TRUCK INDUSTRY COUNCIL
SAFER GREENER ESSENTIAL

# Technical Guide

# Procedure for hot component surface temperature testing to support AS2809:2020 Road Tank Vehicles for Dangerous Goods


**Edition 1.1, December 2020**

NSW GOVERNMENT | SafeWork NSW

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Our Ref: CA2020/231, 2019/012847

Mr Chris Loose
Truck Industry Council
PO Box 5350
Kingston ACT 2603

**HOT COMPONENT SURFACE TEMPERATURE TESTING**

Dear Mr Loose

The Competent Authorities Panel (CAP) has considered your application for endorsement of the Truck Industry Council (TIC) Technical Guide titled *Procedure for hot component surface temperature testing to support AS 2809:2020 Road Tank Vehicles for Dangerous Goods*, First Edition dated November 2020.

On behalf of CAP I am pleased to endorse the Technical Guide as one accepted method of measuring hot component temperatures on vehicles for the purpose of compliance with Australian Standard 2809. CAP members have recommended that the Technical Guide be considered for inclusion as an informative appendix to AS 2809 so that it is widely available and maintained alongside the standard.

I would also like to express CAP members' appreciation to the TIC for developing the Technical Guide to support compliance and safe systems of work within the dangerous goods transport industry.

Yours sincerely

Daniel Massey
CAP Chair
State Inspector Dangerous Goods & Explosives
SafeWork NSW

This document is available at www.truck-industry-council.org.
Please refer to this website for the latest version.

For further information please contact
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This Guide was originally developed by the Truck Industry Council (TIC) at the request of TIC members and industry to assist the Dangerous Goods industry to identify the hot components as defined in AS2809:2020 Road Tank Vehicles for Dangerous Goods, that need to be shielded from spillage or loss of containment.

Operators, suppliers and enforcement agencies must comply with the Australian Design Rules (ADRs), the Australian Vehicle Standards Regulations, the Roadworthiness Guidelines and any specific information and instructions provided by manufacturers in relation to vehicle's systems and components.

We wish to acknowledge the invaluable advice from TIC members and Safe Load Program Pty Ltd.

## Use of this Guide

- Where available, Original Equipment (Truck) Manufacturers (OEM) technical information and/or guidelines should take precedence over other information sources. TIC recommends that the vehicle OEM should be consulted before any modifications are undertaken on the vehicle.
- In the event that OEM technical information and/or guidelines is not available, Vehicle Standards Bulletin 6 (VSB6): National Code of Practice Heavy Vehicle Modifications should be used to facilitate the vehicle modification/s.
- In the event that the above information sources are not available and/or do not offer guidance for the modification/s to be undertaken, this Guide may be used to facilitate the vehicle modification/s.

## DISCLAIMER

TIC and its members make no representations and provides no warranty that the information and recommendations contained in this Guide is suitable for use by or applicable to all Original Equipment Manufacturers (OEMs), up to date, complete or without exception. Reliance or use upon the information or recommendations is voluntary and the user accepts all risks and responsibility for any such reliance or use and to the maximum extent permitted by law the TIC and its members excludes all liability to any person arising directly or indirectly out of any such reliance or use.

## Document version control

| Edition | Date | Nature of change / comments | Author/Editors |
|---|---|---|---|
| First | November 2020 | Initial release | Author: Chris Loose, TIC, Technical Officer.<br>Reviewed: Mark Hammond, TIC, Chief Technical Officer. |
| 1.1 | December 2020 | Only change was the inclusion of the CAP endorsement as the inside front cover | As above |

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# 1) Introduction

Australian Standards, AS 2809.1:2020 Road tank vehicles for dangerous goods, Part 1: General requirements for all road tank vehicles and AS 2809.2:2020 Road tank vehicles for dangerous goods, Part 2: Road tank vehicles for flammable liquids (AS2809:2020), are called up in the Australian Code for the Transport of Dangerous Goods. These standards acknowledge that not all vehicle components need to be shielded against cargo spillage, if their surface temperatures operate at 20°C below the autoignition temperature of the cargo carried by the vehicle. This technical guide details a suggested procedure to assess hot components of a vehicle for compliance to AS2809:2020 that could be undertaken by a suitably qualified person.

# 2) Hot component definitions[1]

**Hot component as defined in AS2809.1:2020:**

> *Any surface element of a vehicle's propulsion engine, auxiliary engine, or engine exhaust system that can reach or exceed a temperature of 180°C*
>
> This covers common fuels types of Jet A1, Diesel, petrol and their bio fuel equivalents;
> And;
>
> *If the auto ignition temperature of the cargo to be carried by the vehicle is less than 200°C then any surface element that can reach or exceed a temperature 20°C below the auto ignition temperature of the cargo, is considered to be a hot component.*

Note - The autoignition temperatures of the Dangerous Goods cargo should be sourced from a legitimate expert source.

[1] Source 2809.1-2020 and 2809.2-2020 Road Tank Vehicles for Dangerous Goods Parts 1 & 2.

**Spillage hazards:**

- The road tank vehicle must be designed to avoid cargo drips and spillage onto critical components under normal operation. *Shields or deflectors shall be provided where potential spillage or leakage of cargo could create a hazard*[2].

**Spillage control [3]:**

Any element of the vehicle defined as a "hot component" must *be protected in the event of a cargo spill or leak, by a means of a shield or deflector*.

*The following spillage hazard control requirements must apply:*

*a) The distance between a spillage shield and any cargo-carrying component must be not less than 75mm,*
*b) The minimum distance between any hot component and the spillage shield must be not less than 50mm,*
*c) Either of the dimensions in Items b) and c) can be reduced to not less than 25mm as long as the total distance between the hot component and cargo carrying component is not reduced below 125mm.*

*Note: - Consideration should be given to routing of cargo pipework away from the vehicle brakes.*

Note: - Blocking off the airflow around engine/exhaust system or from exiting under the cab and away from those areas will increase operating temperatures of the engine and its surrounding components. Experience has shown that impeding air flow in such areas will lead to accelerate deterioration of perishable items such as air, oil and fuel lines as well as electric systems, etc.

## 3) Test

**Measurement equipment and technique**

Surface temperature measurement equipment capability: -

An accuracy of at least ±3 °C over the range from 150 °C to 300 °C.

Equipment calibration should be in line with manufacturers guidance and undertaken by a NATA, or an equivalent authorised facility within the equipment manufacturers recommended timeframe.

If a heat gun or camera is to be used, the manufacturer's instructions should be followed. It should be held perpendicular to the measurement point with the narrowest focus point that should not exceed the boundary of the hot component and that can be safely achieved.

[2] Source 2809.1-2020 Road Tank Vehicles for Dangerous Goods Parts 1.
[3] Source 2809.2-2020 Road Tank Vehicles for Dangerous Goods Parts 2

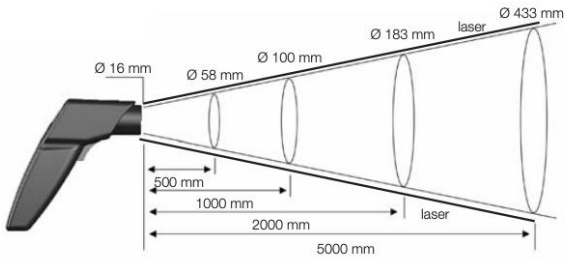


**Figure 1: Example of the focusing range of an infra-red gun or camera**

**Typical areas in which hot component must be assessed, but is not necessarily inclusive of all areas.**

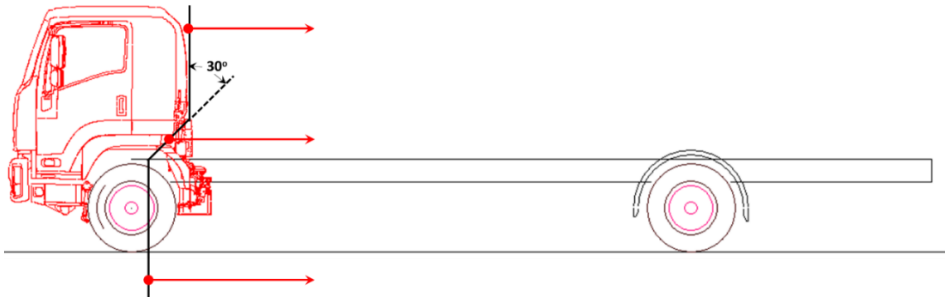


**Figure 2: Example of the area where hot components must be assessed.**

Any exhaust surface or engine component rearwards of the cab or sleeper compartment that can potentially come in contact with spill or leaking cargo must be assessed. Typically, all upward and rearward facing surfaces rear of the vehicle cabin and all surfaces that could potentially be accessed by a cargo spill under the vehicle cabin must be measured as defined by the following planes, as illustrated in figure 2 above:

a) A plane vertically downwards against the back of the cab to top of the rear engine tunnel opening, followed by,

b) A plane 30-degress down and forward through to the top surface of the chassis rail, and finally,

c) A plane vertically downwards to the ground. lowest point rearwards of the intersection.

Note

- A louvred shield or guard could be installed to the rear of the engine tunnel/cab designed to direct spills/leaks or splashes away from hot components under the cab. This would reduce the need for testing and shielding the hot components under the cab.
- If a confirmed hot component extends forward of the vertical plane that extends from the cab's back to the ground, it should be shielded 100 mm forward of this plane to protect from cargo run-off from the shield or cab.
- Examples: exhaust pipes, exhaust manifold, turbo charger, exhaust after treatment component.

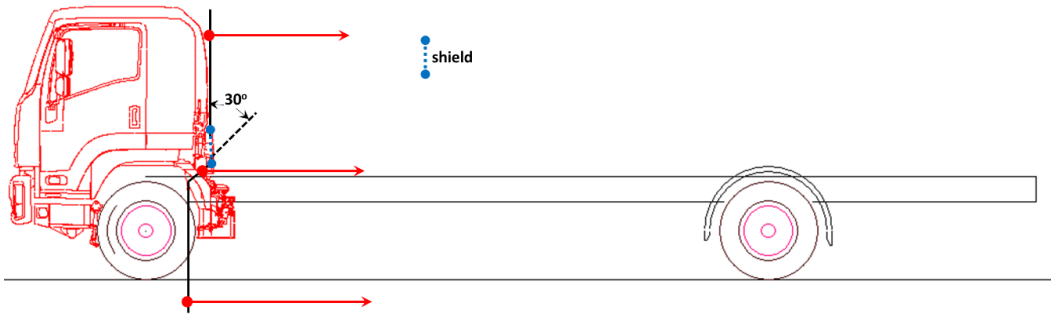


**Figure 3: Example of the area where hot components must be assessed with a shield installed.**

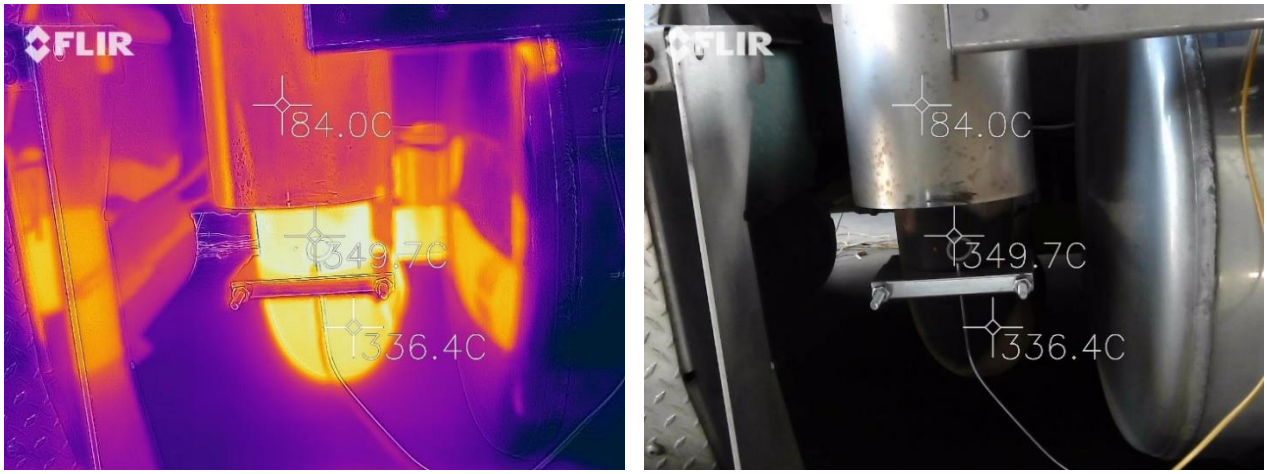


**Figure 4a-b: Exhaust pipe temperature with standard heat shield, taken by thermal camera with and without infra-red filter. Shown under full engine load.**

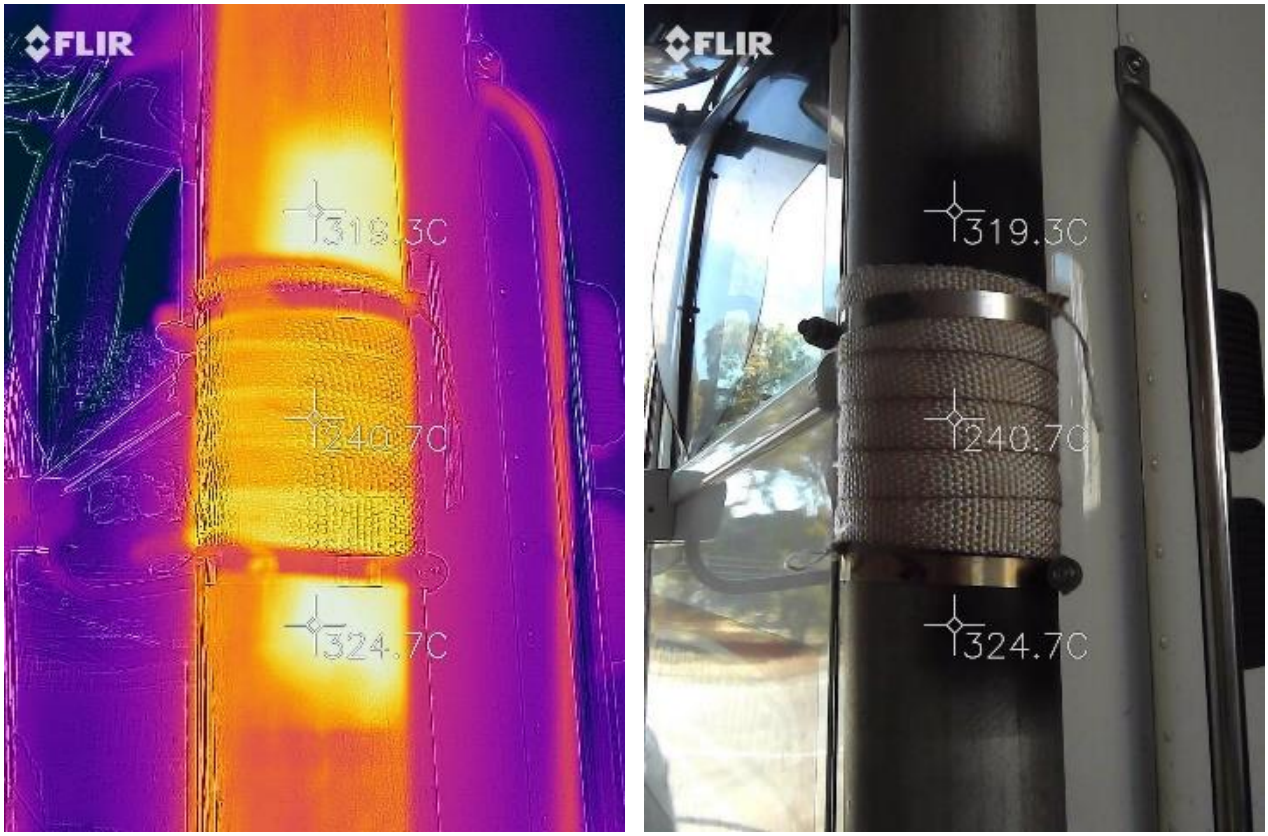


**Figure 5a-b: Exhaust pipe temperature without standard heat shield taken by thermal camera with and without infra-red filter. Note that the fibreglass heat wrap, in this case, is not adequate for compliance to the standard. Shown under full engine load.**

**Use of thermo camera or infra-red gun on surfaces.**

Surfaces that are reflective including components that are galvanised, aluminised or have a chromed surface should not be assessed by either a thermo camera or infrared gun. If required, treat the surface with an appropriate high temperature matt black paint before using these temperature measuring techniques. Alternatively, thermo couples should be used with a data recorder for the assessment.

**Figure 6: Exhaust pipe with heat shield remove. The hot component test surface has been prepared with matt finish ready for thermo camera/gun testing. In this case, a clamped thermo couple was also used to validate the testing approach. Note: in practice only one test method is required.**

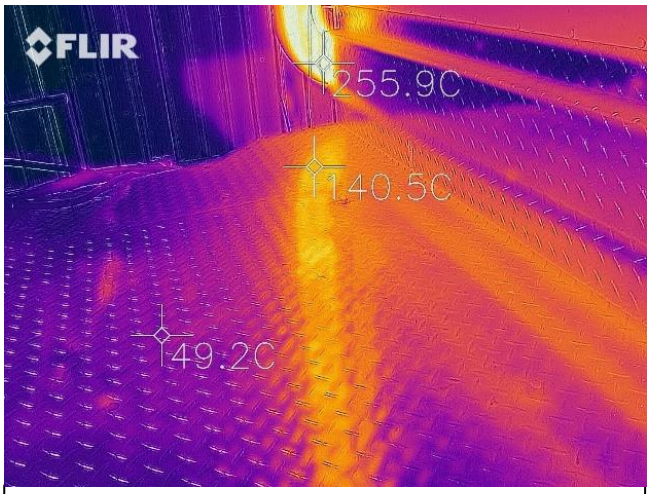


**Figure 7: Deck plate, highlighted by a bright orange colour band, is illustrating the issue of reflected heat off the unshielded vertical exhaust pipe and will result in an inaccurate temperature reading if using an infra-red device. Surface preparation is required and guidance is typically provided with the infra-red measuring instrument.**

...



**Figure 8a-b: Exhaust pipe with After Treatment Device (ATD) without heat shield taken by thermal camera. Note the ATD is double insulated in this case and does not need further shielding.**

**Test conditions:**

- Weather
  Test must be conducted with a minimum ambient temperature greater than 5 °C with no precipitation having occurred 30 minutes before conducting the test. Ambient temperature within 5 metres of any hot components, must be recorded at the start and end of each test with the average used for the assessment of the hot components.
- Vehicle
  For assessment and approval to AS2809:2020, the vehicle must be presented for testing as a completed vehicle modified for the cartage of Dangerous Goods, complete with cargo shields and/or deflectors in order for the testing to confirm effectiveness of the shielding.

CAUTION: - Only vehicles that are free of cargo and flammable vapours should be tested.

**Hot Component test procedure:**

1. Locate and secure the test unit on a chassis dyno as required or to an equivalent device that can load the powertrain to 100% of rated engine power. Follow all safety procedures relevant to the site and the equipment being used. Appropriate personal protective equipment must be used.
2. Record the ambient temperature at start and again at the end of the test cycle. Note: If the ambient temperature varies by more than 5°C for the period of the test, then the test must be recorded as a fail.
3. When safe to do so, start the engine (propulsion or auxiliary), allow about 5 minutes to warm the engine.
4. Engage gear(s) appropriate for the test and test equipment.
5. Increase the engine RPM to governed engine speed, when safe to do so, gradually apply dyno load until engine speed drops by no more than 200 rpm from governed engine rpm with maximum throttle position.
6. Allow hot component temperatures to stabilise for 30 minutes or until the hot component temperature's rate of change is less than 10 °C per hour.
7. Measure and record the surface temperatures of the hot components.
8. Measure and record the surface temperatures for same identified location again after 5 minutes has elapsed. If the identified surface temperature is within ±1 °C of the original temperature, this should be recorded as the maximum surface temperature.

Note: -

- Components identified as potentially reaching hot component status must be measured and recorded at more than one test point. Example: – an engine exhaust manifold would be measured at a minimum of 2 points.
- For trucks equipped with a Diesel Particular Filter (DPF), in order to achieve steady temperatures, it is recommended that a DPF regeneration does not occur during hot component testing. This could be achieved by initiating a regeneration prior to testing, or inhibiting regeneration during the testing period. Allow 30 minutes after the completion of the DPF regeneration cycle before undertaking hot component surface temperature testing.
- Once the unit has been assessed as complying to AS2809:2020, if required, a stationary regeneration of the DPF can be undertaken with a loaded vehicle located in a suitable area. A suitable area is a space located outside all hazardous areas; any area where cargo is transferred and assumes there are no spills, vapour, leaks, or other hazards present.

**Pass / Fail Assessment:**

Ambient test temperature must be corrected for.

Hot components with a maximum surface temperature of 180 °C, or less, is a guide for a pass for the majority of Dangerous Goods for mixed cargos, such as jet A1, diesel and petrol, while operating in ambient conditions of 40 °C or above.

Therefore, if the test is conducted at an average minimum ambient condition of 15 °C, the surface must not exceed 155 °C and proportionally between. That is:

Corrected ambient temperature: 40 °C – 15 °C = 25 °C

Thus, corrected test surface temperature: 180 °C – 25 °C = 155 °C

**Test Report Authorisation requirements:**

Final testing must be witnessed, and the test report authorised by a hot component test assessor/approver.

## 4) Action to be taken by TIC members

The following action will be taken by TIC and its members:

- Encourage members of the OEM's authorised sales and service outlets to advise their customers of this Guide.
- Support the industry to undertake testing effectively and efficiently.

# 5) Glossary of terms and references

The following references apply to this voluntary Technical Guide.

**ATD/ATS - After treatment device / system**

Part of the exhaust system which manages the noxious exhaust emissions of a diesel engine. It can be made up of a SCR catalyst and/or DPF.

**AVE - Authorised Vehicle Examiner**

A registered person assessed as being capable of approving vehicle modifications and capabilities in the state or territory to Vehicle Standards Bulletin (VSB) #6 - Heavy Vehicle Modifications.

**DPF - Diesel Particulate Filter**

Part of the engine's exhaust after-treatment system design to capture exhaust smoke particulates

**Hot component – refer to Section 2 of this document.**

**Hot component test assessor/approver**

This person could be an AVE authorised for Section A Engines of VSB6 within the State or Territory in which the test is being undertaken, or an appropriate qualified representative of the engine, truck Original Equipment Manufacturer (OEM) or competent person as define by AS2809:2020.

**OEM - Original Equipment Manufacturers**

A member of TIC who distributes, manufactures trucks or components as detailed in section 6.

**Shall - Australia Standards' term**

A mandatory requirement and has been replaced in guide with "must".

**Should - Australia Standards' term**

A recommendation in the standard. It is expected that best practice would require these features or their equivalent.

# 6) List of Truck Industry Council (TIC) members *

- Allison Transmissions Australia Pty Ltd
- Cummins South Pacific Pty Ltd
- Daimler Truck and Bus Australia Pty Ltd (Fuso, Mercedes-Benz & Freightliner Trucks)
- Eaton Pty Ltd
- Hino Motor Sales Australia Pty Ltd (Hino Trucks)
- Isuzu Australia Ltd (Isuzu Trucks)
- Iveco Trucks Australia Ltd (Iveco Trucks, Iveco Vans & International Trucks)
- Navistar AusPac Pty Ltd
- PACCAR Australia Pty Ltd (Kenworth & DAF Trucks)
- Penske Commercial Vehicles Australia Pty Ltd (Western Star, MAN & Dennis Eagle Trucks)
- Penske Power Systems Ltd
- Scania Australia Pty Ltd (Scania Trucks)
- Volvo Group Australia Pty Ltd (Volvo, Mack & UD Trucks)

*** Correct as of publication date.**

**A current member listing can be found on the TIC's website – [www.truck-industry-council.org](http://www.truck-industry-council.org)**