General Risk Assessment

Prepared by Tzara Enterprises 3rd September 2013

Disclaimer

The compilation of information contained in this document relies upon material and data derived from a number of third party sources and is intended as a guide only in devising risk and safety management systems for the installation and use of the ET Braking System in vehicles to confirm its safety, and is not designed to replace or be used instead of an appropriately designed safety management plan for each individual component part that makes up the ET Braking System. Users should rely on component manufacturers guidelines, their own advice, skills and experience in applying risk and safety measures when using the ET Braking System in individual vehicles, various conditions and workplaces.

The information in this document is provided voluntarily and for information purposes only.

Accuracy of Assessment

The information contained in the ET Braking System Risk Assessment document is true and accurate and is attested to by the following persons & organisations.

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ET Braking System P/L

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Content

About This Risk Assessment

- This risk assessment document is designed to be a living document. As changes occur in the design and implementation processes, risks need to be reviewed, assessed for severity and potential, and migrated or managed by all relevant stakeholders.
- The risk factors outlined in this document are based on the current design process, it is therefore recommended that as evolution occurs in the design and installation process a review of any changes to potential risks should occur.
- Use of this document does not relieve the user of the ET Braking System (or a person on whose behalf it is used) of any obligation or duty that might arise under any legislation (including the Occupational Health & Safety Act 2000, any other Act containing requirements relating to transport safety and any regulations and rules under those Acts) covering the activities to which this document has been or is to be applied.

Risk Assessment Purpose

- This Risk Assessment document is primarily intended for the use of Assessors involved in the approval of the ET Braking Systems. The information contained within the assessment is also a valuable tool for manufacturers, service/maintenance organisations, users and others concerned with the safe operation of the ET Braking System on free-steered vehicles.

ET Braking System - Scope of Risk Assessment

- This risk assessment has focused on the Electronic Control Module (ECM) device which is the patented ET Braking System product. Further components which make up a vehicles braking system process (to which the ECM is connected) will be “off the shelf” products manufactured and warrantied by other companies, and therefore are not the subject of this risk assessment.
- It is assumed that persons using any components beyond the ET Braking System ECM as part of the overall design of a vehicle will review the accompanying risk assessments for those products as provided by the companies that supply/manufacturer them.
- The scope of this risk assessment covers the installation risks, and operational risks associated with using the ET Braking System in vehicles with specific regard to confirming it’s safety.
- The ET Braking System changes the standard behaviour of the vehicle therefore a review of risks associated with the potential failure of parts associated with the ET Braking Systems operation have been considered
- The ET Braking System is installed and can potentially be effected by human interaction, therefore a review of risks associated with the potential failure as a result of human or substance interaction with the ET Braking Systems operation have been considered.

Introduction

Various Australian Standards and the relevant statutory requirements lay down standard criteria for the design and performance of braking systems fitted to on-road and off-road vehicles.

Manufacturers, Service Organisations and the Users of free-steered vehicles have a 'duty of care' under the provisions of Occupational Health & Safety Legislation to ensure the safe operation of braking systems.

It is essential for the manufacturer and user that hazards associated with the ET Braking System be assessed and controlled with appropriate treatments. Therefore risk management techniques shall be employed as per AS4360 “Risk Management”/ISO31000

This document was prepared at the request of ET Braking System as a reference document.

Risks to be assessed

This risk assessment will examine the potential impacts to the safe operation/installation of the ET Braking System and impacts from use of the ET Braking System on persons/property

Risk Types:

- Kinetic Energy - Hit by moving objects, Explosion, Penetrating objects, Vibration, Acoustic / Noise,
- Energy – Electrical, Gravity, Falling objects,
- Temperature/Weather Effects – Heat, Cold, Rain / Flood (Emersion), Wind, Pressure (Diving / Altitude), Smoke
- Chemical / Hazardous Substance – Liquids, Fumes, Gases, Vapours / Mists, Solids
- Environmental impacts from the product - Energy consumption, Nuisance noise, Dust, Hazardous waste, Hazardous emissions
- Manual Tasks / Ergonomics - Manual tasks (repetitive, heavy)
- User, Training & Servicing & Installation Risks

Risk Ratings Applied

When applying the Overall Risk Ratings to the items within assessment table we have considered the following factors:

- **Probability** - What is the probability of the issue/event occurring on a day to day to basis during operation of the ETBS within a vehicle?
- **Impact** – what would be the severity of the consequences to people and property, if the event occurred, **and the ET Braking System failed to operate**?

Refer to the Risk Assessment Legend for detailed explanation of the ratings.

Risk Assessment - Overall Rating

Assessed Risk Level		Description of Risk Level	Actions
☐	Low	If an incident were to occur, there would be little likelihood that an injury would result.	Undertake the activity with the existing controls in place.
☐	Medium	If an incident were to occur, there would be some chance that an injury requiring First Aid would result.	Additional controls may be needed.
☐	High	If an incident were to occur, it would be likely that an injury requiring medical treatment would result.	Controls will need to be in place before the activity is undertaken.
☐	Extreme	If an incident were to occur, it would be likely that a permanent, debilitating injury or death would result.	Consider alternatives to doing the activity. Significant control measures will need to be implemented to ensure safety.

Hierarchy of Control	
Most effective (High level)	**Elimination**: remove the hazard completely from the workplace or activity
	Substitution: replace a hazard with a less dangerous one (e.g. a less hazardous chemical)
	Redesign: making a machine or work process safer (e.g. raise a bench to reduce bending)
	Isolation: separate people from the hazard (e.g. safety barrier)
	Administration: putting rules, signage or training in place to make a workplace safer (e.g. induction training, highlighting trip hazards)
Least effective (Low level)	**Personal Protective Equipment (PPE)**: Protective clothing and equipment (e.g. gloves, hats)

Risk Assessment Legend

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Critical
Almost Certain	Medium	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	High	Extreme
Possible	Low	Medium	High	High	High
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Low	Low	Medium

Consequence	Description of Consequence
1. Insignificant	No treatment required
2. Minor	Minor injury requiring First Aid treatment (e.g. minor cuts, bruises, bumps)
3. Moderate	Injury requiring medical treatment or lost time
4. Major	Serious injury (injuries) requiring specialist medical treatment or hospitalisation
5. Critical	Loss of life, permanent disability or multiple serious injuries

Likelihood	Description of Likelihood
1. Rare	Will only occur in exceptional circumstances
2. Unlikely	Not likely to occur within the foreseeable future, or within the project lifecycle
3. Possible	May occur within the foreseeable future, or within the project lifecycle
4. Likely	Likely to occur within the foreseeable future, or within the project lifecycle
5. Almost Certain	Almost certain to occur within the foreseeable future or within the project lifecycle

Risk Management Plan

Risk	Probability	Impact	Owner	Mitigation Plan
Kinetic Energy Risks				
Could the ETBS operation be effected by being **hit by moving objects**?	Low	Low	Manufacturer & Service Tech/User	IP65 Protective device used to protect ECM from moving objects, Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by **Explosion**?	Low	Low	Manufacturer & Service Tech/User	Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by **Penetrating objects**?	Low	Low	Manufacturer & Service Tech/User	Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by **Vibration**?	Low	Low	Manufacturer	Vehicle Vibration doesn't have any affect on the ECM as the ECM is housed inside of the vibration resistant IP65 box as part of the ETBS design. Normal/default setting applies to brakes if ETBS fails therefore safe operation of brake system maintained.
Could the ETBS operation be effected by **Acoustic / Noise**?	Low	Low	Manufacturer	Vehicle Noise/External noise/acoustic, doesn't have any affect on the ECM/other parts of ETBS. Normal/default setting applies to brakes if ETBS fails therefore safe operation of brake system maintained.

Risk Management Plan

Risk	Probability	Impact	Owner	Mitigation Plan
Could the ETBS operation be effected by **wear and tear**?	Medium (see each part)	Low	Manufacturer & Service Tech/User	**ECM** wear and tear – each time the vehicle is serviced the ECM has to be inspected for normal wear & tear (these instructions would form part of the product manual/service manual) **Connections** wear & tear – protection and servicing requirements as per above **Kit parts** – wear & tear – protection & servicing requirements as per above Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by **accident/collision of vehicle**?	Medium	Low	Manufacturer & Service Tech/User	Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS create a risk to person or property being **hit by moving objects** as result of its operation or installation?	Low	High	Manufacturer & Service Tech/User	Installation of the ETBS must be completed by a qualified Auto-Electrician who has been trained in installing the ETBS
Could the ETBS create a risk of **Explosion** as result of its operation or installation?	Low	High	Manufacturer/ Installer	The ETBS has no explosive material in the area surrounding the device.
Could the ETBS create a risk to person or property of **Penetrating objects** as result of its operation or installation?	Low	High	Manufacturer & Service Tech/User	A warning label must be placed on the ECM protection box “Only to be opened by Qualified Auto Electrician”

Risk Management Plan

Risk	Probability	Impact	Owner	Mitigation Plan
Could the ETBS create a risk to person or property due to **vibration** as result of its operation or installation?	Low	Medium	Manufacturer	The ETBS doesn't create any increase in vibration felt by driver when foot is on Accelerator. The ETBS does not create any other vibration risks.
Could the ETBS create a risk to person or property due to Acoustic / Noise as result of its operation or installation?	Low	Medium	Manufacturer	The ETBS doesn't create any increase in noise emission heard by the driver or external to vehicle.
Could the ETBS create a risk to person or property (other interdependent parts) due to wear and tear?	Low	Medium	Manufacturer & Service Tech/User	Each time a vehicle is serviced the ECM has to be inspected for normal wear & tear (these instructions would form part of the product manual/service manual)
Could the ETBS operation be effected by Electrical issues/faults?	Medium	Low	Manufacturer	The power source for the ECM is the vehicles battery. Normal/default setting applies to brakes if ETBS fails therefore safe operation of brake system maintained.
Could the ETBS operation be effected by Gravity?	Low	Low	Manufacturer	Normal/default setting applies to brakes if ETBS fails therefore safe operation of brake system maintained.

Risk Management Plan

Risk	Probability	Impact	Owner	Mitigation Plan
Energy Risks				
Could the ETBS operation be effected by Falling Objects?	Low	Low	Manufacturer	Positioning of ECM & the way it is attached & protected should sufficiently mitigate this risk. Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS create a risk to person or property due Electrical issues/faults?	Low	Low	Manufacturer	The ETBS is Low Voltage therefore electrocution is not possible. If electrical failure or fault and ETBS ceases operating Normal/default setting applies to brakes if ETBS fails therefore safe operation of brake system maintained.
Could the ETBS create a risk to person or property due Gravity?	Low	Low	Manufacturer & Service Tech/User	Installation process to define requirements for ensuring device and components remain in place for life of vehicle
Could the ETBS create a risk to person or property due Falling Objects?	Low	Low	Manufacturer & Service Tech/User	Installation process to define requirements for ensuring device and components remain in place for life of vehicle

Risk Management Plan

Risk	Probability	Impact	Owner	Mitigation Plan
Temperature/Weather Effects Risks				
Could the ETBS operation be effected by Heat?	Low	Low	Manufacturer	ETBS is protected by the IP65 box rated to +70 Celsius Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by Cold?	Low	Low	Manufacturer	ETBS is protected by the IP65 box rated to -40 Celsius Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by Rain / Flood (Emersion)?	Low	Low	Manufacturer	ECM protected by IP65 box from emersion up to 1m Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by Wind?	Low	Low	Manufacturer	ECM protected by IP65 box Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by Pressure (Diving / Altitude)?	Low	Low	Manufacturer	ECM protected by IP65 box Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.

Risk Management Plan

Risk	Probability	Impact	Owner	Mitigation Plan
Could the ETBS operation be effected by Smoke?	Low	Low	Manufacturer	ECM protected by IP65 box Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Temperature/Weather Effects Risks				
Could the ETBS create a risk to person or property due to Heat?	Low	Medium	Manufacturer	The ECM does not emit heat to touch as it is in an IP65 protective box.
Could the ETBS create a risk to person or property due to Cold?	Low	Medium	Manufacturer	The ECM is protected by the IP65 box and is not affected by freezing
Could the ETBS create a risk to person or property due to Smoke?	Low	Medium	Manufacturer	The ECM does not emit smoke and is in an IP65 protective box.

Risk Management Plan

Risk	Probability	Impact	Owner	Mitigation Plan
Chemical/Hazardous Substance Risks				
Could the ETBS operation be effected by Liquids?	Low	Low	Manufacturer	ECM protected by IP65 box from emersion up to 1m Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by Fumes?	Low	Low	Manufacturer	ECM protected by IP65 box from emersion up to 1m Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by Gases?	Low	Low	Manufacturer	ECM protected by IP65 box from emersion up to 1m Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by Vapours / Mists?	Low	Low	Manufacturer	ECM protected by IP65 box from emersion up to 1m Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by Solids?	Low	Low	Manufacturer	ECM protected by IP65 box from emersion up to 1m Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.

Risk Management Plan

Risk	Probability	Impact	Owner	Mitigation Plan
Chemical/Hazardous Substance Risks				
Could the ETBS create a risk to person or property due to Liquids?	Low	Low	Manufacturer	The ETBS produces no liquids
Could the ETBS create a risk to person or property due to Fumes?	Low	Low	Manufacturer	The ETBS produces no Fumes
Could the ETBS create a risk to person or property due to Gases?	Low	Low	Manufacturer	The ETBS produces no Gases
Could the ETBS create a risk to person or property due to Vapours / Mists?	Low	Low	Manufacturer	ETBS is protected by IP65 box, and produces no liquid nor has any liquid around nor part of the ETBS
Could the ETBS create a risk to person or property due to Solids?	Low	Low	Manufacturer	ETBS is protected by IP65 box, and produces no solid substances nor has any solid hazardous substances around or as part of the ETBS

Risk Management Plan

Risk	Probability	Impact	Owner	Mitigation Plan
Environmental impacts on the product Risks				
Could the ETBS operation be effected by Dust?	Low	Low	Manufacturer	ECM protected by IP65 box from emersion up to 1m Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by Hazardous waste?	Low	Low	Manufacturer	ECM protected by IP65 box from emersion up to 1m Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.
Could the ETBS operation be effected by Hazardous emissions?	Low	Low	Manufacturer	ECM protected by IP65 box from emersion up to 1m Normal/default setting applies to brakes if ETBS fails due to damage therefore safe operation of brake system maintained.

Risk Management Plan

Risk	Probability	Impact	Owner	Mitigation Plan
Environmental impacts from the product Risks				
Could the ETBS usage in the vehicle create a risk to person or property due to Energy consumption? (Fuel consumption, tire wear, brake pads and other components)	Low	Low	Manufacturer	The ECM's Power source is the vehicle battery, and puts minimal drain on the battery, therefore low impact to the operation of the vehicle. There maybe over time less wear and tear for vehicles, and possible fuel saving and reduction CO2 emissions.
Could the ETBS create a risk to person or property due to Nuisance noise?	Low	Low	Manufacturer	The ETBS does not create additional/more frequent braking noises/nuisance noise. Possible reduction in noise achievable.
Could the ETBS create a risk to person or property due to Dust?	Low	Low	Manufacturer	The ETBS does not create any dust as a result of use.
Could the ETBS create a risk to person or property due to Hazardous waste?	Low	Low	Manufacturer	The ETBS does not create hazardous waste (inc Radiation, emissions, liquids/oils/fumes and other substances)
Could the ETBS create a risk to person or property due to Hazardous emissions?	Low	Low	Manufacturer	The ETBS does not create hazardous waste (inc Radiation, emissions, liquids/oils/fumes and other substances)

Risk Management Plan

Risk	Probability	Impact	Owner	Mitigation Plan
Manual Tasks / Ergonomics Risks				
Could the ETBS effective/safe operation or installation be effected by Manual tasks (repetitive, heavy)?	Medium	Low	Manufacturer & Service Tech/User	Install process and OH&S guidelines apply, warning labels to be applied Normal/default setting applies to brakes if ETBS fails therefore safe operation of brake system maintained.
Could the ETBS create a risk to person or property due to Manual tasks (repetitive, heavy)?	Medium	High	Manufacturer & Service Tech/User	Install process and OH&S guidelines apply, warning labels to be applied (Refer to separate Ergonomic Consultant report)
Muscle fatigue or excessive load pressure application by user?	Low	Medium	Manufacturer & Service Tech/User	No additional pressure required as brake is applied as user lifts foot from accelerator. Normal/default setting applies to brakes if ETBS fails therefore safe operation of brake system maintained. (Refer to separate Ergonomic Consultant report)
Installation heavy lifting, tight spaces, twisting at angles to install	Medium	High	Manufacturer & Service Tech/User	Install process and OH&S guidelines apply, warning labels to be applied

Risk Management Plan

Risk	Probability	Impact	Owner	Mitigation Plan
User, Training & Servicing & Installation Risks				
Could the ETBS effective/safe operation or installation **be effected by** using persons not correctly trained for servicing, installation or driving?	Medium	Medium	Manufacturer & Service Tech/User	Normal/default setting applies to brakes if ETBS fails therefore safe operation of brake system maintained. Documentation to be supplied for installation process by Manufacturer A warning label must be placed on the ECM protection box
Could the ETBS **create** a risk to person or property due to use by/ servicing by persons not correctly trained?	Medium	Medium	Manufacturer & Service Tech/User	Normal/default setting applies to brakes if ETBS fails therefore safe operation of brake system maintained. Documentation to be supplied for installation process by Manufacturer A warning label must be placed on the ECM protection box
Could the ETBS effective/safe operation or installation be effected by a person tampering with the ECM or changing code?	Low	High	Manufacturer	Software within the ECM is protected by embedded code and can not be adjusted by installers/service tech's A warning label must be placed on the ECM protection box
Can the ETBS be installed in such as way as to remove the default braking process	Low	Extreme	Manufacturer & Service Tech/User	The ETBS does not interfere with the encoder and does not impede normal brake functionality. It adds to the existing system, it does not disconnect it – Documentation to be supplied for installation process by Manufacturer

Risk Management Plan

Risk	Probability	Impact	Owner	Mitigation Plan
Could the ETBS effective/safe operation or installation be effected by using incompatible parts?	Medium	Low	Manufacturer	Normal/default setting applies to brakes if ETBS fails therefore safe operation of brake system maintained. Documentation to be supplied with specifications of compatible parts by Manufacturer
Could the ETBS effective/safe operation or installation be effected by being installed in different model/types of vehicles?	Medium	Low	Manufacturer	Normal/default setting applies to brakes if ETBS fails therefore safe operation of brake system maintained. Documentation to be supplied with specifications of compatible parts by Manufacturer
Could the ETBS effective/safe operation be effected by the user lifting their foot off the accelerator too quickly?	High	Low	Manufacturer	ETBS is tested to reduce acceleration at a safe speed if user lifts foot off the brake suddenly. (Refer to testing for ETBS results)
Failure of Brake Assist Light (Dashboard)	Low	Low	Manufacturer & Service Tech/User	Does not affect the operation of the ETBS, service schedule to include set duration for replacement of globe to Brake Assist Light

IP65 Protection for the ETBS ECM

What does the IP65 rating mean?

The IP code indicates the degree of protection provided by the enclosure in which the object exists. This is defined by International Standard IEC 529 Second Edition 1989-11 entitled *Degrees of protection provided by enclosures (IP code)*, as follows:

IP x y, where:

x	Protection against solid bodies	y	Protection against liquids
0	No protection	0	No protection
1	Objects greater than 50 mm	1	Vertical dripping water
2	Objects greater than 12 mm	2	75-90 degrees dripping water
3	Objects greater than 2.5 mm	3	Sprayed water
4	Objects greater than 1.0 mm	4	Splashed water
5	Dust protected	5	Water jets
6	Dust tight	6	Heavy seas
-	-	7	Effects of immersion
-	-	8	Indefinite immersion

The IP 65 box used is temperature rated at -40 to +70 Celsius

Therefore, as the ETBS ECM will be protected by a box, which has a rating of IP65, it is dust tight and protected against spraying water jets, making it suitable for wash-down of the vehicle it's mounted on.

Design assumptions

- As a transport braking system can be classified as a safety critical item, the ET Braking system has been designed in accordance with the **Vehicle Standard (Australian Design Rule 35/03 – Commercial Vehicle Brake Systems) 2009** - It would be expected that any assessment carried out for approval purposes would use this document as a compliance document.
- Brake Independence - The braking systems shall be sufficiently independent so that failure of one system will not prevent the operation of the other systems.
- Anti-locking - All braking systems should be designed to eliminate, or minimise, as far as practicable, the locking of wheels during brake application.
- Enclosure - Mechanical braking assemblies shall be totally enclosed.
- Surface Temperatures - Mechanical brake assemblies shall be designed to limit surface temperature to a maximum of 150 degrees Centigrade under conditions of normal duty cycle operation when tested to the requirements specified.
- Ancillary components - Interlocks, valves, logic components, associated mechanical devices shall be engineered, so as to minimise as far as practicable any accidental application, failure or release of any brake, by reason of system, design or component failure
- Accumulators shall be securely installed - A guard shall be installed between accumulators and any personnel within a vehicle. The structure of the vehicle may meet this requirement.

ET Braking System – Brake interactions

Example of brake interactions and scenarios for garbage trucks with single of dual control with automatic transmission (APBA = Accelerator Pedal with Braking Action)