

1. PURPOSE

This specification sets out recommended minimum standards for materials and processes used to manufacture and install intruder resistant (close spaced/ anti-climb) welded mesh fencing. The specification has been developed to ensure purchasers of this type of fencing receive a product that is fit for purpose, has an extended service life and is aesthetically pleasing. Compliance with this specification will ensure products provided comply with relevant Standards and established industry best practice.

The italic paragraphs and notes throughout this document serve to highlight the functional or performance requirement of the product or installation that that particular section of the specification sets out. They may also give the reader some background to the reason for a particular requirement. Purchasers using this specification may wish to delete the italic sections from the document before providing it to potential suppliers.

2. REFERENCES

- ENA DOC 015 - 2006 National Guidelines for prevention of unauthorised access to electricity infrastructure.
- AS2067 - Switchgear Assemblies and Ancillary Equipment for Alternating Voltages above 1 kV.
- AS/NZS 1170.2 2002 Structural Design Actions, Part 2 wind actions.
- BS1722-14:2006 Part 14: Specification for open mesh steel panels.
- EN 10223-4:1998 Steel Wire and wire products for fences – Part 4. Steel wire welded mesh fencing & BS 1722-14:2006 Part 14: Specification for open mesh steel AS/NZS 2312:2002 - Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings.
- AS 2423-2002 - Coated steel wire fencing products for terrestrial, aquatic and general use.
- AS/NZS 1163:2009 Cold-formed structural steel hollow sections.
- AS/NZS 3678:2011 Structural steel - hot-rolled plates and floor plates.
- AS/NZS1365 Tolerances for flat-rolled steel products.
- AS/NZS 4680:2006 – Hot dip galvanized (zinc) coatings on fabricated ferrous articles
- AS 1319-1994 Safety signs for the occupational environment

3. CLOSE SPACE WELDED MESH SECURITY FENCING

3.1. PRODUCT REQUIREMENTS

The fence assembly shall comply with the relevant Clauses of AS 1170.1, AS 1170.2, AS 1170.3 and AS 1170.4.

3.2. MINIMUM REQUIREMENTS

Fence Mesh Pattern

The horizontal wires shall be resistance welded at 12.5mm centres (nominal) and the vertical (line) wires to be resistance welded at 75 mm centres (nominal). The resulting aperture shall have a tolerance $\pm 0.5\text{mm}$.

The sheets are to be 2400mm wide x 2400mm high (nominal) to achieve a 2400mm high fence and 2400mm wide x 3000mm high (nominal) to achieve a 3000mm high fence.

Mesh Material

Horizontal wires shall be Ø4mm drawn Zinc Aluminium coated wire

Vertical wires Ø4mm drawn Zinc Aluminium coated wire

The wire shall have a diameter tolerance of $\pm 0.08\text{mm}$

Yield strength 400 - 510MPa

Tensile strength 500 - 625MPa

Weld shear strength to a minimum of 75% of the wire tensile strength

Coating: Zinc Alloy minimum 280 grams per square/metre

Complaint to Australian Standard AS/NZS 4534:2006 Clause FS.1.3

Fasteners

The mesh sheet shall be fixed to the post using M8 x 25mm long galvanised cup head (tamper resistant) bolts fitted from the attack side of the fence. A mesh security washer 2.5mm gauge (nominal) and standard hex nut are fitted to the bolt from the non-attack side. There are to be a minimum of 34 fixings per panel. There shall be a minimum of 8 x M8 tamper proof shear nuts per panel. Fasteners to be hot dipped galvanised to AS/NZS 4680:2006. The vertical line wires of the mesh should be located on the attack side of the fence to minimise scalability.

Top and Bottom Rail

The sheet is to be supported by a top and bottom rail that is connected to the posts. Rails shall be 50 x 50 x 4mm equal angle, 350MPa (minimum) material. The vertical face of the rail is to have a series of elongated 25 x 10mm slots at 230mm centres (nominally) to allow fixing of the mesh to the non-attack (normally inside) side of the rail. Rails shall be hot dipped galvanised to AS/NZS 4680: 2006 after fabrication.

Fence Topping

Option 1 The fence shall be fitted with Ø550mm Flat Loops of razor wire, fixed to five strands of standard barb to increase the effective height of the fence to 3000mm. The loops of razor wire are to have short barbs at 25mm centres. The loops shall be fixed to the barbed wire at 250mm centres (maximum) with a maspro clip or tie wire. The strands of barb wire are to be installed at 100mm centres (nominally) supported with a barb extension fixed to each post. The barbed wire is to be fixed to the extension with tie wire or a U-clip (galvanised) and a 14g self drilling tek screw.

The barb extensions shall be made from 50 x 50 x 4mm equal angle steel, 350MPa grade material (minimum) and is to be hot dipped galvanised to AS/NZS 4680: 2006 after fabrication.

Option 2 The fence shall be fitted with Ø550mm helical concertina short barb razor wire to increase the effective height of the fence to 3000mm. The shall top rail shall have 12 x elongated 25x10mm slots at 200mm centres to fix the razor wire. The razor wire shall be fixed to the top rail with an M8 x 25mm cup head bolt installed from the upper side and a nut from the underside of the rail.

Option 3 The fence shall be fitted with serrated rail that has a series of sharp 50mm high (nominal) spikes to deter scaling of the fence. Rail to be 1mm (minimum) gauge material and be hot dipped galvanised to AS/NZS 4680:2006 after fabrication The serrated rail shall be fixed to the top rail with an M8 x 25mm cup head bolt installed from the upper side and a nut from the underside of the rail or a 14g self drilling tek screw.

3.3. FENCE POSTS

3.3.1. PRODUCT REQUIREMENTS

The fence posts shall be structurally adequate in compliance with AS/NZS 1170.2 2002 and made from steel material with a minimum tensile strength of 350MPa. Posts are to be installed at 2400mm centres (nominally). The fence posts are to have a flange to the attack side that allows the mesh sheet to be installed to the non-attack side of this (behind) flange. This flange is to have a series of elongated 25x10mm slots at 230mm centres nominally that allow the mesh sheet to be fixed to the post. The post shall be hot dipped galvanised to AS/NZS 4680:2006 after fabrication. Post lengths may vary to suit site conditions or Principal's requirements.

3.4. GATES

Both Single and Double Gates shall be manufactured to the following specifications noting latch and drop bolt configurations for single and double gates may vary slightly.

Gate Width:	Maximum 3000mm
Gate Height:	3000mm
Rails:	65mm x 65mm x 2.5mm SHS (minimum)
Gate Stiles:	65mm x 65mm x 2.5 SHS (minimum)
Gate Frame:	Personnel Access (PA) gate leaves are to be swung inside a gate frame constructed from 65mm x 65mm x 2.5 SHS. The sides of the PA gate frame are to be fitted with 50 x 25 x 4mm angle webbing such that the adjoining mesh sheet can be connected to the frame. The webbing is to have a series of elongated 25x10mm slots at 230mm centres (nominally).
Mesh fixing:	50 x 25 x 4mm angle webbing is to be fabricated into the gate leaf such that mesh infill panel can be fitted to the non-attack side of the webbing. The webbing is to have a series of elongated 25x10mm slots at 230mm centres (nominally).
Gate Hinges:	Supplied and fitted with a suitably sized grease packed ball bearing hinge at top (that allows adjustment of the level of the gate) and lubricated tapered roller bearing hinge at bottom. Hinges to be screwed with M10 stainless steel screws with anti-tamper drive or bolted through the gate post with a suitably sized bolt. Bolts shall be supplied with anti-tamper 'shear nuts' or similar.
<i>There are light ball bearing hinges (Goliath or equivalent) available in the market but in our experience these are unsuitable for welded mesh fencing applications. The reason being, they are not able to handle the loads applied to the gates in service. Ball bearing hinges also do not have the capacity to allow adjustment of the level of the gate.</i>	
Gate Latch:	Gates shall be supplied and fitted with a horizontal slide bolt. Slide bolt is lockable in both the open and closed positions and to be made from 20mm diameter steel. The latch shall have a female receiver for the slide bolt which to be elongated in height and to be screwed/ bolted to the closing post or the adjacent gate stile in the case of a double gate.

- Latch access: Gates shall be fitted with a hand hole assembly to allow access to the latch from the attack side of the gate (normally the outside). The hand hole is to be fabricated from 4mm steel (minimum) and shall be of a design so as to prevent the latch being attacked and not create a climb point over the gate. It must also allow the latch to be operated with relative ease. Where the gate is fitted with a hand hole the latch shall be of a design that allows the latch to be operated with relative ease.
- Drop Bolt: Security Pin type Ø16mm x 500mm long lockable drop bolt that is screwed to the gate.
- Drop Bolt Receiver: A steel drop bolt receiver unit shall be supplied for double gates that is suitable for cleaning away debris. The unit shall be of a design so as to receive both drop bolts in the closed (down) position in the one unit. Ferrules or pipe are not acceptable.

3.5. DOUBLE GATE POSTS

- Post Size: The size of the double gate post shall be determined by the width of the gate leaf it supports as per the table below. i.e. a 3000mm Double gate is comprised of two (2) 1500mm gate leaves.

Gate Leaf Width	Post Size
Up to 1400mm wide	100 x 100 x 5mm
1401mm to 2400mm wide	150 x 150 x 5mm
2401mm to 3000mm wide	150 x 150 x 9mm

- Post length: Post shall be sized according to the footing design of the proposed fence installation. Typically the post shall be no shorter than 4000mm for installations in natural ground.

4. STEEL

The fencing shall be manufactured using structural steel sections which comply with the following minimum standards:

- AS 1163 – Structural steel hollow sections – Product Designation AS 1163 C350LO.

Galvanised in accordance with:

- AS 4750-2003 – Electro-galvanised (zinc) coating on ferrous hollow and open sections – Product Designation AS 4750 ZE 50/50; or
- AS 4792 Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process AS 4792 IB 50/50; or
- AS/NZS 4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles.

5. FABRICATION AND ASSOCIATED PROCESSES

5.1. CUTTING

Cuts shall be generally free of sharps and burrs.

5.2. GRINDING

Grinding of fencing components during fabrication shall be kept to a minimum. Where grinding of weld zone is required after hot dip galvanising care shall be taken to minimise damage to galvanising and be suitably repaired.

5.3. WELDING

All welds are to be mild steel structural welds. Note hinges and associated parts may be electroplated rather than galvanised after fabrication to prevent corrosion. Welds are to be formed in neat consistent bead with good penetration. Care should be taken to ensure splatter is minimised during welding and any splatter is removed.

6. FINISH REQUIREMENTS

6.1. MANDATORY COATING SYSTEM

It is mandatory that all fence components except welded mesh, locking hardware, gate hinging components and barbed topping are to be hot dipped galvanised after fabrication compliant to AS 4680:2006.

6.2. OPTIONAL POWDER COATING

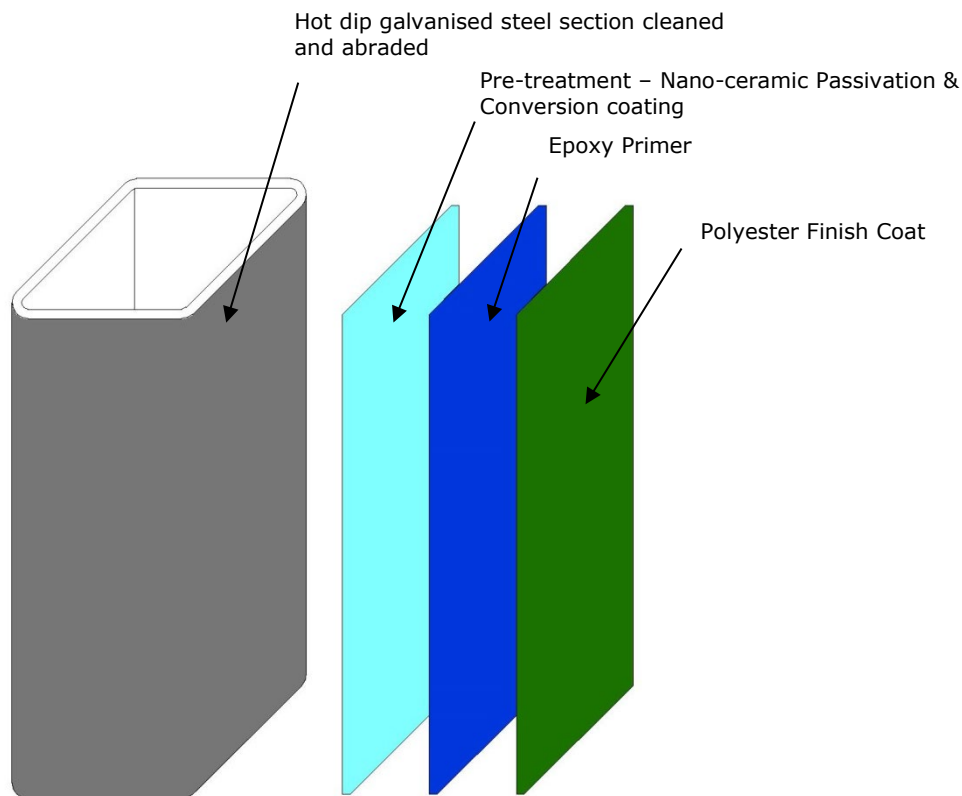
6.2.1. LIGHT ABRASION OF THE GALVANISED STEELWORK

The following applies for all fencing materials prior to application of powder coating:

1. Remove all traces of surface contaminants such as oil, grease, dirt etc with a hot alkali rinse.
2. Rinse with de-ionised water.
3. Abrasively "brush" blast clean all surfaces in accord with AS 1627.4"1989, Class 1 Metal finishing - Preparation and pretreatment of surfaces - Abrasive blast cleaning of steel (using non metallic abrasive garnet as the blast media). This will remove all surface corrosion (such as zinc corrosion products) and surface contamination (including surface post treatments), and lightly profile 'key' the surface with minimal reduction in galvanised coating thickness (no more than 10 microns). Visually the finished surface should show a dull appearance, which has a surface profile suitable for the adhesion of the coatings. Blasting media should not be Limestone nor Aluminium magnesium silicate. The medium should be clean of contaminants. Care should be taken to minimise the removal of the protective zinc coating
4. Degas the components by heating to approximately 20 degrees greater than the coating curing temperature (depending on the wall thickness of material to be powder coated).
5. Remove all traces of surface contaminants such as oil, grease, dirt etc with a hot alkali rinse.
6. Rinse with de-ionised water.
7. Apply a chemical conversion coating.
8. Rinse with de-ionised water.
9. Within 4 hours of cleaning apply an epoxy primer and "green" cure the coating per manufactures recommendations.
10. Immediately apply polyester top coat and fully cure per manufactures recommendations.

The above process is industry best practice but is considerably more expensive than simply powder coating over a hot dip galvanised surface. The adhesion of the powder coating with this surface preparation will far exceed powder coating an unprepared hot dip galvanised surface. The problem applying a polyester powder coat to a galvanised surface is that polyester top coat is slightly porous and so over time pollutants and salts will penetrate the coating and react with the zinc surface and the result is delamination of the coating. Epoxy is not porous and so prevents the salts/ pollutants making contact with the surface and resulting in corrosion and coating delamination. It also makes for a superior primer for the durable polyester top coat to bind. Often the galvanised surface can smooth which does aid good adhesion. The abrasion 'keys' the surface.

The product should be degassed before powder coating to avoid pin holing of the coating as gases trapped in the hot dip galvanised coating escape.



Within 24 hours of abrasion materials should be degreased in a hot alkali bath, rinsed and a conversion coating applied. Powder application shall occur within 24 hours of substrate pre-treatment.

Pre-treatment systems are maintained and tested in accordance with AS 4506.2005 Metal finishing - Thermoset powder coatings and the pretreatment chemical supplier's recommendations.

6.2.2. OPTION 1 - STANDARD COATING SYSTEM

This option will consist of a polyester powder coating (or other approved exterior grade powder) in the nominated colour and gloss finish, applied in accordance with AS4506.2005 Table 2.1 Atmospheric Classification C2 – Moderate (Exterior) Medium.

Polyester type coatings are the industry standard in Australia for external finishes and are manufactured extensively in Australia specifically for Australian conditions. Atmospheric Classification C2 covers all installation locations except those in tropical, high marine, industrial or worse environments.

Testing of powder coated products shall be carried in accordance with AS 4506.2005 Section 2 for the stated atmospheric classification. In addition to the requirements of AS 4506 products will be required to:

1. Have minimum thickness of 80 micron; and
2. Achieve 500 hrs Neutral Salt Spray Performance.

The 80 micron thickness specification is higher than the 60 micron minimum specified by AS4506.2005 to ensure consistent colour, gloss and an extended coating life in accordance with industry best practice. 500 hrs Neutral Salt performance is the accepted industry standard for Atmospheric Classification C2 conditions.

6.2.3. OPTION 2 – ANTI GRAFFITI COATING SYSTEM

The coating will consist of polyurethane anti graffiti powder coating in the nominated colour and gloss finish applied in accordance with AS4506.2005 Table 2.1 Atmospheric Classification C2 – Moderate (Exterior) Medium.

Testing of powder coated products shall be carried in accordance with AS 4506.2005 Section 2 for the stated atmospheric classification. In addition to the requirements of AS 4506 products will be required to:

1. Have minimum thickness of 80 micron; and
2. Achieve 500 hrs Neutral Salt Spray Performance.

This coating allows the ready removal of graffiti by way of a prescribed cleaning process. Using anti-graffiti coatings can significantly reduce the maintenance costs of an installation in graffiti prone areas.

6.2.4. LIGHT ABRASION OF THE UNGALVANISED STEELWORK

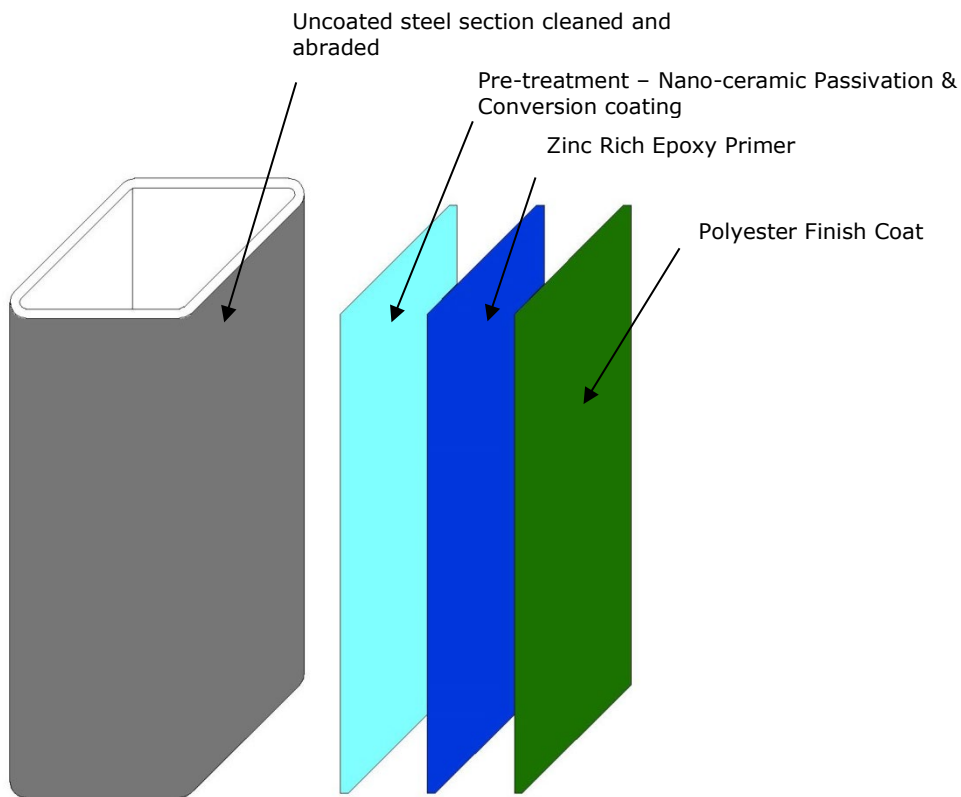
Alternatively to hot galvanising the steel work after fabrication the components in black/painted steel can have the following surface preparation:

1. Remove all traces of surface contaminants such as oil, grease, dirt etc with a hot alkali rinse.
2. Rinse with de-ionised water.
3. Abrasively "brush" blast clean all surfaces in accord with AS 1627.4"1989, Class 1 Metal finishing - Preparation and pretreatment of surfaces - Abrasive blast cleaning of steel (using non metallic abrasive garnet as the blast media). This will remove all surface corrosion (such as zinc corrosion products) and surface contamination (including surface post treatments), and lightly profile the surface with minimal reduction in galvanised coating thickness (no more than 10 microns). Visually the finished surface should show a dull appearance, which has a surface profile suitable for the adhesion of the coatings. Blasting media should not be Limestone nor Aluminium magnesium silicate. The medium should be clean of contaminants.
4. Remove all traces of surface contaminants such as oil, grease, dirt etc with a hot alkali rinse.
5. Rinse with de-ionised water.
6. Apply a chemical conversion coating.
7. Within 24 hours of cleaning apply a zinc rich primer and "green" cure the coating per manufactures recommendations.
8. Immediately apply polyester top coat and fully cure per manufactures recommendations.

The above process will give much greater adhesion of the powder coating to the steel substrate as compared to hot dip galvanising and then powder coating. The combination of abrading the steel surface then applying an epoxy primer and then top coat will give excellent film adhesion and thus corrosion protection to the steel work. The epoxy binds extremely well to the naked abraded steel and

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is as noted above is not porous and so prevents the salts/ pollutants making contact with the surface and resulting in corrosion and coating delamination. It also makes for a superior primer for the durable polyester top coat to bind. This process eliminates the cost of hot dip galvanising.



7. QUALITY ASSURANCE

7.1. QUALITY MANAGEMENT PLAN

The manufacturer and powder coater shall ensure a Quality Management Plan is maintained in respect of the product fabrication, hot dip galvanising, and powder coating, which includes Inspection and Test Plans (ITP's). The Contractor may be required to produce copies of relevant ITP to demonstrate compliance with the requirement of this Technical Specification.

7.2. CERTIFICATES OF COMPLIANCE

Certificate of Compliance must be provided by the Contractor at the completion of the works.

When considering the veracity of a Certificate of Compliance the purchaser should consider whether or not the party making the statement is reputable, has its own Quality Assurance System ideally certified to be in accordance with ISO 9001, and its relationship to the supplier of the fencing. Consideration should also be given to whether or not materials used are imported.

8. COPYRIGHT

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9. REVISIONS

REV.	DESCRIPTION OF CHANGE	DATE	AUTHORISED BY
A (original)		21/4/12	S.Belfield
B		25/3/13	S.Belfield