EVALUATION OF FREEZE-DEHYDRATED BEEFSTEAKS FOR NAVY USE

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U. S. NAVAL SUPPLY RESEARCH AND DEVELOPMENT FACILITY
BAYONNE, NEW JERSEY

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by

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ABSTRACT

A study was conducted to determine the suitability of freeze-dehydrated beefsteaks for Navy use. Two types of dehydrated beefsteaks were procured under the limited Purchase Description No. LP/P DES C-149-61, dated 12 June 1961. They were dehydrated rib-eye steaks, Type I, and dehydrated round steaks, Type IV. It was found that one pound of dehydrated rib-eye steaks yields approximately 1.65 pounds of ready-to-eat steaks, and one pound of dehydrated round yields 1.91 pounds of ready-to-eat steaks. The rib-eye steaks had no apparent defects; whereas, the round steaks had such defects as heavy connective tissue, excessive fat, and irregularity of shape, which adversely affected its over-all acceptability. Both the rib-eye and round steaks (without defects) were organoleptically acceptable. The rib-eye, on a per steak basis, due partially to a difference in portion size, costs approximately 72.5% more than the round steak. It was recommended that both types of steak not be considered as a direct substitute for fresh beefsteaks, but as an emergency item for shipboard use when such items are deemed necessary and cost is not a factor. In addition, the round steak not be considered unless the over-all quality of the product can be improved.

SUMMARY

PROBLEM

To determine the suitability of freeze-dehydrated rib-eye, Type I, and round, Type IV, beefsteaks for Navy use.

CONCLUSIONS

1. Freeze-dehydrated rib-eye steaks are organoleptically acceptable.

2. Freeze-dehydrated round steaks without defects are organoleptically acceptable; whereas, steaks with defects are not acceptable.

3. One pound of dehydrated rib-eye steaks yields 1.65 pounds of ready-to-eat steaks.

4. One pound of dehydrated round steak yields 1.91 pounds of ready-to-eat steaks.

5. Eight No. 10 cans of rib-eye steaks are required per 100 portions. For round steaks, 10 No. 10 cans are required.

6. On the basis of individual steaks, due partially to a difference in portion size, dehydrated rib-eye steaks are 72.5% more expensive than dehydrated round steaks.

7. At 98.6°F. the maximum storage life is 6 months.* In excess of 6 months, the product becomes unacceptably tough and dry.

8. Neither the rib-eye (Type I) nor the round (Type IV) should be considered as a direct substitute for fresh beef, but should be considered only as an emergency item when cost is not a limiting factor.

*J. J. Connell, paper on "The Effects of Freeze-Drying and Subsequent Storage on the Proteins of Flesh Foods", Chicago, Ill. (Conference on Freeze-Drying of Foods) Apr 1961.

RECOMMENDATIONS

It is recommended that:

1. Neither type of steak be considered as a direct substitute for fresh beefsteaks, but only as an emergency item for shipboard use when such items are deemed necessary and cost is not the controlling factor.

2. Freeze-dehydrated round steaks not be considered for Navy use unless over-all quality of products exceed that of the items received for evaluation.

3. The coolest available nonrefrigerated storage area should be selected for storing the freeze-dehydrated beefsteaks.

EVALUATION OF FREEZE-DEHYDRATED BEEFSTEAKS FOR NAVY USE

INTRODUCTION

Dehydrated foods are dry storage items and, consequently, do not require chill or freezer storage. From the Navy's point of view, the substitution of dehydrates for fresh or frozen foods requiring chill and freezer space alleviates, to some extent, the existing critical shortage of refrigerated space aboard most Navy vessels. However, before making such a substitution, each dehydrate must be evaluated on the basis of over-all organoleptic acceptance, utility, cost per portion, space and weight requirements, and storage characteristics, to determine if it has a place in Navy feeding.

At the request of the Navy Subsistence Office, freeze-dehydrated rib-eye and round beefsteaks were evaluated by NAVSUPRANDFAC. The evaluation was conducted as part of a continuing study of ration dense food products authorized by the Bureau of Supplies and Accounts.*

DESCRIPTION OF TEST PRODUCTS

Freeze-dehydrated beefsteaks are fresh steaks from which most of the natural moisture has been removed by "freeze-dehydration". In the freeze-dehydration process, water in the solid state (frozen) is removed from the product by sublimation (enter the vapor or gas state without passing through the liquid state). Two different types of freeze dehydrated beefsteaks were forwarded for evaluation, Type I, rib-eye, and Type IV, round. See Figs. 1 and 2. The dehydrated rib-eye steaks were processed from rib-eye cuts obtained from meat between the 6th and 12th ribs of the carcass. This meat was deboned, trimmed, molded and sliced so that the final dehydrated product was of 4" x 4" x 1/2" (plus or minus 1/8 inch for 1/2" thickness). The dehydrated round steaks were processed from both top and bottom round and knuckles in the proportion in which they naturally occured in the carcass. The fresh meat was deboned, sliced into 5-1/2 ounce steaks (plus or minus 1/2 ounces) with a thickness of not less than 1/4 inches, nor more than 5/8 inches. The sliced meat was then mechanically tenderized.

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*CHBUSANDA ltr W12 of 3 Jan 1960.

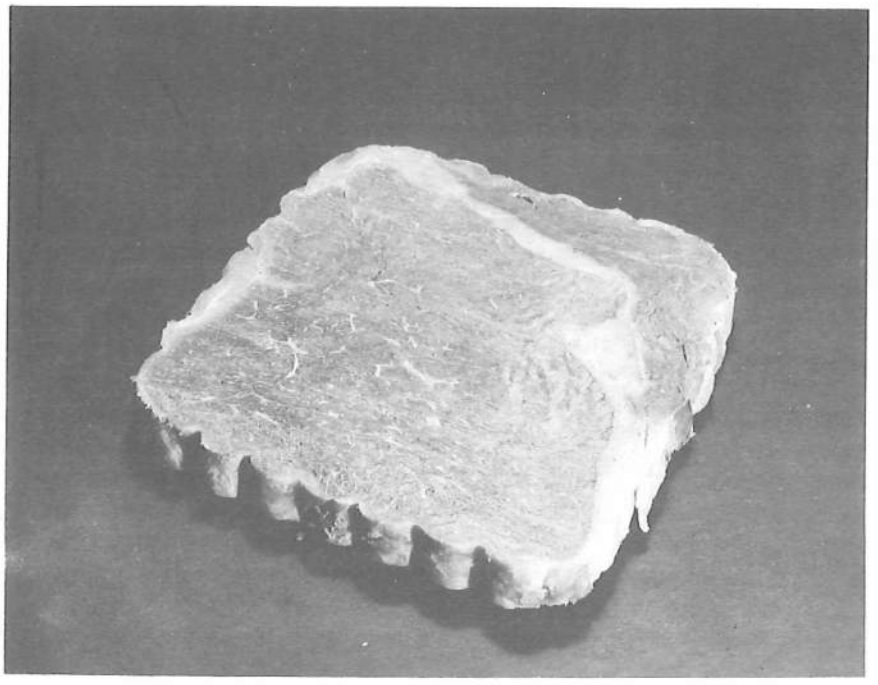


Fig. 1. - Dehydrated rib-eye beefsteak NAVSUPRANDFAC Photo No. 865-1

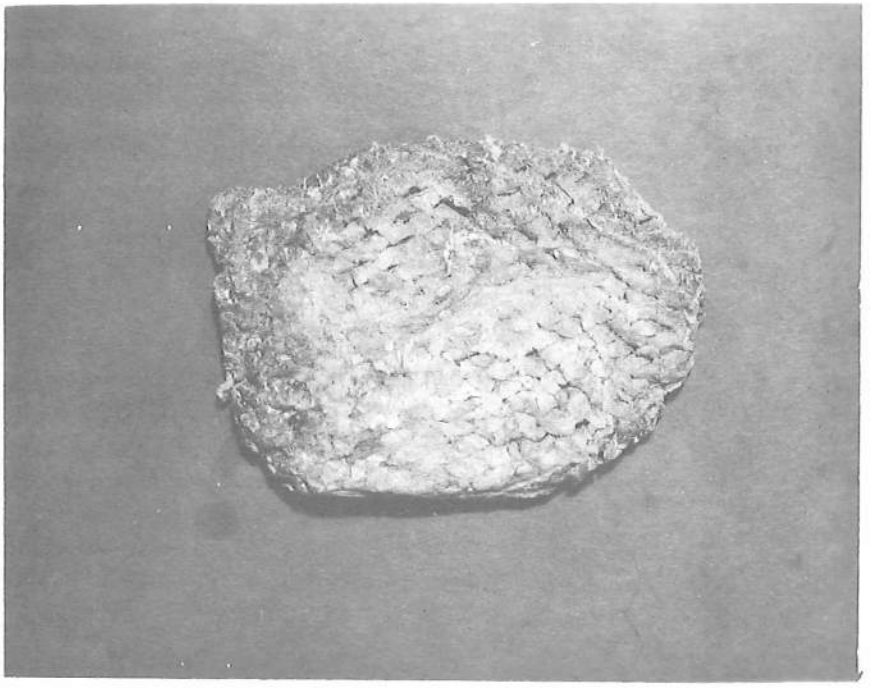


Fig. 2. - Dehydrated round beefsteak (mechanically tenderized) as received NAVSUPRANDFAC Photo No. 865-5

The dehydrated rib-eye steaks were packed on November 1961, and the dehydrated round steaks on October 1961 in accordance with the QM Limited Product Purchase Description LP/P DES C-149-61 dated 12 June 1961.*

EXAMINATION OF DEHYDRATED BEEFSTEAKS FOR CONFORMANCE TO THE PURCHASE DESCRIPTION LP/P DES C-149-61 DATED JUNE 1961*

Procedure

Types I and IV dehydrated beefsteaks were examined for certain physical characteristics specified in the Purchase Description, plus other characteristics not specified in the Purchase Description, which it was felt would definitely affect the over-all organoleptic acceptance of the prepared item. Ten cases per type of dehydrate were selected at random for tests. One No. 10 can per case was examined for the following defects:

1. Heavy Connective Tissue. Since the Purchase Description does not include an examination of the dehydrated product at the user's level for heavy connective tissue, the steaks were rehydrated and examined as specified for the fresh beef at the time of processing. See Paragraph 4.4.3.1, Table III Examination of Boned and Trimmed Beef.

2. Excessive Surface Seam Fat. The Purchase Description contains no requirements for excessive surface and seam fat. Steaks possessing surface and seam fat that covers more than 25% of the total area on either side of the rehydrated steak were considered as a defect.

3. Steaks Not Sliced at Right Angle to the Muscle Tissue. The existing Purchase Description contains no such examination for the dehydrated steaks, Types I and IV, but only for the fresh rib-eye steaks prior to dehydration.

4. Examination of Dehydrated Beefsteaks. The dehydrates were examined for the following defects as prescribed in Table VIII under paragraph 4.4.4, Examination of End Item of the Purchase Description LP/P DES C-149-61:

a. Shape: "Not characteristic of type specified."

*See Appendix A for Purchase Description.

b. Thickness: "Type I greater than 5/8 or less than 3/8 inch in thickness. Type IV greater than 5/8 or less than 1/4 inch in thickness."

c. Evidence of Thawing: "Glazed area or an aggregate of glazed areas exceeding 1/4 inch in diameter."

d. Evidence of Improper Processing: "Damp or soggy areas (1 or more)."

e. Broken Pieces: "More than 3 per cent by weight of steaks."

f. Meat Sawdust: "One or more surfaces or edges contains traces of meat sawdust" (applicable to Type I).

g. Color of Lean: "Dark brown."

h. Color of Fat: "Light yellow to light brown. Color not uniform on cross section."

i. Moisture Penetration: "Cross section shows dry areas in pieces after submersion in water (approximately 70°F.) for 30 minutes (Type I), or 15 minutes (Type IV)."

j. Odor and Flavor of Rehydrated Cooked Product: "After rehydration in water (approximately 70°F.) for 30 minutes (Type I) or 15 minutes (Type IV), the cooked product possesses undesirable odor or flavor."

Findings

1. The Type I, rib-eye beefsteaks, examined had no defects.

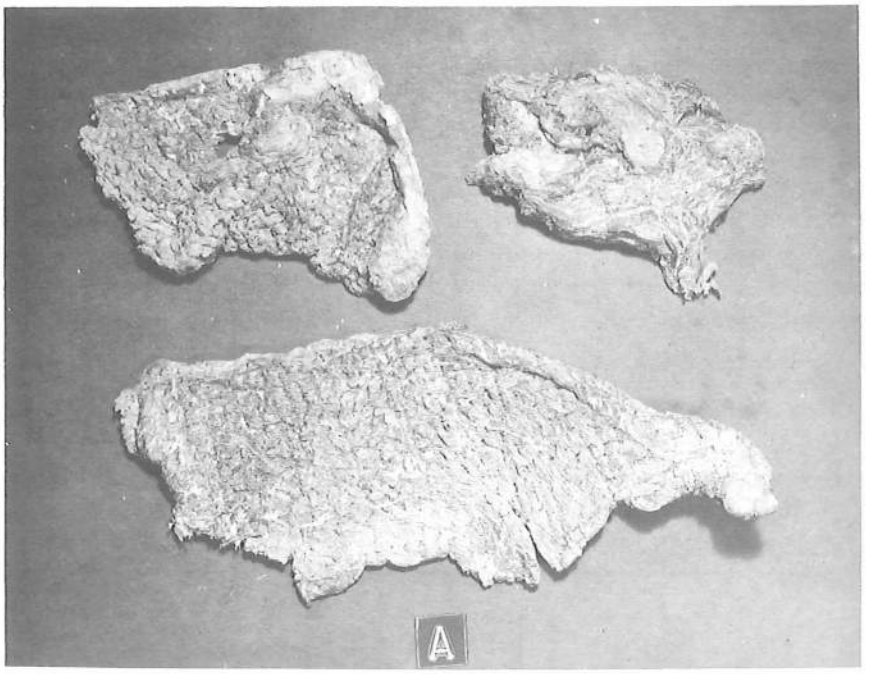
2. Table I lists defects found in Type IV, round beefsteaks. Also, see Fig. 3.

Discussion of Findings

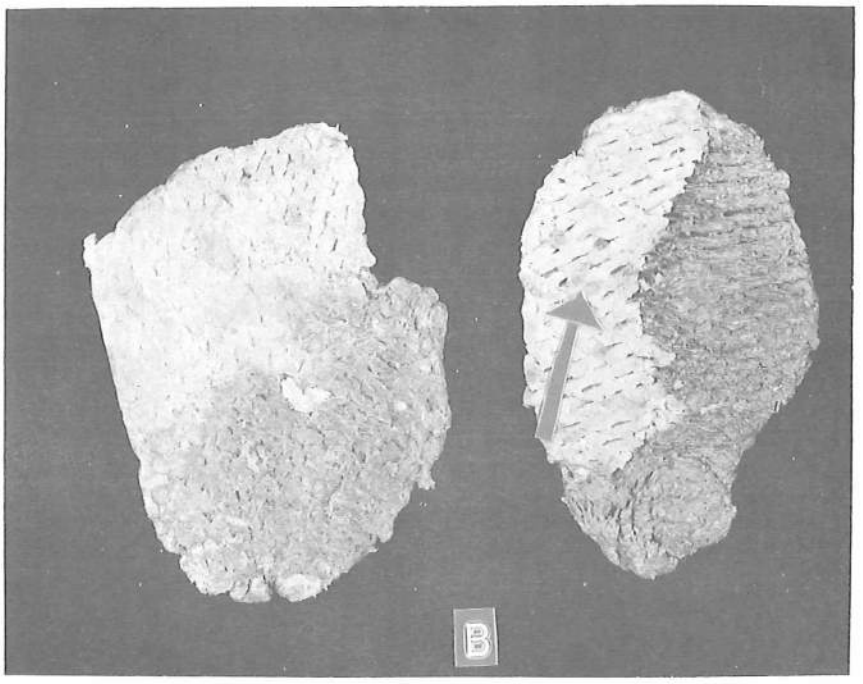
Normally, food items processed for preproduction procurement under limited purchase description are of excellent quality. However, this was not the case with the freeze-dehydrated round steaks, Type IV. The round steaks received for evaluation were of poor quality and possessed such visual defects as heavy connective tissue, excessive surface fat, irregularity of shape and improper thickness, as illustrated in Fig. 3. The above defects appeared to be the results of poor workmanship at the processing plant. It was felt that such defects could be corrected readily by the processor.

TABLE I. DISCERNIBLE DEFECTS IN FREEZE-DEHYDRATED ROUND BEEFSTEAKS, TYPE IV, PACKAGED IN NO. 10 CAN
(BASED ON AN AVERAGE OF 10 STEAKS PER CAN)

	CAN NUMBER									
	1	2	3	4	5	6	7	8	9	10
Heavy Connective Tissue (No. of pieces per can)	3	3	5	4	5	1	2	1	8	6
Excessive Surface Fat (No. of pieces per can)	2	3	1	1	2	1	1	0	8	2
Shape (No. of pieces per can)	2	0	0	1	1	2	0	3	0	1
Thickness Greater Than 5/8"	0	1	2	5	2	1	6	4	5	8
Less than 1/4" (No. of pieces per can)	2	0	0	2	0	1	3	5	3	2
Broken Pieces More than 3% by weight of steaks (Yes or No)	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes
Weight of broken (unusable) size pieces (oz.)	2 oz.	2.5 oz	0.5 oz.	1.2 oz.	0.5 oz.	0.0 oz.	2.7 oz.	6.5 oz.	4.0 oz.	5.0 oz.
Evidence of thawing Evidence of Improper Processing Meat Sawdust Color of Lean Color of Fat Moisture Penetration Odor and Flavor of Rehydrated Cooked Product Steaks not Sliced at Right Angle to Muscle Tissue	NO APPARENT DEFECTS									



NAVSUPRANDFAC
Photo No. 865-4



NAVSUPRANDFAC
Photo No. 865-8

Fig. 3. - Dehydrated round beefsteaks. (A) Illustrates heavy connective tissue, gristle and irregularity of shape. (B) Illustrates excessive surface fat. (Note that approximately 50% of the surface of the steaks is covered with surface fat.)

DETERMINATION OF REHYDRATION QUALITIES AND RATIO, READY-TO-EAT COOKED YIELD RATIO AND EQUIVALENT WEIGHT RATIO

Procedure

Based on findings in the preceding section, only those dehydrated round steaks without defects were used throughout the remaining study.*

Laboratory tests were conducted on 10 - 1 lb. samples of dehydrated rib-eye and round steaks, selected at random. The samples were rehydrated in accordance with the Purchase Description LP/P DES C-149-6 dated 12 June 1961, paragraph 5.3.1, "Cans", Cooking Directions as follows: "Cover with cool salted water (1 teaspoon salt per quart of water), Soak for about 30 minutes, Drain...." Temperature of the water used for rehydration was 50°F. Immediately following the 30-minute rehydration period, the steaks were placed on a U. S. Standard Sieve No. 8 and allowed to drain for 1 minute prior to weighing. The weight of rehydrated product obtained from one pound of dehydrate is expressed as the rehydration ratio according to the following formula:

Rehydration Ratio = 1 lb. of dehydrate: Weight of rehydrated product obtained from 1 lb. of dehydrate

The drained rib-eye beefsteaks were then grilled on a calibrated 19 KW Navy griddle at 400°F. for 35 to 40 seconds per side; the round steaks approximately 1 minute per side. The cooked steaks were then allowed to drain for 1 minute on a U. S. Standard Sieve No. 8 prior to weighing. The cooked yield ratio was calculated as follows:

Ready-to-eat Cooked Yield Ratio = 1 lb. of dehydrate: Weight of ready-to-eat, cooked product obtained from 1 lb. of dehydrate

Findings

1. The dehydrated rib-eye steaks had an average rehydration ratio of 1:2.08 and an average ready-to-eat, cooked yield ratio of 1:1.65. See Table II.

2. The dehydrated round steaks had an average rehydration ratio of 1:2.76 and an average ready-to-eat, cooked yield ratio of 1:1.91. See Table II.

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*Exception to the rule was the NAVSUPRANDFAC taste panel testing of the round steaks.

TABLE II. AVERAGE REHYDRATION AND READY-TO-EAT COOKED YIELD RATIO OF FREEZE-REHYDRATED BEEFSTEAKS

Type of Steak	Average Weight of Dehydrate Prior Rehydration (Ounce)	Average Weight of Rehydrated Product (Ounce)	Average Rehydration Ratio	Average Weight of Rehydrated Product After Grilling (Ounce)	Average Ready-to-eat Cooked Yield Ratio to Dehydrate
Rib-eye	160	333.1	1:2.08	264.2	1:1.65
Round	160	441.3	1:2.76	306.3	1:1.91

Discussion of Findings

It should be noted that the grilling period for both types of dehydrated beefsteaks was considerably less than would be expected for a piece of fresh beef with the same thickness. Grilling in excess of 1 minute per side for either type of beef yielded tough, dry grilled steaks, the apparent result of excessive moisture losses. Such losses were expected since the dehydrate is porous and once rehydrated has a tendency to lose moisture more readily than the fresh counterpart. Based on the average rehydration and ready-to-eat, cooked yield ratios, found in Table II, the rib-eye steaks have a grilling loss of 20% and the round steaks, 30.8%. The larger grilling loss for the round steaks was anticipated since: (1) the round steaks have a larger rehydration ratio and consequently more moisture to lose; (2) the meat was mechanically tenderized thereby increasing the surface area from which moisture and fat losses could occur during grilling; and (3) the cooking period for the round steaks was greater.

ORGANOLEPTIC ACCEPTANCE OF DEHYDRATED BEEFSTEAKS

Procedure

1. Based on preliminary test results, experimental tests were conducted to determine whether the use of meat tenderizer would substantially improve the texture of dehydrated round steak when prepared as a grilled item. The tenderizer was either (a) added to the water used for rehydration (at levels of 1/2 tsp., 1 tsp. and 1-1/2 tsp. per quart of water), or (b) sprinkled directly on the rehydrated steaks in accordance with the manufacturer's directions.

2. The dehydrated rib-eye steaks* were prepared and served as a grilled item. The round steaks were served as both grilled and Swiss steak.* The prepared products were organoleptically evaluated at the NAVSUPRANDFAC and operationally in the following general messes: USS FRANKLIN D. ROOSEVELT (CVA-42) and NAS, Floyd Bennett Field, Brooklyn, N. Y.

Except for one series of tests conducted at NAVSUPRANDFAC, the round steaks evaluated were without visual defects. For the special NAVSUPRANDFAC test prior to rehydration, the round steaks were visually inspected and divided into two groups. Group (1) contained those steaks which had such defects as heavy connective tissue, excessive fat, etc., and group (2) consisted of steaks without such defects.

The completed questionnaires obtained from the NAVSUPRANDFAC taste panel and the general messes, ashore and afloat, were analyzed to determine the over-all acceptance of the subject items under study.

Findings

1. It was found that meat tenderizer in the concentration of 1 teaspoon per quart of water best improves the texture of grilled round steaks.

2. Both the NAVSUPRANDFAC and the general mess test results showed that both rib-eye and round steaks (without defects) are acceptable. See Table III.

3. Round steaks having visual defects were not acceptable; whereas, round steaks without defects were acceptable. See Table IV.

Discussion of Findings

Since the use of a meat tenderizer greatly improved the texture of the dehydrated round steak, meat tenderizer was used in the concentration of 1 teaspoon per quart of water throughout the entire organoleptic evaluation. It should be noted in Table IV that grilled rib-eye steaks are acceptable, and in Tables III and IV that round steaks without defects produce an acceptable grilled and Swiss steak. The general comments obtained at both the NAVSUPRANDFAC taste panel and in the operational general mess tests indicate that both the rib-eye and round steak (without defects) are organoleptically acceptable, but leave much to be desired. Such undesirable qualities as "lacks typical steak flavor", "overdone", and "dry" were found to be characteristic of the freeze-dehydrated products. Many participants on verbal questioning associated overdoneness with the brownish meat color. It was observed during preparation that the meat was never pinkish in color, but brownish in color prior to and after grilling.

*All steaks tested were less than 1 year old since date of pack.

TABLE III. NAVSUPRANDFAC TASTE PANEL AND FIELD OPERATIONAL TEST RESULTS FOR ORGANOLEPTIC ACCEPTANCE OF DEHYDRATED BEEFSTEAKS

NAVSUPRANDFAC TASTE PANEL

Type of Dehydrate	Method of Preparation	Hedonic Rating		Per Cent Dislike	Acceptable	General Comments
		Numerical Value	Phrase Description			
Rib-Eye*	Grilled Steak	6.7	Like Slightly	3.3	Yes	"Lacks typical steak flavor" "Overdone" "Dry"
Round**	Swiss Steak	6.7	Like Slightly	5.5	Yes	"Steaks are odd shaped" "Too much gristle and fat" "Slightly tough"
	Grilled Steak	6.2	Like Slightly	7.1	Yes	"Overdone" "Lacks typical steak flavor" "Dry"

FIELD OPERATIONAL TEST

Rib-Eye*	Grilled Steak	7.6(1) 7.4(2)	Like Moderately Like Moderately	2.1 4.7	Yes	"Could use a larger portion" "One steak is not sufficient as a main course" "Good lean meat" "Doesn't look or taste like rib-eye steak" "Overdone" "Dry"
Round**	Swiss Steak	6.8(1) 6.4(2)	Like Slightly Like Slightly	13.5 14.5	Yes	"Steak tastes OK, but was tough" "Dry"
	Grilled Steak	6.3(1) 5.9(2)	Like Slightly Neither Like Nor Dislike	10.0 9.4	Yes	"Portion was small" "Too much fat" "Overdone"

*Swiss steaks were not prepared from rib-eye.
**Steaks tested were without visual defects.

(1) NAS FLOYD BENNETT FIELD, Brooklyn, N.Y.
(2) USS FRANKLIN D. ROOSEVELT (CVA-42)

TABLE IV. NAVSUPRANDFAC TASTE PANEL ORGANOLEPTIC ACCEPTANCE OF TYPE IV (ROUND) BEEFSTEAKS WITH AND WITHOUT VISUAL DEFECTS

Type IV Beefsteaks Method of Preparation	Steaks Had Defects		AVERAGE HEDONIC RATING		Per Cent Dislike	Acceptable
	Yes	No	Numerical	Phrase Description		
Swiss Steaks		x	6.4	Like Slightly	14	Yes
	x		4.6	Dislike Slightly	50	No
Grilled Steaks		x	7.1	Like Moderately	3	Yes
	x		3.2	Dislike Moderately	61	No

Participants at the NAVSUPRANDFAC and at the General Messes verbally indicated that a serving of one rib-eye steak or one round steak is insufficient under normal operating conditions, but would suffice as a portion under emergency conditions.

ESTIMATED PORTION AND WEIGHT COSTS

Procedure

The estimated cost per portion of steak was based on a ration of one rib-eye or one round steak. The cost per portion was mathematically determined as follows:

$$\text{Cost per steak} = \text{Average weight per dehydrated steak (expressed in lbs.)} \times \text{Cost per pound of dehydrated steak}$$

The average weight per dehydrated steak was mathematically determined from a sample size of 50 steaks, and the cost per pound of steak was obtained from the Federal Supply Catalog for Nonperishables, dated April 1962.*

* Prices were not quoted in the Federal Supply Catalog for the remainder of 1962.

The estimated cost per ounce of grilled steak (ready-to-eat, cooked portion) was calculated as follows:

Cost per ready-to-eat ounce of steak = Cost per individual steak ÷ ounces of ready-to-eat steak*

Ounces of ready-to-eat steak = Weight per dehydrated steak (in ounces) ÷ Yield Ratio (obtained from Table II of this report)

Findings

1. The average weight and cost and preparation data pertinent to each type of dehydrated steak are summarized in Table V.

TABLE V. SUMMARY OF AVERAGE WEIGHT AND COST AND PREPARATION DATA

	Rib-Eye Steak	Round Steak
Weight per dehydrated steak (avg.)	.106 lb.	.100 lb.
Cost per lb. dehydrated steak	$6.50/lb.	$4.00/lb.
Cost per dehydrated steak	$0.689	$0.400
Cost per ounce of dehydrated steak	$0.40625	$0.2500
Weight of grilled steak (avg.) (ready-to-eat)	.1325 lb. 2.7984 oz.	.191 lb. 3.056 oz.
Cost per oz. of grilled steak (ready-to-eat)	$0.247	$0.13089

Discussion of Findings

Based on the above cost calculations, it should be noted that the dehydrated rib-eye steaks cost $0.289 more per steak than the round (based on costs and weight of individual dehydrated steaks received for test). Based on ready-to-eat steak, the rib-eye costs $0.115 more per ounce than the round. Since an individual portion is based on the serving of one steak, both the purchased and ready-to-eat cost per steak are equivalent. On the per steak basis, the rib-eye steaks are approximately 72.3% more expensive than the round.

BREAKOUT, SPACE AND WEIGHT REQUIREMENTS

Procedure

Cases of freeze-dehydrated beefsteaks were measured and the case and contents were weighed to determine the following:

*Prices were not quoted in the Federal Supply Catalog for the remainder of 1962.

1. Average cubic feet (volume) per case
2. Average gross weight per case
3. Average net weight per case
4. Average cube factor per case

The above information, plus the average weight per individual dehydrated rib-eye and round steak, were used to mathematically determine the theoretical breakout, space and weight requirements per 100 portions.

Findings

1. See Table VI for physical characteristics of cases of freeze-dehydrated beefsteaks.

2. It was found that 8 No. 10 cans of rib-eye (1-1/3 cases, 1.33 cu. ft., net weight 11 lb.) are required per 100 portions.

3. It was found that 10 No. 10 cans of round (1-2/3 cases, 1.66 cu. ft., net weight 10 lb.) are required per 100 portions.

TABLE VI. DIMENSIONAL, SPACE AND WEIGHT CHARACTERISTICS OF CASES OF FREEZE-DEHYDRATED BEEFSTEAKS

Physical Characteristics	MEASURED OR CALCULATED VALUES	
	Rib-Eye	Round
Average case dimensions	12-1/2" x 7-1/2" x 18-1/2"	12-1/2" x 7-1/2" x 18-1/2"
Approximate volume/case	1 cu. ft.	1 cu. ft.
Average Gross Weight/case	13.75 lb.	11.95 lb.
Average Net Weight/case	8.25 lb.	6.00 lb.
Average Cube Factor/case	.1212 cu. ft./lb.	.1666 cu. ft./lb.

Discussion of Findings

It should be noted that the cube factor of the round beefsteak was larger than that of the rib-eye. The larger cube factor was the result of packaging irregular size and odd shaped round steaks, which could not be stacked on the bottom end (base) of the can. Instead the round steaks were stacked generally on the cylinder portion of the can.

GENERAL DISCUSSION

Other factors worthy of consideration are: (1) the effects of temperature on the product during storage, and (2) the approximate storage life of the product. Since the subject freeze-dehydrated items are relatively new, available information concerning above factors are limited. According to one article, "The Effects of Water and Temperature on the Deterioration of Freeze-Dried Beef During Storage",* the rehydration qualities of the dehydrate are affected by high storage temperatures. The authors claim that both the rate of rehydration and the amount of water taken up by the dry tissue during rehydration decrease with increased storage temperatures. For our purposes, the rate of rehydration can be considered insignificant, unless the period of rehydration is exceptionally long. However, differences in per cent rehydration of product stored at temperatures of 68°F. and 90°F. are important and should be noted in Table VI.

At a recent conference on freeze-drying of foods, a paper was presented on "The Effects of Freeze-Drying and Subsequent Storage on the Proteins of Flesh Foods".* The speaker claimed that during storage "the texture of the dehydrate deteriorates at a rate which depends markedly upon the temperature of storage and moisture content of the processed product". At temperatures of 37°C (98.6°F.) the product can be stored at least 6 months, providing the moisture content of the dehydrated product is 3% or less. In excess of 6 months, the product commences to become unacceptably tough and dry. Based on the above claims, predictions can be made that the subject dehydrated items will have a storage life of 6 months without adverse effects upon the rehydration qualities of the product. Such a prediction is predicated upon such facts as (1) the proposed Military Specification MIL-P___'63, Beefsteak, Dehydrated, Raw specifies a maximum moisture content of 2%; (2) the processed product is packaged in a sealed No. 10 can; and (3) in majority instances, ambient storage temperatures would not exceed that of 98.6°F. for prolonged period of time.

*J. J. Connell, paper on "The Effects of Freeze-Drying and Subsequent Storage on the Proteins of Flesh Foods", Chicago, Ill. (Conference on Freeze-Drying of Foods) Apr 1961.

TABLE VI. PER CENT REHYDRATION OF SAMPLES OF STORAGE STUDY II*

Storage Temperature (°F.)	Average Per Cent Rehydration	
	30 seconds (rehydration)	Final (rehydration)
0	79.2 ± 2.3	81.2 ± 2.3
68	61.2 ± 6.6	74.5 ± 1.7
90	44.2 ± 6.6	60.2 ± 5.8

*J. S. Thompson, J. B. Fox, Jr., W. A. Landmann, "The Effects of Water and Temperature on the Deterioration of Freeze-Dried Beef During Storage", (Food Technology) Sept 1962, Vol. 16, No. 9, page 131.

TECHNICAL DATA FOR DEHYDRATED RIB-EYE AND ROUND STEAKS
(Based on steaks tested)

Case Dimensions, Weight and Cube Data

Dimensions Approximately 12-1/2" x 7-1/2" x 18-1/2"

Weight*

Gross	Rib-eye ... 13.75 lb.	Round ... 11.95 lb.
Net	Rib-eye ... 8.25 lb.	Round ... 6.00 lb.

*Each case contains 6 No. 10 tin cans.

Cube 1 cubic foot

Cube Factor

Rib-eye	0.1212 cubic feet per lb.
Round	0.1666 cubic feet per lb.

Issue Rate

Rib-eye	8 No. 10 tin cans of dehydrated rib-eye steaks (1-1/3 cases) are required per 100 individual servings consisting of 2.8 oz. of ready-to-eat serving.
Round	10 No. 10 tin cans of dehydrated round steaks (1-2/3 cases) are required per 100 individual servings, consisting of 3.1 oz. ready-to-eat per serving.

Rehydration Ratio

Rib-eye	1 lb. of dehydrate yields 2.08 lb. of reconstituted raw meat.
Round	1 lb. of dehydrate yields 2.76 lb. of reconstituted raw meat.

Yield Ratio

Rib-eye	1 lb. of dehydrate yields 1.65 lb. of grilled steak.
Round	1 lb. of dehydrate yields 1.91 lb. of grilled steak.

Directions for Use

Rib-eye	Soak the dehydrate for 30 minutes in cold tap water to which 1 teaspoon of regular table salt has been added per quart of water used, drain for 1 minute, grill at approximately 400°F. for 35 to 40 seconds per side, season to taste, and serve.
Round	Soak the dehydrate for 30 minutes in cold tap water to which 1 teaspoon of meat tenderizer* and 1 teaspoon of table salt has been added per quart of water used, drain for 1 minute, grill at approximately 400°F. for 1 minute per side, season to taste, and serve.

*See Appendix A.

APPENDIX A

LP/P.DES C-149-61
12 June 1961
SUPERSEDING
LP/P.DES C-136-60
23 August 1960

QUARTERMASTER CORPS

LIMITED PRODUCTION PURCHASE DESCRIPTION

BEEFSTEAKS, RAW, DEHYDRATED

The use of this document in procurement is restricted to the specific procurement for which it was originally furnished.

FSC 8905

NOTE.--This initial draft dated 12 June 1961, prepared by the Quartermaster Corps, Quartermaster Food and Container Institute for the Armed Forces, has not been approved and is subject to modification. DO NOT USE FOR PROCUREMENT PURPOSES.

MIL-B-

1961

(Proposed)

MILITARY SPECIFICATION

BEEFSTEAKS, RAW, DEHYDRATED

(Approval paragraph to be inserted in final draft).

1. SCOPE

1.1 Scope.--This specification covers raw, freeze-dehydrated beefsteaks for use by the Armed Forces as a component of operational rations and as an item of general issue.

1.2 Classification.--The dehydrated beefsteaks shall be of the following types, as specified (see 6.1):

Type

I - Rib eye.
II - Top sirloin butt - center cut.
III - Loin strip.
IV - Round - mechanically tenderized.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issues in effect on date of invitation for bids, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

PPP-B-566 - Boxes, Folding, Paperboard.
PPP-B-585 - Boxes; Wood, Wirebound.
PPP-B-621 - Boxes, Wood, Nailed and Lock-Corner.
PPP-B-636 - Box, Fiberboard.

Military

MIL-L-1497 - Labeling of Metal Cans for Subsistence Items.
MIL-C-10506 - Coatings, Exterior, for Tinned Food Cans.

FSC 8905

STANDARDS

Military

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-109 - Inspection Terms and Definitions.
MIL-STD-129 - Marking for Shipment and Storage.

2.2 Other publications.--The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issues in effect on date of invitation for bids shall apply.

U. S. Department of Health, Education, and Welfare

Federal Food, Drug, and Cosmetic Act and General Regulations for Its Enforcement.

(Application for copies should be addressed to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.)

Association of Official Agricultural Chemists

Official Methods of Analysis.

(Application for copies should be addressed to the Association of Official Agricultural Chemists, Box 540, Benjamin Franklin Station, Washington 4, D. C.)

American Dry Milk Institute, Inc.

Standards for Grades for the Dry Milk Industry, including Methods of Analysis; Bulletin 916.

(Application for copies should be addressed to American Dry Milk Institute, Inc., 221 North LaSalle Street, Chicago 1, Illinois).

The United States Pharmacopoeial Convention, Inc.

Pharmacopoeia of the United States.

(Application for copies should be addressed to the United States Pharmacopoeial Convention, Inc., 46 Park Avenue, New York, N. Y.)

United States Department of Agriculture

Regulations Governing the Meat Inspection of the U. S. Department of Agriculture.
U. S. Standards for Grades of Carcass Beef.

(Application for copies should be addressed to Meat Inspection Division, Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C.)

3. REQUIREMENTS

3.1 Pre-production sample approval.--When specified (see 6.1), a sample of the finished product shall be submitted to the contracting officer for approval before production is commenced.

3.2 Material.

3.2.1 Beef.--The beef from which the steaks are prepared shall be of U. S. Good grade, complying with U. S. Standards for Grades of Carcass Beef, and, in addition, shall be clean, sound, and in excellent condition at time of processing. The internal temperature of any beef cut at its thickest point shall not exceed 42° F. at time of processing. The beef shall not have been frozen prior to the freezing processes described in 3.3.

3.2.2 Nitrogen.--The nitrogen shall be U. S. Pharmacopoeia grade and shall be water pumped.

3.3 Processing.

3.3.1 Boning and trimming.--The beef shall be completely boned. Bone slivers, cartilage, blood clots, bruised meat, heavy connective tissue, and tendons, shall be removed and excluded from all types. The fat remaining after trimming shall be of such amount that the finished product complies with 3.4.

3.3.1.1 Type I, rib eye.--Type I product shall be the rib eye obtained from the 7 bone rib (6th through 12th ribs). The lip muscle (longissimus costarum) lying immediately adjacent to the rib eye shall be excluded.

3.3.1.2 Type II, top sirloin butt.--Type II product shall be obtained from the top sirloin butt, center cut. The sirloin butt shall be separated from the short loin by cutting at right angles to the backbone and adjacent to the anterior end of the pinbone. After boning, the top sirloin butt shall be separated from the bottom sirloin butt by cutting approximately parallel with the backline up to within 3/4 inch of the seam between the two. This point lies immediately beneath the heavy fat deposit on the bone side. The fat deposit shall be completely trimmed from the sirloin butt. That portion of the biceps femoris on the outside of the top sirloin butt shall be removed and excluded. The sacrosciatic ligament shall be removed and excluded. The top sirloin butt shall remain intact.

3.3.1.3 Type III, loin strip.--Type III product shall be obtained by separating the loin wing from the loin strip by a straight cut extending from the eye muscle at the rib end to a point even with the eye muscle at the pinbone end. The backstrap and heavy tendons shall be excluded. The loin strip shall remain intact.

3.3.1.4 Type IV, round.--Type IV product shall be from the top round, bottom round, and knuckle, in the proportions in which they naturally occur. The knuckle cover, gracilis muscle, heel meat, trimmings, tag ends, and popliteal lymph glands, shall be excluded.

3.3.2 Forming, freezing, and slicing.

3.3.2.1 Type I.

3.3.2.1.1 Forming.--Within 24 hours after boning and trimming, the meat shall be formed by using molds or casings to produce uniform cylindrical pieces from which steaks may be sliced to fit snugly into the cans specified in 5.1.1. (Note: As an aid to the manufacturer and not as a requirement, a 3-3/4 inch diameter is suggested.)

3.3.2.1.2 Freezing.--Within 4 hours after forming and while still in the molds (or casings), the beef shall be transferred to a wind tunnel or sharp freezer with circulating air at a temperature not to exceed minus 10° F. Any other method of freezing which produces equivalent results may be used. After freezing and until sliced, the beef shall be retained at a uniform temperature not to exceed minus 10° F.

3.3.2.1.3 Slicing.--The solidly frozen pieces of beef shall be removed from the molds (or casings) and sliced (without tempering) at approximately right angles to the muscle fibers (across the grain). Slicing shall be performed by use of a band saw or gangsaw or by any other means which produces equivalent results. Slicing shall begin within 24 hours after meat is placed in freezer. Slicing operation shall be governed by the time-temperature combinations cited in Table I.

Table I.--Time-temperature limitation for slicing.

Maximum room temperature*	10° F.	20° F.	30° F.	40° F.
Maximum allowable time out of freezer**	5 hours	40 minutes	20 minutes	10 minutes

*Slicing room and intermediate rooms.
**Portable container for transferring meat is synonymous with freezer provided temperature does not exceed minus 10° F.

After slicing and until dehydration (see 3.3.4), the sliced beef shall be retained in the freezer at a temperature not to exceed minus 10° F.

3.3.2.2 Types II and III.

3.3.2.2.1 Freezing.--Within 4 hours after boning and trimming, the beef shall be frozen, placed in a freezer, as specified in 3.3.2.1.2, except that the meat shall be in its natural (unformed) shape.

3.3.2.2.2 Slicing.--The solidly frozen pieces of meat shall be sliced as specified in 3.3.2.1.3. The weight of each steak shall be 6 ounces + 1 ounce. The frozen steaks shall be retained at a temperature not to exceed minus 10° F. until time of dehydration. The dehydration process shall be started within 24 hours after slicing.

3.3.2.3 Type IV.

3.3.2.3.1 Slicing and tenderizing.--The beef (before freezing) shall be sliced at approximately right angles to the muscle fibers (across the grain). Each slice shall be put through a mechanical tenderizer (twice only), having sharp blades so as to produce rows of clean-cut scores at approximately right angles to each other without crushing the meat. Each steak shall weigh 5-1/2 ounces, + 1/2 ounce, immediately after tenderizing. The preparation shall be so controlled that the thickness of the final product complies with 3.4.1. The tenderized steaks shall contain no folded or knitted pieces and shall not separate when lifted by one end.

3.3.2.3.2 Freezing.--Within 4 hours after slicing and tenderizing, the steaks shall be placed flat in a wind tunnel or sharp freezer with circulating air at a temperature not to exceed minus 10° F. Any other method of freezing which produces equivalent results may be used. The steaks shall not be stacked or crowded during freezing.

3.3.3 Transfer and holding time.--In case it is necessary to transfer the beef from one plant to another during processing (3.3 through 3.3.2.3.2) this shall be done only while the beef is frozen (3.3.2.1.2, 3.3.2.2.1, and 3.3.2.3.2) and properly enclosed so that the temperature will not exceed minus 10° F.

3.3.4 Dehydration.--Dehydration process shall be commenced within 10 days after slicing. The product shall be freeze dehydrated (i.e., conversion of the water directly from solid to vapor phase, omitting the liquid phase entirely) at an absolute pressure not to exceed 1.5 millimeters of mercury, except that momentary increases in pressure for short periods of time due to placing additional chambers in system or other operational factors may be permitted, provided that no thawing of the product or moisture drip in the product occurs. After dehydration is completed, the pressure shall be equalized to atmospheric level with nitrogen, and the product shall be immediately packaged as specified in 5.1. In no case shall more than 8 hours elapse between time the chamber is opened and time product is completely packaged. During interim, product shall be adequately protected from oxygen and moisture.

3.4 Finished product.--The finished product shall comply with 3.4.1 and 3.4.2.

3.4.1 Physical requirements.

(a) Shape shall be characteristic of the type specified.
(b) Types I, II, and III shall be 1/2, ± 1/8, inch thick. Type IV shall be not less than 1/4 nor more than 5/8 inch thick.
(c) Neither surface shall contain more than a trace of meat sawdust, (applicable to types I, II and III).
(d) Product shall show no sign of having thawed and shall contain no damp or soggy areas, and may contain a minimum of glazed areas.
(e) At time of packaging, not more than 3 percent by weight of the dehydrated beefsteaks shall be broken.
(f) Lean surface shall be light red to light brown.
(g) Fat shall be white to cream colored. A cross section shall show the same uniform color with no dark areas.
(h) When the steak is submersed in water at approximately 70° F. for 30 minutes for types I, II and III, or 15 minutes for type IV, a cross section shall show moisture penetration throughout the piece.
(i) When rehydrated in water at a temperature of approximately 70° F. for 30 minutes for types I, II, and III, or 15 minutes for type IV, and grilled, the cooked product shall have flavor, odor, and texture in a range considered acceptable as normal for grilled frozen beefsteak. There shall be no undesirable flavor or odor.

3.4.2 Analytical requirements:

Requirement	Sample unit (percent, maximum)
Moisture (determined on alternate steaks in sample unit, trimmed free of surface and seam fat)	2.5
Fat (determined on remaining steaks without trimming)	58.0
Oxygen in headspace gas	2.0

3.5 The fresh beef shall be prepared only in a plant which is operated under continuous inspection by Meat Inspection Division, Agricultural Research Service, U. S. Department of Agriculture.

3.6 Plants performing the processing and dehydration shall be operated under continuous inspection by Meat Inspection Division, U. S. Department of Agriculture. All equipment coming in contact with the product shall be of material and construction that may be easily kept in a sanitary condition and will cause no discoloration of the product.

3.7 The product shall be handled and delivered under the same sanitary conditions that govern the handling and movements of similar products within and between establishments operated under continuous inspection by Meat Inspection Division, Agricultural Research Service, U. S. Department of Agriculture.

3.8 All deliveries shall conform in every respect to the provisions of the Federal Food, Drug, and Cosmetic Act and General Regulations for Its Enforcement.

3.9 Workmanship.--The processing plant, grounds, equipment, personnel practices and sanitary practices used in the production of this item, shall be such as to minimize the possibility of contamination of the product through microbial growth, dust, pests, rodents, condensate, or other unsanitary sources. The product shall be prepared and processed with minimum delay between the various stages in production.

4. QUALITY ASSURANCE PROVISIONS

4.1 The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Definitions.--Standard MIL-STD-109 shall apply for definitions of inspection terms used herein.

4.3 Pre-acceptance inspection (plant sanitation inspection).--The product, prepared in an establishment as specified in 3.6, shall be inspected, passed, and marked in accordance with Regulations Governing the Meat Inspection of the U. S. Department of Agriculture.

4.4 Acceptance inspection.--Inspections required and determination of acceptability shall be in accordance with provisions set forth in Standard MIL-STD-105, except where otherwise indicated hereinafter.

4.4.1 Lot average or lot average and unit requirements.--When the requirement is applicable to the lot average only, the material shall be considered acceptable if the average result is within specified limits. When the requirement is applicable to the lot average and sample unit, the material shall be considered acceptable if both the average and unit results are within specified limits.

4.4.2 Inspection of components.--Quality assurance provisions for components and materials described herein shall be in accordance with this specification and subsidiary specifications to the extent applicable, except that this specification shall govern in the event of conflict.

4.4.2.1 Examination of beef component.--Examination of beef component shall be in accordance with Standard MIL-STD-105 and Table II. The inspection level for examination shall be L-3; the sample unit shall be a beef side, beef quarter, or appropriate wholesale cut, and the lot size shall be expressed in terms of number of sides, quarters, or wholesale cuts (or both). The acceptable quality levels, expressed as defects per hundred units, shall be 1.5 for Major A, 6.5 for Major B, and 15.0 for Total defects.

Table II.--Examination of beef components.

Examine 1/	Defect	Major		Minor
		A	B	
Condition	Sticky.	X		
	Slimy.	X		
Odor	Putrid, rancid, musty, or foreign.	X		
Refrigeration	Presence of ice crystals or other evidence of having been frozen.			X
	Over 42° F.		X	
	Over 50° F.	X		
Presence of prohibited material	Foreign material (rust, wood-sawdust, wood, animal excreta, or other extraneous material, occurring singly or in combination). 2/	X		

1/ All beef shall comply with 3.2.1 and shall bear the official USDA legend for USDA Good grade. Any sample unit not being in compliance shall be the basis for rejection of an entire lot.

2/ Presence of paint, glass particles, metal particles, or other extraneous material, which could result in a harmful product or contaminate the product, will be basis for rejection of an entire lot.

4.4.2.2 Testing of components.--Testing shall be as outlined below. Unless otherwise specified, results shall apply to lot average.

Component	Sample unit	Unit of lot size	Inspection level	Reference paragraph
Can, 401 by 411	1 can with lid	Can and lid	L-3; 7 units minimum	5.1.1.1
Can, 5 gallons	1 end, cover, and one 4 by 4 inch panel from side	Can and cover	L-3; 7 units minimum	5.1.1.2
Inner bag	3 bags	Bag	L-2	5.1.2.1
Paperboard tray	3 trays	Tray	L-2	5.1.2.1
Outer bag	3 bags or equivalent in area	Bag or sheet	L-2	5.1.2.1.1

4.4.3 Intermediate inspection.--The Government will perform intermediate inspection during manufacture of the product, in order to ascertain compliance with the requirements of 3.3 through 3.3.4. Faulty conditions, when not corrected immediately after being reported to the contractor's representative, will be basis for rejection of the entire production lot.

4.4.3.1 Intermediate examination of boned and trimmed beef.--Examination of boned and trimmed beef shall be performed prior to placing of cuts in casings or molds. Classification of defects found during examination shall be in accordance with Table III. The lot size shall be expressed in terms of number of pounds. The sample for examination shall be the appropriate number of pounds indicated by inspection level L-8 of Standard MIL-STD-105, and shall be representative of all cuts (when possible) of the lot. The sample shall not exceed the poundage indicated by the inspection level by more than the weight of one cut. The acceptable quality level, expressed as defects per hundred units (defects per hundred pounds), shall be 1.0 for Major B, and 15.0 for Total defects.

Table III.--Examination of boned and trimmed beef.

Examine	Defect	Major B	Minor
Presence of prohibited material 1/	Bone particle.		X
	Cartilage particle.		X
	Blood clot.		X
	Heavy connective tissue.		X
	Tendon.		X
	Moderate bruise. 2/		X
	Extensive bruise. 2/	X	

Table III.--Examination of boned and trimmed beef. (Cont'd.)

Examine	Defect	Major B	Minor
Type I, rib eye	Lip muscle present.		X
Type II, top sirloin butt	Biceps femoris on outside of top sirloin butt.		X
	Any part of sacro-sciatic ligament present (do not tally as heavy connective tissue).		X
	Not intact.		X
Type III, loin strip	Loin wing present.		X
	Not intact.		X
Type IV, round	Knuckle cover, gracilis muscle, heel meat, tag end, or popliteal lymph gland, present.		X

1/ Presence of foreign material, e.g., wood, sawdust, animal excreta, paint, glass, metal, or other extraneous material, shall be the basis for rejection of a lot.

2/ Moderate bruises shall be those whose individual diameter is 2-1/2 inches or less which extend into the tissue less than 1 inch.

Deep or extensive bruises shall be those whose individual diameter exceeds 2-1/2 inches or those of any diameter which extend into the tissue one inch or more.

4.4.3.2 Intermediate examination of beefsteaks.--Examination of types I through III shall be performed prior to transfer to the dehydrator. Examination of type IV shall be performed immediately after tenderizing. The sample size for examination shall be in accordance with inspection level II of Standard MIL-STD-105. The sample unit shall be one steak. A lot shall consist of one type only, except that types I through III may be combined into a lot, if produced simultaneously. With reference to lots composed of type I through III steaks, sample units shall be selected of the different type steaks in proportion to their ratio within the lot. Lot size shall be expressed in terms of pounds. The acceptable quality levels, expressed as defects per hundred units, shall be 1.0 for Major A, 4.0 for Major B, and 10.0 for Total defects.

Table IV.--Intermediate examination of frozen beef slices.

Examine	Defect	Major A	Major B	Minor
Weight	Types II and III:			
	Greater than 7 ounces.			X
	Less than 5 but not less than 4-1/2 ounces.			X
	Less than 4-1/2 ounces.		X	

Table IV--Intermediate examination of frozen beef slices. (Cont'd)

Examine	Defect	Major A	Major B	Minor
Weight (cont'd)	Type IV:			
	Greater than 6 ounces.			X
	Less than 5 but not less than 4-1/2 ounces.			X
	Less than 4-1/2 ounces.		X	
Meat sawdust	Presence of meat sawdust on type I, II, or III steaks.			X
Type IV, round cuts 1/	Not tenderized.	X		
	Separates when lifted by one end.			X
Steaks, type I, II, and III	Not solidly frozen.	X		
	Not cut at approximate right angle to muscle fibers.		X	

1/ The inspector shall inspect a sufficient quantity prior to tenderizing, to assure that steaks are not folded or knitted.

4.4.4 Examination of end item.--Classification of defects shall be in accordance with Tables V through IX. The sample unit shall be one primary container or the contents of one primary container. (A primary container is defined as a can or carton). Lot size shall be expressed in terms of number of primary containers. A lot shall be composed of one size primary container inclosing the same size and number of inner packaging units; and composed of product from only one dehydrator load. The following procedures shall be used for the examinations of Table VI: for type I product - one outer bag and two inner bags or trays shall be examined per carton; for types II through IV product - one outer bag and two inner bags or trays, when so packaged; or for types II through IV product, one outer bag and one inner bag or tray, when so packaged. The following procedures shall be used for examinations of Table VIII: Sample units shall be selected of the different type steaks in proportion to their ratio within the lot; the amount of product to be examined from each sample unit shall be: 1 steak per 401 by 411 can, 20 steaks per 5 gallon can, 6 steaks per carton containing 50 steaks, and 3 steaks per carton containing 25 steaks.

Table V.--External examination of primary containers.

		Cans 1/			Cartons		
Examine	Defects	Major A	Major B	Minor	Major A	Major B	Minor
Design 2/	Not type, style, or size specified.		X			X	
Condition	Sifter, leaker, tear, or hole.	X			X		
	Objectionable odor.					X	
	Not clean. 3/			X			X
	Not closed.	X				X	

Table V.--External examination of primary containers. (Cont'd)

Examine	Defects	Cans 1/			Cartons		
		Major A	Major B	Minor	Major A	Major B	Minor
Condition (cont'd)	Springer, flipper, or sweller.	X					
	False seam.	X					
	Severe dent.		X			X	
	Dent causing sharp ridge.		X				
	Severe paneling, buckling, or collapsed can.		X				
	Cable cut.		X				
	Pitted rust.		X				
	Moderate dent.			X			
	Excessive amount of flux on ends or sides. 4/			X			
Labeling	Nomenclature, or directions for use, missing, incorrect, or illegible					X	
	Other information missing, incorrect, or illegible.						X
Inner packaging units	Not number of outer bags, inner bags, or trays specified.					X	

1/ Classification of can defects shall be made in accordance with VIG Set No. 33A-2D, when applicable. VIG Set No. 33A-2D shall be made available by the Government inspector for reference.

2/ Defects for size are not applicable to packaging for types II through IV steaks.

3/ Cans showing a very thin film of grease which is discernible to the touch but not readily discernible visually are considered to be clean.

4/ Traces of flux at edges of soldered areas, normally encountered in can manufacturing but not enough to cause corrosion, will not be considered excessive.

Table VI.--External examination of inner packaging units of carton.

Examine	Defects	Outer bags			Inner bags			Trays		
		Major		Minor	Major		Minor	Major		Minor
		A	B		A	B		A	B	
Design 1/	Not material or size specified.		X			X			X	
Condition	Broken, leaker, sifter, tear or hole, as applicable.	X			X			X		
	Evidence of delamination.	X		X						
	Objectionable odor.		X				X			X
	Not clean.			X			X			X
Closure	Not closed or sealed, as applicable		X			X				
	Width of seal (top, bottom, or sides) more than 7/16 or less than 5/16 inch.			X						

1/ Defects for size are not applicable to packaging for types II through IV steaks.

Table VII.--Examination of net weight.

Examine	Defects	Cans	Cartons 1/
		Minor	Minor
Net weight up to but not more than 1 pound 2/	More than 10 percent less than marked weight.	X	X
Net weight more than 1 pound but not more than 10 pounds 2/	More than 5 percent under marked weight.	X	X

1/ Pertains to flexible packaging only.

2/ Average net weight less than the marked net weight shall be basis for rejection of lot.

Table VIII.--Examination of dehydrated beefsteaks. 1/

Examine	Defects	Major B	Minor
Shape	Not characteristic of type specified.	X	
Thickness	Types I, II and III greater than 5/8 or less than 3/8 inch in thickness.		X
	Type IV greater than 5/8 or less than 1/4 inch in thickness		X
Evidence of thawing	Glazed area or an aggregate of glazed areas exceeding 1/4 inch in diameter.		X
Evidence of improper processing	Damp or soggy areas (1 or more).		X

Table VIII.--Examination of dehydrated beefsteaks.1/ (Cont'd)

Examine	Defects	Major B	Minor
Broken pieces	More than 3 percent by weight of steaks.		X
Meat sawdust	One or more surfaces or edges contains traces of meat sawdust (applicable to types I, II, and III).		X
Color of lean	Dark brown.		X
Color of fat	Light yellow to light brown.		X
	Color not uniform on cross section.		X
Moisture penetration	Cross section shows dry areas in pieces after submersion in water (approximately 70° F.) for 30 minutes (types I, II and III) or 15 minutes (type IV).	X	
Odor and flavor of rehydrated cooked product	After rehydration in water (approximately 70° F.) for 30 minutes (types I, II and III) or 15 minutes (type IV), the cooked product possesses undesirable odor or flavor.	X	
Piece count:			
Type I:			
Can	Less or more than 8 pieces.		X
Inner bag or tray	Less than 12 or more than 13 pieces.		X
Other types:			
Carton	More or less than 25 pieces per carton.		X

1/ Presence of foreign material, e.g., wood, hair, paint, glass, or metal particles, (or other extraneous material, shall be basis for rejection of an entire lot.

Table IX.--Examination of containers for leakage (see 4.6.2).

Examine	Defect	Major A
Can or outer bag (flexible package)	Leak indicated by a steady progression of bubbles.	X

4.4.4.1 Acceptable quality levels and inspection levels.--The acceptable quality levels and inspection levels (of Standard MIL-STD-105), for examination of end item shall be as follows:

Examination Table	Inspection level	AQLs expressed in defects per hundred units: Major A	Major B	Minor	Total
V	L-4	1.0	4.0	-	10.0
VI	L-3	1.0	4.0	-	10.0
VII	L-3	-	-	2.5	-
VIII	L-3	-	6.5	-	15.0
IX	L-3	2.5	-	-	-

4.4.4.2 Labeling.--Determination of acceptability shall be in accordance with Specification MIL-L-1497.

4.4.4.3 Shipping container.--Determination of acceptability shall be in accordance with Specifications PPP-B-636, PPP-B-621, or PPP-B-585, as applicable.

4.4.4.4 Coating of cans.--When coating of cans is required to be in accordance with Specification MIL-C-10506, determination of acceptability shall be in accordance with that specification.

4.4.4.5 Packing.--Examination shall be performed for arrangement of cans or cartons within the outer shipping container as specified in 5.2.1 and 5.2.2. Inspection level shall be L-2 of Standard MIL-STD-105. Sample unit shall be one packed outer shipping container. Lot size shall be expressed in terms of number of packed outer shipping containers. Failure to comply with the requirements of the applicable paragraphs shall be the basis for rejection of the entire lot.

4.4.5 Procedures for sampling and testing of end item.--Procedures for testing for moisture, fat, and oxygen requirements shall be as specified in 4.6. The sample unit for testing shall be one filled, sealed container. Sample size shall be the number of containers indicated by inspection level L-2 of Standard MIL-STD-105. Test requirements shall be lot average requirements and shall be reported on a pass or fail basis. The product in the cans tested for oxygen shall be used for determination of moisture and fat.

4.5 Standby test samples.--The Government reserves the right to withdraw and hold standby test samples of components or end item or both (quantity of which shall be not more than twice that of the original samples), for inspection purposes. These samples, if not used, will be returned to the vendor.

4.6 Tests.--Test procedures and controls which differ from those specified herein, may be used by the contractor if they provide a quality assurance equivalent to that specified. If the Government inspection activity determines that such procedures and controls do not provide, as a minimum, such quality assurance, the contractor will use the test procedures set forth herein. In case of dispute as to test results, the test methods specified herein will govern.

4.6.1 Chemical analyses.--Chemical analyses for moisture, fat, and oxygen determinations shall be made as specified in 4.6.1.1, 4.6.1.2, and 4.6.1.3, respectively.

4.6.1.1 Moisture.--Moisture determination shall be in accordance with the following method from Official Methods of Analysis of the Association of Official Agricultural Chemists. Determination shall be made on alternate steaks in sample unit after removing surface and seam fat from each steak.

Test	Source	Method
Moisture	Chapter: Meat and meat products, section: Meat	Moisture - Air Drying

4.6.1.2 Fat.--Fat determination shall be in accordance with the following method from Official Methods of Analysis of the Association of Official Agricultural Chemists. Determination shall be made on steaks remaining from the test specified in 4.6.1.1. Surface fat and seam fat shall not be removed.

Test	Source	Method
Fat	Chapter: Meat and meat products, section: Meat	Crude fat using petroleum ether

4.6.1.3 Oxygen.--Oxygen content in headspace gas in can or bag shall be determined in accordance with American Dry Milk Institute publication entitled Standards for Grades for the Dry Milk Industry, including Methods of Analysis; Bulletin 916.

4.6.2 Leakage test.--The filled can or flexible package shall be tested for leakage by submerging in water, contained in a desiccator, or other suitable container, and maintaining a vacuum of 10 inches of mercury (atmospheric pressure 29.9 inches), for at least one minute. A leak is indicated by a steady progression of bubbles. Packages with isolated bubbles caused by entrapped air will not be considered as leakers.

5. PREPARATION FOR DELIVERY

5.1 Packaging - levels A and B.--Packaging shall be in accordance with 5.1.1 or 5.1.2, as specified (see 6.1). The materials used for packaging and packing shall impart no objectionable odor or flavor to the product.

5.1.1 Cans.

5.1.1.1 Type I.--Eight pieces of type I product (see 3.3.2.1.1), shall be packaged in a size 401 by 411, open-top style, round, metal can, with soldered side seam and compound-lined, double-seamed ends. The can shall be made throughout from commercial 0.25-pound electrolytic tin plate. The product shall be gas packed by first removing the air from the filled can and replacing it with nitrogen. The cans shall be hermetically sealed so as to be free from leaks when tested in accordance with 4.6.2. The oxygen content of the gases in the sealed can shall not exceed the limits specified

in 3.4.2 after at least one week from the time of closing the can, when tested in accordance with 4.6.1.3. The can shall be coated in accordance with 5.1.1.1.1 or 5.1.1.1.2, as specified (see 6.1).

5.1.1.1.1 Method 1.--The can shall be coated outside with an enamel conforming to type I or II, or when specified (see 6.1); type III of Specification MIL-C-10506.

5.1.1.1.2 Method 2.--Cans with or without commercial exterior coating will be acceptable.

5.1.1.2 Types II, III or IV.--Types II, III, or IV product shall be placed in a square 5-gallon can, having dimensions of 9-3/8 by 9-3/8 by 13-3/4 or 13-7/8 inches, and shall have an opening capable of hermetic sealing. Cans shall be filled to greatest practicable capacity. The cans shall have soldered side seams and compound-lined, double-seamed ends, soldered top and bottom. Alternatively, the cans may be constructed with soldered side seams and compound-lined or unlined, single or double-seamed ends, soldered top and bottom. Prior to placing the product in the container, one inch of a creped cellulose material shall be evenly distributed and firmly packed on the bottom of the container. No finely shredded material shall be used. The cans shall be gas packed in accordance with 5.1.1.1 and hermetically sealed so as to be free from leaks. The oxygen content of the gasess in the sealed can shall not exceed the limits specified in 3.4.2 after at least one week from time of closing the can, when tested in accordance with 4.6.1.3.

5.1.2 Flexible packaging.

5.1.2.1 Type I.--Twelve or 13 pieces of the product, formed as specified in 3.3.2.1.1, shall be stacked and placed in a bag made from 0.002-inch thick polyethylene. The bag shall be 6 inches wide and 11-1/2 inches high (inside dimensions). The bag shall be closed by folding the open end. The polyethylene bag shall be perforated to permit easy removal of air from the package. Two bags containing 13 pieces each and 2 bags containing 12 pieces each (50 pieces in all) shall be placed upright in a snug-fitting outer bag. The outer bag shall be constructed and sealed in accordance with 5.1.2.1.1. The filled and sealed outer bag shall be placed in a carton conforming to 5.1.2.1.2, and the carton shall be closed. Alternatively, the pieces shall be placed in a good grade, full height snug-fitting paperboard tray. The paperboard shall be not less than 0.024-inch thick, and shall be made from materials that will impart no odor or flavor to the product, and shall be treated with a grease-resistant coating. Four trays (50 pieces in all) shall be inserted into the snug-fitting outer bag specified in 5.1.2.1.1.

5.1.2.1.1 Outer bag.--The outer bag shall be constructed from not less than 0.002-inch food grade vinyl, laminated to 0.0003-inch aluminum foil, laminated to 0.0005-inch polyester. The laminant shall be an odorless and permanently plastic water-resistant material other than wax. The combined sheet shall show no evidence of delamination when made into bags or heat

sealed. Prior to sealing the bag, the air shall be removed by exhaustion and replaced with nitrogen gas. The bag shall be hermeticaly sealed by heat sealing with seals having a width of 3/8, ± 1/16, inch. The oxygen content of the gases in the sealed bag shall not exceed 2.0 percent when tested in accordance with 4.6.1.3, not less than 3 days after filling and sealing the package. The filled and sealed package shall not show leakage when tested in accordance with 4.6.2.

5.1.2.1.2 Carton.--The carton shall be a folding, paperboard box, constructed in accordance with style III or VIII, type A, class b, of Specification PPP-B-566. The carton shall be made from not less than 0.040-inch thick solid sulfite or solid unbleached kraft paperboard (or both combined), having a minimum bursting strength of 72 pounds per square inch. The cover shall be supplied with notched tucks, pye locks, or split locks.

5.1.2.2 Types II, III or IV.--Twenty-five pieces of type II, III, or IV product shall be packaged as specified in 5.1.2.1, except that dimensions specified for bags and cartons shall not apply. Processor shall employ bags and cartons of the size commensurate with the specific product being processed.

5.2 Packing.--The product shall be packed in accordance with 5.2.1 or 5.2.2, as specified (see 6.1).

5.2.1 Level A.

5.2.1.1 Cans.

5.2.1.1.1 Type I.--Twenty-four cans of type I product, arranged 4 in length, 3 in width, and 2 in depth, shall be packed on end in a fiberboard box, constructed and closed in accordance with type I or II, class 2, grade 3, style RSC, of Specification PPP-B-636. The box shall be strapped in accordance with Specification PPP-B-636 except that 3 flat straps shall be used. Two straps shall be applied lengthwise over the top, ends, and bottom, and the third strap shall be applied girthwise, centered over the top, sides, and bottom. The longer straps shall be applied first.

5.2.1.1.1.1 Nailed wood box.--Alternatively, a nailed wood box, constructed and strapped in accordance with style 4, class 2, for type 2 load, of Specification PPP-B-621, may be used.

5.2.1.1.1.2 Wirebound wood box.--Alternatively, a wirebound wood box, constructed and closed in accordance with style 2, 2A, or 3, class 3 use, for type 2 load, of Specification PPP-B-585, may be used.

5.2.1.1.2 Type II, III and IV.--One can of type II, III or IV product shall be placed in a snug-fitting shipping container complying with 5.2.1.1.1.

5.2.1.2 Flexible packages--all types.--Six packages of the product, packaged as specified in 5.1.2, arranged 3 in length, 1 in width, and 1 in depth, shall be packaged in a fiberboard box as specified in 5.2.1.1.1.

5.2.2 Level B.

5.2.2.1 Cans.--The cans of the product, arranged as specified in 5.2.1.1.1, shall be packed in a snug-fitting fiberboard, nailed wood box, or wirebound wood box, constructed in accordance with type I or II, class 1, of Specification PPP-B-636; style 4, class 1, for type 2 load, of Specification PPP-B-621, or style 2, 2A, or 3, for class 1 use, type 2 load, of Specification PPP-B-585, respectively. The flaps of the fiberboard containers shall be securely sealed with an adhesive commercially used for the specific product being packed, applied throughout the entire area of contact between the flaps, or by a combination of stitching one set of flaps prior to packing and sealing the other flaps with the adhesive. When flaps are stitched, the stitches shall be distributed so as to fasten all flaps securely together over the entire area of contact between the inner and outer flaps and to prevent lifting of free edges and corners of the outer flaps.

5.2.2.2 Flexible packages.--Six packages of the product, packaged as specified in 5.1.2, and arranged as specified in 5.2.1.2, shall be packed in a snug-fitting fiberboard box constructed and closed as specified in 5.2.2.1.

5.3 Labeling and marking.

5.3.1 Cans.--Cans shall be labeled in accordance with method 1 or 2 of Specification MIL-L-1497, as specified (see 6.1), and the following information shall be included:

BEEFSTEAKS, RAW, DEHYDRATED (in letters larger than any others used for the label)
Type I (Rib eye))
Type II (Top sirloin butt)) as applicable
Type III (Loin strip))
Type IV (Round, mechanically tenderized)
Net weight
Name of processor
Date of packaging (day, month, year)
Dehydrator code number*

COOKING DIRECTIONS

Cover with cool salted water (1 teaspoon salt per quart of water). Soak for about 30 minutes. Drain, grill quickly on hot griddle.

* Each dehydrator batch of finished product shall be identified by a separate code number.

5.3.2 Cartons.--The cartons, containing the bags, shall be labeled with the information specified in 5.3.1. Labeling of the bags is not required.

5.3.3 Shipping containers.--Shipping containers shall be marked in accordance with Standard MIL-STD-129.

6. NOTES

6.1 Ordering data.--Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Type of product required (see 1.2).
(c) Whether preproduction sample is to be furnished (see 3.1).
(d) Type of packaging required (see 5.1).
(e) Method of exterior can coating required (see 5.1.1.1).
(f) When type III exterior can coating is required (see 5.1.1.1.1).
(g) Applicable level of packing (see 5.2).
(h) Method of can labeling required (see 5.3.1).

6.2 Methods applicable to level A packing and can labeling.

6.2.1 Method 1.--Method 1 should be used when a high degree of water resistance is desired and when extreme handling and climatic conditions and extended outside storage are anticipated.

6.2.2 Method 2.--Method 2 should be used when a moderate degree of water resistance is desired and when extreme handling and climatic conditions and extended outside storage are not anticipated.

Notice.--When Government drawings, specifications or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodians:
Army - Quartermaster Corps
Navy - Bureau of Supplies and Accounts
Air Force - MAAMA

Preparing Activity:
Army - Quartermaster Corps

Naval Supply Research and Development Facility, Bayonne, New Jersey.

EVALUATION OF FREEZE-DEHYDRATED BEEFSTEAKS FOR NAVY USE, by B. MacNulty. Aug. 1963. 17p app. tab. fig.

A study was conducted to determine the suitability of freeze-dehydrated beefsteaks for Navy use. Two types of dehydrated beefsteaks were procured under the limited Purchase Description No. LP/P DES C-149-61, dated 12 June 1961. They were dehydrated rib-eye steaks, Type I, and dehydrated round steaks, Type IV. 1. It was found that one pound of dehydrated rib-eye steaks yields approximately 1.65 pounds of ready-to-eat steaks, and one pound of dehydrated round yields 1.91 pounds of ready-to-eat steaks. The rib-eye steaks had no apparent defects; whereas the round steaks had such defects as heavy connective tissue, excessive fat, and irregularity of sbape, which adversely affected it's over-all acceptability. Both the rib-eye and round steaks (witbout defects) were organoleptically acceptable. 2. The rib-eye, on a per steak basis, due partially to a difference in portion size costs approximately 72.5% more than the round steak. It was recommended tbat both types of steak not be considered as a direct substitute for fresh beefsteaks, but as an emergency item for shipboard use when such items are deemed necessary and cost is not a factor. In addition, tbe round steak not be considered unless the over-all quality of the product can be improved.

1. Rations (Military)—Test results
2. Beef—Frozen
3. Beef—Dehydration

I. Title

II. MacNulty, B.

III. NT F015-13-02-69-59

IV. System No. 2202-06959-2

Naval Supply Research and Development Facility, Bayonne, New Jersey.

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