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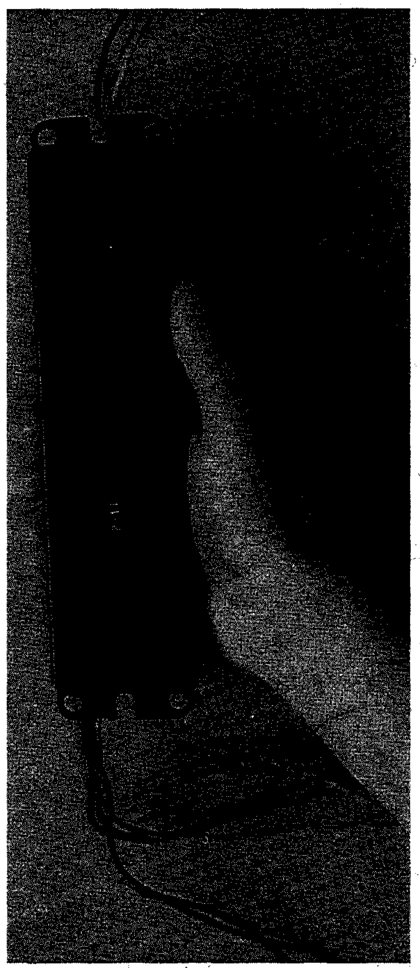

Identification of Lamp Ballasts Containing PCBs

Report EPS 2/CC/2
(revised)
August 1991

Canada

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ENVIRONMENTAL PROTECTION SERIES

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Commercial Chemicals Branch
Environment Canada

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Readers' Comments

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Abstract

Information was collected on the operation, construction, identification, storage and disposal of lamp ballasts. Particular attention was given to identifying lamp ballasts that could contain PCB-filled capacitors.

Résumé

On a recueilli des renseignements sur le fonctionnement, la constitution, l'identification, le stockage et l'élimination des ballasts de lampes. Une attention particulière a été portée à l'identification des ballasts dont les condensateurs contiennent des BPC.

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Section 1

Introduction

Public concern has been growing about the use of polychlorinated biphenyls (PCBs) in commercial products. Lamp ballast capacitors are among some of the products that may contain PCBs. Inquiries from government agencies (federal, provincial, and municipal), industry, and the public have increased with the growing knowledge that PCBs are in such widespread use. Inevitably, the inquiries concern: the potential for PCB leakage from ballast capacitors; the risk of heating and exploding; how to identify a ballast that contains PCBs; and, of course, the potential risk to human health.

To answer these questions, Environment Canada conducted a study concerning the identification of ballasts containing PCB-filled capacitors; domestic and foreign manufacturers of PCB-containing ballasts; the total quantity of PCBs in use in ballasts; and any potential problems. This study does not address the actual or potential risk to human health arising from the use of PCB-ballasts in fluorescent lamps since this is within the mandate of Health and Welfare Canada.

The study was undertaken by the Commercial Chemicals Branch of Conservation and Protection, which is responsible for enforcing the *Canadian Environmental Protection Act* (CEPA) and the regulations and interim orders developed under the Act that pertain to commercial chemicals.

Ballast Use and Location

Fluorescent and High Intensity Discharge (HID) lamps require ballasts. A ballast is designed to maintain a constant current through it, despite variations in applied voltage or changes in the rest of the circuit. As current passing through the ballast increases, the ballast increases in impedance; likewise the ballast decreases in impedance as the current passing through it decreases. The ballast acts, therefore, as a variable load on the system, differing from "load resistors" which have a constant resistance. The required ballast action is obtained by using a reactive and capacitive component to limit the lamp current. Any increase in the current passing through the ballast causes an increase in the temperature which results in a slight increase in resistance and reduces the current.

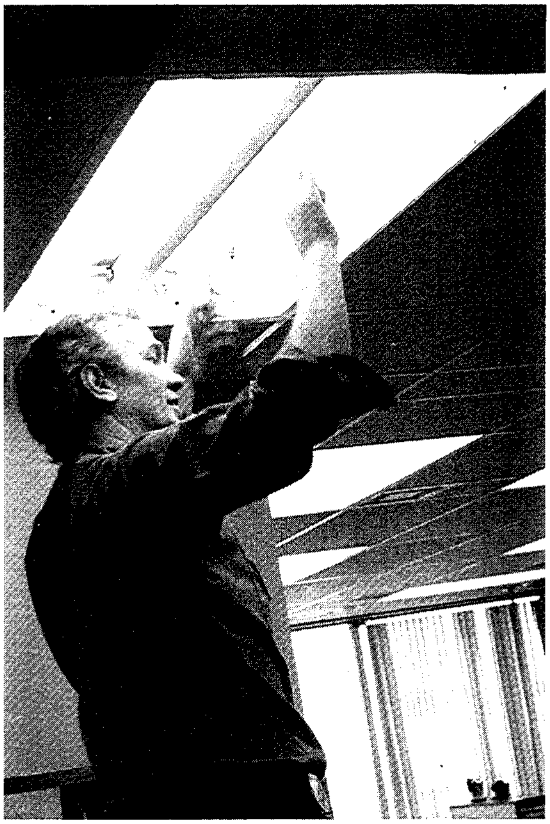
Ballasts are used to compensate for any variations in the line voltage or to compensate for negative volt-ampere characteristics of other devices, such as fluorescent lamps and other vapour lamps. Ballasts permit the economical dimming and flashing of rapid-start lamps, providing a range of applications and control not possible with previous lamp types. These rapid-start lamps are commonly used in flashing signs, and in residential and commercial lighting where continuously variable illumination levels are desired.

2.1 Fluorescent Lamp Ballasts

There are several different types of fluorescent lamp ballasts. The most common is the rapid-start ballast used to operate two, four-foot fluorescent lamps. Fluorescent lamp ballasts are usually mounted between the fluorescent tubes on the light fixture and are shielded with a metal protective device which reduces heat radiation (Photo 1).

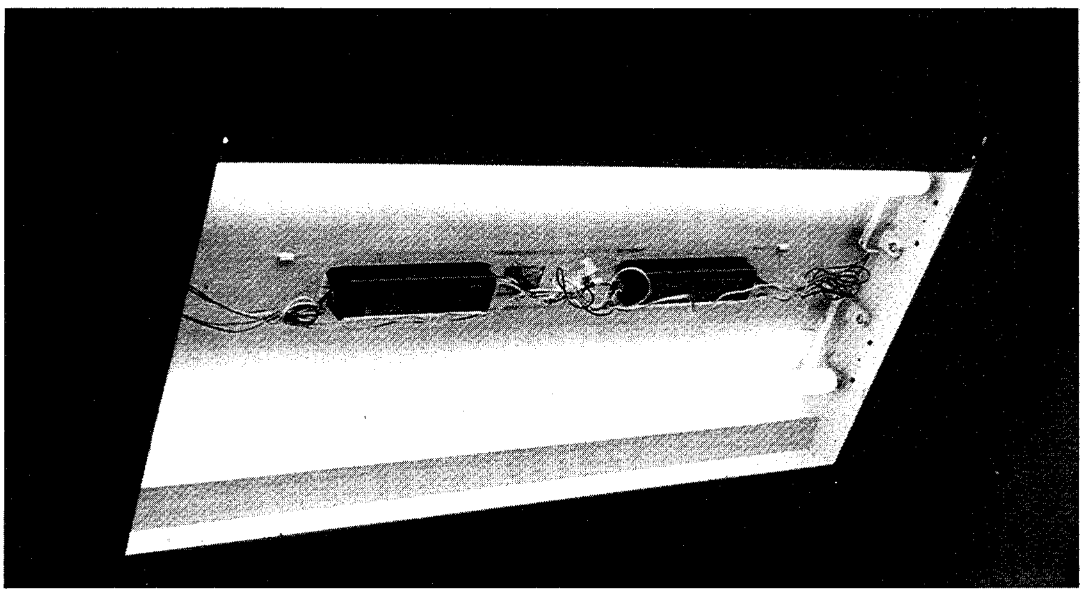
2.2 High Intensity Discharge (HID) Lamp Ballasts

High Intensity Discharge (HID) lamps differ in appearance from fluorescent lamps but have similar electrical characteristics and require ballasts for starting and controlling the lamp circuit. The main types of HID lamps are mercury, metal halide, and high-pressure sodium. High Intensity Discharge ballasts can be found both outdoors (e.g., in streetlamps) and indoors (e.g., in indoor parking garages). The ballast is either enclosed in its own box and fastened to the outside of the light fixture or located inside the light housing.



1a. The fluorescent tubes on both sides of the heat shield are removed for access to the ballasts.

1b. The heat shield is removed, exposing the lamp ballasts.



1c. Exposed lamp ballasts.

Photo 1 Fluorescent Lamp Unit

Description of Ballasts and Capacitors

3.1 Ballast Construction

3.1.1 Fluorescent Lamp Ballasts

The housing of a typical ballast for two, 40-watt lamps is heavy-gauge steel measuring 5.8 x 2.16 cm (not including the mounting brackets). Typical ballasts contain a reactor (a core and coil assembly), a capacitor, and a thermal protector (Photo 2). The reactor measures approximately 10.2 × 5.5 × 3.8 cm deep. It is the capacitor that could contain PCBs.

When the ballast is manufactured, the core and coil assembly are mounted inside the ballast housing and are connected to the capacitor. The colour-coded, interconnecting wires are designed primarily for ease of installation. Fluorescent ballasts are filled with an asphalt/silica compound which is mixed with very fine silica powder. This compound serves to dissipate heat, protect from moisture, and reduce sound produced by the core and coil assembly.

Fixture safety specifications from the Canadian Standards Association (CSA) require that the ballast case temperatures not exceed 90° C under normal operation. Furthermore, the thermal protector within the ballast (Photo 2) de-energizes the circuit when the internal temperature exceeds 105° C. The thermal protector may be either an automatic resettable type or a non-resettable type. Once the non-resettable protector is deactivated by high temperature, the ballast must be replaced. Some ballasts are designed to de-energize at 120° C, at which temperature a small amount of asphalt compound may soften and leak out.

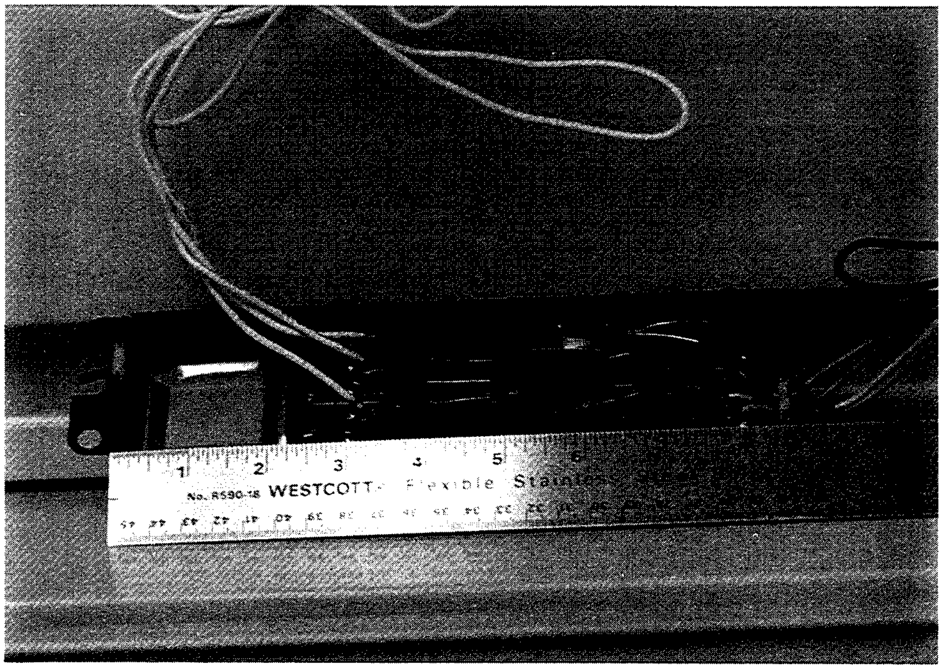
3.1.2 High Intensity Discharge (HID) Ballasts

Because most HID lamps operate at much higher wattage than fluorescent lamps, the average HID ballast requires much higher reactance and capacitance than the typical fluorescent ballast. Some HID ballasts do not have an asphalt seal and some have more than one capacitor. The PCB content of the capacitor depends on its voltage and capacitance ratings. These ratings depend on the size and type of lamp and the performance specifications of the ballast. Generally, metal halide lamps require higher voltage than mercury lamps. Most HID ballasts contain between 0.091 kg and 0.386 kg of PCBs.

3.1.3 Potential for PCB Release from Ballasts

Because of the elaborate physical containment of the components in fluorescent lamp ballasts and their low normal operating temperatures, it is unlikely that PCBs will escape into the environment. It is possible, however, for a ballast to overheat and some of the asphalt compound to leak out. It is this small amount of asphalt compound that is generally mistaken for a PCB leakage. When cooled to room temperature, the asphalt will re-harden; however, the PCB dielectric from a capacitor, if present, will remain as a heavy oil.

High Intensity Discharge ballasts without asphalt sealant have a greater potential for leakage due to puncture or perforation of the capacitor. These ballasts are sometimes located where they are exposed to moisture



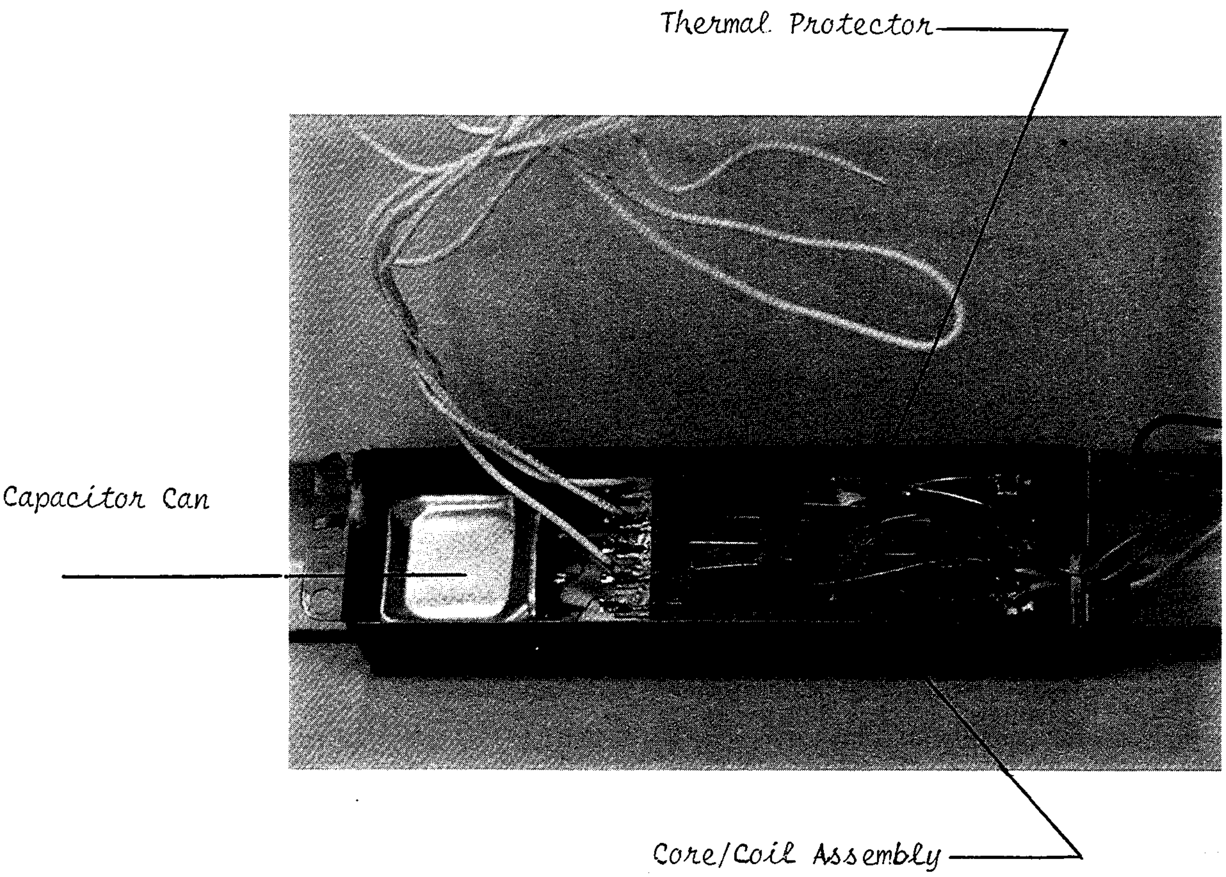


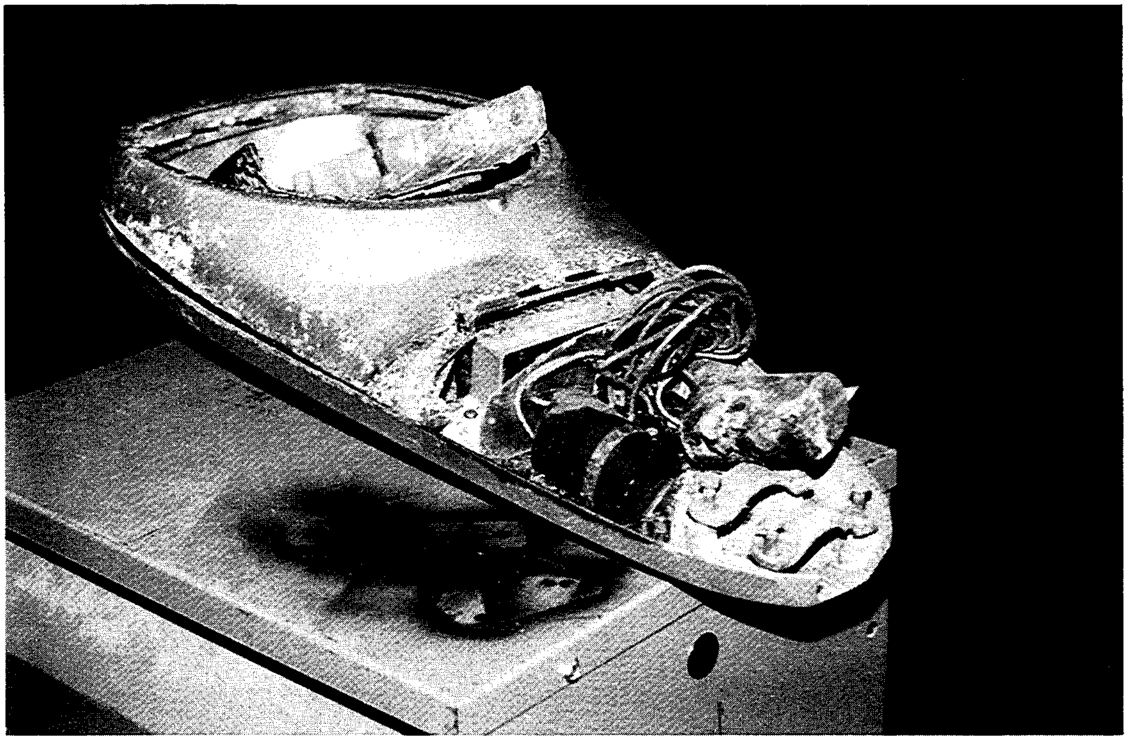
Photo 2 Components of a Fluorescent Lamp Ballast

and road salt. Photo 3 shows a used street lamp with rusted internal components.

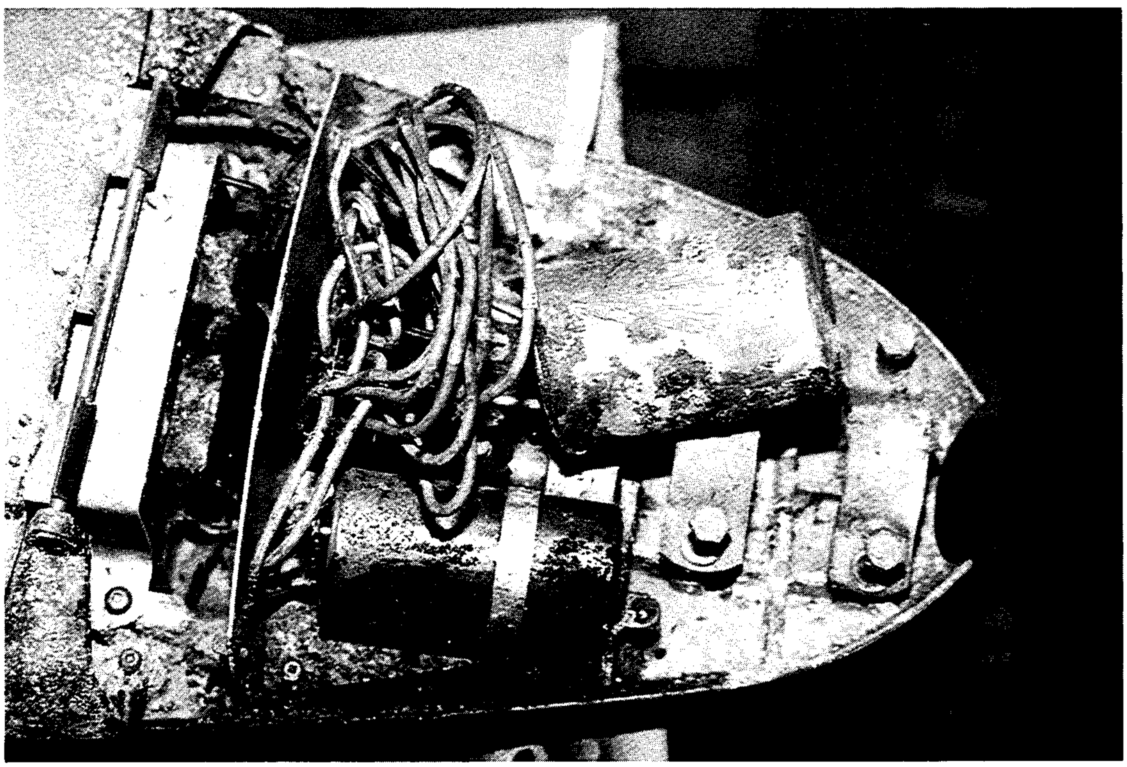
3.2 *Ballast Capacitors*

There are many types of capacitors and they differ primarily in the type of material used as a dielectric. Typical dielectrics are plastic-film, mica, ceramic, and oil-impregnated paper. In ballast capacitors manufactured with oil-impregnated paper, one of the oils used was PCBs.

A typical capacitor can for a fluorescent ballast is 5.1 × 5.1 × 1.9 cm and is made of tinned steel. A capacitor used for two, four-foot fluorescent lamps contains 23.6 g (17.2 mL) of PCBs. The largest amount of PCBs found in a ballast is in fixtures for 1500 Metal Halide lamps, which have three capacitors and are used only outdoors. Each of the capacitors in these lamps could contain about 185 mL of PCBs. Some of the PCBs are absorbed in the paper layers of the capacitor.



3a. HID Street Lamp



3b. Close-up of HID Street Lamp

Photo 3 High Intensity Discharge (HID) Street Lamp