

ArmorZone™

MASH TL2 Temporary Safety Barrier

Product Manual

MASH TL2 COMPLIANT

MASH TL1 COMPLIANT



Release 03/19 (Australia/New Zealand)

www.ingalcivil.com.au

1.0 Introduction

ArmorZone™ is a MASH TL-2 barrier made up of plastic units that when joined together using a steel pin and filled with water provides positive work zone barrier protection to temporary construction sites and other miscellaneous roadside activities.

The unique ArmorZone™ MASH TL2 polyethylene composition, profile design and steel pin allow the barrier to be installed straight or down to a minimum radius of 92' (28m) if required.

When correctly installed the ArmorZone™ MASH TL2 system is capable of stopping, containing or redirecting an errant vehicle in a safe manner under these worldwide test standards.

If required the ArmorZone™ MASH TL2 barrier connects directly to the ArmorZone™ TL2 end treatment which negates the need to shield or flare the ends of the barrier.

ArmorZone™ MASH TL2 barrier has been designed and tested to meet the evaluation criteria for end treatment to MASH Test Level 2 (TL-2) for crash cushions.

ArmorZone™ MASH TL2 barrier is designed and constructed to provide acceptable structural adequacy, minimal occupant risk and safe trajectory as set forth in these worldwide test standards for longitudinal barriers and end treatments.

During testing when impacted with vehicles ranging between 1100kg to 2270kg at speeds up to 70km/h and angles up to 25 degrees, the impacting vehicle is controlled in a safe manner.

2.0 Before Installation

Placement of ArmorZone™ MASH TL2 shall be in accordance with the design as provided for the temporary work zone. Installation shall be in accordance with the installation instructions supplied for this product.

Depending on the circumstances at the site, installation including the filling of a unit (using a truck mounted

water tanker) should take no more than 1 minute for each 2.0m unit.

ArmorZone™ MASH TL2 is a highly engineered safety device made up of a relatively small number of parts. Before starting installation ensure that one is familiar with the make up of the system.

3.0 Limitations and Warnings



WARNING: ArmorZone MASH TL2 barriers must NOT be installed with ArmorZone NCHRP-350 barriers, due to their different crash rating and performance. Please see ArmorZone MASH TL2 identification and installation section.

ArmorZone™ MASH TL2 barrier and end treatment have been rigorously tested and evaluated per the evaluation criteria in the MASH guidelines for crash cushions. The impact conditions recommended are intended to address typical in-service collisions.

When properly installed and maintained ArmorZone™ MASH TL2 barrier and end treatment allows an impacting vehicle to be stopped, contained or re-directed in a safe and predictable manner under the MASH impact conditions.

Vehicle impacts that vary from the MASH impact conditions described for longitudinal barriers and crash cushions may result in significantly different results than those experienced in testing. Vehicle impact characteristics different than, or in excess of, those encountered in compliance testing (weight, speed and angle) may result in system performance that may not meet the evaluation criteria.

The ArmorZone™ MASH TL2 barrier can be installed with the ArmorZone® end treatment. If this treatment is not used the end of the barrier must be shielded or flared as per Road Controlling Authority requirements.



4.0 System Design and Design Considerations

4.1 ArmorZone MASH TL2 Identification and Installation



IMPORTANT:

ArmorZone MASH TL2 barriers must NOT be installed with ArmorZone NCHRP350 barriers, due to their different crash rating and performance.

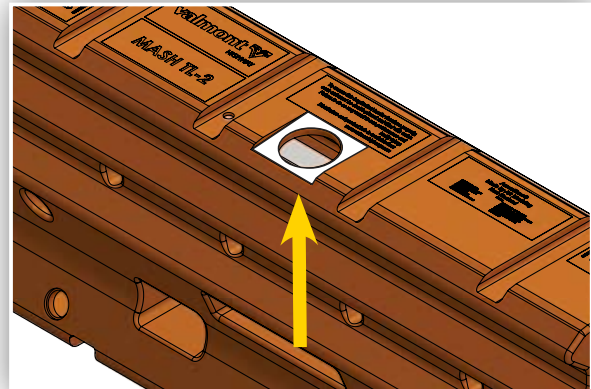
ArmorZone MASH TL2 barriers can be quickly identified by the following:

- White coloured fill lid (ArmorZone NCHRP350 barriers have orange coloured fill lids)
- Steel Connector Bar (not present on ArmorZone NCHRP350 barriers). Visible at the ends of the barriers and also through the water fill hole.
- The text "MASH TL2" moulded into the top of the barrier (not present on the ArmorZone NCHRP350 barriers)

Please note the yellow ArmorZone End Treatment has been crash tested to MASH TL2 and NCHRP350 can therefore be used with MASH TL2 and NCHRP350 barriers.



ArmorZone MASH TL2 Temporary Safety Barrier



ArmorZone MASH TL2 White Coloured Fill Lid and Steel Connector Bar visible inside the barrier under the fill lid



ArmorZone MASH TL2 Barrier Connector Bar



MASH TL-2 Molded into top of Barrier

4.2 Slopes

A maximum slope of 10:1 is preferable.

On slopes greater than this, follow the Road Controlling Authority's guidelines.

4.3 Curbs

ArmorZone™ MASH TL2 has been designed and tested so the centre of gravity of the impacting vehicle is a constant height in relation to the barrier. For this reason, it is preferred that curbs or channels are not in front or behind the barrier as they will result in altering the height of the vehicle at impact. If there is no option but to install ArmorZone™ MASH TL2 near a curb, consult Road Controlling Authority's guidelines.



4.4 Undulating Ground Conditions

Site specific grading may be necessary to ensure that there are no "humps" or "hollows" that may significantly alter the impacting vehicles stability or substantially alter the barrier height in relation to the ground.

4.5 Median and Roadside Applications

ArmorZone™ MASH TL2 can be used in both 'roadside' and 'median' applications where the 'gating' behaviour can be accommodated safely.

4.5.6 Minimum Length of Need

The minimum "Length of Need" (L.O.N) is the minimum length, excluding leading and trailing terminal ends, that when installed correctly, will enable a safety barrier system to achieve the level performance in accordance with its maximum specification. Specifically, for the ArmorZone™ MASH TL2, it is the minimum number of individual ArmorZone™ MASH TL2 Longitudinal barrier segments that will safely contain and redirect an errant vehicle, when impacted under conditions equivalent to those specified for a MASH TL2 system. The minimum L.O.N for the ArmorZone™ MASH TL2 on a two-way

road with a posted speed limit of 70 km/h and a clear zone for approaching traffic is 50 m. This comprises of 50 m or 25 x ArmorZone™ MASH TL2 Orange coloured Longitudinal barrier segments. Each filled barrier segments must be filled with 440 L of water.

4.7 End Treatment

In order to prevent the ends of the ArmorZone™ MASH TL2 L.O.N forming a hazard to errant vehicles, the ArmorZone™ MASH TL2 system must be installed with the ArmorZone™ TL2 temporary barrier End Treatment at the leading and trailing ends of the L.O.N. Each ArmorZone™ TL2 temporary barrier End Treatment consists of 2 m or 1 x ArmorZone™ TL2 Yellow coloured End Treatment barrier segment. When connected to either end of the L.O.N, the total minimum length of the barrier system is 54 m.

4.8 Point of Need

The Point of Need is the first and last location along the barriers L.O.N where the installation, when installed correctly, is known to achieve the level of performance in accordance with its maximum specification. Specifically for a longitudinal safety barrier is it is first and last point at which the barrier becomes redirective. When considering a site installation, this is the location where the safety requirement point begins and ends, namely the position where the hazard / work zone should be located with respect to the barrier system. For further details consult the road controlling authority guidelines for the state or territory where the barriers are to be used. See page 5, ArmorZone MASH TL2 installation layout for point of need.

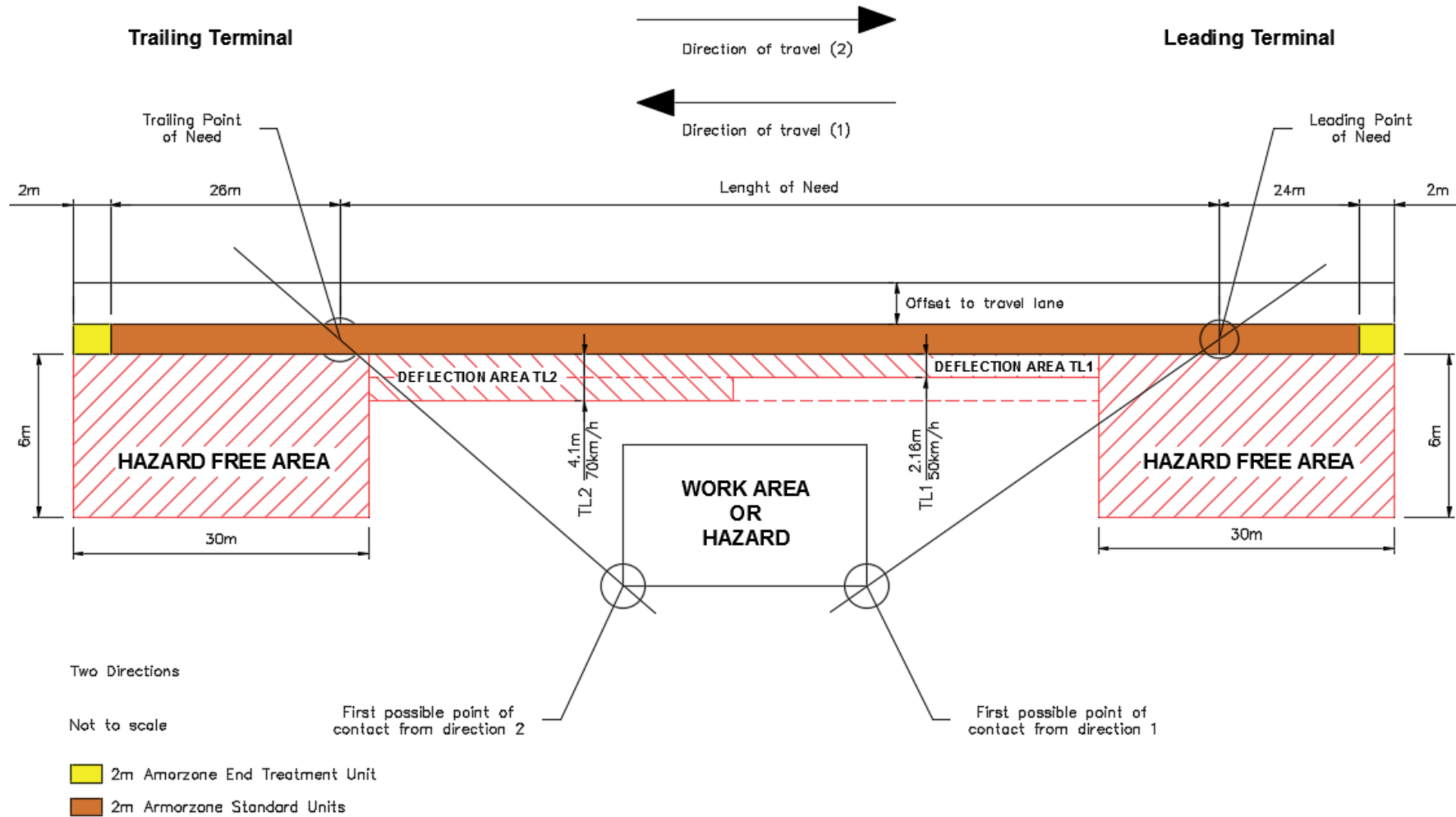
4.9 Soil Conditions

ArmorZone™ MASH TL2 is installed above ground so soil conditions on site are not applicable. However it is recommended ArmorZone™ MASH TL2 systems are installed on a compacted surface.

4.10 Freezing Conditions

The ArmorZone™ MASH TL2 barrier is filled with water and for that reason it MUST NOT be used in conditions where the water can freeze.

ARMORZONE™ MASH TL2/TL1 INSTALLATION LAYOUT



4.11 Deflection

Test 2-11 MASH TL2

2270kg pickup, 25 degree angle at 70km/h

Dynamic Deflection	Permanent Deflection
4.10m	4.10m

Test 2-10 MASH TL2

1110kg car, 25 degree angle at 70km/h

Dynamic Deflection	Permanent Deflection
2.02m	2.02m

Test 2-11 MASH TL2 Modified Shallow Impact Angle

2270kg pickup, 7 degree angle at 70km/h

Dynamic Deflection	Permanent Deflection
0.65m	0.65m

Note: Results are from actual crash testing and the test article length was 50m.

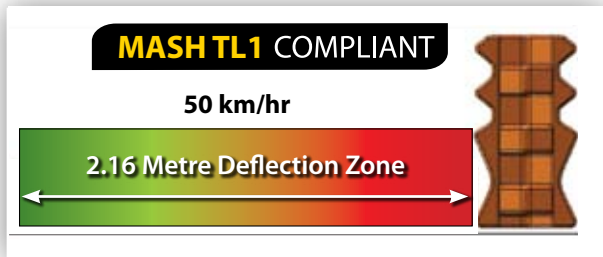
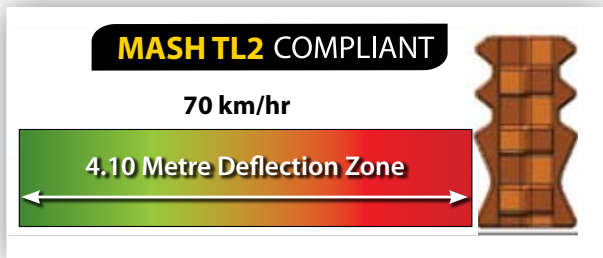
4.12 Design Speed

ArmorZone™ MASH TL2 barrier is restricted to locations where the design speed is limited to 70km/h.

Test 1-11 MASH TL1

2270kg pickup, 25 degree angle at 50km/h

Dynamic Deflection	Permanent Deflection
2.16m	2.16m



4.13 Barrier Unit Type Configuration

ArmorZone™ MASH TL2 barrier unit types located between the PoN and the end of the system are always the same configuration. This is one ArmorZone™ End Treatment unit at the 'exposed end' connected to as many ArmorZone™ MASH TL2 Standard units as required to reach the PoN which contain 440 litres of water each.



NOTE: ArmorZone™ End Treatment units **MUST NOT** be used in any location other than the barrier end, including the re-directive longitudinal barrier section between the PoN's.



4.14 ArmorZone™ MASH TL2 Lifting Techniques

It is recommended that ArmorZone™ MASH TL2 units are transported on a flatbed truck in securely strapped bundles of 13. Each bundle requires 3 straps for safe transportation and unloading, and the required configuration is shown below. (Bundles must be removed from the truck one at a time by the lifting points using a fork hoist or crane with appropriate lifting equipment).

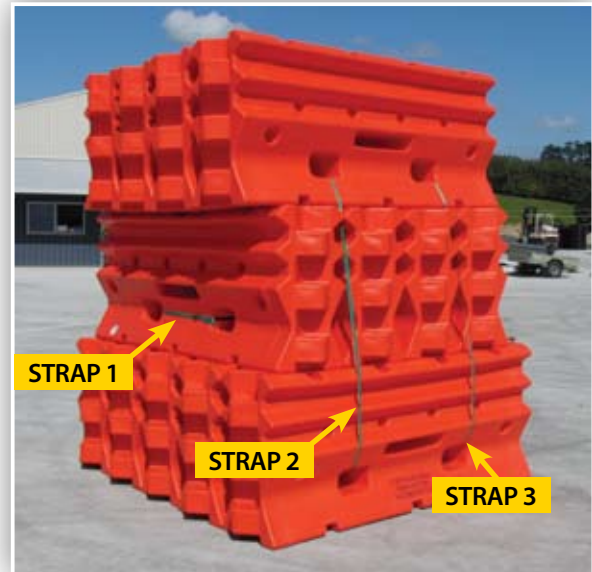
Once a bundle is on the ground the levels can be lowered one row at a time. The recommended technique is to have the fork hoist forks supporting the top level before straps 2 and 3 are removed. The middle level can then be lowered and strap 1 removed.

Note: Each ArmorZone™ MASH TL2 unit has 'through holes' designed not only to provide strength to the barrier but also so that they can be used as 'lifting points'.

Once the ArmorZone™ MASH TL2 barrier bundles rows have been lowered to ground the units can be manoeuvred into position by one personnel. If for whatever reason a barrier unit is required to be lifted this must be done by 2 personnel.

At the end of each ArmorZone™ MASH TL2 unit are 'lugs' which can be used as manual lifting points. Personnel must wear the correct safety gear.

An empty ArmorZone™ MASH TL2 unit weighs 56kg and this detail is 'stamped' on the top of each unit so all personnel will be aware of this fact. Personnel must be 'fit for task' and educated in safe lifting techniques including Risk Assessment.

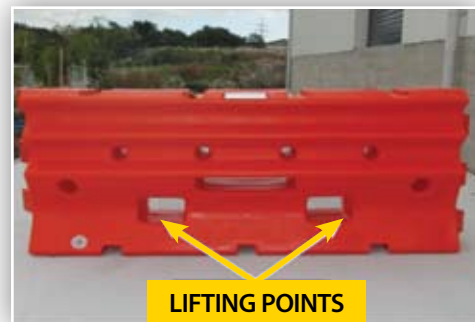


2 personnel can lift an empty ArmorZone™ MASH TL2 unit.

No attempt shall be made to lift an ArmorZone™ MASH TL2 unit that contains water.



Manual Lifting Points



Machine Lifting Points

5.0 Parts Identification



MASH TL2 Unit
(HDPE)



End Treatment Unit
(HDPE)

6.0 Bill of Materials

For every 2.0m (linear) of temporary barrier the following components are required:

- 2.0m ArmorZone™ MASH TL2 Unit..... 1 required
- Steel Pin 1 required
- Water 440 Litres
- 2.0m ArmorZone® End Treatment Unit & Pin..... Water is not required

Note: ArmorZone™ End Treatment units must be used to protect the end of the barrier as shown in the temporary work zone design drawings. Steel pins must **not** be installed in the ArmorZone End Treatment end which is exposed to traffic.



Steel Pin
(Hot Dipped Galvanised)

7.0 Installation Preparation

7.1 Getting Started

It is essential that ArmorZone™ MASH TL2 barrier and ArmorZone® end treatment are installed correctly. Please carefully read and understand the following instructions before installing system.

Note: These instructions relate only to the installation of ArmorZone™ MASH TL2 and are for standard installations only.

ArmorZone™ MASH TL2 is designed so that it has exactly the same components and barrier setup whether in a 'roadside' or 'median' application. For all installations, commence placement of the units at one end and connect the units together until the correct barrier length and position is achieved. Please ensure that the checklists for both barrier and end treatment are completed for every installation.



Before handling any ArmorZone™ units all personnel involved need to be familiar with the instructions contained in the Lifting Techniques (section 4.14) section in the manual.

7.2 Preparation

Before installing ArmorZone™ MASH TL2, ensure that all components required for the system are on site and have been identified. ArmorZone™ MASH TL2 is a highly engineered safety device made up of a relatively small number of parts. Before starting installation ensure that one is familiar with the make up of the system. Refer to the Parts Identification and Bill of Materials section in this manual for more information.

Ensure that the area where ArmorZone™ MASH TL2 is to be installed is flat enough (max slope 10:1) and compacted, so that the ground conditions will not significantly alter the height of the vehicle in relation to the height of the barrier.

Minor site grading may be required.

7.3 Tools Required

There are no tools required to install the components of ArmorZone™ MASH TL2. The units can be manually lifted and positioned by 2 personnel and the steel pin used to connect the units is simply dropped into position.

Each unit requires approx 440 litres of water and it is recommended that a large truck mounted tanker with large fill hose is sourced for fast barrier construction. The diameter of the 'fill hole' is 125mm.



8.0 Installation Instructions

8.1 Step 1 – Site Preparation

It is preferred that ArmorZone™ MASH TL2 barrier is installed on compacted flat, level ground.

Ensure that sufficient width and traffic control is available before installing ArmorZone™ MASH TL2. Due to the bulky nature of the units, deployment will be from a flat deck truck or similar. Each unit requires 440 litres of water and it is recommended that a large truck mounted tanker is used.

ArmorZone™ MASH TL2 barrier should be installed in a tangent position to the direction of travel and in accordance with the temporary work zone design.

ArmorZone™ MASH TL2 units are dispatched in bundles of up to 13 (shown in Figure 1). To ensure safe unloading of the units, use a fork hoist or similar to lower each row to ground level.



Figure 1: ArmorZone™ MASH TL2 units are dispatched in bundles of up to 13.



Use a fork hoist or similar to lower each row to ground level.

Safety Statements

General Safety

- All required traffic safety precautions should be complied with. All workers should wear required safety clothing (high visibility vests, steel capped footwear, gloves and hard hats). Gloves should be worn at all times.



Gloves



Hard Hat



Steel-Capped Footwear



Hi-Visibility Vest

- Only authorised trained personnel should operate any machinery. Where overhead machinery is used, care must be taken to avoid any overhead hazards.

ArmorZone™ MASH TL2 Safety Statements

- All installers must be well clear of the water tanker when the units are being filled.
- ArmorZone™ MASH TL2 is a stand alone barrier and does not require at any stage during installation that the surrounding soil is dug or drilled in anyway.
- The empty units weigh 56kg and can be pushed at ground level by one person. If lifting of a unit is required this must be done by two persons. Do not attempt to lift a unit which contains water.
- Final positioning of the empty units and placement of the steel pin connectors should be done by one person so as to remove the risk of hands and fingers being caught between the components.

8.2 Step 2 – Placement of the Barrier Units

Unload the units and set out in a row along the intended barrier position. Make sure the configuration of the ends will fit together (shown in Figure 2).

Lifting the units is a 2 person job; they weigh 56kg each when empty.

Slide the units into position (shown in Figure 3).

The units must fit flush together so that the vertical holes on each unit line up (shown in Figure 4 & 5).

Note: If the drainage bung is on the workzone side of the barrier when assembled, it will allow for safe access when decommissioning the barrier.

Note: None of the units are fixed to the ground in any way.



Drainage Bung



Bung Spanner



Figure 2: When setting out, ensure the configuration of the ends will fit together.



Figure 3: Sliding the units into position.



Figure 4: Units are pushed together to align the vertical holes



Figure 5: The units must fit flush together so that the vertical holes on each unit line up.

8.3 Connecting the Barrier Units

Once the units are 'flush fit' aligned, the steel pin can be positioned down the 2 vertical alignment holes (shown in Figure 6 & 7).

Care must be taken not to pinch a hand or finger when inserting the pin. Gloves must be worn.

The steel pin sits in the vertical holes under its own weight only and is not connected to the barrier units in any other way.

Note: If slight curvature of the barrier is required, position as required at this point.



Figure 6: Once the units are aligned, the steel pin can be dropped into the alignment holes. Take care not to pinch hands or fingers between the top of the pin and the top of the barrier.

8.4 Step 4 – Filling the Barrier Units

Lifting the flap on the top of the unit will allow access to the 125mm diameter water 'fill hole' (shown in Figure 8).

Using a truck mounted tanker fill each unit to the top with water (shown in Figure 9).

Check that there are no leaks before filling the next unit. If there is a leak the unit must be replaced. It may be possible to fix at a later stage depending on the damage.



Figure 7: Check the steel pin has gone through the alignment holes.



Figure 8: Lift the flap on the top of the unit to allow access to the water 'fill hole'.



Figure 9: Using a truck mounted tanker fill each unit to the top with water.



NOTE:

The ArmorZone® end treatment unit is never filled with water. Through design it is not possible to hold water through error or weather conditions.

8.5 Step 5 – Connecting the End Treatment Unit (Optional)

If protection is required for the end of the barrier, the ArmorZone® end treatment unit can be connected to the barrier in a tangent position.

Position the end treatment unit so that the lugs line up with the end barrier unit. Slide the unit into position so that the vertical holes line up (shown in Figure 11 & 12).

Once the units are 'flush fit' aligned, the 'twin pin' connector can be positioned down the 2 vertical alignment holes (shown in Figure 13 & 14).

Note: The end treatment unit is not and can not be filled with water.

The connector sits in the vertical holes under its own weight only and is not connected to the barrier units in any other way.

Note: The end treatment unit is NOT fixed to the ground in any way and must NOT have the 'twin pin' connector inserted at the exposed end of the unit.

8.6 Step 6 – Delineation (Optional)

Depending on location, delineation may be required as per the Road Controlling Authority Guidelines or as outlined in the temporary work zone design.

For further details contact your ArmorZone® distributor.

Delineation must be glued to the top of the standard unit. Delineation can be glued, screwed, riveted or bolted to the front of the end treatment unit.

Note: Substrate used for the delineation should have a maximum thickness of 1.2mm so to not interfere with the performance of the system. The recommended glue is a fast curing polyurethane constructive adhesive such as Sika SuperGrip® 30 minute. For this product and any alternative brands used, make sure one is familiar with the hazards associated with the adhesive which are outlined on the product itself.



Figure 10: Position the end treatment unit so that the lugs line up with the end barrier unit.



Figure 11: Slide the unit into position so that the vertical holes line up.



Figure 12: Once the units are aligned, the steel pin can be dropped into the alignment holes.



Figure 13: Ensure the steel pin has gone through the alignment holes.

9.0 Installation Examples

Note: A minimum 92' (28m) radius curvature can be achieved when the 'flush fit' connection is made between ArmorZone™ MASH TL2 units. It is recommended that this positioning should be completed before the units are filled with water.



Straight Installation



Curved Installation



Installed End Treatment



Installed End Treatment

10.0 Decommission

Before the barrier units can be uplifted ALL water must be removed. This is achieved by either pumping the water out the top using a flexible hose to a truck mounted tank, or by releasing the bung at the bottom to express the contents. Guidance on which method to use should be sort from the Site Project Manager.

Remove the pins from the units so they can be separated from the barrier, and then replace the pin.

Using a fork hoist or similar stack the rows in to the recommended bundle of 13 units. Strap together with 3 separate cables to secure the bundle for lifting and transportation (shown in Figure 14).

Further details on this can be found in the Lifting Technique section in this product manual.

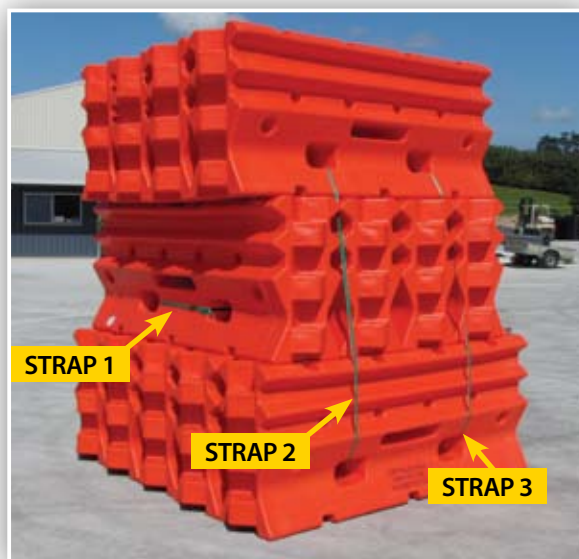


Figure 14: Strapping for transport

11.0 ArmorZone™ MASH TL2 Temporary Safety Barrier & End Treatment Installation Checklist

Location:

Installed By:

Date:

Signed:

Inspected By:

Date:

Signed:

Barrier		
The units are positioned on level ground	<input type="checkbox"/> Yes	<input type="checkbox"/> No
The set-out of the barrier is as per the design instructions	<input type="checkbox"/> Yes	<input type="checkbox"/> No
The lugs of each unit have a 'flush fit' with each other and the steel pin is positioned through both vertical holes in the lugs of each unit	<input type="checkbox"/> Yes	<input type="checkbox"/> No
The lid and bung are attached to each unit correctly so as to ensure the units will remain full of water as intended	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Each unit is filled to the top with water (approx 440 litres) and check for leaks	<input type="checkbox"/> Yes	<input type="checkbox"/> No
The barrier is not fixed to the ground or any other device in any way	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Attach delineation as required by the Road Controlling Authority Guidelines	<input type="checkbox"/> Yes	<input type="checkbox"/> No
End Treatment		
The end treatment unit is positioned on level ground	<input type="checkbox"/> Yes	<input type="checkbox"/> No
The set-out of the system is as per the design instructions	<input type="checkbox"/> Yes	<input type="checkbox"/> No
The ArmorZone® end treatment unit is connected to the ArmorZone™ MASH TL2 barrier using the twin pin steel connector through both vertical holes in the lugs of each unit	<input type="checkbox"/> Yes	<input type="checkbox"/> No
The lugs of each unit have a 'flush fit' with each other	<input type="checkbox"/> Yes	<input type="checkbox"/> No
The end treatment unit is not and can not be filled with water	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Do not install a twin pin connector at the upstream end of the end treatment unit	<input type="checkbox"/> Yes	<input type="checkbox"/> No
The end treatment unit is not fixed to the ground or any other device in any way	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Attach delineation as required by the Road Controlling Authority Guidelines	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Disclaimer:

Important Note: The conformity of the installation is the responsibility of the installation contractor, and Ingal Civil Products accepts no liability for or in connection with any installation that is outside of the specifications of this manual or the Road Controlling Authority. For more information, please refer to our Standard Terms and Conditions of Sale available on our website: www.ingalcivil.com.au.

12.0 Maintenance

ArmorZone™ MASH TL2 is a maintenance free system but it is recommended that inspections are carried out periodically to ensure that the system is installed as required.

Over a long period of time in extreme conditions it may be possible for evaporation to take place and it is imperative that all the barrier units remain filled to the correct level. ArmorZone™ MASH TL2 barrier units are fitted with fill level indicators which allow for 'drive by' inspection which makes it easy to ascertain that each barrier contains the required amount of water or not.

It is also important that the ArmorZone™ end treatment unit is inspected periodically as to confirm that it is in the correct position, undamaged and not filled with significant debris.

13.0 ArmorZone™ MASH TL2 System – Repair

Recommended tools:

- Flat deck truck and suitable lifting equipment
- A truck mounted water tanker
- A crow bar or similar (with curved pincher grip)

Replacement parts required for a severe impact:

- ArmorZone™ MASH TL2 Standard and / or End Treatment Units
- ArmorZone™ Steel Pins
- Water for each standard unit

Typical vehicle impacts causing damage to an ArmorZone™ MASH TL2 system will either be head on

the end treatment unit or from a side on impact into multiple barrier units.

When an ArmorZone™ MASH TL2 system is damaged it is extremely important that it is reinstated as required in a timely manner and the following examples show how to assess damaged components that must be replaced.

Any ArmorZone™ MASH TL2 units that clearly show damage like large holes or significant deformation must be replaced accordingly.

It is also important that less obviously damaged units that are no longer fit for use are replaced and they can be determined using the following 2 methods.

13.1 Water-tight check

Fill all barrier units with water that do not have the required water level and check for leaks. Any barrier that is found to have even the smallest leak must be replaced.

However, small leaks and holes in the centre section of the ArmorZone™ MASH TL2 can be repaired as per the 'Repair Guide' and the 'Plastic Weld Guide' of this manual.

Note: It is assumed that all barriers that do still have the correct water level will not have a leak and the fill level indicator is activated fully.



End On Impact



Side On Impact

13.2 HDPE integrity check

All impacted barrier units (and the unit upstream and downstream of the impact area) that are intended to be re-used (and show they do not leak) must be inspected in the following manner for fatigue.

Access is needed to each barrier end so that the 3 'end lugs' can be closely viewed. As shown in the photo below the HDPE before complete failure shows a 'white stress mark' if the integrity has been significantly affected. Regardless of the size of this condition, all barrier units found to show it must be replaced.

Label all damaged units clearly so that future use does not take place by mistake.

Note: These testing techniques are not relevant to the ArmorZone™ End Treatment unit. If there is any sign of deformation however, the unit must be replaced.

The above techniques accurately determined which ArmorZone™ MASH TL2 units can be re-used or need replacing. The following steps along with the Installation Instructions contained in this manual, explain how the ArmorZone™ MASH TL2 barrier can be reinstated as required.

13.3 Recycling

The ArmorZone™ MASH TL2 Barrier and End Treatment are manufactured from HDPE and therefore the material in any units damaged beyond repair can be recycled. The connector pins are manufactured from steel and can also be recycled.



Leaking Barrier Treatment



White Stress Mark

13.4 Repair Guide

ArmorZone™ MASH TL2 barriers can only be repaired if the damage sustained is in accordance with these guidelines. Not only is the size of repair important, but also the location.

Repair is only to make the barrier water-tight again. Any barriers which have structural damage must be discarded (recycled), as they cannot be used a vehicle barrier.

- Maximum permissible size of a repair is 50mm x 12mm.
- Damage must be located between the green area indicated on diagram (shown below).
- Repair must be carried out by suitably trained personnel.
- Only HDPE plastic wire supplied by Ingal Civil Products to be used.
- The welding rod is the same for MASH and NCHRP-350 barriers.



Damage must be located between the green area indicated above



Welder & HDPE Plastic Wire

13.5 Plastic Welding

In some circumstances it is acceptable to repair an ArmorZone™ MASH TL2 plastic barrier unit.

If repair is allowed, carefully follow the instructions below.

Preparation:

- Ensure that the area is clean of all dirt, oil and grease
- Drill a small hole at each end of the crack
- 'V' out the crack to allow weld penetration



Initial Crack



Holes & "V"

Equipment Required:

- A hot air welder with a 5mm nozzle (i.e. Leister or Techspan)
- ArmorZone™ welding rod (same material as the barrier itself)



Hot Air Welder



Welding Rod

Welding

- Clean the 'V' and welding rod with solvent
- Adjust heat setting on welder and then place the welding rod at the end of the 'V'. Heat both at the same time
- When molten, force the welding rod into the 'V' and move along the crack

Note: If the plastic turns brown the welder is too hot. If the welding rod is not melting into the plastic, either slow down or turn the welder temperature up.



Molten Plastic



Finished Weld

Finishing:

- Use a die-grinder to make the raised weld flush
- Flame repaired area to wet to remove small scratches



Sand Weld Flush



Flame to Finish

Note: Repair must be carried out by suitably trained personnel and ONLY ArmorZone™ welding rod can be used.

13.6 Key Steps to Disassemble Barrier:

- Separate the impacted units (and the unit upstream and downstream of the impact area) by removing the steel pins. (Photos below show how to deal with difficult to remove pins)
- Assess which units are damaged using the techniques described in this section.
- Set aside all damaged units and completely empty of water for safe collection.
- Set aside all damaged pins. (Both ArmorZone™ units and pins are 100% recyclable)

13.7 Key Steps for Barrier Reinstatement

- Align barrier units (re-usable and replacement) as required to reconstruct the system.
- Install the ArmorZone™ steel pins (re-usable and replacement) between each unit.
- Fill all units with water to the required level. (Water fill level indicator must be activated)
- Connect ArmorZone™ end treatment unit and delineation as required.



14.0 Frequently Asked Questions

1. What type of equipment is required to install ArmorZone™ MASH TL2?

Each unit weighs 56kg (empty) so can be unloaded, moved by hand by 2 personnel.

Units are connected together by fitting the steel pin by hand. To fill the units it is recommended that a truck mounted water tanker is used due to the large volume of water. For details on all safe handling consult the Lifting Technique section in this product manual.

2. Can standard ArmorZone Barriers (NCHRP-350 version with no internal steel connector bar) be used in the same deployment as MASH TL2 barriers?

No. Standard (NCHRP-350) barriers must not be deployed with MASH TL2 barriers and vice-versa.

3. How can you identify an ArmorZone™ MASH TL2 barrier from a standard ArmorZone barrier?

A MASH barrier has "MASH TL2" moulded into the top of the barrier and has a white fill flap. The MASH TL2 barrier also has an internal steel bar which is visible on the ends of the barriers and can also be seen by looking into the fill hole.

4. Does your company provide spare parts? What is the lead-time for supply?

It is important to fix a damaged barrier as soon as possible because it most probably won't perform as required when damaged.

Replacement components are available from Ingal Civil Products.

5. On average, how long does it take to install an ArmorZone™ MASH TL2 Barrier?

Depending on the application and circumstances at the site, installation and assembly of the system should take a 2 person crew approximately 1 hour to install a 120m section.

6. What about vandalism, can ArmorZone™ MASH TL2 be easily damaged?

The units are constructed using strong polyethylene and would not easily be damaged. The construction is similar to 'other' water filled barriers and this is not considered an issue.

7. How easily can ArmorZone™ MASH TL2 be restored after impact?

The system is made up of very few components and is modular so easily repaired. A flat deck truck, crow bar and water tanker will be required to reinstate.

(For further details on repairing an ArmorZone™ barrier consult the Repair section of this manual).

8. What maintenance is required? What is the expected performance life?

ArmorZone™ MASH TL2 is a maintenance free system but periodic inspection is recommended.

For further details on maintenance consult the System Design section of this manual.

See separate Assessment of Materials report for details on performance life.

9. What is the Deflection of ArmorZone™ MASH TL2 Barrier?

ArmorZone™ MASH TL2 has been tested to a range of different standards. (For further details on all performance consult the System Design section of this manual)

10. What Terminal End can be used with the ArmorZone™ MASH TL2 Barrier?

A NCHRP 350 TL-2 ArmorZone™ end treatment must be connected to the barrier. Contact your ArmorZone™ distributor for further information on this product.

11. What is ArmorZone™ MASH TL2 Barrier connected to?

ArmorZone™ MASH TL2 barrier is a free standing system and is not anchored in anyway.

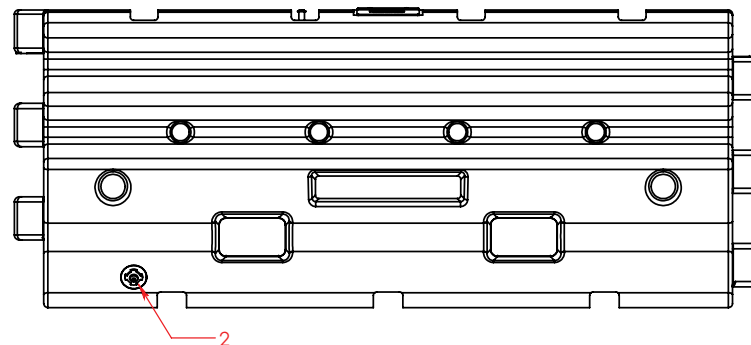
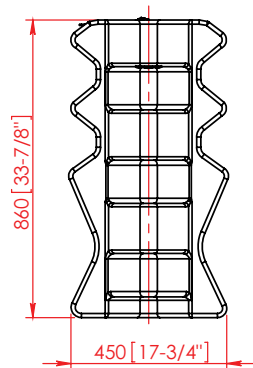
12. Can ArmorZone™ MASH TL2 units be moved when full?

No, no attempt shall be made to lift an ArmorZone™ MASH TL2 unit that contains water.

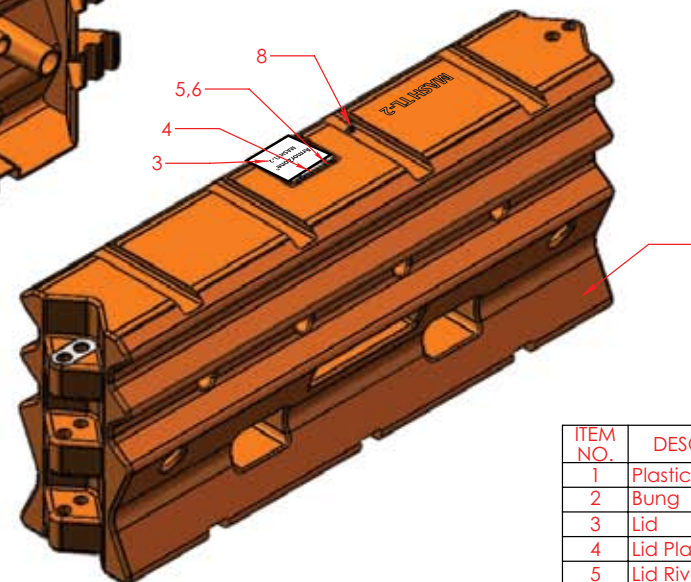
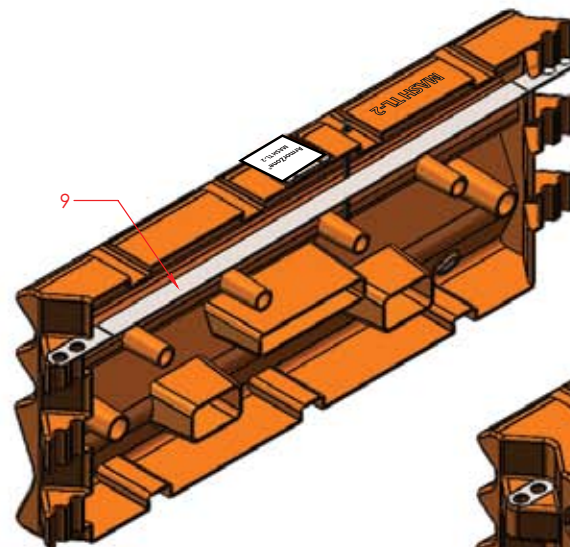
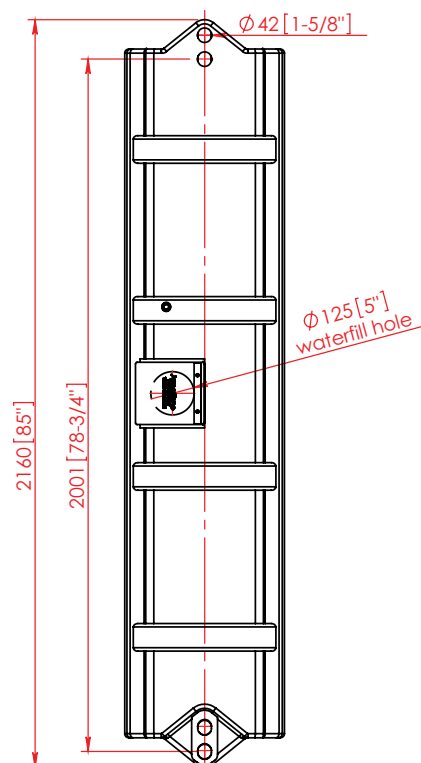
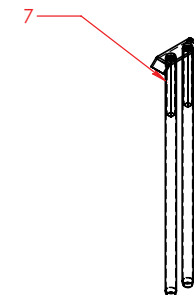
13. Can ArmorZone™ MASH TL2 units be damaged by fire?

ArmorZone™ MASH TL2 is made of HDPE and joined together using steel pins. It is possible that under extreme conditions, like large fires, that the components of the system can be damaged.

For further information on damaged ArmorZone™ barriers consult the Repair section and the Installation Instructions contained in this manual.



Note:
Steel Connector installed
Empty weight 56kg
Water volume 440 l
Full weight 496kg



ITEM NO.	DESCRIPTION	QTY.
1	Plastic Shell	1
2	Bung	1
3	Lid	1
4	Lid Plate	1
5	Lid Rivet	2
6	Lid Washer	2
7	Reinforced Pin	1
8	Full Indicator	1
9	Steel Connector	1

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SCALE: 1:20

Standard
Tolerance

	DATE	INIT.
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APPR'D BY	20/12/2010	DJ



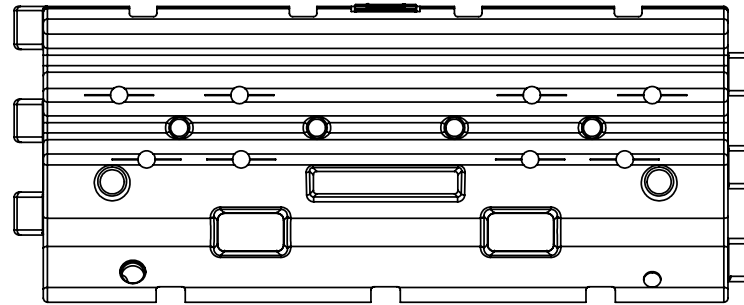
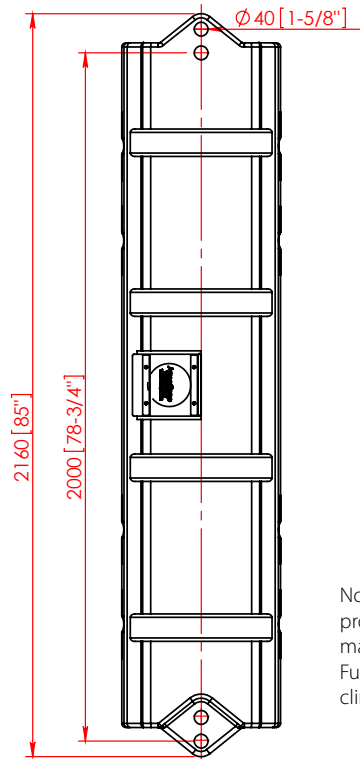
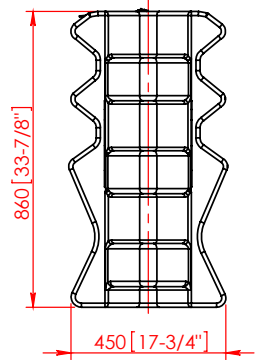
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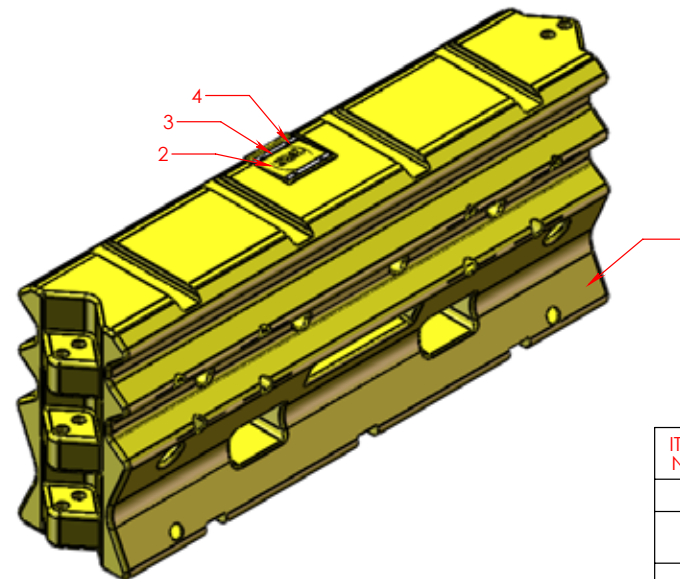
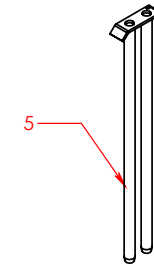
REV. CHANGES DATE

ArmorZone™ MASH TL-2

SHEET	DRAWING NUMBER	REV.
1 OF 1	P-AZ-A1S	



Note:
No Steel Connector inside
Weight 50kg



Note: All dimensions are nominal only. This is a rotomolded product and is therefore subject to shrinkage after manufacture so some variation in dimensions will occur. Further variances may be experienced depending on climatic conditions.

ITEM NO.	DESCRIPTION	QTY.
1	Plastic Shell	1
2	Lid	1
3	Lid Plate	2
4	Lid Screw	4
5	Standard Pin	1

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REV.	CHANGES	DATE
A	INITIAL ISSUE	11/11/2010

SCALE: 1:20	DATE	INIT.
DRAWN BY	11/11/2010	LW
APPR'D BY	11/11/2010	BM

Standard Tolerance

ArmorZone™ End Treatment



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SHEET	DRAWING NUMBER	REV.
1 OF 1	AI0274	A



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