SRS smart systems – logic

Identifying & understanding SRS (Frontal SRS/Pretensioners/SIPS/ROPS)

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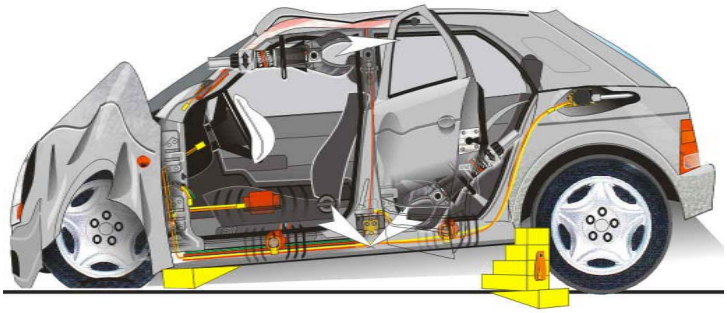
A paper for discussion, data collection and research



First published – April 2004 Last revised June 2005

ResQmed Ltd, St Andrews House, 21 Head Street, Halstead, Essex CO9 2AU, ENGLAND

Sharing / collection of information research and study site

SRS smart systems – logic

Identifying & understanding SRS (Frontal SRS/Pretensioners/SIPS/ROPS)

By Len Watson

Content

- Active Menu -

A paper for discussion, data collection and research

This program has been designed to share structured information pertinent to SRS smart systems with a view to generating a response to risk-assessment and the solutions available to rescue technicians when performing vehicle extrication evolutions.

The participant/reader is invited to comment and collect and submit data relevant to the issues raised in this document. We seek your permission to share your comments and submitted data with all participants in this project and would like to thank you in advance for your imput.

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Introduction

In recent years motor vehicle technology has overtaken the emergency services preparedness programs and we are desperately seeking safe methods to practice our extrication techniques. Basically fire departments are looking to design standard operating procedures for safe practice, particularly where they cannot gain access to disconnect a vehicle's battery at the roadside.

Some manufacturers offer rescuers guidelines in the form of publications but the information is of too general a nature and all fail to address the real situations rescuers face and are therefore of no value what-so-ever. There are two reasons for this:-

- One – The designs of systems are very much individual for each vehicle type, and therefore proprietary, so providing detail is not in the manufacturer's best interest.
- Two - Providing information can result in litigation where someone offers an alternative design that the manufacturer should have thought of when risk assessing their product.

The industry is very sensitive on this subject and wishes to minimise any risk of litigation and blame that may arise.

The problem that rescuers face in trying to perform extrication evolutions and develop Standard Operating Procedures (SOP's) for casualty entrapment rescue, is that they can never know how every individual system operates, and there can always be an exception to the rule due to new designs. Therefore, in real terms, the best that can be hoped for in the light of the prevailing circumstances is to minimise risk. Rescuers must be able to understand these systems, recognise potential risk and equate this information to their extrication strategy, which in turn must be measured in terms of casualty outcomes. For this to evolve we must appreciate that a certain logic must be put in place for –

- Systems and abbreviations
- General markings and identification
- The different deployment configurations
- Battery disconnection/status.
- Investigation, identification & assessment
- Risk diffusion/mitigation
- Research – Discussion and sharing of data/information

Systems and abbreviations

Supplementary Restraint System (SRS) is the most common name in use for passive safety systems. However the title of SRS is too wide a catchment area to be of any real value in rationalising safety systems for rescue purposes. Therefore for practical reasons and a greater understanding, SRS is divided here into more precise categories:-

- Frontal Airbag System - Steering wheel airbag, front passenger airbag and knee bolster and seat ramp airbag (SRS)
- Pretensioner System (PTS)
- Side Impact Protection Systems - Door airbags, seat mounted airbags, inflation curtains and head protection systems (SIPS)
- Roll Over Protection System (ROPS)

The steering wheel airbag and front passenger airbag and pretensioners are forward-plane orientated, while SIPS are lateral plane, and ROPS triggered by an electronic tilt switch. With the exception of some pretensioner systems (PTS) the categories operate on separate circuits and as such, allows us to identify the inference rescue evolutions is likely to have on each individual system. Some PTS, in addition to being forward plane orientated, can be triggered by side impact sensors. Mechanical systems are self-contained with their own individual sensor, which for PTS are forward plane oriented only.

General markings and identification

Markings

- Stickers
- Decals
- Mouldings
- Instrument panel light

A few prestige vehicles (Rolls-Royce, Bentley) have no markings, as such markings are not considered aesthetic and identification will have to be based on foreknowledge and likelihood of inclusion.

Apart from older cars having a noticeably smaller steering wheel boss, today we are very much reliant on markings and knowledge of the various systems.

Frontal airbags, incorporated within the steering wheel boss and the dash area on the front passenger's side, are most likely to have the following markings embossed on the trim to indicate SRS inclusion:-

Front airbag system

- SRS
- SIR
- AIRBAG
- PTS

Seatbelt pretensioner systems have NO markings. We can expect pretensioners to be concealed within the centre post, that is, if we cannot locate them elsewhere. For example, where it is evident that the retractor is mounted on the seat or where we can identify a buckle pretensioner; or we may locate a remote electronic pretensioner under the outboard seat valance with a cable running to the retractor mounted in the base of the centre post. then we know that the centre post does not conceal a pretensioner.

Pretensioner positioning -

- Electronic pretensioner fixed to retractor (base of centre post)
- Electronic pretensioner fixed to retractor (middle of centre post)
- Electronic pretensioner fixed to retractor (middle of rear door post)
- Electronic pretensioner fixed to floorpan concealed by the outboard seat valance.
- Electronic pretensioner fixed to retractor (rear parcel shelf)
- Electronic pretensioner fixed to retractor (seat mounted)
- Electronic buckle pretensioner (seat mounted)
- Mechanical buckle pretensioner (seat mounted)

Some buckle pretensioners have a convoluted rubber covering over the cable leading to the actual buckle while others operate on a lever system and are more bulky in appearance.

Side Impact Protection System (SIPS)

- AIRBAG - electronic - door mounted, trim deploying offering pelvic protection
- AIRBAG – mechanical pyrotechnic - door mounted, trim deploying offering pelvic protection
- AIRBAG - electronic - door mounted, trim deploying offering pelvic, thoracic and head protection

- AIRBAG – electronic - door mounted, window deploying offering head protection
- AIRBAG – electronic - seat mounted, trim deploying offering thoracic protection
- AIRBAG – electronic - seat mounted, trim deploying offering thoracic and head protection
- AIRBAG – mechanical pyrotechnic - seat mounted, trim deploying offering pelvic protection
- IC – Single air curtain - electronic operation, gas cylinder with pyrotechnic heat expansion - Roof side channel mounted with cylinder in roof side channel or rear roof post - roof lining deployment offering head protection
- IC – Dual air curtain - electronic operation, 2 gas cylinders with pyrotechnic heat expansion - Roof side channel mounted with cylinders location in the windscreen pillar and rear side channel or rear roof post - roof lining deployment offering head protection
- HPS – electronic operation, gas cylinder with pyrotechnic heat expansion – Roof side channel mounted with cylinder location in the windscreen pillar (For front occupants only.

Roll over protection system (ROPS) – Sports car/Roadster and Convertibles only.

- Sprung pop-up bars - electronically activated and mechanically deployed.
- Sprung pop-up arm - electronically activated and mechanically deployed.

Tell-tail design features

- Large and deep steering wheel hub/boss
- Strategic weakening to moulding on door trim.
- SRS label on trim but no visual moulding on doors could indicate the inclusion of a window deploying airbag.
- SRS label on roof pillars and larger moulding/contour to roof lining could conceal IC/HPS
- SRS moulding to outboard side of front seat-backs
- Corrugated rubber moulding to seatbelt buckle pretensioner
- Remote mechanical actuator for pretensioner to outboard side of front seat
- Percussion cap and pyrotechnical lines behind outboard seat valance

The different deployment configurations

SRS – Frontal airbag systems:

Smart Systems

In the 1990's, frontal airbags and pretensioners designs began to change from a "Deploy or not deploy" trigger to a smart system that decides if the seat belt pre-tensioner and/or airbag should be deployed. This configuration was mainly based on whether or not the front occupants have their seatbelts buckled. The restraint system electronic control module (ECM) now determines how many stages and at what sequence multi generator airbags should be deployed. During a collision, the restraints system ECM determines which seat belts are in use and how quickly the vehicle is decelerating allowing the ECM to determine which airbag or airbags should be deployed, how many stages should deploy, and in what sequence.

Examples of deployment scenarios

In these examples, there are two occupants in the front seats. The vehicle has two dual-stage front airbags and front seat belt pre-tensioners.

1st Threshold (minor impact) -

- both seat belts are buckled; both seat belt pretensioners deploy, but no airbags deploy.
- one seat belt is buckled; only that occupant's seat belt pretensioner will deploy. Frontal airbags and the other pretensioner will not deploy.

- neither of the seat belts are buckled; frontal airbags and seat belt pretensioners will not deploy - *Depending on the system and the designed parameters, one generator of the duel stage airbag may deploy.*

2nd Threshold (severe impact) -

- both seat belts are buckled, both seat belt pre-tensioners and both airbags deploy. If the system uses dual-stage airbags, the stages may deploy simultaneously, or be staggered to maintain longer airbag inflation.
- neither seat belt is buckled, both airbags deploy, but not the seat-belt tensioners. If the system uses dual-stage airbags, the stages may deploy simultaneously, or be staggered to maintain longer airbag inflation.

If a passive restraint module does not deploy, be aware of the various systems before drawing any conclusions. As early as 1994, BMW was using a passive restraint system that could identify if someone was in the front passenger seat. This system is called occupant recognition (OR) and the airbag will not deploy if the seat is vacant.

Weight Classification System - WCS

Along with the operation of systems that monitor seat belt use for determining airbag deployment, a weight classification system (WCS) can also determine multi generator airbag deployment by -

- the weight of the occupant in the front seat. This is determined by either a silicone-filled bladder or electronic strain gauges.
- stress on the seat belt.
- proximity of the passenger to the airbag. This is either determined with a seat position sensor or ultrasonic sensors.

As an example, occupants can be categorised in three groups depending on weight. When weight is detected on the front passenger seat equivalent to -

- less than 17 kg (37 lb), the WCS is designed to prevent deployment of the front passenger airbag. Some production models use a "low risk deployment" feature, ensuring that if specific crash criteria occurs, the least forceful airbag charge may be activated for an occupant between 17.5 kg (38 lb), and two gas generators for 45 kg (98 lb).
- for adults more than 45 kg (99 lb), all gas generators may be allowed to fully function depending on the crash data received.

SIPS - Left hand side

Configuration 1 – Seat mounted airbags and IC/HPS (Left side only)

- In a side-on impact only SIP systems on the side of impact will deploy. The SIP system on the opposite RH side of the car and frontal airbags and pretensioners will not deploy.

Configuration 2 – Seat mounted airbags, IC/HPS (Left side only) and all-seating seatbelt pretensioners

- In a side-on impact only SIP systems on the side of impact and all buckled seatbelt pretensioners will deploy. The SIP system on the opposite RH side of the car and frontal airbags and unbuckled seatbelt pretensioners will not deploy.

SIPS – Right hand side

Configuration 1 – Seat mounted airbags and IC/HPS (Right side only)

- In a side-on impact only the SIP system on the side of impact will deploy. The SIP system on the opposite LH side of the car and frontal airbags and seatbelt pretensioners will not deploy.

Configuration 2 – Seat mounted airbags, IC/HPS (Right side only) and all-seating seatbelt pretensioners

- In a side-on impact only SIP systems on the side of impact and all buckled seatbelt pretensioners will deploy. The SIP system on the opposite LH side of the car and frontal airbags and unbuckled seatbelt pretensioners will not deploy.

Battery Disconnection/Status

Should disconnecting the battery be a prime concern or, be considered a last resort prior to performing extrication due to the electrical features that can be of assistance in orientating the vehicle – centralised locking systems, electric windows, adjustable pedals, power seats, sun roofs? Unless there is an indication of an electrical fire or threat from 'Keyless Go' or 'Ready Go' – see appendix 1 - common sense would seem to dictate that battery disconnection be left until the rescue team deems it essential.

A vehicle's battery can survive a serious crash and in many instances, where access is not available, it cannot be disconnected at the roadside (Overturned vehicle, under-ride crash or battery installed under entrapped casualty or simply cannot be located or is impractical to disconnect). In these circumstances extrication evolutions will have to be performed with the vehicles power supply intact. Although in modern vehicles (2000>) where the ignition is switched to off, power to safety systems is cut, other systems such as electric seats, door windows and locks etc. will remain energised and could be the cause of direct short circuit when dismantling the vehicle. However, some vehicles are equipped with automatic battery disconnect in the event of a crash, but retains power to SRS and curtsey lights, while other systems cut the positive battery cable when frontal airbags deploy, isolating all other systems on the vehicle.

It is therefore very necessary for rescuers to be educated in risk recognition, risk assessment, risk control measures and risk critical information.

Investigation, identification & assessment 'Pry before you cut'

After a crash the different deployment criteria for today's advanced passive restraint systems leave inherent problems for the rescuer. Emergency professionals are faced with the possibility of meeting any of the configurations mentioned above. Without knowing how the systems are designed to operate, and what or who was in the front seats of the vehicle, it is impossible to fully identify what risks remain and how the rescue may further compromise these systems as the entrapped casualty is cut free and the vehicle's battery cannot be disconnected.

Where some airbags have deployed in the crash it is essential to inspect all SRS/SIPS to determine which remain undeployed and identify all mechanical systems.

Areas difficult to recognise

- Type of door airbag fitted – Trim or window deploying, pelvic or thoracic airbag
- Type of seat airbag fitted – electronic or pyrotechnic, thoracic or thoracic and head airbag.
- Multi gas generator monitors – Milli second delay or subject to weight classification system WCS
- IC/HPS – air curtain or head protection bolster
- Pretensioners additionally wired to SIP sensor
- DSU and Sensor positioning
- Compromised sensors and wiring

After a crash the vehicles engine will have invariably stopped. Switching off the vehicle's ignition is a good starting point. This action will de-energised most modern vehicles' safety and fuel systems. Generally this is not the case with pre model year 2000 vehicles where all

Risk diffusion/mitigation

undeployed SRS systems will remain energised. However, switching off the ignition can be considered a primary safety function, particularly for those first on scene and first responders. Where the vehicle is equipped with 'Keyless Go' or 'Ready Go', ensure the electric motor is shut off or the 'Keyless Go' transponder is removed from the vehicle – *see appendix 1*

To safely manage extrication rescue, a definite and efficient strategy is very necessary. Upon disconnecting the vehicle's battery a suitable waiting period must allow the SRS capacitor to drain – *see appendix 2* – before any extrication (Cutting, spreading, ramming) is performed. We must also appreciate that the battery cannot always be disconnected. The importance of switching off the ignition is vital in newer vehicles as the ignition switch energises these systems, but remember, other systems will remain energised i.e. electric seats, courtesy lights, music centres and centralised locking systems.

Where the battery cannot be disconnected, even with the ignition switched off some vehicles will still retain power to seats, door locks, electric windows, curtsey lights and alarm. Cutting, stretching and breaking of wiring consistent with the use of power hydraulic tools can lead to short circuit and static build-up sufficient to deploy all intact modules on the same circuit – see appendix 3.

To remove pertinent areas of interior trim and investigate installation slots for SRS inclusion will give a known degree of accuracy when cutting is required and a positive awareness of what we are trying to avoid. Knowing where to find SRS modules, cylinders, sensors, wiring and connector plugs is one thing, but what to do when we have identified them is another.

We need to know the answer to specific questions, even more so where we are unable to disconnect the vehicle's battery –

Q 1. When performing certain extrication evolutions on model year 1999 or older, with the vehicles ignition switched OFF :-

1. Can we safely disconnect the SRS connection to individual modules, between the sensor and the module?
2. Can we safely cut wiring to individual modules, between the sensor and the module?
3. Can we safely cut wiring to sensors, between the Diagnostic Sensing Unit and sensor?

Q 2. When performing certain extrication evolutions with the vehicle's ignition switched OFF on model year 2000 or newer:-

4. Can we safely disconnect the SRS connection to individual modules, between the sensor and the module?
5. Can we safely cut wiring to individual modules, between the sensor and the module?
6. Can we safely cut wiring to sensors, between the Diagnostic Sensing Unit and sensor?

Q 3. When performing certain extrication evolutions on model year 2000 or newer with the Vehicle's ignition ON:-

9. Can we safely disconnect the SRS connection to individual modules, between the sensor and the module?
10. Can we safely cut wiring to individual modules, between the sensor and the module?
11. Can we safely cut wiring to sensors, between the Diagnostic Sensing Unit and sensor?

What it boils down to can be addressed by questions 4 and 5. On the understanding that the battery cannot be disconnected, we state that the ignition is always switched off and the Key/'Keyless-Go' transponder removed from the vehicle. We also state as a first option, 'implement appropriate avoidance measures' – See appendix 4. Inadvertent deployment is likely to trigger all modules on the same system, therefore, where possible, modules should be disconnected from the connector plug in preference to cutting as this would seem to carry the lowest instance of inadvertent deployment.

However, where we cannot disconnect via connectors the only option left is to cut SRS wiring. Please note that removal of SRS fuses requires considerable foreknowledge and the many different procedures for the various model types and systems would be impractical for roadside adaptation. Particularly in the severely damaged car where steering wheels cannot be straightened to gain access to the SRS fuse under the steering column or where fuses to individual systems are inaccessible. The question now arises, how do we cut SRS wiring?

Q 4. Where SRS wiring between Sensor and Module must be cut, should wiring be cut:-

a. One wire at a time using insulated cutters only?
b. Or the SRS harness singled out and cut with a grounded wire cutter?

Q 5. Where SRS wiring between the Control Unit and Sensor must be cut, should wiring be cut:-

a. One at a time using insulated cutters only?
b. Or the SRS harness singled out and cut with a grounded wire cutter?

Without the answer to these specific questions rescuers will find themselves at a loss when making judgement calls as to the exact risk they face, the control measures they must take to guarantee the safety of both the casualty and rescuers.

The research and development of rescue needs your input. Be you in the Rescue Profession, Motor Industry or a Service Engineer your input or feedback is vital and essential to drive motor vehicle entrapment rescue forward.

Research - Sharing and Collection of Information

[Data information centre]

This program has been designed to share structured information pertinent to SRS smart systems with a view to generating a response to risk-assess the options available to rescue technicians when performing vehicle extrication evolutions.

The participant/reader is invited to comment and collect and submit data relevant to the issues raised in this document. We seek your permission to share your comments and submitted data with all participants in this project and would like to thank you in advance for your imput.

Use the Data collection facility within the program to comment or to answer the questions posed in this document.

This facility is WEB linked and updated on a regular basis with readers' comments and information. Where the reader wishes to be kept informed of other research projects and news letters, please frequent the WEB page - www.resqmed.com

Appendix 1

Keyless Go:

Condition -

Entry and starting authorisation without the need for a key.

'Keyless Go' authorization systems will have an ignition switch the same as any other car. The 'Keyless Go' system offers the driver the advantage of a transponder card/unit that allows the locked vehicle to be entered and driven away without the need to use the vehicle's key or pressing a transmitter button. To open doors, the transponder must be within a 1.5 m (5 Ft) range on the outside of the vehicle or within the passenger cell for the start/stop button to be functional. To start the engine it is only then necessary to press the Start button.

The most common location for the transponder is in the driver's pocket, center consol or in the glove compartment. For operation of the start/stop button, the service/foot brake must be depressed/ actuated.

Unlocking doors with Keyless Go -

The Keyless Go transmitter card must be on the outside of the vehicle within a range of 1.5m / 5 Feet:-

- **Pull any of the door handles to unlock**
- **Actuate the button on the transponder to release the boot/trunk**

Stopping the engine on vehicles with 'Keyless Go' -

Where the key is not present in the ignition, the engine can be shut off as follows -

- **Engage handbrake -** *Where the driver's feet are trapped, operation of the foot operated parking brake may prove impossible due to bodywork intrusion in the footwell.*
- **Move the gear shift lever to 'N' or select 'P'**
- **Press start/stop button once**
- **Remove the transponder - Unlock all doors and luggage compartment/hatchback and hand the transponder to the incident commander.**

Where the key is in the ignition

Where the key is installed in the ignition switch, the key will have priority for stopping and starting the engine. On automatics the key can only be removed when the selector lever is in 'P' (Park) position.

- **Engage handbrake -** *Where the driver's feet are trapped, operation of the foot operated parking brake may prove impossible due to bodywork intrusion in the footwell.*
- **Move the gear shift lever to neutral 'N' or select 'P' (Automatic transmission)**
- **Switch the ignition off.**
- **Remove the vehicles key and transponder. Unlock all doors and luggage compartment/hatchback and hand the key to the incident commander. The transponder must be removed from the vehicle to deactivate the ignition, SRS, Fuel pump etc.**

IMPORTANT:

The 'Keyless Go' transponder, when it comes within range (5 m - 15 feet), will power up the vehicle's safety systems, and unlock all doors. The card/transponder is most likely to be located on the driver (shirt pocket, coat or trouser pocket). It may also be placed in the centre console or glove compartment. **Where the battery cannot be disconnected, the Incident Commander or Police Officer holding the 'Keyless Go' transponder, should under no circumstances approach the vehicle with it is on their person.**

Appendix 2

Ready Go:

Stopping the engine on vehicles with 'Ready Go' -

Hybrid vehicles are equipped with a 'Ready go' system. The vehicle can be driven away at anytime in the 'Ready' mode, even though the petrol engine is stopped.

- **The engine can start at any time while in the 'Ready' mode**
- **Motive power is 'Off' only when the 'Ready' indicator is 'Off'.**

Stopping the engine and electric motor on vehicles with 'Ready Go' -

- **Engage handbrake -** *Where the driver's feet are trapped, operation of the foot operated parking brake may prove impossible due to bodywork intrusion in the footwell.*
- **Move the gear shift lever to neutral 'N' or select 'P' (Automatic transmission)**
- **Switch the ignition off - Turn ignition key to lock position.**
- **Remove the vehicles key.**
- **Use the key/remote to unlock all doors and luggage compartment/hatchback and hand the key to the incident commander.**

Notes:

The hybrid vehicle is fitted with a ground fault monitor which continuously monitors for high voltage leakage to the metal chassis. When a leak is detected the on board computer will immediately open relays shutting off supply to the HT leads and the engine compartment. Please note – the 12 volt supply will not be affected.

In a forward plane collision where frontal airbags deploy the relays will automatically open to stop electricity flow to HT leads and the inverter and electric motor. Serious accidents over 40% front off center (where frontal airbags do not deploy), side-on and rear impacts, will leave the HT system live.

The Hybrid vehicle can also be equipped with 'keyless Go'. Some 'keyless go' cards operate when inserted into a slot in the dash and must be removed from the vehicle to deactivate the 12 volt electrical system (Ignition, SRS, Fuel pump etc.).

Disabling the Hybrid vehicle -

- **Switch off the main switch for the HV power supply. Allow at least 5 minutes for the capacitor to drain to below 50 volts (Manufacturers do not give an estimation for total power dissipation).**
- **Where access to the main switch is not available, remove the IGCT relay in the engine compartment (Removing the relay will only shut off power to the inverter and electric motor and will NOT isolate the HT battery pack or capacitor.**
- **Disconnect the 12 volt battery. Allow sufficient time for the SRS capacitor to drain.**

WARNING –
Never open or tamper with HV components. DO NOT cut, jack, chock or spread against HT cables.

REMEMBER -
All HV cables rearward of the Reformer will be direct current (DC)

Appendix 3

Note: Information of Air Bag Deactivation Times in this document was provided by the automobile manufacturers. Rescue guidelines were coordinated with the U.S. Fire Administration (USFA) and the automobile manufacturers.

Air Bag Deactivation Times

Acura

Integra	(MY 87-94) -1.5 min. (MY 95-97) - 3 min.
Legend	(MY 87-88) - 15 sec. (MY 89-92) - 30 sec. (MY 93-94) - 2 min. (MY 95-97) - 3 min.
Legend Coupe LS	(MY 91) - 2 min. (MY 92) - 30 sec. (MY 93-94) - 2 min. (MY 95-97) - 3 min.
Sedan STD	(MY 94) - 2 min. (MY 95-97) - 3 min.
NSX	(MY 91-92) - 30 sec. (MY 93-94) - 90 sec. (MY 95-97) - 3 min.
Vigor LS	(MY 92-94) - 30 sec. (MY 95-97) - 3 min.
Vigor GS	(MY 93-94) - 90 sec. (M 95-97) - 3 min.
SLX	(MY 96-97) - 15 sec.

Audi

(MY 89-95) - 10 sec.
(MY 96-97) - 3 sec.

Bentley and Rolls Royce

(MY 90-93) - 30 min.
(MY 94-97) - 6 min.

BMW

(MY 86-93 and MY 94 for the '7-Carline') - 20 min.

(MY 94 Vehicles made after 9/93) - 1 sec.

Hyundai

(MY 94-97) - 30 sec.

Isuzu

Impulse and Stylus	(MY 89-94) - 10 min.
Rodeo	(MY 89-97) - 15 sec.
Trooper	(MY 89-95) - 2 min. (MY 96-97) - 15 sec.

Jaguar

XJS	(Up to MY 96) - Mechanical air bags (MY 97) - 60 sec.
Sedan Models	(MY 89-97) - 60 sec.
X100	(MY 95-97) - 60 sec.

Jeep and Eagle

Grand Cherokee (Laredo)	(MY 89-94) - 2 min. (MY 95-96) - 90 sec. (MY 97) - 15 sec.
Cherokee and Wrangler	(MY 89-94) - 2 min. (MY 95-96) - NA (MY 97) - 15 sec.
Vision	(MY 89-94) - 2 min. (MY 95-97) - 90 sec.

Land Rover

(MY 94-97) - 10 min.

Lincoln

(MY 1985-89) - 0 sec.
(MY 90) - 15 sec.
(MY 91-97) - 1 min.

Mazda

MX-5	(MY 95-97) - 10 min.
All others	(MY 89-94) - 10 min. (MY 95-97) - 1 min.

Chrysler

LHS and Concorde	(MY 89-94) -2 min. (MY 95-97) - 90 sec.
LeBaron Convertible	(MY 89-94) - 2 min. (MY 95) - 90 sec. (MY 96-97) - NA
Town & Country	(MY 89-94) - 2 min. (MY 95-97) - 15 sec.
Sebring Convertible and Sebring Coupe	(MY 89-94) - 2 min. (MY 95) - NA (MY 96-97) - 15 sec.

Dodge

Caravan, Ram Van, and Stratus	(MY 89-94) - 2 min. (MY 95-97) - 15 sec.
Dakota and Neon	(MY 89-94) - 2 min. (MY 95-96) - 90 sec. (MY 97) - 15 sec.
Intrepid and Ram Pickup	(MY 89-94) - 2 min. (MY 95-97) - 90 sec.
Spirit	(MY 89 - 94) - 2 min. (MY 95) - 90 sec. (MY 96-97) - NA
Viper	(MY 89-94) - 2 min. (MY 95-96) - NA (MY 97) - 15 sec.

Ferrari

456 GT	(MY 1995, Vehicles made up to 12/95) - 30 sec. (MY 1996, Vehicles made after 7/96) - 1 sec.
456 GTA	(MY 1996 -1997, Vehicles made begin-ing 7/96) - 1 sec.
F355	(MY 1995, Vehicles made up to 3/96) - 30 sec. (MY 1996 -1997, Vehicles made after 3/96) - 1 sec.

Ford

	(MY 85-89) - 0 sec. (MY 90) - 15 sec. (MY 91-97) - 1 min.

Mercedes Benz

	(MY 89-97) - 1 sec. Side air bags (MY 95-97) - 1 sec.

Mercury

Villager	(MY 85-89) - 0 sec. (MY 90) - 15 sec. (MY 91-93) - 60 sec. (MY 94-96) - 10 min. (MY 97) - 3 min.
Others	(MY 85-89) - 0 sec. (MY 90) - 15 sec. (MY 91-97) - 1 min.

Mitsubishi

	(MY 89-97) - 1 min.

Nissan and Infinity

	(MY 89-94) - 2 min. (MY 95-97) - 3 min.

Plymouth

Breeze	(MY 89-94) - 2 min. (MY 95) - NA (MY 96) - 90 sec. (MY 97) - 15 sec.
Voyager	(MY 89-94) - 2 min. (MY 95-97) - 15 sec.
Acclaim	(MY 89-94) - 2 min. (MY 95) - 90 sec. (MY 96-97) - NA
All other models	(MY 89-94) - 2 min. (MY 96-97) - 15 sec.

Porsche

944	(MY 90-94) - 20 min. (MY 95-97) - 1 sec.
968 and 928	(MY 90-94) - 20 min. (MY 95-97) - 1 sec.
911	(MY 90-94) - 5 min. (MY 95-97) - 1 sec.

GM and Saturn		
		(All 87-97) - 10 min.
Geo		
		(MY 94-97) - 60 sec.
Honda		
	Accord Wagon	(MY 91-93) - 45 sec. (MY 94) - 2 min. (MY 95-97) - 3 min.
	Accord Coupe/ Coupe SE	(MY 92-93) - 45 sec. (MY 94) - 2 min. (MY 95-97) - 3 min.
	Accord Sedan	(MY 92-94) - 45 sec. (MY 95-97) - 3 min.
	Civic 3D and 4D	(MY 94) - 90 sec. (MY 95-97) - 3 min.
	Civic del Sol, Car, Coupe DX and EX, and Hatchback	(MY 89-93) - 30 sec. (MY 94) - 90 sec. (MY 95-97) - 3 min.
	Honda Passport	(MY 89-94) - 90 sec. (MY 95-97) - 15 sec.
	Honda Prelude S and Si	(MY 92-93) - 30 sec. (MY 94) - 90 sec. (MY 95-97) - 3 min.
	All Other Preludes	(MY 92-94) - 90 sec. (MY 95-97) - 3 min.
Saab		
	900	(MY 90-93) - 20 min. (MY 94) - 0 sec. (MY 95-97) - 20 sec.
	9000	(MY 90-93) - 20 min. (MY 94) - 0 sec. (MY 95-97) - 20 sec.
Subaru		
		(MY 89-97) - 80 sec.
Suzuki		
	Esteem	(MY 95) - 15 sec. (MY 96) - 15 sec. (MY 97) - 90 sec.
	Swift	(MY 95) - 10 sec. (MY 96) - 15 sec. (MY 97) - 90 sec.
	Sidekick-2 door, Sidekick-4 Door, Sidekick Sport, & X-90	(MY 95-96) - 15 sec. (MY 97) - 90 sec.
Toyota and Lexus		
		(MY 90-91) - 20 sec. (MY 92-97) - 90 sec.
Volvo		
		(MY 89-97) - 10 sec.
Volkswagon		
	Cabriolet	(MY 90-93) - 20 min.
	All other models	(MY 94-97) - 1 sec.

Appendix 4

Extrication evolutions

Vehicle upright

- Vehicle stabilisation
- Glass management (EPG)
- Roof removal
  - Complete (IC/HPS)
  - Flap back (IC/HPS)
  - Side flat (IC/HPS)
  - Forward flap (IC/HPS)
- Door forcing
  - Forcing the doorlock (SIPS)
  - Forcing/removal from hinges (SIPS)
- Side removal
  - Centre post complete with rear door (SIPS, PTS)
  - Centre post rip (SIPS, PTS)
  - 2 door: Side panel removal (SIPS, PTS)

Typical entrapment extrication

Cutting the rear roof post

Dash relocation

- Dash roll (SRS, SIPS, PTS)
- Dash Lift (SRS, SIPS, PTS)
- Steering wheel relocation (Dash crossmember, SRS, PTS)

Side removal 4 door car

Seat adjustment, seat back and seat base removal

- Forced seat reversing (SIPS, PTS)
- Forced seat back removal (SIPS, PTS)
- Forced seat base removal (SIPS, PTS)

Seat forcing

Vehicle on-its-side

- Vehicle stabilisation
- Roof fold down (SIPS [IC], PTS)
- Roof fold down (SIPS [HPS], PTS)

Vehicle on its roof

- Vehicle stabilisation
- Inverted door forcing/removal
  - Inverted door forcing (SIPS/Fuel systems)
  - Inverted door removal (SIPS [IC/HPS], PTS)
- Inverted side removal
  - Centre post complete with rear door (SIPS [IC/HPS], PTS)
  - 2 door: side panel removal (SIPS [IC/HPS], PTS)
  - Clam (Inverted ramming and cutting with IC)
  - Clam (Inverted ramming and cutting with HPS)

Side removal with inverted ramming and cutting

Appendix 5

Safety Instructions and Bag Deployment Paths.

WHEN WORKING WITH LIVE SYSTEMS: PRY BEFORE YOU CUT - Strip the trim, inspect installation slots and identify all risks. Avoid all SRS modules, high pressure cylinders, connectors and wherever possible, DO NOT cut SRS wiring together with other wiring.

- **To accidentally activate one module could activate all other electronic modules on the same system**

When cutting, spreading or ramming, disconnecting or cutting module wiring -

- **DO NOT place 'hard protection' between an undeployed airbag and the casualty or rescuer**
- **STAY OUT OF THE REACH OF BAG DEPLOYMENT PATHS - When performing extrication that is in anyway likely to compromise SRS or SIPS, DO NOT reach across airbags or SIPS deployment paths. Always observe and maintain the 500, 250 and 150 mm (20, 10 and 6 inch) rule.**

500mm/20" – front passenger airbag, HPS, IC, door/window and some seat mounted modules
250mm/10" - Steering wheel airbag
150mm/6" - Door and seat mounted airbag cushioning depth

REMEMBER - *IC and HPS deploy downwards and the door's window airbag and seat modules deploy outwards and upwards.*

WARNING - *Where the vehicle has come to rest on-its-side or on-its-roof, the direction of bag deployment will alter accordingly.*

WARNING - *Some seatbelt pre-tensioners and buckle pre-tensioners are also wired into the SIPS system. On vehicles where pre-tensioners remain undeployed, keep hands away from the buckle retraction path.*

END

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ResQmed Ltd, St Andrews House, 21 Head Street, Halstead, Essex CO9 2AU, ENGLAND