NFPA No. 232-1926

PROTECTION OF RECORDS

Consolidated Reports of the

Committee on Protection of Records

Reprinted from Proceedings of

Annual Meetings, 1923, 1924, 1925, 1926

Price forty cents

1926

NATIONAL FIRE PROTECTION ASSOCIATION
INTERNATIONAL
40 CENTRAL STREET
BOSTON, MASSACHUSETTS

D29d-1500-10-26

Committee on Protection of Records

H. P. WEAVER, *Chairman*

J. H. BISSELL
National Electric Light Association
F. A. FALL
National Association of Credit Men
CLARENCE HELLER
Consulting Engineer
S. H. INGBERG
U. S. Bureau of Standards
LEROY E. KERN
American Institute of Architects
WARREN F. KIMBALL
National Retail Dry Goods Association
JOHN C. KNIGHT
National Association Building Owners and Managers
R. K. PORTER
Underwriters' Laboratories
H. E. C. RAINEY
Underwriters' Association of the District of Columbia
W. F. STEFFENS
Railway Fire Protection Association
R. E. WILSON
Associated Factory Mutual Fire Insurance Companies

Note

This pamphlet, consisting of extracts from the reports of the Committee on Protection of Records presented at the meetings of the National Fire Protection Association in 1923, 1924, 1925 and 1926, is printed for the convenience of those interested in this subject. The pamphlet is of a tentative character, and will be revised in future editions as the work of the committee develops. Some sections have been officially adopted, others are incomplete and are subject to revision and enlargement.

NATIONAL FIRE PROTECTION ASSOCIATION.

September, 1926.

Contents

Introduction

(From Preliminary Report, 1923)

Earlier Attitude Toward Care of Records.

Of late there has been a quickened appreciation of the value of records to business, and the alert have not failed to recognize the grave consequences which may follow their destruction by fire. This has stimulated marked progress in the engineering aspects of the subject with the result that the best practice today presents a marked contrast to that of a few years ago. The factors which contributed to this early indifference are of interest because they are by no means eliminated and still operate powerfully to retard recognition of the problems and progress toward its solution. The factors are such as these:

a—There is no direct economic incentive for improving the protection of uninsured records such as is found in the insurance savings which may be secured by the proper safeguarding of insurable property.

b—No proof of loss is required following their destruction since they are uninsured, and attempts to segregate the cost of a record loss have been almost unheard of. Indeed, many of the costs are indirect, concealed, and difficult to ascertain.

c—Reticence as to the consequences of record losses has been almost complete on the part of those who have suffered them. This has encouraged the mistaken inference that the losses have been of little real consequence.

d—"The books" have often been considered the only important records of business. The persistence of this tradition has permitted the neglect of other records equally important.

e—Since records are uninsured, their replacement cost must come out of the earnings of the business, often at a time when it is already crippled by fire. There has been failure to contrast this with the loss of property for which reimbursement in the form of insurance can be secured.

Clearly maximum precautions are justified for an uninsured risk.

f—Misplaced confidence, above all, has caused invaluable records to be entrusted to protective devices of little effectiveness. Many vaults and safes were good. For lack of definite engineering test data many more have contributed only a false sense of security. Today accurately controlled furnace and other tests are disclosing weaknesses hitherto unrealized.

Despite the still existing handicap of these earlier ideas, record protection is thrusting itself forward in a way that demands attention and an answer.

The Present Need.

The present growing interest in record protection is largely, though not entirely, a spontaneous and unguided recognition of need, following along lines of least resistance and often a by-product of other developments. Important progress has been accomplished in many special lines, but now

there is need to view the whole problem broadly, to single out and weigh its various phases, and to recognize those which are under-developed. The Committee should endeavor to advance these backward portions of the whole subject in order that unbalanced knowledge may not lead to faulty conclusions.

Fundamentally, it is now necessary to do three things:

a—Establish the fact that records have a value translatable into dollars, and that their destruction is followed by financial loss, partly indirect but largely direct and measurable.

b—Determine and demonstrate the adequacy or inadequacy of present methods of record protection upon which reliance is commonly placed.

c—Ascertain what modifications of present practice are necessary to secure proper protection.

To do these things wisely, will be no small task, to only a portion of which the Committee can at any one time address itself. In general terms, however, the outline of the fire protection problem may be stated bearing in mind however that the first of the fundamentals above stated is not essentially an engineering question.

The Problem.

The problem of record protection may be considered under two major divisions:

a—General methods of fire protection.

b—Special methods of record protection.

General Methods of Fire Protection.

As to the first, no detailed discussion is required by members of this Association. It is clear that those things which contribute to fire safety in general must contribute to record safety and to the effectiveness of special devices for the protection of records. In this direction the Committee has only to apply the lessons which have been so thoroughly learned and the standards which have been so well developed by the Association in the past.

This important point of difference, however, should not be overlooked. Many records are irreplaceable at any cost. Others have a value which is intangible and not subject to statement in dollars. Still others can be appraised quite as accurately as any physical property. In whichever class they fall they represent, in the aggregate, astonishngly large values—usually far in excess of customary office contents. All of this means that for purposes of record protection there may be ample justification for a degree of protection much beyond customary practice when only commercial and replaceable values are involved. With this in mind, we may turn to more specialized parts of the question.

Special Methods of Record Protection.

In general three basic methods of protection may be distinguished:

a—Duplicate records may be kept at a point not subject to the same fire.

b—Records surrounded by combustible materials may be placed in containers constructed to withstand the heat of a fire and possible falls and blows.

c—Combustible surroundings may be eliminated, or records may be separated from them so that exposure becomes very slight.

Most methods of record protection partake of one or more of these principles. Out of the application of the principles have arisen many in-

teresting questions of systems of duplication, document buildings, vaults, safes, record rooms, steel files, wooden files, supervision of records, record drills, etc.

DOCUMENT BUILDINGS. There are many instances of business concerns and others which have provided at an unexposed location a detached building of strictly fire-resistive construction, in which large numbers of infrequently used but important records may be kept. Many of the characteristics proper to such a building are known, but further study is needed on many other points not yet so clearly established.

VAULTS. Prior to the preparation of the present specifications probably the most authoritative attempt to date to establish standards for the fire-protection features of vaults is found in the specifications with which we are all familiar, entitled "Regulations of the National Board of Fire Underwriters for the Installation of Vaults, as Recommended by the National Fire Protection Association, Edition of 1916." If all vault construction followed the rules there laid down, there would be little room for criticism. However, other types of construction are most commonly met and must be dealt with. Here, as in many other aspects of record protection, there is pressing need for actual engineering test data upon which sound judgments can be based. Far too much of present practice seems to be based on traditions and inferences, perhaps not capable of withstanding too close scrutiny. Test data, as to walls, floors, etc., developed for other purposes, may serve quite conclusively. Much is to be desired however in the present state of knowledge concerning such things as doors, vestibules, vestibule settings, interior equipment, lighting, heating, ventilation, exclusion of water, etc., as applied to vaults for the storage of important records.

SAFES. Many years before scientific furnace tests were thought of, bitter controversies raged between safe manufacturers as to the relative fire resistive merits of their devices. Only of late years has orderly engineering study thrown dependable light upon the subject, much of which is as yet unexplored. New types have been developed and they display many virtues. Older types in tremendous number are still in use, however, and will doubtless continue to be so for many years. Far too little is known as to the degree of confidence which may be placed in these.

RECORD ROOMS. For bulky collections of records, not of the first importance, storage in vaults and safes often is impractical. In a building of strictly fire-resistive construction, such records may be separated from the exposure due to combustible contents by placing them in steel files, in a room separated from the remainder of the building, by proper incombustible partitions having any openings adequately protected. Questions then arise as to the value of such protection, the degree to which combustible contents and trim must be eliminated, the effectiveness of ordinary steel filing devices in separating the records into non-continuous groups between which fire may not be expected to spread, the need for automatic sprinklers, the degree of protection necessary against internal and external exposure, and many other points upon which it is true that data now available throws considerable but by no means conclusive light.

STEEL FILES. It is probably true that the fire-resistive merits of steel files have at various times been understated as well as overstated. Here again, such opinions as have been reached are based largely upon judgment aided only by actual fire experiences, which may easily be misleading, and such opinion is almost entirely unsupported by data derived from controlled tests. It is believed that there is a big field in

record protection for the ordinary steel file, though perhaps not along the precise lines of use that hitherto have been followed.

WOODEN FILES. From a fire standpoint we may be inclined to condemn the wooden file almost without a hearing. Nevertheless, it must be recognized that its use is widespread, and it may very properly be a part of the duty of the committee to consider the forms of protection which must be thrown about such files if reasonable safety is to be secured in their use, perhaps for records not of the first importance.

CONSISTENT USE OF PROTECTIVE EQUIPMENT. Protective equipment, even though adequate, is of little value unless it is consistently used, and unless there has been forethought concerning procedure in an emergency. Grave oversights in both these directions are more commonly found than not, and the Committee in due course should emphasize this phase of the question, should outline drills for restoring records to their places of safety, quickly, accurately, and without confusion or oversight. Attention should be called to the inconsistencies introduced by permitting records ordinarily protected to be transferred, sometimes for considerable periods, to the custody of others, who do not similarly protect them; by failing to put records away at the close of working hours; and by allowing them to accumulate outside of protective containers as a matter of convenience or accessibility.

1. Value of Records

(From Introduction to 1926 Report)

To show that records have money value is to take a long step toward an inescapable conclusion that they must be protected against loss by fire. Indications multiply that increasingly the hard-headed business man clearly recognizes the existence and magnitude of such values, sometimes almost spectacular in amount, particularly when contrasted with the rather casual regard in which these values have often been held in the past.

The evidence so far groups itself for the most part under three headings:

a. The very substantial expenditures which are being made everywhere for the physical protection of records, and the increasingly rigid standards of protection that are demanded by record owners.

b. The placing of insurance on records in considerable amount, indicating a willingness on the part of record owners to pay a premium on such insurance, and on the part of the insurance carriers to recognize a tangible insurable value, as to which a practical settlement can be made in event of a loss.

c. In public utility valuation and rate cases, the introduction of the money value of records as one of the factors in "going value," and hence in the determination of rates. A recent decision by the United States Supreme Court specifically recognizes the inclusion of such values, and a number of public utilities are having actual appraisals made of the money value of their records for valuation purposes.

All of these things point to the fact that those who own considerable aggregations of records are observing in them a tangible value in dollars. With this realization comes an appreciation that they must be protected against loss, and upon this basis rests a much more practical interest in the subject than could be built upon any attempt, however enthusiastic, to emphasize purely intangible values.

2. Classification of Records

(Consolidated Sections from 1924 and 1925 Reports)

An intelligent approach to the problem of record protection involves a recognition of the value of records, the hazards to which they are exposed, and the relative merits of the protective methods available.

But before these general principles can be wisely applied in a practical way, it is necessary to examine all of the records searchingly, and to separate them into groups based upon the importance of providing protection for them. This makes possible a program of protection within reasonable financial limitations, by indicating the minimum number of records demanding the highest degree of safety. At the same time, such a grouping, carefully done, guards against the probability of important links in the chain of records being overlooked, a condition almost certain to occur if decision is on the basis of generalities and not on a detailed analysis (from the point of view of possible fire loss) of each type of record and its relation to all others and to the carrying on of the affairs of the establishment.

Suggested Classification

It will be evident that any workable system of classification must be simple, and that it cannot be based on hard and fast definitions, for it will be found in the actual application, that nearly every case will be decided by a variety of factors the weights of which must be appraised as a matter of judgment, rather than on the basis of sharply drawn definitions.

A method that has been found satisfactory assumes four broad classes which may be designated as

Class 1—vital
" 2—important
" 3—useful
" 4—non-essential

These groups may be explained by the illustrations shown below. These are illustrations merely. There are many others in each class, and some of those indicated may be found to belong in other classes in many instances.

CLASS 1—VITAL RECORDS

In this group will be placed usually, such records as charters, franchises, minutes of directors' meetings, deeds, abstracts, easements, options, stock transfer and bond records, important contracts, general books and supporting papers, accounts receivable, tax returns, and many other accounting records. Here may be found also many engineering records, such as drawings and tracings, property plans, appraisals, inventories, etc. Numerous other items of similar importance will be discovered upon examination.

CLASS 2—IMPORTANT RECORDS

In this class will be placed many statistical studies, derived accounting records, which could be reproduced again from the original sources if necessary though at considerable expense and labor. The great mass of operating records usually belong in this group, particularly those of informative character whose purpose is to maintain a check upon efficiencies, operating costs, etc. Minor contracts and similar papers are included. In general, Class 2 covers those records not important enough to be placed in Class 1, but still clearly more valuable than those in Class 3 described below.

CLASS 3—USEFUL RECORDS

General correspondence is perhaps the best illustration of this group. Its loss would occasion much inconvenience, but with a few exceptions,

would present no insuperable obstacle to the continuous operation of the business.

CLASS 4—NON-ESSENTIAL RECORDS

This includes principally the material which upon examination is deemed eligible for destruction, as outlined elsewhere in this report.

Factors Influencing Classification

Some of the more common factors which influence classification may be readily stated, but it will be found in each individual case that there are many others which must be considered. All factors should be duly weighed before assigning a classification.

CONTINGENT VALUE

Some types of records have what might be called a contingent value. For instance, minutes of meetings might in many cases be lost without serious consequences, provided the business proceeds smoothly and without difficulty. Such minutes, however, might be of the utmost value in event of legal complications or internal difficulties.

LEGAL VALUE

Many records will be of value from a legal standpoint. It should be remembered that there are important differences to be observed in records in this regard. From a legal standpoint a duplicate copy of any sort is not as useful as the signed original, and hence for such purposes, the maintenance of duplicates at another point may not be an adequate safeguard. For this reason the originals would be placed in a higher classification than the duplicates.

INTERFERENCE WITH OPERATIONS

As business is handled to-day, particularly in the larger organizations, records are an important implement in carrying on productive operations. Without them production might be seriously interfered with, deliveries to customers might be delayed, and collection of outstanding bills might be seriously interrupted. All these consequences of possible loss should be considered in assigning a classification to any given record.

RELATIONS WITH PUBLIC OR CUSTOMERS

To almost any enterprise, records are an essential factor in rendering satisfactory service to the customer. In the case of a public service corporation, this is of particular importance, although it applies with evident force to the concern having customers in any form. Loss of records means that service to customers cannot be continued, on the accustomed orderly basis, and dissatisfaction, if not resentment, is very likely to follow.

RELATIONS WITH GOVERNMENT AUTHORITIES

Public service corporations are faced by the problem of maintaining satisfactory relations (to which suitable records contribute) with public service commissions, and on account of relations with various taxing bodies and other governmental authorities, practically all business organizations could be thrown into very serious confusion by the destruction of the records pertaining to these contacts.

DIFFICULTY OF REPLACEMENT

Some records will be recognized at once as non-replaceable. This includes not only historical records, such as those in the possession of Governmental authorities, museums, libraries, and not a few business organizations, but also certain very common records, which, if lost, could not be reconstructed in the original form, but, at the most, could only be replaced by substitutes. To replace an old set of general books would be almost an impossibility. Minutes of directors' meetings cannot be replaced in the strictest sense because the meeting covered by the minutes can never be held over again. Many other such instances could be cited.

Other records are replaceable but only at a cost almost prohibitive. Consider, for instance, the cost of replacing the records covering an underground gas or electric distribution system for a large city. Or, consider the difficulties in the way of reconstructing, if completely destroyed, the stock transfer records of a large corporation.

These possibilities should be squarely faced and should be given due weight in determining the classification of records to which they apply.

EXPENSE OF REPLACEMENT

The clerical or engineering labor necessary to replace records, even when it is possible to replace them, may be astonishingly large. This will be recognized when thought is given to the current expenses of departments constantly at work on the making of records. To reconstruct, under emergency conditions, the work of many departments for many years clearly would involve a very substantial sum.

Thought must be given also to the additional expense attendant upon the absence of records. Instances are known, for example, where it is necessary to maintain additional engineering staffs, costing hundreds of thousands of dollars annually, by reason of the fact that data, previously available from records which were destroyed, must now be secured by physical survey in the field.

Method of Classifying

It is important that records be classified by actual physical survey of the records in detail. Misleading results are almost certain to follow any attempt to work from an assumed knowledge of the various record systems, and the factors that make them up. Detailed examination almost always discloses important points that are otherwise overlooked. With business methods as complex as they are to-day, the department head, though familiar with broad principles, cannot maintain an intimate knowledge of the detailed applications in the minute points of daily routine, which, however, constitute vital parts of the record system. The most practical procedure is to go over all records methodically, taking them as found at each location and examining each type of record to ascertain its relation to others, its importance, and hence its classification, making note meanwhile of the degree of protection existing for that particular unit, and of the protection probably warranted.

Department heads and those actually handling records should be freely consulted in establishing the classifications, but it will be found wise to have the one person make the classification for all departments, in order that there may be uniformity of viewpoint, and in order that there may be developed in the mind of one individual, a picture of the entire record situation, which will prevent the distorted judgments likely otherwise to arise. The individual making the classification should have a sufficiently broad knowledge of business in general, and of the affairs of the establishment in particular, so that he will be competent to draw out the facts from the department heads and others in charge of records, to temper their opinions where necessary, and finally to evaluate the records wisely, so that his conclusions may contribute accurately to proper decisions as to the protection justified in each case.

Typical Illustration

Taking a typical group of records for purposes of illustration, classifications such as the following might be assigned to them under the various headings. It will be realized that no hard and fast rules can be laid down, because each case must be decided on its own merits. Typical records of an electric light and power company have been used for this example. Orderly destruction of records is a matter of sufficient importance to require special treatment which has been given earlier in this

report. Illustrations have been included in the list which follows merely to show how this factor may be included in a tabulated study of a record situation. See table below.

Classification of Records

Record	Relative Importance as to Protection against			Useful Life
	Fire	Water	Theft	
CORPORATE RECORDS				
Charters	1	1	2	Permanent
Franchises	1	1	2	Permanent
Minutes of Meetings of Board of Directors	1	1	2	Permanent
FINANCIAL AND ACCOUNTING				
Mortgages	1	1	2	Permanent
Legal Opinions	1	1	4	Permanent
Bond coupons (paid)	1	2	1	Optional but certificate of destruction should be made
Stock transfer records	1	1	2	Permanent
Vouchers and journal entries	1	1	4	Permanent
Cash books	1	1	4	Permanent
Journals	1	1	4	Permanent
Ledgers	1	1	4	Permanent
Consumers' Ledgers	1	1	4	7 years
Tax returns	1	1	4	Permanent
ENGINEERING AND OPERATING				
Surveys	1	1	4	Permanent
Power Station Tracings	1	1	4	Permanent
Overhead distribution maps	1	1	4	Permanent
Underground " "	1	1	4	Permanent
Transformer records	1	1	4	Permanent
Meter records	1	1	4	Permanent
PROPERTY RECORDS				
Options	1	1	2	Until expiration
Easements	1	1	2	Permanent
Leases	1	1	3	Permanent
Abstracts of title	1	1	2	Permanent
Deeds	1	1	2	Permanent
Rights of way	1	1	2	Permanent
Water rights	1	1	2	Permanent
Property record books	1	1	4	Permanent
Maps, plans, surveys	1	1	4	Permanent
CONTRACTS				
Contracts carrying guarantees penalties, etc.	1	1	3	Permanent or until expiration
Power contracts	2	2	3	7 years after exp.
Domestic consumer contracts	2	2	3	7 years after exp.
CORRESPONDENCE				
Executive correspondence	2	2	2	Permanent
General correspondence	3	3	4	Destroy at option
PRINTED MATTER				
Catalogs	4	4	4	Destroy at option
Periodicals	4	4	4	Destroy at option

Protection Appropriate to Each Class

Having established a classification of the various records under these headings, the next step is to define the protection appropriate for each class.

Protection Against Fire

Class 1 (vital) records clearly should have the best protection practically possible. This may be achieved by duplicates kept where not subject to the same fire, or by vaults or safes, such as may be expected to resist successfully any fire exposure to which they may be subjected.

Class 2 (important) records may include largely those whose importance is somewhat debatable and as to which further consideration may be necessary before final decision is made as to the provision of protection. Attendant circumsatnces often will need to be very carefully weighed.

Class 3 (useful) records, such as general correspondence, are generally quite voluminous, and are not of sufficient importance to demand special forms of protection. Reduction of combustible surroundings by use of steel filing equipment may be advisable in some instances, though this should not be regarded as protection against heat from the burning of combustible material. Ordinarily, they may be allowed to remain as found.

Class 4 (non-essential) records manifestly demand no special protection save that any undue accumulations should be disposed of, and they should not be allowed to occupy space in vaults and safes to the exclusion of more important material.

Protection Against Water Damage

The seriousness of water damage to records is often over-rated. Many kinds of records can be even submerged in water without losing their legibility, although their physical conditions thereafter will probably be such as to necessitate copying for further use.

Most fire resistive record containers afford considerable protection against serious water damage, though if submerged, few will completely exclude water for any extended period.

It will be evident that basement vaults are objectionable from the point of view of water damage, and in any story records should be raised a few inches above the floor, even in vaults.

Protection Against Theft

This Committee does not feel it to be within its scope to set up standards for protection against burglary or theft. Most of the current fire-resistive containers are moderately burglar resistive, but no more.

It may be proper to call attention to the fact that most good heat insulators do not resist mechanical attack, while on the other hand special steels, effective against burlgar attack, are excellent conductors of heat. Hence when protection against both fire and burglary is desired, the solution lies in burglar proof safes within fire-resistive vaults, or smaller burglar proof chests within fire-resistive safes.

3. Record Losses

(From 1924 Report)

Any attempt to ascertain accurately the number, extent, and seriousness of record losses is handicapped by a number of obstacles. The money losses attendant upon record destruction are often indirect and concealed in operating costs, and since ordinarily they are uninsured, little effort is made to ascertain the precise amount of loss, as would be done if insurance were involved. There is a natural tendency toward reticence on the part of those who have lost their records, and this has brought about the mistaken inference that losses have been of little real consequence.

Nevertheless, if we are to arrive at a true understanding of the importance of this problem, we must endeavor to ascertain, to visualize, and to state the consequences of record losses in direct and indirect costs, inconvenience, interference with operations, loss of good will of customers, and the many other factors which properly apply.

The Committee is in the process of collecting data on this subject from available sources, and hopes in a later report to submit specific information to the Association. In the meantime, it is urged that all members of the Association call to the attention of the Committee any record losses of which they are aware, giving as full information as it is possible to obtain, and permitting the Committee to investigate further, if possible.

In any attempts to appraise the consequences of a record loss, it must be recognized that only a portion of the records will be capable of having a money value placed upon them. There are many records which cannot be so treated, but no responsible business man will deny the seriousness of the loss of these.

In those establishments where serious record losses have occurred, it will be found that there is little tendency to underestimate the consequences, and increasing numbers of executives are not awaiting the evidence of an actual record loss, but clearly foresee the seriousness of one, and are making provision in advance to protect themselves against such an occurrence.

4. Severity, Duration and Control of Exposure

(Tentative. Reprinted from 1924 Report. Exception has been taken to certain paragraphs as is indicated by the footnotes giving stenographic record of the discussion at the meeting of the National Fire Protection Association. This section will be rewritten when the results of experimental work now under way are available.)

4001. This section is concerned with the fire conditions to which record vaults, safes or other containers may be subjected. These can be recognized as of four general types:

(1) Heat exposure from burning, glowing or hot materials.

(2) Impact from falling building members, materials, equipment or other building contents.

(3) Shock from explosions occurring within or outside the record container.

(4) Water damage incident to fire extinguishment.

The effects of impacts (2) and explosions (3) must be considered in the protection of records from fire since they lay the construction open to fire attack or make it less fire resistant.

Heat Exposure

4101. The intensity and duration of a fire, even with a given building type and occupancy, is subject to great variations due to the particular conditions incident to each fire as regards amount, character and concentration of combustible materials, wall and floor openings and wind conditions in relation to the air supply and the extent to which the severity of the fire and its after effects are modified by the fire fighting methods employed. In considering the conditions for which provisions must be made it is, therefore, generally necessary to neglect conditions giving rise to fires of minor severity and consider only those giving maximum severity in intensity and duration. This necessitates assuming complete destruction of all combustible portions of buildings and contents under conditions favorable for the development of fires of the most destructive intensity and duration probable for the given building and occupancy.

4102. Some information from observation of fire effects is available as it concerns maximum temperatures developed and effects on building materials, construction, and devices. By comparing these with effects in test fires of known temperature and duration, an approximate measure of the severity of building fires is obtained. A few experiments have also been made to determine directly, intensity and duration by burning out typical occupancies with measurement of temperatures from the beginning of the fire to the cooling of the ruins. While the results obtained are not as yet fully conclusive, taken in connection with information from fire

---

MR. SECKERSON: (Herring-Hall-Marvin Safe Co.): A considerable knowledge of the mental processes of the man who has records to protect, leads me to suggest that this Association should avoid if possible affording an excuse for the owner of records to provide protection along lines of least resistance, or protection that would in any way be a compromise with the maximum that might be needed or demanded, and for

effects in buildings, it can be tentatively stated that with fire resistive interior and exterior construction, housing the lighter occupancies from the fire standpoint, the probable maximum severity of a fire completely destroying combustible contents and trim does not generally exceed the first hour of the standard fire test exposure, and only with exceptionally heavy concentrations of materials for the given occupancies will it equal the severity of the first 1½ hours of the standard test.

4103. Office, residential and institutional occupancies can be named as typical of those giving rise to fires of the probable severity outlined in the preceding paragraph. At the other end of the scale, fires in buildings or parts of buildings normally housing large amounts of combustible materials, such as those used for storage of merchandise, are known to have attained intensity and duration fully equal in effect to the standard 4-hour fire test. Under the conflagration conditions, severity may be somewhat increased due to the higher temperature of the air over the burning area. Where the building or its interior framing or structural members are of combustible or non-fire resistive construction, the fire effects on record containers are usually more severe since they generally are exposed to the fire in a larger portion of the building than with fire-resistive construction where usually no exposure other than that incident to fire in one story (or portions thereof) need be considered. Also with combustible or non-fire resistive construction the containers or portions thereof are more likely to be covered with hot debris for a longer period after the fire, which is one of the most severe conditions to which a container can be subjected.

Impacts

4201. In fire-resistive construction no heavy impacts are probable both as regards objects falling on the container or the fall of the container itself. The most severe would be those from falling partitions, or sudden settling of safes resting on combustible top floors. With combustible or non-fire resistive construction the impacts can have a wide range in severity, depending on the height of the building and the type of construction. Vault construction can also be severely taxed by stresses from failure of adjacent building members. Light vault construction may also be injured by high-pressure hose streams used in fire extinguishment.

Explosion Shock

4301. Record vaults should not be located in buildings housing explosives in sufficient quantities to wreck them. Where this cannot be avoided, a measure of protection can be provided by vault construction that will resist explosion shock. Explosions from smoke produced by ordinary combustible materials sometimes occur and on this account even where there are no explosives present it is desirable to incorporate in record containers, the maximum structural strength that can consistently be attained.

Record containers must also be suitably safeguarded, by details incorporated in the construction, to prevent explosions occurring within

---

that reason there may be some criticism both of §4102 and of the succeeding paragraph.

MR. A. R. SMALL: I would suggest that the committee should give very careful consideration to §4102 because of the danger of putting the N. F. P. A., even informally, on record to the effect that a 1½ hour fire exposure condition is representative of general exposures for even the lighter occupancies of fire-resistive construction. Sufficient experience has not yet been had in comparing actual fire results with performance in fire tests to justify even such an informal commitment of the N. F. P. A.

them from gases generated when they are exposed to fire. Unless this is done the construction may be wrecked or the doors forced open.

Water Damage

4401. Damage from the water used in fire extinguishment outside of record vaults can generally be avoided, except in basements, by using raised floors.

Doors of containers can not with ordinary construction be made water tight; safes falling into basements in fires in non-fire resistive buildings may have their contents damaged by water. Automatic fire extinguishment with water inside of vaults should be applied with caution, if at all. All openings to record rooms should be labelled to prevent firemen from opening the doors or directing hose streams into them, unless a fire is in progress within. At a distance from a record room or a vault, it may be desirable to provide a sign indicating the location of the records so that firemen may avoid any needless water damage, and so that they may make special effort to safeguard the records.

It should be noted that water damage seldom results in total destruction of records, as they are seldom so damaged from this cause that the record is illegible.

Control of Exposure

4501. As the fire that does the least damage is the one that is prevented from occurring or spreading beyond its initial stage all the means and methods of fire prevention outside and within record containers apply with particular force to record protection. Under no conditions in the ordinary course of business can all records be protected whose loss would cause serious inconvenience and financial loss.

4502. All structural provisions that have been found effective in preventing and controlling the spread of fire can be employed to advantage. Attention has already been called to the superiority of the fire-resistive building type in decreasing the damage caused by fire, impact, and water. If to structural fire resistance are added incombustible floor surface and interior major trim, the probability of origin and rapid spread of fire is further greatly decreased. The fire can be confined to the portion of the building where it originates by suitable horizontal and vertical sub-division with vertical and horizontal openings properly protected. The above structural provisions apply with particular force in large rooms or buildings used exclusively for housing records. Protection against fires from without the building can be had by protecting all openings against the exposure to which they are subject.

4503. A further degree of safety can be obtained by placing buildings to be used exclusively for records at such distance from other buildings, and making them of such construction as not to be endangered by the burning of surrounding buildings. The general fire loss records indicate that only about 15 per cent of the fire loss is from communicated fires. Where the occupancy is solely record handling and storage, the likelihood of fire originating on the premises is relatively slight and can be kept at a minimum by careful maintenance. Under these circumstances, the exterior exposure hazard occupies a relatively more important place than would ordinarily be the case. It is important also to bear in mind that for purposes of record protection there may be complete justification for a degree of protection much beyond customary practice when only commercial and replaceable values are involved.

5. Protection of Records by Duplication

(From 1924 Report)

Properly done, there is probably no more completely effective method of safeguarding records against loss by fire than by keeping duplicate records on other premises not subject to the same fire, even under conflagration conditions.

Based on the theory that fire will seldom, if ever, occur simultaneously in two places remote from each other, some companies have found it expedient to place duplicates of important records at a point some reasonable distance from the main base of operations, preferably in a fire-resistive vault, although this latter precaution is not essential to the fundamental principle of safety secured by separation of two or more sets of records. In the case of one important railroad, the point of duplicate storage is in a fire-resistive warehouse, in which space is rented for the purpose. A prominent life insurance company places its duplicate records in a fire resistive building located in a suburban town, daily messenger service with which is maintained. Under such systems of operations, the original records would preferably be placed at the point having the lesser fire hazard, but of two points, otherwise equally desirable, at the point where least need for consulting them would exist, using the duplicates at the other location for that purpose. By means of duplication, the information carried by the records is safeguarded, and in event of loss of either set, the cost of replacement would be very materially less than were neither set available. It is evident that if one set is destroyed, extraordinary care should be taken of the other set, until new duplicates have been made.

Methods of Duplication

For the duplication of records, two important considerations must govern, i. e., accuracy of the copies, and permanency or durability. Photograph reproductions are usually considered ideal in respect to the former quality, legally and otherwise, but involve high first cost, on account of the negative and subsequent printing necessary. The quality of the sensitive paper used and proper handling of it chemically may have considerable bearing on the permanence of the results. The alternate process of photostating eliminates the cost of the ordinary photographic negative, but as often made commercially, the fixation and incomplete removal of the unused sensitizing chemicals may render the print subject to rapid deterioration after a few years. Whatever process is used must be thoroughly carried out as to details or the results are bound to be unfortunate. Some form of photographic reproduction is obviously desirable for types of records, the originals of which are made on heavy paper, or on paper printed on both sides, such as deeds, mortgages, insurance records, and similar documents. The photographic processes are limited to reproduction of sheets of only moderate size. For larger sheets and where a considerable number of copies warrant, lithographing or similar processes can be used to advantage.

With typewritten matter it is often very easy to secure an extra copy for filing at remote points simply by making the duplicate when the original sheets are written, a method involving negligible cost.

Another form of record for which duplication may be desirable is that made on tracing cloth or on thin paper through which light rays can easily penetrate, such as the drawings and specifications of engineers and architects. Exact duplication of such records is possible by contact prints on sensitized paper, in the form of blue prints, Van Dyke brown prints, or white prints made from negatives first printed on Van Dyke brown paper. Unless made with more care than the usual commercial prints these cannot be considered as permanent in character, due to improper chemical fixation and subsequent deterioration, as well as by reason of the physical properties of the paper used, which may disintegrate. For scale drawings it may be necessary to consider the question of distortion due to shrinkage of the paper. In this respect, certain lithograph processes reproduce an ordinary drawing without change of dimensions and are permanent in character. As no special treatment of the surfaces is necessary, and the ink used is carbon black and varnish, the reproductions are not subject to deterioration. Tracings duplicated by this process can be used interchangeably with originals, thus permitting, if desired, originals to be permanently filed, and duplicates to be used for current work and consultation.

Before deciding on any form of duplication, careful consideration should be given to the treatment that the originals may receive in the process. Frequently some form of oil or paraffin treatment, to render original sheets transparent for ease of contact printing, may result in injury to these sheets. Similar consideration should be given to the quality of the material selected for the duplicate copies. Engineers' and architects' drawings and specifications should preferably be duplicated on a good quality of tracing cloth.

Instances are known of the use of pyroxylin plastic (celluloid) for record reproduction either in place of tracing cloth, or as photographic negatives. This manifestly introduces serious hazard, unless the slow-burning (acetate) cellulose is used rather than the ordinary nitro-cellulose.

In this connection special consideration of the fire hazard must also be given to processes of reproduction involving final coating of collodion to preserve the integrity of the printed matter beneath.

For records that are to be preserved on paper, full consideration should be given to the relative durability of rag stock bond paper as compared to sulphite stock paper which may have a very limited life.

It must be remembered that in any system of duplication there may be two values at stake. The first, and probably most important, is the possession of the information carried by the record. The second value, often found, lies in the actual money cost of reconstructing duplicates from the copies saved. For instance, to retrace several thousand blue prints is a very costly operation.

Finally, if dependence is placed on duplicate records, care must be taken to maintain the duplicates in complete file. If removed for consultation or other use they may be returned promptly to the storage point. Even if they are only duplicates, they should be protected with the same care as original records, and should be checked periodically to insure that the set is complete, and that the records have not begun to deteriorate physically.

6. Record Safes

(From 1924 Report)

The fire protection afforded by portable safes has been the subject of scientific investigation for several years, and tests are continually being conducted by the Underwriters' Laboratories, individual manufacturers, and the United States Bureau of Standards. It is therefore the opinion of this Committee that it is possible for a prospective user to obtain a safe which will protect its contents from fire within certain well defined limits, this protection and these limits being certified to by competent and impartial authorities.

Investigation indicates that in a great majority of cases, the weak part of a safe from a fire protection viewpoint, is the door joints, and the fact that safes giving the best test performances have interlocking joints instead of the commonly found stepped joints is believed to be worthy of comment.

The effect of many details of construction on the fire protection afforded by a safe are still the subject of investigation; among the subjects being considered are the following:

a—The effect of age on the heat-insulating value of the safe.

b—The structural strength necessary, or that practical to incorporate in the safe.

c—The efficiency of the provision made to guard against internal explosion.

It is probable that the fire protection afforded by all safes decreases somewhat with age. The rapidity of this deterioration depends upon the use, the type of the door joints, the location of the safe, the character of the insulation, and other factors.

With a view toward obtaining positive information regarding this subject, Underwriters' Laboratories is conducting yearly re-tests, the samples used being from safes in actual service, but the application of the information obtained in this manner to the general science of safe construction will be apparent only after a term of years.

The strength necessary to incorporate in the structure will always be somewhat indeterminate. The strength of the exposed steel structure depends considerably on how hot it is at the time when it is called upon to resist impact or crushing stresses, the outer steel shell and framework losing a large part of their strength when heated to a high degree.

It is obvious that the resistance of a safe even when cold will vary in accordance with the direction of the stresses. A safe might be unaffected by a blow from a falling column or girder if it received the impact on one corner, while the same blow might wreck the safe if it struck it on the back, and there is no possibility of predetermining how such stresses will be applied.

It seems probable that safes can be designed which will protect their contents against any temperature to which they are likely to be exposed, provided they are not subjected to impacts or crushing stresses. The protection afforded by a safe, therefore, depends considerably upon whether or not the safe will fall or will have heavy materials or devices fall upon it.

It is only within a comparatively short time that the public generally has become aware that safes are liable to fail from internal explosion, and the probability of a safe failing from this cause is still the subject of investigation.

From the outline given it will be seen that the fire protection to be expected from safes involves a number of technical points that can only be decided by tests and investigations made under conditions as representative as possible of those to which these devices will be subjected under fire conditions. It is therefore recommended that the use of safes for the protection of records be restricted to those types which have been subjected to such scientific tests and the construction of which is certified to by a competent and impartial authority.

7. Vaults and Record Rooms

INTRODUCTION

(From 1924 Report)

It is the purpose of this committee not only to develop specifications for the construction of vaults which will properly protect their contents under all conditions but also to point out the deficiencies of certain common methods of construction by which the safety of records in vaults is often endangered.

Fundamental Requirements

In the design of a vault there are a number of fundamental requirements which must not be overlooked if the structure is to withstand successfully the effects of a severe fire and is to protect the records which it contains. These requirements include:

a—Wall, floor and roof construction of materials having sufficient fire resisting qualities to resist the action of the most severe fire to which the enclosure may be exposed and also having adequate heat insulating resistance to prevent destruction of contents from high temperatures due to heat transmitted to the interior of the vault.

b—Foundations and other supporting members of such design and construction that they will safely carry the weight of the vault and its contents when these supports are subjected to fire.

c—Provision against the impact of falling building members and building contents such as safes, machinery and other heavy objects.

d—Independence of the structure of the vault enclosure from the building members, at least to such an extent that failure of the building will not cause failure of the vault.

e—Proper protection of door openings.

Existing Vaults

Many existing vaults in the construction of which fundamental principles have not been observed, are of such construction that if exposed to a fire of appreciable magnitude, they would be of practically no value in protecting the valuable records which they contain.

In many office buildings the vaults are of light construction, and are sometimes structurally deficient in many respects, to an extent that can often be easily noted by a casual inspection. Some vault installations have actually been discovered having combustible framework flimsily protected with plaster. It is not unusual to find vault walls carried up to the under side of false ceilings which would be quickly destroyed in a fire. Even where the vault has an independent roof, it is sometimes of such light construction that it would be easily ruptured by the slightest impact. It is not uncommon to find walls supported directly on the wooden floors of buildings and with supporting walls or columns of such construction that the vault would quickly collapse in a fire. Other vaults make use of parts of building walls without proper bond or anchorage to these walls so that the failure of the building would also destroy the

integrity of the vault structure. It is always desirable to build the vault entirely independent of the building members whenever this can be accomplished.

Usually in the eyes of the layman nearly any enclosure is regarded as a vault if its entrance is equipped with single or double steel plate doors. The construction and supports of the enclosures are seldom if ever investigated. The door itself very often fails to protect the opening properly. This important feature of construction is covered in another section of this report.

Vault construction calls for an unusually good grade of workmanship, if it is to meet satisfactorily all the conditions which may be imposed upon it in case of fire. For this reason the committee feels that there is need for the development of recognized and organized agencies competent to pass upon the design and supervise the erection of such structures.

Vault Classification

In considering classifications, the committee is of the opinion that but two classifications will be necessary, the first known as the "ground supported vault" and the second as the "structure supported vault," the definitions of which are obvious. The specifications are being prepared from the standpoint of the fire resisting qualities of the enclosures rather than from that of protection against burglary.

In addition to the vault enclosures proper there are two other forms of vaults known as the "document building" and the "record room."

Document Buildings

The "document building" is defined as an isolated, strictly fire resistive building, usually in an outlying district, in which inactive records can be kept. A number of cases have come to the notice of the committee where companies have considered it worth while to provide such buildings. Such an arrangement permits the transfer of a large amount of records from working areas in valuable office space, releasing it for other purposes. Such records are thus brought together where they can be kept under proper conditions and supervision, and where they escape the hazards inherent upon storage at locations never really intended for that purpose. Very frequently important records are crowded out of vaults and other reasonably safe storages into out-of-the-way corners where they may not only lack protection but may actually be exposed to grave hazards.

A document building, if large enough, may be put in charge of one or more persons, competent to handle and file the records and to handle inquiries over the telephone, in order to avoid, as far as possible, actually removing the records.

A building of this type should of course have the characteristics of a vault as to construction, absence of combustible interior finish, arrangement of lighting, heating, etc. Exterior openings should be protected in suitable manner.

Record Rooms

The "record room," which is another variation of the vault, can be used to advantage where there is a large volume of records not of the utmost importance, but of sufficient value to warrant a certain amount of special protection. The most practical plan in some cases, if the building is of strictly fire resistive construction, may be to assign a section of a floor for the purposes of a "record room," separating it by reasonably substantial fire resistive partition construction, having all openings into

the main portion of the floor protected by fire doors of the type approved for openings in vertical shafts (Class B, Regulations on Protection of Openings in Walls and Partitions) and having exterior openings protected by wired glass windows with such supplementary protection to the window openings as the situation may justify.

From such a room all wooden trim, wooden wearing floors, etc., should be eliminated and furniture and filing equipment should also be of metal. Under these circumstances, records may be kept in ordinary steel files, on the assumption that there is little likelihood of spread of fire from unit to unit. Automatic sprinkler protection is highly desirable for record rooms.

VAULT ENCLOSURES AND SUPPORTS

(Officially adopted 1926)

General.

7101. These specifications are designed to apply to the construction of vaults which are built for the protection of records from fire only and are not intended to include protection against burglary such as is necessary in the bank vault.

7102. A vault is designed to accomplish a specific purpose, i. e., the complete protection of its contents in case of fire. It is accordingly most important that its construction be such that there will be no doubt as to its ability to fulfill the object for which it is installed. This depends not only upon its heat insulating qualities, but also upon the maintenance of the integrity of the structure under the strains and impacts to which it may be subjected during a fire. Therefore, the design, the selection of materials, and supervision of the construction should be entrusted only to a competent engineer or architect.

7103. It is recognized that under certain conditions the accumulation of hot or burning debris about a vault may produce a "soaking effect" of such duration that it cannot be taken care of by construction alone within practicable limitations. The cooling of this debris by the application of water in such cases is of the utmost importance.

7104. Concrete, on account of its monolithic character, is admirably suited for this type of construction. Brick masonry can also be so laid as to be practically monolithic, but as usually found, with vertical joints without mortar, except what happens to be forced into them from the horizontal bedding, may develop serious weakness at the critical time. Only by "shoving" joints, or grouting, can monolithic work be secured in which full confidence can be placed. For vaults of a height exceeding a few stories, the use of a structural steel framework in connection with protecting concrete or brick masonry may be considered favorably as assuring monolithic integrity, even if the walls of the main building fail. This type of construction also materially aids in bonding together such parts of the structure as might otherwise be difficult to unite positively. It will be evident that if the building in which a vault is located is of other than fire-resistive construction, no main building members should have any structural connection with the vault structure, unless specially designed so that the integrity of the vault will not be affected by collapse of the building.

7105. Thickness of vault walls will usually be determined primarily by structural considerations, such as load capacity, general stability, and resistance to impact. Generally, walls thus designed will have adequate, if

not surplus, heat insulating properties, and this has been a determining factor in the schedule of recommended wall thicknesses.

7106. The impression seems to persist that air space between thin walls of masonry tied together at intervals is a necessity in vault construction, and that for the same reason, vault doors must be double with air space between. On the contrary, the resistance against transmission of heat, as demonstrated by furnace tests, is not appreciably influenced by such air spaces, but is in general a direct function of the thickness of masonry available to afford such resistance. Moreover, the presence of air spaces and the separation of walls into two thin walls reduces the resistance of the structure to impact from falling materials, such as building walls, machinery, and safes, a condition that must always be anticipated in the design of a vault. The Committee accordingly recommends the use of solid wall construction where greatest resistance is necessary.

7107. Vaults are classified in two groups according to the type of support, ground supported vaults and structure supported vaults, as indicated and defined below. There is also a sub-division in each class based upon the resistance periods to fire. The fire conditions in buildings will, of course, vary according to the type of building construction and nature of the contents. No attempt has been made to specify the class of vault needed for any particular building or occupancy.

7108. These specifications are applicable to vaults of any size so far as fire exposure is concerned. It will be appreciated, however, that with increase in size there are possibilities of larger values subjected to loss in a single enclosure, and there is also an increased hazard from fire within the vault. It is therefore recommended that individual vaults or divisions of a vault be limited to 5000 cubic feet with a maximum height limitation of 11 feet.

7109. The use of materials and constructions other than those specified in these requirements will be recognized upon submission of proof as to their merits from both a fire-resistance and structural standpoint.

7110. Masonry stresses, proportions for concrete and mortar and provisions for lateral support of walls shall conform with the "Recommended Minimum Requirements for Masonry Wall Construction" of the Building Code Committee of the U. S. Department of Commerce" as they apply for outside bearing walls.

7111. Full protection against destruction of contents by heat for the given time periods shall be considered as obtained when so constructed that no point on the interior wall surfaces shall reach a temperature exceeding 300° F. when the separate vault members or the vault as a whole are exposed to a fire regulated according to the standard time temperature exposure curve. It is considered that this requirement will keep the general inside temperatures of the vault considerably below 300° F. and insure usability of records or other contents after the fire.

SPECIFICATIONS FOR GROUND SUPPORTED VAULTS

(Officially adopted 1926)

7201. Fire Resistance Classifications.

Ground supported vaults are those supported directly on the ground and independent of the building in which they are located. They are intended to afford full protection to their contents even in the event of complete destruction of the building.

Six Hour Vaults.

This classification is recommended where the construction and occupancy are such that a degree of fire resistance equivalent to six hours of the standard test is deemed necessary.

Four Hour Vaults

This classification is recommended where the construction and occupancy are such that a degree of fire resistance equivalent to four hours of the standard test is deemed necessary.

Two Hour Vaults

This classification is recommended where the construction and occupancy are such that a degree of fire resistance equivalent to two hours of the standard test is deemed necessary.

SIX HOUR VAULTS.

7211. Foundations.

Foundations shall be of concrete, stone or brick masonry of ample size to take the entire load of the vault structure and its contents.

7212. Walls.

a. MATERIALS. Walls shall be built solid of reinforced concrete, or brick well bedded in mortar, or of protected steel or reinforced concrete framework with panels of reinforced concrete, plain concrete or brick. Stone and gravel aggregates for concrete shall be selected with regard to their fire-resistive properties. Siliceous gravel shall not be used for the coarse aggregate, unless adequately reinforced against spalling as by wire mesh near the surface, as this material is particularly subject to disintegration under heat. There shall be a covering of at least 2 inches of concrete over all reinforcement.

NOTE: The concrete and reinforcement shall comply with the recommendations of the current report of the Joint Committee on Concrete and Reinforced Concrete. Brick shall conform to the current standards for building brick of the American Society for Testing Materials.

Where a structural steel framework is used, the steel shall be protected with at least 4 inches of concrete, brick, or its equivalent tied with steel ties or wire mesh equivalent to No. 7 (A. S. W. gage, 0.177 inch diameter) wire on 8 inch pitch. Brick protection if used, shall be filled solidly to the steel with concrete. At the joints between columns, beams and panels, the panels shall be well bonded to the columns by notching or rabetting into the concrete to a depth and width of at least 1 inch. Temperature reinforcement for concrete shall consist of steel rods at least ½ inch in diameter spaced 4 inches on centres and running at right angles in both directions. Rods shall be securely wired at intersections not over 12 inches apart in both directions and be installed centrally in each panel wall. Any equivalent form of temperature reinforcement may be used.

b. THICKNESS. Walls shall be at least of the thickness specified in Table 1, the variations depending on the materials used, the type of building construction, and the number of stories. However, in the lower story of buildings over two stories in height, the minimum thickness shall in no case be less than 12 inches for reinforced concrete nor 16 inches for brick. These minimum thicknesses apply to the vault construction only.

c. INDEPENDENCE. Vault walls shall be structurally independent of the building wherever possible. If connected in any manner, the connection shall be so made that in event of the collapse of the building the building members may move or fall without affecting the stability or fire-resistive qualities of the vault.

In fire-resistive construction provision shall be made for expansion of the interior building members as otherwise severe thrusts may be exerted on the vault structure.

NOTE: Under moderately severe conditions of heating an expansion in the concrete or steel equivalent to 1/16 inch per foot is possible.

Where building members join those of the vault they shall project into the vault not more than 4 inches, and in no case shall the wall thickness be less than 8 inches at these points. All beams or bearing members adjoining the vault shall be designed to release freely in case of failure. Where the outside walls of a building are used to serve as a portion of the vault walls, the latter shall be effectively bonded to the building walls.

NOTE: Attention is called to the fact that the method of building a vault wall against the outer wall of building, and omitting bonding, will not insure the integrity of the vault, and that vault walls erected after the building are likely to settle and break connections with building walls. Also falling building walls may tear away wall used jointly for building and vaults, and cause failure of vault.

7213. Roof.

a. MATERIALS. Roof construction shall be of reinforced concrete or protected structural steel with reinforced concrete slabs or fillers of adequate strength and fire resistance.

b. THICKNESS. Roof shall be unpierced and shall be at least 8 inches in thickness. Greater thickness may be necessary to provide strength for loads and impacts as specified below.

c. INDEPENDENCE. Vault roofs shall be entirely independent of floors, roofs, or ceilings of buildings. Vaults should preferably be built to extend to the top floor of the building, and the top of the vault located as close to the underside of the building roof as possible.

d. BONDING. The roof and walls of the vault shall be thoroughly bonded together. If construction is of reinforced concrete throughout, the reinforcing steel in the roof shall be carried into the walls and the wall reinforcement into the roof. If there are steel beams in the roof, these shall be securely fastened to structural members imbedded in the walls. If walls are of brick suitable anchors shall be provided.

e. PROVISION AGAINST IMPACT. Where the roof is more than 12 inches below the roof of the building, the vault walls should be parapetted at least 12 inches above the vault roof and the space thus formed filled with sand, gypsum or similar material, to act as a cushion against impact from falling materials and also to serve as further insulation against accumulation of burning debris on the vault roof. Adequate drainage shall be provided for this space above the roof.

f. DESIGN. Roof shall be designed for a live load of at least 350 lbs. per sq. ft. to take care of impact loading. Where local conditions are especially severe, such as near masonry walls or large tanks, loads of from 500 to 1000 lbs. per sq. ft. should be assumed and maximum spans in at least one direction should not exceed 10 feet.

NOTE: It is not deemed practicable to design the roof entirely to prevent possibility of damage from a heavy safe or machine falling through a considerable distance. Such equipment should be so located as not to endanger vault structures below.

g. INTERIOR SUPPORTS. Where long spans are needed, the introduction of interior columns, girders or division walls may be necessary. All interior steel work and reinforcing shall be protected with a covering having a fire resistance classification of not less than three hours.

7214. Floors.

a. MATERIALS AND THICKNESS. Floors shall be of noncombustible material of a construction having a fire resistance classification not less

than two hours. Floors shall be unpierced, not less than 6 inches thick and greater if necessary to support the full load of floor and contents.

b. FLOORING. No wood or other combustible material shall be used in the floor or surfacing.

c. INDEPENDENCE. Floors shall be thoroughly bonded to the vault walls and shall be independent of floors of the building.

7215. Doors.

Shall conform to specifications as given below.

7216. Water Tightness.

a. WALLS, ROOFS AND FLOORS shall be effectively waterproofed, preferably using a mixture of concrete of proper grading, mixture and placing for the purpose. No combustible membrane or coating shall be employed except on a roof exposed to the weather.

b. Provision shall preferably be made to prevent entrance of water at door openings. Raised or sloping sills and large drains in building floors outside of vaults are suggested.

7217. Ventilation.

Ventilation of interior shall be only through door openings. Walls, floors, and roofs shall not be pierced.

7218. Inspection.

The construction of the vault shall be under the immediate supervision of a competent engineer or architect to insure that it is built in accordance with the above recommendations and that careful workmanship is obtained throughout.

FOUR HOUR VAULTS.

7221. Foundations.

Same as for six hour vaults.

7222. Walls.

a. MATERIALS. Same as for six hour vaults.

b. THICKNESS. Shall be as specified for four hour classification in Table 1. In the lower story, however, the minimum thickness shall in no case be less than 12 inches for reinforced concrete nor 16 inches for brick. These minimum thicknesses apply to the vault construction only.

c. INDEPENDENCE. Same as for six hour vaults.

7223. Roof.

Same as for six hour vaults.

7224. Floors.

Same as for six hour vaults.

7225. Doors.

Shall conform to specifications for vault doors as given in section below.

7226. Water Tightness.

Same as for six hour vaults.

7227. Ventilation.

Same as for six hour vaults.

7228. Inspection.

Same as for six hour vaults.

TWO HOUR VAULTS.

7231. Foundations.

Same as for six hour vaults.

7232. Walls.

a. MATERIALS. Walls shall be built of reinforced concrete, brick well bedded in mortar, load bearing hollow clay tile, hollow concrete blocks, or of protected steel, or reinforced concrete framework with panels of these materials.

The hollow concrete building block shall have cement proportions from 1:3 to 1:7 and either air or steam cured, and mixed with either dry, damp, or wet consistencies and of fine and coarse aggregates of crushed limestone, of crushed slag, or crushed cinders or of sand and calcarious pebbles, when assembled into walls one unit thick.

The hollow clay tile shall be not less than two-cell for 8 inch and not less than three-cell for 12 inch, conforming with the current Specifications of the A. S. T. M. for load bearing wall tile.

Hollow walls shall be plastered on both sides with at least ⅝ inches of gypsum or Portland cement plaster. Where a structural steel framework is used the steel framework shall have protection having a fire-resistance classification of not less than two hours. At the joints, between columns, beams and panels, the latter shall be well bonded to the columns and beams, the panels to be notched or rabbetted into the concrete of the columns for a depth of at least one inch, but in no case shall the construction be such that the fire-resistance classification of any portion is less than 2 hours.

b. THICKNESS. Walls and wall panels shall be not less than the minimum thickness specified in Table 1 for two hour vaults.

c. INDEPENDENCE. To conform with requirements for six hour vaults except that when concrete block or hollow clay tile are used for walls without frames, such walls shall serve as bearing members for the vault only.

7233. Roof.

Same as for six hour vaults.

7234. Floors.

Same as for six hour vaults.

7235. Doors.

Shall conform to Specifications given in the Section on Vault Doors.

7236. Water Tightness.

Same as for six hour vaults.

7237. Ventilation.

Same as for six hour vaults.

7238. Inspection.

Same as for six hour vaults.

TABLE 1.

Minimum Wall Thicknesses — Ground Supported Vaults

a. Six Hour Vaults

No. of Stories Counting from Top down	KIND OF WALL CONSTRUCTION			
	Reinforced Concrete	Brick or Plain Concrete	Protected Steel or Reinforced Concrete Frames	
			Reinforced Concrete Panels	Brick or Plain Concrete Panels
Top	10	12	10	12
2nd	10	12	10	12
3rd	10	12	10	12
4th	12	16	10	12
5th	12	16	12	16
6th	12	20	12	16
7th			12	16
8th			12	16
9th			12	16
10th			14	16

b. Four Hour Vaults

No. of Stories Counting from Top down	KIND OF WALL CONSTRUCTION			
	Reinforced Concrete	Brick or Plain Concrete	Protected Steel or Reinforced Concrete Frames	
			Reinforced Concrete Panels	Brick or Plain Concrete Panels
Top	8	12	8	12
2nd	8	12	8	12
3rd	10	12	10	12
4th	10	16	10	12
5th	12	16	12	16
6th	12	16	12	16
7th			12	16
8th			12	16
9th			12	16
10th			12	16

c. Two Hour Vaults

No. of Stories Counting from Top Down	KIND OF WALL CONSTRUCTION					
	Reinforced Concrete	Brick	Hollow Clay Tile or Concrete Block	Protected Steel or Reinforced Concrete Frames		
				Reinforced Concrete Panels	Brick or Plain Concrete Panels	Hollow Clay Tile or Concrete Block Panels
Top	6	8	12	6	8	12
2nd	8	12	12	8	12	12
3rd	10	12	16	10	12	16
4th	10	16	20	10	12	16
5th	12	16		12	16	20
6th	12	16		12	16	20
7th				12	16	20
8th				12	16	20
9th				12	16	20
10th				12	16	20

SPECIFICATIONS FOR STRUCTURE SUPPORTED VAULTS.

(Tentatively adopted 1926)

7301. Fire Resistance Classifications.

Structure Supported Vaults are those supported by the framework of buildings of fire-resistive construction. These vaults may be located individually on any floor of such a building and are designed to afford full protection to their contents, assuming the integrity of the supporting structure.

Six Hour Vaults.

This classification is recommended where the construction and occupancy are such that a degree of fire resistance equivalent to six hours of the standard test is deemed necessary.

Four Hour Vaults.

This classification is recommended where the construction and occupancy are such that a degree of fire resistance equivalent to four hours of the standard test is deemed necessary.

Two Hour Vaults.

This classification is recommended where the construction and occupancy are such that a degree of fire resistance equivalent to two hours of the standard test is deemed necessary.

General Specifications.

7311. Supporting Structure.

a. STRENGTH. The structure supporting the vault shall be of adequate strength to carry the full building loads as well as the entire weight of the vault structure and contents.

b. FIRE RESISTANCE. There shall be no combustible material in any portion of the supporting members of the structure. All structural members of the building shall have a degree of fire resistance equivalent to at least the same number of hours of the standard test as that for which the vault is rated.

7312. Walls.

a. LOCATION AND ARRANGEMENT. The walls of the vault shall follow the panels of the building whenever possible, and shall extend from floor to ceiling of the building in the stories where the vault is located.

If vaults are located on more than one story, they shall preferably be placed one above the other in the several stories.

b. MATERIALS. Walls of vaults of the various classifications shall be built of the materials and in the manner specified for ground supported vaults of equivalent classifications.

c. THICKNESS. The thickness of vault walls of the various classifications shall be not less than the minimum thicknesses for the various materials specified for the top stories of ground supported vaults as given in Table 1 except that the minimum thickness of walls of hollow clay tile or concrete block for a two hour vault may be 8 inches.

d. BONDING. Vault walls shall be effectively bonded at the top and bottom to the floor or roof of the building in the stories where the vault is located. Suitable bonding shall also be secured between the walls and adjoining building columns as well as between vault walls and outside

walls of the building where the latter are used to serve as a portion of the vault walls.

7313. Roof and Floor.

a. The building floors or roof of the building shall serve for the roof and floors of the vault. The roof or floor shall be unpierced.

b. No wood or other combustible material shall be used in the flooring or surfacing.

7314. Interior Supports.

Where there are interior supporting columns in a vault they shall have a degree of fire resistance equivalent to not less than three hours of the standard fire test.

7315. Doors.

Shall conform to specifications as given below.

7316. Water Tightness.

Shall conform to the specifications for Ground Supported Vaults.

7317. Ventilation.

Ventilation of interior shall be only through door openings. Walls, floors and roofs shall not be pierced.

7318. Inspection.

The construction of the vault shall be under the immediate supervision of a competent engineer or architect to insure that it is built in accordance with the above recommendations and that careful workmanship is obtained throughout.

RECORD ROOMS.

(One Hour Classification.)

This classification is recommended where the construction and occupancy are such that a degree of fire resistance equivalent to one hour of the standard test is deemed necessary. Such enclosures are not to be considered as vaults but are termed record rooms. Specifications for this class of construction will be prepared later.

VAULT DOORS.

(Officially adopted 1926)

General.

7501. In order to obtain the greatest amount of fire resistance vaults should obviously be provided with doors affording fire protection approximately equivalent to that of the walls in which they are installed. Structural considerations, however, sometimes demand wall thicknesses greater than are essential for purposes of fire protection, and in such cases a door having a lower classification than the wall in which it is installed may give the necessary protection. In these cases, the classification of the vault is obviously determined by the door rather than by the vault structure.

7502. Attention is called to the necessity of intimate and continuous contact of the door frame (vestibule) with the wall structure, as it is probable that vault failures may occur from neglect of this important installation feature.

Masonry should be placed close against the metal of the vestibule. If the door is installed after the wall opening is prepared, careful attention should be given to the grouting of the vestibule in position. Carefully detailed direction sheets covering methods of installation should be attached to each vestibule when shipped.

7503. There has been little reliable information (such as can only be obtained by tests under standard conditions) on the efficiency of various types of vault doors. The general specifications which follow are consequently based on admittedly limited data and should not be permitted to act as an obstruction to development. Therefore, doors of any design and construction may be recognized and should be given preference when bearing evidence of classification by an organization which is properly equipped and qualified for experimental testing and inspection of devices at factories, doors of such designs having demonstrated their efficiency by passing actual tests.

Standard Tests.

7511. Standard tests consist of a fire endurance test and a hose stream test. In the endurance test, the door is mounted in the test wall with the unexposed side surrounded by an insulated compartment representing the vault chamber.

This chamber consists of an insulated box with an open side so designed that it may be closed by the wall of the furnace in which the door is mounted, making a tight joint. Walls, floor and ceiling of chamber are lined with insulation at least 2 inches in thickness. Cubic feet of space inside of chamber are not more than 20 times the number of square feet in the door opening.

7512. Temperatures on the exposed side are increased in accordance with the standard time temperature curve, and the classification is based on the time at which a temperature of 300° F. is indicated on a temperature measuring device located 2 inches from the unexposed surface of the door opposite the joints or when passage of flame is observed.

7513. In the hose stream test the door is subjected to fire for half the classification period determined from the endurance test, then subjected for one minute to a hose stream from a 1⅛ inch nozzle 20 feet from the door with a pressure of 30 lbs. and is promptly re-exposed to the fire for the other half of the period. The failure point in this test is the same as in the endurance test, namely a temperature of 300° F. or passage of flame.

SPECIFICATIONS FOR VAULT DOORS.

7521. Classification.

Vault doors are classified as 6 hour, 4 hour, or 2 hour when the construction is such that they are capable of withstanding an exposure equivalent to 6 hours, 4 hours, or 2 hours of the standard test.

7522. General Design.

Doors may be single or mounted in pairs, but in all cases to have insulation mounted between the inner and outer face plates.

NOTE: It is believed that inner uninsulated doors have some value in keeping combustible material well inside the vault chamber and they may be installed if desired.

7523. Strength.

The door structure shall have adequate strength to withstand the wear and tear of normal operation, and such rough usage as may be reasonably anticipated for a device of its class.

7524. Insulating Material.

Doors shall be insulated with nonflammable heat insulating material of at least the thicknesses specified in the following table:

Classification	*Thickness of Insulation*
6 hour	Not less than 5 in.
4 hour	" " " 4 in.
2 hour	" " " 3 in.

7525. Details of Construction.

a. Doors shall be mounted in a vestibule with or without inner doors creating a dead air space, and shall have a total thickness sufficient to provide for the specified thickness of insulation and sufficient additional room for locking mechanism. Edges of the door shall be so formed as to provide tongued and grooved joints.

b. Vestibule shall consist of an open steel box carrying on its inner face the insulated head, sill and jamb structures formed to engage all four edges of the door. Edges of the box shall be provided with flanges overlapping the outer and inner surfaces of the wall at least 3 inches on the outside and 2 inches on the inside. Sides of the vestibule shall be at least 1/16 inch thick, and the entire structure shall be braced and stiffened in such a manner as to provide a rigid support for the doors.

c. When in the closed position doors shall be secured to the frame at intervals not exceeding 2 feet on all four sides.

NOTE: Hinges are considered as fastenings but must be reinforced with bolts if the spacing does not come within the specifications given.

d. Inner doors, if used, shall be of steel plate, at least 3/16 inch thick, reinforced to give stability, closing against stops and provided with suitable hardware.

DOORS FOR RECORD ROOMS.

(One Hour Classification)

Specifications for this class of construction will be prepared later.

UNINSULATED STEEL VAULT DOORS.

(*Tentatively adopted 1925*)

Since the uninsulated vault door is widely used it is felt that it should be given a classification although this classification is outside of the groups covered by these specifications. Therefore, on the basis of such furnace tests as have been made, a classification of one-half hour is given to the type of uninsulated vault door described.

Classification One-half Hour.

Uninsulated steel double doors shall be mounted in vestibules with opening not to exceed 3 feet in width or 7 feet in height. Space between doors shall be not less than 18 inches. Outer door shall be single, inner doors shall be mounted in pairs. Outer door shall be made of ¼ inch plate reinforced at the edges to provide a thickness of not less than ½ inch. Inner doors shall be not less than 3/16 inch thick. Outer doors shall be held in the closed position at not less than four points on each side and at one point at top and bottom. Inner doors shall be held in position by three latch bolts in addition to the hinges. All doors shall close against stops, the overlap being not less than ⅜ inch.

Vestibule shall be of steel not less than 1/16 inch thick stretched between hoops formed of angle iron or other structural steel members

having a thickness of at least ¼ inch. Vestibules shall be provided with heavy steel flanges overlapping each side of the wall, these flanges to overlap the wall at least 2¾ inches on the outside and 2 inches on the inside. In all cases masonry of wall shall extend between the flanges coming in contact with the back of the vestibule.

VAULT INTERIOR EQUIPMENT

(Under this heading are grouped a number of points which relate to the proper equipment and maintenance of a vault.)

(From 1924 Tentative Report. Certain details of this section were criticized at the meeting of the National Fire Protection Association, as is indicated by the footnote taken from the stenographic record of the discussion.)

Filing Equipment

7611. Filing equipment should preferably be of steel throughout. Containers should be entirely enclosed if possible, but if contents are such as to make complete enclosure impracticable, containers having only the front end open are advisable. Cubical contents of individual containers should be kept as small as possible.

7612. Where wooden interior equipment is present, automatic sprinklers may be installed, although this is not considered as good practice as steel equipment without sprinkler protection.

Lighting

7621. The lighting should be electric, so arranged that both wires of the circuit are cut off when the doors are closed. Common methods of accomplishing this are given below in order of merit.

(a) Interior wiring in conduit with as many fixed lamps as are needed for adequate illumination; this interior system to be supplied by a short extension cord through doorway to live receptacle outside vault. Cord may be protected by flexible armor or by short length of rigid steel conduit with bushings or taped in place on the cord at the point of door closure.

(b) Interior wiring controlled by door switch, switch opening *both* sides of the circuit.

(c) Interior wiring controlled by outside switch with red pilot light.

7622. Wiring should be in conduit preferably exposed, and there should be no pendant or extension cord within the vault.

7623. Care should be taken to make vault lighting adequate. Otherwise matches or other hazardous forms of illumination are likely to be used.

Heating

7631. Ordinarily vaults require no heating. Where steam coils are used, a hazard is invariably introduced. Open flame heaters, electrical heaters, etc., should not be employed.

Ventilation

7641. Many example of hazards introduced into vaults by ventilating systems are found. Openings are cut through walls to permit of ventilation. Fans are installed, usually supplied by makeshift wiring.

It is possible to install mechanical ventilation, either drawing through or discharging through doorway, and not necessitating additional wall openings. Increase in height of door will be desirable when this is done, and any such system should be so arranged that electric power supply to any apparatus within the vaults will be cut off when doors are closed.

Ducts passing through walls, even though protected by doors or shutters, create an additional hazard.

Housekeeping

7651. General cleanliness should be of the highest type. Foreign materials should not be kept in vaults. This has been emphasized by finding in vaults such things as gasoline, kerosene, lubricating oils, oily rags, nitrocellulose moving picture and X-Ray films, and the film mounts used by dentists, turpentine, reserve supply of matches, etc.

Smoking inside vaults should be positively forbidden.

Telephone and Alarm

7661. Where possible, telephone connections should be installed inside the vault, or alarm bells should be arranged so that a person locked inside the vault can ring an alarm on the outside.

Alarm bells have also been successfully arranged that ring inside when the door is about to be closed, a second switch on the outside door or the other half of a double inside door shutting off the bell.

MR. J. B. LONGACRE (Philadelphia): Has any consideration been given to the protection of vault interiors by automatic sprinklers?

MR. WEAVER: The feeling of the committee was that where a vault is of good design and equipped throughout with non-combustible furniture, it probably would be as well to leave the sprinklers out; where it is not of modern design and has wooden shelving, it is better to put the sprinklers in. It is a matter for individual decision.

MR. LONGACRE: The water hazard to records is very serious.

MR. WEAVER: It is much overestimated I think. We have had some experiments with ledgers actually put in tubs of water and allowed to remain for days, then taken out. The bindings fell apart, but the ledgers were still legible.

8. Destruction of Records No Longer Useful

(Officially adopted 1926)

The path of least resistance is to let records accumulate whether they have value or not. Without an authorized procedure for their destruction, usually no one cares to take the responsibility of disposing of them even though they may have outlived their usefulness.

Obsolete and useless records take up valuable floor space, occupy costly filing equipment, entail constant labor costs for filing them, transferring them to make room for current records, or searching through them for old data frequently rather casually called for. Perhaps the most serious objection to retaining these old and useless records is that they frequently occupy space in vaults, safes and other protective containers, to the exclusion of much more important current material. Often accumulations of old records are objectionable merely by reason of their presence in vaults, because they add to the combustible contents, and constitute an exposure to important records.

There is a feeling among some companies and individuals that the less said about the destruction of records, the better; and there is perhaps a fancied security in the retention of old records, but which in reality does not exist. Nevertheless, the steady accumulation of old books and records from year to year presents a situation that must be met, and met in some systematic and definite manner.

Some one at some time must take the responsibility for the destruction of records which should not be permitted to accumulate indefinitely in some inadequate storage or in space that might be used for the storage of something more valuable than obsolete records.

Plan of Procedure.

It is recommended that certain designated officers of mature judgment be given the necessary authority by the Directors to decide upon destruction of records and the manner of disposal.

The National Electric Light Association Code suggests that this authority be conferred by title only rather than by name and title, and thus obviate the necessity of filing a new resolution each time a successor in office is appointed. In line with this suggestion, one group of utility operators doing a nation-wide business designates to their traveling auditors the necessary and final authority for the destruction of the obsolete records of their constituent companies. The auditor, in turn, has associated with him the chief accountant of the company whose records are to be destroyed, thus affording a double check to this work.

A complete list of the records for destruction should be prepared and passed on by the person or persons having the final authority to make sure that the period of preservation as outlined in the Code, or any state requirements or statutes of limitation have been met.

The method of disposition of records is sometimes a problem. Whether to destroy by fire or by sale as scrap paper, is a question. On the whole, it is preferable to destroy by fire since very careful consideration must be given to the nature of any records disposed of by sale. The authority for destruction should be signed by the officer or officers designated and be submitted to the person responsible for the actual destruc-