

AS 4822:2024



STANDARDS
Australia



External field joint coatings for steel pipelines



AS 4822:2024

This Australian Standard ® was prepared by ME-038, Petroleum Pipelines. It was approved on behalf of Standards Australia's Standards Development and Accreditation Committee on 16 October 2024.

This Standard was published on 1 November 2024.

The following are represented on Committee ME-038:

- APGA Research and Standards Committee
- Australasian Corrosion Association
- Australian Energy Producers
- Australian Pipelines and Gas Association
- Department for Energy and Mining, SA
- Department of Energy, Mines, Industry Regulation and Safety Western Australia
- Department of Industry, Tourism and Trade (NT)
- Energy Networks Australia
- Energy Safe Victoria
- Engineers Australia
- Office of Energy and Climate Change-NSW Treasury
- Resources Safety & Health Queensland
- Weld Australia

This Standard was issued in draft form for comment as DR AS 4822:2024.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:

www.standards.org.au

ISBN 978 1 76139 891 9

External field joint coatings for steel pipelines

Originated as AS 4822—2008.
Previous edition 2018.
Third edition 2024.

© Standards Australia Limited 2024

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth).

Preface

This Standard was prepared by the Australian members of the Standards Australia/Standards New Zealand Committee ME-038, Petroleum Pipelines, to supersede AS 4822:2018.

The objective of this document is to provide manufacturers, suppliers, specifiers and users of oil and gas pipelines information on the application of and testing requirements for external field joint coatings (FJCs) of seamless or welded steel pipelines for onshore steel pipelines.

The major changes in this edition are as follows:

- (a) Type tests are more clearly identified and a definition has been added.
- (b) Some tests have been reclassified as Type tests.
- (c) An electrical resistivity type test has been added for liquid applied coatings.
- (d) The peel rate for polymeric tape laboratory testing has been changed to align with the rate used for field testing.
- (e) Some peel test requirements have been changed for tape coatings and ALVPC.

The inclusion of roles and responsibilities in AS 4822 was approved by PMG on 20/06/2023.

The terms “normative” and “informative” are used in Standards to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a Standard, whereas an “informative” appendix is only for information and guidance.

Contents

Preface	ii
1 Scope and general	1
1.1 Scope	1
1.2 Normative references	1
1.3 Terms and definitions	2
1.4 Symbols and abbreviated terms	4
1.4.1 Symbols	4
1.4.2 Abbreviated terms	4
1.5 General requirements — Field joint coatings (FJCs)	5
2 Selection of FJCs	5
2.1 General	5
2.2 Types of FJCs	5
3 Application	6
3.1 Application procedure specification (APS)	6
3.2 Coating materials	7
3.2.1 Information to be supplied	7
3.2.2 Marking on shipment of coating materials	7
3.3 Type tests (TT)	7
3.4 Procedure qualification trial (PQT)	7
3.5 Qualification of coating and inspection personnel	8
3.6 Pre-production trial (PPT)	8
3.7 Production testing and inspection	9
4 Surface preparation, application, inspection, testing, repair and safety	9
4.1 Surface preparation	9
4.1.1 General	9
4.1.2 Preparation of the steel substrate	9
4.2 Preliminary quality inspection	10
4.3 Prior to the application of the coating	10
4.4 Visual inspection of the applied coating	11
4.5 Testing of the FJC and repairs	11
4.6 Safety considerations	11
5 Petrolatum and polymeric tape coatings	11
5.1 General	11
5.2 Description of the coatings	12
5.2.1 Petrolatum tapes (Type 1A)	12
5.2.2 Polymeric tapes (Type 1B)	12
5.3 Surface preparation	12
5.4 Application of the coatings	12
5.4.1 General	12
5.4.2 Application of the primer	12
5.4.3 Application of petrolatum tapes	13
5.4.4 Application of polymeric tape	13
5.5 Inspection and testing of the applied coatings	13
5.5.1 General	13
5.5.2 General Inspection	14
5.5.3 Thickness	14
5.5.4 Holiday detection	14
5.5.5 Impact resistance	14
5.5.6 Indentation resistance	14
5.5.7 Drip resistance	14
5.5.8 Cathodic disbondment	14
5.5.9 Peel strength between tape layers of polymeric tapes	14
5.5.10 Peel strength to pipe surface and factory-applied coating	15

5.5.11	Lap shear strength of polymeric tapes	15
5.5.12	Thermal ageing resistance of polymeric tapes	15
6	Heat-shrinkable coatings	20
6.1	General	20
6.2	Description of the coatings	20
6.2.1	General	20
6.2.2	Type 2A	20
6.2.3	Type 2B	20
6.3	Surface preparation	20
6.4	Application of the coatings	21
6.4.1	General	21
6.4.2	Preheating the joint	21
6.4.3	Application of the primer	22
6.4.4	Application of heat-shrinkable materials	22
6.5	Inspection and testing of the applied coatings	22
6.5.1	General	22
6.5.2	General inspection	22
6.5.3	Thickness	22
6.5.4	Holiday detection	22
6.5.5	Impact resistance	23
6.5.6	Indentation resistance	23
6.5.7	Lap shear strength of polymeric tapes	23
6.5.8	Thermal ageing resistance of polymeric tapes	23
6.5.9	Peel strength	23
6.5.10	Cathodic disbondment	23
7	Fusion-bonded epoxy (FBE) coatings	26
7.1	General	26
7.2	Storage conditions	26
7.3	Containers	27
7.4	Transport of FBE powder	27
7.4.1	Containers	27
7.5	Description of the coatings	27
7.6	Surface preparation	27
7.7	Application of the coatings	28
7.7.1	General	28
7.7.2	Heating	28
7.7.3	Application of epoxy powder	28
7.7.4	Field joint coating repairs	28
7.8	Inspection and testing of the applied coatings	29
7.8.1	General	29
7.8.2	Visual aspect	29
7.8.3	Thickness	29
7.8.4	Holiday detection	29
7.8.5	Adhesion	29
7.8.6	Degree of cure	29
7.8.7	Impact resistance	29
7.8.8	Cathodic disbondment	29
7.8.9	Hot water soak test	30
8	Liquid applied coatings	31
8.1	General	31
8.2	Description of the coatings	31
8.2.1	Liquid epoxy (4A)	31
8.2.2	Liquid polyurethane (4B)	31
8.2.3	Fibre reinforced epoxy (4C)	31
8.3	Surface preparation	31
8.4	Application of the coatings	32
8.4.1	General	32

8.4.2	Heating of the area to be coated	32
8.4.3	Coating application	32
8.5	Inspection and testing of the applied coatings	32
8.5.1	General	32
8.5.2	Thickness	32
8.5.3	Visual inspection	33
8.5.4	Holiday detection	33
8.5.5	Adhesion	33
8.5.6	Impact resistance	33
8.5.7	Hardness	33
8.5.8	Flexibility	33
8.5.9	Cathodic disbondment	33
8.5.10	Hot water soak	33
8.5.11	Electrical resistivity	34
9	Amorphous low viscosity polyolefin coatings (ALVPC)	37
9.1	General	37
9.2	Description of the coatings	37
9.3	Surface preparation	37
9.4	Application of the coatings	37
9.4.1	General	37
9.4.2	Application	37
9.5	Inspection and testing of the applied coatings	38
9.5.1	General	38
9.5.2	General inspection	38
9.5.3	Thickness	38
9.5.4	Holiday detection	38
9.5.5	Impact resistance	38
9.5.6	Indentation resistance	38
9.5.7	Drip resistance	38
9.5.8	Cathodic disbondment	38
9.5.9	Peel strength between tape layers of polymeric tapes	39
9.5.10	Peel strength to pipe surface and factory-applied coating	39
9.5.11	Lap shear strength	39
	Appendix A (informative) Purchasing guidelines	42
	Appendix B (normative) Peel strength test	44
	Appendix C (normative) Impact test	49
	Appendix D (normative) Indentation test	51
	Appendix E (normative) Hot water soak test	53
	Appendix F (normative) Drip resistance of petrolatum tapes and ALVPC	55
	Appendix G (normative) Lap shear strength	57
	Appendix H (normative) Peel strength between layers	60
	Appendix I (normative) Thermal ageing resistance	63
	Appendix J (normative) Flexibility	66
	Appendix K (informative) Guide to compatibility of coatings	68
	Bibliography	70

NOTES

Australian Standard®

External field joint coatings for steel pipelines

1 Scope and general

1.1 Scope

This document sets out minimum requirements for the field joint coating (FJC) of seamless and welded steel buried onshore pipelines. It specifies the application and testing of corrosion protection coatings applied to steel surfaces left bare after the pipes and fittings (components) are joined by welding.

Field joint coatings may be specified for the repair and maintenance of existing pipelines. For those applications only, the end user may waive, or change, some of the requirements specified in this standard. This may be required as a result of the existing pipeline coating type, its condition, and/or application restrictions.

NOTE 1 Field joints and other specific points are coated on site.

NOTE 2 Information to be supplied at the time of order is given in [Appendix A](#).

NOTE 3 Coatings detailed in this document are suitable for use with cathodic protection systems.

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document:

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS 1145.3, *Determination of tensile properties of plastics materials, Part 3: Test conditions for films and sheets*

AS 1391, *Metallic materials—Tensile testing at ambient temperature*

AS 1627.2, *Metal finishing—Preparation and pretreatment of surfaces, Part 2: Power tool cleaning*

AS 1627.4, *Metal finishing—Preparation and pretreatment of surfaces, Part 4: Abrasive blast cleaning of steel*

AS 1627.9, *Metal finishing—Preparation and pretreatment of surfaces, Part 9: Pictorial surface preparation standards for painting steel surfaces*

AS 2706, *Numerical values—Rounding and interpretation of limiting values*

AS 3862, *External fusion-bonded epoxy coating for steel pipes*

AS 3894.1, *Site testing of protective coatings, Part 1: Non-conductive coatings—Continuity testing—High voltage ('brush') method*

AS 3894.3, *Site testing of protective coatings, Part 3: Determination of dry film thickness*

AS 3894.4, *Site testing of protective coatings, Part 4: Assessment of degree of cure*

AS 3894.5, *Site testing of protective coatings, Part 5: Determination of surface profile*

AS 3894.6, *Site testing of protective coatings, Part 6: Determination of residual contaminants*

AS 3894.9, *Site testing of protective coatings, Part 9: Determination of adhesion*

AS 4352, *Tests for coating resistance to cathodic disbonding*

ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 4624, *Paints and varnishes — Pull-off test for adhesion*

ISO 8502-3, *Preparation of steel substrates before application of paints and related products — Tests for the assessment of surface cleanliness — Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)*

ISO 21809-3, *Petroleum and natural gas industries — External coatings for buried or submerged pipelines used in pipeline transportation systems — Part 3: Field joint coatings*

ASTM D2240, *Standard Test Method for Rubber Property—Durometer Hardness*

SSPC-SP 1, *Solvent Cleaning*

1.3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

1.3.1 application procedure specification APS

procedure describing coating materials and all the steps for surface preparation, coating application, inspection and testing, stripping and repair (if allowed) for the application of an FJC

1.3.2 applicator

person who undertakes the coating application

1.3.3 applicator company

company that undertakes the coating application

1.3.4 batch

discrete and continuous identified manufacturing run using product of the same source

1.3.5 batch certificate

certificate of conformance of a batch issued by the manufacturer

1.3.6 bonding primer

material applied as a film to the primed metal surface in order to ensure adhesion of the subsequent protective layer

1.3.7 coating defect

any deleterious imperfection in the coating, including disbonded areas, areas of low film thickness and holidays

1.3.8 cutback

length of pipe left uncoated at each end for joining purposes (e.g. welding)

1.3.9 end user

company operating the pipeline system

1.3.10**holiday**

discontinuity of protective coating that exposes the steel to the outside environment

1.3.11**inspector**

person who carries out inspection of materials or phases of coating application

1.3.12**manufacturer**

company that manufactures a coating material

1.3.13**may**

indicates the existence of an option

1.3.14**maximum design temperature, T_{maxOp}**

maximum temperature for which the pipeline system has been designed and could experience / operate in service specified by the end user

Note 1 to entry: The suitability of the maximum rated temperature of the FJC ($T_{maxRated}$) should be considered by the end user.

Note 2 to entry: Guidance in determining the maximum design temperature is provided in AS/NZS 2885.1:2018 Clause 4.4.

1.3.15**maximum rated temperature, $T_{maxRated}$**

maximum temperature recommended for use of the coating. It is specified by the coating manufacturer

1.3.16**pre-production trial****PPT**

series of tests carried out before start of coating operations, aimed at verifying the conformity of an FJC system

Note 1 to entry: The PPT qualifies the application process. The PPT is carried out during coating operations and includes materials used, surface preparation, application processes, equipment and inspection/testing procedures.

1.3.17**primer**

material applied as a film on substrate (metal and/or factory-applied coating) to ensure adhesion of the subsequent protective coating

1.3.18**procedure qualification trial****PQT**

coating application and testing activity carried out for the qualification of the FJC system

Note 1 to entry: The PQT qualifies the coating system and application process and is carried out prior to the start of coating operations and includes materials used, surface preparation, application processes, equipment and inspection/testing procedures.

1.3.19**purchaser**

company that provides the FJC specifications

1.3.20**quality plan**

document specifying which procedures and associated resources are applied by whom and when to a specific project, product, process or contract

1.3.21**shall**

indicates that a statement is mandatory

1.3.22**should**

indicates a recommendation

1.3.23**Type test****TT**

non-project specific, and infrequent test, to determine specific properties of the field joint coating

1.4 Symbols and abbreviated terms**1.4.1 Symbols****Symbol Definition**

A_0	peel strength to pipe surface at 23 °C without heat ageing
A_{70}	peel strength to pipe surface at 23 °C after heat ageing for 70 days
A_{100}	peel strength to pipe surface at 23 °C after heat ageing for 100 days
E_0	elongation at break without heat ageing (arithmetic mean of five results)
E_{70}	elongation at break after heat ageing for 70 days (arithmetic mean of five results)
E_{100}	elongation at break after heat ageing for 100 days (arithmetic mean of five results)
P_0	peel strength between layers at 23 °C without heat ageing
P_{70}	peel strength between layers at 23 °C after heat ageing for 70 days
P_{100}	peel strength between layers at 23 °C after heat ageing for 100 days
C	test piece thickness, in millimetres (see Figure J.1)
D	diameter of required mandrel, in millimetres
E	specified strain expressed as a percentage
ΔT_g	change in the glass transition temperature between two or more successive thermal analysis scans

1.4.2 Abbreviated terms

ALVPC	amorphous low viscosity polyolefin coatings
APS	application procedure specification
DFT	dry film thickness
DSC	differential scanning calorimetry
EP	liquid applied epoxy
FBE	fusion-bonded epoxy powder coating
FJC	field joint coating
MEK	methyl ethyl ketone

PE	Polyethylene
PPT	pre-production trial
PQT	procedure qualification trial
PU	liquid applied polyurethane
SDS	safety data sheet

1.5 General requirements — Field joint coatings (FJCs)

General industry practice is that external pipeline coatings be factory-applied except for field joints and other specific items, which are coated on site.

Field joints shall be protected with a coating system that is compatible with the factory-applied pipe coating. The FJC shall provide similar performance to the factory-applied pipe coating and allow satisfactory application under the predicted field conditions.

The performance of FJCs is a critical part of the corrosion protection of steel pipelines. The FJC shall be carefully selected for each application, considering its importance in providing satisfactory corrosion protection for the service life under the construction and operating conditions of the pipeline.

Rounding of numerical values shall be in accordance with AS 2706.

NOTE 1 The FJCs described herein have different performance characteristics. The end user should decide on the FJC taking into consideration the factory-applied coating, the desired application and performance characteristics, including resistance to impact, creep, indentation, cathodic disbondment, loss of adhesion, operating temperature and ageing.

NOTE 2 Specialist applicator companies, which may be employed for large and complex projects, should be selected based on a verifiable successful record of the same FJC in a similar project environment.

2 Selection of FJCs

2.1 General

The FJC shall be selected to be —

- (a) compatible with the factory-applied pipe coating;
- (b) suitable for service under the operating conditions of the pipeline;
- (c) suitable for service in the environment in which the pipeline is laid;
- (d) fit to perform for the anticipated life of the factory-applied coating or the design life of the pipeline, as applicable; and
- (e) suitable for the intended construction handling and installation technique.

NOTE 1 Selection of the FJC is a task done by, overseen or approved by a delegated person with specialist competency (for example, the designer or owner) as it requires detailed knowledge of the design, functionality and use should be made by, or approved by, the designer or owner of the pipeline.

NOTE 2 For guidance on FJC selection, see [Appendix K](#).

2.2 Types of FJCs

The FJC coatings covered by this document are listed in [Table 2.1](#).

Table 2.1 — Classification of FJC types

Code	Section	Type of FJC
1A	5	Petrolatum tapes
1B	5	Cold-applied polymeric tapes
2A	6	Heat-shrinkable coatings, polyethylene based
2B	6	Heat-shrinkable coatings, polyethylene based, applied over a liquid applied epoxy (EP) layer
3A	7	Fusion-bonded epoxy — single layer
3B	7	Fusion-bonded epoxy — dual layer
4A	8	Liquid applied epoxy (EP)
4B	8	Liquid applied polyurethane
4C	8	Fibre-reinforced epoxy
5A	9	Amorphous low viscosity polyolefin with tape outer wrap
5B	9	Amorphous low viscosity polyolefin with sleeve outer wrap

3 Application

3.1 Application procedure specification (APS)

Prior to start of application and any agreed PQT and/or PPT (see [Clauses 3.3](#) and [3.5](#)), the APS shall be prepared (that is a compilation of documents related to the project-specific control of FJC), including the following:

- (a) A list of all PPE and detailed safe working procedures.
- (b) A list of tools, testing and inspection equipment, and coating supplies to be used.
- (c) Preparation of the steel surface and factory-applied coating, including inspection prior to application (see [Clause 4.1](#)).
- (d) Coating and abrasive blasting material properties (see [Clauses 3.2](#) and [4.1.2.2](#)).
- (e) Receipt, handling and storage of coating and abrasive blasting materials (see [Clauses 3.2](#) and [4.1.2.2](#)).
- (f) Coating application procedure.
- (g) Inspection and testing of applied FJC (see [Clause 3.6](#)).
- (h) Repair and testing of defective FJC.
- (i) Marking, traceability and documentation.

The APS shall cover all items associated with quality control as defined in this document and any agreed options for the specific FJC system. The APS shall be approved by the purchaser. The approved APS shall not be changed by the applicator without prior written authorization of the purchaser and all coating work, testing and inspection shall be carried out according to the APS.

The time necessary for the various operations related to surface preparation, heating, coating application and testing shall be defined (e.g. during PQT and/or PPT) in order not to delay the pipeline construction operations.

NOTE The purchaser may specify that the APS be approved prior to the start of production and prior to any agreed PQT and/or PPT.

3.2 Coating materials

3.2.1 Information to be supplied

The coating material shall include the following information:

- (a) In the case of coatings proposed by the coating applicator company, information that provides evidence of suitability of the proposed coating for the required application.
- (b) Production test certificates (batch certificates), as specified in this document, for the actual coating material, and any agreed optional requirements.
- (c) Conditions for application of the coating materials (field joint and repair of FJC).
- (d) Packaging, storage and safety requirements of coating materials.

3.2.2 Marking on shipment of coating materials

Marking on each shipment of coating materials shall include, as a minimum, the following information:

- (a) Manufacturer's name.
- (b) Name and complete identification of material, including origin.
- (c) Reference to applicable coating material Standards, if any.
- (d) Reference to material safety data sheet (SDS).
- (e) Production batch number.
- (f) Weight/size.
- (g) Date of production.
- (h) Shelf life.

3.3 Type tests (TT)

Type tests are undertaken on the coating systems by the coating manufacturer. These tests do not relate to specific projects. They are undertaken to demonstrate general coating properties.

3.4 Procedure qualification trial (PQT)

Test methods, frequencies and acceptance criteria shall conform to the sections of this document relating to the FJC system, and any agreed optional requirements.

The PQT shall be performed in a timely manner to ensure the PPT is fully implemented prior to the commencement of construction.

NOTE 1 End user or purchaser and applicator company may also agree to carry out a PQT independent of any specific project. By agreement, this may include use of data from previous or independent testing.

NOTE 2 The manufacturer or supplier should provide assistance during the PQT to ensure the correct use of the coating material(s) and to train the applicator's personnel.

The following applies to PQT:

- (a) The APS to be used shall be submitted to the purchaser for approval.

NOTE 3 Sufficient time should be allowed for review prior to conducting the PQT.

- (b) Where heating is required as part of the FJC curing process (for example liquid epoxy and FBE), the PQT shall be carried out on joints (or test zones) having the same diameter and the same thickness as that of the production FJC. Qualification tests for other FJCs shall be carried out on pipes having a similar diameter to that of the actual pipes.
- (c) Tests shall be carried out on actual joints or test zones distributed along an actual pipe coated with the actual factory-applied coating. The length of the test zones shall be equivalent to the FJC length.
- (d) A girth cap weld shall be added at the centre of each of the test zones in order to simulate the field weld.
- (e) All tools and equipment (e.g. for induction heating, abrasive blasting, coating application and inspection) to be used for the PQT of a specific FJC system shall be of the same type as those to be used for the actual FJC.
- (f) Unless otherwise specified in the purchaser's specification, at least three tests shall be conducted.
- (g) Coating repairs shall be included in the PQT (except if they are not allowed).
- (h) The method of stripping of defective FJC shall be included in the PQT.
- (i) A complete report of the qualification test results shall be submitted to the purchaser for approval.

3.5 Qualification of coating and inspection personnel

All coating applicators shall be qualified to undertake the coating application procedure and repair work. The applicator shall be trained, qualified and certified as being competent in the application and repair of the FJC. The manufacturer or the supplier shall provide the training and issue the certification. In addition, all coating applicators shall have successfully passed the PPT qualification test.

Coating inspectors shall be trained and certified in the inspection of the specific coating being applied. The manufacturer or the supplier shall provide the training and the certification.

3.6 Pre-production trial (PPT)

The purpose of the PPT is to verify that the following are in conformance with the requirements of this document, any project specification and the result of any relevant PQT:

- (a) The coating system.
- (b) Materials.
- (c) Application procedure.
- (d) Equipment to be used for surface preparation.
- (e) Application and repair of the coating system.
- (f) Qualification of the coating applicator and inspectors.

Personnel shall undergo PPT qualification prior to undertaking production field joint coating. PPT qualification should be undertaken at site to simulate site conditions.

NOTE 1 The PPT should be carried out at the start of the operations when equipment and personnel are mobilized on site for the FJC project and as required during the project.

NOTE 2 The PPT should be performed on the first joints to be coated (or if agreed on a separate pipe) sufficiently in advance so as not to delay the project.

3.7 Production testing and inspection

An inspection and testing procedure shall be documented in a quality plan (or “inspection and testing plan”). The plan shall be adhered to during production FJC activities. The plan shall cover the following items:

- (a) Surface preparation.
- (b) Coating application.
- (c) Specified properties of the applied FJC.

Test methods and acceptance criteria shall conform to the FJC system and agreed options as specified in this document.

NOTE The results of PQT, PPT and production testing should be fully recorded and documented and provided to the purchaser in accordance with [Clauses 3.3](#) and [3.4](#) (also see [Clause A.5](#)).

4 Surface preparation, application, inspection, testing, repair and safety

4.1 Surface preparation

4.1.1 General

Surface preparation shall be carried out in accordance with the specification of the manufacturer, and as specified in this section.

Welds that are to be coated should be of similar height and shape to that qualified during the PQT and PPT.

4.1.2 Preparation of the steel substrate

4.1.2.1 General

At the time of application of the coating, the surface to be coated shall be dry and free of any contamination detrimental to surface preparation (such as detritus, dust, non-adhering particles, grease, oil, soluble salts, etc) or to adhesion of the coating on the steel.

If necessary, extra cleaning shall be carried out to remove the following:

- (a) Greasy and waxy substances (using a totally volatile solvent, as required), or other contamination, as specified in SSPC-SP 1.
- (b) Weld spatter, slag, and burrs that can pierce the coating (using approved grinding or filing techniques).
- (c) Areas of rust or scaling by spot abrasive blast cleaning or wire brushing, as specified in the appropriate application procedure.

4.1.2.2 Abrasive blast cleaning

The method of preparation of the substrate shall be abrasive blast cleaning unless otherwise agreed. Recycling of abrasive may be acceptable, provided suitable abrasive material is used. The minimum cleanliness of the surface after abrasive blast cleaning shall be in accordance with AS 1627.4 and be a minimum class of surface preparation of Class Sa 2 ½.

Abrasive materials shall be silica free non-metallic or metallic, and conform to AS 1627.4. They shall be free from contamination and contain less than 100 mg/kg chlorides and less than 0.3 % copper.

All surface imperfections that are detrimental to the performance of the FJC shall be removed. The residual thickness of the pipe wall shall be not less than the specified minimum thickness for the pipe. The profile/roughness shall be checked in accordance with the requirements of AS 3894.5 or other method where specified by the purchaser.

The profile shall be of an angular and dense nature over the entire joint surface to be coated.

Compressed air for blast cleaning shall be free of oil, condensed moisture, and any other contaminants. Blasting equipment that includes devices to recycle abrasives shall have equipment that ensures removal of dust, fines, corrosion materials, and other contaminants.

At the beginning of the FJC shift and periodically throughout the shift it shall be demonstrated that the blasting procedure will provide the specified surface cleanliness and anchor profile. The frequency shall be specified by the purchaser.

Dust and detritus shall be removed from the substrate following the surface preparation procedure.

At the beginning of the FJC shift and periodically throughout the shift the level of chloride ions shall be measured in accordance with the requirements of AS 3894.6. The level of chloride ions shall be equal to or less than 25 mg/m², unless otherwise agreed. The frequency of testing shall be specified by the purchaser.

4.1.2.3 Wire brush cleaning

Dust and detritus shall be removed from the field joint following the preparation of the substrate and the surrounding factory-applied coating. Where specified, wire brush cleaning shall be undertaken in accordance with AS 1627.2.

4.1.2.4 Reconditioning

If, after joint surface preparation the substrate is contaminated or corrodes, the joint shall undergo further partial or total surface preparation to ensure the coating is applied to a surface that has been cleaned and prepared in accordance with the manufacturer's specification and [Clauses 4.1.2.1 to 4.1.2.3](#).

4.1.2.5 Preparation of the adjoining factory-applied coating

The factory-applied coated area on either side of the exposed substrate shall be prepared to facilitate the adhesion of the FJC. The factory-applied coating shall be chamfered to an angle not greater than 30° to the pipe surface. The method of preparation shall not cause damage outside the FJC area.

NOTE Additional requirements for each of the FJC materials are given in [Clauses 5.3, 6.3, 7.6](#) and [8.3](#).

4.2 Preliminary quality inspection

The preliminary quality inspection shall ascertain that —

- (a) the materials used for surface preparation and the FJC conform to the material specification; and
- (b) the storage conditions are in accordance with the manufacturer's instructions.

4.3 Prior to the application of the coating

The following are undertaken prior to the application of the coating:

- (a) The temperature of the joint substrate shall be at least 3 °C above the dewpoint, and the joint shall be dry.
- (b) Dust contamination shall be determined in accordance with ISO 8502-3 and shall be ≤ Class 3 for FJC Types 1A, 5A and 5B and ≤ Class 2 for FJC Types 1B, 2A, 2B, 3A, 3B, 4A, 4B, and 4C.

- (c) The coating shall be applied by qualified personnel in accordance with the specified procedure. The procedure shall have been approved by the purchaser.
- (d) The joint shall not be exposed for a length of time that could result in oxidation of its surface, detrimental to the quality and adhesion of the coating.
- (e) At the time of application of the coating, the temperature of the substrate shall be within the temperature range as detailed in the manufacturer's specification.
- (f) FJCs that require heating, as part of the application process, shall employ heating methods that raise the temperature sufficiently, and sufficiently uniformly, to ensure correct application over the entire FJC.

NOTE 1 During bad weather (rain, wind, airborne dust, etc.), cleaning and coating operations may only continue, provided effective protective enclosures are installed.

NOTE 2 Chemical treatment of the steel may be used to supplement the surface preparation, by agreement between the manufacturer, purchaser and the applicator.

4.4 Visual inspection of the applied coating

When inspected visually, the applied coating shall be homogenous across the entire field joint. In particular, no surface imperfections detrimental to the quality of the coating (embedded grit, foreign particles, pitting, blisters, etc.) shall be allowed.

4.5 Testing of the FJC and repairs

Regular inspection and testing procedures during production shall be carried out in accordance with the quality plan.

NOTE 1 Test procedures and acceptance criteria are given in [Clauses 5.5, 6.5, 7.8](#) and [8.5](#), and [Appendices B to J](#).

NOTE 2 Recommendations for frequencies are given in the relevant section for each of the FJC materials.

4.6 Safety considerations

Potential hazards include exposure to vapours, dust, fumes, gases, and noise (from blasting or a spray gun).

Applicators shall conform to the procedures in the manufacturer's technical manuals, and the FJC SDS.

Where required, the steel substrate shall be electrically grounded to eliminate static charges associated with surface preparation and coating operations.

NOTE Applicators have an obligation to conform with all legal and regulatory requirements with respect to safety.

5 Petrolatum and polymeric tape coatings

5.1 General

Identification of coatings made from tapes shall be in accordance with [Table 5.1](#) and meet the requirements of [Table 5.2](#), [Table 5.3](#), and [Table 5.4](#), as applicable.

Information concerning the coating materials shall be given as data sheets by the manufacturer to the applicator in accordance with [Table 5.5](#) for primer and [Table 5.6](#) for tapes, as a minimum.

Application instructions shall be provided by the manufacturer as set out in [Table 5.7](#) (as a minimum).

5.2 Description of the coatings

5.2.1 Petrolatum tapes (Type 1A)

Petrolatum tape coatings can consist of a primer plus single or multiple layers of fabric fully impregnated with a neutral petroleum wax compound. Testing requirements are specified for TmaxRated temperatures of 30 °C and 50 °C.

The primer for Type 1A tapes shall contain at least 1.0 % of corrosion inhibitor (e.g. mimosa tannin).

5.2.2 Polymeric tapes (Type 1B)

Cold-applied polymeric tape coatings can consist of a bonding primer and multiple layers of one or several polymeric tapes. Testing requirements are specified for TmaxRated temperatures of 50 °C and 80 °C.

Specific polymeric tapes allowing higher maximum operating temperature may be used. Where such tapes are used, requirements shall be agreed after qualification.

5.3 Surface preparation

Surface preparation shall be carried out in accordance with [Section 4](#) and the specification of the manufacturer.

For petrolatum coatings (Type 1A), as a minimum requirement, the area to be coated shall be cleaned with a powered steel wire brush. The degree of cleanliness shall conform to AS 1627.2 and be such that, when viewed without magnification, the surface shall be free from visible oil, grease and dirt, and from poorly adhering rust, paint coating and foreign matter. The surface shall have a metallic sheen arising from the metallic substrate. All mill scale shall be removed from the steel.

For polymeric tapes (Type 1B), as minimum, the substrate to be coated shall be abrasive blast cleaned in accordance with AS 1627.4 to a minimum class of surface preparation of Class Sa 2 ½ or mechanical rotary bristle cleaning to produce a cleanliness in accordance with AS 1627.4 to a minimum class of surface preparation of Class Sa 2 ½.

The edges of the factory-applied coating shall be suitably roughened beyond the required FJC overlap onto the factory-applied coating (see also [Clause 5.4.4](#)). The profile on the pipe steel for coating type 1B shall be angular, between 50 µm and 110 µm, or as specified by the manufacturer.

5.4 Application of the coatings

5.4.1 General

Application of the coating shall be carried out in accordance with [Clause 4.2](#) and the written application instructions of the manufacturer.

5.4.2 Application of the primer

The primer shall be applied in accordance with the written application instructions of the manufacturer, as set out in [Table 5.7](#).

Some primers require that the tape be applied when the primer is still tacky, while others require that the primer be dry. The manufacturer's instructions shall apply in terms of the condition of the primer at the time of wrapping.

5.4.3 Application of petrolatum tapes

The application of petrolatum or wax tapes shall be in accordance with the manufacturer's instructions (see [Table 5.7](#)). As a minimum, the following application procedure shall apply:

- (a) If visible moisture is present, wipe the surface to be free from moisture.
- (b) Prepare the surface as specified.
- (c) Apply a thin coat of compatible primer (if any) by brush or by hand.
- (d) Wrap the area to be coated spirally with tapes of recommended width, employing the correct overlap.
- (e) Use sufficient means to ensure complete conformability of the coating to the pipe surface.
- (f) Apply any outer wrap (if specified by the manufacturer's instructions or the purchaser's specification).

The overlap of tapes onto factory-applied coating shall be at least 75 mm. The over-wrap shall overlap the tape by at least 25 mm.

NOTE The application of a compatible mastic to the weld should be considered to prevent tenting.

5.4.4 Application of polymeric tape

The application of polymeric tapes shall be in accordance with the manufacturer's instructions (see [Table 5.7](#)). As a minimum, the following application procedure shall apply:

- (a) Prepare the surface according to [Clause 5.3](#).
- (b) Apply a coat of compatible primer in accordance with the manufacturer's instruction.
- (c) Wrap the area to be coated spirally with tapes of an adequate width, employing the right overlap and using sufficient tension to ensure a complete conformability of the coating.

The tape shall be applied with an overlap of not less than 55 % and not less than 25 mm, whichever is the greater. In a two-tape system, the over-wrap shall be applied with an overlap of not less than 25 mm.

The tape wrap shall start and finish at the horizontal axis of the pipe, pointing in the downward direction.

The overlap of tapes onto factory-applied coating shall be at least 75 mm. The over-wrap shall overlap the tape by at least 25 mm.

NOTE 1 Hand-wrapping machines may be of assistance in ensuring correct application of the tape.

NOTE 2 The height of weld beads at field joints should be low enough so that the tape remains in intimate contact with the steel substrate on either side of the weld bead. Alternatively, bituminous/butyl filler mastic may be used to provide a smooth contour to prevent voids beneath the tape.

NOTE 3 The width of the tape that is used depends on the diameter of the pipes. For all types of application, an appropriate width should be chosen to avoid wrinkling, which can occur if the material is too wide.

5.5 Inspection and testing of the applied coatings

5.5.1 General

The tests specified in [Clauses 5.5.3 to 5.5.12](#) shall be carried out for each product. Type testing (TT), procedure qualification (PQT), pre-production (PPT) and production quality control testing shall be carried out as specified in [Table 5.2](#), [Tables 5.3](#) and [5.4](#)

5.5.2 General Inspection

After application, the tape coating shall be smooth, have uniform overlap, be free of wrinkles, air bubbles, lack of adhesion, laminations and any other coating defects. The tape wrap shall start and finish at the horizontal axis of the pipe, pointing in the downward direction.

5.5.3 Thickness

The nominal thickness is the calculated sum of the thickness of all the layers of the coating before application.

The minimum thickness of the coating on the body of the joint shall be not less than 90 % of the nominal value, or as otherwise agreed to by the purchaser.

Unless otherwise agreed with the purchaser, the minimum thickness on the weld cap shall be not less than 80 % of the nominal value.

NOTE 1 The coating thickness on the weld cap is normally less than on the body because some of the polymeric adhesive will flow from the weld cap to the body, both during and after the application. This is necessary to prevent voids in the coating and is not detrimental to the corrosion protection.

NOTE 2 The coating thickness should be measured using the method given in AS 3894.3.

5.5.4 Holiday detection

The entire surface of the coated joint shall be checked for holidays or other discontinuities according to the method and test voltages specified in AS 3894.1.

Holidays shall be repaired applying a new tape wrap unless otherwise agreed.

5.5.5 Impact resistance

The impact resistance shall be measured using the method given in [Appendix C](#). The impact resistance shall meet the values given in [Tables 5.2](#) and [5.3](#).

5.5.6 Indentation resistance

The indentation resistance shall be measured using the method given in [Appendix D](#). The indentation resistance shall meet the values given in [Table 5.3](#).

5.5.7 Drip resistance

The drip resistance of petrolatum tapes shall be measured using the method given in [Appendix F](#). The drip resistance shall meet the requirements given in [Table 5.2](#).

5.5.8 Cathodic disbondment

The cathodic disbondment shall be measured using the method given in AS 4352 and meet the values given in [Table 5.2](#) and [Table 5.4](#).

5.5.9 Peel strength between tape layers of polymeric tapes

The peel strength between tape layers of polymeric tapes shall be measured using the method given in [Appendix H](#). The peel strength between layers of polymeric tapes shall meet the values given in [Table 5.3](#).

5.5.10 Peel strength to pipe surface and factory-applied coating

5.5.10.1 General

The minimal waiting period between application of the coating and the peel strength test shall be as given in [Table 5.8](#), unless specified otherwise by the coating manufacturer.

5.5.10.2 Petrolatum tapes (Type 1A)

Petrolatum tapes shall leave a film of compound on the substrate when peeled off.

5.5.10.3 Polymeric tapes (Type 1B)

The peel strength shall be measured using the method given in [Appendix B](#). The peel strength of polymeric tapes (Type 1B) shall meet the values given in [Tables 5.3](#) and [5.4](#).

5.5.10.4 Peel strength after immersion in water

The peel strength shall be measured after immersion in water for 24 h, the test temperature being 50 °C or 80 °C for Type 1B, in accordance with the T_{max}Rated temperature of the coating, and 30 °C or 50 °C for Type 1A.

Petrolatum tapes shall leave a continuous film of compound on the substrate when peeled off after immersion in water.

For polymeric tapes, the peel strength after immersion in water shall be measured using the method given in [Appendix B](#). The peel strength after immersion in water shall meet the values given in [Table 5.3](#).

5.5.11 Lap shear strength of polymeric tapes

The lap shear strength resistance of polymeric tapes shall be measured using the method given in [Appendix G](#). The lap shear strength of polymeric tapes shall meet the values given in [Table 5.3](#).

5.5.12 Thermal ageing resistance of polymeric tapes

The thermal ageing resistance shall be measured using the method given in [Appendix H](#). The thermal ageing resistance shall meet the values given in [Table 5.3](#). Where agreed by the purchaser, smaller diameter pipe may be used for PQT laboratory testing, for the situation where the actual pipe size may not be able to be tested in Australia due to the unavailability of suitably sized laboratory equipment.

Table 5.1 — Coating identification

Coating trade name	
Basic type of coating material (1A or 1B)	
Primer trade name	
Number of layers ^a	
Trade names of all layers	
Nominal thickness of coating system	
Compatible factory-applied coatings ^b	
^a Excluding primer.	

Table 5.1 (continued)

Coating trade name
^b State all types of factory-applied coating that have been tested successfully with the coating.

Table 5.2 — TT, PQT, PPT and Production inspection and test plan and minimum requirements for Type 1A tapes (Petrolatum tapes, for TmaxRated temperatures of 30 °C and 50 °C)

Property	Test method	Number of TT test pieces	Number of PQT joints	Number of PPT joints	Production frequency	Requirement
Impact resistance	Appendix C	3	Nil	Nil	Nil	≥ 0.8 J/mm
Drip resistance at 50 °C (for 30°C TmaxRated tape)	Appendix F	3	Nil	Nil	Nil	No dripping of compound
Drip resistance at 70 °C (for 50°C TmaxRated tape)	Appendix F	3	Nil	Nil	Nil	No dripping of compound
Surface cleanliness	AS 1627.2		3	3	Every joint	Clause 5.3
Thickness	AS 3894.3		3	3	Nil	Clause 5.5.3
Holiday detection	AS 3894.1		3	3	Nil	No holiday
Cathodic disbondment at 23 °C, 28 days ^a	AS 4352		3	Nil	Nil	≤ 20 mm
Cathodic disbondment at 50 °C, 28 days (for high temperature tape) ^a	AS 4352		3	Nil	Nil	≤ 20 mm
Peel strength to pipe surface and factory-applied coating	Manually peel strip 25 × 100 mm		3	3	Nil	Leave continuous film of compound on the substrate
Peel strength to pipe surface and factory-applied coating before and after 28 day hot water immersion test at 30 °C for Tmaxrated at 30°C	Manually peel strip 25 × 100 mm		3	3	Nil	Leave continuous film of compound on the substrate
Peel strength to pipe surface and factory-applied coating before and after 28 day hot water immersion test at 50 °C for TmaxRated at 50°C	Manually peel strip 25 × 100 mm		3	3	Nil	Leave continuous film of compound on the substrate
^a During CD testing if material exudes to significantly reduce the size of the intentional holiday, the surplus material shall be removed to maintain the current constant.						

Table 5.3 — TT Requirements for Type 1B^a (Polymeric tapes for TmaxRated temperatures of 50 °C or 80 °C)

Property	Test method and number of tests	Requirement
Thermal ageing resistance	Appendix I	$1.25 \geq E_{100} / E_0 \geq 0.75$
Ratio of:		$E_{100} / E_{70} \geq 0.8$
Elongation at break		$P_{100} / P_0 \geq 0.75$
Peel strength between tape layers		$P_{100} / P_{70} \geq 0.8$