

Document Title

Details

Asset Condition Grading

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1. Purpose

The purpose of the First Gas Limited (First Gas) standards is to provide a comprehensive reference source for use by First Gas personnel and others involved in the design, construction and maintenance of natural gas networks.

The purpose of this standard is to provide a guide to determining the condition grade of First Gas distribution assets using both visual and performance based assessments. Asset condition information underpins a wide range of asset management and asset reporting activities ranging from managing asset renewal planning to compliance with information disclosure reporting requirements.

This standard is intended to help maintenance and asset management personnel apply rational, consistent and justifiable condition ratings to a range of gas distribution assets.

2. Policy

All First Gas design, construction and maintenance activities shall be undertaken in accordance with the relevant standards.

3. General

3.1 Scope

This standard applies to asset condition assessments that are to be carried out to meet the requirements of *Schedule 12A: Report of Asset Condition of the Gas Distribution Information Disclosure Determination 2012*.

This standard applies to the condition assessment of the following gas distribution asset types:

- Buried mains and service pipelines.
- Mains and service valves (excluding service riser valves).
- Special pipeline crossings.
- CP systems including anode beds, test points and transformer rectifiers.
- DRS installations.
- Telemetry installations.

3.2 Health and safety

All work on First Gas assets must be undertaken in accordance with statutory, First Gas, and industry health and safety requirements, and in a manner that ensures the continued safety of all people.

All work carried out on First Gas assets must be undertaken and completed in a manner that ensures compliance with the *Gas (Safety and Measurement) Regulations 2010* and associated New Zealand and First Gas standards.

All personnel involved in work on First Gas assets must be competent as required under the *Gas (Safety and Measurement) Regulations 2010*, and must hold the relevant Certificate of Competency as specified in *GNS0080*.

3.3 Environmental

All work on First Gas assets must be undertaken and completed in accordance with the *Resource Management Act 1991*, any Local Authority requirements and consents, and any First Gas environmental protection requirements.

In addition, all work must be carried out in a manner that avoids or minimises any adverse effect on the environment, damage to property, or disruption or nuisance to people, including the public.

4. References

Reference	Title	Page
Standards		
AS 2832.1 - 2004	Cathodic protection of metals – Part 1: Pipes and cables	8, 7
First Gas		
GNS0002	Design of district regulating stations	10
GNS0080	Personnel qualification	4
Other		
Gas (Safety and Measurement) Regulations 2010		3
Resource Management Act 1991		4
Gas Distribution Information Disclosure Determination 2012		3, 13

5. Definitions

<u>CP</u>	Cathodic protection
<u>CP system</u>	An interconnected system of CP test points, sacrificial anodes, groundbeds and TR equipment that provides CP to a discrete network of steel pipelines
<u>DRS</u>	District regulator station
<u>Special crossings</u>	An aboveground section of main pipe or service pipe and associated assets (i.e. support structures, vents, casings etc.), where the pipe and associated assets are installed for the purpose of crossing a road, railway or river etc.

6. General

Depending on the asset type, condition assessments are to be carried out by means of visual and/or performance based assessments.

Visual assessment involves determining the present state of an asset by observing visible features with or without optical aids such as binoculars, mirrors or cameras. Performance based assessments involve determining the present state of individual assets (or a group of assets - e.g. all LP mains pipelines) by comparing the current or recent performance of the asset (or group of assets) with its past performance or with a set of established performance criteria.

The following table sets out the grading system that is to be applied to all asset types. This approach provides consistency across all asset types and allows consistent comparison of the current 'base condition' of assets with their condition in future assessments.

Grade	Definition
1	End of serviceable life, immediate intervention required
2	Material deterioration but asset condition still within serviceable life parameters. Intervention likely to be required within 3 years.
3	Normal deterioration requiring regular monitoring
4	Good or as new condition
Unknown	Condition unknown or not yet assessed

Site assessments (i.e. visual condition assessments and performance based assessments where applicable) are to be carried out annually and in conjunction with scheduled preventative maintenance inspections.

The condition grading tables provided in the following sections provide descriptions that enable grading of the respective gas distribution assets into the generic grading classifications described in table above.

In some cases multiple assessment criteria have been described for a particular assessment grade (e.g. level of corrosion; coating condition etc.). In these cases its possible for the condition assessment to match criteria which correspond to different grade ratings - e.g. a coating assessment results in a grade 2 rating and a corrosion assessment results is a grade 3 rating. Where this occurs, the lowest grading is to be assigned - e.g. where the condition of a particular asset meets the criteria described for both a grade 2 rating and a grade 3 rating, the asset is to be assigned a grade 2 rating.

7. Special crossings

Condition assessments of special crossings will differ slightly depending on whether the crossing being assessed comprises a steel carrier pipe or a different type of carrier pipe (e.g. PE). Condition assessments shall be based on visual assessments carried out as part of routine preventative maintenance inspections.

The condition of steel special crossings is to be determined by carrying out assessments of the following elements of the special crossing installation:

- Pipeline coating condition.
- Severity of pipeline corrosion.
- Extent pipeline corrosion.
- Condition of pipeline supports.

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- Access to pipeline.

The condition of other special crossings is to be determined by carrying out assessments of the following elements of the special crossing installation:

- Pipeline casing condition.
- Condition of pipeline supports.
- Access to pipeline.

In order to ensure an adequate level of granularity is achieved for the special crossing condition assessments, the initial assessments shall be based on a 7 point grading system. The results of the initial assessment shall then be mapped to the final 4 point grading system. The following tables provide the criteria to be applied to determine the condition grade of the individual elements of the DRS installation:

Item	Description	Grade
Steel pipeline crossing	Severe pipeline corrosion which reduces the wall thickness of the pipeline to the extent that the present MAOP rating of the pipeline is placed at risk	1
	Moderate pipeline corrosion is present – e.g. pitting; Corrosion effects 10% or more of pipeline surface; Pipeline coating cracked or split, or coating deterioration effects 5% or more of pipeline surface; Pipeline support brackets are badly corroded or not secure; Poor or no access to pipeline	3
	Corrosion effects less than 10% of pipeline surface; Pipeline coating deterioration effects less than 5% of pipeline surface; Surface corrosion on pipeline support brackets; Fair access to pipeline	5
	No corrosion evident on pipeline or pipeline supports; No pipeline coating defects; Good access to pipeline	7

Item	Description	Grade
Other pipeline crossing	Severe corrosion or other damage to pipeline casing which compromises the integrity of the casing to the extent that the carrier pipe is at risk of being exposed to external loads or other threats (e.g. UV exposure)	1
	Moderate corrosion or other damage to pipeline casing; Pipeline support brackets are badly corroded or not secure; Poor or no access to pipeline	3
	Minor corrosion or other damage to pipeline casing; Surface corrosion on pipeline support brackets; Fair access to pipeline	5
	No corrosion or other damage to pipeline casing or pipeline casing supports; Good access to pipeline	7

The results of the initial 7 point grade assessments are to be mapped to a final 4 point grade in accordance with the following table.

Initial 7 point grading of crossing	Final 4 point grading of crossing
Grade 1 or grade 2	Grade 1
Grade 3 or grade 4	Grade 2

Initial 7 point grading of crossing	Final 4 point grading of crossing
Grade 5 or grade 6	Grade 3
Grade 7	Grade 4

8. Cathodic protection

CP systems comprise the group of CP anode, test point and transformer rectifier (TR) assets that provide corrosion protection to the discrete steel pipeline system on which the assets have been installed. In the case of the Auckland IP20 system (which is a large contiguous pipeline system) the pipeline system has been sectorised into 8 logical CP systems based on the relative geographic locations of the 8 transformer-rectifiers and groundbeds installed on the pipeline system.

The condition of a CP system is to be determined by assessing the condition of the system's anodes beds, TR unit/s (if any) and CP test points.

The condition assessment of an anode bed is to be made by comparing the present performance of the anode bed with its previous performance – e.g. when it was originally commissioned. The condition of a sacrificial (galvanic) anode bed is to be assessed by means of current output (i.e. amps) measurement. The condition of an impressed current (IC) anode bed is to be assessed by means of resistance (i.e. ohms) measurement.

The condition assessment of a transformer rectifier (TR) unit is to be made by means of a visual assessment of its physical condition, an assessment of whether or not the unit has adequate surge protection and an assessment of the unit's reliability performance.

The condition assessment of CP test points is to be based on test points that are on a preventive maintenance inspection schedule. The assessment is to include a visual condition assessment of individual test points, and an overall assessment of the adequacy of CP system test point spacing (i.e. for the CP system) against the requirements stipulated in AS2832.1.

The overall condition of individual CP systems is to be determined by calculating the average of the grade ratings assigned to the individual elements (i.e. galvanic anode bed, test point etc.) of the CP system being assessed.

Item	Description	Grade
Galvanic anode bed	<50% x commissioning output amps	1
	Approximately 50% x commissioning output amps	2
	Approximately 75% x commissioning output amps	3
	Negligible change from commissioning output amps	4

Item	Description	Grade
IC anode bed	>2 x commissioning ohms	1
	Approximately 2 x commissioning ohms	2
	Approximately 1.5 x commissioning ohms	3
	Negligible change from commissioning ohms	4

Item	Description	Grade
Test point	No/intermittent electrical connection to pipe/anode; Severe housing damage or defect requiring replacement in the short term; Severe connector damage or defect preventing proper functioning; Test point design not fit-for-purpose	1

Item	Description	Grade
	(e.g. valve box); Extremely poor access to test point and/or connections	
	Housing deterioration or damage but substantially functional; Connector deterioration or damage but substantially functional; Defective test point design but substantially functional; Poor access to test point and/or connections; CP system test point spacing inadequate with respect to AS2832.1 requirements	2
	Minor housing deterioration or damage but doesn't impact performance; Minor connector deterioration or damage but doesn't impact performance; Older test point design but presently has little effect on performance; Reasonable access to test point and/or connections	3
	Electrical connection to pipe/anode is sound and reliable; Sound modern housing and well maintained; Connectors in sound condition and well maintained; Modern housing with good design and access	4

Item	Description	Grade
Transformer rectifier	Severe corrosion or damage, TR does not work, or is safety hazard; 10 or more reliability issues experienced over past year	1
	Deterioration or damage but substantially functional and not presently a safety hazard; TR has inadequate surge protection; 5 to 10 reliability issues experienced over past year	2
	Deterioration or damage that presently has little effect on performance and not presently a safety hazard; Less than 5 reliability issues experienced over past year	3
	No damage or deterioration; TR has adequate surge protection; Nil reliability issues experienced over past year	4

9. District regulator stations

The condition of DRS assets is to be determined by assessing the following elements of the DRS installation - the assessments include visual assessments carried out as part of routine preventive maintenance inspections as well as additional compliance and obsolescence assessments:

- The condition of the enclosure – the assessment shall be based on the results of visual assessments carried out as part of routine preventive maintenance inspections and include an assessment of the condition of the enclosure as well as an assessment of the enclosure access and security.
- The condition of the equipment and pipework - assessments of the following equipment items shall be based on the results of visual assessments carried out as part of routine preventive maintenance inspections, and include separate assessments of equipment installed on the working and standby streams, and on each outlet stream:
 - Active regulator.
 - Monitor regulator.
 - OPSO.
 - Pipework.

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- Filter.
- Relief valve.
- Meter.
- Corrector.
- Regulator obsolescence - the assessment is to indicate if any of the installed regulators (i.e. active, monitor or relief valve regulators) are known to be obsolete.
- Compliance with industry code requirements - separate assessments are to be carried out for the following items:
 - Fire valves - the assessment shall be based on the results of visual assessments carried out as part of routine preventive maintenance inspections.
 - Relief capacity.
 - Relief vent location - the assessment shall be based on the results of visual assessments carried out as part of routine preventive maintenance inspections.
 - Ventilation capacity.
- Compliance with First Gas DRS design requirements – factors to be considered in the assessment are the number of filters (if any) installed, the existence of a standby stream, the use of a token bypass and the proximity of the DRS to buildings.

In order to ensure an adequate level of granularity is achieved for the DRS condition assessments, the initial assessments shall be based on a 7 point grading system; The results of the initial assessment shall then be mapped to the final 4 point grading system. The following tables provide the criteria to be applied to determine the condition grade of the individual elements of the DRS installation:

Item	Description	Grade
DRS enclosure	Severe corrosion, damage, defect or safety hazard; Access extremely poor or hazardous; Needs urgent attention	1
	Deterioration, damage or defect likely to affect function but not presently a safety hazard; Access in poor condition	3
	Functionally sound structure but appearance affected by staining, peeling paintwork etc.; Some minor problems with access or site	5
	No damage or deterioration; Good access and secure	7

Item	Description	Grade
DRS equipment and pipework	Urgent remedial action required (e.g. severe/pitting corrosion)	1
	Planned remedial action required (e.g. moderate/surface corrosion; evidence of water ingress etc.)	3
	Targeted monitoring required (e.g. blistered/flaking paint etc.)	5
	Good condition – normal monitoring only required	7

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Item	Description	Grade
Regulator obsolescence	One or more of the regulators is known to be an obsolete model	1
	The obsolescence of the regulators is unknown	4
	None of the regulators is known to be an obsolete model	7

Item	Description	Grade
Industry code compliance - fire valves	DRS has no inlet or outlet fire valves	1
	DRS has outlet fire valve only	3
	DRS has inlet fire valve only	5
	DRS has inlet and outlet fire valves	7

Item	Description	Grade
Industry code compliance - relief capacity	Relief capacity is non-compliant with AS/NZS4645	1
	Relief capacity is unknown	4
	Relief capacity is compliant with AS/NZS4645	7

Item	Description	Grade
Industry code compliance - relief vent location	Relief vent/s are not compliant with AS/NZS4645	1
	Relief vent/s compliance is unknown	4
	Relief vent/s are compliant with AS/NZS4645	7

Item	Description	Grade
First Gas standard compliance - ventilation capacity	Ventilation capacity is non-compliant with <i>GNS0002</i>	1
	Ventilation compliance is unknown	4
	Ventilation capacity is compliant with <i>GNS0002</i>	7

Item	Description	Grade
Compliance with First Gas DRS design requirements	The location and design of the DRS is not compliant with First Gas DRS design requirements	1
	Compliance with First Gas DRS design requirements is unknown	4
	The location and design of the DRS is compliant with First Gas DRS design requirements	7

The overall condition of each DRS installation is to be determined by calculating the average of the grade ratings assigned to the individual elements of the DRS, as well as considering the count of the number of individual elements of the DRS where the grade rating is less than 4. The results of the initial 7 point grade assessments are to be mapped to a final 4 point grade in accordance with the following table.

Initial 7 point grading of DRS	Final 4 point grading of DRS
DRS has more than 4 individual elements with a grade of less than 4	Grade 1
DRS has 3 or 4 individual elements with a grade of less than 4	Grade 2
Average grade of all individual DRS elements is between 4 and 6	Grade 3
Average grade of all individual DRS elements is 7	Grade 4

10. Telemetry

The condition of telemetry field equipment is to be determined by means of a visual assessment of the telemetry enclosure (i.e. cabinet) and mast (where applicable), and an assessment of the age and obsolescence of installed electrical and instrumentation (E&I) systems (i.e. router, corrector, RTU modules etc.)

The overall condition of individual telemetry installations is to be determined by calculating the average of the grade ratings assigned to the two elements (i.e. housing/mast and E&I equipment) of the installation.

Item	Description	Grade
Telemetry housing / mast condition	Severe damage, defect or safety hazard; Will require replacement in the short term	1
	Deterioration or damage but substantially functional and not presently a safety hazard	2
	Minor deterioration or damage; Does not impact performance	3
	No damage or deterioration	4

Item	Description	Grade
Electrical and instrumentation systems	N/A	1
	Most of the equipment is beyond its design life; Some of the key components are obsolete (i.e. spares and support no longer available); Performance reliability issues exist with key components	2
	Most of the installed equipment is within its design life; Performance of key components is largely reliable	3
	Most of the equipment was installed within the past 5 years; No performance reliability issues	4

11. Buried mains and service pipes

Separate assessments are to be carried out for each of the following operating pressure/material asset categories:

- IP steel mains.
- IP steel services.
- MP PE mains.
- MP steel mains.
- MP other mains.
- MP PE services.
- MP steel services.
- MP other services.
- LP PE mains.
- LP steel mains.
- LP other mains.
- LP PE services.

- LP steel services.
- LP other services.

The condition of buried mains and service pipelines is to be determined using Siebel fault data as a proxy for condition data. Siebel gas fault records for the relevant FY period are to be filtered by “Failure Mode” data to exclude all “Third Party Damage” faults, and by “Gas Asset Sub-Type” data to exclude all faults that are not related to mains pipe, service pipe or service riser assets.

The total number of faults for each of the assessment categories (i.e. mains/service, pressure and material categories) is to be normalised against the system length (i.e. as at the end of the relevant FY period) for that assessment category. The normalised fault rate (i.e. PRE per km of pipe) is then matched against fault-rate bands to determine the condition grade of the assessment category (the fault-rate bands have been developed using historical PRE rate data).

For the purposes of the condition assessment, no mains or service pipelines are to be considered to be grade 1 - i.e. all mains and service pipelines that are identified as being at the end of their serviceable life and are in need of immediate intervention are repaired or replaced on a reactive basis as part of First Gas reactive maintenance programme.

The condition of mains and service pipes in each of the assessment categories (i.e. mains/service, pressure and material categories) is to be graded according to the following table.

Item	Description	Grade
Mains / Service pipe	N/A	1
	Pipes scheduled for replacement under currently approved pipeline replacement programmes	2
	0.05 to 0.3 PRE per km mains/service pipe pa	3
	<0.05 PRE per km mains/service pipe pa	4

12. Valves

The condition of buried mains and service valves is to be graded collectively. Separate assessments are to be carried out for each of the following categories:

- IP valves.
- MP valves.
- LP valves.

Valve condition assessments are to be based on SAP PM valve defect-notification records – i.e. SAP PM holds valve defect-notifications for defects identified as part of preventative maintenance activities, and SAP PM valve defect-notifications are also raised for reactive faults for mains and service valves where the need for follow-up corrective work is identified.

As valve preventive-maintenance cycles include annual and biennial cycles (i.e. depending on the location and type of valve), the SAP PM notification data used for the valve condition assessment is to cover a two-year period.

The condition of valves is to be ascertained from the following SAP PM data:

- N1 and N2 type notifications (where they exist) are to be used to assess the condition of each valve.
- N3 type notifications are to be used to identify all valves that had preventive maintenance inspections scheduled for the review period.

- SAP PM FLOC records are to be used to identify the total population of valves.

The condition of valves in each of the assessment categories (i.e. IP valves, MP valves and LP valves) is to be graded according to the following table.

Item	Description	Grade
Buried mains and service valves	All valves that had N1 or N2 notifications raised within the review period that resulted in the replacement of the valve	1
	All valves that had N1 or N2 notifications raised within the review period for seized valve, leaking valve or broken stem/spindle defects or other malfunction that would severely limit the proper operation of the valve	2
	All valves that had N1 or N2 notifications raised within the review period but excluding valves assessed as Grade 1, Grade 2 or Unknown; All valves which have been inspected within the review period but had no N1 or N2 notifications raised and not assessed as Grade 4	3
	All new valves (i.e. installed within past 5 years) which have been inspected within the review period but had no N1 or N2 notifications raised	4
	All valves that have had N1 or N2 notifications raised within the review period for lost-valve defects; All valves that have not been inspected within the review period	Unknown

13. Reporting

Where multiple elements of an asset are assessed (e.g. anode bed, test point etc.) the overall grade rating for the site is to be determined by calculating the average of the grade ratings assigned to the individual elements.

The results of the condition assessments are to be aggregated for each of the grade rankings (i.e. Grades 1, 2, 3, 4 and Unknown), and the results for each grade presented as a percentage of the total population of the assets assessed for each of the operating pressure, asset category and asset class headings shown in Schedule 12a of the *Gas Distribution Information Disclosure Determination 2012* (refer section 14.1).

14. Attachments

14.1 Schedule 12a: Report on asset condition

14.1 Schedule 12a: Report on asset condition

		Company Name		AMP Planning Period		Asset condition at start of planning period (percentage of units by grade)							Data accuracy (1-4)	% of asset forecast to be replaced in next 5 years	
		Grade 1	Grade 2	Grade 3	Grade 4	Grade unknown									
sch ref	Units	Asset category	Asset class	Operating Pressure	Asset category	Asset class	Units	Grade 1	Grade 2	Grade 3	Grade 4	Grade unknown	Data accuracy (1-4)	% of asset forecast to be replaced in next 5 years	
7															
8		Intermediate Pressure	Main pipe	IP PE main pipe			km								
9		Intermediate Pressure	Main pipe	IP steel main pipe			km								
10		Intermediate Pressure	Main pipe	IP other main pipe			km								
11		Intermediate Pressure	Service pipe	IP PE service pipe			km								
12		Intermediate Pressure	Service pipe	IP steel service pipe			km								
13		Intermediate Pressure	Service pipe	IP other service pipe			km								
14		Intermediate Pressure	Stations	Intermediate pressure DRS			No.								
15		Intermediate Pressure	Line valve	IP line valves			No.								
16		Intermediate Pressure	Special crossings	IP crossings			No.								
17		Medium Pressure	Main pipe	MP PE main pipe			km								
18		Medium Pressure	Main pipe	MP steel main pipe			km								
19		Medium Pressure	Main pipe	MP other main pipe			km								
20		Medium Pressure	Service pipe	MP PE service pipe			km								
21		Medium Pressure	Service pipe	MP steel service pipe			km								
22		Medium Pressure	Service pipe	MP other service pipe			km								
23		Medium Pressure	Stations	Medium pressure DRS			No.								
24		Medium Pressure	Line valve	MP line valves			No.								
25		Medium Pressure	Special crossings	MP special crossings			No.								
26		Low Pressure	Main pipe	LP PE main pipe			km								
27		Low Pressure	Main pipe	LP steel main pipe			km								
28		Low Pressure	Main pipe	LP other main pipe			km								
29		Low Pressure	Service pipe	LP PE service pipe			km								
30		Low Pressure	Service pipe	LP steel service pipe			km								
31		Low Pressure	Service pipe	LP other service pipe			km								
32		Low Pressure	Line valve	LP line valves			No.								
33		Low Pressure	Special crossings	LP special crossings			No.								
34		Low Pressure	Monitoring & control systems	Remote terminal units			No.								
35		All	Cathodic protection systems	Cathodic protection			No.								
36		All													