A CRITICAL EVALUATION OF THE PACKAGING OF COMPONENTS IN A KIT, FIRST AID, SURVIVAL CARE, INDIVIDUAL

> Thesis for the Degree of M. S. MICHIGAN STATE UNIVERSITY Forest L. Neal 1962

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By

Forest L. Neal

AN ABSTRACT OF A THESIS

Submitted to Michigan State University in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

School of Packaging

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This study was undertaken for the purpose of investigating the possibility of reducing the weight and cube of one of the military first aid kits.

It was found that the size of the kit was largely influenced by the containers used for the components. Accordingly, the investigation was centered around the packaging of the individual items making up the kit.

Various packaging materials were evaluated. A selection of the most effective materials was made, considering such factors as conformance to the shape of the items, toughness, temperature use range, moisture vapor transmission rate, gas transmission rate, resistance to acids, alkalies and grease, machineability, printability, compatibility, and ease of opening.

The component items were repackaged in the materials selected and a significant reduction in weight and cube was obtained. It was found that weight of the components can be reduced from 227 to 188.6 grams and the cube of the components reduced from 44.4 to 35.1 cubic inches.

Changes in military procurement documents are recommended in the study. These changes are essential, providing industry with detailed packaging instructions which will insure the minimum weight and cube utilization.

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TABLE OF CONTENTS

Chapter	,	Page
I.	INTRODUCTION	1
	Background	1 4 6
II.	MILITARY PACKAGING CCMPARED WITH COMMERCIAL PACKAGING	8
	The Product	9
	Distribution	9 17
III.	SELECTION OF PACKAGING MATERIALS	19
	Minimizing Weight and Cube Material Toughness	20 20 21 23 23 25 27
IV.	EVALUATION OF COMPONENT ITEM PACKAGING	2 9
	<pre>Item FSN, 6505-663-2636, Sodium Chloride, Sodium Bicarbonate Mixture, 4.5 gm, 2s. Item FSN, 6510-597-7468, Bandage, Absor- bent, Adhesive, 3/4 x 3 inches, 18 s Item FSN 6510-201-7455, Dressing, First Aid, Individual Troop, 4 x 7 inches . Item FSN 6510-201-1755, Bandage Muslin, 37 x 37 x 52 inches Item (No FSN), Water Purification Tablets, 6s</pre>	29 32 35 38 42
V .	PACKAGING FOR DISTRIBUTION	43
	<pre>Item FSN 6505-663-2636, Sodium Chloride, Sodium Bicarbonate Mixture, 4.5 gm., 2 s</pre>	44 46 48

Chapter

,

V. PACKAGING FOR DISTRIBUTION, cont.

		It It	em 3' em	F3 73 (1	5N c 3 Vo	65 7 FS	SIC x SN))-2 52),	201 2 i Wa	L-] inc	175 che er	55, es Pu	E iri	Bar fi	nda .ca	ige iti	e N	lus 1	sli Tat	in,	• ts	•	49
			2	5	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	ΣT
VI.	C	ONC	LU	SIC	DNS	5	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	52
		Cc Ur	ompo it	one Pa	ent ack	, F ag	^o ac gir	cka 1g	agi Fc	ing or	St	• or	• ag	ge	• an	Id	Di	st	ri	bu	iti	.on	52 54
VII.	RE	CC)MM	ENI	DAT	'IC)NS	3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	55
		Cc Ur	ompo it	one Pa	ent ack	. F ag	Pac gir	cka ng	agi fo	ine or	s St	or	•ag	se	ar	Id	Di	Ist	ri	bu	iti	lon	55 56
BIBLICGRA	PHY	Ι.	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	63
APPENDIX	• •	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	65

Page

LIST OF TABLES

Table		Page
1.	Compatibility Test, Water Purification Tablets .	24
2.	Compatibility Test, Water Purification Tablets With Polyethylene, Foil, Kraft Lamination .	25
3.	Summary of Weight and Cube Data, Items Packaged In Prototype Kit	66
4.	Summary of Weight and Cube Data, Items Packaged With Proposed Changes	66
5.	Weight and Cube Comparison, Large Interior Con- tainer Contents	67
6.	Weight and Cube Comparison, Small Interior Con- tainer Contents	67
7.	Weight and Cube Comparison, Total First Aid Kit Contents	67

LIST OF ILLUSTRATIONS

Figure	e	Page
l.	Prototype First Aid Kit	5
2.	Heat Sealed Package With Notched Edge	27
3.	Item FSN 6505-663-2636, Sodium Chloride, Sodium Bicarbonate Mixture, 4.5 gm., 2s	31
4.	Item FSN 6510-597-7468, Bandage, Absorbent, Adhesive, $3/4 \times 3$ inches, $185 \cdot \cdot \cdot \cdot \cdot \cdot \cdot$	34
5.	Item FSN 6510-201-7455, Dressing, First Aid, Individual Troop, 4 x 7 inches	37
6.	Item FSN 6510-201-1755, Bandage, Muslin, 37 x 37 x 52 inches	39
7.	Item (No FSN), Water Purification Tablets	41
8.	First Aid Kit With Proposed Packaging Changes	57
9.	Size Comparison, Prototype First Aid Kit and The First Aid Kit With Proposed Packaging Changes	69

CHAPTER I

INTRODUCTION

Background

Prior to the development of nuclear weapons, the first aid kit for the individual soldier consisted of a pressure bandage which was carried in a canvas case attached to the individual's pistol belt. The bandage was considered sufficient for emergency first aid type care for chest wounds, gun shot wounds, lacerations, abrasions, and other injuries experienced by the fighting man.

Under nuclear warfare conditions, the individual may experience radiation exposure, thermal and radiation burns, accompanying shock, in addition to those injuries incurred under conventional warfare situations. To provide for these hazards, Army Medical Service personnel considered that additional items were required for the individual's first aid kit.

The requirement for the additional items for the first aid kit was reviewed by the United States Seventh Army, Europe, and the United States Continental Army Command. Both commands recommended that a new first aid kit be developed to include items for use by nuclear type casualties.

The Armed Services Medical Materiel Coordination

Committee established a development project to develop the first aid kit.¹ This first aid kit was to consist of two interior packets which would fit into an outer container of such shape and size to permit attachment to the standard pistol or rifle belt.

The smaller interior container was to contain: One packet, first aid, field, brown dressing. Six gauze, absorbent, adhesive, 1 x 3 inches. Eight water purification tablets.

The larger interior container was to contain:

Three electrolyte salt packets.

One bandage, triangular, muslin.

One burn ointment, bland.

One packet, first aid, field, brown dressing.

Six gauze, absorbent, adhesive, 1 x 3 inches.

Sixteen water purification tablets.

In addition to the above components, the Armed Services Medical Materiel Coordination Committee established guide lines for the development of the kit. They were in the form of military and essential characteristics, as follows:

¹Armed Services Medical Material Item Review Report, Serial E681a, Subtask 6-59-04-049.102, 26 June 1957. Washington: Armed Services Medical Materiel Coordination Committee, 1957.

1. Shall be of such size and shape as to permit attachment to standard pistol and rifle belts without interfering with the wearer's efficient discharge of duties under combat conditions.

2. Closure shall be such as to remain fastened while carried by the soldier under field conditions, yet capable of being easily opened by an injured soldier.

3. Shall be of such size and shape to accommodate the necessary components.

4. Shall contain two inner packets which shall be waterproof and capable of protecting their contents from extremes of temperature, dust, mildew, and humidity.

5. Inner packets shall be made in such a manner as to permit their easy and quick withdrawal.

6. Inner packets shall be capable of being easily opened by an injured individual even when gloves are worn.

7. The larger of the inner packets shall be capable of being reclosed in such a manner as to protect contents once the seal is broken.

8. Components shall be labeled so as to be readily identifiable by individuals not familiar with the Federal Item Identification.

9. The larger inner packet shall include directions as to the proper use of the components.²

Subsequently, a prototype of the first aid kit was developed by the Medical Equipment Development Laboratory, Fort Totten, Flushing, Long Island, New York.

The first aid kit was inspected by the author and it was evident that a reduction in the cube of the first aid kit could be attained through certain changes in the packaging

2_{Ibid}.

of components. Accordingly, it is the evaluation of the component packaging that is the subject of this thesis.

Description of Prototype Kit

The exterior container of the first aid kit consists of a canvas pouch, approximately $8 \ge 2 \ge 5$ inches, equipped with fasteners for the pistol belt and a nylon friction type closure. (Item A, Figure 1.)

The larger interior container is made of a rigid plastic material in a telescopic style. The exterior dimensions of the larger container are $4 \frac{3}{4} \times 2 \times 4 \frac{1}{4}$ inches. (Item B, Figure 1.)

The smaller interior container is a plastic bag with a string tie closure. Approximate dimensions of the smaller interior container are $3 \times 2 \times 4 1/4$ inches. (Item C, Figure 1.)

Individual items, with the exception of the water purification tablets, are in unit packages used for distribution as described in applicable federal and military specifications. The water purification tables are in wax coated strip type packages, developed by the Quartermaster Corps for this first aid kit.

Due to professional considerations, components of the first aid kit were changed from the original listing. The items in the prototype first aid kit are as follows: 1. Smaller Interior Container

One each-FSN 6510-201-7455, Dressing, First Aid, Field,

Figure 1

Prototype First Aid Kit

This photograph illustrates the various containers utilized for the kit. "A" is the canvas pouch which holds the two interior containers, B and C. The pouch dimensions are $8 \ge 2 \ge 5$ inches. "B" is the large interior container fabricated in a telescopic style with dimensions of $4 = 3/4 \ge 2 \ge 4 = 1/4$ inches. "C" is the smaller interior container which consists of a polyethylene bag with a string tie closure. Dimensions of this container are approximately $3 \ge 2 \ge 4 = 1/4$ inches.



Individual Troop, 4 x 7 inches, "First Aid Packet."

One package-FSN 6510-597-7468, Bandage, Absorbent, Adhesive, $3/4 \times 3$ inches, 18s.

One strip-(No FSN) Water Purification Tablets, Iodine, 6s.

2. Larger Interior Container

Two packages-FSN 6505-663-2636, Sodium Chloride, Sodium Bicarbonate Mixture, 4.5 gm., 2s.

One package-FSN 6510-597-7468, Bandage, Absorbent, Adhesive, $3/4 \times 3$ inches, 18s.

One each-FSN 6510-201-7455, Dressing, First Aid,

Field, Individual Troop, 4 x 7 inches, "First Aid Packet."
One each-FSN 6510-201-1755, Bandage, Muslin, 37 x
37 x 52 inches.

Two strips(No FSN) Water Purification Tablets, Iodine, 6s.

Specific description of the packaging of these items will follow as each item is discussed.

Method of Evaluation

The overall size and weight of the first aid kit is dependent upon the components. Accordingly, the first concentrated effort was expended on reviewing military and federal specifications which prescribe the packaging of the component items.

Commercial literature was then reviewed for the possibility of there being materials, other than those

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indicated in specifications, which might be applicable for component packaging.

Where applicable, laboratory tests were performed to determine the effectiveness of materials.

Components were then repackaged utilizing materials which provides as much protection as the current packaging and which reduces significantly the weight and cube of the first aid kit.

CHAPTER II

MILITARY PACKAGING COMPARED WITH COMMERCIAL PACKAGING

For most of the items making up the stock list for military medical materiel, there are similar commercial items.³ Should a comparison of the items stocked at a local surgical supply house or pharmacy be made with those stocked in a military supply activity many identical items in both activities would be observed. Further examination of the commodities would reveal that the basic difference in commercial and military medical items is in the packaging. In commercial packaging of medical materiel, there is a large diversity of package design with product identification accomplished through use of proprietary names. In military packaging of medical materiel, standardization of packaging and utilization of chemical and generic terms for identification of the products are common procedures.

Development of a package which is to contain a military item has much in common with package development for a commercial item. The techniques used are essentially

³Department of the Army, <u>Department of the Army</u> <u>Supply Manual</u>, SM 8-C3, Washington: Government Printing Office, 1961, p. 2.

the same but in most instances the degree of protection afforded the military item will be much greater than for its commercial counter part.

There are three general areas to be considered in the development of a package:⁴

1. The product.

2. Merchandising, storage, handling, and use factors.

3. The package and its components.

It is within these general areas that military and commercial packaging will be compared.

The Product

Basic to both military and commercial packaging are the characteristics of the product to be packaged. In this area a full knowledge of the product and available packaging materials is required. One of the most important considerations for both military and commercial packaging is the control of liquid moisture and water vapor. This is of greater importance in military packaging because of the additional length of time in storage and the greater potential for exposure to handling and climatic hazards.

Merchandising, Storage, Handling, and Use Factors

<u>Merchandising</u>. The greatest apparent difference in military and commercial packaging falls within this classification. The design of the unit container in commercial packaging must consider point-of-sale attractiveness. The

^{4&}quot;Package Design," <u>Modern Packaging Encyclopedia</u>, 1951, Chilton Co., 1957. pp. 8-19.

commercial package today is considered a silent salesman and much research is being done in color, container shape and printing to make the package more attractive to the consumer, thus stimulating his or her impulse to buy. This consideration in many instances results in the use of a container larger than that needed for basic protective packaging of the item, more expensive material processing because of the elaborate printing and design, and a possible compromise in the choice of packaging materials to assure the ultimate of sales appeal to the customer. These considerations thus have a greater impact on weight and cube requirements which in turn result in more storage space and higher transportation requirements than would be the case if the merchandising aspect received less emphasis.

Military packaging is primarly concerned with providing the desired protection at the least cost with minimum weight and cube utilization. Sales appeal is not a consideration. However, item protection, identification and user utility are factors of concern in the development of the military package.

<u>Storage</u>. Storage facilities for commercial products may be classified as:⁵

⁵Fredrick, John R., <u>Using Public Warehouses</u>. Philadelphia: Chilton Co., 1957. pp. 8-19.

- 1. General Merchandise Warehouses.
- 2. Cold Storage and Refrigerated Warehouses.
- 3. Special Commodity Warehouses.

These storage facilities may be public warehouses or warehouses owned or leased by the manufacturer or distributor. They are designed to accommodate the in-storage protection desired for commercial commodities. Storage time for commercial commodities is in general relatively short because of the desire of the seller to maximize profits through high inventory turn-over.

Storage facilities for military products follow the same type classification. In the United States, and at fixed installations overseas, the protection provided by the warehouses is essentially the same. However, the quality of military storage facilities drastically changes in overseas areas during hostilities. Military storage facilities then become extremely limited. Material is stored in abandoned buildings, under tents, covered with tarpaulins, and in the open. Under these storage conditions military material is exposed to extremes of climatic, The lack of chemical, and biological deterioration forces. adequate warehouses or improved storage facilities makes it imperative that packaging of military material provide protection under the most unfavorable storage conditions.

The length of time in storage for large quantities of military material exceeds that for commercial commodities. A large percentage of military materiel is procured against mobilization requirements. Because of this, the length of time in storage for these items is indefinite. To assure availability of medical materiel, for example, there have been in storage since World War II large quantities of many items which would be immediately required should a mobilization of our forces be initiated. It is obvious that the packaging for this long-term storage must provide a greater degree of protection than that required for similar items in the commercial distribution system.

<u>Climatic Hazards</u>. Commercial packaging, except for those items to be exported, is concerned with protection against the climatic conditions existing in the United States. These conditions are relatively severe in some areas. For example, the Western desert has 5 to 10 inches of rain per year and 300 days of sun and temperatures to 120° F, and the Northern states experience temperature drops to -30° F. in the winter⁶. While these conditions are severe, the material is stored and transported under conditions which can be controlled and which are probably the best in the world.

Military materiel on the other hand, may find itself riding the deck of a ship in movement to an overseas destination, stored in the open on a beach, then moved by indigenous personnel to a distribution point where it receives the only protection available, coverage by a tarpaulin.

⁶Greathouse, Glen A., and Wessel, Carl J., <u>Deterior</u>-<u>ation of Materials</u>. New York: Reinhold Publishing Co., 1954, pp. 3-69.

At the destination storage area climatic conditions may be severe. Should the materiel be in a tropical rainforest area, it would be subjected to an environment characterized by an average temperature between 80° F and 85° F., and abundant rainfall with continual high relative humidity.⁷ This environment is the optimum or near optimum for flourishing microbial life as well as that required for extreme metal corrosion reactions. An example of this environment is presented by Greathouse and Wessel⁸ in their description of deciduous forest areas in the Philippines being practically free of leaf mold owing to microbial action keeping the mold reduced to slime.

Should the materiel be in extremely dry climate areas, the desert regions, it would be subjected to an environment characterized by the situation where the evaporation exceeds precipitation.⁹ Problems in the desert result from high day temperatures, ultraviolet radiations, dust and sand combined with sudden violent winds, and large daily temperature fluctuations. Greathouse and Wessel also report temperatures of black finished objects reaching 200° F., when the equipment was in operation. Increases in chemical reactions and heat aging of equipment are common

> 7<u>Ibid</u>., pp. 55-60. ⁸<u>Ibid</u>., p. 56. ⁹<u>Ibid</u>., pp. 61-62.

in the desert areas. Moisture and fungus problems are rare, although termites which nest well below the surface have been found in extremely dry climate areas.¹⁰

Should the materiel be in an extremely cold climate area, it would be subjected to changes in physical and mechanical properties due to the cold rather than actual destruction of the materials by other components of the climate. Moisture control in this environment is extremely important because condensation occurs when cold equipment is brought into a warm enclosure or by personnel breathing on light and delicate equipment. This condensation can contribute to corrosion. Many plastics loose their desirable characteristics in extremely cold areas. Accordingly, care should be exercised in the selection of films for military packaging. Mildew and insect problems are rare in extremely cold areas.¹¹

Because of the possibility that military forces may be committed in these areas of extreme climatic conditions, military packaging must be of the quality that will protect materiel against the extremes of deterioration forces found in these varied environments.

Handling and Shipping Hazards. In the distribution system in the United States, the handling and shipping hazards

> 10<u>Ibid</u>., pp. 62. 11<u>Ibid</u>., pp. 62-64.

are essentially the same for military and commercial materiel. Both military and commercial materiel move through similar distribution, transportation and handling systems. Accordingly, packaging for immediate consumption or for a short storage period may be essentially the same for military and commercial requirements. But military materiel is not, for most items, procured for intended use in this country. Therefore it must be packaged for protection against hazards that exist anywhere in the world.

Shipping and handling hazards can be most severe and are associated with mechanical damage to the items or containers. In general, the shipping and handling hazards are impact, shock, vibration, and forces which crush or distort. Shipping and handling hazards are intensified by climatic conditions, with moisture being the most significant factor to the mechanical failure of a package.

From personal observations the author has seen dunnage being ripped from a freight car door by the forks of a lift truck, allowing the materiel to fall from 8 to 10 feet onto a hard stand; cargo being unloaded from a ship by cargo net where one end of the net is loosened and the cargo tumbles onto the dock; stock handlers dropping items from approximately 3 feet to the ground; and material falling from the tail gate of a truck to the ground. Because of the extensive use of indigenous personnel and facilities provided by host countries, these are normal hazards encountered by military shipments. Such hazards must be considered

when the military package is being designed.

Protection against pilferage and tampering is also of greater importance in military packaging because of the greater exposure in the world wide distribution of military materiel.

<u>Use Factors</u>. In commercial packaging, as has been previously discussed, much effort has gone into making the package attractive for stimulation of the impulse to buy. In many instances useless gadgetry is included in the package design. In these areas, the container size is increased considerably. Such cost and size luxuries have little place in military packaging.

Another factor which affects the quality of the package is the availability of replacement items to the user. For the commercial product, there usually is available a replacement from the store where the item was initially purchased. Or, in the United States, a replacement may be obtained from any place in the United States and be moved to any other place in the United States within a few hours by Air Freight or by some other premium means of transportation. Replacement of the military item may not be so simple.

The military item may have been transported by train and truck across the United States, moved by ship to Korea, and moved again by train and truck to an outpost in the mountains. At some point it is transferred to the back of a man who carries it to the unit where it is later distributed

to the individual who will use the item. The transportation line may be over 5,000 miles, with many potential hazards for the item in route. It is essential that when the individual opens the package he finds the desired item in a servicable condition for immediate use.

The Package and Its Components

For the life saving items to be carried by the individual soldier, a package which contains the wrong item, or the right item in a deteriorated condition, may result in the death of an injured soldier needing the item in an emergency. Getting an immediate replacement life saving item under battle field conditions may not be accomplished in time to save the life of the injured individual.

To assure that the above situation does not occur, packaging of military first aid items requires positive identification and the ultimate of protection against the hazards of distribution and the wear and tear given the containers when carried on the pistol belts of soldiers. The packaging must provide protection for the items when the soldier is wading swamps in the jungle, in a snow bank in the Artic, in the sand storms and intense heat of the desert, or when he is crawling through the rugged terrain on a mountain side.

Of significant importance is the ease of opening of the container. Because the soldier may be alone when injured, each first aid item must be readily accessable to

him even though he has limited use of his hands and has no cutting or puncturing tools for opening containers.

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CHAPTER III

SELECTION OF PACKAGING MATERIALS

The various mechanical and climatic hazards to which the items in the first aid kit may be exposed were discussed in the previous chapter. With these hazards in mind, the following prerequisites were established for materials to be used for component packaging:

1. The material should conform to the shape of the item to be packaged so as to minimize the weight and cube.

2. The material should be strong enough to provide protection for the item against mechanical hazards that may be encountered.

3. The material must have a wide temperature use range, from -40° F. to $+120^{\circ}$ F.

4. The material must have a low moisture vapor transmission rate.

5. For the Sodium Chloide, Sodium Bicarbonate Mixture, and the Water Purification Tablets, the material must have a low gas transmission rate.

6. The material must be resistant to acids, alkalies, and grease.

7. The material must have good machineability.

8. The material must have good printability or be transparent for item identification and user instructions.

9. The material must be compatible with the item being packaged. There should be no chemical reaction.

10. The material must be such that the container can easily be opened with the hands.

Against these prerequisites, commercially available packaging materials were evaluated for possible use. The best summary of the qualities of the various packaging materials was found in the Modern Packaging Encyclopedia.¹²

Minimizing Weight and Cube

As will be discussed in Chapter IV, several items in the first aid kit are packaged in chipboard cartons and fiber board sleeves. These containers do not conform to the shape of the items. As a result, the packages are larger than they would have been had flexible materials been used for the containers. Accordingly, cartons should be eliminated from consideration as suitable unit containers for components of the first aid kit. Weight and cube savings are presented as the packaging of each component item is discussed in the following chapter.

Material Strength

The first aid kit will be carried on the pistol belt of the soldier and the components will be subjected to a

^{12&}quot;Properties of Packaging Films." <u>Modern Packaging</u> Encyclopedia, 1962, Vol. 35, No. 3A.

significant amount of punishment. It will experience violent impacts, tensile and compressive forces as it comes in contact with the ground, vehicles, weapons, etc. To protect the contents, the packaging materials should be very strong.

Because of the low resistance to impact, the following materials can be eliminated from consideration:

High density polyethylene

Cellulose acetate

Polystyrene

In addition, the chipboard cartons readily absorb moisture and fail upon exposure to high humidity environments. Because of this, their resistance to mechanical hazards is limited.

Temperature Use Range

The first aid kit may go with the soldier to various stations in the world where extremes in temperature are experienced. Therefore protection for the items should be provided for environments where the temperature may be from -40° F. to $+120^{\circ}$ F.

Because the following materials become brittle at subzero temperatures, they also can be eliminated from consideration as packaging materials for the component items:

Cellophane

Cellulose acetate

Moisture Vapor and Gas Transmission

For the Sodium Chloride, Sodium Bicarbonate Mixture and the Water Purification Tablets, protection against moisture, vapor and gas transmission is critical. To provide the maximum protection in this area a lamination which includes aluminum foil is essential.

For the bandages, gas transmission is not critical. The bandages can be protected against moisture and vapor by using a flexible barrier material which has a low moisture vapor transmission rate.

Materials which have relatively high moisture vapor transmission rates and are unacceptable for component packaging are:

> Cellulose acetate Polystyrene Polyvinylchloride Uncoated Paper

Resistance to Acids, Alkalies, and Greases

Because of the unknown environment to which the components of the first aid kit may be exposed, the items should be protected against damage from acids, alkalies, and greases.

The materials which should be eliminated from consideration because of their low resistance to these contaminants are: Cellophane Cellulose acetate Polyvinylidene chloride

Printability and Machineability

Printability and machineability of the flexible barrier materials presents no problem.

Compatibility

The only items in the first aid kit that presents a compatibility problem are the Water Purification Tablets.

To evaluate the compatibility of different materials which might possibly be used as a container or as a laminate with aluminum foil, the water purification tablets were exposed to the materials for 30 days in an oven at 45° C. The test was accomplished in both wet and dry environments.

The wet environment condition consisted of 25 ml of distilled water in a sealed weighing bottle which also contained one water purification tablet and a weighed sample of the packaging material under consideration.

The dry environment consisted of one water purification tablet and a weighed sample of the packaging material under consideration in a dry sealed weighing bottle.

The purpose of the test was to obtain information regarding changes in characteristics of the packaging materials when exposed to the tablets in a controlled condition. The oven was used for the purpose of speeding up any reaction that

would take place. Following in Table I, are the results of the observations.

Table 1

COMPATIBILITY TEST WATER PURIFICATION TABLETS 30 DAYS AT 45° C

Material	Initial Weight (gm)	Color Change	Final Weight Dry Exposure (gm)	Final Weight Wet Exposure (gm)
Pliofilm	.0395	To dark brown	.0396	
Pliofilm	.311	To light yellow/ brown		.0325
Polyvinyl Chloride	.0512	To pale yellow	.0518	
Polyvinyl Chloride	.0510	To pale yellow		.0526
Saran	.0459	To pale yellow	.0455	
Saran	.0436	To pale yellow		.0494
Polyethylene	.0798	To v ery slight yellow cast	.0798	
Polyethylene	.0650	To very light brown		.0658

From Table 1, it can be seen that polyethylene was the most compatible material for the Water Purification Tablets.

The Water Purification Tablets were then packaged in a polyethylene-foil-kraft laminated strip type package for
further observation. The strip pack was subjected to a 15 day conditioning in an oven at 45° C. Following in Table II are the results of the compatibility test.

TABLE II

COMPATIBILITY TEST WATER PURIFICATION TABLETS WITH POLYETHYLENE-FOIL-KRAFT LAMINATION 15 DAYS AT 45° C

BEGINNING TABLET WEIGHT (gm)	FINAL WEIGHT (gm)	WEIGHT LOSS (gm)
.1160	.1152	.0008
.1133	.1120	.0013
.1107	.1093	.0014
.1111	.1103	.0008
.1076	.1061	.0015
.1137	.1124	.0013
.1150	.1135	.0015
.7874	•7788	.0086

As can be seen in Table II, there was an average of slightly over 1% loss in weight of the Water Purification Tables during the 15 day period.

EASE OF OPENING

Of utmost importance in the packaging of the first aid kit components is that the items must be readily accessable to the user. When heat sealed flexible materials are used, the package must be easily opened. To evaluate this property, sample heat sealed bags were fabricated from:

4 mil polyethylene

2 mil polyethylene

Mylar-polyethylene lamination

Kraft-polyethylene lamination

Kraft-foil-polyethylene lamination

Of the above, the polyethylene bags were the most difficult to tear open. It is the opinion of the author that the 4 mil polyethylene bag could not be opened by an injured individual without the aid of a cutting or puncturing instrument.

The 2 mil polyethylene bag was also difficult to tear. However, when the edge was notched the container could be torn but the tear was not straight.

The mylar-polyethylene bag was also difficult to tear. However, when the bag was notched the container could be opened with ease.

Polyethylene laminated to kraft, and kraft and foil were the least difficult to tear before the bag edge was notched.

All of the above materials were found to tear easier when the edge of the material was notched. This improvement in tearing of the polyethylene however was slight. The mylar-polyethylene bag was easiest to open after notching. In addition, the tear was straight across the web which is an important factor when all of the package

contents are not to be utilized immediately.

An illustration of a bag with the notched web is shown in Figure II.

FIGURE 2

HEAT SEALED PACKAGE WITH NOTCHED EDGE



Selection of Packaging Materials

After considering the qualities of the various packaging materials, the following laminated materials were selected as the most effective for packaging of components of the first aid kit:

Kraft-foil-polyethylene for the Sodium Chloride, Sodium Bicarbonate Mixture and the Water Purification Tablets.

Mylar-polyethylene for the bandages.

The kraft-foil-polyethylene lamination is a tough package, is heat sealable and has a low moisture-vapor-gas transmission rate. The material is stable over a wide temperature range. The mylar-polyethylene lamination is a tough packaging material, is heat sealable and has a low moisture vapor transmission rate. It is also stable over a wide temperature range. The material is sufficiently flexible to permit the heat sealed edges to be folded over the edge of the package, conforming to the shape of the item, thus minimizing the cube.

The two interior containers must be reusable, provide physical protection to the items and must be waterproof. For this purpose, medium density,40 mil polyethylene, injection molded, telescopic style containers have been selected. The closure can be accomplished by pressure sensitive tape.

CHAPTER IV

EVALUATION OF COMPONENT ITEM PACKAGING

In this chapter the packaging of each item, as set forth in applicable specifications, is described. Deficiencies in these packaging specifications are pointed out along with potential packaging changes which could result in a decrease in weight and cube requirements for the items.

Item FSN 6505-663-2636, Sodium Chloride, Sodium Bicarbonate Mixture, 4.5 gm., 2s:

Packaging for the above item is specified in Military Medical Purchase Description No. 4, 2 July 1961.¹³

The purchase description specifies that the mixture shall be filled in envelopes fabricated of waterproof, vaporproof, flexible barrier material which meets the requirements of Mil-B-131. The barrier material for this purpose is a lamination of kraft paper and aluminum foil with a polyethylene lining for heat sealing. (Item B, Figure 3)

The purchase description also specifies that, "two of these envelopes shall be placed in a 'protector,' which

¹³Military Medical Supply Agency. <u>Military Medical</u> <u>Purchase Description No. 4, 3 July 1961, 6505-663-2636,</u> <u>Sodium Chloride, Sodium Bicarbonate Mixture, 4.5 gm., 2s.</u> Brooklyn, N. Y.: Military Medical Supply Agency, 1961.

shall be fabricated from 25 point natural sulfate fiber kraft board with an average Mullen bursting strength of not less than 175 pounds." The exterior and interior faces of the fiberboard shall be calandered to permit printing as required and shall be treated with a clear lacquer or other material for resistance to moisture. The protector shall be die cut and scored to size and design as shown on Military Medical Supply Agency drawing No. 2000. Closure of the protector shall be by pressure sensitive tape. (Item A, Figure 3)

Dimensions of the unit package are $3 3/4 \times 2 3/16 \times 5/8$ inches, or 5.1 cubic inches.

Weight of the unit package is 18.8 grams.

Dimensions of the two envelopes, without protector, are $3 \frac{5}{8} \times 2 \times \frac{1}{2}$ inches, or 3.6 cubic inches.

Weight of the two envelopes, without protector, is 13.1 grams.

As previously stated, two units of this item are packaged in the large interior container of the first aid kits. One of the purposes of this interior container is to provide physical protection to the contents. With this protection provided, the fiberboard protectors may be eliminated without compromising the physical protection of the mixture. Essential protection from vapor, gas, and moisture is provided by the barrier material from which the envelopes are fabricated.

Figure 3

Item FSN 6505-663-2636, Sodium Chloride, Sodium Bicarbonate Mixture, 4.5 gm, 2s.

Illustration "A" depicts the two envelopes of the mixture being contained by a fiber board sleeve. The sleeve is secured by pressure sensitive tape. Dimensions of the sleeve are $3 \frac{3}{4} \times 2 \frac{3}{16} \times \frac{5}{8}$ inches.

Illustration "B" depicts the two envelopes which are contained in the sleeve. The envelopes are fabricated from a lamination of Kraft, aluminum foil and polyethylene. Dimensions of the two envelopes are 3 $5/8 \ge 2 \ge 1/2$ inches.



Elimination of the protectors will reduce both weight and cube of the item by 30%, or 11.4 grams, and 3 cubic inches.

Item FSN 6510-597-7468, Bandage, Absorbent, Adhesive, $3/4 \times 3$ inches, 18s:

Packaging for the above item is specified in Military Medical Purchase Description No. 3, 20 August 1959,¹⁴ and Federal Specification, DDD-B-35, 26 February, 1957.¹⁵

The above specifications specify that 18 bandages shall be packaged in a size 1 carton conforming to Military Specification, Mil-B-16152. The carton is fabricated from chip board with exterior dimensions of $4 \ge 2 \frac{1}{4} \le \frac{5}{8}$ inches, or 5.6 cubic inches. Weight of the cartoned item is 32.2 grams. (Item A, Figure 4)

Bandages supplied by Johnson and Johnson, Bauer and Black, were used for samples. The individual Johnson and Johnson bandage measured 3 $5/16 \times 7/8 \times 1/6$ inches each. Eighteen of the bandages without the carton, and in a position for bag packaging, measured 3 $5/16 \times 1 3/4 \times 7/16$ inches. The individual Bauer and Black bandage measured

¹⁴Military Medical Supply Agency. <u>Military Medical</u> Purchase Description No. 3, 20 August 1959, <u>6510-597-7468</u>, <u>Bandage, Absorbent, Adhesive, 3/4 x 3 inches, 18s</u>. Brooklyn, N.Y.: Military Medical Supply Agency, 1959.

¹⁵Military Medical Supply Agency. <u>Federal Specifica-</u> <u>tion, DDD-B-35, Bandage, Absorbent, Adhesive, 23 December</u> <u>1958.</u> Washington: Government Printing Office, 1958.

 $3 \frac{3}{4} \times 1 \frac{1}{4} \times \frac{1}{16}$ inches each. Eighteen of the Bauer and Black bandages without the carton, and in a position for bag packaging, measured $3 \frac{3}{4} \times 2 \frac{1}{2} \times \frac{7}{16}$ inches.

The size of the packages differ because of the difference in materials and packaging techniques used by the manufacturers. The Bauer and Black paper overwrap is 3/4 inch longer and 1/2 inch wider than the individual packaged bandage.

Two packages of the bandages are contained in the first aid kit, one in the larger and one in the smaller interior compartments.

There is a gross waste of space in placing the carton-packaged bandages in each of the containers. Physical protection provided by the carton is not needed because this function is accomplished by the two interior containers of the first aid kit. Protection from moisture is accomplished by the individual bandage wrappers.

By packaging the bandages in a bag fabricated from a flexible material, the package dimensions can be reduced to $3 \ 3/4 \ x \ 1 \ 3/4 \ x \ 7/16$ inches, or 2.9 cubic inches. This is a reduction of 2.7 cubic inches for each package of bandages, or, 5.4 cubic inches for both packages in the first aid kit. See Item B, Figure 4. There will also be an accompanying weight reduction of approximately 10 grams for each package, depending on the material used for the bag.

Packaging of this item into bags instead of cartons will reduce both weight and cube of the bandage package by

Figure 4

Item FSN 6510-597-7468, Bandage, Absorbent, Adhesive, 3/4 x 3 inches, 18s.

Illustration "A" depicts the carton which is currently used as the container for the 18 bandages. Dimensions of the carton are $4 \times 2 \frac{1}{4} \times \frac{5}{8}$ inches.

Illustration "B" depicts the 18 bandages packaged in a bag fabricated from a mylor polyethylene lamination. Dimensions of the bag are $3 3/4 \times 1 3/4 \times 7/16$ inches.

The bag is notched at the lower right corner to facilitate opening.



55% and 30% respectively.

Item FSN 6510-201-7455, Dressing, First Aid, Field, Individual Troop, 4 x 7 inches, "First Aid Packet":

Packaging for the above item is specified in Military Medical Purchase Description No. 8, 1 September 1959,¹⁶ and Military Specification Mil-D-15141b, 10 November 1958.¹⁷

The above publications specify that each wrapped and sterilized dressing shall be packaged in a bag fabricated of polyethylene tubing having an average wall thickness of 0.004 inch. Excess air shall be expelled and the closure of the bag shall be effected by a heat seal. The sealed bag shall be further packaged in a size 2 carton designated in Mil-B-16152, which is further packaged in a double slide carton fabricated of 25 point solid kraft board which has been coated with resin free wax for waterproofing. (Item A, Figure 5)

The two bandages in the prototype first aid kit were evidently purchased prior to the current military specification because they were wrapped in paper and packaged in a heat sealed moisture-vaporproof bag fabricated of

¹⁶Military Medical Supply Agency. <u>Military Medical</u> <u>Purchase Description No. 8, 1 September 1959, 6510-201-7455</u>, Dressing, First Aid, Field, Individual Troop, 4 x 7 inches.

^{17&}lt;sub>Military Medical Supply Agency. Military Specification, Mil-D-1514lb, Dressing, First Aid and Individual Troop, Camouflaged, 10 November 1958. Washington: Government Printing Office, 1938.</sub>

kraft paper laminated to aluminum foil, with a polyethylene lining, of the Mil-B-131 type. Cartons had been removed prior to placing the bandages in each of the interior containers. (Item B, Figure 5)

Dimensions of the bandages, without unit cartons, are $3 \frac{3}{4} \times 2 \times 1$ inches, or 7.5 cubic inches. Weight of the bandages, without unit cartons, is 31.6 grams. Total weight of the two bandages is 63.2 grams, total cube is 15 cubic inches.

In using the flexible barrier material for the packaging of the bandages, no further significant weight and cube reductions can be attained. The bandages have been compression packaged and the bag edges have been folded to the contour of the bandage.

As has been previously cited, the current specification requires that each wrapped bandage shall be packaged in a bag fabricated of 0.004 inch polyethylene. This material will provide excellent protection against moisture, dirt, etc. However, an injured person without a cutting or puncturing instrument would have extreme difficulty in opening the bandage package, because of the high tear resistance of this thickness of polyethylene. There are four different field dressings procured under Mil-D-1514lb, and each is required to be packaged in the 0.004 inch polyethylene bag. From a cost and protection standpoint, this is a fine package in that it is effective in protecting economically the contents through storage and distribution

Figure 5

Item FSN 6510-201-7455, Dressing, First Aid, Individual Troop, 4 x 7 inches.

Illustration "A" depicts the Dressing packaged in a double slide carton. This package is currently carried in a canvas pouch by the individual soldier. Dimensions are $4 \ge 2 \frac{1}{8} \ge 1 \frac{1}{8}$ inches.

Illustration "B" depicts the dressing packaged in a bag fabricated from a lamination of Kraft, aluminum foil and polyethylene. This package is inserted in the double slide carton. Dimensions are $3 \frac{3}{4} \times 2 \times 1$ inches.

Illustration "C" depicts the dressing packaged in a bag fabricated from a lamination of mylar and polyethylene. Dimensions are $3 \frac{3}{4} \times 2 \times 1$ inches.



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channels until it reaches the user. Here, from a user standpoint, the injured soldier in the field, the polyethylene bag is not satisfactory because it cannot be easily opened.

The desired protection can be obtained and the opening difficulty overcome by using polyethylene in a lamination with other materials, such as kraft-foil-polyethylene, kraft-polyethylene, or mylar-polyethylene. A bandage packaged in a mylar-polyethylene bag is illustrated in Figure 5, Item C.

Item FSN 6510-201-1755, Bandage, Muslin, 37 x 37 x 52 Inches:

Packaging for the above item is specified in Military Medical Purchase Description No. 7, 5 June 1961,¹⁸ and Federal Specification, DDD-B-85, 23 December 1958.¹⁹

The above publications specify that each compressed bandage, with two safety pins placed in the fold of the bandage, shall be packaged in a bag fabricated of polyethylene tubing having an average wall thickness of 0.004 inch. Excess air shall be expelled and the closure of the bag effected by heat sealing. The sealed bag is further packaged in a size 1 carton designated in Mil-B-16152, except

¹⁸Military Medical Supply Agency. <u>Military Medical</u> <u>Purchase Description No. 7, 5 June 1961, 6510-201-1755, Band-</u> <u>age, Muslin, 37 x 37 x 52 inches</u>, Brooklyn, N.Y.: Military Medical Supply Agency, 1961.

¹⁹Military Medical Supply Agency. <u>Federal Specifica-</u> tion, DDD-B-85, Bandage, Muslin, 37 x 37 x 52 inches, 23 December 1958. Washington: Government Printing Office, 1958.

Item FSN 6510-201-1755, Bandage, Muslin, 37 x 37 x 52 inches.

Illustration "A" depicts the carton which is currently used on the container for the bandage. Dimensions of the carton are 4 $1/8 \ge 2 \frac{1}{8} \ge 3/4$ inches.

Illustration "B" depicts the bandage in a scaled polyethylene bag. Note that there is no item identification on the bag. Dimensions of this package are $3 \frac{3}{4} \times 2 \times \frac{3}{4}$ inches.

Illustration "C" depicts the bandage packaged in a bag fabricated from a lamination of mylar and polyethylene. Identification and user instruction are on paper which has been inserted in the bag prior to heat sealing.



that the width shall not exceed 3/4 inch. (Item A, Figure 6) There is no requirement in the purchase description or specification for marking the polyethylene bag or for using an identification insert for the package. Unit identification is specified for the carton only. When the bag is separated from the carton, identification is lost. This is unsatisfactory from a user point of view. (Item B, Figure 6)

Exterior dimensions of the carton are $4 \ 1/8 \ x \ 2 \ 1/8 \ x$ 3/4 inches, or 6.2 cubic inches. Weight of the unit is 52.8 grams. Weight of the empty carton is 7.0 grams.

Elimination of the carton from the packaging of the bandage, for use in the first aid kit, will reduce the item size to $3 3/4 \times 2 \times 3/4$ inches, or 5.6 cubic inches, and will reduce the weight by 7.0 grams. The bandage will, however, require identification marking. (Item C, Figure 6) Elimination of the carton will provide a 14% reduction in weight of the bandage package and a 9% reduction in the cube.

The polyethylene bag prescribed in the specification is an excellent package from a distribution standpoint. However, from a user point of view, the bag is unsatisfactory because of opening difficulties, as described in the packaging of the previous item. Again, opening of the package can be facilitated by using a lamination of polyethylene with other materials and by notching one of the heat sealed edges of the bag as is illustrated in figure II.

Figure 7

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Water Purification Tablets

Illustration "A" depicts the package which has been folded for insertion into the first aid kit.

Illustration "B" depicts identification and user instructions which are on a label.

Illustration "C" depicts the strip pack. Each tablet is sealed in a one square inch area of the material. The dark color is due to the package having been dipped in wax. Dimensions of the package are $3 \frac{1}{4} \times \frac{1}{8} \times \frac{1}{8}$ inches.



Item (No FSN), Water Purification Tablets, 6s:

No specification or purchase description is available for this item in that it is a newly developed item, designed for use in the prototype first aid kit.

Each tablet is heat sealed in a strip pack-type package with an area of 1 square inch required for each tablet. The interior lamination of the strip appears to be cellophane. In addition, the strip has been dipped in wax. (Figure 7) Identification marking and instructions for use are printed on a label which is attached to the end of the strip by pressure sensitive tape.

Dimensions of each strip pack, which is folded in the center, after the third tablet, are $3 \frac{1}{4} \times \frac{1}{8} \times \frac{1}{8}$ inch, or 0.5 cubic inch. Each strip weighs 3.0 grams. Total cube for the three packages in the kit is 1.5 cubic inches, the total weight is 9.0 grams.

While this package may provide adequate protection to the tablets production difficulties may be experienced because current strip packaging machinery used by industry does not include a system for wax dip after the heat seal is made.

CHAPTER V

PACKAGING FOR DISTRIBUTION

The previous chapter was primarly concerned with packaging of components for use only in the First Aid Kit, Survival, Individual Care. Such considerations cannot stand alone because of other uses of the items. A review of the catalog for medical material revealed the items contained in the first aid kit are also used as components for over 29 other kits, sets, and outfits.²⁰ and as end items. Accordingly, consideration must be given in the package design for protection and identification of the items during the distribution process. The package must provide protection through multiple handlings by personnel throughout the supply system, protection from the mechanical and chemical damage associated with transportation. Because the areas in the world where the product will be used are unknown at the time of procurement, packaging must also provide for protection in extremely cold, dry, hot, humid environments.

²⁰Department of the Army. <u>Department of the Army</u> <u>Supply Manual, 8-4-C3-13, June 1961</u>. Brooklyn, N.Y.: Military Medical Supply Agency, 1961.

At the same time consideration must be given to reduction to the weight and cube of each item so that economies in storage space and transportation can be realized. Ability of industry to package on a mass basis must also be considered because of the high war time requirements for these life saving items. High speed machinery must be available to efficiently and economically accomplish the packaging operations.

With these considerations in mind the following changes are indicated in the packaging specifications and purchase descriptions for the component items. Specific paragraph changes in these documents which are required for implementation of the recommendations in this thesis are contained in Chapter VII.

Item FSN 6505-6632636, Sodium Chloride, Sodium Bicarbonate Mixture, 4.5 gm., 2s:

The physical protection for this item through storage, handling, and transportation activities is provided primarily by the intermediate package, a 0.040 inch thick paperboard carton. When the item is received by the user it normally carried in first aid kits, sets and outfits. Physical protection in these cases is accomplished by the containers for the kits, sets, and outfits. Therefore the "protector" is not needed. The primary function of the protector then becomes a device for holding the two envelopes together, providing for the unit of issue, namely two

envelopes. Chemical and climatic protection is provided by the material from which the envelope is fabricated, a lamination of kraft paper, aluminum foil and polyethylene.

By changing the unit of issue to "one envelope" the protector may be eliminated. This will result in a saving in packaging and transportation costs and storage space due to the reduction in weight and cube for the item.

The potential weight and cube reductions are as follows:

INTERMEDIATE CARTON

Package	Contents	Weight of Contents w/o carton	Cube of Contents w/o Carton
Present inter- mediate carton	48 envelopes w/24 protectors	451.2 gm	122.4 cu.in.
Recommended packaging, w/o protectors	48 envelopes	314.4 gm	86.4 cu.in.

Potential weight and cube reductions in the intermediate carton--136.8 grams and 36.0 cubic inches.

SHIPPING CONTAINER

Packing	Contents	Weight	Cube
Existing packing	2304 envelopes 2/1152 protectors	21676.6 gm	5875.2 cu.in.
Recommended packing w/o protectors	2304 envelopes	15091.2 gm	4147.2 cu.in.
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Potential weight and cube reductions in the shipping container--6585.4 gms., or 14.5 lbs., and 1728 cu. ins., or 1 cu. ft. In addition to the reduction of the weight and cube, there will be an accompanying reduction in the material for the intermediate carton and the shipping container. This cost saving will be significant.

The marking surface on the envelopes is satisfactory, providing sufficient space for identification and instructional information. See Item B, Figure 3.

Item 6510-597-7468, Bandage Absorbent, Adhesive, $3/4 \times 3$ inches, 18s:

As has been previously described in Specification DDD-B-35, 18 bandages are packaged in a Mil-B-16152, size 1 carton. Forty-eight of these cartons are further packaged in an intermediate carton and 12 intermediate cartons are packed in a shipping container.

There is a gross waste of space in the unit packaging of this item. This waste of space can be eliminated by packaging the bandages in heat sealable bags fabricated of flexible materials. As stated in Chapter III, bags fabricated of a mylar-polyethylene lamination are most effective containers for this item.

Physical protection for the unit package is provided during storage and transportation by the intermediate carton and shipping container. Physical protection is provided the bandages, when in the hands of the user, by the container for the set, kit, or outfit.

By changing the unit container from a carton to a bag, a reduction in weight and cube is attained. This results

in a savings in container material, transportation costs, and storage space.

The attainable weight and cube reductions are as follows:

UNIT PACKAGE

Package	Weight	Cube	
Existing carton package	32.2 gm	5.6 cu.in.	
Proposed package, w/o carton	22.2 gm	2.9 cu.in.	
Potential savings per unit	10.0 gm	2.7 cu.in.	
INTERMEDIATE PA	ACKAGE		
Package	Weight	Cube	
Existing intermediate package,	1545.6 gm.	268.8 cu.in.	
48 cartons			
Proposed intermediate package,	1065.6 gm.	139.2 cu.in.	
48 bags			
Potential savings per interme-	480.0 gm.	129.6 cu.in.	
diate package			
SHIPPING CONTAINER			
Package	Weight	Cube	
Existing shipping container	18547.2 gm	3225.6 cu.in.	
w/576 cartons			
Proposed shipping container	12787.2 gm	1670.4 cu.in.	
w/ 576 bags			
Potential savings per shipping	5760.0 gm	1555.2 cu.in.	
container	(12.7 1bs)	(U.9 cu.it.)	

Marking required for the unit carton can be printed readily on the surface of the bag, or can be printed on inserts and placed in the bag with the bandages during packaging operations. See Item C, Figure 4.

Item FSN 6510-201-7455, Dressing, First Aid, Field, Individual Troop, 4 x 7 inches, "First Aid Packet":

Current specifications require that this dressing be packaged in a 4 mil polyethylene bag which is heat sealed. The bag is further packaged in a carton which is inserted into a double slide carton.

As with the two previous items, physical protection for the unit package is provided during storage and transportation by the intermediate carton and shipping container. When in the hands of the user, physical protection is provided by the carton and the polyethylene bag. Identification and instructional use marking is required for both the carton and bag. This is an excellent package for storage and distribution but it is unsatisfactory for use in the field because of the difficulty in opening the polyethylene bag.

To overcome the opening disadvantage, and to provide protection for the item, it is considered that the mylar-polyethylene laminated bag is the best container for this item.

Because of the toughness of the mylar-polyethylene lamination, a savings in weight can be attained by elimination of the inner carton and utilizing only the double sleeve carton for physical protection of the item when it is carried in the current Quartermaster case by the individual soldier.

When the item is placed in the First Aid Kit, Survival, the double sleeve may be eliminated.

Elimination of the inner carton, a size 2 carton described in Specification Mil-B-16152, will result in the following weight reduction. (There will be no reduction in cube.)

Package	Savings in weight
Unit package	9.2 gm
Intermediate package of 24	220.8 gm
bandages	
Shipping container of 288	2649.6 gm or 5.8 lbs.
bandages	

The disadvantages of the polyethylene bag for this item also apply to items 6510-201-7425, 6510-201-7430, and 6510-201-7435.

Elimination of the unit carton can be accomplished without compromising the protection of the bandages against physical damage.

Item FSN 6510-201-1755, Bandage, Muslin, 37 x 37 x 52 inches:

The current specification requires that this bandage be packaged in a 4 mil polyethylene bag. The bandage is further packaged in a size 1 carton as designated in Specification, Mil-B-16152. There is no requirement in the bandage specification that the polyethylene bag be marked for identification.

The bandage is used in several sets, kits, and outfits.

In some cases to reduce the weight and cube of the set, kit, or outfit, the carton is removed prior to the bandage being placed in the container. Without identification marking on the bag the user will be confused as to its contents. In addition, the user of the bandage, as with the previous items, will have difficulty in opening the bag due to the tear resistance of polyethylene. As with the previous items, the opening difficulty can be eliminated by using a mylar-polyethylene laminated bag instead of the polyethlene alone.

Physical protection for the unit package is provided during storage and transportation by the intermediate carton and shipping container. Physical protection is provided the bandage, when in the hands of the user, by the container for the set, kit, or outfit.

There will be no weight and cube savings in using the laminated bag instead of the polyethylene bag. But, elimination of the unit carton will result in a savings in material and weight and cube, as is indicated below.

Package	Weight	Cube
Unit package savings	7 gm	0.6 cu.in.
Intermediate package savings	168 gm	14.4 cu.in.
24 bandages		
Shipping container savings	2016 gm	172.8 cu.in.
288 bandages	(4.4 lbs.)	(0.1 cu.ft.)

No FSN, Water Purification Tablets, 6s:

This package as developed by the Quartermaster Corps consists of a waxed coated "strip pack" package, with each tablet heat sealed in a 1 square inch area of the strip.

Because of wax coating on the basic material from which the package has been fabricated, it is considered that fabrication of this package would not be compatible with production machinery currently utilized by industry in mass strip packaging operations. A review of manufacturers literature on strip pack equipment revealed that the machinery used for this purpose formed packages from flexible materials. Closureswere accomplished by heat sealing as a part of the machine operations. There was no provision for wax coating in the machine operations. The coating would require an additional production process. It is also considered that with the variety of laminations available from industry, a laminated material is available which can be economically produced and which will provide protection of the water purification tablets, and be suitable for handling on automatic machinery currently available for strip pack operations. Such a material, as pointed out in Chapter III is a lamination of kraft, aluminum foil, and polyethylene.

No significant weight and cube savings are anticipated for this item.

CHAPTER VI

CONCLUSIONS

The following conclusions are presented in two parts: those associated with packaging of the items for use in the first aid kit; and those concerning the packaging of the items for storage and distribution.

Component Packaging

User utility can be improved and reductions in weight and cube can be achieved by redesigning the containers for each of the first aid kit component items. Potential weight and cube savings are summarized in Appendix A. The following conclusions concerning component packaging have been reached:

Item 6505-663-2636, Sodium Chloride, Sodium
Bicarbonate, 4.5 gm., 2s;

The fiberboard protector for this item is not necessary and should be eliminated.

2. Item (No FSN), Water Purification Tables, 6s;

The present strip-pack used for this item is unsatisfactory from a production stampoint. Use of a strip-pack lamination, without wax, which includes aluminum foil is essential to meet production and protection requirements.

3. Item 6510-597-7468, Bandage, Absorbent, Adhesive, 3/4 x 3 inches, 18s;

Current packaging requirements for this item, which specifies the use of a carton, results in a gross waste in weight and cube. The carton for this item should be eliminated and the bandages packaged in a bag fabricated from a flexible barrier material. A lamination of mylar and polyethylene would be an excellent material. The bag should be notched as is illustrated in Figure 2.

4. Item 6510-201-7455, Dressing, First Aid, Field, Individual Troop, 4 x 7 inches, "First Aid Packet";

The polyethylene specified for the unit container for this item is unsatisfactory because of its high tear resistance. The unit container for this item should be a bag fabricated from a lamination of mylar and polyethylene. To provide for ease of opening, the edge of the bag should be notched as is illustrated in Figure 2.

The inventory of this item which is packaged in a lamination of kraft, foil, and polyethylene may be used without the double sleeve or carton for inclusion in the first aid kit until supplies are exhausted.

5. Item6510-201-1755, Bandage, Muslin, 37 x 37 x 52;

The polyethylene bag, specified for the unit container for this item, is unsatisfactory due to its high tear resistance. The container for this item should be fabricated from a mylar-polyethylene lamination. To provide for ease of opening, the edge of the bag should be notched as illus-

strated in Figure 2.

Current marking requirements are unsatisfactory because there are no identification or instructional markings specified for the bag.

The carton specified for the item is not necessary and should be eliminated.

Unit Packaging for Storage and Distribution

Because of the protection against mechanical hazards in storage and distribution which is provided by the intermediate and shipping containers, cartons can be eliminated from the packaging requirements for the following items without compromising their protection:

Item 6510-201-1755, Bandage, Muslin, 37 x 37 x
52 inches

2. Item 6510-201-7455, Dressing, First Aid, Field, Individual Troop, 4 x 7 inches, "First Aid Packet"

3. Item 6510-597-7486, Bandage, Absorbent, Adhesive, $3/4 \times 3$ inches, 18s

Savings in materials, storage space, and transportation cost, can be attained by elimination of the protector from Item 6505-663-2636, Sodium Chloride, Sodium Bicarbonate, Mixture, 4.5 gm., 2 s, and by changing the unit of issue from "2s" to "each".
CHAPTER VII

RECOMMENDATIONS

As with the conclusions presented in the previous chapter, the recommendations are presented in two parts, those concerning the packaging of the items for use in the first aid kit, and those concerning packaging requirements for storage and distribution.

Component Packaging

For the packaging of components for use in the first aid kit, it is recommended that:

1. Protectors be eliminated from the unit packaging of Item 6505-663-2636, Sodium Chloride, Sodium Bicarbonate Mixture, 4.5 gm., 2s.

2. Bags fabricated from a lamination of 2 mil mylar and 2 mil polyethylene be used for the unit container for the following items;

a. 6510-201-1755, Bandage, Muslin, 37 x 37 x 52 inches

b. 6510-201-7455, Dressing, First Aid, Field, Individual Troop, 4 x 7 inches, "First Aid Packet"

c. 6510-597-7468, Bandage, Absorbent, Adhesive, 3/4 x 3 inches, 18s

Bags for the above items be notched for ease of opening, as is illustrated in Figure 2.

4. Items packaged in the 4 mil polyethylene bags not be used in any first aid kits.

5. Stocks of first aid kit items packaged in kraft, foil, polyethylene laminated bags continue to be used in first aid kits until supplies of these items are exhausted.

6. All unit containers be marked for identification and instructional use.

7. The water purification tablets be packaged in a strip pack fabricated from a lamination of kraft, foil, and polyethylene which meets the requirements of Specification Mil-B-131.

8. The large and small interior containers for the first aid kit be fabricated from polyethylene which is 40 mils thick, and that they be of a telescopic style. (See Figure 8)

Unit Packaging for Storage and Distribution

In order to effect the economies that will accrue through reduction in weight and cube, it is necessary that the procurement documents be changed to reflect the proposed packaging changes. Accordingly, the following recommendations are concerned with changes to specifications and purchase descriptions for the component items of the first aid kit:

1. For Item 6505-663-2636, Sodium Chloride, Sodium Bicarbonate Mixture, 4.5 gm., 2s it is recommended that

Figure 8

First Aid Kit with Proposed Packaging Changes

Illustration "A" depicts the canvas pouch for the kit which has been reduced in size from 8 x 2 x 5 inches to 5 x 2 x 4 inches.

Illustration "B" depicts the larger interior container which has been reduced in size from 4 $3/4 \ge 2 \ge 4$ 1/4 inches to 3 $1/2 \ge 2 \ge 4$ inches.

Illustration "C" depicts the smaller interior container which has been reduced in size from $3 \ge 2 \ge 4 \le 1/4$ inches to $1 \le 1/2 \ge 2 \le 4 \le 1/4$ inches.

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Purchase Description No. 4, 3 July 1961,²¹ be changed as follows;

a. Delete "2s" from the item description.

b. Change paragraph 5.1.1. to read: "Unit of issue. One envelope constitutes one unit of issue."

c. Change Table I, paragraph 5.1.2., to read: Unit package Intermediate package Exterior Container

l unit 48 units 2304 units

d. Change paragraph 5.1.3.1. to read: "Unit package. Shall consist of one envelope. Unit package shall conform to the following requirements:"

e. Delete paragraphs 5.1.3.1.1. and 5.1.3.1.2.

f. Change the first two sentences of paragraph 5.1.3.2 to read: "Intermediate package. Forty-eight envelopes shall be packaged in a box constructed in accordance with Specification PPP-B-665, style D, paper board thickness shall be not less than 0.40 inch in thickness."

g. Change "1152" units in line 1 of paragraph
5.2.1. to read: "2304" units.

h. Delete from the second sentence in paragraph 5.3.2.: "Each protector (Part 1) and".

i. Delete from the fifth line in paragraph 5.3.2.:"2s".

2. For Item 6510-201-1755, Bandage, Muslin, 37 x 37 x 52 inches, it is recommended that Specification DDD-B- 85^{22}

²¹<u>Ibid</u>. ²²Ibid.

be changed as follows;

a. Change paragraph 5.1.3.1.2. to read: "Compression. The folded bandage shall be compressed to fit into a bag whose dimensions shall not exceed 3 $3/4 \ge 2 \ge 3/4$ inches when sealed. The edges of the bag shall be folded as required in paragraph 5.1.3.2.1."

b. Change paragraph 5.1.3.2.1. to read: "Bag. Each compressed bandage, with two safety pins placed neatly in the fold of the bandage, shall be packaged in a bag fabricated from a lamination of 2 mil polyester and 2 mil polyethylene. Excess air shall be expelled or evacuated, and closure effected by heat sealing. One edge of the bag shall be notched as is illustrated in paragraph 5.1.3.2.2. All edges of the bag shall be neatly folded back against the sides to form a compact rectangular package, the dimensions of which shall not exceed 3 $3/4 \ge 2 \ge 3/4$ inches."

c. Delete paragraph 5.1.3.2.2. (In place of this information substitute the drawing in Figure 2, Chapter III.)

d. In paragraph 5.3.1., change the word "carton" to read: "bag".

e. In paragraph 5.3.1.1., change the word "carton" to read: "bag".

f. In paragraph 5.3.1.2., change the word "carton" to read: "bag".

g. Delete paragraphs 5.3.1.3. and 5.3.1.4.

3. For Item 6510-201-7455, Dressing, First Aid, Field, Individual Troop, 4 x 7 inches. (Also applicable to items 6510-201-7425, 6510-201-7430, and 6510-201-7435);

It is recommended that Specification $Mil-D-1514lb^{23}$ be changed as follows;

a. In paragraph 4.2.2., change "Major 120" to read; "Polyester, polyethylene bag not effectively heat sealed."

b. Change paragraph 5.1.3.1.1.1. to read: "Bag. Each wrapped and sterilized dressing shall be packaged in a bag fabricated from 2 mil polyester and 2 mil polyethylene laminated material.

c. Change the third sentence of paragraph 5.1.3.1.1.5. to read: "One edge of the bag shall be neatly folded back against the sides to form a compact rectangular package not to exceed the dimensions specified in Table 2." (At the end of the paragraph, add the drawing in Figure 2, Chapter III.)

d. Delete paragraphs: 5.1.3.1.1.4. and 5.

e. Change Table 2 to read:

Federal Stock Number	Dressing Size	L	Bag Size w (Inches)	D
6510-201-7425	1	6	1 5/8	3 5/8
6510-201-7430	2			
6510-201-7435	3	3 3/4	2	l
6510-201-7455	3	3 3/4	2	1

²³<u>Ibid</u>.

f. Change paragraph 5.1.3.2.1. to read: "Bag. Each wrapped and sterilized dressing shall be packaged in a bag fabricated from a lamination of 2 mil polyester and 2 mil polyethylene.

g. Change the third sentence of paragraph 5.1. 3.2.2. to read: "One edge of the bag shall be notched as is illustrated in paragraph 5.1.3.1.1.1. All edges of the bag shall be neatly folded back against the sides to form a compact rectangular package not to exceed the dimensions specified in Table II."

h. Delete the last 2 sentences in paragraphs 5.1.3.1.1.3. and 5.1.3.1.2.3..

4. For Item 6510-597-7468, Bandage, Absorbent, Adhesive, $3/4 \times 3$ inches, 18s it is recommended that Specification DDD-B-35²⁴ be changed as follows;

a. In Table II, paragraph 5.1.2., change the column heading which reads "Number of bandages in unit carton" to read: "Number of bandages in unit package".

b. Change paragraph 5.1.3.7. to read: "Unit package".

c. Change paragraph 5.1.3.1.1. to read: "Stock No. 6510-597-7468.--The number of bandages specified in Table II shall be packaged in a bag fabricated from a lamination of 2 mil polyester and 2 mil polyethylene. Closure of the bag shall be effected by heat sealing. One edge of each bag shall be notched as is illustrated below. All

²⁴Ibid.

edges of the bag shall be neatly folded back against the sides to form a compact rectangular package, not to exceed $3 3/4 \times 1 3/4$ inches. (At the end of the paragraph, add the drawing in Figure 2, Chapter III)

f. Change paragraph 5.3.1. to read: "Unit package".

g. In the first three sentences of paragraph 5.3.1.1., change the words "carton" to read: "bag".

Recommend that Purchase Description No. 3^{25} for Item 6510-597-7468 be changed as follows:

a. Change line 3, which reads "Unit carton,"to read: "Unit package".

b. Change line 13, which reads "Unit Carton", to read: "Unit package."

5. For the Water Purification Tablets, 6s, it is recommended that this item be referred back to the Quartermaster Corps for further Research and Development, with the recommendation that the item be packaged in a strip pack fabricated from a lamination of kraft, foil, and polyethylene.

25_{Ibid}.

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<u>Military Medical Purchase Description No. 8</u>, <u>1 September 1959, 6510-201-7455, Dressing, First Aid,</u> <u>Field, Individual Troop, 4 x 7 inches</u>. Brooklyn, N.Y.: Military Medical Supply Agency, 1959.

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TABLE III

SUMMARY OF WEIGHT AND CUBE DATA

Items as Packaged in Prototype Kit

Item	Dimensions-inches	Cube-inches	Weight-gm
6505-663-2636	3 3/4 x 2 3/16 x 5/8	5.1	18.8
6510-201-1755	4 1/8 x 2 1/8 x 3/4	6.2	52.8
6510-201-7455	3 3/4 x 2 x 1	7.5	31.6
6510-597-7468	4 x 2 1/4 x 5/8	5.6	32.2
Water Purifi- cation Tablets	3 1/4 x 1 1/8 x 1/8	0.5	3.0

TABLE IV

SUMMARY OF WEIGHT AND CUBE DATA

Item	Dimensions-inches	Cube-inches	Weight-gm
6505-663-2636	3 5/8 x 2 x 1/2	3.6	13.1
6510-201-1755	3 3/4 x 2 x 3/4	5.6	45.8
6510-201-7455	3 3/4 x 2 x 1	7.5	31.6
6510-597-7468	3 3/4 x 1 3/4 x 7/16	2.9	22.2
Water Purifi- cation Tablets	3 1/4 x 1 1/8 x 1/8	0.5	3.0

TABLE V

WEIGHT AND CUBE COMPARISON

Large Interior Container Contents

Item	Quantity	*Weig	*Weight-grams		*Cube-inches	
		Α	В	А	В	
6505-663-2636	2	37.6	26.2	10.2	7.2	
6510-201-1755	l	52.8	45.8	6.2	5.6	
6510-201-7455	1	31.6	31.6	7.5	7.5	
6510-597-7468	l	32.2	22.2	5.6	2.9	
Water Purifi- cation Tablets	2	6.0	6.0	1.0	1.0	
	TOTAL	160.2	131.8	30.5	24.2	

TABLE VI

WEIGHT AND CUBE COMPARISON

Small Interior Container Contents

Item	Quantity	*Weigh	*Weight-grams		*Cube-inches	
		А	В	А	В	
6510-201-7455	1	31.6	31.6	7.5	7.5	
6510-597-7468	1	32.2	22.2	5.6	2.9	
Water Purifi- cation Tablets	1	3.0	3.0	0.5	0.5	
	TOTAL	66.8	56.8	13.6	10.9	

*A--Prototype Kit Items B--Proposed Packaging Changes

TABLE VII

WEIGHT AND CUBE COMPARISON

Total First Aid Kit Contents

Items	Weight-grams	Cub e-inc hes	
Prototype First Aid Kit Items	227.0	44.4	
Proposed First Aid Kit Items	188.6	35.1	

The proposed packaging changes will result in: Large interior container items--A 17% reduction in weight and a 20% reduction in the cube of the contents.

Small interior container items--A 14% reduction in weight and a 20% reduction in the cube of the contents.

For all Components of the kit--A 16% reduction in weight and a 20% reduction in the cube of the contents of the first aid kit. This is illustrated in Figure 9. The top row, A, is the prototype kit and the bottom row, B, is the first aid kit in which the proposed changes are incorporated.

Figure 9

Size Comparison, Phototype First Aid Kit and the First Aid Kit with Proposed Packaging Changes.

The top row "A" depicts the prototype First Aid kit. The bottom row "B" depicts the First Aid Kit with proposed packaging changes. Reduction in size due to changes in packaging are obvious.

KIT, FIRST AID, SURVIVAL CARE, INDIVIDUAL

A

B

SIZE COMPARISON

ROOM USE ONLY

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