

| NAVISTAR INC.                                                                                                                                                                                                                                                                                                                           |                                       |                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------------------------------|
| TMS<br>(TRUCK MATERIAL SPECIFICATION)                                                                                                                                                                                                                                                                                                   |                                       | NUMBER:<br>TMS- 4514                    |
| TITLE:<br>Ink-Striping Cross-Linked Polyethylene Wire Insulation                                                                                                                                                                                                                                                                        | CURRENT REV No.:<br>0912              | DATE:<br>December 2009                  |
| WRITTEN/EDITED BY:<br>Materials Engineering                                                                                                                                                                                                                                                                                             | APPROVED BY:<br>Materials Engineering | SUPERSEDES:<br>Rev. B-1, September 2000 |
| <b>PRINTED COPIES OF THIS DOCUMENT MUST BE VERIFIED FOR CURRENT REVISION</b>                                                                                                                                                                                                                                                            |                                       |                                         |
| <i>This specification may involve hazardous materials, equipment, and procedures. This specification does not purport to address all of the safety issues associated with its use. The user is responsible to consult appropriate safety and health practices and to determine the applicability of regulatory limits prior to use.</i> |                                       |                                         |
| Change Notice: Replaced "International Truck and Engine Corporation" with "Navistar, Inc." per corporate directive; added CEMS B-50 requirement; editorial changes.                                                                                                                                                                     |                                       |                                         |
| Reference: File 30-14G                                                                                                                                                                                                                                                                                                                  | Keywords: Striping; Wire Insulation   |                                         |

## 1.0 APPLICATION

This specification covers inks used to put stripes and hash marks on cross-linked polyethylene insulated wire. The specification provides inks that will give a distinct color on various colors of insulation and possess excellent color retention.

## 2.0 SCOPE

This specification covers the general requirements, property and performance requirements, test methods and quality control of color coded wire.

### 2.1 Restricted Chemical Substances

Effective January 1, 2007, all product supplied to the requirements of this specification must comply with the requirements of the CEMS B-50 specification.

## 3.0 REFERENCE DOCUMENTS

Unless otherwise specified, the latest issue of all referenced standards shall apply. The following standards, specifications and regulations are referenced in this specification.

|                                              |                     |
|----------------------------------------------|---------------------|
| Quality System Standard ISO 9001 or TS-16949 | NAVISTAR CEMS B-50  |
| CFR Title 29, Section 1910                   | NAVISTAR CEMS GT-31 |
| NAVISTAR Manufacturing Std. MS-D-13          | NAVISTAR TMS-9543   |
| NAVISTAR Eng. Design Std. A-16               |                     |

## 4.0 REQUIREMENTS

### 4.1 Liquid Properties

#### 4.1.1 Material

The inks shall be formulated for use on cross-linked polyethylene. The following colors shall be available: Black, White, Yellow, Red, Green, Blue, Orange, Brown, Violet, Gray, Pink, Aqua, Silver, Gold. The colors shall match color chips available from Materials Engineering, TDTC.

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|----------------------------|--------------------------------------------------------------------------------|--------------------------|

#### 4.1.2 Stability

There shall be no leveraging or curdling of the ink after being stored for 30 days at room temperature [ $21 \pm 3^{\circ}\text{C}$  ( $70 \pm 5^{\circ}\text{F}$ )] in a 3/4 filled sealed container. Settling, which can be readily dispersed with agitation, is permissible.

#### 4.1.3 Toxicity

The ink shall not contain any benzene, aniline oil, or hydrolizable chlorinated hydrocarbons, and constituents must be approved by Navistar Safety Department.

#### 4.1.4 Reduction

The use of the recommended solvents to reduce the viscosity for processing shall not affect the intensity of color for identification and/or dry film performance.

### 4.2 Dry Film Properties

#### 4.2.1 Chemical Resistance

The inks, when properly applied to cross-linked polyethylene, shall withstand degradation when subjected to immersion in the test fluids indicated in Table 1.

##### 4.2.1.1 Test Method

Immerse or expose a section of the striped wire in the indicated test fluid(s) for the specified time period at the specified temperature. Then remove the wire and dry with an absorbent paper towel, unless otherwise indicated.

##### 4.2.1.2 Required

The ink stripe shall not have been removed by the solution nor the wiping action of the towel.

**Table 1 – Immersion test Fluids**

| <u>Fluid</u>                | <u>Temperature</u>                                         | <u>Time</u> |
|-----------------------------|------------------------------------------------------------|-------------|
| Gasoline                    | $21 \pm 1^{\circ}\text{C}$ ( $70 \pm 2^{\circ}\text{F}$ )  | 48 Hours    |
| Brake Fluid                 | $21 \pm 1^{\circ}\text{C}$ ( $70 \pm 2^{\circ}\text{F}$ )  | 48 Hours    |
| Diesel Fuel                 | $21 \pm 1^{\circ}\text{C}$ ( $70 \pm 2^{\circ}\text{F}$ )  | 48 Hours    |
| Ethylene Glycol (50% water) | $82 \pm 3^{\circ}\text{C}$ ( $180 \pm 5^{\circ}\text{F}$ ) | 5 Minutes   |
| SAE 20 Engine Oil           | $21 \pm 1^{\circ}\text{C}$ ( $70 \pm 2^{\circ}\text{F}$ )  | 48 Hours    |
| Steam Blast w*/cleaner      | $21 \pm 1^{\circ}\text{C}$ ( $70 \pm 2^{\circ}\text{F}$ )  | 5 Minutes   |
| Engine Cleaner *            | $21 \pm 1^{\circ}\text{C}$ ( $70 \pm 2^{\circ}\text{F}$ )  | 10 Minutes  |

\* Samples shall be rinsed in water and allowed to dry without wiping.

### 4.3 Ultraviolet Light Stability

#### 4.3.1 Test Method

Expose a sample of striped wire for 800 hours in a Q Panel QUV machine at 8/4 cycle (8 hours UV light, 4 hours condensation) per CEMS GT-31 method C.

#### 4.3.2 Required

The ink shall not be removed or lose its color identification at the conclusion of the specified test period.

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