AMRL-TR-65-160

DEVELOPMENT OF DEHYDRATED AND BITE-SIZED FOOD ITEMS

HERBERT A. HOLLENDER
MARY KLICKA
UNITED STATES ARMY NATICK LABORATORIES

DECEMBER 1965

AEROSPACE MEDICAL RESEARCH LABORATORIES
AEROSPACE MEDICAL DIVISION
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

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FOREWORD

This research effort was initiated by Elwood W. Speckmann, First Lieutenant, USAF, of the Biomedical Laboratory, Aerospace Medical Research Laboratories, Wright-Patterson Air Force Base, Ohio. The research and development of food items was accomplished by the Food Division, US Army Natick Laboratories, Natick, Massachusetts, under Military Interdepartmental Purchase Request (MIPR) No. AM 3-40007 "Research Services for Food-Items to Meet Air Force Aerospace Requirements." A subcontract was awarded to Pillsbury Company for the development of 15 bite-sized pieces of food and an edible coating. The work was performed in support of Project No. 7164, "Biomedical Criteria for Aerospace Flight," and Task No. 716405, "Aerospace Nutrition." Dr. Herbert Hollender served as technical administrator and Mary Klicka contributed to the developmental effort by the US Army Natick Laboratories. Work was begun in March 1963 and was completed during March 1964.

This technical report has been reviewed and is approved.

WAYNE H. McCANDLESS
Technical Director
Biomedical Laboratory
Aerospace Medical Research Laboratories

ABSTRACT

Prolonged aerospace missions necessitate severe restrictions on the weight and size of all material carried on board the space vehicle. These limitations must be applied to the astronauts' food, as well. Therefore to meet these restrictions and to provide optimum nutrition, the US Army Natick Laboratories (NLABS) developed, evaluated, and supplied a variety of prototype dehydrated and bite-sized foods to the Aerospace Medical Research Laboratories for further evaluation. The formulations and production guides for each food item are included. Pillsbury developed various dessert bite-sized food pieces as well as a good food coating for encapsulating the food cubes for use in aerospace systems. Compressed 0.75 in. cubes with rounded corners and edges were suggested for aerospace missions. The encapsulation process employed two immiscible systems, a film former in the continuous phase surrounding a liquid, or once liquid, discontinuous phase, and a plasticizer to form the stable dispersion. The stable dispersion when applied to the dessert bits adhered tenaciously and then air dried to a smooth, nonsticky, moisture resistant, and oxygen resistant coating. The best coating formula consisted of 45% melted lard, 9% sodium caseinate, 2% gelatin, 3% cornstarch, 41% sucrose, and 100 ml water. On the basis of taste panel evaluations of these foods, an acceptable, nutritious 3-day menu cycle with 4 meals per day can be recommended for aerospace missions. The menu supplied 2500 kcal per day, of which 48.6% of the energy was supplied by carbohydrates, 32.7% by fat, and 18.7% by protein.

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SECTION I

INTRODUCTION

The feasibility of using tubed foods, freeze-dehydrated foods, and algae for nutrition of the astronaut during aerospace travel has been investigated (ref 1). The Aerospace Medical Research Laboratories (AMRL) evaluation (ref 2) of preliminary prototype foods for simulated aerospace missions has indicated that maintenance of human subjects on a precooked-dehydrated diet did not result in harmful effects on psychological, physiological, psychomotor, or social function during confinement. Information concerning the development, preference ratings, and results from evaluations of stability through 6 months of storage at 37.3 C (100 F) of (1) dehydrated and (2) bite-sized food items are included in this report.

Fifty-nine different prototype foods developed for and accepted by the National Aeronautics and Space Administration (NASA), Manned Spacecraft Center, Houston, Texas, for preliminary testing as potential diet components for personnel participating in space missions were supplied to the Air Force for evaluation. Emphasis was placed on planning menus suitable for use in the AMRL Life Support Systems Evaluator and in obtaining the nutritional and other data desired on these foods.

The prototoype foods can be divided into two major categories (1) dehydrated products requiring reconstitution before consumption and (2) bite-sized solids. All classes of foods were compressed and/or coated, i.e., cereals, desserts, fruits, fruit juices, meats and meat substitutes, soups, and vegetables.

SECTION II

METHOD

A total of 31 bread, cake, and dessert bite-sized pieces coated with an edible coating were developed by the Pillsbury Company. The pieces were not to exceed 19.1 mm (.75 in.) cubes and were to be coated to prevent crumbling and stickiness. The edible coating developed was a stable dispersion of ingredients using a film former, a liquid immiscible in this film former, and a plasticizer which causes the desired film formation. From the 31 items received, 18 items were selected for technological evaluation and stability studies. Of these, five are included in the menus provided in table V. Appendix I covers the formulation for the dehydrated and bite-sized foods furnished to the Aerospace Medical Research Laboratories (AMRL) for evaluation. Appendix II covers the Pillsbury Company report of the development of bite-sized pieces and their edible coating.

SECTION III

RESULTS AND DISCUSSION

Results from the U.S. Army Natick Laboratories (NLABS) and the Aerospace Medical Research Laboratories (AMRL) taste panel evaluations of 18 specially produced coated dessert and cereal cubes are listed in table I. Processed American cheese, Norwegian rye bread, oatmeal bread and cheese bread were not acceptable to both groups. In addition, the AMRL taste panelists did not like the compressed fig bar, pound cake, peanut butter cream on graham crackers, and chocolate cake. The remaining items were only liked moderately by both groups. The unit net weight data for these bite-sized cubes are listed in table II. In general, the disliked items were of lighter weight than were the acceptable items.

Cooperative studies between NLABS and the Nestle Company have resulted in the development of other types of bite-sized items having a high caloric value utilizing basic carriers. Two high-melting 43.3 C (110 F) carriers (1) fat, nonfat milk solids, and carbohydrate; and (2) fat and nonfat milk solids were developed for use with nuts, cereals, dried fruits, cheese, bacon, potato chips, and combinations of these items. Fruits were added to the sweetened carrier and other varieties of items were combined with unsweetened carrier. All pieces were protected against stickiness by a thin zein — acetylated monoglyceride, transparent coating. Results of the NLABS taste panel evaluations of the cereal, nut and fruit in carrier bite-sized products are listed in table III. The bacon and Wheaties were the only items disliked. Chopped almonds and chopped peanuts were considered the best (liked moderately) of the 17 items evaluated. The chopped almonds, coconut, currants and almonds and lemon peel have been suggested for inclusion in future menus for aerospace missions. The unit net weight data for these bite-sized products are listed in table IV. In general, the nuts were heavy in comparison to the other products evaluated but they were more acceptable.

A 3-day cycle menu with four meals per day has been developed for use in simulated aerospace missions. This menu is listed in table V and the menu summary is listed in table VI. The nutritive content of these menus is listed in table VII. A total of 2500 kcal are provided of which 48.6% of the energy is derived from carbohydrate, 32.7% from fat and 18.7% from protein.

Forty-seven different foods were included; however, formulations and nutritional data are provided on additional products to enable substitutions and supplementations. The nutritional data per 100 gm of product are listed in table VIII.

All foods requiring reconstitution will reconstitute in 26.6 C (80 F) water although acceptability is increased for meats and vegetable products with higher temperature water. All of these items will reconstitute within 5 minutes when water at 76.1 C (160 F) is used. With 26.6 C (80 F) water, some items will require up to 20 minutes for optimum reconstitution.

TABLE I

Preference Data Obtained on Contract Produced Specially Coated Dessert and Cereal Cubes

	NLABS Inhouse Ratings[1]	AMRL Air Force Ratings[1]
Compressed Corn Flake and Peanut Butter Cream Bar	7.24	5.10
Compressed Fruit Cake	6.91	6.90
Compressed Fig Bar	6.87	2.80
Commercial Nut Fudge	6.84	7.63
Milk Chocolate	6.74	7.20
Compressed Orange Raisin Nut Bar	6.66	6.54
Compressed Cereal Nut Bar	6.53	6.10
Compressed Date Nut Bar	6.46	6.33
Compressed Kellogg "K" Peanut Cream Bar	6.26	6.59
Brownies	5.96	5.00
Compressed Gingerbread	5.64	6.25
Pound Cake	5.44	4.80
Peanut Butter Cream on Graham Crackers	5.24	4.73
Chocolate Cake	5.22	4.88
Processed American Cheese	4.70	2.33
Norwegian Rye Bread	4.61	3.30
Oatmeal Bread	4.40	3.36
Cheese Bread	3.86	3.50

[1]All products were rated on the 9-point hedonic scale. Inhouse evaluations were accomplished at the U.S. Army Natick Labs, (NLABS) and Air Force efforts at the Aerospace Medical Research Labs (AMRL), W-PAFB, Ohio.

TABLE II

Unit Net Weight Data for Bite-Sized Cubes
(Average Net Weight Per Cube)

A. Specially Coated Dessert and Cereal Cubes

	Weight in gm		
Compressed Corn Flake and Peanut Butter Cream Bar	6.7		
Compressed Fruitcake	9.1	(6.5)	
Compressed Fig Bar	6.6		
Commercial Nut Fudge	7.4		
Compressed Orange Raisin Nut Bar	8.65	(6.7)	(8.3)
Compressed Cereal Nut Bar	8.5	(8.6)	(6.2)
Compressed Date Nut Bar	7.5	(7.1)	(7.7)
Compressed Kellogg "K" Peanut Cream Bar	6.9	(7.3)	
Brownies	6.2	(8.2)	
Compressed Gingerbread	6.2	(7.0)	
Pound Cake	2.9	(4.5)	(5.0)
Peanut Butter Cream on Graham Crackers	5.45		
Chocolate Cake	5.0		
Processed American Cheese	5.9		
Norwegian Rye Bread	3.55		
Oatmeal Bread	3.75		
Cheese Bread	3.7		

Note: Values in parenthesis represent other average weights obtained with different production lots.

TABLE III

Preference Data Obtained on Cereal, Nut and Fruit in Carrier Bite-Sized Products 19.05 mm. (.75 inch)

	NLAB Ratings[1]
Chopped Almonds	6.61
Chopped Peanuts	6.60
Walnuts	6.45
Special K and Almonds	6.30
Walnuts and Raisins	6.27
Grapenuts	6.25
Currants	6.24
Coconut	6.21
Currants and Almonds	6.16
Lemon Peel	6.14
Candied Fruit	5.92
Grapenuts, Raisins, Walnuts and Orange Peel	5.86
Banana Solids	5.70
Candied Orange Peel	5.60
Orange Peel and Almonds	5.60
Grapenuts and Raisins	5.48
Bacon and Wheaties	3.78

[1]All products were rated on the 9-point hedonic scale.

TABLE IV

Unit Net Weight Data for Bite-Sized Cubes
(Average Net Weight Per Cube)

Cereal, Nut and Fruit in Carrier Bite-Sized Products

	Weight in gm
Chopped Almonds	8.7
Chopped Peanuts	8.5 (8) (9.0)
Walnuts	8.7 (9)
Special K and Almonds	9.3
Walnuts and Raisins	9.3
Grapenuts	8.7
Currants	9.4
Coconut	7.8 (8.8)
Currants and Almonds	9.5
Lemon Peel	9.8 (9)
Candied Fruit	9.8
Grapenuts, Raisins, Walnuts and Orange Peel	9.3
Banana Solids	9.2
Candied Orange Peel	9.9
Orange Peel and Almonds	8.95
Grapenuts and Raisins	10.05
Bacon and Wheaties	9.15
Pineapple	7.0 (9.4)
Apricot	6.5 (9.2)
Strawberry	7.0

TABLE V

Suggested 3-day Cycle of Menus for Simulated Aerospace Mission Use

MEAL	*Day 1*	*Day 2*	*Day 3*
A	Canadian Bacon in Sauce Scrambled Eggs Sugar Frosted Flakes Toasted Bread Cubes Grapefruit Juice	Sausage Patties Oatmeal with Milk and Sugar Toast Butterscotch Pudding Coffee with cream and sugar	Beef Hash Peanut Butter Sandwich Date Nut Cube Cocoa Beverage
B	Salmon Salad Cheese Sandwich Lemon Peel Cubes Cocoa Beverage	Chicken Stew with Vegetables Potato Chip Cubes Cereal Nut Bar Cubes Fruit Cocktail	Chicken with Gravy Corn Chowder Chopped Almonds Toast Tea
C	Shrimp Cocktail Potato Soup Toast Strawberry Cereal Cubes Tea	Beef Pot Roast Cheese Sandwiches Green Beans in Cream Sauce Coconut Cubes Cocoa Beverage	Veal in Barbecue Sauce Mashed Potato Rice Cereal Cube Compressed Fruit Cake Apple Juice
D	Beef with Vegetables Toasted Bread Cubes Pears Currants and Almonds Pineapple Juice	Spaghetti with Meat Sauce Chicken Sandwiches Strawberries Toasted Bread Cubes Orange Raisin Nut Cubes Grapefruit Juice	Beef with Gravy Potato Chip Cubes Apricots Commercial Nut Fudge Tea

TABLE VI — MENU SUMMARY

Food Item	*Unit*	*Net Wt Per Unit (gm)*	*Menu 1* A	B	C	D	*Menu 2* A	B	C	D	*Menu 3* A	B	C	D	*Ounces Water for Reconstitution*	
Beef Hash	Bar	18.00									2				4	H
Beef Pot Roast	Bar	18.00							1						2	H
Beef with Gravy	Bar	24.00												2	4	H
Beef with Vegetables	Bar	17.00				2									4	H
Canadian Bacon in Sauce	Bar	16.00	2												3	H
Chicken Stew w/Vegetables	Bar	15.00						2							4	H
Chicken with Gravy	Bar	16.00										2			4	H
Salmon Salad	Bar	26.00		1											2	
Sausage Patties	Bar	20.00					2								4	H
Shrimp Cocktail	Bar	20.00			2										3	
Spaghetti with Meat Sauce	Bar	14.00								2					4	H
Veal in Barbecue Sauce	Bar	26.00											2		4	H
Cheese Sandwich	Piece	3.7		6					5							
Chicken Sandwich	Piece	2.9								5						
Peanut Butter Sandwich	Piece	5.5									5					
Potato Chip Cubes	Cube	6.45						5						5		
Rice Cereal Cube	Cube	5.50											3			
Strawberry Cereal Cube	Cube	7.2			5											
Toast	Piece	1.9			5		5					5				
Toasted Bread Cubes	Cube	7.1	5			5										
Corn Chowder		56.00										1			5	H
Potato Soup		49.00			1										5	H
Strawberries	Bar	(15.00)								1					2	
Apricots	Bar	(15.00)												1	2	

TABLE VI — MENU SUMMARY (Cont)

Food Item	*Unit*	*Net Wt. Per Unit (gm)*	*Menu 1* A	B	C	D	*Menu 2* A	B	C	D	*Menu 3* A	B	C	D	*Ounces Water for Reconstitution*	
Fruit Cocktail	Bar	15.00						2							4	
Pears	Bar	(15.00)				1									2	
Oatmeal		34.00					1								4½	H
Sugar Frosted Flakes		36.75	1												3	
Scrambled Eggs	Bar	18.00	1												2	H
Apple Juice		26.00											1		5½	
Grapefruit Juice		21.00	1							1					5½	
Pineapple Juice		28.00				1									5½	
Butterscotch Pudding		50.00					1								3	
Green Beans in Cream Sauce	Bar	15.00							1						3	H
Potatoes, Mashed		20.00											1		4	H
Cereal Nut Bar	Cube	8.50						5								
Chopped Almonds	Cube	8.75										4				
Coconut	Cube	7.75							4							
Commercial Nut Fudge	Cube	7.40												4		
Compressed Fruit Cake	Cube	9.10											4			
Currants and Almonds	Cube	9.45				3										
Lemon Peel	Cube	9.85		4												
Orange Raisin Nut	Cube	8.65								4						
Date Nut	Cube	7.10									5					
Cocoa		42.00		1					1		1				5	H
Coffee w/Cream, Sugar		12.50					1								8	H
Tea w/Lemon, Sugar		8.00			1							1		1	8	H

TABLE VII

Nutrient composition or three day menu cycle composed of dehydrated and bite-sized food items

Suggested Menus — 1st Day

Sample Identification		Water	Energy	Protein	Fat	Carbohydrate Total	Carbohydrate Fiber	Ash	Calcium	Phosphorus	Iron	Sodium	Potassium	Magnesium	Chloride as Na Cl
	wt./gm/	gm	Cal.	gm	gm	gm	gm	gm	mg	mg	mg	mg	mg	mg	gm
Meal A															
Canadian Bacon in Sauce	32.00	0.6	146	12.2	5.2	12.6	0.24	1.5	20	134	0.8	403	122	10.0	0.64
Scrambled Eggs	18.00	0.2	106*	8.3	7.3	1.2		1.0	40	113	1.6	221	137	8.6	0.58
Sugar Frosted Flakes	36.75	1.0	139	3.4	0.1	31.3	0.11	1.0	74	50	0.2	210	110	6.4	0.66
Toasted Bread Cubes	35.50	1.9	169	5.3	7.4	20.1	0.15	0.8	14	40	0.5	180	70	0.2	0.51
Grapefruit Juice	21.00	0.4	80	1.0	tr	18.9	0.07	0.7	14	20	0.1	tr	310	13.5	0.02
Total	143.25	4.1	640	30.2	20.0	84.1	0.57	5.0	162	357	3.2	1014	749	38.7	2.41
Meal B															
Salmon Salad	26.00	0.1	153	12.8	11.1	0.5	0.07	1.5	42	93	0.5	380	160	9.5	1.01
Cheese Sandwich	22.20	0.4	114	9.6	6.4	4.4	0.10	1.4	162	132	0.4	300	36	9.4	0.80
Lemon Peel Cubes	39.40	2.4	184*	4.0	9.2	22.8		1.2							
Cocoa Beverage	42.00	0.7	186	3.1	5.1	31.3	0.28	1.3	91	130	0.7	140	270	25.2	0.30
Total	129.60	3.6	637	29.5	31.8	59.5		5.4							

*Asterisk caloric values were calculated using specific energy values. All other caloric values were computed using the general 4, 9, 4 caloric factors.

TABLE VII (Cont)

1st Day

Sample Identification	wt./gm/	Water	Energy	Protein	Fat	Carbohydrate Total	Carbohydrate Fiber	Ash	Calcium	Phosphorus	Iron	Sodium	Potassium	Magnesium	Chloride as Na Cl
		gm	Cal.	gm	gm	gm	gm	gm	mg	mg	mg	mg	mg	mg	gm
Meal C															
Shrimp Cocktail	40.00	1.1	155	21.2	2.1	12.8	0.37	2.8	93	160	0.9	800	213	4.3	1.84
Potato Soup	49.00	1.2	222	2.8	8.2	34.3	0.32	2.5	84	160	0.8	480	610	5.9	1.34
Toast	9.50	0.2	50	1.6	2.7	4.7	0.04	0.3	7	10	0.1	140	10	0.2	0.29
Strawberry Cereal Cubes	36.00	1.5	167	3.3	6.2	24.5	0.47	0.7	11	20	0.7	60	90	0.2	0.48
Tea	8.00	tr	32	0.1	tr	7.7	0.02	0.1	tr	tr	tr	tr	40	1.2	0.01
Total	142.50	4.0	626	29.0	19.2	84.0	1.22	6.4	195	350	2.5	1480	963	11.8	3.96
Meal D															
Beef w/Vegetables	34.00	0.8	137	19.0	2.6	9.2	0.58	2.3	18	173	2.0	517	541	24.1	1.22
Toasted Bread Cubes	35.50	1.9	169	5.3	7.4	20.1	0.15	0.8	14	40	0.5	180	70	0.2	0.51
Pears	15.00	0.1	54*	0.3	0.3	14.1	1.10	0.2	11	17	0.6	15	122	3.7	tr
Currants and Almonds	28.35	0.9	147*	3.6	9.3	13.8									
Pineapple Juice	28.00	0.2	109	0.6	tr	26.5	0.18	0.7	33	tr	0.3	tr	270	22.4	0.09
Total	140.85	3.9	616	28.8	19.6	83.7									

TABLE VII (Cont)

2nd Day

Sample Identification	wt./gm/	Water gm	Energy Cal.	Protein gm	Fat gm	Carbohydrate Total gm	Carbohydrate Fiber gm	Ash gm	Calcium mg	Phosphorus mg	Iron mg	Sodium mg	Potassium mg	Magnesium mg	Chloride as Na Cl gm
Meal A															
Sausage Patties	40.00	0.8	212	21.0	13.0	2.8	0.24	2.4	12	168	4.6	620	272	15.8	1.70
Oatmeal with Milk and Sugar	34.00	0.6	144	5.7	2.9	23.8	0.30	1.0	118	136	1.0	99	173	24.7	0.31
Toast	9.50	0.2	50	1.6	2.7	4.7	0.04	0.3	7	10	0.1	140	10	0.2	0.29
Butterscotch Pudding	50.00	0.3	220	0.8	5.6	41.6	0.62	1.6	174	195	0.4	330	140	0.8	0.40
Coffee w/Cream and Sugar	12.50	0.2	54	0.7	1.3	10.0	tr	0.3	5	26	0.1	10	114	8.4	tr
Total	146.00	2.1	680	29.8	25.5	82.9	1.20	5.6	316	535	6.2	1199	709	49.9	2.70
Meal B															
Chicken Stew w/Vegetables	30.00	0.6	118	21.2	1.6	4.4	0.18	2.1	30	130	0.4	552	162	16.0	1.54
Potato Chip Cubes	32.25	1.2	153	2.7	6.7	20.4	0.30	1.2	11	50	0.5	220	300	10.5	0.44
Cereal Nut Bar Cubes	42.50	4.0	205*	4.5	12.0	22.5		0.5	13						
Fruit Cocktail.	30.00	0.9	115	0.8	0.1	27.8	0.80	0.4	28	24	0.4	24	214	6.8	0.02
Total	134.75	6.6	591	29.2	20.4	75.1		4.2	82						

TABLE VII (Cont)

2nd Day

Sample Identification	wt./gm/	Water gm	Energy Cal.	Protein gm	Fat gm	Carbohydrate Total gm	Carbohydrate Fiber gm	Ash gm	Calcium mg	Phosphorus mg	Iron mg	Sodium mg	Potassium mg	Magnesium mg	Chloride as Na Cl gm
Meal C															
Beef Pot Roast	18.00	0.5	77	12.4	2.4	1.6	0.14	1.17	4	90	0.7	270	160	9.81	0.69
Cheese Sandwiches	18.50	0.3	95	8.0	5.4	3.6	0.09	1.2	135	110	0.3	250	30	7.84	0.67
Green Beans in Cream Sauce	15.00	0.3	72	2.0	3.8	7.5	0.56	1.4	66	40	1.0	380	110	7.31	1.05
Coconut Cubes	31.00	0.4	168*	3.6	11.2	14.8									
Cocoa Beverage	42.00	0.7	186	3.1	5.1	31.8	0.28	1.3	91	130	0.7	140	270	25.2	0.30
Total	124.50	2.2	598	29.1	27.9	59.3									
Meal D															
Spaghetti w/Meat Sauce	28.00	0.4	120	13.2	3.8	8.2	0.10	2.28	14	134	1.4	644	230	21.8	1.64
Chicken Sandwiches	14.50	0.4	57	8.5	0.9	3.8	0.07	0.9	12	40	0.3	280	50	7.21	0.64
Strawberries	15.00	0.2	59	0.3	0.2	13.9	(0.30)	(0.4)	12	21	0.3	(tr)	(246)	(4.7)	(0.03)
Toasted Bread Cubes	35.50	1.9	169	5.3	7.4	20.1	0.15	0.8	14	40	0.5	180	70	0.21	0.51
Orange Raisin Nut Cubes	34.60	3.6	160*	2.4	8.4	19.6			26		0.4				
Grapefruit Juice	21.00	0.4	80	1.0	tr	18.9	0.07	0.7	14	20	0.1	tr	310	13.5	0.02
Total	148.60	6.9	645	30.7	20.7	84.5			91						

TABLE VII (Cont)

3rd Day

Sample Identification	wt./gm/	Water gm	Energy Cal.	Protein gm	Fat gm	Carbohydrate Total gm	Carbohydrate Fiber gm	Ash gm	Calcium mg	Phosphorus mg	Iron mg	Sodium mg	Potassium mg	Magnesium mg	Chloride as Na Cl gm
Meal A															
Beef Hash	36.00	0.8	152	15.0	4.2	13.4		2.0							
Peanut Butter Sandwich	27.50	1.0	149	8.5	9.2	8.1	0.26	0.7	16	70	0.4	80	60	14.25	0.45
Date Nut Cube	35.50	3.4	170	2.4	8.7	20.5	1.4	0.5	23		0.3				0.19
Cocoa Beverage	42.00	0.7	186	3.1	5.1	31.8	0.28	1.3	91	130	0.7	140	270	25.2	0.30
Total	141.00	5.9	657	29.0	27.2	73.8									
Meal B															
Chicken with Gravy	32.00	0.6	122	16.2	1.4	11.2	0.70	2.8	56	125	0.6	688	214	18.20	2.00
Corn Chowder	56.00	1.6	252	4.9	9.4	37.0	0.95	3.1	81	170	0.3	580	230	23.74	1.87
Chopped Almonds	35.00	0.8	196	5.6	13.2	14.4									
Toast	9.50	0.2	50	1.6	2.7	4.7	0.04	0.3	7	10	0.1	140	10	0.16	0.29
Tea	8.00	tr	32	0.1	tr	7.7	0.02	0.1	tr	tr	tr	tr	40	1.2	0.01
Total	140.50	3.2	652	28.4	26.7	75.0									

TABLE VII (Cont)

3rd Day

Sample Identification	wt./gm/	Water gm	Energy Cal.	Protein gm	Fat gm	Carbohydrate Total gm	Carbohydrate Fiber gm	Ash gm	Calcium mg	Phosphorus mg	Iron mg	Sodium mg	sium Potassium mg	sium Magnesium mg	as Na Cl Chloride gm
Meal C															
Veal in Barbecue Sauce	52.00	2.8	212	25.6	6.2	13.4	0.94	3.8	24	216	3.0	326	320	20.0	2.12
Mashed Potato	20.00	1.1	76	1.5	1.6	14.4		1.4							
Rice Cereal Cube	17.50	0.9	75*	1.7	2.8	11.8		0.4	tr		0.1				0.27
Comp. Fruit Cake	36.40	5.0	157	2.3	6.7	21.8	1.07	0.5	34		0.2				
Apple Juice	26.00	0.4	102	0.1	tr	25.2	NF	0.3	9	10	1.6	tr	110	5.3	0.02
Total	151.90	10.2	622	31.2	17.3	86.6		6.4							
Meal D															
Beef with Gravy	48.00	1.7	198	24.8	5.8	11.8	0.30	4.0	46	250	0.4	902	480	23.86	2.40
Potato Chip Cubes	32.25	1.2	153	2.7	6.7	20.4	0.30	1.2	11	50	0.5	220	300	10.45	0.44
Apricots	15.00	0.2	59	0.3	0.2	14.0	0.30	0.4	17	11	0.4	8	146	2.50	tr
Comm. Nut Fudge	29.60	2.0	144	1.2	6.8	19.2		0.4	11		0.4				
Tea	8.00	tr	32	0.1	tr	7.7	0.02	0.1	tr	tr	tr	tr	40	1.2	0.01
Total	132.85	5.1	586	29.1	19.5	73.1	0.92	6.1	85		1.7				

TABLE VII (Cont)

Summary

	Sample Identification	wt./gm/	gm	Cal.	gm	gm	Carbohydrate		Ash	Calcium	Phos-phorus	Iron	Sodium	Potas-sium	Magne-sium	Chloride as Na Cl
							Total	Fiber								
			Water	Energy	Protein	Fat	gm	gm	gm	mg	mg	mg	mg	mg	mg	gm
Day 1	Meal A	143.25	4.1	640	30.2	20.0	84.1	0.57	5.0	162	357	3.2	1014	749	38.7	2.41
	Meal B	129.60	3.6	637	29.5	31.8	59.5		5.4							
	Meal C	142.50	4.0	626	29.0	19.2	84.0	1.22	6.4	195	350	2.5	1480	963	11.8	3.96
	Meal D	140.85	3.9	616	28.8	19.6	83.7									
	Total	556.20	15.6	2519	117.5	90.6	311.3									
Day 2	Meal A	146.00	2.1	680	29.8	25.5	82.9	1.20	5.6	316	535	6.2	1199	709	49.9	2.70
	Meal B	134.75	6.6	591	29.2	20.4	75.1		4.2	82						
	Meal C	124.50	2.2	598	29.1	27.9	59.3									
	Meal D	147.60	6.9	645	30.7	20.7	84.5			91						
	Total	552.85	17.8	2514	118.8	94.5	301.8									
Day 3	Meal A	141.00	5.9	657	29.0	27.2	73.8									
	Meal B	140.50	3.2	652	28.4	26.7	75.0									
	Meal C	151.90	10.2	622	31.2	17.3	86.6		6.4							
	Meal D	132.85	5.1	586	29.1	19.5	73.1	0.92	6.1	85		1.7				
	Total	566.25	24.4	2517	117.7	90.7	308.5									

TABLE VIII

Nutrient Composition Per 100 grams of Product of Components of 3-day Cycle Menus

Sample Identification (Per 100 gm Portion)	Water	Energy	Protein	Fat	Carbohydrate		Ash	Calcium	Phos-phorus	Iron	Sodium	Potas-sium	Magne-sium	Chloride as Na Cl
					Total	Fiber								
	Pct	Cal	gm	gm	gm	gm	gm	mg	mg	mg	mg	mg	mg	gm
Beef Hash	2.33	421	41.56	11.72	37.43		6.96							3.89
Beef Pot Roast	1.79	429	68.90	12.83	9.41	0.82	7.07	33.20	600	10.32	1540	220	72.65	
Beef Pot Roast	2.71	430	68.74	13.28	8.78	0.77	6.49	23.3	500	3.8	1500	890	54.5	3.82
Beef Pot Roast	1.71	444	69.6	15.1	7.34	2.74	6.25	16	340	9.0	585	520	26	3.30
Beef with Gravy	0.74	447	74.36	14.48	4.90		5.52							4.10
Beef with Gravy	3.6	411	51.7	11.9	24.4	0.61	8.4	97	520	0.8	1880	1000	49.7	4.98
Beef with Gravy	2.82	441	73.8	15.4	1.81	0.32	6.17	16	265	6.0	550	435	34	2.88
Beef with Gravy	0.82	465	49.85	18.2	25.47	0.66	5.66	16.5	255	6.5	605	415	28	3.00
Beef with Vegetables	2.04	398	51.73	7.80	30.32	0.72	8.11	73.58	520	6.87	2010	360	80.15	
Beef with Vegetables	2.32	403	55.88	7.78	27.34	1.72	6.68	50.1	510	5.6	1520	1590	70.9	3.56
Canadian Bacon in Sauce	2.00	455	38.02	16.31	39.13	0.75	4.54	62.2	420	2.4	1260	380	31.4	2.00
Chicken Stew w/Vegetables	2.05	392	70.47	5.58	14.87	0.62	7.03	98.6	430	1.4	1840	540	53.4	5.16
Chicken Stew w/Vegetables	2.29	373	52.0	3.25	33.97	3.41	8.49	93.8	280	3.7	735	495	35	5.79
Chicken Stew w/Vegetables	5.50	358	65.15	2.6	18.50	5.26	8.25	92.2	385	3.4	710	515	42	5.96
Chicken with Gravy	1.86	379	50.41	4.20	34.84	2.20	8.69	176.4	390	1.9	2150	670	56.9	6.30
Salmon Salad	0.48	588	49.29	42.61	1.81	0.27	5.81	161.3	350	1.9	1460	620	36.5	3.90
Sausage Patties	2.02	531	52.34	32.65	7.03	0.59	5.96	28.1	420	11.6	1550	680	39.5	4.25
Sausage Patties	1.36	582	46.21	39.42	7.17	0.79	5.84							4.25

TABLE VIII (Cont)

Nutrient Composition Per 100 grams of Product of Components of 3-day Cycle Menus

Sample Identification (Per 100 gm Portion)	Water	Energy	Protein	Fat	Carbohydrate		Ash	Calcium	Phosphorus	Iron	Sodium	Potassium	Magnesium	Chloride as Na Cl
					Total	Fiber								
	Pct	Cal	gm	gm	gm	gm	gm	mg	mg	mg	mg	mg	mg	gm
Shrimp Cocktail	2.62	388	53.11	5.34	31.85	0.92	7.08	234	400	2.2	2000	520	10.6	4.61
Shrimp Cocktail	1.41	399	58.60	6.56	26.32	0.50	7.11							4.51
Spaghetti w/Meat Sauce	1.61	429	47.23	13.65	29.35	0.38	8.16	49.2	480	4.8	2300	820	77.9	5.83
Spaghetti w/Meat Sauce	3.08	419	51.6	12.2	25.62	0.44	7.50	49.9	420	5.6	1385	460	42	4.72
Spaghetti w/Meat Sauce	1.70	422	54.1	12.2	23.97	0.51	8.03	53.4	445	56	1484	445	30	4.94
Veal in Barbecue Sauce	5.50	409	49.4	12.0	25.75	1.82	7.35	47.3	415	5.8	625	615	38	4.06
Cheese Sandwich	1.9	512	43.4	29.0	19.4	0.49	6.3	731	580	1.8	1350	0.15	42.4	3.63
Chicken Sandwich	1.33	448	58.13	13.9	22.51		4.13	2						
Chicken Sandwich	2.8	393	58.4	6.1	26.2	0.50	6.5	84	270	2.2	1960	360	49.7	4.38
Peanut Butter Sandwich	3.5	543	31.0	33.6	29.2	0.95	2.7	59	250	1.3	290	230	51.8	1.62
Potato Chip Cubes	3.8	474	8.3	20.9	63.2	0.92	3.8	33	150	1.5	680	930	32.4	1.36
Rice Cereal Cube	4.61	467	10.25	18.62	35.41	0.30	1.93							1.36
Rice Cereal Cube	5.35	455	10.19	16.94	65.46		2.06	5		0.68				1.65
Strawberry Cereal Cubes	3.6	464	9.1	17.3	68.0	1.35	2.0	31	50	2.0	180	240	0.6	1.32
Toast	1.7	522	16.7	28.5	49.8	0.41	3.3	71	70	1.0	1510	0.15	1.7	3.09
Toasted Bread Cubes	5.4	474	14.9	20.9	56.6	0.42	2.2	39	110	1.3	520	190	0.6	1.43
Corn Chowder	2.94	450	8.82	16.79	65.85	1.70	5.60	144.4	310	0.61	1040	410	42.4	3.34
Potato Soup	2.64	464	5.96	19.63	65.95	1.43	5.82	212.6	280	0.87	640	560	45.1	3.06

TABLE VIII (Cont)

Nutrient Composition Per 100 grams of Product of Components of 3-day Cycle Menus

Sample Identification (Per 100 gm Portion)	Water	Energy	Protein	Fat	Carbohydrate		Ash	Calcium	Phos-phorus	Iron	Sodium	Potas-sium	Magne-sium	Chloride as Na Cl
					Total	Fiber								
	Pct	Cal	gm	gm	gm	gm	gm	mg	mg	mg	mg	mg	mg	gm
Potato Soup	2.37	454	5.65	16.83	70.00	0.65	5.05	171	330	1.6	970	1250	12.0	2.74
Apricots	1.30	392	1.73	1.32	93.30	2.04	2.35	111	70	2.9	50	970	16.8	0.05
Fruit Cocktail	2.87	384	2.79	0.23	92.67	2.80	1.44	91	80	1.4	80	710	22.4	0.09
Pears	0.75	360	1.82	1.91	93.83	7.32	1.59	71	110	4.2	100	810	25.0	
Strawberries	1.4	393	2.14	1.4	92.85	2.14	2.8	79	143	2.1	—	1643	31.4	0.21
Oatmeal	1.67	424	16.67	8.59	70.04	0.96	3.03	348	400	2.9	290	510	72.5	0.91
Sugar Frosted Flakes	2.7	379	9.2	0.2	85.1	0.30	2.8	202	140	0.6	580	310	17.5	1.80
Scrambled Eggs	1.3	590	46.2	40.3	6.7		5.5	222	625	9.1	1230	760	47.9	3.24
Apple Juice	1.4	391	0.3	0.1	97.2	NF	1.0	33	40	6.0	10	440	20.4	0.06
Grapefruit Juice	1.8	381	4.7	0.1	90.3	0.31	3.1	68	100	0.6	20	1470	64.1	0.07
Pineapple Juice	0.7	388	2.1	0.1	94.7	0.63	2.4	117	40	1.1	30	980	80.1	0.33
Butterscotch Pudding	0.67	440	1.66	11.07	83.31	1.23	3.29	347	390	0.8	660	280	1.5	0.79
Green Beans in Cream Sauce	1.84	481	13.19	25.35	49.98	3.76	9.64	440	250	6.6	2560	720	48.7	7.03
Mashed Potato	5.5	378	7.5	8.0	72.1		7.0							
Cocoa w/Coffee Whitener	1.60	442	7.51	11.99	76.00	3.56	2.90	190	270	1.5	340	570	38.3	0.63
Cocoa w/Coffee Whitener	1.62	442	7.42	12.10	75.80	0.67	3.01	217	300	1.57	330	650	59.9	0.72
Coffee w/Cream and Sugar	1.6	432	5.6	10.4	80.0		2.4	40	208	0.8	80	912	67.2	
Tea w/Lemon and Sugar	0.33	394	1.49	0.48	95.79	0.23	1.68	1	30	0.3	20	480	14.4	0.11

TABLE VIII (Cont)

Cereal, Nuts and Fruits in Carrier 19.05 mm. (¾" Cubes)

Sample Identification (Per 100 gm Portion)	Water	Energy	Protein	Fat	Carbohydrate Total	Carbohydrate Fiber	Ash	Calcium	Phosphorus	Iron	Sodium	Potassium	Magnesium	Chloride as Na Cl
	Pct	Cal	gm	gm	gm	gm	gm	mg	mg	mg	mg	mg	mg	gm
Chopped Almonds	1.74	572	15.80	38.20	41.15	0.86	3.11							0.43
Chopped Peanuts	1.85	567	20.11	37.31	37.71	0.51	3.02							0.55
Walnuts	2.14	614	14.03	46.60	34.41	0.45	2.82							0.45
Special K and Almonds	1.97	552	16.87	34.20	44.18	0.68	2.78							0.67
Walnuts and Raisins	4.23	533	11.65	32.21	49.16	0.45	2.75							0.43
Grapenuts (cereal)	1.95	502	12.54	24.18	58.54	0.51	2.79							0.55
Currants	4.19	490	10.25	23.64	58.99	0.45	2.93							0.48
Coconut	1.56	575	11.09	38.29	46.51	1.23	2.55							0.43
Currants and Almonds	3.00	539	13.10	32.54	48.42	0.49	2.94							0.32
Lemon Peel	5.54	480	9.99	22.33	59.79	0.72	2.35	375	240	1.8	180	450	24.1	0.55
Candied Fruit	5.80	480	9.77	22.58	59.34	0.44	2.51							0.41
Candied Fruit	6.27	465	10.07	19.96	61.3	0.62	2.36	343	250	0.8	170	570	25.8	0.35
Grapenuts, Raisins, Walnuts and Orange Peel	3.60	511	11.94	27.09	54.75	0.28	2.62							0.65
Banana Solids	1.08	511	10.46	25.10	60.79	0.28	2.57							0.44
Banana Solids	1.40	509	11.33	25.09	59.4	0.52	2.78	381	270	0.4	180	630	35.4	0.54
Candied Orange Peel	5.86	488	9.36	24.08	58.46	0.44	2.24							0.44
Orange Peel and Almonds	3.95	517	12.34	28.70	52.43	0.76	2.58							0.27
Grapenuts and Raisins	3.07	494	11.40	23.68	58.94	0.35	2.91							0.58

TABLE VIII (Cont)

Friut Juice in Carrier 19.05mm. (¾" Cubes) and Meat, Egg or Cheese and Potato in Carrier 19.05 mm. (¾" Cubes)

Sample Identification (Per 100 gm Portion)	Water	Energy	Protein	Fat	Carbohydrate Total	Carbohydrate Fiber	Ash	Calcium	Phosphorus	Iron	Sodium	Potassium	Magnesium	Chloride as Na Cl
	Pct	Cal	gm	gm	gm	gm	gm	mg	mg	mg	mg	mg	mg	gm
Pineapple	2.33	502	11.35	24.34	59.32	1.94	2.66							0.52
Pineapple	1.87	502	11.60	24.08	59.8	0.97	2.63	385	270	0.6	160	650	34.0	0.31
Apricot	1.80	511	12.59	26.13	56.26	1.27	3.22							0.56
Apricot	1.64	509	12.30	25.52	57.5	0.78	3.10	405	320	0.6	170	810	1.9	0.60
Strawberry	1.80	510	12.96	28.00	54.13	2.15	3.11							0.63
Strawberry	1.55	522	12.63	28.20	54.5	1.16	3.08	435	290	1.0	200	690	34.0	0.47
Cheese and Potato Sticks	4.34	507	24.24	29.69	35.81	0.53	5.92							1.81
Canadian Bacon and Potato Chips	7.65	489	25.05	28.39	32.89	0.31	6.02							2.44
Potato Chips, Canadian Bacon, Whole Egg	6.85	493	26.29	28.68	32.48	0.59	5.70							1.89
Fried Beef and Potato Chips	7.66	483	23.34	27.74	34.93	0.36	6.33							2.01

TABLE VIII (Cont)

Specially Coated Dessert and Cereal Cubes

Sample Identification (Per 100 gm Portion)	Water	Energy	Protein	Fat	Carbohydrate		Ash	Calcium	Phosphorus	Iron	Sodium	Potassium	Magnesium	Chloride as Na Cl
					Total	Fiber								
	Pct	Cal	gm	gm	gm	gm	gm	mg	mg	mg	mg	mg	mg	gm
Compressed Orange Raisin Nut Bar	10.75	474	6.70	24.41	56.90	6.24	1.24	74		0.79				0.26
Compressed Cereal Nut Bar	9.53	497	10.14	27.81	51.50	2.18	1.02	29		0.21				0.58
Compressed Date Nut Bar	9.61	478	6.81	24.45	57.66	3.98	1.47	64		0.75				0.54
Milk Chocolate	2.25	556	7.72	34.11	54.65		1.27	186		0.55				0.22
Commercial Nut Fudge	6.39	488	4.16	23.37	65.26		0.82	38		0.75				0.32
Pound Cake	10.01	498	7.99	28.51	52.47	0.16	1.02	35		0.36				0.62
Pound Cake	8.95	497	8.36	27.36	54.25	0.30	1.08	66	90	1.0	300	60	27.0	0.55
Brownies	8.79	539	7.70	35.71	46.75	1.90	1.05	63		0.57				0.18
Brownies	6.37	561	7.68	38.06	46.76	1.24	1.13	49	140	1.1	190	180	25.8	0.18
Norwegian Rye	9.12	489	9.29	26.73	52.83		2.03	54		0.69				1.36
Chocolate Cake	10.81	506	8.14	30.59	49.47		0.99	25		0.94				0.33
Oatmeal Bread	9.57	470	9.28	23.08	56.21		1.86	54		0.71				1.09
Processed American Cheese	14.14	482	23.45	33.10	22.63		6.88	662		0.57				1.85
Compressed Fruit Cake	13.75	430	6.30	18.30	60.14	2.96	1.51	93		0.65				0.53
Compr Cornflake Peanut Cream Bar	8.39	486	11.04	25.20	53.71		1.66	16		0.68				1.04
Compr Cornflake Peanut Cream Bar	7.29	484	10.99	24.30	55.71	1.15	1.71	16		0.7				0.64
Peanut Butter Cream on Graham Crackers	10.98	480	9.61	25.88	52.10		1.43	55		0.32				0.48
Peanut Butter Cream on Graham Crackers	8.05	484	9.34	24.58	56.34	0.50	1.69							0.47

TABLE VIII (Cont)

Specially Coated Dessert and Cereal Cubes

Sample Identification (Per 100 gm Portion)	Water	Energy	Protein	Fat	Carbohydrate		Ash	Calcium	Phos-phorus	Iron	Sodium	Potas-sium	Magne-sium	Chloride as Na Cl
					Total	Fiber								
	Pct	Cal	gm	gm	gm	gm	gm	mg	mg	mg	mg	mg	mg	gm
Compressed Gingerbread	13.51	463	5.97	24.84	53.84		1.84	91		0.74				0.78
Compressed Gingerbread	12.40	449	5.91	21.71	57.58	0.31	2.40	109	70	3.1	350	580	27.0	0.55
Compressed Gingerbread	11.31	448	6.78	20.11	59.86	0.45	1.94							0.54
Compressed Fig Bars	13.80	396	4.35	11.37	69.03		1.45	57		0.42				0.77
Compressed Fig Bars	12.87	409	4.35	13.17	68.31	1.32	1.30							0.56
Compressed Kellogg "K" Peanut Cream Bar	7.88	450	12.33	17.43	61.04		1.32	28		1.00				0.46
Compressed Kellogg "K" Peanut Cream Bar	7.11	484	11.26	23.35	57.12	0.41	1.16	28		1.0				0.34
Cheese Bread	8.67	495	11.22	27.56	50.60		1.95	118		0.71				0.92
Cheese Bread	9.70	483	13.17	26.32	48.28		2.53							1.14

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APPENDIX I

FREEZE DEHYDRATED FOOD REQUIRING RECONSTITUTION

APPENDIX I

PRODUCTION GUIDES AND PRODUCT FORMULATIONS FOR DEHYDRATED AND BITE-SIZED FOODS

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FREEZE-DEHYDRATED PRODUCTS REQUIRING RECONSTITUTION

DRY MIXES REQUIRING RECONSTITUTION

Mashed Potatoes
Applesauce
Soups
Puddings
Cereals
Cocoa
Tea
Coffee

BITE-SIZED PRODUCTS

FREEZE DEHYDRATED

Beef Sandwich
Cheese Sandwich
Chicken Sandwich
Peanut Butter Sandwich
Bacon and Egg Omelet (Egg Bites)
Beef Bites
Chicken Bites
Cinnamon Toast
Toast

COMPRESSED

Bacon Bars
Fruit Cereal Cubes
Toasted Bread Cubes
Rice Cereal Cubes
Potato Cubes

BAKED OR COOKED

Pineapple (Fruitcake I)
Date Fruitcake (Fruitcake II)
Cereal, Nuts and Fruits in Carrier 19.05mm (¾-inch cube)

FRUIT JUICES

(Referenced military specifications only are cited.)

Beef Pot Roast — Quality Requirements

BASIC PERFORMANCE

a. *Appearance* — Beef Pot Roast in the dehydrated state should be a firm rectangular bar having the following dimensions: 8.89 cm (3½ inches) in length, 5.08 cm (2 inches in width, and 14.28 mm (9/16 inches) in thickness ± 1.58 mm (1/16 inch) in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.46 mm (± 1.58) mm (11/16 (± 1/16) inch).

b. *Rehydration* — One bar, 18 gm ± 1.0 gm, shall completely rehydrate with exactly 59.20 ml (2 fluid ounces) of 26.6 C (80 F) water in 15-20 minutes. No deviation in the volume of water to be added to the product can be permitted. The product shall rehydrate completely without stirring. No unrehydrated particles can be tolerated.

c. *Texture* — The rehydrated beef pot roast product shall pass through a plastic feeding tube 19.05 mm (¾ inch) in diameter and approximately 5.08 cm (2 inches) in length. The texture of the rehydrated product shall not be pasty. Components shall be identifiable.

d. *Flavor* — Rehydrated product shall not possess any foreign chemical odor or flavor.

CHEMICAL ANALYSIS

The freeze dehydrated beef pot roast product in the final container should not possess more than 2.00% moisture (6 hour vacuum 100 C oven method).

Chemical analysis for moisture and residual headspace oxygen determination or vacuum determinations shall be performed. Chemical analysis for moisture shall be made in accordance with Official Methods of Analysis of the Association of Official Agricultural Chemists, chapter Meat and Meat Products section Meat. Oxygen shall be determined in accordance with American Dry Milk Institute Publication, Standards for Grades for the Dry Milk Industry, including Methods of Analysis, Bulletin 916.

The sample unit for these examinations shall be finished product selected at random from the total production and shall consist of at least four units (bars).

PACKAGING

One or more bars shall be packaged under vacuum in a metal can. The can shall not be larger than 401 x 411 in size but may be any suitable size thereunder. The bars shall be adequately packaged so as to insure delivery of intact unbroken units. Broken bars cannot be tolerated.

The cans of bars shall be sealed under not less than 66.04 cm (26 inches) of vacuum.

The cans of finished bars shall be labeled with the name of the item and the number of bars each contains.

Evidence shall be displayed through quality control records that adequate control was established to insure maintenance of the 66.04 cm (26 inches) of vacuum.

No greater than ± 1.0 gm tolerance on the unit net weight of a bar can be tolerated in view of the lack of flexibility in the volume of water to be added for reconstitution.

SPECIAL QUALITY CONTROL PROVISIONS

a. On completion of the drying process, the pressure inside the chamber should be ad-

justed to atmospheric conditions by flooding the chamber with nitrogen gas of high purity.

b. Adequate arrangements should be made to protect finished product from picking up atmospheric moisture, before and during packaging.

c. Not more than 51.6 C (125 F) plate temperature should be used during the freeze dehydration process.

The production description to follow has been determined through limited number of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however the formulation and ingredients as described in Production Description shall be strictly complied with.

Beef Pot Roast — Production Description

Preparation of beef:

U.S. Good or U.S. Choice, fresh chilled, trimmed, top rounds, boneless with rump and shank off was used. All fat, connective tissue, membraneous material were removed. The rounds were cut along muscle junctures and were stuffed into spring type molds (cylindrical or square 10.16 cm (4 inch) diameter; 38.10 cm (15 inches) long).

Processing:

The meat stuffed in molds was cooked for 1½ hours — including 15 minutes come up time, at 4.53 kg (10#) pressure at 115.5 C (240 F) in a steam retort. Inside the retort the meat molds were placed on trays to catch the meat juices. Molds and trays were covered with a foil material to prevent retort moisture from dripping into beef juice.

Cooked meat was chilled overnight under constant pressure (spring-type molds) in the molds.

Chilled cooked meat logs were sliced to 6.35 mm (¼ inch) thick slices and hand diced to 6.35 mm (¼ inch) cubes.

Formulation:	*% by Weight*	*Experimental Production*
Beef, cooked, 6.35 mm (¼ inch) diced	49.50%	10.78 kg (23 lbs. 13 oz.)
Dehydrated gravy mix for Beef Pot Roast	4.25%	0.99 kg (2 lbs. 3 oz.)
Beef Broth, diluted ½ part by weight — Broth to ½ part by weight water, (diluted beef broth should be used to prepare gravy)	45.20%	9.97 kg (22 lbs. 0 oz.)

Preparation:

1. Fill standard 340.08 gm (12 ounce) capacity luncheon meat cans (314 x 202 x 304) with diced beef (50% of final mix).

2. Add to warm diluted beef broth the dry gravy powder, (for proportions see formulation). Mix in Hobart mixer.
3. Add hot rehydrated gravy to cans filled with meat cubes (to each 28.34 gms (1 oz) of beef add 29.6 ml (1 oz) of gravy).
4. Mix gravy and beef cubes in can with a flat blade.
5. Proportion of gravy mix and beef cubes in cans should be 1:1.
6. Blast freeze cans.
7. Remove frozen blocks from cans.
8. Saw frozen blocks to 14.28 mm (9/16 plus inch) thick bars on a band saw.
9. Place bars on a flat dehydrator tray. Return tray to blast freezer.

General Information:

Gravy Mix for Beef Pot Roast (Q.S.M.)

Ingredient	*% by Weight*
Instant Clearjel (pre-gelatinized starch)	40.00
Soup and Gravy Base, Beef	50.00
Hydrogenated Vegetable Fat	4.00
Hydrolyzed Vegetable Protein	5.50
Caramel Color (powder)	.50

Beef Hash — Quality Requirements

BASIC PERFORMANCE

a. *Appearance** — Beef Hash in the dehydrated state should be a firm wafer having any of the following shapes:

(1) disc — with a diameter not exceeding the diameter of a standard 202 x 314 can.

(2) square — no smaller than 5.08 cm x 5.08 cm (2" x 2") and no larger than 10.16 cm x 10.16 cm (4" x 4") (with or without rounded corners).

(3) rectangular — with no side less than 2.85 cm (1⅛") long and no side greater than 12.7 cm (5") long (with or without rounded corners).

*When specified, rectangular bars shall meet the following requirements in lieu of those specified under Par a. (3) and par b:

Appearance — Beef Hash in the dehydrated state should be a firm rectangular bar having the following dimensions: 8.89 cm (3½ inches) in length, 5.08 cm (2 inches) in width, and 14.2 mm (9/16 inch) in thickness, + 1.58 mm (1/16) inch in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.4 ± 1.58 mm (11/16 ± 1/16 inch)

Rehydration — One bar, 18 gm ± 1.0 gm, shall completely rehydrate with exactly 59.2 ml (2 fluid ounces) of 26.6 C (80 F) water in 15 minutes.

One serving, 28 gm ± 0.5 gm of the dehydrated product may consist of one or more wafers of product. Weight of one wafer of the finished product is not critical as long as the product meets requirements of paragraph b through d below.

b. *Rehydration* — One serving, 28 gm ± 0.5 dehydrated Beef Hash discs, packaged in a flexible pouch shall completely rehydrate with exactly 88.8 ml (3 fluid ounces) of 77.2 C (162 F) water in 20-25 minutes. No deviation in the volume of water to be added to the product can be permitted. The product shall rehydrate completely without stirring. No unrehydrated particles can be tolerated.

c. *Texture* — The rehydrated Beef Hash product shall pass through a rubber feeding tube one inch in diameter, terminating in a spherical segment with a height equal to the radius. The opening through which the food shall pass is formed by incising the spherical segment to a depth equal to the radius. The texture of the rehydrated product shall not be pasty, components should be identifiable.

d. *Flavor* — Rehydrated product should not possess any foreign chemical odor or flavor.

CHEMICAL ANALYSIS

The freeze dehydrated Beef Hash product in the final container should not possess more than 2.00% moisture (6 hour vacuum 100 C oven method).

Chemical analysis for moisture and residual headspace oxygen determination or vacuum determinations (for pouches) shall be performed. Chemical analysis for moisture shall be made in accordance with Official Methods of Analysis of the Association of Official Agricultural Chemists, chapter Meat and Meat Products section Meat. Oxygen shall be determined in accordance with American Dry Milk Institute Publication, Standards for Grades for the Dry Milk Industry, including Methods of Analysis, Bulletin 916.

The sample unit for these examinations shall be finished product selected at random from the total production and shall consist of at least two pouches of finished product.

PACKAGING

Flexible Pouches

28 gm ± 5 gm of finished product shall be packaged in a heat sealed pouch no smaller than 12.7 x 17.78 cm (5" x 7") deep and no larger than 16.4 x 20.9 cm (6½" x 8¼") deep with 9.52 mm (⅜") seals on 3 sides made of a lamination of .01270 mm (0.0005 inch) thick polyester film laminated to .008890 mm (0.00035 inch) aluminum foil laminated to .0508 mm (0.002 inch) food grade vinyl film.

Pouches made of the laminates specified but of a heavier gauge material are acceptable. Up to one-half inch variations in the flexible pouch dimensions will be acceptable, provided the pouch permits satisfactory reconstitution of product. Prior to filling, the pouches shall be shaped on a mandrel to accommodate the food shapes and the bottom ears of the pouch folded over and taped. The pouches shall be sealed under not less than 68.58 cms (27") of vacuum.

The finished product shall not contain pulverized product or fines.

No greater than ± 0.5 gm tolerance on the unit net weight can be tolerated in view of the lack of flexibility in the volume of water to be added for reconstitution.

Residual headspace oxygen level in the package shall be less than 1.50% by volume or, alternately the pouches shall be sealed under not less than 66.04 cm (26 inches) of vacuum.

Evidence shall be displayed through quality control records that adequate control was established to insure maintenance of the low oxygen levels or less than 66.04 (26 inches) of vacuum.

Individual servings (flexible pouch) shall be labeled as follows:

BEEF HASH

To Reconstitute: "Add 88.8 ml (3 oz) hot water.

Let stand 20-25 minutes. Keep hot."

SPECIAL QUALITY CONTROL PROVISIONS

a. On completion of the drying process, the pressure inside the chamber should be adjusted to atmospheric conditions by flooding the chamber with nitrogen gas of high purity.

b. Adequate arrangements should be made to protect finished product from picking up atmospheric moisture, before and during packaging.

c. Not more than 46.1 C (125 F) plate temperature should be used during the freeze dehydration process.

The production description was determined through a limited number of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however, the formulation and ingredients as described in Production Description shall be strictly complied with.

Beef Hash — Production Description

Beef:

U.S. Good or U.S. Choice, fresh chilled, trimmed top rounds, boneless with rump and shank off was used. After all the connective tissue and membraneous material was removed, meat was ground through a 12.7 mm (½") plate. Ground meat was cooked in a steam kettle for 1¼ hours (+ ¼ hour come up time) in its own juice. Juices were poured off and used to prepare gravy. Meat was spread out on flat trays to cool overnight.

Potatoes:

Fresh, peeled, diced to 6.35 mm (¼") cubes on Hobart attachment, steam cooked at atmospheric pressure for 20 minutes. Washed with cold H_2O after cooking. Variety: Idaho Russet No. 1.

Gravy:

Special, onion free "Swiss Steak" gravy. (See Information.)

Formulation:

	% by Weight	*Experimental Product*
Meat, hash style, cooked	24.48	6.11 kg (13 lbs 8 oz)
Potatoes, diced, cooked	36.62	9.15 kg (20 lbs 3 oz)
Special Swiss Steak, gravy, dehy.	1.93	0.48 kg (1 lb 1 oz)
Diluted Beef Broth (½:½)	36.28	9.07 kg (20 lbs 0 oz)
MSG	0.34	0.085 kg — (3 oz)
Salt	0.34	0.085 kg — (3 oz)

Preparation:

For discs only. Contractor must develop appropriate method for production of square or rectangular wafers.

1. Blend Meat (hash style), cooked potatoes, rehydrated gravy (rehydrated in ½ part by weight of hot broth to ½ part by weight of H_2O), monosodium glutamate (MSG) and salt in proportions as indicated in formulation.
2. Fill 202 x 314 cans with hash mixture.
3. Blast-freeze cans.
4. Remove frozen product from cans, slice cylinders to 12.7 mm (½") thick discs on a band saw.
5. Place discs on dehydrator trays and return to freezer.

Information:

Gravy: Special onion free "Swiss Steak" Gravy

	gm	*%*
Instant clear gel	725.0	29.00
Caramel color powder	75.0	3.00
Onion powder	25.0	1.00
Salt	450.0	18.00
MSG	21.0	0.83
White pepper, ground	6.0	0.25
HVP	25.0	1.00
Oleo stock	350.0	14.00
Lard flakes	75.0	3.00
Dry vinegar	37.5	1.50
Powdered milk, nonfat	700.0	28.00
Celery, ground	7.5	.30
	2497.0	99.88

Approximately 25.0 kg (882 oz) 24.99 kg (55 lbs 2 oz) of hash mix will yield approximately 149 servings of dehydrated product; 28 gm dehydrated product per serving.

Beef with Gravy — Quality Requirements

BASIC PERFORMANCE

a. *Appearance* — Beef with Gravy in the dehydrated state should be a firm rectangular bar having the following dimensions: 8.89 cm (3½ inches) in length. 5.08 cm (2 inches) in width, and 14.28 mm (9/16 inches) in thickness ± 1.58 mm (± 1/16 inch in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.46 mm (± 1.58 mm) 11/16 (± 1/16) inch.

b. Rehydration — one bar, 24 gm ± 1.0 gm shall completely rehydrate with exactly 59.2 ml (2 fluid ounces) of 26.6 C (80 F) water in 15-20 minutes. No deviation in the volume of water to be added to the product can be permitted. The product shall rehydrate completely without stirring. No unrehydrated particles can be tolerated.

c. *Texture* — The rehydrated beef with gravy product shall pass through a plastic feed-

ing tube 19.05 mm (¾ inch) in diameter and approximately 5.08 cm (2 inches) in length. The texture of the rehydrated product shall not be pasty. Components shall be identifiable.

d. *Flavor* — Rehydrated product shall not possess any foreign chemical odor or flavor.

CHEMICAL ANALYSIS

The said freeze dehydrated beef with gravy product in the final container should not possess more than 2.00% moisture (6 hour vacuum 100 C oven method).

Chemical analysis for moisture and residual headspace oxygen determination or vacuum determinations shall be performed. Chemical analysis for moisture shall be made in accordance with Official Methods of Analysis of the Association of Official Agricultural Chemists, chapter Meat and Meat Products section Meat. Oxygen shall be determined in accordance with American Dry Milk Institute Publication, Standards for Grades for the Dry Milk Industry, including Methods of Analysis, Bulletin 916.

The sample unit for these examinations shall be finished product selected at random from the total production and shall consist of at least four units (bars).

PACKAGING

One or more bars shall be packaged under vacuum in a metal can. The can shall not be larger than 401 x 411 in size but may be any suitable size thereunder. The bars shall be adequately packaged so as to insure delivery of intact unbroken units. Broken bars cannot be tolerated.

The cans of bars shall be sealed under not less than 66.04 cm (26 inches) of vacuum.

The cans of finished bars shall be labeled with the name of the item and the number of bars each contains.

Evidence shall be displayed through quality control records that adequate control was established to insure maintenance of the 66.04 cm (26 inches) of vacuum.

No greater than ± gm tolerance on the unit net weight of a bar can be tolerated in view of the lack of flexibility in the volume of water to be added for reconstitution.

SPECIAL QUALITY CONTROL PROVISIONS

a. On completion of the drying process, the pressure inside the chamber should be adjusted to atmospheric conditions by flooding the chamber with nitrogen gas of high purity.

b. Adequate arrangements should be made to protect finished product from picking up atmospheric moisture, before and during packaging.

c. Not more than 51.6 C (125 F) plate temperature should be used during the freeze dehydration process.

The production description was determined through limited number of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however, the formulation and ingredients as described in Production Description shall be strictly complied with.

Beef Gravy — Production Description

Preparation of Beef:

U.S. Good or U.S. Choice, fresh chilled, trimmed, top rounds, boneless with rump and shank off was used. All fat, connective tissue, and membranaceous material removed. The rounds were cut along muscle junctures and were stuffed into spring type molds (cylindrical or square 10.16 cm (4 inch) diameter; 38.1 cm (15 inches) long).

Processing:

The meat stuffed in molds was cooked for 1½ hours — including 15 minutes come up time, at 4.53 kg (10 lb) pressure at 115.5 C (240 F) in a steam retort. Inside the retort the meat molds were placed on trays to catch the meat juices. Molds and trays were covered with a foil material to prevent retort moisture from dripping into beef juice.

Cooked meat was chilled overnight under constant pressure (spring-type molds) in the molds.

Chilled cooked meat logs were sliced to 6.35 mm (¼ inch) thick slices and hand diced to 6.35 mm (¼ inch) cubes.

Beef:

See section on processing of beef.

Gravy:

Brown gravy mix for sliced beef, dehydrated.

Formulation:

	% by Weight	*Experimental Product*
Beef, cubed 6.35 mm (¼ inch) precooked	68.31	12.78 kg (28 lbs 3 oz)
Brown gravy mix, dehydrated	4.37	0.764 kg (1 lb 11 oz)
Beef broth, diluted (½ broth : ½ water)	27.31	5.12 kg (11 lbs 5 oz)

Preparation:

1. Add to warm diluted beef broth (½ : ½) the dehydrated gravy mix in proportion as indicated in formulation 0.764 kg : 5.12 kg (1 lb 11 oz . 11 lbs 5 oz liquid). Mix in Hobart mixer.
2. Blend diced beef with hot gravy mix in proportion as indicated in formulation. Mixing by hand is recommended.
3. Fill appropriate molds with mixture.
4. Blast freeze product.
5. Remove frozen blocks from molds, slice to 14.28 + mm (9/16 + inch) thick slices on a band saw.
6. Place slices on dehydrator trays and return to freezer.

7. Freeze dehydrate product.

General Information:

Brown Gravy Mix for Sliced Beef

Ingredient	*% by Weight*
Pregelatinized Waxy Maize Starch	39.344
Caramel Color (powder)	1.640
Onion Powder	4.922
Salt	31.969
Monosodium Glutamate	3.922
Black Pepper, ground	0.500
Oleo Stock	17.203
Citric Acid	0.500

Beef w/Vegetables — Quality Requirements

BASIC PERFORMANCE

a. *Appearance* — Beef w/Vegetables in the dehydrated state should be a firm rectangular bar having the following dimensions: 8.89 cm (3½ inches) in length, 5.08 cm (2 inches) in width, and 14.28 mm (9/16 inches) in thickness, 1.58 mm (± 1/16 inch) in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.46 (± 1.58) mm (11/16 ± 1/16) inch).

b. *Rehydration* — One bar, 17 gm, ± 1.0 gm, shall completely rehydrate with exactly 59.2 ml (2 fluid ounces) of 26.6 C (80 F) water in 20-25 minutes. No deviation in the volume of water to be added to the product can be permitted. The product shall rehydrate completely without stirring. No unrehydrated particles can be tolerated.

c. *Texture* — The rehydrated beef w/vegetables product shall pass through a plastic feeding tube 19.05 mm (¾ inch) in diameter and approximately 5.08 cm (2 inches) in length. The texture of the rehydrated product shall not be pasty. Components shall be identifiable.

d. *Flavor* — Rehydrated product shall not possess any foreign chemical odor or flavor.

CHEMICAL ANALYSIS

The freeze dehydrated beef w/vegetables product in the final container should not possess more than 2.00% moisture (6 hour vacuum 100 C oven method).

Chemical analysis for moisture and residual headspace oxygen determination or vacuum determinations shall be performed. Chemical analysis for moisture shall be made in accordance with Official methods of Analysis of the Association of Official Agricultural Chemists, chapter Meat and Meat Products section Meat. Oxygen shall be determined in accordance with American Dry Milk Institute Publication, Standards for Grades for the Dry Milk Industry, including Methods of Analysis, Bulletin 916.

The sample unit for these examinations shall be finished product selected at random from the total production and shall consist of at least four units (bars).

PACKAGING

One or more bars shall be packaged under vacuum in a metal can. The can shall not be

larger than 401 x 411 in size but may be any suitable size thereunder. The bars shall be adequately packaged so as to insure delivery of intact unbroken units. Broken bars cannot be tolerated.

The cans of bars shall be sealed under not less than 66.2 cm (26 inches) of vacuum.

The cans of finished bars shall be labeled with the name of the item and the number of bars each contains.

Evidence shall be displayed through quality control records that adequate control was established to insure maintenance of the 66.2 (26 inches) of vacuum.

No greater than ± 1.0 gm tolerance on the unit net weight of a bar can be tolerated in view of the lack of flexibility in the volume of water to be added for reconstitution.

SPECIAL QUALITY CONTROL PROVISIONS

a. On completion of the drying process, the pressure inside the chamber should be adjusted to atmospheric conditions by flooding the chamber with nitrogen gas of high purity.

b. Adequate arrangements should be made to protect finished product from picking up atmospheric moisture, before and during packaging.

c. Not more than 51.6 C (125 F) plate temperature should be used during the freeze dehydration process.

The production description was determined through limited number of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however, the formulation and ingredients as described in Production Description shall be strictly complied with.

Beef w/Vegetables — Production Description

Processing of beef for Beef w/Vegetables —

Preparation of Beef:

U.S. Good or U.S. Choice, fresh chilled, trimmed, top rounds, boneless with rump and shank off was used. All fat, connective tissue and membranaceous material were removed. The rounds were cut along muscle junctures and were stuffed into spring type molds (cylindrical or square 10.16 cm (4 inch) diameter; 38.1 cm (15 inches) long).

Processing:

The meat stuffed in molds was cooked for 1½ hours — including 15 minutes come up time at 4.53 kg (10#) pressure at 115.5 C (240 F) in a steam retort. Inside the retort the meat molds were placed on trays to catch the meat juices. Molds and trays were covered with a foil material to prevent retort moisture from dripping into beef juice.

Cooked meat was chilled overnight under constant pressure (spring-type molds) in the molds.

Chilled cooked meat logs were sliced to 6.35 mm (¼ inch) thick slices and hand diced to 6.35 mm (¼ inch) cubes.

Potatoes: Fresh, peeled, diced to 6.35 (¼ inch) cubes on Hobart attachments.

Steam cooked at atmospheric pressure for 20 minutes. Washed with cold H_2O after cooking. Variety: Idaho Russet No. 1.

Carrots: Fresh, peeled, diced to 6.35 mm (¼ inch) cubes on Hobart attachment, cooked as potatoes.

Peas: Fresh, frozen, searified, cooked in water until done. Variety: Libby's Frozen Peas, Dark Seeded Perfection variety, grown in Washington State, not size graded.

Gravy: Gravy Mix for Beef Stew.

Formulation:

	% by Weight	*Experimental Product*
Beef, cubed 6.35 mm (¼ inch), precooked	27.86	5.1 kg (11 lbs 8 oz)
Potatoes, cubed 6.35 mm (¼ inch), precooked	12.44	2.30 kg (5 lbs 2 oz)
Peas, cooked	8.65	1.06 kg (3 lbs 9 oz)
Carrots, cubed 6.35 mm (¼ inch), cooked	12.44	2.30 kg (5 lbs 2 oz)
Dehydrated gravy mix for beef stew	3.78	0.75 kg (1 lb 9 oz)
Beef broth, diluted (½ broth, ½ water)	34.83	6.55 kg (14 lbs 6 oz)

1. Mix cubed beef, potato cubes, carrot cubes, and peas in proportion as described under Formulation. Use hand mixing to avoid shattering.
2. Fill 314 x 202 x 304 cans with beef and vegetable cubes. (62% of final mix.)
3. Add to diluted (½ : ½) beef broth gravy powder in proportion as indicated in Formulation, 0.75 kg (1 lb 9 oz) gravy powder, 6.55 kg (14 lbs 6 oz) broth, diluted) Mix in Hobart mixer.
4. Add hot rehydrated gravy (38% of final mix) to cans filled with beef and vegetable cubes.
5. Mix cubes and gravy in cans with a flat blade.
6. Proceed as by Pot Roast Production Guide.

General Information:

Gravy Mix for Beef Stew

Ingredient	*% by Weight*
Instant Clearjel	40.00
Soup and Gravy Base, Beef	50.00
Hydrogenated Vegetable Fat	4.00
Hydrolyzed Vegetable Protein	5.50
Caramel Color (powder)	.50

Canadian Bacon in Sauce — Quality Requirements

BASIC PERFORMANCE

a. *Appearance* — Bacon in the dehydrated state should be a firm rectangular bar having the following dimensions: 8.89 cm (3½ inches) in length, 5.08 cm (2 inches) in width, and 14.28 mm (9/16 inch) in thickness, ± 1.58 mm (± 1/16 inch) in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.46 mm (± 1.58) mm (11/16 ± 1/16) inch).

b. *Rehydration* — one bar, 16 gm ± 1 gm shall rehydrate with 59.2 ml (2 fluid ounces) 26.6 C (80 F) water, in 10-20 minutes. The product shall rehydrate without stirring. No unrehydrated particles can be tolerated.

c. *Texture* — The rehydrated bacon product shall pass through a plastic feeding tube 19.05 mm (¾ inch) in diameter and approximately 5.08 cm (2 inches) in length. The texture of the rehydrated product shall not be pasty. Components shall be identifiable.

d. *Flavor* — Rehydrated product shall not possess any foreign chemical odor or flavor.

CHEMICAL ANALYSIS

The said freeze dehydrated bacon product in the final container should not possess more than 2.00% moisture (6-hour vacuum [illegible] C oven method).

Chemical analysis for moisture and residual headspace oxygen determination or vacuum determinations shall be performed. Chemical analysis for moisture shall be made in accordance with Official Methods of Analysis of the Association of Official Agricultural Chemists, chapter Meat and Meat Products section Meat. Oxygen shall be determined in accordance with American Dry Milk Institute Publication, Standards for Grades for the Dry Milk Industry, including Methods of Analysis, Bulletin 916.

The sample unit for these examinations shall be finished product selected at random from the total production and shall consist of at least four units (bars).

PACKAGING

One or more bars shall be packaged under vacuum in a metal can. The can shall not be larger than 401 x 411 in size but may be any suitable size thereunder. The bars shall be adequately packaged so as to insure delivery of intact unbroken units. Broken bars cannot be tolerated.

The cans of bars shall be sealed under not less than 66.2 cm (26 inches) of vacuum.

The cans of finished bars shall be labeled with the name of the item and the number of bars each contains.

Evidence shall be displayed through quality control records that adequate control was established to insure maintenance of the 66.2 cm (26 inches) of vacuum.

SPECIAL QUALITY CONTROL PROVISIONS

a. On completion of the drying process, the pressure inside the chamber should be adjusted to atmospheric conditions by flooding the chamber with nitrogen gas of high purity.

b. Adequate arrangements should be made to protect finished product from picking up atmospheric moisture, before and during packaging.

c. Not more than 51.6 C (125 F) plate temperature should be used during the freeze dehydration process.

The production description was determined through limited number of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however the formulation and ingredients as described in Production Description shall be strictly complied with.

Bacon — Production Description

Bacon — Canadian Bacon Preparation:

Bacon was trimmed, and gristle, cartilage, and fat were removed. Bacon was sliced on a rotary slicer to 3.17 mm (⅛") thick slices, and diced manually to 6.35 mm (¼") pieces. The diced bacon was washed over with tepid water, with constant agitation, for a few minutes to remove excess salt. All excess water should be drained. Bacon with medium smoke, and low salt content should be used.

Sauce: Applesauce portion: Use canned applesauce, Mott's or Musselmann's brand (glass jars preferred).

White Sauce Portion: Use Accent — International's New "Sauce-Quik."

Mix one part by weight of "Sauce-Quik" into four parts by weight of rapidly boiling water. Stir and cook until very thick and smooth. Make sure sauce is fully cooked before using.

Mix three parts by weight of applesauce with one part by weight of prepared, fully cooked "Sauce-Quik."

Formulation	*% by Weight*	*Experimental Product*
Canadian Bacon, diced	50.0	12.8 kg (28 lbs 7 oz)
Applesauce	37.5	9.66 kg (21 lbs 5 oz)
Cooked "Sauce-Quik"	12.5	3.20 kg (7 lbs 2 oz)

Preparation:

1. Mix bacon and sauce in a proportion of 1 : 1.
2. Fill cans with bacon and sauce mix. (Can size: 314 x 202 x 304)
3. Blast freeze cans.
4. Remove frozen blocks from cans.
5. Saw frozen blocks to 14.28 mm (9/16") + thick bars on a band saw.
6. Place bars on a flat dehydrator tray. Return tray to blast freezer.

NOTE: Prior to dehydration, the temperature of the product should not rise over -28.9 C (-20 F). Freezing point of mix is quite low due to sugar content. Any degree of thawing will cause the product to stick to dehydrator trays, consequently, dehydrated product wil be hard to remove from trays.

Chicken Stew w/Vegetables — Quality Requirements

BASIC PERFORMANCE

a. *Appearance* — Chicken Stew w/Vegetables in the dehydrated state should be a firm rectangular bar having the following dimensions: 8.89 cm (3½ inches) in length, 5.08 cm (2 inches) in width. and 14.28 mm (9/16) inches in thickness, ± 1.58 mm (1/16 inch) in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.46 (±1.58 mm) (11/16 (± 1/16) inch).

b. *Rehydration* — One bar, 15 gm, ± 1.0 gm, shall completely rehydrate with exactly 59.2 ml (2 fluid ounces) of 26.6 C. (80 F) water in 20-25 minutes. No deviation in the volume of water to be added to the product can be permitted. The product shall rehydrate completely without stirring. No unrehydrated particles can be tolerated.

c. *Texture* — The rehydrated Chicken Stew w/Vegetables product shall pass through a plastic feeding tube 19.05 mm (¾ inch) in diameter and approximately 5.08 cm (2 inches) in length. The texture of the rehydrated product shall not be pasty. Components shall be identifiable.

d. *Flavor* — Rehydrated product shall not possess any foreign chemical odor or flavor.

CHEMICAL ANALYSIS

The said freeze dehydrated Chicken Stew w/Vegetables product in the final container should not possess more than 2.00% moisture (6 hour vacuum 100 C oven method).

Chemical analysis for moisture and residual headspace oxygen determination or vacuum determinations shall be performed. Chemical analysis for moisture shall be made in accordance with Official Methods of Analysis of the Association of Official Agricultural Chemists, chapter Meat and Meat Products section Meat. Oxygen shall be determined in accordance with American Dry Milk Institute Publication, Standards for Grades for the Dry Milk Industry, including Methods of Analysis, Bulletin 916.

The sample unit for these examinations shall be finished product selected at random from the total production and shall consist of at least four units (bars).

PACKAGING

One or more bars shall be packaged under vacuum in a metal can. The can shall not be larger than 401 x 411 in size but may be any suitable size thereunder. The bars shall be adequately packaged so as to insure delivery of intact unbroken units. Broken bars cannot be tolerated.

The cans of bars shall be sealed under not less than 66.04 cm (26 inches) of vacuum.

The cans of finished bars shall be labeled with the name of the item and the number of bars each contains.

Evidence shall be displayed through quality control records that adequate control was established to insure maintenance of the 66.04 cm (26 inches) of vacuum.

No greater than ± 1.0 gm tolerance on the unit net weight of a bar can be tolerated in view of the lack of flexibility in the volume of water to be added for reconstitution.

SPECIAL QUALITY CONTROL PROVISIONS

a. On completion of the drying process, the pressure inside the chamber should be ad-

justed to atmospheric conditions by flooding the chamber with nitrogen gas of high purity.

b. Adequate arrangements should be made to protect finished product from picking up atmospheric moisture, before and during packaging.

c. Not more than 51.6 C (125 F) plate temperature should be used during the freeze dehydration process.

The production description was determined through limited number of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however, the formulation and ingredients as described in Production Description shall be strictly complied with.

Freeze Dehydrated Chicken Stew w/Vegetables — Production Description

Processing of chicken meat for Chicken Stew w/Vegetables —

Preparation of chicken meat: U.S.D.A. Grade A, fresh chilled roasting chickens 1.81-2.72 (4-6 lbs) average weight were used. Only the white meat was utilized. Skin membrane, connective tissues and ligaments were removed from the breasts as well as whatever fat might have been present. The meat was then stuffed into spring type molds (cylindrical or square 10.16 cm (4 inch) diameter; 38.0 cm (15 inches) long).

Processing: The chicken meat, stuffed in the molds was cooked for 1½ hours including 15 minutes come up time — at 4.53 kg (10#) pressure and 115.5 C (240 F) in a steam retort. Meat juices were discarded. Cooked meat was chilled overnight under constant pressure in spring-type molds. Chilled cooked meat was sliced mechanically, then hand diced to 6.35 mm (¼") cubes. Two 1.81-2.72 kg (4-6 lb), chilled chickens will yield approximately 700 gm of cooked, diced white meat.

CHICKEN STEW W/VEGETABLES

Chicken meat: See section on processing of chicken meat.

Gravy: Gravy mix for chicken stew, dehydrated.

Potatoes: Use fresh Idaho Russet No. 1 potatoes. Peel, dice to 6.35 mm (¼") cubes on Hobart attachment, steam cook at atmospheric pressure for 20 minutes. Wash with cold water after cooking.

Carrots: Use fresh, peeled, diced to 6.35 mm (¼") cubes on Hobart attachment. Cook as potatoes.

Peas: Use fresh, frozen, scarified, Libby's Frozen Peas, Dark Shaded Perfection variety grown in Washington State. Cook peas in water until well done.

Formulation:

	% by Weight	*Experimental Product*
Chicken 6.35 mm (¼") cubed, cooked	23.6	5.01 kg (11 lbs 2 oz)
Potatoes, 6.35 mm (¼") cubed, cooked	17.0	3.62 kg (8 lbs)
Peas, cooked	15.8	3.36 kg (7 lbs 7 oz)
Carrots	10.5	2.2 kg (4 lbs 15 oz)
Gravy mix for chicken stew, powder	4.9	1.0 kg (2 lbs 5 oz)
Hot water for reconst. of gravy powder	27.8	5.90 kg (13 lbs 2 oz)
Salt	.5	

1. Mix cubed chicken, potato cubes, carrot cubes, and peas in proportion as indicated under Formulation. Use hand mixing to avoid shattering.
2. Rehydrate gravy powder and salt with hot water in proportion as indicated in formulation 1.0 kg (2 lbs 5 oz) gravy powder 113.39 gm (4 oz) salt to 5.90 kg (13 lbs 2 oz) water.
3. Add rehydrated gravy mix to cans filled with chicken and vegetable cubes, in proportion of 1 part by weight of gravy mix to 2 parts by weight of chicken-vegetable cubes.
4. Mix cubes and gravy in cans with a flat blade.
5. Pressed as by chicken and gravy.

General Information:

Gravy Mix for Chicken Stew w/Vegetables

Ingredient	*% by Weight*
Soup and Gravy Base, Chicken Flavored	21.83
Salt	5.46
Poultry Seasoning	0.18
Monosodium Glutamate	0.09
Milo Starch	36.22
Nonfat Milk Solids	36.22

Chicken with Gravy — Quality Requirements

BASIC PERFORMANCE

a. *Appearance* — Chicken with gravy in the dehydrated state should be a firm rectangular bar having the following dimensions: 8.89 cm (3½ inches) in length, 5.08 cm (2 inches in width, and 14.28 mm (9/16) inches in thickness, ± 1.58 mm (± 1/16 inch) in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.46 (± 1.58) mm (11/16 (± 1/16) inch).

b. Rehydration — one bar, 16 gm ± 1 gm, shall completely rehydrate with exactly 59.2 ml (2 fluid ounces) of 26.6 C (80 F) water in 10-15 minutes. No deviation in the volume of water to be added to the product can be permitted. The product shall rehydrate completely without stirring. No unrehydrated particles can be tolerated.

c. *Texture* — The rehydrated chicken with gravy product shall pass through a plastic feeding tube 19.05 mm (¾ inch) in diameter and approximately 5.08 cm (2 inches) in length. The texture of the rehydrated product shall not be pasty. Components shall be identifiable.

d. *Flavor* — Rehydrated product shall not possess any foreign chemical odor or flavor.

CHEMICAL ANALYSIS

The said freeze dehydrated chicken with gravy product in the final container should not have more than 2.00% moisture (6 hour vacuum 100 C oven method).

Chemical analysis for moisture and residual headspace oxygen determination or vacuum determinations shall be performed. Chemical analysis for moisture shall be made in accordance with Official Methods of Analysis of the Association of Official Agricultural

Chemists, chapter Meat and Meat Products section Meat. Oxygen shall be determined in accordance with American Dry Milk Institute Publication, Standards for Grades for the Dry Milk Industry, including Methods of Analysis, Bulletin 916.

The sample unit for these examinations shall be finished product selected at random from the total production and shall consist of at least four units (bars).

PACKAGING

One or more bars shall be packaged under vacuum in a metal can. The can shall not be larger than 401 x 411 in size but may be any suitable size thereunder. The bars shall be adequately packaged so as to insure delivery of intact unbroken units. Broken bars cannot be tolerated.

The cans of bars shall be sealed under not less than 66.04 cm (26 inches) of vacuum.

The cans of finished bars shall be labeled with the name of the item and the number of bars each contains.

Evidence shall be displayed through quality contro' records that adequate control was established to insure maintenance of the 66.04 cm (26 inches) of vacuum.

No greater than ± 1.0 gm tolerance on the unit net weight of a bar can be tolerated in view of the lack of flexibility in the volume of water to be added for reconstitution.

SPECIAL QUALITY CONTROL PROVISIONS

a. On completion of the drying process, the pressure inside the chamber should be adjusted to atmospheric conditions by flooding the chamber with nitrogen gas of high purity.

b. Adequate arrangements should be made to protect finished product from picking up atmospheric moisture, before and during packaging.

c. Not more than 51.5 C (125 F) plate temperature should be used during the freeze dehydration process.

The production description was determined through limited number of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however the formulation and ingredients as described in Production Description shall be strictly complied with.

Freeze Dehydrated Chicken Gravy Item — Production Description

Processing of chicken meat for Chicken/Gravy —

Preparation of chicken meat: U.S.D.A. Grade A, fresh chilled roasting chicken 1.81-2.72 kg (4-6 lbs) average weight were used. Only the white meat was utilized. Skin membrane, connective tissues, ligaments were removed from breasts as well as whatever fat might have been present. The meat was then stuffed into spring type molds (cylindrical or square 10.16 cm (4 inch) diameter; 38.10 cm (15 inches) long).

Processing: The chicken meat stuffed in molds was cooked for 1½ hours including 15 minutes come up time — at 4.53 kg (10#) pressure at 115.5 C (240 F) in a steam retort. Meat juices were discarded. Cooked meat was chilled overnight under constant pressure in spring-type molds. Chilled cooked meat was sliced mechanically, then hand diced to 6.35 mm (¼") cubes. Two 1.81-2.72 kg (4-6 lbs) chilled chicken will yield approximately 700 gm of cooked, diced white meat.

CHICKEN AND GRAVY

Chicken Meat: See section on processing of chicken.

Gravy: Gravy mix for chicken and gravy.

Formulation:

	% by Weight	*Experimental Product*
Chicken, cooked, diced 6.35 mm (¼") cubes	45.8	7.25 kg (16 lbs)
Gravy mix for chicken and gravy, dehydrated	7.1	1.10 kg (2 lbs 8 oz)
Water to be used to prepare gravy mix	47.1	7.46 kg (16 lbs 8 oz)

Preparation:

1. Rehydrate dehydrated gravy with hot water in proportion as indicated in formulation. 1.10 kg ((2 lbs 8 oz) gravy powder : 7.46 kg (16 lbs 8 oz) hot water).
2. Add hot rehydrated gravy mix to standard 340.19 gm (12 ounce) capacity luncheon meat cans (314 x 202 x 304) filled with chicken cubes, 5½ parts by weight of gravy to 4½ parts by weight of meat.
3. Mix cubes and gravy in cans with a flat blade.
4. Blast freeze cans.
5. Remove frozen blocks from cans.
6. Saw frozen blocks to 14.28 mm (9/16 plus inches) thick bars on a band saw.
7. Place bars on a flat dehydrator tray. Return tray to blast freezer.

General Information:

Gravy Mix for Chicken and Gravy

Ingredient	*% by Weight*
Soup and Gravy Base, Chicken Flavored	45.50
Milo Starch	31.00
Nonfat Milk Solids	21.00
Minced Onions, White, Dehydrated	1.50
Celery, Diced, Dehydrated	0.80
Black Pepper, Ground	0.20

Pork Sausage Patties and Links, Precooked — Quality Requirements

Classification — The dehydrated pork sausage shall be of the following styles, as specified (see 6.1) :

Style 1 — Patties

Style 2 — Links

REQUIREMENTS

Material.

Pork — Pork shall be boneless pork obtained from full-cut loins or regular bone-in hams weighing not over 8.16 kg (18 pounds) or from bone-in picnics weighing not over 3.62 kg (8 pounds) or from any combination of these sources. The pork shall be clean, sound, and wholesome and free from foreign or undesirable odors and extraneous material. It shall not have been frozen at any time previous to its use in the product. Fat content shall be such that the finished product will meet the requirements of Corn Meal.

Corn Meal — Corn meal shall comply with the requirements of specification N-C-521, Type II, Class B, Granulation 1, Color b. Pre-gelatinized corn meal (corn flour) shall comply with the same requirements except that the granulation shall be such that no more than 7 percent by weight is retained on a U.S. No. 60 screen and except that when water 21.1-37.7 C (70-100 F) is added the corn meal shall form a smooth paste indicating complete gelatinization of the starch.

Frying fat and shortening. Frying fat and shortening shall be hydrogenated vegetables fat or oil. It shall have good flavor and be free from rancidity, sourness, and foreign flavor or odor. It shall have a stability of not less than 40 hours (active oxygen method) and a smoke point of not less than a temperature of 204.4 C. Antioxidants permitted by Meat Inspection Division, Agricultural Research Service, U.S. Department of Agriculture, may be incorporated in the amounts permitted by the regulations.

Salt. Salt shall be clean, white, refined sodium chloride with or without anticaking agents. Iodized salt shall not be used.

Pepper. Pepper shall be ground black pepper complying with Specification EE-S-631.

Rosemary. Rosemary shall be ground rosemary complying with Specification EE-S-631.

Sugar. Sugar shall be white, refined, granulated cane or beet sugar, or both combined.

Nitrogen. Nitrogen shall be U.S. Pharmacopoeia grade and shall be water or liquid nitrogen pumped.

Preparation

Formula. The following formula shall be used for 45.35 kg (100 pounds) of mixture:

	Kg	*Pounds*	*Gms*	*Ounces*
Pork, boneless	34.0	(75)	226.79	(8)
Corn Meal	0.90	(2)	226.79	(8)
Water	9.07	(20)	—	—
Salt	0.45	(1)	92.12	(3¼)
Shortening	—	—	226.79	(8)
Sugar	—	—	85.04	(3)
Pepper	—	—	28.34	(1)
Rosemary	—	—	21.26	(¾)

Pork Sausage Mixture — All of the ingredients except the pork shall be blended and cooked until the starch in the corn meal is completely and smoothly gelatinized. Alternatively, pregelatinized corn meal (corn flour) may be used in the place of the corn meal. In this case, cooking of the corn meal is unnecessary and the shortening may be replaced in the formula with an equal amount of pork. The boneless pork shall be ground through a plate having holes 12.7 to 25.4 mm (½ to 1-inch) in diameter. The cooked corn meal shall

be evenly distributed on top of, or layered with, the coarse ground pork in a suitable meat truck or container and then ground through a plate having holes 4.76 mm (3/16-inch) in diameter. Mechanical mixing shall not be used.

Forming.

Style 1. Style 1 shall be formed in a rectilinear shape so that the final product shall comply with the dimensional requirements in physical characteristics.

Style 2. Style 2 product shall be formed, extruded, or stuffed into artificial cannings in a cylindrical shape so that the final product shall comply with the dimensional requirements in physical characteristics.

Frying. The formed product shall be fried in deep fate at a temperature of 162.7 to 204.4 C (325 to 400 F), drained, and frozen. Times and temperatures shall comply with time and temperature requirements.

Time and temperature requirements. Times and temperatures for raw material handling and product preparation shall not exceed the following limitations:

1. Maximum time from boning of pork to start of grinding	72 hours
2. Maximum time from grinding of pork to forming of patties or links	24 hours
3. Minimum time after frying for the product to reach an internal temperature of -17.7 C (0 F)	16 hours
4. Maximum time from frying to start of dehydration	10 days
5. Maximum temperature of pork and pork mixture during preparation	10 C (50 F)
6. Minimum internal temperature attained from frying process (including come-up during draining)	65.5 C (150 F)
Maximum storage temperature of product after freezing	-17.7 C (0 F)

Dehydration. The product shall be freeze dehydrated (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 the system or other operational factors, may be permitted provided that no thawing of the product or moisture drip on the product shall occur. After dehydration is completed, the pressure shall be equalized with nitrogen and the product packaged immediately as specified in specification. In no case shall more than 16 hours elapse between the time the chamber is opened and time the product is completely packaged. During the interim, product shall be adequately protected from oxygen and moisture by either holding under a nitrogen atmosphere with 2.0 percent or less oxygen or under a vacuum of at least 68.5 cm (27 inches) of mercury for the entire period. If vacuum is used, it must be broken with nitrogen.

Finished Product. The finished product shall comply with the provision of physical characteristics and analytical requirements.

Physical Characteristics. The final product shall comply with the following characteristics.

Dehydrated product.

1. There shall be no foreign material extraneous to the product such as but not limited to dirt, glass, paint.
2. There shall be no foreign material not extraneous to the product such as string, casing, paper.

3. There shall be no burned areas as evidenced by black color larger than 12.7 mm (½ inch) in any dimension. (Black color which disappears after the product has been in rehydration water for 10 minutes as in Item 18 below, shall not be considered burnt.)

4. At least 90 percent of the product by weight shall consist of whole pieces meeting the following requirements:

   a. Dimensions (Edge and Surface imperfections caused by frying shall not be considered).

Style 1. Patties (for space feeding use only)

Length	Not more than 6.35 cm (2½ inches)
Width	5.08 cm ± 1.58 mm (2 ± 1/16 inches)
Thickness	Not more than 14.28 mm (9/16 inch)
Weight	20 ± 1 gm

Style 2. Links

Length	5.08 - 6.35 cm (2 - 2½ inches)
Diameter	9.52 to 15.87 mm (⅜ to ⅝ inch)

   b. Warping. Individual pieces of the product shall show no warping over 9.52 mm (⅜ inch.) (Warping shall be considered as the distance from a flat surface to any point of the underside of the product laid on that flat surface.)

5. There shall be no evidence of incomplete dehydration such as deep or soggy areas.

6. There shall be no evidence of thawing in the dehydration such as glazed areas measuring more than 12.70 mm (½ inch) in any dimension or dark colored cores of any dimension.

Rehydrated Product.

7. When rehydrated in an excess of hot water (82.1 - 100 C) (180 - 212 F) for 30 seconds the product shall be rehydrated completely except for any crust caused by frying.

8. When rehydrated as in item 7 above, the product shall possess a pork sausage flavor and shall show no signs of rancidity or other off flavors or odors.

9. The product shall contain no bone measuring more than 6.35 mm (¼ inch) in any dimension.

Analytical requirements. The product shall comply with the following analytical requirements:

	Percent, maximum
Moisture (unit basis)	2.0
Fat (lot basis)	60.0
Salt (unit basis)	3.0
Oxygen in headspace gas (unit basis)	2.0

Plants performing the processing and dehydration shall be operated under continuous inspection by Meat Inspection Service, U.S. Department of Agriculture.

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

Spaghetti w/Meat Sauce — Quality requirements

BASIC PERFORMANCE

a. *Appearance* — Spaghetti w/Meat Sauce in the dehydrated state should be a firm rectangular bar having the following dimensions: 8.89 cm (3½ inches) in length, 5.08 cm (2 inches) in width, and 14.28 cm (9/16) inches in thickness, + 1.58 mm (± 1/16 inch) in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.46 (+ 1.58) mm 11/16 (± 1/16) inch.)

b. Rehydration — One bar, 14 gm. ± 1.0 gm, shall completely rehydrate with exactly 59.2 ml (2 fluid ounces) of 26.6 C (80 F) water in 20 minutes. No deviation in the volume of water to be added to the product can be permitted. The product shall rehydrate completely without stirring. No unrehydrated particles can be tolerated.

c. Texture — The rehydrated Spaghetti w/Meat Sauce product shall pass through a plastic feeding tube 19.05 mm (¾ inch) in diameter and approximately 5.08 cm (2 inches) in length. The texture of the rehydrated product shall not be pasty. Components shall be identifiable.

d. *Flavor* — Rehydrated product shall not possess any foreign chemical odor or flavor.

CHEMICAL ANALYSIS

The said freeze dehydrated Spaghetti w/Meat Sauce product in the final container should not possess more than 2.00% moisture (6 hour vacuum 100 C oven method).

Chemical analysis for moisture and residual headspace oxygen determination or vacuum determinations shall be performed. Chemical analysis for moisture shall be made in accordance with Official Methods of Analysis of the Association of Official Agricultural Chemists, chapter Meat and Meat Products section Meat. Oxygen shall be determined in accordance with American Dry Milk Institute Publication, Standards for Grades for the Dry Milk Industry, including Methods of Analysis, Bulletin 916.

The sample unit for these examinations shall be finished product selected at random from the total production and shall consist of at least four units (bars).

PACKAGING

One or more bars shall be packaged under vacuum in a metal can. The can shall not be larger than 401 x 411 in size but may be any suitable size thereunder. The bars shall be adequately packaged so as to insure delivery of intact unbroken units. Broken bars cannot be tolerated.

The cans of bars shall be sealed under not less than 66.04 cm (26 inches) of vacuum.

The cans of finished bars shall be labeled with the name of the item and the number of bars each contains.

Evidence shall be displayed through quality control records that adequate control was established to insure maintenance of the 66.04 cm (26 inches) of vacuum.

No greater than + 1.0 gm tolerance on the unit net weight of a bar can be tolerated in view of the lack of flexibility in the volume of water to be added for reconstitution.

SPECIAL QUALITY CONTROL PROVISIONS

a. On completion of the drying process, the pressure inside the chamber should be adjusted to atmospheric conditions by flooding the chamber with nitrogen gas of high purity.

b. Adequate arrangements should be made to protect finished product from picking up atmospheric moisture, before and during packaging.

c. Not more than 51.5 C (125 F) plate temperature should be used during the freeze dehydration process.

The production description was determined through limited number of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however the formulation and ingredients as described in Production Description shall be strictly complied with.

Spaghetti w/Meat Sauce — Production Description

Beef: U. S. Good or U. S. Choice, fresh chilled, trimmed top rounds, boneless with rump and shank off was used. After all the connective tissue and membraneous material were removed, meat was ground through a 6.35 mm (¼") plate. Ground meat was cooked in its own juice in a steam kettle or a pressure cooker until well done.

Juices were poured off and used to prepare gravy. Meat was spread out on flat trays to cool overnight.

Noodles: "Angel Hair" style noodles were cooked in water (unsalted) until well done. Cooked noodles were washed thoroughly with cold water to remove excess starch.

Gravy: See information.

Formulation:	*% by Weight*	*Experimental Product*
Ground beef, cooked	28	1644.27 gm (58 oz)
Brown gravy for Sliced Beef	3.2	184.27 gm (6.5 oz)
Filtered, Chilled Meat Juice	15.5	907.18 gm (32 oz)
Water	28.6	1700.97 gm (60 oz)
Cooked, Washed, "Angel Hair" Style Noodles	24.7	1455.32 gm (51.3 oz)
	100.0	

Preparation:

1. Blend ground beef, rehydrated gravy, cooked noodles in proportion as indicated in formulation.
2. Fill appropriate molds with mixture.
3. Blast freeze product.
4. Remove frozen blocks from molds, slice to 14.28 mm (9/16 + inch) thick slices on a band saw.
5. Place slices on dehydrator trays and return to freezer.
6. Freeze dry product.

Information:

Gravy:

Ingredient	*% By Weight*
Pregelatinized Waxy Maize Starch	39.344
Caramel Color, (powder)	1.640
Onion Powder	4.922
Salt	31.969
Monosodium Glutamate	3.922
Black Pepper, ground	0.500
Oleo Stock	17.203
Citric Acid	0.500

Veal in Barbecue Sauce — Quality Requirement

BASIC PERFORMANCE

a. *Appearance* — Veal in Barbecue Sauce in the dehydrated state should be a firm rectangular bar having the following dimensions: 8.39 cm (?½ inches) in length, 5.08 cm (2 inches) in width, and 14.28 mm (9/16 inch) in thickness, ± 1.58 mm (± 1/16 inch) in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.46 (± 1.58) mm (11/16 (± 1/16) inch.)

b. *Rehydration* — One bar of the size indicated above*, shall rehydrate with 59.2 ml (2 fluid ounces) of 26.6 C (80 F) water in 10-20 minutes. The product shall rehydrate without stirring. No unrehydrated particles can be tolerated.

c. *Texture* — The rehydrated veal product shall pass through a plastic feeding tube 19.05 mm (¾ inch) in diameter and approximately 5.08 cm (2 inches) in length. The texture of the rehydrated product shall not be pasty. Components shall be identifiable.

d. *Flavor* — Rehydrated product shall not possess any foreign chemical odor or flavor.

CHEMICAL ANALYSIS

The said freeze dehydrated veal product in the final container should not possess more than 2.00% moisture (6 hour vacuum 100 C oven method).

Chemical analysis for moisture and residual headspace oxygen determination or vacuum determinations shall be performed. Chemical analysis for moisture shall be made in accordance with Official Methods of Analysis of the Association of Official Agricultural Chemists, chapter Meat and Meat Products section Meat. Oxygen shall be determined in accordance with American Dry Milk Institute Publication, Standards for Grades for the Dry Milk Industry, including Methods of Analysis, Bulletin 916.

The sample unit for these examinations shall be finished product selected at random from the total production and shall consist of at least four units (bars).

PACKAGING

One or more bars shall be packaged under vacuum in a metal can. The can shall not be larger than 401 x 411 in size but may be any suitable size thereunder. The bars shall be adequately packaged so as to insure delivery of intact unbroken units. Broken bars cannot be tolerated.

The cans of bars shall be sealed under not less than 66.04 cm (26 inches) of vacuum.

*26 gm ± 1 gm

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5. Blast freeze cans.
6. Remove frozen product from cans, slice frozen product to 14.28 mm (9/16") + thick bars on a band saw.
7. Place bars on dehydrator trays and return to freezer.

Information:

Gravy: Barbecue Sauce Mix — Wilson No. II.

Lard Flakes	3.53
Oleo Stock	14.10
Apple Sauce, Dehydrated	15.29
Worcestershire Sauce	4.70
Onion Powder, White	13.00
Tomato Flakes, Dehydrated	17.64
Salt	8.82
Brown Sugar	7.05
Grapefruit Juice Powder	5.90
Beef Extract	2.35
Hydrolyzed Vegetable Protein	1.76
Paprika	1.17
Yeast Extract	1.17
Garlic Powder	.59
Soluble Celery Seasoning	.23
Black Pepper	.35
Dry Vinegar (Synthetic)	2.35
Total	$100.00

Information on dehydrated product yield is not available.

SCRAMBLED EGGS AND SALADS

Scrambled Eggs

Formula for Dry Egg Mixture:

Whole egg solids	51.0
Milk solids — non-fat	30.0
Vegetable oil	15.0
Salt	1.75

1. Reconstitute dry egg mixture by adding 1.18 liter (2½ pints) of water to 0.45 kg (1 lb) egg mixture.
2. Pour reconstituted eggs into molds which will produce 18 gm bars having rounded corners and the following dimensions: 8.89 cm (3½ inches) in length, 5.08 cm (2 inches) in width and 14.28 mm (9/16 inches) in thickness ± 1.58 mm (1/16 inch) in width in any dimension.
3. Follow preparation instructions for freeze drying, 4 through 7, of product requirements for chicken with gravy.

German Potato Salad

	Weight	*Per Cent*
Onion (dehydrated, diced)	226.79 gm (8 oz)	4.4
Potato (cooked)	3.84 kg (8 lbs 8 oz)	76.6
Mayonnaise	226.79 gm (8 oz)	4.4
Pepper, white gl.	2 gm	0.05
Vinegar, 5%	296.0 ml (10 oz)	5.5
Bacon Fat	56.69 gm (2 oz)	1.0
Salt	70.86 gm (2½ oz)	1.3
Sugar	56.69 gm (2 oz)	1.1
Bacon (cooked)	283.49 gm (10 oz)	5.5

Salmon Salad

Salmon	9.13 kg (20 lbs 2½ oz)	80.6
Onion (rehydrated)	297.66 gm (10½ oz)	2.5
Mayonnaise	1.67 kg (3 lbs 11¼ oz)	14.8
Corn Meal (pregelatinized)	226.79 gm (8 oz)	2.0

Tuna Salad

Tuna	7.48 kg (18 lbs 4½ oz)	73.1
Mayonnaise	1.51 kg (3 lbs 5½ oz)	13.4
Pickle Relish	1.10 kg (2 lbs 8½ oz)	10.1
Corn Meal	226.79 gm (8 oz)	2.0
Salt	155.91 gm (5½ oz)	1.4

Chicken Salad

Chicken Meat (cooked)	1.36 kg (3 lbs)	68.1
Celery	255.14 gm (9 oz)	12.8
Bacon	127.56 gm (4½ oz)	6.3
Mayonnaise	255.14 gm (9 oz)	12.8

Shrimp Salad

Shrimp (rehydrated)	1.3 kg (48 oz)	65.1
Catsup (Star Cross brand)	340.19 gm (12 oz)	16.3
Sauce (Hoffman House brand)	388.38 gm (13.7 oz)	18.6

1. Mix carefully to avoid mushy product.
2. Follow preparation procedures for bars and freeze drying provided in documents for Beef Pot Roast, Chicken with Gravy and other meat mixtures.
3. Bar weights in gm — German Potato Salad, 17 gm; Salmon Salad, 26 gm; Tuna Salad, 25 gm; Chicken Salad, 28 gm; Shrimp Salad 20 gm.

FRUITS AND VEGETABLES

Research Prototypes

Requirements

GENERAL REQUIREMENTS:

The freeze dehydrated products shall be in a form so that one serving shall fit into can 202

x 314, except that the height shall not exceed 7.30 cm (2⅞"), due to the design of the dispenser. (Product may also be produced in rectangular bar shapes—See footnote [1] for bar requirements).

The products shall rehydrate within 20 minutes when water, of the specified amount and temperature, is added. No stirring, just shaking the container is permitted for rehydration. The rehydrated product shall pass through a rubber feeding tube one inch in diameter, terminating in a spherical segment with the height equal to the radius. The opening through which the product shall pass is formed by incising the spherical segment to a depth equal to the radius.

The rehydrated products shall possess a palatable flavor which is characteristic of the product, and a texture typical of the products, which closely resemble table-ready foods. (Totally unrehydrated product, as that caused by case hardening, cannot be tolerated).

MOISTURE CONTENT:

The moisture content of the dehydrated product shall not exceed 2.0% in the final container. No desiccant shall be used. The moisture content of dehydrated fruits and vegetables shall be determined by the vacuum oven method, drying at 70 C for 16 hours.

PACKAGING:

a. Cans (202 x 314 — The dehydrated product shall be packaged in clean, dry cans as described below. Arrangements should be made to eliminate the possibility of freeze-dehydrated product picking up atmospheric moisture, before and during packaging.

   (1) Pack one serving of dehydrated product per can (maximum tolerance ± 0.5 gm).

   (2) Seal under vacuum not less than 66.04 cm (26 inches).

   (3) Label can with proper label.

   (4) Store sealed product at a temperature below 10 C (50 F) until shipped.

b. Flexible Pouches — One serving of freeze-dehydrated product shall be packaged in a heat sealed pouch 12.70 cm (5") wide by 17.78 cm (7") deep with 9.52 mm (⅜") seals on 3 sides made of a lamination of 0.0127 mm (0.0005 inch) thick polyester film laminated to 0.00889 mm (0.00035 inch) aluminum foil laminated to 0.00508 mm (0.0002 inch) food grade vinyl film. Prior to filling, the pouches shall be shaped on a mandrel to accommodate the food discs and the bottom ears of the pouch folded over and taped. The pouches shall be sealed under not less than 68.5 cm (27") of vacuum. Pouches made of the laminates specified but of heavier gauge material are acceptable. Up to one-half inch variations in flexible pouch dimensions will be acceptable, provided the pouch permits satisfactory reconstitution of product.

a. *Appearance:*

Fruit and Vegetable bars in the dehydrated state should be a firm rectangular bar having the following dimensions: 8.89 cm (3½ inches) in length, 5.08 cm (2 inches) in width, and 14.28 mm (9/16 inches) in thickness, 1.58 mm (± 1/16 inch) in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.46 (± 1.58) mm (11/16 (± 1/16) inch.)

b. *Preparation:*

[1]When specified rectangular bars shall meet the following requirements.

Following processing procedures outlined in Part B — Production Guide for Green or Wax Beans in Cream Sauce.

This production description given has been determined through a limited number of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however, the formulation and ingredients as described shall be strictly complied with.

Fruit Cocktail — Quality Requirements

BASIC PERFORMANCE

Fruit Cocktail in the dehydrated state should be a firm rectangular bar having the following dimension: 8.89 cm (3½ inches) in length, 5.08 cm (2 inches) in width, and 14.28 mm (9/16 inch) in thickness, ± 1.58 mm (± 1/16 inch) in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.46 (± 1.58) mm (± 1/16) inch.)

a. *Rehydration* — One bar, 15.0 gm plus or minus 1.5 gm shall rehydrate with 59.2 ml (2 fluid ounces 26.6 C (80 F) water in 5 minutes. The product shall rehydrate without stirring. No unrehydrated particles will be tolerated.

b. *Texture* — The rehydrated Fruit Cocktail shall pass through a plastic feeding tube 19.05 mm (¾ inch) in diameter and approximately 5.08 cm (2 inches) in length. The texture of the rehydrated product shall not be pasty. Fruit pieces shall be identifiable, shall be discrete and shall not have a pureed appearance.

c. *Flavor* — Dehydrated product shall not possess any foreign chemical odor or flavor.

CHEMICAL ANALYSIS

The freeze dehydrated fruit in the final container shall not possess more than 3.00% moisture (16 hour vacuum 70 C oven method).

Chemical analysis for moisture and residual headspace oxygen determination or vacuum determinations shall be performed. Chemical analysis for moisture shall be made in accordance with Official Methods of Analysis of the Association of Official Agricultural Chemists, chapter Meat and Meat Products section Meat. Oxygen shall be determined in accordance with American Dry Milk Institute Publication. Standards for Grades for the Dry Milk Industry, including Methods of Analysis, Bulletin 916.

The sample unit for these examinations shall be finished product selected at random from the total production and shall consist of at least four units (bars).

PACKAGING

One or more bars shall be packaged under vacuum in a metal can. The can shall not be larger than 401 x 411 in size but may be any suitable smaller size can. The bars shall be adequately packaged so as to insure delivery of intact unbroken units. Broken bars shall not be tolerated.

The cans of bars shall be sealed under not less than 66.04 cm (26 inches) of vacuum.

The cans of finished bars shall be labeled with the name of the item and the number of bars each contains.

Evidence shall be displayed through quality control records that adequate control was established to insure maintenance of the 66.04 cm (26 inches) of vacuum.

SPECIAL QUALITY CONTROL PROVISIONS

a. On completion of the drying process, the pressure inside the chamber should be adjusted to atmospheric conditions by flooding the chamber with nitrogen gas of high purity.

b. Adequate arrangements should be made to protect finished product from picking up atmospheric moisture, before and during packaging.

c. Not more than 54.4 C (130 F) plate temperature should be used during the freeze dehydration of the product on expanded metal trays suspended between plates.

The production description was determined through limited number of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however the formulation and ingredients as described in Production Description, shall be strictly complied with.

Fruit Cocktail — Production Description

Formulation: Fruit Cocktail; canned; drained 0.45 kg (1.0 lb)

Calcium cyclamate 0.67 gm

Preparation:

1. U. S. choice or better canned Fruit Cocktail in heavy syrup (see U. S. Standard for Grades of Canned Fruit Cocktail) shall be drained for two minutes and calcium cyclamate thoroughly mixed with the drained product in the proportion of 0.67 gm calcium cyclamate to 453.59 gm (16 oz) of the drained product.
2. Fill the mixed product into 202 x 314 molds.

NOTE: Luncheon meat cans, 340.19 gm (12 oz) capacity, 314 x 202 x 304 were used.

3. Blast freeze the molds containing the product.
4. Remove frozen product from molds with minimum thawing, slice frozen product into 17.46 ± 1.58 mm (11/16 inch ± 1/16 inch) thick bars with a band saw.
5. Place sawed frozen bars in single 17.46 mm (11/16") layer on expanded metal trays and return to freezer.

NOTE: Slabs of "Dry Ice" under the expanded metal tray while accumulating the bars on the tray after sawing reduces the thawing.

6. Freeze dehydrate at not more than 54.4 C (130 F) plate temperature with the expanded metal trays suspended (not in contact) between the plates.

Peaches — Quality Requirements

BASIC PERFORMANCE

Peaches in the dehydrated state should be a firm rectangular bar having the following dimensions: 8.89 cm (3½ inches) in length, 5.08 cm (2 inches) in width, and 14.28 mm (9/16 inch) in thickness, 1.58 mm (± 1/16 inch) in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.46 (± 1.58) mm (11/16 (plus or minus 1/16) inch).

a. *Rehydration* — One bar, 13.0 gm plus or minus 1.3 gm shall rehydrate with 59.2 ml (2 fluid ounces) 26.6 C (80 F) water in 5 minutes. The product shall rehydrate without stirring. No unrehydrated particles will be tolerated.

b. *Texture* — The rehydrated peaches shall pass through a plastic feeding tube 19.05 mm (¾ inch) in diameter and approximately 5.08 cm (2 inches) in length. The texture of the rehydrated product shall not be pasty. Fruit pieces shall be identifiable, shall be discrete and shall not have a pureed appearance.

c. *Flavor* — Dehydrated product shall not possess any foreign chemical odor or flavor.

CHEMICAL ANALYSIS

The freeze dehydrated fruit in the final container shall not possess more than 3.00% moisture (16 hour vacuum 70 C oven method).

Chemical analysis for moisture and residual headspace oxygen determination or vacuum determinations shall be performed. Chemical analysis for moisture shall be made in accordance with Official Methods of Analysis of the Association of Official Agricultural Chemists, chapter Meat and Meat Products section Meat. Oxygen shall be determined in accordance with American Dry Milk Institute Publication, Standards for Grades for the Dry Milk Industry, including Methods of Analysis, Bulletin 916.

The sample unit for these examinations shall be finished product selected at random from the total production and shall consist of at least four units (bars).

PACKAGING

One or more bars shall be packaged under vacuum in a metal can. The can shall not be larger than 401 x 411 in size but may be any suitable smaller size can. The bars shall be adequately packaged so as to insure delivery of intact unbroken units. Broken bars shall not be tolerated.

The cans of bars shall be sealed under not less than 66.04 cm (26 inches) of vacuum.

The cans of finished bars shall be labeled with the name of the item and the number of bars each contains.

Evidence shall be displayed through quality control records that adequate control was established to insure maintenance of the 66.04 cm (26 inches) of vacuum.

SPECIAL QUALITY CONTROL PROVISIONS

a. On completion of the drying process, the pressure inside the chamber should be adjusted to atmospheric conditions by flooding the chamber with nitrogen gas of high purity.

b. Adequate arrangements should be made to protect finished product from picking up atmospheric moisture, before and during packaging.

c. Not more than 54.4 C (130 F) plate temperature should be used during the freeze dehydration of the product on expanded metal trays suspended between plates.

Carrots in Cream Sauce — Quality Requirements

BASIC PERFORMANCE

a. *Appearance* — Carrots in cream sauce in the dehydrated state should be a firm rectan-

gular bar having the following dimensions: 8.89 cm (3½ inches) in length, 5.08 cm (2 inches) in width, and 14.28 mm (9/16 inches) in thickness, ± 1.58 mm (1/16 inch) in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.46 (± 1.58) mm (11/16 (± 1/16) inch.)

b. *Rehydration* — One bar, 10 gm. ± 1.0 gm, shall completely rehydrate with exactly 59.2 ml (2 fluid ounces) of 26.6 C (80 F) water in 20-25 minutes. No deviation in the volume of water to be added to the product can be permitted. The product shall rehydrate completely without stirring. No unrehydrated particles can be tolerated.

c. *Texture* — The rehydrated carrots in cream sauce product shall pass through a plastic feeding tube 19.05 mm (¾ inch) in diameter and approximately 5.08 cm (2 inches) in length. The texture of the rehydrated product shall not be pasty. Components shall be identifiable.

d. *Flavor* — Rehydrated product shall not possess any foreign chemical odor or flavor.

CHEMICAL ANALYSIS

The said freeze dehydrated carrots in cream sauce product in the final container should not possess more than 2.00% moisture (6 hour vacuum 100 C oven method).

Chemical analysis for moisture and residual headspace oxygen determination or vacuum determinations shall be performed. Chemical analysis for moisture shall be made in accordance with Official Methods of Analysis of the Association of Official Agricultural Chemists, chapter Meat and Meat Products section Meat. Oxygen shall be determined in accordance with American Dry Milk Institute Publication, Standards for Grades for the Dry Milk Industry, including Methods of Analysis, Bulletin 916.

The sample unit for these examinations shall be finished product selected at random from the total production and shall consist of at least four units (bars).

PACKAGING

One or more bars shall be packaged under vacuum in a metal can. The can shall not be larger than 401 x 411 in size, but may be any suitable size thereunder. The bars shall be adequately packaged so as to insure delivery of intact unbroken units. Broken bars cannot be tolerated.

The cans of bars shall be sealed under not less than 66.04 cm (26 inches) of vacuum.

The cans of finished bars shall be labeled with the name of the item and the number of bars each contains.

Evidence shall be displayed through quality control records that adequate control was established to insure maintenance of the 66.04 cm (26 inches) of vacuum.

No greater than ± 1.0 gm tolerance on the unit net weight of a bar can be tolerated in view of the lack of flexibility in the volume of water to be added for reconstitution.

SPECIAL QUALITY CONTROL PROVISIONS

a. On completion of the drying process, the pressure inside the chamber should be adjusted to atmospheric conditions by flooding the chamber with nitrogen gas of high purity.

b. Adequate arrangements should be made to protect finished product from picking up atmospheric moisture, before and during packaging.

c. Not more than 51.5 C (125 F) plate temperature should be used during the freeze dehydration process.

The production description was determined through limited number of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however the formulation and ingredients as described in Production Description, shall be strictly complied with.

Carrots in Cream Sauce — Production Description

Carrots: Fresh, red-cored, stump rooted varieties with strong carrot flavor medium to large (free from woodives) should be used. The following varieties are recommended:

Red-cored Chantenay
James' Intermediate
Stump-rooted Intermediate

Sauce: "Sauce Quick."

Preparation of Carrots:

Peel fresh carrots.

Dice to 6.35 mm (¼ inch) cubes on Hobart attachment.

Wash dice briefly.

Cook in steam cooker at atmospheric pressure for 20 minutes or until thoroughly cooked.

Do not wash after cooking.

Preparation of White Sauce: Add to 9.92 kg (350 ounces) of boiling water 2.83 kg (100 ounces) of "Sauce Quick." Cook mix to a creamy consistency. Some more water should be added during cooking to compensate for lost moisture. Make sure sauce is fully cooked before using.

Formulation:

	Experimental Product
Carrots, Cooked, Diced	9.07 kg (20 lbs)
Cooked "Sauce Quick"	9.07 kg (20 lbs)

Preparation:

1. Mix cooked, diced carrots and cooked "Sauce Quick" in proportion as indicated in formulation.
2. Fill appropriate molds or cans with carrots and sauce mix. (can size: 314 x 202 x 304).
3. Blast freeze cans.
4. Remove frozen blocks from cans.
5. Saw frozen cylinders to 14.28 mm (9/16 inch) thick bars on a band saw.
6. Place blocks on a flat dehydrator tray. Return tray to blast freezer.
7. Freeze dehydrate product at 750 microns absolute pressure and 46.1 C (115 F) plate temperature.

NOTE: Prior to dehydration, the temperature of product should not rise over -23.3 C (-10 F). Any degree of thawing will cause the product to stick to dehydrator trays, consequently, dehydrated product will be hard to remove from trays.

Approximately 21.77 kg (48 pounds) of mix will yield 3.0 kg (106 ounces) of dehydrated product.

Green or Wax Beans in Cream Sauce — Quality Requirements

BASIC PERFORMANCE

a. *Appearance:* Green or wax beans in cream sauce in the dehydrated state should be a firm rectangular bar having the following dimensions: 8.89 cm (3½ inches) in length, 5.08 cm (2 inches) in width, and 14.28 mm (9/16 inches) in thickness, ± 1.58 mm (1/16 inch) in any dimension. The corners of each bar shall be rounded using a radius of curvature of 17.46 (± 1.58) mm (11/16 (± 1/16) inch.)

b. *Rehydration:* One bar, 10 gm, ± 1.0 gm, shall completely rehydrate with exactly 59.2 ml (2 fluid ounces) of 26.6 C (80 F) water in 20-25 minutes. No deviation in the volume of water to be added to the product can be permitted. The product shall rehydrate completely without stirring. No unrehydrated particles can be tolerated.

c. *Texture:* The rehydrated green or wax beans in cream sauce product shall pass through a plastic feeding tube 19.05 mm (¾ inch) in diameter and approximately 5.08 cm (2 inches) in length. The texture of the rehydrated product shall not be pasty. Components shall be identifiable.

d. *Flavor:* Rehydrated product shall not possess any foreign chemical odor or flavor.

CHEMICAL ANALYSIS

The said freeze dehydrated green or wax beans in cream sauce product in the final container should not possess more than 2.00% moisture (6 hour vacuum 100 C oven method).

Chemical analysis for moisture and residual headspace oxygen determination or vacuum determinations shall be performed. Chemical analysis for moisture shall be made in accordance with Official Methods of Analysis of the Association of Official Agricultural Chemists, chapter Meat and Meat Products section Meat. Oxygen shall be determined in accordance with American Dry Milk Institute Publication, Standards for Grades for the Dry Milk Industry, including Methods of Analysis, Bulletin 916.

The sample unit for these examinations shall be finished product selected at random from the total production and shall consist of at least four units (bars).

PACKAGING

One or more bars shall be packaged under vacuum in a metal can. The can shall not be larger than 401 x 411 in size, but may be any suitable size thereunder. The bars shall be adequately packaged so as to insure delivery of intact unbroken units. Broken bars cannot be tolerated.

The cans of bars shall be sealed under not less than 66.04 cm (26 inches) of vacuum.

The cans of finished bars shall be labeled with the name of the item and the number of bars each contains.

Evidence shall be displayed through quality control records that adequate control was established to insure maintenance of the 66.04 cm (26 inches) of vacuum.

No greater than ± 1.0 gm tolerance on the unit net weight of a bar can be tolerated in view of the lack of flexibility in the volume of water to be added for reconstitution.

SPECIAL QUALITY CONTROL PROVISIONS

a. On completion of the drying process, the pressure inside the chamber should be adjusted to atmospheric conditions by flooding the chamber with nitrogen gas of high purity.

b. Adequate arrangements should be made to protect finished product from picking up atmospheric moisture, before and during packaging.

c. Not more than 51.5 C (125 F) plate temperature should be used during the freeze dehydration process.

The production description given has been determined through limited numbers of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however, the formulation and ingredients as described, shall be strictly complied with.

Green or Wax Beans in Cream Sauce — Production Description

Materials and Preparation:

Cut beans — U. S. Grade A canned green or wax beans or U. S. Grade A frozen green or wax beans.

Processing of Beans:

Cut beans into 6.35 to 12.70 mm (¼ to ½ inch) long cuts. Where frozen beans are used, they must be cooked until tender in salted water.

White Sauce:

"Sauce Quick" Accent International, 4701 W. Iowa, Skokie, Illinois. Preparation proportion: 0.76 kg (1.68 lb) Sauce Quick 2.68 kg (5.92 lb) water.

Formulation:

3.62 kg (8 lb) prepared beans.
3.44 kg (7.6 lb) prepared sauce.

Processing:

1. Fill mixture into appropriate molds or cans. (Can size: 314 x 202 x 304)
2. Blast-freeze cans.
3. Remove frozen product from cans. Slice cylinders into 14.28 (9/16") thick bars.
4. Place bars on dehydrator trays, return to freezer.
5. Freeze-dry.

Packaging:

Package 10 gm of freeze-dried product per container.

NOTE: Prior to dehydration, the temperature of product should not rise over -23.3 C (-10 F). Any degree of thawing will cause the product to stick to dehydrator trays, consequently, dehydrated product will be hard to remove from trays.

Approximately 21.77 kg (48 pounds) of mix will yield 3.0 kg (106 ounces) of dehydrated product.

Tomatoes — Production Description

Materials: U. S. Grade A canned tomatoes.

Preparation and Processing:

1. Add 15 gm of sugar to each No. 10 can of tomatoes.
2. Cut tomatoes into quarters and fill into 202 x 314 can molds, using proportionate amount of juice to tomato.
3. Freeze.
4. Remove frozen cylinders and saw into 12.70 mm (½ inch) discs. Place on freeze-dryer trays. Maintain frozen state during whole operation.
5. Freeze-dry.

Packaging: Package 9 gm of dehydrated product per container.

Labeling: Package should be labeled as follows:

"TOMATOES ADD 85.04 GM (3 OZ) HOT 73.8 C (165 F) WATER.
LET STAND 5 MIN. KEEP HOT."

NOTE: When produced in rectangular bar form 8.89 cm x 5.08 cm x 14.28 mm x 1.58 mm (3½" x 2" x 9/16" (± 1/16") in all dimensions) actual weight per bar will need to be determined.

The production description given has been determined through limited numbers of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however, the formulation and ingredients as described shall be strictly complied with.

Plain Diced Potatoes and Parsleyed Diced Potatoes — Production Description

Materials: No. 1 Idaho Russet Potatoes shall be used.

Preparation and Processing:

1. Peel potatoes and remove all blemishes.
2. Cut into 6.35 mm (¼ inch) dice.
3. Cook diced potatoes in salted water 28.34 gm salt to 2.83 liters of water (1 oz salt to 3 qts of water) until done (translucent).

4. Quench in cold salted water (same proportion as above) then load on freeze-dryer tray approximately 2.70 mm (½") deep.
5. For parsleyed potatoes, sprinkle dehydrated parsley over tray load, using 198.44 gm (7 oz) per 6.80 kg (15 lbs) of cooked diced potatoes.
6. Freeze-dry.

Packaging: Package 15 gm per container of either style product.

Labeling: The package shall be labeled, as applicable, as follows:

"PLAIN DICED POTATOES
ADD 85.04 GM (3 OZ) HOT 73.8 C (165 F) WATER.
LET STAND 15 MIN. KEEP HOT."

or

"PARSLEYED POTATOES
ADD 85.04 GM (3 OZ) HOT 73.8 C (165 F) WATER.
LET STAND 15 MIN. KEEP HOT."

NOTE: When produced in rectangular bar form 8.89 cm x 5.08 cm x 14.28 mm x 1.58 mm (3½" x 2" x 9/16" (± 1/16") in any dimension) actual weight per bar will need to be determined.

The production description given has been determined through limited numbers of small quantity production studies. Adherence to these details is not mandatory as far as production technique is concerned, however, the formulation and ingredients as described shall be strictly complied with.

Diced Potatoes with Gravy — Production Description

Materials: No. 1 Idaho Russet Potatoes shall be used.

Preparation and Processing:

1. Peel potatoes and remove all blemishes.
2. Cut into 6.35 mm (¼ inch) dice.
3. Quench in cold water.
4. Make up gravy using gravy mix. (see formula below).
5. Mix potatoes and gravy in ratio of 1.36 kg (3 lbs) potatoes to 396.8 gm (14 oz) gravy. Mix carefully to avoid mashing.
6. Fill mix into 202 x 314 cans (or molds of same diameter).
7. Freeze at -28.8 C to -34.4 C (-20 to -30 F).
8. Remove frozen cylinder from molds.
9. Saw cylinder into 12.70 mm (½") thick slices. Maintain conditions so as to keep discs frozen until dehydrated.
10. Freeze dry frozen discs.
11. Package 15.5 gm dehydrated product per container.

Formula for Gravy: (Brown gravy mix for sliced beef)

Pregelatinized waxy maize starch	39.344%
Caramel color/powder	1.540
Onion powder	4.922
Salt	31.969
M.S.G.	3.922
Black pepper, grd	0.500
Oleo stock	17.203
Citric acid	0.500

NOTE: When produced in rectangular bar form 8.89 cm x 5.08 cm x 14.28 mm x 1.58 mm (3½" x 2" x 9/16" (± 1/16") in any dimension) actual weight per bar will need to be determined.

APRICOT BARS

Material:

Apricots: Frozen peeled apricot halves, Blenheim variety, fancy quality were used in the development work.

Sugar: White, refined granulated cane or beet surgar shall be used.

Calcium cyclamate: Food grade calcium cyclamate shall be used.

Formula:

Frozen apricot halves	6.45 kg (1.0 pounds)
Sugar	63.78 gm (2.25 ounces)
Calcium cyclamate	1.0 gm

Preparation:

Mixing: The frozen apricots shall be partially thawed and mixed with the mixture of sugar and calcium cyclamate. The mixture should stand for two hours and be mixed again before filling. (Note: The mixing should be done gently and with care to retain product identity).

Apricot bars weigh 15 gm.

PEAR BARS

Material:

Pears: Frozen, peeled and cored, sliced fancy Bartlett pears were used in the development work.

Sugar: White, refined, granulated cane or beet sugar shall be used.

Calcium cyclamate: Food grade calcium cyclamate shall be used.

Formula:

Frozen sliced pears	0.45 kg (1.0 lb)
Sugar	56.69 gm (2.0 ounces)

Calcium cyclamate	1.0 gm

Preparation:

Mixing: The frozen pears shall be partially thawed and mixed with the mixture of sugar and calcium cyclamate. The mixture should stand two hours and be mixed again before filling. (Note: The mixing should be done gently and with care to retain product identity).

Wt pear bars 15 gm

STRAWBERRY BARS

Material:

Strawberries with sugar: Frozen whole strawberries (4 parts fruit plus 1 part sugar) U. S. Grade A were used.

Strawberries: Frozen whole strawberries (no sugar) U. S. Grade A were used.

Calcium cyclamate: Food grade quality calcium cyclamate shall be used.

Formula:

Frozen whole strawberries (4 + 1) 1	0.56 kg (1.25 lb)
Frozen whole strawberries (no sugar)	0.45 kg (1.0 lb)
Calcium cyclamate	2.0 gm

Preparation: Same as peach bars.

Wt strawberry bars 15 gm

Freeze-Dehydrated Products Requiring Reconstitution

CEREALS

Formulations for Oatmeal and Farina Cereal Mixes, Cooked

Product: These products are freeze-dried cereal mixes intended for special use. (Brand name items listed were those used in the development work. No indorsement of those items over other similar items is stated or implied).

Formula: The product shall be formulated as follows:

a. *Farina Cereal — Cook Type*

Ingredients:	*% by Weight*
Farina Cereal — Cook Type*	51.50
Salt	0.33
Nonfat Dry Milk Solid	28.24
Sugar	13.29
Shortening, Hydrogenated	6.64
Total	100.00

b. *Oatmeal*

Ingredients:	*% by Weight*
Oatmeal**	51.33
Nonfat Dry Milk	28.15
Sugar	13.24
Shortening	6.62
Salt	0.33
Imitation Maplenut Flavor	0.33
Total	100.00

Preparation:

a. The dry mix shall be blended uniformly according to the formulations specified in paragraph 2. Care should be taken in mixing so that no lumps of any one material will be present in the finished mix. V-type blender, ribbon blender or Hobart may be used to mix ingredients.

b. The finished mix shall be cooked with sufficient water so that the starch is completely gelatinized. (See mfgr's recommendation for cooking procedures. If slurry becomes too thick, additional water should be added.

c. The slurry shall be spread on the solid, flat tray with divider placed over it to facilitate heat penetration. The slurry is frozen in a blast freezer to -28.8 to -34.4 C (-20 to -30 F). The product shall be freeze dehydrated at a maximum pressure of 1.5 mm and a maximum temperature of dry product in the dehydrator of 48.8 C (120 F).

d. The freeze-dried product shall be powdered in a Fitzpatrick Comminutor using a 6.35 mm (¼") opening screen and repeated, using a No. 8 screen 2.37 mm (0.0937" opening). Any other equipment giving equivalent results may be used.

Finished Product: The dry products shall conform to the following weights per serving:

	Weight (gm)
Farina Cereal	34.0
Oatmeal	34.0

Each product shall rehydrate completely with 133.20 ml (4½ fluid ounces) of water 65.5 C (150 F).

**Farina Cereal — Cook Type* — Cream of Wheat, a commercially available product, manufactured by Ralston Purina Company, was used in developmental work.

***Oatmeal, Maple Flavored* — Maypo, a commercially available product manufactured by Maltex Company, was used in the developmental work.

Dry Mixes Requiring Reconstitution

Formula for Mashed Potatoes:

100 gm potato flakes (Rogers)
5 gm salt
0.5 gm white pepper, ground
8.0 gm 100 hr* shortening (Prymex)
5 gm nonfat dry milk

*Stable for 100 hrs.

Serving:

20.00 gm above mixture
118.4 ml (4 oz) hot water. Mix until smooth.

Formula for Applesauce:

1/3 Apple Beverage, Instant (MIL-A-35099)
2/3 Applesauce (MIL-A-35045)

Mix thoroughly to get uniform distribution, serving 42 gm above formula.

SOUP AND PUDDING FORMULAS

Ingredients	*% by Wt.*
Mushroom Soup	
Lipton's Mushroom Soup	34
Coffeemate	66
	100
Pea Soup	
Simmer-type Pea Soup	55
Coffeemate	43
Clearjel	2
	100
Potato Soup	
Simplot's Potato Granules	46.0
Waxy Maize Clearjel	5.0
Onion Powder	0.5
Salt	2.33
Pepper, White	.04
Celery Powder	.13
Coffeemate	46.0
	100.00
Apricot Pudding	
Inst. Jello Lemon Pudding Mix	40
Coffee Blend	20
Crushed F.D. Apricots	25
Sugar, Baker's Special	15
	100

Ingredients	*% by Wt.*
Banana Pudding	
Inst. Jello Banana Pudding Mix	87.5
Coffeemate	12.5
	100.0
Butterscotch Pudding	
Royal Inst. Butterscotch Pudding	67
Coffeemate	33
	100
Chocolate Pudding	
Royal Inst. Chocolate Pudding	66
Coffeemate	33
Clearjel	1
	100
Corn Chowder	
Precooked Dehy Cr Style Corn	56
Coffeemate	36
Soup and Gravy Base, Chicken	8
	100

PUFFED CEREALS

All Star Cereal and Sugar Frosted Cereal

a. *Formulation:*

(1) All Star Cereal Mix

Ingredients	%
All Star Cereal (chopped)	61.54
Non fat dry milk	34.61
Sugar	3.85
TOTAL:	100.00

(2) Sugar Frosted Flakes Mix

Ingredients	%
Frosted Corn Flakes (chopped)	81.63
Non fat dry milk	18.37
TOTAL:	100.00

b. *Mixing Procedure:*

Ingredients for the above formulation must be weighed separately in order to assure uniformity of the serving portions. The cereal must be chopped to approximately 9.52 mm (3/8") to assure ease of passage through the orifice of the space tube or console. The cereal may be chopped in a Buffalo chopper or an equivalent machine which will serve the same purpose. Care must be exercised when operating the Buffalo chopper to prevent excessive pulverization of the cereal.

The cereal per serving for "All Star" and "Sugar Frosted Flakes" are 24 gm and 36.75 gm respectively. Each will reconstitute with 88.8 ml (3 ounces) of cold water (stir).

Cocoa Beverage Powder

Formulation and ingredients by percent:

Sugar (food grade, bakers special)	45.0
"Coffee-blend"	35.0
Non Fat Dry Milk (food grade, extra grade, low heat) (instantized, agglomerated)	9.9
Cocoa	9.5
Salt (sodium chloride, food grade, granulated, noniodized)	0.5
Ethyl Vanillan (powdered, food grade "Ethavan")	0.1

Fabrication:

Ingredients dry blended under sanitary conditions governed by precautions to insure basic ingredients and finished product to be free from excessive moisture content (not more than 4% of finished product) and contamination of all descriptions (excepting microbio-

logical in which case bacteria per gm are not to exceed 10,000 using a standard plate count and a coliform count of not more than 10 per gm using the standard test).

Before blending, all ingredients should be free from lumps with particular attention directed towards the cocoa which, if conditions warrant, should be passed through on 8 mesh or smaller sieve just prior to blending wit' the other ingredients.

Blending of ingredients may be in any order with a suggested order of the ingredients of largest percentage being blended first and successive additions of ingredients of lesser percentage; or, a pre-blend of ingredients of lesser percentage being made and added to ingredients of larger percentage and final blending finished.

Blending should be carried out using adequate equipment for a sufficient length of time to insure homogenous dispersion of all ingredients and uniform color without any unusual white particles present when inspected with aided visual observations.

Two suggested pieces of equipment for blending are (1) "Patterson-Kelly V Blender", and (2) a ribbon blender; both of which should be of sufficient size.

All equipment should be thoroughly clean before use and maintained as such for all blending.

After blending, the finished product should be handled and held under conditions to insure freedom from contamination, stickiness, and moisture pick-up.

Instant Tea with Sugar and Lemon

For 30 Servings

Nestea (Nestle Instant Tea)	15 gm
Sugar	225 gm
Lemon Crystals (Juice crystals from Plant City, Florida)	4.5 gm
	244.5 gm

Blend in small Waring Blender until powdered and mixed. Do not over heat blender. 2-3 minutes should be enough.

8.15 gm mix per 148.0 ml (5 ounces) water.

Instant Coffee with Sugar and Lemon

For 10 servings

25 gm instant coffee	(For maximum solubility in 71.1 C (160 F) water, *freeze dried* coffee is preferred but any commercial product is acceptable)
60 gm sugar	
40 gm coffee whitener	(Carnation product "Coffee-mate" was used in developmental work)

Blend in small Waring Blender until powdered and mixed. Do not overheat blender. 2-3 minutes should be enough.

12.5 gm mix per serving.

BEEF SANDWICH

INGREDIENTS

Beef:

Preparation of beef: U. S. Good or U. S. Choice, fresh chilled, trimmed, top rounds, boneless with rump and shank off was used. All fat, connective tissues, and membraneous material were removed. The rounds were cut along muscle junctures and were stuffed into spring type molds (cylindrical or square — 10.16 cm (4 inch) diameter; 38.0 cm (15 inches) long).

Processing: The meat stuffed in molds was cooked for 1½ hours — including 15 minutes come up time, at 4.5 kg (10 lb) pressure at 115.5 C (240 F) in a steam retort. Inside the retort the meat molds were placed on trays to catch the meat juices. Molds and trays were covered with a foil material to prevent retort moisture from dripping into beef juice.

Cooked meat was [illegible]ed overnight under constant pressure (spring-type molds) in the molds.

Gelatin: Food grade, 275 bloom.

Monosodium Glutamate: Food grade.

Gravy Mix: Powdered, gravy mix for Pot Roast, Quick-Serve meal formulation.

Beef Broth: Product of above cooking process.

Bread: Rye bread, sliced to 6.35 mm (2/8") thick slices. Use slices without large (eye) holes.

Shortening: Vegetable — 100 hours.

Formulation:

Sandwich spread. (All weights are proportions).

453.59 gm (16 oz) Beef, prepared as in Ingredients — ground through 6.35 mm (¼") plate.

56.69 gm (2 oz) Shortening, vegetable — 100 hours.

243.80 gm (8.6 oz) — Gravy Mix. Prepare mix from 1 part by weight, Pot Roast Gravy — See Ingredients.

Four parts by weight, beef broth — see Ingredients.

162.8 ml (5.5 oz) Liquid gelatin. Dissolve 1.5 parts by weight of food grade gelatin (See Ingredients) in 473.6 ml (16 oz) of diluted beef broth. Dilute broth with water 50:50.

9.3 gm Monosodium Glutamate in 40 ml (40 cc) H_2O.

Preparation:

1. Mix ingredients of sandwich filling in a Hobart mixer.
   a. Blend ground beef and liquid gravy mix.

b. Add hot shortening.

c. Add Monosodium Glutamate.

d. Add gelatin mix — keep gelatin hot.

e. Blend ingredients thoroughly — keep spread warm.

2. Spread filling in a 6.35 mm (¼") thick layer on bread slice (bread sliced to to 6.35 mm (2/8").
3. Place top slice on bread with the filling on top.
4. Soak entire sandwich in liquid gelatin (see formulation). Top and bottom should be soaked thoroughly.
5. Chill "soaked" sandwiches until gelatin congeals.
6. Cut desired bite size pieces with a "cooky" cutter.
7. Freeze bite size pieces. Protect them from freezer burn.
8. Freeze dehydrate product 34.01 kg (75 lb) or less pressure. Radiant heat not more than 37.7 C (100 F) is recommended.
9. Release vacuum with N_2.
10. Seal cans with low O_2 in headspace.

CHEESE SANDWICH

INGREDIENTS

"Cheese Tang", commercially produced spray dehydrated American cheddar cheese.

Gelatin: Food grade 275 bloom.

Bread: Rye bread, sliced to 6.35 mm (2/8") thickness. Use slices without large holes.

Formulation:

Gelatin: Dissolve 1.5 part by weight of food grade 275 bloom gelatin, in 16 parts by weight of water.

Cheese spread:

Prepare cheese spread in small quantities and keep it warm to avoid fast congealing. Recommended method: Mix 25 gm of Cheese Tang with 25 gm of liquified gelatin (see gelatin above). This amount will cover about one slice.

Preparation:

To prepare sandwiches proceed the same way as by beef sandwiches. Use for dip the gelatin solution specified in formulation.

CHICKEN SANDWICH

INGREDIENTS

Chicken Meats

Preparation of Meat: USDA Grade A fresh chilled roasting chickens, 1.81-2.72 kg (4-6 lbs) average weight, were used. Only the white meat was utilized. Breast portions with bones were cooked in a steam cooker under pressure 2.72 kg (6 lbs) for 75 minutes. Cooked white meat was removed from bones; all the skin, connecting tissues and ligaments were removed from meat.

Gelatin: Food grade, 275 bloom.

Monosodium Glutamate: Food grade.

Gravy Mix: Powdered, gravy mix for chicken and gravy, QSM type.

Chicken Soup and Gravy Base:

MIL-S-35022A

Bread: Rye bread, sliced to 6.35 mm (2/8") thick slices. Use slices without large holes.

Shortening: Vegetable — 100 hours.

Formulation: Sandwich spread (all weights are given in proportions).

439.41 gm (15.5 oz) chicken, cooked, white meat, ground on 6.35 mm (¼") plate.

99.22 gm (3.5 oz) gravy mix. Prepare mix from two parts by weight of gravy mix for chicken and gravy.

10 parts by weight of H_2O.

9.92 gm (0.35 oz) vegetable shortening — 100 hours.

103.6 ml (3.5 oz) gelatin, liquid.

1.5 part by weight of 275 bloom food grade gelatin dissolved in 16 parts by weight H_2O.

22.1 gm Monosodium Glutamate.

Gelatin dip for soaking sandwiches.

Prepare gelatin mix as follows:

Dissolve 1.5 part by weight of food grade gelatin in 16 parts by weight of H_2O. Add to this 13 gm of chicken soup and gravy base.

Preparation:

1. Mix ingredients of sandwich filling in a Hobart mixer.
   a. Blend chicken meat and liquid gravy mix.
   b. Add hot shortening.
   c. Add monosodium glutamate.
   d. Add hot gelatin mix.
   e. Blend ingredients thoroughly. Keep spread warm.
2. Proceed the same way as for preparation of Beef Sandwiches. Use special gelatin enforced with soup and gravy base mix as indicated in formulation.

PEANUT BUTTER SANDWICH

INGREDIENTS

Peanut butter: Only one brand of peanut butter was successfully used. Manufacturer: Cinderella Foods, Dawson, Ga.

Labeled: Peanut Butter (Fortified). Any Ration cans; refer to Order No. CHI 21101-63.

White bread: Hard wheat flour, straight dough bread, no bread softener used. Bread should be baked completely. Loaves with soft texture and large holes cannot be used. White bread for toasting cannot be used. Use 6.35 mm (2/8") thick slices.

Formulation:

Gelatin: Dissolve 1.5 part by weight of food grade 275 bloom gelatin in 16 parts by weight of water.

Peanut Butter: Use can as it is.

Preparation:

To prepare sandwiches proceed the same way as by Beef Sandwiches. Use for dip, the gelatin solution specified in formulation.

BACON AND EGG OMELET
(EGG BITES)

INGREDIENTS

Eggs: Fresh, grade A, Table grade.

Bacon: Regular commercial, low salt, cured bacon.

Formulation:

Weights are in proportion.

36 eggs, whole, broken.

6 hard boiled eggs, chopped.

102 gm of fried bacon. Bacon slabs were sliced into strips, ground and fried to crisp consistency.

255.14 gm (9 oz) hot bacon fat, rendered from bacon.

Preparation:

Use ingredients in proportion as indicated by formulation.

1. Break eggs, mix in Hobart mixer.
2. Add chopped boiled eggs.
3. Add well drained, crisp fried bacon.
4. Add hot bacon fat.

5. Well blended mix was warmed in a double boiler over hot water until slightly coagulated.
6. Slightly cooked mix was poured into a flat pan, in a 19.05 mm (¾") layer.
7. Product was cooked in a steam cooker (no pressure) until layer completely hardened.
8. Cooked egg was chilled and bite-sized pieces cut with a cooky cutter.
9. Egg Bites were blast frozen and freeze-dehydrated. Radiant heating not over 37.78 C (100 F) was used.
10. Dehydrated product should be packed under no oxygen in headspace.

BEEF BITES

INGREDIENTS

Beef: Preparation of beef identical with beef for beef sandwiches.

Gelatin: Food grade, 275 bloom.

Monosodium Glutamate: Food Grade.

Onions: Fresh.

Shortening: Vegetable, 100 hours.

Pepper: Food Grade, White.

Savory: Ground, food grade.

Beef Soup and Gravy Base: Specification Item MIL-S-3271S.

Formulation:

Weights are given in proportions.

1. Mix 2½ ounces of Beef soup and gravy base (Specification product) into 1184 ml (40 fl oz) of water.
2. Dissolve in above liquid 25 gm of food grade gelatin —

   12.5 gm monosodium glutamate.

   29 gm, fresh minced onions.

   39.2 gm, vegetable shortening, hot

   0.25 gm white pepper.

   0.42 gm ground savory.

Mix all ingredients in a Hobart mixer. Keep it hot.

3. Add 1.13 kg (40 oz) of cooked ground beef (6.35 mm (¼" plate)) mix.
4. Spread mix on flat pans in a 12.70 to 15.87 mm (4/8" to 5/8") thick layer. Chill product until congeals.
5. Proceed as in paragraphs 5 through 10 for beef sandwiches.

CHICKEN BITES

INGREDIENTS

Chicken meat: Same as for chicken sandwiches.

Gelatin: Food grade, 275 bloom.

Shortening: Vegetable, 100 hours.

Onions: Fresh.

Savory: Food Grade.

Pepper: White, Food Grade.

Chicken Soup and Gravy Base: Powdered. MIL-S-35022A.

Gravy for Chicken and Gravy: Powdered. QS Meal Type.

Formulation:

Weights are given in proportions.

1. Mix 41.4 ml (1.4 oz) of chicken soup and gravy base (specification product) into 651.2 ml (22 fluid ounces) of water.
2. Dissolve and mix into above liquid, the following items:

   9.8 gm gelatin, 275 bloom
   14 gm onions, fresh, minced
   0.27 gm savory
   0.13 gm ground white pepper
   10.0 ml (0.34 ounces) gravy for chicken and gravy
   47.7 gm shortening (hot)

   Mix, keep it hot.
3. Add 623.68 gm (22 ounces) of cooked white meat, ground.
4. Proceed as in paragraph 4 through 10 for beef bites.

CINNAMON TOAST

INGREDIENTS

Bread: White bread — same as for peanut butter sandwiches. Slice to 9.52 mm (3/8") thickness.

Gelatin: Food grade 275 bloom.

Shortening: Vegetable, 100 hours.

Salt: Food Grade, NaCl.

Cinnamon: Food grade.

Sugar: Food Grade, bakers' sugar.

Formulation:

Fat-Gelatin Mix: Prepare as for Toast, plain, so as to not add any salt or butter flavor.

Gelatin Dip: Dissolve 1½ parts by weight food grade gelatin in 16 parts by weight of water. Add to each eight-ounces of the above mix, 40 gm of sugar.

Sugar Cinnamon powder:

Blend 60 parts by weight sugar
20 parts by weight cinnamon
2 parts by weight salt.

Preparation:

1. Follow 1 through 4 (paragraphs) as for Toast, Plain.
2. Roll fat and gelatin coated pieces with hot sugar cinnamon powder.
3. Chill product.
4. Coat product with gelatin dip (Formulation).
5. Proceed as in paragraphs 7 through 10 for Toast, Plain.

TOAST, PLAIN

INGREDIENTS

Bread: White bread, same as for peanut butter sandwiches. Slice to 9.52 mm (⅜") thickness.

Gelatin: Food Grade 275 bloom.

Shortening: Vegetable, 100 hours.

Salt: Food Grade, NaCl.

Butter flavor: Any good grade, starter distillate butter flavored intensifier. (Nu-Tone, Mayer Blanke)

Formulation:

Fat-Gelatin Mix: Dissolve 1.5 parts by weight of food grade 275 bloom gelatin in 16 parts by weight of H_2O. Mix to two parts by weight of the above dissolved gelatin, two parts by weight of vegetable shortening. Add to the above proportions two drops of butter flavor and four gm salt.

Preparation:

1. Slice white bread to 9.52 mm (⅜") thick slices. Chill bread.
2. Cut the bite-sized pieces out of each slice as desired.
3. Toast bread pieces.
4. Brush fat and gelatin mix on toasted pieces.
5. Chill fat coated toast pieces until they congeal.
6. Coat congealed pieces with a gelatin dip made of 1.5 parts of food grade gelatin 275 bloom, and 16 parts by weight of H_2O.

7. Chill product.
8. Blast freeze product.
9. Freeze dehydrate product. Use less than 37.7 C (100 F) radiant heating.
10. Pack finished product under no headspace O_2.

Bite-Sized Products — Compressed

BACON BARS

Bacon bars are made of compressed fried lean bacon. The bars presently used are 2.54 cm x 7.64 cm x 6.35 mm (1 x 3 x ¼") in size, and weigh approximately 14-15 gm each.

Method of Fabrication:

Mild cured bacon (derind and formed) is sliced around 7 to 8 slices to the inch and deep fat fried between screens (to prevent curling). The bacon is fried to deep brown color, up to the point that it is pliable when warm (but crisp when cold). The slices are then placed in a form, alternating slices so that lean of one slice is opposite the lean of the top or next slice. The form is then closed and placed in a hydraulic press and pressed with sufficient force to form a bar. The resulting bar is approximately one half (½) the weight or 50% yield of the fried bacon.

The bacon bars are then placed in aluminum foil (laminated) pouches and sealed under vacuum. Holding bars at 4.4 C (40 F) after packing has demonstrated that a lacquer-like finished bar is obtained after 48 hours.

BITE-SIZED

Bite-sized bars are made from cutting the above bars in three equal portions.

CEREAL-FRUIT COMBINATION

1. Frosted Flakes plus Strawberries:

Frosted Flakes	60%
Hydrogenated Shortening	17%
Spray-dried egg albumin	7%
Freeze-dehydrated strawberries	11%
Sorbitol (70% aqueous soln.)	5%

2. Frosted Flakes plus Apricots:

   Same as 1 above except replace the strawberries with apricots.

3. Frosted Flakes plus Apples:

   Same as 1 above except replace the strawberries with apples.

Formula for Bite-sized pieces Toasted Bread-Malt Combination (Toasted Bread Cubes)

Melba Toast plus Malt sirup:

Melba Toast	60%
Shortening	17%
Egg albumen	7%
Malt sirup	6%
Sucrose	5%
Sorbitol (70% aqueous sol.)	5%

SUGGESTED METHODS OF PREPARATION

Bite-sized pieces of cereal-fruit combination:

1. Break up the freeze-dehydrated fruit by either rolling with a rolling pin or running it through the Waring Blendor.
2. In small electric mixing bowl, blend together the hydrogenated shortening, egg albumin, and the fruit until it appears to be uniformly blended.
3. In another electric mixing bowl, break up the frosted flakes until they are reduced to a size that is suitable for pressing into a bar of a size that may be cut into 19.05 x 19.05 x 15.87 mm (¾ x ¾ x ⅝") bite-sized pieces.
4. Sprinkle the sorbitol over the flakes and mix a few seconds. then add the shortening, albumin. fruit mixture and continue mixing until the mixture appears to be uniformly distributed.
5. Press mixture into bars of size required.
6. Place in freezer either overnight or at least for several hours.
7. Using electric saw, cut into the required bite-sized pieces.
8. Coat with gelatin coating.
9. Freeze dry, then vacuum pack in small cans.

Toasted bread-malt combination, bite-sized pieces:

1. Break up the Melba toast with a rolling pin.
2. In small electric mixing bowl, blend together the shortening, egg albumin, sugar, and malt sirup until it appears to be uniformly blended.
3. In another electric mixing bowl put the ground-up Melba toast.
4. Sprinkle the sorbitol over the toast and mix a few seconds, then add the shortening, albumin, sugar, malt mixture and continue mixing until the mixture appears to be uniformly distributed.
5. Same as step 5 in above cereal-fruit bar.
6. Same as step 6 in above cereal-fruit bar.
7. Same as step 7 in above cereal-fruit bar.
8. Same as step 8 in above cereal-fruit bar.
9. Same as step 9 in above cereal-fruit bar.

Bite-sized pieces of cereal-fruit combination:

Procedure for Large Batches:

Ingredients used are Cereal, Freeze-dried fruit, Spray-dried albumin, Vegetable shortening, Sorbitol (70% aqueous solution)

1. The freeze-dried fruit may be pulverized to uniform size by using either a Buffalo chopper or, if for extremely large production, a Fritz Mill.
2. The cereal (in this case, frosted flakes) may be broken down to a size of approximately 6.35 mm (¼") (these are not uniform in size), in either a large bowl using a paddle mixer or in the Buffalo chopper or any equipment that will give similar results.
3. Mix the pulverized fruit, broken down cereal pieces, and albumin until well blended.
4. Sprinkle sorbitol sol. over the mix until sorbitol appears to be uniformly distributed.
5. Add shortening and mix thoroughly but not to the extent tha the mix will gum up.
6. Send the completed, blended mix through the mixer (either Buffalo chopper or Fritz Mill, or large bowl mixer) equipment depending upon the size of the batch.
7. Pressing operation: Weight 42.52 gm (1½ oz) of the finished mix, place into die of the hydraulic press, and press up to 421.9 kg/sq cent. (6000#/sq in.) if Carver press is used. The choice of die to be used is based on finished bite-sized cube.
8. The bars may be cut into cubes 19.05 x 19.05 x 15.87 mm (¾ x ¾ x ⅝") by means of an electric band saw.
9. Coating operation: The bite-sized pieces may be coated by dipping into gelatin solution prepared by dissolving 28.34 gm (1 oz) of gelatin (Swift's U-Cop-Co. brand, bloom 275, edible grade) in 473.6 ml (16 ounces) of hot water. The coating must be thin.
10. Place the pieces on the freeze-dry tray, not touching each other, so they will not stick together, and allow them to dry slightly so they will not stick to the tray. The trays are the *special* trays used for freeze-drying.
11. Place into the freeze-dryer. using radiant heat in vapor space, not more than 37.7 C (100 F). Freeze-drying will take approximately 5 hours but to get good results 8 to 10 hours or overnight may be necessary.

Bite-sized pieces of Cereal-Fruit Combinations
Bread-Malt Combination

INGREDIENTS

Melba toast, malt, sucrose, albumin, shortening, sorbitol.

Procedure for this is essentially the same as that above. The toast is broken down to approximately same size as the cereal above; the sucrose, albumin, and toast are blended together; the sorbitol and malt mixture are incorporated ir o the mix until uniformly distributed; the shortening is added and blended in; the entire mix then sent through the Buffalo chopper, or mill, or mixing bowl (depending upon size of the batch).

The remainder of the procedure (pressing, cutting, coating, and freeze-drying same as that used in the cereal-fruit bar combination above.

Rice-Cereal Cubes

Ingredients	*% by Weight*
Corn flakes, plain	15
Corn flakes, sugar coated	35
Rice — oven puffed	15
Shortening, hydrogenated	18
Egg albumen, dehydrated	7
Starch, dehydrated	4
Sorbitol (70% aqueous sol.)	5
Water	1
	100

Follow steps 2 thru 9 in suggested Methods of Preparation for bite-sized pieces of cereal-fruit combinations and Toasted Bread, Malt Combination.

POTATO CUBE FORMULATION

1.

Formula	*% Composition*
Potato Sticks*	69.0
Matzo Meal, ground	19.9
Sorbitol (70% solution)	8.0
Water	2.0
Onion Powder	1.0
Celery salt, soluble seasoning	0.1

*Fried in hydrogenated cotton seed or peanut oil stabilized with antioxidant 73.0% H_2O, 12.2 ± 0.7% salt.

2. *Mix formulation and mixing:*

   a. Potato sticks should be ground in a Fritz-Mill (equipped with 4.76 mm (3/16) to 6.35 mm (¼ inch) diameter screen openings) into small particles. Do not grind into a butter. If this type of equipment is not available and the quantity being prepared is not large the potato sticks may be broken up by pressing with a rolling pin.

   b. The seasoning shall be mixed with a portion of the Matzo meal and then mixed with the remaining Matzo meal.

   c. The sorbitol and water shall be mixed together and slowly added to the ground potato sticks.

   d. The two portions shall then be blended together.

3. *Compression:*

   a. Mix shall be equillibrated for two days and then compressed in a 2.54 cm (1 inch) by 7.62 cm (3 inch) mold under 580.1 kg/sq cent. (8,250 psi) with a 15 second dwell.
   b. Fifty gm of material shall be compressed at one time resulting in a bar with 2.54 cm x 7.62 cm x 19.05 mm (1 inch by 3 inches by ¾ inch) dimensions.

4. *Cutting:*

   The bars shall be cut into 19.05 mm (¾") cubes on a band saw.

5. *Enrobing:*

a. The cubes shall be enrobed in gelatin to achieve a very firm outer shell which prevents flaking.

b. The enrobing shall be accomplished as follows:

(1) 42.52 gm (1½ oz) of food gelatin shall be mixed with 473.6 ml (16 fluid ounces) of water in a pan over medium heat. Mixing and stirring shall be continued until all lumps are gone and the gelatin has a smooth even texture.

(2) Each cube shall be placed in the gelatin and submerged momentarily to allow a good coat of gelatin on each cube.

(3) A cube shall be placed on a flat wire tray to allow the excess gelatin to drip off. The cubes shall be turned over in order to keep the cubes from sticking to the tray and prevent excess gelatin from building up on one side.

(4) The cube shall be then placed on a wax paper covered tray and placed in a refrigerator to harden the gelatin and to hold the cubes until they have all been enrobed.

(5) The cubes shall be placed in a blast freezer for at least two hours before placing in the freeze dryer.

(6) The cubes shall be freeze-dried at approximately 35 C (95 F) for 17 hours at 400 microns pressure.

(7) The cubes shall be removed from the freeze dryer and canned. The gelatin used was Wilson's Pure Food Gelatin.

Bite-Sized Products — Baked or Cooked

FRUIT AND NUT CONFECTION, BITE-SIZED, COATED

(FRUITCAKE I AND II)

REQUIREMENTS

Preaward Sample Approval — When specified samples of the finished product shall be submitted to the Contracting Officer for approval before award of contract is accomplished.

Preproduction Sample Approval — When specified samples of the finished product shall be submitted to the Contracting Officer for approval before production is commenced.

Material — All material shall be of edible grade and shall be clean, sound, and wholesome and free from evidence of insect infestation and any other objectionable foreign matter.

Wheat Flour — The wheat flour shall comply with Type I, Class A or B, Style 1 or 2 of Specification N-F-481, except that the requirement for diastatic activity does not apply.

Sugar — Sugar shall be fully refined cane or beet sugar or a combination of both.

Salt — Salt shall be white, refined sodium chloride with or without anticaking agent. Iodized salt shall not be used.

Chemical Leavening — Chemical leavening shall conform to Federal Specification, EE-B-25, titled, "Baking Powder."

Flavoring — Flavoring shall be vanilla or vanillin or ethyl vanillin or as a mixture of any two flavors listed in this paragraph.

Eggs — Only fresh shell eggs shall be used. the shell eggs shall conform to Class 1 of Procurement Grade I of Federal Specification C-C-271.

Pecan Midgets — Pecans shall be of the latest crop and of Nr. 1 pieces. defined in Table II as "Midgets," in Federal Specification Y-P-190, titled, "Pecans, Shelled, Fresh."

Cherries — Cherries shall conform to Type I, of Military Specification MIL-F-35054, titled, "Fruit, Candied."

Pineapple — Pineapple shall conform to Type II, of Military Specification MIL-F-35054, titled, "Fruit, Candied."

Dates — Dates shall conform to Type I or II, Style II, "Pieces," Grade A (Fancy) of Federal Specification, Y-D-126 titled, "Dates."

Edible Paper — The edible paper shall be cellophane-like paper derived from pure potato or rice starch which shall be tasteless, flexible, and tenacious.

Gelatin — Gelatin shall conform to Federal Specification C-D-221, titled, "Dessert Powders and Gelatin. Plain, Edible" except that the bloom (jelly strength) shall not be less than 275. (A.O.A.C.)

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

Formula

Type I — Pineapple

The following proportions and blends shall be used.

Ingredients	*%*
Sifted Bread Flour	7.4
Sugar	11.3
Salt	0.4
Baking Powder	0.2
Eggs	18.5
Vanilla	0.4
Pecan Midgets	23.7
Cherries	11.5
Pineapple	26.6
	100.0 (4)

Type II — Date

Ingredients	*%*
Sifted Bread Flour	7.4
Sugar	11.3
Salt	0.4
Baking Powder	0.2
Eggs	18.5
Vanilla	0.4
Pecan Midgets	23.7
Cherries	11.5
Date Pieces	26.6
	100.0

Blending Procedure — Place nuts, dates or pineapple and cherries in a large bowl. Mix together. Sift together flour, sugar, salt, baking powder over fruit and nut mixture and blend. Beat eggs and vanilla until frothy and pour over mixture in the bowl and mix until strings of gluten appear in the mixture.

Panning — Place batter in pans that have been lined with silicon treated vegetable parchment paper.

Baking — The panned batter shall be baked at 132.2 to 157.2 C (300 to 325 F) until done.

Baked Product — The baked product shall be cooled immediately and sliced. Pieces shall be 3.17 cm x 2.54 cm x 15.87 mm ± 1.58 mm (1¼ inch x 1 inch x ⅝ inch ± 1/6 of an inch) in all dimensions. The moisture of the product at this point in production shall be 13% or less.

Gelatin Coating — The gelatin coating shall be prepared using the ratio of one gelatin to sixteen water and shall be heated until completely dissolved. The confection pieces shall be coated by dipping into the gelatin solution. Pieces of edible paper measuring 3.17 cm x 2.54 cm ± 1.58 cm (1¼ inch by 1 inch ± 1/16 inch), shall be pressed onto the gelatined surfaces of the matching sided surfaces. The product shall be allowed to dry in a controlled temperature and humidity room devoid of dust in the presence of ultraviolet light. The moisture of the completed cubes shall be 13% or less.

Cereal, Nut and Fruits in Carrier 19.05 mm. (¾" cubes)

1. *Banana Solids*

80.0%	sweetened carrier
20.0%	banana flakes
100.0%	

2. *Pineapple Cubes*

20.0%	(freeze-dried)
80.0%	carrier
0.3-0.5%	Citric Acid

3. *Apricot Cubes*

14.0%	Apricots (freeze-dried)
86.0%	Carrier
0.3-0.5%	Citric Acid

4. *Sweetened Carrier*

38.0%	Spray Process Skim Malt Powder
31.5%	Powdered Sugar
30.2%	#10 Vegetable Fat
.3%	Lecithin
100.0%	

5. *Chopped Almonds*

28.57%	Chopped almonds
.01%	Almond oil
71.42%	Sweetened carrier
100.00%	

6. *Currants and Almonds*

13.60%	Chopped almonds
.01%	Almond oil
13.60%	Currants
72.79%	Sweetened carrier
100.00%	

7. *Coconut*

25.00%	Desiccated coconut
.03%	Coconut flavor
74.97%	Sweetened carrier
100.00%	

8. *Lemon Peel*

27.00%	Candied lemon peel
.18%	Citric acid
.14%	Artificial color
.07%	Lemon oil
72.61%	Sweetened carrier
100.00%	

NOTE: Carrier shall be high melting point formula.

Formulations and Preparation Procedures Covered in Published Military Specification

Juice, Orange, Instant (Grade A product)	MIL-J-35049
Juice, Grapefruit, Instant, (Style II, Grade A product)	MIL-J-35050
Juice, Grapefruit and Orange Instant, Blended, Style II product	MIL-J-35073
Grape Beverage, Instant	MIL-G-35096
Apple Beverage, Instant	MIL-A-35099
Applesauce, Instant	MIL-A-35045
Soup, Dehydrated, Green Pea, Simmer Type	MIL-S-3059B
Pineapple Juice (Commercial item)	

APPENDIX II

Development of Bite-Sized Food Pieces

SECTION I

INTRODUCTION

The early research was chiefly concerned with working out the overall acceptability of different coatings based on a patented process of Jack R. Durst's assigned to The Pillsbury Company. The Pillsbury Company has agreed to the government's use of this process on the bite-sized pieces of food covered in this contract on a royalty free basis.

The process is essentially a stable dispersion or encapsulation process. It is simply two immiscible systems, a film former in the continuous phase surrounding a liquid or once liquid discontinuous phase. The following are needed to form the stable dispersion: (1) A film former, something that is capable of forming a film around something. (2) A liquid which is immiscible in this film former. (3) A plasticizer which actually makes the film former able to form a film. (4) Proper mixing.

Specifically, for our coatings we take a protein, such as sodium caseinate, that is hydrated or can be hydrated and limit the amount of the plasticizer which is, in this case, water, so that we have just enough of the plasticizer to form a film of protein around a shortening which is immiscible in the protein film. This can't be accomplished by simple mixings, such as with a Waring Blendor or Hamilton Beach rotary mixer. Once the stable dispersion is formed, it can be diluted with additional water to give whatever viscosity is desired. The viscosity can also be changed with change of temperature being less at higher temperatures than at lower temperatures. Other materials, such as sugars, vitamins, flavorings, minerals, colors, other proteins, preservatives, etc. may be added to the stable dispersion either before or after the formation of the dispersion depending on the desired results. For example, if one wishes to add a fat soluble flavoring or coloring, they should be added to the fat before the dispersion is formed since the fat will be encapsulated with a film of protein.

An important point in this process is that we add no emulsifiers. Emulsifiers can actually hinder or prevent the formation of our stable dispersion, because they can make the water (the plasticizer) more compatible with the melted shortening and thus prevent the stretching of a film around the liquid fat globule. A film around a sphere is a thermodynamically stable structure. The stable dispersion when applied to the dessert bits adheres tenaciously and then air dries to a smooth, nonsticky, moisture resistant, and oxygen re-

sistant coating. This coating when placed in the mouth will disperse due to the moisture and temperature of the mouth and thus not give a waxy or fatty mouth feel or taste.

SECTION II
METHODS AND RESULTS

Based on work done previously at Pillsbury's Research Laboratories, a basic formula for a coating to perform functions as outlined in the Scope of the Contract was formulated. It was as follows: Formula 1

25% nonfat milk solids
50% melted lard
25% sucrose

The stable dispersion coating was made as follows: 100 gm of the lard is melted and held at a temperature of 150 F and placed in a Waring Blendor. Fifty gm each of nonfat milk solids and sucrose are added to the melted lard and the whole blended until the melted lard coats all the dry particles. Sixty-five ml of water heated to 150 F are then added with vigorous mixing. A stable dispersion forms after 1 minute of mixing. The sides of the blender are scraped and mixing continued an additional minute. The stability of the dispersion is checked by taking a drop of the dispersion and adding it to 200 ml of hot (150 F) water. If the dispersion is properly made, no free fat globules will be apparent, just a milky appearing liquid. If the dispersion is not stable, free fat globules will float to the top of the hot water. The nonfat milk solids are the film formers in this case and the melted lard the liquid that is immiscible in the film former. Lard or other fats normally solid at room temperature are used for two purposes. (1) We have found from past experiences that when this type of fat is used, a coating is formed which is moisture resistant under the conditions given in the Scope of the Contract after the coating has dried. (2) A solid fat is normally a saturated fat and therefore more stable to oxygen.

As it turned out, even though the above formulation did form a stable dispersion, it was too difficult to apply and when dried did not have the strength and flexibility we desired. Using the formula as a starting point, we explored the following variables:

I. The variation of Amounts and Types of Film Formers

(a) *Egg Albumen as Principal Film Former*

Formula 2

(Exclusive of Water)	*Amount*
45% melted lard	90 gm
26% nonfat milk solids	52 gm
25% sucrose	52 gm
4% dried egg albumen	8 gm
	130 ml water

The coating was made by standard procedure except temperatures were kept between 120-130 F to prevent denaturation of the egg albumen. This coating coated brownie bits fairly well at 115 F when hand dipped, but tended to be too thin and have too much run-off of the bit being coated for most optimum results.

Formula 3

The formula was varied by increasing the egg albumen to 8%, dropping the non-

fat milk solids to 22%, and lowering the water to 100 ml, but the coating was still difficult to apply for most optimum results. When this coating and the previous coating were placed on fruit cake, no stickiness resulted from a week's storage at 78 F and 53.5% relative humidity.

Formula 4

The formula was changed to the following:

45% melted lard	90 gm
14% egg albumen	28 gm
41% sucrose	82 gm
	100 ml water

This made a coating that was fairly good once applied and held up well under vacuum, 1/2 atmosphere oxygen, and low and high humidities.

Formula 5

Formula 4 was altered to replace the sucrose with Karo syrup allowing for the water in the syrup.

90 gm melted lard
28 gm dried albumen
108 gm Karo syrup
74 ml water

This formula made a coating that was more sticky than the others. Possibly a mixture of sucrose and the syrup would be a good compromise.

Formula 6

One additional formulation was made using egg albumen as the principal film former.

50% melted lard	100 gm
8% dried egg albumen	16 gm
2% Knox gelatin	4 gm
40% sucrose	100 ml water

This coating was fairly good, but still ran off the bits being coated to a greater extent than was desired. In all of the coatings containing egg albumen, care must be exercised that the temperature of the coating is not raised too high to denature the egg albumen.

(b) *Sodium Caseinate as Principal Film Former*

Formula 7

In Formula 7 sodium caseinate was used as the principal film former. The dispersions were made as per standard procedures given in Formula 1.

Formula	*Amount*
45% melted lard flakes	90 gm
14% sodium caseinate	28 gm
41% sucrose	82 gm
	100 ml water

This coating was fairly hard to apply, but once applied gave a rather strong coating that was quite moisture resistant.

Formula 8

Same as Formula 7 except lard flakes were replaced by lard. This was a poorer coating than Formula 7 because it tends to crack under vacuum.

Formula 9

In Formula 9 the amount of sodium caseinate was lowered, being replaced by gelatin and the lard flakes were replaced by regular lard.

Formula	*Amount*
45% melted lard	90 gm
12% sodium caseinate	24 gm
2% Knox gelatin	4 gm
41% Sucrose	82 gm
	130 ml water

Formula 9 coated bits much easier than Formula 7 and when the coating dried made a good coating which was flexible yet tough and would protect the coated bit.

Formula 10

The sodium caseinate was lowered in Formula 10 and the gelatin dissolved in the water before being added.

Formula	*Amount*
45% melted lard	90 gm
9% Sodium caseinate	18 gm
2% gelatin	4 gm
44% Sucrose	88 gm
	100 ml water

Formula 10 coating was easier to use in coating bits than the previously used formulas containing sodium caseinate, yet gave a flexible, nonsticky, tough coating to the bits. Care was necessary, though, to prevent excessive run-off from the coated bit before the coating set.

Formula 11

To help prevent the run-off encountered in Formula 9 a portion of the sucrose was replaced by cornstarch.

Formula	*Amount*
45% melted lard	90 gm
9% sodium caseinate	18 gm
2% gelatin (dissolved in water)	4 gm
3% Cornstarch (National)	82 gm
41% Sucrose	100 ml water

Formula 11 coating is the best coating to date for our coating work.

II. Storage Tests of Coated Dessert Bits in Controlled Humidity ½ Atmosphere Oxygen @ 80F.

A number of dessert bits were coated with some of the different coatings given in Section I. These coated bits were placed in open metal containers and these containers were placed in two vacuum desiccators whose relative humidity were controlled. One was set at 53.5% relative humidity by saturated solution of Magnesium Nitrate and the other at 22.9% relative humidity by a saturated solution of Potassium acetate. The atmosphere of these desiccators was adjusted to 1/2 atmosphere of oxygen by evacuating the desiccators and all connecting lines to 6 inches of mercury (1/5 atmosphere) then bleeding in oxygen to atmospheric pressure. This was repeated four times and after the fourth time the desiccators were adjusted to 1/2 atmosphere of oxygen and the desiccators sealed. The coated dessert bits were left in the desiccators for 4 days at 20.7 C and then opened and the coated dessert bits evaluated. On checking prior to opening, no loss of oxygen had occurred in either desiccator. The results of the storage tests are given in Table IX.

TABLE IX

Four Day Storage Test of Coated Dessert Bits in ½ Atmosphere of Oxygen, 22.9% Relative Humidity, and 53.9% Relative Humidity, and 20.7 C Temperature.

Formula of Coating	*Coating Condition (Same for 22.9% and 53.9% relative humidity)*	*Product Condition (Same for 22.9% and 53.9% relative humidity)*
2	Some breaks of edges of bits	Nut-Brownie Okay.
2	Okay	Fruit Cake in Good Condition.
4	In excellent condition, still flexible	Pound Cake still moist and fresh tasting.
5	Okay but a little sticky	High fat brownie still moist but coating has syrup flavor and smell.
6	Quite good	High fat brownie still moist and tasted good.
6	Okay	Nut-brownie in same shape as when placed in desiccator.
7	Good	High fat brownie in good shape.
7	Shell Tough and Strong	Nut Brownie in good shape.
8	Coating Cracked in Some Cases	High Fat Brownie Still Tastes OK and is Moist.
8	Some Cracking of Coating	Low Fat Brownie still okay
9	Okay	Pound Cake in Good Shape
10	Good Coating	Pound Cake in Good Shape

There was no difference in the coatings under the two extremes of relative humidity used and even though some cracking due to pressure changes did occur in coating 2 and 8, the products were still in the condition that they were in when placed in the 1/2 atmosphere of oxygen. Apparently the cracking was not deep enough to make a complete break. Also, since apparently all variations stood up to the storage test, then the main criteria for coatings of this type will be to find one that handles most easily in the coating operation itself.

III. Sticking Problems

These coatings will stick rather tenaciously to the dessert bits they are coating. One problem encountered in the coating operation has been that once the dessert bit has been coated and placed on a surface to dry, the coating will also stick to this surface. If the bit does not have much strength, it will tear apart when one attempts to remove it from the surface.

Attempts were made to coat the surfaces with release agents to prevent sticking. The following agents were used with very little success.

1. silicone pan release
2. dry fry
3. Lecithin
4. Lard
5. Flour
6. Powdered Sugar
7. Cornstarch

If the coated bits were placed on a smooth surface, such as an aluminum cookie sheet, cellophane, saran film, polyethylene film, or silicone treated paper, and dried to a given point, they could be successfully removed without destroying the bit. In the laboratory, we have found the simplest way is to place the freshly coated bits on cookie sheets, let them air dry so they can be easily handled, and then simply run a thin knife edge between the bit and the cookie sheet to free the bit. An FDA approved release paper coated with Daubert R-30-203-2 coating has worked well in recent tests.

IV. Additions of Flavors and Colors to the Coatings

Flavors and colors could be added to the coating without altering the functionality of the coatings. The following flavors have been added to Formula 11.

1. Lemon Extract
2. Lemon Oil
3. Caramel
4. Cocoa
5. Vanilla
6. Chocolate
7. Cream de mint

Yellow and green food colorings have also been added. Only in the case of cocoa do we change Formula 11 to any extent. This is done by replacing the starch with 4.5% cocoa and dropping the sucrose from 41% to 39.5%.

V. Effect of Salts

In coating a Norwegian rye dessert bit. sodium chloride was added to coating Formula 11. There was an increase in viscosity after the addition making it necessary to add additional water to get the proper viscosity for coating. This phenomena was investigated further and the salt was found to primarily affect the gelatin in Formula 11 and the sodium caseinate to a smaller extent also. Since our tap water is from wells and is quite hard. distilled water was tried in place of the tap water in Formula 11. It was possible to make a usable coating with 35% less water, therefore allowing a heavier coating to be applied in one application.

VI. Coating Machine

A chocolate enrober has been altered so that it can be used to coat bits with our coatings. A diagram of the coater is given in figure I. Work is continuing to perfect a dispersion-type coating which is most optimum for use in this machine.

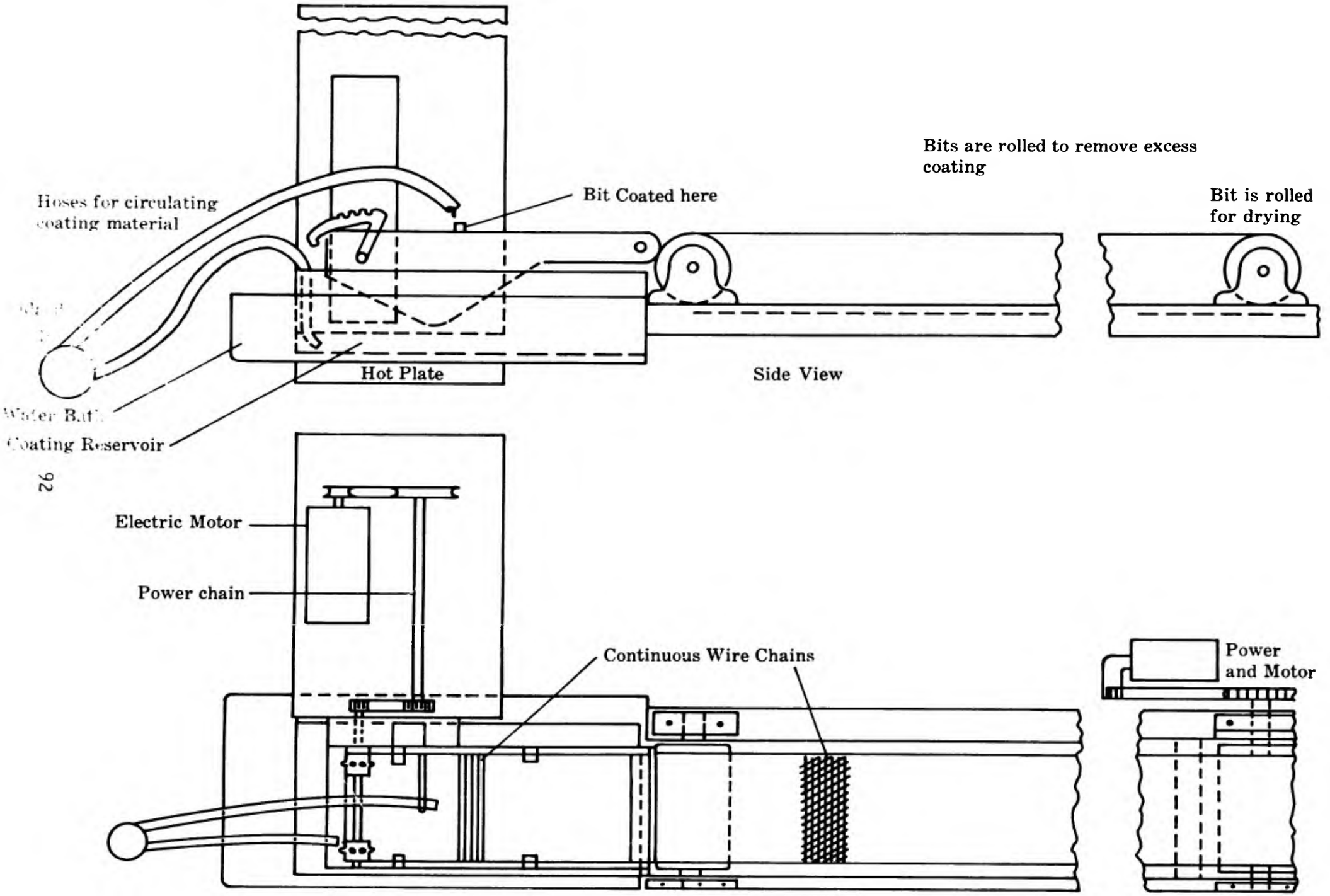

FIGURE NO. 1 COATING MACHINE

VII. Formulation Work — To Get Best Formulation for use in the Coating Machine

A series of experiments was performed in which the formula for the coating was varied from Formula 11 to get the least run-off of the coating on a bit once the bit was coated on the converted chocolate enrober. The variations tried were: (1) replacing sucrose with lactose, (2) increasing the quantity of cornstarch, (3) decreasing amount of sodium caseinate (4) removing the corn starch (5) addition of 0.1% adipic acid plus lowering the sodium caseinate, (6) addition of 0.1% adipic acid plus replacement of 10% of sucrose with lactose plus lowering of the sodium caseinate, (7) lowering sodium caseinate to 8%, increasing the cornstarch to 5% plus additional of 0.1% citric acid. Variation 7 proved to give the best performance on the coater.

Formula 12 gives these variations.

Formula 12	*Amounts*
45% Lard Flakes	90 gm
8% Sodium Caseinate	16 gm
5% Cornstarch	10 gm
2% Gelatin	4 gm
40% Sucrose	80 gm
0.1% Citric Acid	72 gm
	75 ml distilled water

VIII. Addition of Preservatives

To help insure the bacteriological stabilitv of the dessert bits and coatings, potassium sorbate and propyl parasept were each added to Formula 12 at the level of 0.1% of the solids.

IX. Dessert Bits made by the Pillsbury Company and submitted for approval

Sample	*Coating*
1. Compressed Orange Raisin Nut Bar	Formula 11
2. Compressed Cereal Nut Bar	Formula 11 (cocoa flavored)
3. Compressed Cereal Nut Bar	Formula 11
4. Compressed Date Nut Bar	Formula 11
5. Compressed Brownies	Formula 11 (chocolate liquor flavoring)
6. Dates	Formula 11 (cocoa flavored) 2 coatings
7. Dates	Formula 11
8. Milk Chocolate	Formula 11
9. Commercial Nut Fudge	Formula 11
10. Brownies	Formula 11 (cocoa flavored)
11. Pound Cake	Formula 11 (lemon oil flavor and yellow color added)
12. Pound Cake	Formula 11
13. Pound Cake	Formula 11 (lemon extract flavored)
14. Brownies	Formula 11 1% Glycerin added
15. Norwegian Rye Bread	Formula 11 1% Sodium Chloride added
16. Chocolate Cake	Formula 11 (cocoa flavored)
17. Chocolate Cake	Formula 11
18. Chocolate Cake	Formula 11 (mint flavor and green color added)
19. Oatmeal Bread	Formula 11 1% Sodium Chloride added

Sample	*Coating*
20. Processed American Cheese	Formula 11
21. Norwegian Rye Bread	Formula 11 2% Glycerin added
22. Commercial Product (called "Fireside Sweetie Pie")	Formula 11
23. Fruit Cake	Formula 11
24. Compressed Corn Flakes Peanut Cream Bar	Formula 12
25. Peanut Butter Cream Center on Graham Crackers	Formula 12 — Double coated
26. Compressed Gingerbread Cake	Formula 12 — Double coated
27. Compressed Fig Bars	Formula 12 — Double coated
28. Compressed Popcorn and Candy Bar	Formula 12 — Double coated
29. Compressed Kellogg "K" Peanut Cream Bar®	Formula 12 — Double coated
30. Butter Cream Center on Graham Crackers	Formula 12 — Double coated
31. Cheese Bread	Formula 12 — Double coated

X. Dessert Bits Accepted for Further Testing by QMC

One hundred of each of the following listed bits were made and coated and sent to Mr. H. B. Cosler, Acting Chief, Cereal and General Products Branch, Food Division, Quartermaster Food and Container Institute, Chicago, Illinois, for further testing.

1. Compressed Orange Raisin Nut Bar
2. Compressed Cereal Nut Bar
3. Compressed Date Nut Bar
4. Milk Chocolate
5. Commercial Nut Fudge
6. Pound Cake
7. Brownies
8. Norwegian Rye Bread
9. Chocolate Cake
10. Oatmeal Bread
11. Processed American Cheese
12. Compressed Fruit Cake
13. Compressed Corn Flake Peanut Cream Bar
14. Peanut Butter Cream on Graham Crackers
15. Compressed Gingerbread
16. Compressed Fig Bars
17. Compressed Kellogg "K" Peanut Cream Bar®
18. Cheese Bread

XI. The Following Data give the Formula or Receipes used to make the accepted Dessert Bits and the Process of Cubing and Coating

1. Compressed Orange Raisin Nut Bars

A. *Ingredients*

133 gm shortening (2/3 cup)
300 gm brown sugar (1½ cups)
100 gm whole eggs (fresh)
14.18 gm grated orange peel (2 tablespoons)
45 gm orange juice (3 tablespoons)
224 gm general purpose flour (2c)
4 gm soda (1 teaspoon)
2 gm salt (½ teaspoon)
2.4 gm cinnamon (1 teaspoon)
1.2 gm nutmeg (½ teaspoon)
.6 gm cloves (¼ teaspoon)
164 gm coated raisins (1 cup)
118 gm chopped pecans (each pecan cut 4-5 times)

B. *Method*

1. Cream shortening, sugar in a mixer (large bowl) on Speed 5 for 5 minutes.
2. Add eggs and cream 2 minutes longer on Speed 5.
3. Add orange peel, orange juice and all dry ingredients (sifted together). Mix on Speed 2 for 2 minutes.
4. Stir in raisins and nuts by hand.
5. Spread in 2-8" greased square pans.
6. Bake at 350 F for 30 minutes.
7. Cool.

C. *Process of Cubing and Coating*

The cooled product was placed in a mixer and broken up into small pieces. Two hundred gm of the product were placed into a 4" x 4" mold and compressed into a 4" x 4" x ¾" block. This block was in turn cut into ¾-inch cubes. The cubes were placed on wire racks and sprayed on all sides but the bottom with two coats of coating*Formula 12 (preservatives added) diluted with 20 parts distilled water to 100 parts coating. As soon as the tops had dried (overnight at room temperature (80 F) or 1½ hours at 60 C in air oven), the bottoms were coated with the same coating using a brush.

2. Compressed Cereal Nut Bar

A. *Cereal-Nut Mix*

150 gm Rice Krispies®
200 gm Cornflakes®
150 gm Coconut
432 gm Salted Peanuts (canned skinless) were just halved.

Method

1. Place in bowl of A-200 mixer.
2. With paddle mix just to blend (15 seconds).

B. *Syrup*

400 gm granulated sugar
240 gm coffee cream (20% butterfat)
656 gm light corn syrup

Method

1. Cook syrup to very soft ball stage (200 F)

C. *Cereal-Nut Bar*

1. With paddle going, pour syrup over cereal-nut mix, and mix until just blended.
2. Spread on large 14" x 18" tray.
3. Smooth and press down with roller.
4. Chill.

D. *Process of Cubing and Coating*

180 gm of the chilled product was placed into a 4" x 4" mold and compressed into a 4" x 4" x ¾" block. This block was in turn cut into ¾" cubes. The cubes were placed on wire racks and sprayed on all sides but the bottom with two coats of coating, Formula 12 (preservatives added) with 4.5% cocoa replacing the 5% starch and the sucrose being raised 0.5%. This coating was diluted with 20 parts distilled water to 100 parts coating to facilitate spraying. As soon as the tops had dried (overnight at room temperature (80 F) or 1½ hours at 60 C in an air oven), the bottoms were coated with the same coating using a brush.

3. Compressed Date Nut Bars

A. *Ingredients*

200 gm whole eggs
400 gm powdered sugar
28 gm flour
4 gm salt — 1 teaspoon
8 gm baking powder — 2 teaspoons
356 gm dates — pitted — cut into 5-6 pieces and halved
248 gm cut up pecans (each pecan cut 4 times)

B. *Method*

1. Beat whole eggs in small bowl of mixer on Speed 8 for 5 minutes.
2. Gradually add the powdered sugar beating until thick on Speed 5 for 5 minutes.
3. Sift the flour, salt and baking powder over cut up dates and nuts. Mix well. Fold into egg-sugar mixture.
4. Spread into two 9" square pans, lightly greased.
5. Bake at 350 F for 30-40 minutes.

C. *Process of Cubing and Coating*

One hundred and eighty-five gm of the product were placed into a 4" x 4" mold which contained ¾" [illegible] grids and compressed into ¾" cubes. The cubes were placed

on wire racks and spraved on all sides but the bottom with two coats of coating Formula 12 (preservatives added) diluted with 20 parts distilled water to 100 parts coating. As soon as the tops had dried (overnight at room temperature or 1½ hours at 60 C in an air oven), the bottoms were coated with the same coating using a brush.

4. Milk Chocolate

Commercial milk chocolate was heated to 105 F and placed in ¾ inch cube molds and allowed to harden. The cubes were placed on wire racks and sprayed on all sides but the bottom with two coats of coating Formula 12 (preservatives added) diluted with 20 parts distilled water to 100 parts coating. As soon as the tops had dried (overnight at room temperature) the bottoms were coated with the same coating using a brush.

5. Commercial Nut Fudge

Commercial nut fudge was bought precut in ¾" cubes. The cubes were coated the same way as the milk chocolate.

6. Pound Cake

A. *Ingredients*

339 gm shortening
750 gm granulated sugar
12 gm grated lemon peel
45 gm lemon juice
474 ml whole milk
15 ml vanilla
750 gm general purpose flour
15 gm salt
12 gm Baking Powder
450 gm whole eggs blended together

B. *Method*

1. Cream shortening and sugar in N-50 bowl and mix on Speed 2 for 3 minutes.
2. Add lemon peel, juice and milk and mix for 1 minute on Speed 1.
3. Add dry ingredients and mix on Speed 1 for 1 minute.
4. Add 1/3 eggs and beat for 1 minute on Speed 1. Repeat twice. Then mix an additional minute.
5. Scale out 650 gm batter into a greased and floured 9" x 5" x 3" loaf pan.
6. Bake at 300 F for one hour and 20 minutes.

C. *Process for Cubing and Coating*

The pound cake was cooled and sliced into ¾" cubes by means of a meat slicer. The cubes were coated using our coating machine and coating Formula 12 (preservatives added). The coated bits were placed on a special release paper coated with an FDA approved coating R-30-203-2 of the Daubert Chemical Company. The bits then were allowed to air dry at room temperature (80 F) overnight.

7. Brownies

A. *Ingredients*

300 gm shortening
168 gm (6-1 ounce squares) of chocolate
252 gm general purpose flour
4 gm baking powder (1 teaspoon)
6 gm salt (1½ teaspoons)
300 gm whole fresh eggs
600 gm granulated sugar
45 ml vanilla
372 gm broken pecans (each pecan cut 4-5 times)

B. *Method*

1. Melt shortening and chocolate together over hot water. Cool.
2. Sift flour, baking powder, and salt together.
3. Beat eggs in large bowl of mixer until light and thick. Speed 10 — 5 minutes.
4. Add sugar gradually to beaten eggs and beat for 2 minutes on Speed 5.
5. Add the chocolate mixture to sugar-egg mixture on Speed 1 and beat for 1 minute.
6. Stir in flour, vanilla, nuts by hand.
7. Spread in greased 14" x 18" tray.
8. Bake at 350 F for 30-40 minutes.

C. *Process for Cubing and Coating*

The brownies were broken up in a mixer and 185 gm of the product were placed into a 4" x 4" mold which contained ¾" cube grids and compressed into ¾" cubes. The cubes were placed on wire racks and sprayed on all sides but the bottom with two coats of coating Formula 12 (preservatives added) diluted with 20 parts distilled water to 100 parts coating. As soon as the tops had dried (overnight at room temperature (80 F) or 1½ hours at 60 C in an air oven) the bottoms were coated with the same coating using a brush.

8. Norwegian Rye Bread

A. *Ingredients*

488 gm buttermilk
150 gm brown sugar
109 gm molasses

100 gm shortening
24 gm salt

B. *Method*

1. Combine all ingredients in a saucepan.
2. Bring to a boil.
3. Pour into A-200 bowl.
4. Then add:

   1 teaspoon soda — 4 gm
   354 ml cold water
   2 tablespoons orange rind
   600 gm medium rye flour

5. Mix on speed 1 for 2-3 minutes.
6. Then add:

   21 gm active dry yeast reconstituted in 236 ml warm water (110 F)
   900 gm white flour.

7. Mix for 5 minutes — Speed 1.
8. Knead on floured surface until smooth.
9. Place in greased bowl and ferment in proofing cabinet, temp 86 F until double in bulk (1-1½ hours).
10. Punch dough and cover. Let rest for 20 minutes.
11. Weigh out 1 lb pieces of dough.
12. Pan in 9" x 5" x 3" pans.
13. Proof in cabinet for 30 minutes.
14. Bake at 350 F for 45 minutes.

C. *Process for Cubing and Coating*

The cooled bread was sliced into ¾" cubes by means of a meat slicer. The cubes were placed on a wire rack and sprayed on all sides but the bottom with two coats of coating Formula 12 (preservatives added) diluted with 25 parts distilled water to 100 parts coating. Formula 12 was altered to the extent that 1 part of the sucrose was replaced with 1 part of sodium chloride. As soon as the tops had dried (overnight at room temperature (80 F) or 1½ hours at 60 C in an air oven) the bottoms were coated with the same coating using a brush.

9. Chocolate Cake

A. *Ingredients*

159 gm shortening
56 gm cocoa
275 gm granulated sugar
5 ml vanilla

60 gm egg yolks
225 gm general purpose flour
12 gm baking powder
3 gm salt
236 ml ice water
60 gm egg whites

B. *Method*

1. Cream shortening and cocoa using large bowl of mixer for 1 minute on Speed 5.
2. Add sugar gradually and mix for 5 minutes on Speed 5.
3. Add the egg yolks and vanilla. Mix for 2 minutes, Speed 5.
4. Sift the flour, baking powder, and salt together. Add all at once to above mix.
5. Add the ice water. Mix 1-2 minutes on Speed 1.
6. Fold in beaten egg whites (stiff).
7. Pour into 13" x 9" pan.
8. Bake at 350 F 30-40 minutes.

C. *Process for Cubing and Coating*

The chocolate cake was cooled and sliced into ¾" cubes by means of a meat slicer. The cubes were placed on wire racks and sprayed on all sides but the bottom with two coats of coating Formula 12 (preservatives added) with 4.5% cocoa replacing the 5% starch and the sucrose being raised 0.5%. This coating was diluted with 20 parts distilled water to 100 parts coating to facilitate spraying. As soon as the tops had dried (overnight at room temperature (80 F) or 1½ hours at 60 C in an air oven) the bottoms were coated with the same coating using a brush.

10. Oatmeal Bread

A. *Ingredients*

1180 ml boiling water
200 gm regular rolled oats
410 gm molasses
100 gm shortening
20 gm salt
1800 gm general purpose flour
21 gm dry activated yeast in 295 ml water

B. *Method*

1. In large saucepan bring the 1180 ml water to a boil.
2. Add the rolled oats and stir until it comes to a boil. Remove from heat.
3. Add the molasses, shortening and salt. Stir until well blended. Cool to 110 F.
4. Pour into bowl of mixer. Add ½ the flour and with paddle mix for 2 minutes, Speed 1.
5. Dissolve yeast in [illegible] (110 F). Then add to bread dough, along with rest

of flour. Mix until well-developed—5 minutes—Speed 1.

6. Place on well-floured board and knead until smooth.
7. Place in greased bowl and ferment in proofing cabinet (temp - wet — 86 F) until double in bulk (1-1½ hours).
8. Punch dough and let rest covered for 20 minutes.
9. Weigh out 1 lb pieces of dough.
10. Pan in 9" x 5" x 3" pans.
11. Proof for 30-40 minutes in proofing cabinet.
12. Bake at 350 F for 45-50 minutes.

C. *Process for Cubing and Coating*

The oatmeal bread was cooled and sliced into ¾" cubes by means of a meat slicer. The cubes were coated using our coating machine and coating Formula 12 (preservatives added). Formula 12 was altered to the extent that 1 part of the sucrose was replaced with 1 part of sodium chloride. The coated bits were placed on a special release paper coated with FDA approved coating R-30-203-2. The bits were then allowed to air dry at room temperature (80 F) overnight.

11. Processed American Cheese

Processed American cheese was cut into ¾" cubes and allowed to air dry for 1½ hours to firm up the pieces. The cubes were coated the same way as the milk chocolate.

12. Compressed Fruit Cake

A. *Ingredients*

336 gm	all purpose flour	
200 gm	shortening	
200 gm	brown sugar	
8 gm	salt	
4.8 gm	ground cinnamon	
1.2 gm	ground nutmeg	
1.2 gm	ground cloves	
200 gm	whole egg (fresh)	
252 gm	currants	
152 gm	dates (cut into 10-12 pieces)	
95 gm	red candied pineapple	all cut into pieces approx 2/16" - 3/16" sq
95 gm	green candied pineapple	
95 gm	red candied cherries	
95 gm	green candied cherries	
60 gm	pecans chopped	
60 gm	walnuts chopped	
60 gm	filberts chopped	
60 gm	almonds chopped	
164 gm	molasses	
120 gm	pineapple juice, unsweetened	

B. *Method*

1. Cream shortening and sugars in N-50 mixer bowl with paddle at Speed 2 for 3 minutes.
2. Add egg in 50 gm portions, beating mixture at Speed 2 for 1 minute after each addition. Continue beating an additional 2 minutes.
3. Blend in fruits and nuts at Speed 1 for 1 minute.
4. Combine molasses and pineapple juice. Add liquid and sifted dry ingredients alternately to the creamed mixture, beginning and ending with the dry ingredients, while mixing at Speed 1. Each addition should be blended in thoroughly.
5. Remove batter to pan which has been well-greased and floured on the bottom and sides and lined with waxed paper on the bottom. (Baking pan, 3 quart size #233.)
6. Bake at 275 F for 2-2½ hours with pan of water placed on the lower rack of oven during baking.

C. *Process for Cubing and Coating*

One hundred and sixty-five gm of the fruit cake were placed into a 4" x 4" mold and compressed into a 4" x 4" x ¾" block. This block was in turn cut into ¾" cubes. The cubes were coated using our coating machine and coating Formula 12 (preservatives added). The coated bits were placed on a special release paper coated with FDA approved coating Daubert R-30-203-2. The bits were then allowed to air dry at room temperature (80 F) overnight.

13. Peanut Butter Cream on Graham Crackers

A. *Filling*

145 gm ground graham crackers (using blendor)
227 gm peanut butter
200 gm brown sugar
163 gm whole fresh milk

Method

1. Place in top of double boiler with water boiling in lower part.
2. Stir until thick (15-20 minutes).
3. Cool to room temperature.

B. *Bar*

1. Using matched graham crackers, spread 1 level tablespoon filling between 2 graham crackers to ¾" total thickness.

C. *Process of Cubing and Coating*

The product was cubed by cutting at right angles to the filling. Some difficulty arose in getting uniform pieces due to the brittleness of the crackers. The cubes were placed on wire racks and sprayed on all sides but the bottom with two coats of coating Formula 12 (preservatives added) diluted with 20 parts distilled water to 100 parts

coating. As soon as the tops had dried (overnight at room temperature or 1½ hours at 60 C in air oven) the bottoms were coated with the same coating using a brush.

14. Compressed Gingerbread

A. *Ingredients*

200 gm shortening
200 gm granulated sugar
100 gm whole fresh eggs
338 gm molasses
336 gm general purpose flour
6 gm salt
6 gm soda
1 teaspoon ginger
1 tablespoon cinnamon
236 ml boiling water

B. *Method*

1. Cream shortening and sugar using N-50 mixer bowl and mixer — Cream for 5 minutes on Speed 1.
2. Add eggs and molasses — cream for 2 minutes on Speed 1.
3. Sift together the dry ingredients. Add all at once with boiling water. Mix for 1-2 minutes on Speed 1.
4. Pour into greased 14" x 16" pan.
5. Bake 350 F — 25-35 minutes.

C. *Process of Cubing and Coating*

Pieces of gingerbread 4" x 4" x 1½" were compressed into blocks 4" x 4" x ¾". These blocks were in turn cut into ¾" cubes. Some difficulty did arise in that some of the cubes did not retain their ¾" cube size, but sprang back to somewhat larger dimensions. These pieces were in turn cut back to ¾" cubes as close as possible. The cubes were coated using our coating machine and coating Formula 12 (preservative added). The coated bits were placed on a special release paper coated with FDA approved coating, Daubert R-30-203-2. The bits were then allowed to air dry at room temperature (80 F) overnight.

15. Compressed Fig Bars

Fig bars were broken up in a mixer. Two hundred gm of the product were placed into a 4" x 4" mold and compressed into a 4" x 4" x ¾" block. This block was in turn cut into ¾" cubes. The cubes were coated using our coating machine and coating Formula 12 (preservative added). The coated bits were placed on a special release paper coated with FDA approved R-30-203-2. The bits were then allowed to air dry at room temperature (80 F) overnight.

16. Compressed Kellogg "K" Peanut Cream Bar

A. *Ingredients*

656 gm white corn syrup
400 gm granulated sugar
681 gm peanut butter
360 gm Special K cereal®

B. *Method*

1. In a large saucepan bring syrup and sugar to a boil. Remove from heat.
2. Add the peanut butter and stir until smooth.
3. Pour over cereal and mix.
4. Place in 11" x 16" pan.
5. Level smooth — cool.

C. *Process of Cubing and Coating*

One hundred and eighty gm of the chilled product was placed into a 4" x 4" mold and compressed into a 4" x 4" x ¾" block. This block was in turn cut into ¾ inch cubes. The cubes were coated using our coating machine and coating Formula 12 (preservative added). The coated bits were placed on a special release paper coated with FDA approved coating R-30-203-2. The bits were then allowed to air dry at room temperature (80 F) overnight.

17. Cheese Bread

A. *Ingredients*

826 ml water
146 gm yellow cornmeal
24 gm salt
328 gm molasses
50 gm shortening
1120 gm general purpose flour
14 gm active dry yeast in 236 ml warm water
454 gm grated American Cheese

B. *Method*

1. In a large saucepan combine the water, cornmeal, and salt. Bring to a boil and cook until thickened. Remove from heat.
2. Add the molasses and shortening. Cool to warm (110 F).
3. Place in bowl of mixer. Add ½ flour and with paddle mix for 23 minutes on Speed 1.
4. Add the yeast dissolved in the warm water and the rest of the flour. Mix on Speed 1 for 5 minutes.
5. Place on a floured board and knead until smooth.
6. Place in a greased bowl and ferment in proofing cabinet (86 F) until double in bulk. (1-1½ hours)
7. Punch dough and [illegible] for 20 minutes.

8. Divide dough into 4 portions. Add 1/4 lb grated American cheese to each loaf using N-50 bowl and hook and mix for 15 seconds.
9. Pan into loaf tins.
10. Proof in cabinet for 30 minutes.
11. Bake at 350 F for 45-55 minutes.

C. *Process of Cubing and Coating*

The cheese bread was cooled and sliced into 3/4" cubes by means of a meat slicer. The cubes were coated using our coating machine and coating Formula 12 (preservatives added). Formula 12 was altered to the extent that 1 part of the sucrose was replaced with 1 part of sodium chloride. The coated bits were placed on a special release paper coated with FDA approved coating R-30-203-2. The bits were then allowed to air dry at room temperature (80 F) overnight.

XII. Storage Tests of Accepted Coated Dessert Bits in Controlled Humidity, 1/2 Atmosphere of Oxygen and 80 F.

The conditions of the storage tests are the same as were used in Section II.

TABLE X

Storage Tests of Accepted Dessert Bits Under 53.5% Relative Humidity, 1/2 Atmosphere, Oxygen 80 F.

Sample	*Initial Weight (gm)*	*Weight after 3 days (gm)*	*% of Change*	*Quality of Product*
Compressed Orange-Raisin Nut Bar	33.32	33.12	-0.60	Coating okay, product good.
Compressed Cereal Nut Bar	39.39	39.26	-0.36	Coating and product good.
Compressed Date Nut Bar	35.76	35.59	-0.47	2 cracked pieces, 2 OK — coating a little dry. Product good.
Commercial Nut Fudge	9.44	9.35	-0.95	Coating cracked from 1/5 atmosphere pressure. Product tasted good, coating too dry.
Pound Cake	22.29	22.16	-0.58	Coating and product good.
Brownies	31.65	31.38	-0.85	Coating OK, possibly a little dry. Product good.
Norwegian Rye	13.48	13.38	-0.67	Coating OK — product OK. A little dry but was coated this way.
Oatmeal Bread	15.68	15.48	-1.20	Coating OK — product OK. A little dry but was coated this way.

Sample	*Initial Weight (gm)*	*Weight after 3 days (gm)*	*% of Change*	*Quality of Product*
Processed Amer. Cheese	27.55	26.98	-2.06	Coating good, prod. good.
Compressed Cornflakes Peanut Cream Bar	35.46	35.37	-0.25	2 pieces cracked at 1/5 atmosphere pressure, 2 OK, cracks on corners. Prod. OK, coating little dry.
Peanut Butter Cream on Graham Crackers	19.72	19.56	-0.81	Coating and product both good.
Compressed Gingerbread	34.00	33.62	-1.12	Coating and Product are excellent.
Compressed Fig Bars	22.32	22.19	-0.58	Coating and Product are good.
Compressed Kellogg K and Peanut Cream Bar	33.61	33.51	-0.30	Coating good, product good.
Cheese Bread	12.81	12.67	-1.09	Coating okay —product good, a little dry but was coated this way.

NOTE: None of the bits cracked under the ½ atmosphere required.

TABLE XI

Storage Tests of Accepted Dessert Bits Under 22.9% Relative Humidity, ½ Atmosphere, Oxygen 80 F. 3 Days Storage

Sample	*Initial Weight (gm)*	*Weight after 3 days (gm)*	*% of Change*	*Quality of Product*
Compressed Orange-Raisin Nut Bar	30.72	30.34	-1.23	2 of 4 cracked at 1/5 atmosphere pressure but not all the way through. Coating a little dry — Product OK.
Compressed Cereal Nut Bar	37.99	37.77	-0.7	Product and coating excellent.
Compressed Date Nut Bar	34.91	34.58	-0.93	All cracked at 1/5 atmosphere pressure but not all the way through. Coating a little dry — Product good.
Commercial Nut Fudge	9.92	9.80	-1.21	All cracked at 1/5 atmosphere pressure but not all the way through. Product good.
Pound Cake	20.49	20.18	-1.51	Coating and Product good.

Sample	*Initial Weight (gm)*	*Weight after 3 days (gm)*	*% of Change*	*Quality of Product*
Brownies	30.03	29.75	-0.93	Coating and Product good.
Norwegian Rye	14.61	14.39	-1.50	Coating okay — Product a little dry but was so coated.
Oatmeal Bread	16.11	15.81	-1.87	Coating and Product okay.
Processed American Cheese	25.82	27.21*	—	Coating OK, Product OK.
Compressed Cornflakes Peanut Cream Bar	37.36	37.16	- .53	Some cracking of coating under 1/5 atmosphere pressure, coating little dry, product okay.
Peanut Butter Cream on Graham Cracker Bar	19.41	19.19	-1.13	Product and coating good.
Compressed Gingerbread	31.97	31.54	-1.34	Product and coating good.
Compressed Fig Bars	22.03	21.83	-0.91	Product and coating good.
Compressed Kellogg K and Peanut Cream Bar	31.51	31.30	-0.66	1/3 cracked but not all the way through. Coating a little dry.
Cheese Bread	13.70	13.46	-1.75	Product and coating okay.

*Splashed a little of the humidity control solution on bits.

NOTE: None of the bits cracked under the 1/2 atmosphere required.

Even though some surface cracks did occur on some of the coated bits under the 6 inches of mercury pressure (1/5 atmosphere), none of the cracks were evident at 1/2 atmosphere pressure. Also, even at the 1/5 atmosphere pressure, none of the coating actually broke through and all of the products were in good shape after the three days under the 1/2 atmosphere of oxygen and the different relative humidities. Another point of interest is that there was a small loss of weight in the samples being greater with the 22.9% relative humidity than the 55.5% relative humidity. Since there was a small loss of weight (presumably moisture) even at the 55.5% relative humidity, these samples could be stored at higher relative humidities without picking up too much water.

SECTION III

DISCUSSION

We would like to again emphasize that the coatings applied to the dessert bits are relative in their ability to resist moisture and oxygen transfer. They were designed to be as palatable as possible at mouth temperatures and moisture content; i.e., they were designed to dissolve under the moisture and temperature of the mouth but to resist moisture both as to pick up and loss under other conditions. Both temperature and moisture are necessary to have them dissolve readily. In turn, since they are relative and not absolute coatings, in time it is possible to dry the coatings with prolonged heat and low humidities so they will not function as a flexible coating. We have found that if the centers of the bits

have not dried out under the preceding conditions, the coating can be made flexible again by repeated spraying of small droplets of hot water on the surface of the coated bits allowing time in between spraying for the water to penetrate without causing stickiness. If these bits are then stored in closed containers, they will be good again for an extended period of time.

We would also like to point out that the coatings used to date are not the limit as to strength and flexibility. If it is found necessary through testing to have a coating which will hold up under more stringent conditions than were given in the Scope of the Contract, we feel sure that a coating of this type could be made to hold up under those new conditions.

SECTION IV

RECOMMENDATIONS

1. We recommend that the ¾" cubes be made with rounded corners and edges rather than with the present sharp corners and edges. This would make it much easier to put on a more even coating, and once the coating is on, it would be much stronger since there would be no sharp points or edges to start flaws in the coating.

2. Compressed bits should be used since they are stronger, smoother on surface, and can be more accurately made into the desired shape and thus more easily coated.

3. Further work should be done to develop centers from meats and vegetables and combinations of these ingredients.

4. Engineering research should be done to improve the techniques of application of the coatings to the bits.

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13. ABSTRACT Prolonged aerospace missions necessitate severe restrictions on the weight and size of all material carried on board the space vehicle. These limitations must be applied to the astronauts' food, as well. Therefore to meet these restrictions and to provide optimum nutrition, the US Army Natick Laboratories (NLABS) developed, evaluated, and supplied, a variety of prototype dehydrated and bite-sized foods to the Aerospace Medical Research Laboratories for further evaluation. The formulations and production guides for each food item are included. Pillsbury developed various dessert bite-sized food pieces as well as a good food coating for encapsulating the food cubes for use in aerospace systems. Compressed 0.75 in. cubes with rounded corners and edges were suggested for aerospace missions. The encapsulation process employed two immiscible systems, a film former in the continuous phase surrounding a liquid, or once liquid, discontinuous phase, and a plasticizer to form the stable dispersion. The stable dispersion when applied to the dessert bits adhered tenaciously and then air dried to a smooth, nonsticky, moisture resistant, and oxygen resistant coating. The best coating formula consisted of 45% melted lard, 9% sodium caseinate, 2% gelatin, 3% cornstarch, 41% sucrose, and 100 ml water. On the basis of taste panel evaluations of these foods, an acceptable, nutritious 3-day menu cycle with 4 meals per day can be recommended for aerospace missions. The menu supplied 2500 kcal per day, of which 48.6% of the energy was supplied by carbohydrates, 32.7% by fat, and 18.7% by protein.

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Security Classification

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