



AIRBAG SYSTEM

SECTION WD - ELISE NORTH AMERICA

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WD.1 - GENERAL DESCRIPTION

The Lotus Elise for USA markets, introduced for 2005 model year, is equipped with a driver and passenger frontal airbag system, which includes pyrotechnic seat belt pre-tensioners for both the driver and passenger. The airbag Supplementary Restraint System (SRS) is supplemental to the seat belts, and does not render the seat belts redundant. Seat belts have proven to be the single most effective safety device, and should be worn at all times by both driver and passenger, no matter how short the journey. Properly worn seat belts also ensure that the seat occupant is in the best position for full effectiveness of the airbag.

WARNING: Airbags inflate with great force, in a fraction of a second, and if a vehicle occupant is too close to the airbag (less than 10 inches {250 mm}) or incorrectly positioned, they could be killed or seriously injured.

The SRS is designed to operate when the vehicle is involved in a frontal, or near frontal collision, and the impact (rate of deceleration) as detected by a vehicle mounted sensor, is sufficient to warrant airbag and seat belt tensioning protection to both occupants. The airbag for the driver is housed in the centre of the steering wheel, and that for the passenger in the front of the fascia. When triggered, both bags inflate in a fraction of a second to form a cushion for the driver's and passenger's upper bodies. The bags then deflate very rapidly to minimise any obstruction to the driver. Initiated at the same time as the airbags is a pyrotechnic device on each seat belt reel assembly, which uses a rack and pinion mechanism in order to apply a tightening force to the belt reel and remove any slack from the belt. The force sustained by the belt and its user is then controlled by a torsion bar within the belt reel to limit the deceleration force to which the occupant is subjected.

Note that the SRS will deploy only in moderate to severe frontal and near frontal collisions, and is not designed to be triggered in rollover, rear or low speed frontal collisions, or in some types of side impacts.

The system incorporates a self-diagnostic facility, which continuously monitors the SRS electrical circuits for faults, and if necessary, lights a tell tale lamp in the instrument cluster. Most components of the SRS will require replacement after an airbag deployment.

WD.2 - AIRBAG TELL TALE

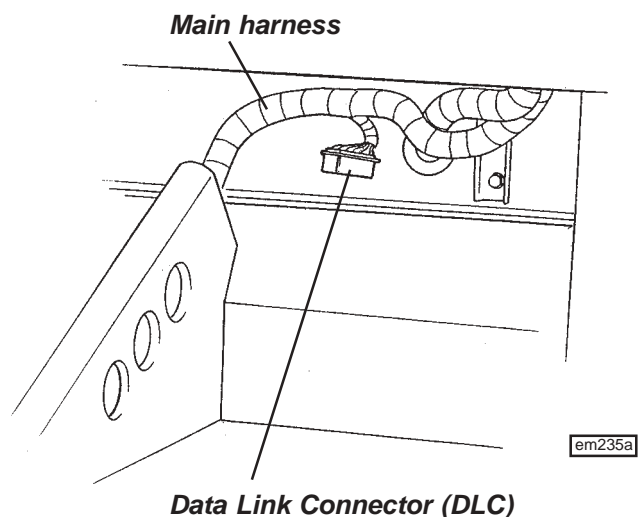


A tell tale lamp in the instrument cluster will light for a few seconds following ignition switch on, and then go out. If the lamp remains lit, or comes on at any other time, a fault in the airbag system is indicated.

WARNING: If the airbag tell tale does not operate as described above, a fault in the SRS system is indicated. The airbags may not inflate correctly or at all, or may inflate without warning. The system should be interrogated using the Lotus Scan tool, and diagnosed and rectified without delay.

WD.3 - DATA LINK CONNECTOR (DLC)

In order to provide for communication with the SRS Sensing and Diagnostic Module (SDM), the Lotus Scan tool may be plugged into the special 16 terminal harness connector socket, known as a Data Link Connector, located off the main harness and accessible from the passenger footwell. Communication with engine management and anti-lock brakes is also available via this connector.





WD.4 - TROUBLE CODES

All the time the ignition is switched on, the Sensing and Diagnostic Module (SDM) continuously monitors the resistance of various parts of the SRS electrical circuit, and compares these values with pre-programmed tolerance bands to enable it to recognise 'faults' in the system and light the airbag tell tale lamp in the instrument cluster. If such a fault is detected, the SDM stores a 'Trouble Code' for that particular type of fault in its memory.

- i). Current (Present) Codes - Faults that are currently being detected. Current codes are stored in the SDM Random Access Memory (RAM), which will be cleared if the vehicle battery is disconnected.
- ii). History (Not present) Codes - All faults detected since the last time faults were cleared from the memory using the Lotus Scan tool. History codes are stored in the SDM Electronically Erasable Programmable Read Only Memory (EEPROM) and are not cleared if the battery is disconnected.

Vehicle crash data is also stored in coded form in the SDM and is not erasable. New SDMs are supplied only against V.I.N. and on exchange with the old unit.

WD.5 - LOTUS SCAN TOOL

In order to provide for communication with the airbag SDM, engine management system ECU and anti-lock brake system, a hand held electronic scanner 'Lotus Scan 2' (part number T000T1418F), may be plugged into the Data Link Connector (see earlier)

Amongst the operations available using the 'Lotus Scan 2' tool are:

- Reading of Trouble Codes
- Clearing of Trouble Codes
- Reading live data

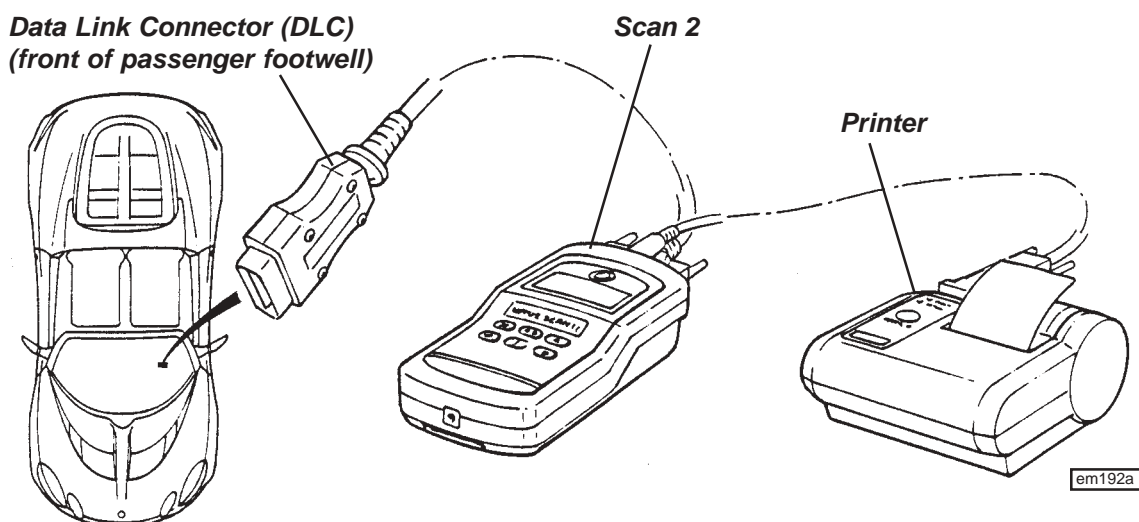
Operating instructions are provided with the tool.

Important Note

The power supply transformer is used for overnight charging of the printer, and also for powering the Scan 2 tool during software downloading from a PC (personal computer). For the software download operation, the Scan tool requires a power supply from the mains via the transformer and an inverter. Two types of inverter have been used; early kits used an adaptor lead to plug into the bottom end of the Scanner tool. Later kits use an adaptor plug fitting into the top end of the scanner.

When charging the printer, **it is most important that the inverter is NOT used**, or damage to the transformer may be caused. Incorrect connection is possible only with the early type adaptor lead, with which extra care should be exercised.

1. Reading data from vehicle



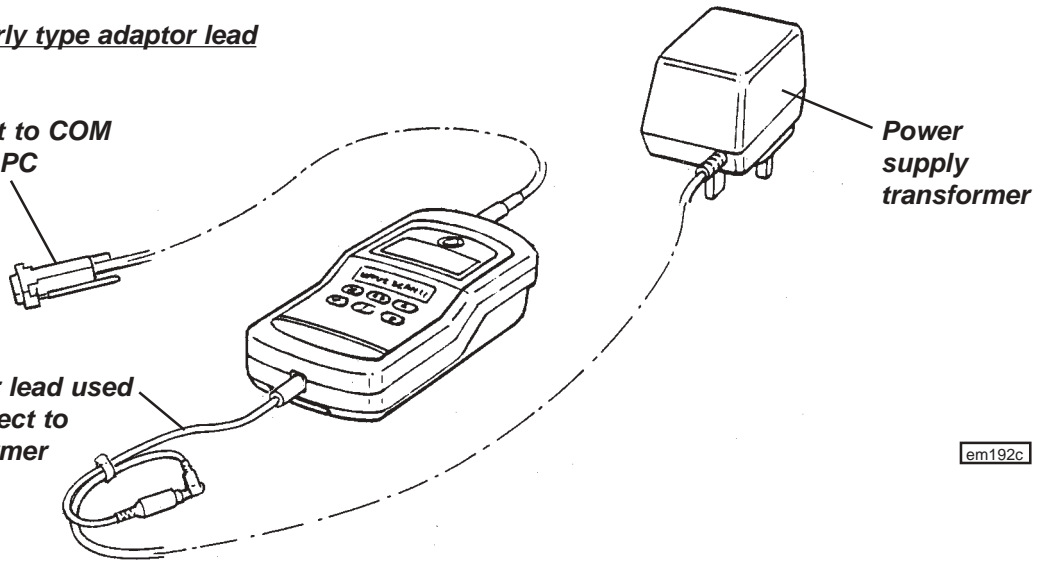


2. Downloading software from P.C.

With early type adaptor lead

Connect to COM port on PC

Adaptor lead used to connect to transformer



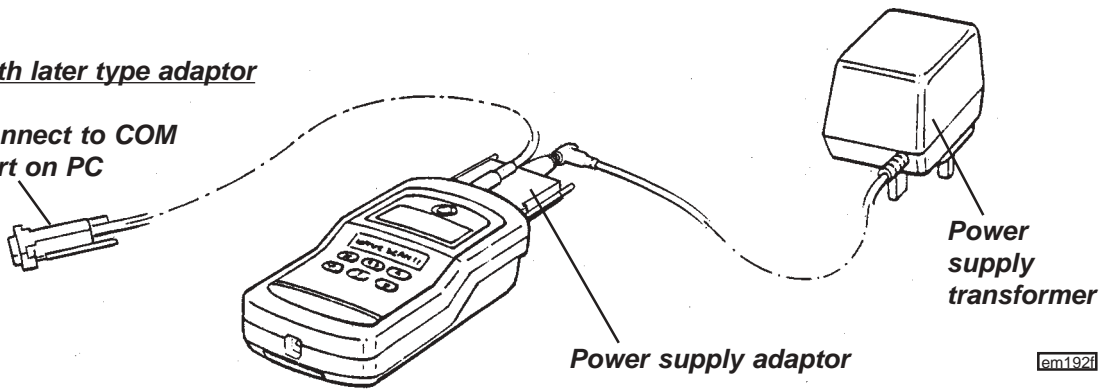
em192c

With later type adaptor

Connect to COM port on PC

Power supply adaptor

Power supply transformer



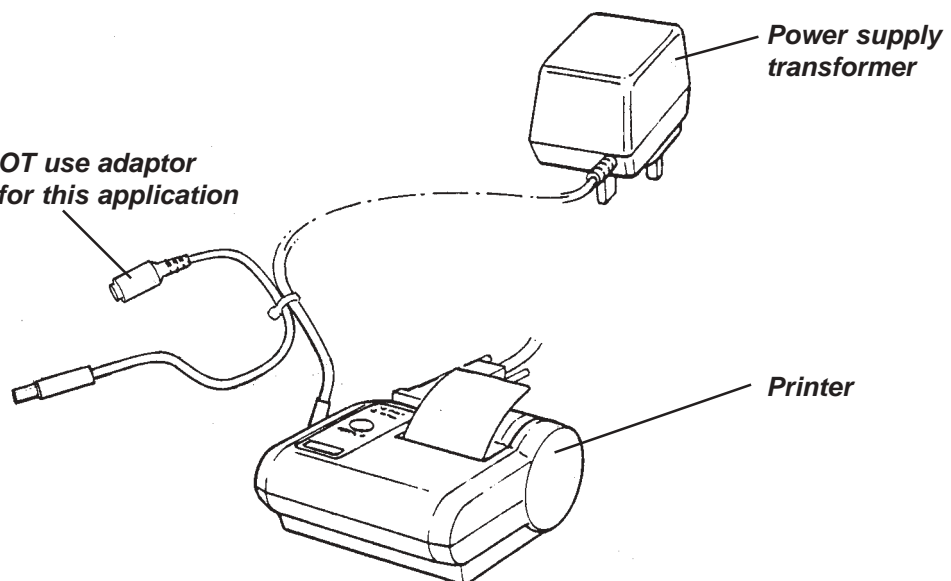
em192f

3. Charging printer

Do NOT use adaptor lead for this application

Power supply transformer

Printer





WD.6 - SAFETY PRECAUTIONS, SHIPPING, STORAGE & DISPOSAL

WARNING: The SDM can maintain sufficient voltage to cause an airbag deployment for up to 20 seconds after the battery has been disconnected. Before working on the airbag system, or in close proximity to an airbag, first take the following precautions to temporarily disable the airbag system:

1. Turn off the ignition.
2. Before disconnecting the battery, use the Lotus Scan tool to read any stored trouble codes.
3. Disconnect the negative (earth) lead from the battery and tape back to ensure that no contact with the battery negative terminal can be made.
4. Wait for 30 seconds.
5. If working on or near the steering wheel, locate the yellow harness connector alongside the steering column near the column upper fixing. Unplug this connector. Note that the connector is fitted with 'shorting bars' which automatically interconnect the high and low terminals of the airbag to prevent accidental deployment caused by a voltage differential.

When service work has been completed, reconnect the harness plug and secure with its locking feature, and reconnect the battery. Ensure the airbag tell tale lights for a few seconds with ignition and then goes out.

Storage

- Airbag modules and SDMs should not be stored at temperatures above 176°F (80°C).
- Airbag modules and SDMs should not be stored in damp conditions.
- Do not store airbag module or SDM boxes more than two high.
- Always store and handle airbag modules and SDMs in an upright position. Never store SDMs upside down.

Sensor & Diagnostic Module (SDM)

The SDM is calibrated specifically to the Elise, and is mounted on a dedicated bracket to the scuttle beam. Never use an SDM from another vehicle, or modify its mounting to the Elise.

WARNING:

- Handle the SDM with great care. Never strike or jar the SDM as this could cause airbag deployment and result in personal injury or improper operation of the SRS.
- All module and mounting bracket bolts must be correctly installed and tightened to assure proper security and operation.
- Never power up the SRS when the SDM is not properly mounted and secured, since the SDM is easily triggered when not attached, and could result in deployment causing personal injury.
- Do not use or attempt to repair a damaged SDM.

Inflator Module

Live (Undeployed) Inflator Modules: Special care is necessary when handling and storing a live (undeployed) inflator module. In the unlikely event of accidental deployment, the rapid gas generation produced during deployment of the air bag could cause violent movement of the inflator module or surrounding objects, and result in personal injury.

WARNING:

- When carrying a live inflator module, make sure the bag and trim cover are pointed away from you. In case of an accidental deployment, the bag will then deploy with minimal chance of injury.
- When placing a live inflator module on a bench or other surface, always face the bag and trim cover upwards, away from the surface. This is necessary so that a free space is provided to allow the air bag to expand in the unlikely event of accidental deployment. Otherwise, personal injury may result.
- Never carry the inflator module by the wires or connector on the underside of the module.
- Do not use or attempt to repair a damaged inflator module, and NEVER apply any electrical power to the module except as specified in the diagnostic procedures.

Inflator Module Shipping Procedures for Live (Undeployed) Inflator Modules

The transportation of uninstalled inflator modules is regulated by the Hazardous Materials Regulations of



the U.S. Dept, of Transportation (DOT) and most state governments. Special procedures are required for transportation. Lotus recommends that the dealers and repair shops check with the hazardous material section of their respective state police authority for applicable shipping requirements.

For all shipments on public roads, the DOT has classified the uninstalled inflator module as a flammable solid under a special exemption process. It should always be shipped and stored in the approved cardboard container in which it is purchased. The container should be marked with "Flammable Solid , n.o.s., UN1325, DOT-E8236" and labelled with the specified red and white flammable solid label. Each shipping location must have a copy of the exemption on file. A shipping paper (e.g., a customer receipt) must accompany each shipment and identify the module as "Flammable Solid, n.o.s., UN1325, DOT-E8236". Transportation, storage and handling of the module should be in accordance with the exemption and the requirements for a DOT flammable solid. Do not expose the module to heat, open flame, impact, friction, or electrical charge.

Inflator Module Scrapping Procedures

WARNING: Failure to follow proper SRS inflator module disposal procedures can result in airbag deployment which may cause personal injury. Undeployed inflator modules must not be disposed of through normal refuse channels. The undeployed inflator module contains substances that can cause severe illness or personal injury if the sealed container is damaged during disposal. Disposal in any manner inconsistent with proper procedures may be a violation of federal, state and/or local laws.

Reference should be made to the local State authority for the correct disposal procedures for deployed inflator modules.

Vehicle Scrapping Procedures

Some vehicles equipped with SRS that have live (undeployed) inflator modules may have to be scrapped because they have completed their useful life, or have been severely damaged in a non-deployment type accident. The following procedure should be followed when scrapping a vehicle with an undeployed module.

1. Follow the safety procedure detailed in sub-section WD.6 to turn off the ignition, disconnect the battery and unplug the yellow 4-way connector to the inflator module, alongside the steering column.
2. Follow the procedure detailed in sub-section WD.11 to gain access to the passenger airbag module.
3. At the driver's airbag harness alongside the steering column, cut the harness side of the SRS wiring approx. 3 to 6 inches from the yellow connector.
4. Splice 2 wires at least 20 feet long to the red/blue and the red/green coloured cables in this connector block.
5. Reconnect the yellow 4-way connector block now equipped with 2 x 20ft long cables.
6. Check that the inflator module is secured to the steering wheel.
7. Remove all loose objects from the front seat.
8. Ensure no one is in the vehicle.
9. Stretch wires away from car to their full length.
10. Apply 12 volts across the wires to deploy the air bag.
11. Do not touch the inflator module area for 20 minutes due to the heat generated during deployment.
12. Wear gloves and safety glasses to handle the deployed air bag. Wash your hands with mild soap and water afterwards.
13. Repeat steps 3 to 12 for the passenger airbag, splicing the 20ft cables into the two wires connecting the SDM to the airbag.

Deployed Inflator Modules

WARNING: Safety precautions must be observed when handling a deployed inflator module. After deployment, the air bag surface may contain a white packing powder used to ease deployment, together with a small amount of sodium hydroxide dust, a by-product of the sodium azide reaction during deployment that can be irritating to the skin if left on for an extended period of time. Always wear gloves and safety glasses when handling a deployed inflator module, and wash your hands with a mild soap and water afterwards.



Inspections Required After an Accident

All SRS system components, including harnesses and brackets, must be inspected after an accident. If any are damaged or bent, they must be replaced even if a deployment did not occur. **If the SRS was deployed, the following components MUST be renewed even if there is no visible damage to the parts:**

Driver airbag module;
Passenger airbag module;
Sensor & Diagnostic Module (SDM);
Driver and passenger pyrotechnic seat belt assemblies;
Rotary connector;
Passenger airbag mounting brackets (2);
Passenger airbag shute (2);
Passenger airbag door assembly (trim panel);
Dash panel upper extrusion.

Inspect the steering column for damage or telescoping (see Section HG) and column mounting brackets for damage. Inspect the chassis scuttle beam in the area of the passenger airbag mounting brackets for damage or distortion. Inspect the SRS wiring harness and connectors for damage or any signs of overheating. Do not attempt to repair the steering column or chassis or any of the above mentioned components. Service is by replacement only.

WARNING: Proper operation of the SRS system requires that any repairs to the vehicle structure return it to its original production configuration. Deployment, or any visible damage to the SRS components and/or their respective mounting brackets requires replacement, not repair.

WD.7 - THEORY OF OPERATION

The key components of the Supplementary Restraint System (SRS) are the following:

- Sensor & Diagnostic Module (SDM);
- Driver airbag module;
- Passenger airbag module;
- Rotary connector;
- Seat belt pre-tensioners.

Sensor & Diagnostic Module (SDM)

The SDM is the main electronic control unit (ECU) of the SRS, whose function is to detect rates of forward deceleration, and when interpreted as a collision accident requiring supplementary occupant protection, the SDM triggers as a single set, the driver and passenger airbags and both seat belt pre-tensioners. Additional functions are to maintain an energy reserve in case of vehicle battery power interruption, operation of a dash mounted tell tale lamp, and a electronic diagnostic and event recording facility accessible via a workshop scanner tool.

The unit is mounted by a dedicated bracket to the top of the passenger side scuttle beam, accessible after removal of the fascia top.

The following functionality is provided by the SDM;

- Sensing of frontal impact crash events and vehicle specific discrimination between non-deployment and deployment-requiring events as well as the deployment of the frontal airbags and seat belt pre-tensioners.
- In case of a required deployment, timely activation of the activation current for the deployment loops.
- Detection of electrical system faults which may influence the readiness of the system to deploy, or increase the probability of an inadvertent deployment by:
 - continuous electrical monitoring of all deployment circuits (without any effect on the readiness of the system);
 - continuous monitoring of the supply voltage and the lamp circuitry (dependent on lamp driver activation status);
 - SDM self test;
 - activation of a tell tale lamp in case of a detected system fault.



- Fault storage and 'Crashrecording' within EEPROM ('crashrecording': recording of system parameters (e.g. fault status in deployment events).
- Diagnostic communication using an ISO9141 protocol.

Frontal Impact Sensing and Deployment

The SDM contains an integrated accelerometer which provides a nearly linear proportional electrical representation of the acceleration experienced by the vehicle along the longitudinal axis. This signal is amplified and filtered to reduce unwanted electronic noise and to compensate for offset drifts. The filtered signal is then digitized to provide an input for evaluation by the crash algorithm. As soon as the crash algorithm detects that pre-defined thresholds have been exceeded, the SDM activates both airbags and both seat belt pre-tensioners.

To enhance system reliability under normal driving conditions, an additional electromechanical 'safing' sensor is included to ensure that the SRS is armed only when significant deceleration occurs. In order to protect against undesired deployments in case of severe EMI, humidity or accelerometer fault, the deceleration condition monitoring by the safing sensor occurs in addition to, and independent of, the crash algorithm.

Neither the seat belt pre-tensioners nor the airbags will be activated by the SDM as long as the diagnostic mode is active.

Fault Display

The following conditions lead to a fault display in the form of continuous illumination of the airbag tell tale.

- One or more trouble codes requiring tell tale lamp activation in the 'historic' and 'present' condition are stored in the SDM's EEPROM.
- One or more trouble codes requiring tell tale lamp activation in the 'present' condition only are stored in the SDM's EEPROM, the condition of which is, or has been, 'present' in the current operating cycle. For all faults requiring four consecutive incidents for a trouble code to be set, the 'present' condition and fault display will be activated already after two consecutive events if the related trouble code has already been stored in a previous operating cycle.
- Faults concerning the voltage supply (overvoltage/undervoltage) will lead to tell tale activation only until the regular voltage range has been reached again (turn-off delay max. 5s after return from undervoltage and max. 20s after return from overvoltage). There are no related trouble codes.
- The airbag tell tale will not be activated due to SRS warning lamp related faults.
- The tell tale will be activated immediately after entering the diagnostic mode, or on deployment of the SRS.

Excluding the exceptions stated above, it is not possible to switch off the tell tale other than by resetting the fault codes stored in the EEPROM. This is not possible after an airbag deployment - the SDM must be renewed.

The following delays apply for the detection and display of faults. The delays apply from the extinguishing of the tell tale, following the ignition switch on bulb check period:

- 1 to 5 secs - for external deployment circuit faults and overvoltage supply.
- 12 to 20 secs - for undervoltage supply.
- up to 15 secs - for SDM internal faults.

The tell tale will be activated without SDM intervention in the following situations:

- the minimum voltage of 8.0 V has not been exceeded after switching on the ignition.
- the energy reserve (in SDM) has run low, which may be caused by supply voltages below 7.8 V.
- the watchdog has interfered.

A trouble code readout using tell tale blink codes is not implemented.

Power Supply & Grounding

The nominal supply voltage of +12 volts is derived from terminal 5 when the ignition is switched on. The SDM internal ground (terminal 7) must be securely connected to the vehicle chassis ground. To provide redundant grounding, the SDM housing is internally connected to the ground connector pin.

Supply Voltage Range

The SDM is designed to operate within the following voltage ranges:



System fault detection, SDM self test: min. 8.0 V; max. 16.0 V

Below 10.0 V system readiness may be delayed by 3 s.

Below 9.0 V system readiness may be delayed by 10 s.

System fault detection and SDM self test are reduced as long as an undervoltage condition is detected, which could already apply for supply voltages below 10.5 V.

Activation of airbags: min. 8.0 V; max. 16.0 V.

Activation of seat belt pre-tensioners: min. 10.0 V; max. 16.0 V.

Energy Reserve

Energy reserve capacitors within the SDM are provided to allow SRS deployment if the vehicle battery power supply is interrupted during the time of vehicle impact. The capacitors provide full support of the acceleration sensing and airbag initiation capability for a minimum of 150 ms after a loss of external power supply, provided that before the loss, the SDM had been supplied with:

at least 10.0 V for at least 10 s; or

at least 9.0 V for at least 13 s; or

at least 8.0 V for at least 20 s.

The capacitors will be discharged down to a point where no initiation of airbags is possible within a max. of 20 s after removal of the power supply.

WD.8 - SENSOR & DIAGNOSTIC MODULE (SDM)

To Replace SDM

WARNING: The SDM must be replaced after SRS deployment. Do not attempt to repair or reuse.

The SDM is mounted on a bracket riveted to the top of the passenger side scuttle beam, and is accessible only after removal of the fascia (dash) top panel.

1. Follow the safety procedure detailed in sub-section WD.6 to turn off the ignition, disconnect the battery and unplug the yellow 4-way connector to the inflator module, alongside the steering column.
2. Column shrouds: Remove the two screws retaining the top part of the shroud, and the four screws retaining the lower part, and withdraw both parts from the column.
3. Instrument shroud: Pull the instrument shroud backwards to release the four spring clips from their apertures in the dash panel.
4. Sill top trims: Release the two screws at the bottom of the coin pockets at the front of each sill, and pull the sill top trim panels from the chassis.
5. Dash end panels: Release the two screws within the top of each coin pocket, and withdraw the switch panel (driver's side) and blanking panel (passenger side) from the dash end panel. Unplug the wiring harness from the switch panel.
From within the aperture, release the two screws retaining each end panel to the dash, and pull the panel rearwards to withdraw the spring clips in the top of the panel from the dash.
6. Airbag door: Pull the airbag door away from the dash, which action will probably require the four retaining clips to be renewed. Note that the door is constrained by two tether straps.

WARNING:

- **The only permitted repair to the airbag door and tether strap assembly is the replacement of the plastic retaining clips which secure the door to the dashboard. If the clips are broken, they MUST be replaced ONLY by the correct Lotus supplied parts. Do not attempt to fix the door in position by any other means.**
- **After SRS deployment, the airbag door assembly MUST be replaced even if there is no visible damage.**



7. Centre vent panel and radio surround: Release the two screws at each side of the panel and withdraw.
8. Fascia top panel: Remove the 5 screws securing the rear edge of the panel to the dash rail, and withdraw the panel rearwards to disengage the two spigots from the base of the windscreen surround. Disconnect the speaker cables.
9. SDM: Unplug the harness connector from the SDM. Release the four retaining nuts, and withdraw the sensor and diagnostic module from its mounting bracket.

Refitment of the SDM is a reversal of the removal procedure, but remember to check that the tether strap bracket for the airbag trimmed door has been secured before the fascia top panel is fitted, and that new push fasteners for the airbag door will be required.

WD.9 - DRIVER AIRBAG MODULE

WARNING: Safety precautions must be observed when handling a deployed airbag. After deployment, the airbag surface may contain a white packing powder used to ease deployment, together with a small amount of sodium hydroxide dust, a by-product of the sodium azide reaction during deployment that can be irritating to the skin if left on for an extended period of time. Always wear gloves and safety glasses when handling a deployed inflator module, and wash your hands with a mild soap and water afterwards.

The driver's airbag (or inflator module) is housed in the hub of the steering wheel, beneath a moulded trim cover designed to hinge open in the event of deployment. The module comprises:

- an inflatable fabric bag;
- an inflator (canister of gas generating material)
- an initiator (or 'squib')

When the vehicle suffers a forward deceleration of sufficient magnitude to close both the safing sensor and integrated accelerometer within the SDM, current flows through the deployment loop of both the driver and passenger airbag module initiators and ignites the gas generating material. Each bag inflates in a fraction of a second, the driver's bag bursting open the steering wheel centre trim cover, and then deflates via vents in the bag, with the whole cycle taking less than one second. The airbag is designed for a single deployment, and must then be renewed.

In order to help prevent unwanted deployment of the driver's airbag when servicing the steering column or other SRS components, a shorting bar is incorporated in the airbag side of the 4-way harness connector plug located alongside the steering column. The shorting bar operates when the connector is unplugged, to short across the feed and return connections to the airbag. Thus, if a positive feed, or earth is inadvertently applied to the connector terminals, both sides of the inflator module will be subject to the same electrical potential, and no deployment will occur.

To replace driver's airbag

WARNING: The following procedures must be followed in the order listed to temporarily disable the airbag system whilst working in the immediate vicinity of an airbag. Failure to follow this procedure could cause unintended airbag deployment, resulting in personal injury and unnecessary airbag system repairs.

- a). Turn off ignition.
 - b). Disconnect the negative battery cable, and tape back to ensure that it cannot contact the battery terminal.
 - c). From alongside the steering column, in the area of the column upper fixing, locate and disconnect the driver's airbag yellow 4-way harness connector plug.
1. Column shrouds: Remove the two screws retaining the top part of the shroud, and the four screws retaining the lower part, and withdraw both parts from the column.
 2. On the reverse side of the steering wheel, locate and remove the two socket head screws, accessible via holes in the plastic shroud around the steering wheel hub. Withdraw the airbag module and disconnect



the yellow harness connector.

WARNING: When carrying a live airbag module, make sure the bag and trim cover are pointed away from you. In case of an accidental deployment, the bag will then deploy with minimal chance of injury. When placing a live airbag module on a bench or other surface, always face the bag and trim cover upwards, away from the surface. This is necessary so that a free space is provided to allow the airbag to expand in the unlikely event of accidental deployment.

3. If a driver's airbag is deployed, refer to steering section HG to determine whether the steering column telescoping mechanism has been activated, and if necessary, renew the column assembly.
4. Mate the new airbag yellow connector plug with the harness plug in the steering wheel hub, and locate the module into the steering wheel. Fit the two socket head retaining screws and tighten to 7Nm.
5. When all service work is complete, connect the harness plug alongside the steering column, and reconnect the battery. Turn on the ignition and check that the airbag tell tale lights for a few seconds and then goes out.

WD.10 - ROTARY CONNECTOR

WARNING: The rotary connector **MUST** be replaced after SRS deployment even if there is no visible damage.

The rotary connector is a device which fits between the steering wheel and column, and allows the steering wheel to turn whilst maintaining electrical continuity to the airbag module and horn buttons. The assembly consists of an annular housing fitted over the top end of the steering column, and containing a coil of four wires. The wires are:

- +ve feed to the inflator module (switched by the safing sensor);
- ground to the inflator module (switched by the microprocessor accelerometer);
- input to the horn buttons;
- output from the horn buttons.

The steering column side of the device is fitted with a 4 way connector block which plugs into the SRS harness. The steering wheel side of the device has two 2-way connector plugs, one for the airbag module, and one for the horn buttons. The coil housing is constructed in two parts, with the outer part fixed to the outer (stationary column, and the inner part keyed to the inner (rotating) column.

The two parts of the coil housing slide inside of each other in such a way as to allow the steering wheel to be rotated through its full travel, lock to lock, whilst maintaining an unbroken feed to each of the four circuits in the steering wheel hub, via the continuous wires in the coils.

In order to help prevent unwanted deployment of the air bag when servicing the steering column or other SIR components, a shorting bar is incorporated in the rotary connector side of the 4-way SRS harness connector plug. This shorting bar operates when the connector is unplugged, to short across the feed and return connections to the inflator module. Thus, if a positive feed, or earth is inadvertently applied to the connector terminals, both sides of the inflator module will be subject to the same potential, and no deployment will occur.

When servicing the rotary connector, it is most important that the correct orientation of the connector is maintained on refitment, or the connector will run out of travel and be broken.

To replace the rotary connector

1. Remove the airbag module from the steering wheel (see sub-section WD.8).
2. Disconnect the horn harness plug.
3. Bend back the locking tabs and release the nut securing the wheel to the column. Before attempting to remove the wheel, ensure the front wheels are pointing straight ahead, and match mark the position of the steering wheel hub against the column to aid re-assembly.
4. Using a suitable steering wheel puller tool, position the legs to reach through the holes in the wheel hub



and bear directly against the hub, without interfering with the rotary connector. The centre screw should bear against the end of the column. Withdraw the wheel/hub/rotary connector assembly from the column splines.

Alternatively, for better puller access, the steering wheel can first be removed from the hub by releasing the four retaining screws.

CAUTION: If excessive force is applied to either the wheel or column without an appropriate puller, the telescoping mechanism of the outer column may be overridden, necessitating column replacement.

5. Release the two countersunk screws retaining the rotary connector to the steering wheel hub.
6. On refitment, feed the airbag and horn connector plugs on the rotary connector through the hole in the steering wheel hub, and secure the unit to the hub with the two countersunk screws. If necessary, refit the steering wheel to the hub and secure with the four screws. Mate the horn buttons harness connector plug.
7. Before fitting the wheel/hub/rotary connector assembly to the column, the rotary connector must be centralised: Turn the connector centre element fully counterclockwise until tight, then turn clockwise approximately 2.5 turns until the arrow marks on the two parts of the rotary connector are aligned. Make sure the front wheels are pointing straight ahead, and fit the assembly onto the column with the hub to column match marks (made on disassembly) aligned, and engage the spring loaded pin on the column switch housing with the slot in the rotary connector.
8. Fit a new locking tab washer, followed by the steering wheel nut, and torque tighten to 25 Nm (18.5 lbf.ft). Bend up the locking tabs to secure.
9. Mate the airbag harness connector plug and fit the airbag module into the steering wheel. Retain with the two socket head screws and tighten to 7Nm.
10. Refit the column shrouds, and when all service work is complete, mate the horn/airbag connector to the vehicle harness (clipping the connector to the column) and reconnect the battery. Check that the airbag tell tale lights for a few seconds with ignition, and then goes out.

WD.11 - PASSENGER AIRBAG MODULE

WARNING: Safety precautions must be observed when handling a deployed airbag. After deployment, the airbag surface may contain a white packing powder used to ease deployment, together with a small amount of sodium hydroxide dust, a by-product of the sodium azide reaction during deployment that can be irritating to the skin if left on for an extended period of time. Always wear gloves and safety glasses when handling a deployed inflator module, and wash your hands with a mild soap and water afterwards.

The passenger's airbag (or inflator module) is housed within the passenger side of the fascia, mounted on a bracket to the scuttle beam, and arranged to deploy via an aperture in the dash panel covered by a trimmed 'door'. The door is designed to break away in the event of airbag deployment, but is tethered to the dash by two restraining straps. The airbag module comprises:

- an inflatable fabric bag;
- an inflator (canister of gas generating material)
- an initiator (or 'squib')

When the vehicle suffers a forward deceleration of sufficient magnitude to close both the safing sensor and integrated accelerometer within the SDM, current flows through the deployment loop of both the driver and passenger airbag module initiators and ignites the gas generating material. Each bag inflates in a fraction of a second, the passenger's bag bursting through the dash panel 'door', and then deflates via vents in the bag, with the whole cycle taking less than one second. The airbag is designed for a single deployment, and must then be renewed.



WARNING: The harness connector for the passenger's airbag is accessible only after removing the fascia top panel, so care should be taken to avoid working in close proximity to the airbag door in case of unintended deployment.

To replace passenger's airbag

WARNING: The following procedures must be followed in the order listed to temporarily disable the airbag system whilst working in the immediate vicinity of an airbag. Failure to follow this procedure could cause unintended airbag deployment, resulting in personal injury and unnecessary airbag system repairs.

- a). Turn off ignition.
 - b). Disconnect the negative battery cable, and tape back to ensure that it cannot contact the battery terminal.
 - c). From alongside the steering column, in the area of the column upper fixing, locate and disconnect the yellow driver's airbag harness connector plug.
1. For access to the passenger's airbag module, the fascia top panel must first be removed. Refer to sub-section WD.8.
 2. From the right hand end of the airbag module, pull out the security tag and unplug the harness connector.
 3. Release the two nuts and remove the airbag door tether strap bracket from the module mounting bracket.
 4. Release the four nuts and the dash steady brackets securing the airbag module, and withdraw the module from its mounting bracket.

WARNING: When carrying a live airbag module, make sure the bag and trim cover are pointed away from you. In case of an accidental deployment, the bag will then deploy with minimal chance of injury. When placing a live airbag module on a bench or other surface, always face the bag and trim cover upwards, away from the surface. This is necessary so that a free space is provided to allow the airbag to expand in the unlikely event of accidental deployment.

5. If an airbag deployment has occurred, the chassis scuttle beam, airbag mounting bracket, dash extrusions and all associated parts must be carefully examined for distortion and renewed where necessary.

WARNING: Proper operation of the SRS system requires that the vehicle structure remains in its original production configuration. Any damage to the SRS components and/or their respective mounting brackets, including the chassis, requires replacement, not repair.

6. If necessary, fit the airbag mounting brackets to the scuttle beam, and tighten the four M8 fixing bolts to 15 Nm.
7. Fit the airbag module to the mounting brackets, together with the dash steady brackets. Tighten the four M6 nuts to 6 Nm.
8. Fit the airbox door tether strap bracket to the airbag module mounting bracket, and tighten the two nuts to 10 Nm.
9. Plug in the harness connector into the RH side of the module and retain with the security tag.
10. Refit the fascia top panel (see sub-section WD.8).
11. Refit the column shrouds, and when all service work is complete, mate the horn/airbag connector to the vehicle harness (clipping the connector to the column) and reconnect the battery. Check that the airbag tell tale lights for a few seconds with ignition, and then goes out.



WD.12 - SEAT BELT PRE-TENSIONERS

WARNING:

- Failure to comply with the instructions, safety standards and operating procedures as described in this section, may cause vehicle damage and/or personal injury.
- Both driver and passenger seat belt assemblies must be replaced after SRS deployment. Do not attempt to repair or reuse.

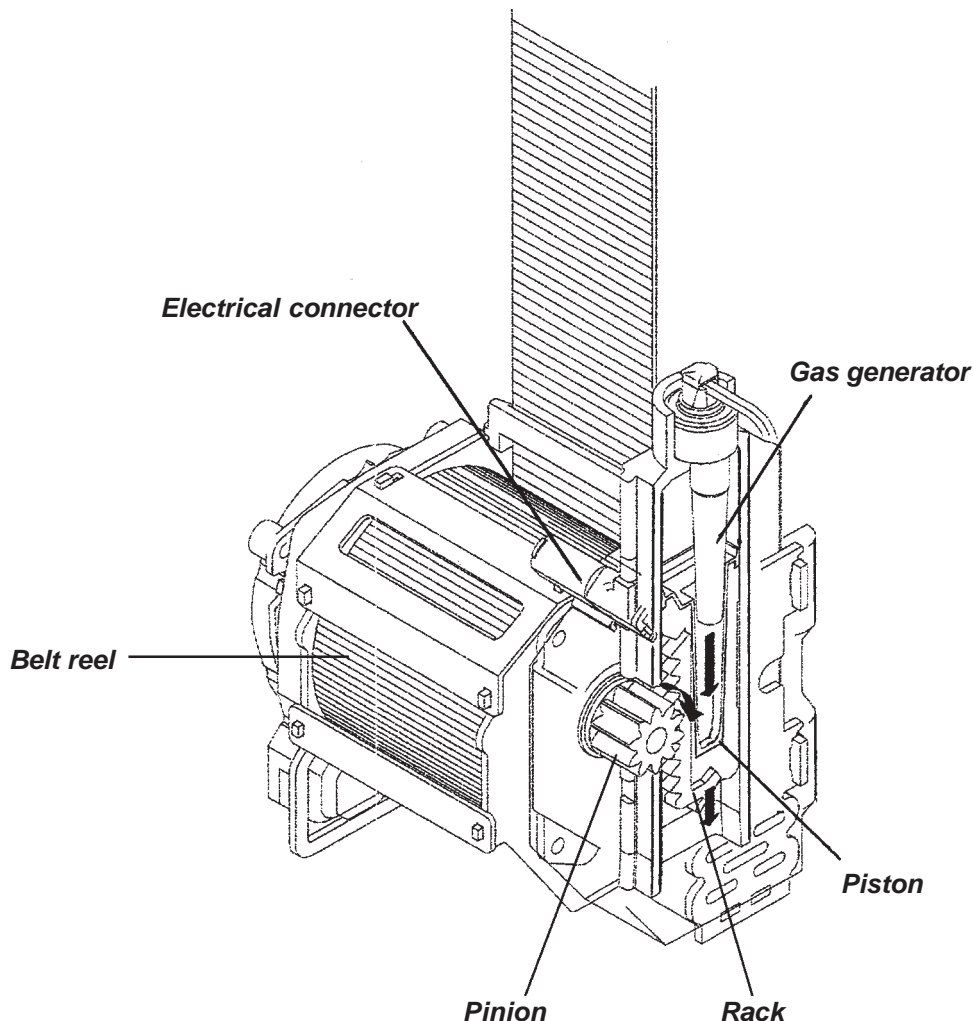
Device Operation

The seat belt pre-tensioners are triggered together with the airbags, and use a pyrotechnic device on each seat belt reel assembly, to operate a rack and pinion mechanism which applies a tightening force to the belt reel to remove any slack from the belt. Under normal operation, the rack is fully raised and disengaged from the pinion, allowing normal spooling of the reel for belt withdrawal and retraction.

When airbag/pre-tensioner triggering conditions apply, the SDM signals ignition of the gas generator, the pressure from which forces the piston and toothed rack downwards, causing rotation of the pinion gear and a re-winding of the seat belt webbing. The force sustained by the belt and its user is then controlled by a torsion bar within the belt reel to limit the deceleration force to which the occupant is subjected during the crash event.

The belt pre-tensioning mechanism is designed to operate only once, such that both belt assemblies should be renewed after airbag/seat belt pre-tensioner deployment. Activation of the pyrotechnic mechanism is indicated by the belt reel being locked, and allowing neither extraction nor retraction of the belt.

WARNING: Following an impact in which the pre-tensioning element is activated, the seat belt assembly is rendered inoperable. The car should not be driven until the belt assembly has been renewed.



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Removal of Seat Belt Assembly

WARNING: Before removing or refitting a pyrotechnic seat belt assembly, the ignition key should be withdrawn, and the battery leads disconnected from both positive and negative terminals, and isolated to ensure that accidental contact cannot occur.

Each seat belt reel assembly is secured, via a spacer block, to the seat belt mounting bracket/roof hoop by a single bolt. Note that an orientation tang is incorporated on the belt reel which engages with a hole in the spacer, and that the spacer is keyed to the mounting bracket by a roll pin.

1. Check that the key is removed from the ignition switch.
2. Disconnect both battery cables, and insulate to ensure that accidental contact cannot occur.
3. Remove both seats by releasing the seat belt from the seat (noting the 10mm spacer), and the seat runners or frame from the floor.
4. Remove the centre tunnel rear cup holder liner after removing the single screw from inside the base. Remove the two screws then exposed securing the cup holder, and remove the holder, disconnecting the auxiliary power socket.
5. Remove the 4 fixings along the top of the cabin rear bulkhead trim panel, and withdraw the panel, disconnecting the speakers and interior lamp.
6. Hinge up the plastic cover and release the belt slide from the roof hoop, noting the 5mm spacer.
7. Allow at least one minute from disconnecting the battery before disconnecting the electrical connector from the gas generator on the seat belt assembly. Release the Torx head fixing bolt and withdraw the belt reel assembly and spacer block.

Fitment of Seat Belt Assembly

WARNING: Before removing or refitting a pyrotechnic seat belt assembly, the ignition key should be withdrawn, and the battery leads disconnected from both positive and negative terminals, and isolated to ensure that accidental contact cannot occur.

Each seat belt reel assembly is secured, via a spacer block, to the seat belt mounting bracket/roof hoop by a single bolt. Note that an orientation tang is incorporated on the belt reel which engages with a hole in the spacer, and that the spacer is keyed to the mounting bracket by a roll pin.

1. Fit the seat belt reel assembly and alloy spacer to the bracket on the mounting frame, with the spacer block located by its roll pin into the hole in the bracket, and the belt reel tang located in the upper hole in the spacer. Fit and tighten the single Torx head fixing bolt (discarding the cardboard retaining washer if fitted) to 45 Nm (33 lbf.ft). Plug the harness connector plug into the gas generator on the belt assembly.
2. Fit the belt slide to the roof hoop with the 5mm spacer interposed, and tighten the special shouldered bolt to 45 Nm (33 lbf.ft). Check that the hoop is free to pivot. Clip the plastic cover into position.
3. Refit the cabin rear bulkhead trim panel, connecting the interior lamp and speakers, and retain with the four screws.
4. Refit the cup holder, connecting the power socket, and liner.
5. Refit the seats and fit the seat belt to the seat frame with the 10mm spacer between belt and seat. Tighten the special shouldered bolt to 33 Nm (24 lbf.ft). Check that the belt eye is free to pivot.
6. Reconnect the battery, turn on the ignition, and check that the airbag tell tale lamp lights for a few seconds and then goes out.



Safety Standard

The pre-tensioning function is energised via pyrotechnic materials, therefore manipulation, handling and storage **MUST** be performed to the specified procedures as described to avoid any occurrence of injury to the operator or damage to the pre-tensioning unit.

In normal conditions, the pre-tensioner assembly can only be activated through the action of the electric ignition control during impact. During the activation phase of the pyrotechnic charge, small gas quantities are developed. The main constituent of the gases is Nitrogen:

Note! This gas is not toxic.

The pre-tensioner assemblies must be protected against exposure;

- To temperatures over 90°C (195°F) at contact with surfaces
- 90°C during 106 hrs.
- From sparks and naked flames.

WARNING: If exposed to temperatures in excess of 140°C, self-ignition of the pyrotechnic charge of the gas generator may occur. Exposure to temperatures in excess of 165°C, self-ignition of the pyrotechnic charge will occur.

Also, if exposed to temperatures between 90°C (285°F) and 165°C (330°F), deterioration of the pyrotechnic charge ignition is possible. The consequences of this could be failure to activate at prescribed levels. The pre-tensioner must be protected against stresses, shocks and dropping. Pre-tensioners that have been subjected to such treatment must be discarded and returned to the supplier with accompanying paperwork describing the reasons for return.

Never store pre-tensioner assemblies with other flammable or combustible materials. Gas generators **MUST** be prevented from coming into contact with acid, water, grease and heavy metals: **Contact with these substances may cause toxic or dangerous gases, or explosive mixtures.**

Any residual fuel of the gas generator, not burned during ignition, is slightly flammable. The unit, therefore, must **never** be disassembled, damaged or the parts manipulated. Any advertising or demonstrations of the pre-tensioner assembly should only be carried out using inert pre-tensioners (without the pyrotechnic charge). The base of the pre-tensioner must be painted green, with visible and indelible wording, stating '**Inert Assembly**'. It must incorporate the KSS logo, signed with indelible ink by the person responsible for the supply of the product.

WARNING: Never disassemble the pre-tensioner or any of its components!

Transportation of belt with pre-tensioner

Transport on road vehicles should be carried out with the assemblies stored in the luggage compartment. Never transport in the passenger compartment. Never transport the pre-tensioner manually or holding it by the webbing: this can result in damage to the assembly.

Storage of belt with pre-tensioner

Belts with pre-tensioning elements should be stored in containers or boxes that can be locked with a key, and ventilated. They **MUST** be stored in an area free from flames and heat sources. On completion of work, or during work break periods, pre-tensioner belts should be returned to the storage container and locked with a key.

Disposal of belts with pre-tensioner

Charged pre-tensioners to be scrapped and not fitted to a car must be activated. This should be carried out only by the belt manufacturers, or specialised workshops.

Vehicle disposal

Charged pre-tensioners fitted to a vehicle **MUST** be removed before the vehicle is dismantled for scrapping. If the pre-tensioner is not activated during an accident, the device must be considered as still to be in a 'charged' condition.

General safety instructions/dangers for health

- When handling activated pre-tensioners, use safety glasses and vinyl or nitrile protection gloves.
- After handling a loaded pre-tensioner, wash hands with soap and water.



- There is no danger of exposure to propellants in the sealed system. The propellant mix is in a solid state, therefore no inhalation is possible, even if the gas generator cartridge is broken.
- Avoid skin contact and do not ingest the propellant.

First aid

Ingestion: Help the person vomit if conscious. Call a physician.

Skin contact: Wash immediately with soap and water. Call a physician.

Eyes: Wash the eyes immediately with running water for a minimum of 10 minutes. Call a physician.

Inhalation: Take the person immediately to fresh air. Call a physician.

General notice

Storage, transport, dismantling and/or recycling of the pre-tensioner shall be carried out according to the legal and local regulations, taking account also of directives for masonry, fire fighting, transport, environmental protection and the safety and health of all staff.

WARNING: The seat belt pre-tensioner devices fitted on the Lotus Elise are designed and calibrated specifically for this particular model. Pre-tensioners must not be adapted, re-used or installed on any other vehicle - they must only be fitted to the prescribed vehicle with specific homologation continuity.

Any attempt to re-use, adapt or install pre-tensioners on a different vehicle can cause severe or fatal injuries to the occupants during normal operation as well as the result of an accident.