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DAIRY PROCESSING PLANT PRODUCT STANDARDIZATION AND PROCESSING EFFICIENCY

KOSOVO CLUSTER AND BUSINESS SUPPORT PROJECT

March 26, 2007

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DAIRY PROCESSING PLANT PRODUCT STANDARDIZATION AND PROCESSING EFFICIENCY

THIS REPORT DESCRIBES ASSISTANCE GIVEN TO SELECTED KOSOVO DAIRY PROCESSORS IN THE IMPLEMENTATION OF PRODUCT STANDARDIZATION AND IMPROVEMENTS IN PROCESS EFFICIENCY.

Kosovo Cluster and Business Support project – Dairy Processing Plant Product Standardization and Processing Efficiency.
Contract No. AFP-I-00-03-00030-00, TO #800

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PURPOSE OF ASSIGNMENT

KCBS requests the services of a dairy processing specialist to assist with the implementation of product standardization and improve process efficiency in selected KCBS dairy processor client plants. The goal of this assignment is to increase revenue by at least 10% at 3 client dairy processors with related improvement in profits.

BACKGROUND

There are nine commercial dairy processing companies currently operating in Kosovo as KCBS regular clients. These companies are located throughout Kosovo with a total processing capacity of 85,000 liters of milk a day. They could easily increase processing capacity to 100,000 liters a day with minor upgrades to existing equipment. These companies currently range in processing size from the largest at 30,000 liters a day, to the smallest at 1,500 liters a day. They supply a limited range of dairy products to the domestic market. KCBS with STTA assistance has developed new dairy products in six major dairy plants. The amount of raw milk being processed in dairy plants is increasing. Currently it is estimated that 25-30 percent of all milk produced in Kosovo goes through commercial processing channels. The balance is sold on the green market as un-pasteurized milk or home made cheeses, etc.

KVFA (Kosovo Veterinarian and Food Agency) has issued licenses for operation to eighteen dairy processors. The KVFA standards that have been set up are minimum standards required by local government. At this time, the improvement in production of higher quality milk is in process. Supplying high quality raw milk to dairy processors is the most fundamental step needed to improve the Kosovo dairy industry. However, without corresponding improvements in the way dairy companies process the milk, the economic benefits of farm level improvement will be impaired. Thus the need for improved efficiency and quality control in the Kosovo dairy processing plants which is the focus of this assignment.

EXECUTIVE SUMMARY

The assignment tasks and accomplishments have been generally achieved along with a clear indication of complimentary current and future objectives to further upgrade the local dairy industry from farm to market and in so doing enhance the consumer preference of domestic products over imported products within the territory. Another potential benefit for the local dairy industry is the export of finished product which is achievable through compliance with international standards, chief amongst which is the European Union standards and practices, which in turn incorporate many USA standards in some form or another.

The restraints of fiscal investment from within are recognized and perhaps contribute to the pace at which improvement and attainment of goals and objectives can be set. However, certain basic improvements are a necessity and do not place great demand on immediate cash investment by participants. It becomes a question of commitment and attitude coupled with technical assistance by KSBS within the objectives of the current project.

Chief amongst these suggested programs are:

- Complimentary programs of product bacteriological quality improvement at the processing plant
- Recognition of raising the standard for equipment purchases to initially focus on used equipment while encouraging new equipment procurement
- Upgrading the industry as a whole to international standards for both product and processing within the farm to market concept
- Educational programs to develop greater capability of maintenance of equipment at the processing plant
- Understanding of events which lead to rapid degradation of dairy products and what prevention steps can be initiated

FIELD ACTIVITIES TO ACHIEVE PURPOSE

Summary of Visits to Primary Clients
January 29 and February 17, 2007

ABI

Assessed the potential for the introduction of producing "Philadelphia" type cream cheese and reviewed the present processing equipment and methods with a view to improving processing efficiencies and standardization of products.

(a) although the equipment as installed is not ideal, a distinct possibility to use some of the equipment exists to produce cream cheese. The availability of a Clarifier, Separator, Pasteurizer and Homogenizer to process the milk provides a good basis to maximize the best quality finished product while recognizing that the facility is old, operating equipment condition suffers from low maintenance programs and the fresh milk quality, although improving, is still high in bacteria count and somatic cells. Some degree of experimentation in producing test batches of cream cheese will be needed as the "duplicator" designated for use as the heating/cooling/fermentation tank does not have the desired agitator and the personnel have no experience of producing stabilized products. The viscosity of cream cheese, after the stabilizer is added and the product further cooled, may require a different product removal pump from the "duplicator" and for the product to be hand filled into plastic cups. Foil heat seal can be applied with the sealing section of an existing filler and the re-usable lid applied manually.

(b) The separator is placed in a position within the pasteurizer unit to allow milk at a temperature of approximately 56 C to enter the separator. Manual valves are adjusted to control the amount of cream returned to the skim milk. More study is required to determine improvements that can be implemented to standardize products effectively.

(c) Altogether 5 visits were made to Abi. Currently, some 18,000 liters per day fresh milk is received from 20 milk collection centers and 3 farmers. It is anticipated that the fresh milk intake will rise to 25,000 liters per day during the months May, June and July. A clarifier is installed in the fresh milk intake line but has not been operating for some time. The homogenizer as installed is not in operation as the plant personnel lack the knowledge to replace the piston seals and prevent lubrication water from entering the product and severe product losses to drain. Some welded pipelines were found to have inferior weldings and as such are a serious contamination risk. Other product distribution piping systems were found to be unclean. A central CIP system is in operation but the use of low quality chemicals for cleaning solutions gives rise to unreliable results. No Quality Assurance testing for hygiene is performed. Some tanks are not fitted with CIP spray devices and are cleaned manually. The Quality Control laboratory performs routine tests on fresh milk and some finished products.

(d) The pasteurizer does not have positive flow control and assured flow divert when temperature profiles for pasteurization are not sustained.

BYLMETI

Assessed the equipment and processing methods to determine what may be needed to produce cream cheese and standardization of products.

(a) the pasteurizer is not equipped with a positive displacement pump, homogenizer and a temperature recorder/controller. An homogenizer would have to be installed as a

minimum to be able to produce cream cheese. The enclosed cheese make vat or the fermentor as used for yogurt could be used for the heating/cooling/fermentation/ addition of the stabilizer for cream cheese. Some degree of experimentation will be needed to produce the cream cheese.

(b) The separator, as used, with manual valves for adjusting the cream return into the skim milk is placed in a position to allow milk at an approximate temperature of 43/44 C to enter the separator. Further study is required to determine improvements and implement standardization of products more efficiently.

(c) The Client requested further assistance in developing equipment specifications for a new pasteurizer.

(d) The tanks are not fitted with CIP spray devices and are cleaned manually. Some tanks have small personnel access ports so entry into the tanks for cleaning is limited. Bylmeti have a new processing plant building with a separate cheese make room. No CIP system installed so pipelines are cleaned in place using tanks on the mezzanine as surge tanks for cleaning solutions. No Quality Assurance testing is performed for hygiene. Housekeeping is good.

(e) A hot well is installed for denaturing of milk proteins in lieu of a holding tube

(f) This is a new facility and even though used equipment is installed, most is in relatively reasonable condition. Tanks are on a mezzanine and product flows by gravity to the filling area and separate cheese make room.

(g) The facility was scheduled for cream cheese development with small 50 liter batches even though no homogenizer is installed.

RONA

Reviewed the equipment and facility

(a) Client requested further assistance in developing a business plan. Specifically, the sections dealing with equipment sizing, production capacity to meet sales projections, staffing and financials. Some new business planning is being provided by a Finnish Group inclusive of a new facility.

(b) KCBS and the Client agreed that the new business plan expected to be received by end February from the Finnish Group is to be reviewed and further assistance from KCBS identified and established.

(c) The current facility is run down and all the equipment is relatively old.

GOLAJ

Reviewed the equipment and facility.

(a) Client has and still is experiencing electrical power interruption on a daily basis which makes any program of improvement in the process extremely difficult to achieve.

(b) The separator and plate type pasteurizer is not in operation although they do use a small pilot capacity separator along with tank pasteurization to produce yogurt and fluid milk and on occasions white cheese and ricotta. The plate-type pasteurizer is not in operation due to the power supply situation. With the restraints in operation caused by power interruption, there are no immediate plans to put the larger separator or the plate type pasteurizer back into operation.

(c) The benefits of product standardization were explained and the economic returns of reduced fat content for all products were highlighted.

AJKA

Reviewed the equipment and facility

(a) Client has made a significant up grade in the building by increasing the size of the processing room, adding a separate cheese make room and adding an ageing room for hard cheeses.

(b) Increased the capacity by adding a 5 ton per hour pasteurizer but has no separator and no homogenizer

(c) Without a homogenizer, this facility can not be considered for cream cheese production and the fermentation tanks may not have the agitator mechanism for incorporating the stabilizer without some degree of experimentation

(d) The Client recognizes the economical benefits of using a separator and standardizing the products.

KABI

Reviewed the equipment and the present facility as well as visited the new building which is being readied for transfer of existing equipment from the present facility together with new equipment and services/utilities.

The layout of the present facility is congested with a separate room for cheese production

(a) The Client uses both a separator and an homogenizer

(b) Client requests assistance in determining process equipment specifications and utility requirements as well as layout for the new facility and planning for the transfer of production

(c) It appears that any improvements in the existing production facility will not be undertaken at this time

(d) Under the foregoing circumstances, the Client's interest to consider cream cheese is doubtful

Visit to MAGICE Company on January 29, 2007.

Owner: Lulzim Aliu

Magicice started business importing ice cream products, mainly from Bulgaria, and distributing these products to selling outlets in Kosovo. Magicice distribute ice cream products mostly to small shops and supermarkets.

Magicice built a new production facility and equipped it with used ice cream equipment. They started production in 2006 producing small individual serving cups.

Magicice has plans to produce drinkable yogurt and increase the ice cream products with the addition of ice cream bars on sticks. Used equipment for producing the bars is in place but not completely installed.

Objectives:

(1) evaluate the equipment as installed for the production of yogurt

(2) evaluate the proposed methods for the processing of yogurt

(3) evaluate the ice cream equipment

(4) inspect the milk pick-up over the road tanker to be used for raw milk transportation

Yogurt:

Frozen culture is to be used.

Upon inspection, the following status in the equipment installation was found.

- milk receiving and plate cooler in place but not complete
- entry into building for receiving of raw fresh milk not started
- stainless steel piping not complete
- milk storage tank, ferment tank, ancillary tanks, pasteurizer, homogenizer(from ice cream pasteurizer) in place.
- filler not in place

Yoghurt Concerns:

2. agitator in fermentation tank does not sweep the walls, cross-bracing design unsuitable for homogenous mixing of yogurt, speed maybe too high(1300 rpm motor with 3 to 1 ratio?)
3. heat exchange surface of fermentation tank available even with 1 degree C ice water may not be efficient in reducing temperature of yogurt quickly from 45 to 35 C within 15 minutes
4. present plan is to pasteurize the milk at 72 C and hold for 15 seconds at flow rate of 3000 l.p.h.
5. all manual valves on pasteurizer
6. no temperature recorder/controller for heating in control panel
7. no timing pump, unless homogenizer is used as timing pump

Yoghurt Recommendations:

1. with high bacteria count of fresh milk, suggest raising pasteurizing temperature to 74 C and increasing hold time to 20 seconds by installing flow control valve and flow meter on discharge of centrifugal feed pump and installing bypass around the homogenizer
2. replace the 2 x manual valves at end of holding tube with automatic divert valve operated by pasteurizer temperature controller
3. re-circulate yogurt through the plate heat exchanger for more rapid cooling after fermentation
4. install opposite baffles on arms or cross-braces of fermentation tank agitator to effect better mixing
5. install vertical baffles on side braces of fermentation tank agitator to sweep yogurt from wall of tank
6. reduce r.p.m. of fermentation tank agitator to less than 200r.p.m.
7. during trials on start-up, determine cycle of operating/stopping agitator to obtain optimum results during heating, fermentation and cooling
8. install separator/clarifier to remove somatic cells and reduce fat content of fresh milk to approximately 2% for drinkable yogurt
9. use fat/cream for ice cream

Ice Cream:

The Consultant was informed that ice cream is produced using SMP. No information given at the time of the visit on other ingredients such as fat, sugar, stabilizer, emulsifier.

- mixing/blending equipment(liquiverter), pasteurizer(minus homogenizer), flavor/ageing tanks, single cylinder freezer, rotary and in line cup fillers installed.
- Stick bar machine in place but not completely installed
- Single cylinder freezer in place but not operational

Ice Cream Recommendations:

1. consider using cream/fat and fresh milk and re-formulate ice cream mixes to improve quality
2. overrun, quickness of hardening, type of stabilizer may be subject to review to seek further improvements in quality

Fresh Milk Road Pick-Up Tanker:

The electrical and control system for the hydraulic system and pump is not functioning.

The 2 x compartment tank is generally in good condition although there are some small imperfections in the surface of one compartment which can be polished out.

Information Plates:

- Ahrens & Bode, Alversdorfer Weg 1, 38356 Schoningen, Niedersachsen, Germany manufactured the 2 x compartment tank, pumps and controls on the chassis. Tel. # (49) 05352/513-0
- Zahlwerk Type: ABODAT(model)
- Fabrik # 11009211
- Type # 283207 manufactured 1986 (serial number)
- Qmax- 500 lpm Qmin- 50 lpm
- Impulswertickiet – 0.1 l/imp. (printer)
- Fabrik # 214170
- 4300 liters each compartment for total capacity 8600 liters

KCBS to contact Ahrens & Bode to arrange a Service Technician to repair and make the equipment operational.

Note: KCBS later introduced the mechanic to Magicice.

LUIJA e SHARRIT, Bresane Village, Dragash

The production facility occupies an old building and produces in the basement area white cheese, mozzarella and ricotta. Luija uses a plate type pasteurizer 1500 LPH with automated flow diversion valve, flow control valve on discharge of centrifugal supply pump discharge, holding tube and temperature recorder/controller. Cheese is produced in 3 x rectangular make vats and a round vat for ricotta. The whey is discarded.

Fresh milk of approximately 3.8% fat, up to 2 tons per day in May, June and July, is received direct from the farmers and cooled in the jacketed holding tank.

Cooker/extruder is used for mozzarella. All cheeses are produced using rennet.

The facility has a tiled floor and half-tiled walls and many are in need of replacement.

The facility experiences many interruptions in electrical power and operates with a standby generator on an adhoc basis.

Some GMP in effect: Cleaning regimens, Hand wash stations, Foot bath at entrance. Note: This is the only processing plant with an installed plate-type pasteurizer as observed by the Consultant to have automated flow diversion, controlled product flow and operating temperature recorder consistent with EU Standards.

TASK FINDINGS AND RECOMMENDATIONS

Task 1: Work with at least 3 selected dairy plants to introduce product standardization procedures in those plants.

Accomplishment: Visited with seven primary Clients and explained the basics of product standardization and identified equipment needed and methodology most suitable i.e. standardizing in continuous operation whereby the initial processing produces "clean" skim which is used to adjust the product produced with manual setting of the cream/skim valves of the separator to required fat levels. Thus all product flows are subjected to the pasteurization process. Some Clients will need to add more tanks to hold the skim milk prior to adding back to the specific product such as 3.2% yogurt. Instrumentation to determine fat levels and to be used as the basis of calculating the addition of skim needs to be available at the processing plant level.

Task 2: Provide on-site training to dairy plant employees regarding standardization procedures and improved process efficiency.

Accomplishment: In addition to explanations and discussions at each processing plant, a power point presentation was developed and presented to the Processor Association of some 14 members. This presentation included technical aspects of product standardization, economic impact and profitability, market opportunities vis a vis imported dairy products, equipment specifications for purchasing and suggestions for future Association activities.

Task 3: Evaluate present equipment and processes in the dairy plants with recommendations for improvement where appropriate.

Accomplishment: The impact on present processing plant operations of procuring "as is" used equipment mainly relying on price consideration has been highlighted with all Clients. Appropriate proposals for purchasing at least reconditioned used equipment and installing separators for product standardization are referred to in the Annex.

Task 4: Meet with dairy process management to explain the benefits and need for product standardization and improving process efficiency.

Accomplishment: See task 2 reference

Task 5: Evaluate the best opportunity and assist in development of new dairy products

Accomplishment: KCBS had identified cream cheese as a new product for the Clients. Contact with suppliers of required ingredients (locust bean gum/carragheenan/guar gum) stabilizers and lactic acid cultures) was made and samples obtained. Product formulation and processing methods were identified and then further adjusted to the circumstances of availability of equipment and other factors at 2 locations (ABI & Bylmeti). Unfortunately, due to failure of the first attempts, further experimentation needs to be undertaken to produce a cream cheese product with less than ideal equipment and process control.

Recommendations

All processing plants visited are dominantly equipped with used equipment. Some of the equipment is up to 35 to 40 years old.

Much of the equipment is in poor operating condition and not subject to regular maintenance or preventative maintenance programs. Original spare parts are not abundantly available. The equipment ownership has changed many times and unfortunately, each facility does not have all the skills and knowledge of the equipment to keep the equipment in good operating condition.

Consequently, the operating efficiencies and optimum performance of the equipment is less than desired for producing optimum product quality.

Past and current assistance programs aimed at increasing fresh milk quality at the farm and milk collection centers coupled with recently introduced testing by accredited laboratories operated by the Kosovo Government (UNMIK) are having the expected result.

This needs to be matched with the processing plants capabilities to minimize product degradation and contamination. Quality improvement in processing plants not only should include product quality improvement of taste, formulation integrity, health enhancement but also reduce contamination leading to improved shelf life through rigorous programs of cleaning, hygiene, sanitation of the plant and the equipment. The planned programs of KCBS of HCCP and GMP need to highlight the cleaning of the equipment by introducing and educating plant personnel in both manual and automated cleaning programs.

These programs should emphasize the use of cleaning and sanitizing solutions made up of specialty chemicals and not “raw” unprocessed cleaning compounds. Automated cleaning programs need to blend the use of proper procedures of solution flows, chemical concentrations and temperatures for sufficient length of time to ensure cleaning is repeatable and reliable with clean-in-place systems, when used, on a day by day basis.

Equipment needs to be adapted or procured for CIP practices and the product contact surfaces need to be such that cleaning can be effected appropriately.

For equipment that is intended for manual cleaning with or without mechanical aids, regimens and protocols customized to individual processing plants and the specific equipment within the plants needs to be formulized, introduced and the plant personnel instructed in these practices.

Similarly, education and training of plant mechanics in processing equipment maintenance should be considered as the next logical step in the continuous improvement of overall product quality and plant operating efficiencies. In this way economic gain and increase in profit can result at the plant processing level in the chain of farm to market.

Quality Assurance in testing the state of the equipment after cleaning needs to stepped up and bacteriological purity standards need to be instituted and maintained.

Most processing plants suffer from unreliable electrical power supply and one in particular, Golaj, is in a zone classification of C which is subject to frequent power “black outs” which together with inadequate stand by electrical generation, makes it extremely difficult to process the milk as delivered daily. Perhaps Golaj may warrant some special consideration with regard to acquiring electrical power generation sufficient for the processing plant operation on a daily basis.

Most plate-type pasteurizers in use are not fully equipped to assure reliable pasteurization and the safeguards to prevent unpasteurized milk from being further processed into finished product. Reliance on operating personnel to recognize unsafe product operating conditions and to take corrective action prevails over a minimum level of automated control which is a high level of risk for contaminated and incorrectly processed product. This situation needs to have a prioritized consideration and to warrant some immediate action with appropriate investment to modify equipment and/or replace equipment.

Handling of product within the processing plants and throughout the distribution channels, although not a focus of this assignment, is needful of attention and improvements made. Heat shock and exposure to environments of above 7 degrees C will degrade the product

and lead to short shelf life coupled with less than optimum quality. The consumer preferences for domestic product will be influenced by these factors and practices should they go without improvements. The planned GMP program should be extended to include these aspects.

ECONOMIC RESULTS

Although immediate results cannot be demonstrated in this assignment, the basis for payback and future profitability has been shown with the establishment of reduced fat levels in finished products through product standardization and to meet the competition of imported dairy products. Further benefits such as consumer health should be advantageous to promote to generate consumer preferences for domestic products and to provide alternatives to the processors convenience to produce and market “full fat” dairy products.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE ACTIVITY

Conclusions drawn from this assignment can and should become the focus of both planned and new specific projects with the general framework of the KCBS Project. The suggestions and recommendations are highlighted below:

- Emphasize GMP and HACCP programs to include cleaning and hygienic practices within processing plants
- Assist in broadening the Processors Association activities to include a technical library for equipment and processing specifications, product identity standards, improvements/education programs for processing plant operatives
- Consideration of specific equipment maintenance instruction with the help of original equipment manufacturers on a group basis rather than a one-on-one at each plant
- Extension of UNMIK facilities to include processed product bacteriological purity at the individual processing plant level as an immediate service until such time the plant themselves establish quality assurance capability
- Consider an integration of dairy product quality improvement from farm to market to include milk production, processing of finished product and distribution of finished product within the processing plant/delivery channels and in outlet selling locations. Establish the standards and monitoring of same.

ANNEXES

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INTRODUCTION TO IMPROVED DAIRY PROCESSING AND DAIRY PRODUCTS STANDARDIZATION

BY

ZIJADIN GOJNOVCI, DAIRY PROCESSING SPECIALIST
J. MEL JOLLY, CONSULTANT

OVERVIEW

- IMPORTED PRODUCTS HAVE ADJUSTED FAT LEVELS OF “LIGHT” TO “REDUCED” USUALLY BETWEEN 1% TO 3.4% BUT NOT FULL FAT
- DOMESTIC PRODUCTS CATER TO IMPLANTED CONSUMMER DEMAND OF FULL FAT

OPPORTUNITY FOR INCREASING PROFITABILITY

- COST OF FRESH MILK IS BASED UPON BASE PRICE CALCULATION USING 0.065 EUROS PER FAT PERCENTAGE POINT PER LITER OF MILK
- TRACE THE FAT THROUGH THE PROCESS
- RECOVER FAT AND IN SO DOING STANDARDIZE PRODUCTS TO CONSISTANT AND REPEATABLE LEVELS IN FINISHED PRODUCTS
- MONITOR OPERATION WITH EMPHASIS ON REDUCING FAT LOSSES
- ADDITIONAL PROFIT FROM PRODUCTION AND SALES OF VALUE ADDED PRODUCTS USING CREAM FROM STANDARDIZATION OF OTHER PRODUCTS TO LOWER FAT LEVELS

FRESH MILK @3.8% BUTTERFAT

- **ASSUME 3.6% FAT STANDARDIZED PRODUCT**
  0.2 X 0.065 = 0.013 EURO X 3 TONS PER DAY = 37 EURO
- **ASSUME 3.2% FAT STANDARDIZED PRODUCT**
  0.6 X 0.065 = 0.039 X 3 TONS PER DAY = 112.32 EURO
- **ASSUME 2.8% FAT STANDARDIZED PRODUCT**
  1 X 0.065 = 0.065 X 3 TONS PER DAY = 187.20 EURO

- **Improved Production Capacity**

- STANDARDIZING ON LINE

- STANDARDIZING IN CONTINUOUS OPERATION

- **Improved Processing & New Product Development**
- COLD MILK SEPARATOR
- WARM MILK SEPARATOR

PASTEURIZER – LOCATION OF SEPARATOR

- REGENERATION UP
- FRESH MILK PRIOR TO PASTEURIZING

TREATMENT OF CREAM

- PASTEURIZING AND COOLING
- DEACTIVATION OF LIPASE ENZYME

PRODUCT IDENTITY STANDARDIZATION

- DESCRIPTION
- NAME & LABEL
- KDPA services

NEW PRODUCTS FROM CREAM

- BUTTER
- BUTTER BLENDS
- CREAM
  - SINGLE
  - DOUBLE
  - FROZEN
  - WHIPPED
- MIXED CREAM WITH PEPPERS
- SOUR CREAM

PERCEPTION OF CONSUMMER

- DIFFERENCES IN MOUTH FEEL
- VISUAL
- HEALTH
- PRICE

SUMMARY

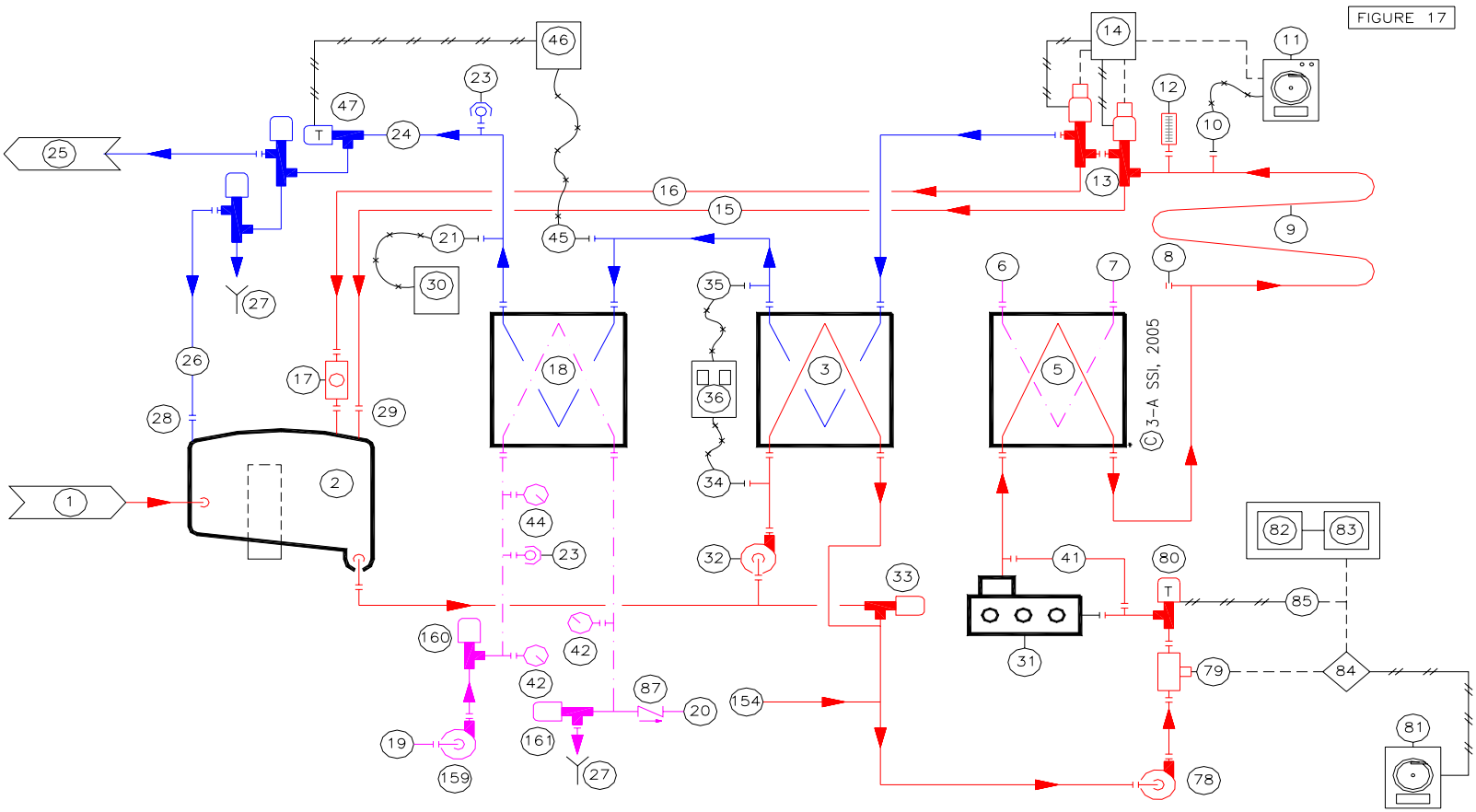
RECONDITIONED WARM MILK SEPARATOR – ASSUME PRICE OF **20,000 EURO**

- OPERATION 313 DAYS PER YEAR @ **3 TONS PER DAY**
- PAYBACK AT 3.6% FAT PRODUCT **1.73 YEARS**
- PAYBACK AT 3.2% FAT PRODUCT **6 MONTHS**
- PAYBACK AT 2.8% FAT PRODUCT **4 MONTHS**

Pasteurizer

- Flow control
- Time temperature of pasteurization

Figure 17.HTST Pasteurizer with Booster Pump, Meter Based Timing System and Homogenizer with Bypass Line



Example :
Application for separator

1. **Separation and clarification of milk**
2. **Bacterial clarification of milk and whey**
3. **Concentration of cream**
4. **Skimming of milk and whey**

Conclusion

KCBS Concerns:

- The separator must be in good operation conditions
- Buying used without reconditioning by authorized party is high risk
- Separator is sophisticated machines operating at high speed, the risk is safety and operating efficiency
- Be careful what you by and what you install




calculations for buisness plan	Necessary milk quantities calculation for Baku plant in 2005									
	2005									
	No. days	volumes Ltr or Kg	litres per Kg	Litres/day	total milk/year	fat %	total fat/day	total non fat/day	total fat/year	total non fat/year
farms milk	360	15000	1	15000	5400000	3.8	570	14430	205200	5194800
purchased milk	360	20000	1	20000	7200000	3.5	700	19300	252000	6948000
milkpowder	360	15000	1	15000	5400000	2.5	375	14625	135000	5265000
total		50000		50000	18000000		1645	48355	592200	17407800
Milk dividing for production										
pasteurized milk	360	1500	1	1500	540000	3.2	48	1452	17280	522720
pasteurized milk	360	1000	1	1000	360000	1.5	15	985	5400	354600
total		2500		2500	900000		63	2437	22680	877320
cream 30%	360	300	1	300	108000	30	90	210	32400	75600
sour cream 25%	**360**	800	1	800	288000	25	200	600	72000	216000
sour cream 20%	360	500	1	500	180000	20	100	400	36000	144000
sour cream 15%	360	2000	1	2000	720000	15	300	1700	108000	612000
sour cream 10%	360	3000	1	3000	1080000	10	300	2700	108000	972000
total	360	6600		6600	2376000		990	5610	356400	2019600
yogurt normal	360	4000	1	4000	1440000	3.2	128	3872	46080	1393920
fruit yoghurt	360	2500	1	2500	900000	3.2	80	2420	28800	871200
total		6500		6500	2340000		208	6292	74880	2265120
kefir	360	1500	1	1500	540000	3.2	48	1452	17280	522720
total		1500		1500	540000		48	1452	17280	522720
ayran	360	2500	1	2500	900000	0.1	2.5	2497.5	900	899100
ayran	360	1500	1	1500	540000	1.4	21	1479	7560	532440
total		4000		4000	1440000		23.5	3976.5	8460	1431540
								whey		
salted curd 18 %	360	200	6	1200	432000	3.6	43.2	1157	15552	416448
curd 18%	360	300	6	1800	648000	3	54	1746	19440	628560
curd with fruit 20%	360	300	6	1800	648000	3.2	57.6	1742	20736	627264
sirog/chocolat 6%	360	300	6	1800	648000	1	18	1782	6480	641520
diet cottage cheese 11 %	360	200	6	1200	432000	1.3	15.6	1184	5616	426384
curd with fruit 4%	360	400	6	2400	864000	0.8	19.2	2381	6912	857088
low fat tvorog	360	2000	6	12000	4320000	0.05	6	11994	2160	4317840
total		3700		22200	7992000	1.0%	213.6	21986	76896	7915104
whey products						1.0%	150	14736	54000	5305104
total milk fat curd (cottage cheese						2.0%	363.6	14886	130896	
sysma-yoghurt (national yogurt	360	200	3	600	216000	3.5	7	593	2520	213480
total		200		600	216000		7	593	2520	213480
total needs				43900	15804000		1703.1	42347	613116	7329780
in				50000	18000000		1645	48355	592200	17407800
difference milk + fat				6100	2196000		-58.1	6158	-20916	10078020
return whey							150	14736	54000	5305104
total product										
babies products	360			6100	2196000	3.2	195.2	5904.8	2196000	2125728

ANNEX II: METHODOLOGY FOR CREAM CHEESE

METHOD USED

BATCH#1: 240 liters milk

1. adjust fresh milk to 3.6% fat
2. pump into jacketed tank fitted with total sweep agitator
3. heat to 84 C
4. take 480 grams locust bean gum and dry mix with 240 grams carragheen and dissolve in small quantity cold milk with high agitation. In 240 liters this will be 0.3% addition.
5. slowly add stabilizer mix to tank and hold for 10 minutes at 84 C
6. cool to 28 C
7. add culture (lactic acid) Chas. Hansen eXact 704 per recommended dosage
8. incubate for 12 hours to reach optimum pH of 4.7
9. check and remove excess whey before filling and check final pH
10. agitate and fill hot into plastic container and apply heat foil lid and cover cap
11. place in cooler to set

The foregoing was a compromise to use existing equipment and unknown dissolve(hot or cold) stabilizer combination.

Batch size too small to pass through existing pasteurizer

No homogenizer in operating condition (piston seals leaking allowing lubricating water into milk.

Original duplicator (tank) too high speed agitator.

Date: Feb.13, 2007

ANNEX III: KABI NEW PLANT

Products	Package Size	Package Type	Milk Usage		Fat %
			Present	Planned	
Pasteurized milk	1 liter	bags	1000	2000	3.2
drinkable yogurt	180 g	cups	1500	3000	3.2
drinkable yogurt	1 liter	bottle	500	1000	3.2
set yogurt	500 g	cups	1000	2000	3.2
set yogurt	800 g	cups	300	600	3.2
set yogurt	350 g	cups	200	400	3.2
ESP yogurt	1 liter	bottle	0	3300	2
white cheese	1 kg, 2 kg, 3 kg, 4 kg 0.5 kg		1100	2200	3.8
other semi-hard cheese	500 g, 800 g	vacuum pack			
sharri cheese	2 kg				
cream w/peppers	1 kg, 2 kg	plastic container	500	1000	3.8
TOTAL			6100	15500	

KABI, NEW PLANT LAYOUT
(refer to layout sketch)

Introduction:

Kabi are planning to relocate their production to a new facility and equip the facility with new and existing equipment from the current facility.
A new building has been built but not fully completed.
The building consists of a split level office section with the production to be housed on the lower floor consisting of an area of approximately 1466 sq. meters plus a mezzanine floor of approximately 67 sq. meters. The ceiling height in the main open area is some 8 meters high.
The floor is presently finished with a coating and is considered, by the Consultant, unsuitable to withstand the milk acids and chemical cleaning solutions that come into contact with the floor during processing.

Production:

Kabi currently process approximately 6000 liters of milk per day into a range of dairy products consisting of:-

- pasteurized milk
- set yogurt
- drinkable yogurt
- white cheese
- sharri cheese

and plan to add extended shelf life (ESP) yogurt

- cream with peppers

Kabi plan to increase the fresh milk intake to 15,500 liters per day.

Equipment:

(1) Fresh Milk Intake: Not all milk as received will be pre-cooled so recommend a plate type cooler be installed. The milk should be received at a different location to other traffic, materials and finished products. Dump tank scale and filter.
(2) 3 x 5000 liter ss tanks with cooling jackets and slow speed agitators for fresh milk storage
(3) Pasteurizer: Recommend a new plate type pasteurizer be purchased to the specifications attached to this report and to include a warm milk separator and a homogenizer with a capacity of 5000 liters per hour.
(4) Cream: Plate type cooler after separation 100 liters per hour, 1 x 200 liter ss cream tank with cooling jacket
(5) Cheese: 3 x 500 liter ss make vats, 1 x 1000 liter ss make vat, 2 x 1000 liter ss finishing tables, 1 x 500 liter ss finishing table, 1 x hooping ss table, 40 x 10 kg hoops, 1 x 1000 liter ss brine tank, 1 x 1000 liter ss brine make up tank, 1 x cutting/work ss table, 1 x ss work table, 1 x shrink wrapper, 1 x plastic container filler, 1 x 1500 liter ss whey tank with cooling jacket, 1 x COP tank (manual cleaning of parts), cheese making accessories-cutters, stirrers, knives, brine dispensing, scales, brushes
(6) Yogurt: 2 x 1500 liter ss incubation tanks, 1 x 1000 liter ss incubation tank, 1 x 1000 liter tubular heat exchanger, 1 x ESP filler, 2 x cup fillers, 2 x filling tables, 1 x tray packer, 1 x tray shrink wrapper, 1 x fruit preparation system,
(7) Pasteurized Milk: 1 x 2000 liter ss tank with cooling jacket, 1 x filler, 1 tray packer
(8) Wash Stations: 3 x hand wash stations place by entrances to production floor
(9) Foot Baths: 2 x foot baths
(10) Cleaning: 1 x 4 tank CIP System for lines and process tanks
(11) Cheese Ageing: Wooden shelves
(12) Storage Rooms: Shelving
(13) Transport Carts/Trolleys: Recommended ss basket-type carts with casters be used for collecting finished product from the end of the production lines and transporting the finished product to storage rooms and from storage rooms to load out.

Utilities:

- 1 x 100 hp steam boiler(housed in separate but attached room
- 1 x stand-by electrical generator with 75% capacity of plant electrical power requirements
- 1 x chilled water ice builder-1 C, 10,000 kg
- 1 x 60 scfm compressed air system with desicator/dryer
- Chilled rooms to have separate Freon refrigerant units

ANNEX IV: Pasteurizer Specification & Separator Proposal

PROJECT AND EQUIPMENT ENGINEERING AND SUPPLY

Basically the processing plants need services to include the detailed engineering in the following categories:

- Layout planning and detailed coordination/clarification of details
- Equipment and process specifications
- Design of product and cleaning pipelines
- Instrumentation and process control inclusive of configuration and dimensioning
- Arrangement of components
- Calculation of material requirements and technical specifications
- Definition and identification of interfaces
- Technical description of the processes
- Quality assurance and quality control
- Monitoring of time schedules
- Cost control
- Supervision of construction and installation work
- Commissioning of plant components
- Plant operator training
- Technical support for production
- Documentation in the form of operator instructions and maintenance procedures

REQUEST FOR QUOTATION FOR MILK PASTEURIZER

Milk pasteurizer to be mounted on stainless steel frame (skid) with equipment pre-wired, pre-piped complete to include the following:-

Capacity: 5 metric tons per hour

Product: Whole fresh milk with 4% butterfat

Temperature profile:

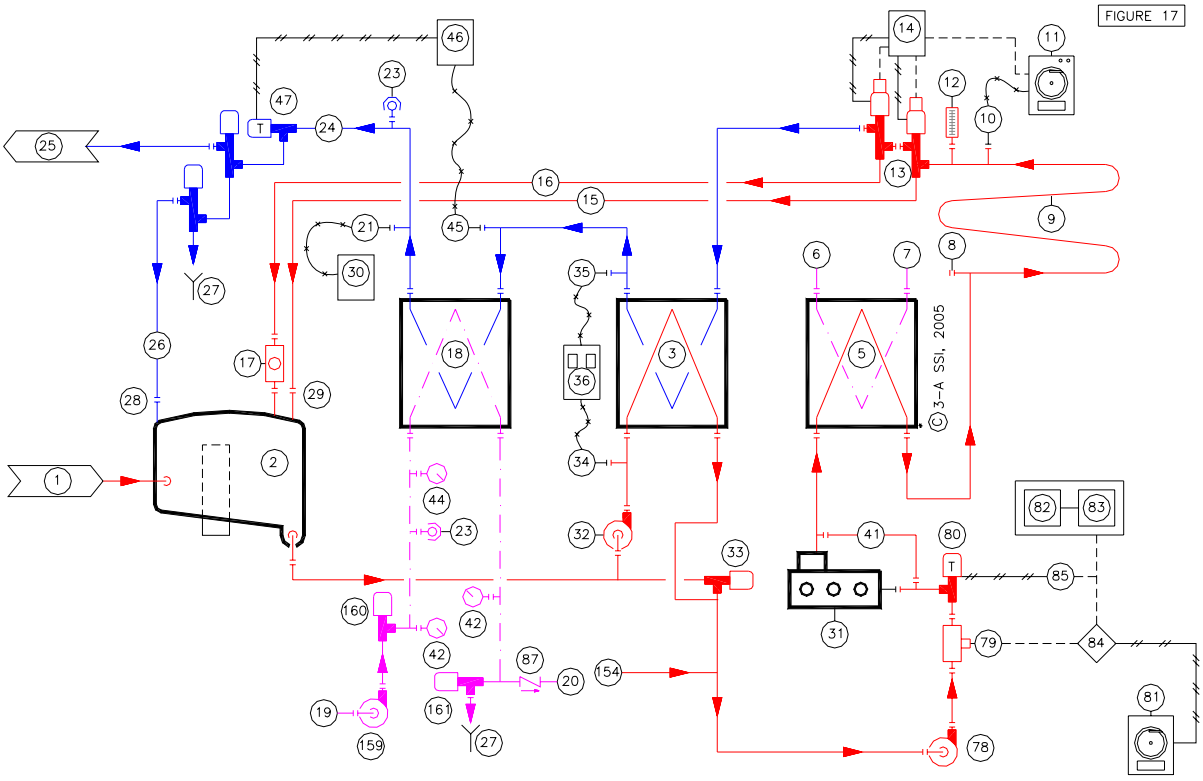
	Product Inlet	Regeneration Up	Heating/Pasteurization	Regeneration Down	Final Cooling
(1)	5	64	72	13	5
(2)	5	66	74	13	5
(3)	5	68	77	14	5
(4)	5	71	80	14	5

Utilities/Services Available:

- Steam @ 1 bar pressure

- Well water @ 16 degrees C
- Electrical Power 3 phase 50 Hertz Volts 220
- Compressed air @ 4 bar pressure

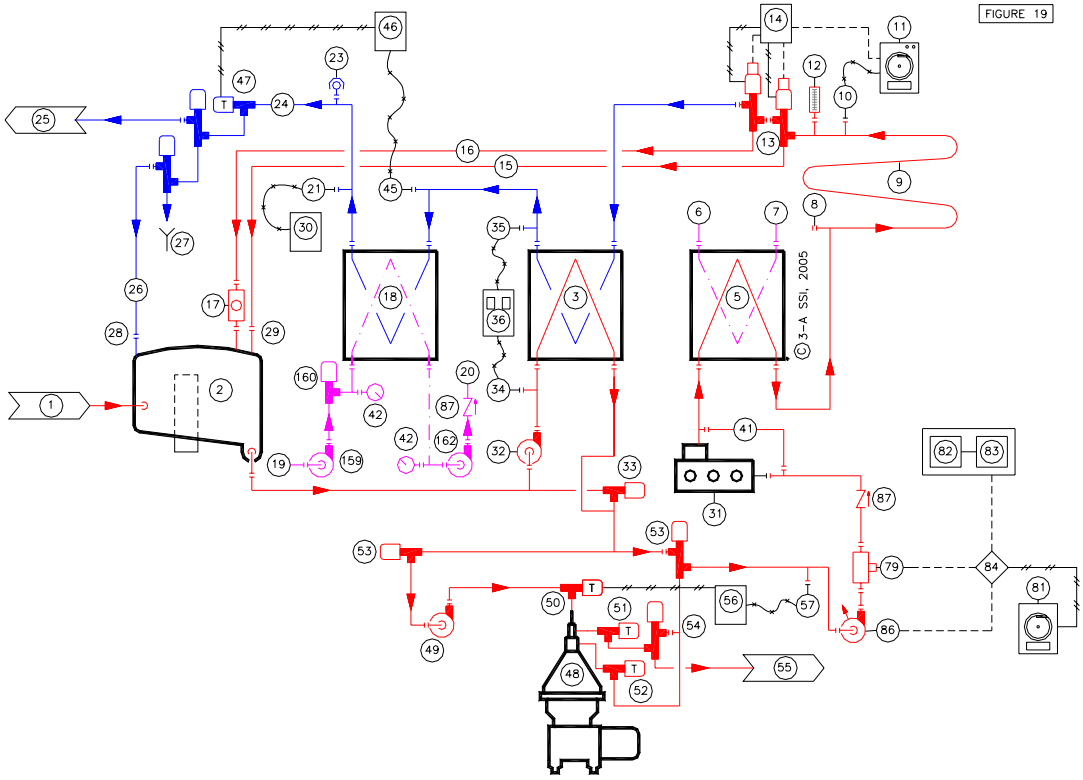
HTST Pasteurizer with Booster Pump, Meter Based Timing System and Homogenizer with Bypass Line



1. Raw Product Inlet
2. Constant Level Tank (CLT)
3. Product-to-Product Regenerator No.1
5. Heater Section
6. Heating Media Outlet
7. Heating Media Inlet
8. Electrolyte Timing Solution Injection Port
9. Holding Tube
10. STLR Hot Product Temperature Sensor
11. Safety Thermal Limit Recorder (STLR)
12. Indicating Thermometer
13. Flow Diversion Device (FDD)
14. FDD Control Enclosure
15. Divert Flow Line
16. Leak Detect Flow Line
17. Sight Glass (View Port)
18. Pasteurized Product Cooler Section
19. Cooling Media Inlet
20. Cooling Media Outlet
21. Cooled Product Temperature Sensor
23. Vacuum Breaker
24. Vacuum Breaker Line >12 inches (305mm) Above Highest Raw Product Lines
25. Pasteurized Product Outlet

26. Pasteurized Product Recycle Line
27. Drain (Waste)
28. Recycle Line Connection >2.0 Pipe Diameters Above Overflow Level
29. Leak Detect/Divert Line Connections >2.0 Pipe Diameters Above Overflow Level
30. Cooled Product Temperature Recorder
31. Homogenizer
32. Centrifugal Booster Pump
33. Regenerator Bypass Valve
34. Raw Product Regenerator Pressure Sensor
35. Pasteurized Product Regenerator Pressure Sensor
36. Regenerator Differential Pressure Switch (RDPS)
41. Homogenizer Recirculation Line
42. Pressure Indicator
44. Pressure Switch
45. Pasteurized Product Pressure Sensor
46. Back Pressure Controller
47. Back-Pressure Control Valve
78. Meter Based Timing System (MBTS) Centrifugal Timing Pump
79. Electromagnetic Flow Meter
80. MBTS Flow Control Valve
81. MBTS Flow Rate Recorder
82. MBTS High Flow Rate Alarm
83. MBTS Low Flow / Loss of Signal Alarm
84. MBTS Flow Rate Controller
85. MBTS Flow Control Valve Current to Pneumatic (I/P) Transducer
87. Check Valve
154. Vitamin Injection Point
159. Cooling Media Supply Pump
160. Cooling Media Stop Valve
161. Cooling Media Drain Valve

HTST Pasteurizer with Booster Pump, Meter Based Timing System with AC Drive Timing Pump, Homogenizer, and CIP-Type Separator Between Regenerator and Heater



1. Raw Product Inlet
2. Constant Level Tank (CLT)
3. Product-to-Product Regenerator No.1
5. Heater Section
6. Heating Media Outlet
7. Heating Media Inlet
8. Electrolyte Timing Solution Injection Port
9. Holding Tube
10. STLR Hot Product Temperature Sensor
11. Safety Thermal Limit Recorder (STLR)
12. Indicating Thermometer
13. Flow Diversion Device (FDD)
14. FDD Control Enclosure
15. Divert Flow Line
16. Leak Detect Flow Line
17. Sight Glass (View Port)
18. Pasteurized Product Cooler Section
19. Cooling Media Inlet
20. Cooling Media Outlet
21. Cooled Product Temperature Sensor
23. Vacuum Breaker
24. Vacuum Breaker Line >12 inches (305mm) Above Highest Raw Product Lines
25. Pasteurized Product Outlet
26. Pasteurized Product Recycle Line
27. Drain (Waste)
28. Recycle Line Connection >2.0 Pipe Diameters Above Overflow Level
29. Leak Detect/Divert Line Connections >2.0 Pipe Diameters Above Overflow Level
30. Cooled Product Temperature Recorder
31. Homogenizer
32. Centrifugal Booster Pump
33. Regenerator Bypass Valve
34. Raw Product Regenerator Pressure Sensor

35. Pasteurized Product Regenerator Pressure Sensor
36. Regenerator Differential Pressure Switch (RDPS)
41. Homogenizer Recirculation Line
42. Pressure Indicator
45. Pasteurized Product Pressure Sensor
46. Back Pressure Controller
47. Back-Pressure Control Valve
48. Separator
49. Centrifugal Separator Stuffing Pump
50. Separator Feed Valve
51. Cream Back Pressure Valve
52. Skim Back Pressure Valve
53. Separator Bypass Valve (Valve Out Valve)
54. Cream Return Valve
55. Heat Treated Cream Outlet
56. Separator Feed Pressure Controller
57. Separator Feed Pressure Sensor
79. Electromagnetic Flow Meter
81. MBTS Flow Rate Recorder
82. MBTS High Flow Rate Alarm
83. MBTS Low Flow / Loss of Signal Alarm
84. MBTS Flow Rate Controller
86. MBTS Centrifugal Timing Pump with AC Variable Frequency Drive
87. Check Valve
159. Cooling Media Supply Pump
160. Cooling Media Stop Valve
162. Cooling Media Return Pump

Product Contact Surfaces of Equipment and Product Piping:

Stainless steel type 304 (ASTM A-276/A-666 or equivalent) or better and to have a carbon content not to exceed 0.08% for welded components. All internal welds that are accessible, to be ground and polished to at least 0.8μm Ra. Material certifications to be provided.

Balance Tank:

Minimum capacity to operating level 190 liters
Atmospheric break between operating level and location of inlets except for product inlet.
Water inlet connection to be stainless steel with check valve and shut off valve.

Centrifugal Booster Pump :

Capacity to enable CIP of pasteurizer.

Centrifugal Timing Pump (MBTS)with AC Variable Frequency Drive

- MBTS Flow Rate Controller
- Flow Meter
- High Flow Rate Alarm
- MBTS Low Flow / Loss of Signal Alarm

Plate Type Heat Exchanger:

- regeneration, heating and cooling sections
- regeneration at least 88%(depends upon milk temperature to hot milk separator for maximum efficiency of separation)
- bolt type take up
- clip-in gaskets or glued-in gaskets
- Plate thickness not less than 20 gauge and quantity of plates per section to be stated

Holding Tube:

- 16 seconds hold at rated capacity of pasteurizer
- Automated flow diversion device(FDD)
- Sight glass in divert line
- Leak detection port in FDD
- The holding tube shall be designed to have a continuously upward slope, in the direction of flow, of not less than 20.8 mm per m from its beginning to the connection at the inlet of the FDD.
- Supports for holding tubes shall be provided so as to maintain all parts of the holding tube in a fixed position free from any movement laterally or vertically.
- The holding tube shall be provided with fittings for installing an indicating thermometer and the temperature sensor of the temperature recorder/controller at the outlet end.

Hot Water Set: (For heating section of plate heat exchanger)

- steam/water mixer or shell and tube heat exchanger
- recirculation pump
- drain valve
- water make up valve
- expansion valve
- thermometer in line to plate heat exchanger
- steam regulating valve

Hygienic(sanitary) Valves & Fittings:

- pneumatic actuator for Flow Diversion Valve
- manual butterfly valves with option for pneumatic operated product valves
- fitting/connection type DIN or fi diameter
- stainless steel product piping interconnecting balance tank, plate heat exchanger, holding tube

Control Panel:

- enclosure to be stainless steel
- Safety Thermal Limit Recorder (STLR)
- FDD Control Enclosure
- indicator lights for divert, forward flow and recycle
- light/ push button switches for pumps, separator, homogenizer
- Clean-in-place(CIP) override for flow diversion valve
- Pneumatic solenoid valves for automated product valves with air filter/oil trap and pressure regulator valve
- Filter and moisture/oil trap for air supply to temperature recorder/controller

Mounting frame:

- stainless steel with adjustable legs(feet) to provide minimum 100 mm floor clearance
- for hollow frames, bolt holes must be sealed and all frame members must be sealed to prevent product/soil from entering hollow frame
- frame must be open with minimum use of solid plates
- components must be placed on frame with access for disassembly and maintenance
- Frame dimensions and overall height requirements length…… width……..height……

Engineering:

- provide schematic drawing
- provide operating instructions in English
- provide utilities required

Terms and Conditions

Price: FOB Manufacturing Plant
Installation and Commissioning/Training to be included as separate price
Service/Spare Parts for one year recommended list and price per part
Payment Terms: Direct wire transfer
20% downpayment
50% against shipment
20% completion of installation
10% after commissioning

Proposal: Alfa Laval Model 390 Reconditioned Separator for Warm Milk

We offer to furnish the equipment subject to prior sale and/or materials and/or services described in this quotation based on the information furnished to Separators, Inc.

1. Machine Description

One (1) reconditioned **Alfa Laval model 390 Reconditioned Separator**. Frame and cover are constructed of type (at least) 304 stainless steel. Suitable for a capacity of 44 LPM output (skim). Machine is rated for an input of 2,905 LPH @ approximately 55 C. The separator is offered complete with:

- One 3HP, 3 phase, 220/440 volts, 60HZ drive motor (direct drive, requires VFD)
- Ball Feet
- One set of bowl insertion tools
- One instruction manual for parts identification and operation procedures

Rebuild Procedure: The above centrifuge will be completely reconditioned with:

- Frame and covers, interior and exterior, are restored to like new condition;
- New seals, gaskets and bearings are used in assembly, along with refurbished and/or new parts;
- The bowl is independently balanced;
- The entire unit, plus electrical controls, is subjected to test run check for smoothness of operation, pre-set certain variables for ease of start-up and trim balanced.

Net Price – F.O.B. Indianapolis, IN….……US$29,500.00 each

2. VFD Motor Starter, 230/460 volt:

Danfoss VLT series Variable Frequency 3 HP drive to properly start and run your 3 HP motor at 230/460 volts. The drive's housing is rated NEMA 1. Fully programmed with the correct parameters to properly start and run the centrifuge drive motor. Coast to stop when motor stop is selected. Restart on the fly capable in the event of a power brown out, accidental stop, etc. 60 Hz reached output relay. Drive failure output relay. Start drive motor with maintained contact closure. Stop by unlatching the start contact closure. Includes direct drive coupler.

Net Price F.O.B. Indianapolis, IN……US$ 1,275.00

Other voltages quoted upon request

VFD can be mounted in either a NEMA 12 or NEMA 4X enclosure, with or without fused disconnect switch. (Always check with State and local electrical codes on disconnect requirements.) **When placing the VFD inside the NEMA 12 or NEMA 4X enclosures, the addition of an air operated panel air conditioning Vortex device will be required due to the heat build up inside of the enclosure.**

3. Optional Valves: One 1.5" micrometer valve, one tee, one back pressure gauge (0-100 PSI) for optimum control of recommended skim milk pressure.

Net Price: F.O.B. Indianapolis, Indiana. ……. US$ 1,755.00

4. Optional Gauge: One pressure gauge (Bottom Mount)
Net Price: F.O.B. Indianapolis, Indiana. ……US$ 324.00

Start-Up: Separators, Inc. will provide start up assistance per the included rate sheet. Customer is responsible for contracting and scheduling trades involved with the installation, e.g. riggers, plumbers, electricians, welders, etc. Once equipment is in place and completely connected, Separators, Inc. service technician will assist and train customer's staff in all phases of assembly, disassembly, basic maintenance, operating procedures in processing and CIP. A service report will be issued requiring customer sign off. Any additional work has to be pre-approved by Separators, Inc.

Terms: Forty percent (40%) down payment with placement of purchase order, balance due prior to shipment.

Equipment availability is subject to prior sale until written purchase order and down payment are received. This proposal shall remain firm for thirty (30) days and is subject to the terms and conditions set forth by Separators, Inc.

Warranty: Three hundred and sixty five (365) day's parts and labor, as per the enclosed Equipment Warranty statement. One-year extension available - see warranty.

Delivery: Based on present factory loading, delivery is approximately ten (10) to twelve (12) weeks after receipt of purchase order, down payment and resolution of all technical and commercial questions.

Cancellation: Cancellation can only be instituted upon written request by authorized purchaser and written acknowledgement by Separators, Inc. at which time Separators, Inc. will estimate the percentage of completion of order including engineering and drafting costs, cancellation costs to Separators Inc. from suppliers with proper documentation. Purchaser's obligation will be to pay Separators, Inc. cancellation charge of 20% of the list price of equipment included in the cancelled order or the documented cost of the percentage of completion, whichever is greater, plus any cancellation charges which may be charged back by other manufacturers or suppliers to Separators, Inc. on items which Separators, Inc. may have ordered to complete purchasers order.

Bill Otter
Separators, Inc.

5707 West Minnesota St.
Indianapolis, IN 46241

Main Office: 800-233-9022
Home Office Phone/Fax: (260) 490-7077
Cell Phone: (260) 402-2018
Email: botter@sepinc.com

ANNEX V: CLEAN-IN-PLACE (CIP)

3-A® Accepted Practices for Permanently Installed Product and Solution Pipelines and Cleaning Systems Used in Milk and Milk Product Processing Plants, Number 605-04

Formulated by
International Association of Food Industry Suppliers (IAFIS)
International Association for Food Protection (IAFP)
United States Public Health Service (USPHS)
The Dairy Industry Committee (DIC)

It is the purpose of the IAFIS, IAFP, USPHS, and DIC in connection with the development of the 3-A Sanitary Standards program to allow and encourage full freedom for inventive genius or new developments. Practices for permanently installed product and solution pipelines and cleaning systems specifications heretofore or hereafter developed which so differ in design. materials, and construction, or otherwise, as not to conform to the following practices but which in the manufacturer's or fabricator's opinion, are equivalent or better may be submitted for joint consideration of the IAFIS, IAFPS, USPHS and DIC at any time. NOTE: Use current revisions of editions of all referenced documents cited herein. Standard English is the official language of 3-A Sanitary Standards and 3-A Accepted Practices.

A SCOPE

A1 These 3-A Accepted Practices provide for the installation and mechanical cleaning and sanitizing of rigid pipelines used for milk and milk processing systems in which the connections are welded or are provided with permanently installed CIP fittings. These 3-A Accepted Practices also specify materials, fabrication and other requirements for the rigid cleaning solution lines and for the mechanical cleaning (CIP) unit which circulates the pre-rinse, rinse, cleaning solutions and post-rinse liquids used for cleaning and sanitizing the product pipelines and process equipment. The mechanical cleaning and sanitizing of individual items of equipment may be found in the 3-A Sanitary Standards covering the specific equipment. This practice does not pertain to cleaning systems used on dairy farms, nor to large diameter piping used for conveying dry product in milk drying or instantizing systems. (See Appendix, Section P for an example of a mechanical (CIP) cleaning unit.)

B DEFINITIONS

B1 *CIP (Cleaned-ln-Place)/Mechanical Cleaning*: Shall denote cleaning solely by circulation and/or flowing chemical detergent solutions and water rinses onto and over the surfaces to be cleaned, by mechanical means.

B2 **Pipelines**

B2.1 *Permanently Installed Product Pipelines*: Shall mean rigid pipelines which have welded joints or permanently installed CIP fittings and are designed for CIP cleaning and which are used for milk and milk products

B2.2 *Permanently Installed Solution Pipelines*: Shall mean rigid pipelines which have welded joints or have permanently installed CIP type fittings and are used exclusively for the supply and recirculation of cleaning and/or sanitizing solutions, except those used to supply concentrated cleaning and/or sanitizing materials to the point of use.

B3 *Permanently Installed CIP Fittings*: Shall mean welded or gasketed fittings designed for CIP cleaning which form substantially smooth, flush interior surfaces.

B4 *Product*: Shall mean milk and milk products.

B5 *Product Contact Surfaces*: Shall mean all surfaces that are exposed to the product or from which liquids may drain, drop, or be drawn into the product.

B6 *Solutions*: Shall mean those solutions used for flushing, cleaning, rinsing, and sanitizing.

B7 *Solution Contact Surfaces*: Shall mean the interior surfaces of the system which are used exclusively for supply and recirculation of cleaning and/or sanitizing solutions, except those used to supply concentrated cleaning and/or sanitizing materials to the point of use.

B8 *Nonproduct Contact Surfaces*: Shall mean all other exposed surfaces.

B9 **Mechanical Cleaning (CIP) Unit**

B9.1 *Mechanical Cleaning (CIP) Unit*: Shall mean equipment assembled as a unit dedicated to and used exclusively for supply and recirculation of cleaning and/or sanitizing solutions. This equipment may include but is not limited to the following:

B9.1.1 *Solution Pump(s);*

B9.1.2 *Solution Tank(s);*

B9.1.3 *Solution Supply and Return Valve(s) and Valve Manifold(s);*

B9.1.4 *Fittings;*

B9.1.5 *Solution Contact Heat Exchanger(s) or Steam Injector(s);*

B9.1.6 *Instrument Fitting(s) and;*

B9.1.7 *Straincrs.*

B9.2 The mechanical cleaning (CIP) unit does not include utility piping.

B10 Tungsten Inert Gas (TIG) Method: Shall mean electric welding with a tungsten electrode shielded by an inert gas, to produce a butt fusion weld.

B11 *Non CIP Appurtenances*: Shall mean those appurtenances such as plug valves, sample cocks, instrument fittings, pumps and parts having the same functional purposes and not designed for mechanical cleaning.

B12 *Utility Piping*: Shall mean other system service piping such as the steam supply line up to and including the steam supply valve; chemical injection lines up to and including the chemical shut-off device; water supply lines up to and including the water shut-off valve.

C **MATERIALS**

C1 The materials of equipment included in the product and solution pipelines and mechanical cleaning units for which there are applicable 3-A Sanitary Standards or Accepted Practices shall comply with the material criteria of the applicable Standards or Practices.

C2 All other product and solution contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series[1] or corresponding Alloy Cast Institute (ACI)[2] types (See Appendix, Section I.), or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types and is nontoxic and nonabsorbent, or heat-resistant glass piping, except that:

C2.1 Rubber and rubber-like materials may be used for gaskets, seals and short take-down jumpers.

[1] The data for this series are contained in the AISI Steel Products Manual, Stainless & Heat Resisting Steels, December 1974, Table 2-1, pp. 18-20. Available from the Iron and Steel Society, 186 Thorn Hill Road, Warrendale, PA 15086 (724) 776-9460.

[2] Alloy Casting Institute Division, Steel Founders Society of America, Cast Metal Federation Bldg., 455 State St., Des Plaines, IL 60016 (708) 299-9160

C2.2 Rubber and rubber-like materials shall comply with the applicable provisions of the 3-A Standards for Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-.

C2.3 Plastic materials may be used for gaskets, seals, sight ports and short take-down jumpers.

C2.4 Plastic materials shall comply with the applicable provisions of the 3-A Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-.

C.3 Utility piping need not be stainless steel

C.4 Paper gaskets shall not be used.

D **FABRICATION**

D1 The fabrication criteria of equipment included in the permanently installed product and solution pipelines for which there are applicable 3-A Sanitary Standards or Accepted Practices shall be those of the applicable 3-A Sanitary Standard or Accepted Practice.

D2 All other product contact surfaces shall have a finish at least as smooth as a No. 4 ground finish on stainless steel sheets, and be free of imperfections such as pits, folds and crevices in the final fabricated form. (See Appendix, Section J.)

D3 All solution contact surfaces shall be at least as smooth as a No. 4 ground finish on stainless steel sheets, except for those of castings for solution heat exchanger(s)/steam injector(s) and pumps. This does not preclude the

use of a No. 2B finish for solution contact surfaces.

D3.1 The solution contact surfaces of castings for heat exchangers(s)/steam injector(s) and for pumps shall be at least as smooth as ACI Surface Indicator Scale SIS- I . (See Appendix, Section M.)

D4 Product lines shall comply with the provisions of 3-A Standards for Polished Metal Tubing for Dairy Products, Number 33-.

D5 Product and solution lines and equipment shall have permanently installed CIP fittings or welded joints. Gasketed CIP fittings shall be readily demountable for inspection.

D6 Welded joins shall be smooth and free from pits, folds, crevices, cracks, inclusions, or other defects. (See Section G.)

D7 Removable fittings may be used with or without gaskets and shall be of such design as to form substantially flush interior joints.

D7.1 Gaskets, when used, shall be self-positioning and form a substantially flush interior joint.

D8 Power operated solution valves shall have an open space of at least 1in. (25 mm), clear for inspection, between the actuator and the valve.

D9 Non CIP appurtenances, such as plug valves, instrument fittings, sample cocks, pumps and parts having the same functional purposes which have product or solution contact surfaces shall be readily demountable and easily disassembled for manual cleaning and sanitizing.

D10 **Radii**

D10.1 All internal angles of 135° or less on product contact and solution contact surfaces shall have minimum radii of 1/4 in. (6 mm) except that:

D10.1.1 The radii in gasket retaining grooves except for those for standard 1/4 in (6 mm) and smaller O-Rings, shall be not less than 1/8 in. (3 mm).

D10.1.2 Smaller radii may be used when they are required for essential functional reasons, such as those in pump impelIers. In no case shall radii be less than 1/32 in. (1 mm). The angle must be readily accessible for cleaning and inspection.

D10:1.3 The radii in grooves for standard 1/4 in. (6 mm) O-Rings shall be not less than 3/32 in. (2 mm) and for standard 1/8; in. (3 mm) O-Rings shall be not less than 1/32 in. (1 mm).

D11 All product contact and solution contact surfaces shall be cleanable, either when in an assembled position or when removed. System appurtenances shall be accessible for inspection.

D12 Lines and fittings for the application of air under pressure shall comply with the applicable provisions of 3-A Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products and Product Contact Surfaces, Number 604-.

D13 Nonproduct contact surfaces shall be smooth, free of pockets and crevices and be readily cleanable.

D14 There shall be no threads on product contact surfaces or on solution contact surfaces

D15 **Information Plate**

Cleaning solution pumps designed and used solely for CIP recirculation shall be provided with an information plate permanently affixed to the pump, next to the name plate stating: "This pump shall be used solely for pumping cleaning and/or sanitizing solutions."

E **INSTALLATION**

El Pipelines shall be supported so that they remain in alignment and position. The support system shall be designed so as to preclude electrolytic action between support(s) and pipeline(s).

E2 Each separate cleaning circuit, including product and solution lines, shall be provided with a sufficient number of access points, such as valves, fittings, or removable sections to make possible adequate inspection and examination of representative interior surfaces.

E3 Pipelines shall be drainable or self-draining and pitched to drain points.

E4 Upon completion of welded pipeline installations and prior to use, all interior line and weld areas shall be subjected to circulation of cleaning solution of 0.5 to 1% alkalinity at a minimum of 160° F (71.1° C) for 30 minutes, followed by an adequate post rinse, followed by circulation of 0.5% minimum and 1% maximum phosphoric or nitric acid solution at 150° F (65.6° C) to 180° F (82.2° C) for 10 minutes to clean all interior surfaces of ferric impurities. (This is not intended for passivation.) This treatment shall be followed by an adequate rinse.

F **LAYOUT AND ENGINEERING REQUIREMENTS**

Fl Prior to installation, a drawing or equivalent plan shall be made available to the regulatory agency by the processor for each installation, or subsequent addition or modification, showing each permanent circuit to be cleaned.

F2 The mechanical cleaning unit shall be designed so that the suction intake of the primary circulating pump shall be flooded at all times during the cleaning cycle.

F3 Solution temperature shall be automatically controlled by the use of temperature control system with a response range of + 5° F (+ 3° C).

F4 The mechanical cleaning unit shall be provided with a recording thermometer or similar device complying with these specifications or a recording device which has been reviewed by the FDA and found to provide efficient information to adequately evaluate the cleaning and sanitizing regimen and which is approved by the local regulatory agency shall be installed in the return solution line or other appropriate areas to record the temperature and time during which the line or equipment is exposed to cleaning and sanitizing solutions. The Scale range shall be: 60° F to 180° F (16 to 83° C) with extensions of scale on either side permissible; graduated in time-scale divisions of not more than 15 minutes. Above 110° F (44° C), the chart is to be graduated in temperature divisions of not more than 2° F (1° C) spaced not less than 0.0625 in. (0.159 mm) apart. Provided that the temperature-scale divisions of 2° F (1° C) spaced not less than 0.40 in. (1 mm) apart are permitted when the ink line is thin enough to be easily distinguished from the printed line. Temperatures shall be accurate within 2° F (1° C) plus or minus, when above 110° F (44° C). The pen-arm setting device shall be easily accessible and simple to adjust. The pen and chart paper shall be designed to make a line not over 0.025 in. (0.635 mm) wide and be easy to maintain. The stem fitting shall have a pressure-tight seat against the inside wall of pipe and no threads shall be exposed to solution. The sensor shall be protected against damage at 212° F (100° C). Circular charts shall make one revolution in not more than 24 h. Strip charts shall not move less than 1 in. (25 mm) per h. More than one record of the cleaning operation shall not overlap the same section of the chart for either circular or strip-type charts.

F5 All connections between any solution circuit and any product circuit shall be effectively separated to positively prevent the commingling of the product and solution during processing. (See Appendix, Section N.)

F6 There shall be no cross-connection(s) between the safe water supply and any unsafe or questionable water supply, or any source of pollution through which the safe water supply might become contaminated. For example, a connection between the water supply piping and make-up: tank, unless protected by an air gap or effective back-flow preventer constitutes a violation of this practice.

G **INSTALLATION WELDING REQUIREMENTS**

G1 All welding of sanitary product pipelines and solution lines shall be made by the TIG method or an equally satisfactory method. The following precautions shall be taken:

G1.l Inert back-up gas shall be used to protect and control the interior of the weld.

G1.2 The welding surface (interior, face and exterior) shall be cleaned and freed of all foreign matter and surface oxide before welding. Iron-free abrasive shall be used when cleaning surfaces.

G1.3 All tube and fitting ends shall be square cut and deburred.

G1.4 Welding procedures shall assure uniform and complete penetration of the weld at all times.

G1.5 All welds having pits, craters, ridges, or imbedded foreign materials shall be removed and the joints shall be properly re-welded.

G1.6 Internal and external grinding and/or polishing of pipeline welds is not required. If grinding and/or polishing of external weld surfaces is desired by either the installer or the user, such finishing shall be delayed until after inspection and acceptance of the welding by the applicable regulatory agencies unless internal weld surfaces are easily accessible for inspection.

G1.7 An acceptable sample weld piece shall be provided when required.

G1.8 A boroscope or other acceptable inspection device shall be available to use to inspect representative welds.

H CLEANING AND SANITIZING PROCEDURES

H1 A mechanical flushing, cleaning, rinsing and sanitizing regimen which has been demonstrated to be effective shall be employed. Because of the possibilities of corrosion, the

recommendations of the cleaning compound manufacturer shall be followed with respect to the time, temperature and the concentration of specific acid or alkaline solutions and sanitizers. To insure proper strength of solution and to avoid corrosion, the cleaning compound shall be completely dissolved or dispersed prior to circulation. (See Appendix, Section O for one regimen found to be satisfactory.)

H2 Pulsing of all product outing valves shall be done during each phase of cleaning cycle, ie. rinse, wash, rinse, sanitize.

H3 A description of the cleaning regimen which has been demonstrated to be effective for each circuit shall be made available by the processor.

H4 Reverse osmosis permeate or cow water (condensed vapors removed from liquid dairy products by vacuum evaporation) produced in compliance with Appendix D-V of the Pasteurized Milk Ordinance where applicable may only be used as a pre-rinse to drain and to make up cleaning solutions, but cannot be used as the final rinse or to make up sanitizing solutions.

APPENDIX

NOTE: This appendix is an adjunct to the preceding sections of these practices. Its purpose is to provide information and guidance in the design, fabrication and installation of rigid pipelines and cleaning systems.

I **STAINLESS STEEL MATERIALS**

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of Section C.2 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08%. The reference cited in C.2 sets forth the chemical ranges and limits of acceptable stainless steels of the 300 series. Cast grades of stainless steel equivalent to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. These cast grades are covered by ASTM[3] specifications A351/A351M, A743/743M and A744/744M.

J **PRODUCT CONTACT SURFACE FINISH**

Surface finish equivalent to 150 grit or better as obtained with silicon carbide, properly applied on stainless steel sheets, is considered in compliance with the requirements of Sections D.2.

K **FLOW RATES**

A circulating unit, consisting of a motor driven pump and solution tank, should be provided and deliver a minimum flow rate of 5 ft per sec (FPS) per line when cleaning. In split flow arrangements, a pressure differential should be maintained or flow should be sequenced through multiple paths to assure a minimum flow rate of 5 FPS (1.5 meter per second [MPS]). In all cases, sufficient flow should be maintained to assure that the lines are fully flooded at all times. Table I gives examples of minimum recommended flow rates for CIP systems to meet the 5 FPS (1.5 MPS) mean flow velocity.

[3] Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Phone: (610) 832-9500.

TABLE 1: Recommended flow rates to achieve 5 FPS or 1.5 MPS.

Sanitary Tube Size				Flow Rate	
)	)	D	)		
in.		cm.		PM	'M
1.0	0.875	2.5	2.22	9.4	35.6
1.5	1.375	3.8	3.50	24.0	90.8
2.0	1.875	5.1	4.75	43.0	163.0
2.5	2.375	6.4	6.033	69.0	261.0
3.0	2.875	7.6	7.303	102.0	386.0
4.0	3.850	10.0	9.779	182.0	689.0

These flow rates are usually adequate for cleaning pipelines which handle milk and other relatively low-fat products. However, for more viscous products, such as cream, ice cream mix, or concentrated milk products, it may be necessary to change these velocities and/or other cleaning variables. Other variables to be considered are time, temperature, and concentration of cleaning formulations.

L TYPES OF WELDS

L1 *Automatic Weld*: A fully automatic weld is that made by equipment which starts and completes the weld, strikes, and controls the arc with no manual adjustment of control during the welding cycle and will consistently make repetitive welds.

L2 *Semi-automatic Weld*: A semi-automatic weld is that made by equipment which requires manual strike and/or manual control during the welding cycle and will consistently make repetitive welds.

L3 *Hand Weld*: A weld in which the positioning of the arc is manually controlled.

M SPECIFICATIONS FOR VISUAL INSPECTION OF CAST SURFACE FINISH

M1 Because RMS (root mean square) values are applicable strictly to machined surfaces, it is essential to use a scale of cast surfaces in designating the general surface smoothness desired on castings. The reason for establishing a visual standard is to overcome the obvious inadequacy of any arithmetical or geometrical measuring system when applied to the surface of a casting.

M2 The ACI SURFACE INDICATOR SCALE is the one to be used for the surfaces of castings for pumps or other appurtenances. (See subsection D.3. 1 of these Practices.) The scale provides a measure of the degree of general smoothness which can be attained

on alloy castings by currently available processes. There are four surfaces shown on the scale.

M3 Copies of the SPECIFICATIONS FOR VISUAL INSPECTION OF CAST SURFACE FINISH as well as the SURFACE INDICATOR SCALE can be obtained from the Alloy Casting Institute Division, Steel Founders' Society of America, Cast Metal Federation Bldg., 455 State St., Des Plaines, IL 60016, (708-299-9160).

N **SEPARATION OF CLEANING AND PROCESSING CIRCUITS**

N1 During processing, pipelines and equipment used to contain or conduct milk and milk products shall be effectively separated from tanks or circuits containing cleaning and/or sanitizing solutions (See Section F.5). This can be accomplished by:

N1.1 A complete physical separation of all tanks, pipelines and circuits; or

N1.2 Separation is by at least two automatically controlled valves with a drainable opening to the atmosphere between the valves. The opening to the atmosphere should be equal to the largest pipeline size and the valves should be position detectable. The installation of such valves shall include an automatic fail safe system to prevent product contamination with cleaner and/or sanitizing solutions.

N2 The design of the product and cleaning and/or sanitizing solution pipeline system should provide for the permanent

installation of as much of the pipeline as possible.

N3 All unnecessary bypass and return connections should be eliminated.

N4 The piping configuration should enable all processing to be completed without piping changes and yet permit quick conversion to cleaning circuits, except for those changes required for separation of Grade A products and non-Grade A products.

O **CLEANING AND SANIIZING EXAMPLE**

O1 All solution and product contact surfaces such as down tubes, fill tubes, manhole gaskets, petcocks, plug valves, check valves, instrument fittings and air purgers not designed for mechanical cleaning and sanitizing procedures should be cleaned and sanitized manually.

O1.1 Immediately after concluding the day's operations, all connections between cleaned-in-place lines and processing equipment which are not included in the cleaning circuit should be removed, the openings capped, by-pass connections made, and the lines flushed thoroughly with tempered water (not to exceed 120° F or 49° C, entering circuit) continuously discarding the rinse water near the downstream end of the solution return line until the discarded effluent is clear.

O1.2 Circulate an effective detergent solution for a period of time at a concentration and

temperature capable of effectively removing the soil residue in the circuit.

O1.3 Thoroughly rinse the detergent solution from the circuit.

O1.4 Circulate an acid detergent, when needed, as a supplement to the routine circulation. Follow this acid detergent treatment with a thorough rinse.

O1.5 Sanitize all product contact surfaces immediately before use with one or a combination of the following commonly used methods:

O1.5.1 Circulation of water at a minimum temperature of 170° F (76.6° C) (at the discharge end) through the circuit for 5 minutes and drained.

O1.5.2 Pumping of an approved chemical sanitizer solution of acceptable strength and recommended temperature through product lines and equipment for at least 1 minute and drained. Halogen based sanitizers (chlorine and iodine) allowed to remain on surfaces for longer than necessary may cause corrosion.

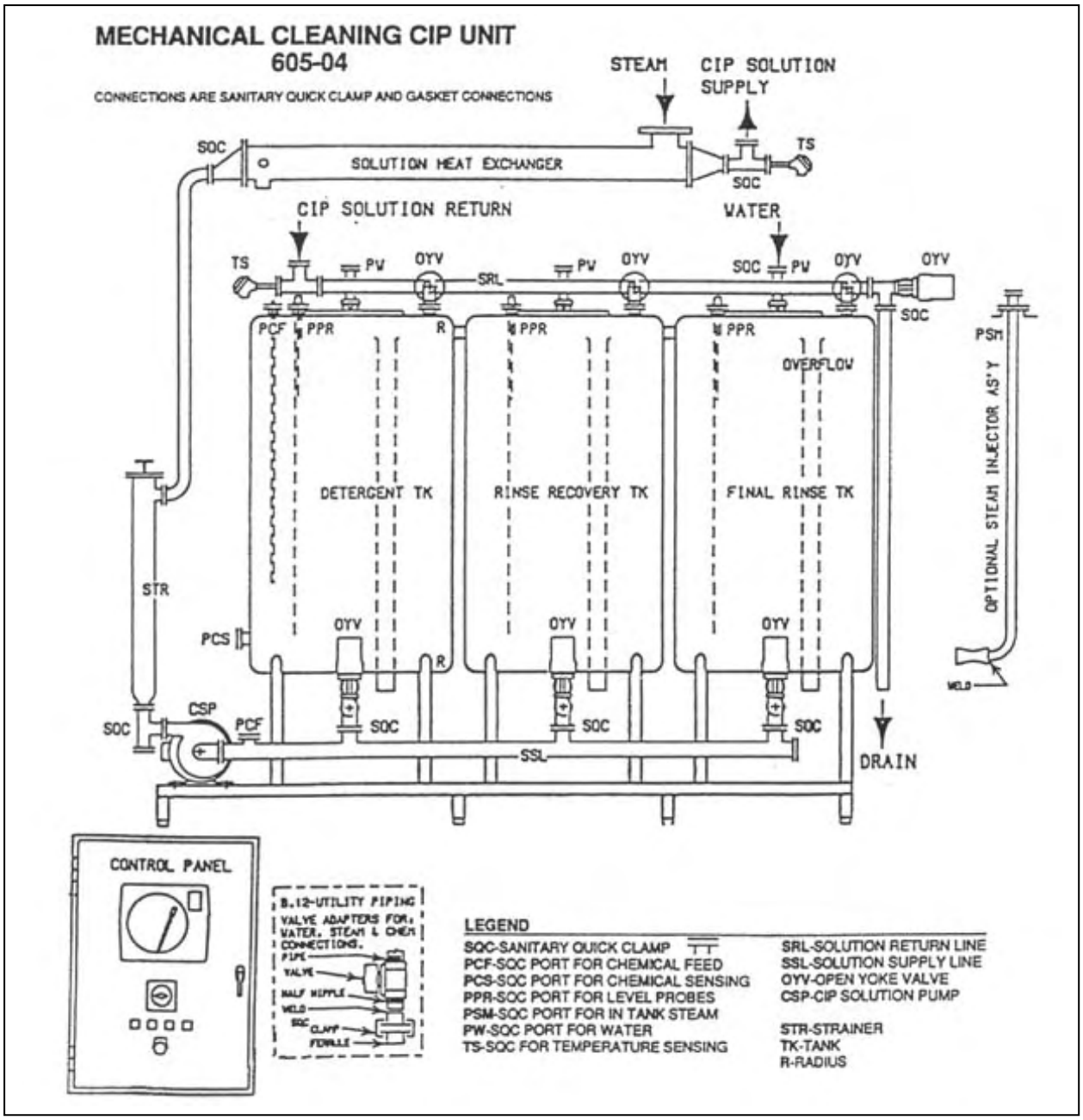
O1.5.3 Exposure to steam for at least 15 minutes after the temperature of the drainage at the outlet has reached 170° F (76.7° C) or for 5 minutes after the temperature of the drainage at the outlet has reached 200° F (93.3° C)

NOTE: Approved sanitization procedures and

related recommendations are provided in detail in the Grade "A Pasteurized Milk Ordinance Recommendations of the U.S. Public Health Service/Food and Drug Administration."

P SCHEMATIC EXAMPLES OF MECHANICAL CLEANING (CIP) UNIT

These amended accepted practices shall become effective August 20, 1994, at which time the 3-A Accepted Practices for Permanently Installed Sanitary Product-Pipelines and Cleaning Systems, with Amendment, Number 605-03 are rescinded and become null and void.


MECHANICAL CLEANING CIP UNIT
605-04
CONNECTIONS ARE SANITARY QUICK CLAMP AND GASKET CONNECTIONS
STEAM
CIP SOLUTION SUPPLY
SOC
SOLUTION HEAT EXCHANGER
TS
CIP SOLUTION RETURN
WATER
PV
OYV
SRL
PCF
PPR
R
OVERFLOW
DETERGENT TK
RINSE RECOVERY TK
FINAL RINSE TK
PSM
OPTIONAL STEAM INJECTOR ASSY
STR
PCS
CSP
SSL
DRAIN
CONTROL PANEL
B.12-UTILITY PIPING
VALVE ADAPTERS FOR WATER, STEAM & CHEM CONNECTIONS.
PIPE
VALVE
HALF NIPPLE
WELD
SOC
CLAMP
FERRULE
LEGEND
SQC-SANITARY QUICK CLAMP
PCF-SOC PORT FOR CHEMICAL FEED
PCS-SOC PORT FOR CHEMICAL SENSING
PPR-SOC PORT FOR LEVEL PROBES
PSM-SOC PORT FOR IN TANK STEAM
PW-SOC PORT FOR WATER
TS-SOC FOR TEMPERATURE SENSING
SRL-SOLUTION RETURN LINE
SSL-SOLUTION SUPPLY LINE
OYV-OPEN YOKE VALVE
CSP-CIP SOLUTION PUMP
STR-STRAINER
TK-TANK
R-RADIUS