

# Engineering Report



## Refrigeration Engineering Corporation

P.O. Box 3-C / San Antonio, Texas 78217

5660 E. Houston Street / San Antonio, Texas 78220

Telephone (512) 662-3700 / Telex 272 532 RECO UR / FAX (512) 662-5875

Date

1/90

No.

105B

Subject: RECO CASCADE IQF FREEZERS

RECO's patented Cascade type IQF Freezer has a unique approach to initiating fluidization. By installing one or more "humps" (usually three) on the first stage of the Cascade System, full fluidization is started rapidly because of the variation in the incoming product density. The high velocity, low temperature air that is being directed from beneath the belt agitates, fluidizes and provides for uniform glazing of the product.

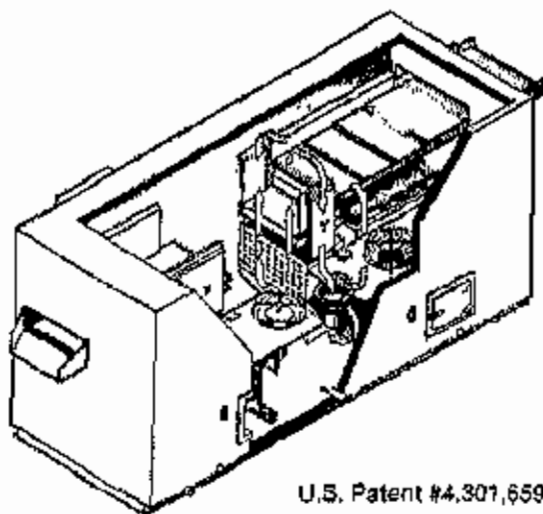


### IQF CASCADE SYSTEM

The Cascade System is an inline freezer (figure 1) providing positive transportation of the product. The product is loaded in a thin layer (1/2" to 2") on the first stage where fluidization is initiated. It is then transferred to the second stage where the product may be 4" to 8" deep. In this stage, the product is in dense phase fluidization. Each particle of product is surrounded by cold air which is directed from beneath the belt. Each belt has a hydraulic or electrical drive, both outside the freezing area, retention time on each belt and can be adjusted to provide proper freezing.

### RECO IQF FREEZER

RECO's Cascade IQF Freezer employs a unique approach to initiating fluidization. Standard sizes range from 1,600 to 24,000 pounds per hour.



U.S. Patent #4,301,659

### RECOMMENDED EQUIPMENT

The following product loading and belt conditioning devices are designed to help achieve maximum operating capacity and efficiency from the freezer tunnel. The type of device will vary slightly from product to product and the freezer may have one or several of these items.

**DEWATERING SHAKER (Wet Vegetables):** A proper dewatering device is necessary for efficient performance of the tunnel operation when processing wet vegetables. A part of the moisture carried into the freezer by the product is deposited on coils, thus reducing heat transfer. A good dewatering system is a necessity for an efficient freezer operation as it will control the time between defrost periods. RECO's performance guarantees are based on no more than 2% free water on the product to be frozen.

**SHAKER SPREADER:** This is an integral part of the dewatering shaker equipment. It is attached directly to the dewatering device. Its prime function is to distribute products evenly across the freezer loading belt. This assures coverage of the entire belt area, regardless of quantity. This is extremely important, because the proper product density is necessary to assure equal air distribution through the product. Equal air distribution improves fluidization. RECO's performance guarantees are based on equal distribution of product across the entire mesh belt.

**Note:** All dewatering and/or shaker equipment must be leveled properly to assure good product distribution. Separate shaker spreaders are also available.

**PRODUCT FEEDER (Optional):** This is a metering device which controls the amount of product flowing into the freezer. It is part of the essential equipment only if the product flow rate fluctuates more than 20% of the time. This device controls the thickness of product or product density on the belt and helps assure even air distribution across the loading belt.

**BELT WASHER AND DRYER:** The belt washer and dryer (usually on the first stage belt only) is used to clean frost and product debris off the belts to assure minimum air pressure drop and even air flow across the belt. It is required for wet product (vegetables) application.

Belt washers may be equipped with a timer, complete with a solenoid valve to turn the water on at selected time intervals. This device cuts down water consumption and cleans the belt regularly.

**BELT ENTRANCE HEATER:** The belt entrance heater consists of heater strips installed between the belt runner and belt support to eliminate ice build-up caused by wet product as it enters the freezer. This is required for wet product (vegetables) application.

**BELT LOADER (Fried Products, Large Portions):** The belt loader consists of multi-belts of various lengths, feeding at a 90° angle to the freezer belt. This multi-belt loader assures coverage of the entire width of the freezer belt.

## IQF FREEZER GENERAL DESCRIPTION

**REFRIGERATION EVAPORATOR:** The refrigeration effect of the RECO IQF Freezer is provided by an aluminum plate finned coil heat exchanger. RECO recommends, four to one, downfeed liquid recirculation.

The coil fin spacing is varied to assure maximum time between defrosts. Time between defrosts will vary with product and its water content.

**CENTRIFUGAL FANS:** Air distribution is provided by an aluminum centrifugal fan directly connected to an electric motor. The fans are selected for high efficiency and constant air delivery, assuring proper air flow at all times. Air volume is adjusted with inlet dampers.

**CONVEYOR SYSTEM:** The product conveyor employed in the freezer is comprised of the following components:

- ♦ Conveyor Mesh Belt - All stainless steel woven mesh belt with cross rods for support and carried by stainless steel side chains.
- ♦ Conveyor Drive Motors - With the hydraulic system, each belt is driven through a drive roll and sprockets by a hydraulic motor. The motor is complete with variable speed flow control valve, 3-way stop valve and safety relief valve. The hydraulic pumping station can be furnished with two 100% pumps with electric motors.

With the electrical drive system, each belt is driven by a variable speed drive complete with variable speed control mechanism.

- ♦ Conveyor Belt Support - The conveyor travels through the freezer on low friction polyethylene wear strips which protects the mesh against abrasion and wear and provides a low friction factor to reduce conveyor horsepower requirements.

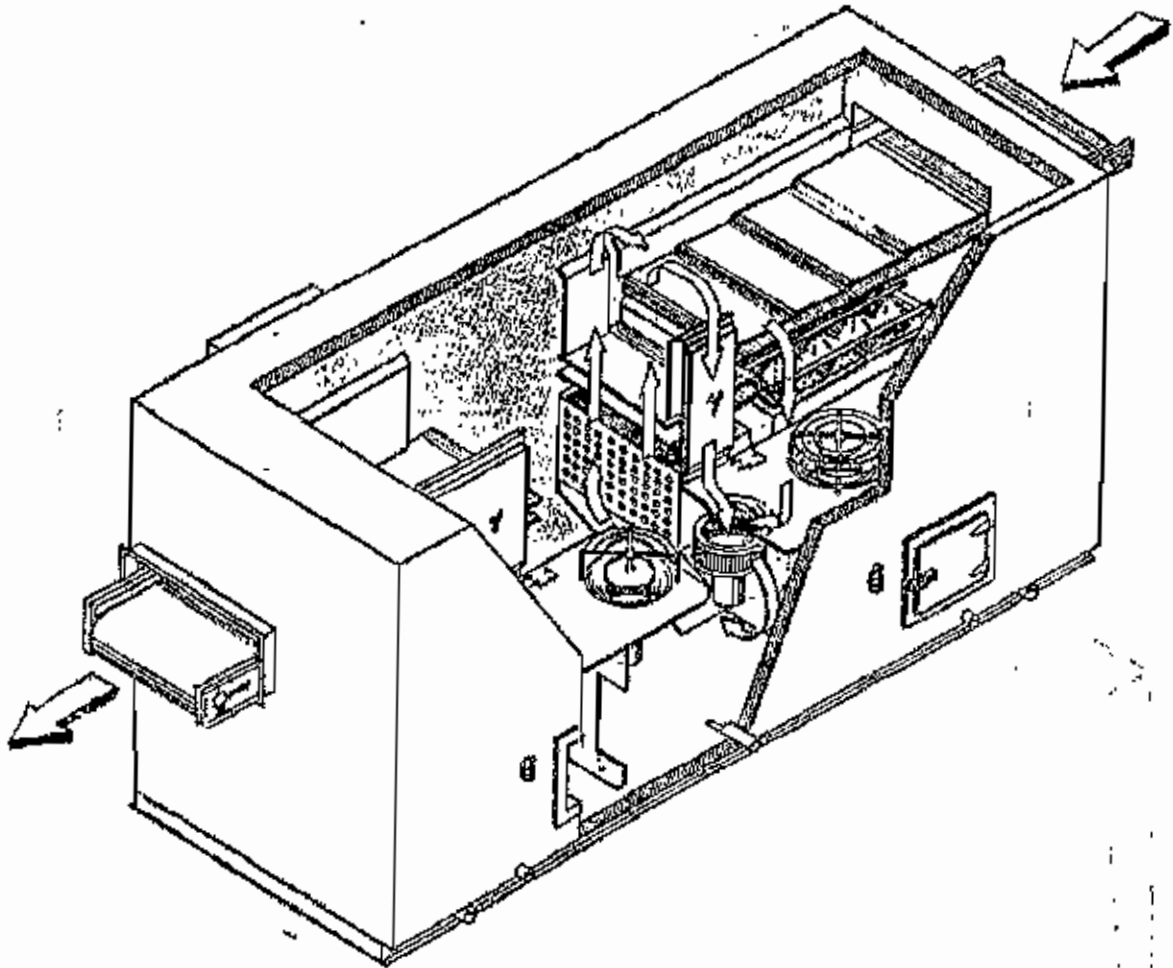
**DEFROST SYSTEM:** The coil defrost system is constructed of PVC pipe with spray nozzles to assure proper water distribution over the entire coil area.

**FREEZER ENCLOSURE:** The entire RECO IQF Freezer is assembled on a structural steel skid. The inner skin is all welded 304 stainless steel construction. It is fully insulated with 5" to 6" of polyurethane insulation with a vapor barrier. The freezer is equipped with stainless steel clad access doors at locations required for easy maintenance, cleaning and inspection. The exterior is covered with stainless steel clad marine plywood.

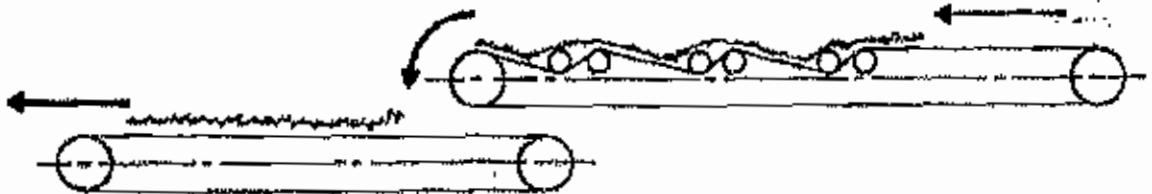
**ELECTRICAL CONTROL PANEL:** The electrical control panel can be mounted on the side or end of the freezer. It includes all necessary starters, switches, fuses and pilot lights for all motors, lights and heaters. All electrical components are water tight. Fan motors, lights, etc., are wired and conduits are properly sealed in the freezer.

Note: The panel can be installed at a remote location if desired.

FIG. #1



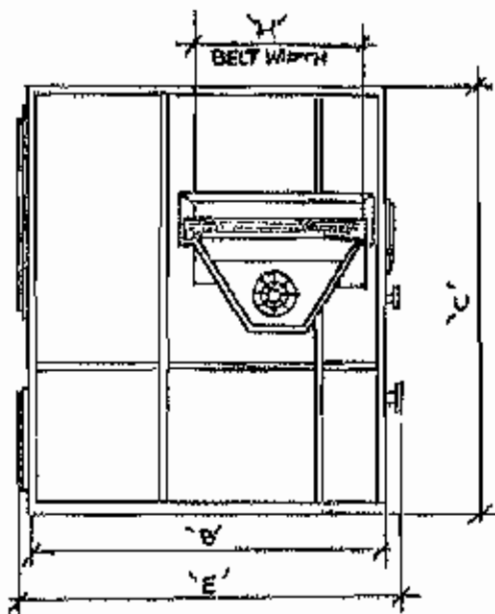
RECO CASCADE I.O.F.  
STANDARD INLINE FREEZER



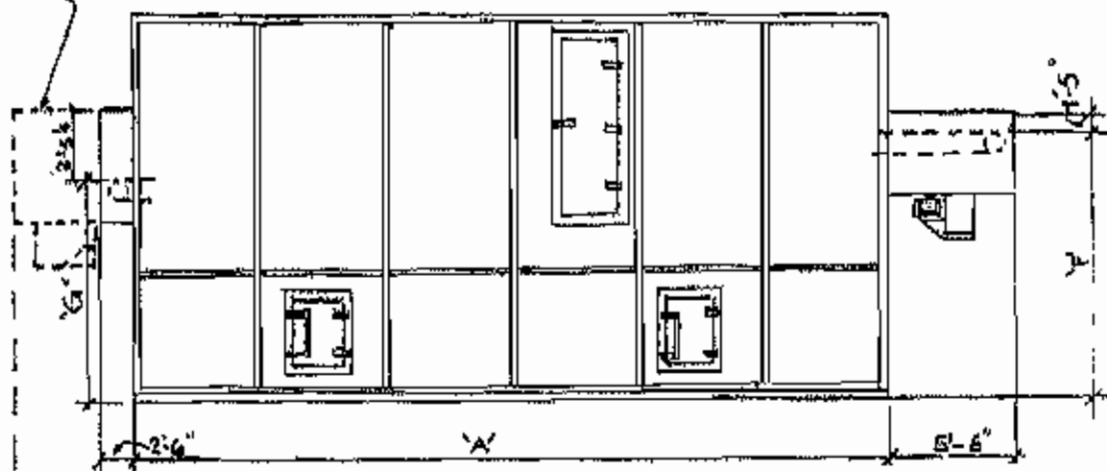
RECO CASCADE IQF FREEZER DIMENSIONS AND PHYSICAL DATA

Figure 2

| IQF MODEL NUMBER                 |   | 44    | 60    | 80    | 100   | 120   | 140   | 160   | 180   |
|----------------------------------|---|-------|-------|-------|-------|-------|-------|-------|-------|
| UNIT LENGTH                      | A | 21'0" | 25'0" | 29'0" | 33'0" | 37'0" | 41'0" | 45'0" | 41'0" |
| UNIT WIDTH                       | B | 10'6" | 10'6" | 10'6" | 10'6" | 10'6" | 10'6" | 10'6" | 11'6" |
| UNIT HEIGHT                      | C | 12'0" | 12'0" | 12'0" | 12'0" | 12'0" | 12'0" | 12'0" | 12'0" |
| OVERALL UNIT LENGTH              | D | 29'0" | 33'0" | 37'0" | 41'0" | 45'0" | 49'0" | 53'0" | 49'0" |
| OVERALL UNIT WIDTH               | E | 11'6" | 11'6" | 11'6" | 11'6" | 11'6" | 11'6" | 11'6" | 12'6" |
| LOADING BELT HEIGHT              | F | 8'3"  | 8'3"  | 8'3"  | 8'3"  | 8'3"  | 8'3"  | 8'3"  | 8'3"  |
| DISCHARGE BELT HEIGHT            | G | 7'0"  | 7'0"  | 7'0"  | 7'0"  | 7'0"  | 7'0"  | 8'0"  | 7'0"  |
| BELT WIDTH                       | H | 47"   | 59"   | 59"   | 59"   | 59"   | 59"   | 59"   | 71"   |
| SHIPPING WEIGHT<br>(APPROX. CWT) |   | 220   | 280   | 300   | 350   | 400   | 450   | 500   | 475   |



OPTIONAL BELT WASHER/DRYER



GENERAL INFORMATION FOR RECO CASCADE IQF FREEZER

TABLE I

| IQF MODEL NUMBER                               | 44   | 60   | 80   | 100   | 120   | 140   | 160   | 180   |
|--|------|------|------|-------|-------|-------|-------|-------|
| CAPACITY (PEAS) LBS/HR                         | 4400 | 6000 | 8000 | 10000 | 12000 | 14000 | 16000 | 18000 |
| BELT WIDTH FT                                  | 4    | 5    | 5    | 5     | 5     | 5     | 5     | 6     |
| PRODUCT INLET TEMP °F                          | 70   | 70   | 70   | 70    | 70    | 70    | 70    | 70    |
| PRODUCT OUTLET TEMP °F                         | 0    | 0    | 0    | 0     | 0     | 0     | 0     | 0     |
| TR REQUIREMENT                                 | 82   | 105  | 134  | 164   | 194   | 225   | 254   | 286   |
| *EVAP TEMP (°F)<br>RECIRCULATED                | -30  | -30  | -30  | -30   | -30   | -30   | -30   | -30   |
| NUMBER OF FREEZER FANS                         | 4    | 4    | 5    | 6     | 7     | 8     | 9     | 10    |
| FAN HP REQUIRED EACH                           | 15   | 15   | 15   | 15    | 15    | 15    | 15    | 15    |
| NUMBER OF BELT DRIVES                          | 2    | 2    | 2    | 2     | 2     | 2     | 2     | 2     |
| HYDRAULIC POWER MOTOR                          | 5    | 5    | 5    | 5     | 5     | 5     | 5     | 7½    |
| BELT DRYER                                     | 7-½  | 7-½  | 7-½  | 7-½   | 7-½   | 7-½   | 7-½   | 10    |
| **BELT WASHER WATER<br>REQUIRED EACH (15 PSIG) | 25   | 30   | 30   | 30    | 30    | 30    | 30    | 40    |
| *** DEFROST WATER<br>REQUIRED 15 PSIG          | 180  | 256  | 320  | 352   | 400   | 432   | 480   | 510   |

\* Measured at IQF Freezer Coils  
 \*\* Belt Washer Water at 90°F  
 \*\*\* Defrost Water at 70°F

SELECTION TABLE FOR VEGETABLES AND FRUIT  
(Average 70°F Entering Product)

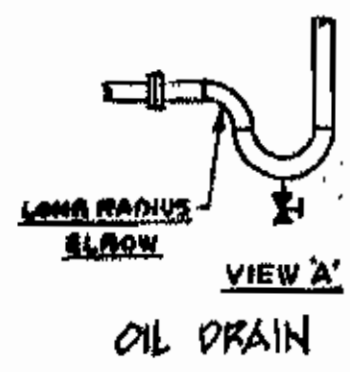
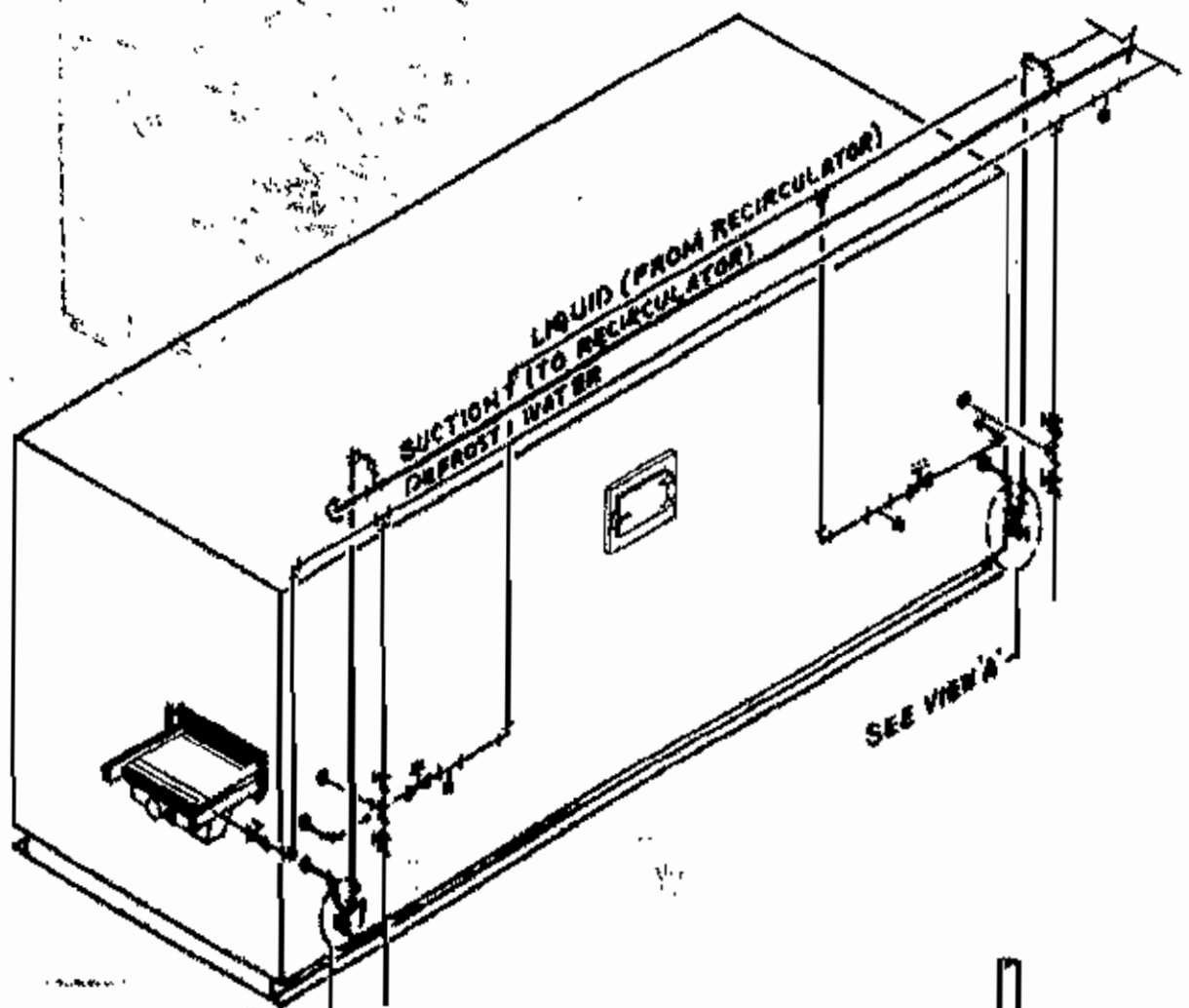
TABLE II

| IQF MODEL NUMBER                       | P.F. |       | 44   | 60   | 80   | 100   | 120   | 140   | 160   | 180   |
|--|------|-------|------|------|------|-------|-------|-------|-------|-------|
| *GREEN BEANS<br>Cut 1-1 1/2"           | .92  | lb/hr | 4048 | 5520 | 7360 | 9200  | 11040 | 12880 | 14720 | 16560 |
|  |      | TR    | 88   | 113  | 144  | 177   | 210   | 242   | 274   | 309   |
| *BROCCOLI<br>Cut 1 1/2"                | .80  | lb/hr | 3520 | 4800 | 6400 | 8000  | 9600  | 11200 | 12800 | 14400 |
|  |      | TR    | 80   | 102  | 131  | 160   | 189   | 218   | 247   | 278   |
| *CARROTS<br>Sliced 3/8"                | .83  | lb/hr | 3652 | 4980 | 6640 | 8300  | 9960  | 11620 | 13280 | 14940 |
|  |      | TR    | 81   | 103  | 132  | 161   | 191   | 220   | 249   | 281   |
| *CAULIFLOWER<br>Florets 1"             | .70  | lb/hr | 3080 | 4200 | 5600 | 7000  | 8400  | 9800  | 11200 | 12600 |
|  |      | TR    | 74   | 94   | 119  | 146   | 172   | 198   | 224   | 252   |
| *CUT CORN                              | .90  | lb/hr | 3960 | 5400 | 7200 | 9000  | 10800 | 12600 | 14400 | 16200 |
|  |      | TR    | 76   | 97   | 124  | 152   | 179   | 207   | 233   | 263   |
| *COB CORN 5"                           | .70  | lb/hr | 3080 | 4200 | 5600 | 7000  | 8400  | 9800  | 11200 | 12600 |
|  |      | TR    | 65   | 82   | 103  | 125   | 148   | 170   | 191   | 216   |
| *ONIONS<br>Diced 3/8"                  | .83  | lb/hr | 3652 | 4980 | 6640 | 8300  | 9960  | 11620 | 13280 | 14940 |
|  |      | TR    | 80   | 102  | 131  | 160   | 189   | 218   | 247   | 278   |
| *PEAS, Blackeyed,<br>Sweet, Green      | 1.00 | lb/hr | 4400 | 6000 | 8000 | 10000 | 12000 | 14000 | 16000 | 18000 |
|  |      | TR    | 82   | 108  | 134  | 165   | 195   | 225   | 254   | 287   |
| *PEPPER<br>Green, Sliced               | .90  | lb/hr | 3960 | 5400 | 7200 | 9000  | 10800 | 12600 | 14400 | 16200 |
|  |      | TR    | 88   | 113  | 145  | 178   | 211   | 244   | 276   | 310   |
| POTATOES, Crinkle<br>Cut, French Fried | .80  | lb/hr | 3520 | 4800 | 6400 | 8000  | 9600  | 11200 | 12800 | 14400 |
|  |      | TR    | 72   | 92   | 117  | 142   | 168   | 194   | 219   | 247   |
| BLUEBERRIES<br>3/8"                    | .92  | lb/hr | 4048 | 5520 | 7360 | 9200  | 11040 | 12880 | 14720 | 16560 |
|  |      | TR    | 80   | 103  | 131  | 161   | 190   | 220   | 248   | 280   |
| CHERRIES,<br>Soup                      | .80  | lb/hr | 3520 | 4800 | 6400 | 8000  | 9600  | 11200 | 12800 | 14400 |
|  |      | TR    | 74   | 93   | 119  | 145   | 171   | 198   | 223   | 251   |
| STRAWBERRIES<br>1"                     | .67  | lb/hr | 2948 | 4020 | 5360 | 6700  | 8040  | 9380  | 10720 | 12060 |
|  |      | TR    | 68   | 86   | 109  | 133   | 157   | 181   | 204   | 229   |

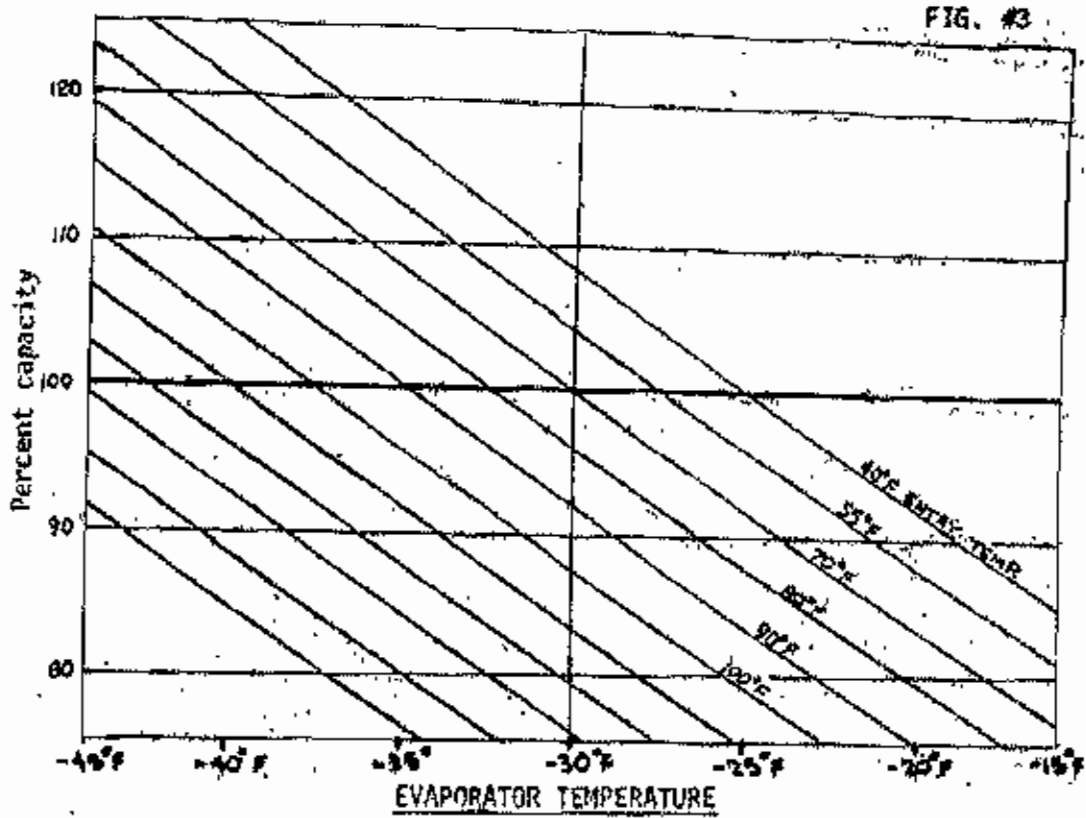
Note: TR is based on blanched product.

- \* Measured at IQF Freezer Coils
- \*\* Belt Washer Water at 90°F
- \*\*\* Defrost Water at 70°F

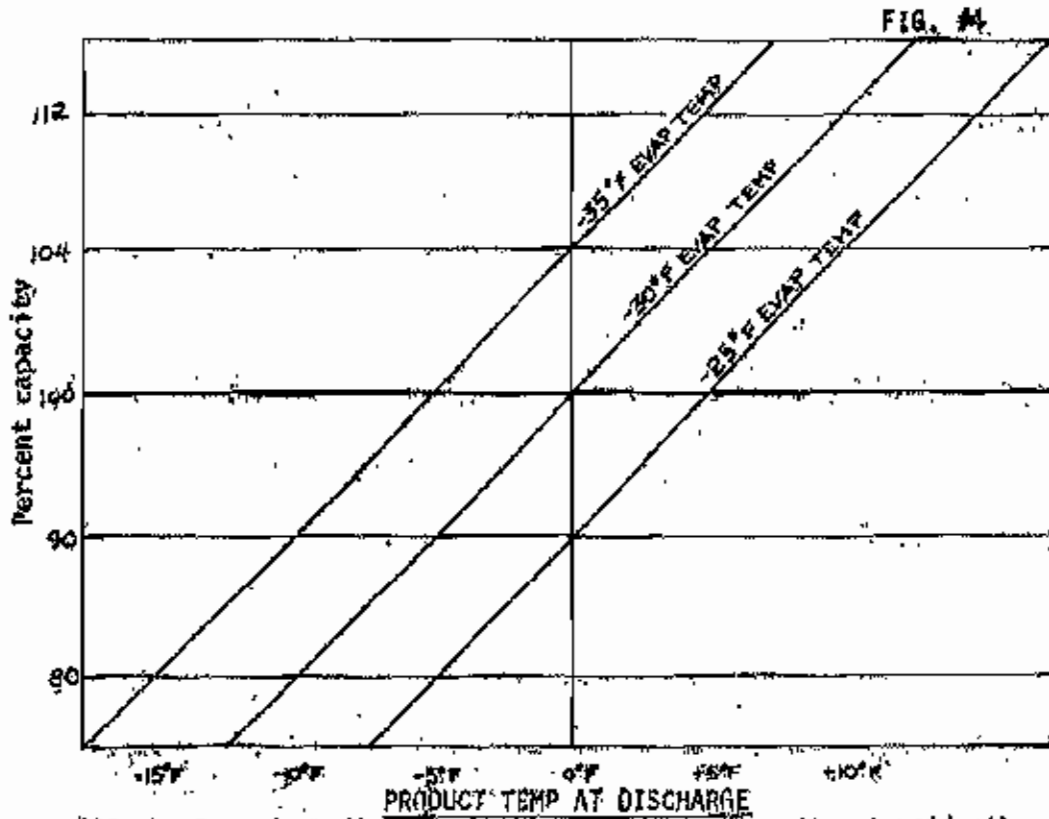
### I.Q.F. FREEZER PIPING DIAGRAM







Effect of Evap. Temp. on Cascade Freezer capacity at various entry temperatures ( 0° F discharge temp. )



Effect of product discharge temp. on system capacity at various suction temperatures ( 70° F inlet temp. )