
Date: 8 January 2013

To: Technical Advisory Group

From: Mohamed Yoosuf

RE: **PVC-U DWV Expanda Joints, Expansion Bends and Swivel Expansion Joints for gravity sewer applications**

1. Introduction

This paper seeks TAG endorsement for the use of PVC-U DWV Expanda Joints, Expansion bends and Swivel Expansion Joints of size DN 100 to DN 150 for gravity sewer applications within City West Water's (CWW) licensed area.

2. Company Information

Storm Plastics (SA) Pty Ltd was established in 1989 by its current owner, Marty Bennett, a master plumber and drainage contractor. It is a South Australian company, with distribution throughout Australia. After much research and development, flexible plumbing fittings were manufactured to alleviate the effects of re-active soils, i.e. broken stormwater and sewer drains, which are the major causes for houses cracking, also are revolutionising the repair and cut-ins to sewer PVC-U drains.



The Expanda Joint, the first of many fittings, was tested by University of South Australia, and authorised in all States by various Water Authorities. The Expanda Joint complies with Australian Standards and is currently being sold nationally. Storm Plastics (SA) Pty Ltd manufactures the PVC-U component pieces in SA.

The Swivel Joint was added to the range of products in 1993. Consulting Engineers to the building trade are currently specifying both the Expanda Joint and the Swivel Joint in soil reports involving areas of highly reactive clay soils.

Storm Plastics (SA) Pty Ltd is an ISO 9001:2008 (Reg. No. 1274) Quality endorsed company by JAS-ANZ for design and manufacturing of PVC-U DWV flexible fittings for gravity sewer and storm water applications.

3. Product Information

Due to the extremes in temperature in Australia and the prevalence of reactive soils, Storm Plastics (SA) Pty Ltd recommends that provision be made for movement in the design and installation of all PVC-U drainage systems without exception.

This paper evaluates the following Storm Plastics PVC-U DWV products:

- a) PVC-U DWV Expanda Joints M&F (plain and taped) DN100
- b) PVC-U DWV Expansion Bends F&F x 90° DN100 and DN150
- c) PVC-U DWV Swivel Expansion Joints M&F DN100 and DN150

All the above types of fittings are WaterMark Level 1 (Certificate No. WMKA21411) product certified to AS/NZS 1260:2009 PVC-U pipes and fittings for drain, waste and vent applications by SAI Global.

The Swivel Joint assembly in combination with the Expanda Joint have permitted Soil Engineers to overcome many of the problems associated with reactive soils and the structural damage caused. The movement associated with reactive soils varies considerably depending on the conditions prevailing. When reactive soil moves, it does so simultaneously in a horizontal and vertical plane, not unlike a wave action in slow motion as it expands/contracts. This will inflict extreme forces upon anything before it. It is a natural force which is almost impossible to counteract without incurring considerable expense.

The outcome of such events frequently causes distortion damage to drainage systems and building structures over 20 years. It has been proven that the Storm Plastics range of 'swivel' and 'expansion' joints, when installed correctly, will provide flexibility to a pipework system and prevent breakages.

3.1 DWV PVC-U Expanda Joint

Expanda Joint is suitable for repair, stack work and cut-ins as it provides longitudinal movement (flexibility) in a drainage system when installed correctly. Specialised care is required to determine the most suitable location to install Expanda Joints into a drainage system.

Expanda Joints are high performance low cost fittings, manufactured to tolerances that ensure an effective seal and a long service life aimed at alleviating the stresses likely to be imposed upon drainage systems.

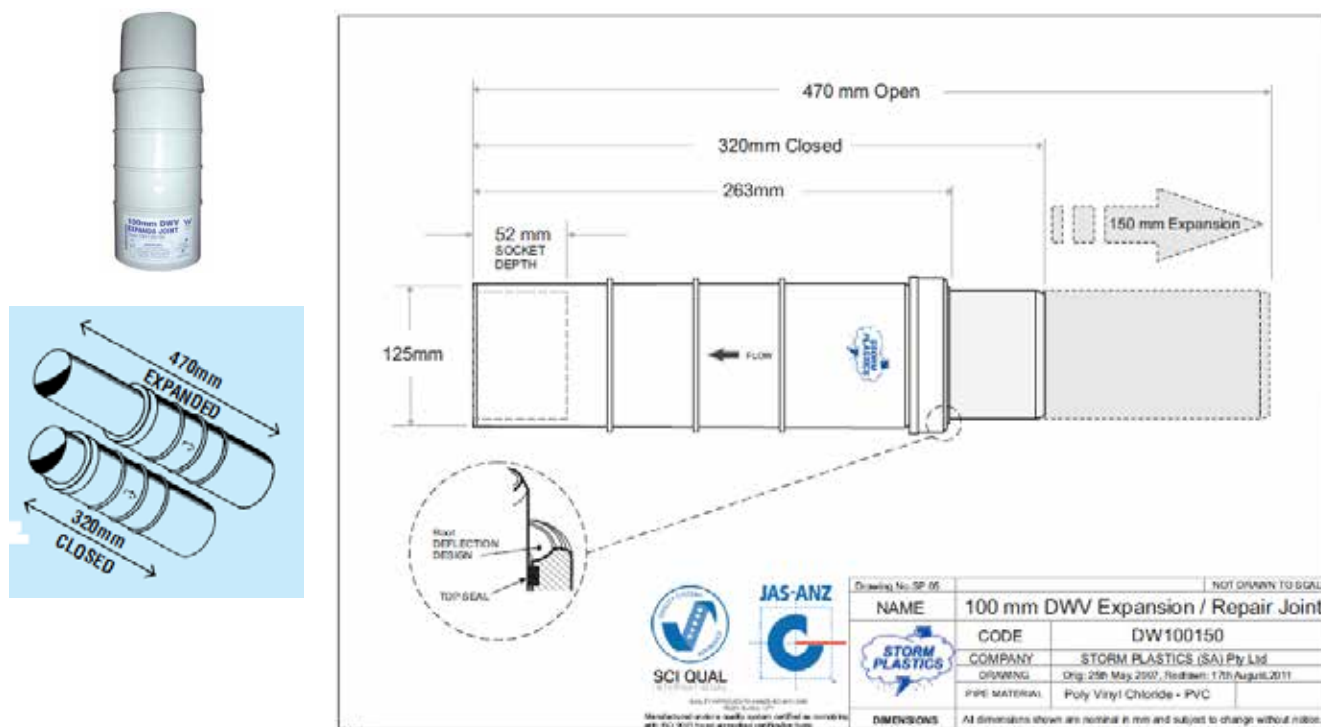


Figure 1: DN100 DWV PVC-U M&F Expanda Joint

Expanda Joints can be used in vertical or horizontal positions as a repair fitting or as a drainage fitting to accommodate expansion or contraction above or below ground.

Table 1 shows the range of DN100 DWV Expanda Joints considered in this assessment.

Table 1: List of DN100 DWV Expanda Joint

Item	Model Identification	Product Description
a)	DW100100MF	DN100 M&F Expansion Joint , allowing up to 100mm movement. Fitting measures 365mm open, 265mm closed.
b)	DW100100MM	DN100 M&M Expansion Joint , allowing up to 100mm movement. Fitting measures 365mm open, 265mm closed.
c)	DW100150MF	DN100 M&F Expansion Joint , allowing up to 150mm movement. Fitting measures 460mm open, 310mm closed.
d)	DW100150MM	DN100 M&M Expansion Joint , allowing up to 150mm movement. Fitting measures 460mm open, 310mm closed.
e)	DW100150T	DN100 M&F Expanda Joint Taped with Expanda Tape allowing up to 150mm movement
f)	DW100220MF	DN100 M&F Expansion Joint , allowing up to 220mm movement. Fitting measures 595mm open, 375mm closed.
g)	DW100220MM	DN100 M&M Expansion Joint , allowing up to 220mm movement. Fitting measures 595mm open, 375mm closed.

The 'Expanda Joint' being a flexible fitting, does need extra care and attention for maximum performance. For the benefit of the installer, a removable cardboard spacer is inserted into the bottom of the main socket section. This spacer should only be removed at the time of installation.

In the event that it is displaced before installation (i.e. when held in storage), it is important that there should always be a gap of not less than 20mm between the end of the spigot and the bottom of the socket. At the time of installation the spacer is to be removed and the spigot pushed home to the bottom of the socket then immediately withdrawn to the nominated working position. The working position for the Expanda Joint should be set half way or as nominated by the site Soils Engineer.

Table 2 shows the range of M&F DWV Fabricated Expansion Repair Joints included in this assessment.



Table 2: List of M&F DWV Fabricated Expansion Repair Joints

Item	Model Identification	Product Description
a)	DW100280	DN100 M&F DWV Fabricated Expansion Repair Joints , allowing up to 280mm movement. Fitting measures 715mm open, 435mm closed.
b)	DW150240	DN150 M&F DWV Fabricated Expansion Repair Joints , allowing up to 240mm movement. Fitting measures 790mm open, 550mm closed.

3.1.1 Underground installation of the Expanda Joint

It is recommended that the rubber ring joint be wrapped in denso tape impregnated with copper sulphate crystals to deter root intrusion into the joint.

Figure 2 illustrates instructions for use of the Expanda Joint for Cut-ins, repair and stack work.

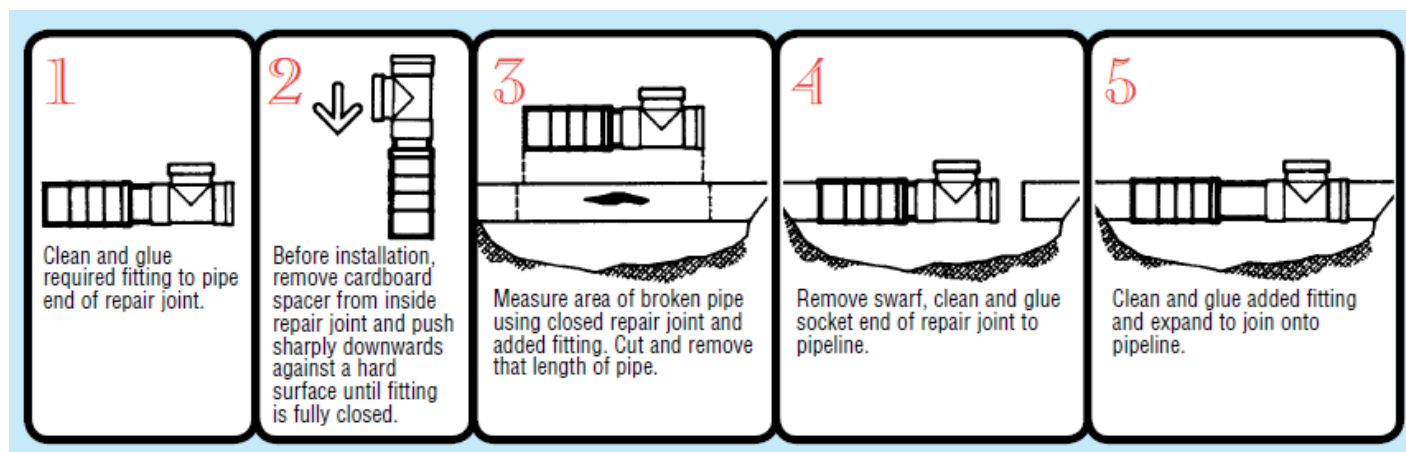


Figure 2: Guidelines for use of the Expanda Joint for Cut-ins, repair and stack work

Figure 3 illustrates instructions for use of the Expanda Joint as a flexible coupling in drainage installations (ref. AS 2870:1996 Residential slabs and footings Sections 5.5.4-b and 6.6-f)

- Section 5.5.4 (b) - Connection of stormwater drains and waste drains shall include flexible connections.
- Section 6.6 (f) - Joints in plumbing pipes within 3 m of the house under construction shall be articulated to accommodate ground movements without leakage. Septic tanks in particular require careful detailing.

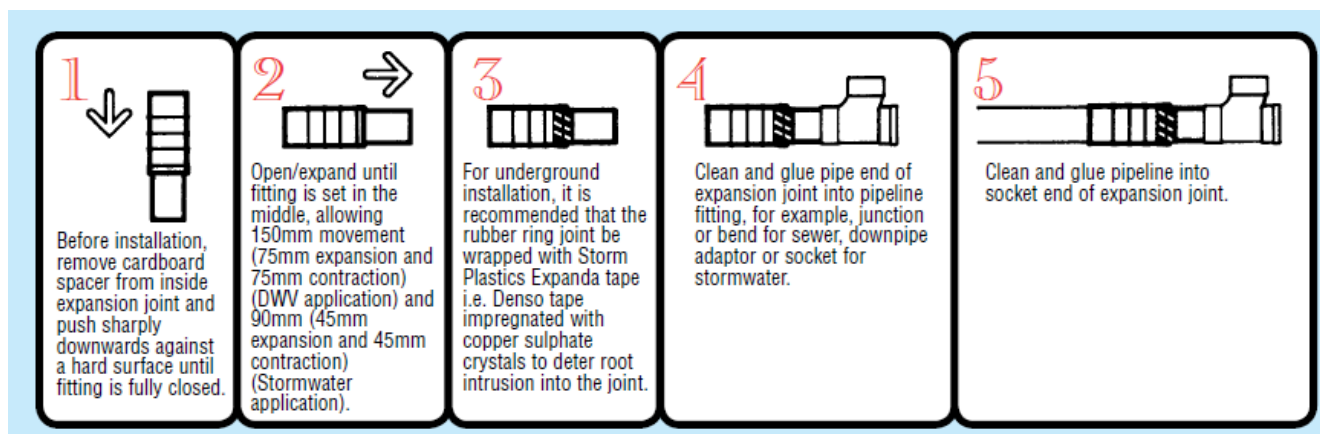


Figure 3: Guidelines for use of the Expanda Joint as a flexible coupling in drainage installations.

3.2 DWV PVC-U Swivel Expansion Joints

Storm Plastics (SA) Pty Ltd introduced 100mm and 150mm Swivel Joint assemblies into the Australian market in 1993 to complement their range of Expanda Joints which only provided movement in a longitudinal direction.

The availability of the Swivel Joint assembly, with a longitudinal expansion / sliding joint, has provided the additional flexibility necessary for underground drainage systems to work more closely with the forces of Nature.

The Swivel Joint assembly, with a rotational capability of 360° and an angular deflection to 15° from its axis, combined with the longitudinal expansion/contraction component has become a much sought after compact combination unit. Swivel Joint assemblies are NOT intended to be used as a bend.

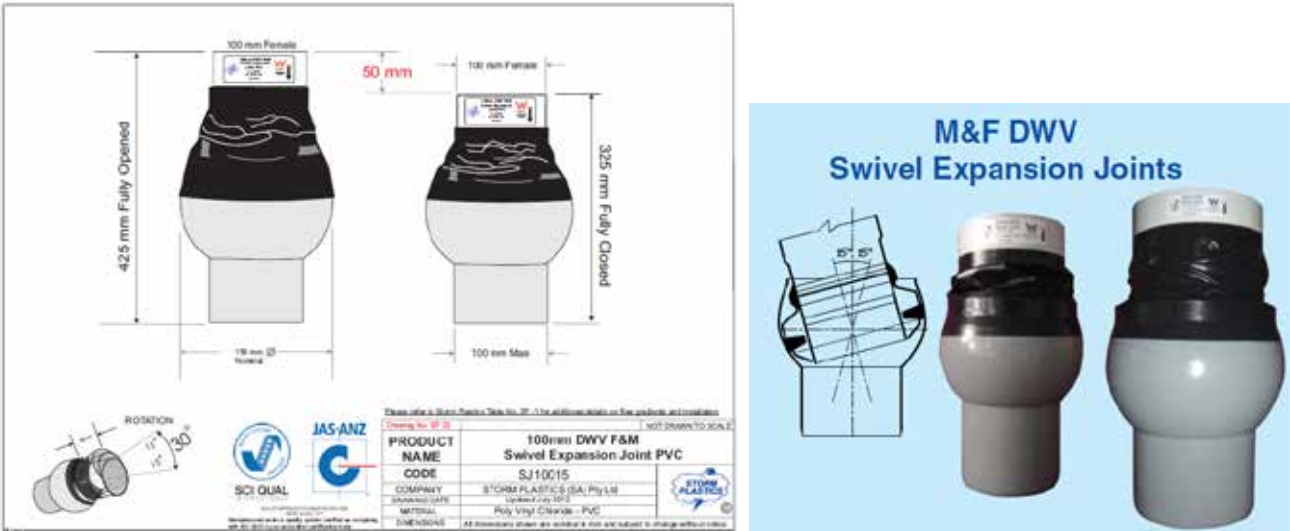


Figure 4: Swivel Expanda Joint

Table 3 shows the range of DN100 and DN150 Swivel Expansion Joints included in this assessment.

Table 3: List of DN100 & 150 DWV Swivel Expansion Joint

Item	Model Identification	Product Description
a)	DSJ/EXTEJ100	DN100 Double Swivel/Extended Expansion Joint , allows +/- 15° rotation either end & various lengths of movements
b)	SJ/EXTEJ100	DN100 M&F Swivel Expansion Joint , allows +/- 15° rotation either end & various lengths of movements
c)	SJ10015	DN100 M&F Expansion Joint , allows +/- 15° rotation and 50mm expansion.
d)	SJ100BENDCOMBO	DN100 F&F Swivel Expansion 90° Bend Combo Joint , allows +/- 15° rotation & up to 100mm movement. Fitting measures 570mm open, 470mm closed.
e)	SJ100EXPCOMBOOFF	DN100 F&M Swivel Expansion Combo Joint , allows +/- 15° rotation & up to 100mm movement. Fitting measures 425mm open, 325mm closed.
f)	SJ100EXPCOMBOOFM	DN100 F&F Swivel Expansion Combo 90° Bend Combo Joint , allows +/- 15° rotation & up to 100mm movement. Fitting measures 570mm open, 470mm closed.
g)	SJ15015	DN150 M&F Swivel Expansion Joint , allows +/- 15° rotation and 60mm Expansion.

Figure 5 illustrates a typical sewer drainage layout using ‘Expanda’ and ‘Swivel’ joints.

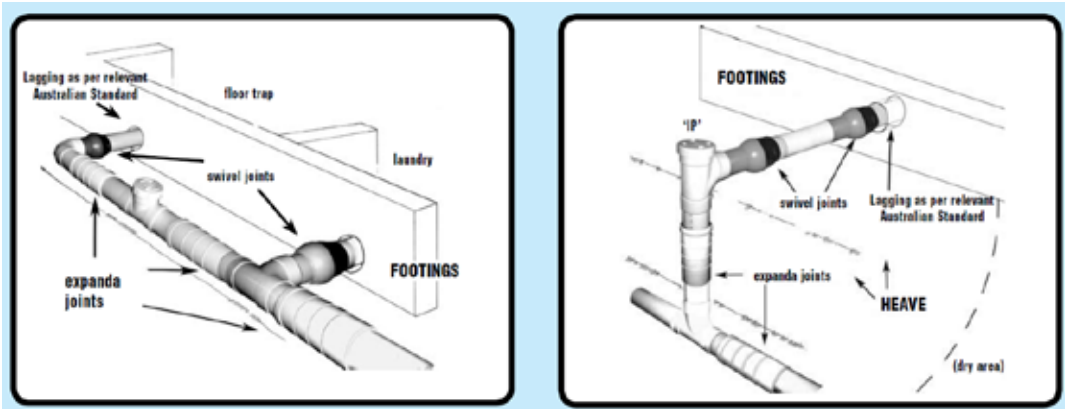


Figure 5: Guidelines of sewer drainage layout using Expanda and Swivel Joints

Figure 6 illustrates how an Expanda Joint and Swivel Expansion Joint can protect a drain from potential damage caused by reactive soil movements. Reactive soils in general are clay type soils that swell on wetting and shrink on drying.

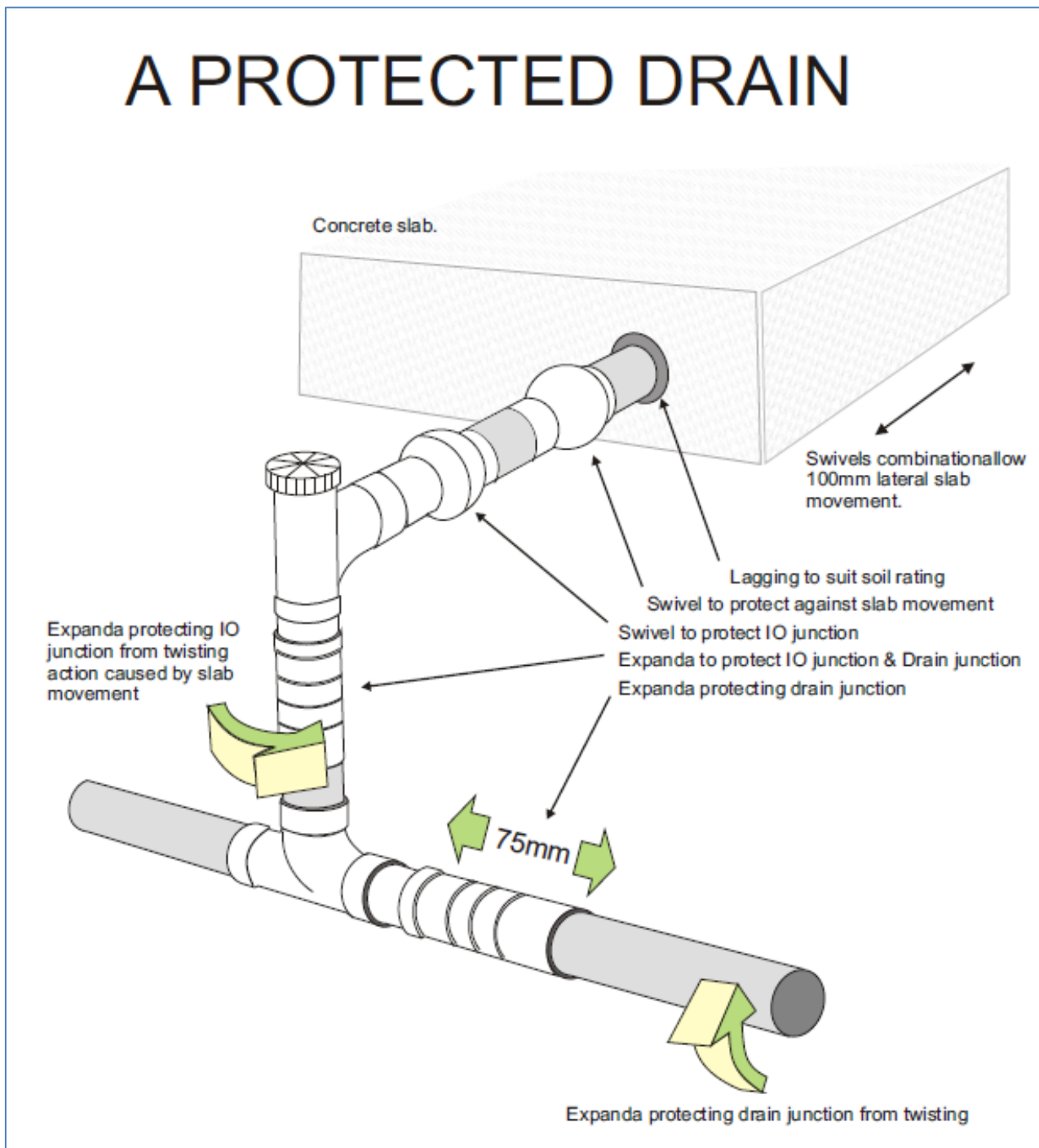


Figure 6: Installation of Expanda and Swivel Expansion Joints on a drain construction

3.3 Fabricated DWV PVC-U Expansion Bends

The following Storm Plastics' fabricated Expansion Bends are included in this assessment:

Fabricated DWV Expansion Bends				
	Size	Code	Expansion	Top to invert (overall measurement)
	100	DW10090155	155mm	330mm
	100	DW10090240	240mm	420mm
	100	DW10045155	155mm	300mm
	100	DW10045240	240mm	390mm
	150	DW15090240	240mm	520mm
	150	DW15045240	240mm	470mm

Table 4: List of DN100 & 150 DWV Expansion Bends

Item	Model Identification	Product Description
a)	DW10090155	DN100 F&F x 90° Fabricated DWV Expansion bend allowing up to 155mm movement, with top to invert 330mm
b)	DW10090240	DN100 F&F x 90° Fabricated DWV Expansion bend allowing up to 240mm movement, with top to invert 420mm
c)	DW10045155	DN100 F&F x 90° Fabricated DWV Expansion bend allowing up to 240mm movement, with top to invert 300mm
d)	DW10045240	DN100 F&F x 90° Fabricated DWV Expansion bend allowing up to 240mm movement, with top to invert 390mm
e)	DW15090240	DN150 F&F x 90° Fabricated DWV Expansion bend allowing up to 240mm movement, with top to invert 520mm
f)	DW15045240	DN150 F&F x 90° Fabricated DWV Expansion bend allowing up to 240mm movement, with top to invert 470mm

4. Performance Tests conducted on Expanda Joint and Swivel Joint

All Storm Plastics products that are WaterMark certified have been tested to AS/NZS 1260 and AS 1646 requirements.

Storm Plastics conducted performance tests as detailed in table 5 through 'University of South Australia's Australian Irrigation and Hydraulics Technology Centre':

Table 5: Performance Tests

Test No.	AS/NZS 1260:2002 PVC-U Pipes and Fittings for Drain, Waste and Vent Application	Tested in accordance with AS/NZS 1462:1998 - Methods of test for plastics pipes and fittings	Scope of Test	Results
1	Section 3.4.2: Tests on Elastomeric Seal Joints	Method 10: Method for hydrostatic pressure testing of fittings and elastomeric seal joints for non-pressure applications.	When tested in accordance with AS/NZS 1462.8, with a diametral distortion of 7.5%, the assembled joint shall withstand an internal pressure of 80 +5, -0 kPa for 60 +5, -0 min without leakage.	Pass
2	Section 3.4.3: Tests on Elastomeric Seal Joints	AS/NZS 1462.8:1998 - Methods of test for plastics pipes and fittings - Method 8: Method of test for infiltration	When tested in accordance with AS/NZS 1462.8, with a diametral distortion of 7.5%, the assembled joint shall not leak, when subjected to an internal vacuum corresponding to a gauge pressure of -80 kPa to -85 kPa for 60 +5, -0 min.	Pass
3	Section 3.4.4: Contact width and pressure	AS/NZS 1462.13:2006 - Methods of test for plastics pipes and fittings - Method 13: Method for the determination of elastomeric seal joint contact width and pressure.	When determined in accordance with AS/NZS 1462.13, elastomeric seals manufactured to AS 1646 and AS 681.1 shall have a contact pressure exceeding 0.4 MPa over a continuous width of 4 mm.	Pass
4	MP 52 - 2001 Manual of authorization procedures for plumbing and drainage products: Section 6.5.7 a) Hydrostatic and vacuum pressure test			Pass

Storm Plastics uses three types of elastomeric seals with their DWV PVC-U fittings. All seals comply with AS 1646, AS 681.1 and EN 681.1 as follows:

- a) O-Ring Seals
- b) Multi Point Contact Seals
- c) SK System Seals

Storm Plastics provided the following samples as detailed in table 6 for the performance tests:

Table 6: Samples used in the Performance Tests

Sample	Elastomeric Seals used	Supplier of Elastomeric Seal
DW100150 - 100mm M&F DWV PVC-U Expanda Joint allowing up to 150mm movement	Multi Point Contact Seals	Kelseal Rubber, NSW as per AS 1646 / AS 681.1
SJ10015 - 100mm M&F DWV PVC-U Swivel Expansion Joint, allows +/- 15° rotation and 50mm expansion	SK System Seals for longitudinal movement; and 10mm dia large O-ring seal for swivel rotational movement (Refer figure 7 below)	MOL Germany as per EN681.1
SJ15015 - 150mm M&F DWV PVC-U Swivel Expansion Joint, allows +/- 15° rotation and 60mm expansion		

Note: 100mm Expanda Joint uses 'Multi Point Contact Seal' but 150mm Expanda Joint uses 'SK System Seal'.

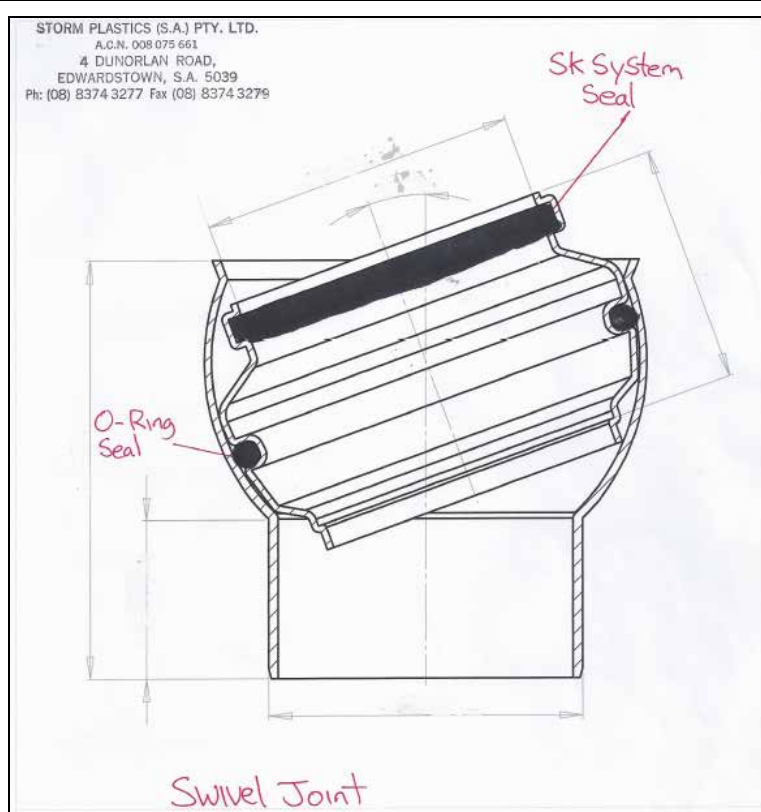


Figure 7: Swivel Joint with 'O-ring seal' and 'SK System seal'



Figure 8: 100mm Expanda Joint DW100150 Vacuum test with distortion



Figure 9: 100mm Expanda Joint DW100150 Hydrostatic test with distortion



Figure 10: Contact width and pressure on Expanda Joint



Figure 11: 100mm Swivel Joint SJ10015 Hydrostatic test with distortion



Figure 12: Vacuum test for swivel joint



Figure 13: Test rig with swivel joint specimen



Figure 14: Infiltration test setup showing swivel joint filled with red colour water

4.1 Test Results

All three samples met the test requirements outlined in AS/NZS 1260 and MP 52 (2001) and in table 5. It is worthwhile to mention results of Test No. 3 (Contact width and pressure as per AS/NZS 1260 Section 3.4.4) as below:

- 100mm Expanda Joint had a maximum effective seal width of 11.8mm (instead of 4mm) at 415 kPa and no leakage.
- 100mm Swivel Expansion Joint had a maximum effective seal width of 5.8mm (instead of 4mm) at 415 kPa and no leakage.
- 150mm Swivel Expansion Joint had a maximum effective seal width of 5.1mm (instead of 4mm) at 415 kPa and no leakage.

Refer to Appendix B summary of performance tests.

5. Product Warranty

In Australia, the supply of goods is covered by the normal commercial and legal requirements of the Competition and Consumer Act 2010, which covers manufacture to the relevant Standard. Storm Plastics (SA) Pty Ltd offers a standard warranty of 12 months.

6. Water Agency Experience with the product and field trial

As the Underground Solution Specialists for Reactive Soils, Storm Plastics products are widely used by Water Authorities and Contractors in SA, QLD and VIC (MWC) and other Australian States for drainage and storm water applications for a number of years.

List of approvals for 100mm Expanda Joint (since 1991)

- a) Ministry of Environment & Planning TAS (now divided into three water corporations)
- b) Sydney Water Board (now SWC)
- c) Melbourne & Metropolitan Board of Works (now MWC)
- d) SA Water
- e) Hunter Water Board NSW
- f) Broken Hill Water Board NSW
- g) ACT Electricity & Water
- h) Board of Works Bendigo

Refer to Appendix C for copies of authorisation letters issued to Storm Plastics range of flexible expansion joint fittings by the Melbourne & Metropolitan Board of Works and Fmg Koukourou Engineers.

7. Life Expectancy

AS/NZS 1260 states that by convention, DWV PVC-U plastics pipe systems are often designed on the basis of 50 years extrapolated test data. This is established international practice but is not intended to imply the service life of drainage pipes is limited to 50 years.

For correctly manufactured and installed systems, the actual life cannot be predicted, but can logically be expected to be well in excess of 100 years before major rehabilitation is required.

Storm Plastics products have been installed in Australia since 1989.

8. Product Assessment

This product has been assessed for conformance with CWW product acceptance criteria. There is no WSAA Product Specification for "DWV PVC-U Flexible Expansion Joint Fittings" included in this evaluation, although they are product certified to AS/NZS 1260.

9. Recommendation

It is recommended that TAG approves Storm Plastics range of flexible expansion joint fittings as listed below for gravity sewer application, subjected to a successful field trial.

Item	Model Identification	Product Description
1. DN100 DWV Expanda Joint		
a)	DW100100MF	DN100 M&F Expansion Joint , allowing up to 100mm movement. Fitting measures 365mm open, 265mm closed.
b)	DW100100MM	DN100 M&M Expansion Joint , allowing up to 100mm movement. Fitting measures 365mm open, 265mm closed.
c)	DW100150MF	DN100 M&F Expansion Joint , allowing up to 150mm movement. Fitting measures 460mm open, 310mm closed.
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g)	DW100220MM	DN100 M&M Expansion Joint , allowing up to 220mm movement. Fitting measures 595mm open, 375mm closed.
2. M&F DWV Fabricated Expansion Repair Joints		
a)	DW100280	DN100 M&F DWV Fabricated Expansion Repair Joints , allowing up to 280mm movement. Fitting measures 715mm open, 435mm closed.
b)	DW150240	DN150 M&F DWV Fabricated Expansion Repair Joints , allowing up to 240mm movement. Fitting measures 790mm open, 550mm closed.
3. DN100 & 150 DWV Swivel Expansion Joint		
a)	DSJ/EXTEJ100	DN100 Double Swivel/Extended Expansion Joint , allows +/- 15° rotation either end & various lengths of movements
b)	SJ/EXTEJ100	DN100 M&F Swivel Expansion Joint , allows +/- 15° rotation either end & various lengths of movements
c)	SJ10015	DN100 M&F Expansion Joint , allows +/- 15° rotation and 50mm expansion.
d)	SJ100BENDCOMBO	DN100 F&F Swivel Expansion 90° Bend Combo Joint , allows +/- 15° rotation & up to 100mm movement. Fitting measures 570mm open, 470mm closed.
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g)	SJ15015	DN150 M&F Swivel Expansion Joint , allows +/- 15° rotation and 60mm Expansion.
4. DN100 & 150 DWV Expansion Bends		
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e)	DW15090240	DN150 F&F x 90° Fabricated DWV Expansion bend allowing up to 240mm movement, with top to invert 520mm
f)	DW15045240	DN150 F&F x 90° Fabricated DWV Expansion bend allowing up to 240mm movement, with top to invert 470mm

Memorandum

Subject to TAG endorsement, Standards & Design will arrange a field trial with Network Operations and notify Storm Plastics.

Should this trial be successful, Storm Plastics' DWV PVC-U flexible expansion joint fittings will be included in the MRWA Products Web Portal.

Mohamed Yoosuf
Standards & Design
Engineering

Endorsed by

Robert Jagger
Manager Standards
Engineering

Ross Carruthers
Manager Standards & Design
Engineering

APPENDIX A



CERTIFICATE OF CONFORMITY

SAI Global hereby grants:

Storm Plastics (SA) Pty Ltd

4 Dunorlan Road, Edwardstown, SA 5039, Australia

Watermark Certificate of Conformity - Level 1

Evaluated to:
AS/NZS 1260:2009 - PVC-U pipes and fittings for drain, waste and vent application

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APPENDIX B



University of South Australia

Division of IT, Engineering and the Environment

Educating Professionals • Creating and Applying Knowledge • Serving the Community

AS/NZS 1260:2002 PVC-U Pipes and Fittings for Drain, Waste and Vent Application:

Tests on Elastomeric Seal Joints (Sections 3.4.2 & 3.4.3)

TEST REPORT- Final

Attention

Mr Marco Elbe

Storm Plastics (SA) Pty. Ltd.
4 Dunorlan Road
Edwardstown SA 5039

Prepared by

David Pezzaniti
Australian Irrigation and
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Date of issue

24 August, 2010



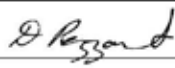
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SUMMARY

Specimen Number	Hydrostatic Pressure Test to: AS 1260 3.4.2	Infiltration test to: AS 1260 3.4.3
SP-4	PASS	PASS
SP-5	PASS	PASS
SP-6	PASS	PASS

Testing and reporting by:

David Pezzaniti BEng, CPEng, MIEAust.	
Tim Golding Dip(Eng)	

Memorandum

Australian Irrigation and Hydraulics Technology Centre
Division of IT, Engineering and the Environment
Telephone: + 61 8 8302 3652
Facsimile: + 61 8 8302 3386

24th August 2010

Mr Marco Elbe
Storm Plastics
4 Dunorlan Road
Edwardstown SA 5039

Dear Mr Elbe,

Testing of the Storm Plastics' DWV 100mm expanda joint, 100m swivel joint and 150m swivel joint has been conducted in accordance with:

AS/NZS 1260: 2006:2002

Clauses 3.4.2 & 3.3.1 Hydrostatic Pressure and included diametral distortion and was for 60 minutes.

Clause 3.4.3 Liquid Infiltration Test and this also included diametral distortion and was for 60 minutes.

In summary the specimen has met the requirements outlined in AS/NZS 1260:2002 section 3.4.2 and 3.4.3.

Enclosed is a report outlining the procedures, results and instruments used for conducting the tests.

Should you have any queries do not hesitate to contact me.

Kind regards

David Pezzaniti
Group Leader
Australian Irrigation Technology Centre
Division of IT, Engineering and the Environment
University of South Australia.



Testing Conducted to :

AS/NZS 1462.13:2001- Method 13. Elastometric seal joint contact width and pressure

MP 52 - 2001 Manual of authorization procedures for plumbing and drainage products: Section 6.5.7 a) Hydrostatic and vacuum pressure test

REPORT

Attention

Mr Marco Elbe

Storm Plastics (SA) Pty. Ltd.
4 Dunorlan Road
Edwardstown SA 5039

Prepared by

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Date of issue

15 August, 2005



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Memorandum

Australian Irrigation Technology Centre
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15th August 2005

Mr Marco Elbe
Stormplastics
4 Duncroan Road
Edwardstown SA 5039

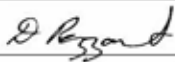
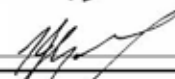
Dear Mr Elbe,

Testing of the Storm Plastics' DWV expanda joint and swivel expansion joints has been carried in accordance to:

- AS/NZS 1462.13:2001- Method 13. Elastometric seal joint contact width and pressure; and
- MP 52 - (2001) Manual of authorization procedures for plumbing and drainage products: Section 6.5.7 (a) Hydrostatic and vacuum pressure test.

In summary the specimens met the test requirements outlined in AS/NZS 1462.13:2001- Method 13 and MP 52 (2001). Enclosed includes a report of the evaluation and calibration sheets.

Testing and reporting by:

David Pezzaniti BEng, CFEng, MIEAust.	
Tim Golding Dip(Eng)	

Kind regards

David Pezzaniti

SUMMARY

TESTS	DN 100SP 100mmDWV Expanda Joint	DN 100ART 650 100mmSwivel Joint	DN 150ART652 150mm Swivel Joint
<i>Elastomeric seal joint contact width and pressure</i> (AS/NZS 1462.13:2001- Method 13)	PASS	PASS	PASS
Hydrostatic Pressure test MP 52 - (2001)	PASS	PASS	PASS
Vacuum pressure test MP 52 - (2001)	PASS	PASS	PASS

APPENDIX C

**BOARD OF
WORKS**

HSN 2426

FITTING AUTHORISATION

100mm Dia. SEWER/SWV EXPANDA JOINT

Submitted by: Storm Plastics (SA) Pty Ltd
99 Somerset Avenue
CUMBERLAND PARK, SA 5041

Authorisation is given for the installation of the above fitting on Property Service Drains connected to the Board's Sewerage System subject to the following conditions:

1. The fitting complying with the requirements of both AS1415-1984 "Unplasticized PVC (UPVC) Pipes and Fittings for Soil, Waste and Vent (SWV) Applications" and AS1260-1984 "Unplasticized PVC (UPVC) Pipes and Fittings for Sewerage Applications" and any amendments thereof; and
2. Being installed in accordance with the Board's "Plumbing Code and Sewerage Regulations" By-Law No.202.


I J Beith
MANAGER
PLUMBING INDUSTRY STANDARDS
17th JUNE 1991

HSN Index Authorisations
SANITARY FITTINGS & MATERIALS
990/201/1655



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