

ArmorBuffa™

MASH TL3 Temporary End Treatment

Product Manual

Australian State Road Authority approved for use in speed zones up to 80km/h

MASH TL3 COMPLIANT



Release 08/22

www.ingalcivil.co.nz

1.0 Introduction

The ArmorBuffa™ is a non-redirective, gating, crash cushion designed to meet the latest test standards defined in the Manual for Assessing Safety Hardware (MASH), Second Edition, 2016. The ArmorBuffa™ system utilises a Transition, water-filled Elements and a Nose Piece to absorb kinetic energy and safely contain or control the penetration trajectory of impacting vehicles.

The system is comprised of a Nose Piece, water-filled Elements, Pins, a Transition and mechanical anchors. All Elements are always filled with water.

The system has a nominal 1100mm height, 460mm width, and an effective length of 9,313mm for TL-3 when installed on a temporary concrete barrier.

ArmorBuffa™ is designed to protect the end of an unanchored temporary F-Type concrete barrier.

2.0 Recommended Tools

NOTE: The list of tools, safety equipment, and traffic control is a general recommendation and should not be considered a comprehensive list. Depending on the specific characteristics of the job site and the complexity of the repair or assembly, more or less tools may be necessary.

Required Tools

- Tape Measure
- Chalk Line
- Marking Paint
- Rotary Hammer
- Masonry Bit
- Torque Wrench
- Compressed Air
- 3/4" Diameter Brush
- 1/2" Drive Deep Sockets M20, M16, M36
- Impact Wrench (pneumatic or electric)
- 16mm x 200mm

NOTE: Water source with a flexible hose (maximum 76mm diameter) and a minimum 2800L capacity is required for the 4 element, TL-3 system.

Safety Equipment



Gloves



Hard Hat



Steel-Capped Footwear



Safety Vest



Safety Glasses



Dust Mask



Hearing Protection

Traffic Control

- Traffic Control Equipment
- Traffic Control Plan



3.0 Parts Identification

3.1 ArmorBuffa MASH TL3 Identification and Installation



Use only Ingal Civil Products parts that are specified by Ingal Civil Products for use with the ArmorBuffa™ System. The use of unspecified parts is prohibited and could result in severe personal injury or death.

PART #	DESCRIPTION	CONCRETE KIT
10200320	ArmorBuffa Transition F-Type Concrete	1
10200322	ArmorBuffa Element - Orange	1
10200323	ArmorBuffa Element - Yellow	3
10200324	ArmorBuffa Steel Nose Assembly	1
10200325	ArmorBuffa Nose Cover	1
10200326	ArmorBuffa Cable	1
10200327	ArmorBuffa Nose Pin	1
10200328	ArmorBuffa Asymmetric Pin	1
10200204	ArmorZone Pin	3
10200329	ArmorBuffa Transition F-Type Concrete Fixing Bolt Kit	1
10200045	ArmorBuffa MASH TL3 F-Type Concrete Kit - Complete	
10200200	Drainage Bung	
10200202	Bung Spanner	1



3.0 Parts Identification (continued)



10200320
ArmorBuffa Transition F-Type Concrete
Concrete Kit: 1



10200322
ArmorBuffa Element - Orange
Concrete Kit: 1



10200323
ArmorBuffa Element - Yellow
Concrete Kit: 3



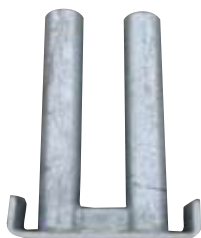
10200324
ArmorBuffa Steel Nose Assembly
Concrete Kit: 1



10200325
ArmorBuffa Nose Cover
Concrete Kit: 1



10200326
ArmorBuffa Cable
Concrete Kit: 1



10200327
ArmorBuffa Nose Pin
Concrete Kit: 1



10200328
ArmorBuffa Asymmetric Pin
Concrete Kit: 1



10200204
ArmorZone Pin
Concrete Kit: 3



10200329
ArmorBuffa Transition F-Type
Concrete Fixing Bolt Kit
Concrete Kit: 1



10200045
ArmorBuffa MASH TL3 F-Type Concrete Kit



10200200
Drainage Bung



10200202
Bung Spanner

4.0 Preparation

4.1 Foundation

The ArmorBuffa™ system is designed to perform on a variety of foundations including concrete, asphalt, and any other surfaces capable of bearing the weight of the system.

Uneven surfaces should be flattened, and large debris removed from the foundation prior to installation.

Cross slopes of up to 8% (5° or 1:12 slope) can be accommodated with the standard hardware and the instructions provided in this manual. For slopes in excess of 8%, contact Ingal Civil Products.

4.2 Transition

ArmorBuffa™ is designed to accommodate a temporary F-Type concrete barrier.

Placement and installation of the ArmorBuffa™ system must be accomplished in accordance with the Austroads Design Guide and ASBAP and other state and local standards.

Before installing the ArmorBuffa™ system, ensure that all the materials required for the system are on site and have been identified.

5.0 Documentation

Prior to installation and assembly of the ArmorBuffa™ system, ensure you have read and understand the installation and assembly instructions. The following items should be reviewed and understood prior to installation.

- Installation and Assembly Manual (check for current revision posted at www.ingalcivil.co.nz).
- System Drawings (check www.ingalcivil.co.nz for current revision, located in installation manual).

6.0 Important Notes

- Sign Convention
 - The term Front = At the Nose Plate
 - The term Rear = At the Transition
- This manual follows installation steps for a complete ArmorBuffa™ system that is installed on site or relocated to another location.

See Page 16 for water filling instructions.



In regions where the water filled elements could become frozen, appropriate anti-freeze solutions should be used.

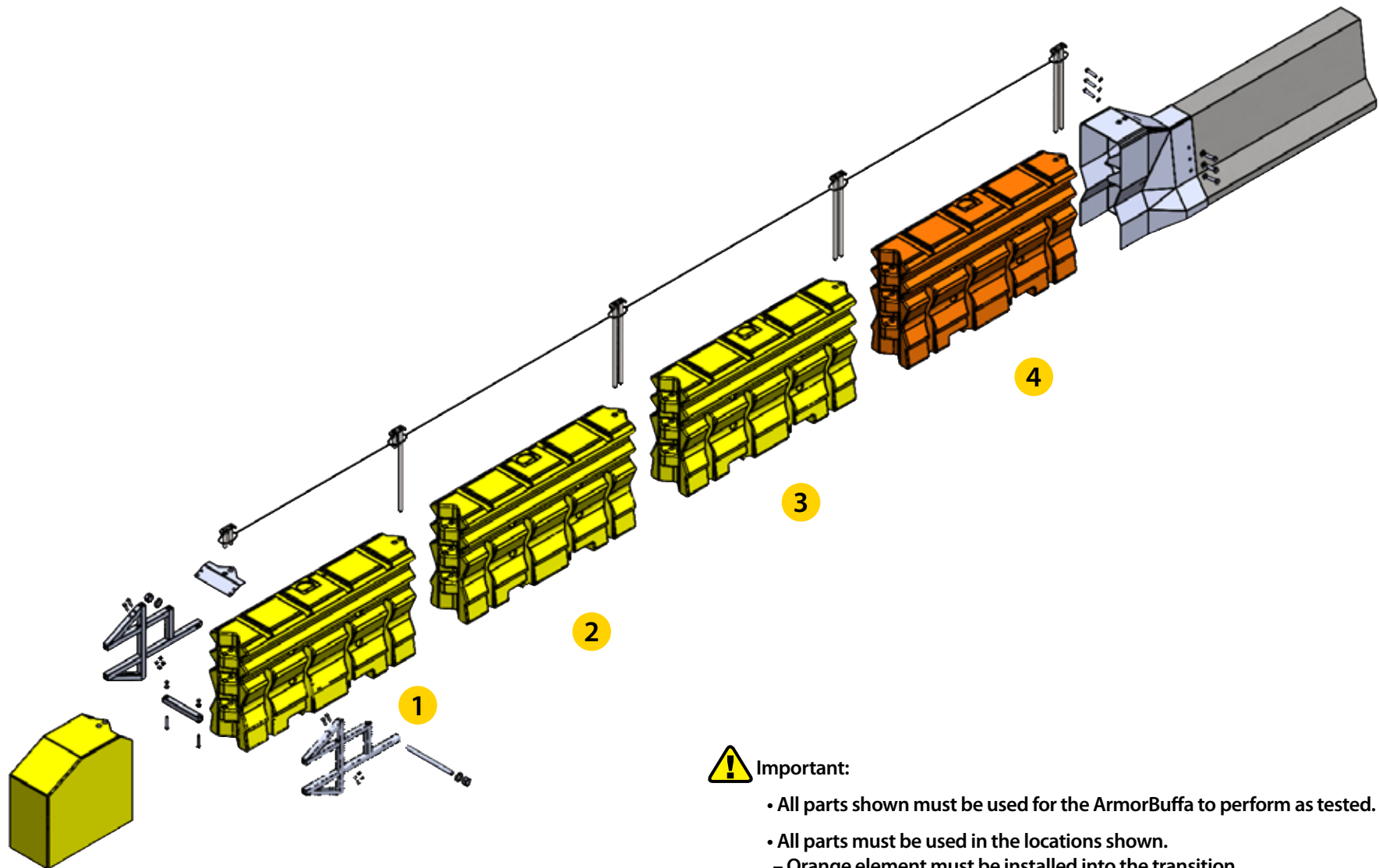
Failure to do so will result in improper performance of the system and may cause serious bodily injury.

Care should be taken to ensure that appropriate Anti-Freeze solutions are used in accordance with federal, state, and local requirements.

7.0 Anchoring Specifications

The ArmorBuffa™ system uses M16 x 150mm Excalibur™ Screw Bolts or equivalent for anchoring to temporary concrete barrier.

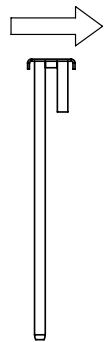
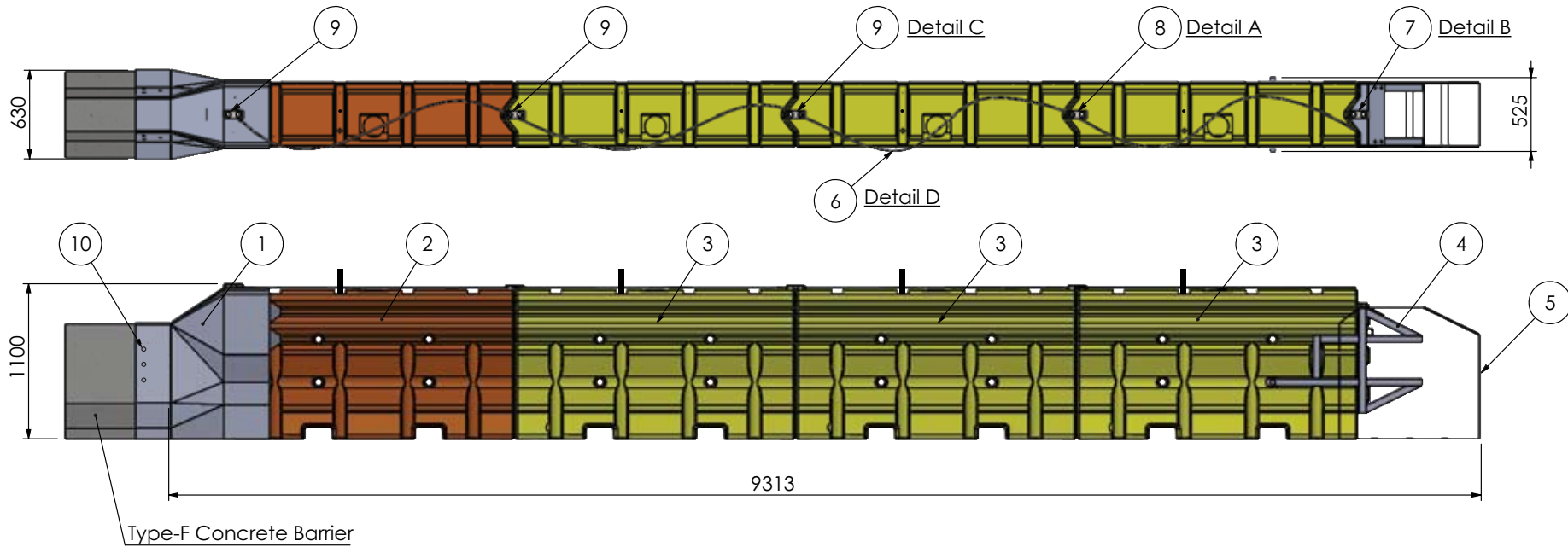
8.0 ArmorBuffa Exploded Assembly Overview



Important:

- All parts shown must be used for the ArmorBuffa to perform as tested.
- All parts must be used in the locations shown.
 - Orange element must be installed into the transition.
 - The 3 types of connector pins must be installed in the locations shown.
- All elements must be completely filled with water.
- All elements must be drained before moving.

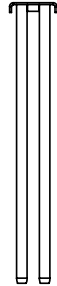
8.1 ArmorBuffa MASH TL3 F-Type Concrete Kit



Detail A - Asymmetric Pin orientation: short pin to the front of the system.



Detail B
Nose Pin



Detail C
ArmorZone Pin



Detail D
ArmorBuffa Cable (4x slings looped)

ID	Description	Part No.	Qty
1	ArmorBuffa Transition F-Type Concrete	10200320	1
2	ArmorBuffa Element - Orange	10200322	1
3	ArmorBuffa Element - Yellow	10200323	3
4	ArmorBuffa Steel Nose Assembly	10200324	1
5	ArmorBuffa Nose Cover	10200325	1
6	ArmorBuffa Cable	10200326	1
7	ArmorBuffa Nose Pin	10200327	1
8	ArmorBuffa Asymmetric Pin	10200328	1
9	ArmorZone Pin	10200204	3
10	ArmorBuffa Transition F-Type Concrete Fixing Bolt Kit	10200329	1

REV	DESCRIPTION	APPD	DATE
	ORIGINAL ISSUE - 23.10.2020		

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Valmont Highway Technology
Level 3, Building A, 11 Talavera Road
Macquarie Park, NSW 2113, Australia
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TOLERANCES
Whole Numbers :
One Decimal Place :
Bend Angle :
Straightness :
Scale:

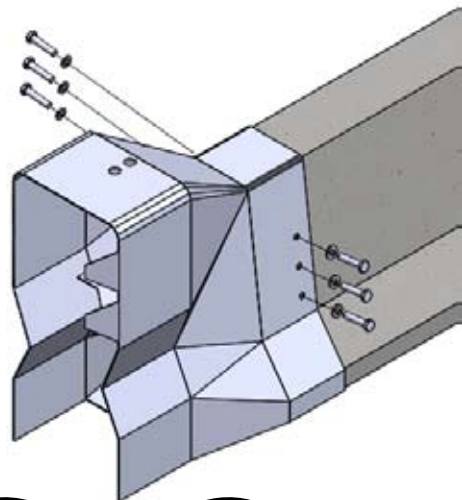
CLIENT
MATERIAL
FINISH

ITEM ArmorBuffa MASH TL3 F-Type Concrete KIT		
DRAWING NUMBER 10200045		
DRAWN VB	CHECKED JA	APPROVED LB

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9.0 INSTALLATION PROCEDURE

STEP 1A Transition Fixing to Concrete F-Type



Dust Mask



Safety Glasses



Gloves



Hearing Protection

INSTRUCTIONS

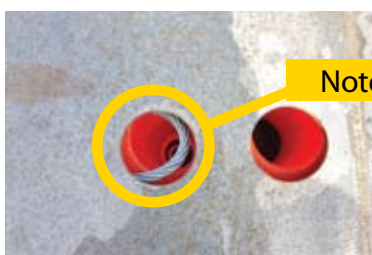
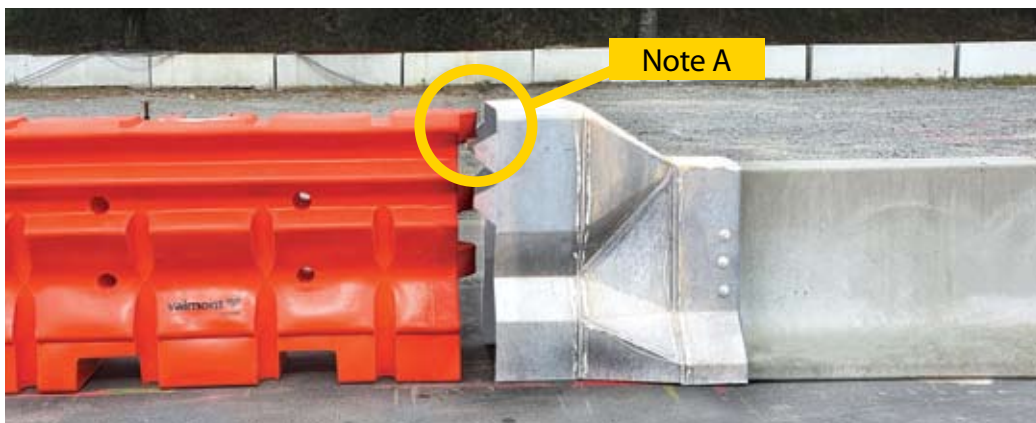
1. Slide transition over the end of the temporary concrete barrier, ensuring it is pushed on as far as possible flush up against the end of the barrier. Then mark the location of the 6 holes.
2. Remove the transition and drill 6 x 16mmx150mm holes as marked. If a hole cannot be drilled due to encountering rebar, then the use of 2 screw bolts per side is permitted.
3. Slide the transition back into place and then screw in the 2 or 3 Excalibur™ bolts per side, firmly fastening the transition to the barrier.



Wear proper PPE when clearing debris. This operation produces concrete dust.

STEP 2

Attachment to ArmorBuffa Elements

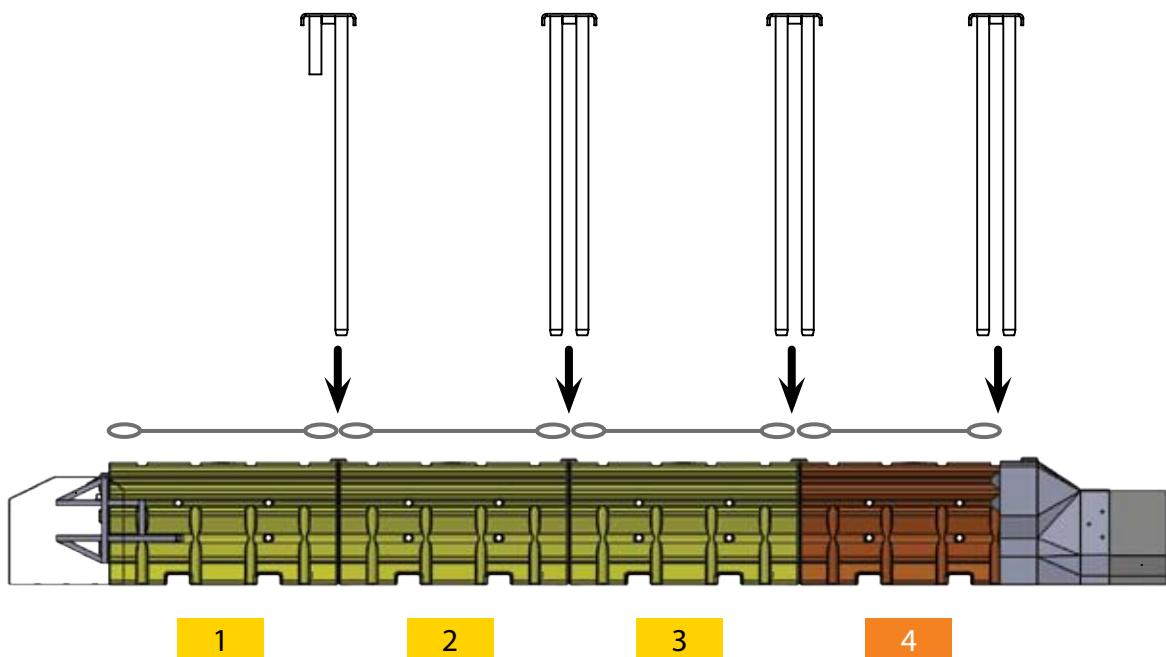


INSTRUCTIONS

1. Check the drain bung is tight so it will not leak.
2. Slide the orange element into the transition ensuring the element is orientated as shown in Note A with the element end with the highest connector lug inserted.
3. Insert standard twin pin into the transition holes, coupling the orange element and steel cable together, as shown in Note B.
4. Slide the 3 yellow elements into position.

STEP 3

Adding ArmorBuffa Elements

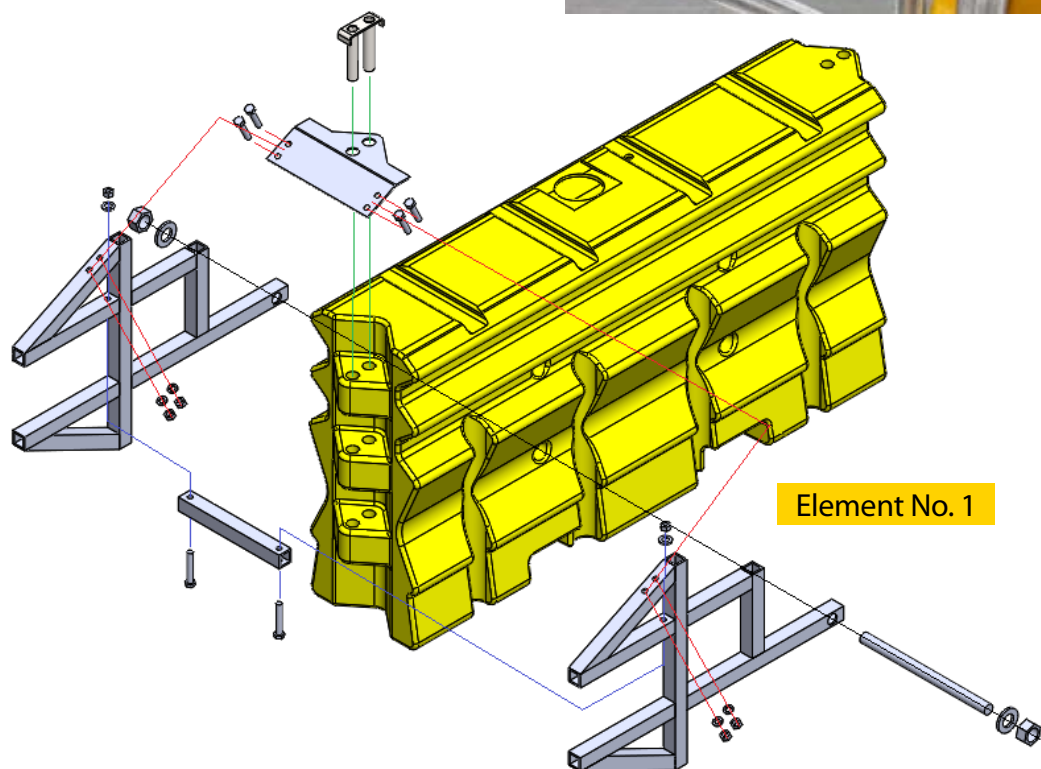


INSTRUCTIONS

1. Pin the 3 yellow elements with the pins as shown, engaging the steel cable.
2. The the asymmetric pin must be used to connect the yellow elements 1 and 2.

STEP 4

ArmorBuffa Nose Plate Assembly



INSTRUCTIONS

1. Bolt the steel nose onto the exposed end of yellow element No. 1, as shown above.
2. Tighten nuts and bolts to 50Nm.

STEP 5

ArmorBuffa Steel Nose Assembly



INSTRUCTIONS

1. Fit the cable through the nose pin as shown in Note A.
2. Slide the yellow plastic nose cover into position and insert the nose pin through the nose cover into the steel nose assembly as shown in Note B. Ensuring the pin engages the cable loop.

STEP 6

Final Inspection and Filling of Elements

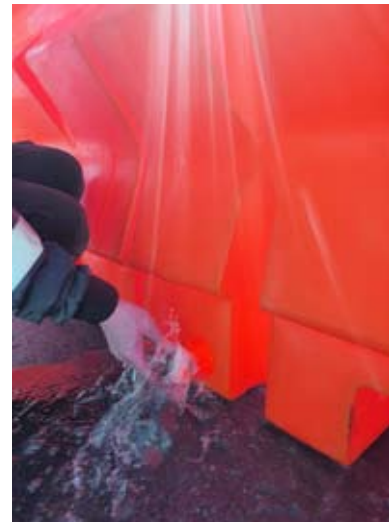
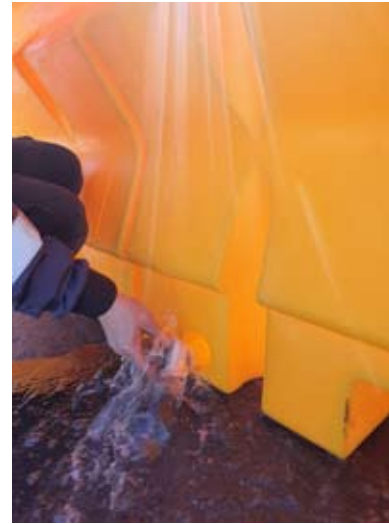


INSTRUCTIONS

1. Inspect installed system ensuring the correct pins are in the correct locations and that the steel cable is engaged through each pin.
2. Fill all 4 elements (1 x orange and 3 x yellow) with water to capacity (within 25mm of the top) using the filling port, 700 litres per element.
3. Ensure the Water Fill Level Indicators are raised above the top of the element, indicating the element is full of water.
4. Check there are no leaks in the elements or around the drain bungs.

STEP 7

Disassembly and Relocation



INSTRUCTIONS

1. Drain elements by removing the bungs and then disassemble in the reverse order of assembly.



Do not stack full elements! Do not lift or move full elements!

Note: The transition can be left on the end of the temporary barrier for transportation and relocation, as can the steel nose assembly be left on the plastic Element No. 1.

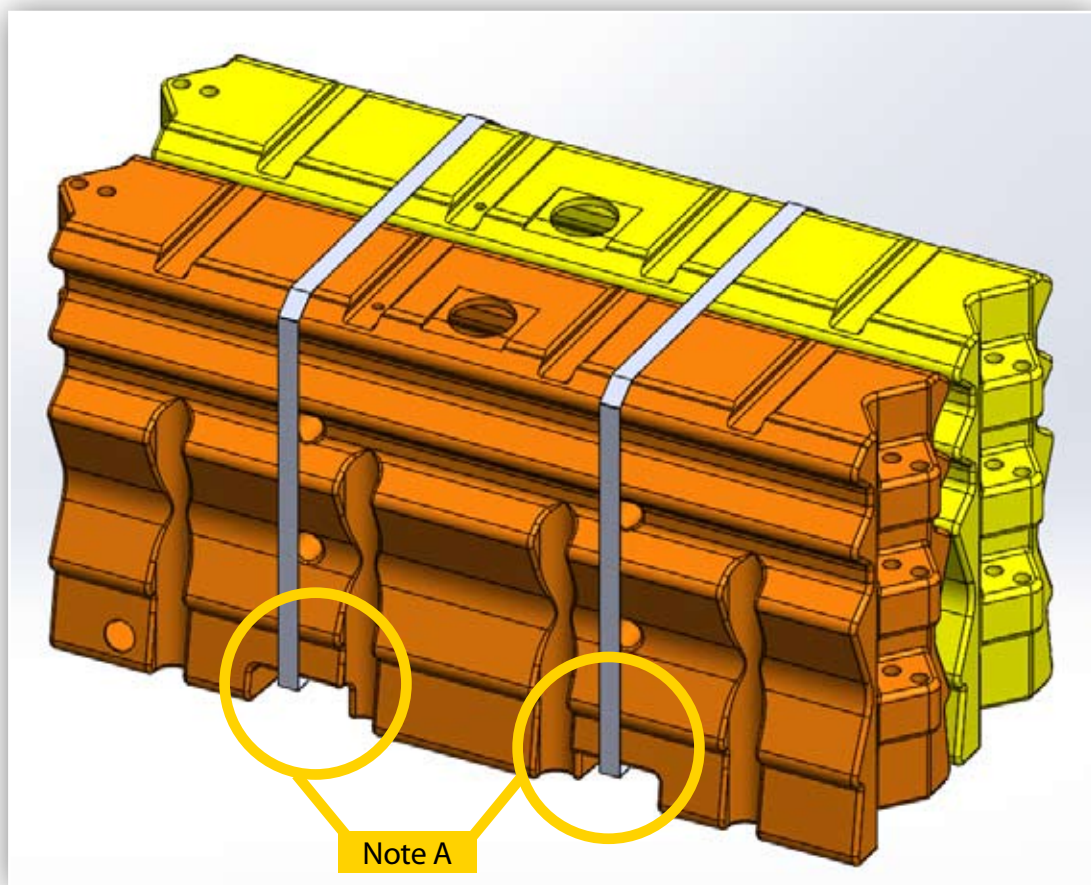
10.0 ArmorBuffa Element Capacity

Liquid Capacity L
700 Litres

11.0 Transportation and Storage

When empty, Elements are designed to be transported and stored in strapped bundles of 2, as shown below, and can be lifted via the forklift pockets shown in Note A.

The Transition Piece, Steel Nose Assembly and Nose Cover are to be strapped to pallets for transportation.



WARNING: Elements must be emptied before being moved or transported.

12.0 Inspector Checklist

Confirm all items in the checklist have been properly completed and hardware installed properly.

Installation Checklist

Item	Date	Initial
Nose Piece is firmly attached to Element No. 1.		
The cable assembly is linked through each of the five (5) connector pins.		
All Elements and Nose Cover are connected with the correct pin (refer to diagrams on pages 7, 8 and 9).		
Transition is secured to the Transition Barrier with two or three (2 or 3) M16 Anchors on each side		
All Element(s) full of water and the Water Fill Level Indicators are raised above the top of the element.		
Plug at drain ports fully seated and secure with no sign of leakage.		

Inspector signature: _____

Date: _____

13.0 Maintenance Inspection

Crash cushions, like all roadside safety hardware, require inspection to ensure they are in acceptable working condition. Regular inspections of the ArmorBuffa™ system is recommended and shall be made by the local highway authority. Frequency of the inspections shall be made based on site conditions, traffic volumes, and crash history. The water level in all elements must be checked regularly. This can be done by checking that the Water Fill Level Indicators are raised above the top of the elements. Please follow the Local guidelines for frequency of inspections to ensure adequate repairs are made to the system. Walk-up inspections are recommended at least twice a year.

14.0 Walk-Up Inspections

Recommended Frequency – Twice a Year

Before performing walk-up inspections, ensure traffic control is deployed in accordance with local guidelines.

Check for:

- Water level is within 25mm of the top of the Element's fill ports (verified by the Water Fill Level Indicators being raised above the top of the elements).
- Damage caused by vehicle impacts
- Damage caused by impacts from roadside maintenance equipment
- Misalignment
- Missing components
- Vandalism
- Clear and dispose of any debris in and around the system

After inspection is complete, ensure all items identified during the inspection process are corrected. The ArmorBuffa™ system shall be returned to proper condition as outlined in the installation instructions.

Walk-Up Inspection

Item	Comment
Water level is within 25mm of the top (check the Water Fill Level Indicators are raised above the top of the element).	
Damage caused by vehicle impacts	
Minor damage caused by impacts from roadside maintenance equipment	
Misalignment	
Missing components	
Vandalism	
Clear and dispose of any debris in and around the system	
Grading around system	
Fill Lids are fully seated. (Step 6, Page 16)	

Inspector Signature: _____ Date: _____

Print Name: _____ Location: _____

15.0 Design Life

The design life of the ArmorBuffa MASH TL3 End Treatment is 20 years. This is based on the properties and performance of the UV stabilised HDPE and MDPE plastic and also the hot dip galvanizing of the connector pins, steel transition and steel nose assembly. Please note each plastic element has a unique serial number to enable manufacturing traceability.

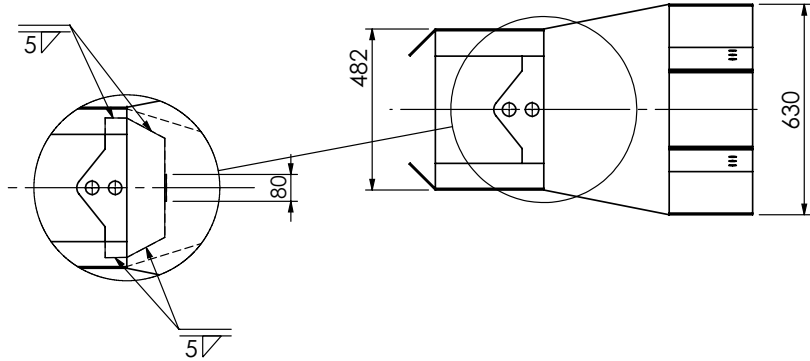
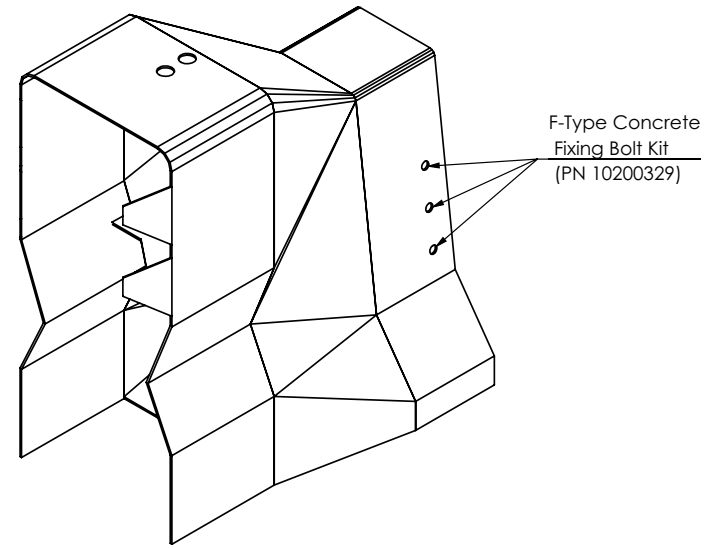
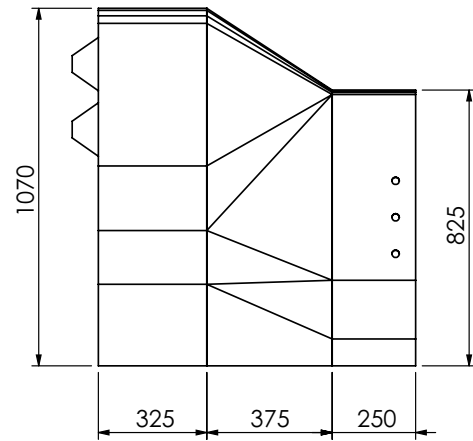
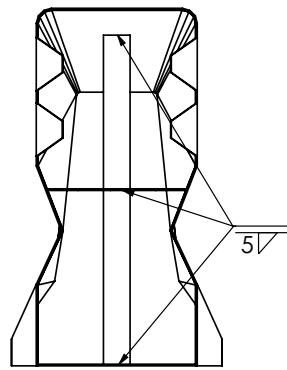
16.0 Maintenance

ArmorBuffa™ MASH TL3 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 elements remain filled to the correct level.

17.0 Recycling

The ArmorBuffa™ MASH TL3 End Treatment is manufactured from UV stabilised HDPE and MDPE and therefore the material in any units damaged beyond repair can be recycled. The connector pins, nosepiece and transition are manufactured from steel and can also be recycled.



Notes:
Finish = HDGalv AS/NZS 4680

REV	DESCRIPTION	APPD	DATE
1	HOLES FOR FIXING BOLTS UPDATED	JA	29/10/20
0	ORIGINAL ISSUE - 23.10.2020		



Valmont Highway Technology

Level 3, Building A, 11 Talavera Road
Macquarie Park, NSW 2113, Australia

T: +612 9814 1777 www.valmonthighway.com

TOLERANCES

Whole Numbers :
One Decimal Place :
Bend Angle :
Straightness :

Scale:

CLIENT

MATERIAL

5mm BMT G250

FINISH

HDGalv

ITEM

ArmorBuffa Transition
F-Type Concrete

DRAWING NUMBER

10200320

DRAWN

VB

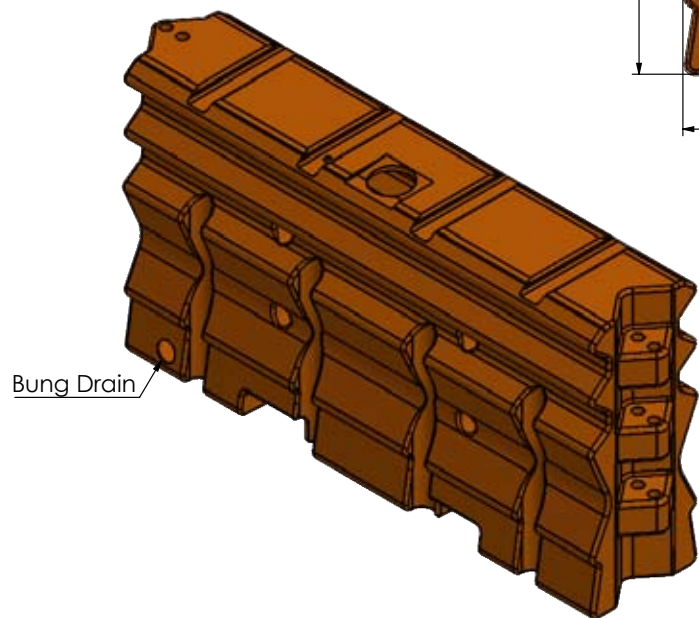
CHECKED

JA

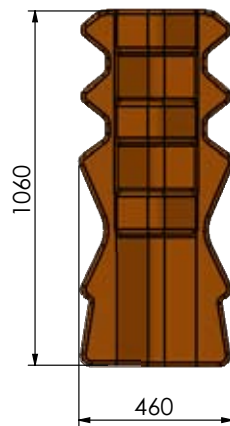
APPROVED

LB

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Bung Drain



- Notes:**
- Weight = 63kg (empty)
= 763kg (full)
 - Water per unit = 700 litres

REV	DESCRIPTION	APPD	DATE
1	Notes added, bung drain added.	JA	02/11/20

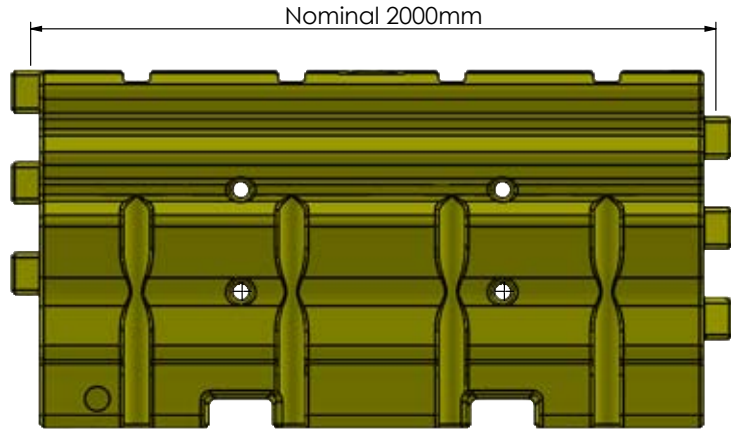
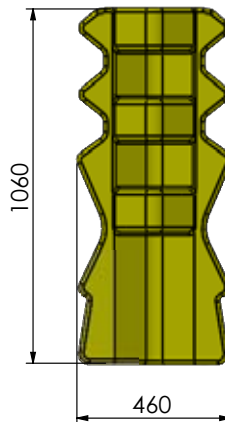
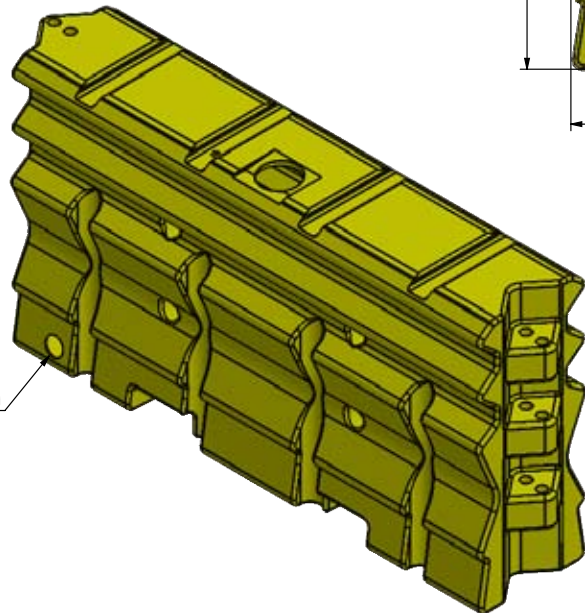
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TOLERANCES
 Whole Numbers :
 One Decimal Place :
 Bend Angle :
 Straightness :
 Scale:

CLIENT
 MATERIAL
 FINISH

ITEM	ArmorBuffa Element Orange		
DRAWING NUMBER	10200322		
DRAWN	CHECKED	APPROVED	
VB	JA	LB	

FOLDER F:\Engineering\3 - CURRENT DRAWINGS\COMPONENT DRAWINGS\SLDDRWs\10200322 - ArmorBuffa Element - Orange\



- Notes:**
1. Weight = 50kg (empty)
= 750kg (full)
 2. Water per unit = 700 litres

REV	DESCRIPTION	APPD	DATE
1	Notes updated, bung drain added.	JA	02/11/20

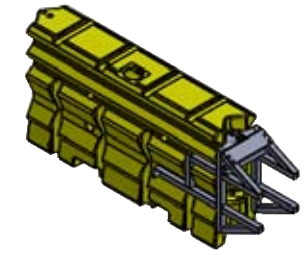
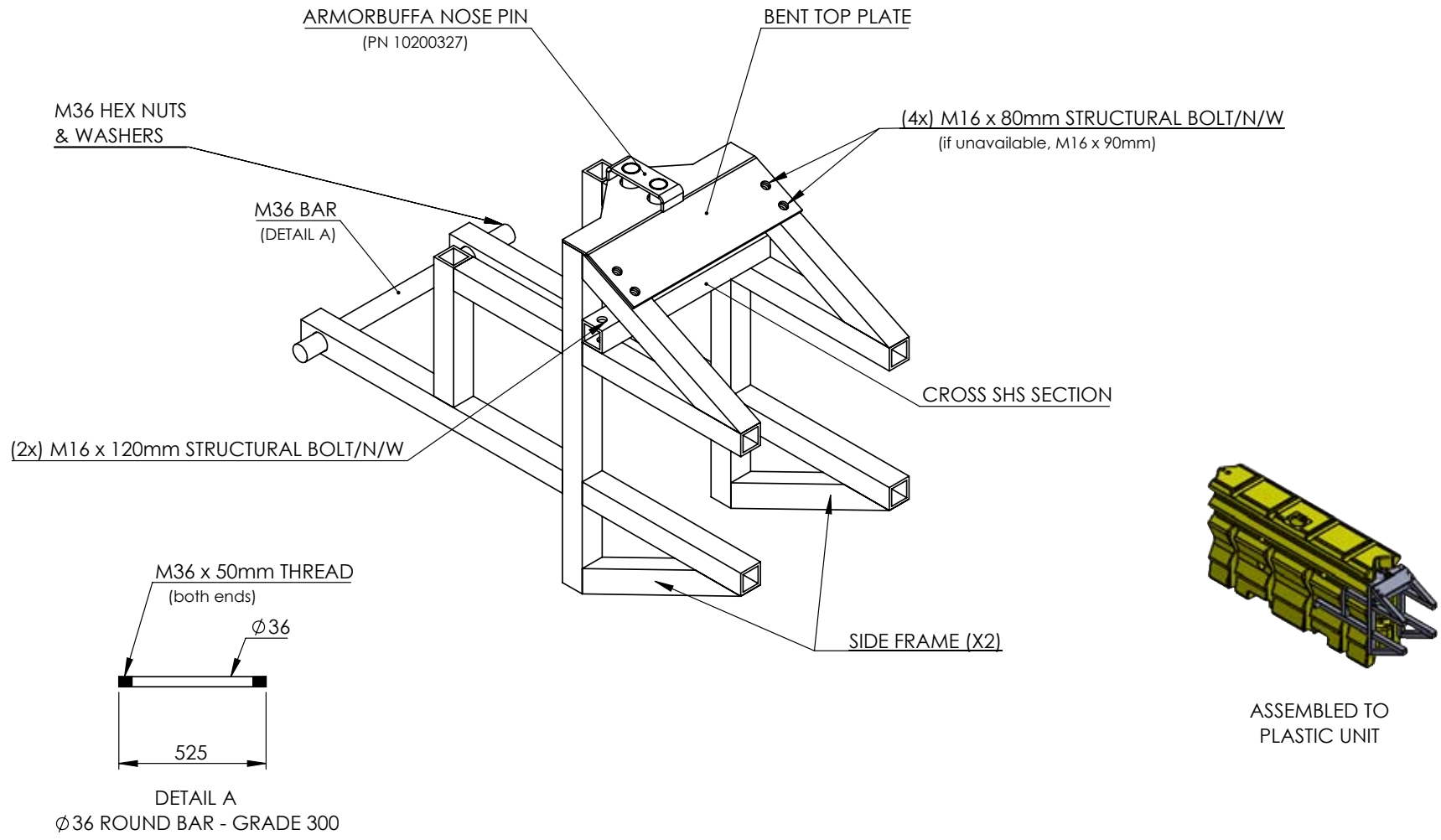
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 Valmont Highway Technology
 Level 3, Building A, 11 Talavera Road
 Macquarie Park, NSW 2113, Australia
 T: +612 9814 1777 www.valmonthighway.com

TOLERANCES
 Whole Numbers :
 One Decimal Place :
 Bend Angle :
 Straightness :
 Scale:

CLIENT
 MATERIAL
 FINISH

ITEM	ArmorBuffa Element Yellow		
DRAWING NUMBER	10200323		
DRAWN	CHECKED	APPROVED	
VB	JA	LB	

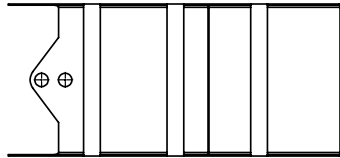
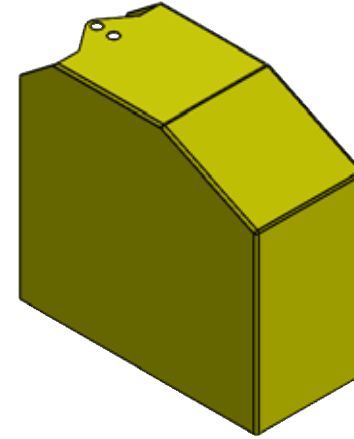
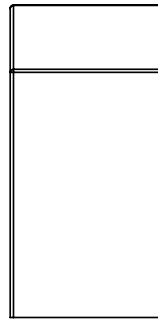
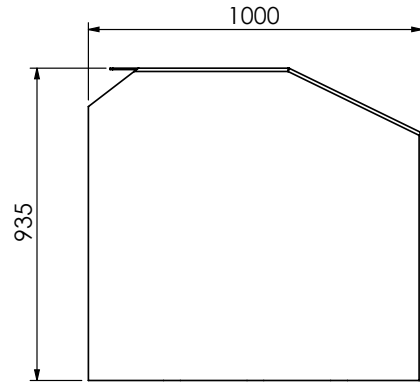
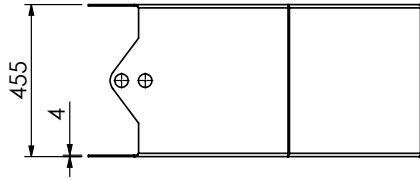
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ASSEMBLED TO PLASTIC UNIT

				<p>Valmont Highway Technology Level 3, Building A, 11 Talavera Road Macquarie Park, NSW 2113, Australia T: +612 9814 1777 www.valmonthighway.com</p>	TOLERANCES Whole Numbers : One Decimal Place : Bend Angle : Straightness : Scale:		CLIENT MATERIAL FINISH HDGalv		ITEM ArmorBuffa Steel Nose Assembly DRAWING NUMBER <p style="text-align: center; font-size: 24px;">10200324</p>		
REV	DESCRIPTION	APPD	DATE		ORIGINAL ISSUE - 23.10.2020		DRAWN	CHECKED	APPROVED VB JA LB		

FOLDER F:\Engineering\3. CURRENT DRAWINGS\COMPONENT DRAWINGS\SLDDRWs\10200324 - ArmorBuffa Steel Nose Assembly



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Level 3, Building A, 11 Talavera Road

Macquarie Park, NSW 2113, Australia

T: +612 9814 1777 www.valmonthighway.com

TOLERANCES

Whole Numbers :

One Decimal Place :

Bend Angle :

Straightness :

Scale:

CLIENT

MATERIAL

FINISH

ITEM

ArmorBuffa Nose Cover

DRAWING NUMBER

10200325

DRAWN

VB

CHECKED

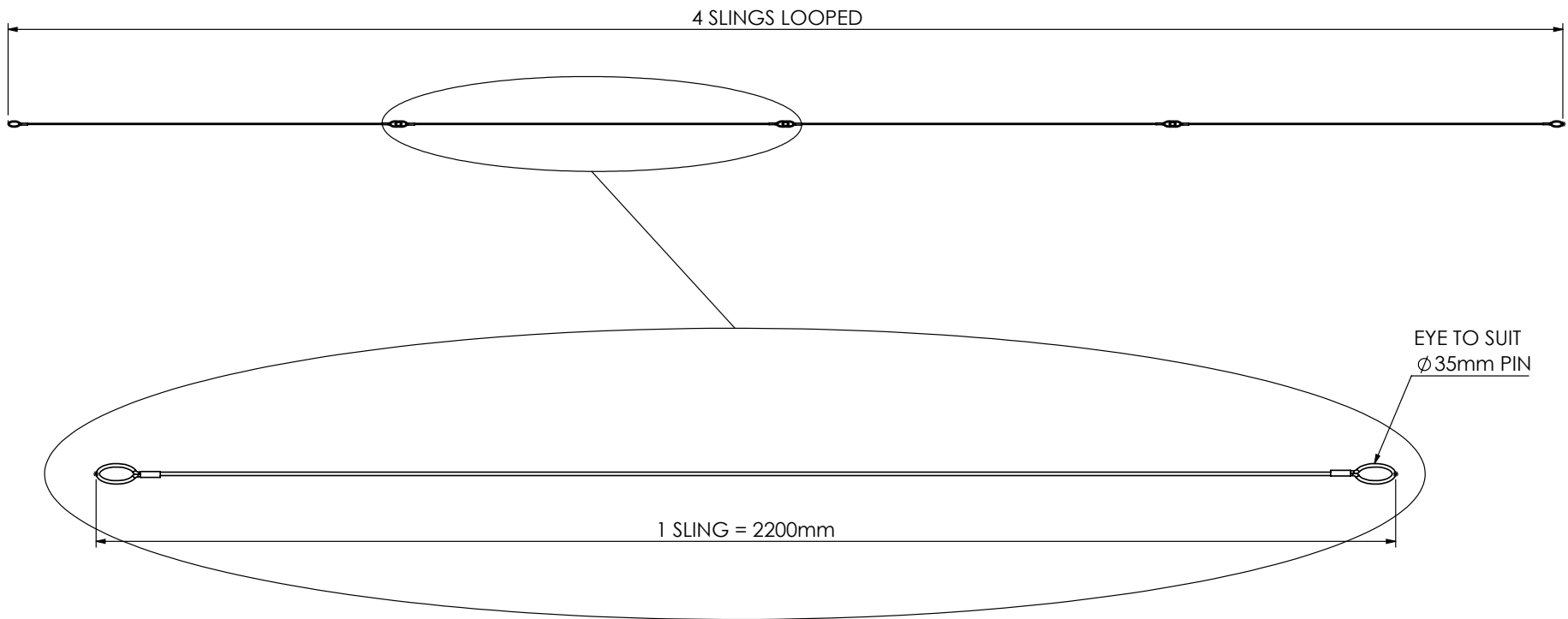
JA

APPROVED


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REV	DESCRIPTION	APPD	DATE
	ORIGINAL ISSUE - 23.10.2020		

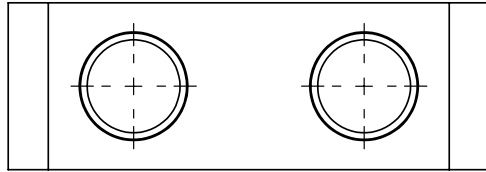
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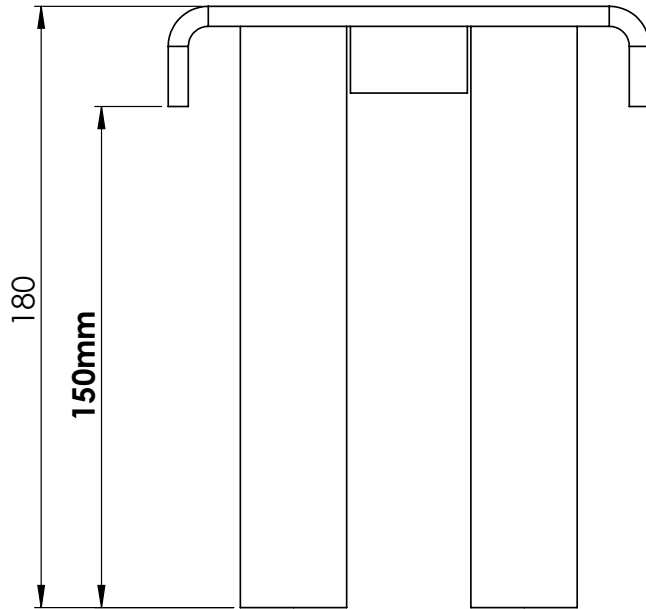
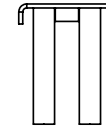
Wire Rope Info:
 Diameter: ϕ 6mm
 Construction: 7/19 IWRC
 Grade: 2070
 AS 1666.1-2009


				 Valmont Highway Technology Level 3, Building A, 11 Talavera Road Macquarie Park, NSW 2113, Australia T: +612 9814 1777 www.valmonthighway.com	TOLERANCES Whole Numbers : One Decimal Place : Bend Angle : Straightness : Scale:		CLIENT MATERIAL FINISH		ITEM ArmorBuffa Cable DRAWING NUMBER 10200326	
REV	DESCRIPTION	APPD	DATE				DRAWN	CHECKED	APPROVED	
	ORIGINAL ISSUE - 26.10.2020					VB	JA	LB		

FOLDER F:\Engineering\3 - CURRENT DRAWINGS\COMPONENT DRAWINGS\SLDRWs\10200326 - ArmorBuffa Cable\

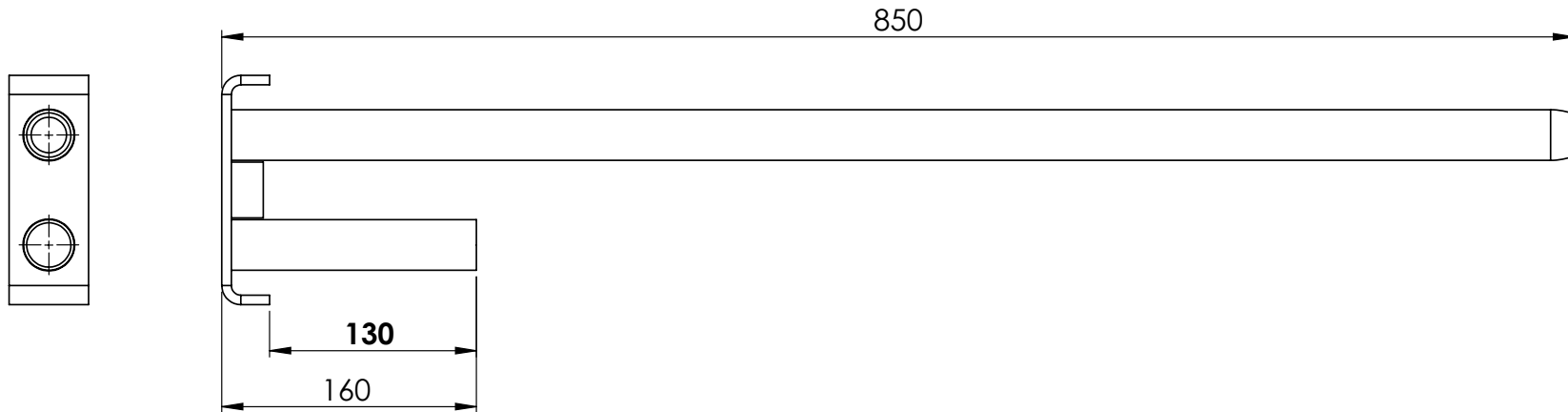


Short 150mm
Twin Pin

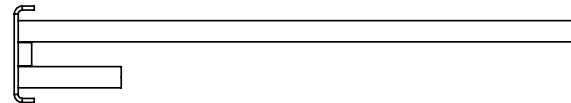



				 valmont HIGHWAY Valmont Highway Technology Level 3, Building A, 11 Talavera Road Macquarie Park, NSW 2113, Australia T: +612 9814 1777 www.valmonthighway.com	TOLERANCES Whole Numbers : One Decimal Place : Bend Angle : Straightness : Scale:	CLIENT MATERIAL FINISH	ITEM ArmorBuffa Nose Pin DRAWING NUMBER 10200327
REV	DESCRIPTION	APPD	DATE		ORIGINAL ISSUE - 23.10.2020	DRAWN VB	CHECKED JA

FOLDER F:\Engineering\3. CURRENT DRAWINGS\COMPONENT DRAWINGS\SLDDRWs\10200327 - ArmorBuffa Nose Pin

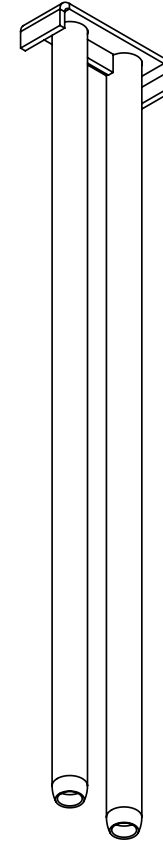
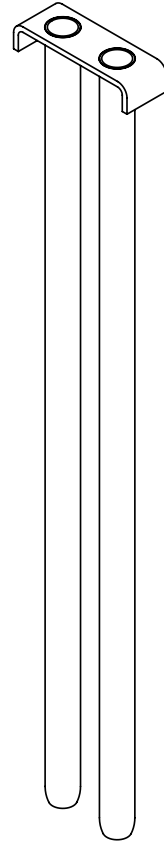
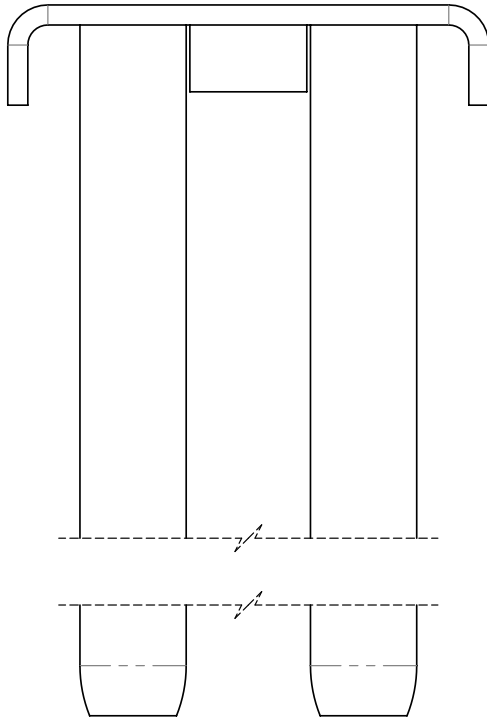
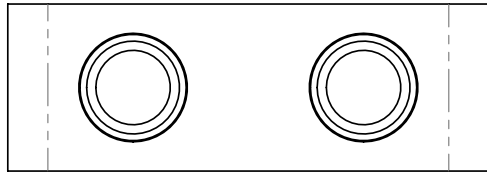


Asymmetric
Twin Pin



				 Valmont Highway Technology Level 3, Building A, 11 Talavera Road Macquarie Park, NSW 2113, Australia T: +612 9814 1777 www.valmonthighway.com	TOLERANCES Whole Numbers : One Decimal Place : Bend Angle : Straightness : Scale:	CLIENT MATERIAL FINISH	ITEM ArmorBuffa Asymmetric Pin DRAWING NUMBER 10200328	DRAWN VB	CHECKED JA	APPROVED LB
	ORIGINAL ISSUE - 23.10.2020									
REV	DESCRIPTION	APPD	DATE							

FOLDER F:\Engineering\3. CURRENT DRAWINGS\COMPONENT DRAWINGS\SLDDRWs\10200328 - ArmorBuffa Asymmetric Pin\



NOTE:
HOT DIP GALVANIZED

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REV.	CHANGES	DATE
2	ADD SPACER	17/03/2016
1	INITIAL ISSUE	28/03/2012

SCALE: 1:2		
	DATE	INIT.
DRAWN BY	17/03/2016	LW
APPR'D BY	17/03/2016	BM

Twin Pin for ArmorZone

		12 Offenhauser Dr East Tamaki New Zealand +64 9 215 5231 info@valmonthighway.com	
		SHEET	DRAWING NUMBER
1 OF 1		10200204	2



For more information

contact us on the web

www.ingalcivil.co.nz

North Island
Ph: 021 2464 997

South Island
Ph: 021 1983 311

Email: sales@ingalcivil.co.nz

Head Office: Sydney
57-65 Airds Road, Minto, NSW 2566
Ph: +61 2 9827 3333
Fax: +61 2 9827 3300
Local call (within Australia):
1300 446 425
Email: sales@ingalcivil.com.au