and Waste Systems offer many different installation benefits. A number of different methods for connection from soil stack to waste pipework are offered: boss pipes, strap-on and patch bosses and multiple connection boss branches, with boss connectors to fit all waste systems. The Marley WC Manifold system was developed for use in commercial situations and allows a range of toilets to be connected to a horizontal float above floor level and eliminate the need for specially fabricated fittings. The pipe support system is designed specifically for suspending sanitary pipework both horizontally and vertically. The trapped floor gully has a separate main body and base to allow the bottom part of the gully to be trimmed on site prior to installation, therefore the depth of the water seal can be varied to suit different situations. For commercial applications, a choice of fire protection sleeve or pipe wraps offering up to four hours resistance. Please refer to pages 50 to 54 for further information.

A free advisory service is available to offer technical assistance regarding product and installation details. Those involved with the building industry may take advantage of design services provided by the company for customers who have made a commitment to use or specify Marley Plumbing & Drainage products.

Whilst every effort is made to ensure details are accurate and up to date, our continual product development and improvement programme, may cause dimensional details to change.

Technical Hotline: 01622 852695
Fax: 01622 858041

Availability

Marley Plumbing & Drainage Products are available from a national network of distributors and stockists. For details of your local stockist contact the Marley Plumbing & Drainage Head Office or any of our Regional Sales Offices, listed below.

Scotland
Birkenshaw Industrial Estate, Uddingston, Glasgow G71 5PA
Telephone: 01698 815231   Fax: 01698 810307

Export Division
Lenham, Maidstone, Kent ME17 2DE England
Telephone: +44 (0)1622 858888   Fax: +44 (0)1622 850778
Environment

The environment is one of the most important issues in today’s society. As a manufacturer, Marley Plumbing & Drainage places great emphasis on ensuring that all manufacturing processes and practices are environmentally responsible. This extends to packaging as well as raw material handling and process controls. Marley also play an active role at industry level via the British Plastics Federation, where broader industry wide environmental issues are addressed.

British Plastics Federation: Tel: 020 7457 5000

British & European Standards

BS EN 1329: 2000, Plastics piping systems for soil and waste discharge (low and high temperature) within the building structure – PVCu.
BS EN 1455-1: 2000, Plastics piping systems for soil and waste (low and high temperature) within the building structure – ABS.
BS 5627: 1984, Specification for plastics connectors for use with horizontal outlet vitreous china WC pans.
BS 3943: 1979, Specification for plastics waste traps.
BS 6209: 1982, Specification for solvent cement for non-pressure thermoplastics pipe systems.

Many items bear the British Standards Institution Kite Mark symbol. This mark may be used only by those licensed under the Certification Mark scheme operated by the British Standards Institution. The presence of this mark on, or in relation to, a product is an assurance that the goods have been produced under a system of supervision, control and testing operated during manufacture. This includes periodical inspection of the manufacturer’s works in accordance with the Certification Mark scheme.

Products indicated by this symbol comprise of components not covered by Marley Plumbing and Drainage BS EN ISO 9001 Scope of Registration. However these products have been fully inspected and tested in accordance with our own Quality Management System requirements.

Also available from Marley Plumbing & Drainage:
Alutec aluminium rainwater systems
Alutec roof, floor & shower outlets
Rainwater systems
Underground drainage systems including Quantum highway & sewer systems
Equator hot & cold water systems
### MUPVC Solvent Weld Waste System
Suitable for internal and external applications. Available in 32mm, 40mm & 50mm.

See page 18

### ABS Solvent Weld Waste System
Lightweight and cost effective for internal installation. Available in 32mm, 40mm & 50mm.

See page 20

### Polypropylene Push-Fit Waste System
For internal use, ideally suited to fast installation. Available in 32mm and 40mm.

See page 22

### Polypropylene Multi-Fit Waste System
Multi-fit compression socket, for internal use, accepts plastic and copper pipework. Available in 32mm and 40mm.

See page 23

### PVCu Solvent Weld Overflow System
A complete range of pipe work and fittings for all vent and overflow applications. Available in 21.5mm.

See page 24

### Universal Compression Joint Traps
A new range of injection moulded waste traps, manufactured in high temperature polypropylene. Available in 32mm, 40mm and 50mm.

See page 26
<table>
<thead>
<tr>
<th>PVCu Soil &amp; Vent Components</th>
<th>Colour Availability</th>
<th>Size</th>
<th>British/European Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>A complete system, available with both ring seal and solvent weld joints. Available in 82mm, 110mm and 160mm.</td>
<td>Black</td>
<td>82mm 110mm 160mm</td>
<td>BS 4514 BS EN 1329</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WC Connectors</th>
<th>Size</th>
<th>British/European Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectors for all BS WC pans. Available with solvent weld or push-fit joints.</td>
<td>110mm</td>
<td>BS 5627</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WC Manifold Components</th>
<th>Size</th>
<th>British/European Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>The manifold system allows ranges of toilets to be connected horizontally. Ideal for commercial applications.</td>
<td>110mm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Floor Outlet Components</th>
<th>Size</th>
<th>British/European Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available as separate components or as an all in one trapped floor outlet.</td>
<td>50mm 82mm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fire Protection Range</th>
<th>Size</th>
<th>British/European Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire sleeves and pipe wraps, providing up to 4 hours rating.</td>
<td>55mm 82mm 110mm 160mm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pipe Support Components</th>
<th>Size</th>
<th>British/European Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designed specifically to meet the needs of supporting horizontal or vertical suspended PVCu pipework.</td>
<td>32mm 40mm 50mm 82mm 110mm 160mm</td>
<td></td>
</tr>
</tbody>
</table>
Material and manufacture

Marley Plumbing & Drainage pipes and fittings for above ground sanitary pipework systems are manufactured from different plastics materials including PVCu, ABS and Polypropylene.

The table below details the important dimensions and weights of each of the systems together with the relevant British and European Standard. All pipes are manufactured using a continuous extrusion process and fittings are produced by high-pressure injection moulding.

Dimensions and weights

<table>
<thead>
<tr>
<th>Pipe Material Standard</th>
<th>BS Nominal Size mm/inch</th>
<th>Mean Outside Diameter mm</th>
<th>Wall Min Thickness mm</th>
<th>Weight kg/metre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PVCu</td>
<td>82</td>
<td>82.4</td>
<td>82.8</td>
<td>3.20</td>
</tr>
<tr>
<td>BS EN 1329</td>
<td>110</td>
<td>110.0</td>
<td>110.3</td>
<td>3.20</td>
</tr>
<tr>
<td>BS 4514</td>
<td>160</td>
<td>160.0</td>
<td>160.4</td>
<td>3.20</td>
</tr>
<tr>
<td>Waste</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MUPVC</td>
<td>32/1½</td>
<td>36.15</td>
<td>36.45</td>
<td>1.80</td>
</tr>
<tr>
<td>BS 5255</td>
<td>40/1½</td>
<td>42.75</td>
<td>43.05</td>
<td>1.90</td>
</tr>
<tr>
<td></td>
<td>50/2</td>
<td>55.75</td>
<td>56.05</td>
<td>2.00</td>
</tr>
<tr>
<td>Waste</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABS</td>
<td>32/1½</td>
<td>36.15</td>
<td>36.45</td>
<td>1.80</td>
</tr>
<tr>
<td>BS 5255</td>
<td>40/1½</td>
<td>42.75</td>
<td>43.05</td>
<td>1.90</td>
</tr>
<tr>
<td>BS EN 1455-1</td>
<td>50/2</td>
<td>55.75</td>
<td>56.05</td>
<td>2.00</td>
</tr>
<tr>
<td>Waste</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polypropylene</td>
<td>32/1½</td>
<td>34.45</td>
<td>34.75</td>
<td>1.80</td>
</tr>
<tr>
<td>BS 5254</td>
<td>40/1½</td>
<td>40.85</td>
<td>41.15</td>
<td>1.90</td>
</tr>
<tr>
<td>Overflow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PVCu</td>
<td>21.5/¾</td>
<td>21.55</td>
<td>21.70</td>
<td>1.10</td>
</tr>
</tbody>
</table>

Methods of jointing

While the principal method of jointing 82, 110 and 160mm pipes and fittings is by ring seal, many components in the range are also available with sockets that allow for solvent weld jointing. This particular technique is widely used on smaller diameter waste and overflow pipework although expansion and copper adaptor couplings include a ring seal to allow for thermal movement.

As polypropylene cannot be solvent welded, the ring seal method of jointing is used throughout the system.

Chemical and temperature resistance

Most plastics used for sanitary pipework are highly resistant to those chemicals normally found in domestic waste water and sewerage systems. Enquiries are often received regarding the specification of materials for commercial and domestic applications where chemicals and higher temperature discharges are likely to occur. Where this needs to be taken into consideration, provided the relevant details are supplied, the appropriate technical recommendations can be made regarding the suitability of different materials to ensure satisfactory performance.

Generally the maximum working temperature of Marley PVCu and MUPVC soil and waste systems when subjected to continuous flow is 70°C and 75°C respectively. Higher intermittent discharges of up to 95°C may be accommodated provided the period of discharge does not exceed two minutes duration.

Alternatively, reference can be made to BS CP312 Part 1: 1973 and ISO publications TR10358/7620 which provide comprehensive information on chemical and temperature resistance of plastics and rubber materials.

Thermal movement

The coefficient of linear expansion for PVCu is 0.06mm/m°C. As a result a 3m length of pipe will increase in length by approximately 3.6mm when subjected to a 20°C temperature variation. Therefore, it is important to ensure that any movement is controlled and ring seal joints are installed to accommodate any expansion that may occur due to increases in ambient temperature or hot water discharges.

Applications

ABS and polypropylene waste pipes and fittings are designed for internal use and should not be fitted externally as they will be subject to ultraviolet light degradation. If fitted externally it is recommended that they are protected by the application of a suitable paint or are boxed in.

The large diameter 82, 110 and 160mm pipes and fittings featured in this catalogue are also suitable for use as internal and external rainwater pipes to drain flat roofs and metal gutter systems on commercial and industrial buildings.
Sanitary pipework design

All sanitary pipework systems should be designed to satisfy the following regulations and standards where applicable.

The Building Standards (Scotland) Regulations 1990: Part M.
The Building Regulations (Northern Ireland) 1994, Technical Handbook N.

BS EN 12056: 2000, Parts 1 to 5.

The above is a new European Standard which has British Standard status and supersedes BS 5572: 1994 Code of Practice for Sanitary Pipework which has been withdrawn. The new standard has five sections, parts 1, 2 and 5 deal specifically with sanitary pipework and parts 3 and 4 refer to roof drainage and the design of wastewater lifting plants.

Bends at the base of stacks

Bends at the base of vertical stacks should be of long radius and have a minimum centre line radius of 200mm on a 110mm nominal size stack. Two 45° radius bends may also be used as an alternative to provide the change of direction and connection to the building drain. The same design principle should also be adopted where offsets occur in stacks of one or more storey height.

Branches at the base of stacks

For single dwellings up to three storeys high, the distance between the centre line of the lowest branch connection and the invert of the drain should be at least 450mm. For multi-storey systems up to five storeys high, the minimum distance should be 740mm and for systems higher than five floors no connections are permissible at ground floor level. Where this occurs a separate stub stack should be provided to serve the ground floor or individual appliances should have their own separate connection to the building drain.

Regular consultation is essential between Architects and Plumbing Engineers throughout the building design stage as the careful arrangement of kitchen and bathroom appliances will simplify the final sanitary pipework layout. This will help to ensure that an efficient sanitary pipework system is installed at minimum cost.

The design information provided in this catalogue is endorsed in the above publications and while every effort has been made to ensure accuracy, no responsibility can be accepted for errors or omissions. For detailed guidance please consult the relevant documents referred to above.

NB: Typical fittings illustrated, alternatives are available.
Offsets in stacks
Offsets in the wet portion of a discharge stack should be avoided wherever possible but where they have to be fitted a large radius or two 45° bends should be used to create each change of direction. Offsets in lightly loaded stacks up to three storeys high do not require offset venting but on multi-storey buildings this may be necessary depending on the loading of the stack and the numbers of floors above the offset. The principles previously described for bends and branches at the base of a stack should also be applied.

Stub stacks
An unventilated stub stack terminated with an access fitting may be used to connect a group of ground floor appliances to the building drain provided the vertical drop to the invert level of the drain does not exceed 1.5m from a WC and 2.5m from a waste appliance. Where one or more stub stacks are connected to the same drain, the head of the run should be ventilated to atmosphere or air admittance valves fitted to each stub stack arrangement.

Prevention of cross-flow
Where small diameter branch waste pipes connect to a discharge stack they must be arranged to eliminate the risk of cross-flow from one branch to the other. A branch creates a no entry zone for opposing waste connections, which varies depending on the stack diameter. No connections should be made within the restricted zone although entry is permissible on the centre line of the boundary directly opposite or at right angles.

Stub waste
This technique is often used to connect isolated ground floor waste appliances such as basins, baths, shower trays and sinks to eliminate exposed pipework or low level ducting. The 110mm unventilated PVCu drain is terminated at finished floor level with a reducer and boss adaptor to suit the size of waste from the appliance.

<table>
<thead>
<tr>
<th>Stack size</th>
<th>Height of zone 'H'</th>
</tr>
</thead>
<tbody>
<tr>
<td>82mm</td>
<td>90mm</td>
</tr>
<tr>
<td>110mm</td>
<td>110mm</td>
</tr>
<tr>
<td>160mm</td>
<td>250mm</td>
</tr>
</tbody>
</table>

To prevent cross-flow from a large diameter branch to a smaller waste connection, the latter should be made to the stack at or above the centre line of the larger branch, at right angles or at least 200mm below the restricted zone. Entry is permissible on the boundary centre line directly opposite or at right angles.

'H' = 200mm irrespective of stack diameter
Prevention of cross-flow
The Marley Collar Boss was specifically designed to overcome installation problems imposed by the 200mm restricted zone and to allow multiple low level bath or shower waste pipes to be connected to the stack above floor level. Cross-flow is prevented as the circular annular chamber protects the small diameter waste connections from the WC discharge, allowing waste water to flow freely and merge below the critical zone. Different combinations of 110mm branches can be used with the collar boss to accommodate various WC positions which may be up to 3 metres from the vertical stack.

Marley Monitor anti-syphon trap
The Marley Monitor anti-syphon bottle trap, WBA3W/WBA4W, was specially developed to prevent self-syphonage from basins, which can occur particularly where the waste pipe drops vertically from the appliance before falling at an even gradient to the discharge stack. The trap also eliminates the need for a secondary vent pipe where basins are located further than the recommended 3m maximum from the stack. Non-mechanical, the trap operates as air is drawn in through a central by-pass tube to eliminate any syphonic action and ensure the trap seal is maintained. Generally, appliances such as sinks, baths, and showers do not suffer from self-syphonage as the trap seal is replenished at the end of the discharge due to the flat bottom design of the appliance. Tubular traps are recommended for such appliances as they ensure unrestricted discharge and reduce the risk of blockage and prevent the accumulation of sediment.

Branch pipe gradients
The gradient of a branch pipe should be uniform and adequate to drain the pipe and appliance efficiently. A minimum gradient of 18mm/metre should be adopted for 32, 40, and 50mm nominal size pipes, but larger diameter 82, 110, and 160mm branch runs may be laid flatter at 9mm/metre fall where the discharge flow rate exceeds 2.5 litres/second.

Branch pipe lengths
The following information is taken from Table 8 of BS EN 12056: 2: 2000 and provides general guidance on the recommended lengths of unventilated branch pipes for a variety of sanitary appliances.

<table>
<thead>
<tr>
<th>Appliances</th>
<th>Dia (mm)</th>
<th>Min. trap seal (mm)</th>
<th>Max. length of pipe (m)</th>
<th>Pipe gradient (%)</th>
<th>Max. bends</th>
<th>Max. drop (H) (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washbasin or bidet</td>
<td>32</td>
<td>75</td>
<td>1.7</td>
<td>2.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Washbasin or bidet</td>
<td>40</td>
<td>75</td>
<td>3.0</td>
<td>1.8 to 4.4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Bath or shower</td>
<td>40</td>
<td>50</td>
<td>No limit</td>
<td>1.8 to 9.0</td>
<td>No limit</td>
<td>1.5</td>
</tr>
<tr>
<td>Bowl urinal</td>
<td>40</td>
<td>50</td>
<td>3.0</td>
<td>1.8 to 9.0</td>
<td>No limit</td>
<td>1.5</td>
</tr>
<tr>
<td>Trough urinal</td>
<td>50</td>
<td>75</td>
<td>3.0</td>
<td>1.8 to 9.0</td>
<td>No limit</td>
<td>1.5</td>
</tr>
<tr>
<td>Kitchen sink</td>
<td>40</td>
<td>75</td>
<td>No limit</td>
<td>1.8 to 9.0</td>
<td>No limit</td>
<td>1.5</td>
</tr>
<tr>
<td>Dishwasher or washing machine</td>
<td>40</td>
<td>75</td>
<td>3.0</td>
<td>1.8 to 4.4</td>
<td>No limit</td>
<td>1.5</td>
</tr>
<tr>
<td>WC</td>
<td>110</td>
<td>50</td>
<td>No limit</td>
<td>1.8 Min</td>
<td>No limit</td>
<td>1.5</td>
</tr>
</tbody>
</table>

The maximum lengths given above may be increased where the branch pipe is ventilated or an air admittance valve is used. For further details refer to the above standard.
Durgo air admittance valve

The Durgo valve is designed to reduce the number of ventilating pipes and subsequent roof penetrations in domestic, commercial and public buildings. Suitable for use in sanitary pipework systems up to ten storeys high, the valve must be fitted in a vertical position above the flood level of the highest appliance connecting to the stack. Valves should be installed within the building in a ventilated duct or roof space where there is no risk of freezing and must be accessible for inspection and testing.

The 50, 82 and 110mm size valves have been assessed by the British Board of Agrément and awarded Certificate No 97/3427 which permits their use in accordance with the Building Regulations. A copy of the full certificate is available and provides comprehensive information on their use and installation.

When installed the valve will remain closed unless the system is subject to negative pressure whereby the diaphragm will lift and allow air to be drawn in to eliminate symphonic action. Positive pressure ensures the valve closes and prevents foul air escaping from the system. Each valve is supplied boxed with a polystyrene insulation cover that should remain in position after installation, as this will protect the valve against freezing, particularly when installed in a roof space.

To ventilate the underground drainage system and to minimise the effects of back pressure should a blockage occur, the branch or main drain serving a stack or stacks fitted with Durgo valves may require conventional venting at a point upstream of the stack connection.

For up to and including four dwellings, 1, 2, or 3 storeys in height, additional drain venting is not required. Where a drain serves more than four such dwellings equipped with the valve, the drain should be vented according to the following rules:

- 5 to 10 such dwellings – conventional ventilation to be provided at the head of the system.
- 11 to 20 such dwellings – conventional ventilation to be provided at the mid-point and at the head of the system.

For multi-storey domestic dwellings (other than those referred to previously) and non-domestic buildings, conventional drain venting should be provided if more than one such building, each equipped with the valves, is connected to a common drain which itself is not vented by means of a ventilating stack or a discharge stack not fitted with a valve.

Stacks should not be fitted with valves when the connecting drain is subject to periodic surcharging or is fitted with an intercepting trap. An open vent must be provided and this also applies to stacks that discharge to a cesspool or septic tank.
Fire protection

The Building Regulations 1991 (as amended) require that a building shall be sub-divided into compartments where necessary to inhibit the spread of fire. Plastics pipework is permitted to penetrate separating walls, compartment walls and floors provided the appropriate measures are taken to prevent the spread of fire in accordance with Part B of the Approved Document (1992).

To comply with this, pipes must be enclosed within a fire resistance enclosure which extends from floor to ceiling within each storey. The enclosure must have a class ‘O’ internal surface and have each side formed by a separating wall, external wall or by casing. Any casing must have a minimum 1/2 hour fire resistance and penetrations of the duct must be limited to 160mm vertical and 110mm horizontal.

Where longer periods of fire resistance are required, Marley fire sleeves or pipe wraps can be fitted to provide a fire rating of up to 4 hours depending on the actual construction detail. Tests carried out at the Warrington Fire Research Centre in accordance with BS 476: Part 20: 1987 verified the integrity of each construction detail shown opposite in respect of fire spread.

In addition to the above, tests carried out at FIRTO on a variety of typical sanitary pipework arrangements proved that it was possible to achieve up to 1½ hour fire rating through a compartment floor without a fire sleeve or pipe wrap where the stack was terminated by an air admittance valve. Various other arrangements were also tested and achieved a minimum of 2 hours integrity. The test work and technical evaluation was independently assessed by the British Board of Agrément who issued Agrément Certificate 86/1785 together with eleven detail sheets illustrating each assembly. Copies of this original certificate and the detail sheets are available from Marley Plumbing & Drainage.

<table>
<thead>
<tr>
<th>Pipe size (mm)</th>
<th>55</th>
<th>82</th>
<th>110</th>
<th>160</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire rating</td>
<td>240 mins</td>
<td>180 mins</td>
<td>240 mins</td>
<td>120 mins</td>
</tr>
</tbody>
</table>

The construction illustrated above achieved a 1½ hour fire resistance rating without the need for a fire resistance enclosure. The enclosure is necessary to achieve a 2 hour rating.
WC manifold system

Developed for use in sanitary pipework systems in schools, hospitals, public and commercial buildings, the manifold system allows ranges of toilets to be connected to a horizontal float above floor level and eliminate the need for specially fabricated fittings.

The components are suitable for installation in a duct, or for fitting on the surface of the wall directly behind the pan. Where the manifold is fitted directly behind the range of toilets, the minimum distance between the end of the WC spigot and the face of the wall is 150mm.

To facilitate varying angles and gradients the 110 x 90mm manifold branch has a radial socket to match both options of adjustable WC bend. When the selected bend is cut to the appropriate line and solvent welded into the socket on the manifold branch a uniform fall is obtained between each toilet on the horizontal float.

To accommodate different dimensions between the WC spigot and horizontal float, the adjustable spigot bend SM43W may be trimmed by up to 35mm or the extension pipe SM45W can be used with the pan connector SM44W and SA323W cap & seal.

The WC socket on both the SM42W and SM44W should be trimmed to suit the length of pan spigot before the SA323W is fitted.

For installation details see page 53.