

# ISO 15589-1:2015-03 (E)

## Petroleum, petrochemical and natural gas industries - Cathodic protection of pipeline systems - Part 1: On-land pipelines

---

Contents		Page
8	Basic requirements for cathodic protection design .....	18
8.1	General .....	18
8.2	Basic information for cathodic protection design .....	19
8.3	Contents of cathodic protection design report .....	20
8.4	Cathodic protection current demand .....	20
8.4.1	Calculation of the theoretical total current demand .....	20
8.4.2	Current demand based on coating breakdown factors .....	21
8.4.3	Current demand based on current density values for coated pipelines .....	22
8.5	Cathodic protection equipment .....	23
8.5.1	Cathodic protection cables .....	23
8.5.2	Cable connection .....	24
8.5.3	Precautions to respect for distribution boxes and test stations .....	25
8.6	Temporary protection .....	26
8.7	Specific case of existing pipelines .....	26
8.7.1	General .....	26
8.7.2	Parallel pipelines .....	27
8.7.3	Parallelism or crossing with a.c. power systems .....	27
8.8	Trenchless installation methods .....	27
9	Impressed current stations .....	28
9.1	General .....	28
9.2	Power supply .....	28
9.3	Groundbeds .....	29
9.3.1	General .....	29
9.3.2	Deep-well groundbeds .....	29
9.3.3	Shallow groundbeds .....	30
9.3.4	Impressed-current anodes and conductive backfill .....	31
9.4	Output control .....	32
9.4.1	General .....	32
9.4.2	Current distribution for multiple pipelines .....	32
9.4.3	Potential control .....	33
10	Galvanic anode systems .....	33
10.1	General .....	33
10.2	Design requirements .....	34
10.3	Zinc anodes .....	34
10.4	Magnesium anodes .....	35
10.5	Design of the anode system .....	37
10.6	Anode backfill .....	38
10.7	Cables and cable connections .....	39
10.8	Anode installation .....	39
11	Monitoring facilities .....	39
11.1	General .....	39
11.2	Locations of test stations .....	39
11.3	Description of test stations .....	40
11.4	Use of probes and coupons .....	40
11.5	Bonding to other pipelines .....	41
11.6	Test facilities at cased crossings .....	41
11.7	Test facilities at isolating joints .....	41
11.8	Line current monitoring test stations .....	41

<b>11.9</b>	<b>Drain-point test facilities .....</b>	<b>41</b>
<b>11.10</b>	<b>Miscellaneous monitoring facilities .....</b>	<b>41</b>
<b>12</b>	<b>Commissioning .....</b>	<b>41</b>
<b>12.1</b>	<b>General .....</b>	<b>41</b>
<b>12.2</b>	<b>Preliminary tests .....</b>	<b>42</b>
<b>12.3</b>	<b>Start up .....</b>	<b>43</b>
<b>12.3.1</b>	<b>Impressed current stations .....</b>	<b>43</b>
<b>12.3.2</b>	<b>Galvanic anodes .....</b>	<b>43</b>
<b>12.3.3</b>	<b>Drainage stations .....</b>	<b>44</b>
<b>12.3.4</b>	<b>Test stations .....</b>	<b>44</b>
<b>12.4</b>	<b>Verification of cathodic protection effectiveness .....</b>	<b>44</b>
<b>12.4.1</b>	<b>General .....</b>	<b>44</b>
<b>12.4.2</b>	<b>Measurements of d.c. potential and a.c. voltage .....</b>	<b>44</b>
<b>12.4.3</b>	<b>Current measurements .....</b>	<b>45</b>
<b>12.4.4</b>	<b>Adjustments .....</b>	<b>45</b>
<b>12.5</b>	<b>Commissioning report .....</b>	<b>45</b>
<b>12.5.1</b>	<b>Installation documentation .....</b>	<b>45</b>
<b>12.5.2</b>	<b>Commissioning measurements .....</b>	<b>45</b>
<b>13</b>	<b>Monitoring, inspection, and maintenance .....</b>	<b>46</b>
<b>13.1</b>	<b>General .....</b>	<b>46</b>
<b>13.2</b>	<b>Implementation of inspection .....</b>	<b>47</b>
<b>13.3</b>	<b>Periodicities of inspection .....</b>	<b>47</b>
<b>13.4</b>	<b>Remote monitoring .....</b>	<b>50</b>
<b>13.5</b>	<b>Specialized surveys .....</b>	<b>50</b>
<b>13.6</b>	<b>Monitoring plan .....</b>	<b>50</b>
<b>13.7</b>	<b>Monitoring equipment .....</b>	<b>50</b>
<b>13.8</b>	<b>Maintenance and repair .....</b>	<b>51</b>
<b>14</b>	<b>Documentation .....</b>	<b>51</b>
<b>14.1</b>	<b>Design documentation .....</b>	<b>51</b>
<b>14.1.1</b>	<b>General .....</b>	<b>51</b>
<b>14.1.2</b>	<b>Construction details and installation procedures .....</b>	<b>52</b>
<b>14.2</b>	<b>Commissioning documentation .....</b>	<b>53</b>
<b>14.3</b>	<b>Operating and maintenance documentation .....</b>	<b>53</b>
<b>14.3.1</b>	<b>General .....</b>	<b>53</b>
<b>14.3.2</b>	<b>Inspection and monitoring data .....</b>	<b>54</b>
<b>14.3.3</b>	<b>Maintenance records .....</b>	<b>54</b>
<b>Annex A (normative) Cathodic protection measurements .....</b>	<b>55</b>	
<b>Annex B (normative) Electrical interference .....</b>	<b>63</b>	
<b>Annex C (informative) Fault detection of impressed-current systems during operation .....</b>	<b>67</b>	
<b>Annex D (informative) Description of specialized surveys .....</b>	<b>69</b>	
<b>Annex E (informative) Attenuation of protection .....</b>	<b>76</b>	
<b>Annex F (informative) Electrical tests for isolating joints before installation .....</b>	<b>79</b>	
<b>Bibliography .....</b>	<b>80</b>	