

# ISO 19906:2010-12 (E)

## Petroleum and natural gas industries - Arctic offshore structures

---

<b>Contents</b>		<b>Page</b>
Foreword .....		vi
Introduction .....		vii
<b>1</b>	<b>Scope .....</b>	<b>1</b>
<b>2</b>	<b>Normative references .....</b>	<b>1</b>
<b>3</b>	<b>Terms and definitions .....</b>	<b>2</b>
<b>4</b>	<b>Symbols and abbreviated terms .....</b>	<b>10</b>
<b>4.1</b>	<b>Symbols .....</b>	<b>10</b>
<b>4.2</b>	<b>Abbreviated terms .....</b>	<b>10</b>
<b>5</b>	<b>General requirements and conditions .....</b>	<b>11</b>
<b>5.1</b>	<b>Fundamental requirements .....</b>	<b>11</b>
<b>5.2</b>	<b>Design methods .....</b>	<b>12</b>
<b>5.3</b>	<b>Site-specific considerations .....</b>	<b>12</b>
<b>5.4</b>	<b>Construction, transportation and installation .....</b>	<b>13</b>
<b>5.5</b>	<b>Design considerations .....</b>	<b>13</b>
<b>5.6</b>	<b>Environmental protection .....</b>	<b>14</b>
<b>5.7</b>	<b>Vibrations and crew comfort .....</b>	<b>14</b>
<b>6</b>	<b>Physical environmental conditions .....</b>	<b>14</b>
<b>6.1</b>	<b>General .....</b>	<b>14</b>
<b>6.2</b>	<b>Daylight hours .....</b>	<b>15</b>
<b>6.3</b>	<b>Meteorology .....</b>	<b>15</b>
<b>6.4</b>	<b>Oceanography .....</b>	<b>16</b>
<b>6.5</b>	<b>Sea ice and icebergs .....</b>	<b>17</b>
<b>6.6</b>	<b>Seabed considerations .....</b>	<b>18</b>
<b>7</b>	<b>Reliability and limit states design .....</b>	<b>19</b>
<b>7.1</b>	<b>Design philosophy .....</b>	<b>19</b>
<b>7.2</b>	<b>Limit states design method .....</b>	<b>21</b>
<b>8</b>	<b>Actions and action effects .....</b>	<b>26</b>
<b>8.1</b>	<b>General .....</b>	<b>26</b>
<b>8.2</b>	<b>Ice actions .....</b>	<b>26</b>
<b>8.3</b>	<b>Metocean related actions .....</b>	<b>31</b>
<b>8.4</b>	<b>Seismic actions .....</b>	<b>32</b>
<b>9</b>	<b>Foundation design .....</b>	<b>33</b>
<b>9.1</b>	<b>General .....</b>	<b>33</b>
<b>9.2</b>	<b>Site investigation .....</b>	<b>34</b>
<b>9.3</b>	<b>Characteristic material properties .....</b>	<b>36</b>
<b>9.4</b>	<b>Design considerations .....</b>	<b>37</b>
<b>9.5</b>	<b>Gravity base structures .....</b>	<b>40</b>
<b>9.6</b>	<b>Piled structures .....</b>	<b>42</b>
<b>9.7</b>	<b>Floating structures .....</b>	<b>43</b>
<b>9.8</b>	<b>Scour .....</b>	<b>44</b>
<b>9.9</b>	<b>Inspection and performance monitoring .....</b>	<b>45</b>
<b>9.10</b>	<b>Seismic analysis .....</b>	<b>45</b>

<b>10</b>	<b>Man-made islands</b> .....	<b>45</b>
10.1	General .....	45
10.2	Island types .....	45
10.3	Design considerations .....	47
10.4	Seismic design .....	52
10.5	Construction .....	53
10.6	Monitoring and maintenance .....	53
10.7	Decommissioning and reclamation .....	54
<b>11</b>	<b>Fixed steel structures</b> .....	<b>54</b>
11.1	General .....	54
11.2	General design requirements .....	55
11.3	Structural modelling and analysis .....	55
11.4	Strength of tubular members and joints .....	56
11.5	Strength of stiffened-plate panels .....	56
11.6	Strength of steel-concrete composite walls .....	56
11.7	Seismic design .....	58
11.8	Fatigue .....	59
11.9	Materials, testing and NDT .....	59
11.10	Corrosion and abrasion protection .....	60
11.11	Welding .....	60
<b>12</b>	<b>Fixed concrete structures</b> .....	<b>60</b>
12.1	General requirements .....	60
12.2	Actions and action effects .....	61
12.3	Structural analysis .....	61
12.4	Concrete works .....	63
12.5	Mechanical systems .....	69
12.6	Marine operations and construction afloat .....	70
12.7	Corrosion control .....	70
12.8	Inspection and condition monitoring .....	70
<b>13</b>	<b>Floating structures</b> .....	<b>71</b>
13.1	General .....	71
13.2	General design methodology .....	71
13.3	Environment .....	73
13.4	Actions .....	73
13.5	Hull integrity .....	75
13.6	Hull stability .....	76
13.7	Stationkeeping .....	77
13.8	Mechanical systems .....	79
13.9	Operations .....	82
<b>14</b>	<b>Subsea production systems</b> .....	<b>84</b>
14.1	General .....	84
14.2	Ice and seabed considerations .....	85
14.3	Actions on subsea production systems .....	87
14.4	Seismic design .....	89
14.5	Risk reduction .....	89
<b>15</b>	<b>Topsides</b> .....	<b>90</b>
15.1	Overall considerations .....	90
15.2	Design and operational requirements .....	93
15.3	Seismic design .....	101
<b>16</b>	<b>Other ice engineering topics</b> .....	<b>102</b>
16.1	Ice roads and supplies over ice .....	102
16.2	Artificial ice islands .....	104
16.3	Protection barriers .....	105
16.4	Measurements of ice pressure and actions .....	107
16.5	Ice tank modelling .....	108

<b>16.6</b>	<b>Offloading in ice .....</b>	<b>109</b>
<b>17</b>	<b>Ice management .....</b>	<b>110</b>
<b>17.1</b>	<b>General .....</b>	<b>110</b>
<b>17.2</b>	<b>Ice management system .....</b>	<b>111</b>
<b>17.3</b>	<b>Ice management system capabilities .....</b>	<b>112</b>
<b>17.4</b>	<b>Ice management planning and operations .....</b>	<b>113</b>
<b>18</b>	<b>Escape, evacuation and rescue .....</b>	<b>114</b>
<b>18.1</b>	<b>General .....</b>	<b>114</b>
<b>18.2</b>	<b>EER philosophy .....</b>	<b>115</b>
<b>18.3</b>	<b>EER strategy .....</b>	<b>115</b>
<b>18.4</b>	<b>Environment .....</b>	<b>115</b>
<b>18.5</b>	<b>Hazard and risk analysis .....</b>	<b>116</b>
<b>18.6</b>	<b>Continuous assessment .....</b>	<b>117</b>
<b>18.7</b>	<b>EER system design .....</b>	<b>117</b>
<b>18.8</b>	<b>Emergency response organization .....</b>	<b>117</b>
<b>18.9</b>	<b>Competency assurance .....</b>	<b>118</b>
<b>18.10</b>	<b>Communications and alarms .....</b>	<b>118</b>
<b>18.11</b>	<b>Personal protective equipment .....</b>	<b>118</b>
<b>18.12</b>	<b>Man overboard recovery .....</b>	<b>118</b>
<b>18.13</b>	<b>Escape design .....</b>	<b>119</b>
<b>18.14</b>	<b>Evacuation design .....</b>	<b>119</b>
<b>18.15</b>	<b>Rescue design .....</b>	<b>120</b>
	<b>Annex A (informative) Additional information and guidance .....</b>	<b>121</b>
	<b>Annex B (informative) Regional information .....</b>	<b>331</b>
	<b>Bibliography .....</b>	<b>444</b>