INFORMATION SHEET

BUILDING SERVICES

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WIRE BALUSTRADE CONSTRUCTION

This information sheet has been prepared specifically to provide details on wire balustrades. More information on general requirements for balustrades is available in the information sheet titled "*Balustrade Construction for Class 1 buildings*".

Wire Balustrade Construction

A wire balustrade consists of a series of tensioned wire rope connected either vertically or horizontally to supports in order to prevent a person from falling from a roof, stairway, or raised floor level. It does not include wire mesh fences.

For clarity, the following terms are defined in relation to wire balustrades:

- Continuous – the wire spans over three or more supports
- Non-continuous – the wire is supported over two supports.
- Pulley Block – a device consisting of a wheel in which a wire runs around to change its direction.
- Permissible Deflection – is the allowable bending of the wire.
- Support Rails – are the horizontal components of the balustrade system that span across the top and bottom to provide structural support.

Openings in balustrades (including decorative balustrades) must be constructed so that any opening does not permit a 125mm diameter solid cone to pass through it. For stairs, the space is measured above the nosing line.

To comply with this requirement, spacing of support posts (post or rail spacing), wire tension, deflection and lay of wire (number of strands by the number of individual wires in each strand) are specified within the Building Code of Australia (BCA).

Wire Tension

The installer needs to ensure that the required wire tension is achieved and maximum permissible deflections are not exceeded. The tension can be measured using a strain indicator, if available, or the deflection can be measured using a 2kg mass suspended at mid-span on the wire between support posts.

The tension and deflection measurements will depend on the type of wire used, support post or rail spacing, wire diameter and lay, and wire spacing. **Table 3.9.2.1** (see below) of BCA Volume 2 gives the required wire tension for Stainless Steel horizontal wire systems and non-continuous vertical systems. **Table 3.9.2.2** (see below) of BCA Volume 2 gives the widest spacing between wires (in mm) and the required wire tension (N) for continuous vertical wire systems or near vertical sloped wire systems. **Table 3.9.2.3** (see below) gives the maximum permissible deflection for stainless steel wires.

Spacing

In horizontal systems and non-continuous vertical wire balustrades, the maximum spacing is 100mm and for continuous vertical wire systems 110mm.

Other Provisions

Other provisions include:

- For vertical wires the use of 2 pulley blocks to each 180° change of direction in the wire
- The maximum spacing for support rails in vertical systems is 900 mm to ensure that the rails do not deflect and decrease the tension in the wires.
- Care and maintenance are necessary to ensure that the wire tension will be maintained during the life of the balustrade. In some situations, it is necessary to install 'locking off' devices to prevent loosening of wires.

HIA members can contact HIA's Building Services staff for more information on 1300 650 620 or email HIA_technical@hia.com.au.

Extracts from Building Code of Australia, Volume 2 Housing Provisions

Table 3.9.2.1 WIRE BALUSTRADE CONSTRUCTION – REQUIRED TENSION FOR STAINLESS STEEL HORIZONTAL WIRES

			Clear distance between posts (mm)								
			600	800	900	1000	1200	1500	1800	2000	2500
Wire dia. (mm)	Lay	Wire spacing (mm)	Minimum *required* tension in Newtons (N)								
2.5	7×7	60	55	190	263	415	478	823	1080	1139	X
		80	382	630	730	824	1025	1288	X	X	X
		100	869	1218	1368	X	X	X	X	X	X
2.5	1×19	60	35	218	310	402	585	810	1125	1325	X
		80	420	630	735	840	1050	1400	1750	X	X
		100	1140	1565	X	X	X	X	X	X	X
3.0	7×7	60	15	178	270	314	506	660	965	1168	1491
		80	250	413	500	741	818	1083	1370	1565	X
		100	865	1278	1390	1639	X	X	X	X	X
3.0	1×19	60	25	183	261	340	520	790	1025	1180	X
		80	325	555	670	785	1015	1330	1725	1980	X
		100	1090	1500	1705	1910	X	X	X	X	X
4.0	7×7	60	5	73	97	122	235	440	664	813	1178
		80	196	422	480	524	760	1100	1358	1530	2130
		100	835	1182	1360	1528	1837	2381	2811	3098	X
4.0	1×19	60	5	5	10	15	20	147	593	890	1280
		80	30	192	300	415	593	1105	1303	1435	1844
		100	853	1308	1487	1610	2048	2608	3094	3418	3849
4.0	7×19	60	155	290	358	425	599	860	1080	1285	1540
		80	394	654	785	915	1143	1485	1860	2105	2615
		100	1038	1412	1598	1785	2165	2735	X	X	X

Notes:

1. Lay = number of strands by the number of individual wires in each strand. For example a lay of 7×19 consists of 7 strands with 19 individual wires in each strand.
2. Where a change of direction is made in a run of wire, the tensioning device is to be placed at the end of the longest span.
3. If a 3.2 mm wire is used the tension figures for 3.0 mm wire are applied.
4. This table may also be used for a set of non-continuous (single) vertical wires forming a balustrade using the appropriate clear distance between posts as the vertical clear distance between the rails.
5. X = Not allowed because the required tension would exceed the safe load of the wire.
6. Tension measured with a strain indicator.

Table 3.9.2.2 CONTINUOUS WIRE BALUSTRADE CONSTRUCTION – REQUIRED TENSION FOR VERTICAL OR NEAR VERTICAL STAINLESS STEEL WIRES

Wire dia. (mm)	Lay	Widest spacing between wires (mm)	Maximum clear spacing between rails (mm)
			900
			Required tension in Newtons (N)
2.5	7×19	80	145
		100	310
		110	610
2.5	7×7	80	130
		100	280
		110	500

Notes:
1. Lay = number of strands by the number of individual wires in each strand. For example a lay of 7×19 consists of 7 strands with 19 individual wires in each strand.
2. Vertical wires require two pulley blocks to each 180^{o} change of direction in the wire.
3. Near vertical wires may only require one pulley block for each change of direction.
4. Tension measured with a strain indicator.
5. The table only includes 7×7 and 7×19 wires due to other wires not having sufficient flexibility to make the necessary turns.

Table 3.9.2.3 WIRE BALUSTRADE CONSTRUCTION – MAXIMUM PERMISSIBLE DEFLECTION FOR STAINLESS STEEL WIRES

		Clear distance between posts(mm)					
		600	900	1200	1500	1800	2000
Wire dia. (mm)	Wire spacing (mm)	Maximum permissible deflection of each wire in mm when a 2 kg mass is suspended at mid span					
2.5	60	17	11	9	8	8	8
	80	7	5	5	5	X	X
3.0	60	19	13	8	7	7	7
	80	8	6	6	5	5	5
4.0	60	18	12	8	8	7	7
	80	8	6	4	4	4	4

Notes:
1. Where a change of direction is made in a run of wire the 2 kg mass must be placed at the middle of the longest span.
2. If a 3.2 mm wire is used the deflection figures for 3.0 mm wire are applied.
3. This table may also be used for a set of non-continuous (single) vertical wires forming a balustrade using the appropriate clear distance between posts as the vertical clear distance between the rails. The deflection (offset) is measured by hooking a standard spring scale to the mid span of each wire and pulling it horizontally until a force of 19.6 N is applied.
4. X = Not allowed because the *required* tension would exceed the safe load of the wire.
5. This table has been limited to 60 mm and 80 mm spaces for 2.5 mm, 3 mm and 4 mm diameter wires because the *required* wire tensions at greater spacings would require the tension to be beyond the wire safe load limit, or the allowed deflection would be impractical to measure.