

Introducing... **HUB ALERT™** Heat Sensing Labels



HUB ALERT™

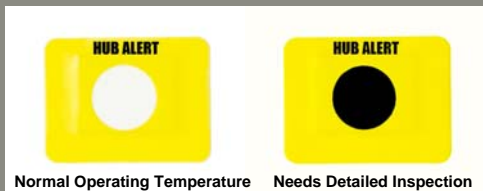
**IDENTIFY ABOVE NORMAL WHEEL
END OPERATING TEMPERATURES
BEFORE THEY CAUSE EXPENSIVE
REPAIRS!!**

- The normal operating temperature of hub/hubcap grease or oil should not exceed 225° F (107° C).
- **HUB ALERT™** will alert you to above normal wheel end operating temperature!



HUB ALERT™

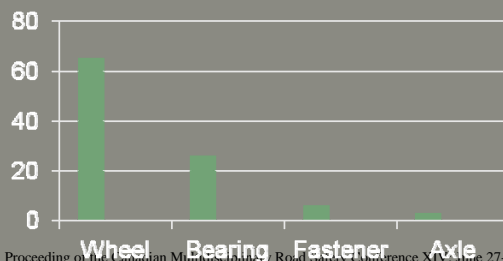
- **HUB ALERT™** heat sensing label will turn **BLACK** when hub/hubcap surface temperature reaches 250°F (121°C).
- **HUB ALERT™** indicates the need for a more detailed inspection of the overheating wheel end.



HUB ALERT™

HUB ALERT™ can reduce the risk of dangerous and costly wheel separation from bearing failure!

- Bearing failure is the 2nd largest cause of wheel separation (26%) after wheel fastener issues.



Source: Proceeding of the Canadian Municipalities Road Safety Conference XIV June 27-30, 2004; Ottawa, Ontario

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Proper Wheel Bearing Installation and Maintenance is Critical for Preventing Bearing Failure.

- Requires following a precise installation procedure for proper adjustment.
- Wheel bearings must be properly lubricated.
- Wheel ends must be inspected regularly for lubricant leaks.
- Inspection for damaged seals and hubcaps is necessary.



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Frequent Hub Cap and Hub Inspection by Driver and Maintenance Staff is the Solution to Lower Maintenance Costs!

- \$300-\$500 replace bearings, seal, oil/grease, labor.
- \$1200-\$1500 to repair axle damage / stub axle.
- \$500 minimum roadside wrecker / service call.

HUB ALERT™ provides convenient, accurate hub and hub cap monitoring by drivers and maintenance staff.



HUB ALERT™

Features:

- Hi-tech sensor integrated with a weather resistant adhesive label
- Thermosensitive area is hermetically sealed against moisture, oil, grease, fuels, solvents, water and steam
- Easy to install and Highly visible for quick problem detection
- Sensor area activates immediately as surface temperature reaches threshold level



HUB ALERT™

Features:

- Sensor accurately identifies overheated hub/hubcap surfaces
- Adhesive attaches label to hub/hubcap and is highly effective in resisting displacement from environmental conditions
- Remains attached during maintenance procedures including high pressure spray washing of wheels.
- Independently tested for both Temperature Activation and Adhesion Effectiveness.



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Benefits:

- Early alert to overheating wheel end issues
- Indicates possible overheating bearings
- Identifies potential leaking seals
- Indicates possible over heating brake conditions



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Benefits:

- Preventative maintenance reduces potentially expensive repairs
- Avoidance of over the road emergency repairs
- Eliminates expensive repair and replacement due to component failure.
- Routine daily inspection prevents potential wheel end problems and equipment downtime.



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How It Works:

- Normal wheel end operating temperatures of Hub or Hubcap oil should not exceed 225°F.



- The **HUB ALERT™** sensor has a preset 250°F temperature threshold at which the sensor will activate.



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How It Works:

- **HUB ALERT™** will commence activation when hub or hubcap surface temperatures reach between 245°F and 250°F.
- When the surface temperature reaches the 250°F threshold temperature the WHITE sensor area turns BLACK.



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How It Works:

- Activation of **HUB ALERT™** indicates that the wheel end operating temperature is above the normal operating level and *a more detailed inspection is required.*
- The heat sensing area of the label remains BLACK until it is replaced. By remaining BLACK even after the wheel end has cooled down, a continuous alert is provided.
- After identifying and resolving the overheating issue, a replacement **HUB ALERT™** needs to be installed for continued monitoring of the wheel end temperature.

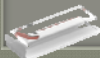


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INDEPENDENTLY TESTED:

Exova, a global provider of laboratory testing, advising and assuring services was selected to perform 2 test studies:

- ❖ Temperature Activation of **HUB ALERT™** Heat Sensing Labels (EXOVA REPORT NUMBER 11-15-C0165B Revision 1)
- ❖ Adhesion Effectiveness of **HUB ALERT™** Heat Sensing Labels (EXOVA REPORT NUMBER 11-15-C0165A Revision 1)



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Temperature Activation:

Three sets of Temperature Activation Tests were conducted as follows:

1. Temperature activation of 5 **HUB ALERT™** labels attached to a steel hub and hub cap.
2. Temperature activation of 3 **HUB ALERT™** labels attached to a plastic hub cap.
3. Temperature activation of 3 **HUB ALERT™** labels attached to an aluminum hub cap.



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Temperature Activation Procedure:

- Prior to application, surfaces were pre-cleaned with degreaser and/or sandpaper as required.
- Hub and hubcaps were filled with hub oil and surface temperature was recorded.
- Oil was heated gradually with a heat probe and surface temperatures were monitored.
- Temperature at which initial **HUB ALERT™** activation occurred was recorded.
- Temperature at which full activation of **HUB ALERT™** occurred (sensor area turned BLACK) was recorded.



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Temperature Activation Results:

HUB ALERT™ temperature activation occurred at the preset threshold temperature of 250°F within the acceptable specification variance of plus or minus 2.5%

- Plastic hub cap activation 244°F to 246°F
- Aluminum hub cap activation 246°F to 248°F
- Steel hub and hub cap activation 246°F to 252°F



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Adhesion Effectiveness:

Three sets of Adhesion Effectiveness Tests were Conducted as follows:

1. Pressure Washing Resistance after overnight conditioning at ambient laboratory temperature
2. Pressure Washing Resistance after overnight conditioning at 225 °F
3. Pressure Washing Resistance after overnight conditioning at -25 °F



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Adhesion Effectiveness Procedure:

- Prior to application, surfaces were pre-cleaned with degreaser and/or sandpaper as required.
- **HUB ALERT™** heat sensing labels were applied to a Plastic hub cap, Aluminum hub cap and a Steel hub and hub.
- After conditioning the hub and hubcaps to specified temperatures water pressure at 2,000 psi was sprayed from 12 inches onto the heat sensing labels.
- **HUB ALERT™** labels were subjected to constant pressure for 3 seconds using multiple “pass by strokes”.



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Adhesion Effectiveness Results:

All **HUB ALERT™** heat sensing labels successfully resisted lifting, loosening or washout during the 2,000 psi pressure spraying at ambient temperature (80°F), extreme heat conditions (225°F) and severe cold temperature (-25°F).

- *“Regarding the pressure washing resistance tests performed after conditioning at ambient temperature (27°C, 81°F), none of the labels applied to the aluminum, plastic and steel hubs exhibited any visible loss of adhesion after spraying, nor any other visible signs of deterioration.”*



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Adhesion Effectiveness Results:

- *“Regarding the pressure washing resistance tests performed after conditioning at hot temperature (107°C, 225°F), none of the labels applied to the aluminum, plastic and steel hubs exhibited any visible loss of adhesion after spraying, nor any other visible signs of deterioration.”*
- *“Regarding the pressure washing resistance tests performed after conditioning at cold temperature (-32°C, -25°F), none of the labels applied to the aluminum, plastic and steel hubs exhibited any visible loss of adhesion after spraying, nor any other visible signs of deterioration.”*



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