Gas Industry Standard

GIS/PA9:2022

Specification for

Paint Systems

Properties and Performance Requirements

Cadent Your Gas Network

Gas Networks Ireland

Northern Gas Networks

nationalgrid

SGN Your gas. Our network.

WALES&WEST UTILITIES

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 issued as BG/PS/PA9	January 1991
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Editorial update to reflect demerger November 2000	June 2001
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1. Scope

This standard identifies the properties and specifies the minimum performance requirements for paint systems suitable for use in accordance with GIS/PA10. This is achieved through the definition of Function Performance Specification(s) (FPS) for each Specific Painting Application (SPA) identified in GIS/PA10. Where this is no obvious SPA provided by GIS/PA10, the Gas Transporter and Nominated Competent Person shall be contacted for clarification.

This standard provides a clear definition of the requirements for paint systems and a structured approach for paint system(s) qualification. This standard identifies the essential and a proportion of the desirable physical, chemical and performance parameters of a paint system that are to be considered in the qualification process of the paint system(s) selected using GIS/PA10.

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 Statutes and Regulations

ACT 1974 ch 37	*Health and Safety at Work etc. Act 1974*
NI Order 1978 No 1039 (NI 9)	Health and safety at Work (Northern Ireland) Order 1978
ACT 1990 ch.43	*Environmental Protection Act – 1990*
ACT 1991 ch.57	*Water Resources Act 1991*
SI 1991 No 2839	*The Environmental Protection (Duty of Care) Regulations 1991*
NI Order 1997 No 2778 (NI 19)	The Waste and Contaminated Land (Northern Ireland) Order 1997
NI Order 1999 No 662 (NI 6)	The Water (Northern Ireland Order 1999
SI 2002 No 2677	*Control of Substances Hazardous to Health (COSHH) Regulations 2002*
SI 2003 No 34	*Control of Substances Hazardous to Health Regulations (Northern Ireland) 2003*
SI 2012 1715	*The Volatile Organic Compounds in Paints, Varnishes and Vehicle Refinishing Products Regulations 2012.*
ACT 2013 asp 5	*Water Resources (Scotland) Act 2013*
SSI 2014 No 4	*The Environmental Protection (Duty of Care) (Scotland) Regulations 2014*
SI 2015 No 51	*The Construction (Design and Management) Regulations 2015*
SR 2016 No 146	*The Construction (Design and Management) Regulations (Northern Ireland) 2016*

2.2 British and European standards

ISO 1516	*Determination of flash/no flash -- Closed cup equilibrium method*
ISO 2409	*Paints and varnishes -- Cross-cut test*
ISO 2431	*Paints and varnishes -- Determination of flow time by use of flow cups*
ISO 2592	*Petroleum and related products -- Determination of flash and fire points -- Cleveland open cup method*
ISO 2808	*Paints and varnishes – Determination of film thickness*

ISO 2811 *Paints and varnishes -- Determination of density -- Part 1: Pycnometer method*

ISO 2813 *Paints and varnishes -- Determination of gloss value at 20 degrees, 60 degrees and 85 degrees*

ISO 3233-1 *Paints and varnishes -- Determination of the percentage volume of non-volatile matter -- Part 1: Method using a coated test panel to determine non-volatile matter and to determine dry film density by the Archimedes principle*

ISO 3233-2 *Paints and varnishes -- Determination of the percentage volume of non-volatile matter -- Part 2: Method using the determination of non-volatile-matter content in accordance with ISO 3251 and determination of dry film density on coated test panels by the Archimedes principle*

ISO 3233-3 *Paints and varnishes -- Determination of the percentage volume of non-volatile matter -- Part 3: Determination by calculation from the non-volatile-matter content determined in accordance with ISO 3251, the density of the coating material and the density of the solvent in the coating material*

ISO 3270 *Paints and varnishes and their raw materials -- Temperatures and humidities for conditioning and testing*

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

ISO 4628-2 *Paints and varnishes -- Evaluation of degradation of coatings -- Designation of quantity and size of defects, and of intensity of uniform changes in appearance -- Part 2: Assessment of degree of blistering*

ISO 4628-3 *Paints and varnishes -- Evaluation of degradation of coatings -- Designation of quantity and size of defects, and of intensity of uniform changes in appearance -- Part 3: Assessment of degree of rusting*

ISO 4628-4 *Paints and varnishes -- Evaluation of degradation of coatings -- Designation of quantity and size of defects, and of intensity of uniform changes in appearance -- Part 4: Assessment of degree of cracking*

ISO 4628-5 *Paints and varnishes -- Evaluation of degradation of coatings -- Designation of quantity and size of defects, and of intensity of uniform changes in appearance -- Part 5: Assessment of degree of flaking*

ISO 4628-6 Paints *and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 6: Assessment of degree of chalking by tape method*

ISO 6270-1 *Paints and varnishes -- Determination of resistance to humidity -- Part 1: Condensation (single-sided exposure)*

ISO 9001 *Quality management systems -- Requirements*

ISO 9117-1 *Paints and varnishes -- Drying tests -- Part 1: Determination of through-dry state and through-dry time*

ISO 9223 *Corrosion of metals and alloys — Corrosivity of atmospheres — Classification, determination and estimation*

ISO 9227 *Corrosion tests in artificial atmospheres -- Salt spray tests*

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 12944-2 *Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 2: Classification of environments*

ISO 12944-6 *Paints and varnishes -- Corrosion protection of steel structures by protective paint systems -- Part 6: Laboratory performance test methods*

ISO 16862 *Paints and varnishes -- Evaluation of sag resistance*

2.3 American Society for Testing and Materials

ASTM D2196 *Standard Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield type) Viscometer*

ASTM D6944 *Standard Practice for Determining the Resistance of Cured Coatings to Thermal Cycling*

ASTM D3960 *Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings*

ASTM D5125 *Standard Test Method for Viscosity of Paints and Related Materials by ISO Flow Cups*

2.4 Gas Industry Standards

GIS/PA10 *Specification for Maintenance Painting at Works and Site for Above Ground Pipeline and Plant Installations.*

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

2.5 Gas Transporter Specifications

GDN/PM/SCO/2 Permit to Work

NOTE

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

3. Terms and Definitions

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

3.1 Definitions

3.1.1 Essential Requirement

A minimum pre-requisite of a paint system which is dictated by the functional requirements of the SPA.

3.1.2 Desirable Requirement

A desirable parameter is where the parameter and the pertinent value or requirement is considered to be advantageous for the paint system to demonstrate.

3.1.3 Paint Coat

A single film applied as part of a paint component.

3.1.4 Painting Contractor

This is the company that applies the paint material to the components to be painted in accordance with the provisions of designated presiding literature e.g. manufacturer’s data sheet.

3.1.5 Paint Component

General term used to describe a singular part of the total paint system.

3.1.6 Paint Manufacturer

This is the original producer of the paint system.

3.2 Paint Supplier

This is the supplier of the paint system in a condition suitable for application to the product to be painted.

3.2.1 Paint System

The sum total of the coats of paint(s) or related product applied to the substrate material in a determined order. For example, primer, intermediate and topcoat.

3.2.2 Purchaser

This is the company that purchases the applied paint.

3.3 Abbreviations

SPA: Specific Paint Application

APS: Application Procedure Specification

FPS: Functional Paint Specification

TSA: Thermally Sprayed Aluminum

PQR: Paint Qualification Record

WFT: Wet Film Thickness

DFT: Nominal Dry Film Thickness

3.4 Environmental Requirements

The paint system shall comply with the Environmental Protection Act 1990.

All works carried out on the site including storage and disposal of paint and all waste materials shall be in accordance with the current environmental requirements (see Annex A, A.1 and A.3).

The Painting Contractor shall be alerted of the possible toxic nature of the deposits and paint debris, and the appropriate action and certification required for their disposal (see Annex A, Clause A.3.l).

4. Conformance

4.1 Units of measurement

In this standard, for data expressed in both SI and USC units, a dot (on the line) is used as the decimal separator, and no comma or space is used as the thousand's separator, in order to be consistent with other Gas Transporter specifications.

5. Qualification

5.1 General Requirements

All paints shall be qualified in accordance with GIS/PA9 before use on the Gas Transporter's assets. The intention of this document is to qualify paints to a series of functional parameters collated into a Functional Performance Specification (FPS).

Each FPS defines a number of functional parameters and respective qualification requirements which relate to a Specific Paint Application(s) (SPA) (GIS/PA10). Each functional parameter is defined as either essential or desirable.

Paint systems qualified to the chosen FPS may only be used when the related SPA is selected through the guidance given in GIS/PA10.

Paint systems which do not have a valid Paint Qualification Record (PQR) shall be qualified in accordance with the requirements of this standard. Figure 1 shows the paint qualification route and further detail is provided in the sections below.

5.2 Types of Functional Parameter

Each FPS detail individual paint parameters which are considered pertinent for the SPAs that link to them. All of the FPS are detailed within Annex E.

The individual parameters are defined by two types, essential and/or desirable:

- **Essential:** an essential parameter is a minimum pre-requisite of a paint system which is dictated by the functional requirements of the SPA. If an item indicated as essential is not met within the product information then the paint system shall not proceed further in the qualification process.
- **Desirable:** a desirable parameter is where the parameter and the pertinent value or requirement is considered to be advantageous for the paint system to demonstrate.

Desirable parameters can be looked at in closer detail in the closing stages of the paint system selection process; those paint systems that are the top performers in the desirable field within a tendered short list will be given greater consideration in the selection process.

5.3 Nominated Competent Persons

All qualifications (Section 5.4) will require the use of a Nominated Competent Person (NCP).

The NCP is an individual or service provider which the Gas Transporter considers competent to act on its behalf to witness and/or evaluate the qualification of a paint system.

The NCP (either individually or across the service provider's team) should have completed an appropriate entry level coatings qualification (e.g. ICorr or NACE Level 1, or BGAS Painting Inspector Grade 2), be an Incorporated Engineer in an appropriate mechanical or materials engineering discipline with 3 years general experience of coatings application and/or managing and supervising coatings application.

The Gas Transporter reserves the right to allocate or remove NCP status from an individual or service provider.

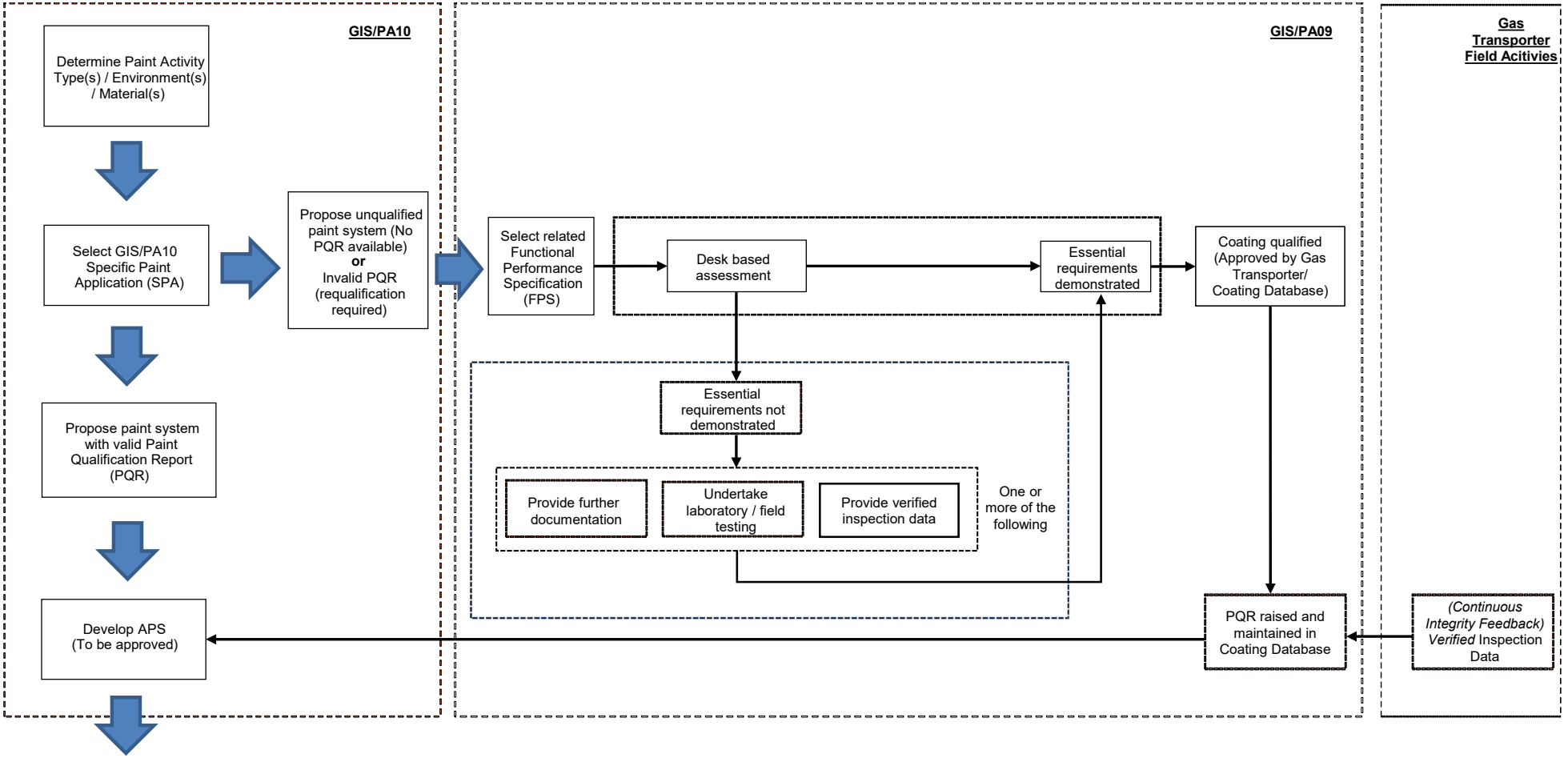

Figure 1: Qualification route for paint systems to be used in GIS/PA10

5.4 Qualification

Qualification of paint systems is based upon the following principles:

- Demonstration of detailed essential requirements through NCP desk based assessment of verified laboratory testing data, field trial results and/or inspection data.
- Where essential requirements cannot be demonstrated through NCP desk based assessment, provision of the necessary requirements through verified laboratory testing, field trials and/or inspection data.

All provided evidence must be underwritten through the following requirements:

- Provided laboratory and field trial data undertaken by one of the following:
    - Independent testing laboratory i.e. United Kingdom Accreditation Service (UKAS). Certification of accreditation shall be available on request.
    - Paint system manufacturer laboratory which has been subjected to audit and assessment by an NCP (Section 5.3) within a five year period.
- Inspection data provided from one of the following sources:
    - A Gas Transporter e.g. VS/02 inspection.
    - Gas Transporter approved inspection service provider

The qualification process shall be at the discretion of the Gas Transporter or NCP. The Gas Transporter or the NCP reserve the right to dismiss evidence it believes does not adequately meet the requirements. The Gas Transporter of NCP may request a full independent qualification even if the coating performance is demonstrated through manufacturers documentation / laboratory results.

Where the essential requirements are verified by the NCP or Gas Transporter, a PQR shall be issued.

5.5 Painting Qualification Record and Qualified Paints

A PQR shall be issued and made available for every qualified paint system.

A PQR template is provided in Annex C. An example of a PQR is shown in Annex D.

As part of coating/paint registry management the paint system shall be valid for use on the Gas Transporter's sites for five (5) years following qualification. After five (5) years the paint system should be reviewed to establish the ongoing acceptability of the paint system to the Gas Transporter's requirements. This may lead to requalification if determined by the Gas Transporter or NCP.

The paint system shall remain valid for the five (5) year period even in the event that this standard is updated within the paint systems validity period. However, the Network reserve the right to enforce requalification of a paint system following an update of this document if it is considered necessary e.g. there is a significant change within a referenced paint standard.

The PQR and qualified manufacturers data sheet shall be used to develop the Application Specification Procedure detailed in GIS/PA10.

The batch number(s) of the sample(s) shall be detailed on the PQR.

5.5.1 Integrity Feedback

Following qualification, it is important to continuously understand the performance of a qualified coating *e.g.* ease of application, service life. Through best endeavors, the use of a qualified coating should be recorded on PQRs (e.g. project/location) such that site coating documentation (e.g. APS) and future inspection data can be reviewed.

5.5.2 Requalification

No change in the paint formulation, materials source, or in the method of processing shall be made following the issue of a PQR. Any change to these parameters may necessitate requalification or further testing to demonstrate specific essential requirements.

If it is considered by the Gas Transporter that no requalification is required, a change note shall be added to the PQR and the PQR shall be re-issued.

As part of coating/paint registry management; the five (5) years qualification period does not reset if a PQR is re-issued following an action which does not require re-qualification e.g. accepted changed in formulation.

6. Technical and Commercial Requirements

6.1 Technical Requirements

The paint supplier, Painting Contractor or paint manufacturer shall comply with all legal requirements and, if requested by the Gas Transporter, shall disclose in confidence the composition of the paints supplied.

The manufacturer shall provide details on the properties listed below. The information shall be supplied for each component within the system qualified. Standards are provided for guidance only; other standards may be accepted following Gas Transporter review. All properties shall be detailed based upon values specific to standard conditions (ISO 3270).

- Non-volatile matter by volume (ISO 3233-1, ISO 3233-2, ISO 3233-3).
- Maximum Volatile Organic Compound (VOC) (ASTM D3960).
- Viscosity (ASTM D5125 / ISO 2431 / ASTM D2196).
- Density g/ml. (ISO 2811).
- Pigment dispersion (Standard to be based upon pigment type and referenced).
- Surface and through drying time (ISO 9117-1).
- Sag resistance (ISO 16862).
- Gloss (ISO 2813).
- Flash point (ISO 1516, ISO 2592).

6.2 Commercial Requirements

Paints shall not be dispatched until all quality control testing has been carried out and satisfactory results obtained. Paint which has exceeded its expiry date shall not be used and quarantined.

Paints shall be supplied in suitable containers which shall be permanently and legibly marked with the following information:

- Manufacturer's name.
- PQR Number.
- Name and description of product, including components (where applicable).
- The colour code (where specified by the Gas Transporter).
- Any special storage requirements.
- The date of issue and expiry date.
- Application grade (e.g. brush, spray).
- Batch identification code.
- Identification of parts and mixing ratio by volume for multi-pack materials only.
- Any markings required by current legislation.

Note: Certificates of Conformity (C of C) may be accepted in place of each container being individually marked with the PQR Number; however these shall be explicit and detail a repeat of the batch identification code(s) as displayed on each container, the date of dispatch, location of delivery and the number of containers. Two copies of the C of C are required, one to accompany the consignment and the other to the Gas Transporter’s address from where the order was placed.

6.3 Variants to the Standard

Where a Painting Contractor or Paint Supplier proposes to deviate from this standard it shall be subject to the deviation procedure following consultation with the Gas Transporter.

7. Testing Requirements

7.1 Testing Procedures

The paint system shall be applied in accordance with the Manufacturer's instructions.

The target dry film thickness (DFT) stated on the Manufacturers data sheet shall be achieved. For the purposes of this standard, the target range shall be considered the nominal DFT (nDFT).

No measured values shall be below the minimum DFT defined in the Manufacturers data sheet for each coat. As over thickness can be detrimental to coating performance the degree of acceptable over thickness shall be determined with the manufacturer and recorded within the PQR. The maximum thickness of each coat shall not exceed the criteria for DFT as defined in ISO 12944-6.

With the exception of mesophase (e.g. viscoelastic, waxy) material, the average DFT of individual coats shall be recorded within the PQR.

All wet film thickness (WFT) and DFT shall be measured in accordance with ISO 2808.

As a minimum, testing shall be carried out and assessed in accordance with the standards specified in with the FPS.

Where applicable, paint systems shall be tested on the appropriate substrate relevant to the FPS e.g. 316L Stainless Steel.

Paint systems are only qualified to the material substrates they have been tested on and qualified to.

7.2 Test Panels

As a minimum, painting qualification shall be undertaken on test panels. However, some FPS may require qualification testing on additional test pieces and these will be stated where applicable.

Test panels shall be fabricated in line with the requirements of ISO 12944-6 unless otherwise stipulated within the testing standard required by the functional parameter in the FPS.

Where required for age resistance testing a scribe line shall be made on the test panels. The scribe line shall be in accordance with ISO 12944-6. The scribe line shall disturb the paint such that the test plate material is visible. Effort shall be made to ensure the cut depth into the test plate material is kept to a minimum.

For ageing resistance testing, the scribe line shall always be set horizontally within the testing cabinet.

Unless otherwise agreed, a minimum of three test panels shall be prepared for each testing requirement within the FPS.

Surface preparation and application of the paint system to each test panel shall be in accordance with the manufacturer's data sheet. The requirements of all surface preparation and application techniques detailed in the FPS shall be qualified.

All test panels shall be photographed before and after testing. The photographs shall include a date, time, test type and signature of the independent tester and/or NCP (as indicated in any inspection and test plan (ITP)).

Unless otherwise stated within the FPS, test panels shall be kept in a controlled climate for a period of seven (7) days for curing before any testing. The controlled climate shall be in accordance with ISO 3270. If required, the scribe line shall be cut after this time.

Annex - A Safety

A.1 General

Personnel shall comply with all relevant regulations when cleaning, painting and disposal procedures are being carried out (see Statutes and Regulations, see Section 2.1.

Attention is drawn to the safety section of paint manufacturer's data sheets, to Personal Protective Equipment, COSHH, environmental and temporary works requirements.

A.2 Safety Precautions on Site

A.2.1 All site work is normally subject to a Permit to Work system, (see GDN/PM/SCO/2). The Painting Contractor shall comply with the requirements of this system at all times. No work will be allowed to take place until a Permit to Work or form of authority has been issued.

A representative shall be nominated by the Painting Contractor to act on his behalf; his duties shall include obtaining Permits to Work or Forms of Authority. This representative shall agree with the Site Engineer at the beginning of each day, or by alternative arrangement, the extent of the work to be undertaken and the precautions needed. Once agreed, this program should not be modified unless further permission is obtained. The Painting Contractor's nominated representative shall be responsible for ensuring that the Permit to Work or Form of Authority in force is always appropriate to the work being undertaken.

A.2.2 Delay in the provision of Permit to Work or Form of Authority will be avoided if prior warning is given to the Site Engineer.

A.2.3 The requirements of CDM shall be followed.

A.2.4 All pressurised equipment, associated nozzles, etc., and electrically or pneumatically operated power tool equipment shall be earthed. 'No Smoking' regulations shall be observed, and the Gas Transporter reserves the right to demand the removal from site of any person who disregards this instruction.

A.2.5 The Painting Contractor shall not operate any Gas Transporter’s valves or plant on site.

A.2.6 The Painting Contractor shall note that certain areas on the installation are deemed 'hazardous'. When working in such areas, the use of non-spark tools for cleaning purposes and flameproof equipment is required.

A.2.7 Where sheeting is used (e.g. for protection against accidental paint spillage), it is essential that the material be non-flammable. Tarpaulin sheets shall not be permitted on the site.

A.2.8 During the work, the site shall be kept in an orderly manner and no materials or plant shall be placed in any buildings or positions where they could present a hazard to persons passing by on their normal duties.

A.2.9 Only diesel engine vehicles are allowed on site subject to approval of the Site Engineer. Vehicles so admitted shall keep to the designated roadways.

A.2.10 If doubt exists regarding the demarcation of hazardous areas, working areas, or the requirement of any Form of Authority or Permit to Work, the Site Engineer shall provide an interpretation.

A.2.11 The Painting Contractor shall acquaint themselves with all installation safety and security restrictions.

A.2.12 In the event of an accident on site, the Painting Contractor shall notify the Site Engineer and details shall be entered in the installation's Accident Record Book. This does not relieve the Painting Contractor of his own responsibilities in respect to GIS/PA10

A.2.13 The method of work and the equipment used by the Painting Contractor may be inspected by the Gas Transporter, or their representative, at any time without prior notice. No inspection in any way relieves the Painting Contractor of any responsibility, under the Health and Safety at Work etc. Act 1974, or otherwise, in the method of work or use of equipment.

A.2.14 Aluminium based light metal equipment such as ladders and scaffolding shall not be used in potentially hazardous areas as these cause sparking when struck against a steel surface.

A.2.15 Until approval has been given by the Site Engineer, fixed access equipment should be left in position and any movable equipment required to enable works to be carried out (ladders, towers, etc.) should remain on site and be readily available for use.

A.3 Environmental Requirements

A.3.1 Environmental protection

A.3.1.1 All waste materials resulting from surface preparation and painting Operations covered in this standardt shall be properly disposed of in accordance with the requirements of the Environmental Protection Act - EPA - (Duty of Care) 1990.

A.3.1.2 When surface preparation and painting Operations covered in this standard are carried out in the vicinity of rivers, lakes or other water courses, special precautions may be necessary to prevent the possibility of pollution.

Care shall be taken to ensure Operations are carried out in accordance with the requirements of the Water Resources Act 1991.

A.4 Statutory Regulations

A.4.1 All 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).

A.4.2 Due regard shall be taken in respect of the legislation regarding the use and care of protective clothing and other safety aids.

A.4.3 It is an obligation that the Gas Transporter shall ensure that all personnel involved in the activities covered in this specification, be made fully aware of the relevant safety aspects, including the dangers of toxic materials.

A.4.4 All activities concerning these substances shall have been subjected to an assessment under the Control of Substances Hazardous to Health (COSHH) Regulations 2002.

Annex - B SPA / FPS lookup

Table 1: Summary of SPA defined in GIS/PA10

SPA	Activity Type	Description	Material	Environment	Temp Range	FPS
SPA-1	General	General Painting (Ferrous Material)	Metallic (Ferrous)	All (up to C4)	-15°C to 100°C	FPS 1
SPA-2	Patch	Patch Painting (Ferrous Material)	Metallic (Ferrous)	All (up to C4)	-15°C to 120°C	FPS 2
SPA-3	General and Patch	Indoor Painting	Metallic (Ferrous)	Indoor (C1 only)	-15°C to 120°C	FPS 3
SPA-4	General and Patch	Non-Ferrous Painting	Metallic (Non-Ferrous)	All (up to C4)	-15°C to 120°C	FPS 4
SPA-5	General and Patch	Non-Metallic	Non-metallic	All (up to C4)	-15°C to 120°C	FPS 4
SPA-6	General and Patch	High Temperature (100°C to 340°C)	Metallic (Ferrous)	All (up to C4)	120 °C to 340°C	FPS 5
SPA-7	General and Patch	High Temperature (340°C to 500°C)	Metallic (Ferrous)	All (up to C4)	340°C to 500°C	FPS 6
SPA-8	Temporary	Temporary Paint	Metallic (Ferrous)	All (up to C4)	-15°C to 120°C	FPS 7
SPA-9	Flange	Outer Flange Joint (and Bolting)	Metallic (All)	All (up to C4)	-15°C to 120°C	FPS 8
SPA-10	General and Patch	Galvanized Surface	Metallic (Galvanised)	All (up to C4)	-15°C to 120°C	FPS 4
SPA-11	General and Patch	Condensing / Wet Surface	Metallic (Ferrous)	All (up to C4)	-15°C to 120°C	FPS 9
SPA-12*	General and Patch	Risers	GIS/CW5	GIS/CW5	GIS/CW5	N/A

*SPA-12 qualified through GIS/CW5

Annex - C Paint Qualification Report Template

PQR Number		Issue No.	

Paint System Name		Function Performance Specifications Qualified	
Manufacturer			

Type	Manufactures Data Sheet	Qualified values (if applicable) (Highlight if different from Data sheet)	Reference	Accept
Surface Preparation Method(s)				
Surface Cleanliness (Primer)				
Surface Profile				
Application Methods				
Notes				

Coat	Description	Data Sheet WFT	Data Sheet DFT	Average Applied & Qualified WFT	Average Applied & Qualified DFT	Accept?
1st Coat						
2nd Coat						
3rd Coat						
4th Coat						
5th Coat						
Notes (Highlight important changes)						

Parameter	Essential Requirement (Applicable / Met)	Brief Details of requirements met	Accept based upon essential requirement? (Yes/No)	Ref.
Gen. Manuf. Info.				
Colour				
Finish				
Substrate				
Components				
Pigments				
Volume Solids				
Dry Film Thickness				
No. of coats				
Pot Life				
Drying/Cure Time				
Mixing Ratio				
Thinner				
Shelf Life				
Water Resistance				
UV Resistance				
Chemical Resist.				
Adhesion				
Abrasion				
Mechanical Flex.				
Thermal Stability				
Weather resistance				
Micro. Resistance				
Age Resistance				
Removability				
Min. Surface Clean./ Min. Surface Prep				
Application Method				
Application Condit.				

*** NR = No requirement**

Desirable Parameters Information

Additional Notes (e.g. specific application notes, thinning required, changes to PQR)

Sample Batch numbers	

References

ALL REFERENCES SHALL BE ATTACHED TO THIS PQR BEFORE SIGNING

Independent Body (Signature) **Name:**		**Date**	
Gas Transporter Acceptance (Signature) **Name**		**Date**	

PQR Valid to	

Field Use Record / Inspection Records

Annex - D Paint Qualification Report Example

PQR Number	2019-1	Issue No.	1

Paint System Name	Anti-corrosion coating 123	Function Performance Specifications Qualified	FPS-1
Manufacturer	Manufacturer A		

Type	Manufactures Data Sheet	Qualified values (if applicable) (Highlight if different from Data sheet)	Reference	Accept
Surface Preparation Method(s)	Abrasive Blast, Hand Tool prep	**Abrasive Blast only**	Report No. 111-333-555-666	Yes
Surface Cleanliness (Primer)	ISO 8501-1 SA 2.5	ISO 8501-1 SA2.5	Report No. 111-333-555-666	Yes
Surface Profile	50-75um	**50-100 um**	Report No. 111-333-555-666	Yes
Application Methods	Spray, Brush	**Spray only**	Report No. 111-333-555-666	Yes
Notes				

Coat	Description	Data Sheet WFT	Data Sheet DFT	Average Applied & Qualified WFT	Average Applied & Qualified DFT	Accept?
1st Coat	Coating A	300	200	300	200	
2nd Coat	Coating A	300	200	300	200	
3rd Coat						
4th Coat						
5th Coat						
Notes (Highlight important changes)						
• Application showed no issues.						

Parameter	Essential Requirement (Applicable / Met)	Brief Details of requirements met	Accept based upon essential requirement? (Yes/No)	Ref.
Gen. Manuf. Info.	Yes		Yes	Report No. 111-333-555-666
Colour	Yes		Yes	E-mail correspondence
Finish	Yes		Yes	Report No. 111-222-345-111
Substrate	Yes		Yes	Manufacturer Data sheet, Report No. 111-222-345-111
Components	No		N/A	-
Pigments	No		N/A	-
Volume Solids	No		N/A	-
Dry Film Thickness	Yes		Yes (See Notes)	
No. of coats	No		N/A	
Pot Life	Yes		Yes	Manufacturer Data sheet Report No. 111-222-345-111
Drying/Cure Time	No		-	-
Mixing Ratio	No		-	-
Thinner	Yes		Yes	Manufacturer Data sheet
Shelf Life	No		-	-
Water Resistance	No		-	-
UV Resistance	No		-	-
Chemical Resist.	No		-	-
Adhesion	Yes		Yes	Report No. 111-253-345-111
Abrasion	No		-	-
Mechanical Flex.	Yes		Yes	Report No. 111-253-345-111
Thermal Stability	Yes		Yes	Report No. 229-8-345-111
Weather resistance	No		-	-
Micro. Resistance	No	-	-	
Age Resistance	Yes	Yes		Report No. 36-99-45-100
Removability	No	-		-

Parameter	Essential Requirement (Applicable / Met)	Brief Details of requirements met	Accept based upon essential requirement? (Yes/No)	Ref.
Min. Surface Clean./ Min. Surface Prep	Yes	Yes		Manufacturer Data sheet Report No. 36-99-45-100
Application Method	Yes	Yes		Manufacturer Data sheet Report No. 36-99-45-100
Application Condit.	Yes	Yes		Manufacturer Data sheet Report No. 36-99-45-100
	Yes	Yes		Report No. 36-99-45-100

*** NR = No requirement**

Desirable Parameters Information
> 5MPa average adhesion average following ageing resistance testing (Reference. Report No. 36-99-45-100)

Additional Notes (e.g. specific application notes, thinning required, changes to PQR)
Note, only abrasive blast and spray application demonstrated, PQR only valid for these surface preparation/ application methods. Any APS should be using this PQR should reflect this.

Sample Batch numbers	

References

ALL REFERENCES SHALL BE ATTACHED TO THIS PQR BEFORE SIGNING

Independent Body (Signature) **Name:**	AB	**Date**	
Gas Transporter Acceptance (Signature) **Name**	BC	**Date**	20/05/2021

PQR Valid to	20/05/2026

Field Use Record / Inspection Records

Annex - E Functional Paint Specifications (FPS)

E.1 FPS 1 (General, Ferrous Materials)

Type of Paint Parameter (FPS 1)	Essential Requirement	Desirable Requirement
General Manufacturer Information	The general paint requirements set out in Section 6 shall be provided. The manufacturer's origin and contact details shall be available, including equivalent information on the manufacturing facilities of the paint system being screened for selection. The paint system manufacturer shall be ISO 9001 accredited or equivalent. The manufacturer shall have a technical product support department.	Local manufacturing and availability of any paint system is desirable over those available through overseas suppliers and/or manufacturers It is desirable that the manufacturer have a proven reputation within the paint systems industry and production history. This may not be the case for new companies with new paint system technologies. In their consideration engineering judgment will need to be applied and the risk/benefits ratio considered.
Colour	Primers, progressive build and topcoats coats shall be of contrasting colours.	
Finish	The paint system shall cure or set rigid if applied in the liquid form, it should not remain viscous or tacky.	
Substrate	The paint system shall be suitable for application to ferrous materials.	It is desirable if the paint system can be applied to other non-ferrous metals and meets the requirements for FPS 4
Components	There are no special requirements with respect to components on the condition that the performance requirements of the FPS are met.	
Pigments	There are no special requirements with respect to pigments, fillers and additives on the condition that the performance requirements of the FPS are met.	
Volume Solids	There are no special requirements with respect to volume solids on the condition that the performance requirements of the FPS are met.	
Dry Thickness	There are no special requirements with respect to dry film thickness on the condition that the performance requirements of the FPS are met.	
No. of coats		It is desirable that the paint system consists of as few coats as possible. It should be highlighted on the PQR if the paint system can be applied in < 2 coats.
Pot Life		As a minimum requirement, the paint system shall have a pot life of ≥ 8 hrs.
Drying Time / Curing	There are no special requirements with respect to drying time / curing on the condition that the performance requirements of the FPS are met.	
Mixing / Mixing Ratio	There are no special requirements with respect to mixing ratio on the condition that the performance requirements of the FPS are met. If mixing is required the specific details shall be documented.	

Type of Paint Parameter (FPS 1)	Essential Requirement	Desirable Requirement
Thinner	If thinning is required, this should be clearly stated together with the information identifying the type and the amount (thinner/paint system ratio) of thinner. All requirements for thinning shall be in strict accordance with The Volatile Organic Compounds in Paints, Varnishes and Vehicle Refinishing Products Regulations.	It is desirable that no thinning is required.
Shelf Life	There is no requirement with regards to the paint system shelf life. If the paint system components have a very short shelf life then the availability should be crosschecked.	
Water Resistance		It is desirable that the paint system has undergone immersion testing (ISO 12944 Im1, Im2 and Im3). If applicable, evidence should be provided.
UV Resistance		The paint system will likely be exposed to normal exposure levels of UV. It is desirable that paint system demonstrates an ability to resist UV degradation.
Chemical Resistance	There are no special requirements with respect to chemical resistance on the condition that the performance requirements of the FPS are met.	

Adhesion	The adhesion testing requirements according to ISO 12944-6 Table 3 shall be demonstrated:
	• ISO 4624, Method A or B Pull-off, Minimum pull-off value of 2.5 MPA for each measurement.
	  ○ 0% adhesive failure between steel / metalised steel respectively and the first coat (unless pull-off values are at least 5 MPA).
	  ○ Force built up is controlled and linear as described in ISO 4624 e.g. use of automatic hydraulic test equipment.
	  ○ Minimum of 3 dollies per panel.
	• For a DFT ≤ 250 µm (measured value without correction, calibrated on smooth surface) ISO 2409 Cross-cut test meeting a required classification from 0 to 2
		At a DFT > 250µm, an ISO 2409 cross cut classification 0 is desirable both before and after age resistance testing.
		
		A minimum pull-off value of 5 MPa is desirable with 0% adhesive failure between steel/metalised steel respectively and the first coat. Where this occurs the values shall be recorded to allow comparison with other systems.

Abrasion		It is desirable that resistance to abrasion (e.g. Taber) is demonstrated. If applicable, evidence should be provided.
Mechanical Flexibility	The paint shall be demonstrated through literature to have sufficient flexibility that no paint system defects are likely post-cure due to changes in geometry.	

Type of Paint Parameter (FPS 1)	Essential Requirement	Desirable Requirement
Thermal Stability	The paint shall be demonstrated to be suitable for an operating temperature of between -5°C to 100°C.	The paint shall be demonstrated to be meet the thermal testing procedure set out in ASTM D6944, Test Method 2. The test temperature shall be between -5 °C to 100 °C The assessment of the test panels shall be in accordance with requirements stated within adhesion section of this table.
Weather resistance	There are no special requirements with respect to weather resistance on the condition that the performance requirements of the FPS are met.	
Microbiological Resistance	There are no special requirements with respect to microbiological resistance on the condition that the performance requirements of the FPS are met.	
Age Resistance	The selected paint system shall be qualified in accordance to corrosivity category C4 (very high) in accordance with ISO 12944-6 Table 1, Test Regime 2. Due to the requirements for UV testing, paint system qualified to solely Test Regime 1 shall not be considered (see desirable requirements). The paint system shall meet the requirements of ISO 12944-6, Section 6.3: • ISO 4628-2 (Blistering) requirement 0 (S0) (immediately following ageing) • ISO 4628-3 Rusting requirement Ri0 (immediately following ageing) • ISO 4628-2 (Cracking) requirement 0 (S0) (immediately following ageing) • ISO 4628-2 (Flaking) requirement 0 (S0) (immediately following ageing) • Corrosion at scribe after cyclic ageing test. Maximum 3.0 mm corrosion at scribe as average value. Assessment to be carried out within 8h after end of test • ISO 4624, Method A or B Pull-off, Minimum pull-off value of 2.5 MPA for each measurement. o 0% adhesive failure between steel / metalised steel respectively and the first coat (unless pull-off values are at least 5 MPA). o Force built up is controlled and linear as described in ISO 4624 e.g. use of automatic hydraulic test equipment. o Minimum of 3 dollies per panel. Note, For a DFT ≤ 250 µm (measured value without correction, calibrated on smooth surface) ISO 2409 Cross-cut test meeting a required classification from 0 to 2. Other recognised standards (e.g. NORSOK) may be considered on the basis the testing undertaken is equal to or more severe than the environment being test (e.g. NORSOK System 1 – Offshore). Environmental testing without artificial UV shall not be accepted.	It is desirable that the requirements of a C5M category are met. It is desirable that the corrosion at the scribe line does not exceed 1.5 mm average after cyclic testing It is desirable that the paint system can the meet the assessment requirements following both ISO 12944-6 Test Regime 1 and Test regime 2. It is desirable that the paint system is tested concurrently with a reference system. The reference system shall be a paint system which is judged to have shown good performance over a minimum of five years by the Network.

Type of Paint Parameter (FPS 1)	Essential Requirement	Desirable Requirement
Removability	There are no requirements with regards to removability.	
Minimum Surface Preparation / Cleanliness	It is essential that the minimum surface preparation requirements do not exceed ISO 8501-1 SA 2.5.	
Application Methods	The primary application method for the paint system shall be spraying. Brush application is also required to for small repairs and stripe paint system at the time of application.	
Application Conditions	It is essential that the paint system can be applied under ambient environmental conditions defined in GIS/PA10 Section 13.4.	

E.2 FPS 2 (Patch Painting, Ferrous Materials)

Type of Paint Parameter (FPS 2)	Essential Requirement	Desirable Requirement
General Manufacturer Information	The general paint requirements set out in Section 6 shall be provided. The manufacturer's origin and contact details shall be available, including equivalent information on the manufacturing facilities of the paint system being screened for selection. The paint system manufacturer shall be ISO 9001 accredited or equivalent. The manufacturer shall have a technical product support department.	Local manufacturing and availability of any paint system is desirable over those available through overseas suppliers and/or manufacturers It is desirable that the manufacturer have a proven reputation within the paint systems industry and production history. This may not be the case for new companies with new paint system technologies. In their consideration engineering judgment will need to be applied and the risk/benefits ratio considered.
Colour	It is essential that the paint system is available in a bright vivid colour.	
Finish	The paint system shall cure or set rigid if applied in the liquid form, it should not remain viscous or tacky.	
Substrate	The paint system shall be suitable for application to ferrous materials.	It is desirable if the paint system can be applied to other non-ferrous metals and meets the requirements for FPS 4
Components	The paint system shall consist of no more than two components.	
Pigments / Additives		It is desirable that the paint system contains a corrosion inhibitor additive.
Volume Solids	There are no special requirements with respect to volume solids on the condition that the performance requirements of the FPS are met.	
Dry Film Thickness	There are no special requirements with respect to dry film thickness on the condition that the performance requirements of the FPS are met.	
No. of coats	It is essential that the paint system can be applied in two coats.	It is desirable that the paint system can be applied in one coat.
Pot Life	.	As a minimum requirement, the paint system shall have a pot life of ≥ 4 hrs
Drying Time / Curing	There are no special requirements with respect to drying time / curing on the condition that the performance requirements of the FPS are met.	
Mixing Ratio	There are no special requirements with respect to mixing ratio on the condition that the performance requirements of the FPS are met. If mixing is required the specific details shall be documented.	

Type of Paint Parameter (FPS 2)	Essential Requirement	Desirable Requirement
Thinner	It is essential that the paint system does not require thinning.	
Shelf Life	There is no requirement within the selection stage of a paint system with regards to the paint system shelf life. If the paint system components have a very short shelf life then the availability should be crosschecked.	
Water Resistance		It is desirable that the paint system has undergone immersion testing (ISO 12944 Im1, Im2 and Im3). If applicable, evidence should be provided.
UV Resistance		The paint system will likely be exposed to normal exposure levels of UV. It is desirable that paint system demonstrates an ability to resist UV degradation.
Chemical Resistance	There are no special requirements with respect to chemical resistance on the condition that the performance requirements of the FPS are met.	
Adhesion	The adhesion testing requirements according to ISO 12944-6 Table 3 shall be demonstrated: • ISO 4624, Method A or B Pull-off, Minimum pull-off value of 2.5 MPA for each measurement. o 0% adhesive failure between steel / metalised steel respectively and the first coat (unless pull-off values are at least 5 MPA). o Force built up is controlled and linear as described in ISO 4624 e.g. use of automatic hydraulic test equipment. o Minimum of 3 dollies per panel. For a DFT ≤ 250 µm (measured value without correction, calibrated on smooth surface) ISO 2409 Cross-cut test meeting a required classification from 0 to 2	At a DFT > 250µm an ISO 2409 cross cut classification 0 is desirable both before and after age resistance testing. A minimum pull-off value of 5 MPa is desirable with 0% adhesive failure between steel / metalised steel respectively and the first coat. Where this occurs the values shall be recorded to allow comparison with other systems.
Abrasion	There are no special requirements with regards to abrasion resistance on the condition that the performance requirements of the FPS are met.	
Mechanical Flexibility	The paint shall be demonstrated through literature to have sufficient flexibility that no paint system defects are likely post-cure due to changes in geometry.	
Thermal Stability	The paint shall be demonstrated to be suitable for an operating temperature of between -5°C to 100°C.	The paint shall be demonstrated to be meet the thermal testing procedure set out in ASTM D6944, Test Method 2. The test temperature shall be between -5 °C to 100 °C The assessment of the test panels shall be in accordance with requirements stated within adhesion section of this table.
Weather resistance	There are no special requirements with respect to weather resistance on the condition that the performance requirements of the FPS are met.	

Type of Paint Parameter (FPS 2)	Essential Requirement	Desirable Requirement
Microbiological Resistance	There are no special requirements with respect to microbiological resistance on the condition that the performance requirements of the FPS are met.	
Age Resistance	The selected paint system shall be qualified in accordance to corrosivity category C4 (very high) in accordance with ISO 12944-6 Table 1, Test Regime 2. Due to the requirements for UV testing, paint system qualified to solely Test Regime 1 shall not be considered (see desirable requirements). The paint system shall meet the requirements of ISO 12944-6, Section 6.3: • ISO 4628-2 (Blistering) requirement 0 (S0) (immediately following ageing) • ISO 4628-3 Rusting requirement Ri0 (immediately following ageing) • ISO 4628-4 (Cracking) requirement 0 (S0) (immediately following ageing) • ISO 4628-5 (Flaking) requirement 0 (S0) (immediately following ageing) • Corrosion at scribe after cyclic ageing test. Maximum 3.0 mm corrosion at scribe as average value. Assessment to be carried out within 8h after end of test • ISO 4624, Method A or B Pull-off, Minimum pull-off value of 2.5 MPA for each measurement. o 0% adhesive failure between steel / metalised steel respectively and the first coat (unless pull-off values are at least 5 MPA). o Force built up is controlled and linear as described in ISO 4624 e.g. use of automatic hydraulic test equipment. o Minimum of 3 dollies per panel. Note, For a DFT ≤ 250 µm (measured value without correction, calibrated on smooth surface) ISO 2409 Cross-cut test meeting a required classification from 0 to 2. Other recognised standards (e.g. NORSOK) may be considered on the basis the testing undertaken is equal to or more severe than the environment being test (e.g. NORSOK System 1 – Offshore). Environmental testing without artificial UV shall not be accepted.	It is desirable that the requirements of a C5M category are met. It is desirable that the corrosion at the scribe line does not exceed 1.5 mm average after cyclic testing It is desirable that the paint system can the meet the assessment requirements following both ISO 12944-6 Test Regime 1 and Test regime 2. It is desirable that the paint system is tested concurrently with a reference system. The reference system shall be a paint system which is judged to have shown good performance over a minimum of five years by the Network.
Removability	There are no requirements with regards to removability.	
Minimum Surface Preparation / Cleanliness	It is essential that the paint system is tolerable to hand/power tool surface preparation. The test plates shall be prepared to ISO 8501-1 ST3.	
Application Methods	The primary application method for the paint system shall be brush. The test panels shall be prepared by this method.	
Application Conditions	It is essential that the paint system can be applied under ambient environment conditions defined in GIS/PA10 Section 13.4	

E.3 FPS 3 (Indoor Painting)

Type of Paint Parameter (FPS 3)	Essential Requirement	Desirable Requirement
General Manufacturer Information	The general paint requirements set out in Section 6 shall be provided. The manufacturer's origin and contact details shall be available, including equivalent information on the manufacturing facilities of the paint system being screened for selection. The paint system manufacturer shall be ISO 9001 accredited or equivalent. The manufacturer shall have a technical product support department.	Local manufacturing and availability of any paint system is desirable over those available through overseas suppliers and/or manufacturers It is desirable that the manufacturer have a proven reputation within the paint systems industry and production history. This may not be the case for new companies with new paint system technologies. In their consideration engineering judgment will need to be applied and the risk/benefits ratio considered.
Colour	Primers, progressive build and topcoats coats shall be of contrasting colours.	
Finish	The paint system shall cure or set rigid if applied in the liquid form, it should not remain viscous or tacky.	
Substrate	The paint system shall be suitable for application to ferrous materials.	
Components	There are no special requirements with respect to components on the condition that the performance requirements of the FPS are met.	
Pigments	There are no special requirements with respect to pigments, fillers and additives on the condition that the performance requirements of the FPS are met.	
Volume Solids	There are no special requirements with respect to volume solids on the condition that the performance requirements of the FPS are met.	
Dry Film Thickness	There are no special requirements with respect to dry film thickness on the condition that the performance requirements of the FPS are met.	
No. of coats		It is desirable that the paint system is applied in one coat.
Pot Life	As a minimum requirement, the paint system shall have a pot life of ≥ 8 hrs.	
Drying Time / Curing	There are no special requirements with respect to drying time / curing on the condition that the performance requirements of the FPS are met.	
Mixing Ratio	There are no special requirements with respect to mixing ratio on the condition that the performance requirements of the FPS are met. If mixing is required the specific details shall be documented.	

Type of Paint Parameter (FPS 3)	Essential Requirement	Desirable Requirement
Thinner	It is essential that no thinning is required.	
Shelf Life	There is no requirement with regards to the paint system shelf life. If the paint system components have a very short shelf life then the availability should be crosschecked.	
Water Resistance	There are no special requirements with respect to water resistance on the condition that the performance requirements of the FPS are met.	
UV Resistance	There are no special requirements with respect to UV resistance on the condition that the performance requirements of the FPS are met.	
Chemical Resistance	There are no special requirements with respect to chemical resistance on the condition that the performance requirements of the FPS are met.	
Adhesion	The adhesion testing requirements according to ISO 12944-6 Table 3 shall be achieved. For a paint system DFT > 250 µm, ISO 2409 cross cut classification between 0 to 2 shall be achieved. For all paint systems, a minimum pull off value of 2.5 MPA for each measurement. 0% adhesive failure between steel/metallised steel respectively and the first coat.	
Abrasion	There are no special requirements with respect to abrasion resistance on the condition that the performance requirements of the FPS are met.	
Mechanical Flexibility	The paint shall be demonstrated through literature to have sufficient flexibility that no paint system defects are likely post-cure due to changes in geometry.	
Thermal Stability	The paint shall be demonstrated to be meet the thermal testing procedure set out in ASTM D6944, Test Method 2. The test temperature shall be between -5 °C to 100 °C The assessment of the test panels shall be in accordance with requirements stated within adhesion section of this table.	
Weather resistance	There are no special requirements with respect to weather resistance on the condition that the performance requirements of the FPS are met.	
Microbiological Resistance	There are no special requirements with respect to microbiological resistance on the condition that the performance requirements of the FPS are met.	

Type of Paint Parameter (FPS 3)	Essential Requirement	Desirable Requirement
Age Resistance		It is desirable that the manufacturer can demonstrate use of the paint system within an indoor environment over a minimum of 7 (seven) years. The data should show the paint system to have maintained a good condition and that no paint system defects occurred.
Removability	There are no requirements with regards to removability.	
Minimum Surface Preparation / Cleanliness	It is essential that the minimum surface preparation requirements do not exceed ISO 8501-1 SA 2.5	
Application Methods	There are no specification requirements with regards to application method. The application methods qualified shall be reported on the PQR.	
Application Conditions	It is essential that the paint system can be applied under ambient environmental conditions defined in GIS/PA10 Section 13.4.	

E.4 - FPS 4 (Non-Ferrous Painting, Non-Metallic Painting, Galvanised Surface)

Type of Paint Parameter (FPS 4)	Essential Requirement	Desirable Requirement
General Manufacturer Information	The general paint requirements set out in Section 5.4 shall be provided. The manufacturer's origin and contact details shall be available, including equivalent information on the manufacturing facilities of the paint system being screened for selection. The paint system manufacturer shall be ISO 9001 accredited or equivalent. The manufacturer shall have a technical product support department.	Local manufacturing and availability of any paint system is desirable over those available through overseas suppliers and/or manufacturers It is desirable that the manufacturer have a proven reputation within the paint systems industry and production history. This may not be the case for new companies with new paint system technologies. In their consideration engineering judgment will need to be applied and the risk/benefits ratio considered.
Colour	Primers, progressive builds and topcoats coats shall be of contrasting colours.	
Finish	The paint system shall cure or set rigid if applied in the liquid form, it should not remain viscous or tacky.	
Substrate	The paint system shall be suitable for non-ferrous substrates. For each non-ferrous substrate the paint system is suitable for the essential requirements shall be demonstrated for each material type. Expected performance cannot be inferred from one substrate material to another. The non-ferrous substrates the paint systems are demonstrated to be suitable for shall be recorded in the PQR.	It is desirable that the paint system performance can be demonstrated to more than one substrate material
Components	There are no special requirements with respect to components on the condition that the performance requirements of the FPS are met.	
Pigments	There are no special requirements with respect to pigments, fillers and additives on the condition that the performance requirements of the FPS are met.	
Volume Solids	There are no special requirements with respect to volume solids on the condition that the performance requirements of the FPS are met.	
Dry Film Thickness	There are no special requirements with respect to dry film thickness on the condition that the performance requirements of the FPS are met.	

Type of Paint Parameter (FPS 4)	Essential Requirement	Desirable Requirement
No. of coats		It is desirable that the paint system consists of as few coats as possible. It should be highlighted on the PQR if the paint system can be applied in < 2 coats.
Pot Life		It is desirable that the paint system shall have a pot life of ≥ 8 hrs such that it can be used within a shift.
Drying Time / Curing	There are no special requirements with respect to drying time / curing on the condition that the performance requirements of the FPS are met.	
Mixing Ratio	There are no special requirements with respect to mixing ratio on the condition that the performance requirements of the FPS are met.	
Thinner	If thinning is required, this should be clearly stated together with the information identifying the type and the amount (thinner/paint system ratio) of thinner. All requirements for thinning shall be in strict accordance with The Volatile Organic Compounds in Paints, Varnishes and Vehicle Refinishing Products Regulations.	It is desirable that no thinning is required.
Shelf Life	There is no requirement with regards to the paint system shelf life. If the paint system components have a very short shelf life then the availability should be crosschecked.	
Water Resistance	It is essential that the paint system demonstrates a suitability for water immersion.	It is desirable that evidence is provided showing performance under water immersion conditions. Preference will be given to systems depending upon the number of years demonstrated.
UV Resistance		The paint system will likely be exposed to normal exposure levels of UV. It is desirable that any top coat components and single coat systems have ultra violet resistance.
Chemical Resistance	There are no special requirements with regards to chemical resistance.	
Adhesion	There are no special requirements with respect to adhesion on the condition that the performance requirements of the FPS are met.	
Abrasion		Evidence of abrasion resistance (e.g. Taber) is desirable.

Type of Paint Parameter (FPS 4)	Essential Requirement	Desirable Requirement
Mechanical Flexibility	It is essential that evidence is provided to show that the cured paint will to have sufficient flexibility that no paint system defects are likely post-cure due to changes in geometry.	
Thermal Stability	The thermal stability of the paint system product shall be demonstrated. The paint shall be stable within the temperature range from -5°C to 100°C and show no detrimental effects under cyclic temperature changes.	It is desirable that the paint is demonstrated to meet the thermal testing procedure set out in ASTM D6944, Test Method B. The temperature range shall be from -5°C to 100°C.
Weather resistance	No other specific weather resistance is required, other than those already accounted for individually.	
Microbiological Resistance	There are no essential or desirable requirements with regards to microbiological resistance.	
Age Resistance	Evidence shall be provided showing performance of the paint system. The evidence shall demonstrate the paint performance in a C4 (very high) corrosivity category (as defined in ISO 12944-2). Evidence detailing performance in a more severe environment will also be acceptable.	It is desirable that the manufacturer can demonstrate use of the paint system within a C4 (very high) corrosivity category (as defined in ISO 12944-2) over a minimum of 7 (seven) years. The data should show the paint system to have maintained a good condition and that no paint system defects occurred. It is extremely desirable that the manufacturer can demonstrate use of the paint system within a C4 (very high) corrosivity category (as defined in ISO 12944-2) over a minimum of 10 (ten) years. The data should show the paint system to have maintained a good condition and that no paint system defects occurred.
Removability	There are no restrictions on the removability of the paint system.	
Minimum Surface Preparation / Cleanliness	It is essential that the minimum surface preparation requirements do not exceed a sweep blast.	It is desirable that a minimum amount of surface preparation is required. This is considered to be no greater than hand tool abrasion (keying) and a wipe of surface with a clean lint-free cloth.
Application Methods	There are no special requirements with respect to application method on the condition that the performance requirements of the FPS are met. The performance of each applicable method shall be demonstrated.	
Application Conditions	It is essential that the paint system can be applied under ambient environmental conditions defined in GIS/PA10 Section 13.4.	

E.5 - FPS 5 (High Temperature, 100°C to 340°C)

Type of Paint Parameter (FPS 5)	Essential Requirement	Desirable Requirement
General Manufacturer Information	The general paint requirements set out in Section 6 shall be provided. The manufacturer's origin and contact details shall be available, including equivalent information on the manufacturing facilities of the paint system being screened for selection. The paint system manufacturer shall be ISO 9001 accredited or equivalent. The manufacturer shall have a technical product support department.	Local manufacturing and availability of any paint system is desirable over those available through overseas suppliers and/or manufacturers It is desirable that the manufacturer have a proven reputation within the paint systems industry and production history. This may not be the case for new companies with new paint system technologies. In their consideration engineering judgment will need to be applied and the risk/benefits ratio considered.
Colour	Primers, progressive build and topcoats coats shall be of contrasting colours.	
Finish	The paint system shall cure or set rigid if applied in the liquid form, it should not remain viscous or tacky.	
Substrate	The paint system shall be suitable for application to ferrous materials.	It is desirable if the paint system can be applied to other non-ferrous metals.
Components	There are no special requirements with respect to components on the condition that the performance requirements of the FPS are met.	
Pigments	There are no special requirements with respect to pigments, fillers and additives on the condition that the performance requirements of the FPS are met.	
Volume Solids	There are no special requirements with respect to volume solids on the condition that the performance requirements of the FPS are met.	
Dry Film Thickness	There are no special requirements with respect to dry film thickness on the condition that the performance requirements of the FPS are met.	
No. of coats		It is desirable that the paint system consists of as few coats as possible. It should be highlighted on the PQR if the paint system can be applied in > 2 coats.

Type of Paint Parameter (FPS 5)	Essential Requirement	Desirable Requirement
Pot Life		It is desirable that the paint system shall have a pot life of ≥ 8 hrs such that it can be used within a shift.
Drying Time / Curing	There are no special requirements with respect to drying time / curing on the condition that the performance requirements of the FPS are met.	
Mixing Ratio	There are no special requirements with respect to mixing ratio on the condition that the performance requirements of the FPS are met.	
Thinner	If thinning is required, this should be clearly stated together with the information identifying the type and the amount (thinner/paint system ratio) of thinner. All requirements for thinning shall be in strict accordance with The Volatile Organic Compounds in Paints, Varnishes and Vehicle Refinishing Products Regulations.	It is desirable that no thinning is required.
Shelf Life	There is no requirement within the selection stage of a paint system with regards to the paint system shelf life. If the paint system components have a very short shelf life then the availability should be crosschecked.	
Water Resistance	There are no special requirements with respect to water resistance on the condition that the performance requirements of the FPS are met.	
UV Resistance		The paint system will likely be exposed to normal exposure levels of UV. It is desirable that any top coat components and single coat systems have ultra violet resistance.
Chemical Resistance	There are no special requirements with respect to chemical resistance on the condition that the performance requirements of the FPS are met.	
Adhesion	Adhesion requirements are set for specific paint parameters. These requirements shall be met where they are considered essential.	
Abrasion	There are no special requirements with regards to abrasion resistance on the condition that the performance requirements of the FPS are met.	

Type of Paint Parameter (FPS 5)	Essential Requirement	Desirable Requirement
Mechanical Flexibility	The paint shall be demonstrated through literature to have sufficient flexibility that no paint system defects are likely post-cure due to changes in geometry.	

Thermal Stability	The paint shall be demonstrated to be meet the thermal testing procedure set out in ASTM D6944, Test Method B. The temperature range shall be from -5°C to 340°C. Following thermal testing the assessments detailed below shall be carried out.
	
	Immediately following thermal testing the assessment of the test panels shall be in accordance with following requirements of ISO 12944-6, Section 6.3:
	• ISO 4628-2 (Blistering) requirement 0 (S0)
	• ISO 4628-3 Rusting requirement Ri0
	• ISO 4628-4 (Cracking) requirement 0 (S0)
	• ISO 4628-5 (Flaking) requirement 0 (S0)
	After 7 days reconditioning following thermal testing in a standard atmosphere (as defined in ISO 3270) the test panels shall be assessed in accordance with following requirements of ISO 12944-6, Section 6.3:
	• ISO 4624, Method A or B Pull-off, Minimum pull-off value of 2.5 MPA for each measurement.
	  ○ 0% adhesive failure between steel / metalised steel respectively and the first coat (unless pull-off values are at least 5 MPA).
	  ○ Force built up is controlled and linear as described in ISO 4624 e.g. use of automatic hydraulic test equipment.
	  ○ Minimum of 3 dollies per panel.
	• For a DFT ≤ 250 µm (measured value without correction, calibrated on smooth surface) ISO 2409 Cross-cut test meeting a required classification from 0 to 2.	

Weather resistance	There are no special requirements with respect to weather resistance on the condition that the performance requirements of the FPS are met.	
Microbiological Resistance	There are no special requirements with respect to microbiological resistance on the condition that the performance requirements of the FPS are met.	

Type of Paint Parameter (FPS 5)	Essential Requirement	Desirable Requirement

Age Resistance	The selected paint system shall be tested in accordance to corrosivity category C4 (very high) in accordance with ISO 12944-6 Table 1, Test Regime 2. **These tests shall be undertaken on painted panels thermally aged (see thermal stability).**
	
	Due to the requirements for UV testing, paint system qualified to solely Test Regime 1 shall not be considered (see desirable requirements).
	
	The paint system shall meet the requirements of ISO 12944-6, Section 6.3 Table 4:
	• ISO 4628-2 (Blistering) requirement 0 (S0) (immediately following ageing)
	• ISO 4628-3 Rusting requirement Ri0 (immediately following ageing)
	• ISO 4628-4 (Cracking) requirement 0 (S0) (immediately following ageing)
	• ISO 4628-5 (Flaking) requirement 0 (S0) (immediately following ageing)
	• Corrosion at scribe after cyclic ageing test. Maximum 3.0 mm corrosion at scribe as average value. Assessment to be carried out within 8h after end of test
	• ISO 4624, Method A or B Pull-off, Minimum pull-off value of 2.5 MPA for each measurement.
	  ○ 0% adhesive failure between steel / metalised steel respectively and the first coat (unless pull-off values are at least 5 MPA).
	  ○ Force built up is controlled and linear as described in ISO 4624 e.g. use of automatic hydraulic test equipment.
	  ○ Minimum of 3 dollies per panel.
	• For a DFT ≤ 250 µm (measured value without correction, calibrated on smooth surface) ISO 2409 Cross-cut test meeting a required classification from 0 to 2.
		It is desirable that both Test Regime 1 and Test Regime 2 have been carried out and meet the performance requirements of ISO 12944-6 Table 4.
		
		It is desirable that the maximum distance from the scribe line after cyclic testing is ≤ 1.5 mm (as an average value)

Removability	There are no restrictions on the removability of the paint system.	
Minimum Surface Preparation / Cleanliness		It is desirable that the minimum surface preparation requirements do not exceed ISO 8501-1 SA 2.5.
Application Methods		It is desirable that the primary application method for the paint system shall be spraying.
Application Conditions	It is essential that the paint system can be applied under ambient environmental conditions defined in GIS/PA10 Section 13.4.	

E.6 - FPS 6 (High Temperature, 340°C to 500°C)

Type of Paint Parameter (FPS 6)	Essential Requirement	Desirable Requirement
General Manufacturer Information	The general paint requirements set out in Section 5.4 shall be provided. The manufacturer's origin and contact details shall be available, including equivalent information on the manufacturing facilities of the paint system being screened for selection. The paint system manufacturer shall be ISO 9001 accredited or equivalent. The manufacturer shall have a technical product support department.	Local manufacturing and availability of any paint system is desirable over those available through overseas suppliers and/or manufacturers It is desirable that the manufacturer have a proven reputation within the paint systems industry and production history. This may not be the case for new companies with new paint system technologies. In their consideration engineering judgment will need to be applied and the risk/benefits ratio considered.
Colour	Primers, progressive build and topcoats coats shall be of contrasting colours.	
Finish	The paint system shall cure or set rigid if applied in the liquid form, it should not remain viscous or tacky.	
Substrate	The paint system shall be suitable for application to ferrous materials.	It is desirable if the paint system can be applied to other non-ferrous metals.
Components	There are no requirements with respect to component.	
Pigments	There are no special requirements with respect to pigments, fillers and additives on the condition that the performance requirements of the FPS are met.	
Volume Solids	There are no special requirements with respect to volume solids on the condition that the performance requirements of the FPS are met.	
Dry Film Thickness	There are no special requirements with respect to dry film thickness on the condition that the performance requirements of the FPS are met.	

Type of Paint Parameter (FPS 6)	Essential Requirement	Desirable Requirement
No. of coats		It is desirable that the paint system consists of as few coats as possible. It should be highlighted on the PQR if the paint system can be applied in > 2 coats.
Pot Life		It is desirable that the paint system shall have a pot life of ≥ 8 hrs such that it can be used within a shift.
Drying Time / Curing	There are no special requirements with respect to drying time / curing on the condition that the performance requirements of the FPS are met.	
Mixing Ratio	There are no special requirements with respect to mixing ratio on the condition that the performance requirements of the FPS are met.	
Thinner	If thinning is required, this should be clearly stated together with the information identifying the type and the amount (thinner/paint system ratio) of thinner. All requirements for thinning shall be in strict accordance with the Volatile Organic Compounds in Paints, Varnishes and Vehicle Refinishing Products Regulations.	It is desirable that no thinning is required.
Shelf Life	There is no requirement within the selection stage of a paint system with regards to the paint system shelf life. If the paint system components have a very short shelf life then the availability should be crosschecked.	
Water Resistance	There are no special requirements with respect to water resistance on the condition that the performance requirements of the FPS are met.	
UV Resistance		The paint system will likely be exposed to normal exposure levels of UV. It is desirable that any top coat components and single coat systems have ultra violet resistance.
Chemical Resistance	There are no special requirements with respect to chemical resistance on the condition that the performance requirements of the FPS are met.	

Type of Paint Parameter (FPS 6)	Essential Requirement	Desirable Requirement
Adhesion	Adhesion requirements are set for specific paint parameters. These requirements shall be met where they are considered essential.	
Abrasion	There are no special requirements with regards to abrasion resistance on the condition that the performance requirements of the FPS are met.	
Mechanical Flexibility	The paint shall be judged to have sufficient flexibility that no paint system defects are likely Post-cure due to changes in geometry.	

Thermal Stability	The paint shall be demonstrated to be meet the thermal testing procedure set out in ASTM D6944, Test Method B. The temperature range shall be from -5°C to 500°C. Following thermal testing the assessments detailed below shall be carried out.
	
	Immediately following thermal testing the assessment of the test panels shall be in accordance with following requirements of ISO 12944-6, Section 6.3:
	• ISO 4628-2 (Blistering) requirement 0 (S0)
	• ISO 4628-3 Rusting requirement Ri0
	• ISO 4628-4 (Cracking) requirement 0 (S0)
	• ISO 4628-5 (Flaking) requirement 0 (S0)
	After 7 days reconditioning following thermal testing in a standard atmosphere (as defined in ISO 3270) the test panels shall be assessed in accordance with following requirements of ISO 12944-6, Section 6.3:
	• ISO 4624, Method A or B Pull-off, Minimum pull-off value of 2.5 MPA for each measurement.
	  ○ 0% adhesive failure between steel / metalised steel respectively and the first coat (unless pull-off values are at least 5 MPA).
	  ○ Force built up is controlled and linear as described in ISO 4624 e.g. use of automatic hydraulic test equipment.
	  ○ Minimum of 3 dollies per panel.
	• For a DFT ≤ 250 µm (measured value without correction, calibrated on smooth surface) ISO 2409 Cross-cut test meeting a required classification from 0 to 2.	

Weather resistance	There are no special requirements with respect to weather resistance on the condition that the performance requirements of the FPS are met.	
Microbiological Resistance	There are no special requirements with respect to microbiological resistance on the condition that the performance requirements of the FPS are met.	

Type of Paint Parameter (FPS 6)	Essential Requirement	Desirable Requirement

Age Resistance	The selected paint system shall be tested in accordance to corrosivity category C4 (very high) in accordance with ISO 12944-6 Table 1, Test Regime 2. **These tests shall be undertaken on painted panels thermally aged (see thermal stability).**
	
	Due to the requirements for UV testing, paint system qualified to solely Test Regime 1 shall not be considered (see desirable requirements).
	
	The paint system shall meet the requirements of ISO 12944-6, Section 6.3 Table 4:
	• ISO 4628-2 (Blistering) requirement 0 (S0) (immediately following ageing)
	• ISO 4628-3 Rusting requirement Ri0 (immediately following ageing)
	• ISO 4628-4 (Cracking) requirement 0 (S0) (immediately following ageing)
	• ISO 4628-5 (Flaking) requirement 0 (S0) (immediately following ageing)
	• Corrosion at scribe after cyclic ageing test. Maximum 3.0 mm corrosion at scribe as average value. Assessment to be carried out within 8h after end of test
	• ISO 4624, Method A or B Pull-off, Minimum pull-off value of 2.5 MPA for each measurement.
	  ○ 0% adhesive failure between steel / metalised steel respectively and the first coat (unless pull-off values are at least 5 MPA).
	  ○ Force built up is controlled and linear as described in ISO 4624 e.g. use of automatic hydraulic test equipment.
	  ○ Minimum of 3 dollies per panel.
	• For a DFT ≤ 250 µm (measured value without correction, calibrated on smooth surface) ISO 2409 Cross-cut test meeting a required classification from 0 to 2.
		It is desirable that both Test Regime 1 and Test Regime 2 have been carried out and meet the performance requirements of ISO 12944-6 Table 4.
		
		It is desirable that the maximum distance from the scribe line after cyclic testing is ≤ 1.5 mm (as an average value)

Removability	There are no restrictions on the removability of the paint system.	
Minimum Surface Preparation / Cleanliness		It is desirable that the minimum surface preparation requirements do not exceed ISO 8501-1 SA 2.5.
Application Methods		It is desirable that the primary application method for the paint system shall be spraying.
Application Conditions	It is essential that the paint system can be applied under ambient environmental conditions defined in GIS/PA10 Section 13.4.	

E.7 - FPS 7 (Temporary Paint)

Type of Paint Parameter (FPS 7)	Essential Requirement	Desirable Requirement
General Manufacturer Information	The general paint requirements set out in Section 6 shall be provided. The manufacturer's origin and contact details shall be available, including equivalent information on the manufacturing facilities of the paint system being screened for selection. The paint system manufacturer shall be ISO 9001 accredited or equivalent. The manufacturer shall have a technical product support department.	Local manufacturing and availability of any paint system is desirable over those available through overseas suppliers and/or manufacturers It is desirable that the manufacturer have a proven reputation within the paint systems industry and production history. This may not be the case for new companies with new paint system technologies. In their consideration engineering judgment will need to be applied and the risk/benefits ratio considered.
Colour	The paint system shall be available in a vivid colour	It is desirable that the paint system is available in bright pink.
Finish	There are no restrictions on the finish of the paint system,	
Substrate	The paint system shall be suitable for application to ferrous materials.	
Components	The paint system shall be a single component.	
Pigments / Fillers / Additive	It is essential that the paint system either contains a corrosion inhibitor additive or forms a moisture resistant barrier following cure.	It is desirable that both of the requirements noted in the essential requirements are met.
Volume Solids	There are no restrictions on the volume solids content of the paint system.	
Dry Film Thickness	There is no limit for the minimum and maximum dry film thickness. Tolerance in relation to over thickness should be wide due to the likely difficulties of application and potential over application	
No. of coats	It is essential that the area can be covered in one coat (or application)	
Pot Life	From first usage the paint system must be able to use for further use for the entire shelf life. The paint system shall remain stable within its packaging.	
Drying Time / Curing		It is desirable that the paint system cures (dry to handle) within one (1) hour.

Type of Paint Parameter (FPS 7)	Essential Requirement	Desirable Requirement
Mixing Ratio	The paint system shall be a single component. Therefore it is essential that no mixing of two or more different components is required. Mixing or agitation of the single product is acceptable.	
Thinner	No thinning of the paint system is permissible.	
Shelf Life	The paint system shall have a minimum shelf life of two (2) years	
Water Resistance	The paint system shall either: • Act as a total moisture barrier and shall not allow for water permeation. • Allow tolerable levels of absorption and permeation but contains inhibitive properties at the paint system-substrate interface.	It is desirable that the paint system can tolerate water immersion.
UV Resistance		The paint system will likely be exposed to normal exposure levels of UV. It is desirable that paint system demonstrates an ability to resist UV degradation.
Chemical Resistance	There are no special requirements with respect to chemical resistance on the condition that the performance requirements of the FPS are met.	

Adhesion	Before age resistance, the paint system shall meet the following adhesion requirements:
	• ISO 4624, Method A or B Pull-off.
	• The adhesion shall be such that adhesion failure shall be as a result of the removal of corrosion product (rust). Subsequently
	  ○ Adhesive failure (between corrosion product and the cured paint system) is not acceptable.
	  ○ Cohesive failure is not acceptable.
	• Force built up shall be controlled and linear as described in ISO 4624 e.g. use of automatic hydraulic test equipment.
	• Minimum of 3 dollies per panel.
	The adhesion tests shall be carried out on paint system panels prepared as stated within the minimum surface preparation requirements.	

Abrasion	There are no special requirements with regards to abrasion resistance on the condition that the performance requirements of the FPS are met.	
Mechanical Flexibility	When applied, the paint system shall be judged to have sufficient flexibility that no paint system defects are likely post-cure due to changes in geometry.	

Type of Paint Parameter (FPS 7)	Essential Requirement	Desirable Requirement
Thermal Stability	The paint shall be demonstrated to be meet the thermal testing procedure set out in ASTM D6944, Test Method B. The temperature range shall be from -5°C to 100°C. Following thermal stability testing no degradation or paint system defects of the paint system shall be evident (as per the guidance given in ISO 4628). **Note the test panels are not required to be pre-treated for the thermal stability test.**	
Weather resistance	There are no special requirements with respect to weather resistance on the condition that the performance requirements of the FPS are met.	
Microbiological Resistance	There are no special requirements with respect to microbiological resistance on the condition that the performance requirements of the FPS are met.	
Age Resistance	The selected paint system shall be tested in accordance to corrosivity category C4 (very high) in accordance with ISO 12944-6 Table 1, Test Regime 2. **These tests shall be undertaken on pre-treated panels (see minimum surface preparation)**. Note: • There is no requirement for the addition of a scribe line. • This test is for comparative review by the Gas Transporter (or the responsible person) only. There are no minimum performance requirements. • The panels will be evaluated by the Gas Transporter (or the responsible person) to: • ISO 4628-2 (blistering), • ISO 4628-3 (rusting), • ISO 4628-4 (cracking) and • ISO 46264-5 (flaking) and • ISO 4628-6 (chalking). Due to the requirements for UV testing, paint system qualified to solely Test Regime 1 shall not be considered (see desirable requirements). Other recognised standards (e.g. NORSOK) may be considered on the basis the testing undertaken is equal to or more severe than the environment being test (e.g. NORSOK System 1 – Offshore). Environmental testing without artificial UV shall not be accepted.	It is desirable that following the age resistance testing, the paint system meets the minimum **pull-off** adhesion requirements reported in ISO 12944-6 Section 6.2, Table 4: • Test is carried out after 7d reconditioning in a standard atmosphere as defined in ISO 3270. • ISO 4624, Method A or B Pull-off, Minimum pull-off value of 2.5 MPA for each measurement. • 0% adhesive failure between steel / metalised steel respectively and the first coat (unless pull-off values are at least 5 MPA). • Force built up is controlled and linear as described in ISO 4624 e.g. use of automatic hydraulic test equipment. • Minimum of 3 dollies per panel. Due to the absence of a smooth test panel surface (following pre-treatment), cross-cut adhesion (ISO 2409) testing shall not be considered.
Removability	There are no restrictions on the removability of the paint system.	

Type of Paint Parameter (FPS 7)	Essential Requirement	Desirable Requirement
Minimum Surface Preparation	The paint system shall be surface tolerant and capable of application to an un-prepared and un-clean corroded surface. Where stipulated shall be demonstrated on test panels which have undergone pre-treatment. The test panels shall be subjected to water condensation and neutral salt spray testing as defined for a C2 (very high) environment within ISO 12944-6 Table 1: • Water Condensation (ISO 6270-1), 240 hours • Neutral Salt Spray (ISO 9227), 480 hours. The test panels shall be used after seven (7) days further conditioning in a standard atmosphere as defined in ISO 3270.	
Minimum Surface Cleanliness	The paint system shall be surface tolerant and capable of application to an un-prepared and un-clean corroded surface.	
Application Methods		It is desirable the paint system can be applied by a spray can.
Application Conditions	It is essential that the paint system can be applied under ambient environmental conditions.	
Other	There are no additional essential or desirable requirements.	

E.8 - FPS 8 (Flange Joint and Bolting)

Type of Paint Parameter (FPS 8)	Essential Requirements	Desirable Requirement
General Manufacturer Information	The general paint requirements set out in Section 6 shall be provided. The manufacturer's origin and contact details shall be available, including equivalent information on the manufacturing facilities of the paint system being screened for selection. The paint system manufacturer shall be ISO 9001 accredited or equivalent. The manufacturer shall have a technical product support department.	Local manufacturing and availability of any paint system is desirable over those available through overseas suppliers and/or manufacturers It is desirable that the manufacturer have a proven reputation within the paint systems industry and production history. This may not be the case for new companies with new paint system technologies. In their consideration engineering judgment will need to be applied and the risk/benefits ratio considered.
Colour	Primers, progressive build and topcoats coats shall be of contrasting colours.	
Finish	The paint system shall cure or set rigid if applied in the liquid form, it should not remain viscous or tacky. Mesophase material shall not become more viscous and flow under expected environmental conditions.	
Substrate	The paint system shall be suitable for application to carbon steel, stainless steel and aluminium.	
Components		It is desirable that the paint system consists of one component. Subsequently, it is desirable that one paint system product is required.
Pigments	Primer and/or base coat components of any paint system shall contain an anti-corrosion pigment. This same characteristic is required of single coat systems.	
Volume Solids	There is no requirement for the volume solids content of the paint system.	
Dry Film Thickness	There is no limit for the minimum and maximum dry film thickness. Tolerance in relation to over thickness should be wide due to the likely difficulties of application and potential over application	
No. of coats		It is desirable that only one coat is required to achieve the required dry film thickness.
Pot Life	As a minimum requirement, the paint system shall have a pot life of ≥ 8 hrs.	A pot life of ≥ 24 hrs is desirable. This is to enable re-paint system within 24 hrs with the same paint system mix.
Drying Time / Curing	There are no special requirements with respect to drying time / curing on the condition that the performance requirements of the FPS are met.	

Type of Paint Parameter (FPS 8)	Essential Requirement	Desirable Requirement
Mixing Ratio	There are no special requirements with respect to mixing ratio on the condition that the performance requirements of the FPS are met.	
Thinner	If thinning is required, this should be clearly stated together with the information identifying the type and the amount (thinner/paint system ratio) of thinner. All requirements for thinning shall be in strict accordance with The Volatile Organic Compounds in Paints, Varnishes and Vehicle Refinishing Products Regulations.	It is desirable that no thinning is required.
Shelf Life	There is no requirement within the selection stage of a paint system with regards to the paint system shelf life. If the paint system components have a very short shelf life then the availability should be crosschecked.	
Water Resistance	The paint system shall act as a total moisture barrier and shall not allow for water permeation. Tolerable levels of absorption and permeation will only be considered if the paint system is shown to have inhibitive properties at the paint system-substrate interface. The system shall show minimal signs of dimensional instability or loss of adhesion during water absorption and drying, such that the effects are not detriment to the paint systems performance.	
UV Resistance		The paint system will likely be exposed to normal exposure levels of UV. It is desirable that any top coat components and single coat systems have ultra violet resistance.
Chemical Resistance	There are no special requirements with respect to chemical resistance on the condition that the performance requirements of the FPS are met.	
Adhesion	No specific adhesion requirement is required for the paint system. However, the adhesion must be such that the age resistance requirements are met	
Abrasion	Adhesion requirements are set for specific paint parameters. These requirements shall be met where they are considered essential.	
Mechanical Flexibility	The paint shall be judged to have sufficient flexibility that no paint system defects are likely post-cure due to changes in geometry	
Thermal Stability	The paint system shall be suitable to withstand dry deposition (as per ISO 9223) and intended operating temperature of the paint system within the range of –15 to 100 °C. Under the thermal stability criteria the paint system must not deform under creep during its service life under the strain of its own mass.	

Type of Paint Parameter (FPS 8)	Essential Requirement	Desirable Requirement
Weather resistance	No other specific weather resistance is required, other than those already accounted for individually.	
Microbiological Resistance		It is desirable that any top coat components and single coat systems offer resistance to microbiological activity.
Age Resistance	The selected paint system shall be ultimately qualified in accordance to a recognised international paint system standard, e.g. ISO 12944-6. As a minimum one of the following corrosion performance tests shall have been demonstrated; Cyclic corrosion (condensation), Salt spray (fog) testing, Cyclic fog/dry testing (Prohesion), Corrosion testing from a scribed line (rust creepage and filiform corrosion).	
Removability	Due to periodic inspection requirements, the paint system shall be easily removable The ease of removal should be quantified and based on laboratory or field trials. For paint systems which are to be removed by solvent or will require other chemical means, either must not compromise H/S&E regulations and should not require complicated and lengthy handling or disposal procedures.	
Minimum Surface Preparation	The minimum level of surface preparation shall conform to the classification of 'Hand Tool Cleaning' as defined in ISO 8501-1 or other corresponding standards.	
Minimum Surface Cleanliness	There are no special requirements. The level of surface cleanliness should conform to the manufacturers' specifications	
Mixing	There are no special requirements.	
Application Methods	The selected paint system shall be suitable for brush, spray, trowel and other hand application over prepared steel surfaces (see below). Other application techniques are acceptable provided they are suitable for on-site application and are such that all areas are coated. In certain difficult access situations the paint system must be able to be applied by any novel means to ensure coverage. The intended paint system shall not be hindered or restricted by any geometry	
Application Conditions	It is essential that the paint system can be applied under ambient environmental conditions.	
Other	It is essential that a case study demonstrating the application of the paint system to a flanged arrangement is provided. The case study shall provide photographs of the application process.	

Qualification Route A

E.9 - FPS 9 (Condensing / Wet Surface)

Type of Paint Parameter (FPS 9)	Essential Requirement	Desirable Requirement
General Manufacturer Information	The general paint requirements set out in Section 6 shall be provided. The manufacturer's origin and contact details shall be available, including equivalent information on the manufacturing facilities of the paint system being screened for selection. The paint system manufacturer shall be ISO 9001 accredited or equivalent. The manufacturer shall have a technical product support department.	Local manufacturing and availability of any paint system is desirable over those available through overseas suppliers and/or manufacturers It is desirable that the manufacturer have a proven reputation within the paint systems industry and production history. This may not be the case for new companies with new paint system technologies. In their consideration engineering judgment will need to be applied and the risk/benefits ratio considered.
Colour	Primers, progressive builds and topcoats coats shall be of contrasting colours.	
Finish	The paint system shall cure or set rigid if applied in the liquid form, it should not remain viscous or tacky.	
Substrate	The paint system shall be suitable for application to ferrous materials.	It is desirable if the paint system can be applied to other non-ferrous metals and meets the requirements for FPS 4 (Non-ferrous painting)
Components	There are no special requirements with respect to components on the condition that the performance requirements of the FPS are met.	
Pigments	There are no special requirements with respect to pigments, fillers and additives on the condition that the performance requirements of the FPS are met.	
Volume Solids	There are no special requirements with respect to volume solids on the condition that the performance requirements of the FPS are met.	
Dry Film Thickness	There are no special requirements with respect to dry film thickness on the condition that the performance requirements of the FPS are met.	
No. of coats		It is desirable that the paint system consists of as few coats as possible. It should be highlighted on the PQR if the paint system can be applied in < 2 coats.
Pot Life	As a minimum requirement, the paint system shall have a pot life of ≥ 8 hrs.	
Drying Time / Curing	The individual coats of the system shall be demonstrated to cure under condensing conditions (see other).	

Type of Paint Parameter (FPS 9)	Essential Requirement	Desirable Requirement
Mixing / Mixing Ratio	There are no special requirements with respect to mixing ratio on the condition that the performance requirements of the FPS are met.	
Thinner	If thinning is required, this should be clearly stated together with the information identifying the type and the amount (thinner/paint system ratio) of thinner. All requirements for thinning shall be in strict accordance with The Volatile Organic Compounds in Paints, Varnishes and Vehicle Refinishing Products Regulations.	It is desirable that no thinning is required.
Shelf Life	There is no requirement with regards to the paint system shelf life. If the paint system components have a very short shelf life then the availability should be crosschecked.	
Water Resistance		It is desirable that the paint system has undergone immersion testing (ISO 12944 Im1, Im2 and Im3). It is desirable that the paint system can be demonstrated to be applied and cure within an immersed environment.
UV Resistance		The paint system will likely be exposed to normal exposure levels of UV. It is desirable that paint system demonstrates an ability to resist UV degradation.
Chemical Resistance	There are no special requirements with regards to chemical resistance.	

Adhesion	The adhesion testing requirements according to ISO 12944-6 Table 3 shall be achieved. The requirements shall be met before age resistance testing:
	• ISO 4624, Method A or B Pull-off, Minimum pull-off value of 2.5 MPA for each measurement.
	  ○ 0% adhesive failure between steel / metalised steel respectively and the first coat (unless pull-off values are at least 5 MPA).
	  ○ Force built up is controlled and linear as described in ISO 4624 e.g. use of automatic hydraulic test equipment.
	  ○ Minimum of 3 dollies per panel.
	• For a DFT ≤ 250 µm (measured value without correction, calibrated on smooth surface) ISO 2409 Cross-cut test meeting a required classification from 0 to 2
		At a DFT > 250µm an ISO 2409 cross cut classification 0 is desirable both before and after age resistance testing.
		
		A minimum pull-off value of 5 MPa is desirable with 0% adhesive failure between steel/metalised steel respectively and the first coat. Where this occurs the values shall be recorded to allow comparison with other systems.

Abrasion	There are no special requirements with regards to abrasion resistance	It is desirable that resistance to abrasion (e.g. Taber) is demonstrated.
Mechanical Flexibility	The paint shall be judged to have sufficient flexibility that no paint system defects are likely post-cure due to changes in geometry.	

Type of Paint Parameter (FPS 9)	Essential Requirement	Desirable Requirement
Thermal Stability	The paint shall be demonstrated to be meet the thermal testing procedure set out in ASTM D6944, Test Method B. The assessment of the test panels shall be in accordance with ISO 12944-6, Section 6.3. Note, the test plates can be prepared under manufacturer data sheet conditions.	
Age Resistance	The selected paint system shall be qualified in accordance to corrosivity category C4 (very high) in accordance with ISO 12944-6 Table 1, Test Regime 2. Due to the requirements for UV testing, paint system qualified to solely Test Regime 1 shall not be considered (see desirable requirements). The paint system shall meet the requirements of ISO 12944-6, Section 6.3: • ISO 4628-2 (Blistering) requirement 0 (S0) (immediately following ageing) • ISO 4628-3 Rusting requirement Ri0 (immediately following ageing) • ISO 4628-4 (Cracking) requirement 0 (S0) (immediately following ageing) • ISO 4628-5 (Flaking) requirement 0 (S0) (immediately following ageing) • Corrosion at scribe after cyclic ageing test. Maximum 3.0 mm corrosion at scribe as average value. Assessment to be carried out within 8h after end of test • ISO 4624, Method A or B Pull-off, Minimum pull-off value of 2.5 MPA for each measurement. o 0% adhesive failure between steel / metalised steel respectively and the first coat (unless pull-off values are at least 5 MPA). o Force built up is controlled and linear as described in ISO 4624 e.g. use of automatic hydraulic test equipment. o Minimum of 3 dollies per panel. For a DFT ≤ 250 µm (measured value without correction, calibrated on smooth surface) ISO 2409 Cross-cut test meeting a required classification from 0 to 2. Other recognised standards (e.g. NORSOK) may be considered on the basis the testing undertaken is equal to or more severe than the environment being test (e.g. NORSOK System 1 – Offshore). Environmental testing without artificial UV shall not be accepted.	It is desirable that the requirements of a C5M category are met. It is desirable that the corrosion at the scribe line does not exceed 1.5 mm average after cyclic testing It is desirable that the paint system can the meet the assessment requirements following both ISO 12944-6 Test Regime 1 and Test regime 2. It is desirable that the paint system is tested concurrently with a reference system. The reference system shall be a paint system which is judged to have shown good performance over a minimum of five years by the Gas Transporter.
Removability	There are no requirements with regards to removability.	
Minimum Surface Preparation / Cleanliness	It is essential that the minimum surface preparation requirements do not exceed ISO 8501-1 SA 2.5.	

Type of Paint Parameter (FPS 9)	Essential Requirement	Desirable Requirement
Application Methods	The primary application method for the paint system shall be spraying. Brush application is also required to for small repairs and stripe paint system at the time of application.	
Application Conditions	It is essential that the paint system can be applied under condensing or wet conditions. The following requirements shall be demonstrated: 1. The test plates (three) are subjected to one hour of water condensation conditions as defined in ISO 6270-1 2. The test plates are immediately prepared in accordance with the manufacturers requirements. 3. The first coat of the paint system is applied in accordance with manufacturer's requirements. 4. The test plates are the returned to condensing conditions (as defined in ISO 6270-1) for the cure time of the first coat. 5. Following cure of the first coat, further coats are applied in accordance with the manufacturer's requirements to achieve the necessary DFT. Between each coat, the cure must occur under condensation conditions (as defined in ISO 6270-1). 6. Once the DFT is achieved and the final cure has occurred the test panels shall be tested (and meet the requirements) in accordance with ISO 12944-6 Section 6.2, Table 3 as detailed below. The tests shall be carried out within 24 hours after the final cure. ISO 4624, Method A or B Pull-off, Minimum pull-off value of 2.5 MPA for each measurement. • 0% adhesive failure between steel / metalised steel respectively and the first coat (unless pull-off values are at least 5 MPA). • Force built up is controlled and linear as described in ISO 4624 e.g. use of automatic hydraulic test equipment. • Minimum of 3 dollies per panel. For a DFT ≤ 250 µm (measured value without correction, calibrated on smooth surface) ISO 2409 Cross-cut test meeting a required classification from 0 to 2.	At a DFT > 250µm an ISO 2409 cross cut classification 0 is desirable both before and after age resistance testing. A minimum pull-off value of 5 MPa is desirable with 0% adhesive failure between steel / metalised steel respectively and the first coat. Where this occurs the values shall be recorded to allow comparison with other systems.