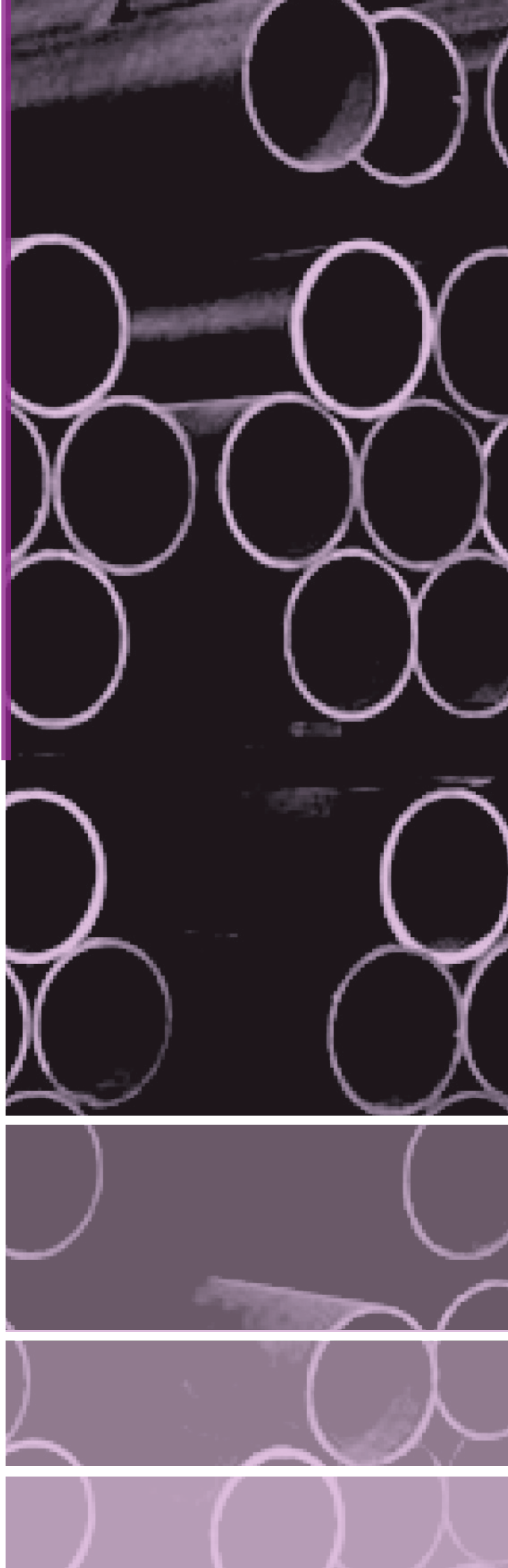


# STEEL PIPES



7c) ERW Steel Pipes for Concrete Lined Pipes

British Standard (Extracts from BS EN 10224 : 2002 / MS 1968 : 2007)

<b>General Information</b>	BS EN 10224 specifies the requirements for cold-formed welded circular hollow sections that used for the conveyance of aqueous liquids, including water for human consumption.																																																												
<b>Chemical Composition</b>	<p>The Cast analysis of the steel shall comply with the requirement of Table 1.</p> <p>Table 1. Chemical composition limits of the cast analysis</p> <table border="1"> <thead> <tr> <th colspan="2">Steel Grade</th> <th colspan="5">% By Mass, Maximum</th> </tr> <tr> <th>Steel Name</th> <th>Steel Number</th> <th>C</th> <th>Si</th> <th>Mn</th> <th>P</th> <th>S</th> </tr> </thead> <tbody> <tr> <td>L235</td> <td>0252</td> <td>0.16</td> <td>0.35</td> <td>1.20</td> <td>0.030</td> <td>0.025</td> </tr> <tr> <td>L275</td> <td>0260</td> <td>0.20</td> <td>0.40</td> <td>1.40</td> <td>0.030</td> <td>0.025</td> </tr> <tr> <td>L355</td> <td>0419</td> <td>0.22</td> <td>0.55</td> <td>1.60</td> <td>0.030</td> <td>0.025</td> </tr> </tbody> </table> <p>For steel L355 additions of niobium, titanium and vanadium are permitted at the discretion of the manufacturer. In this case the inspection documents shall be state the level of these elements.</p> <p>Table 2. Permissible deviation of the product analysis from the specified cast analysis limits given in Table 1.</p> <table border="1"> <thead> <tr> <th>Element</th> <th>Limiting Values %</th> <th>Permissible Deviation</th> </tr> </thead> <tbody> <tr> <td rowspan="2">C</td> <td>≤ 0.20</td> <td>+ 0.02</td> </tr> <tr> <td>&gt; 0.20</td> <td>+ 0.03</td> </tr> <tr> <td>Si</td> <td>≤ 0.55</td> <td>+ 0.05</td> </tr> <tr> <td>Mn</td> <td>≤ 1.60</td> <td>+ 0.10</td> </tr> <tr> <td>P</td> <td>≤ 0.030</td> <td>+ 0.005</td> </tr> <tr> <td>S</td> <td>≤ 0.025</td> <td>+ 0.005</td> </tr> <tr> <td rowspan="2">Cu</td> <td>≤ 0.35</td> <td>+ 0.05</td> </tr> <tr> <td>&gt; 0.35</td> <td>+ 0.07</td> </tr> </tbody> </table>	Steel Grade		% By Mass, Maximum					Steel Name	Steel Number	C	Si	Mn	P	S	L235	0252	0.16	0.35	1.20	0.030	0.025	L275	0260	0.20	0.40	1.40	0.030	0.025	L355	0419	0.22	0.55	1.60	0.030	0.025	Element	Limiting Values %	Permissible Deviation	C	≤ 0.20	+ 0.02	> 0.20	+ 0.03	Si	≤ 0.55	+ 0.05	Mn	≤ 1.60	+ 0.10	P	≤ 0.030	+ 0.005	S	≤ 0.025	+ 0.005	Cu	≤ 0.35	+ 0.05	> 0.35	+ 0.07
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<b>Mechanical Strength (Tensile Test)</b>	<p>The minimum yield strength, tensile strength range and minimum elongation for the tubes covered shall be accordance to Table 3</p> <p>Table 3. the minimum yield and tensile strength requirement</p> <table border="1"> <thead> <tr> <th rowspan="3">Steel Grade/ Name</th> <th rowspan="3">Tensile Strength MPa</th> <th colspan="2">Min Yield Strength MPa</th> <th colspan="2">Minimum Elongation A% (<math>L_0 = 5.65 \sqrt{S_0}</math>)</th> </tr> <tr> <th colspan="2">For Thickness in mm</th> <th rowspan="2">Longitudinal</th> <th rowspan="2">Transverse</th> </tr> <tr> <th>T ≤ 16</th> <th>T &gt; 16</th> </tr> </thead> <tbody> <tr> <td>L235</td> <td>360 - 500</td> <td>235</td> <td>225</td> <td>25</td> <td>23</td> </tr> <tr> <td>L275</td> <td>430 - 570</td> <td>275</td> <td>265</td> <td>21</td> <td>19</td> </tr> <tr> <td>L355</td> <td>500 - 650</td> <td>355</td> <td>345</td> <td>21</td> <td>19</td> </tr> </tbody> </table>	Steel Grade/ Name	Tensile Strength MPa	Min Yield Strength MPa		Minimum Elongation A% ( $L_0 = 5.65 \sqrt{S_0}$ )		For Thickness in mm		Longitudinal	Transverse	T ≤ 16	T > 16	L235	360 - 500	235	225	25	23	L275	430 - 570	275	265	21	19	L355	500 - 650	355	345	21	19																														
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<b>Bending Test</b>	<p>The weld of submerged arc welded tubes and the seam weld of fitting and fittings components made from plate or strip shall pass a weld bend test and the test pieces shall be bent through an angle of 180° around a bar of the diameter specified in Table 4. The pipe shall be free from the occurrence of flaws or cracks on its weld metal, fusion line, heat affected zone or parent metal.</p> <p>Table 4. Weld bend test</p> <table border="1"> <thead> <tr> <th>Steel Name</th> <th>Diameter Of Mandrel For The Weld Bend Test</th> </tr> </thead> <tbody> <tr> <td>L235</td> <td>3T</td> </tr> <tr> <td>L275</td> <td>4T</td> </tr> <tr> <td>L355</td> <td>4T</td> </tr> </tbody> </table>	Steel Name	Diameter Of Mandrel For The Weld Bend Test	L235	3T	L275	4T	L355	4T																																																				
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<b>Drift Expanding Test</b>	The drift expanding test may replace the flattening test for tubes up to and including 150 mm diameter and 10 mm thickness at the direction of the manufacturer. One end of the test piece shall be expanded using a cone with an included angle (β) of 60° until the increase in outside diameter is not less than the appropriate value given in Table 5 and EW tubes shall pass a drift expanding test in according with Table 5. No cracks or imperfections shall be permitted in the metal or in the weld, except that slight incipient cracking at the edges of the test piece shall not be cause for rejection																																																												

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<b>Hydrostatic Test</b>	<p>The Tube shall withstand the test without leakage or visible deformation. The hydrostatic test shall be carried out at a test pressure of 70 bar or P, calculated from the following equation, whichever is the lower, unless is specified by the purchaser.</p> $P = \frac{20ST}{D}$ <p>Where</p> <ul style="list-style-type: none"> <li>P is the test pressure in bar</li> <li>D is the specified outside diameter (mm)</li> <li>T is the specified wall thickness (mm)</li> <li>S is the stress in MPa corresponding to 70% of the specified minimum yield strength (Table 3) for the type pf steel concerned.</li> </ul>

<b>Tolerances On Dimensions and Mass</b>	<p>The Tolerances on dimensions shall be as specified in Table 6.</p> <p>Table 6. Tolerance on dimensions</p> <table border="1"> <thead> <tr> <th rowspan="2">Characteristic</th> <th colspan="2">Circular Hollow Sections</th> </tr> <tr> <th>Specified OD (mm)</th> <th>Tolerance (mm)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Outside Dimension (OD)</td> <td>OD ≤ 219.1</td> <td>±1% of diameter with a minimum of ± 0.5 mm</td> </tr> <tr> <td>OD &gt; 219.1</td> <td>±0.75% of diameter</td> </tr> <tr> <td>Thickness (t)</td> <td colspan="2">Shall not exceed ±10% or ±0.3mm, whichever is greater.</td> </tr> <tr> <td rowspan="4">Length</td> <td rowspan="2">Length mm</td> <td colspan="2" style="text-align: center;">Tube outside diameter</td> </tr> <tr> <td>&lt; 406.4 mm</td> <td>≥ 406.4 mm</td> </tr> <tr> <td>2000 &lt; L ≤ 6000</td> <td>+10 mm 0</td> <td>+25 mm 0</td> </tr> <tr> <td>6000 &lt; L ≤ 12000</td> <td>+15 mm 0</td> <td>+50 mm 0</td> </tr> <tr> <td></td> <td>L &gt; 12000</td> <td colspan="2">+ by agreement 0</td> </tr> <tr> <td>Straightness</td> <td colspan="2">Shall not deviate from straightness by more than 0.2% of the total length</td> </tr> <tr> <td>Out-of-roundness (o)</td> <td colspan="2">Shall not exceed 2%</td> </tr> <tr> <td>Concavity / convexity</td> <td colspan="2" style="text-align: center;">-</td> </tr> <tr> <td>Radius of Corners</td> <td colspan="2" style="text-align: center;">-</td> </tr> <tr> <td>Squareness of side</td> <td colspan="2" style="text-align: center;">-</td> </tr> <tr> <td>Twist</td> <td colspan="2" style="text-align: center;">-</td> </tr> <tr> <td>Inner Flash</td> <td colspan="2">Height of the internal weld bead Shall not exceed (0.5 + 0.05T) mm</td> </tr> <tr> <td rowspan="3">End tolerance on diameter</td> <td>Outside diameter mm</td> <td colspan="2">End tolerance</td> </tr> <tr> <td>≤ 219.1</td> <td colspan="2">± 0.5 mm or ± 0.5% D whichever is the greater</td> </tr> <tr> <td>219.1 &lt; D ≤ 2032 &gt; 2032</td> <td colspan="2">± 1.6 mm ± 3 mm</td> </tr> <tr> <td rowspan="2">End Facing</td> <td>Bevel angle</td> <td colspan="2">Root face</td> </tr> <tr> <td>30°, +5°, -0°</td> <td colspan="2">1.6 ± 0.8 mm</td> </tr> <tr> <td>Mass (m) per unit length</td> <td colspan="2" style="text-align: center;">-</td> </tr> </tbody> </table>			Characteristic	Circular Hollow Sections		Specified OD (mm)	Tolerance (mm)	Outside Dimension (OD)	OD ≤ 219.1	±1% of diameter with a minimum of ± 0.5 mm	OD > 219.1	±0.75% of diameter	Thickness (t)	Shall not exceed ±10% or ±0.3mm, whichever is greater.		Length	Length mm	Tube outside diameter		< 406.4 mm	≥ 406.4 mm	2000 < L ≤ 6000	+10 mm 0	+25 mm 0	6000 < L ≤ 12000	+15 mm 0	+50 mm 0		L > 12000	+ by agreement 0		Straightness	Shall not deviate from straightness by more than 0.2% of the total length		Out-of-roundness (o)	Shall not exceed 2%		Concavity / convexity	-		Radius of Corners	-		Squareness of side	-		Twist	-		Inner Flash	Height of the internal weld bead Shall not exceed (0.5 + 0.05T) mm		End tolerance on diameter	Outside diameter mm	End tolerance		≤ 219.1	± 0.5 mm or ± 0.5% D whichever is the greater		219.1 < D ≤ 2032 > 2032	± 1.6 mm ± 3 mm		End Facing	Bevel angle	Root face		30°, +5°, -0°	1.6 ± 0.8 mm		Mass (m) per unit length	-	
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## 7d) ERW Steel Tubes for Concrete Lined Pipes

- Grade : ERW 320  
ERW 360  
ERW 430

## BS 3601 - JKR Dimension

Outside Diameter mm	Minimum Wall Thickness mm	Outside Diameter		Calculated Weight Plain Ends kg/m	Hydrostatic Test Pressure (Steel 430) bar
		Minimum mm	Maximum mm		
121.9	4.10	120.7	123.1	11.91	70
177.3	4.10	176.0	178.6	17.51	70
232.2	4.10	230.5	233.9	23.06	70
286.0	4.10	283.9	288.1	28.50	63
345.4	5.80	342.8	348.0	48.57	70
399.3	5.80	396.3	402.3	56.28	64
426.0	5.80	422.8	429.2	60.10	60
453.1	5.80	449.7	456.5	63.98	56

## BS 3601 - BS 534 Dimension

Outside Diameter mm	Minimum Wall Thickness mm	Outside Diameter		Calculated Weight Plain Ends kg/m	Hydrostatic Test Pressure (Steel 430) bar
		Minimum mm	Maximum mm		
114.3	3.60	113.2	115.4	9.83	70
139.7	3.60	138.3	141.1	12.08	70
168.3	3.60	166.6	170.0	14.62	70
193.7	4.00	192.2	195.2	18.71	70
219.1	4.00	217.5	220.7	21.22	70
244.5	4.00	242.7	246.3	23.72	70
273.0	4.00	270.9	275.0	26.53	64
323.9	4.00	321.5	326.3	31.55	54
355.6	4.50	352.9	358.3	38.96	56
406.4	4.50	403.4	409.4	44.60	49
457.0	5.00	453.6	460.4	55.73	48