

# Installation Manual

## RAPTOR<sup>®</sup>



### TL-1 Crash Cushion

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# RAPTOR® Introduction

## Introduction

**RAPTOR®** is a compact crash cushion made from durable HDPE which can be installed at many sites, otherwise regarded as lacking in space to protect in the traditional manner. The system consists of 2 pieces which connect together and provide protection from a rigid object which is positioned in the central void.

The system has been designed and tested to meet the evaluation criteria of NCHRP 350 Test Level 1 (TL-1) for a crash cushion.

The **RAPTOR®** is a free standing low cost crash cushion and is not anchored in anyway.

## Limitations and Warnings

**RAPTOR®** has been rigorously tested and evaluated per the evaluation criteria in the NCHRP 350 guidelines for gating crash cushions. The impact conditions recommended in NCHRP 350 are intended to address typical in-service collisions.

**RAPTOR®** systems allow an impacting vehicle to be contained in a safe and predictable manner under the NCHRP 350 impact conditions. It is imperative that the system is installed as per manufacturers' specification.

Vehicle impacts that vary from the NCHRP 350 impact conditions described for 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 NCHRP 350 testing (weight, speed and angle) may result in system performance that may not meet the NCHRP 350 evaluation criteria.

## Before Installation

Design, selection and placement of the **RAPTOR®** must be in accordance with the Road Controlling Authority's guidelines and the details shown in the construction drawings. Installation must be in accordance with the installation instructions supplied for this product.

Depending on the application and circumstances at the site, installation and assembly of the system should take a two person crew less than 30 minutes.

**RAPTOR®** is a highly engineered safety device made up of a small number of parts. Before starting installation ensure that one is familiar with the make-up of the system.

# Design Considerations

## 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. It is preferred that the **RAPTOR**<sup>®</sup> is installed on flat level ground. The area around the hazard must be level for a 1500mm cord when pulled along the centreline of the hazard. (Shown in figure A)



Figure A.

## Curbs & Slopes

As with all road side safety hardware, **RAPTOR**<sup>®</sup> has been designed and tested so that the centre of gravity of the impacting vehicle is at or near the same height as middle of the system. For this reason, it is preferred that curbs or channels are not installed in front of the system as they will result in altering the height of the vehicle at impact. If there is no option but to install near a curb advice should be followed from the Road Controlling Authority's guidelines.

If the device is to be installed lower than road level itself, this distance cannot be greater than 100mm. (Shown in figure B)

A maximum slope of 10:1 is preferable. On slopes greater than this, advice should be followed from the Road Controlling Authority's guidelines. (Shown in figure C)

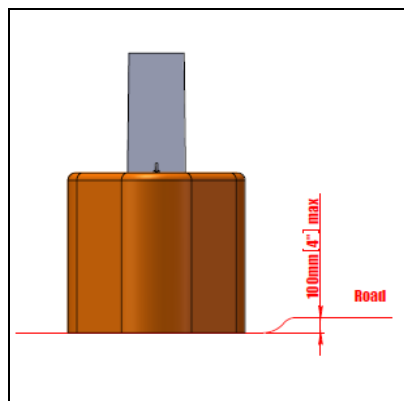


Figure B.

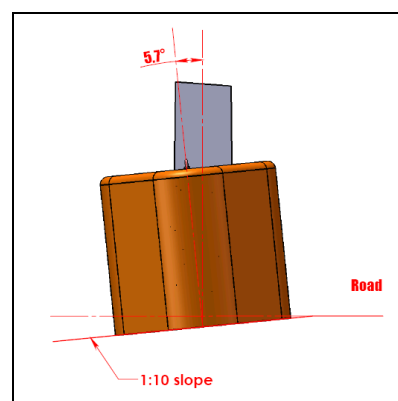


Figure C.

# System Design

## Orientation

The installation orientation is always tangent/parallel to the direction vehicles are travelling.  
(Shown in figure D)

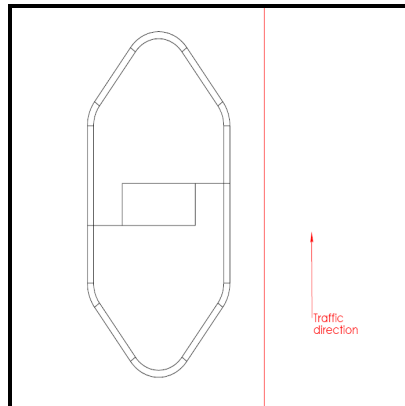


Figure D.

## Hazard Size

There are two **RAPTOR**<sup>®</sup> systems available called the **300** and **600**. The void sizes are the only difference between them and they measure 300mm x 590mm, and 600mm x 590mm respectively. (Shown in Figures E & F)

When choosing which system to use, ensure that the void size is sufficient size and allows the device to be installed with the correct orientation.

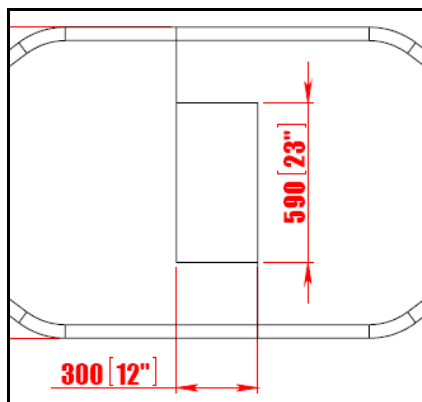


Figure E.

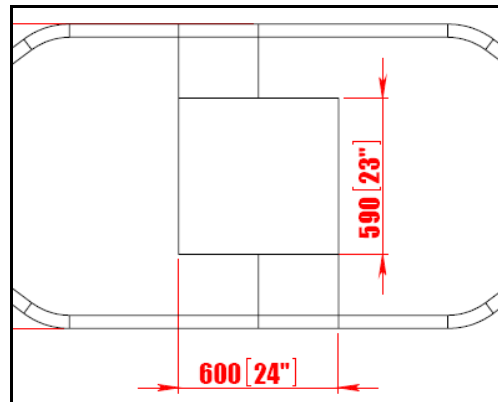


Figure F.

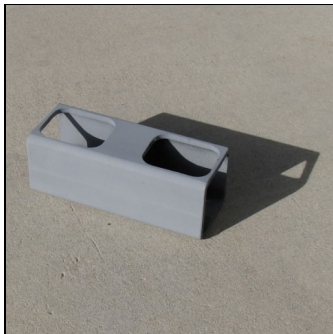
# RAPTOR® - Parts Identification



Shell



Packer Piece



Short Connector



Long Connector



Bolt & Washer

All steel components used in the RAPTOR® are hot dipped galvanized

## Delineation Examples



Top Mounted



Side Mounted

**DELINEATION MUST BE GLUED. SCREWS AND RIVETS ARE NOT ACCEPTABLE.**

**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.

# RAPTOR® – Installation Preparation

## Getting Started

Determine which **RAPTOR®** system is best suited to fit the object being protected. Refer to **Hazard Size** in the **System Design** section of this manual for more information on the void size of the **RAPTOR® 300** and **600** systems.

## Preparation

Before installing a **RAPTOR®** ensure that all components required for the system are on site and have been identified. **RAPTOR®** is a highly engineered safety device made up of a 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.

## Tools Required

The tools required to install **RAPTOR®** are:

- A crane truck or fork hoist
- Suitable lifting equipment (including guy ropes) that can connect to the lifting eye
- 32mm socket and a minimum 50mm extension
- Pry bar
- 2 Tonne ratchet tie down (commonly used to strap freight down on trucks)

## Safety Statements

### General Safety

- All required traffic safety precautions should be complied with. All workers should wear required safety clothing. (Examples, and not limited to, include: high visibility vests, safety helmet, steel capped footwear, gloves etc.) Gloves should be worn at all times.
- Only Authorized trained personnel should operate any machinery. Where overhead machinery is used, care must be taken to avoid any overhead hazards.

### RAPTOR® Safety Statements

- Each shell weighs 110kg so lifting is conducted using suitable machinery and equipment. A crane truck or fork hoist is recommended to lift the shells, and always use the centrally located lifting eye to attach the rigging. Tag lines can be attached to the lifting eye or side connection bolts.
- DO NOT attempt to lift using lifting straps around the HDPE shell as the plastic is slippery and straps may slide off.
- Avoid placing hands or fingers in and around moving parts when components are being lifted and manoeuvred into place. (i.e. around connection holes etc.)

**At NO time is it required that personnel need to work at height or have suspended loads pass overhead. It is recommended that personnel are as many metres away from the suspended load as it is lifted.**



# RAPTOR® - Installation Instructions

## Step 1 – Site Preparation

Site specific grading may be required to ensure that the RAPTOR® is installed on flat, compact, level ground. Refer to *Undulating Ground Conditions* and *Slopes & Curbs* in the *Design Considerations* section of this manual for more information.

## Step 2 – Installing the Shells

**BEFORE UNLOADING THE SHELLS ENSURE THAT THE OPERATION OF THE LIFTING DEVICE IS WELL CLEAR OF ANY OVERHEAD HAZARDS**

**ALWAYS ATTACH THE LIFTING EQUIPMENT TO THE LIFTING EYE LOCATED ON THE TOP OF EACH SHELL. THE TAG LINE CAN BE CONNECTED TO THE SAME LIFTING EYE OR THE BOLTS LOCATED ON THE SIDE.**

Using a crane truck or fork hoist, lift the first shell into the approximate finished position. (Shown in Figure 1) And then repeat for the second shell. (Shown in Figure 2)

**Note:** The shell orientation is always parallel to the direction of traffic flow.



Figure 1.



Figure 2.

Final positioning can be done using a pry bar. (Shown in Figure 3)



Figure 3.



# RAPTOR® - Installation Instructions

## Step 3 – Connecting the Shells

Using a 2 Tonne ratchet tie down (or similar), pull the two RAPTOR® shells tightly together and align vertically using a pry bar. (Shown in Figure 4)

If the larger 600 system is being installed, fit the packer piece first. The notches face towards the outside. (Shown in Figure 5)



Figure 4.



Figure 5.

Hold the connector bars in place and fix to the shells using two M16 x 40mm hex head bolts and washers. (Shown in Figure 6)

**Note:** Different length connectors are required for each system and the details of each can be found in the *Parts identification* section of this manual.

Repeat until all 10 connectors required are attached. (5 on each side)

Tighten all bolts with a socket to complete the installation and remove the ratchet tie down. (shown in Figure 7)



Figure 6.



Figure 7.

# RAPTOR® - Installation Instructions

## Step 4 – Delineation

Delineation must be attached to the RAPTOR® as required by the Road Controlling Authority.

Further details can be found in the *Delineation* section in this product manual.

## RAPTOR® – Installation Examples



RAPTOR® 300



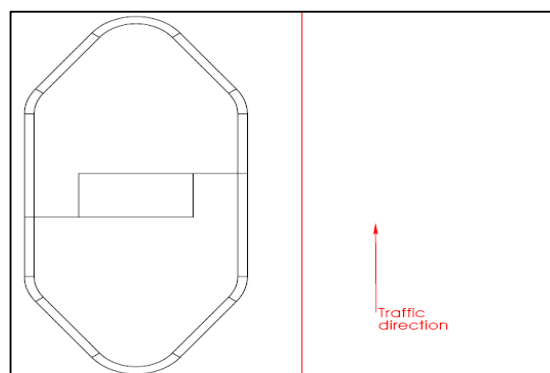
RAPTOR® 600

# INSTALLATION CHECKLIST

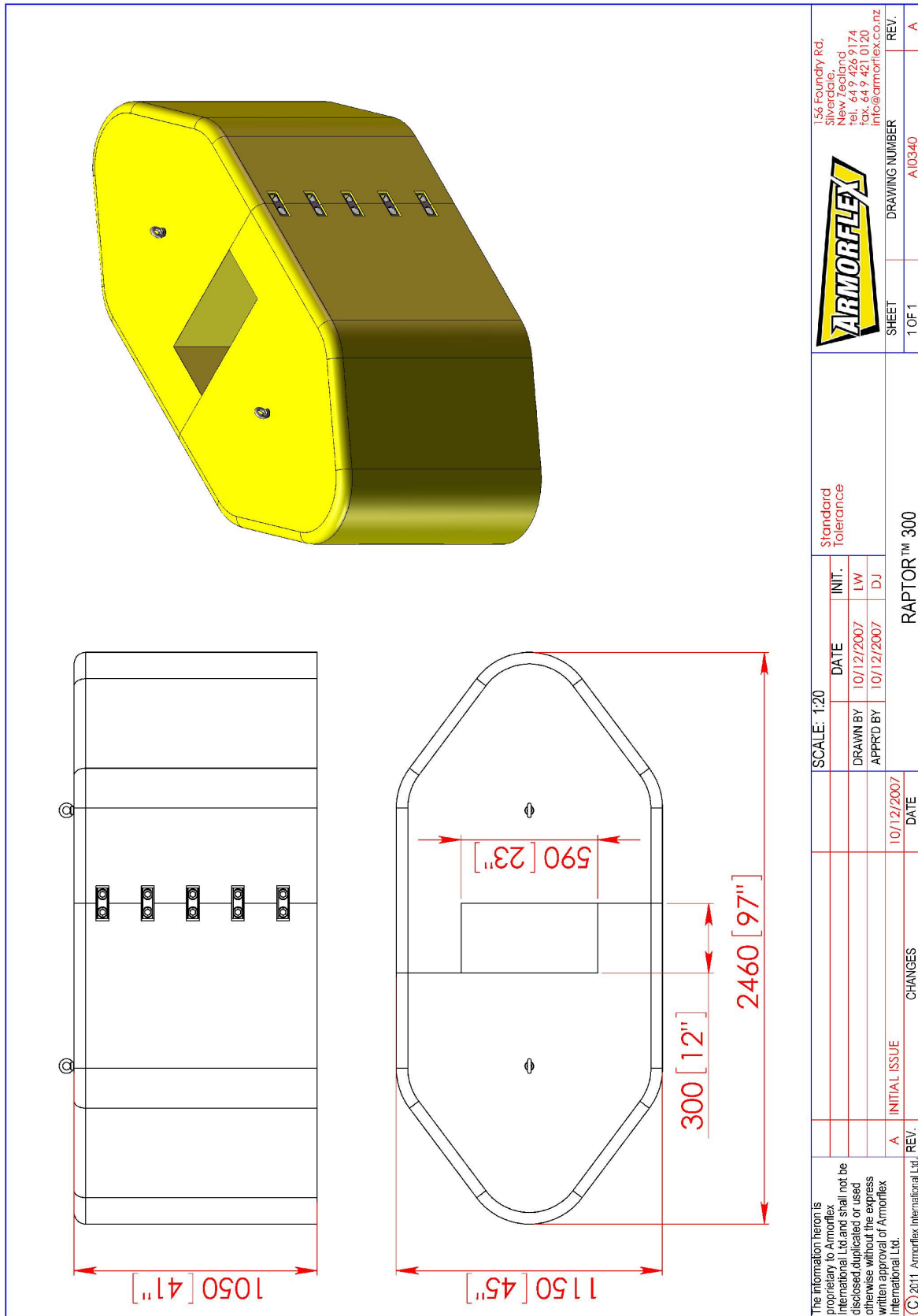
## RAPTOR<sup>®</sup> 300 and 600 SYSTEMS

<b>Location</b>				
<b>Installed By</b>		<b>Date</b>		
<b>Inspected By</b>		<b>Date</b>		
			<b>Y/N</b>	
			<b>N/A</b>	
<b>General</b> <ul style="list-style-type: none"> <li>Ground is level for a 1500mm cord when pulled along the centreline of the hazard</li> <li><b>RAPTOR<sup>®</sup></b> is oriented to face direction of traffic (see below)</li> <li>Attach delineation as required by the Road Controlling Authority</li> </ul> <b>RAPTOR<sup>®</sup> 300</b> <ul style="list-style-type: none"> <li>The Short Connectors are installed and bolts tight</li> </ul> <b>RAPTOR<sup>®</sup> 600</b> <ul style="list-style-type: none"> <li>The Packer is placed between the Shells correctly</li> <li>The Long Connectors are installed and bolts tight</li> </ul>				

### Comments:

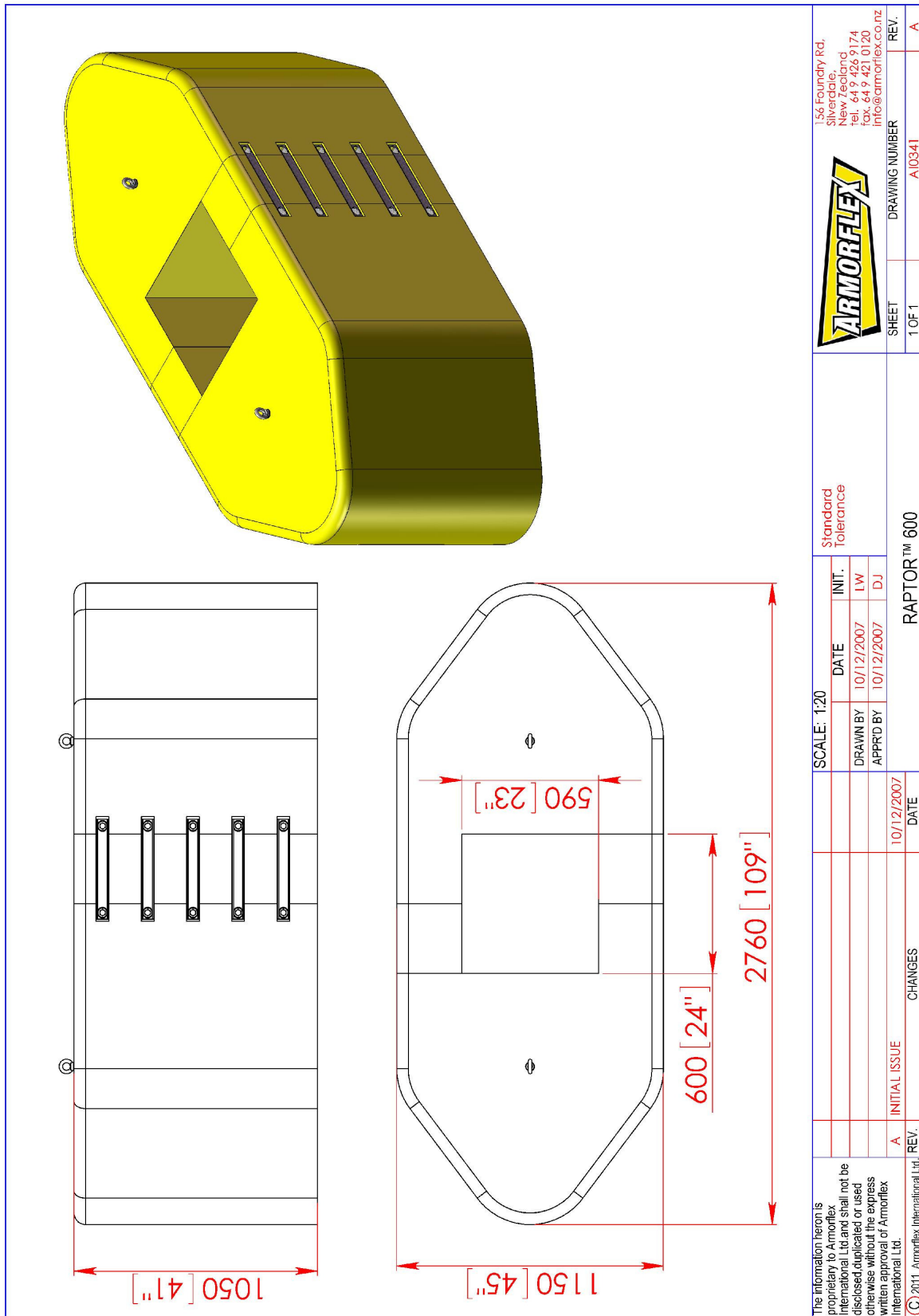


# Appendix – Technical Drawings



**RAPTOR® 300** (300mm x 590mm Void)

## APPENDIX – Technical Drawings (continued)



**RAPTOR® 600** (600mm x 590mm Void)