Monitoring and Maintenance of Cathodic Protection (CP) Systems

Amendment Details

<table>
<thead>
<tr>
<th>Rev. No.</th>
<th>Date</th>
<th>Purpose</th>
<th>Prepared by</th>
<th>Reviewed by</th>
<th>Approved by</th>
</tr>
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<tr>
<td>00</td>
<td>04.09.2015</td>
<td>Draft for Comments</td>
<td>AAK/SSV</td>
<td>Sites</td>
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<tr>
<td>01</td>
<td>29.09.2015</td>
<td>Revised Draft of Comments – wider circulation</td>
<td>AAK/SSV</td>
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<tr>
<td>02</td>
<td>15.01.2016</td>
<td>Issued for Implementation</td>
<td>AAK/SSV</td>
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<td>ESR</td>
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Rev. No. | Report No.   | Issue Date |
----------|--------------|------------|
02         | CIMG-GD-4-2015-0001 | 15.01.2016 |
1.0 Preamble

1.1 With the objectives outlined in the CIMG Charter of activities Ref: CIMG-GD-1-2015-0001, it has been sought to document the guidelines and best practices with regard to Monitoring & Maintenance of Cathodic Protection that shall be adopted all across GAIL installations for a uniform implementation across the company.

2.0 Objective

2.1 To ensure all the buried pipelines in GAIL are cathodicaly protected with regard to national / international codes & standards and best practices for a sustained safe operation from external corrosion threat point of view.

2.2 To standardize the various monitoring and maintenance activities pertaining to Cathodic Protection, with regard to regulations & best practices, minimum time intervals and uniform records thereof.

3.0 Scope

3.1 This guidance document shall be applicable to all the buried pipeline assets of GAIL and shall be adhered to by all the concerned pipeline maintenance personnel at various maintenance bases in their regular monitoring & maintenance programs.

4.0 Approach & Methodology

4.1 All the activities related to the Monitoring and Maintenance of Cathodic Protection have been identified based the PNGRB Guideline, OISD and other relevant Codes & Standards of CP System and is tabulated at Appendix I and details of each activity elaborated in Appendix II. The standardized formats for record of different activities are given in Appendix III.
4.2 This Guidance Document has been prepared based on MOPNG Guidelines, Codes, Standards Industry current best practices and Company Policy and issued (hosted in the Intranet) for major activities / areas. The same will be regularly reviewed and updated as necessary. All in-house and out-sourced services wherever applicable shall be conducted based on these Guidance Documents.

4.3 All CP reports, site queries, management instructions, external requirements shall be logged at CIMG as per the guidelines mentioned in CIMG Charter.

4.4 List of nodal officers from various RIMG / maintenance groups shall be drawn up for close interaction with CIMG and other external agencies related to integrity matters. Members of site RIMG / maintenance groups shall also be coopted in the review of survey data wherever necessary.

4.5 Various pipeline maintenance bases shall carry out the monitoring and maintenance of the different components of CP system applicable to their pipeline network in accordance with the broad guidelines, frequency and format of records as indicated in Appendices I, II & III.

4.6 A portal in GAIL Intranet (DEPARTMENT => OPERATION & MAINTENANCE => CATHODIC PROTECTION SYSTEM) has also been established for the site personnel to upload the records in specified formats and at specified time intervals. These records shall be utilized for various analytical purposes including CPIMS.

4.7 The field data shall be reviewed by the concerned pipeline maintenance base personnel and RIMG to identify anomalies and exceptions and take remediation required if any.

4.8 CIMG will collate all the data pertaining to particular network / regions and review the data where required with further inputs from sites. Any observation / recommendation will be provided to the sites.
4.9 Any issue requiring clarification form CIMG or SME may be referred by sites to CIMG and the same will be examined for necessary recommendation to sites within the shortest possible time.

4.10 CIMG will organize an Integrity Meet twice in a year to deliberate various site issues and corporate initiatives.

4.11 Action for periodical training and workshops for RIMG & members of different pipeline maintenance bases shall be coordinated by CIMG, including NACE CP certification.

4.12 Requisite technical literature and software tools will be acquired and disseminated on a continual basis.

5.0 Deliverables

5.1 Sites: Data upload in specified formats (Appendix III)

5.2 CIMG: Review Reports for each network / region on a quarterly basis and also, clarifications / recommendation on any specific query as & when required.
## Appendix – I

### Regular Monitoring & Maintenance Activities:

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Monitoring &amp; Maintenance activities</th>
<th>Reference / Standards</th>
<th>Clause Ref No</th>
<th>Frequency as per reference</th>
<th>Frequency Suggested</th>
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<tbody>
<tr>
<td>1</td>
<td>Verification of Power Availability for CP Equipment (CPPSM / CPTR) during the month in % terms</td>
<td>Letter from MoPNG D.O.No. R 29011/27/2014-OR-I Dt 02.09.2014</td>
<td></td>
<td></td>
<td>Monthly</td>
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<tr>
<td>2</td>
<td>PSP at feeding Points &amp; CP Unit Parameters. (Monthly for Unit Connected to SCADA Otherwise Fortnightly)</td>
<td>PNGRB OISD 226</td>
<td>1E 12.3.5</td>
<td>Monthly / Fortnightly</td>
<td>Monthly / Fortnightly</td>
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<tr>
<td></td>
<td>Inspection of CP Unit</td>
<td>PNGRB OISD 226</td>
<td>1E 12.3.5</td>
<td>Once in a Six / Two Month</td>
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<tr>
<td>3</td>
<td>Current Density Calculation</td>
<td>OISD SOP for Pipeline</td>
<td>7</td>
<td>Yearly</td>
<td>Monthly</td>
</tr>
<tr>
<td>4</td>
<td>Measurement of ON PSP &amp; OFF PSP</td>
<td>PNGRB OISD 226 BIS 8062</td>
<td>1E 12.3.5 11.1.2</td>
<td>Quarterly / Yearly</td>
<td>Quarterly / Once in three Qtr</td>
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<tr>
<td></td>
<td>Measurement of ON PSP &amp; OFF PSP – Non Piggable Pipeline</td>
<td>OISD 233</td>
<td>2.4.7</td>
<td>Quarterly / Half Yearly</td>
<td>Quarterly / Half Yearly</td>
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<tr>
<td>5</td>
<td>Monitoring of Polarisation Coupon</td>
<td>OISD 188 BIS 8062</td>
<td>5.10.6 11.1.1.e</td>
<td>Quarterly</td>
<td>Quarterly</td>
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<td>6</td>
<td>Current consumption data should be taken at the test stations where current measurement facility exists</td>
<td>PNGRB OISD 226 BIS 8062</td>
<td>1E 12.3.5 11.1.2</td>
<td>Yearly</td>
<td>Quarterly</td>
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<td>7</td>
<td>Protective devices (Polarisation Cell)</td>
<td>PNGRB OISD 226</td>
<td>1E 12.3.5</td>
<td>Quarterly</td>
<td>Quarterly</td>
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<td>8</td>
<td>Protective devices (Surge Diverter,)</td>
<td>PNGRB OISD 226</td>
<td>1E 12.3.5</td>
<td>Quarterly</td>
<td>Quarterly</td>
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<tr>
<td>9</td>
<td>Resistance of Galvanic Anodes installed for grounding of AC Interference</td>
<td>PNGRB IMS</td>
<td>5.2</td>
<td>Yearly</td>
<td>Yearly</td>
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Revision No. | Report No. | Issue Date |
-------------|------------|------------|
02           | CIMG-GD-4-2015-0001 | 15.01.2016 |
Title: Monitoring & Maintenance of Cathodic Protection (CP) Systems

Type: Guidance Documents

Reference No.: CIMG-GD-4-2015-0001

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<td>10</td>
<td>Integrity Test of Isolating Joints</td>
<td>PNGRB OISD 226</td>
<td>1E 12.3.6</td>
<td>Yearly</td>
<td>Yearly</td>
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<td>11</td>
<td>Integrity of Casing &amp; Carrier Pipe.</td>
<td>OISD SOP BIS 8062</td>
<td>7 11.4.3</td>
<td>Yearly</td>
<td>Yearly</td>
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<td>12</td>
<td>Condition Monitoring of DC Interference bonds.</td>
<td>PNGRB OISD 226</td>
<td>1E 12.3.5</td>
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<td>13</td>
<td>Monitoring &amp; Maintenance of Anode Ground Bed</td>
<td>PNGRB IMS</td>
<td>5.2</td>
<td>Yearly</td>
<td>Half Yearly</td>
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<tr>
<td>14</td>
<td>Monitoring &amp; Maintenance of External ER Probe</td>
<td>OISD 188</td>
<td>5.10.6</td>
<td>Quarterly</td>
<td>Half Yearly</td>
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CP Survey for Piggable Pipeline:

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<th>Types of Survey</th>
<th>Reference / Standards</th>
<th>Clause Ref No</th>
<th>Frequency as per reference</th>
<th>Frequency Suggested</th>
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<tr>
<td>1</td>
<td>CIPL Survey</td>
<td>PNGRB OISD 226</td>
<td>1E 12.3.6 9.2.1</td>
<td>Once in five years</td>
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<td>2</td>
<td>CAT / DCVG Survey</td>
<td>PNGRB OISD 226</td>
<td>1E 12.3.6 9.2.1</td>
<td>Once in five years</td>
<td></td>
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<tr>
<td>3</td>
<td>Coating Conductance Survey</td>
<td>BIS 8062</td>
<td>11.1.1.a</td>
<td>Frequency Not mentioned,</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>However as per revised O&amp;M Policy frequency is once in a five year.</td>
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<tr>
<td>4</td>
<td>AC / DC Interference &amp; Mitigation</td>
<td>PNGRB OISD 226</td>
<td>1F 12.3.5.D &amp; 11.1.2.d 862.116</td>
<td>Not stipulated by any existing standards. However as per revised O&amp;M Policy frequency is once in a five year.</td>
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<tr>
<td>5</td>
<td>Corrosion Survey (Soil Resistivity &amp; Soil Chemical Analysis)</td>
<td>OISD 188</td>
<td>5.15</td>
<td>Once in 10 Year</td>
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### CP Survey for Non-Piggable pipeline:

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<th>SI No</th>
<th>Types of Survey</th>
<th>Reference / Standards</th>
<th>Clause Ref No</th>
<th>Frequency as per reference</th>
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<tr>
<td>1</td>
<td>CIPL Survey</td>
<td>OISD 233</td>
<td>5.4.3</td>
<td>Notwithstanding above, 1st CPL survey of cathodically protected pipeline shall be carried out immediately, and 2nd CPL survey shall be carried out after 3 years. Subsequent survey shall be carried out based on assessment of in house expert or SME, the frequency of survey shall not exceed 5 years.</td>
</tr>
<tr>
<td>2</td>
<td>CAT / DCVG Survey</td>
<td>OISD 226</td>
<td>5.4.4</td>
<td>Direct Current Voltage gradient (DCVG) Survey shall be carried at probable coating defect location identified by CPL survey</td>
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<td>3</td>
<td>AC / DC Interference &amp; Mitigation</td>
<td>PNGRB OISD 226 BIS 8062 ASME B 31.8</td>
<td>1F 12.3.5.D 11.1.2.d 862.116</td>
<td>Not stipulated by any existing standards. However as per revised O&amp;M Policy frequency is once in a five year.</td>
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<tr>
<td>4</td>
<td>Corrosion Survey (Soil Resistivity &amp; Soil Chemical Analysis)</td>
<td>OISD 188</td>
<td>5.15</td>
<td>Once in 10 Year</td>
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Appendix – II

1. **POWER AVAILABILITY OF CP EQUIPMENT (CPTR/ CPPSM /CPVSM):**

   As per Letter of MoPNG D.O.No. R 29011/27/2014-OR-I Dt 02.09.2015, “A system of recording percentage availability of power must be adopted at all CP locations”. Accordingly all sites are required to adopt a system to establish the power availability to CP System in percentage terms which is not connected to SCADA. The CP Unit connected to SCADA; we can get the history of CP Unit parameter from SCADA that will confirm the availability of the CP Unit. If Power availability to the CP Unit of any station comes below 95%, appropriate action is required to ensure the power availability to CP Unit is more than 95%.

   A column is incorporated in the below mentioned Monitoring of CPPSM / CPTRU / CPVSM format.

   Format No. - CIMG-FM-4-2015-001 - Rev – 01
   Title - Monitoring & Maintenance of CPPSM / CPTRU / CPVSM
   Suggested frequency - Monthly

2. **MONITORING AND MAINTENANCE OF CPTR / CPPSM / CPVSM:**

   Pipeline wise list of CP Unit shall be maintained at each O&M Base. As per PNGRB Guideline, soil potential and TR unit data shall be recorded at least once per month at all CP feed points and as per OISD frequency is Fortnightly.

   It is recommended to carry out Monitoring and Maintenance of CPTR / CPPSM / CPVSM connected to SCADA or any other types of remote monitoring, should be Monthly and for others i.e. CP unit not connected to any types of remote monitoring system should be carried out on fortnightly basis. During Monitoring of CP Unit, Target PSP in the CP Unit is to be set to maintain the desired PSP on the pipeline in the field.

   A suggested format for Monitoring of CPPSM / CPTRU / CPVSM is mentioned below.

   Format No. - CIMG-FM-4-2015-001 - Rev – 01
   Title – Monitoring & Maintenance of CPPSM / CPTRU / CPVSM
   Suggested frequency – Monthly / Fortnightly
3. **CURRENT DENSITY CALCULATION:**

As per OISD SOP for Integrity Assessment of Cross Country Petroleum & Natural Gas Pipelines, current density of the pipeline should be calculated on monthly basis.

The current density should be calculated based on the monthly current consumption of the CP Unit for the pipeline section

Pipeline section, wherever independent CP unit is not installed, current for these pipeline should be measured from the Cathode Junction Box / Bonding location.

A suggested format for Current Density Calculation is as under:

Format No. - CIMG-FM-4-2015-002 - Rev – 01
Title – Current Density Calculation.

4. **MEASUREMENT OF PIPE TO SOIL POTENTIAL (PSP) (ON & ON / OFF):**

Pipeline wise master list of Test Station with type shall be maintained at O&M Base. As per PNGRB Guideline, Pipe to Soil (Electrolyte) Potential (PSP) shall be recorded at least once in a Quarter (Once in Three Month). ON PSP should be recorded for three quarter and ON & OFF PSP should be recorded in one quarter.

Criteria for Cathodic Protection – Polarised (Instant OFF) Pipe to Soil Potential (PSP) of the cathodically protected underground structure / Pipeline shall be maintained between (-) 0.850 to (-) 1.200 V. OFF PSP less negative than (-) 0.850V is considered as Under Protection and may lead to the external corrosion and OFF PSP more negative than (-) 1.200 V is considered as Over Protection and may lead to coating disbondment. However, for SRB & Anaerobic regions, the minimum polarized potential shall be maintained more negative than (-) 0.95 V.

Frequency of Monitoring of Pipe to Soil Potential (PSP) has been considered in line with the recommendation of corrosion audit to consider the seasonal variation of the soil for ON/OFF PSP Monitoring. It is suggested to change the PSP ON and ON/OFF sequence from THREE QUARTER ON & ONE QUARTER ON/OFF to TWO QUARTER ON & ONE QUARTER ON/OFF.
ON PSP recorded during ON & OFF PSP Monitoring, should be maintained till next ON & OFF PSP Monitoring survey to compare the current ON PSP reading corresponding with previous ON/OFF PSP readings to ensure that the pipeline PSP is within the protection criteria.

A suggested format for PSP monitoring is mentioned below.

Format No. - CIMG-FM-4-2015-003 - Rev – 01  
Title – Monitoring of Pipe to Soil Potential.  
Suggested frequency – Quarterly (Two Qtr ON and one Qtr ON/OFF)

5. **MONITORING OF POLARISATION COUPON:**

Polarisation coupons connected to the CP system on the structure, thus simulating a similar-sized bare area of the structure’s surface, such as at a holiday in the coating. The polarisation coupon may be disconnected from the circuit during periodic testing and it’s instant-disconnect potential measured. These measurements represent the polarized potentials of the structure in the vicinity of the polarisation coupon.

Pipeline wise list of Polarisation coupon shall be maintained at O&M Base.

ON / OFF Potential of the Polarisation Coupon should be recorded during Quarterly PSP Monitoring and summarised as per suggested format. During monitoring, if OFF PSP of the polarisation coupon observed is less negative than (-) 0.850 Volt, current of the nearest CP Unit should be increased and after Min 24 Hrs. one more set of polarisation coupon reading should be recorded for the validation.

Pipeline where polarisation coupons are not installed, efforts should be made to install the polarisation coupon as per the NACE SP 0104-2014 guidelines.

The size of the CP coupon should simulate the largest anticipated coating holiday size on the structure in the area under investigation. For pipeline where 3LPE coating are used, size of the holiday/bare surface in the coupon should be 1 Sq cm (1 cm x 1 cm) and for the pipeline having coaltar coating holiday/bare surface in the coupon should 100 Sq cm (10 cm x 10 cm).

CP coupon should be installed such that it receives the same current density as the structure in that area and does not shield cathodic current from the structure. For a flat
coupon with one coated surface, the bare/holiday surface should face away from the structure.

The placement of a coupon should be dictated by the need to gain information about the polarization of a structure. The information about current density, direction of current flow (to or from the structure), the specific IR drop associated with the coupon location, and the corrosiveness of the environment can provide additional information about the level of corrosion protection that ordinarily cannot be provided by other methods. Coupons should be placed in each environment to help identify the effectiveness of the impressed current system in that specific environment.

Coupon should be installed at minimum following locations.

- AT CP Stations
- Midpoint of two CP Station / Far end of pipeline from CP Station.
- Foreign pipeline crossings OR Foreign CP interference exists.
- Stray current sources include DC traction systems, foreign rectifiers, telluric earth currents, and high-voltage direct-current (HVDC) electrodes
- AC Interference area
- The pipeline is protected by sacrificial anode.
- Long-line or telluric currents that result in IR-drop errors that interruption cannot eliminate.
- The area where known CP problem exists.
- In areas in which multiple impressed-current sources influence the structure-to-electrolyte potential, interruption of all current sources is not always practical.
- Top of a dry, rocky hill areas
- Low-lying wet / marshy area
- Suction and discharge of compressor stations

A typical sketch is mentioned below:
Format for Monitoring of Polarisation Coupon is merged with Monitoring of Pipe to Soil Potential

Format No. - CIMG-FM-4-2015-003 - Rev – 01
Suggested frequency – Quarterly

6. **CURRENT MEASUREMENT AT “B” TYPE TEST STATIONS:**

Pipeline wise list of current measurement test station (i.e. “B” Type) shall be maintained at O&M Base. As per statutory guidelines, current consumption data should be taken at the test stations where current measurement facility exists at least once in a year. However this can be recorded during every PSP monitoring.
Format for recording current at “B” type test station is merged with Monitoring of Pipe to Soil Potential.

Format No. - CIMG-FM-4-2015-003 - Rev – 01
Suggested frequency – Quarterly

7. MONITORING OF POLARISATION CELL:

Pipeline wise list of Polarization cells shall be maintained at O&M Base. As per PNGRB & OISD, condition of the protective device should be checked quarterly. During PSP monitoring condition of the Polarization cell should be recorded. For Electrolytic type Polarization cell, color of the electrolyte is important, and for Solid State Polarisation Cell (SSPC), condition of the SSPC i.e. Damage or OK to be checked.

A suggested format for Monitoring of Polarisation Cell is merged with Monitoring of Pipe to Soil Potential

Format No. – CIMG-FM-4-2015-003 – Rev – 01
Suggested frequency – Quarterly

8. MONITORING OF SURGE DIVERTER:

Pipeline wise list of surge diverters shall be maintained at O&M Base. As per PNGRB & OISD, condition of the protective device should be checked quarterly. During PSP monitoring, physical condition of the surge diverter i.e. Damage or OK.

A suggested format for Monitoring of Surge Diverter is merged with Monitoring of Pipe to Soil Potential

Format No. - CIMG-FM-4-2015-003 - Rev – 01
Suggested frequency – Quarterly

9. MONITORING OF RESISTANCE OF GALVANIC ANODES INSTALLED FOR GROUNDING OF AC INTERFERENCE AT HT LINE CROSSINGS / PARALLEL RUNNING:

Pipeline wise list of Galvanic Anodes / GI Earthing provided for grounding of AC Interference mitigations shall be maintained at O&M Base.
As per the PNGRB IMS documents, Grounding resistance of Galvanic Anodes / Solid Earthing provided for grounding of AC Interference Voltage should be recorded at least once in year. Three Pin Wenner Method should be used for the recording grounding resistance. Value of the grounding resistance should be maintained as per AC Interference survey & Mitigation recommendations. However if there is no recommendation for Grounding resistance than it should be maintained below 3 Ohms.

A suggested format for recording grounding resistance is merged with Monitoring of Pipe to Soil Potential.

Format No. - CIMG-FM-4-2015-3- Rev – 01
Suggested frequency – Yearly

10. MONITORING OF ISOLATING JOINTS / ISOLATING FLANGE (IJ/IF):

Pipeline wise list of the Isolating Joints (IJ) shall be maintained at O&M Base.

During ON & OFF PSP Monitoring, ON & OFF PSP should recorded of the both the section of the pipeline at the Isolating Joints / Isolating Flange. (IJ/IF) i.e. Protected Side and Un-Protected Side. O&M Base should summarise the ON/OFF PSP of the Protected & Un-Protected side of IJ from the ON/OFF PSP Monitoring report.

As per the ON/OFF PSP monitoring report, if difference between ON &OFF of Un-Protected side is not significant and also the difference in OFF PSP of protected & up-protected section is more that 10mV, then integrity/condition of the IJ/IF is satisfactory.

Format for Integrity Test of Isolating Joints is merged with Monitoring of Pipe to Soil Potential.

Format No. - CIMG-FM-4-2015-003 - Rev – 01
Suggested frequency – Yearly (along with ON/OFF PSP monitoring)

11. INTEGRITY OF CASING & CARRIER PIPE (SHORTING BETWEEN CASING & CARRIER PIPE):

Pipeline wise list of Casing shall be maintained at O&M Base. During ON & OFF PSP Monitoring, ON & OFF PSP of both Carrier pipe & Casing pipes shall be recorded.

If the difference between ON & OFF PSP of the casing pipe is less than 50 mV, this indicates that the integrity of the casing & carrier is satisfactory. And if the different between ON & OFF PSP of the Casing pipe is more than 50mV, its indicates that there is
some contact between casing & carrier pipe. In this case if difference between OFF PSP of the Casing & Carrier pipe is more than 5 mV it indicates that casing pipe & carrier pipe is electrolytic short, and if difference is less than 5mV than casing pipe & carrier pipe is electrically shorted.

O&M Base should review and record the Integrity of Casing & Carrier Pipes based on the ON / OFF PSP Monitoring

Format for Integrity of Casing & Carrier Pipe is merged with Monitoring of Pipe to Soil Potential.

Format No. - CIMG-FM-4-2015-003 - Rev – 01
Suggested frequency – Yearly (along with ON/OFF PSP monitoring)

12. MONITORING OF DC INTERFERENCE BONDS:

Pipeline wise list of the probable DC Interference source like Foreign Pipeline crossing, DC Traction etc. shall be maintained at O&M Base.

At the foreign pipeline crossing and other probable DC Interference locations provision should be exist for the interference survey and provision for the bonding, pipeline should be bonded with resistance if interference is found more than the permissible limit as per code & standard. Wherever above provision does not exist particularly at foreign pipeline crossing, provision shall be made and interference survey must be conducted & mitigation measures should be taken accordingly.

A suggested format for monitoring of DC Interference bond location is as under:

Format No. - CIMG-FM-4-2015-004 - Rev – 01
Title – Monitoring of DC Interference bond
Suggested frequency – Quarterly

13. MONITORING OF ANODE GROUND BED:

Pipeline wise list of the Anode Ground beds shall be maintained at O&M Base

As per the PNGRB IMS documents, Condition monitoring of Anode Ground Bed (AGB) should be carried out once in a year. During Monitoring of the AGB, current in each anode may be equally distributed and total anode ground bed resistance should be maintained as per design, however it should not be more than 3 Ohms (in exceptional cases). Three Pin
Wenner Method should be used for the recording of the individual anode resistance and total ground bed resistance. If total AGB Resistance is above permissible limit necessary maintenance should be carried out to reduce the total AGB Ground Resistance.

A suggested format for Monitoring of AGB is as under

Format No. - CIMG-FM-4-2015-005 - Rev – 01
Title – Monitoring of AGB
Suggested frequency – Half Yearly

14. MONITORING OF EXTERNAL ER PROBE:

Pipeline wise list of External ER Probe shall be maintained at O&M Base
As per OISD 188 Clause 5.10.6., “External coupons / Probes at critical location should be used to evaluate the effectiveness of mitigation program”.

External ER Probes are considered to monitor the corrosiveness of the Electrolyte (Soil). Requirement of External ER probe is not stipulated by any existing standards/codes and requirement of Polarisation Coupon has been mentioned in the various codes.

External ER probe has been installed in some of the pipeline networks and the same may be monitored once in a six month and historical data should be maintained.

A suggested format for Monitoring & Maintenance of External ER Probe is as under:
Title – Monitoring of External ER Probe
Suggested frequency – Half Yearly
Appendix – III

All formats are uploaded in the portal in GAIL Intranet and can be downloaded
DEPARTMENT => OPERATION & MAINTENANCE => CATHODIC PROTECTION
SYSTEM.