Gas Industry Standard

GIS/CW5:2020

Specification for

Field applied external coatings for buried pipework and systems

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Contents

Foreword

Gas Industry Standards (GIS) are revised, when necessary, by the issue of new editions. Users should ensure that they are in possession of the latest edition. Contractors and other users external to Gas Transporters should direct their requests for copies of a GIS to the department or group responsible for the initial issue of their contract documentation.

Comments and queries regarding the technical content of this document should be directed in the first instance to the contract department of the Gas Transporter responsible for the initial issue of their contract documentation.

This standard calls for the use of procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Compliance with this engineering document does not confer immunity from prosecution for breach of statutory or other legal obligations.

Mandatory and non-mandatory requirements

For the purposes of a GIS the following auxiliary verbs have the meanings indicated:

can indicates a physical possibility;

may indicates an option that is not mandatory;

shall indicates a GIS requirement;

should indicates best practice and is the preferred option. If an alternative method is used then a suitable and sufficient risk assessment needs to be completed to show that the alternative method delivers the same, or better, level of protection.

Disclaimer

This engineering document is provided for use by Gas Transporters and such of their contractors as are obliged by the terms of their contracts to comply with this engineering document. Where this engineering document is used by any other party, it is the responsibility of that party to ensure that the engineering document is correctly applied.

Brief history

First published as Code of Practice BG/PS/CW5	December 1988
Second issue published BGES/CW5	July 1994
Editorial update to reflect demerger November 2000 CW/5	June 2001
Details updated and document changed to a Technical Specification. CW5 Supplements CA/1 to CA/14 inc. modified and included as CSA/1 to CSA/10 Revised document added to DDD.	June 2004
Revised to incorporate comments made following document time on DDD and issued to TSG for acceptance by Transco	November 2004
Revised and reissued as GIS/CW5	October 2020

1. Scope

This Gas Industry Standard specifies requirements for buried steel pipes and components for the transmission and distribution of gas, at all pressure ranges, and specifies the procedures for the surface preparation and field applied external coatings that provide corrosion protection to buried pipework and all associated buried components.

The coating processes are related to product groups which embrace materials of similar characteristics (see Table 1). For material specifications concerning fusion bonded epoxy (FBE) powders and multi-component liquids (MCL), reference should be made to GIS/CW6. For tapes and mastics, refer to GIS/CW2.

Selection of the appropriate material for a coating situation should be made by reference to Tables 2 to 5 inclusive.

Only materials and product names that have met the performance requirements of GIS/CW2 or GIS/CW6 and listed in the Gas Transporters (GT's) Coatings Register for which acceptance in writing has been given by the GT or their representative shall be used. Additions will be made from time to time to the information available in order to cover materials that are less widely used and new products.

An appropriate Specific Coating Application (SCA) in Section 7 of this specification details the materials, surface preparation and methods of application to be used. Only the relevant SCA's need to be considered for the coating system in question.

Buried UK pipelines can operate between -20ºC and 50ºC. Selected coatings shall be suitable for temperatures specified by the Gas Transporter in this range.

For bespoke application >50ºC seek guidance from the Gas Transporter.

GIS/CW5 is not intended to inhibit a Contractor from offering, or the Gas Transporter from accepting alternative coating solutions, particularly where there is an innovative or developing technology. If a new technology is available, it is the responsibility of the Contractor to identify any variations from this Specification, provide details and submit the new technology for consideration by the GT.

2. Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

2.1 British and European standards

BS EN ISO 9001, *Quality management systems. Requirements*

2.2 International Organisation for Standardization

ISO 3183, *Petroleum and natural gas industries — Steel pipe for pipeline transportation systems*

ISO 8501-1, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

ISO 8502-9, *Preparation of steel substrates before application of paints and related products – tests for the assessment of surface cleanliness – Part 9: Field method for the conductometric determination of water-soluble salts*

ISO 12809, *Petroleum and natural gas industries — External coatings for buried or submerged pipelines used in pipeline transportation systems — Part 2: Single layer fusion-bonded epoxy coatings*

ISO 14001, *Environmental management systems — Requirements with guidance for use*

ISO/TS 29001*, Petroleum, petrochemical and natural gas industries — Sector-specific quality management systems — Requirements for product and service supply organizations*

2.3 Gas Industry Standards

GIS/CW2, *Performance tests for the supply of cold applied wrapping tapes and tape systems*

GIS/CW5, *Field applied external coatings for buried pipework and systems*

GIS/CW6, *Specification for the external protection of steel line pipe and fittings using fusion bonded powder and other coating systems - requirements and methods of test for coating materials and factory applied coatings*

2.4 Gas Transporter Standards

GN/PM/P/11, *Management Procedure for Inspection, Assessment and Repair of Damaged (non - leaking) Steel Pipelines Greater than 150mm Nominal Diameter, Designed to Operate at Pressures greater than 2 bar*

GN/PM/P/20, *Management Procedure for Inspection, Assessment and Repair of Damaged, Non - Leaking, Steel Pipelines and Pipework up to 150mm Nominal Diameter, Designed to Operate at Pressures greater than 2 bar*

2.5 Statues and Regulations

Control of Substances Hazardous to Health (COSHH) Regulations 2002

Chemicals (Hazard Information and Packaging for Supply) Regulations 2009

Convention Covering International Carriage by Rail - International Carriage of Dangerous Goods by Rail 2015

International Carriage of Dangerous Goods by Road (ADR 2017)

The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2012

Environmental Protection Act - EPA - (Duty of Care) 1991

Health and Safety at Work etc. Act 1974 and other relevant legislations, such as European Union (EU) if applicable

Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

NOTE

Where no date is shown, the latest edition of each standard and specification shall apply.

- Gas Transporters will each have their own procedures & specifications normally in the referenced format */SP/XX/No, where * is replaced by the Gas Transporters reference e.g. T for National Gas Transmission, or SGN, WWU etc. followed by the specification initials and number reference.

3. Terms and Definitions

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

Applicator: company or individual that undertakes the coating application in accordance with the provisions of this part Specification and assigned parts of ISO 21809. If the compounding of the top layer is done prior to or during the application process by the applicator, then the applicator is considered as manufacturer.

Batch: quantity of coating material as defined by the manufacturer.

BGAS: certified qualification provided by the welding institute (TWI).

Contractor: the person, firm or company with whom a Gas Transporter enters into a contract to which this specification applies, including the Contractor's personal representatives, successors and permitted assigns.

Certificate of compliance: one of the types of documents defined by ISO 10474 that is issued in accordance with the purchase requirements.

Coating Register: the controlled list of materials and manufacturers which meet the technical specification requirements, highlighting any restrictions, and for which written notification has been issued.

Cutback: length of pipe left uncoated at each end for joining purposes.

Dew Point: the temperature at which the vapor pressure of the water vapour in the air is equal to the saturated vapour pressure in water.

FROSIO: corrosion protection and surface treatment training and certification body.

Holiday: coating discontinuity that exhibits electrical conductivity when exposed to a specific voltage.

Gas Transporter: a Company with a license to transport gas or their representative appointed from time to time by and notified to the Contractor to act as the Gas Transporter’s representative for the purposes of the contract.

Manufacturer: company responsible for the manufacture of coating material(s).

Manufacturer’s specification: document that specifies the characteristics, test requirements and application recommendations for the coating materials.

Maximum design temperature: maximum temperature (50^{o}C) that the coating can be exposed to during operation.

Pipe diameter length: any length along the pipe axis equal to the specified outside diameter of the pipe.

Pipeline: those facilities through which fluids are conveyed, including pipe, pig traps, components and appurtenances, up to and including the isolating valves.

Pipeline transportation system: pipeline with compressor or pump stations, pressure reduction stations, flow control stations, metering, tankage, supervisory control and data acquisition system (SCADA), safety systems, corrosion protection systems, and any other equipment, facility or building used in the transportation of fluids.

Purchaser: company or individual responsible for providing the product order requirements.

Relative Humidity: the ratio of the actual vapour pressure to the saturation vapor pressure over a plane of liquid water.

Test report: document that provides the quantitative test results for tests conducted in accordance with the requirements of this Specification and others cited such as ISO 21809.

3.1 Abbreviations

CFR coating field repair

COSHH control of substances hazardous to health

CP cathodic protection

CTE coal tar enamel

CALT **Cold applied laminate tape**

FBE fusion bonded epoxy

FJC field joint coating

GIS gas industry standard

GT gas transporter

ICORR institute of corrosion

ITP inspection and testing plan

MCL Multi component liquid

MSDS material safety data sheet

MS manufacturer specification

NACE national association of corrosion engineers

PE polyethylene

PQT procedure qualification trial

REACH registration, evaluation, authorisation & restriction of chemicals

3.2 Units

Internationally accepted (SI) units shall be used

Gas Transporter requirements are that metric Système International (SI) units shall be used. If there is a requirement to use imperial units then SI units will be stated followed by the local requirement in brackets. The following exceptions shall apply:

Temperature - degrees Celsius (ºC)

Dynamic viscosity - centipoise (cP)

Pressure shall be expressed as either gauge pressure in barg or absolute pressure in bara, gauge pressure being referenced to Standard Atmospheric pressure of 1.01325 bara.

The definition of Standard Conditions for pressure and temperature that shall be applied is 1 atmosphere pressure (or 1.01325 bara/0.01325barg) and 15.5556ºC (rather than 0.1MPa and 273.15 degrees Kelvin (0ºC).

NOTE

Any deviations to this definition to be consistent with local standards shall be discussed and agreed with the Gas

Transporter.

4. Health, Safety & Environment

See Annex A and Clause 2.5 of this specification for guidance.

5. Quality

See Annex B of this specification for guidance.

6. General Information

6.1 Surface Preparation

6.1.1 General

The condition of the surface to which the coating is to be applied in the field will directly affect its performance.

Surfaces to be considered include:

a) Any existing pipe coating which is required to be overlapped;

b) The area of exposed metal to be coated.

Details of the appropriate surface preparation and the procedures to be adopted are given in Table 8. Variations from Table 8 may be acceptable where coating properties have been proven during testing at lower quality surface finishes.

6.1.2 Existing pipe coatings

Existing coatings which are to be overlapped shall be:

a) checked for existing adhesion;

b) assessed to determine appropriate removal method (see section 9, Table 8);

c) contoured to eliminate crevices or sharp steps;

d) identified for the most appropriate compatible material group; liquid coating compatibility will be dictated by solvent strength as shown below. Seek technical guidance from coating manufacturer or relevant coating authority.

e) cleaned and primed where applicable in accordance with Section 8.

Table 1 - Solvent Strengths

Solvent Strength in descending order	Common solvent names	Binders
water		Emulsions PVC / PVA, Vinyls, Acrylics, Polyurethane Epoxy, Alkyds
Aliphatic hydrocarbons	White spirit Turpentine Solvent naphthas Hexanes upwards	Alkyds Phenolics
Aromatic hydrocarbons	Xylene Tolulene Benzene	Chlorinated rubber
Ketones	Acetone MEK	Epoxy

6.1.3 Exposed Metal Surfaces

Surface preparation should only take place when the steel surface is 3°C above dew point and when relative humidity is <85%.

At the Gas Transporters discretion alternate conditions stated by a coating system product data sheet and supported by qualification test evidence may be considered.

The two most widely used techniques for surface preparation of metal surfaces are, in order of decreasing effectiveness:

a) blast cleaning (conventional or recovery systems) (Sa1-Sa3);

b) wire brushing (mechanical or hand) (St2-St3).

The choice of method a) or b) above will be dictated by technical and environmental considerations, the type of coating to be used and by economic considerations related to the size of the project.

There are also a range of water blasting techniques (see Clause 6.1.4.1), but these may prove expensive due to the need to supply water and dispose of contaminated waste. High-pressure jetting (see Clause 6.1.4.2), is not suitable since it will not cut a surface profile into the metal. However, it made be used to remove existing coatings and expose original surface profile.

For high pressure pipelines and installations blast cleaning is preferred.

Hand and power tool cleaning methods have been tried and tested over many years but are far

less efficient than blasting. Limited access, operator fatigue or environmental considerations may be factors which influence the choice of methods.

Hand and power tool cleaning is often specified for short term maintenance programmes. One major disadvantage of this method is the lack of surface profile. Wire brushing is a particular problem and will not produce a profile and will actually reduce an existing profile, sometimes resulting in burnishing (polishing) and poor adhesion. Burnishing shall be removed by abrading with coarse emery cloth.

New power tool technologies e.g. 'Bristle Blaster' that facilitate both cleaning and create anchor profile may be considered.

The use of reclaimed grit shall not be permitted.

The standard of surface preparation is defined in Section 9.

Where general corrosion or mechanical damage has occurred, the responsible Engineer should decide what action is required by reference to document GN/PM/P/11 and GN/PM/P/20. An inspection in accordance with P/11 or P/20 may be required.

Any alternative surface preparation methods should be assessed by the Gas Transporter for environmental acceptability and ease of use. Alternative removal methods should be recorded alongside the acceptance/non-acceptance criteria.

Other methods of surface preparation should be proposed as a variant for consideration depending upon the extent of exposed area, the existing coating and coating to be applied.

6.1.3.1 Water blasting

Surface preparation methods using water are more environmentally friendly than open blasting and also, from the safety aspect, spark free. They are ideal for removal of soluble salts, sulphates and chlorides, (the hygroscopics) although complete removal needs high pressure ranges.

Wet blasting methods are also ideal for removing layers of toxic materials, e.g. red lead, calcium plumbate and zinc chromate primers. These materials are safe during application but removal by abrasion results in fine particulate matter passing into the air, which can then be inhaled and passed into the bloodstream.

There are certain disadvantages related to water blasting e.g. supply of large amounts of water and disposal of the resulting slurry (water and detritus as an entity) and also mixing substrate inhibitors if the specification demands it.

Substrate inhibitors are substances, usually sodium compounds, added to the water to retard the formation of corrosion products.

The UK Gas Industry do not allow the use of substrate inhibitors, in which case wet blasting is followed by dry blasting, to remove light oxidation

6.1.3.2 Water jetting

The current water jetting categories defined by NACE are:

- **Low-Pressure Water Cleaning (LP WC)**: pressures below 5,000 psi (34 MPa) – used

primarily as a washing technique. At pressures below 5,000 psi (34 MPa), water removes soluble contamination and some loosely adherent surface contaminants. It reliably removes chalking of aged coatings, leaving the coating surface intact.

- **High-Pressure Water Cleaning (HP WC)**: pressures of 5,000 to 10,000 psi (34 to 70 MPa) – preparation of concrete surfaces prior to coating application. A properly focused HP WC water nozzle can cut through concrete blocks, so the technique is both efficient and dangerous. When used for surface preparation for coatings over steel surfaces, the production rate is relatively low.

  In addition, only loose contamination can be successfully removed when preparing steel surfaces for painting.

- **High-Pressure Water jetting (HP WJ)**: pressures of 10,000 to 30,000 psi (70 to 210 MPa) - surface preparation for coatings seldom uses high-pressure water jetting equipment. It does not clean better than equipment operating at lower pressure, and the production rate is not cost effective.

- **Ultrahigh-Pressure Water jetting (UHP WJ)**: pressures above 30,000 psi (210 MPa) - uses water at very high pressure: 30,000 psi (210 MPa) and above (up to 50,000 psi [340 MPa]). Because of the high pressures required, safe practice demands great care in controlling the waterjet nozzles, since a person struck by high-velocity water at short range could be injured seriously. Most UHP WJ equipment operates with a rotating nozzle and dual water streams. The highly efficient nozzle design produces an effective cleaning pattern while using relatively little water, typically no more than 8 litres per minute. Hold the nozzle close to the surface being cleaned since cleaning efficiency decreases rapidly when the nozzle is held further than 18 in (50 cm) from the surface. The most effective cleaning is achieved when the nozzle is at a maximum distance of approximately 2 in (50 mm), though the blast pattern is then very narrow and production rates may decrease. At this pressure, water removes most contaminants, such as chemical salts, dirt, grease, and mill scale. It will not produce a surface profile but can restore any previously existing surface profile if the equipment is designed to clean the surface to a high standard. Use the highest pressures, 35,000 psi (240 MPs) and above to achieve this high standard. An unexpected benefit of using very high pressures is the heat it generates. The heat limits rust deterioration, and the surface remains relatively clean (though with some *ginger* discoloration).

6.1.3.3 Surface cleaning

The area to be field coated including the adjacent 100mm of factory coating should be cleaned to remove dirt, grease and salt contamination.

The surface to be coated should be free from any visible defects or imperfections. Filling or grinding shall be used to remove any anomalous surface defects such as burrs, weld slag, spatter, or any rough weld caps.

Acceptance level of chloride contamination (assessed according to ISO 8502-9) shall not exceed 2ug/cm^2.

6.2 Site coating inspections and tests

It is essential that field testing and inspections be carried out by competent persons (See Annex C) on all completed site coatings. Varying levels of test should be used depending on the type of coating in question.

The appropriate tests are specified and summarised in Table 7. In some cases, all testing may not be possible, such as 100% holiday testing. In such cases a rigorous visual inspection of the completed coating shall be carried out.

7. Material Selection

7.1 Product Groups

This specification applies only to the following groups of products. The product group number can be linked to the specific coating application using Table 2 below. Any deviation from the table below shall be approved by the Gas Transporter prior to application.

Table 2: Identification of product groups

Product Group Number	Description	Application Reference
1	Cold applied self-adhesive overwrap tapes	SCA1
2	Light duty cold applied laminate tape	SCA1
3	Heavy duty cold applied laminate tape	SCA1
4	Grease / wax based tapes	SCA1
5	Fillers	SCA2
6	Brushing Mastics	SCA3
7	Shrinkable materials (sleeves, tapes, wraparound materials)	SCA4
8	Fusion bonded epoxy powders	SCA5
9	Multi-component liquid coatings for dry surfaces	SCA6
10	Multi-component liquid coatings for wet surfaces	SCA7
11	Hot applied polyolefins	SCA8

Although some of the below products may have been discontinued and no longer be applied to assets, they may currently be in service and recorded under the product group names below.

7.1.1 Product Group 1 – Cold applied self-adhesive overwrap tapes

These are constructed using a plastic carrier film usually in excess of 200 microns which has been coated on one side with an adhesive, usually no more than 25 microns in thickness. The outer wrap tape is normally used over a primary corrosion protection system to significantly improve mechanical protection of grease and wax based tapes or to act as a slip layer when soil shear stressing is likely to occur.

7.1.2 Product Group 2 – Light duty cold applied laminate tapes (CALT)

These tapes are constructed from plastic films coated with a thick layer of adhesive which is usually a rubberised bitumen compound with mastic qualities that bond well to the different materials used in the pipeline industry.

The plastic backing film is generally less than 400 microns that makes the material very pliable during application. These are applied onto a primed surface.

7.1.3 Product Group 3 – Heavy duty cold applied laminate tapes (CALT)

These tapes are of similar construction to the light duty ones but with backing film thicknesses above 400 microns and with an adhesive thickness layer up to 1000 microns. These products are versatile under a wide range of conditions and are ideally suited for straight sections of larger diameter pipelines. These require a primer to be applied to the prepared surface.

7.1.4 Product Group 4 – Grease and wax based tapes

Grease based tapes, petrolatum tapes and wax based tapes are constructed using synthetic

polyester fabric which is fully impregnated with proprietary wax oil blend or wax / paraffin blend with inert material powders added to improve their chemical resistance. These products are very easy to apply and possess good water proofing and anti-corrosion properties. They also have low resistance to mechanical damage. A suitable primer is recommended for prepared surfaces.

7.1.5 Product Group 5 – Fillers and putties

Fillers are a range of inert moulding putties that are used to contour different configurations to produce a reasonably shaped profile suitable for coating using a suitable wrapping system.

7.1.6 Product Group 6 – Brushing mastics

These are versatile single pack high volume solids, high build liquid coatings which can be applied using simple application techniques of brush or trowel. They are compatible with most other types of coating. The high build nature of the material provides good corrosion protection as a single coating system and are ideal in situations where there is no significant contact with the soil such as in valve chambers and ducting. Newer brands of brushing mastic may have been developed with increased soil line resistance.

7.1.7 Product Group 7 – Shrinkable materials (sleeves, wraps, tapes, etc.)

These materials have thermal memory and will ‘shrink’ when heated above a certain temperature. The cross-linked plastic backing has an adhesive underlayer which bonds the sleeve to the object and the backing conforms tightly to it when exposed to heat or infrared radiation. These products have good mechanical propertied.

7.1.8 Product Group 8 – Fusion bonded epoxy (FBE) powders

Fusion bonded epoxy is a thermosetting material that is normally applied under factory conditions which allows for very good control of the product application. This material has very good mechanical and corrosion resistant properties with good compatibility with cathodic protection systems.

7.1.9 Product Group 9 – Multi-component liquids (MCLs)

These are normally comprised of two components which chemically react and cure when mixed together. The mixed material is applied using conventional methods, either brush or spray, but the application shall be completed before the material cures. A cured material forms a very good coating which has excellent resistance to mechanical damage and corrosion. The two components consist of a base and a curing agent. The liquid nature and chemical composition of these components requires strict attention to health and safety practices (see above), but once the material has cured it becomes inert. Mixing ratio, times and thoroughness of the two (or more) components is critical.

7.1.10 Product Group 10 – Damp-tolerant multi-component liquids

A limited range of these products are suitable for coating of damp surfaces, but only those which have been deemed acceptable via suitable field trials or lab testing should be used.

7.1.11 Product Group 11 – Hot applied polyolefin-based coatings

These coatings are normally comprised of three layers:

- an inner fusion bonded epoxy layer;
- a middle layer of chemically modified polyethylene or polypropylene;
- an external layer of polypropylene or polyethylene.

Maximum operational temperature of these coating types is generally low (70°C to 110°C), and in some cases a 2-layer coating may be used instead of a 3-layer with the middle and external layers incorporated into one). The recommended minimum thickness for the epoxy primer is 200um.

7.2 Preferred materials for anti-corrosion protection

The products given in Table 3 specify the preferred welded joint coating considered most compatible with the various types and combinations of field/factory applied coating.

Options are also identified for cases where site or operating conditions preclude the use of the preferred system. However, the use of it can only be undertaken with the prior approval of the Gas Transporter.

7.3 Systems for partially exposed pipe

Special consideration is necessary for pipework at the wind/water line as they may not receive adequate protection from cathodic protection (CP) systems and are vulnerable to corrosion resulting from differential aeration. In addition, UV degradation and mechanical damage due to stones and rocks in the vicinity of the pipe are also a threat.

Any existing coating, with the exception of fusion bonded epoxy (FBE), should be removed and grit blasted for a minimum of 500 mm both above and below ground level and the area coated with a multi-component liquid system (MCL). Where the existing coating is MCL no further action is required provided that good adhesion exists. Where the existing coating is polyethylene or cold applied laminate tape the overlap of the MCL requires two turns of the cold applied laminate tape to prevent any moisture ingress between the coatings. Where the existing coating is FBE the area should be abraded to provide a key for the MCL.

The use of a sand box around the riser should be considered. For pipes other than vertical, this measurement should be to the nearest surface of the pipe to above and below ground level (see Figure 1).

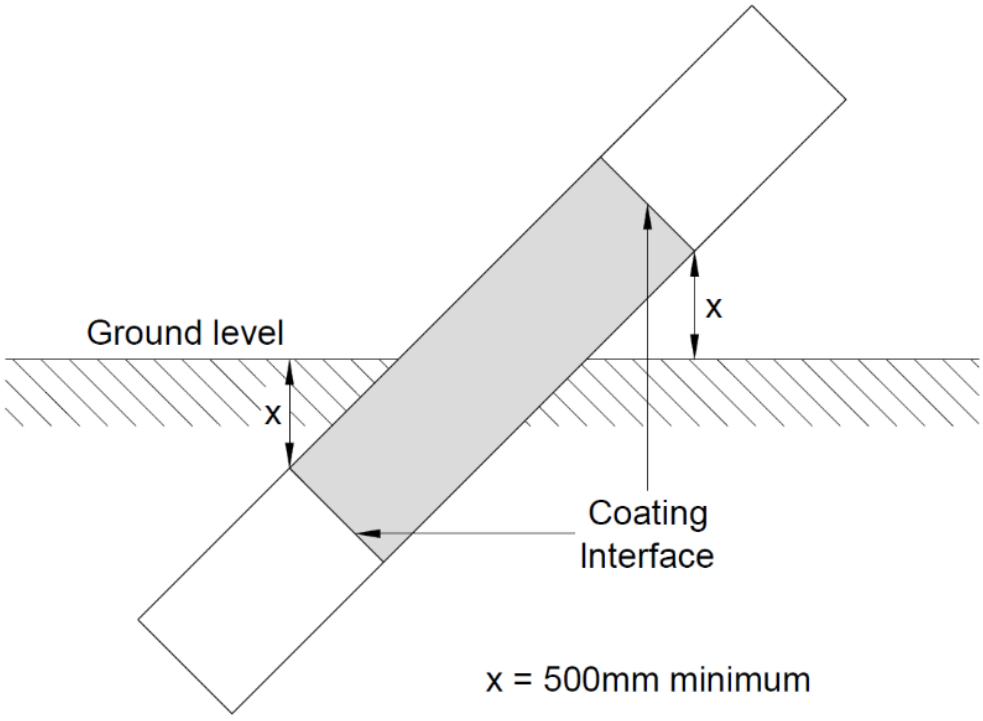

Figure 1: Extent of coating for partially exposed pipe

Table 3: Preferred materials for FJC of welded joints

<table>
<tr><th colspan="2" rowspan="2">Possible components of differing types of coating on each side of a weld</th><th colspan="3">Product group</th></tr>
<tr><th>Preferred</th><th>1st Option</th><th>2nd Option</th></tr>
<tr><td>Fusion Bonded Epoxy</td><td>Cold Applied Laminate Tape</td><td>Cold Applied Laminate Tape</td><td>Multi-Component Liquid</td><td rowspan="11">Shrinkable material</td></tr>
<tr><td>Multi-Component Liquid</td><td>Fusion Bonded Epoxy</td><td rowspan="5">Multi-Component Liquid</td><td rowspan="5">Cold Applied Laminate Tape</td></tr>
<tr><td>Multi-Component Liquid</td><td>Multi-Component Liquid</td></tr>
<tr><td>Coal Tar Enamel</td><td>Fusion Bonded Epoxy</td></tr>
<tr><td>Coal Tar Enamel</td><td>Multi-Component Liquid</td></tr>
<tr><td>Coal Tar Enamel</td><td>Coal Tar Enamel</td></tr>
<tr><td>Polyethylene</td><td>Fusion Bonded Epoxy</td><td rowspan="10">Cold Applied Laminate Tape</td><td rowspan="4">Grease / wax based tape overwrapped with cold applied self-adhesive tape</td></tr>
<tr><td>Polyethylene</td><td>Multi-Component Liquid</td></tr>
<tr><td>Polyethylene</td><td>Coal Tar Enamel</td></tr>
<tr><td>Polyethylene</td><td>Polyethylene</td></tr>
<tr><td>Cold Applied Laminate Tape</td><td>Fusion Bonded Epoxy</td><td rowspan="6">None</td></tr>
<tr><td>Cold Applied Laminate Tape</td><td>Cold Applied Laminate Tape</td></tr>
<tr><td>Cold Applied Laminate Tape</td><td>Multi-Component Liquid</td></tr>
<tr><td>Cold Applied Laminate Tape</td><td>Coal Tar Enamel</td></tr>
<tr><td>Cold Applied Laminate Tape</td><td>Polyethylene</td></tr>
</table>

Table 4: Systems for overwrapping existing pipe coatings

<table>
<tr><th rowspan="2">Existing factory/field applied coating</th><th colspan="2">Product Group</th></tr>
<tr><th>Preferred</th><th>Option</th></tr>
<tr><td>Fusion Bonded Epoxy</td><td>Spray or brush/trowel applied MCL</td><td>Cold Applied laminate tapes</td></tr>
<tr><td>Polyethylene</td><td rowspan="2">Cold Applied laminate tapes</td><td rowspan="2">Grease / wax based tape over wrapped with Cold applied self-adhesive laminate tape</td></tr>
<tr><td>Coal Tar Enamel</td></tr>
<tr><td>Multi-Component liquid</td><td>Spray or brush/trowel applied MCL</td><td>Cold Applied laminate tapes</td></tr>
</table>

Table 5: Repair systems for dry surfaces

Existing factory/field applied coating	**Product Group**		
	Preferred	**Option 1**	**Option 2***
Fusion Bonded Epoxy	Multi-Component liquid	Cold applied laminate tapes	Heat Shrink Materials
Polyethylene	Cold applied laminate tapes	Grease / wax based tapes overwrapped with cold applied self-adhesive tapes	Heat Shrink Materials
Coal Tar Enamel	Multi-Component liquid	Cold applied laminate tapes	Grease / wax based tapes overwrapped with cold applied self-adhesive tapes
Multi-Component liquid			
Cold applied laminate tapes	Cold applied laminate tapes	None	None
Brushing mastic	Brushing mastic	None	None
*Only to be used with prior approval from Gas Transporter			

Table 6: Repair Systems for damp surfaces

Existing factory/field applied coating	**Product Group**	
	Preferred	**Option**
Fusion Bonded Epoxy	Moisture tolerant Multi-Component liquids	Grease / wax based tapes overwrapped with cold applied self-adhesive tapes
Polyethylene	Grease based tapes overwrapped with cold applied self-adhesive tapes	None
Coal Tar Enamel	Moisture tolerant Multi-Component liquids	Grease / wax based tapes overwrapped with cold applied self-adhesive tapes
Multi-Component liquid	Grease / wax based tapes overwrapped with cold applied self-adhesive tapes	None
Cold applied laminate tapes	Moisture tolerant Multi-Component liquids	Grease / wax based tapes overwrapped with cold applied self-adhesive tapes
Brushing mastic	Grease / wax based tapes overwrapped with cold applied self-adhesive tapes	None

7.4 Repair Coatings

7.4.1 Repair coatings for dry surfaces

The main factory applied coating requires repair when damaged. The preferred repair system is given in Table 5. Options are also identified for cases where site or operating conditions preclude the use of the preferred system. However, the use of the second option can only be undertaken with prior approval of the Gas Transporter.

7.4.2 Repair coatings for damp surfaces

Repairs to coatings that are permanently damp require special products that are tolerant to surface moisture. Details of these systems related to the factory and field applied coatings are given in Table 6. However, in all cases, practical steps should be taken to ensure that the surface to be coated is as free from moisture as possible.

An option is identified for cases where site or operating conditions preclude the use of the preferred system. However, its use can only be undertaken with prior approval of the Gas Transporter.

7.4.3 Backfilling and consolidation

It is important that due care is taken during backfilling and consolidation to prevent damage to any coating.

Backfill material shall always be selected so that it does not cause damage to the coating and in the following circumstances non-aggressive imported backfill such as washed sand or stone dust may be required:

a) Where brushing mastics have been used.

b) Where excessive soil stresses may be expected (e.g. in clay soils).

c) Where stony or rocky ground is present. (In these cases, the use of proprietary energy absorbent perforated plastics shields should also be considered).

d) Where existing backfill material is deemed to be unsuitable.

8. Specified Coating Applications (SCA)

8.1 SCA1 – Cold applied tapes – (Product groups 1, 2, 3 and 4)

8.1.1 General

This SCA 1 applies to the application of cold applied tapes covering product groups 1, 2, 3 and 4.

8.1.2 Safety

Before using any materials, reference should be made to Clause 4 – Safety, Health and Environment of this specification.

8.1.3 Materials

Only materials listed in the Coatings Register should be used.

All material should be stored in warm conditions prior to use in accordance with the manufacturer's instructions.

Pipe 50 mm to 300 mm inclusive outside diameter should be wrapped using 50 mm or 100 mm

wide tape; pipe having an outside diameter greater than 300 mm should be wrapped using 100 mm or 150 mm wide tape. Difficulties may be encountered in tensioning tape widths in excess of 150 mm. Bends and particularly tees, should require the use of narrower tapes in certain areas.

At least 2 revolutions of tape shall be applied; tape patches shall not be used.

During adverse weather, tape application should still be carried out if the local environment is controlled to avoid unacceptable conditions. This should be achieved, subject to the satisfaction of the responsible Engineer, by the erection of protective canopies and the use of heaters and de-humidifiers. Where freestanding water exists, a waterproof membrane shall be laid between the work component and the ground.

8.1.4 Wrapping Procedure

The surface to be wrapped shall be prepared in accordance with Section 9. The correct primer should be applied by brush or spray and in accordance with the manufacturer's instructions and extend on to the factory applied coating to beyond the area to be taped. It should be noted that the self-adhesive tape (Product Group 1) does not require a primer and that the grease based (petrolatum) and wax based tapes (Product Group 4) require a priming paste or appropriate solution.

The tape shall be applied with the compound (sticky) side to the pipe, starting and finishing wrapping at the 3 o'clock or 9 o'clock positions and finish with the tape pointing downwards. Where used, the interleaving film shall be removed whilst applying the tape in a spiral fashion to give a minimum of 55% overlap. Sufficient tension shall be applied to the tape to ensure good conformation and, to avoid air pockets, smooth out as application proceeds. The wrapping should start and finish to give a minimum of 75 mm overlap on to the adjoining factory applied coating.

On vertical or inclined sections, the wrapping shall start at the lowest point to avoid water penetration during the service life of the tape.

Grease based tapes should be over wrapped using self-adhesive tape. This overwrap should be applied in a spiral fashion with a 25 mm overlap extending approximately 75 mm beyond the grease-based tape and primer at both ends, finished off by one full turn back on itself. Care should be taken to prevent contamination by grease during application of the last few turns. This should ensure adequate adhesion of the final turn. Wax based tapes cure to form a semi-firm finish. The application of an overwrap self-adhesive tape is not necessary but should be considered depending on the environment where the tape is to be used.

The self-adhesive over-wrapped tape should provide solar protection and help reduce damage from soil movement when used over cold applied laminate tapes.

Wrapping valves, flanges and irregular shapes Valves, flanges and similar components shall be evenly contoured prior to wrapping using methods detailed in SCA 2.

8.1.5 Inspection

Inspection requirements shall be in accordance with Clause 6.2 and Table 7 of this specification.

Bond/adhesion tests should not be performed within 24 h (or longer in cold weather) of completion of wrapping procedures.

Table 7: Site tests required by material group

Description	Visual Inspection	Holiday Detection	*Film thickness measurements	*Adhesion Check	Degree of cure
Light duty cold applied laminate tape	100%	100%	N/A	Sample	N/A
Heavy duty cold applied laminate tape	100%	100%	N/A	Sample	N/A
Grease and wax based tapes	100% before and after wrapping	Sample	N/A	N/A	N/A
Brushing Mastics	100%	100%	Sample	Sample	N/A
Shrinkable materials (sleeves, tapes, wraparound materials)	100%	100%	N/A	Sample	N/A
Fusion bonded epoxy powders	100%	100%	Sample	Sample	N/A
Multi-component liquid coatings for dry surfaces	100%	100%	Sample	Sample	Manufacturer data sheet
Multi-component liquid coatings for wet surfaces	100%	100%	Sample	Sample	N/A
Hot applied polyolefins	100%	100%	Sample	Sample	N/A
*Contractor shall propose testing regime that is representative of the area to be coated; acceptance shall be at the Gas Transporters discretion.					

8.2 SCA2 – Fillers and Putties – (Product Group 5)

8.2.1 General

This SCA 2 applies to the application of fillers and moulding putties that provide a suitable surface profile for wrapping with tapes.

8.2.2 Safety

Before using any materials, reference should be made to Clause 4 - Safety, Health and Environment of this specification.

8.2.3 Materials

Only materials listed in the Coatings Register should be used.

The material should be compatible with and supplied by the same manufacturer as the tape to be used.

8.2.4 Valves, Flanges and Similar Components, Service Pipe and Fittings

Prepare the surface to be coated in accordance with Section 9.

Paint which is in sound condition should not be removed, unless specified.

After ensuring that the surface to be coated is dry, the primer should be applied, by brush or spray, as applicable. Adequate coverage shall be given to all surfaces, including screw threads, bolt heads, nuts, cavities and shoulders.

Proceed immediately to apply the material in small quantities by hand (using trowel or stiff putty knife) to the areas to be filled. The material should be well worked in and packed down to ensure there are no pockets or voids.

NOTE

The 'workability' of the material can be improved in cold weather by conditioning it at room temperature immediately prior to use.

The material should be used in sufficient quantities to produce smooth contours which are suited to subsequent tape application and which do not include any concave areas.

Carry out the wrapping procedures detailed in the SCA 1 as appropriate, taking care not to over-tension when wrapping to avoid excessive creep of the material.

8.3 SCA3 – Brushing Mastics – (Product Group 6)

8.3.1 General

This SCA 3 applies to the application of brushing mastics.

8.3.2 Safety

Before using any materials, reference should be made to Clause 4- Safety, Health and Environment of this specification.

8.3.3 Materials

Only approved materials should be used.

Brushing mastics can have a detrimental effect on some tape systems. Therefore, where a combination of mastics and tapes are used, it is important to ensure that the tape overlaps the mastic in all cases.

Brushing mastics have prolonged drying times that may delay backfilling operations.

8.3.4 Valves, Flanges and Similar Components

The surface to be coated shall be prepared in accordance with Section 9. The primer should be applied, by brush (where appropriate), overlapping on to the existing factory applied coating. Only the correct primer shall be used.

The primed surface shall be clean and dry and free from all traces of moisture before carrying out the coating or repair operations.

Following the manufacturer's instructions, as soon as the primer has dried, one coat of the specified mastic should be applied, laid on evenly by brush, to give the appropriate dry film

thickness specified by the manufacturer, overlapping on to the existing factory applied coating by a minimum of 75 mm.

After the minimum specified drying time, a second coat of the mastic should be applied to give the minimum dry film thickness specified by the manufacturer.

8.3.5 Exposed or Partially Exposed Pipe

Brushing mastics shall not be applied to exposed, or partly exposed pipework and are not suitable for above ground use.

8.3.6 Inspection

Inspection requirements should be in accordance with Clause 6.2, Table 7 and Section 10 of this specification.

8.4 SCA4 – Shrinkable Materials (Sleeves, Tapes, Wrap-Around Materials) – (Product Group 7)

8.4.1 General

This SCA 4 applies to the application of shrinkable materials that comprise of a plastic backing laminated to an adhesive layer which has a thermal memory to cause it to shrink when heated above a certain temperature. These materials are available as a sleeve or in the form that can be formed into a sleeve using mechanical clamps.

8.4.2 Safety

Before using any materials, reference should be made to Clause 4 – Health, Safety and Environment of this specification.

Care should be exercised, particularly during the heating process when blowtorches are used.

8.4.3 Materials

Only materials listed in the Coatings Register should be used.

The manufacturer of shrink material may recommend that a primer should not be used and that the sleeving be applied to a clean, dry surface. However, a suitable filler for pre-treatment of irregular contours can be used and is usually available from the manufacturer of the shrink material

8.4.4 Use of Shrink Materials on Welded Joints

8.4.4.1 Preparation

The surface shall be prepared in accordance with Clause 6.2 of this specification and Section 9, except that only grit blasting is acceptable.

Prior to butt-welding, where shrink sleeves are to be utilized, they should be threaded on to the pipe and left in position adjacent to the joint so that no temporary pipe supports, or permanent features attached to the pipe, should prevent the sleeve from being moved into position for shrinkage after welding. Wrap around materials and tapes are often easier to use.

Subject to site conditions and the type of packaging provided for shrink materials by the manufacturer, precautions shall be taken to protect the materials from the weather, mud and splashes, etc., whilst it is awaiting shrinkage.

The shrink material should be applied after cleaning in accordance with Application Instruction Section 8 and before any rust blooming or contamination of the cleaned surface occurs.

8.4.4.2 Application of Cold Shrink Materials

Shrink materials should be applied in accordance with the manufacturer's recommended instructions.

NOTE

Cold shrink materials will normally be supplied in wraparound or tape form.

The cold shrink process relies on a combination of the tension induced during manufacture and application. During application of cold shrink materials, care should be taken to apply adequate tension.

The cold shrink material shall overlap a minimum of 75 mm on to each end of the factory applied coating.

8.4.4.3 Application of heat shrink materials

Heat shrink materials shall be applied in accordance with the manufacturer's recommended instructions.

Where a sleeve is to be used it shall overlap onto the existing coating by a minimum 75mm overlap at each end onto the existing coating.

Where wraparound materials or tapes are used, they shall overlap a minimum of 75 mm on to each end of the factory applied coating.

Using a high output blowtorch, or other Gas Transporter approved methods of heating, shrinkage should be achieved in accordance with the manufacturer's instructions. Suitable precautions should be taken to prevent charring or deterioration of the shrink material or factory applied coating.

8.4.5 Use of Shrink Materials on Service Pipe and Fittings

The procedure for use of shrink materials on service pipe and fittings should generally be as detailed in Clause 8.4, and in accordance with the manufacturer's instructions.

Where specially prepared mouldings, having closed ends, are used for items such as service tees, particular care should be taken to avoid entrapment of air. The manufacturer's recommendations should be followed when such mouldings are used.

8.4.6 Inspection

Inspection requirements should be in accordance with Clause 6.2, Table 7 and Section 10 of this specification.

Adhesion or other destructive tests are not generally applicable unless undertaken at predetermined locations where additional repair sleeves have been placed in readiness.

8.5 SCA5 – Fusion Bonded Epoxy Powder – (Product Group 8)

8.5.1 General

This SCA 5 applies to the application of fusion bonded epoxy (FBE) powders applied under field conditions to welded joints.

The joint coating should meet the requirements of this specification and GIS/CW6 which requires a Procedure Qualification Trial, (PQT), to be carried out prior to commencement of the works.

8.5.2 Safety

Before using any materials, reference should be made to Clause 4 – Health, Safety and Environment of this specification.

8.5.3 Materials

Only materials listed in the *Coatings Register* should be used.

8.5.4 Surface Preparation

Surface preparation shall be carried out by grit blasting in accordance with the requirements of Section 9. Contamination shall be removed from the pipe within a 500 mm wide band centred over the weld.

8.5.5 Heating

A warning notice shall be displayed when an induction heater is in operation and where there is hot pipe.

As soon as possible after blast cleaning operations have finished, the area to be coated shall be blown clean of any deleterious matter using clean, dry, oil free compressed air. Any impacted grit shall be removed using a clean, stiff bristle brush.

Before any rust blooming of the prepared metal surface occurs, the area to be coated shall be heated to a temperature established during the Procedure Qualification Trial (PQT).

The area to be coated should be heated using induction heating equipment qualified during the procedure trials. The operating parameters for the equipment should be approved by the Engineer. (The induction heater and the FBE powder applicator may be incorporated into a single unit).

The maximum temperature to which the metal is to be heated shall NOT exceed 300^{o}C.

Caution should be taken when heating pipe grades over X80; maximum heating temperature for these grades shall be provided by the pipe manufacturer before any heating operations

Metal surface temperatures should be checked using approved temperature measuring crayons which melt at the required temperature, or other techniques which should be proposed by the Contractor as variants for consideration by the Gas Transporter.

As soon as the required application temperature of the metal has been reached, the heater should be removed from the welded joint area and the FBE powder application equipment placed in position. FBE powder application should commence as soon as the temperature of the metal, measured at the 12 o'clock and 6 o'clock positions on the pipe, comes within the permissible range for spraying the FBE powder.

During conditions of low ambient temperature and/or high winds, it may be necessary to increase the heating temperature to provide adequate curing energy, or to provide protection against the prevailing conditions.

8.5.6 Powder Application

Using a spray technique, the FBE powder shall be applied to the weld and the uncoated area on either side. To minimize differential curing of the FBE powder, the required total thickness should be applied by the machine in as few passes as is reasonably practicable.

For mainline production welds, the spray equipment should be semi-automatic. A manual spray system should be used for the application of FBE powder to weld areas at specific locations with the agreement of the Engineer.

In both clauses above, the number of passes shall be as used in the procedure’s qualification trial.

The coating shall overlap the existing coating by a minimum of 25 mm and be of a minimum thickness of 400µm over the entire blast cleaned area.

The FBE powder level in the spray container should be monitored to ensure that a sufficient quantity is available to complete an application process. Reclaimed FBE powder should be used provided that it is free from contamination and thoroughly mixed with virgin FBE powder at a dilution rate not greater than 25% before adding to the hopper. High concentrations of reclaimed FBE powder will be cause for rejection of the hopper contents.

After cooling, thickness checks should be carried out on either side of the weld joint coating in accordance with Section 10.

Care should be taken to prevent the spray head, braces or hoses, etc., from dragging on the ground during application operations.

Deleterious material shall not be allowed to contaminate the area being coated during the application and curing stages.

The FBE powder container, hoses and all other equipment on the application unit shall be cleaned out after each day's work.

FBE powder shall be kept dry at all times and not in direct sunlight. FBE powder shall not be stored overnight in the apparatus. When not in use, all FBE powder systems shall be stored in accordance with the manufacturer's recommendations to prevent damage and deterioration. The properties of the FBE powder shall be maintained in compliance with GIS/CW6.

Care shall be exercised when FBE powder is used close to any source of ignition.

Adequate safety equipment shall be worn by all operators to prevent inhalation of the FBE powder dust and its contact with the eyes and skin.

When the coated area has cooled to ambient temperature, a holiday check should be carried out in accordance with the methods in Section 9. All holidays shall be repaired.

8.5.7 Curing Check

The coating shall be cured in accordance with the criteria for the particular FBE powder being used (see Section 9).

The method of testing shall be as detailed in GIS/CW6. For each coating machine, the degree of cure shall be checked in accordance with Section 10.

8.5.8 Adhesion Check

The coating shall have adequate adhesion to the pipe.

The method of testing for adhesion shall be as detailed in Section 10 or by methods that should be proposed by the Contractor as variants for consideration by the Gas Transporter.

For each coating machine, the adhesion of the coating shall be checked on the first ten joints to be coated, and provided these are acceptable, subsequently at the rate of one per twenty joints coated, or daily, whichever is the more frequent.

8.5.9 Inspection

Inspection requirements should be in accordance with Clause 6.2, Table 7 and Section 10 of this specification

Any joint coating which fails the criteria for either minimum thickness, cure or adhesion shall be stripped and recoated.

Should any joint fail, cure and adhesion tests shall be undertaken on the next ten production joints.

The Engineer reserves the right to test all joints back to the most recent acceptable joint tests.

8.5.10 Repair of Defects

All defects shall be repaired in accordance with Section 10.

8.5.11 Approval of field joint fusion bonded epoxy powder coating equipment and applicators

8.5.11.1 Process Approval

All processes/equipment for applying field joint coating with FBE powder shall be approved by the Gas Transporter prior to applicator qualification trials.

8.5.11.2 Field joint fusion bonded epoxy powder applicators

General requirements - Written procedures and drawings shall be submitted prior to undertaking qualification trials, providing all details of the method of working and parameters to be used. These procedures shall have the acceptance of the Engineer before trials commence.

Test procedure - Ten welded joints shall be coated under the supervision of the Gas Transporter representatives under simulated or actual field conditions. All ten joints produced shall meet the requirements of this SCA.

Operator qualification - All operators who successfully carry out the heating and FBE powder applications should be deemed to be qualified to carry out production work on any contract, using the same process and equipment within 12 months of completing the trial. Subsequent operators shall be supervised by previously qualified operators in the ratio of four skilled/two unskilled.

8.6 SCA6 – Multi-Component Liquids, (MCL) – (Product Group 9)

8.6.1 General

This specific coating application details the use of multi-component liquids either by spray for large areas or by brush or trowel for localized dry surfaces, repairs, stripe coating of welds and contact points with pipe supports.

8.6.2 Safety

Before using any materials, reference should be made to Clause 4 - Safety, Health and Environment of this specification.

8.6.3 Materials

Only materials listed in the Coatings Register can be used.

8.6.4 Surface Preparation

Surface preparation should be carried out by grit blasting in accordance with the requirements of Section 9. At the discretion of the Gas Transporter, power tools that provide an anchor profile may be used for small areas.

The use of high-pressure water jetting may be considered provided that the original substrate surface profile can be exposed and proved.

Prior to surface preparation and application of the coating, masking should be carried out (e.g. weld bevels, control work, greasing nipples, identification plates) as indicated by the Gas Transporter representative.

8.6.5 Required Ambient Conditions -Temperature and Humidity

Coatings shall never be applied during rain, fog or mist or when there is free moisture on the prepared surface unless the coating product sheet recommends that the coating is compatible with inclement weather and damp surface conditions. By agreement of the Gas Transporter environmental controls should be considered, but these will add cost to the project. Weigh the added cost against the cost of extending the project due to poor weather conditions.

Coating operations shall be suspended when the metal temperature is less than 3 °C above the dew point. At the gas transporters discretion variants may be considered if the coating product data sheet evidences that alternates conditions are suitable.

The application of coating material should be suspended if, during application and subsequent recommended curing times, the relative humidity is liable to rise above the permissible level specified by the manufacturer of the coating material.

During adverse weather conditions, coating may still be carried out if the local environment is controlled to avoid the unacceptable conditions detailed above. This should be achieved, subject to

the satisfaction of the Engineer, by the erection of protective canopies and the use of heaters and de-humidifiers. Where freestanding water exists, a waterproof membrane should be laid between the work piece and the ground.

8.6.6 Pre-Mix Agitation

Each coating component should, where necessary, be stirred or agitated to a homogeneous state before any part of the component is withdrawn from its container.

8.6.7 Mixing for Use

The components (e.g. base and curing agent) of a liquid coating material are normally supplied separately packed. They should be mixed in accordance with the manufacturer's instructions.

If pre-heating of one or more of the coating material components is required prior to mixing and application, this shall be done using equipment acceptable to the Gas Transporter. The procedure should be monitored to ensure that no excessive heating occurs which might affect application or the integrity of the coating.

The quantity of material made up at one time should not exceed that which can be used within the pot life stated by the manufacturer or that necessary to ensure complete coverage of the area to be coated. It is important that only the correct mixing ratio is used.

Material cure time is dependent on ambient temperature. Should it be necessary to shorten the cure time, this should be proposed by the Contractor as a variant for consideration by the Gas Transporter and should be achieved by the application of heat to the prepared surface before coating commences, using a method previously approved by the Gas Transporter.

Thinners should not be used unless recommended by the manufacturer.

Tools and equipment should be cleaned using only those solvents recommended by the manufacturer.

8.6.8 Application

8.6.8.1 Application of Primers

A number of the systems specified require the use of a primer. Primers should be applied by brush or airless spray in accordance with the manufacturer's recommended application instructions. Particular attention should be paid to the following:

- Mixing of two pack primers.
- Recommended dry film thickness.
- Minimum and maximum overcoating times.
- Temperature and humidity considerations, particularly in the case of moisture cured urethane primers

8.6.8.2 Application of multi-component liquids

Coatings should always be applied in accordance with the manufacturer's recommendations.

In cold conditions, it may be required to maintain the materials temperature at approximately 20 °C to assist mixing.

Each layer of MCL coating should be applied in a direction at right angles to the preceding layer. The final surface should be free from irregularities and roughness.

The total finished coating thickness, when cured, should be a minimum of 1500 µm in accordance with GIS/CW6.

Each edge of the finished coating should overlap factory applied fusion bonded epoxy (FBE) powder/MCL coating by approximately 75 mm.

In the case of coal tar enamel coatings, the overlap should not be less than 150 mm.

Pipe should not be handled or backfilled until the coating is hard dry as recommended by the manufacturer.

Coating should be carried out using equipment as recommended by the manufacturer.

Solvent flushing of spray equipment used for rapid cure materials is normally employed to prevent coating material gelling in the gun when spray operations cease for significant periods of time.

Filters should be installed as part of the spray equipment to ensure that particles that would be detrimental to the coating application are not deposited on the surfaces being coated.

Each feed line conveying coating material to the spray gun should be equipped with a pressure gauge fitted with a pulsation damper to facilitate pressure readings. The location of this gauge should be downstream of all pressure drop devices and as near to the gun tip as is reasonably practicable.

All compressed air lines should be fitted with oil and water traps.

8.6.9 Testing

Testing should be carried out in accordance with Clause 6.2, Table 7 and Section 10 of this specification.

8.6.10 Additional Tests

8.6.10.1 General

Where mixing/curing problems are experienced, the tests detailed in clause 8.6.10 of this specification should be carried out at the discretion of the Engineer.

8.6.10.2 Heat Blister Test

Before a pipe is installed, a heat blister test should be carried out according to the requirements of GIS/CW6.

8.6.10.3 Nitrogen determination

The concentration of nitrogen present in a polyurethane coating is indicative of the ratio of polyol to isocyanate reacted to form the polymer. Coatings that contain nitrogen concentrations above or below a level considered by the Gas Transporter to represent correctly metered and mixed material should be rejected.

The Contractor should specify the method used to determine the nitrogen concentration and should quote the values obtained.

8.6.11 Repair of Defects

All defects should be repaired in accordance with Section 11.

8.6.12 Inspection

Inspection requirements should be in accordance with Clause 6.2, Table 7 and Section 10 of this specification.

Any joint or component coating which fails the criteria for either minimum thickness, cure or adhesion should be stripped and re-coated.

Should any joints or component coating fail, cure and adhesion tests should be undertaken on the next ten production joints.

The Engineer reserves the right to test all joints back to the most recent acceptable joint tests.

8.7 SCA7 – Multi-Component Liquid (MCL) Coatings for Damp Surfaces – (Product Group 10)

8.7.1 General

This SCA is intended for use by the Gas Transporter and if it is used where the Gas Transporter is not involved then care should be taken to ensure that it is correctly applied.

Compliance with this SCA does not confer immunity from compliance with any legal or statutory obligation.

8.7.2 Safety

Before using any materials, reference should be made to Clause 4 - Safety, Health and Environment of this specification.

8.7.3 Materials

Only the materials listed in The Coatings Register are covered by this Application Instruction.

Multi-component liquid (MCL) systems designed for damp surfaces are suitable where conditions prevent the surfaces from becoming dry. The use of only these materials listed in The Coatings Register should be permitted.

8.7.4 Surface Preparation

Surface preparation should be carried out by grit blasting in accordance with the requirements of Section 9.

Prior to blast cleaning and application of the coating, masking should be carried out (e.g. weld bevels, control work, greasing nipples, identification plates) as indicated by the Gas Transporter representative.

8.7.5 Pre-Mix Agitation

Each coating component should, when necessary, be stirred or agitated to a homogeneous state before any part of the component is withdrawn from its container.

8.7.6 Mixing for Use

The components (e.g. base and curing agent) of an MCL material are normally supplied separately packed. They should be mixed in accordance with the manufacturer's instructions.

In cold conditions, it may be required to maintain the materials temperature at approximately 20 °C to assist mixing.

Where the components are mixed in the supply tin, mixed MCL material should be transferred from the tin on to a mortar board or a second clean container and given a further short mix to ensure that no inactivated MCL material is present.

The quantity of MCL material made up at one time should not exceed that which can be used within the pot life stated by the manufacturer or that necessary to ensure complete coverage of the area to be coated. It is important that only the correct mixing ratio is used.

Thinners should not be used unless recommended by the manufacturer.

Tools and equipment should be cleaned using only those solvents recommended by the manufacturer.

8.7.7 Application

MCL coatings should always be applied in accordance with the manufacturer's instructions using short, stiff bristle brushes that displace moisture from pipe surfaces. Where large areas are to be coated, the specified thickness should be built up by the application of several complete layers within the pot life of the MCL material. Each layer should be allowed to set for the manufacturer's recommended period before the next layer is applied.

Each layer of MCL coating should be applied in a direction at right angles to the preceding layer. The final surface should be free from irregularities and roughness.

The total finished MCL coating thickness, when cured, should not be less than 1500µm in accordance with GIS/CW6 (or as otherwise specified by the Gas Transporter).

Each edge of the finished MCL coating should overlap factory applied fusion bonded epoxy (FBE) powder/MCL coating by a minimum of 75 mm. In the case of coal tar enamel, the overlap should not be less than 150 mm.

Pipe should not be handled or backfilled until the coating is hard dry (minimum period 24 h).

8.7.8 Inspection

Inspection requirements should be in accordance with Clause 6.2, Table 7 and Section 10 of this specification.

Any joint coating which fails the criteria for either minimum thickness, cure or adhesion should be stripped and recoated.

Should any joints fail, cure and adhesion tests should be undertaken on the next ten production joints.

The Engineer reserves the right to test all joints back to the most recent acceptable joint tests.

8.8 SCA8 – Hot-applied polyolefin-based coatings – (Product Group 11)

8.8.1 General

This SCA 8 applies to the application of hot-applied polyolefin-based coatings applied under field conditions to welded joints.

The joint coating should meet the requirements of this specification and GIS/CW6 which requires a Procedure Qualification Trial, (PQT), to be carried out prior to commencement of the works.

8.8.2 Safety

Before using any materials, reference should be made to Clause 4 – Health, Safety and Environment of this specification.

8.8.3 Materials

Only materials listed in the Coatings Register should be used.

8.8.4 Surface Preparation

Surface preparation shall be carried out by grit blasting in accordance with the requirements of Section 9. Contamination shall be removed from the pipe within a 500 mm wide band centred over the weld.

8.8.5 Heating

A warning notice shall be displayed when an induction heater is in operation and where there is hot pipe.

As soon as possible after blast cleaning operations have finished, the area to be coated shall be blown clean of any deleterious matter using clean, dry, oil free compressed air. Any impacted grit shall be removed using a clean, stiff bristle brush.

Before any rust blooming of the prepared metal surface occurs, the area to be coated shall be heated to a temperature established during the Procedure Qualification Trial (PQT).

The area to be coated should be heated using induction heating equipment qualified during the procedure trials. The operating parameters for the equipment should be approved by the Engineer. (The induction heater and the FBE powder applicator may be incorporated into a single unit).

The maximum temperature to which the metal is to be heated shall NOT exceed 300^{o}C.

Caution should be taken when heating pipe grades over X80, maximum heating temperature for these grades shall be provided by the pipe manufacturer

Metal surface temperatures should be checked using approved temperature measuring crayons which melt at the required temperature, or other techniques which should be proposed by the Contractor as variants for consideration by the Gas Transporter.

As soon as the required application temperature of the metal has been reached, the heater should be removed from the welded joint area and the FBE powder application equipment placed in position. FBE powder application should commence as soon as the temperature of the metal, measured at the 12 o'clock and 6 o'clock positions on the pipe, comes within the permissible range for spraying the FBE powder.

During conditions of low ambient temperature and/or high winds, it may be necessary to increase the heating temperature to provide adequate curing energy, or to provide protection against the prevailing conditions.

8.8.6 Powder Application

Using a spray technique, the powder shall be applied to the weld and the uncoated area on either side. To minimize differential curing of the FBE powder, the required total thickness should be applied by the machine in as few passes as is reasonably practicable.

For mainline production welds, the spray equipment should be semi-automatic. A manual spray system should be used for the application of FBE powder to weld areas at specific locations with the agreement of the Engineer.

In both clauses above, the number of passes shall be as used in the procedure’s qualification trial.

If the polypropylene or polyethylene is to be applied as a powder directly after or with the epoxy in one continuous process, the chemically modified PP or PE shall not overlap the plant-applied/in-situ coating. In all other cases the epoxy coating shall overlap the existing coating by a minimum of 25 mm and be of a minimum thickness of 200µm over the entire blast cleaned area.

The middle layer of chemically modified polyolefin shall be applied within the epoxy gel time. The polyolefin topcoat shall overlap the field applied coating by not less than 50mm, this area should be heated to the specified application temperature prior to application.

The polyolefin top coat can be applied in the following ways:

1. Flame sprayed
2. Pre heated tape or sheet applied in a wraparound method by means of an automatic machine
3. Injection of molten polypropylene

In methods 2 & 3 a heating system shall be used to ensure adhesion between layers of coating. Overlap and temperatures shall be specified in the APS.

The FBE powder level in the spray container should be monitored to ensure that a sufficient quantity is available to complete an application process. Reclaimed FBE powder should be used provided that it is free from contamination and thoroughly mixed with virgin FBE powder at a dilution rate not greater than 25% before adding to the hopper. High concentrations of reclaimed FBE powder will be cause for rejection of the hopper contents.

After cooling, thickness checks should be carried out on either side of the weld joint coating in accordance with Section 10.

Care should be taken to prevent the spray head, braces or hoses, etc., from dragging on the ground during application operations.

Deleterious material shall not be allowed to contaminate the area being coated during the application and curing stages.

The FBE powder container, hoses and all other equipment on the application unit shall be cleaned out after each day's work.

FBE powder shall be kept dry at all times and not in direct sunlight. FBE powder shall not be stored overnight in the apparatus. When not in use, all FBE powder systems shall be stored in accordance with the manufacturer's recommendations to prevent damage and deterioration. The properties of the FBE powder shall be maintained in compliance with GIS/CW6.

Care shall be exercised when FBE powder is used close to any source of ignition.

Adequate safety equipment shall be worn by all operators to prevent inhalation of the FBE powder dust and its contact with the eyes and skin.

When the coated area has cooled to ambient temperature, a holiday check should be carried out in accordance with the methods in Section 10. All holidays shall be repaired.

8.8.7 Curing Check

The coating shall be cured in accordance with the criteria for the particular FBE powder being used (see Section 9).

The method of testing shall be as detailed in GIS/CW6. For each coating machine, the degree of cure and adhesion between layers shall be checked in accordance with GIS/CW6.

8.8.8 Adhesion Check

The coating shall have adequate adhesion to the pipe and between coating layers.

The method of testing for adhesion shall be as detailed in Section 10 or by methods that should be proposed by the Contractor as variants for consideration by the Gas Transporter.

For each coating machine, the adhesion of the coating shall be checked on the first ten joints to be coated, and provided these are acceptable, subsequently at the rate of one per twenty joints coated, or daily, whichever is the more frequent.

8.8.9 Inspection

Inspection requirements should be in accordance with Clause 6.2, Table 7 and Section 10 of this specification

Any joint coating which fails the criteria for either minimum thickness, cure or adhesion shall be stripped and recoated.

Should any joint fail, cure and adhesion tests shall be undertaken on the next ten production joints.

The Engineer reserves the right to test all joints back to the most recent acceptable joint tests.

8.8.10 Repair of Defects

All defects shall be repaired in accordance with Section 11.

9. Surface Preparation

9.1 General

This Section details the standard of surface preparation required prior to the application of specific field applied coatings.

9.2 Safety

Before using any materials, reference should be made to Clause 4 – Health, Safety and Environment of this specification.

9.3 Surface Preparation

All surface preparation and priming activities should be carried out when the surface being prepared is dry, except when moisture tolerant materials are to be applied. Sufficient ground clearance should be left to allow easy access to the bottom of the work piece when required.

Prior to surface preparation, all grease, oil, mud and other surface contaminants such as solar protection, temporary protectives and masking, should be removed from the surface to be coated. Oil, grease and temporary protectives should be removed by an agreed procedure. Any contaminated solvent should be wiped off with clean, dry, lint free cloth using fresh solvent in order to prevent a film or residue forming on the pipe. Solar protection and dirt should be removed from coal tar enamel coating by wire brushing (preferably by mechanical means).

The adhesion of the existing coating should be checked. All loose, jagged or defective material should be removed to provide an even, circumferential contour. The preferred method of removal for each coating type is given in Table 8. Remove any polyethylene (PE) coating puckered by heat from the welding process.

Where weld coating is being carried out, the factory coating to be overlapped should be bevelled or feathered as appropriate. Coal tar enamel should be bevelled for a distance of not less than 100 mm using a trowel or paint scraper and blowtorch. Care should be taken to avoid overheating the original coating. It is important to achieve a smooth bevel when tapes are to be used to overlap the coal tar enamel coating. Jagged or rough finishes left along the edges of fusion bonded epoxy (FBE) powder coatings should be feathered over a distance of 15 mm minimum by light grit blasting.

The overlap region of PE, multi-component liquid (MCL) and FBE powder coatings should be lightly abraded on the surface using a hand wire brush or suitable blast cleaning equipment respectively. The overlap region requiring abrasion should be 75 mm minimum in the case of PE and MCL and 30 mm minimum for FBE powder coatings.

The preparation of metal surfaces should be implemented by blast cleaning or by wire brushing (hand or power) to the minimum requirements given in Table 9.

Mechanical wire brushing is more effective than hand wire brushing, both of which are subject to limitations in the degree of preparation possible. Overzealous use of wire brushing, especially powered brushing, can result in a 'polished' finish that may impair adhesion of the subsequent primer/coating and should therefore be avoided. For hand /power tool usage a Bristle Blaster is preferred as abrasive wheel preparation has been shown to be less effective.

Mill scale cannot be removed by wire brushing, therefore blast cleaning is the most effective method of preparation. By use of the correct type/size of grit, mill scale can be effectively removed, the troughs of corrosion pits cleaned, and a key provided for the subsequent coating.

Mill scale is a surface oxide (blue / black appearance) produced during steel manufacture.

It is cathodic relative to bare steel; develops corrosion cells under a paint film and subsequent early dis-bondment.

Mill scale in small quantities is permitted on a Sa2½ blast standard, but not on Sa3.

Where a primer is to be used, due regard should be given to the size of the grit and the resultant cleaned profile.

Large grit will produce a coarse profile with rogue peaks that may protrude through the dry film thickness of the primer.

For all blast cleaning abrasives containing free silica shall not be used.

All grit and dust should be removed from the prepared surface and the vicinity of the coating operations using dry compressed air or a stiff bristle brush.

On completion of preparation, the time elapsing between cleaning by the appropriate method to the required standard and the application of primer (or coating) should be immediately, before rust blooming occurs.

After blast cleaning, the metal surface shall be inspected and all visible slivers and scabs detrimental to the coating process shall be removed by grinding carried out by a Certified P/11 Technician. After grinding, the remaining wall thickness should comply with the relevant pipe or fitting specification. The ground surface should be subject to further blast cleaning to reinstate the original profile.

During periods of adverse/inclement weather conditions (e.g. snow, rain, mist, fog, high winds), final cleaning and coating operations should only proceed if protective wraps, canopies or other protective methods, as necessary, are used to the agreement of the Engineer.

Water traps, oil traps and filters should be used on all blast cleaning apparatus.

Any blast cleaned surface contaminated with oil, water, etc., should be cleaned and re-blasted until the contaminants are removed, and the appropriate standard of surface preparation obtained. Blast cleaning operations should not be allowed to contaminate or interfere with the coating operation

Table 8: Preferred methods for the removal of anti-corrosion coatings

Type of coating	**Method of Removal**	
	Preferred	**1st Option**
Fusion Bonded Epoxy	Blast Cleaning	Heating and scraping followed by blast cleaning*
Multi-component liquid	Blast Cleaning	None*
Coal Tar Enamel	Copper headed hammer to a firm edge	None*
Polyethylene	Cut and peel outer sleeve, solvent clean and blast clean	None*
Wrapping Tape	Cut and remove to discretion of Engineer	None*

Alternative acceptable removal methods may be suggested by the contractor and confirmed as suitable by the coating manufacturer. These should be assessed by the Gas Transporter for environmental acceptability and ease of use. Alternative removal methods should be recorded alongside the acceptance/non-acceptance criteria.

Table 9: Minimum requirements for surface preparation

Field applied coating group		Minimum proposed preparation standard**	
Ref No.	**Description**	**ISO 8501-1**	**Profile**
1	Cold applied self-adhesive tapes	Overwrap only	Manufacturer data sheet
2	Light duty CALT	St 3/Sa 1	Manufacturer data sheet
3	Heavy Duty CALT	St 3/Sa 1	Manufacturer data sheet
4	Grease and wax based tapes	St 3	Manufacturer data sheet
5	Fillers	St 3/Sa 1	Manufacturer data sheet
6	Brushing Mastics	St 3/Sa 1	Manufacturer data sheet
7	Shrink Materials	St 3/Sa 1	Manufacturer data sheet
8	FBE Powders	Sa 2.5	50um to 100um
9	MCL for dry surfaces	Sa 2.5	75um to 100um
10	MCL for damp surfaces	Sa 2.5	75um to 100um*
11	Hot-applied polyolefins	Sa 2.5	50um to 100um
*This surface will flash rust due to continued presence of surface moisture. **Alternative surface preparations may be considered acceptable with prior qualification testing			

10. Site test methods and values for field applied coatings

10.1 General

Compliance with this Section does not confer immunity from compliance with any legal or statutory obligation.

10.2 Safety

Before using any materials, reference should be made to Clause 4 – Health, Safety and Environment of this specification.

10.3 Holiday Detection

Holiday detection should be carried out using equipment acceptable to the Gas Transporter on surfaces that are at ambient temperature and free from moisture and contamination.

The operating voltage required for each coating system type can be determined based on its total dry film thickness (DFT), test voltages should be determined based on the information given in Table 10 for each of the following coatings:

Table 10: Holiday detection voltage

Coating type	Approx. Mean DFT	Holiday detection voltage
FBE Powder Brushing Mastics	<500µm *	5 kV/mm Or 5V/µm (maximum 30kV)
PE Grease tape Wax tape Coal Tar Enamel Heavy & Light duty CALT Shrink Material MCLs	>500µm	
*A test voltage of 9V or 90V may be used for films with a mean dry film thickness of up to 300 µm by agreement between the interested parties only		

For paint systems with a mean DFT of less than 500µm, low voltage pinhole detectors shall normally be used.

The rate of travel of the probe over the surface should be between 100mm/s and 300 mm/s; the test should not be repeated on the same surface to avoid the risk of damage to the coating. For all coatings, the wire brush type of electrode shall be used.

All holidays, imperfections and damaged areas should be identified with a waterproof marker.

All markings should be sufficiently distant from the holiday imperfections or damaged area to allow surface preparation and repairs to take place without detriment to the adhesion of the coating.

All holiday detectors should be calibrated at the start of every work day and additionally when requested by the Gas Transporter.

Recently exposed pipe cannot be reliably holiday detected due to absorbed moisture in the coating. Visual inspection is therefore the only reliable defect location method until the coating has been allowed to dry

10.4 Film Thickness Measurement

Thin film coatings of Product Groups 6 to 10 inclusive should be checked for film thickness after curing/cooling. An approved standard film thickness gauge, correctly calibrated, should be used, taking measurements at six evenly spaced positions around each joint, or proportionally over the other coated areas

10.5 Adhesion Check

At the discretion of the Responsible Engineer, an adhesion test should be carried out on all applied coatings, especially those in Product Groups 2, 3 and 6 to 10 inclusive at an agreed frequency.

The test procedure should be in accordance with GIS/CW6.

10.6 Degree of Cure

For all materials in Product Group 8, the degree of cure of the coating should be checked on the first ten joints to be coated and, provided these are acceptable, subsequently at the rate of one per hundred joints coated, or daily at an agreed frequency.

The method of test should be in accordance with GIS/CW6 or an alternative method should be proposed by the Contractor as a variant for consideration by the Gas Transporter.

The acceptable range of ΔTg, (glass transition temperatures difference), values should be as declared by the manufacturer and will depend upon the material used.

Samples should be taken from the bare plate area of joint or repair at the 6 o'clock position.

11. Repairs Using Multi-Component Liquid Materials

11.1 General

Compliance with this Section does not confer immunity from compliance with any legal or statutory obligation. Reference should be made to GIS/CW5, Tables 3 to 8 inclusive for guidance on selection of materials.

11.2 Safety

Before using any materials, reference should be made to Clause 4 – Health, Safety and Environment of this specification.

11.3 Materials

Only materials listed in the Coatings Register are covered by this Application Instruction.

The application instructions detailed in Clauses 6 to 10 inclusive outline the recommended procedures for the repair of pinholes and larger coating damage on fusion bonded epoxy (FBE) powder, multi-component liquid (MCL) and coal tar enamel coatings.

11.4 Material Selection

The choice of MCL repair material should take account of the defect size, the quantity of MCL material required to carry out a repair and the delay to the Contractor (in a pipelining situation)'. Where practicable, rapid curing grades of MCL material should be used for repair of pinholes and small areas (up to 100 mm²) of damage. Areas of damage greater than 100 mm² should be repaired using standard grade MCL materials.

Where reasonably practicable, the MCL repair material should be of the same generic type as the coating being repaired.

11.5 Surface Preparation

11.5.1 General

All holidays, imperfections and damage to coatings shall receive surface preparation prior to the application of any repair material used.

11.5.2 Pinholes and small areas (up to 100 mm²) of damaged coating

The area of the pinholes and small areas (up to 100 mm²) of damage in MCL and FBE coatings, together with the adjacent coating, shall be thoroughly abraded using coarse grade emery paper (e.g. 100 grade) to remove corrosion products. All loose coating shall be removed. Wire brushes should be used as an alternative to emery paper. Damaged areas in coal tar enamel coatings should be prepared by wire brushing.

All dust and corrosion products should be removed using a clean, dry, lint free cloth.

The surface shall be dry before application of the repair material.

11.5.3 Large damaged areas (greater than 100 mm²)

All large damaged areas (greater than 100 mm²) of FBE, MCL and coal tar enamel coatings to be patch repaired shall be prepared by blast cleaning to remove loosely bonded coating. The area adjacent to the damage shall be lightly abraded for at least 10 mm from the perimeter of the exposed substrate for FBE and MCL and bevelled for coal tar enamel.

Where the metal substrate is visible, it should be cleaned to ISO 8501 Sa2½ quality in accordance with Section 9 – Surface Preparation.

Corrosion products and dust from the cleaning operation should be removed using clean, dry, oil free compressed air.

The pipe surface shall be maintained in a dry condition during application of the repair material.

11.6 Application of Repair Material

Only an approved two-pack MCL repair material shall be used for the repair of holidays and imperfections of most sizes. Components of the MCL repair material (e.g. base and curing agent) are supplied in separate containers (usually tubes or tins) and shall be thoroughly mixed in the proportions specified by the manufacturer. The components are usually supplied in different colours and evidence of complete mixing is indicated when a uniform colour is achieved without any 'streaking'. The use of two component sachets are allowed.

Where the components are mixed in the supply tin, mixed MCL repair material should be transferred to a mortar board or a second clean container and given a further short mix to ensure that no un-activated material is present.

In cold conditions it may be necessary to maintain the materials temperature at approximately 20°C to assist mixing.

Thinners shall not be used at any time unless recommended by the manufacturer.

Tools and equipment should be cleaned using only those solvents recommended by the manufacturer.

The pot life of the mixed components should be very short (e.g. 5 min), therefore the quantity of MCL repair material made up at one time should not exceed that which can be used within the pot life of the mixed compound or that necessary to ensure complete coverage of the area to be coated. MCL repair material which has exceeded the stated pot life shall not be used.

Two-pack MCL repair materials should be applied using a clean palette knife or trowel, or as directed by the manufacturer. The mixed compound should be applied to the prepared area to obtain a smooth patch of a thickness equal to the minimum thickness of the parent material.

In conditions of low ambient temperature, it should be advantageous to warm the area to be coated before the application of the MCL repair material. The application of heat shall only be undertaken with the prior approval of the Engineer.

All repair areas should be allowed to cure for the period recommended by the manufacturer of the MCL repair material before any further handling of the pipe is attempted.

11.7 Holiday Detection

After curing and prior to ditching, all repaired areas should be subjected to holiday detection in accordance with Section 8.

11.8 Inspection

Inspection requirements should be in accordance with Clause 6.2, Table 7 and Section 10.

Any joint coating which fails the criteria for either minimum thickness, cure or adhesion should be stripped and recoated.

Should any joint fail, cure and adhesion tests should be undertaken on the next ten production joints.

The Responsible Engineer reserves the right to test all joints back to the most recent acceptable joint tests.

Annex A – Health, Safety and Environment

Health & Safety

All work carried out on the Plant or Site shall comply with safe working practices and the specific conditions of a Permit to Work

Contractor shall ensure that all activities involved in the selection, application, inspection and testing of protective coating systems are managed to ensure personnel safety, minimal environmental impact and safe, operable facilities including but not limited to:

i. Implementation of safety measures for protecting workers in accordance with all local and national regulations including provision of appropriate personal protective equipment and training in its use, regular safety briefings/tool-box talks etc. Operations covered in this Specification are subject to the Health and Safety at Work etc. Act 1974 and other relevant legislations, such as European Union (EU) if applicable;

ii. Implementation of appropriate training schemes to ensure personnel have necessary competence to perform their allocated tasks;

iii. Development of method statements and risk assessments for potentially hazardous activities.

iv. Provision of MSDS for all materials;

v. All activities concerning substances shall have been subjected to an assessment under the Control of Substances Hazardous to Health (COSHH) Regulations 2002;

vi. Provision of adequate ventilation and extraction facilities in confined spaces to prevent the build-up of toxic or flammable atmospheres, dust etc;

vii. Provision of appropriate Personal Protective Equipment (PPE) including breathing and hearing protection.

viii. Provision of appropriate breathing and hearing protection;

ix. Provision of adequate access/scaffolding/working platforms in accordance with the Gas transporters procedure if relevant;

x. Provision of adequate access and secure, temporary formwork to ensure safe working environments below grade; in accordance with Gas transporters procedure if relevant;

xi. Provision of adequate safety systems to prevent electric shock and build-up of static electricity;

xii. Provision of appropriate safety systems for use of pressurised air, including test certificates, ‘dead-man’ handles, whip-checks;

xiii. Provision of appropriate fire-fighting equipment and personnel training in the use of equipment;

xiv. Provision of appropriate first aid facilities;

xv. Adherence to local hazardous/flammable area classification restrictions;

xvi. Adherence to appropriate permit-to-work system requirements, including adequate training of personnel in their use;

xvii. Provision of appropriate waste disposal and/or recycling systems to meet all local, national and international requirements.

Environment

Contractor shall ensure that manufacturing and application processes, and any associated materials and substances, do not constitute a toxic, microbiological or organoleptic hazard.

Any Hazard including toxic, corrosive risks and fire risks, associated with the coating materials offered for use to meet the requirements of this specification and associated with the method of application of the product shall be specified by the manufacturer, together with his recommendations for safe handling in accordance with the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR 2017) Appendix C of the Convention Covering International Carriage by Rail - International Carriage of Dangerous Goods by Rail. The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 and the general principles of classification and labelling for supply are explained by the European Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP) on classification, labelling and packaging of substances and mixtures. Seek further guidance from HSE where required.

Materials and substances shall not contain asbestos, heavy metals (such as lead or cadmium), PCBs, CFCs and Halon refrigerants, nor VOCs or isocyanates in excess of local, national and international legal limits.

Provision of appropriate waste disposal and/or recycling systems to meet all local, national and international requirements such as the Environmental Protection Act - EPA - (Duty of Care) 1991.

Contractor shall ensure that manufacturing and application processes, materials and substances do not constitute a toxic, microbiological or organoleptic hazard.

Guidance note: *Isocyanates are typically present during the manufacture and application of polyurethane coating systems – these are potential carcinogens and their use is discouraged however, Company recognises that isocyanate-free coating systems with relevant service experience are currently limited therefore strict adherence to applicable regulations and use of personal protective equipment when handling or applying polyurethane coating systems shall be observed.*

Regarding the use of chromate-based pre-treatments for fusion bonded epoxy coating, hexavalent chromium has now been prohibited in Europe under REACH. Their use is prohibited.

Annex B – Quality

The Contractor shall have an accredited Quality and Environmental Management System that complies with a National or International Standard applicable to their service or supply. The quality system shall be based upon recognised quality standards of which ISO 9001 is a suitable example.

Guidance note:

i. ISO/TS 29001 gives sector-specific guidance on quality management system;

ii. ISO 14001 gives guidance on the selection and use of an environment management system.

A quality assurance group shall have been established, which shall be responsible for reviewing the quality system and ensuring that it is implemented.

Training, experience and competency records for all operatives involved in coating operations shall be maintained and available upon request.

The following competencies are acceptable:

- ICorr Pipeline Coatings Inspector - Level 2;
- NACE Coating Inspector Program - Level 2 & 3;
- Frosio - Level 2 & 3;
- BGAS-CSWIP Site and or Paint Coating Inspector.

Application and test procedures, which comprise the quality system and the ITP shall be submitted to the Gas Transporter for agreement.

The Gas Transporter shall if required make any investigation necessary in order to be assured of compliance by the Contractor and third parties and to reject any material and/or coating that does not comply.

A quality plan and ITP for the activities necessary to satisfy the requirements of this Specification shall be prepared and issued to the Gas transporter for agreement before commencement of work.

The quality plan and ITP shall:

i. include any sub-contracted work and the subcontractor’s quality plans shall be submitted;

ii. be sufficiently detailed to indicate sequentially, and for each discipline, the requisite quality control, inspection, testing, and certification activities with reference to the associated procedures and the acceptance standards;

iii. with due notice, be subject to formal audits by the Gas Transporter. The application of quality control may be monitored by the Gas Transporter or nominated third-party inspectors, who will witness and accept on behalf of the Gas Transporter the inspection, testing, and associated work required by this Specification.

The provision of inspection services reporting directly to the Gas transporter shall in no way relieve the responsibility to verify that the full scope of work is performed entirely in accordance with this Specification and the agreed quality plan and ITP.

The contractor shall issue testing and inspection reports to the Gas Transporter in accordance with ISO 10474.

The contractor shall issue qualification test reports, certificates of compliance for the coating in accordance with the requirements of this Specification and cited parts of ISO 21809-9; and any other requirements specified in the purchase order.

Annex C - Example Site Coating Record

Coating Record																Page 1/1
Field Joint Coating Inspection Report (CW/5)																
Project							Date					Shift				
Customer							Coating System					Thickness				
Standard																
Pipe Grade							Coating Products					Batch No				
												Batch No				
Diameter	24”	Thermo-hygrometer		Roughness Gauge			Holiday Detector									
Thickness		Thermometer		Thickness Gauge			Salt contamination									
No	**Joint No**	**Joint width**	**Relative humidity**	**Dew Point**	**Pipe T**	**Roughness**	**Surface Finish**	**Salt Contamination**	**Pipe T**	**Coating Thickness**				**Holiday Detection (25kV)**	**Visual Inspection**	**Results**
										1	**2**	**3**	**4**			
1			Early in the Shift				Sa2.5	0								
2																
3			Middle of the Shift													
4														OK	OK	OK
Additional lines may be required dependent on number of joints																
	Impact and Adhesion Results						**Network Inspector**			**Contractor Inspector**						
Joint No	Impact Test	Adhesion test		Compressed Air Check	Result		Name			Name						
1	OK			OK	OK											
2							Date			Date						
3																
4																
Additional lines may be required dependent on number of joints																
Comments:																