

# DIN EN ISO 15589-2:2024-10 (E)

## Oil and gas industries including lower carbon energy - Cathodic protection of pipeline transportation systems - Part 2: Offshore pipelines (ISO 15589-2:2024)

---

<b>Contents</b>		<b>Page</b>
European foreword .....		4
Foreword .....		5
Introduction .....		7
<b>1</b>	<b>Scope .....</b>	<b>8</b>
<b>2</b>	<b>Normative references .....</b>	<b>8</b>
<b>3</b>	<b>Terms and definitions .....</b>	<b>9</b>
<b>4</b>	<b>Symbols and abbreviated terms .....</b>	<b>11</b>
<b>4.1</b>	<b>Symbols .....</b>	<b>11</b>
<b>4.2</b>	<b>Abbreviated terms .....</b>	<b>12</b>
<b>5</b>	<b>General .....</b>	<b>13</b>
<b>5.1</b>	<b>Competence assurance .....</b>	<b>13</b>
<b>5.2</b>	<b>Conformity .....</b>	<b>13</b>
<b>6</b>	<b>Cathodic protection system requirements .....</b>	<b>13</b>
<b>6.1</b>	<b>General .....</b>	<b>13</b>
<b>6.2</b>	<b>Selection of CP systems .....</b>	<b>14</b>
<b>6.2.1</b>	<b>General .....</b>	<b>14</b>
<b>6.2.2</b>	<b>System selection considerations .....</b>	<b>14</b>
<b>6.3</b>	<b>Isolating joints .....</b>	<b>15</b>
<b>7</b>	<b>Design parameters .....</b>	<b>16</b>
<b>7.1</b>	<b>General .....</b>	<b>16</b>
<b>7.2</b>	<b>Protection potentials .....</b>	<b>17</b>
<b>7.2.1</b>	<b>Potential criteria .....</b>	<b>17</b>
<b>7.2.2</b>	<b>HISC evaluation .....</b>	<b>18</b>
<b>7.2.3</b>	<b>Thermally sprayed aluminium .....</b>	<b>19</b>
<b>7.3</b>	<b>CP system design life .....</b>	<b>19</b>
<b>7.4</b>	<b>Design current densities for bare steel .....</b>	<b>19</b>
<b>7.4.1</b>	<b>General .....</b>	<b>19</b>
<b>7.4.2</b>	<b>Splash zone .....</b>	<b>21</b>
<b>7.4.3</b>	<b>Buried pipelines .....</b>	<b>21</b>
<b>7.4.4</b>	<b>Thermally sprayed aluminium coated pipelines .....</b>	<b>21</b>
<b>7.4.5</b>	<b>Elevated temperatures .....</b>	<b>21</b>
<b>7.4.6</b>	<b>Current drains .....</b>	<b>21</b>
<b>7.5</b>	<b>Coating breakdown factors .....</b>	<b>22</b>
<b>8</b>	<b>Galvanic anodes .....</b>	<b>24</b>
<b>8.1</b>	<b>Design of system .....</b>	<b>24</b>
<b>8.2</b>	<b>Selection of anode material .....</b>	<b>25</b>
<b>8.3</b>	<b>Electrochemical properties .....</b>	<b>25</b>
<b>8.4</b>	<b>Anode shape and utilization factor .....</b>	<b>26</b>
<b>8.5</b>	<b>Electrical considerations .....</b>	<b>27</b>
<b>9</b>	<b>Galvanic anode manufacturing .....</b>	<b>27</b>

9.1	Pre-production test .....	27
9.2	Coating .....	27
9.3	Anode core materials .....	27
9.4	Aluminium anode materials .....	28
9.5	Zinc anode materials .....	29
10	Galvanic anode quality control .....	29
10.1	General .....	29
10.2	Steel anode cores .....	29
10.3	Chemical analysis of anode alloy .....	29
10.4	Anode mass .....	30
10.5	Anode dimensions and straightness .....	30
10.5.1	Slender anodes .....	30
10.5.2	Bracelet anodes .....	30
10.6	Anode core dimensions and position .....	31
10.7	Anode surface irregularities .....	31
10.7.1	Slender anodes .....	31
10.7.2	Bracelet anodes .....	31
10.8	Cracks .....	31
10.8.1	General .....	31
10.8.2	Aluminium slender anodes .....	32
10.8.3	Aluminium bracelet anodes .....	32
10.9	Internal defects, destructive testing .....	32
10.10	Electrochemical quality control testing .....	33
11	Galvanic anode installation .....	34
12	Impressed-current CP systems .....	35
12.1	Current sources and control .....	35
12.2	Impressed-current anode materials .....	35
12.3	System design .....	35
12.4	Manufacturing and installation considerations .....	36
12.5	Mechanical and electrical considerations .....	37
13	Documentation .....	37
13.1	Design, manufacturing and installation documentation .....	37
13.2	Commissioning procedures .....	38
13.3	Operating and maintenance manual .....	38
14	Operation, monitoring and maintenance of CP systems .....	39
14.1	General .....	39
14.2	Monitoring plans .....	39
14.3	Repair .....	39
	Annex A (normative) Galvanic anode CP design procedures .....	40
	Annex B (normative) Attenuation of protection .....	46
	Annex C (informative) Performance qualification testing of galvanic anode materials .....	50
	Annex D (normative) CP monitoring and surveys .....	51
	Annex E (informative) Interference .....	57
	Annex F (informative) Pipeline design for CP .....	59
	Bibliography .....	65