ELECTRICAL FIRE ANALYSIS

ABOUT THE AUTHORS

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Todd Kerkhoff was born and raised in Dodge City, Kansas. After graduating from Southwestern Oklahoma State University, he went to work for the Dodge City Fire Department. He subsequently returned to college and earned an Associated Degree in Fire Science and a Masters of Business Administration. He has served as adjunct faculty for Dodge City Community College, an Associate Instructor for the University of Kansas Fire & Rescue Training Institute, and a Contract Instructor for the National Fire Academy. He is an IAAI Certified Fire Investigator and has been appointed to several NFPA Technical Committees, including NFPA 73, *The Electrical Inspection Code for Existing Dwellings*, and NFPA 1033, *The Standard for Professional Qualifications for Fire Investigators.* He currently serves as the Fire Marshal for Consolidated Fire District #2 of Northeast Johnson County, Kansas.

Third Edition

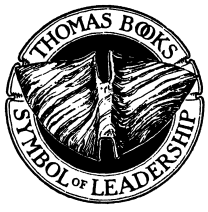
ELECTRICAL FIRE ANALYSIS

By

ROBERT A. YEREANCE

and

TODD KERKHOFF



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PREFACE TO THE THIRD EDITION

The original purpose of this book was to help fire investigators perform their functions more efficiently and accurately. This remains its basic purpose today. However, the book has also proved useful in helping lawyers and others who work with fire investigators appreciate the work of these people and to understand what information they can and cannot provide. This, in turn, enhances the effectiveness of the fire investigator and helps to minimize the frustration of his employers.

Fire investigation has evolved through the years. Today's fire investigator must live within rules largely established by lawyers. In addition, the materials used in homes and work places have changed. Modern man has surrounded himself with flammable materials, with plastics becoming more and more dominant. As I sit writing this, my chair is largely plastic, the desk before me has a plastic finish, the telephone and printer on it are basically organized lumps of plastic, and on the floor there is a carpet and pad that are 100 percent plastic. Plastics generally will burn, and often will melt and flow while burning, thus efficiently spreading a fire. Perhaps I shouldn't have started thinking about this. It's enough to make me a trifle nervous.

This book, and the words in it, will not reduce the hazard. However, it will help the fire investigator analyze a fire scene and arrive at the correct answers to the questions that will be raised by attorneys, home owners, insurance company employees, and others with an interest in knowing the cause. The fire investigator is in a position to provide a useful service but only if he is able to communicate his thoughts and opinions.

Mr. Yereance's teaching experience has been helpful in this communication. He feels that if he could teach electrical engineering to young, hopeful students, he should be able to explain fire origins to attorneys and ultimately to juries. He has been highly successful at this. The opinions he has expressed have been based on the evidence and his analysis of it. If this analysis indicated that the people who hired him were in the wrong, he has not hesitated to tell them. On a few occasions, a client has fired him and hired a different expert, who would give the opinions the client wanted to

hear. However, most were appreciative of this honest input. On one occasion, when he was out of town, his wife told an attorney who called expressing an interest in hiring him, "I should warn you, Bob will tell you what he feels is the truth regardless of which side you are on." To this the attorney replied, "Oh, thank God."

Mr. Kerkhoff's experience in the field of fire investigation comes from the public sector where he serves as a Fire Marshal in suburban Kansas City. His purpose in participating in the writing of this book comes from the industry's need for a definitive treatise pertaining to electrical fire investigation. He recognizes how difficult a challenge a fire investigation can be even for a well-trained investigator. When a complex electrical system is involved, the challenge just becomes that much more daunting.

So study this book and investigate fires with confidence. Present your findings and your interpretation of them clearly. You will soon find that you are providing a valuable service and that your clients appreciate your talents.

R.A.Y.
T.K.

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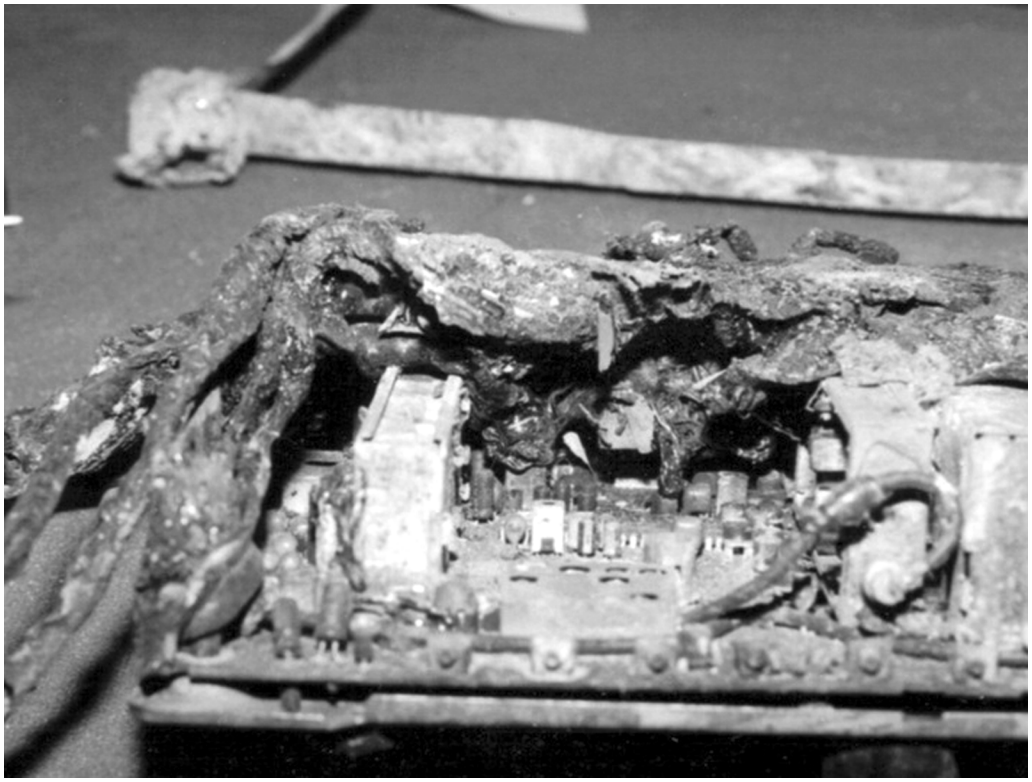
ELECTRICAL FIRE ANALYSIS



Typical Electronics.

Chapter 1

GENERAL BACKGROUND

INTRODUCTION

According to the National Fire Protection Association (NFPA), there are 20,800 fires attributed to electrical distribution or lighting equipment and $697 million of property damage resulting in 330 deaths every year. Actually, no one really knows exactly how many electrical fires occur each year in the United States, nor does anyone know how many lives are lost and how much property damage these fires cause. For years, many fire departments have classified essentially any fire of unknown or uncertain origin as electrical. The chief interest of these fire departments in analyzing a fire scene is to determine whether there is a possibility of arson. If arson does not appear to be a factor, the fire departments lose interest, and the easiest culprit to blame is electricity because this is seldom questioned. Thus, the basic inputs to any statistics-gathering effort are distorted, and any conclusions drawn from the statistics will also be distorted. Yet, even though electricity may be blamed for more fires than it actually causes, it is undoubtedly responsible for a large number of accidental fires.

In 1992, NFPA released the first edition of *NFPA 921, Guide for Fire and Explosion Investigations*. It was hoped that this document, among other benefits, might motivate fire departments to report causes of fires more accurately. It attempts the very difficult task of providing all the information a fire investigator needs. The early versions of *NFPA 921* contained numerous errors and omissions. Many of these have been corrected. The document has been reissued and improved several times and is of great value to the fire investigator. It has become

the definitive treatise in the field of general fire investigation.

In recent years, fire departments have become more sensitive to the need to investigate fire scenes more diligently in an attempt to determine the point of origin and cause with improved confidence. This determination is difficult, and many fire investigators are ill-equipped to attempt it. The majority of fire investigators have arrived at their position as a result of experience as fire fighters. Unfortunately, fighting fires provides little experience in the investigation of fires. The first priority in fighting fires is saving lives. When a blaze is extinguished, the weary fire fighters are ready to retreat to their respective fire stations in no mood or condition to examine the embers. Thus, many fire investigators have come through a hard-knocks school that has prepared them for one trade, only to find they are now expected to be experts in quite another trade. This picture is further complicated by the fact that electricity is a mysterious and poorly understood phenomenon to most people, including fire fighters and fire investigators. They don't know a great deal about electricity.

There are additional interrelated problems. Insurance companies are requiring more and more sophisticated analyses of fire origins to make cases against companies or individuals that may in some way be responsible for these fires. These companies and individuals resist being sued and fight back, not wanting to be unjustly or perhaps even justly held responsible for a catastrophe of whatever proportion. As a result, the fire investigator must not only be more accurate in his determination of the cause of a fire, he must also be able to provide logical reasons to support his conclusions, and he must be able to present these reasons in a manner that is intelligible and convincing to lawyers and juries. Insurance companies also need to know when it is in their best interests to hire an outside fire expert and what can be expected of him. This book is designed to provide guidance in these areas.

Lawyers, in turn, are hopefully knowledgeable about legal matters but may be woefully ignorant about the technical aspects of cases they are hired to present or defend against. They need to know what they can reasonably expect of a fire investigator, both in his role as an investigator and in his role as an expert witness should a lawsuit ensue. Lawyers need to know what the investigator can and cannot do. They need to absorb a degree of background in the field of fire investigation to understand what their experts tell them and to question opposing experts intelligently.

A single book cannot be all things to all people. It is not possible to write a book "to whom it may concern" and produce a result that is useful to anyone. This book is primarily directed to the fire investigator. However, every effort has been made to keep explanations simple and understandable to persons without special knowledge in the hope that this may prove of value to all those with interests in the field of fire investigation. There is occasional repetition in this book. Sometimes it is done for emphasis, sometimes it comes about because the same subject matter deserves discussion under more than one heading. An attempt has been made to minimize this latter category of repetition by referring the reader to other sections of the book, where appropriate. Thus, you will find numerous cross-references throughout the text.

PURPOSE

The purpose of this book is to help you, a fire investigator, determine whether a particular piece of electrical equipment involved in a fire is the culprit that started the fire or is merely an innocent victim damaged by the fire. To do this requires, first, that you perform the role of a fire investigator, gathering facts related to the fire that may help establish its origin, and second, that you interpret these facts to determine the roles of specific equipment in the fire. This book is directed primarily to fires involving electrical equipment. Only a limited attempt is made to instruct you in general fire investigation. However, if you apply the information and approaches presented, you will not only be able to decide which electrical equipment is culprit and which victim, you will also have convincing arguments supporting your opinion. In short, you will have the means to convince yourself, and then a lawyer or insurance adjuster, and finally a jury, that you know what you are doing and have arrived at the only correct answer as to the source of the fire. Although, as noted earlier, a significant amount of accidental household fires are likely electrical in origin, you must remain constantly aware that many fires are not. There are numerous other ways in which a fire can start. It may seem ridiculous to emphasize this point so strongly, but it is necessary that the fire investigator keep an open mind, going where the evidence leads him without bias or preconviction.