



Ingal Civil Products



# Car Park & Industrial Barriers **PRODUCT MANUAL**

OFF HIGHWAY VEHICLE SAFETY BARRIERS





## 1.0 INTRODUCTION

Off highway vehicle safety barriers are a specific range of barriers designed for use in car parks, logistics yards, warehouses, factory facilities, retail parks, loading bays, and many other non-roadside applications. Their objective is the protection of people, plant and buildings.

Traditional highway safety barrier systems are designed to contain and redirect errant vehicles traveling at high velocities and relatively low impact angles. Posts are driven into the ground and the surrounding soil provides lateral post support.

Ingall Civil Products' range of car park and industrial barriers are specifically designed for applications where protection is required from heavy vehicle glancing blows and low speed perpendicular impacts. Traditional bolt down rigid posts provide no energy absorption upon impact resulting in damage to the barrier and post foundations. Ingall's range of flexible post systems absorb impact energy, thereby reducing the pullout forces on the holding down bolts. Fewer holding down bolts are required resulting in an easier to install system and minimal damage to valuable plant and equipment.

## 2.0 BARRIER SELECTION

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Any general perimeter barrier system must be capable of withstanding the relevant impact loads and minimise any residual energy being passed onto the structure that is being protected. The selection of an effective perimeter edge protection is based on a number of variable factors;

- Space available in which to install a barrier system and minimise any encroachment into the travelled way.
- Climability of the barrier.
- Handrail attachments and mesh infill system requirements.
- Edge detail in relation to suitable anchorage of the barrier system.
- Compliance with relevant Australian Standards and Building Codes



## 3.0 STANDARDS

### 3.1 AS1170.1:2002

#### Structural Design Actions,

#### Part 1: Permanent, imposed and other actions

The horizontal impact force on a barrier arising from the movement of vehicles may be calculated as follows;

$$F = mv^2/2\Delta$$

Where:

F = impact force (N)

m = gross vehicle mass (kg)

v = velocity of the vehicle (m/s)

$\Delta$  = sum of the deflection of the vehicle  
(crumple zone) and barrier (m)

The impact force shall be distributed over a 1.5m length at any position along the barrier and shall be assumed to act at 0.5m above floor level for light traffic areas.

Light traffic areas are defined as parking, garages, and driveways restricted to cars, light vans, etc, not exceeding 2500kg gross mass.

In practical terms for car parks, the horizontal impact force on a barrier in a light traffic area is based on a 1500kg vehicle travelling at 2m/s and a 0.1m crumple zone.

The top edge or handrail shall also be designed for the case where a concentrated load of 0.6kN, positioned for the worst effect, acts inward, outward or downward.

## 3.0 STANDARDS



### **3.2 AS2890.1:2004 Parking Facilities, Part 1: Off street car parking**

Barriers shall be constructed to prevent vehicles from running over the edge of a raised platform or deck of a multi-storey car park including the perimeter of all decks above ground level. They are required wherever the edge from the deck to a lower level exceeds 600mm

### **3.3 AS/NZS 1657:1992 Fixed Platforms, Walkways, Stairways and Ladders - Design, Construction and Installation**

In walkway areas, a top rail, supported by posts, parallel to the floor or slope of a walkway at a vertical height of not less than 900mm or more than 1100mm is required.

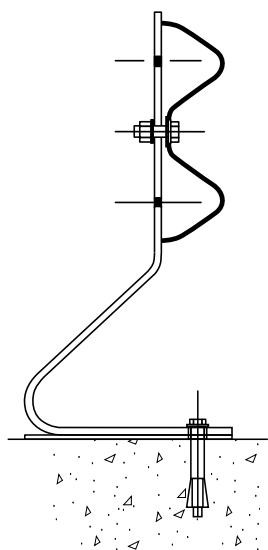
The space between the top rail and the floor may be provided with suitable infill fixed to the top rail and not more than 80mm above the floor. Infill may be fabricated from solid or perforated plate, expanded metal or metal mesh.

### **3.4 Building Code of Australia**

The building code specifies that for balustrading on balconies greater than 1m from the ground, any members (vertical or horizontal) should not permit a 125mm sphere to pass between them.

Once a balcony height of 4m has been exceeded, balustrades should be 1m in height and any horizontal elements within the balustrade or other barrier between 150mm and 760mm above the floor must not facilitate climbing.





**AS1170.1**  
COMPLIANT

## 4.0 INGAL SPRING STEEL BUFFA™ CLASSIC POST

The Spring Steel Buffa™ is manufactured from high-grade spring steel and is heat-treated for strength and flexibility. The Spring Steel Buffa™ can deflect up to 300mm upon impact, reducing the forces on the anchor bolts by up to 75%, thereby minimising damage to both the barrier and the impacting vehicle.

The Classic Post only requires one holding down bolt per post. The dynamic deflection of the barrier is contained within the post footprint area, thereby minimising the required clearance to hazards and maximising floor space. The Classic Post is available with handrail extension pieces and anti-climb mesh infill panels.

## 4.0 INGAL SPRING STEEL BUFFA™ CLASSIC POST



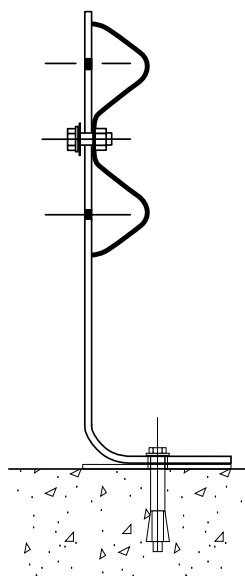
#### 4.1 Classic Post Specifications

|                    |                              |
|--------------------|------------------------------|
| Finish:            | Hot Dip Galvanized to AS4680 |
| Post Height:       | 610mm                        |
| Footprint:         | 300 x 100mm                  |
| Max. Post Spacing: | 2000mm                       |
| Deflection:        | Up to 300mm                  |
| Weight:            | 11kg                         |
| Anchor Bolts:      | 1 off per post               |
| Anchor Bolt Size:  | Dependent upon application   |

#### 4.2 Classic Post Applications

- Perimeter edge and split-level protection for multi-storey car parks
- Internal and external barrier protection for walls in warehouses and logistic depots
- Protection to high value plant and equipment
- Loading bay ramps





**AS1170.1**  
COMPLIANT



## 5.0 INGAL SPRING STEEL BUFFA™ STANDARD POST

The Spring Steel Buffa™ is manufactured from high-grade spring steel and is heat-treated for strength and flexibility. The Spring Steel Buffa™ can deflect up to 300mm upon impact, reducing the forces on the anchor bolts by up to 75%, thereby minimizing damage to both the barrier and the impacting vehicle.

The Standard Post only requires one holding down bolt per post. Rail can be mounted either side of the standard post in order to maximize floor space or to prevent post feet being a trip hazard or to minimize damage to tyres. The Standard Post is available with handrail extension pieces and mesh infill panels

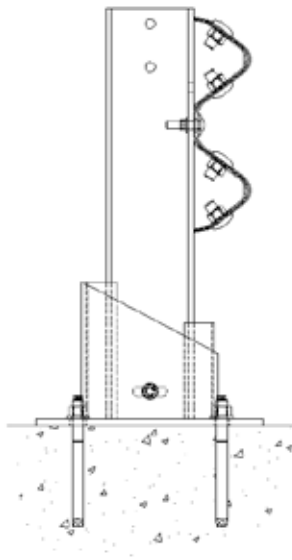
### 5.1 Standard Post Specifications

|                    |                              |
|--------------------|------------------------------|
| Finish:            | Hot Dip Galvanized to AS4680 |
| Post Height:       | 610mm                        |
| Footprint:         | 300 x 100mm                  |
| Max. Post Spacing: | 2000mm                       |
| Deflection:        | Up to 300mm                  |
| Weight:            | 11kg                         |
| Anchor Bolts:      | 1 off per post               |
| Anchor Bolt Size:  | Dependant upon application   |

### 5.2 Standard Post Applications

- Ramp protection on multi-storey car parks
- Split level protection on multi-storey car parks
- Internal and external barrier protection for walls in warehouses and logistic depots
- Protection to high value plant and equipment
- Loading bay ramps

**5.0** INGAL SPRING STEEL  
BUFFA™ STANDARD  
POST



**AS1170.1**  
COMPLIANT



## 6.0 INGAL FLEXI-POST

The Flexi-Post is a semi-rigid steel post with an integral rubber shock absorber. The Flexi-Post is uniquely engineered to withstand regular heavy vehicle impacts of up to 10 tonnes. This is achieved through the rubber shock absorbers positioned within the post socket that allows the post to deflect up to 120mm. This absorption of energy during impact reduces the forces on the anchor bolts and reduces the risk of damage to both the barrier and the impacting vehicle. The Flex-Post is available with handrail extension pieces and mesh infill panels.

### 6.1 Flexi-Post Specifications

|                    |                                 |
|--------------------|---------------------------------|
| Finish:            | Hot Dipped Galvanized to AS4680 |
| Post Height:       | 610mm                           |
| Footprint:         | 330 x 280mm                     |
| Max. Post Spacing: | 2000mm                          |
| Deflection:        | Up to 120mm                     |
| Weight:            | 18kg                            |
| Anchor Bolts:      | 4 off per post                  |
| Anchor Bolt Size   | M16 x 150mm                     |

### 6.2 Flexi-Post Applications

- Collisions at low speeds with heavy vehicles.
- Areas of limited deflection and space.
- Head-on impacts with forklift trucks
- Internal and external barrier protection for walls in warehouses and logistic depots.
- Protection to high value plant and equipment.
- Perimeter and edge protection for multi-storey car parks.

## 6.0 INGAL FLEXI-POST

## 7.0 RIGID POST SYSTEMS

For very light impacts, the inherent strength of a steel barrier, rigidly mounted may be sufficient to withstand impacts without suffering damage. However, the full load of any impact is passed through the barrier into the holding down bolts. Stronger impacts will therefore result in damage to the impacting vehicle, the barrier and the foundations.

Rigid posts are available as C posts or U posts depending upon site requirements.

### 7.1 Rigid Post Specifications

|              |                                              |
|--------------|----------------------------------------------|
| Finish:      | Hot Dip Galvanized to AS4680                 |
| Post Height: | 700 or 750mm (C Post)<br>700mm (U Post)      |
| Footprint:   | 200 x 280mm (C Post)<br>300 x 300mm (U Post) |

Typical Post Spacing: 2000mm

Deflection: Untested to AS1170.1:2002

Weight: 18kg

Anchor Bolts: 4 off per post

Anchor Bolt Size: Dependant upon application

### 7.2 Rigid Post Applications

- Glancing blow collisions at low speeds with light vehicles
- Internal and external barrier protection for walls in warehouses and logistic depots

## 7.0 RIGID POST SYSTEMS





## 8.0 INGAL COLUMN BUFFA™

### 8.0 INGAL COLUMN BUFFA™

Supporting columns are highly vulnerable to damage from vehicle traffic. Repairs are usually costly, and damage may affect the structural integrity of the supporting column. The Column Buffa™ is also suitable for exposed pipework and lighting columns that are located in trafficable areas. The Column Buffa™ is available in full or semi-circle units with single or double rail, providing protection from low speed impacts. Column Buffas™ are supported by spring steel posts ensuring that damage to the barrier, structure and impacting vehicle is minimised. Posts can be turned inwards to prevent a trip hazard or damage to tyres. Each supporting post only requires one holding down bolt per post.

#### 8.1 Column Buffa Specifications

|                     |                              |
|---------------------|------------------------------|
| Finish:             | Hot Dip Galvanized to AS4680 |
| Post Height:        | 610mm                        |
| Internal Diameters: | 500, 750 and 1000mm          |
| Anchor Bolts:       | 1 per post                   |
| Anchor Bolt Size:   | Dependent upon application   |



## 9.0 INSTALLATION OF CLASSIC AND STANDARD POST SYSTEMS

### 9.1 Site Preparation

The site should be prepared free of hazards that may interfere with the installation or operational performance of the system. Some sites may require minor leveling, which can be achieved by placing steel packing plates under the posts.

### 9.2 Recommended Plant & Tools

- Tape Measure
- String Line
- Levelling Device
- Drilling Tools
- Torque Wrench
- Cutting Tools
- Hand Tools

### 9.3 Installation Sequence

The following written instructions should be read in conjunction with Ingals Civil Products Drawings;

- STB -004 Classic Post Arrangement
- STB-018 Standard Post Arrangement
- STB-06 Flexi-Post Arrangement
- STB-35 Handrail Extension and Mesh Infill Panel Arrangement

#### 9.3.1 Post Installation

1. Using a string line, commence set out by marking the ground for each post location. Posts will typically be at 2m centres (max).
2. If installing the standard post, provide a 300mm clearance from the post to the hazard to accommodate for the expected dynamic deflection.
3. If installing a classic post, the dynamic deflection of the system will be contained within the post footprint.
4. Drill holes for each post to the depths as required by the nominated anchor bolt size. If securing with chemical anchors, ensure the holes are free from dust and debris.
5. Place the post above the drilled hole(s) and insert the holding down bolt, tighten to snug tight.

## 9.0 INSTALLATION OF CLASSIC AND STANDARD POST SYSTEMS

### 9.3.2 Handrail Extension Attachment

1. Align the handrail extension piece (also called a crank) with the post and secure through the pre-punched upper hole in the extension piece using an M16x50mm bolt.

Note: Custom height barriers may require an additional; M16 x 50 Bolt through the lower hole of the extension piece and post.

### 9.3.3 Rail Attachment

1. Align the w-beam sections with the posts and secure using the bolts nominated in the ICP drawings.
2. If a handrail extension piece is attached, ensure the extension is vertical before securing the M16x65mm bolt through the rail, post and handrail.
3. Splice rails together using M16x32m bolts eight (8) bolts are required per splice.
4. Rails should be lapped so that the exposed edge is facing away from the approaching traffic.

### 9.3.4 Handrail Attachment

1. Align the handrail section with the extension pieces and secure the handrail with tek screws.
2. Joins in the handrail are made by butting adjacent handrails together at the post extensions prior to securing with tek screws.

3. If a handrail join cannot be located at the post extension, adjacent rails can be spot welded together. A zinc rich paint should then be applied to the welded surfaces.

Note: Joiners are available from Ingal Civil Products for handrail sections and are recommended to avoid welding. However the above instructions are to be followed if you are not using a handrail joiner.

### 9.3.5 Anti-Climb Mesh Attachment

1. Align the angle sections with the pre-punched holes in the handrail extension piece located approximately 100mm below the handrail and secure using an M8 x 30mm cup head bolt and nut. Duplicate this process at the bottom pre-punched hole of the handrail extension piece approximately 100mm from the ground.
2. Joins in the angle sections are made by butting adjacent sections together at the extension piece.
3. Place the anti-climb mesh panel sections between the angle sections, secure at the top and bottom angle sections using the tek screws and saddle washers and also through the corrugation of the w-beam section.
4. Continue this process at spacings of 500mm along the length of the run to secure the mesh.
5. Joins in the mesh panels are made by butting adjacent panels together and securing with the saddle washers and tek screws at the extension piece ensuring both panels are secured.



## 10.0 INSTALLATION CHECKLIST

| Post Installation                                                                                                                            |                              |                             |
|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------------|
| Is the area clear of obstructions that may impede the operational performance of the system                                                  | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Have the posts been positioned at a maximum 2000mm spacing                                                                                   | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Are the posts orientated correctly                                                                                                           | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Have the posts been installed using the holding down bolts nominated in ICP drawings or project engineer                                     | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Handrail Installation                                                                                                                        |                              |                             |
| Are the handrail extensions secured to the posts with two (2) M16 bolts                                                                      | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Are the handrail extensions vertical                                                                                                         | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Has the handrail been attached to the extension pieces with tek screws                                                                       | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Rail Installation                                                                                                                            |                              |                             |
| Are the rails secured to each post                                                                                                           | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Are the rails spliced with eight (8) M16x32mm bolts                                                                                          | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Are the rails spliced ensuring the exposed edge is facing away from oncoming traffic                                                         | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Mesh Infill Installation                                                                                                                     |                              |                             |
| Are the angle sections attached at the top and bottom of the handrail extension pieces                                                       | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Are the mesh anti-climb sections attached to the lower or upper corrugation of the rail using tek screws and saddle washers at 500mm centres | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Are the anti-climb mesh sections tethered at the joins using saddle washers                                                                  | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| General                                                                                                                                      |                              |                             |
| Where the galvanizing has been damaged, has the coating been repaired with a zinc-rich paint                                                 | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Are all fasteners secure                                                                                                                     | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Is all rubbish and debris removed                                                                                                            | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

To ensure the correct installation of the Classic Post and Standard Post systems, you must have answered yes for each applicable question.

## 10.0 INSTALLATION CHECKLIST

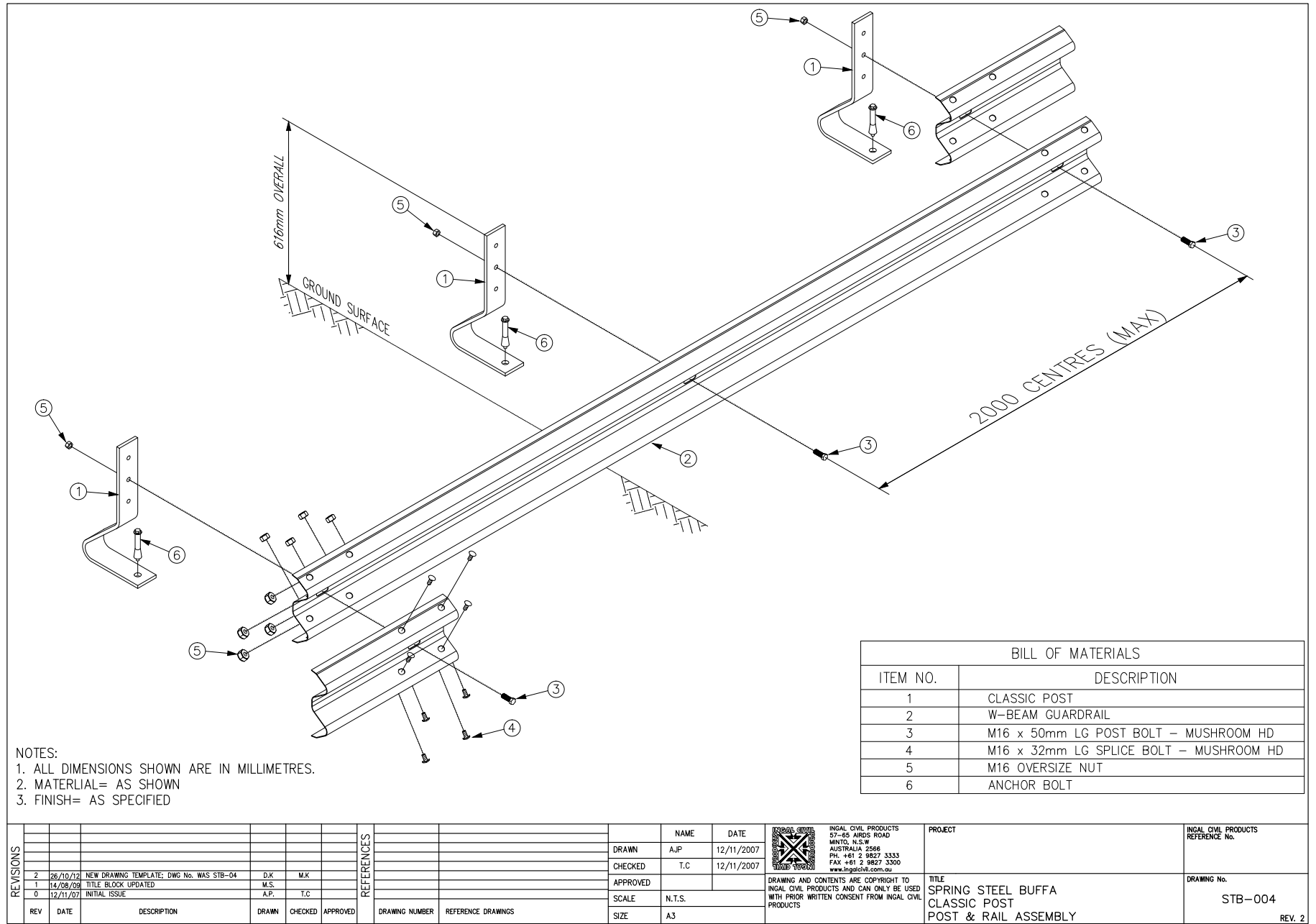
## 11.0 ACCESSORIES

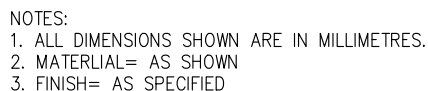
The following accessories are available to compliment your range of car park and industrial barriers;

- Post Caps
- Short W-beam Bullnose Ends
- Wheel Stops
- Speed Humps
- Corner Protectas
- Plastic Rail Caps
- Steel Bollards



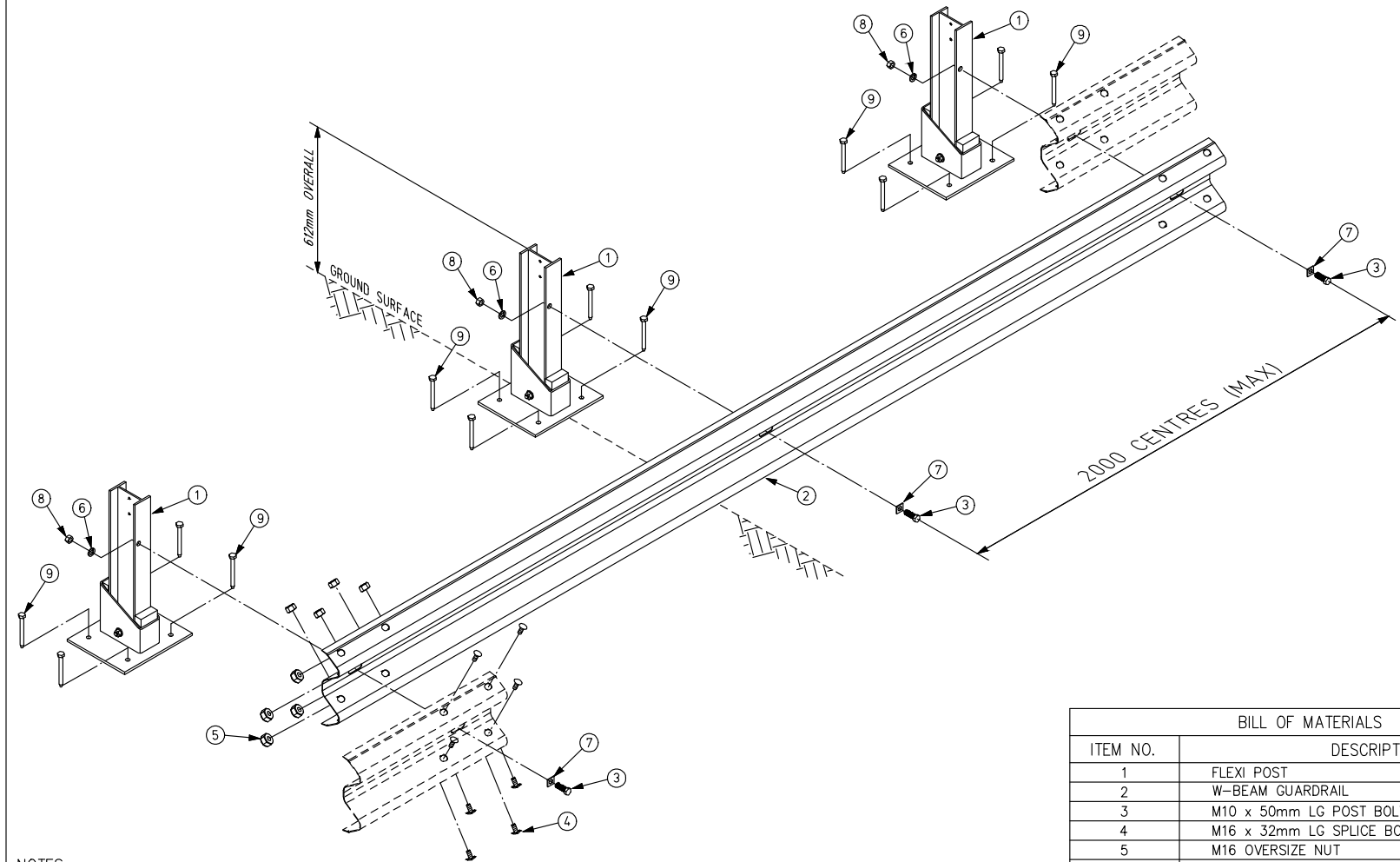
## 11.0 ACCESSORIES





| BILL OF MATERIALS |                                         |
|-------------------|-----------------------------------------|
| ITEM NO.          | DESCRIPTION                             |
| 1                 | STANDARD POST                           |
| 2                 | W-BEAM GUARDRAIL                        |
| 3                 | M16 x 50mm LG POST BOLT – MUSHROOM HD   |
| 4                 | M16 x 32mm LG SPLICE BOLT – MUSHROOM HD |
| 5                 | M16 OVERSIZE NUT                        |
| 6                 | ANCHOR BOLT                             |

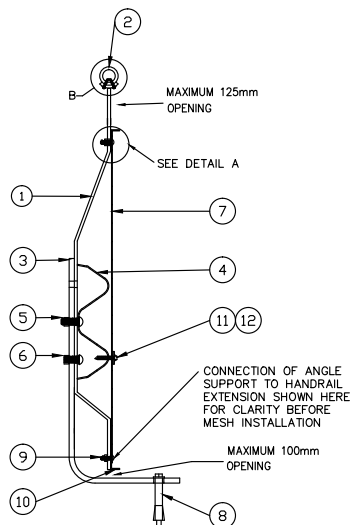
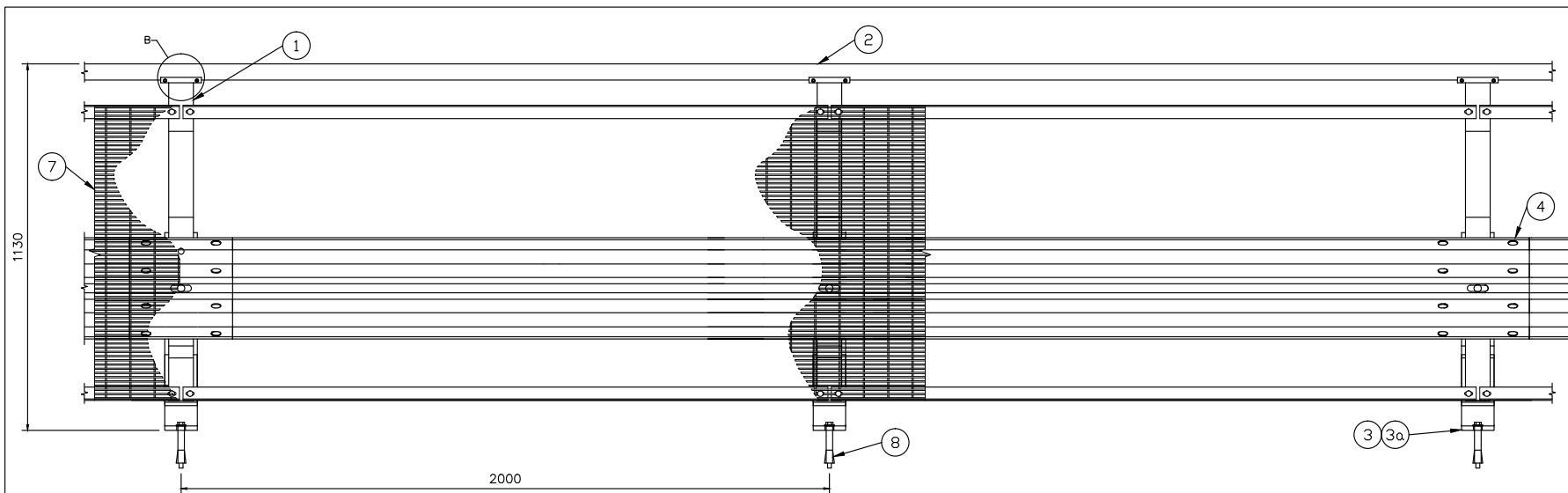
[illegible]



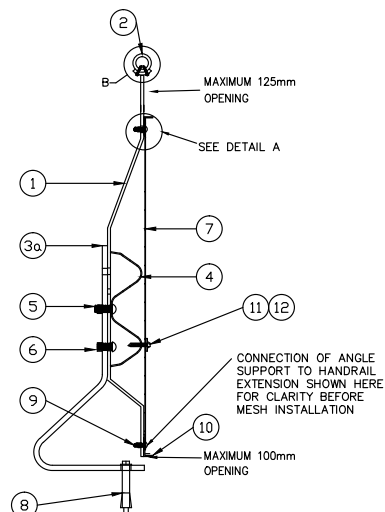
- NOTES:  
1. ALL DIMENSIONS SHOWN ARE IN MILLIMETRES.  
2. MATERIAL= AS SHOWN  
3. FINISH= AS SHOWN

| BILL OF MATERIALS |                                         |
|-------------------|-----------------------------------------|
| ITEM NO.          | DESCRIPTION                             |
| 1                 | FLEXI POST                              |
| 2                 | W-BEAM GUARDRAIL                        |
| 3                 | M10 x 50mm LG POST BOLT                 |
| 4                 | M16 x 32mm LG SPLICE BOLT - MUSHROOM HD |
| 5                 | M16 OVERSIZE NUT                        |
| 6                 | M10 ROUND WASHER                        |
| 7                 | M10 RECTANGULAR WASHER                  |
| 8                 | M10 NUT                                 |
| 9                 | ANCHOR BOLT                             |

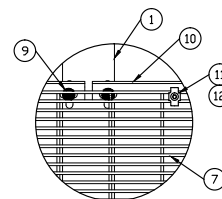
| REVISIONS |          |                      |        | REFERENCES |          |                |                    | NAME     | DATE   |  | INGAL CIVIL PRODUCTS<br>57-55 AIRDS ROAD<br>MUNTO, N.S.W.<br>AUSTRALIA 2566<br>PH. +61 2 9827 3333<br>FAX +61 2 9827 3300<br>www.ingalcivil.com.au | DRAWING AND CONTENTS ARE COPYRIGHT TO<br>INGAL CIVIL PRODUCTS AND CAN ONLY BE USED<br>WITH PRIOR WRITTEN CONSENT FROM INGAL CIVIL<br>PRODUCTS | PROJECT    | INGAL CIVIL PRODUCTS<br>REFERENCE No. |
|-----------|----------|----------------------|--------|------------|----------|----------------|--------------------|----------|--------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------|---------------------------------------|
| 1         | 23/11/12 | NEW DRAWING TEMPLATE | D.K.   | M.K.       |          |                |                    | DRAWN    | A.J.P. | 16/11/07                                                                              |                                                                                                                                                    |                                                                                                                                               | FLEXI POST |                                       |
| 0         | 16/11/07 | INITIAL ISSUE        | A.J.P. | T.C.       |          |                |                    | CHECKED  | T.C.   | 16/11/07                                                                              |                                                                                                                                                    |                                                                                                                                               |            |                                       |
|           |          |                      |        |            |          |                |                    | APPROVED |        |                                                                                       |                                                                                                                                                    |                                                                                                                                               |            |                                       |
|           |          |                      |        |            |          |                |                    | SCALE    | N.T.S. |                                                                                       |                                                                                                                                                    |                                                                                                                                               |            |                                       |
| REV       | DATE     | DESCRIPTION          | DRAWN  | CHECKED    | APPROVED | DRAWING NUMBER | REFERENCE DRAWINGS | SIZE     | A3     |                                                                                       |                                                                                                                                                    |                                                                                                                                               | TITLE      | DRAWING No.                           |
|           |          |                      |        |            |          |                |                    |          |        |                                                                                       |                                                                                                                                                    |                                                                                                                                               | ASSEMBLY   | STB-06                                |
|           |          |                      |        |            |          |                |                    |          |        |                                                                                       |                                                                                                                                                    |                                                                                                                                               |            | REV. 1                                |



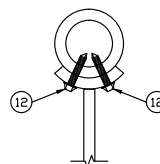
STANDARD POST



CLASSIC POST



DETAIL A



DETAIL B

4-OFF TEK SCREWS  
PER POST CONNECTION

| ITEM NO. | INGAL PART NO.    | DESCRIPTION                        |
|----------|-------------------|------------------------------------|
| 1        | 10001812 (C2804)  | CRANKED HANDRAIL EXTENSION         |
| 2        | 10001713 (C2004G) | 32NB HANDRAIL                      |
| 3        | 10001697 (C1982)  | STANDARD SPRING STEEL BUFFA        |
| 3a       | 10001694 (C1980)  | CLASSIC SPRING STEEL BUFFA         |
| 4        | 10000977 (C1351G) | G4 W-BEAM GUARDRAIL 4.0M N.L.L     |
| 5        | 10001266 (C1589)  | M16 X 65 SPLICE BOLT / NUT         |
| 6        | 10001233 (C1505)  | M16 X 50 POST BOLT / NUT           |
| 7        | 10001738 (C2014)  | 900 X 2400MM ANTI-CLIMB MESH PANEL |
| 8        |                   | ANCHOR BOLT                        |
| 9        | 10001310 (C1646)  | M8 X 30MM BOLT / NUT               |
| 10       | 10001741 (C2015G) | ANGLE SUPPORT FOR MESH             |
| 11       | 10001742 (C2016)  | M10 SADDLE WASHER                  |
| 12       | 10001311 (C1647)  | TEK SCREW 12-14 X 25               |

NOTES:  
1. MATERIAL= AS SHOWN  
2. FINISH= AS SHOWN

| REVISIONS |          |                                         |       |         | REFERENCES |                |                    |          |        | DRAWING INFORMATION |      |         |                                                                          |                      | PROJECT INFORMATION |             |        |  |  | DRAWING No. |  |  |  |  |
|-----------|----------|-----------------------------------------|-------|---------|------------|----------------|--------------------|----------|--------|---------------------|------|---------|--------------------------------------------------------------------------|----------------------|---------------------|-------------|--------|--|--|-------------|--|--|--|--|
| REV       | DATE     | DESCRIPTION                             | DRAWN | CHECKED | APPROVED   | DRAWING NUMBER | REFERENCE DRAWINGS | NAME     | DATE   | SCALE               | SIZE | PROJECT | TITLE                                                                    | INGAL CIVIL PRODUCTS | REFERENCE No.       | DRAWING No. | REV. 1 |  |  |             |  |  |  |  |
| 1         | 29/10/12 | NEW DRAWING TEMPLATE; PART No.s UPDATED | D.K.  | M.S.    |            |                |                    | DRAWN    | MS     | 11/08/2009          | A3   |         | SPRING STEEL BUFFA WITH HANDRAIL AND ANTI-CLIMB MESH GENERAL ARRANGEMENT | INGAL CIVIL PRODUCTS |                     | STB-035     |        |  |  |             |  |  |  |  |
| 0         | 11/08/09 | INITIAL ISSUE                           |       |         |            |                |                    | CHECKED  | T.C.   | 11/08/2009          |      |         |                                                                          |                      |                     |             |        |  |  |             |  |  |  |  |
|           |          |                                         |       |         |            |                |                    | APPROVED |        |                     |      |         |                                                                          |                      |                     |             |        |  |  |             |  |  |  |  |
|           |          |                                         |       |         |            |                |                    | SCALE    | N.T.S. |                     |      |         |                                                                          |                      |                     |             |        |  |  |             |  |  |  |  |
|           |          |                                         |       |         |            |                |                    | SIZE     | A3     |                     |      |         |                                                                          |                      |                     |             |        |  |  |             |  |  |  |  |



Ingal Civil Products



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