

9 Corrosion management

9.1 General

Buried or submerged pipeline sections may be affected by external corrosion arising from the formation of corrosion cells in the surrounding ground or from stray electrical earth currents and should be protected by a combination of suitable anti-corrosion coatings and effective cathodic protection. If cathodic protection will not be effective on or is not applicable to minor parts of the pipeline section, extra care should be taken to exclude coating defects on these parts.

Above-ground sections of pipelines should be protected from atmospheric corrosion by a suitable coating or paint system.

Internal corrosion may be caused by the corrosive effect of the substance being transported and may be controlled by a combination of corrosion inhibitors, internal lining, dehydration or frequent pigging.

Consideration should be given during the design and construction of the pipeline to the [requirements and recommendations](#) for coatings and cathodic protection when selecting an appropriate corrosion protection system. Whenever possible, all components of the pipeline should be factory coated before delivery to site.

Internal and external corrosion of pipeline systems should be managed to prevent unacceptable risk of pipeline failure or loss of operability from corrosion within the specified design life of the pipeline. Corrosion management should include:

- a) identification and evaluation of the potential sources of corrosion;
- b) selection of the pipeline materials;
- c) operating regime and eventual siting of the component (e.g. above or below ground);
- d) identification of the necessary corrosion mitigation;
- e) definition of the requirements for corrosion monitoring and inspection;
- f) review of the findings from corrosion monitoring and inspection;
- g) periodic modification of the requirements of corrosion management, as dictated by experience and changes in the design conditions and environment of the pipeline.

Internal and external corrosivity evaluations should be carried out to document that, for the selected material(s), corrosion can be controlled within the design intent over the design life of the pipeline.

The evaluations should be based on relevant operating and maintenance experience, corrosion monitoring, inspection and/or the results of laboratory testing.

Any corrosion allowance should take into account the type and rate of corrosion predicted for the design life of the pipeline.

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Possible internal and external corrosion of pipeline materials during transport, storage, construction, testing, preservation, commissioning and operational upset conditions should be included in the evaluations.

Coating property requirements are outlined in 8.1.5.

Where coated line pipe is to be stored in the open, a protective outer coating should be applied to within 300 mm from each end.

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9.2 Internal corrosivity evaluation

The design of pipelines should include an assessment of the corrosive nature of the substance being transported.

Possible loss or degradation of the pipeline materials should be determined for all design conditions.

The possible formation of free liquid water should be evaluated for the fluid velocities, pressures and temperatures anticipated during operations.

Components of the fluid(s) that may cause or affect internal corrosion should be identified, and their potential for corrosion determined for the predicted ranges of concentrations, pressures and temperatures.

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EXAMPLES Components which may cause or affect internal corrosion of pipelines transporting natural gases, crude oils or other produced fluids include carbon dioxide, hydrogen sulfide, elemental sulfur, mercury, oxygen, water, dissolved salts (chlorides, bicarbonates, carboxylates, etc.), solid deposits (in relation to line cleanliness), bacterial contamination, chemical additives injected during upstream activities, contamination from upstream process upsets.

The corrosion-related events that should be addressed include:

- a) general material loss and degradation;
- b) localized corrosion, such as pitting under deposits and mesa- or crevice-type attack;
- c) microbiologically induced corrosion;
- d) stress cracking;
- e) hydrogen-induced cracking or stepwise cracking;
- f) stress-oriented, hydrogen-induced cracking;
- g) erosion and erosion-corrosion;
- h) corrosion fatigue;
- i) bimetallic/galvanic couples including preferential weld corrosion.

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9.3 Internal corrosion mitigation

9.3.1 Methods

Methods for the mitigation of internal corrosion include:

- a) modification of operating conditions;
- b) the use of corrosion-resistant materials;
- c) the use of chemical additives;
- d) the application of internal coatings or linings;
- e) the use of regular mechanical cleaning;
- f) the elimination of bimetallic couples.

The compatibility of the selected mitigation with downstream operations should be considered.

9.3.2 Revision of design conditions

The fluid processing facilities upstream of the pipeline, and the procedures for operating the pipeline, may be reviewed to identify opportunities for the removal of corrosive components or conditions identified during the corrosivity evaluation.

9.3.4 Corrosion-resistant materials

The selection of a corrosion-resistant material should take into account the results of the internal and external corrosivity evaluations.

NOTE External corrosion issues may be overcome through selection of an appropriate external coating.

9.3.5 Chemical additives

Where chemical additives, i.e. corrosion inhibitors, are used to control internal corrosion, sufficient corrosion coupons or other monitoring equipment should be installed in suitable locations to monitor the effectiveness of corrosion control. Inhibitor injection equipment should be included in the design, and corrosion monitoring equipment should be designed to permit passage of pigs if required. The corrosion inhibitor selected should not cause deterioration of any components in the piping system or of the substance being conveyed. The effects of high turbulence on the performance of inhibitors should be considered.

Factors to be considered during the selection of chemical additives should include:

- a) consequences of an unplanned interruption to the addition of the additive;
- b) criticality of maximum and minimum dosage;
- c) effectiveness at water-wetted areas over the full pipeline circumference and length;

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- d) velocity variation of pipeline fluids;
- e) partitioning behaviour in multiphase systems;
- f) influence of sediments and scales;
- g) compatibility with other additives;
- h) compatibility with the pipeline component materials, in particular non-metallic materials in pipeline accessories;
- i) personnel safety in chemicals handling;
- j) environmental effects in the event of discharge;
- k) compatibility with operations downstream of the pipeline.

9.3.6 Internal coatings or linings

Coatings or linings may be applied to reduce internal corrosion provided that it is demonstrated that incomplete protection, at areas such as holidays and other defects, does not lead to unacceptable corrosion.

Where internal coatings are used to control corrosion they should be applied in accordance with the quality specifications and dry film thickness requirements established for suitable protection of the pipe material from the substance being conveyed, and the operating regime employed. Reference should be made to API RP 5L2 for recommended practice for internal coating of pipelines. **[ACTION: BSI - Cannot locate copy of this but need to confirm that covers corrosion protection and not just flow control.]**

If pipes are joined by welding such that metal is exposed, consideration should be given to internal coating of the joint area or the use of a suitable inhibitor. Account should also be taken of the internal coating in the selection of pigs to prevent coating damage during pigging.

Factors to be considered during coating or lining selection should include:

- a) internal coating of field joints;
- b) application methods;
- c) availability of repair methods;
- d) operating conditions;
- e) long-term effects of the conveyed fluid(s) on the coating/lining;
- f) resistance to chemical attack;
- g) resistance to pressure change;
- h) influence of temperature gradients over the coating;
- i) compatibility with pigging operations;
- j) physical durability.
- k) level of quality control that can be achieved

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9.3.7 Cleaning

Requirements for the periodic internal mechanical cleaning of a pipeline should be determined. Factors to be considered should include:

- a) the removal of accumulated solids and/or pockets of corrosive liquid to assist in the reduction of corrosion in these areas;
- b) enhancement of the effectiveness of chemical additives.

In choosing a mechanical cleaning device, consideration should be given to:

- the possible consequences of removing protective layers of corrosion products or chemical additives, or damage to internal coatings or linings, by mechanical cleaning;
- the possible adverse effects of contacts between pipeline materials, such as stainless steels, and the materials of mechanical cleaning devices.

9.4 External corrosion evaluation

The possibility of external corrosion occurring should be determined on the basis of pipeline operating temperatures (see 6.2.2) and the external conditions along the pipeline (see 6.3).

Pipelines should be designed and routed to take account of the possible corrosive effects of contaminated or industrial waste ground, naturally aggressive ground, parallel encroachments to a.c. power lines or cables, pylons and stray d.c. earth currents. Parallel a.c. power lines can induce a.c. voltages on pipelines. These voltages can be a shock hazard during construction and operation of the pipelines and can cause a.c. corrosion. A.C. corrosion can occur even at very low a.c. voltages, if the pipeline is cathodically protected. Computer modelling may be required to assess the risk from induced a.c. at the design stage. field measurements can be used on existing pipelines.

Anti-corrosion coatings should be selected to reflect the varying ground conditions found during a soil and resistivity survey carried out along the pipeline route.

Environments which should be considered when evaluating the possibility of external corrosion include:

- a) pipelines on land;
- b) atmosphere (marine/industrial/rural);
- c) sea water (tidal zone/shore approach);
- d) fresh or brackish water;
- e) marshes and swamps;
- f) river crossings;

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- g) dry or wet soil;
- h) inside tunnels, sleeves or caissons.

Environmental parameters that should be considered include:

- ambient temperatures;
- resistivity, salinity and oxygen content of the environment;
- bacterial activity;
- water current;
- degree of burial;
- potential in-growth of tree roots;
- potential soil pollution by hydrocarbons and other pollutants.

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The evaluation of corrosion measures should take into account the probable long-term corrosivity of the environment, rather than be solely confined to the as-installed corrosivity. Due consideration should be given to any known planned changes in the use of the land traversed by the pipeline route which may alter the environmental conditions and thus soil corrosivity, e.g. irrigation of land previously arid or of low corrosivity.

The types of external corrosion damage to be considered should include:

- general metal loss and degradation;
- localized corrosion, e.g. pitting under deposit or crevice attack;
- microbiologically induced corrosion;
- ac corrosion;
- stress-corrosion cracking, e.g. carbonate/bicarbonate attack.

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9.5 External corrosion mitigation

9.5.1 Protection requirements

All metallic pipelines should be provided with an external coating and, for buried or submerged sections, cathodic protection. The use of a corrosion allowance and a durable coating or the use of a corrosion-resistant alloy should also be considered for areas with a high probability of severe corrosion.

9.5.2 External coatings

The effectiveness in providing the required protection and the possible hazards during application and service should be considered when selecting external coatings.

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 prEN standards cannot be referenced in a British Standard. These documents may still be revised only published documents can be referred to.

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External coatings for underground applications should possess suitable mechanical and electrical properties in relation to the pipe size, environment and operating conditions. Coatings should exhibit strong adhesion and resistance to disbonding adjacent to areas of coating damage and adequate resistance to cathodic disbondment. External line pipe coatings should be factory-applied, except for field joints and other special points which would be coated on site. A factory-applied coating is preferred for all pipeline components to ensure adequate surface preparation and coating application under controlled conditions.

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Parameters to be considered when evaluating the effectiveness of external coatings should include:

- a) design/service conditions;
- b) electrical resistivity of the coating;
- c) moisture permeation and its relation to temperature;
- d) required adhesion between the coating and the pipeline base material;
- e) required resistance to shear forces between the coating and any additional coating, thermal insulation coating or environment;
- f) susceptibility to cathodic disbondment;
- g) resistance to ageing, brittleness and cracking;
- h) resistance to chemical attack;
- i) requirements for coating repair;
- j) v.
- k) minimum and maximum climatic temperatures;
- l) v.
- m) method of installation;
- n) resistance to damage during handling, shipping, storage, installation and service, i.e. physical durability.

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Deleted: <#>NOTE High resistivity coatings can focus a.c induced corrosion at minor defects and consideration of this should be made when a pipeline is routed near to a.c. power lines. [ACTION Jane Haswell – check and amend this as necessary].
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All field-welded joints, fittings and below ground components should be coated with a material that is compatible with the pipeline and the linepipe coating and the cathodic protection system. It should give a durable bond with both the factory applied coating and the steel surface. The field applied coating should meet or exceed the line-pipe coating specification and allow satisfactory application under the predicted field conditions.

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[ACTION BSI – add definition for linepipe in Definition section]

Consideration should be given to the use of a hard, abrasion-resistant, compatible external coating such as a polyurethane, FBE or two component epoxy resin system where coated pipe is to be installed by thrust boring or similar “trenchless” methods.

Where additional mechanical protection has been installed, direct contact with the surrounding soil should be maintained.

In order to avoid corrosion under any insulation, an external coating may be required between the pipeline and the insulation.

NOTE For components of irregular shape, different external coating materials to those used for linepipe, may be used (e.g. two component resin system or mastic combined with tape wrapping).

At the point where the pipeline emerges from the ground, additional protection should be applied for a minimum distance of 500 mm.

9.5.3 Cathodic protection

9.5.3.1 General

Defects in the external coating systems enable surrounding corrosive environments to come into contact with the pipeline steel and allow electric corrosion currents to flow, resulting in pipeline corrosion. A cathodic protection system should be installed to mitigate against corrosion. The pipeline section to be cathodically protected should be electrically continuous and should have adequate longitudinal conductivity.

Cathodic protection may be applied by either the sacrificial anode or impressed current anode method and should be designed and constructed in accordance with BS 7361-1, or other internationally recognised standards.

The cathodic protection system should be brought into operation as soon as possible following pipeline construction. Where delays are unavoidable, the use of temporary sacrificial anodes should be considered, particularly in areas with corrosive ground conditions. The application of cathodic protection to a pipeline may cause adverse effects on other buried metallic structures close to the protected pipeline and the procedures of BS 7361-1, or other internationally recognised standards should be followed.

Above-ground sections of pipelines should be electrically isolated from the buried sections and should not carry cathodic protection currents.

9.5.3.2 Cathodic protection potentials

Cathodic protection potentials should be maintained within the limits given in Table 5 and accompanying Notes throughout the design life of the pipeline.

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Table 1 — Cathodic protection potentials for non-alloyed and low-alloyed carbon steel pipelines

Reference electrode		Cu/CUSO4	Ag/AgCl
Water and low-resistivity soil Resistivity <100 Ω.m	Aerobic T < 40 °C	-0.850 V	-0.800 V
	Aerobic T > 60 °C	-0.950 V	-0.900 V
	Anaerobic	-0.950 V	-0.900 V
High-resistivity aerated sandy soil regions	Resistivity 100 Ω.m to 1000 Ω.m	-0.750 V	-0.700 V
	Resistivity > 1000 Ω.m	-0.650 V	-0.600 V

This table is not consistent with BS 7361

Suggest that it is therefore replaced with Table 1 of BS 7361

UK Comment: delete high resistivity aerated sandy soil regions.

ACTION – BSI will seek specialist advice on the cathodic protection section- Dave Fairhurst BP

NOTE 1 Potentials in this Table and in NOTE 4 apply to line pipe materials with (specified minimum yield strengths of 550 MPa or less). **UK**

Comment

NOTE 2 The possibility for hydrogen embrittlement *should* be evaluated for steels with (specified minimum yield strengths of 550 MPa or less). **UK**

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NOTE 3 For all steels the hardness of **seam** and girth welds and their implications for hydrogen embrittlement under cathodic protection *should* be considered.

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NOTE 4 The protection potential at the metal-medium interface *should* not be more negative than -1,150 V in case of CU/CUSO4 reference electrodes, and -1,100 V in case of Ag/AgCl reference electrodes. *However, the protection potentials given above can be used.*

NOTE 5 The required protection potentials for stainless steels vary. However, the protection potentials shown above can be used. For duplex stainless steels used for pipelines, extreme care *should* be taken to avoid voltage overprotection which could lead to hydrogen-induced failures.

NOTE 6 If the protection levels for low-resistivity soils cannot be met, then these values may be used subject to proof of the high-resistance conditions. *Where the environment cannot be characterised with confidence, then the more negative potential criteria should be adopted.* **UK Comment**

NOTE 7 Alternative protection criteria may be applied provided it is demonstrated that the same level of protection against external corrosion is provided.

NOTE 8 The values used should be more negative than those shown within the constraints of the NOTES 1 to 7.

The protection potential criteria shown in Table 5 apply to the metal-medium interface. In the absence of interference currents this potential corresponds to the instantaneous “off” potential.

9.5.3.3 Design

9.5.3.3.1 General

The cathodic protection system should be designed in accordance with BS 7361-1 or other internationally recognised standards.

The current density should be appropriate for the pipeline temperature, the selected coating, the environment to which the pipeline is exposed and other external conditions that can effect current demand. Coating degradation, coating damage during construction and from third-party activities, and metal exposure over the design life should be predicted and taken into account when determining the design current densities.

The design of the cathodic protection system should ensure the cathodically protected pipeline is electrically isolated from other, non-protected electrically earthed structures.

The pipeline system should be protected against the effects of stray currents by appropriate measures.

9.5.3.3.2 Sacrificial anodes

The design of sacrificial anode protection systems should be documented and should include reference to:

- a) pipeline design life (see 5.1);
- b) pipeline operating conditions;
- c) design criteria and environmental conditions;
- d) applicable standards;
- e) requirements for electrical isolation;
- f) calculations of the pipeline area to be protected
- g) current density requirements;
- h) performance of the anode material in the design temperature range;
- i) number and design of the anodes and their distribution;
- j) protection against the effects of possible a.c. and/or d.c. electrical interference.

9.5.3.3.3 Impressed current

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The design of impressed-current protection systems should strive for a uniform current distribution along the pipeline and should define the permanent locations for the measurement of the protection potentials (see 9.5.3.3).

Design documentation should include reference to:

- a) pipeline design life (see 5.1);
- b) pipeline operating conditions;
- c) design criteria and environmental conditions;
- d) requirements for electrical isolation;
- e) calculations of the pipeline area to be protected;
- f) current density requirements
- g) anode ground bed design and location, its current capacity and resistance and the proposed;
- h) cable installation and protection methods;
- i) measures required to mitigate the effects of possible a.c. and/or d.c. electrical interference;
- j) protection requirements prior to the commissioning of the impressed current system;
- k) applicable standards.

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9.5.3.3.4 Connections

Cathodic protection anodes and cables should be joined to the pipeline by connections with a metallurgical bond.

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The design of the connections should consider:

- a) the requirements for adequate electrical conductivity;
- b) the requirements for adequate mechanical strength and protection against potential damage during construction;
- c) the metallurgical effects of heating the line pipe during bonding.

9.5.3.4 AC Mitigation

If personnel safety is at risk from ac voltages on the pipeline or if an a.c. corrosion risk exists, unacceptably high a.c. voltages on a pipeline should be prevented by designing and installing mitigation measures. These may include:

- earthing laid parallel and connected to the pipe;
- earthing mats at valves;

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— connection of polarisation cells or their solid state equivalent across electrical isolating devices to connect the pipeline to earth and to protect the electrical isolating device;

— dead front test posts to prevent third party contact

Any earthing must have a very low resistance to remote earth and must be compatible with the cathodic protection system. Its effect on specialised pipeline surveys must also be considered.

A method of monitoring the risk of ac corrosion e.g. 1cm² coupons, may need to be installed at the test posts.

Mitigation measures should be considered at the design stage and this may be done by computer modelling the power line/ pipeline right of way. This modelling should take into account future variations in load on the power line. The retrospective installation of mitigation measures may also be considered but carries a risk of ac corrosion occurring before installation is complete and the installation of further mitigation measures may be required if the power line load increases.

9.5.3.5 Specific requirements for pipelines

Cathodic protection of long cross-country pipelines should normally be provided by impressed current.

Sacrificial anode systems should be considered for short pipelines particularly in built-up areas. Consideration should be given to the suitability of backfill material at anode locations.

Protected pipelines should, where practical, be electrically isolated from other structures, such as compressor stations and terminals by suitable in-line isolation components to confine cathodic protection to the buried pipeline system.

Isolation joints should be provided with protective devices if damage from lightning or high-voltage earth currents is possible.

The cathodic protection system should be designed and the pipework installed in such a way as to minimize adverse effects on other buried metallic structures.

Low-resistance grounding to other buried metallic structures should be avoided as far as is reasonably practical.

Pipelines should be isolated from structures such as wall entries and restraints made of reinforced concrete, earthing conductors of electrically operated equipment and from bridges.

The possibility of corrosion on the unprotected side of isolation joints should be considered when low-resistance electrolytes exist internally or externally.

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Electrical continuity should be provided across components, other than isolation joints/insulated flanges, which would otherwise increase the longitudinal resistance of the pipeline.

Spark gaps should be installed across isolation joints/insulated flanges to protect the insulation materials from breakdown due to high voltage surges. Careful note should be taken of hazardous area requirements for such equipment.

The corrosion protection requirements of pipeline sections within sleeves or casing pipes should be identified and applied.

Permanent test points for the routine monitoring and testing of the cathodic protection should be installed at the following locations:

- a) crossings with d.c. traction systems;
- b) road, rail and river crossings and large embankments;
- c) sections installed in sleeve pipes or casings;
- d) isolating couplings;
- e) where pipelines run in the vicinity of power transmission systems.;
- f) sheet piles;
- g) crossings of other major metallic structures with, or without, cathodic protection.

Additional test points should be regularly spaced along the pipeline to enable cathodic protection potential measurements to be taken for the entire pipeline route.

NOTE The required test point spacing depends on soil conditions, terrain and location but is normally limited to a maximum of 1km.

The use of doubler plates should be considered when connecting anodes and cables to pipelines.

Possible interference from extraneous current sources in the vicinity of a pipeline and the possible effect of the cathodic protection of a new pipeline on existing protection systems should be evaluated. The possible shielding by thermal insulation and pipeline protection systems (slabs, covers, etc.) should also be considered where appropriate.

9.5.3.6 Cathodic protection system commissioning

Cathodic protection systems based on impressed current should be commissioned as soon as possible following pipeline installation. The requirement for temporary protection should be determined in case of delays.

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Is "doubler plate" a well known term?

Eddie Lee 17/9/01 12:30

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Alan Edwards (Pipeline T..., 14/6/02 16:31)

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For all cathodic protection systems, the appropriate [actions](#) from the list below should be executed early in a system's life:

- a) visual inspection of anodes and pipeline coatings during installation;
- b) testing of power supplies;
- c) completion of an initial cathodic protection survey [including](#):
 - 1) testing for detrimental stray or interference currents;
 - 2) measurement of current demand;
 - 3) testing of isolating couplings;
 - 4) measurement of the cathodic protection potentials along the length of the pipeline;
- d) corrective measures if the specified protection is not achieved;
- e) provision of commissioning records.

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Eddie Lee 7/9/02 13:52
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Suggest giving a timescale within which this should be done.

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[As soon as possible after commissioning, a close interval potential survey \(CIPS\) of the entire pipeline should be undertaken to prove the system.](#)

9.6 Monitoring programmes and methods

9.6.1 Requirement for monitoring

The requirements for corrosion monitoring programmes should be established on the basis of the predicted corrosion mechanisms and corrosion rates (see 9.2 and 9.4), the selected corrosion mitigation methods (see 9.3 and 9.5) and safety and environmental factors.

The use of internal inspection tools should be considered if monitoring of internal or external corrosion or other defects is required over the full length of the pipeline. Approximate rates or trends of corrosion degradation may be determined by analysis of results of consecutive metal loss inspections.

An [internal](#) inspection of the pipeline soon after commissioning should be considered to provide a baseline for the interpretation of future surveys.

9.6.2 Monitoring internal corrosion

9.6.2.1 Selection of techniques

The selection of techniques for the monitoring of internal corrosion should consider:

- a) anticipated type of corrosion;
- b) potential for water separation, erosion, etc. (flow characteristics);
- c) anticipated corrosion rate (see 9.2);
- d) required accuracy;

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- e) available internal and external access;
- f) hindrance of passage of pigs or inspection vehicles by internal obstructions.

NOTE Possible techniques include the installation of devices such as weight loss coupons, to give an indication of the corrosion in the pipeline, or periodic analysis of the fluid to monitor its corrosivity.

9.6.2.2 Location of test points for local corrosion monitoring

Test points for corrosion monitoring should be located along the pipeline or associated facilities, where representative indications of corrosion in the pipeline are most likely to be obtained.

Corrosion probes should be fitted flush with the internal wall of the pipe where pigging may occur. The installation of additional probes in areas of high velocity flow should be considered.

9.6.3 Monitoring external pipeline condition

Accessible pipeline sections should be visually surveyed periodically to assess the conditions of the pipeline and its coating. Buried or submerged pipelines should also be inspected when exposed.

NOTE Periodic close interval potential surveys of the pipeline can be considered for this purpose when the area of possible severe attack cannot readily be visually examined.

The requirements for periodic surveys of the coating of pipelines on land should be determined taking into account the selected coating and predicted degradation, the soil type, the observed cathodic protection potentials and current demands, and known metal loss.

9.6.4 Monitoring cathodic protection

Periodic surveys should be carried out to monitor the level of cathodic protection [and the efficacy of any ac mitigation](#) using, as a minimum, the test points defined in 9.5.3.3 and 9.5.3.4.

The frequency of these surveys should be based on:

- a) the method of cathodic protection;
- b) the uniformity of soil properties along the pipeline;
- c) the coating quality;
- d) safety and environmental concerns;
- e) possible interference from electrical sources
- f) alteration in pipeline operating conditions (i.e. temperature).

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The possible hindrance from a.c. or d.c. interference during the surveys and the interpretation of the results should be considered during the selection of the survey method.

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Close interval potential surveys (CIPS) of the coating should be carried out periodically along the pipeline route as well as other specialist diagnostic techniques as necessary to provide more detailed information concerning the corrosion protection of the pipeline as part of the overall pipeline integrity management program. Such surveys are recommended when abnormal coating damage, severely corrosive conditions and/or stray current interference are suspected.

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9.7 Evaluation of monitoring and inspection results

Permanent records of the corrosion control measures should be maintained. These include: internal and external coating; cathodic protection monitoring results; details and locations of bonding to third party systems; results of surveys e.g. Pearson, CIPS etc.

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All findings of the monitoring and inspection activities should be analysed to:

- a) review the adequacy of the corrosion management;
- b) identify possible improvements;
- c) indicate a requirement for further detailed assessment of the pipeline condition;
- d) indicate the need to modify the corrosion management requirements.

9.8 Corrosion management documentation

Documentation should be prepared describing the following in accordance with the requirements for corrosion management given above (see 9.1 to 9.6):

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- a) the assessment of the corrosion threats and associated potentials for failure;
- b) the choice of materials and corrosion mitigation methods;
- c) the selection of inspection and corrosion monitoring techniques and inspection frequencies;
- d) any specific decommissioning and abandonment requirements associated with the selected corrosion management approach.