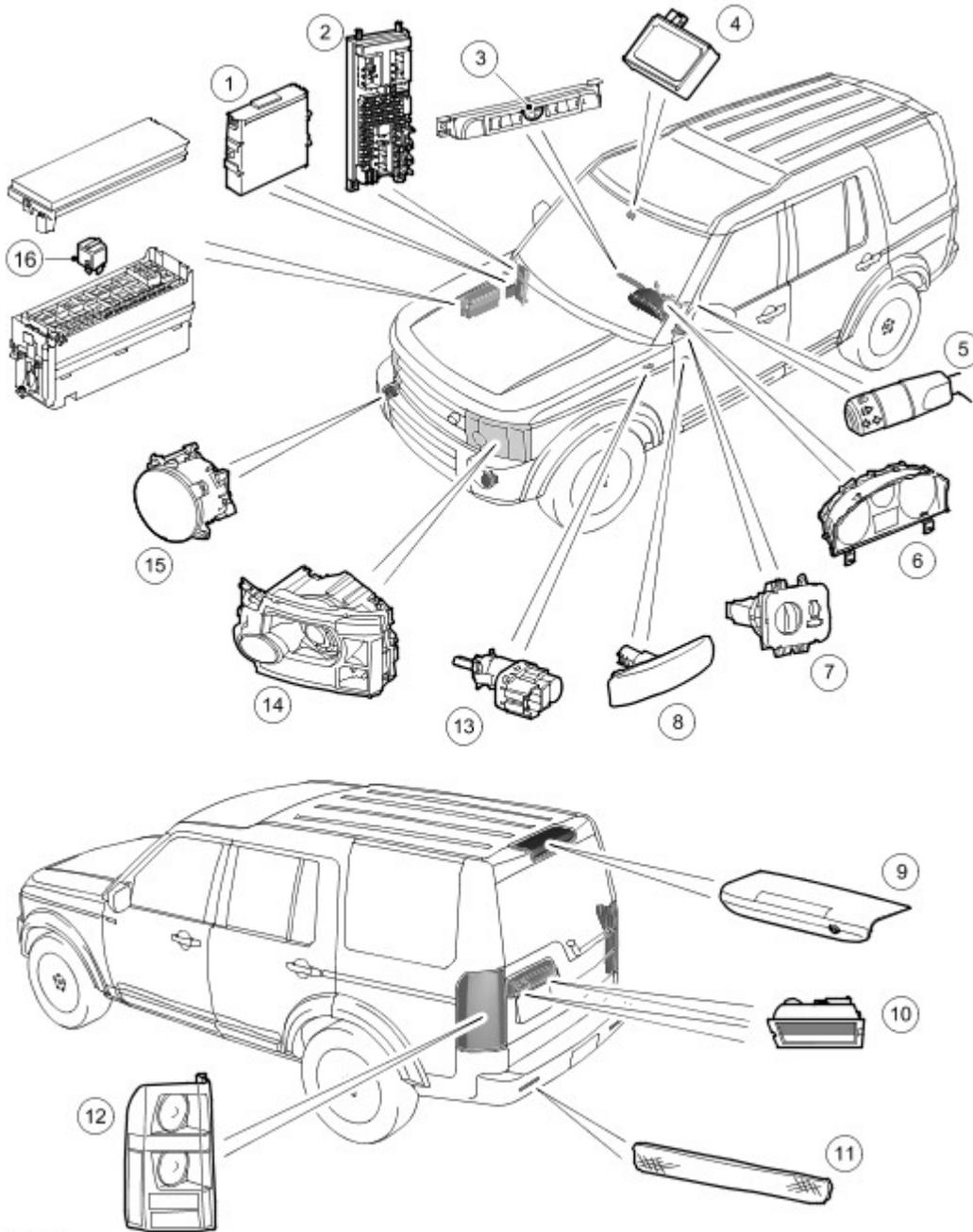


Exterior Lighting

Exterior Lighting Component Location



E43257

Item	Part Number	Description
1	-	Adaptive Front lighting System (AFS) control module
2	-	Central Junction Box (CJB)
3	-	Hazard warning lamp switch
4	-	Rain/light sensor

5	-	LH steering column multifunction switch
6	-	Instrument cluster
7	-	Lighting control switch
8	-	Side turn signal lamp
9	-	High mounted stop lamp
10	-	License plate lamps
11	-	Reflector
12	-	Rear lamp assembly
13	-	Stop lamp switch
14	-	Headlamp assembly
15	-	Front fog lamp
16	-	LH Front fog lamp relay (if fitted)

GENERAL

The exterior lighting system comprises the following exterior lamps:

- Front and rear side lamps
- License plate lamps
- Side marker lamps (if fitted)
- Front and rear turn signal lamps
- Side turn signal lamps
- Stoplamps and high mounted stop lamp
- Reversing lamps
- Rear fog lamps
- Front fog lamps (if fitted)
- Cornering/Static bending lamps (if fitted) - All except NAS
- Low and high beam headlamps.

The exterior lighting system comprises two new features not used on previous Land Rover vehicles; cornering/static bending lamps and Adaptive Front lighting System (AFS). Further details are contained within this section.

Exterior Bulb Type/Rating

The following table shows the bulbs used for the exterior lighting system and their type and specification.

Bulb	Type	Rating
Halogen Headlamps - Low/High beam	Halogen H7	55W
Xenon headlamps - Low/High Beam	Xenon D2S	35W
Headlamps - High Beam	Halogen H7	55W
Front fog lamps	Halogen H11	55W
Rear fog lamps	Bayonet P21	21W
Turn signal lamps - Front	Capless S8W Wedge	27W/7W Note: 7W filament not functional
Side turn signal lamps	Capless W5W	5W
Turn signal lamps - Rear	Bayonet P21	21W
Side lamps - Front	Capless W5W	5W
Stop/Tail lamps	Bayonet - Twin filament P21/5	21W/5W Note: 21W filament not functional on lower tail lamp
High mounted stop lamp	LED's	-
License plate lamps	Capless W5W	5W

Reverse lamps	Bayonet P21	21W
Cornering lamp/Static bending lamp	Halogen H8	35W
NAS - Side marker lamp (front/rear)	Capless W3W	3W

CENTRAL JUNCTION BOX

The Central Junction Box (CJB) is an integrated unit located behind the fascia on the passenger side of the bulkhead. The CJB contains fuses, relays and a number of microprocessors which control the power supply and functionality of the lighting system and other vehicle systems.

Input Signals

The CJB receives inputs from the following switches:

- Lighting control switch Side lamp position Headlamp position Automatic (AUTO) position (if fitted)
 - Side lamp position
 - Headlamp position
 - Automatic (AUTO) position (if fitted)
- Brake switch
- Left hand steering column multifunction switch for turn signal indicators and high beam/headlamp flash
- Hazard flasher switch
- Rain/light sensor (LIN signal)

Circuit Protection

The CJB provides circuit protection for all exterior lighting circuits. Most exterior lighting circuits are protected by conventional fuses, however, the following circuits are protected by Field Effect Transistors (FETs).

- Low beam
- High beam
- Cornering/static bending lamps
- Turn signal lamps
- Trailer turn signal lamps.

Operation of the above listed circuits is protected by FETs which can detect overloads and short circuits. The FETs respond to heat generated by increased current flow caused by a short circuit. On a normal circuit this would cause the fuse to blow. The FETs respond to the heat increase and disconnect the supply to the affected circuit. When the fault is rectified or the FET has cooled, the FET will reset and operate the circuit normally. If the fault persists the FET will cycle, disconnecting and reconnecting the power supply.

The CJB stores fault codes which can be retrieved using T4. The fault code will identify that there is fault on a particular output which will assist with fault detection.

Alarm Indications

The exterior lighting system is used for alarm arm and disarm requests.

When the driver locks the vehicle, a visual indication of a successful lock request is displayed to the driver by the hazard flashers operating three times with a pattern of 500ms on and 500ms off.

When the driver unlocks the vehicle, a visual indication of a successful unlock request is displayed to the driver by the hazard flashers operating once for 3 seconds.

If the alarm is triggered, the hazard flashers are operated for ten 30 second cycles of on for 380ms and off 380ms with a 5 second off delay between each cycle. For additional information, refer to [Anti-Theft - Active](#) (419-01A Anti-Theft - Active)

Lights on Warning Chime

When the ignition switch is in the off (O) or auxiliary (I) position and the lighting control switch is in the side lamp or headlamp position, a warning chime will sound if the driver's door is opened. This indicates to the driver that the exterior lights have been left on.

The chime is generated from the instrument cluster sounder on receipt of a lights on signal, a door open signal and an ignition switch off signal from the CJB on the CAN bus.

Crash Signal Activation

When a crash signal is transmitted from the restraints control module, the CJB activates the hazard flashers and the turn signal indicators in the instrument cluster.

The hazard flashers will continue to operate until the ignition switch is moved to the auxiliary position I or the position O or the restraints control module no longer transmits the crash signal. For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) (501-20B)

Headlamp Timer

The CJB controls a headlamp timer function which allows the headlamps to remain on for a period of time after leaving the vehicle. This is a driver convenience feature which illuminates the driveway after leaving the vehicle.

To select this feature, the lighting control switch must be in the headlamp or side lamp position when the ignition switch is moved from the ignition position to off. The lighting control switch must be moved to the off position or AUTO position (if fitted) to activate the timer. The timer function will then be initiated and low headlamps will be illuminated for the selected timer period.

The timer period is selectable by the driver and can range from off to 60 seconds in 10 second increments. The default timer period is set at 20 seconds.

The default setting can be changed by a Land Rover or authorised dealer or by the driver using the vehicle's customer personalisation options.

With the vehicle stationary and the ignition switch in any position, pressing the trip computer button on the end of the left hand steering column multifunction switch gives access to the options. The options can be scrolled through using the audio search buttons on the steering wheel. The options are displayed in the message centre. When the headlamp timer option is reached, the settings can be changed using the audio search buttons on the steering wheel. When the selection has been made confirmation is performed by pressing the trip computer button. For additional information, refer to [Information and Message Center](#) (413-08)

NOTE :

The headlamp timer feature will be cancelled under the following conditions:

- The ignition switch is moved from auxiliary (I) to ignition (II)
- The lighting control switch is moved from off to side lamps.

The headlamp timer can also be operated using the ignition key personal button, if this feature has been set by the driver. For additional information, refer to [Handles, Locks, Latches and Entry Systems](#) (501-14)

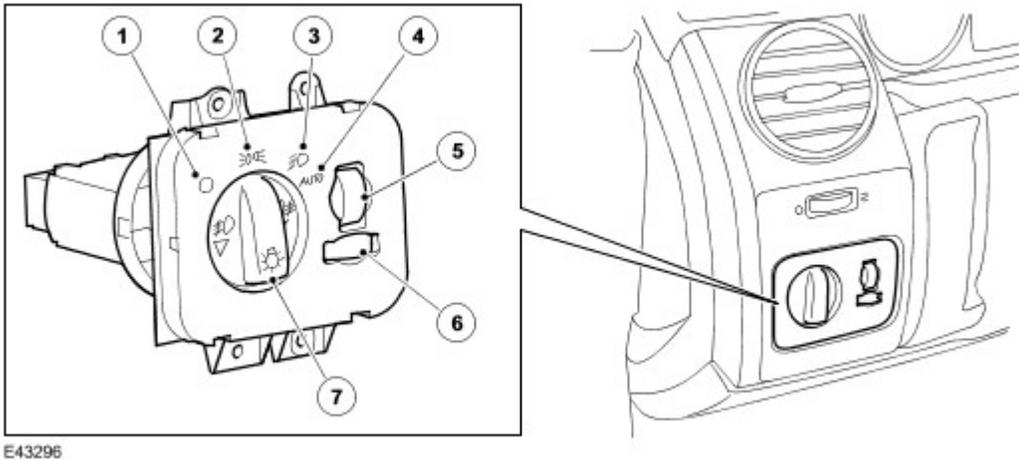
LIGHTING CONTROL SWITCH

The lighting control switch is located in the driver's side of the instrument panel, below the outer fresh air vent. The switch contains a rotary switch for selecting the vehicle exterior lighting functions, a rheostat for manual headlamp levelling (if fitted) and an instrument illumination dimmer rheostat.

Three variants of the switch are available to cover the different vehicle specifications and market variations.

NOTE :

High line lighting control switch shown



E43296

Item	Part Number	Description
1	-	OFF position
2	-	Side lamps position
3	-	Headlamps position
4	-	Automatic headlamps position (if fitted)
5	-	Headlamp levelling control (if fitted - only applicable to vehicles with coil spring suspension)
6	-	Instrument illumination dimmer control
7	-	Rotary control switch

All outputs from the lighting control switch, with the exception of the dimmer control output and the headlamp levelling control output (if applicable), are subject to a voltage drop through the switch of approximately 200mV. Therefore, assuming that the input voltage to the switch is 12V, then the voltage measured at the switch output pins will be 11.8V.

Rotary Control

The rotary control can be rotated to select one of four positions; off, side lamps, headlamps and automatic (AUTO). On vehicles without the automatic feature the switch only has three positions.

Three additional positions for fog lamps are available by pulling the rotary control; all fog lamps off, front fog lamps on only and front and rear fog lamps on. On vehicles without front fog lamps the switch can only be pulled once to activate the rear fog lamps.

On vehicles fitted with front fog lamps, the rotary control can be pulled to select fog lamps when it is in the side lamps or headlamps positions.

On vehicles without front fog lamps the rotary control can only be pulled to select rear fog lamps when it is in the headlamps position.

The fog lamps will be switched off automatically when the rotary control is turned to the off position or pushed in to the fog lamps off position.

Manual Headlamp Levelling Control (if fitted)

The manual headlamp levelling control is only available on vehicles with coil spring suspension and is used to lower the headlamps when an excessive load is placed on the rear of the vehicle, altering the vehicle attitude and raising the headlamp beam.

The control uses a rotary thumbwheel which is connected to a rheostat which gives a variable output to the levelling stepper motors. The motors respond to the output and move to adjust the headlamp position as required.

The control has three marked positions; 0 to 3. The rotary wheel moves in 8, half positions to give fine adjustment control over the headlamp position. The positions relate to vehicle loading or driving conditions as follows: Position 0 is the normal position for unladen driving. Positions 1 to 4 lower the headlamp beam to compensate for a drop in height of the rear of the vehicle.

- 0 = Driver only or driver and front seat passenger
- 0.5 = Driver, front seat passenger and 3rd row seats occupied (7 seat models) or all seats occupied (5 seat models)
- 1 = All seat occupied (7 seat models)
- 1.5 = All seats occupied and maximum rear axle loading
- 2 = Driver only and maximum rear axle loading
- 3 and 4 = Can be used under certain driving conditions, i.e. off-road

Dimmer Control

The dimmer control provides a Pulse Width Modulated (PWM) output to control the illumination brightness of the instrument panel and other fascia illumination. The dimmer switch operates using a rotary thumbwheel which is connected to a rheostat and a high side switch.

The rheostat is a variable resistor which provides a high or low resistance according to its set position. This output is passed to a switchable capacitor or a high side switch. The high side switch uses the output from the rheostat to determine the switching frequency of the capacitor which provides the PWM output of between 8 and 12V to determine the brightness of the illumination.

Automatic Headlamps

Refer to Automatic Headlamps in this section.

HEADLAMP ASSEMBLY

Three types of headlamp are available; Halogen, Bi-Xenon or Adaptive Front lighting System (AFS). The headlamps share a common, clear lens.

The headlamps are located behind the front carrier assembly. Each headlamp is secured to the front carrier assembly with two locking plates. The locking plate slides in grooves in the rear of the headlamp and two holes in each plate locate on pins on the carrier. Each locking plate is pressed down to lock the pins in the locking plate holes. The locking plates allow removal of the headlamp from the carrier for bulb changing without the requirement for special tools.

The rear of the headlamp unit has removable access panels which allow access to the bulbs for replacement. A large cover, which is rotated anti-clockwise to remove, allows access to the low/high beam bulb on both halogen and xenon headlamps. Another removable cover provides access to the high beam only halogen bulb which is retained with a spring clip. A smaller cover can also be rotated anti-clockwise to provide access to the turn signal lamp bulb. Below this cover is a removable cover which provides access to the side lamp bulb, the cornering lamp/static bending lamp bulb and the side marker lamp bulb on NAS models.

The headlamps have two adjustment screws on the rear which allow for the manual setting of the vertical and horizontal alignment. On NAS vehicles the headlamp is regarded as Visual Optically Left (VOL) aiming. The adjustment screws have to be turned equal amounts to maintain the correlation in the vertical axis only. There is no horizontal adjustment. Refer to the Service Repair Procedures manual for headlamp alignment data.

Each headlamp has an integral sixteen pin connector which provides inputs and outputs for the various functions of the headlamp assembly. The usage of the pins differs between model variants, refer to the Electrical Reference Library (ERL) for pin details.

The low beam headlamps are switched on when the ignition switch is in the ignition position (II) and:

- the lighting control switch is in the headlamp position
- the lighting control switch is in the AUTO position and a 'lights on' signal is received by the CJB from the rain/light sensor.

The low beam headlamps can also be operated by the headlamp delay feature.

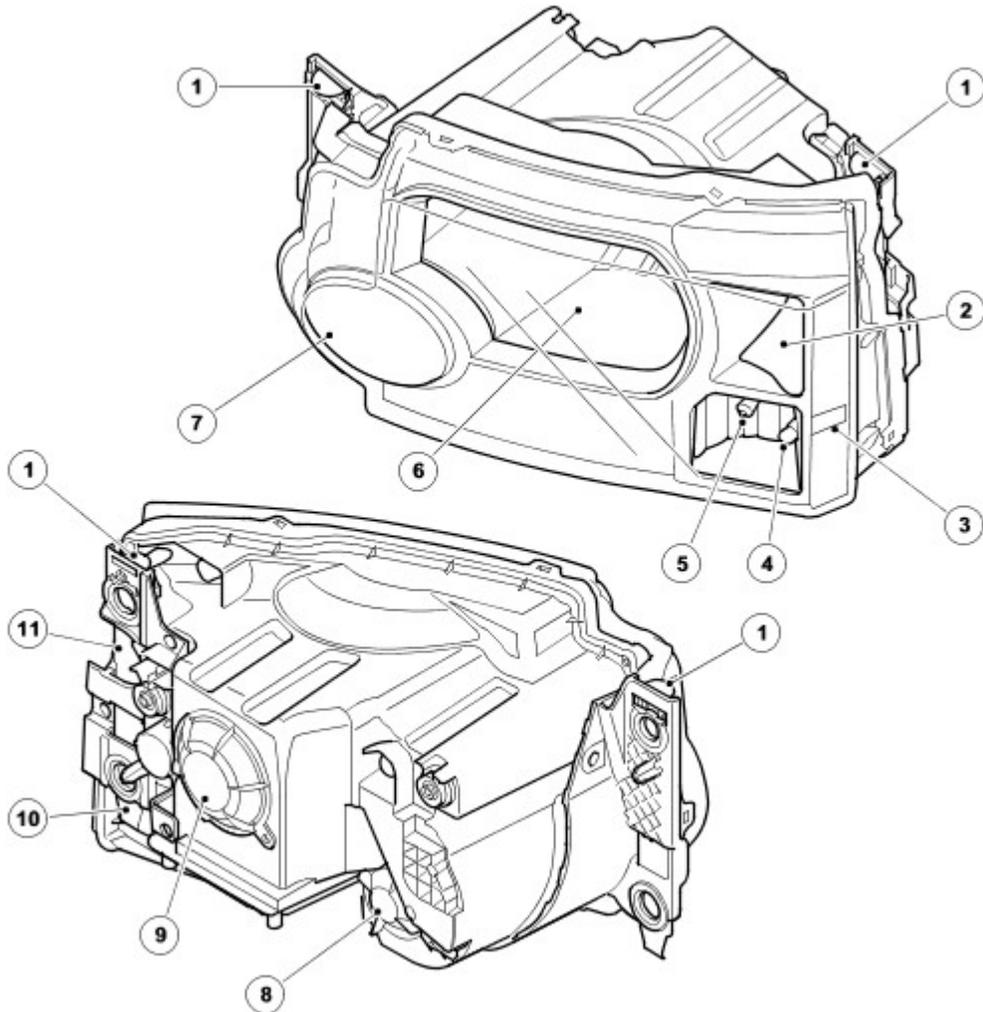
The high beam headlamps are switched on when the ignition switch is in the ignition position (II) and:

- the low beam headlamps are selected on in the headlamp position or activated via the AUTO feature
- The left hand steering column multifunction switch is pushed forward away from the driver.

The high beam headlamps will be switched off when:

- The left hand steering column multifunction switch is moved rearward towards the driver
- The low beam headlamps are switched off
- The ignition switch is moved to the auxiliary position (I) or off position (0).

Halogen Headlamps



E43258

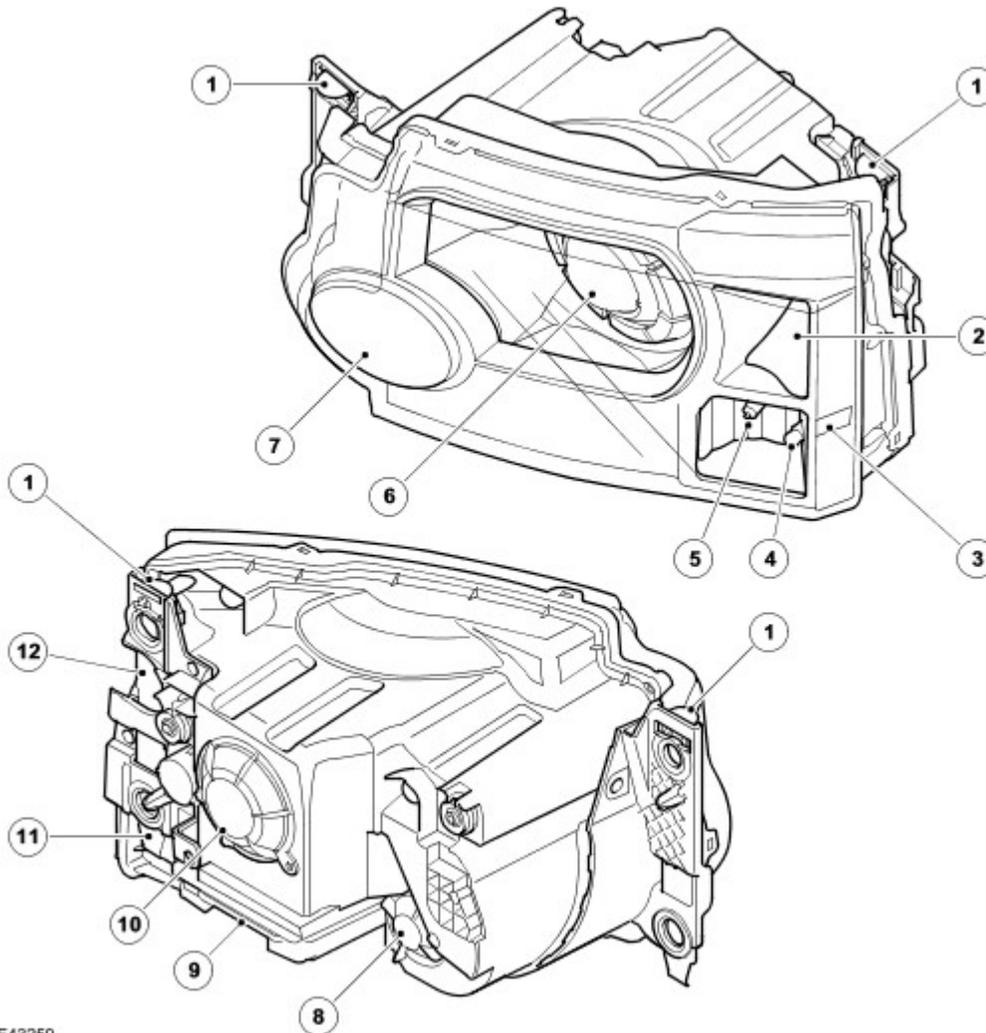
Item	Part Number	Description
1	-	Locking plate
2	-	Turn signal lamp
3	-	Side marker lamp (NAS only)
4	-	Side lamp
5	-	Cornering lamp (if fitted)
6	-	Low/high beam headlamp
7	-	High beam headlamp

8	-	High beam lamp access cover
9	-	Low/high beam lamp access cover
10	-	Side lamp access cover (hidden)
11	-	Turn signal lamp access cover (hidden)

The halogen headlamps use a complex surface reflector for both the low beam lamp and the halogen fill in high beam lamp. This type of reflector has the reflector divided into separate parabolic segments, with each segment having a different focal length. The halogen headlamps require adhesive decals to be applied to the clear outer lens to mask the beam cut-off when driving in opposite drive hand markets.

The low and high beam bulbs are quartz halogen H7, with a rating of 55W. The bulbs are retained in the headlamp unit with conventional wire retaining clips.

Xenon Headlamps



E43259

Item	Part Number	Description
1	-	Locking plate
2	-	Turn signal lamp
3	-	Side marker lamp (NAS only)
4	-	Side lamps

5	-	Cornering lamp (if fitted)
6	-	Xenon low/high beam lamp
7	-	Halogen high beam lamp
8	-	High beam lamp access cover
9	-	Xenon control module
10	-	Low/high beam lamp access cover
11	-	Side lamp access cover (hidden)
12	-	Turn signal lamp access cover (hidden)

Safety Precautions



WARNING : The Xenon system generates up to 28000 volts and contact with this voltage could lead to fatality. Make sure that the headlamps are switched off before working on the system.

The following safety precautions must be followed when working on the xenon headlamp system:

- **DO NOT** attempt any procedures on the xenon headlamps when the lights are switched on.
- Handling of the D2S Xenon bulb must be performed using suitable protective equipment, e.g. gloves and goggles. The glass part of the bulb must not be touched.
- Xenon bulbs must be disposed of as hazardous waste.
- Only operate the lamp in a mounted condition in the reflector.

The xenon headlamps use a complex surface reflector for the Halogen fill in high beam lamp only lighting unit, which is of the same design as the high beam unit used on the Halogen headlamps. This type of reflector has the reflector divided into separate parabolic segments, with each segment having a different focal length.

The high beam bulbs are quartz halogen H7, with a rating of 55W. The bulbs are retained in the headlamp unit with conventional wire retaining clips.

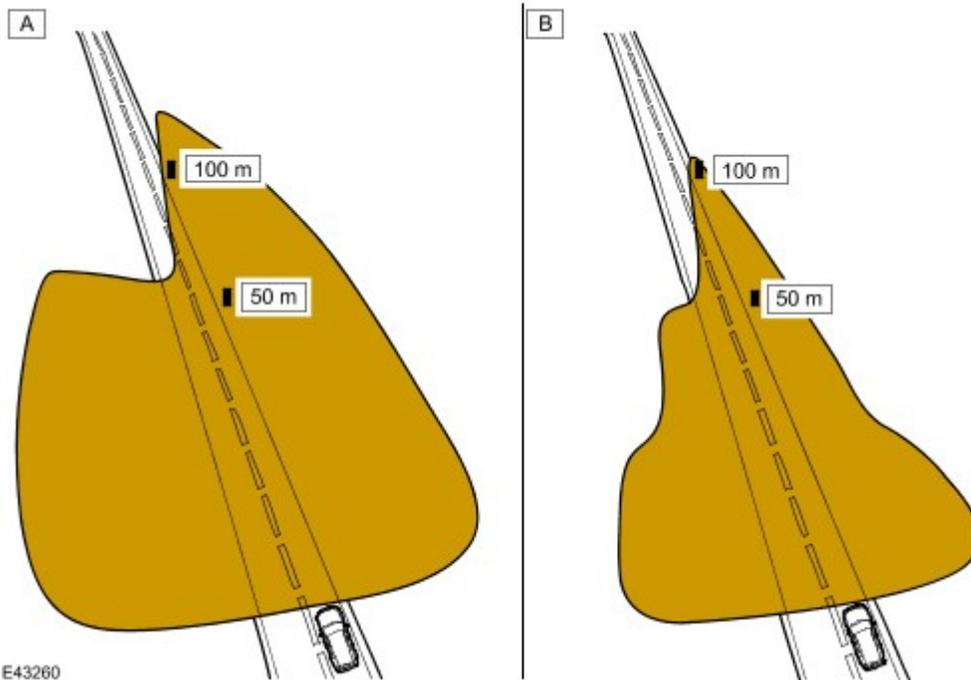
The xenon headlamp is known as bi-xenon and operates as both low beam and high beam headlamp unit. The xenon lamp or High Intensity Discharge (HID) lamp as they are sometimes called, comprises an ellipsoidal lens with a solenoid controlled shutter to change the beam output from low to high beam.

NOTE :

If the lighting control switch is in the OFF position, the xenon lamps do not operate when the high beam 'flash' function is operated. If the lighting switch is in the headlamps position or AUTO position with the low beam lamps active, the xenon low beam will remain on when the high beam 'flash' function is operated.

The xenon headlamp system is controlled by the CJB using a control module for each headlamp and an igniter. The control modules and the igniters provide the regulated power supply required to illuminate the xenon bulbs through their start-up phases of operation.

Xenon/Halogen Headlamp Beam Comparison

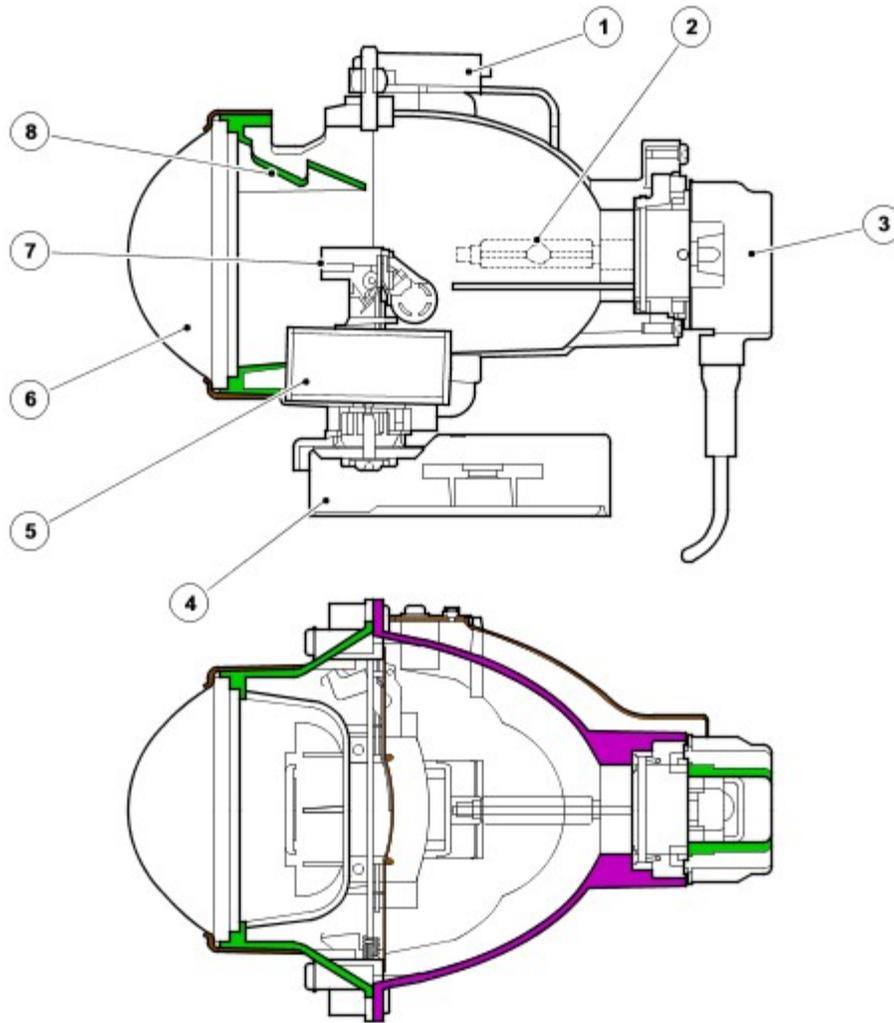


Item	Part Number	Description
A	-	Bi-Xenon
B	-	Halogen

The xenon low/high beam headlamps use ellipsoidal technology for the lens and reflector providing improved night time visibility compared to conventional halogen headlamps. The xenon headlamps provide the following benefits when compared to halogen headlamps:

- Longer bulb life - Approximately 3 to 5 times longer than a halogen bulb
- Increased light output - xenon headlamps output 3 to 4 times more light on the road surface than halogen headlamps
- Blue/White light which is closer to natural daylight - xenon lamps produce a blue/white light compared to a yellow light produced by a halogen bulb
- Improved night time driving visibility - xenon lamps produce a wider and brighter beam in front of the vehicle than conventional halogen bulbs
- Lower running temperatures
- Lower power consumption.

Xenon Headlamp Construction



E43261

Item	Part Number	Description
1	-	Bracket
2	-	DS2 xenon bulb
3	-	DS2 connector
4	-	Swivel actuator (AFS lamp only)
5	-	Solenoid
6	-	Aspheric lens
7	-	Shade
8	-	Shade
9	-	Lens support

The xenon headlamp is a self contained unit located within the headlamp assembly. The unit comprises a reflector, an adaptor ring, the lens, a shutter controller and the xenon bulb, which as an assembly is known as the projector module.

The reflector is curved and provides the mounting for the xenon bulb. The bulb locates in a keyway to ensure correct alignment in the reflector and is secured by pushing and turning to lock. The bulb has a two pin connector which is also a push and turn to lock fitting.

The shutter controller is a solenoid which operates, via a lever mechanism, to the shutter. The shutter is used to change the beam projection from low beam to high beam and visa versa.

A tourist lever mechanism is located on the right hand side of the projector module. This mechanism moves to blank off a

portion of the beam spread to enable the vehicle to be driven in opposite drive hand markets without applying blanking decals to the headlamp lens. The beam is changed by removing the access cover at the rear of the lamp assembly and moving a small lever located near the bulb holder, at the side of the projector module. Make sure that the headlamps are off before removing the access cover.

The xenon bulbs illuminate when an arc of electrical current is established between two electrodes within the bulb. The xenon gas sealed in the bulb reacts to the electrical excitation and the heat generated by the current flow. The xenon gas reaction to the controlled current flow between the electrodes produces the blue/white light.

To operate at full efficiency, the xenon bulb goes through three stages of operation before full output for continuous operation is achieved. The three phases are; start-up phase, warm-up phase and continuous phase.

In the start-up phase, the bulb requires an initial high voltage starting pulse of 18000 to 28000 volts to establish the arc. This is produced by the igniters. The warm-up phase begins once the arc is established. The xenon control modules regulate the supply to the bulbs to 2.6A which gives a lamp output of 75W. During this phase, the xenon gas begins to illuminate brightly and the environment within the bulb stabilises ensuring a continual current flow between the electrodes. When the warm-up phase is complete, the xenon control modules change to continuous phase. The supply voltage to the bulb is reduced and the operating power required for continual operation is reduced to 35W.

The xenon system is controlled by the CJB, the two xenon control modules and the two igniters. The xenon control modules (one per headlamp) receive an operating voltage from the CJB when the headlamps are switched on. The modules regulate the power supply required through the phases of start-up.

The igniters (one per headlamp) generate the initial high voltage required to establish the arc. The igniters have integral coils which generate high voltage pulses required for start-up. Once the xenon bulbs are operating, the igniters provide a closed circuit for regulated power supply from the control modules.

Turn Signal Lamp

The turn signal lamp is incorporated into the outer part of the headlamp assembly. The lamp is located above the side lamp/cornering lamp. The turn signal lamp uses an 27W/7W S8W wedge bulb. The bulb is fitted into a holder which is connected via wires to the main connector on the headlamp housing. The holder is fitted into an aperture in the headlamp housing and rotated to lock into position. The bulb is accessible via a sealed cover which is attached to the rear of the headlamp housing. The cover is secured in the housing by rotating in a clockwise direction until locked. Access to the cover requires removal of the headlamp from the front carrier assembly and removal of the outer locking plate from the headlamp.

The turn signal lamps are operated by the left hand steering column multifunction switch or by the hazard flasher switch. The steering column multifunction switch is only active with the ignition switch in the ignition position (II), the hazard flasher switch is active at all times. When active, the turn signal lamps will flash at a frequency cycle of 380ms on and 380ms off.

If a bulb fails, the remaining turn signal lamps bulbs continue to flash at normal speed. The turn signal indicators in the instrument cluster will flash at double speed to indicate the bulb failure to the driver.

Side Lamp

The side lamp is incorporated into the outer part of the headlamp assembly and is located below the turn signal indicator lamp. The side lamp shares the same housing and reflector as the cornering lamp and static bending lamp (when fitted).

The side lamp uses a capless W5W wedge fitting bulb which locates into a holder which is connected via wires to the main connector on the headlamp housing. The holder is a push fit into a receptacle in the headlamp housing. The bulb is accessible via a removable cover at the rear of the headlamp housing. Access to the cover requires removal of the headlamp from the front carrier assembly and partial removal of the outer locking plate from the headlamp.

The side lamps are operated by selecting side lamps or headlamps on the lighting control switch. The side lamps are operational at all times and are not dependant on the ignition switch position. The side lamps will also be illuminated when the lighting control switch is in the AUTO position and a 'lights on' signal is received by the CJB from the rain/light sensor.

Cornering Lamp

NOTE :

The cornering lamps are not fitted to NAS market vehicles

The cornering lamps are an optional feature designed to illuminate the direction of travel when cornering at low speeds. The design of the lens projects a spread of light from the vehicle at approximately 45 degrees to the vehicle axis.

The cornering lamp is incorporated into the outer part of the headlamp assembly and shares the same housing and reflector as the side lamp.

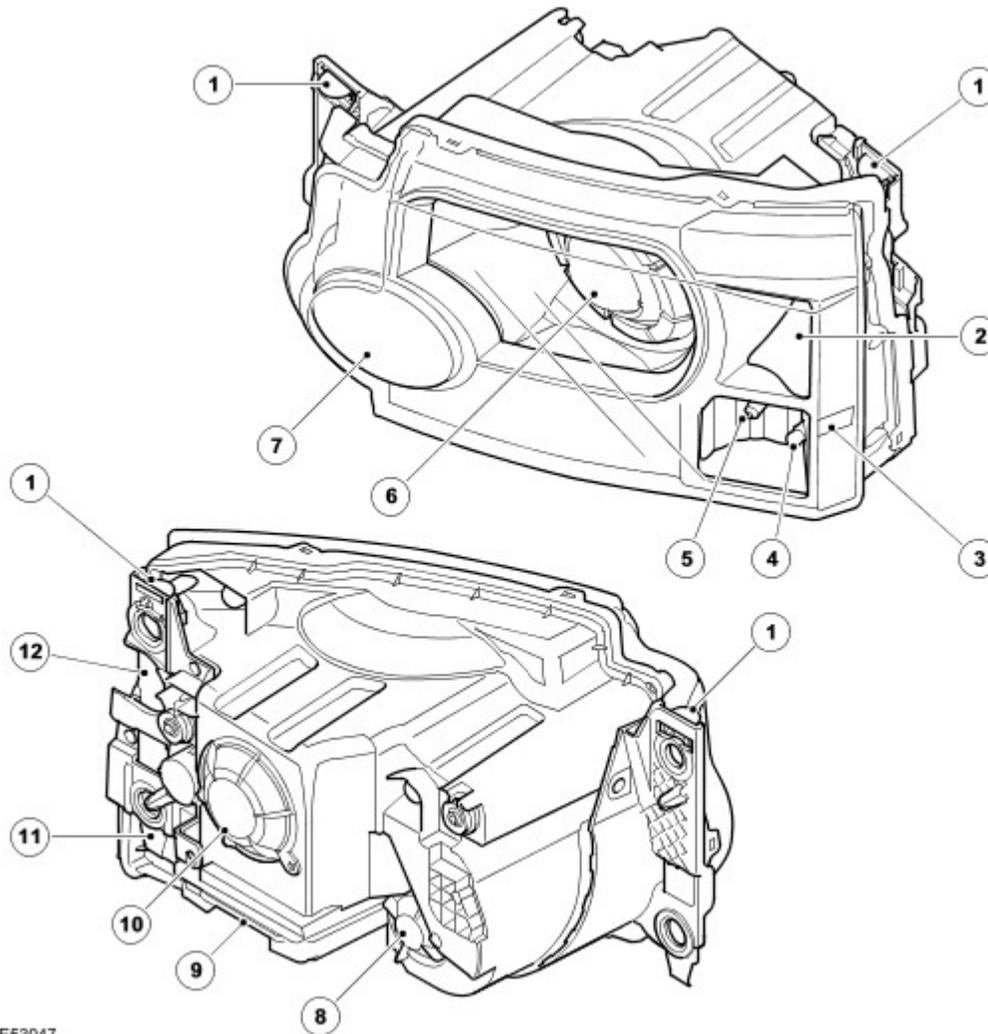
The cornering lamp uses a 35W Halogen H8 bulb which locates in a holder which is connected on the headlamp housing. The holder is located in an aperture in the headlamp housing and rotated to lock. The bulb is accessible via a removable cover at the rear of the headlamp housing.

The cornering lamps are controlled by the left hand steering column multifunction switch with the lighting control switch in the headlamp position and the ignition switch in position II. The cornering lamps are supplied power via the ignition switch to ensure that they do not function with the headlamp delay feature. The cornering lamps are deactivated if the vehicle speed exceeds 25 mph (40 km/h).

Only one cornering lamp will illuminate at any one time. If the left hand turn signal indicators are selected on, the left hand cornering lamp will be illuminated and visa versa, providing the vehicle speed and lighting control switch positions are correct. Cornering lamps are disabled when reverse gear is selected.

ADAPTIVE FRONT LIGHTING SYSTEM (AFS)

Xenon Headlamp Assembly with AFS



E53047

Item	Part Number	Description
------	-------------	-------------

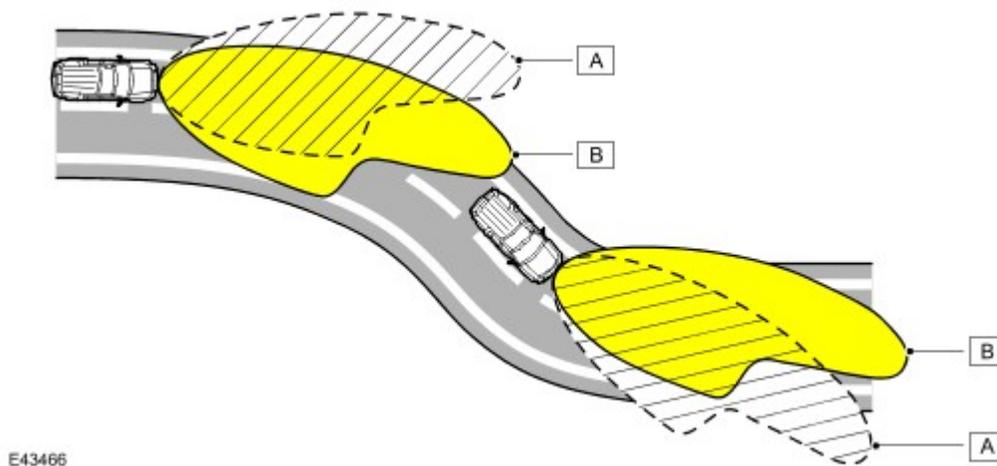
1	-	Locking plate
2	-	Turn signal lamp
3	-	Side marker lamp (NAS only)
4	-	Side lamp
5	-	Static bending lamp (All except NAS)
6	-	Xenon low/high beam AFS lamp
7	-	Halogen high beam lamp
8	-	High beam lamp access cover
9	-	Xenon control module
10	-	Low/high beam lamp access cover
11	-	Side lamp and static bending lamp access cover (hidden)
12	-	Turn signal lamp access cover (hidden)

The AFS is a new system to improve driver visibility under differing driving conditions. AFS provides a larger visible area which is illuminated when cornering by adjusting the position of the beam distribution on the road. Horizontal adjustment is made automatically to the most suitable orientation for the driving conditions using steering angle and information from other vehicle sensors.

AFS is only available with xenon headlamps and also includes the dynamic headlamp levelling system described in the 'Headlamp Levelling' section of this document. The bi-xenon module within the headlamp is controlled by actuator motors which rotate the projector module on its vertical and horizontal axes to adjust the beam output to suit the cornering conditions and vehicle inclination. Only the bi-xenon lamp projector module swivels, the halogen high beam lamp unit remains static.

The AFS system is controlled by an AFS control module which is located at the bottom of the 'A' pillar, behind the CJB. The control module controls the vertical and horizontal alignment of the xenon projector module and the operation of the static bending lamp which is requested by the AFS control module but controlled by the CJB.

AFS Concept



A	Conventional headlamp beam distribution
B	AFS swivel headlamp beam distribution

AFS Control Module

The AFS control module is a dual functionality unit which also incorporates software to control the dynamic headlamp levelling. The AFS control module is connected to the high speed CAN bus and receives inputs from other vehicle systems on the status of the following parameters:

- Steering angle - from steering angle sensor
- Vehicle speed - from ABS module
- Low beam status - from instrument cluster
- Suspension height - from air suspension control module
- Odometer value - for diagnostics only
- Engine running - from ECM
- Gear position - From transmission control module or transfer box control module
- Engine crank - from ECM
- Exterior/interior temperature - for diagnostics only.

The AFS will only operate when the AFS control module receives an engine running signal on the CAN bus. When the engine running signal is received and the lighting control switch is in the headlamps position, the AFS control module performs an initialisation routine.

The AFS will also function when the lighting control switch is in the AUTO position and the AFS control module receives a lights on signal from the rain/light sensor and an engine running signal.

The AFS control module then monitors the inputs from the other vehicle systems to control the AFS functionality according to cornering angles and vehicle speed.

AFS Control Module Connector C2193 Pin Details

Pin No.	Description	Input/Output
1	Ground	Input
2 and 3	Not used	-
4	CAN High	Input/Output
5	CAN Low	Input/Output
6	RH Headlamp swivel actuator signal	Output
7	RH Headlamp swivel actuator signal	Output
8	Not used	-
9	RH Headlamp levelling motor 1 - Positive +	Output
10	RH Headlamp levelling motor 1 - Negative -	Input
11	RH Headlamp levelling motor 2 - Positive +	Output
12	RH Headlamp levelling motor 2 - Negative -	Input
13	12V Ignition feed	Input
14 to 17	Not used	-
18	LH Headlamp swivel actuator signal	Output
19	LH Headlamp swivel actuator signal	Output
20	Not used	-
21	LH Headlamp levelling motor 1 - Positive +	Output
22	LH Headlamp levelling motor 1 - Negative -	Input
23	LH Headlamp levelling motor 2 - Positive +	Output
24	LH Headlamp levelling motor 2 - Negative -	Input

Operating Modes

The AFS has three modes of operation:

- Manoeuvring mode
- Normal driving mode
- High speed mode
- Reverse mode.

Manoeuvring mode is used for speeds up to 18.6 mph (30 km/h). Manoeuvring mode only moves the xenon projector

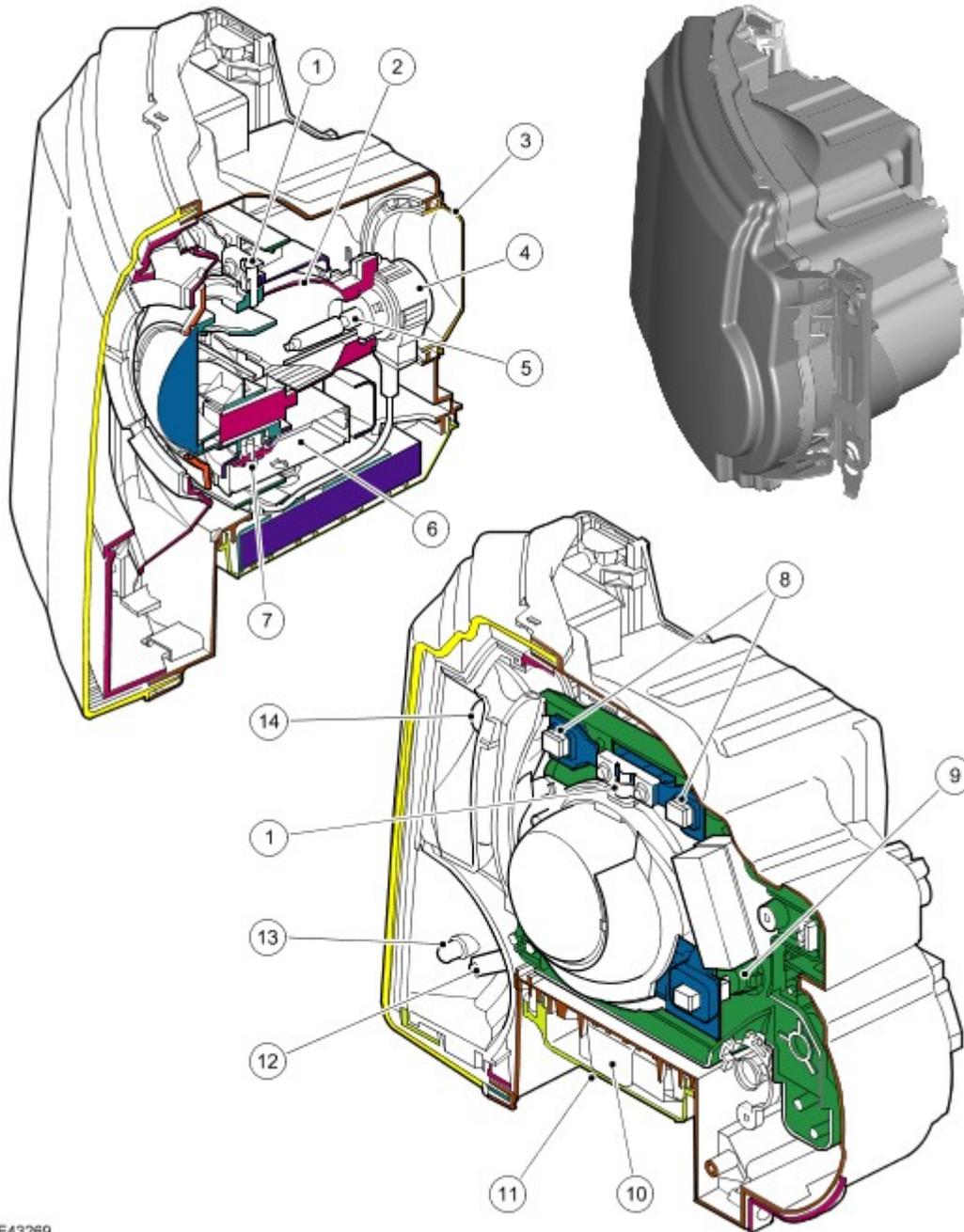
module on the side of the vehicle towards the direction of turn, e.g. Left hand projector module moves to the left during a left hand turn. The opposite projector module is fixed and does not move. This mode allows the maximum amount of swivel range of the projector module to 15 degrees.

Normal driving mode is used for speeds between 18.6 and 43.5 mph (30 and 70 km/h). Normal driving mode moves both xenon projector modules at a ratio of 3:1, e.g during a left hand turn, the left hand projector module moves 3 degrees and the right hand projector module moves 1 degree. This mode allows the maximum amount of swivel range of the projector module in the direction of the turn to 12 degrees.

High speed mode is used for speeds above 43.5 mph (70 km/h). High speed mode moves both xenon projector modules at a ratio of 3:1, e.g during a left hand turn, the left hand projector module moves 3 degrees and the right hand projector module moves 1 degree. This mode allows the maximum amount of swivel range of the projector module in the direction of the turn to 10 degrees.

Reverse mode disables the swivel function when reverse gear is selected. The AFS projector modules move to their central straight ahead position and the static bending lamp, if active, will go off. When reverse gear is deselected, the AFS projector modules will move to a position to match the steering angle and the static bending lamp will illuminate if the operating conditions are correct (i.e. vehicle speed above 1.86 mph (3 km/h)).

Xenon Headlamp Assembly with AFS Construction



E43269

Item	Part Number	Description
1	-	Projector module horizontal pivot
2	-	Reflector
3	-	Access cover
4	-	DS2 xenon lamp connector
5	-	DS2 xenon lamp
6	-	AFS swivel horizontal actuator
7	-	Horizontal actuator drive
8	-	Projector module vertical pivots
9	-	AFS swivel vertical actuator
10	-	Xenon control module

11	-	Control module cover
12	-	Static bending lamp bulb (All except NAS)
13	-	Side lamp bulb
14	-	Turn signal lamp bulb

The AFS xenon headlamp construction is similar to the non-AFS xenon headlamp assembly. The AFS assembly contains an additional carrier frame which provides the location for the AFS components. The remaining lamps are as described previously for the Xenon headlamp assembly. The functionality of the static bending lamp on the AFS headlamp is different from the functionality of the cornering lamp on the xenon headlamp.

The carrier frame has a radial bearing at the top and a thrust washer at the bottom which provide the horizontal pivot points for the xenon projector module. The lamp module lower pivot has a splined end which locates in the mating splines of the AFS horizontal actuator motor. The carrier frame is suspended on two flexible mountings at the top which provide for the vertical pivot points for the xenon projector module which allow for the vertical adjustment of the projector module. The bottom of the carrier frame is attached to the AFS vertical actuator motor.

The AFS actuator motors are dc motors which are driven by a power output from the AFS control module. The AFS control module also provides the earth path for the motor.

The actuators contain a potentiometer which is connected via wires with gold plated connector pins to the AFS control module. The two wires to each actuator provide a feedback signal to the AFS control module to give the precise position of the xenon projector module.

The AFS control module receives front and rear suspension height data to provide dynamic headlamp levelling adjustment via the vertical actuator motor. The AFS control module also receives vehicle speed signals from the ABS module to adjust the projector module vertically to increase the beam range as the vehicle speed increases.

Initialisation Procedure

When the AFS control module receives an ignition on signal, the control module performs the initialisation procedure which ensures that the headlamps are correctly aligned on both their vertical and horizontal axes.

The headlamp levelling initialisation takes less than 3 seconds to complete. The headlamp levelling motors are powered from their current position, which can be either the upper or lower limit or somewhere in between, to their lower position and then back to the 0 degrees position.

The AFS swivel initialisation starts less than 1 second after the headlamp levelling initialisation is activated to ensure that the headlamps are at or below the 0 degree position in the vertical axis, thus preventing glare to oncoming vehicles. The AFS swivel initialisation is completed in less than 2.5 seconds. The LH and RH AFS actuator motors are powered from the 0 degree position to their fully inboard position, then to their fully outboard position and then back to the 0 degree position.

Failure Mode

In the event of a failure of the AFS system, a warning indicator in the instrument cluster is illuminated to warn the driver. The AFS warning indicator illuminates when the ignition switch is in the ignition position (II) and will illuminate continuously until the fault is rectified. The AFS warning indicator will also be illuminated if a failure of the steering angle sensor or the vehicle speed signal is detected.

Illumination of the AFS warning indicator does not necessarily mean that there is a fault with the AFS system. The fault may be caused by a failure of another system preventing the AFS system operating correctly.

The AFS control module performs a diagnostic routine every time AFS is requested. If any fault is found, the AFS control module will suspend the operation of the AFS function.

If the AFS system has failed with the xenon projector module in a position other than the correct straight ahead position, the AFS control module will attempt to drive the xenon projector module to the zero (straight ahead) position. If this is not possible, the AFS control module will lower the projector module using the levelling actuator motors to prevent excess glare to oncoming vehicles.

The AFS control module software can detect an internal failure of the control module control circuits. The control module will power the projector modules to the zero position and prevent further operation.

Faults can be investigated by interrogating the AFS control module using T4 to check for fault codes.

Static Bending Lamps

NOTE :

The static bending lamps are not fitted to NAS market vehicles

The static bending lamps are a standard feature on AFS headlamps designed to illuminate the direction of travel when cornering at low speeds. The design of the lens projects a spread of light from the vehicle at approximately 45 degrees to the vehicle axis. The static bending lamps are controlled by the CJB.

The static bending lamp is incorporated into the outer part of the headlamp assembly and shares the same housing and reflector as the side lamp.

The static bending lamp uses a 35W Halogen H8 bulb which locates in a holder which is connected via wires to the main connector on the headlamp housing. The holder is located in an aperture in the headlamp housing and rotated to lock. The bulb is accessible via a removable cover at the rear of the headlamp housing.

AFS Control

The static bending lamps operate with a steering angle sensor signal which is received by the AFS control module and the CJB. The AFS control module sends a static bending lamp on request to the CJB which activates the static bending lamp bulb.

At speeds above 30 mph (48 km/h), the static bending lamp in the direction of the turn is illuminated when the steering wheel rotation reaches 70 degrees. As the vehicle turn is decreased, the static bending lamp is switched off when the steering wheel rotation reaches 50 degrees.

At speed below 30 mph (48 km/h), the static bending lamp in the direction of the turn is illuminated when the steering wheel rotation reaches 245 degrees. As the vehicle turn is decreased, the static bending lamp is switched off when the steering wheel rotation reaches 225 degrees.

The operation of the static bending lamps is controlled by the CJB. When the operation parameters of the lamp are reached, the CJB fades the static bending lamp bulb on using a PWM voltage over a period of approximately 2 seconds. When the lamp is switched off, the CJB fades the bulb off by decreasing the PWM voltage.

AUTOMATIC HEADLAMP OPERATION

The automatic headlamp function is a driver assistance system. The driver can override the system operation by selection of side lamp or headlamp on if the ambient light conditions require front and rear lighting to be active. The automatic headlamp system uses a light sensor and the CJB, which are connected via the LIN bus to control the headlamp functionality.

A light sensor is incorporated in the rain/light sensor located on the inside of the windshield, below the rear view mirror.

The wiper system also uses the rain/light sensor for automatic wiper operation. For additional information, refer to [Wipers and Washers](#) (501-16 Wipers and Washers)

The light sensor measures the ambient light around the vehicle in a vertical direction and also the angular light level from the front of the vehicle. The rain/light sensor uses vehicle speed signals, wiper switch position and the park position of the front wipers to control the system.

The automatic headlamp operation uses ambient light levels which are monitored by photodiode incorporated in the rain/light sensor. The rain/light sensor sends a lights on/off request to the CJB on the LIN bus, which responds by switching on the low beam headlamps, front side lamps and rear tail lamps.

The automatic headlamps are activated under the following conditions:

- Twilight
- Darkness
- Rain
- Snow
- Tunnels
- Underground or multistoried car parks.

Operation of the automatic headlamps requires the ignition switch to be in position II, the lighting control switch to be in

the 'AUTO' position and a lights on request signal from the light sensor.

HEADLAMP LEVELLING

Headlamp levelling provides for the adjustment of the vertical aim of the headlamps. The levelling system is primarily required to minimise glare to other road users when a heavy load is in the rear of the vehicle.

Three systems of headlamp levelling are available; manual, static and dynamic.

Manual Headlamp Levelling

Manual headlamp levelling is only available on vehicles with halogen headlamps and coil spring suspension.

The manual system comprises the following components:

- Two headlamp levelling motors
- Headlamp levelling rheostat rotary control.

When the ignition switch is in the ignition position (II), power is supplied to the lighting control switch via the ignition relay in the battery junction box and to the headlamp levelling motor in each headlamp assembly via the CJB. When the lighting control rotary switch is moved to the side lamp or headlamp position, the supply from the ignition relay is passed to the levelling rotary control.

Movement of the levelling rotary control produces a variable voltage output, which is sensed by the motors. The motors react to the supplied voltage and move the headlamp to the requested position which relates to the supplied voltage from the levelling rotary control.

The headlamps can only be lowered from their unladen position to compensate for changes in vehicle attitude due to loading.

Vehicle Headlamp Levelling

Vehicle headlamp levelling is only available on vehicles with air suspension.

Vehicle headlamp levelling is performed by the air suspension system and the air suspension control module. The suspension system constantly monitors the vehicle attitude and adjusts the height of the front and/or rear of the vehicle accordingly. This maintains the correct vehicle attitude and consequently maintains the correct headlamp beam alignment.

The vehicle levelling system is fully automatic, therefore the lighting control switch does not have the manual levelling rotary control.

Dynamic Headlamp Levelling (Air Suspension)

Dynamic headlamp levelling is only available on vehicles with the AFS system and air suspension.

The dynamic headlamp levelling adjusts the vertical alignment of the headlamps as a rapid response to changes in vehicle attitude due to acceleration or braking.

The dynamic system is fully automatic, therefore the lighting control switch does not have the manual levelling rotary control.

NOTE :

The AFS system also operates in conjunction with the vehicle levelling system as described previously.

The dynamic system comprises the following components:

- Two headlamp levelling motors
- AFS control module
- Engine running signal from engine control module
- Vehicle speed information from ABS module

- Vehicle height information from air suspension control module.

When the ignition switch is in the ignition position (II), power is supplied to the lighting control switch via the ignition relay in the Battery Junction Box (BJB) and to the AFS control module. When the lighting control rotary switch is moved to the side lamp or headlamp position, the supply from the ignition relay is passed to the AFS control module.

NOTE :

When the AFS control module receives an ignition on signal, the control module performs an initialisation procedure for both the AFS and headlamp levelling motors. Refer to the previous AFS section for details of the initialisation procedure.

The system operates by the AFS control module receiving inputs on the CAN from the air suspension control module for front and rear vehicle height, from the engine control module for engine running signal and from the ABS module for stop lamp switch active (brakes applied) and vehicle speed. The AFS control module processes these signals and provides an output to the headlamp levelling motors to adjust the headlamp vertical aim according to vehicle speed and attitude.

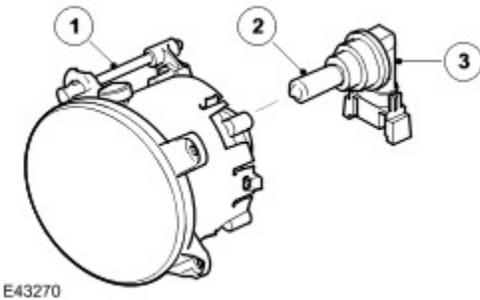
NOTE :

In markets with Daytime Running Lamps (DRL), the dynamic headlamp levelling system will not operate when the DRL are active.

DAYTIME RUNNING LAMPS (DRL)

For additional information, refer to [Daytime Running Lamps \(DRL\)](#) (417-04 Daytime Running Lamps (DRL))

FRONT FOG LAMP (If Fitted)



Item	Part Number	Description
1	-	Adjuster screw
2	-	Halogen bulb
3	-	Bulb holder

Front fog lamps are an optional fitment on low specification vehicles and a standard fitment on high specification vehicles.

Two front fog lamps are located in apertures in the front bumper. Each lamp is secured in the bumper with three screws which are covered with a finisher. The fog lamp has an adjuster screw which is accessible by removal of the lamp surround and is used to set the fog lamp to the correct alignment.

The fog lamp uses a 55W halogen H11 bulb which is located in a holder. The holder is located in a hole in the rear of the fog lamp housing and is turned to lock in position.

The front fog lamps are controlled by the lighting control switch. When the ignition switch is in the ignition position (II) and the lighting control switch is in the side lamp or headlamp position, the lighting control switch can be pulled to the first position to activate the front fog lamps.

If the switch is pulled to the second position, the front and rear fog lamps are activated. A front fog lamp warning indicator

is illuminated in the instrument cluster when the front fog lamps are active.

Front Fog Lamps Functionality (NAS and Canadian Markets Only)

The front fog lamps are powered by an additional relay (relay 5) which is located in the BJB in the engine compartment.

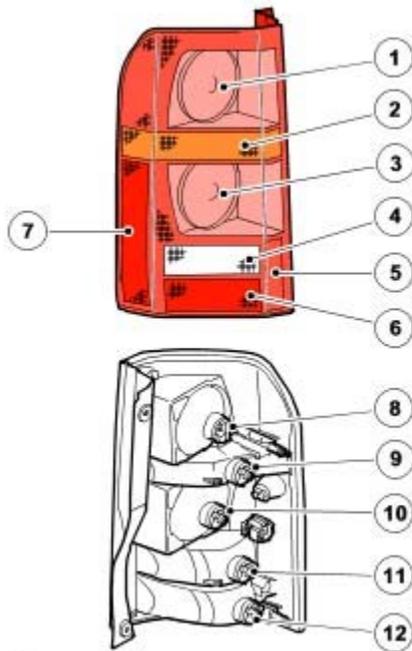
The front fog lamps operate as described previously but with the following differences which cover local laws governing lamp usage.

If the low beam headlamps and the front fog lamps are on at the same time, when the high beam headlamps are switched on, the front fog lamps will be automatically switched off. When the high beam headlamps are switched off, the front fog lamps will be switched back on automatically.

NOTE :

The front fog lamps will also be switched off if the headlamp high beam flash function is operated.

REAR LAMP ASSEMBLY



E43271

Item	Part Number	Description
1	-	Stop/side lamp
2	-	Turn signal lamp
3	-	Side lamp
4	-	Reverse lamp
5	-	Reflector
6	-	Fog lamp
7	-	Side marker lamp (NAS only)
8	-	Stop/side lamp bulb
9	-	Turn signal lamp bulb
10	-	Side lamp bulb
11	-	Reverse lamp bulb



The rear lamp assembly is a one piece unit which contains a stop/tail lamp, a turn signal lamp, a second tail lamp, a reversing lamp and a fog lamp. Five bayonet fitting bulbs are used (six on NAS vehicles with the addition of a side marker lamp). These are located in holders which fit into the applicable hole in the lamp housing and are locked by rotating. Each bulb holder is connected by wires to a connector on the rear of the lamp housing.

The rear lamp assembly is located in a recess in the vehicle body. Two studs on the outer edge of the lamp housing locate in the vehicle body. The lamp is secured with two screws which are located on the inner edge of the lamp housing, near the tailgate aperture.

Rear Stop and Side Lamp

The upper lamp is a combined stop and tail lamp and uses a 21W/5W bayonet fitting bulb. The stop lamp uses the 21W bulb filament and the tail lamp uses the 5W bulb filament.

The stop lamp is activated when the ignition switch is in the ignition position (II) and the brake pedal switch is active (by depressing the brake pedal). The high mounted stop lamp will also be activated when the brake pedal is pressed.

The stop lamps can also be activated by the ABS when Hill Descent Control (HDC) is active. A signal from the ABS module energises a relay which supplies power to the stop lamps and high mounted stop lamp. For additional information, refer to [Anti-Lock Control - Traction Control](#) (206-09A)

Turn Signal Lamp

The turn signal lamp is located below the combined stop/tail lamp and uses a 21W bayonet fitting bulb.

The turn signal lamps are operated by the left hand steering column multifunction switch or by the hazard flasher switch. The steering column multifunction switch is only active with the ignition switch in the ignition position (II), the hazard flasher switch is active at all times. When active, the turn signal lamps will flash at a frequency cycle of 380ms on and 380ms off.

If a bulb fails, the remaining turn signal lamp bulbs on that side of the vehicle flash at normal speed. The applicable turn signal indicator in the instrument cluster will flash at double speed to alert the driver to the bulb failure.

Side Lamp

The side lamp is located below the turn signal indicator and uses a 21W/5W bayonet fitting bulb. Only the 5W filament is used for the side lamp function.

The side lamps are operated by selecting side lamps or headlamps on the lighting control switch. The side lamps are operational at all times and are not dependant on the ignition switch position. The side lamps will also be illuminated when the lighting control switch is in the AUTO position and a 'lights on' signal is received by the CJB from the rain/light sensor.

Reversing Lamp

The reversing lamp is located below the tail lamp and uses a 21W bayonet fitting bulb.

The reverse lamp is active when the ignition switch is in the ignition position (II) and the CJB receives a reverse selected signal on the CAN bus. Both manual and automatic transmissions have a reverse switch which senses when reverse is selected.

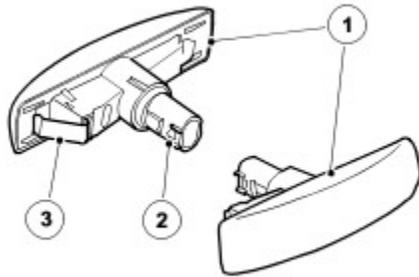
Rear Fog Lamp

The rear fog lamp is located at the bottom of the rear lamp and uses a 21W bayonet fitting bulb.

The rear fog lamp is controlled by the lighting control switch. When the ignition switch is in the ignition position (II) and the lighting control switch is in the side lamp or headlamp position, the lighting control switch can be pulled to the second position (if front fog lamps fitted) to activate the front fog lamps. If front fog lamps are not fitted, the switch need only be pulled to the first position. A rear fog lamp warning indicator is illuminated in the instrument cluster when the rear fog

lamps are active.

SIDE REPEATER LAMP



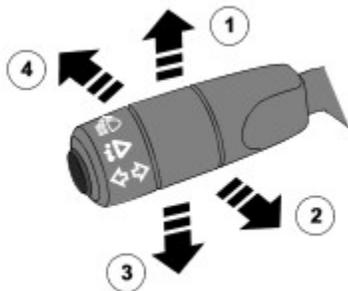
E43272

Item	Part Number	Description
1	-	Side repeater
2	-	Bulb holder
3	-	Clip

The side turn signal lamps are located in the driver and passenger doors, below each door mirror. The lamps are clipped into an aperture in the door panel and can be removed by sliding rearwards and releasing the front edge of the lamp from the door. The side repeater lamps use a W5W capless bulb which is located in a holder.

The side turn signal lamps have the same functionality as the front and rear turn signal lamps and are operated by the left hand steering column multifunction switch or by the hazard flasher switch. The steering column multifunction switch is only active with the ignition switch in the ignition position (II), the hazard flasher switch is active at all times. When active, the side turn signal lamps will flash at a frequency cycle of 380ms on and 380ms off. If a lamp bulb fails, the remaining turn signal lamp bulbs continue to flash at the normal rate.

LEFT HAND STEERING COLUMN MULTIFUNCTION SWITCH



E43273

Item	Part Number	Description
1	-	RH turn signal lamp
2	-	Headlamp flash
3	-	LH turn signal lamp
4	-	Headlamp high beam

The steering column multifunction switch is located on the left hand side of the steering column and controls the following functions:

- Headlamp low/high beam
- Headlamp high beam flash
- Left/right turn signal lamps

- Trip computer functions. For additional information, refer to [Information and Message Center](#) (413-08)

The high beam on and flash functions are connected on separate wires to the CJB. When the switch is operated in either position an earth path is completed which is sensed by the CJB which activates the selected function.

The turn signal lamps are connected and operate in a similar way with the earth path completed through a separate wire which is sensed by the CJB which activates the applicable turn signal lamps.

HAZARD FLASHERS

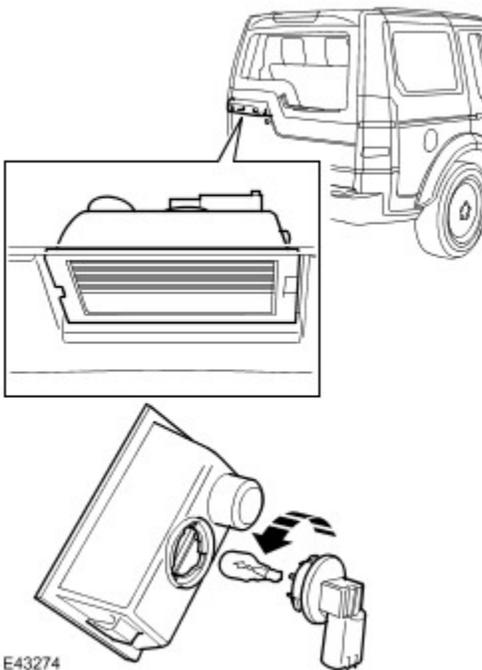
The hazard flashers are controlled by a non-latching switch in the centre of the instrument panel. The hazard flashers operate at all times when selected and are not dependant on ignition switch position.

When the hazard flashers are selected on, all of the front, rear and side turn signal lamps operate as previously described and both left and right turn signal indicators in the instrument cluster also flash. The hazard warning flashers flash at a rate of 380ms on and 380ms off. When the hazard flashers are active, they override any request for turn signal lamp operation.

If a trailer is fitted, the trailer turn signal lamps will flash at the same frequency as the vehicle indicators. The trailer warning indicator in the instrument cluster will also flash. If a trailer bulb is defective, the trailer warning indicator will not flash.

The hazard flashers can also be activated by a crash signal from the restraints control module. This is received by the CJB which activates the hazard flashers. The hazard flashers can be cancelled by moving the ignition switch to the auxiliary position I or the off position O or the crash mode is cancelled by the restraints control module. For additional information, refer to [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) (501-20B)

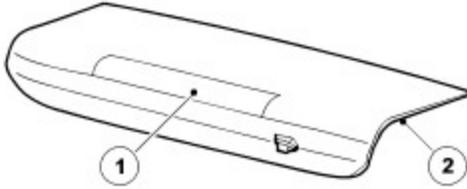
LICENSE PLATE LAMPS



Two license plate lamps are fitted in the tailgate handle, above the license plate in the upper tailgate. Each lamp uses a 5W capless type bulb. The lamps are secured in the upper tail gate handle with integral clips. The lamps can be released from the handle using a small, flat blade screwdriver.

The license plate lamps are active at all times when the side lamps or headlamps are switched on.

HIGH MOUNTED STOP LAMP



E43275

Item	Part Number	Description
1	-	High mounted stop lamp
2	-	Housing

The high mounted stop lamp is located in the upper tailgate. The stop lamp housing also provides location for the tail door window washer jet.

The lamp comprises a plastic housing with a red coloured lens. The lamp is illuminated by a number of Light Emitting Diodes (LED's).

The high mounted stop lamp is activated, along with the tail lamp stop lamps, when the ignition switch is in the ignition position (II) and the brake pedal switch is active (by depressing the brake pedal).

The high mounted stop lamp and the stop lamps can also be activated by the ABS when Hill Descent Control (HDC) is active. A signal from the ABS module energises a relay which supplies power to the stop lamps. For additional information, refer to [Anti-Lock Control - Traction Control](#) (206-09A)

TRAILER LIGHTING

Several different types of trailer socket can be fitted to the vehicle depending on market specifications. Refer to the Electrical Reference Library for specific socket details.

The CJB monitors the turn signal lamps and can detect if more than two lamps are fitted (the side turn signal lamps are not monitored). When a trailer is detected, the trailer warning indicator in the instrument cluster will flash in synchronisation with the turn signal indicators.

If one or more of the turn signal lamps on the vehicle or the trailer are defective, the trailer warning indicator will not flash to alert the driver to the bulb failure.

DIAGNOSTICS

The diagnostic socket is located in the lower instrument panel closing panel, on the driver's side, below the steering column. Various lighting system functions are monitored by different systems which can store fault information. This can be retrieved using T4 or other suitable scan tool.

AFS Control Module Fault Monitoring

The AFS control module has the capability to monitor faults within the AFS and the dynamic headlamp levelling system. The control module can store Diagnostic Trouble Codes (DTC's) relating to the symptoms shown in the following table.

DTC Symptom Description	Customer Symptom	Possible Cause
LH or RH AFS actuator - Communication failure	Swivelling does not function	Open circuit or short circuit to earth
LH or RH AFS Actuator failure	Swivelling does not function	Open circuit or short circuit

		to earth
LH or RH Levelling Motor Failure	Levelling does not function	Open circuit or short circuit to earth or 12V
CAN bus failure	Swivelling and levelling do not function. Other vehicle system functions perhaps also inoperative	Open circuit or short circuit to earth or 12V

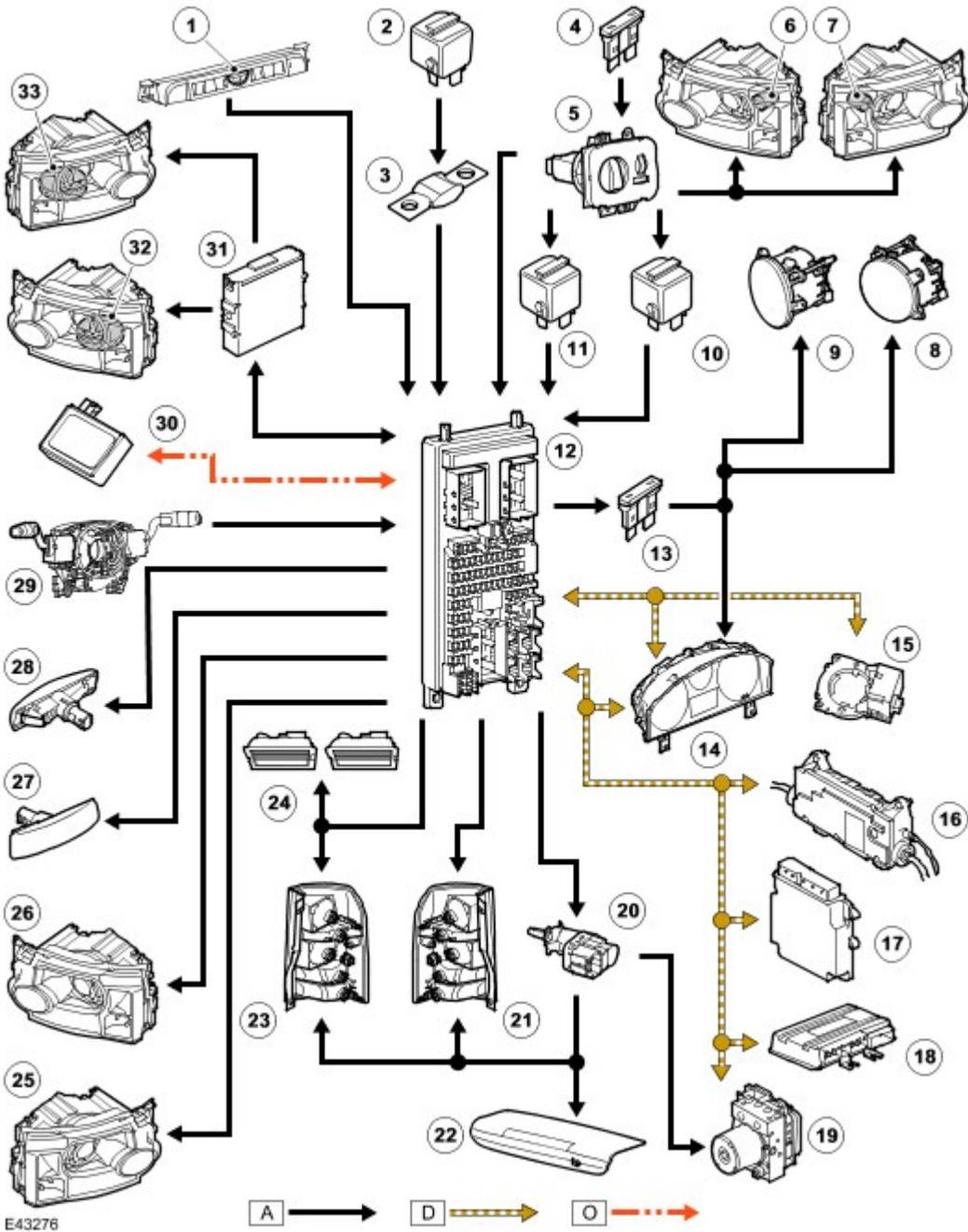
Central Junction Box (CJB)

The CJB monitors the status of the lighting circuits, relays and switches. If a fault occurs, the CJB stores a fault code applicable to the specific fault which can be retrieved using T4 or other suitable scan tool.

CONTROL DIAGRAM

NOTE :

A = Hardwired; **D** = High Speed CAN Bus; **O** = LIN Bus



E43276

Item	Part Number	Description
1	-	Hazard warning lamps switch
2	-	Ignition relay
3	-	Fusible link 2E (permanent 12V supply)
4	-	Fuse 25E (permanent 12V supply)
5	-	Lighting control switch
6	-	LH headlamp levelling motor (if fitted)
7	-	RH headlamp levelling motor (if fitted)
8	-	LH front fog lamp
9	-	RH front fog lamp
10	-	Front fog lamp relay (NAS only)

11	-	Daytime Running Lamps (DRL) relay (if fitted)
12	-	Central Junction Box (CJB)
13	-	Fuse 38P (NAS only)
14	-	Instrument cluster
15	-	Steering angle sensor
16	-	Parking brake module
17	-	Engine Control Module (ECM)
18	-	Air suspension control module
19	-	ABS module
20	-	Stop lamp switch
21	-	RH rear lamp assembly
22	-	High mounted stop lamp
23	-	LH rear lamp assembly
24	-	License plate lamps
25	-	RH front headlamp assembly
26	-	LH front headlamp assembly
27	-	LH side repeater lamp
28	-	RH side repeater lamp
29	-	LH steering column multifunction switch
30	-	Rain/light sensor (if fitted)
31	-	Adaptive Front lighting System (AFS) control module (if fitted)
32	-	LH AFS Actuator (if fitted)
33	-	RH AFS actuator (if fitted)