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9. ABSTRACT

Because of the high temperature and humidity in the coastal region of Ecuador, and because of the high moisture content of the rice, corn, and soybeans grown there, a need exists for a seed drying-processing-storage facility. Accordingly, USAID/Ecuador requested assistance from Mississippi State University in the preparation of designs and equipment specifications for such a facility. It was designed to handle 2,750 metric tons of rice, 560 metric tons of corn, and 1,300 metric tons of soybeans. This report includes the facility designs, equipment specifications, and equipment costs, estimated to be about $400,000. The prepared designs are to be submitted to an Ecuadorian architect for preparation of construction drawings. The architect will also be responsible for preparing construction drawings for administrative buildings, workshops, garages, etc., to be located at the seed facility site.

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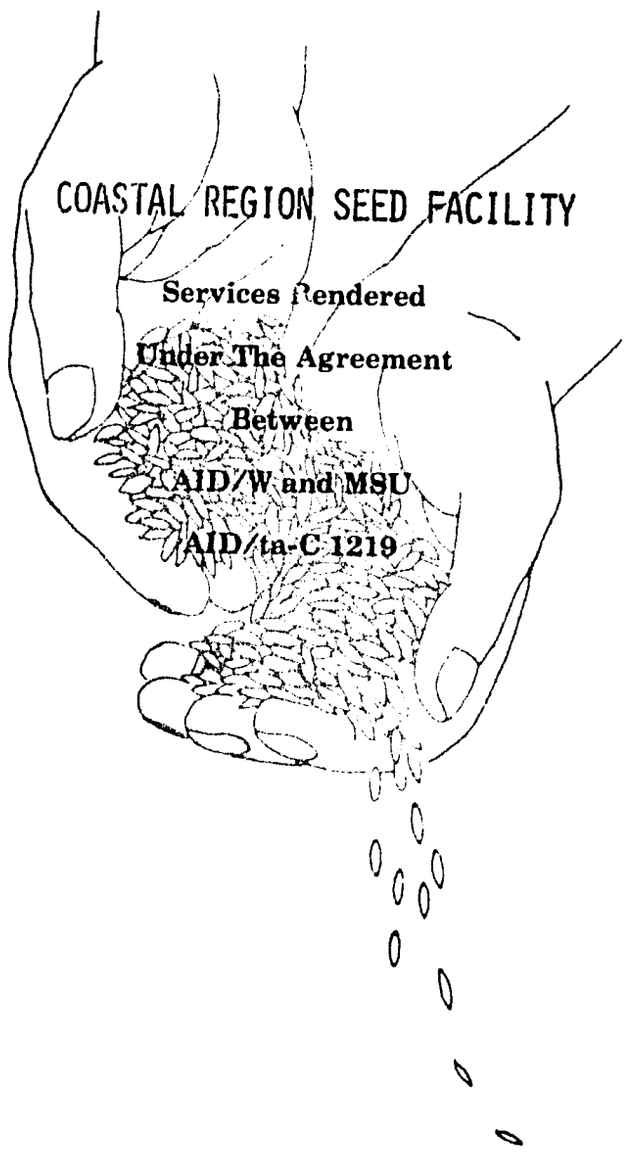

COASTAL REGION SEED FACILITY

Services Rendered

Under The Agreement

Between

AID/W and MSU

AID/ta-C 1219

SEED TECHNOLOGY LABORATORY
MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE, MISSISSIPPI

Report to USAID/Ecuador
and AID/W
on
Coastal Region Seed Facility

Services Rendered
Under the Contract
Between
AID/W and MSU
AID/ta/C-1219

Seed Technology Laboratory
Mississippi State University
Mississippi State, Mississippi

August, 1976

REPORT SUMMARY

TITLE: Coastal Region Seed Facility

CONTRACT: AID/ta-C-1219 with Mississippi State University.

CONSULTANTS: G.M. Dougherty, G.B. Welch, J.C. Delouche

PERIOD OF REPORT: 24 May-14 June, 1976

Related work, Reports TA 75-18 (December, 1975)
and
TA 76-08 (June, 1976)

SUMMARY

To support seed activities of the PDDA (USAID Loan 518-L-033) USAID/Ecuador requested assistance from Mississippi State University in the preparation of designs and equipment specifications for a seed facility to be established in the coastal region of Ecuador. To accelerate the work required an Ecuadorian technician was sent to MSU to work with MSU seed processing engineers. The technician arrived on 24 May and departed on 14 June.

A seed drying-processing-storage facility was designed to handle 2,750 MT rice, 560 MT corn and 1,300 MT soybeans. Designs are included in the report. Equipment specifications were prepared and are included in the report. Equipment costs, FOB Manufacturer, are estimated at approximately $400,000.

Designs prepared are to be submitted to an Ecuadorian architect for preparation of construction drawings. The architect will also be responsible for the preparation of construction drawings for administrative buildings, workshops, garages etc., to be located at the seed facility site.

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REPORT TO USAID/ECUADOR
AND AID/W on Coastal Region
Seed Facility

Background

During October-November, 1975 USAID/E requested and received technical assistance from the MSU/AID/W contract AID/ta-C-1219 in the review of Ecuador's seed program particularly as it affects the implementation of the PDDA funded by USAID loan 518-L-033, and in view of the initiation of a Seed Production and Distribution Project funded by the World Bank (MSU Report TA 75-18).

Follow-up consultations with USAID/E, MAG and EM Semillas officials in May, 1976 (MSU Report TA 76-08, June, 1976) resulted in arrangements being made for the Ecuadorian technician responsible for the construction and operation of a seed processing-storage facility, supporting the seed activities of the PDDA (USAID loan 518-L-033) to work with seed processing engineers of Mississippi State University in an effort to accelerate the preparation of the design and equipment specifications for the facility. The technician arrived Mississippi State University May 24, and departed June 14, 1976.

Considerations

EM Semillas projects the need for a seed handling installation to handle: 2,750 MT rice; 560 MT corn and 1,300 MT soybeans. The installation is to be constructed in the coastal region.

For seed production purposes, two crops of rice and corn, and one crop of soybeans are grown each year. The first rice crop is harvested in April-May, the second crop in August-September. The first crop accounts for 80% of total rice production. The first corn crop, which

accounts for 90% of the total production is harvested in April, May and June. The second crop is harvested in August-September. Soybeans are harvested in October-November.

Seed moisture contents at harvest range from 17% to 28%. Thus, all seed require drying. Average moisture content of soybeans at harvest is 17-18%; rice ranges from 20-22% (second crop) to 26-28%; corn ranges from 18-20% (second crop) to 22-24% for the first crop.

The humidity and temperature in the coastal region is quite high throughout the year. It is generally unfavorable for safe storage of soybeans and corn seed. Relative humidities in the 90's and the temperatures above 24°C, concurrently, are not uncommon.

Assumptions

A. Rice

a) about 2,200 MT will be harvested in April-May, 550 MT in August-September.

b) it will be delivered to the plant in threshed condition.

c) moisture content will be in the range of 20 to 28% and the seed will require drying.

d) it will have to be scalped before drying

e) seed lot sizes will range from 200 to 700 MT

f) storage for 6 to 7 months will be required

B. Corn

a) about 500 MT will be harvested in April, May and June; 60 MT in August and September

b) it will be delivered to the plant shucked, but on the ear, at moisture contents ranging from 18-24%.

c) the seed will require drying

d) it will be hand sorted for removal of "off-types" before drying

e) seed lot sizes will range from 50 to 100 MT

f) storage will be required for 6 to 7 months

C. Soybeans

a) about 1,300 MT will be harvested in October-November

b) it will be delivered to the plant in threshed condition

c) moisture content will be 17-18% and the seed will have to be dried

d) seed lot sizes will range from 30 to 100 MT

e) storage will be required for 6 to 7 months

D. General

The facility will operate on an 8 to 16 hour work day schedule, 20 work days per month.

Proposed Installation

(Drawing Sheets 1 to 7)

General Arrangement and Layout (dwg. sheet 1)

Excluding roadways, the installation occupies an area approximately 4,820M^2 in size. It consists of a metal bin drying-storing facility---8 bins, a seed processing plant-storage building and an ear corn dryer. The drying facilities are located to either side of the centrally positioned seed processing plant building. Two additional metal storage bins, for the storage of shelled corn not be used for seed, are located to the "rear" of the processing plant.

Drying-Storage Bins (dwgs. 2 & 3)

The corrugated metal drying-storage bins are included primarily for rice, but they can be used for soybeans and shelled corn. Used for storage each bin will hold 90 MT rice or 120 MT soybean when filled to eave height. An additional 7 to 8 MT per bin storage can be obtained by filling the area

under the bin roof.

All bins are equipped with metal perforated drying floors. Four bins have individual heater-fan units. Two additional heater-fan units are provided for the other four bins. For drying seed, each bin will hold 45 MT rice or 72 MT soybean. When drying, seed bed depth should not exceed 6 ft. (1.8M).

The bin loading and unloading conveying system permits the product in any one bin to be transferred to any other bin. The system uses belt-bucket type elevators, drag-flight and belt-type horizontal conveyers. Conveyors underneath the bin drying floors are of the auger-type. Conveying equipment being recommended is satisfactory for handling soybeans, rice and shelled corn. Maximum capacity of the receiving conveying system is 20 MT per hour.

Processing Plant (dwgs. 1,2,3,4 & 5)

Excluding the covered driveway between the processing plant and the drying-storage bins, the building measures 20.4M x 20.4M. Building height is 8.5M at the eave and 13.3m at the ridge line. Building dimensions shown are critical. The building has no special construction requirements. All equipment is supported from the concrete floor, it will, however, require some bracing from the superstructure. The concrete floor should have a compressive strength of 2750 lbs. per square inch (1.2 MT per 3.45 cm^2) and be reinforced with No. 6, 6-inch (15.2cm x 15.2cm) reinforcement wire.

Equipment is provided for processing rice, soybean and corn seed. Rice and corn can be processed simultaneously. Processing capacity will depend on the seed kind and the machines required to provide a product of

satisfactory quality. Examples of some equipment operating capacities are shown in Table 1.

Table 1. Approximate maximum operating capacities, in metric tons per hour, for selected machines.

Equipment	Seed Kind		
	Rice	Soybean	Corn
Seed Cleaner (each)	1.4-2.0	4.0-5.0	3.5-4.0
Disc Separator	4.0	-------	-------
Spiral Separators	-------	3.0-4.0	-------
Precision Trader	1.0-1.2	-------	1.0-1.5
Scalperator	20	20	20
Sheller	-------	-------	12
Conveyor[1/]	20	20	20
Elevator (D1000)	20	20	20
Elevator (C_2-500)	10	10	10
Elevator (C_2-175)	4	4	4
Seed Treater	7	5	6
Bagger-Weigher	12-15	12-15	12-15

[1/] No. 6 Super-Flo

A minimum of four processing options are available for each crop (Table 2).

Table 2. Processing options for rice, soybean and corn seed.

Options	Seed Kind		
	Rice	Soybean	Corn
Clean, treat, bag	X	X	X
Clean, bag	X[1/]	X[1/]	X[1/]
Clean, length grade, bag	X[1/]		
Clean, length grade, treat, bag	X		
Clean, spiral, bag		X[1/]	
Clean, spiral, treat, bag		X	
Clean, size grade, bag			X[1/]
Clean, size grade, treat, bag			X

[1/] Recommended options for seed lots to be stored for more than 9 months and seedlots that might be diverted into food or feed marketing channels.

Seed Storage (dwg. 5)

The flat-storage warehouse building occupies a space of $540M^2$. To minimize construction costs it is recommended it be constructed of locally available materials. The concrete floor should meet same specifications furnished for the processing plant floor. A vapor barrier should be placed between the soil and the concrete floor. Special attention is required to assure drainage away from the building is adequate. Capacity of the warehouse is estimated at 570 MT, if pallets are used.

The building is divided into 3 storage rooms. Each room measures 15 ft. (4.5M) x 50 ft. (15.0M) x 35 ft. (10.5M). Each room will hold 190 MT seed. Each room is to be constructed and equipped to maintain conditions of 65^oF (18.3^oC) temperature and 65% relative humidity. Conditioned storage is recommended for soybeans and corn. Especially, seed to be "carried-over" for 18 months. Materials required for vapor proofing and insulating, and the equipment for conditioning, are included in the Equipment Specifications (Appendix 1).

A. Dehumidification (per room)

1. Outside (90^oF) (90% r.h.)
2. Inside (65^oF) 65% r.h.)
3. Volume = 26,250 $ft.^3$
4. Est. capacity at 50% = 4,180 cwt
5. Moisture content (outside air) = 1.92 pints per 1,000 ft^3
6. Max. allowable at 65^oF and 65% r.h. = 0.64 pints/1,000 $ft.^3$
7. Water to be removed = 1.28 pints/1000 $ft.^3$
8. Infiltration (10 changes) = 7500 ft^3/hour
9. Mosture removed from outside air = 10 pints/hour
10. Moisture removed from seed (1% in 30 days) + 6 pints/hour
11. Summary (Moisture removal)
    a) from air = 10 pints/hour
    b) from seed = 6 pints/hour
    Total = 16 pints/hour (8 Liters)

B. Air Conditioning (per room)

1. Building construction = 8-inch concrete block
2. Room size = 26,250 ft^3
3. Outside (90^oF)
4. Inside (65^oF)
5. Entering seed = 26.8 MT (soybean) at 90^oF--to be reduced to 65^oF in 48 hours.
6. Ceiling insulation = 4-inch styrfoam "FR" or equivalent
7. Wall insulation = 2-inches stryfoam "FR" or equivalent
8. Heat gain walls = 6.375 BTU/hour
9. Heat gain ceiling = 3,150 BTU/hour
10. Heat gain (air changes) = 4,000 BTU/hour
11. Heat gain (product load) = 31,250 BTU/hour
12. Heat gain (dehumdification)[1/] = 15,200 BTU/hour
13. Total heat gain = 60,100 BTU/hour

Ear Corn Dryer (dwg. 7)

The ear corn (maize) drier is located to the rear of the processing plant. It is a bin or batch-type drier system, completely covered for all weather operation.

The dryer consists of a centrally positioned air tunnel (plenum) sufficiently large for inside inspections and adjustments, and ten 12 ft. (3.6M) x 14 ft. (4.2M) x 11 ft. (3.2M) bins. Heated air enters the rear of the plenum chamber, passes inot the bins through an adjustable sliding panel in the wall of the plenum chamber. The air then passes through the ear corn and is discharged through an opening in the top of the bin.

Each bin will hold 13 MT of corn when filled. Operation under a system of two bins loading, two bins unloading, and six bins drying, the drying facility will

---

[1/]three Model D20 Remington Dehumidifiers

dry 78 MT corn every 3 days, or an average of 26 MT per day. Drying time to reduce corn to 13 percent moisture is estimated at 3 days.

A dryer unit, capable of delivering approximately 30,000 CFM's against a static pressure of 1-inch and 500,000 BTU's (heat) per hour is recommended for the dryer, as designed.

Plans submitted (dwg.7) should be given to an architect for preparation of construction drawings.

Offices-Laboratory buildings

Designs for an office-laboratory building, workshops etc. were not requested by EM Semillas. An Ecuadorian architect is to be engaged to design all other structures to be located at the site of the Coastal Seed Facility.

TABLE 3.

Recommended List of Equipment
and
Explanation of Need and Uses
(See Appendix I. for Specifications)

Item No.	Description	Est. Cost US$ FOB Supplier
1	Drying/Storage bins, 27 ft. diameter; 20 ft. height at eave; eight (8) drying-storage bins for drying and/or aeration and bulk storage of all kinds of seed	$43,200
2	Heater-fan units for drying system on two bins. (About $6,800 each)	$13,600
3	Heater-fan units for drying system, one unit per bin. (about $5,750 ea.)	$23,000
4	Conveyor, horizontal, belt-type; to convey seed from drying/storage bins to elevator (item 13) to processing line.	$10,500
5	Conveyor, horizontal, drag flite-type; to convey seed to drying/storage bins (item 1). (About $5,750 ea.)	$11,500
6	Conveyor (similar to item 5); reversible flow conveyor to convey seed from elevators (items 12 & 13) to conveyor (item 5). Used to load, or "turn" seed in, drying/storage bins.	$ 1,850
7	Vibrating-dump pit, for efficient receiving of raw seed (except ear corn)	$ 2,300
8	Belt-bucket elevator, high capacity for feeding raw seed from dump pit to scalperator for rough cleaning	$ 2,800
*9	Surge bin for scalperator (item 10)	$ 300
10	Scalper, high capacity rough cleaner to remove foreign material and dust before conveying seed to drying bins and/or processing line.	$ 7,800
11	Vibrating spout conveyor for conveying clean seed discharged from scalper to elevator (item 12)	$ 750

Item No.	Description	Est. Cost US$ FOB Suppliers
12	Belt-bucket elevator (similar to item 8), to convey seed to conveyor (item 14). Seed can be conveyed to drying/storage bins or processing line	$ 6,500
13	Belt-bucket elevator (similar to item 12), to convey seed in drying/storage bins to seed processing line.	$ 6,500
14	Conveyor, horizontal (similar to item 5) conveys seed from elevators (items 12,13) to air screen cleaners	$ 2,760
*15	Surge bin for air screen (item 17)	$ 1,000
*16	Surge bin for air screen cleaner (item 18)	$ 1,000
17	Air-Screen Cleaner. "Basic"cleaning machine used to separate particles differing significantly from crop seed in width and/or thickness. Lightweight particles are removed by the air system.	$13,900
18	Air-Screen Cleaner (same as item 17)	$13,900
19	Belt-bucket elevator, 4 MT capacity; to convey seed discharged from air screen cleaner to surge bins (items 21,22)	$ 2,150
20	Belt-bucket elevator (same as item 19)	$ 2,150
*21	Surge bin (holding bin) for seed discharged from air-screen cleaners	$ 500
*22	Surge bin (same as item 21)	$ 500
23	Belt-bucket elevator, 4 MT capacity; to convey seed from surge bins (items 21,22) to Disc separator and/or Spiral separators.	$ 3,100

Item No.	Description	Est. Cost US$ FOB Supplier
24	Belt-bucket elevator (same as item 23); to convey seed from surge bins (items 21,22) to Precision Grader and/or Spiral separators	$ 3,100
*25	Surge bin for Disc separator	$ 350
26	Seed length separator, disc type; for separating short material (broken rice) from good seed.	$10,000
27	Belt-bucket elevator (similar to item 23); conveys seed discharged from disc separator to surge bins (items 28, 31)	$ 2,500
28	Surge bin for seed treater	$ 500
29	Spiral Separator Assembly; separate "splits" from whole soybeans	$ 5,000
*30	Surge bin (holding bin) 3MT capacity; used to collect "splits" discharged from Spiral Separators	$ 900
*31	Same as item 30; used to collect "whole" soybeans discharged from Spiral separators	$ 900
32	Same as item 27; used to convey seed in surge bin (item 30) to surge bins (items 33,37)	$ 2,500
*33	Surge bin for Precision Grader	$ 300
34	Width and thickness Grader (Precision Grader); used to remove "short grain " from "long grain" rice varieties or to remove "rounds" from "flats" when processing corn.	$ 5,400
35	Belt-bucket elevator (similar to item 27); used to convey seed discharged from the Precision Grader to surge bin (item 37)	$ 1,400
36	Same as item 35; conveys seed from Precision Grader to surge bin (item 38)	$ 1,400
*37	Same as item 28	$ 500

Item No.	Description	Est. Cost US$ FOB Supplier
*38	Same as item 28	$ 500
39	Belt-bucket elevator (similar to item 27); conveys seed to bagger-weigher.	$ 1,000
40	Same as item 39	$ 1,000
41	Same as item 39	$ 1,000
42	Seed Treater, slurry and liquid type, for applying seed treatment materials	$ 4,200
43	Same as item 42	$ 4,200
*44	Surge bin (holding bin), 6.6 MT capacity; used to collect corn discharged from the corn sheller	$ 900
*45	Same as item 44	$ 900
46	Belt-bucket elevator, 10 MT per hour capacity; conveys seed from bins (items 44, 45) to overhead conveyor (item 47)	$ 1,500
47	Conveyor, horizontal, drag flite type; to convey shelled corn from elevators (items 46,56) to air-screen cleaner (item 18)	$ 1,800
48	Conveyor, roller type; conveys bagged seed from bagger-weigher to bag closer (sewing head), about $100 each	$ 200
49	Bagging scale; semi-automatic; for weighed packaging of seed (about $1,000 each)	$ 2,000
50	Sewing head (bag closer); sews packaged seed bags. (About $500 each)	$ 2,000
*51	Surge bin for bagger-weigher (about $250 each)	$ 500
52	Storage bin, 27 ft. diameter, 13.5 ft. height at eave; for storage of grain (non-seed use); (About $8,500 ea.)	$16,500

Item No.	Description	Est. Cost US$ FOB Supplier
53	Conveyor, belt-type with flights; used to unload grain in bins (item 52)	$ 600
54	Conveyor, auger type; conveys grain to storage bins (item 52)	$ 900
55	Same as item 54	$ 1,100
56	Elevator, belt-bucket type (similar to item 46); conveys seed from corn sheller (item 57) to conveyors (items 47,55	$ 3,200
57	Corn Sheller, type best for seed corn; for shelling corn	$ 3,800
*58	Surge bin for corn sheller	$ 300
59	Conveyor, chain-link type; conveys ear corn to corn sheller	$ 600
60	Conveyor (similar to item 4); conveys seed in corn dryer to conveyor (item 59)	$ 4,900
61	Conveyor (similar to item 60); conveys dryer to conveyor (item 60). (About $5,800 ea.)	$11,600
62	Heater-fan unit for corn dryer	$ 5,800
63	Conveyor (similar to item 59); conveys ear-corn from sorting table to conveyor (item 64)	$ 720
64	Conveyor (similar to item 63); conveys ear-corn from conveyor (item 63) to top of corn dryer	$ 620
65	Conveyor, belt-type; conveys seed to corn drying bins	$ 700
66	Same as item 53; conveys seed to corn drying bins	$ 600
67	Ear corn sorting belt; used to permit removal of "off-type" varieties before ear-corn is placed in corn dryer	$ 1,100
68	Dehumidifier, refrigerant type; used to maintain favorable level lof relative humidity in seed storage rooms (About $700 each)	$ 5,600

Item No.	Description	Est. Cost US$ FOB Supplier
69	Air Conditioners; used to maintain favorable temperature in seed storage rooms. (About $700 each.)	$ 4,200
70	Bag Triers; seed sampling probes used in seed quality control. (About $30 each)	$ 180
71 to 84	Seed quality control equipment and supplies (See Appendix I. for identification of items)	$ 4,070
85	Conveyor, belt-type; used in truck loading operations	$ 1,000
86	Bag truck, 4-wheel, for moving seed in sacks (2)	$ 600
87	Bag truck, 2-wheel, for moving seed in sacks (6)	$ 520
88	Platform scale, portable, for weighing sacked seed	$ 300
89	Grain Scoops, for moving seed in bulk (10)	$ 120
90	Lamp guard; shield for portable light	$ 40
91	Sump pump; to remove water leaking into elevator pits (About $160 ea.)	$ 800
92	Air compressor; portable air pressure system for cleaning bins and equipment	$ 600
93	Exhaust fans; remove dust from Disc separator and Precision Grader (about $320 ea.)	$ 640
94	Truck Scale; for weighing trucks as seed is received	$ 5,000
95	Polyethylene sheeting; vapor barrier for seed storage rooms and processing plant	$ 300
96	Insulation; for seed storage rooms (8,000 ft.^{2})	$ 2,500
97	Fire Extinguisher (3)	$ 150
98	Grain tank temperature detection system	$ 1,500

*Local fabrication

Equipment Cost Summary

a) FOB Supplier		$309,070
b) Crating & Inland freight	(10%)	30,907
c) ocean freight	(20%)	59,850[1]
	CIF	$399,827

[1] Less Locally fabricated items

APPENDICES

APPENDIX I.

EQUIPMENT SPECIFICATIONS FOR COASTAL REGION SEED FACILITY

Item No.	Description	No. Req'd.
1	Drying and storage bin; round type, of corrugated metal; 27 ft. (8M) diameter; 20 ft. eave height, 27 ft. (8.1M) O.A. height; To consist of standard foundation ring and seven standard 32-inch rings with following guages: 14,14,17,17,18,20,20. Complete with: a) all assembling hardware & instructions b) center-fill roof ventilator c) four (4) roof manholes with covers d) roof ladder e) walk-in door with door boards (Note: door opening to be cut in 2nd and 3rd full rings) f) channelox perforated drying floor with flashing, hardware and metal floor support standards g) tube-well bin unloading kit including auger h) power head with quick connect clamp, complete with drive and motor sized to convey 20MT per hour (maximum). NOTE: Only four (4) power heads required for the eight (8) bins. Powerhead to discharge seed 5 ft. (1.5M) from bin wall i) outside wall ladder j) inside ladder k) fan transition inlet collar l) bin sweep auger complete with drive and motor. NOTE: Only four (4) sweep augers required for the eight (8) bins. m) all motors to be operable on 220 volt, 60 hz., 3 phase or 110 volt, 60 hz., 1 phase Read Steel Products Model BB-85 or equivalent. NOTE: Bin will be assembled as follows: (base to top) foundation ring; 32-inch (14 ga.) ring; perforated floor; six (6) 32-inch rings, roof. Estimated Cost, FOB Supplier $43,200 (for 8 units)	8

APPENDIX I. (cont.)

Item No.	Description	No. Req'd.
2	Heater-fan unit, for drying seed or grain, heater to be diesel oil burner modified to deliver 1,000,000 BTU per hour; fan to be centrifugal type capable of delivering 32,000 CFM at 4-inch static pressure; standard controls and safety devices, stemmed thermometer; all necessary electrical starters and mechanical drive components; electric drive motor sized to meet CFM specifications and operable on 220 volt, 60 hz., 3 phase; spare parts selected by supplier not to exceed $300. American Drying Systems Model 1210/3 S or equivalent. Est. Cost, FOB Supplier $13,600 (for 2 units)	2
3	Heater-fan unit; for drying seed or grain, heater to be diesel oil burner modified to deliver 500,000 BTU per hour; fan to be centrifugal type capable of delivering 16,500 CFM at 4-inch static pressure; standard controls and safety devices; stemmed thermometer; all necessary electrical starters and mechanical drive components; electric drive motor to be sized to meet specifications and operable on 220 volt, 60 hz., 3 phase; spare parts selected by supplier not to exceed $150. American Drying Systems Model 815/3 S or equivalent. Est. Cost, FOB Supplier $23,000 (for 4 units)	4
4	Belt conveyor; horizontal, 110 ft. (33.5M) length; dual roll idlers to trough shaped belt; 18-inch (.45M) belt of 2-ply, nylon, rubber coated; rated capacity of 20MT seed per hour; channel beam frame construction with: a) discharge housing b) drive guard c) hinged trough weather cover d) flat frame cover e) seven (7) trough hoppers with belt seals f) tail assembly weather cover g) trough side board skirts h) recommended drive and motor of required horsepower with magnetic starter operable on 220 volt, 60 hz., 3 phase.	1

Item No.	Description	No. Req'd.
	i) replacement parts not to exceed $200. Universal Industries Model 3220-18 Dual Idler conveyor or equivalent. Est. Cost FOB Supplier $10,500	
5	Conveyor Drag-Flight Type, one direction flow; 6-inch size; 1,100 cubic foot per hour (20 MT) capacity; high density polyethylene flights mounted on sprocket driven chain convey seed in formed U-trough;trough of 12 gauge metal; fitted with quick release 14 gauge all-weather cover to consist of following (approx. 118 ft. overall length): a) 115 ft.length total conveyor. Note: specific section length required to be determined after preparation of construction dwg's. b) one (1) standard by-pass inlet. c) one (1) take-up head section d) one (1) contoured tail section e) four (4) standard intermediate discharge spouts with rack and pinion curved slide, hand wheel operated f) four (4) two-way offset lockout valves sized to fit intermediate discharge spouts. g) drive and motor of required horsepower (with magnetic starter) operable on 220 volt, 60 hz, 3 phase h) replacement parts selected by supplier not to exceed $300. Screw Conveyor Corporation No. 6 Super-Flo conveyor or equivalent. Est. Cost FOB Supplier $11,500 (for 2 units)	2
6	Conveyor, Drag. Flight Type; reversible flow; 6-inch size; 1,100 cubic foot per hour (20 MT) capacity; high density polyethylene flights mounted on sprocket driven chain convey seed in formed U-trough; trough of 12 ga. metal fitted with quick release 14 gauge all-weather cover to consist of following (approx. 34 ft. overall length): a) 32 ft. length (total) conveyor. Note: specific section lengths required to be determined after preparation of construction dwg's. b) one (1) standard by-pass inlet c) one (1) take-up head section	1

APPENDIX 1. (cont.)

Item No.	Description	No. Req'd.
	d) one (1) fixed head shaft section Note: discharge outlets to be supplied with transitions required to connect outlets to standard by-pass inlets on conveyors (item 5) e) drive and motor of required horsepower (with magnetic starter) operable on 220 volt, 60 hz, 3 phase. f) replacement parts selected by supplier not to exceed $150 Screw Conveyor Corporation No. 6 Super-Flo conveyor or equivalent Est. Cost FOB Supplier $1,850	
7	Custom-built dump for seed with attached shaker discharge spout. Dump hopper to be of slant wall type; 10 ft. long 7 ft. wide, and 4 ft. deep exclusive of shaker spout; 150 bushel capacity; constructed of 11 gauge steel, completely seam welded; entire unit supported from an angle iron framework around top. Shaker spout, all metal, with eccentric drive, leak-proof, self-cleaning; equipped with shut-off slide and handle; 6 inches deep at shallow end and pitched 1½ inches per foot toward discharge; discharge spout 18 inches wide and 18½ feet long; securely mounted beneath bottom opening of dump hopper. Dump hopper and shaker spout complete with drive and TEBB motor of required horsepower operational on 220 V., 60 Hz., three phase. Ferrell-Ross (A.T. Ferrell) Clipper Vibro-Pit or equivalent Est. Cost FOB Supplier $2,300	1
3	Elevator, belt-bucket type; 27 feet. (8.1 M) discharge height; 1000 bushel per hour (20 MT) capacity at 132 ft. per minute belt speed. All metal construction; complete with: a) belting, buckets and assembly hardware b) dump hopper c) bottom-boot cleanout with 4-inch legs d) adjustable elbow (8-inch) with clamp rings e) two (2) 10 ft. section, 8-inch rigid metal spouting (12 ga.) flanged both ends f) drive and motor of required horsepower (with magnetic starter) operable on 220 volt, 60 hz, 3 phase. Drive to be V-belts to countershaft and roller chain drive sprocket to headshaft	1

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
	g) replacement parts not to exceed $150. Universal Industries Model D-1000 "Easy Dump" Elevator or equivalent Est. Cost FOB Supplier $2,800	
9	Surge bin; metal construction, 5 ft. x 5 ft. x 2 ft. (1.5M x 1.5M x 0.6M) bin sidewalls, hoppered bottom (center discharge). Discharge opening sized to feed inlet of scalperator (item 10) Local Fabrication Est. Cost $300	1
10	Scalper (rough cleaner); high capacity; (20 MT) 1000 bushels seed per hour; all metal construction. Equipped with squirrel cage scalping reel to remove large material from seed; rescalping (2nd) reel to salvage good seed taken out with large material; aspiration system to remove light-weight material; of closed circuit, re-circulating air type; adjustable air volume control; seal gate feed into aspiration system; screw conveyor discharge of light screenings. Complete with screens of size used for rice; 4 h.p. electric motor, 220v., 60 Hz., 3 phase; magnetic starter; motor mount and drive; replacement parts selected by supplier not to exceed $300. Carter-Day 24" x 60", Style AM6, Closed Circuit Scalperator or Equivalent Est. Cost FOB Supplier $7,800	1
11	Conveyor, vibrating; all metal construction; self-cleaning; vibrating spout in integral frame suitable for mounting under discharge of machine; spout 8 inches wide; overall length from top of discharge to end of rear frame is 83 3/8 inches; overall depth 11 5/8 inches; overall width, 13 1/8 inches with 1/3 h/p., 110V, 60 Hz. motor	1

APPENDIX I. (cont.)

Item No.	Description	No. Req'd.
	Ferrell-Ross (A.T. Ferrell) Clipper Vibrating Conveyor for No. 9 Cleaners or equivalent Est. Cost FOB Supplier $750	
12,13	Elevator, belt-bucket type; 53 ft. (16M) discharge height; 1000 bushel (20M) per hour capacity at 132 FPM belt speed; All metal construction; complete with: a) belting, buckets, and assembling hardware b) two (2) dump hoppers c) three-way valve, 8-inch, with adapters and transitions d) bottom-boot cleanout with 4-inch legs e) five (5) 8-inch adjustable elbows with clamp rings f) twenty (20) 8-inch clamp rings g) eight (8) 10 ft. sections, rigid, 8-inch metal spouting (12 ga.) flanged both ends h) ten (10) 8-inch loose flanges i) service ladder (43 ft.) j) safety cage (43 ft.) k) weather and dust sealing l) two (2) 8-inch dead stop m) two (2) two-way valves, 8-inch, with flat top adaptor for installation with spouting n) drive guard and backstop o) drive and motor of required horsepower (with magnetic starter) operable on 220 volt, 60 Hz, 3 phase. Drive to be V-belts to shaft mounted reducer, complete with backstop p) service platform q) vent opening in head r) replacement parts ie. belting, cups etc. to be selected by supplier not to exceed $300. Universal Industries Model D-1000 "Easy Dump" Elevator or equivalent Est. Cost FOB Supplier $13,000 (for two units)	2
14	Conveyor Drag-Flight Type, one direction flow, 6-inch size; 1,100 cubic	1

APPENDIX I. (cont.)

Item No.	Description	No. Req'd.
	foot per hour (20 MT) capacity; high density polyethylene flights mounted on sprocket driven chain convey seed in formed U-trough; trough of 12 ga. metal; fitted with quick release 14 ga. all-weather cover to consist of following (approx. 60 ft. overall length): a) 55 ft. length (total) conveyor. Note: Specific section lengths required to be determined after preparation of construction dwg's b) one (1) standard by-pass inlet c) one (1) take-up head section d) one (1) contoured tail section e) two (2) standard intermediate discharge spouts with rack and pinion curved slide, hand wheel operated f) drive and motor of required horsepower (with magnetic starter) operable on 220 V, 60 Hz, 3 phase Screw Conveyor Corporation No. 6 Super-Flo Conveyor or equivalent ESt. Cost FOB Supplier $2,760	
15,16	Surge bin, metal construction, 6 ft. x 8 ft. x 5 ft. deep (1.8M x 2.4M x 1.5M) bin sidewalls, center-discharge hoppered bottom bin with slide-gate. Discharge opening sized to feed inlet of cleaner (item 17). 4.5 MT capacity Local Fabrication Est. Cost $2,000 (for 2 units)	2
17	Seed cleaner, air and screen type; cleaner to have four screens with adjustable shoe shake and screen pitch; two independent adjustable air systems; screen frame size 54-inch x 60-inch with synchronized brush type screen wipers; overall cleaner dimensions (extremes): 152½ in. long; 88-in. wide; 98½ in. height. Average capacity (rice) 70-100 bushels (1.4-2.0 MT) per hour clean seed. Complete with :	1

APPENDIX I.(cont.)

Item No.	Description	No. Req'd.
	a) roll-feed hopper b) adjustable speed feed roll c) fans mounted 45 degree angle to rear d) fan outlets equipped with transitions to discharge air liftings into one cyclone e) cyclone of recommended size to handle both air systems complete with mounting brackets f) fan drive to deliver 1100 RPM's --- sufficient to lift split soybeans g) waste product discharge on left side of cleaner h) vibrating conveyor to discharge clean side on right side of cleaner i) safety guards as required j) drives and motor as required operable on 220 V, 60 Hz, 3 phase k) replacement parts (selected by supplier) not to exceed $200 l) screens as follows: Round Hole: 12;14;16;18 Slotted Hole 1/16 x 1/2; 1/15 x 1/2; 1/14 x 1/2 (2); 7 x 3/4; 9 x 3/4; 10 x 3/4; 11 x 3/4 (cross-slot); Ferrell-Ross (A.T. Ferrell) Clipper Super X-298 D Cleaner or equivalent Est. Cost FOB Supplier $13,900	
18	Seed Cleaner, air and screen type; cleaner to have four screens with adjustable shoe shake and screen pitch; two independent adjustable air systems; screen frame size 54-in. x 60-in. with synchronized brush type screen wipers; overall cleaner dimensions (extremes). 152½ in. long; 88-in. wide; 98½ in. height. Average capacity (rice) 70-100 bushels (1.4-2.0 MT) per hour clean seed. Complete with: a) roll-feed hopper	1

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
	b) adjustable speed feed roll c) fans mounted 45 degree angle to rear d) fan outlet equipped with transitions to discharge air liftings into one cyclone e) cyclone of recommended size to handle both air systems complete with mounting brackets f) fan drive to deliver 1100 RPM's g) waste products discharge on right side of cleaner h) vibrating conveyor to discharge clean seed on left side of cleaner i) safety guards as required j) drives and motor as required operable on 220V, 60 Hz, 3 phase k) replacement parts (selected by supplier) not to exceed $200 l) screens as follows: Round Hole: 12; 14; 20; 22, 24; 30 Slotted Hole: 1/16 x ½; 1/15 x ½; 1/14 x ½; 7 x 3/4; 11 x 3/4; 12 x 3/4 Ferrell-Ross (A.T. Ferrell) Clipper Super X-298 D Cleaner or equivalent Est. Cost FOB Supplier $13,900	
19,20	Elevator, belt-bucket type; 28 ft. (8.4 M) discharge height; 175 bushel per hour (4MT) capacity at 110-125 FPM belt speed. All metal construction; complete with: a) belting, buckets and assembling hardware b) dump hopper c) two-way valve, 6-inch, with transitions and adaptors d) four (4) adjustable elbows, 6-inch e) six (6) loose flanges f) five (5) 10 ft. sections, 6-inch, rigid	2

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
	metal spouting (12 ga) flanged both ends g) drive and motor of required horsepower (with magnetic starter) operable on 110V, 60 Hz, 1 phase h) replacement parts selected by supplier not to exceed $100 Universal Industries Model C2-175 "Easy Dump" Elevator or equivalent Est. Cost FOB Supplier $4,300 (for 2 units)	
21,22	Surge bin; metal construction, 5 ft. x 5 ft. x 5 ft. (1.5 M x 1.5 M x 1.5M) bin sidewalls, center discharge hoppered bottom bin, 2 MT capacity. Discharge opening 6 inches square, equipped with slide-gate. Note: Bins (2) should be mounted in single support frame Local Fabrication Est. Cost $1,000 (for 2 units)	2
23,24	Elevator, belt-bucket type; 35 ft. (10.5M) discharge height; 175 bushel per hour (4MT) capacity at 110-125 FPM belt speed All metal construction; complete with: a) belting, buckets and assembling hardware b) dump hopper c) two-way valve, 6-inch with transitions and adaptors d) six(6) 45 degree elbow, 6-inch with slip ring e) two (2) adjustable elbows, 6-inch f) ten (10) loose flanges g) five (5) 10 ft. sections, 6-inch, rigid metal spouting (12 ga.) flanged both ends h) ten (10) clamp rings i) two (2) dead stops, 6-inch j) one (1) 20 ft. flexible spouting, 6-inch k) drive and motor of required horsepower (with magnetic starter) operable on 110V, 60 Hz, 1 phase	2

APPENDIX I. (cont.)

Item No.	Description	No. Req'd.
	1) replacement parts selected by supplier not to exceed $50 Universal Industries Model C2-175 "Easy Dump" elevator or equivalent Est. Cost FOB Supplier $6,200 (for 2 units)	
25	Surge bin, metal construction, 4 ft. x 4 ft. x 25 ft. (1.2M x 1.2M x 0.8M) bin sidewalls, center discharge double hopper-ed bottom bin, 1.1 MT capacity. Discharge openings 6-inches square with slide-gates. Local Fabrication Est. Cost $350	1
26	Seed length (sizer) separator, disc type; 200 bushel (4 MT) cleaned seed per hour; with cast ends (for rice). Approximate dimensions: 7 ft. (2.1M) height; 4 ft. (1.2 M) width; 8 ft. (2.4 M) length. Complete with: a) discharge spout connectors b) drive and motor (with magnetic starter) operable on 220 V., 60 Hz., 3 phase. c) replacement parts selected by supplier Not to exceed $300 Note: Sample of rice varieties to be submitted to equipment manufacturer, when order is placed to determine correct disc pocket size, type and arrangement. CEA Carter-Day Model (2-high) 2527 Disc separator or equivalent Est. cost FOB Supplier $10,000	1
27,32	Elevator, belt-bucket type; 29 ft. (8.7M) discharge height; 175 bushel per hour (4 MT) capacity of 110-125 FPM belt speed/ All metal construction; complete with: a) belting buckets and assembling hardware b) dump hopper c) two(2) adjustable elbows, 6-inch d) two-way valve, 6-inch with transitions and adaptors	2

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
	e) dead stop, 6-inch f) ten (10) flanges, 6-inch g) four (4) 10 ft. sections, 6-inch rigid metal spouting (12 ga.) flanged both ends h) drive and motor of required horsepower (with magnetic starter) operable on 110V, 60 Hz, 1 phase Universal Industries Model C2-175 "Easy Dump" elevator or equivalent Est. Cost FOB Supplier $5,000 (for 2 unit)	
28,37,38	Surge bin; metal construction, 5 ft. x 5 ft. x 5 ft. (1.5M x 1.5M x 1.5 M) bin sidewalls, center discharge hoppered bottom bin, 2 MT capacity. Discharge opening 6-inches square, equipped with slide gate. Note: Bins 37 and 38 should be mounted in a single support frame Local Fabrication Est. Cost $1,500 (for 3 units)	3
29	Spiral separator assembly, 125 bushel (3.4 MT) per hour capacity (soybean). Complete with: a) five (5) heavy duty spiral separators b) surge bin with leveling auger assembly c) support framing for spirals and surge bin d) two(2) belt conveyors (6-inch) to transport discharged products. Approximate length 8 ft. (2.4 M) e) drives and motors operable on 220V, 60 Hz., 1 phase f) replacement parts not to exceed $100 Note: Spiral assembly will be mounted atop two (2) 6 ft. square, hoppered-bottomed bins, "Whole seed" will be discharged into one bin; "splits"into the other	1

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
	Suggested Vender: Hagen Mfg. Co. (Special Fabrication required) Est. Cost FOB Supplier $5,000	
30,31	Surge bin, metal construction, 6 ft. x 6 ft. x 4 ft. (1.8M x 1.8M x 1.2M) bin sidewalls; center discharge hoppered-bottom bin, 3 MT capacity. Discharge opening 6-inches square, equpped with slide gate. Note: Both bins should be mounted in single support frame. Framing must support weight of bins; seed and spiral assembly. Local Fabrication Est. Cost $1,800 (for 2 units)	2
33	Surge bin; metal construction, 4 ft. x 4 ft. x 3 ft. (1.2M x 1.2M x 1.0M) bin sidewalls, center discharge hoppered-bottom bin, 1 MT capacity. Discharge opening 6-inches square, equipped with slide-gate. Local Fabrication Est. Cost $300	1
34	Width and thickness Grader; for seed separations made by revolving cylinders with slotted (oblong) or round openings. All metal construction; quick cylinder change features; approximate O.A. Dimensions of separator: 33in. wide; 84 in. long; 45 in. wide. Complete with: a) vibrator conveyor to discharge "thrus" product at tailings end of machine b) two (2) size MS slotted hole cylinder assemblies (for corn) c) two (2) size 13 S slotted hole cylinder assemblies (for corn) d) two (2) size 16 R round hole cylinder assemblies (for corn)	1

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
	e) two (2) size 7¼ R round hole (ribbed) (for rice) f) drive and motor of required horsepower operable on 110V, 60 Hz, 1 phase g) replacement parts not to exceed $150 CEA Carter-Day Model No. 2 Precision Grader or equivalent Est. Cost FOB Supplier $5,400	
35,36	Elevator, belt-bucket type; 22 ft.(6.6M) discharge height; 175 bushel per hour (4 MT) capacity at 110-125 FPM belt speed. All metal construction; complete with: a) belting, buckets and assembling hardware b) dump hopper c) adjustable elbow, 6-inch d) 10 ft. section, 6-inch rigid spouting (12 ga.) flanged both ends e) drive and motor of required horsepower operable on 110V, 60 Hz, 1 phase Universal Industries Model C2-175 "Easy Dump" or equivalent Est. Cost FOB Supplier $2,800 (for two units)	2
39,40,41	Elevator, belt-bucket type; 12 ft. (3.6 M) discharge height; 175 bushel per hour (4 MT) capacity at 110-125 FPM belt speed. All metal construction; complete with: a)belting, buckets and assembling hardware b) dump hopper c) adjustable elbow, 6-inch d) 10 ft. section, 6-inch rigid spouting (12 ga.) flanged both ends e) drive and motor of required horsepower operable on 110V, 60 Hz. 1 phase	3

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
	Universal Industries Model C2-175 "Easy Dump" or equivalent Est. Cost. FOB Supplier $3,000 (for 3 units)	
42,43	Seed treater; stainless steel, up to 350 bushel per hour (7.5 MT) capacity. Treats seed with liquids or wettable powder products using Mist-O-Matic principle. Complete with: a) 6 ft. x 8-inch film coater with variable speed drive b) complete set of treatment application cups c) extra pump and hoses for application of a 2nd product d) drive and motors of required horsepower operable on 220V, 60 Hz, 1 phase e) replacement parts not to exceed $150 Gustafson Mfg. Co. Model SS-1 HC Seed treater or equivalent Est. Cost FOB Supplier $8,400 (for 2 units)	2
44,45	Surge bin; metal construction, 2M x 2M x 2.5M. Sidewalls center-discharge hoppered-bottom bin, 6.6 MT capacity Local Fabrication Est. Cost $1,800 (for 2 units)	2
46	Elevator, belt-bucket type; 28 ft. (8.4 M) discharge height; 500 bushel per hour (10 MT) capacity at 270 FPM belt speed. All metal construction complete with: a) belting, buckets and assembling hardware b) dump hopper	1

APPENDIX I. (cont.)

Item No.	Discription	No. Req'd
	c) adjustable elbow, 6-inch d) 10 ft. section, 6-inch rigid spouting (12 ga.) flanged both ends e) 6-inch, 45 degree elbow with slip ring f) drive and motor of required horsepower operable on 110V, 60 Hz. 1 phase g) dump hopper cover h) replacement parts not to exceed $100 Universal Industries Model C2-500 or equivalent Est. Cost FOB Supplier $1,500	
47	Conveyor Drag-Flight Type one direction flow; 6-inch size; 1,100 cubic foot per hour (20 MT) capacity; high density polyethylene flights mounted on sprocket driven chain convey seed in formed U-trough; trough of 12 ga. metal; fitted with quick release 14 ga. all-weather cover. To consist of following (approx. 35 ft. overall length): a) 32 ft. length (total) conveyor. Note: specific section lengths required to be of determined after preparation of construction dwg's. b) two (2) standard by-pass inlets c) take-up head section d) contoured tail section e) two (2) standard intermediate discharge spouts with rack and pinion curved slide, hand wheel operated f) drive and motor of required horsepower (with magnetic starter) operable on 110V, 60 Hz., 1 phase Screw Conveyor Corporation No. 6 Super-Flo Conveyor or equivalent Est. Cost FOB Supplier $1,800	1

APPENDIX I. (cont)

Item No.	Description	No. Req'd
48	Gravity conveyor; roller type, 10 ft. (3M) length x 2 ft. (0.6M) width; 3-inch roller spacing; steel construction Burrows Equipment Co. No. 135-24-3-SS Gravity roller conveyor or equivalent Est. Cost FOB Supplier $200 (for two units)	2
49	Bagging scale; semi-automatic. Complete with : bag tare device; flow control inlet gate; calibrated weigh beam; graduated over-under weight indicator; weight range 25-60 Kgs.; quick bag release and mounting attachments for connection to underside of surge b n. Howe-Richardson Model G-17 Automatic Gross Bagger or equivalent Est. Cost FOB Supplier $2,000 (for two units)	
50	Sewing head (bag closer); for paper and textile bags. Complete with replacement parts kit, operable on 110V, 60 Hz, 1 phase. Portable. Dave Fischbein Company Model D Portable bag closer or equivalent Est. Cost FOB Supplier $2,000 (for 4 units)	4
51	Surge bin; metal construction, 3 ft. x 3 ft. x 2 ft. (0.9M x 0.9M x 0.6M) bin sidewalls, center-discharge hoppered-bottom bin, 0.4 MT capacity Local Fabrication Est. Cost $500 (for 2 units)	2
52	Drying and storage bin; round type, of corrugated metal; 27 ft. (8M) diameter;	2

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
	13.5 ft. eave height, 20 ft. (6M) O.A. height. To consist of foundation ring and five standard 32-inch rings of following gauges: 14, 17, 17, 18, 20 Complete with: a) all assembling hardware and instructions b) center-fill roof ventilator c) four roof man holes with covers d) roof ladder e) walk-in door with door boards (door opening in 1st and 2nd full rings) f) channelox perforated drying floor with flashing hardware and metal floor support standards g) tube-well bin unloading kit including auger h) powerhead with quick connect clamp, complete with drive and motor sized to convey 10 MT per hour (maximum) NOTE: Only one (1) powerhead required for the two (2) bins i) bin sweep auger. NOTE: Only one (1) required for the two (2) bins j) outside wall ladder k) inside ladder l) fan transition inlet collar m) manufacturers recommended areation fan m) all motors to be operable on 110V, 60 Hz., 1 phase or 220 V, 60 Hz. 3 phase. Read Steel Products Model BB-73 Modified or equivalent Est. Cost FOB Supplier $16,500 (For 2 units)	
53,66	Conveyor, belt-type; 16 ft. (4.8M) length; portable, aluminum construction, 500 bushels (10MT) per hour (shelled corn) capacity; 4 ply Neoprene impregnated belt, 6-inch wide with 1-inch high flights riveted to belt every 12 inches Complete with:	2

APPENDIX I. (cont)

Item No.	Description	No. Req'd
	a) overhead motor mount b) drive and motor operable on 110V, 60 Hz., 1 phase Burrows Equipment Co. Portable Aluminum Series 2500 Belt Conveyor or equivalent Est. Cost FOB Supplier $1,200 (for two units)	
54	Conveyor screw (auger) type, one direction flow; 6-inch (screw diameter) size; 10 MT per hour capacity; heavy duty screw (auger) conveys seed in formed U-tough; trough of 12 ga. metal, fitted with quick release 14 ga. all-weather cover to consist of following (approx. 30 ft. overall length): a) inlet hopper with transitions to accept 6-inch diameter spouting b) discharge spout c) drive and motor of required horsepower operable on 220 V, 60 Hz., 3 phase; with magnetic starter. Screw Conveyor Corporation Horizonal screw conveyor or equivalent Est. Cost FOB Supplier $900	1
55	Conveyor Screw(auger) type, one directon flow; 6-inch (screw diameter) size; 10 MT per hour capacity (shelled corn) heavy duty screw (auger) conveys seed in formed U-trough; trough of 12 ga. metal fitted with quick release 14 ga. all-weather cover. To consist of following (approx. 26 ft. overall length): a) inlet hopper b) discharge spout complete with transitions and adapters to connect 2-way look-out valve to the discharge outlet c) two-way lookout valve with transitions to accept 6" diameter round, flanged, spouting	1

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
	d) drive (heavy duty) and motor of required horsepower (with magnetic starter) operable on 220 V, 6 Hz. 3 phase e) replacement parts selected by supplier not to exceed $100 Screw Conveyor Corporation Horizonal screw conveyor or equivalent Est. Cost FOB Supplier $1,000	
56	Elevator, belt-bucket type; 34 ft. (10.2M) discharge height; 500 bushel per hour (10 MT) capacity at 270 FPM belt speed. All metal construction, complete with: a) belting, buckets and assembling hardware b) dump hopper c) three-way valve, 6-inch, with adapters and transitions d) bottom-boot cleanout with 4-inch legs e) three (3) 6-inch adjustable elbows with clamp rings f) two (2) 10 ft. sections, rigid, 6-in. rigid spouting (12 ga.) flanged both ends g) service ladder (26 ft.) h) safety cage (26 ft.) i) service platform j) weather and dust sealing k) vent opening in head l) drive guard and backstop m) dead stop, 6-inch n) two (2) 6-inch 45 degree elbow with slip ring o) drive and motor (with magnetic starter) of required horsepower operable on 220V, 60 Hz., 3 phase p) replacement parts to be selected by supplier not to exceed $100 Universal Industries Model C2-500 or equivalent	1

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
	Est. Cost FOB Supplier $3,200	
57	Corn Sheller; sheller to be suitable for seed corn; up to 400 bushels (12 MT) per hour capacity. Approximate cyclinder spped 1000-1100 RPM; Approximate dimensions: 4 ft. (1.2M) O.A. height; 3 ft. (0.9M) O.A. width; 6 ft. (1.8M) O.A. length. Complete with: a) drive and motor (with magnetic starter) operable on 220 V., 60 Hz., 3 phase b) replacement parts ie. belts, etc. selected by supplier not to exceed $200 Ehrsam Co. Model 3-C Triumph Corn Husker-Sheller or equivalent Est. Cost FOB Supplier $3,800	1
58	Surge bin; metal construction, 4 ft. x 4 ft. x 3 ft. (1.2M x 1.2M x 1.0M) bin sidewalls, hoppered bottom, center-discharge bin. Discharge opening sized to fit inlet of corn sheller Local Fabrication Est. Cost $300	1
59	Conveyor, chain-type Portable; lightweight construction ; 20 ft. (6M) length; up to 10 MT per hour (ear corn) capicity. Complete with: a) Overhead motor mount b) drive and motor of required horsepower operable on 110V, 6 Hz., 1 phase c) replacement parts ie. chair links, belts, etc. selected by supplier not to exceed $100 Burrows Equipment Co. No. 2200 Lightweight portable aluminum elevator Est. Cost FOB Supplier $600	1

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
60	Belt conveyor; horizonal, 55 ft. (16.5M) length; dual idlers to trough shaped belt; 18-inch (.45M) belt of 2-ply nylon rubber coated; rated capacity of 10 MT seed per hour, channel beam frame construction with: a) discharge housing b) drive guard c) flat frame cover d) tail assembly weather cover e) trough side board skirts f) recommended drive and motor of required horsepower (with magnetic starter) operable on 220V, 60 Hz., 3 phase g) replacement parts not to exceed $100 Universal Industries Model 3220-18 Dual Idler Conveyor or equivalent Est. Cost FOB Supplier $4,900	1
61	Belt Conveyor; horizontal, 60 ft. (18M) length; dual roll idlers to trough shaped belt; 18-inch (.45M) belt of 2-ply nylon rubber coated; rated capacity of 10 MT seed per hour; channel beam frame construction with: a) discharge housing b) drive guard c) flat frame cover d) tail assembly weather cover e) trough sideboard skirts f) five (5) trough hoppers with belt seals g) recommended drive and motor of required horsepower (with magnetic starter) operable on 220V, 60 Hz., 3 phase Universal Industries Model 3220-18 Dual Idler Conveyor or equivalent Est. Cost FOB Supplier $11,600 (for 2 units)	2

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
62	Heater-fan unit; for drying seed or grain; heater to be diesel oil burner modified to deliver 500,000 BTU per hour; fan to be centrifugal type capable of delivering 30,000 CFM at 1-inch static pressure, standard controls and safety devices; stemmed thermometer; all necessary electrical starters and mechanical drive components; electric drive motor to be sized to meet specifications and operable on 220 V, 60 Hz., 3 phase; spare parts selected by supplier not to exceed $150 American Drying Systems Model 815/3 S or equivalent Est. Cost FOB Supplier $5,800	1
63	Conveyor, chain-type. Portable; lightweight construction; 32 ft. (9.5M) length; up to 10 MT per hour (ear corn) capacity. Complete with: a) overhead motor mount b) drive and motor of required horsepower operable on 220 V., 60Hz., 3 phase. Burrows Equipment Co. No. 2200 Lightweight, portable , aluminum elevator or equivalent Est. Cost FOB Supplier $720	1
64	Conveyor, chain-type. Portable; lightweight construction; 28 ft. (7.2M) length; up to 10 MT per hour (ear corn) capacity. Complete with: a) overhead motor mount b) drive and motor of required horsepower operable on 220 V., 60 Hz., 3 phase Burrows Equipment Co. No. 2200 lightweight portable, aluminum elevator or equivalent Est. Cost FOB Supplier $620	1

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
65	Conveyor, belt-type; 28 ft.(8.4M) length; pertable aluminum construction; 10 MT per hour (ear corn) capacity (horizontal); 4 ply Neoprene impregnated belt, 6-inch wide with 1-inch high flights. Complete with: a) overhead motor mount b) drive and motor operable on 110 V, 60 Hz., 1 phase Burrows Equipment Co. Portable Aluminum Series 2500 Belt Conveyor or equivalent Est. Cost FOB Supplier $700	1
67	Ear corn sorting belt; 12 ft. (3.6M) length x 18-inch (.45M) width. Complete with: framing to give 42-inch (1.06M) belt height; variable speed drive (30 ft. to 80 ft. per minute) and motor of required horsepower operable on 220V., 60 Hz., 3 phase. Stone Model No. 12, 18" x 12 ft. Sorting Belt or equivalent Est. Cost FOB Supplier $1,100	1
68	Dehumidifier heavy duty industrial type, portable with castors, use R22 refrigerant Rated for removal of 1.8 pints water per hour at 65 degree F and 60% relative humidity. Operational on 220 volt, 60 Hz. 1 phase. The Singer Co., Climate Control Division, Model D-20 (Remington) dehumidifer or equivalent Est. Cost FOB Supplier $5,600 (for 8 units)	8
69	Air conditioner, thru-the-wall type, industrial model, rated for 45,000 BTU per hour Local Supplier Est. Cost FOB Supplier $4,200 (for 6 units)	6

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
70	Bag trier (sample probe); 1M (39-inch) length, 2.2 cm (7/8 inch) outside diameter, double tube, 6 openings Burrows Equipment Co. No. 536 Official Grain Trier or equivalent Est. Cost FOB Supplier $180 (for 6 units)	6
71	Gram scales with weighbeams calibrated as follows:(front) 10 x .1 gram; (rear) 100 x 10 gram; (center) 500 x 100 gram. Complete with scoop and attachment weight set to increase capacity of balance to 2610 grams. Burrows Equipment Co. No. 1301-S Gram scale or equivalent Est. Cost FOB Supplier $110	1
72	Torsion Balance Scale; capacity 120 g. dial 1.0g. x .01g. graduations; readibility 2 mg.; accuracy 5 mg. with polished steel scope, positive acting arrest, silicone fluid dash pots and metal case. Complete with Class P stainless weight set (50 gm. to 1g. in hinged box, with forceps). Burrows Equipment Co. DLM 2-1 Torsion Balance Scale or equivalent Est. Cost FOB Supplier $390	1
73	Fluorescent light and magnifier, desk model. Lens diameter 5-inch (12.7 cm); focal length 13-inch (33 cm); magnification three diopters. Burrows Equipment Co. No. 1819-D Light and Magnifier or equivalent Est. Cost FOB Supplier $110	1

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
74	Forceps, stainless steel, 5-inch with fine smooth point. Burrows Equipment Co. No. 1827 or equivalent Est. Cost FOB Supplier $20 (for 6 units)	6
75	Forceps, stainless steel, 5-inch with medium serrated point. Burrows Equipment Co. No. 1826 or equivalent Est. Cost FOB Supplier $20	6
76	Triphenyl Tetrazolium CI (TTC) (2,35 Triphenyl Tetrazolium Chloride). For chemical purposes Nutritional Biochemicals Corporation Est. Cost. FOB Supplier $200	200 grams
77	Seed germination towels, cut to 10-inch (25.4 cm) x 15-inch (38.1cm) size Anchor Paper Company Est. Cost FOB Supplier $300 (for 40 reams)	40 reams
78	Seed divider; all electric; wearing parts of heavy brass or copper, chrome plated throughout. Operable on 110V, 60 Hz., 1 phase. Gamet Precision Divider or equivalent Est. Cost FOB Supplier $400	1
79	Germinator; approx. dimensions: 25" wide x 18" depth x 29" height. Fully automatic with moisture pan and fresh air chamber; insulated rust proof cabinet and thermopane plexiglass door. Containing: eight (8) aluminum trays,	2

APPENDIX I. (cont)

Item No.	Description	No. Req'd
	dial thermometer, strip heaters. Operable on 110V, 60 Hz., 1 phase. Seedburo Equipment Co. L-D Germinator or equivalent Est. Cost FOB Supplier $780 (for two units)	
80	Sling psychrometer, complete with six (6) replacement thermometers and package of extra wicks Burrows Equipment Co. "Weksler" pocket type or equivalent Est. Cost FOB Supplier $50 (for two units)	2
81	Hygrothermograph; drum type, with 7 day clock. Approximate response time: Relative humidity-2 min.; Temperature - 3 min. Complete with 500 weekly recording charts and special recording ink. Seedburo Equipment Co. Bendix No. 594 Hygrothermograph or equivalent Est. Cost Fob Supplier $400	1
82	Set of twenty four (24) hand screens. 22.8 cm x 22.8 cm (9 x 9-inch) complete with screen rack. Screens sized as follows: Round Hole: 8, 10, 14, 16, 18, 20, 22, 24,26,28,30 Slotted Hole: 1/16 x 1/2 1/15 x 1/2 1/14 x 1/2 1/13 x 1/2 1/12 x 1/2 5 x 3/4 6 x 3/4 7 x 3/4 8 x 3/4 9 x 3/4	1 set

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
	Slotted Hole: 10 x 3/4 11 x 3/4 12 x 3/4	
	Ferrell-Ross (A.T. Ferrell) Hand Test Screens or equivalent	
	Est. Cost FOB Supplier $250	
83	Vacuum Cleaner, industrial type, portable. Complete with dust bag; blower nozzle, hose connector; 4 m (13 ft.) of 5.0 cm (2 inch) diameter hose; operational on 110 V, 60 Hz., 1 phase current	2
	Seedburo Equipment Co. Model 430 "Tornado" vacuum or equivalent	
	Est. Cost Fob Supplier $1,000 (for 2 units)	
84	Hand Tachometer, checks speeds of shafts up to 4,000 RPM. Complete with tips.	2
	Burrows Equipment Co. No. 1436 Tachometer or equivalent	
	Est. Cost FOB Supplier $40 (for 2 units)	
85	Bag Conveyor, belt type, (17 ft. length) with capacity of 300 lbs. distributed load, 150 lb. unit load. Box type frame; 3 ply, grip belting 12" wide; belt speed approx. 50 ft. per minute; switch control (both ends) to start, stop and reverse belt direction; easily accessible pulley adjusents. Complete with undercarriage, drive and motor operable on 220 V., 50 Hz., 1 phase.	1
	Burrows Equipment Co. "R" Series Bag Conveyor or equivalent	
	Est. Cost FOB Supplier $1,000	
86	Platform bag truck; 4-wheels, rubber tires, two 10" x 3" wheels and two 8 x 2½"	2

APPENDIX I. (cont.)

Item No.	Description	No. Req'd.
	casters; steel frame with hardwood deck; heavy steel armored pockets, locked and bolted both ways; removable push handle (metal); load capacity of 3,500 pounds; 30 x 60 platform size. Burrows Equipment Co. No. 1053-B Bag Truck or equivalent Est. Cost FOB Supplier $600 (for 2 units)	
87	Bag truck, 2-wheel, with 22.8 cm (9 inch) nose; 20.3 cm (8 inch) wheels; rubber tires; 1.2m (48 inch) handles; roller bearings. Burrows Equipment Co. No. 1025 AR Minneapolis bag truck or equivalent Est. Cost FOB Supplier $520 (for 6 units)	6
88	Platform scale, portable, double beam type; 100 x ½ lb.; 1,000 lbs. capacity with counter poise weights (provided); open-type lever system; metal construction; corrosion resistant finish; with casters. (Calibrated in metric units of measurement) Fairbanks-Morse No. 1180 or equivalent Est. Cost FOB Supplier $300	1
89	Grain Scoops, Aluminum alloy construction, size 14 Burrows Equipment Co. No. 963 or equivalent Est. Cost FOB Supplier $120 (for 10 units)	10
90	Lamp guard; vapor proof, water tight, dustite. lamp for 100 watt bulb.	1

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
	Burrow Equipment Co. No. 2101 or equivalent Est. Cost FOB Supplier $40	
91	Sump Pump; approximate measurements 1 ft. x 1 ft. Capacity 3000 gallons per hour; hermetically sealed. Operable on 110 V., 60 Hz., 1 phase. Burrows Equipment Co. No. 1455 or equivalent Est. Cost FOB Supplier $800	5
92	Air compressor, portable, complete with: 30 gal. air tank. 25 ft. air hose; motor operable on 220 V., 60 Hz., 3 phase; replacement parts not to exceed $50. Sears Roebuck No. 30 GT 17388 N or equivalent Est. Cost FOB Supplier $600	1
93	Pressure Blower; 6-inch inlet diameter; rated for 600 CFM at 4-inches static pressure. Complete with explosion proof motor of required horsepower operable on 220 V., 60 Hz., 3 phase. McMaster-Carr Supply Co. No. 1953 N 63 or equivalent Est. Cost FOB Supplier $640 (for 2 units)	2
94	Truck Scale: shallow pit type, 30 ton capacity, 9 ft. x 30 ft. (2.7M x 9.0M) deck size with standard weightbeam calibrated in metric system. Burrows Equipment Co. Winslow type "P" truck scale or equivalent Est. Cost (less decking) FOB Supplier $5,000	1

APPENDIX I. (cont.)

Item No.	Description	No. Req'd
95	Polyethylene Film Sheeting, 6 mil thickness, 32 ft. (9.6M) x 100 ft. (30M) roll. McMaster-Carr Supply Co. No. 8553N23 Wide polyethylene film sheeting or equivalent Est. Cost FOB Supplier $300 (for 5 units)	5 rolls
96	Rigid Insulation, 2-inch (5cm) thickness Dow Chemical Co., Styrofoam "FR" or equivalent Est. Cost FOB Supplier $2,500	8,000 $ft.^2$
97	Fire Extinguisher; carbon dioxide type for Class "B"and "C" fires Clean odorless "Sno-Fog" discharge; 5 lb. weight Burrows Equipment Co. NO. 5R Extinguisher or equivalent Est. Cost FOB Supplier $150 (for 3 units)	3
98	Grain tank temperature detection system. Package system for eight (8) Read Steel Products 27 ft. dia. grain bins. Complete with nylon jacketed cable; three(3) cables per bin; five (5) T/C per cable; cable length 22 ft. (6.6M); portable potentiometer with jack handle. Note: Only one (1) potentiometer required for the eight tanks. George A. Rolfes Co. "hot-spot" temperature Scanning System Est. Cost FOB Supplier $1,500	1

APPENDIX II. SUPPLIER INDEX

Companies listed below are suppliers of the items shown in the Equipment Specification List. The referenced items may be available from sources in addition to those listed.

American Drying Systems
1135 N.W. 159th Drive
Miami, Florida 33169

Anchor Paper Company
430 Broadway
St. Paul, Minnesota 55101

Burrows Equipment Company **
1316 Sherman Avenue
Evanston, Illinois 60204

CFA. Carter-Day Company
500 73rd Avenue N.E.
Minneapolis, Minnesora 55432

Corn States Hybrid Service, Inc. *
P.O. Box 2706
Des Moines, Iowa 504'5

David Fischbein Company
2700 30th Avenue, South
Minneapolis, Minnesora 55406

Dow Chemical Company
Abbott Road
Midland, Michigan 48640

Ehrsam Company
300 North Cedar
Abilene, Kansas 67410

Ferrell-Ross
1621 Wheeler Street
Saginaw, Michigan 48601

George A. Rolfes Company
Box 458
Boone, Iowa 50036

Gustafson Manufacturing Co.
6600 South County Road 18
Hopkins, Minnesota 55343

Hagen Manufacturing Co.
1598 Texas Street
Memphis, Tennessee 38106

Howe-Richardson Scale Company
680 Van Houten Avenue
Clifton, New Jersey 07000

McMaster-Carr Supply Company
P.O. Box 4355
Chicago, Illinois 60680

Nutritional Biochemical Corporation
26201 Miles Road
Cleveland, Ohio 44128

Read Steel Products/Read International
906 North 40th Street
Box 7343-A
Birmingham, Alabama 35223

Screw Conveyor Corporation
700 Hoffman Street
Hammond, Indiana 46320

Sears, Roebuck and Company
Atlanta, Georgia 30395

Seedburo Equipment Company **
1022 West Jackson Boulevard
Chicago, Illinois 60607

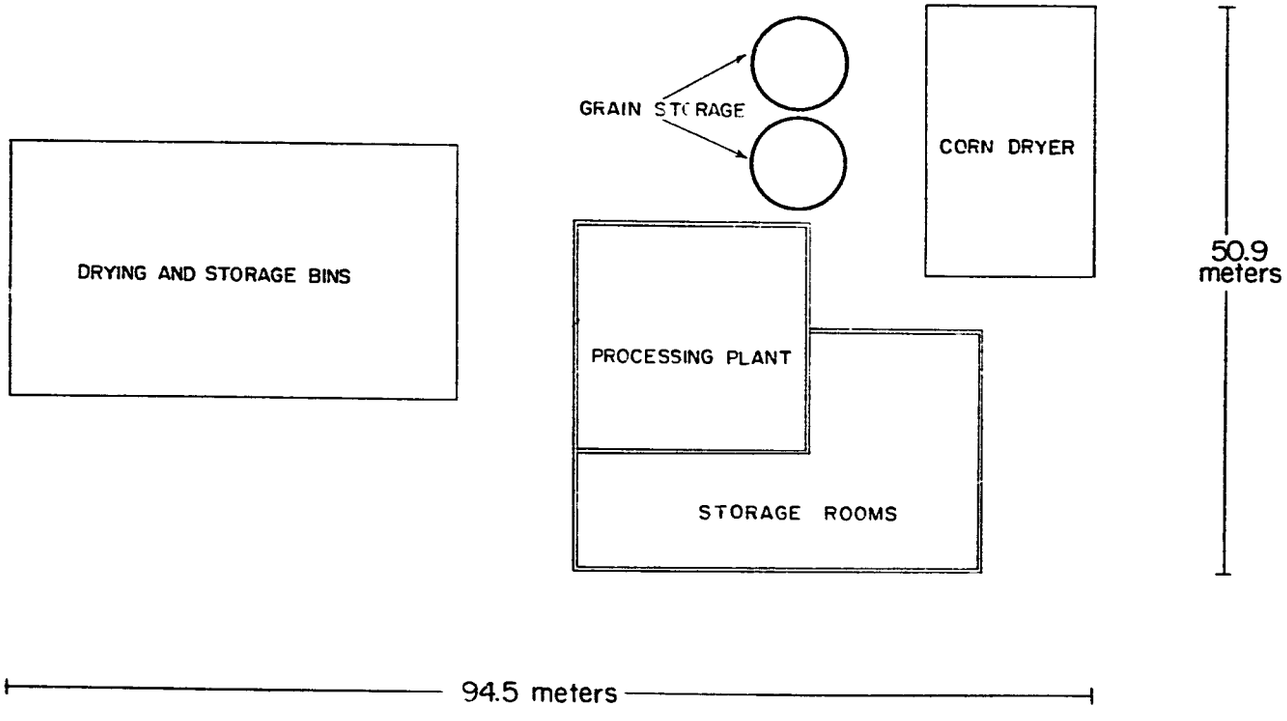
The Singer Company
Climate Control Division
62 Columbus Street
Auburn, New York 13021

Universal Industries
516 Grand Boulevard
Cedar Falls, Iowa 50613

* Supplier of Stone Sorting Belt (item 67) and other items
** Suppliers of Garnet Divider (item 78) and other items

A P P E N D I X 3

(DRAWINGS)



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SOYBEAN, RICE, CORN, SEED FACILITY
COASTAL REGION
ECUADOR

DESIGNED BY: GMD	DATE: JUNE, 1976	SHEET 1 of 7
DRAWN BY: GMD	FILE NO. TA76-10	
APPROVED BY: JCD		

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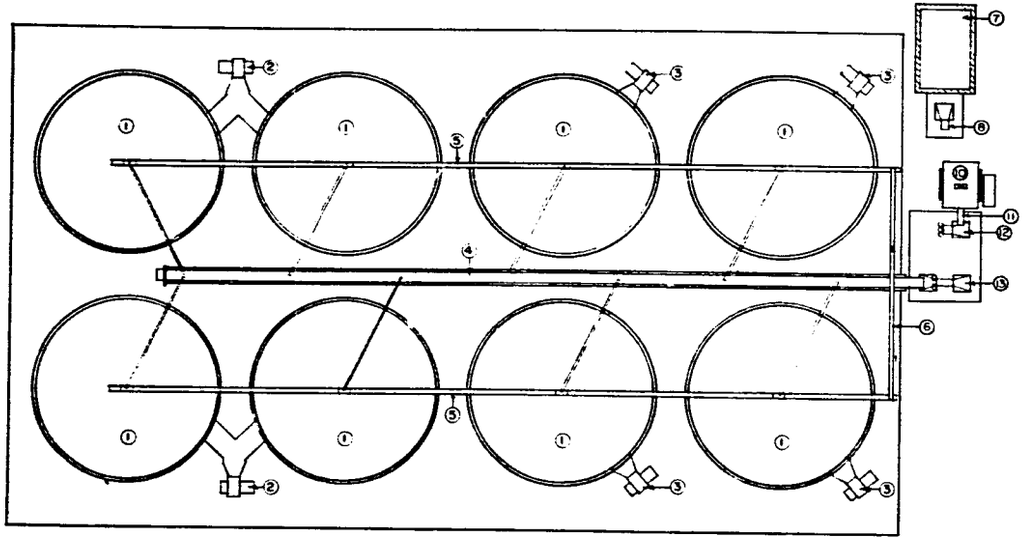

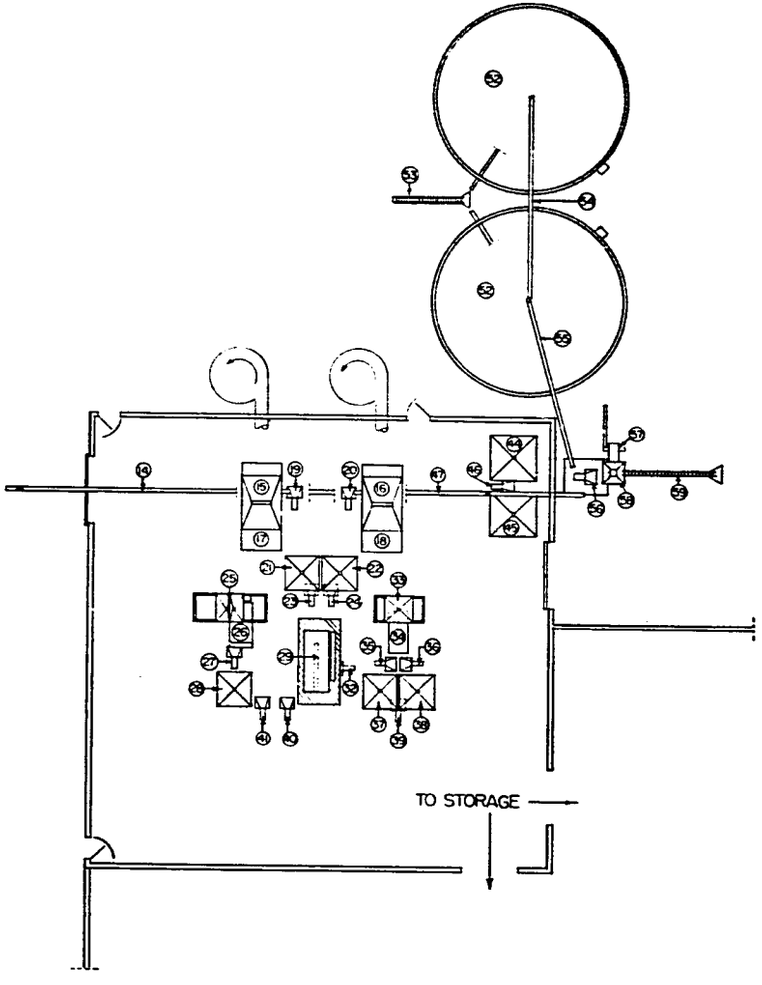

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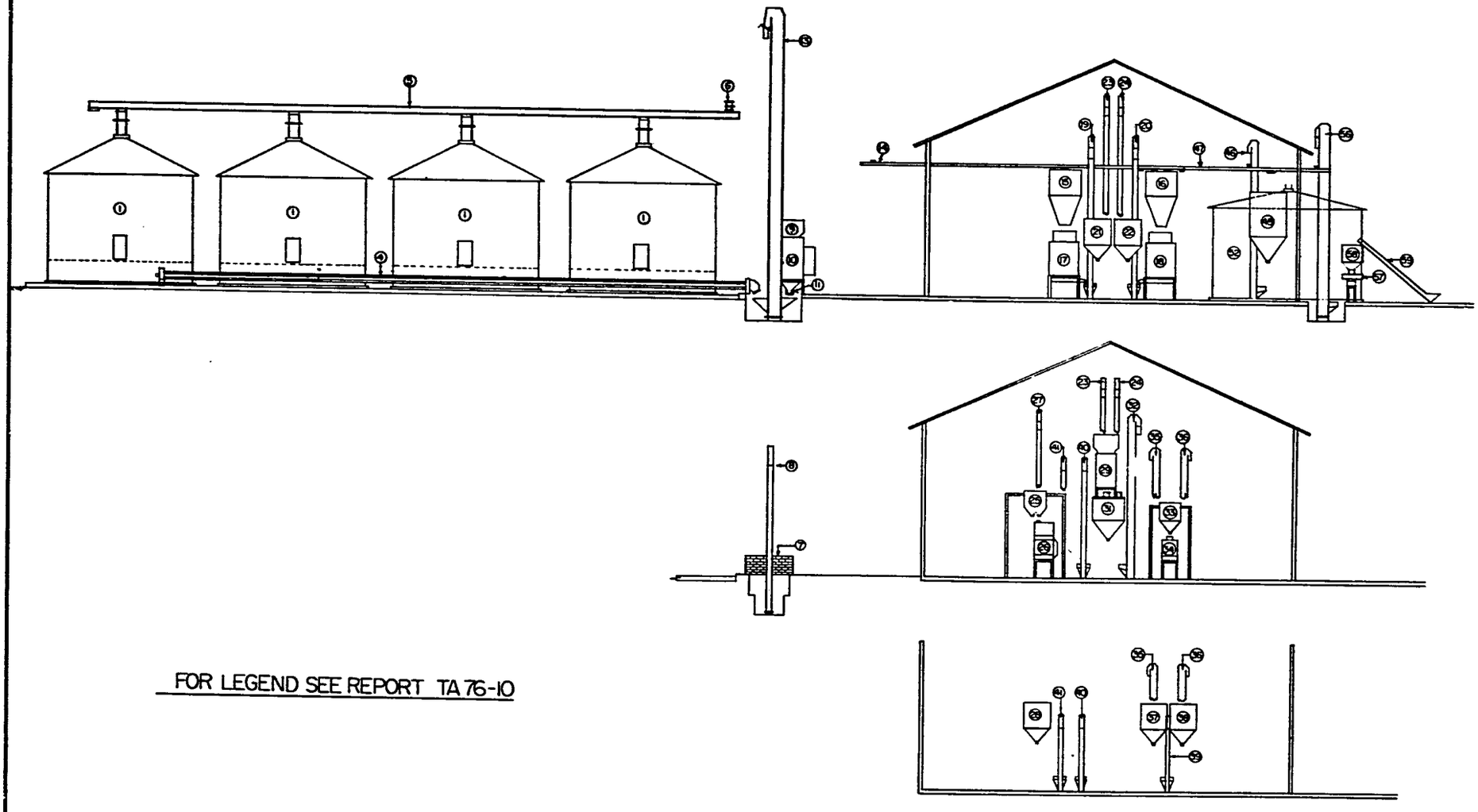

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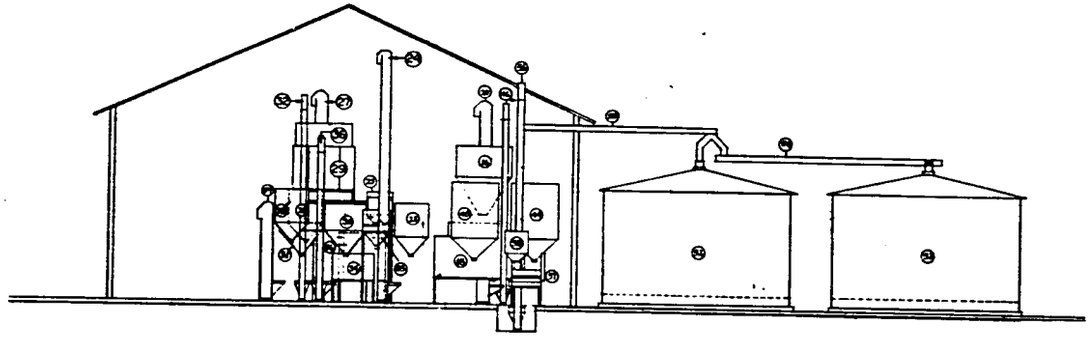

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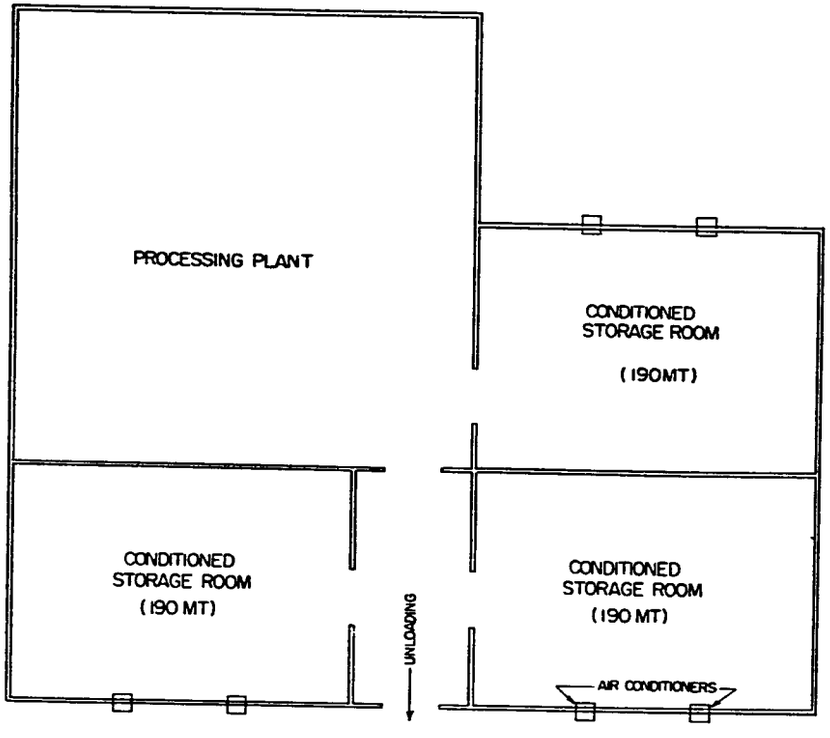

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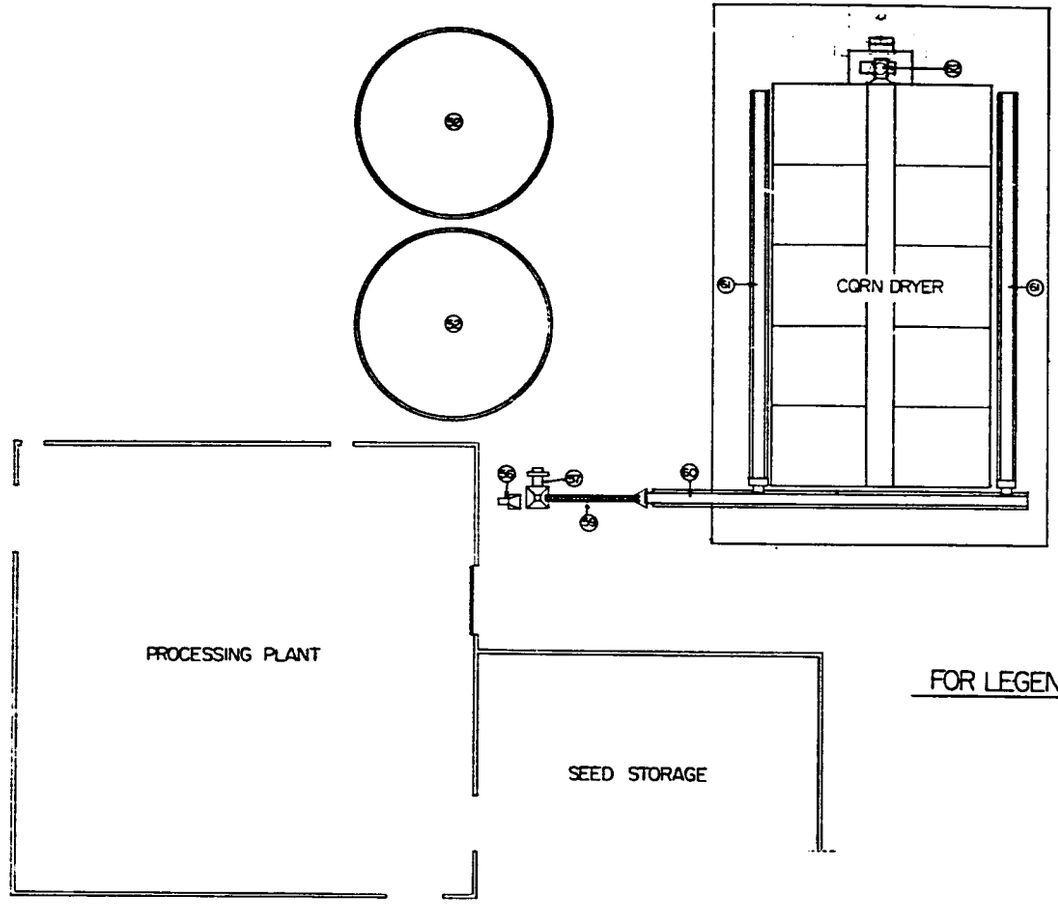

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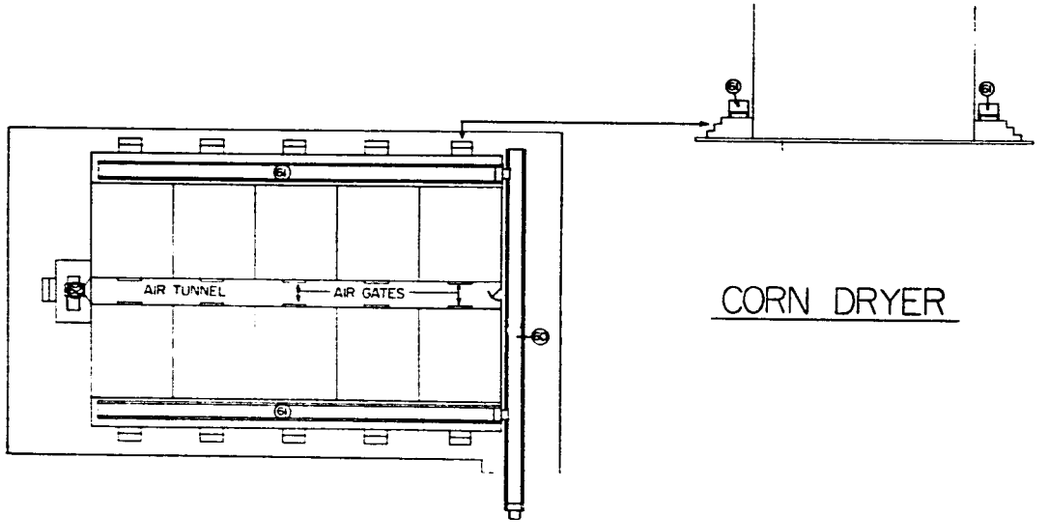
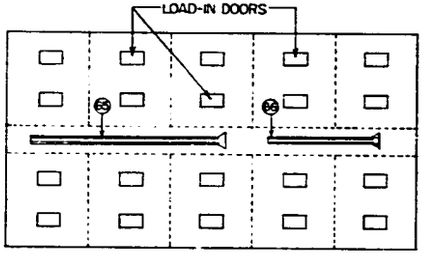


CORN DRYER



FLOOR OVER DRYING BINS

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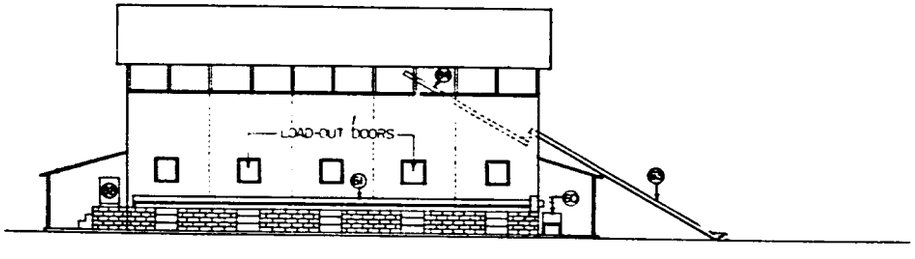

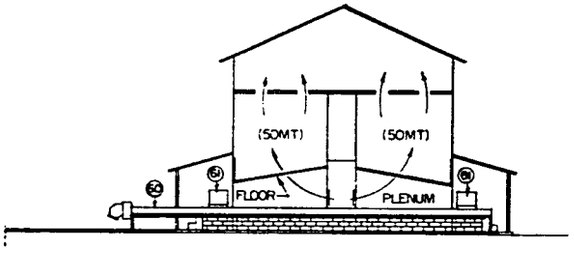

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