

# ISO 21052:2021-11 (E)

## Restrained joint systems for ductile iron pipelines - Calculation rules for lengths to be restrained

---

<b>Contents</b>		<b>Page</b>
Foreword		v
<b>1</b>	<b>Scope</b>	<b>1</b>
<b>2</b>	<b>Normative references</b>	<b>1</b>
<b>3</b>	<b>Terms, definitions and symbols</b>	<b>1</b>
3.1	Terms and definitions	1
3.2	Symbols	3
<b>4</b>	<b>Thrust restraint principles, calculation rules and general specification</b>	<b>4</b>
4.1	Thrust forces	4
4.2	Calculation rules and general specification	4
4.3	Standard jointing systems offer no longitudinal restraint	5
4.4	Restrained joint systems	5
4.5	Length to be restrained	5
4.6	Restrained design method	5
4.7	Gravity thrust blocks	6
<b>5</b>	<b>Thrust force</b>	<b>6</b>
5.1	Internal hydrostatic pressure in straight pipes	6
5.2	Internal hydrostatic pressure in bends	6
5.3	Internal hydrostatic pressure in other configurations	7
<b>6</b>	<b>Restrained joints</b>	<b>8</b>
6.1	Principle	8
6.2	Conservative design	8
6.3	Required prevailing site conditions	8
<b>7</b>	<b>Unit frictional force, <math>F_s</math></b>	<b>8</b>
7.1	Static frictional force	8
7.2	Values of soil cohesion	9
<b>8</b>	<b>Polyethylene encasement and PU coating and other extruded organic coatings</b>	<b>10</b>
<b>9</b>	<b>Unit bearing resistances, <math>R_s</math></b>	<b>10</b>
9.1	Lateral resistance, passive soil pressure	10
9.2	Design value of passive soil pressure	10
9.3	Empirical values of passive soil pressure	11
<b>10</b>	<b>Application to common situations</b>	<b>14</b>
10.1	Horizontal bends	14
10.2	Vertical down bends	15
10.3	Vertical up bends	15
10.4	Tees	16
10.5	Reducers	17
10.6	Dead ends	17
10.7	Encroaching restrained lengths	17
10.8	Equal angle vertical offset ( $\theta$ )	18
10.9	Combined horizontal equal angle bends ( $\theta$ )	19
10.10	Combined horizontal unequal angle bends	20
10.11	Combined vertical equal angle offsets ( $\theta$ )	21
10.11.1	Pipeline under obstruction	21
10.11.2	Pipeline over obstruction	22
<b>11</b>	<b>Restrained lengths</b>	<b>22</b>

<b>12</b>	<b>Installation and laying instruction</b> .....	<b>22</b>
12.1	Select backfill considerations.....	22
12.1.1	Backfill material versus native soil support characteristics.....	22
12.1.2	Swamps or marshes.....	22
12.2	Combining thrust blocks/anchor blocks and restrained joints.....	22
12.3	Pipe in a casing.....	23
12.3.1	Restrained lengths inside casing.....	23
12.3.2	Balancing the thrust force with restraining lengths outside the casing.....	23
12.4	Future excavations.....	23
<b>Annex A</b>	<b>(informative) Dimensions and unit weights of pipes filled with water for preferred class</b> .....	<b>24</b>
<b>Annex B</b>	<b>(informative) Soil classification chart</b> .....	<b>25</b>
<b>Bibliography</b>	.....	<b>26</b>