| INTERNATIONAL TRUCK and ENGINE CORPORATION | | |
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| **CEMS (CORPORATE ENGINEERING MATERIAL SPECIFICATION)** | | *NUMBER:* **CEMS D-15, Part II** |
| *TITLE:* **"O" Ring Materials** | | ***CURRENT ISSUE DATE:*** **December 2001** |
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***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.***

*Change Notice:* **Editorial Changes**

Part II

## 1.0 SCOPE

This specification is in two parts:

Part I - General Elastomeric Materials
Part II - "O" Ring Materials

This part of the specification covers the material requirements of elastomeric materials for "O" rings, rectangular section rings and similar seals or gaskets, used for static or dynamic applications in the Corporation's products. General requirements for rings are cited in the Engineering Standard Parts Book, Sections S and SM, with which this part of the specification will be used.

## 2.0 INTRODUCTION

"O" ring seals are used to prevent leakage in joints of systems carrying various types of fluids at various pressure levels.

## 3.0 CONTENTS


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## 4.0 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 QS-9000 (*ISO 9001*)
INTERNATIONAL IQR Quality Standard
INTERNATIONAL Manufacturing Standard D-13
CFR Title 29, Part 1910
INTERNATIONAL CEMS DT-1
INTERNATIONAL CEMS DT-6

ASTM D 573
ASTM D 1414
ASTM D 1415
ASTM D 1418
ASTM D2000
SAE J 200
SAE J 1703

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## 5.0 CLASSIFICATION OF COMPOUNDS — Part II

The "O" ring seal materials are classified by material type, hardness, and application. Six classes of compounds are covered by this specification. These are listed, with their intended usage, in Table I.

**TABLE I - CLASSIFICATION OF COMPOUNDS**

| Designation | | | | Typical Material (Rubber) | Hardness Shore A | Application | Resistant to |
|---|---|---|---|---|---|---|---|
| International Class | Obsolete International Class | Approx ASTM D 1418 | Approx SAE J 200 ASTM D 2000 | | | | |
| 3 | - | EPDM | CA | ethylene propylene | 70 - 80 | static | nonmineral oils, alcohols, brake fluids or fire resistant fluids such as phosphate esters |
| 3A | - | EPDM | CA | ethylene propylene | 85 - 95 | same as Class 3 – for use with greater pressures and more severe operating conditions | same as Class 3 |
| 5 | 1,2 | NBR | BK | nitrile | 70 – 80 | static and dynamic close tolerances | gasoline, oils, hydraulic fluids, water and 50:50 water – ethylene glycol |
| 6 | 4 | NBR | BK | nitrile | 85 – 95 | same as Class 5 – for use with greater pressures and more severe operating conditions | same as Class 5 |
| 7 | - | FPM | HK | fluoro-carbon | 70 – 80 | static and light dynamic duty and high temperature | hydraulic fluids, fuels and lubricants at temperatures -40ºC (-40ºF) to 230ºC (450ºF) * |
| 8 | - | FPM | HK | fluoro-carbon | 85 – 95 | same as Class 7 – for use with greater pressures | same as Class 7 * |

*Under certain conditions, Class 7 and 8 rings will perform satisfactorily in water and water-ethylene glycol environments. The appropriate materials engineering department should be consulted regarding these applications of Class 7 and 8 rings.

### 5.1 Engineering Qualification (Classes 5, 6, 7, and 8)

Production material can be furnished under this specification only after formal Engineering Qualification. The appropriate purchasing department (refer to the Corporate Purchasing Delegation Manual available from Purchasing and Supplier Development), or Group Engineering facility provided the delegated buyers are notified, will request Materials Engineering, or a Materials Engineering designated facility, to conduct the Engineering Qualification tests with the supplier furnishing all the required samples. Materials submitted for qualification will be accompanied by detailed test information and also by certification that the material meets all requirements of this specification.

After the material has been tested by the approved facility, the design engineering departments will be notified and, if appropriate, invited to conduct performance tests as deemed necessary. On completion of these tests, the purchasing departments involved and all engineering departments will be notified that the material has been either qualified or rejected.

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**Part II**

**5.1 Engineering Qualification (Continued)**

Material subsequently supplied to this specification will have the same formulation as the qualification samples. Any change in composition or method of manufacture will void the qualification and preclude the materials usage for International Truck and Engine Corporation. After reviewing the details of the proposed change in material composition or method of manufacture, the appropriate International purchasing and engineering departments and Materials Engineering may elect to waive requalification evaluations and grant qualification to the product.

Samples submitted for test will consist of 200 SAE 214 "O" rings and 6 ASTM test buttons and slabs.

## 6.0 GENERAL REQUIREMENTS

Requirements for rings of Classes 3, 3A, 5, 6, 7, and 8 are shown in Tables II, III, IV, V, and VI. Inspection tests will be conducted on production rings except where size makes this impractical. In these instances, the supplier will furnish the same compound in SAE 214 "O" rings, unless other suitable size "O" rings are specifically requested by the International manufacturing plant.

**TABLE II - PROPERTY REQUIREMENTS FOR CLASSES 3 AND 3A**

| PROPERTY | | CLASS 3 | CLASS 3A |
|---|---|---|---|
| **ORIGINAL PROPERTIES** | | | |
| Hardness, Shore A | | 70 to 80 | 85 to 95 |
| Tensile Strength, min | psi | 1200 | 1000 |
| | MPa | 8.3 | 6.9 |
| Ultimate Elongation, % min | | 100 | 80 |
| Modulus at 100% Elongation | psi | 400 | 800 |
| | MPa | 2.8 | 8.5 |
| **HEAT AGED PROPERTIES** | | | |
| Aged 70 hours at Aging Temp | | 100ºC (212ºF) | 100ºC (212ºF) |
| Hardness, points change from original hardness, max | | +10 | +10 |
| Tensile Strength, % change from original tensile strength, max | | -15 | -20 |
| Elongation, % change from original elongation, max | | -45 | -50 |
| **COMPRESSION SET PROPERTIES** | | | |
| Compression Set, 70 hours at set temperature | | 100ºC (212ºF) | 100ºC (212ºF) |
| Compression Set, % max | thickness to 0.110 inch (2.8 mm), incl | 50 | 50 |
| | thickness over 0.110 inch (2.8 mm) | 45 | 45 |

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