STEELWRIST
EARTHMOVING EFFICIENCY

LockSense - Worktool lock

LockSense

730325ENA, 16 May 2024, Original language: Swedish

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Functional description of LockSense

LockSense is a system for indicating to the driver in the cab whether or not the attachment

is correctly coupled.

LockSense reduces the risk of accidentally dropping a worktool when coupling.

LockSense consists of several parts;

(1) Two independent **LockSense** locking wedges that detect the coupling status when changing worktools, which

is transmitted by radio.

(2) A central unit (**Quantum Connectivity Gateway, QCG**), which should be mounted high up inside the cabin,

e.g. against the window, which communicates with the locking wedges via radio and with other surrounding systems via CAN bus.

(3) A **display** where the driver can see the lock status (and a service technician can customise the system settings)

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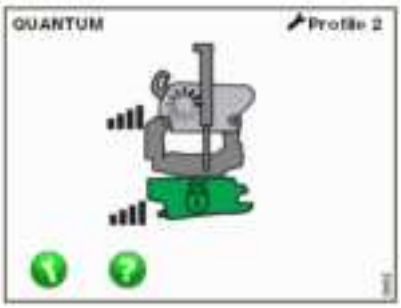
LockSense parts	Location of the QCG
	

Using LockSense

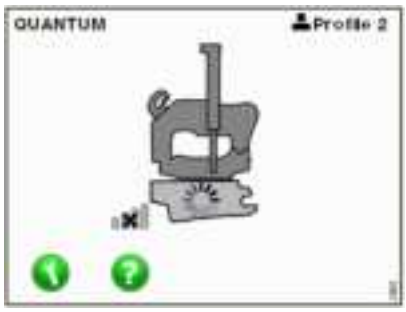


Display menu

LockSense is always enabled when the system is correctly installed. The status is always displayed on the home screen (so there is no need to navigate to the "LockSense" settings) for the LockSense quick coupler(s) installed on the machine.

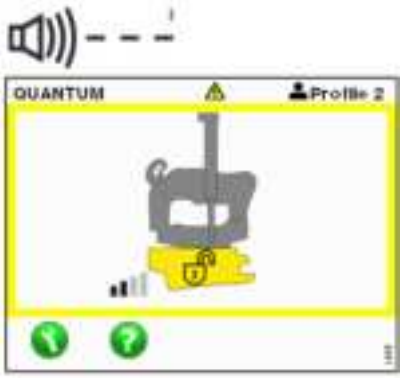
LockSense can be present on both machine worktool attachments and tiltrotator attachments. The illustration on the left is an example of a complete combination when both attachments are installed.

Other illustrations in this manual are with the tiltrotator attachment only.



System startup

This symbol is displayed at startup until communication with the wedges is established. The wedges go into sleep mode when the system is switched off, so it may take some time for the system to wake up.



Open the worktool attachment

Manoeuvre the quick coupler towards the worktool to be used. Or if you want to release a worktool that is already coupled.

Activate the bucket lock switch inside the cab.

LockSense indicates that the locking wedges are opening.

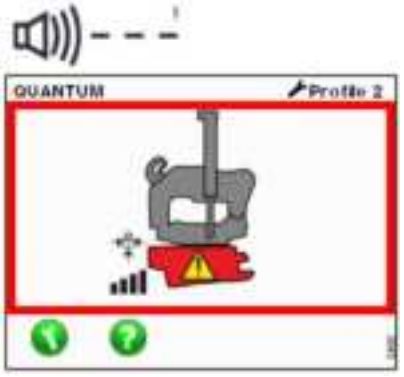
The yellow frame flashes. The buzzer makes a pulsating sound at a certain pitch.

The wedges retract and the worktool attachment opens.

The worktool attachment is open

The worktool attachment is open, the locking wedges are in their innermost position.

The buzzer sounds at a different pitch. The yellow frame has a steady glow.



The worktool attachment is locking

When the worktool is in the correct position in the quick coupler, deactivate the bucket lock switch in the operator's cab.

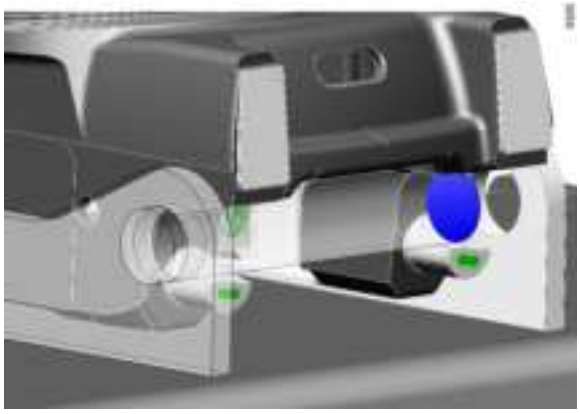
The locking cylinder is/locking cylinders are activated and the wedges move outwards in order to lock the worktool.

The buzzer has an intense and pulsating tone. A red frame flashes around the screen.

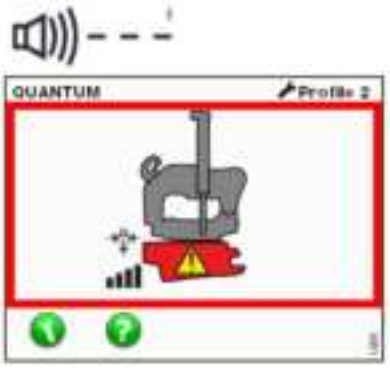
The worktool is locked correctly

The locking wedges are closed and locked under the rear worktool shaft.

A tune is played.



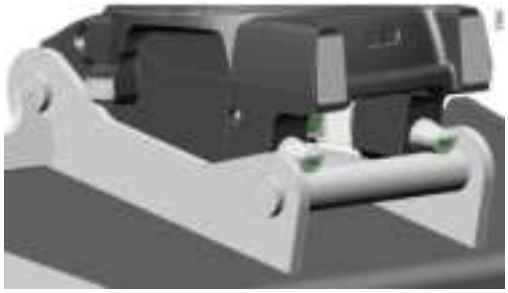
Error messages in LockSense

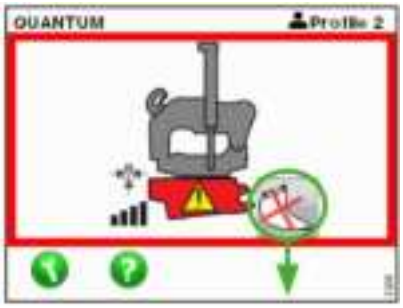


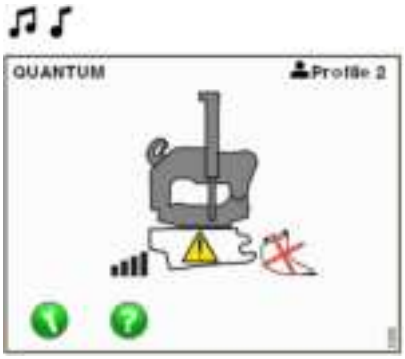
Locking failed

A red frame flashes around the screen. The buzzer sound pulsates intensely.

To continue driving, the driver has to confirm that the attachment is locked without worktools or repeat the locking sequence.







Deliberate locking without worktools (No Worktool)

A red frame flashes around the screen. The buzzer sound pulsates intensely.

The "No Worktool" symbol appears after 3 seconds.

The driver has to confirm that the quick coupler is locked without worktools,

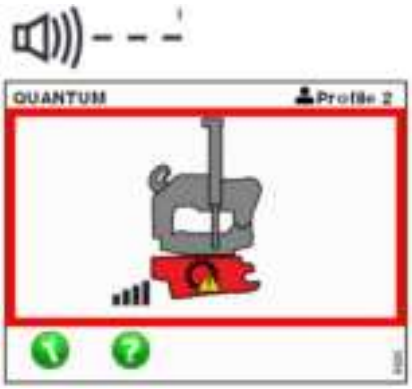
Tap the bucket symbol on the screen.

Tap the green tick to accept. A tune is played.

The driver is urged to read the text before agreeing.

When the driver presses the green tick, he confirms that locking was done intentionally without worktools.

It is important for the driver to be aware of this and not abuse this option.

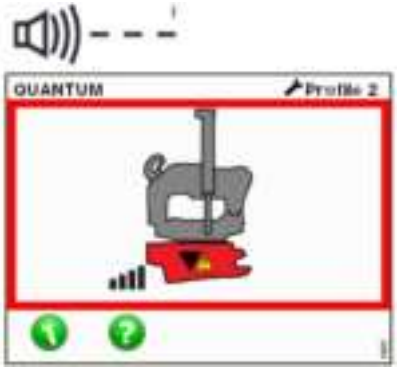


Mechanical failure

A red frame flashes around the screen. The buzzer sound pulsates intensely. The buzzer can be turned off after 3 seconds.

If the driver silences the buzzer, the driver must also click the "green tick" on a warning message

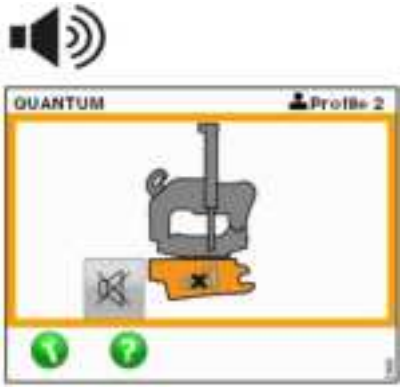
The driver accepts that the fault persists and understands that it must be rectified immediately.



Calibration error

A red frame flashes around the screen. The buzzer sound pulsates intensely. The buzzer can be turned off after 3 seconds.

LockSense must be calibrated to ensure that it functiosn correctly. The driver is warned if locking wedge calibration fails. Go to section; Calibrating LockSense.



Communication failure

The locking wedges communicate constantly with the QCG via radio.

In the event of a communication failure, the driver is warned by the buzzer sounding until communication is re-established. The buzzer can be turned off after 3 seconds.

NOTE: The QCG unit should be mounted high up inside the operator's cab, e.g. against the window, so that there is no signal interference.

Turning off warning sounds

This warning box appears when the warning sound is turned off. **The error will not go away, it has to be remedied immediately.**

Settings - LockSense

"LockSense" in Main Menu

Navigate to "LockSense" in the Main Menu

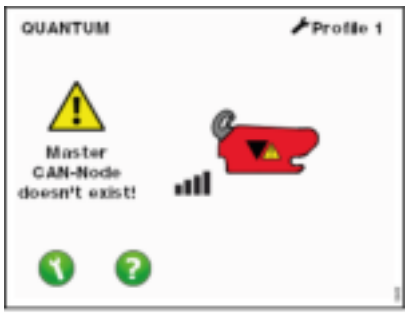
All LockSense settings are behind the service lock. This means that not just anyone can define these LockSense settings.

Quantum Connectivity Gateway (QCG)

Quantum Connectivity Gateway (QCG) installed: This box is checked.

NOTE: If this checkbox is unchecked on the display, no QCG will be expected on the CAN bus.

NOTE: The check box "Standalone LockSense System" should be selected if you have a system consisting of **solely** QCG and Display on the CAN-bus. If you have that configuration and do not select that check box, you get the error message "Master CAN-Node doesn't exist". See bottom picture.



NOTE: The Quantum Connectivity Gateway (QCG) should be mounted high up inside the cab, e.g. against the window, so that there is no signal interference.

Status of LockSense wedges

The status screen shows the current status of the locking wedges:

Signal Strength (RSSI): Indicates the radio communication signal level for each locking wedge

Battery: Shows the battery voltage for each locking wedge.

Angle: Shows the angle in degrees for each locking wedge. Expected values:

• ~0° when the wedges are fully extended without worktools.

• ~10° when the wedges are correctly locked to a worktool.

• ~ (-5°) when the wedges are fully retracted into the quick coupler.

Wedge State: Shows the state of each of the wedges:

• 0 = Wedge fully retracted into the quick coupler

• 1 = The wedge is not correctly locked.

• 2 = Wedge correctly locked

• 3 = The wedge is not correctly locked. The wedge must first be in state 0 so that it can return to state 2.

• 4 = Wedge has calibration error

General LockSense settings

Select one of the following, depending on the type of installation of the machine quick coupler (MQC):

• GPIO

• Inverted GPIO

• CAN

CAN termination can be selected to 0ohm, 120ohm or 600ohm.

Use the checkboxes to indicate the LockSense installation:

• Machine quick coupler (QC)

• Tiltrotator (TR)

MAC Address: MAC Address of the Quantum Connectivity Gateway.

Build Number: Software version for the Quantum Connectivity Gateway

Separate MAC addresses for each locking wedge

The MAC addresses will be displayed here when the system is set up correctly. Although it is possible to set the MAC addresses manually, using the automatic "Wedge Identification" process is recommended.

In the normal digging position (bucket opening facing the operator's cab), set locking wedges QC1 and TR1 on the left side of the quick coupler and tiltrotator, as seen from the operator's cab.

Locking wedge identification

Locking wedge identification is used to identify the locking wedges during a new installation or after replacing one or more locking wedges. Follow the on-screen instructions to ensure that the correct quick coupler or tiltrotator type is selected:

QC: For machine quick coupler

TR: For tiltrotator

Valid Wedges: Shows the number of locking wedges that have been identified and approved. After a successful identification process, two approved locking wedges are available for the machine quick coupler and tiltrotator respectively.

The operator will need a worktool to manually rotate the wedges when prompted during the identification process. This ensures that the correct locking wedges are paired with the LockSense system.

Locking wedge calibration - See section Calibrating locking wedges

This screen allows the locking wedges to be calibrated for both the quick coupler (QC) and the tiltrotator (TR).

Calibration options:

Calibrate QC: Tap to start calibration of the machine quick coupler's wedges.

Calibrate TR: Tap to start calibration of the tiltrotator's wedges.

Important: Each wedge must be fully extended without worktools during the calibration process and must not be physically touched during the process.

Build Number QC1, QC2, TR1 and TR2: Shows the software version of the tiltrotator wedges.

Identification process

To complete the identification process, a worktool is needed to manually rotate the locking wedges, it is necessary to verify that the quick coupler lock can be operated hydraulically and that the "QC Switch Source" is set correctly if the machine quick coupler has LockSense. Note that the QCG settings for the QC lock switch must be correct for the identification of the quick coupler locking wedges to work.

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Identification process - Open the lock

Open the lock for the tiltrotator (TR) or machine quick coupler (QC) and make sure there is no worktool attached.

1) Preparation - Open the lock and make sure both wedges are fully retracted.

2) Start - Click on "Start TR/QC Identification"

Identification process - Open Lock and Start - pop-up screens

Top screen: The tiltrotator lock status has changed

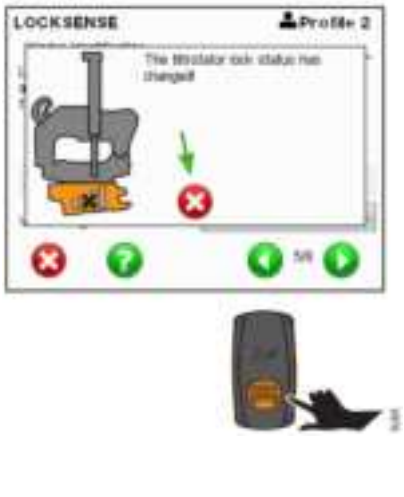
Bottom screen: The tiltrotator lock is open.

Identification process - Search for locking wedges

Searching for nearby LockSense locking wedges

Identification process - Identify specific locking wedges

LockSense locking wedges found. Lock the TR coupling with no worktool attached and make sure both locking wedges are fully extended within 15 seconds



Identification process - Identify specific locking wedges, pop-up screen

The tiltrotator lock status has changed

Identification process - Identify specific locking wedges

Identifying your LockSense wedges...

Identification process - Validate the locking wedges individually

Use a suitable worktool, such as an adjustable wrench or universal pliers, to manually rotate locking wedge 1 clockwise, and the wedges must be turned firmly without much force until it stops, then hold it like that for 3 seconds. Locking wedge 1 is located on the left side as seen from the operator's cab when the tiltrotator is rotated to the normal digging position. Then rotate locking wedge 2 clockwise and hold it for 3 seconds

Identification process - Pair the locking wedges with QCG

The locking wedges are paired with the machine's QCG.

The QCG should be mounted high up, e.g. against the window in the operator's cab, so that there is no signal interference.

Identification process - Pair the lock keys with QCG, pop-up screen

Identification process - Completion

Calibration of locking wedges in LockSense

Calibration process

The calibration is exemplified for tiltrotator worktool attachments, but is done in the same way for machine worktool attachments.

Calibration must be done by or in consultation with a trained technician.

The wedges must be identified and paired prior to calibration.

After calibration, open the wedges and lock them to ensure that calibration was successful.

The QCG should be mounted as high up as possible in the operator's cab, e.g. against the window, in order to minimise signal interference.

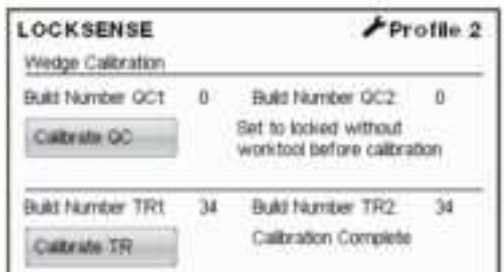
Calibration process - Preparation

Wedges fully extended, and no worktool may be attached.

Calibration process - Start

It is important to select the right (QC or TR) attachment. You can only do one at a time.

Calibration process - Calibration...

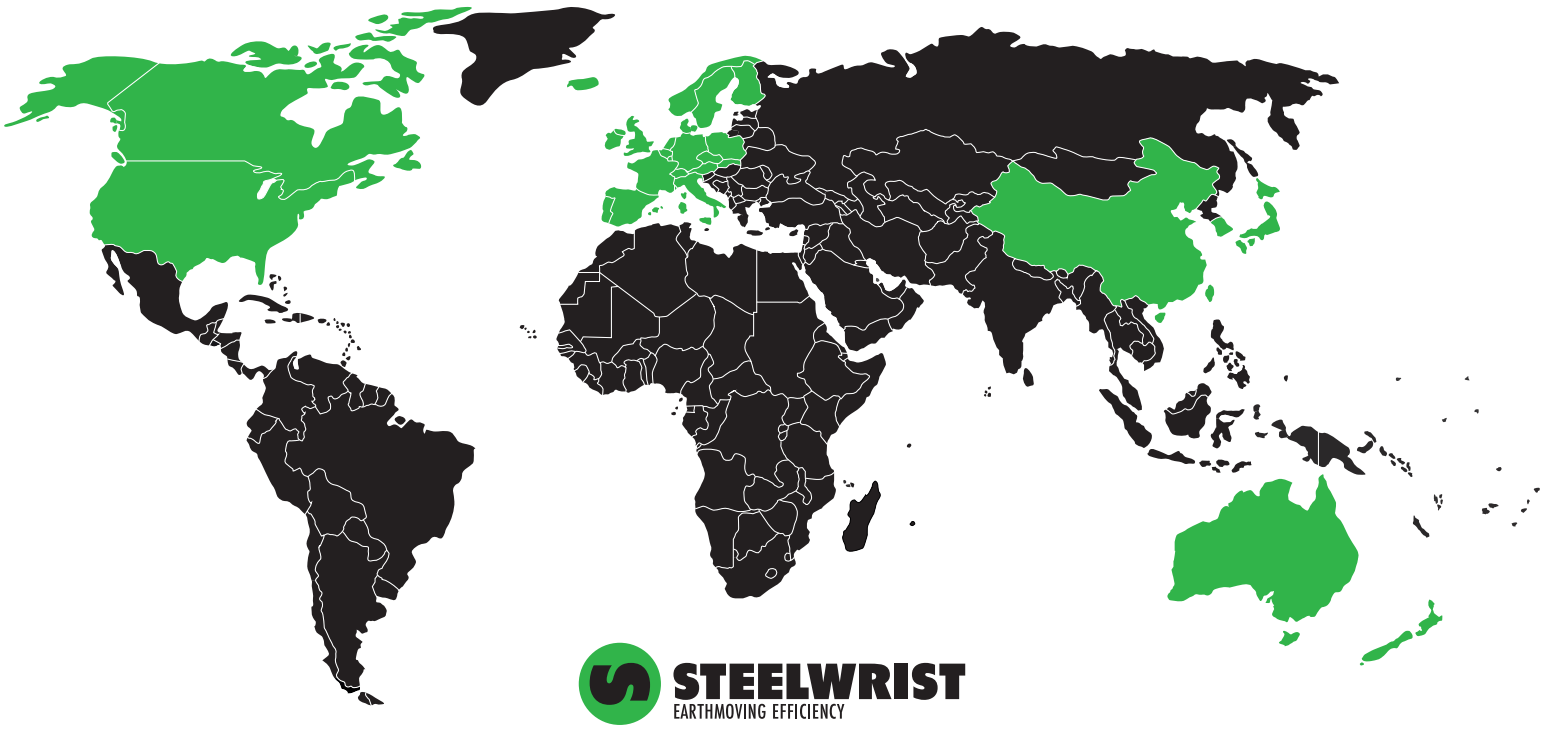


Calibration process - Successful

Calibration process - Check

The angle must be about **0°** when the wedges are fully extended, without worktools, after calibration.

Perform a locking cycle and check that either "No worktool" or "Locked" is displayed for the worktool.



STEELWRIST
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Frequency Bands:
CTA-M Band 1: 1920 MHz to 1980 MHz
CTA-M Band 3: 1710 MHz to 1785 MHz
CTA-M Band 8: 880 MHz to 915 MHz
CTA-M Band 20: 832 MHz to 862 MHz
CTA-M Band 28: 703 MHz to 748 MHz
Bluetooth: 2402 MHz to 2480 MHz
GPS: 1575.42MHz

Max power:
CTA-M Band 1: 25.4dBm
CTA-M Band 3: 25.4dBm
CTA-M Band 8: 25.4dBm
CTA-M Band 20: 25.4dBm
CTA-M Band 28: 25.4dBm
BLE J1: 4.11dBm
BLE J7: 6.65dBm

Modulation Mode:
CTA-M: QPSK/16QAM
BLE: GFSK
GPS: BPSK

Bluetooth V5.1 BLE:
BLE: Channel Spacing: 2MHz

CTA-M: LPWA Antenna, Gain(s): B1: 4.4dBi; B3:4.4dBi; B8: 2.6dBi; B20: 2.6dBi; B28: 2.6dBi
Bluetooth: Metal Antenna, Gain(s): J1: 0.22dBi; J7: -1.72dBi;
GNSS: SMD Antenna.

CE Maintenance

1.Use careful with the earphone maybe excessive sound pressure from earphones and headphones can cause hearing loss.

2.Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.

3.The product shall only be connected to a USB interface of version Type-C.

4.Adapter shall be installed near the equipment and shall be easily accessible.

5.EUT Operating temperature range: 0° C to 40° C .

6.The device complies with RF specifications when the device used at 5mm you're your body.

7.To prevent possible hearing damage. Do not listen at high volume levels for long periods.

Declaration of Conformity

Steelwrist AB hereby declares that this Quantum Connectivity Gateway is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU. In accordance with Article 10(2) and Article 10(10),This product is allowed to be used in all EU member states.

CE

FCC Caution.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-Reorient or relocate the receiving antenna.

-Increase the separation between the equipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.