WSA 04:2022: Sewage Pumping Station Code of Australia (Version 3.1)

Amendment No 1

Revision

Version 3.1 of the 2022 Edition WSA 04 is amended as follows:

SUMMARY This revision applies to the following Clauses 1.5.3, 3.12, 4.2, 5.1, 5.1.1, 5.2.2, 5.4,5.4.3, 5.4.3.1, 5.5, 5.5.1, 5.5.2, 5.5.2.1, 5.5.2.2, 5.5.3, 5.5.3.1, 5/8, 5.11, 11.5.4, Table 11.1, Clause 11.8, 11.11.1, 12.3.6.5, 12.3.7, 12.3.7 ,12.3.9, 12.3.10.2, 12.3.12.5, 18.5.4, 18.5.6, 26.12,28.1,28.1.1,28.1.2,28.1.2.1, 28.1.2.2, 28.1.2.3, 28.1.3, 28.1.4, 28.1.5, 28.17.1, 28.17.2, 28.17.3, 28.17.4,28.17.5, 28.17.6, 28.18.

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I GLOSSARY OF TERMS

Revise and update the Reference documents as follows:

Delete definition for blue and purple

III REFERENCED DOCUMENTS

Revise and update the Reference documents as follows:

AS

AS/NZS

EN

PIPA

POP 014	Assessment of Polyethylene Welds	28.17.4.1, 28.17.5.1.1 28.17.5.2.1
POP 003	Butt fusion jointing of PE pipes and fittings – Recommended parameters	28.17.3,

ISO

13953	Polyethylene (PE) pipes and fittings Determination of the tensile strength and failure mode of test pieces from a butt-fused joint	28.17.4, 28.17.4.1
13954	Plastics pipes and fittings -- Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm (note the size restriction)	28.17.3, 28.17.4
21307	Plastics pipes and fittings -- Butt fusion jointing procedures for	28.17.2, 28.17.4.1

	polyethylene (PE) pipes and fittings used in the construction of gas and water distribution systems	
12176	Plastics pipes and fittings Equipment for fusion jointing polyethylene systems	
	Part 1: Butt fusion	28.17.2
	Part 2: Electrofusion	28.17.3

WSAA
Remove reference to WSA 01

WSA 01	Polyethylene Pipeline Code	5.5.2
WSA 402	Product and Material Information and Guidance – Gravity Sewerage	4.2, 5.1, 5.1.1
WSA 403	Product and Material Information and Guidance – Water Supply	4.2, 5.1, 5.1.1
WSA TN 08	Product Conformity Assessment Requirements	5.1

1.5.3 Designer responsibilities

Inserted new Note under 4th paragraph.

Laws around registration of engineers are different in each state. In Australia, each state and territory is responsible for registration of engineers. Some jurisdictions don't require an engineer to be registered to practice and others have statutory regulations that require it. To ascertain the current state and territory registration requirements refer to Engineers Australia website https://www.engineersaustralia.org.au

3.12 DISUSED OR REDUNDANT ITEMS

Inserted new 3rd, 4th and 5th paragraph in new Note between paragraph 4 and 5.

All works on disused or redundant items in road reserves shall comply with the road authority's requirements.

All works on disused or redundant in railway reserves shall comply with the railway authority's requirements.

Leaving any asbestos waste underground, including sectioned, broken or fragmented AC pipe as a result of AC pipe replacement, removal or rehabilitation may be a contravention of environmental protection law and occupational health and safety laws.

Removal of AC pressure mains shall be done in accordance with all relevant legislation and regulations.

Inserted the following after the last paragraph:

For discussed or redundant gravity sewers refer to WSA 02:2011 Clause 5.2.9 Disused sewers.

The works undertaken on disused or redundant items shall be recorded as part of the Work As Constructed details.

4.2 PROTECTION AGAINST DEGRADATION

Insert new references to WSA 402 and WSA 403 and insert an external link to this document.

Replace 2nd paragraph with

Protection strategies may include, but are not limited to:

5.1 General

Replaced the last three paragraphs with the following:

Product Specifications are listed on the WSAA website and have been published in an eBook format. Individual links to Product Specifications are provided within this Code to enhance user experience.

Note: For links to Product Specifications within this Code to work correctly, Users will need to have checked out the Product Specifications eBook from the WSAA Shop.

Each Product Specification nominates default quality assurance requirements for the product. Refer to WSA TN 08 Product Conformity Assessment Requirements and WSA 402 Part 2 and WSA 403 Part 2.

Note: This Technical Note (WSA TN-08) sets out product conformity assessment requirements to supplement the conformity testing and assessment requirements of the product Standard(s) called up in a duly nominated (e.g. WSAA) Product Specification. WSA TN 08 is available from the WSAA Shop.

Additional specifications may at times be added and existing specifications may at times be changed. Water Agencies may have additional, fewer or modified specifications listed on their websites that take precedence.

Where product specifications are not available, arrangements should be made to develop and publish such documents to address essential product attributes.

When in doubt, specialist advice should be obtained, including from the pipe manufacturer.

All products and materials used in contact with drinking and non-drinking water shall comply with AS/NZS 4020.

5.1.1 Selection Guide for Pipeline Systems

Insert a new heading 5.1.1. after the last paragraph 5.1.1 Selection Guide for Pipeline Systems

The WSAA Product and Material Information and Guidance materials (WSA-402) and (WSA 403) contain information on the principal pipeline system attributes and some details of ancillary products used in the construction

(a) of sewerage infrastructure and referenced in Gravity Sewerage Code of Australia WSA 02. It outlines aspects such as product specifications, product descriptions and classifications, joint types, water industry experience and recommendations on use.
(b) of water supply networks and referenced in Water Supply Code of Australia WSA 03. It outlines aspects such as product specifications, product descriptions and classifications, joint types, water industry experience and recommendations on use.

They do not provide instructions on life expectancy for pipeline systems as this is dependent upon design, manufacture, transport, handling, installation, operation, protection from third party damage and other external factors..

WSAA Product and Material Information and Guidance materials (WSA 402 and WSA 403) has been published in an eBook format. A PDF copy of these publications can be downloaded directly from this eBook. Individual links to WSA 402 and WSA 403 are provided within this Code to enhance user experience.

Product and material information, specifications and guidance including pipeline system selection and quality assurance options are available from WSAA. Where product specifications are not available, arrangements should be made to develop and publish such documents to address essential product attributes

Please note that in order for the link to Product and Material Information and Guidance materials (WSA 402 and WSA 403) to function properly within this Code, Users must have purchased and checked out the WSA 402 and WSA 403 eBooks from the WSAA Shop.

5.4 Product Specifications

Relevant Product Specifications include:

Included WSA PS 201

> WSA PS – 201 DUCTILE IRON FITTINGS (CIOD) FOR PRESSURE AND NON-PRESSURE APPLICATIONS - DRINKING WATER, NON-DRINKING WATER SUPPLY AND SEWERAGE

Amended title of WSA PS – 212 as follows:

> See WSA PS – 212 (Replaced by WSA PS – 201)

Included the flowing product specifications after WSA PS – 230

> WSA PS – 243 POLYVINYLCHLORIDE, UNPLASTICISED (PVC-U) FITTINGS (BS EN 1401-1) FOR NON-PRESSURE APPLICATIONS – SEWERAGE
>
> WSA PS – 236 VARIABLE BEND, POST-FORMED PVC-U FITTINGS FOR NON-PRESSURE APPLICATIONS - SEWERAGE

5.5.2 Sizes and configurations

Amended Clause 5.5.2 (a) as follows:

> (c) Jointing of PE mains shall be specified in accordance with 15.21 WELDING OF PE PIPES

5.4.3.1 Sizes and configurations

Inserted new last paragraph.

> EN 1401-1 dimensional requirements for PVC injection moulded fittings comply with the dimensional requirements of AS/NZS 1260.

5.5 PE PIPELINE SYSTEMS

5.5.1 Product Specifications

Inserted the following WSA PS

> WSA PS – 271 DUCTILE IRON WIDE TOLERANCE MECHANICAL COUPLINGS AND FLANGE ADAPTERS WITH END THRUST RESTRAINT FOR PRESSURE APPLICATIONS – DRINKING WATER, NON-DRINKING WATER SUPPLY AND SEWERAGE

WSA PS – 278 GATE VALVES, RESILIENT SEATED, WITH INTEGRAL POLYETHYLENE (PE) ENDS FOR PRESSURE APPLICATIONS – DRINKING WATER, NON-DRINKING WATER SUPPLY AND SEWERAGE

WSA PS – 279 EUROPEAN GATE VALVES, RESILIENT SEATED, WITH INTEGRAL POLYETHYLENE (PE) ENDS FOR PRESSURE APPLICATIONS – DRINKING WATER, NON-DRINKING WATER SUPPLY AND SEWERAGE

WSA PS – 281 GATE VALVES, RESILIENT SEATED WITH RESTRAINED FLEXIBLE JOINTS FOR POLYETHYLENE PIPE IN PRESSURE APPLICATIONS – DRINKING WATER, NON-DRINKING WATER SUPPLY AND SEWERAGE

Relevant Product Specifications for PE pipeline systems for non pressure applications include:

Amended the title of WSA PS 241 as follows:

WSA PS–241 POLYETHYLENE (PE), ~~RIBBED~~ STRUCTURED WALL CONSTRUCTION, PIPES AND FITTINGS FOR NON-PRESSURE APPLICATIONS – SEWERAGE

5.5.2 Size and Configuration

Changed heading to 5.5.2 PE PRESSURE PIPELINE SYSTEMS

Insert new title 5.5.2.1 Size and Configuration

5.5.2 PE PRESSURE PIPELINE SYSTEMS Size and Configuration

5.5.2.1 Size and Configuration

The nominal diameter, pipe pressure classification, material class (PE100), length and form of pipes (straight lengths or coils), types, materials and classes of fittings shall be detailed in the Design Drawings and/or Specification. The means of tapping the pressure sewer mains shall also be detailed in the Design Drawings and/or Specifications noting that:

(a) Where tapping is specified for PE pressure sewer mains use either:

(i) an authorised electrofusion tapping saddle complying with WSA PS–329 or

(ii) an authorised mechanical tapping saddle complying with WSA PS–310.

(b) Direct tapping of all reticulation sized mains is not permitted.

(c) Jointing of PE mains shall be specified in accordance with 28.17 WELDING OF PE PIPES.

(d) All mechanical couplings shall be self-restraining.

(e) PE stub flanges and backing rings shall comply with PIPA Guideline POP007 and be sourced from the (Water Agency approved) supplier of polyethylene pipe or fittings.

NOTE

PIPA Industry Guideline POP007 provides guidelines for the geometric specification of metal backing flanges suitable for use with PE flange adaptors in the sizes DN 20 through to DN 1000 and flanges in accordance with AS 2129, AS/NZS 4331.1 (ISO 7005-1) and AS/NZS 4087

.

Insert new title 5.5.2.2 PE fabricated fittings for pressure applications

5.5.2.2 PE fabricated fittings for pressure applications

Polyethylene (PE) fabricated fittings, for use with polyethylene pipe made to AS/NZS 4130, shall be de-rated by the manufacturer applying the fitting geometry factor and fusion method factor, in accordance with AS/NZS 4129. Where fitting geometry is not covered by AS/NZS 4129 derating factors in PIPA Guideline POP 006 shall apply.

NOTE . De-rating the nominal pressure class is required where PE pipe or fittings will be subjected to cyclic pressures or where temperatures exceed 20°C.

Insert new title 5.5.3 PE fabricated fittings for pressure applications

Insert new title 5.5.3.1 Size and Configuration

5.5.3 PE NON-PRESSURE PIPELINE SYSTEMS

5.5.3.1 Size and Configuration

The nominal diameter, pipe pressure classification, material class length and form of pipes (straight lengths or coils), joint types (butt weld or electrofusion), construction type (plain wall or structured wall) and types, materials and SDR of fittings shall be detailed in Product Specifications, which should be referenced in the Design Drawings and/or Specification.

5.8 GRP Pipeline System

5.8.1 Product Specifications

Insert new Product Specification

WSA PS – 219 GLASS REINFORCED PLASTICS (GRP) PIPES AND FITTINGS FOR PRESSURE AND NON-PRESSURE APPLICATIONS - DRINKING WATER, NON-DRINKING WATER SUPPLY AND SEWERAGE

5.11.1. Product Specifications

Insert New WSA PS – 345

WSA PS – 345 POLYMERIC MAKE-UP RINGS FOR SEWERAGE ACCESS CHAMBERS

11.5. 4 Minimum pressure class

Amended first sentence, Change Class to PN

11.6 PLASTICS PIPES

Amended Table 11.1 as follows and added new Note 6 and 7

TABLE 11.1

~~PRESSURE~~ TEMPERATURE DE-RATING FACTORS FOR PLASTICS PIPES OPERATING AT ELEVATED TEMPERATURES

Pipe material	**De-rating factor[1], t**					
	Time weighted 12 month average temperature[1], °C					
	20	**25**	**30**	**35**	**40**	**50**
PVC-U[5]	1.0	0.94	0.87	0.78	0.70	0.58
PVC-M[5]	1.0	0.94	0.87	0.78	0.70	0.58
PVC-O[5]	1.0	0.94	0.87	0.78	0.70	0.58
~~PE 80B[2]~~	~~1.0~~	~~1.0~~	~~0.83~~	~~0.77~~	~~0.77~~	~~.077~~
PE 100[2,6]	1.0	0.91	0.91	0.83	0.83	.071
GRP[4]	1.0	1.0	1.0	1.0	1.0	1.0

1. At elevated temperatures, a reduction in the design life may occur.

2. The ~~figures~~ values for ~~PE80B and~~ PE100 are based on PIPA POP013 Temperature derating of PE pipelines. The guidance provided in POP013 is based on typical PE compounds used in Australia and New Zealand to manufacture AS/NZS 4130 PE pipe and listed in ~~PIPA Guideline~~ POP004 ~~Polyethylene Pipe Compounds~~.
3. Multiply the temperature de-rating factor t by the PN number of the pipe to determine the derated PN of the pipe.
4. The figures for GRP are based on a polyester body resin. However, for continuous operation ≥35°C vinylester resins are required. No temperature de-rating is required up to 50°C for GRP pipes with vinylester body resins.
5. The ~~figures~~ values for PVC pipe de-rating are based on PIPA "Temperature Derating of PVC Pipes for Pressure Applications" (TN003) ~~and "PVC Pressure Pipes Design for Dynamic Stresses" (POP101).~~
6. Where temperature derating factors for PE fabricated fittings operating at temperatures above 20°C is required. Refer to ~~PIPA~~ POP013 for further information.
7. For PE pipes operating continuously at temperatures ≥35°C the life expectancy may be impacted – see PIPA POP013

11.8 PIPELINE MATERIALS

Deleted the last sentence. Inserted the following paragraph.

Refer to the 5.1.1. Selection Guide for Pipeline Systems for Product and Material Information and Guidance documents available on the WSAA website.

11.11 RECEIVING SYSTEM

11.11.1 General

Deleted second last paragraph

> ~~As a rule of thumb, some Water Agencies nominate "accommodation of ultimate flows" as being within 2/3 of the diameter of the receiving sewer~~.

Insert new title

> 12.3.6.5 Encased PE pipelines
>
> When grouting or encasing PE pipes, it is important to determine the maximum hydrostatic grouting pressure and the maximum temperatures that may be generated due to the exothermic reaction caused by the concrete curing. This will assist with determining if the MAOP selected of the encased PE pipe will be sufficient to prevent the pipe from deflecting or buckling. If you have concerns about the grouting pressure, you can carry out the grouting process with the pipe being internally pressurised.
>
> Where PE pipes are to be encased in concrete precautions shall be taken to protect the pipe surface from damage that could occur as a result of because of differential movement of the encased pipe.
>
> *Protection may be by wrapping in a compressible membrane with a minimum of 2-3 mm made polyethylene, PVC , geotextile fabric or felt.*

NOTE : Encasement in concrete may compromise the inherent flexibility of a PE pipeline and should only be used in special circumstances. In unstable ground conditions, the use of geotextile to form a ground beam (as shown in AS/NZS 2566.2) may provide a superior solution.

12.3.7 Above ground crossings

Insert new third paragraph.

Where a section of pressure main is to be supported by a bridge, the bridge designer shall be consulted to determine expected bridge movements and deflections due to dead/live load, braking forces, temperature etc. Where necessary, the pressure main shall be provided with sufficient articulation to accommodate such movements and deflections.

12.3.9 Trenchless technology

Added reference to 3.6 ENVIRONMENTAL CULTURAL AND HERITAGE CONSIDERATIONS at the end of the second paragraph.

Insert the following paragraph

A general description of each technique is detailed in APPENDIX I — TRENCHLESS TECHNOLOGIES.

Deleted the following from the last sentence

For further information refer to www.astt.com.au.

Inserted the following after the last paragraph and updated the references as follows:

The Australasian Society Trenchless Technology has developed the following Trenchless Guidelines, Standards and Specifications to assist industry users in Australia and New Zealand in utilising these technologies. For further information refer to:

ASTT Guidelines on

HDD, Pipe Bursting and Microtunnelling;

Microtunnelling Design Guidelines Sewer (MDG-S)

ASTT Standards for

Horizontal Directional Drilling;

Pipe Bursting;

Microtunnelling and Pipe Jacking

ASTT Sample Specification for

Horizontal Directional Drilling;

Pipe Bursting;

Microtunnelling and Pipe Jacking;

Design of Structural Pipe Lining

ASTM F1962.

12.3.10.2 THRUST BLOCKS

Insert a new clause and Note after the first paragraph.

PE Electrofusion joints, butt weld joints and compression fittings that comply with AS/NZS 4129 can develop the full axial strength of the pipe and in buried applications do not require thrust blocks to resist internal pressure forces at bends, tees, reducers, offsets, dead ends, etc.

Because of the general absence of anchor blocks in PE pipe systems, caution should be exercised when specifying the use of non-end thrust resistant fittings such as wrap-around stainless steel flanged off-take clamps for post installation works.

12.3.12.5 PE mains

Inserted new last paragraph and Note

PE Electrofusion joints, butt weld joints and compression fittings that comply with AS/NZS 4129 can develop the full axial strength of the pipe and in buried applications do not require thrust blocks to resist internal pressure forces at bends, tees, reducers, offsets, dead ends, etc.

Because of the general absence of anchor blocks in PE pipe systems, caution should be exercised when specifying the use of non-end thrust resistant fittings such as wrap-around stainless steel flanged off-take clamps for post installation works.

18.5.4 On-site storage

In the eighth paragraph replace the term ‘rubber ring’ with an ‘elastomeric seal’ as follows:

Store elastomeric seals, lip seals and gaskets away from sunlight and in an unstrained condition.

Add the following new sentences after the eleventh paragraph.

Electrofusion fittings shall be stored in their original packaging.

Joint lubricants shall be stored in sealed containers until ready for use.

18.5.6 Coiled plastics pipe

Inserted new first paragraph.

> *Coils of pipe may be heavy and it must be remembered the coil is under tension . The amount of energy stored in the coil will depend on the size of pipe, the class of the pipe, and the size of the coil. The amount of energy can be substantial and cause significant injury, death or damage if released in an uncontrolled manner.*

Added the following sentence to the end of the existing first paragraph.

> *Although both ovality and curvature may reduce naturally with time, special equipment is available to facilitate handling and jointing. Coiled pipe is usually limited to a maximum of DN 125.*

Document coil handling and processing requirements using suitable coil handling and levelling equipment to reduce ovality and curvature to an acceptable level to achieve construction tolerances (Refer to 36 TOLERANCES ON AS-CONSTRUCTED WORK).

Validate documented procedures by undertaking a trial installation to demonstrate that coiled pipe can be installed to meet construction tolerances (Refer to 36 TOLERANCES ON AS-CONSTRUCTED WORK).

26.12 EXCAVATION AND PIPELAYING USING TRENCHLESS TECHNIQUES

Delete excavation from the last line of the first sentence.

Insert the following new last paragraph.

> Refer to Appendix I Trenchless Technologies.

28.1 INSTALLATION OF PIPES

Change heading of Clause 28.1 as follows:

> 28.1 INSTALLATION OF PIPES IN TRENCHES
>
> 28.1.1 General

Inserted the following two paragraphs after the last paragraph.

> Maintain the inside of all items clean and dry during the construction of the pressure main. Use exclusion caps, plugs or blank flanges of a suitable design to seal open ends of items as necessary to prevent contamination during pipe laying operations.
>
> At the end of each day’s laying, seal the end of the pipe to prevent ingress of trench material and/or water and other foreign matter.
>
> If at any time pipes become flooded internally with dirty water during storage and/or construction, remove any dirt and foreign matter from within the pipeline.
>
> Undertake welding of pipes in accordance with 28.16 WELDING OF STEEL PIPELINES or 28.17 WELDING OF PE PIPELINES .

28.1.2 Cleaning, inspection and joint preparation

Replace all text with the following:

Inspect all items just prior to use in accordance with 18.2 DELIVERY INSPECTION OF PRODUCTS AND MATERIALS. Remove damaged items from the Works site and replace.

Clean and examine all pipeline system items before installation. Inspect each joint seal for fit and flaws before making the joint in accordance with the manufacturer's instructions.

The jointing methods will vary depending upon the material used and the jointing systems available. The Product and Material Information and Guidance, supplier’s drawings and Standard Drawings provide information on jointing systems.

Insert new Clause 28.1.2.1

28.1.2.1 Socket and spigot with elastomeric seals joints

Inspect each joint seal for fit and flaws before making the joint in accordance with the manufacturer’s instructions.

Do not use damaged, or incorrect seals.

Treat cut pipe ends in accordance with pipe manufacturer’s recommendations.

Chamfer, if required, and provide witness marks on the unmarked length of any cut pipes. Do not score pipes when providing the witness mark.

Ensure the seals, spigot and socket are clean and the correct joint lubricant is used for elastomeric seals.

The above steps apply to pipes formed with sockets or in the form of double socket couplings used to joint plain end pipes. For GRP pipes, a double-socket coupling is usually supplied mounted on one end of the pipe.

Insert new Clause 28.1.2.2

28.1.2.2 Butt Fusion and Electrofusion Welding

For fusion jointing of polyethylene pipes and fittings prepare the jointing surfaces and the geometry of the assembly in accordance with Clauses 15.21 WELDING OF PE PIPELINES

Do not use electrofusion fittings that have been removed from their packaging or have damaged packaging.

PIPA Industry Guideline POP001 Electrofusion Jointing of PE Pipe and Fittings for Pressure Applications may be used for guidance for non-pressure applications.

PIPA Industry Guideline POP003 Butt Fusion Jointing of PE Pipes and Fittings – Recommended Parameters may be used for guidance for non-pressure applications.

28.1.2.3 Coiled Plastics pipes

De-coil and treat plastics pipes in accordance with coil handling and processing procedures previously documented and validated (Refer to 18.5.6 Coiled plastics pipe).

Insertion of new Note

Additional information on storage, transport and handling of coiled PE pipes may be found in PIPA Guideline POP 005. In particular, attention is drawn to the dangers associated with stored energy in coiled pipes or those rolled on drums

.

28.1.3 Laying

Changed clause 28.1.3 Laying to clause 28.1.3. Positioning of the pipeline

28.1.3 Positioning of the pipeline

Position pipes in the trench such that the embedment material can be placed and compacted, as required.

Excavate pockets for sockets, couplings, flanges or other projections so as to ensure the pipeline is fully supported along the full length of pipe barrels. Ensure such pockets are the minimum necessary to keep the projection clear of the bedding material, except where access for joint treatment requires additional excavation.

Adjust the pipe to the correct alignment by re-lifting the pipe without affecting the integrity of the joint.

Where pipes are joined in the trench, to prevent movement, restrain pipes already laid before the next joint is made.

Prevent flotation of pipes during laying in accordance with 15.6 FLOTATION CONTROL.

Lay all pipes with their identification markings facing upwards .

Lay the water main on continuously rising grades from scour valve to local high point, notwithstanding any minor irregularities in the ground surface. Make gradual changes in alignment or grade by deflecting at flexible joints after the joints have been made. Comply with the manufacturer's recommendations in respect of maximum deflection for each joint.

28.1.4 Laying and joining pipes and fittings with elastomeric seals

Complete cleaning, inspection and joint preparation in accordance with 28.1.2.1 SOCKET AND SPIGOT WITH ELASTOMERIC SEAL JOINTS

When joining pipes and fittings with elastomeric seal joints:

(a) Ensure that the inside of the socket is clean.

(b) Where elastomeric seals are required to be fitted, clean and fit the seal if not already fitted. Check that the elastomeric seal sits evenly in the socket.

(c) Apply the manufacturer's specified lubricant to the end of the spigot and chamfer of the pipe spigot.

(d) Align the pipes so that there is no deflection at the joints before inserting the spigot in the socket and pushing it home to the witness mark.

(e) Hold the socket end firmly during jointing to prevent previously assembled joints from moving.

(f) Do not insert a metal spigot (e.g. of a fitting) into the socket of a plastics pipe.

(g) Where pipes are required to be cut in the field:

(i). Check the pipe spigot diameter to ensure it is within tolerance.

(ii). Cut the spigot end square and remove all burrs.

(iii). Chamfer the cut end of the pipe with a taper of approximately 15◦ to approximately half the wall thickness, or as otherwise specified by the pipe manufacturer.

(iv). Witness mark the pipe at the distance specified by the manufacturer and make the joint as specified in (a) to (f).

(v). If the same manufacturer does not make spigots and sockets, refer to the socket manufacturer for the correct witness marking depth.

(h) Push the spigot end of the pipe into the socket of the other pipe, not the other way.

(i) Small diameter pipes can be pushed with a log bar. For larger diameter pipes, use of other equipment like a rack, lever puller or excavator as necessary.

(j) Insert the spigot end into the socket till the socket face is positioned at the witness mark.

(k) Jointing of push on fittings is recommended to be done using rack and lever equipment. Jointing of fittings with the pipe can also be done using a suitable tackle e.g. winch method.

(l) After the joint has been made, check the joint to determine if the seal has been correctly inserted.

(m) Inspect the joint to ensure the manufacturers specified insertion depth has been achieved. Inspect the joint by inserting a metal rule into the socket gap and measure insertion depth . Ensure the manufacturers specification has been met and this depth is uniform around the whole circumference. If a difference outside the specified tolerance is found, dismantle and re-join.

If the joint is to be made using a cut pipe length the pipe spigot diameter must first be checked to ensure it is within tolerance.

For some pipeline systems it's important to select an adjustment pipe (suitably marked according to the applicable standard) for cutting as it will meet the required spigot tolerance for the jointing proposed, without any machining required

Insert new Clause 28.1.5

28.1.5 Laying and jointing of polyethylene pipes and fittings

Undertake inspection and joint preparation in accordance with 28.1.2.2 BUTT FUSION AND ELECTROFUSION WELDING

When fusion jointing of polyethylene pipes and fittings refer to PIPA POP001 and POP003.

Pipes may be jointed at ground level and then lowered into position.

Installation shall allow for thermal contraction and expansion of the PE pipe in accordance with AS/NZS 2033. The allowance shall be sufficient for a temperature change of at least 35°C.

PE pipes shall be laid in the trench to line and level with full embedment and partial trench backfill without restricting the ends until the pipe has had time to stabilise to ground temperature.

Where manual cold bending of the PE pipe has been employed, the combined effect of pipe bending and thermal contraction shall be considered to ensure that strain in the pipe wall remains acceptable.

Undertake welding of pipes in accordance with 28.17 WELDING OF PE PIPELINES.

For trenchless installation of pipes, install in accordance with the Specification and relevant Design Drawings.

28.17 Welding of PE Pipelines

Replace the entire content in Clause 28.17 with the following

28.17.1 General

Use electrofusion or butt fusion for joining pipe-to-pipe or fitting-to-pipe.

Undertake all welding in accordance with the Specification, relevant Design Drawings and approved jointing procedures as specified in Clause 28.17.2 and 28.17.3.

Butt fusion and Electrofusion shall be performed by competent persons having current certification and experience as defined in Clause 28.16.6.

28.17.2 PE Butt Fusion Welding

Butt-fusion jointing procedures shall be in accordance with ISO 21307.

Other fusion procedures may be used subject to approval by the Water Agency.

PIPA Industry Guideline POP003, should be used for guidance on the butt fusion jointing of PE pipe and fittings.

All equipment for butt fusion jointing shall comply with the requirements of ISO 12176-1.

Butt fusion parameters shall be validated by test before welding commences on site.

28.17.3 PE Electrofusion Welding

Electrofusion jointing procedures shall be carried out in accordance with the manufacturer's instructions for each specific size and type of fitting.

Electrofusion control boxes shall comply with ISO 12176-2.

PIPA Industry Guideline POP001, should be used for guidance on the electrofusion jointing of PE pipe and fittings for pressure applications.

Electrofusion joints shall be validated by test before welding commences on site – see clause 28.17.4.2 Electrofusion – Pre-Construction test welds

28.17.4 Weld Testing Butt Fusion and Electrofusion Joints

Joining pipes and fittings by electrofusion or butt fusion shall be to an approved jointing procedure that has been qualified by destructive testing in accordance with ISO 13953 and ISO 13954.

Fusion joining procedures shall be qualified prior to the commencement of welding on site.

28.17.4.1 Butt Fusion – Pre-Construction Test Welds

Before production jointing commences qualification of the butt fusion procedure shall be carried out unless a suitable pre-qualified procedure has been approved by the Water Agency. Qualification establishes the optimum weld procedure for the project within the scope of the ranges for each individual parameter nominated in ISO 21307.

Qualification welds shall optimise the weld parameters and be tested in accordance with ISO 13953 *Polyethylene (PE) pipes and fittings – Determination of the tensile strength and failure mode of test pieces from a butt-fused joint*

Qualified Procedures may be grouped by diameter to reduce the amount of qualification testing. The recommended groupings are shown in Table 28.1 below

Table 28.1: Butt Fusion testing qualification requirements

Procedure Qualification Test Pipe Diameter and for each SDR	Qualifies for sizes
Any ≤DN225	≤DN225
Any >DN225 – DN450	DN225 -DN450
>DN450	Each pipe diameter shall be tested

A pilot weld shall be undertaken for each welder, welding machine, pipe diameter and wall thickness using the qualified procedure.

A record of the parameter values for each weld shall be made.

Each pilot weld shall be performed on the actual pipe used in the project and under site conditions.

Pilot welds shall be tested in accordance with ISO 13953.

Options to assist in the interpretation and assessment of butt fusion tensile tests can be found in PIPA document POP014.

Only when these pre-construction joints pass the acceptance criteria shall the project proceed.

Test samples shall be identified by

pipe size,

(a) SDR,
(b) PE material composition grade,
(c) date,
(d) actual weld parameters used
(e) welder number, machine and welding conditions at the time of welding.

Butt fusion joint samples shall be submitted for destructive testing to an approved NATA registered testing laboratory.

A field welding QA plan shall be submitted, and approved, before welding commences. REFER TO CLAUSE 28.17.5 QUALITY PLAN

28.17.4.2 Electrofusion – Pre-Construction test welds

Before production jointing commences qualification of the electrofusion procedure shall be carried out.

Qualified electrofusion joints may be grouped by diameter to reduce the amount of qualification testing. The recommended groupings are shown in Table 28.2 below

Table 28.2; Electrofusion socket and saddle joint testing qualification requirements

Procedure Qualification Test Pipe Diameter and each fitting brand	Qualifies for sizes
Any ≤DN225	≤DN225
>DN225	Each pipe diameter shall be tested

Test joints shall be cut such that there is a minimum of 300 mm of pipe protruding either side of the joint.

Test samples shall be identified by

(a) pipe size,
(b) SDR,
(c) PE material composition grade,
(d) date,
(e) type and brand of fitting

(f) welder number, machine and welding conditions at the time of welding.

Electrofusion joint samples shall be submitted to an approved NATA registered testing laboratory.

Electrofusion joints shall be tested using the peel decohesion test in accordance with the requirements of ISO 13954.

When tested, electrofusion joints shall meet the requirements of AS/NZS 4129 Clause 3.5 Mechanical characteristics.

Only when these pre-construction joints pass the acceptance criteria shall the project proceed.

28.17.5 Quality plans

A field welding quality plan shall be submitted, and approved, before welding commences.

A quality plan shall be prepared to demonstrate

(a) Safe Work Method statements and Job Safety Analysis
(b) Thermoplastic Welder Personnel Training and Qualifications
(c) Equipment details, brand, model, maintenance, servicing, and calibration of equipment
(d) Welding and joining procedures / including a record of all weld parameters.
(e) Test Sampling Plan for the number of test welds to be undertaken during the construction phase.
(f) Pre-construction test welds using inputs from items (b), (c) and (d)
(g) inspection and test records.

It is also recommended that quality records for each weld, numbered and located on a plan of works, be retained for at least 6 years from the date of installation.

28.17.5.1 Butt fusion – Test Sampling Plan during construction

Before construction commences qualification and pilot welds shall meet the test criteria - refer to Clause 28.17.4.1.

Once construction commences two types of testing shall be applied:

(a) Visual inspection of each joint
(b) Destructive testing of a selected joint. The Water Agency shall nominate the specific joint that will be destructively tested.

28.17.5.1.1 Visual inspection

All butt fusion joints shall be visually inspected around the full circumference.

All butt fusion joints shall be assessed in accordance with Table 1 and Table 2 of PIPA document POP 014. Joints that fail the acceptance criteria shall be reported, the parameters and welding process shall be investigated and corrective action taken. The Water Agency may require the joint be cut out.

All butt fusion joint external weld beads shall be removed using a suitable bead removal tool and then tested in accordance with POP014. If the bead separates, the parameters and welding process shall be investigated, reported and corrective action taken. The Water Agency may require the joint be cut out..

28.17.5.1.2 Destructive testing

Samples for destructive testing of butt fusion joints shall be provided for each individual pipe size and standard dimension ratio (SDR) as follows:

(a) 1 joint in the first 10 joints
(b) 1 joint in every 20 joints (or part thereof) for the remainder of the pipeline after the testing of the first joint as prescribed above meets the testing requirements.

Note: Following a series of successful joint tests the test frequency maybe further reduced with the approval of the Water Agency based on consistent successful welder performance. For example the test frequency could be reduced to 1 joint in every 50 joints (or part thereof) for the remainder of the pipeline.

Where testing reveals nonconformance to the test requirements the joint shall be reported, investigated and any corrective action recommended. In addition the previous weld to the failed test weld shall be cut out and tested. If the second weld also fails to meet the test criteria the project shall be stopped. Testing shall continue until the Contractor can demonstrate the welds meet the testing requirements.

28.17.5.2 Electrofusion – Test Sampling Plan during construction

Production Electrofusion jointing shall only commence following successful testing of the qualification weld.

Once construction commences two types of testing shall be applied:

(a) Visual inspection of each joint
(b) Destructive testing of a selected joint. The Water Agency shall nominate the specific joint that will be destructively tested.

28.17.5.2.1 Visual inspection

All electrofusion joints shall be visually inspected in accordance with the acceptance criteria of Table 4 of POP 014. Joints that fail the acceptance criteria shall be reported, investigated and any corrective action recommended and if required by the Water Agency shall be cut out and replaced with new fittings.

Electrofusion couplings and saddles that indicate error readings, short circuiting, exposed wires, failure of coupling melt indicators and or melt outside the weld zone shall be cut out and replaced with new fittings.

28.17.5.2.2 Destructive testing

Samples for destructive testing of electrofusion joints shall be provided for each individual pipe size as follows:

(a) 1 joint in the first 10 joints
(b) 1 joint in every 20 electrofusion joints (or part thereof) for the remainder of the pipeline after the testing of the first joint as prescribed above meets the testing requirements.

Note: Following a series of successful joint tests the test frequency maybe further reduced with the approval of the Water Agency based on consistent successful welder performance. For example the test frequency could be reduced to 1 joint in every 50 joints (or part thereof) for the remainder of the pipeline.

Where testing reveals nonconformance to the test requirements the joint shall be reported, investigated and any corrective action recommended. In addition the previous weld to the failed test weld shall be cut out and tested. If the second weld also fails to meet the test criteria the project shall be stopped. Testing shall continue until the Contractor can demonstrate the welds meet the testing requirements.

28.17.6 Welder qualifications

All welders shall have successfully undertaken the following Units of Competence of the Plastics, Rubber and/or Cablemaking Training Package PMB07 appropriate to the welding processes used:

(a) PMBWELD301E - Butt weld polyethylene plastic pipelines
(b) PMBWELD302E - Join polyethylene plastic pipelines using electrofusion welding

Training shall be provided by Registered Training Organisations (RTO's) that are accredited by State/Territory Training Authorities under the Australian National Training Authority (ANTA) guidelines and conforming to PMB 07 Competency Standards prepared by Manufacturing Learning Australia, Qualification Framework for the plastics, rubber and cable making industry.

RTOs listed on the PIPA website (https://pipa.com.au/welder-training/) are preferred as they also commit to deliver a detailed course curriculum.

The RTO's providing training in all forms of welding plastics pipeline systems shall have staff qualified in presenting courses that meet competency standards covered by PMBWELD301E and PMBWELD302E.

“Successfully undertaken” shall mean “Statement of Attainment” for all those appropriate Units of Competence.

Only personnel who have successfully completed the above training programs shall be permitted to butt fuse or electrofuse PE systems .

Certification shall be valid for 2 years. At the end of this period, renewal of the certification shall be required.

Certified welders shall demonstrate continuous welding activity and any break of more than six months shall require renewal of certification.

Certification details shall be carried by field personnel on-site, and be made available as required.

In addition to having current certification welders shall be initially restricted to welding pipes and fittings in sizes <DN225 until they can demonstrate either a successful track record of welding within this size range or that they have undertaken specific training on larger size pipe.

Welders demonstrating a successful track record of welding in sizes up to DN225 shall be permitted to weld pipelines up to DN450. Similarly, welders shall demonstrate a successful track record of welding up to DN450 before being permitted to weld pipes and fittings >DN450.

Inserted New Clause 28.18

28.18 Connections to pipes of other materials

Make connections to PVC/ABS/DI/steel/GRP pipelines using PE flange adaptors and backing rings with AS/NZS 4087 Figure B2 mating dimensions.