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DAIRY, FOOD AND ENVIRONMENTAL

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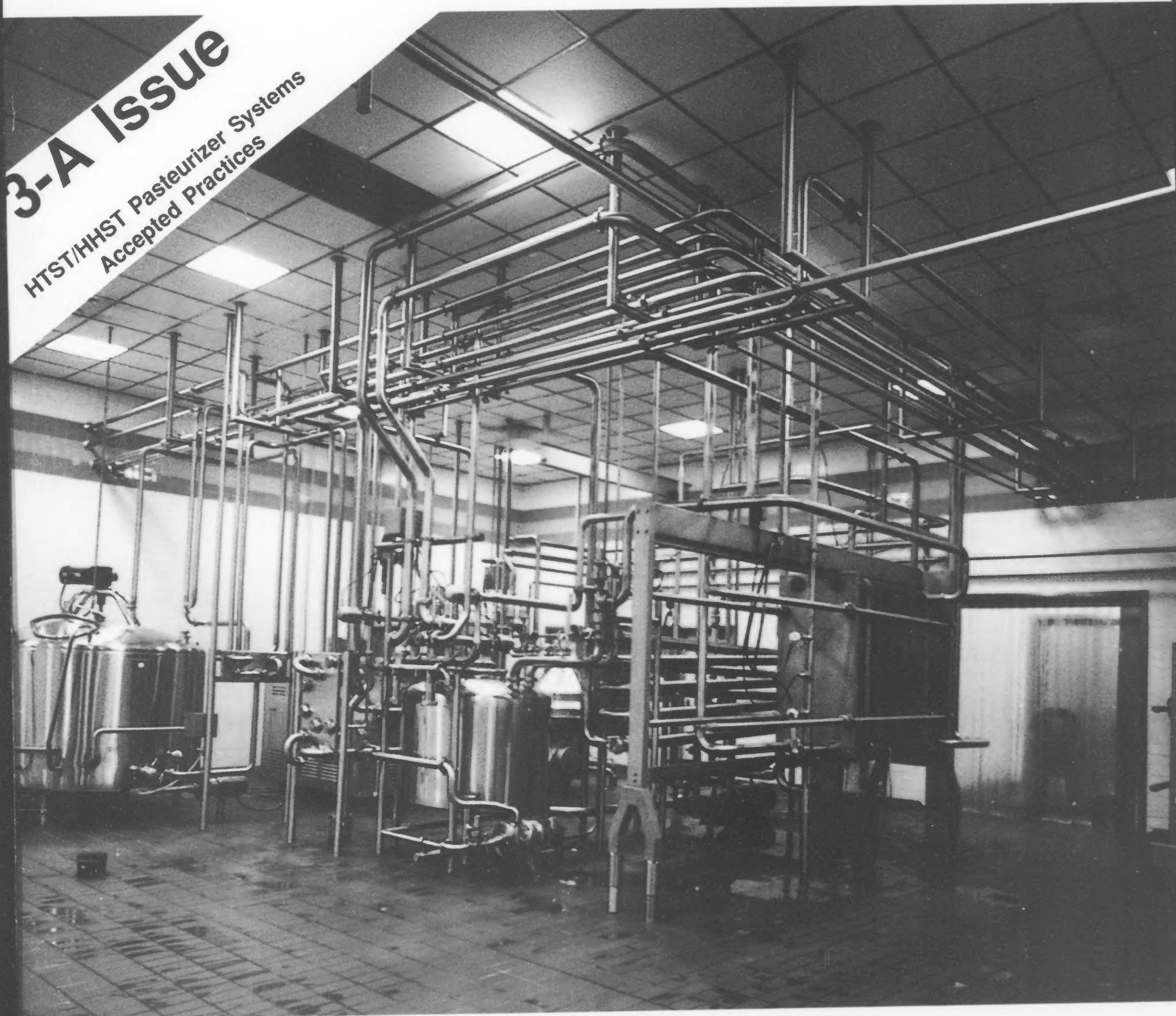

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Westreco Inc., 140 Boardman Road, New Milford, CT 06776; (203)355-0911

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Dairy, Food and Environmental Sanitation CONTENTS

SPECIAL THANKS

The 3-A Sanitary Standards Committees and the International Association of Milk, Food and Environmental Sanitarians would like to give special thanks and recognition to **Dale Seiberling and Seiberling Associates, Inc.** for their assistance on this project.

Their many hours of technical assistance and work on the figures for the HTST/HHST Systems in the 3-A **Accepted Practices for the Sanitary Construction, Installation, Testing and Operation of High-Temperature Short-Time and Higher-Heat Shorter-Time Pasteurizer Systems, Revised, Number 603-06**, were invaluable.

The manpower and materials provided by **Seiberling Associates, Inc.**, and its staff, epitomizes the voluntary cooperation of the 3-A Sanitary Standards Program.

Thank You!

ABOUT THE COVER.... *Photo courtesy of Seiberling Associates, Inc., 11415 Main Street, Roscoe, IL 61073; (815)623-7311, FAX (815)623-2029.*

This photograph is especially valuable in that it shows the temperature and pressure sensors, a constant-level tank, flow control valve, flow diversion valve, etc... essentially everything that the HTST Practice is all about. Even a separator (centrifugal machine) shows through in the background.

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The 3-A Sanitary Standards and Accepted Practices Program: A Brief Overview

The 3-A Sanitary Standards and Accepted Practices program, now over 50 years old, traces its roots to the 1920's. Seeing a need to standardize the design of dairy processing equipment, members of two trade associations and one professional association, the forerunners of today's Milk Industry Foundation (MIF), the Dairy and Food Industries Supply Association (DFISA) and the International Association of Milk, Food and Environmental Sanitarians (IAMFES), came together to write the first uniform standards for fittings used on milk pipe lines. Over the years, other industry groups joined in this cooperative effort to standardize dairy processing equipment. The 3-A designation continues to recognize the contributions of the three original associations.

As the 3-A program continued to grow and broaden its scope to include a variety of dairy processing equipment, it received official recognition from the United States Public Health Service (USPHS) in 1944. Today, representatives of the USPHS, joined by dairy processors, equipment manufacturers and sanitarians formulate the 3-A Sanitary Standards and Accepted Practices.

The 3-A Sanitary Standards Committees are made up of sanitarians from IAMFES and USPHS; dairy processors from the American Butter Institute (ABI), the American Dairy Products Institute (ADPI), the International Ice Cream Association (IICA), the Milk Industry Foundation (MIF) and the National Cheese Institute (NCI); and dairy equipment manufacturers from DFISA. Through the voluntary cooperation of these groups, the 3-A Sanitary Standards and Accepted Practices help to assure the safe and sanitary production of milk and milk products.

Structure of the 3-A Sanitary Standards Committees

The 3-A Sanitary Standards Committees are divided into three groups. The **Sanitary Standards Subcommittee of the Dairy Industry Committee (SSS-DIC)**, represents the dairy processors. The members of this subcommittee are representatives of the various product associations.

The **Technical Committee of the Dairy and Food Industries Supply Association** represents the dairy equipment manufacturers. Their primary purpose is to establish and man the task committees that formulate a standard for a specific piece of processing equipment.

And the sanitarians are represented by the **USPHS** and the **Committee on Sanitary Procedures (CSP) of IAMFES**. The sanitarians provide the 3-A program with expertise on cleaning and sanitizing equipment. Their participation also allows for a uniform adoption and enforcement of milk safety regulations, improving industry compliance.

In order to expedite the consideration of requests for new standards or revisions of existing standards, and to direct the priority and scheduling of proposals, the 3-A Steering Committee was formed. This committee consists of two representatives from each of the three groups (dairy processors, equipment manufacturers and sanitarians) and one representative of the 3-A Symbol Administrative Council (see side panel). Usually, the Steering Committee meets annually to consider requests for new or revised 3-A documents.

Formulating a 3-A Sanitary Standard or Accepted Practice

Action to revise, amend or supplement an existing 3-A Sanitary Standard or Accepted Practice or to create a new one, is initiated by a request from a dairy processor, equipment manufacturer or sanitarian. After the request is approved by the 3-A Steering Committee, DFISA appoints a special Task Committee of its

The 3-A Sanitary Standards Symbol Administrative Council

The 3-A Symbol was developed by the International Association of Milk, Food and Environmental Sanitarians (IAMFES) and registered with the U.S. Patent Office in 1952. In 1956 the 3-A Sanitary Standards Symbol Administrative Council was formed as a separate entity, completely distinct from the 3-A Sanitary Standards Committees. The 3-A Symbol was transferred by IAMFES to the 3-A Symbol Council upon its formation.

The 3-A Symbol Council consists of eight people - four from IAMFES, and two each from the Dairy Industry Committee (DIC) and the Dairy and Food Industries Supply Association (DFISA). These eight people, known as Symbol Trustees, authorize manufacturers to display the 3-A Symbol on dairy processing equipment that is in compliance with 3-A Sanitary Standards, and to use the 3-A Symbol in product literature. They are also charged with reviewing any possible abuses of 3-A Symbol use. The Symbol Council is administered by Secretary-Treasurer Walter Laun, with offices in Cedar Rapids, Iowa. All members of the Symbol Council are volunteers - none receive any reimbursement for council activities.

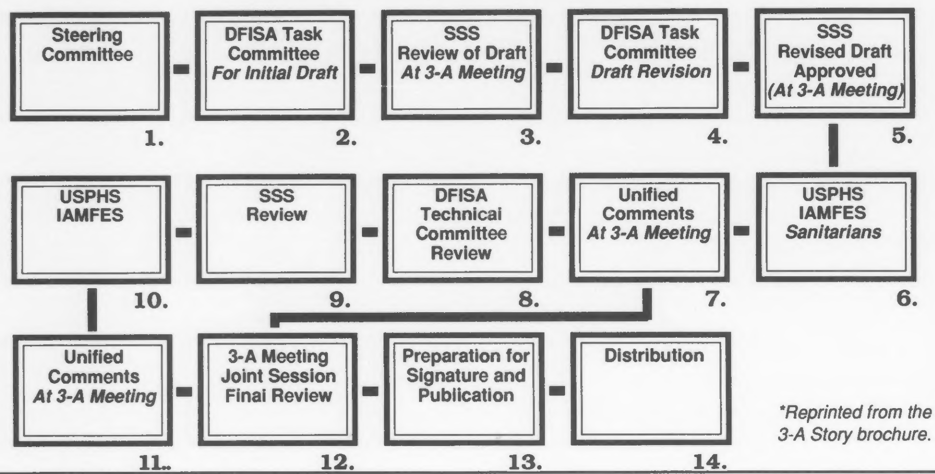
To receive authorization to display the 3-A Symbol, the manufacturer, through a company executive, certifies the equipment complies with all paragraphs of the applicable standards by doing the following:

1. Signing the printed declarations on the application;
2. Initialing every paragraph of pertinent 3-A Sanitary Standards;
3. Submitting a statement regarding the control systems used, and;
4. Submitting descriptive literature, photographs and engineering drawings if requested;
5. The Symbol Council may additionally request submission of small parts for review or reserve the right to arrange for review of prototype equipment (normally not done).

The application is reviewed by the Symbol Council, and, if all areas are in compliance under the specified standard, the manufacturer is then permitted to use the 3-A Symbol.

As noted there is usually not a formal review of the equipment for compliance with 3-A Sanitary Standards. The self-compliance system generally works well - but it does depend on the cooperation of all three segments of the industry. They must be continually vigilant in reviewing equipment for compliance with 3-A Standards. It is also very important to head off trouble

3-A Standard Operating Procedures*



*Reprinted from the 3-A Story brochure.

by making sure equipment is in compliance at or preferably before its installation. If a possible discrepancy is found, written notification should be sent to Robert Wolf, Secretary-Treasurer, of the 3-A Symbol Council. There are also non-compliance forms available.

Upon receipt of a complaint, the Secretary-Treasurer of the Symbol Council will notify the manufacturer and act as mediator to resolve the problem. If the Secretary-Treasurer and manufacturer cannot resolve the problem the manufacturer has the right to appeal it to the complete Symbol Council which meets twice per year in May and October. It should be emphasized that manufacturers participating in this program do so because they want equipment to conform. Generally in instances of non-compliance, the problems have been successfully resolved without revocation of the 3-A Symbol Authorization.

Twice per year, usually February and August, the names of 3-A Symbol Authorization holders are compiled by the Symbol Council and published in Dairy, Food and Environmental Sanitation magazine. The list provides a ready reference to equipment carrying the 3-A Symbol. Another way to check for 3-A Authorization is to request that a company provide a copy of their authorization certificate. Reprints of the symbol holders list as well as all 3-A Sanitary Standards and Accepted Practices are available.

Annually the Symbol Council renews authorization for a manufacturer to use the symbol. The Symbol Council Secretary/Treasurer mails renewal notices to the manufacturers two weeks before the authorization expiration date. A thirty day extension is automatically granted. Sixty days later, a letter is mailed notifying the manufacturer that authorization is being dropped. This period may be extended under certain circumstances. The Symbol Council has no punitive power for non-compliance other than the revocation of authorization to use the protected 3-A Symbol.

Reprinted, with revisions from Vol. 10, No. 2, *Dairy, Food and Environmental Sanitation*

Technical Committee to deal specifically with the requested standard or practice. The Task Committee drafts the initial 3-A document and, upon a two-thirds acceptance of the voting Task Committee members, passes it on to the SSS-DIC.

The SSS-DIC offers comments for revisions of the draft, or may accept it as written. If revisions are requested, the document is sent back to the Task Committee, then reconsidered by the SSS-DIC after revision. Once the document is accepted by consensus of the SSS-DIC, it passes to the CSP-USPHS for comment.

The sanitarians group considers the draft prior to a joint meeting of the 3-A Sanitary Standards Committees. At the meeting, the CSP-USPHS offers written comments and requests for revision if necessary. The document may again be sent back to the Task Committee for revision, then pass through the SSS-DIC and back to the CSP-USPHS group.

When all questions have been resolved at a plenary session of the 3-A Sanitary Standards Committees, the document is given to the 3-A Secretary for final editing. It is then distributed to the chairpersons of the DFISA Technical Committee, SSS-DIC, and IAMFES-CSP, as well as a representative of the USPHS for final signature.

New 3-A Sanitary Standards or Accepted Practices and supplements, amendments or revisions to existing ones normally become effective one year after the final authorizing signature is obtained. In extreme cases, standards or practices may become effective sooner, and revisions to the Sanitary Standards for Multiple-Use Plastic Materials become effective four months after signature.

Publication of all new or revised 3-A Sanitary Standards and Accepted Practices occurs at least 90 day prior to their effective date. These documents appear in the official publication of the International Association of Milk, Food and Environmental Sanitarians, ***Dairy, Food and Environmental Sanitation*** magazine.

Any dairy processing equipment manufacturer who wishes to conform to the 3-A Sanitary Standards and Accepted Practices has one year from the date of signature to do so. It is important to note that compliance with the 3-A Sanitary Standards and Accepted Practices is purely voluntary. The 3-A Program does not carry the weight of law and adherence to it by dairy processors, equipment manufacturers or regulatory personnel is not compulsory.

References

1. The 3-A Sanitary Standards Program: A Review and a Look Forward, 1991. *Dairy, Food and Environmental Sanitation*, Vol. 11, No. 2, pp. 87-89.
2. The 3-A Story. Brochure published by the Dairy and Food Industry Supply Assn. Rockville, MD.
3. Gilmore, T.M., 1990. The 3-A Story, *Dairy, Food and Environmental Sanitation*, Vol. 10, No. 2, pp. 60-63.

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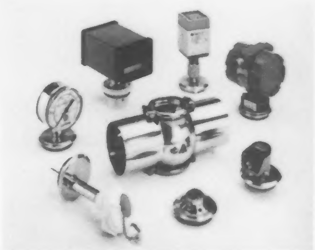

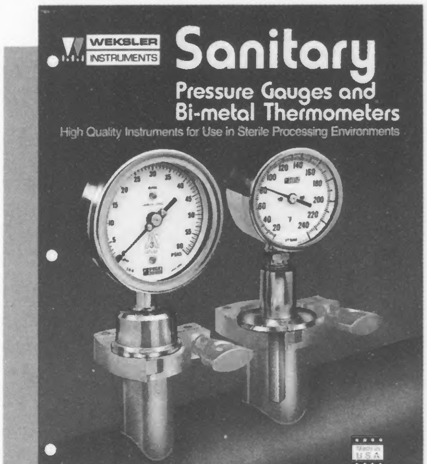

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Holders of 3-A Symbol Council Authorization on June 15, 1992

Questions or statements concerning any of the holders authorizations listed below, or the equipment fabricated, should be addressed to: Walter F. Laun, Administrative Officer 3-A Symbol Council, 4403 First Avenue, Suite 404, Cedar Rapids, IA 52402 (319) 395-9151.

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2 APV Crepaco, Inc. (5/1/56)
100 South CP Ave.
Lake Mills, Wisconsin 53551

28 Cherry-Burrell Corporation (10/3/56)
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365

117 DCI, Inc. (10/28/59)
P.O. Box 1227, 600 No. 54th Ave.
St. Cloud, Minnesota 56301

76 Damrow Company (10/31/57)
(A Div. of DEC Int'l., Inc.)
196 Western Ave., P.O. Box 750
Fond du Lac, Wisconsin 54935-0750

172 Paul Mueller Co. (6/29/60)
P.O. Box 828
Springfield, Missouri 65801

440 Scherping Systems (3/1/85)
801 Kingsley St.
Winsted, Minnesota 55395

571 Viatec Process/Storage Systems (8/21/89)
500 Reed St.
Belding, Michigan, 48809

31 Walker Stainless Equipment Co., Inc. (10/4/56)
Elroy, Wisconsin 53929

02-08 Pumps for Milk and Milk Products

63R AVP Crepaco, Inc. (4/29/57)
100 South CP Ave.
Lake Mills, Wisconsin 53551

636 Abel Pumps Corporation (7/10/91)
79 North Industrial Park
503 North Drive
Sewickley, Pennsylvania 15143-2394
(Mfr: Abel Pumps, Buchen, Germany)

214R Ben H. Anderson Manufactures (5/20/70)
Box A
Morrisonville, Wisconsin 53571

212R Babson Brothers Company (2/20/70)
Dairy Systems Division
1400 West Gale
Galesville, Wisconsin 54630

205R Dairy Equipment Co. (5/22/69)
1919 S. Stoughton Rd., P. O. Box 8050
Madison, Wisconsin 53716

462 Enprotech Corporation (12/5/85)
335 Madison Avenue
New York, New York 10017

671 Flowtech, Inc. (4/1/92)
1900 Lake Park Drive
Smyrna, Georgia 30080

466 Fluid Metering Inc. (1/10/86)
29 Orchard St.
Oyster Bay, New York 11771

306 Fristam Pumps, Inc. (5/2/78)
2410 Parview Road
Middleton, Wisconsin 53562

65R G & H Products Corp. (5/22/57)
7600-57th Avenue
P.O. Box 1199
Kenosha, Wisconsin 53141

145R ITT Jabsco Products (11/20/63)
(Mfg. by ITT Jabsco, England)
1485 Dale Way
Costa Mesa, California 92626

502 INOXPA, S.A. (4/27/87)
(not available in USA)
c/. Telers, 54
17820 Banyoles (Verona) Spain

314 Len E. Ivarson, Inc. (12/22/78)
3100 W. Green Tree Rd.
Milwaukee, Wisconsin 53209

603 Johnson Pumps (UK) Ltd (8/16/90)
325 Highfield Industrial Estate (8/16/90)
Edison Road, Eastbourne
East Sussex, England BN23 6PT
U. S. REP: Johnson Pump of America, Inc.
4825 Scott Street, Suit 306
Schiller Park, Illinois 60176

604 Johnson Pumps (UK) Ltd. (8/16/90)
(Not Available in the U.S.A.)
Highfield Industrial Estate
Edison Road, Eastbourne
East Sussex, England BN23 6PT

373 Luwa Corporation (12/27/82)
(Mfg. by MAAG Gear, Switzerland)
P.O. Box 16348
Charlotte, North Carolina 28297-6348

673 MGI Pumps, Inc. (4/16/92)
9201 Wilmot Road
Kenosha, Wisconsin 53141

654 Mono Pumps Ltd., Dresser Pump Division (10/22/91)
Martin Street
Audenshaw, Manchester
England M34 5DQ
U.S. REP: MonoFlo, Dresser Pump Division
Dresser Industries
821 Live Oak Drive
Chesapeake, Virginia 23320-2601

400 Netzsch Incorporated (8/15/83)
119 Pickering Way
Exton, Pennsylvania 19341-139

595 Seepex US, Inc. (3/16/90)
(Formerly Pumpen - und Maschinenbau)
1834 Valley Street
Dayton, Ohio 45405

241 Puriti, S.A. de C.V. (9/12/72)
Alfredo Nobel 39

Industrial Puente de Vigas
Tlalnepantla, Mexico
148R Robbins & Myers, Inc. (4/22/64)
1895 Jefferson St.
Springfield, Ohio 45506
364 Roper Pump Company (7/28/82)
P.O. Box 269
Commerce, Georgia 30529
568 Shanley Pump & Equipment, Inc. (5/15/89)
(Mfg. by Allweiler, West Germany)
2255-1 Lois Dr.
Rolling Meadows, Illinois 60008
678 Shanley Pump & Equipment (5/11/92)
2255-1 Lois Drive
Rolling Meadows, Illinois 60008
507 Sine Pump (7/21/87)
Division of The Kontro Co., Inc.
500 West River Street
Orange, Massachusetts 01364
567 Stainless Products, Inc. (4/4/89)
1649-72nd Ave.
P.O. Box 169
Somers, Wisconsin 53171
72R L.C. Thomsen Inc. (9/14/57)
1303-43rd St.
Kenosha, Wisconsin 53140
26R Tri-Clover, Inc. (9/29/56)
9201 Wilmot Road
Kenosha, Wisconsin 53141
609 Tuthill Corp. (12/12/90)
Tuthill Pump Division
12500 S. Pulaski Road
Alsip, Illinois 60658
175R Universal Dairy (10/25/56)
11100 N. Congress Ave.
Kansas City, Missouri 64153
52R Viking Pump, Inc. (12/31/56)
A Unit of IDEX Corporation
406 State Street
Cedar Falls, Iowa 50613
29R Waukesha Fluid Handling (10/3/76)
(Formerly Cherry-Burrell
Fluid Handling Division)
611 Sugar Creek Road
Delavan, Wisconsin 53115
408 Westfalia Systemat (10/18/83)
(Mfg. by Westfalia, West Germany)
1862 Brummel Drive
Elk Grove Village, Illinois 60007

04-03 Homogenizers and High Pressure Pumps of the Plunger Type

37 AVP Crepaco, INC. (10/19/56)
100 South CP Ave.
Lake Mills, Wisconsin 53551
75 APV Gaulin, Inc. (6/26/57)
500 Research Dr.
Wilmington, Massachusetts 01887
309 APV Rannie, Inc. (7/19/78)
(Formerly Niro Atomizer Food & Dairy, Inc.)
445 Etna Street
Suite 57
St. Paul, Minnesota 55106
247 Alfa-Laval (4/14/73)
8400 Lake View Parkway
Suite 500
Pleasant Prairie, Wisconsin 53158
390 American Lewa, Inc. (6/9/83)
(Mfg. by Lewa, Germany)
132 Hopping Brook Road
Holliston, Massachusetts 01760
247 Bran & Luebbe, Inc. (4/14/73)
1025 Busch Parkway
Buffalo Grove, Illinois 60015
87 Waukesha Fluid Handling (12/29/57)
(Formerly Cherry-Burrell
Fluid Handling Division)
611 Sugar Creek Road
Delavan, Wisconsin 53115
486 Fowler Products Company (11/18/86)
150 Collins Industrial Blvd.
P.O. Box 1706
Athens, Georgia 30613-1706
558 Niro Soavi S.p.A. (1/389)
43100 Parma (Italy)
VIA M. Da Erba Edoari, 29/A
Distributed in the U. S. by
Niro Hudson, Inc.
1600 Country Road F
Hudson, Wisconsin 54016

05-14 Stainless Steel Automotive Milk Transportation Tanks for Bulk Delivery and/or Farm Pick-up Service

379 Bar-Bel Fabricating Co., Inc. (3/15/83)
N 3760 Hwy 12 & 16
Mauston, Wisconsin 53948
70R Brenner Tank, Inc. (8/5/57)
450 Arlington Ave., P.O. Box 670
Fond du Lac, Wisconsin 54936
40 Hills Stainless Steel & Equipment Co., Inc. (10/20/56)
505 W. Koehn Street
Luverne, Minnesota 56156
66 Kari-Kool Transports, Inc. (5/29/57)
P.O. Box 538
Beaver Dam, Wisconsin 53916
201 Paul Krohnert Mfg. Ltd. (4/1/68)
(not available in USA)
811 Steeles Ave., P.O. Box 126
Milton, Ontario, Canada L9T 2Y3
513 Nova Fabricating Inc. (8/24/87)
404 City Rd.
P.O. Box 231
Avon, Minnesota 56310
85 Polar Tank Trailer, Inc. (12/20/57)
Holdingford, Minnesota 56340
653 Tremar (10/10/91)
(Not available in the U.S.A.)
1, Tougas Street
Iberville, Quebec, Canada J2X 2P7
25 Walker Stainless Equip. Co., Inc. (9/28/68)
618 State Street
New Lisbon, Wisconsin 53950
623 Walker Stainless Eq. Co., Inc. (3/28/91)
560 E. Burleigh Blvd.
P.O. Box 358
Tavares, Florida 32778
437 West-Mark (11/30/84)
2704 Railroad Ave., P.O. Box 418
Ceres, California 95307

08-17 Rev. Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products

349 APN, Inc. (12/15/81)
400 W. Lincoln
Caledonia, Minnesota 55921

260 APV Crepaco, Inc. (08-17 A&B) (5/21/75)
100 South CP Avenue
Lake Mills, Wisconsin 53551

470 Advance Stainless Mfg. Corp. (3/30/86)
218 West Centralia Street
Elkhorn, Wisconsin 53121

380 Allegheny Bradford Corp. (3/21/83)
P.O. Box 200 Route 219 South
Bradford, Pennsylvania 16701

79R Alloy Products Corp. (11/23/57)
1045 Perkins Ave., P.O. Box 529
Waukesha, Wisconsin 53187

621 Bradford Castmetals (2/25/91)
P. O. Box 33
Elm Grove, Wisconsin 53122

645 Cipriani, Inc. - Tassalini S.P.A. (8/27/91)
23195 LaCadena Drive
Suite #103
Laguna Hills, California 92653

528 Dayco Products Inc. (3/16/88)
333 West First Street
Dayton, Ohio 45402-3042

677 EXCEL-A-REC, Inc. (5/8/92)
W141 N5984 Kaul Avenue
Menomonee Falls, Wisconsin 53051

455 Flowtech Inc. (9/17/85)
1900 Lake Park Dr. Suite 345
Smyrna, Georgia 30080

271 The Foxboro Company (3/8/76)
33 Commercial Street
Foxboro, Massachusetts 02035

676 HBS Products, Inc. (4/29/92)
181 Elliot Street
Beverly, MA 01915

67R G & H Products Corp. (6/10/57)
7600-57th Avenue
P.O. Box 1199
Kenosha, Wisconsin 53141

369 IMEX, Inc. (11/3/82)
(Mfg. by Lube Corp., Japan)
4040 Del Ray Ave. Unit 9
Marina del Rey, California 90292

454 Jensen Fittings Corp. (9/11/85)
107-111 Goundry St.
North Tonawanda, New York 14120-5998

389 Lee Industries, Inc. (5/31/83)
P.O. Box 688
Philipsburg, Pennsylvania 16866

239 Lumaco, Inc. (6/30/72)
P.O. Box 688
Teaneck, New Jersey 07666

601 Nave Gmbh (6/15/90)
Am Rotboell 5
6108 Weiterstadt 2
Germany

200R Paul Mueller Co. (3/5/68)
1600 W. Phelps St., Box 828
Springfield, Missouri 65801

242 Puriti, S.A. de C.V. (9/12/72)
Alfredo Nobel 39
Industrial Puente de Vigas
Tlalnepantla, Mexico

424 Robert-James Sales, Inc. (8/31/84)
250 Ramsdell Ave.
Buffalo, New York 14216

334 Stainless Products, Inc. (12/18/80)
1649-72nd Ave., Box 169
Somers, Wisconsin 53171

391 Stork Food Machinery, Inc. (6/9/83)
(Mfg. by Stork Amsterdam, Netherlands)
P.O. Box 1258/Airport Parkway
Gainesville, Georgia 30503

357 Tanaco Products (4/16/82)
3860 Loomis Trail Rd.
Blaine, Washington 98230

449 Tech Controls Enterprise Co., Ltd. (8/2/85)
(Mfg. in Taiwan)
2940 SE 200th Avenue
Issaquah, Washington 98027

73R L.C. Thomsen, Inc. (8/31/57)
1303-43rd. St.
Kenosha, Wisconsin 53140

589 Titan Industries (12/27/89)
11121 Garfield Ave.
South Gate, California 90280

34R Tri-Clover, Inc. (10/15/56)
9201 Wilmot Rd.
Kenosha, Wisconsin 53141

304 VNE Corporation (3/16/78)
1415 Johnson St.
Janesville, Wisconsin 53545

82R Waukesha Fluid Handling (12/18/57)
(Formerly Cherry-Burrell
Fluid Handling Division)
611 Sugar Creek Road
Delavan, Wisconsin 53115

08-17A Compression Type Valves

533 APV Crepaco, Inc. (5/21/75)
100 S. CP Ave.
Lake Mills, Wisconsin 53551

484 APV, Inc. (10/22/86)
1325 Samuelson Rd.
Rockford, Illinois 61109

552 Alloy Products Corp. (11/23/57)
1045 Perkins Ave.
P.O. Box 529
Waukesha, Wisconsin 53187

245 Babson Brothers Company (2/12/73)
Dairy System Division
1400 West Gale Ave.
Galesville, Wisconsin 54630

443 Badger Meter, Inc. (4/30/85)
6116 East 15th Street
P. O. Box 581390
Tulsa, Oklahoma 74158-1390

555 Waukesha Fluid Handling (12/11/57)
(Formerly Cherry-Burrell
Fluid Handling Division)
611 Sugar Creek Road
Delavan, Wisconsin 53115

538 Cipriani, Inc. (7/31/86)
(Mfg. by Fratelli Tassalini, Italy)
23195 La Cadena Drive, Suite 103
Laguna Hills, California 92653

376 Defontaine, Inc. (1/25/83)

(Mfg. by Defontaine, France)
563 A.J. Allen Circle
Wales, Wisconsin 53183

530 G & H Products Corp. (6/10/57)
7600-57th Ave.
P.O. Box 1199
Kenosha, Wisconsin 53141

480 GEA Food and Process Systems Inc. (8/8/86)
8940 Route 108
Columbia, Maryland 21045

607 Kammer Valve, Inc. (9/25/90)
510 Parkway View Drive
Pittsburgh, Pennsylvania 15205

570 LUMACO (8/9/89)
9-11 East Broadway
Hackensack, New Jersey 07601

594 Oden Corp. (3/6/90)
255 Great Arrow Ave.
Buffalo, New York 14207

483 On-Line Instrumentation, Inc. (10/15/86)
Rt. 376, P.O. Box 541
Hopewell Junction, New York 12533

652 Pierre Guerin SA (10/4/91)
BP.12 - 79210
Mauze-Sur-Le-Mignon
France
U.S. Rep: Alfa Technical Group, Inc.
601 Thompson Road N.
Syracuse, New York 13211

551 Puriti, S.A. de C.V. (9/12/72)
Alfredo Nobel 39
Fracc. Ind. Puente de Vigas
Tlalnepantla, Mexico

149R Q-Controls (5/18/64)
Subsidiary of Cesco Magnetics
93 Utility Court
Rohnert Park, California 94928

542 L.C. Thomsen Inc. ((8/31/57)
1303-43rd. St.
Kenosha, Wisconsin 53140

34A Tri-Clover, Inc. (10/15/56)
9201 Wilmot Rd.
Kenosha, Wisconsin 53141

467 Tuchenhagen North America Inc. (1/13/86)
(Mfg. by Otto Tuchenhagen, West Germany)
4119 W. Greentree Road
Milwaukee, Wisconsin 53209

561 VACU-PURG, Inc. (1/26/89)
214 West Main St.
P.O. Box 272
Fredericksburg, Iowa 50630

584 Valvinox Inc. (11/27/89)
654 1ere Rue.
Iberville-QUE-Canada J2X 3B8

86R Waukesha Specialty Co., Inc. (12/20/57)
P.O. Box 160, Hwy 14
Darien, Wisconsin 53144

08-17B Diaphragm-Type Valves

565 APV Rosista, Inc. (10/22/86)
(Mfg. by APV Rosista, Inc. W. Germany & Denmark)
1325 Samuelson Rd.
Rockford, Illinois 61109

615 AsepCo (1/4/91)
170 State Street, Suit 200
Los Altos, California 94022

617 Defontaine, Inc. (2/1/91)
563 A. J. Allen Circle
Wales, Wisconsin 53183

637 Gemu Valves, Inc. (7/10/91)
3800 Camp Creek Parkway
Bldg. 2400, Suite 102
Atlanta, Georgia 30331

514 H. D. Bauman Assoc., Ltd. (8/24/87)
35 Mirona Road
Portsmouth, New Hampshire 03801

203R ITT Grinnell Valve Co., Inc. (11/27/68)
Dia-Flo Division
33 Centerville Rd.
Lancaster, Pennsylvania 17603

494 Saunders Valve, Inc. (2/10/87)
15760 W. Hardy, #440
Houston, Texas 77060

08-17D Automatic Positive Displacement Sampler

291 Accurate Metering Systems Inc. (6/22/77)
(Mfg. by Diessel, Germany)
1650 Wilkening Ct.
Schaumburg, Illinois 60173

284 Bristol Engineering Co. (11/18/76)
210 Beaver St.
P.O. Box 696
Yorkville, Illinois 60560

08-17E Inlet and Outlet Leak-Protector Plug Valve

556 Waukesha Fluid Handling (12/12/57)
(Formerly Cherry-Burrell
Fluid Handling Division)
611 Sugar Creek Road
Delavan, Wisconsin 53115

34E Tri-Clover, Inc. (10/15/56)
9201 Wilmot Rd.
Kenosha, Wisconsin 53141

08-17F Tank Outlet Valve

531 G & H Products Corp. (6/10/57)
7600-57th Ave.
P.O. Box 1199
Kenosha, Wisconsin 53141

534 Lumaco (6/30/72)
9-11 East Broadway
Hackensack, New Jersey 07601

643 Paul Mueller Company (8/22/91)
1600 West Phelps
Springfield, Missouri 65801

08-17G Rupture Discs

422 BS & B Safety Systems, Inc. (6/12/84)
7455 E. 46th St.
Tulsa, Oklahoma 74133

407 Continental Disc Corp. (10/14/83)
4103 Riverside NW
Kansas City, Missouri 64150

08-17H Thermoplastic Plug Type Valves

577 Ralet-Defay (11/2/89)
(U.S. Agent GENICANAM, Chazy, NY)
66, Blvd. Poincare
1070 Brussels, Belgium

08-17I Steam Injected Heaters

560 Pick Heaters, Inc. (1/19/89)
P.O. Box 516
West Bend, Wisconsin 53095

08-17M Vacuum Breakers and Check Valves

09-08 Instrument Fittings and Connections Used on Milk and Milk Products Equipment

32 ABB Kent-Taylor Inc. (10/4/56)
A Subsidiary of Asea Brown Brveri, Inc.
(Formerly Taylor Instruments)
95 Ames Street
P.O. Box 110
Rochester, New York 14692

428 ARI Industries, Inc. (9/12/84)
381 ARI Court
Addison, Illinois 60101

321 Anderson Instrument Co., Inc. (6/14/79)
RD #1
Fultonville, New York 12072

586 Beta Technology, Inc. (12/14/89)
105 Harvey West Blvd.
Santa Cruz, California 95060

315 Burns Engineering, Inc. (2/5/79)
10201 Bren Rd., East
Minnetonka, Minnesota 55343

206 The Foxboro Company (8/11/69)
33 Commercial Street
Foxboro, Massachusetts 02035

592 Claud S. Gordon Co. (2/27/90)
5710 Kenosha St.
P.O. Box 500
Richmond, Illinois 60071

620 Larad Equipment (2/25/91)
26 Pearl Street
Bellingham, Massachusetts 02019

588 Minco Products, Inc. (12/20/89)
7300 Commerce Lane
Minneapolis, Minnesota 55432

418 Niro Hudson (4/2/84)
(Formerly Niro Atomizer Food & Dairy)
1600 County Road F
Hudson, Wisconsin 54016

487 Pyromation, Incorporated (12/16/86)
5211 Industrial Road
Fort Wayne, Indiana 46825

367 RDF Corporation (10/2/82)
23 Elm Ave.
Hudson, New Hampshire 03051

495 Rosemount Analytical Division (2/13/87)
2400 Barranca Pkwy.
Irvine, California 92714

420 Stork Food Machinery, Inc. (4/17/84)
P.O. Box 1258/Airport Parkway
Gainesville, Georgia 30503

32 Taylor Instrument (10/4/56)
Combustion Engineering, Inc.
400 West Avenue, P.O. Box 110
Rochester, New York 14692

444 Tuchenhagen North America, Inc. (6/17/85)
4119 Green Tree Road
Milwaukee, Wisconsin 53209

612 Viatran Corp & Haenni Druckmittler (12/13/90)
300 Industrial Drive
Grand Island, New York 14072

522 Weed Instrument Company, Inc. (12/28/87)
707 Jeffrey Way
Round Rock, Texas 78664

10-03 Milk and Milk Products Filters Using Disposable Filter Media, as Amended

371 Alloy Products Corp. (12/10/82)
1045 Perkins Ave., P.O. Box 529
Waukesha, Wisconsin 53187

593 Filtration Systems (3/2/90)
Div. of Mechanical Mfg. Corp.
10304 NW 50th St.
Sunrise, Florida 33351

435 Sermia International (11/27/84)
26 Emilein Frenette
Ste-Therese, Quebec
Canada J7E 5K6
U. S. Rep: United Dairy
Machinery Corp.
301 Meyer Road
Buffalo, New York 14224

296 L. C. Thomsen, Inc. (8/25/77)
1303 43rd St.
Kenosha, Wisconsin 53140

35 Tri-Clover, Inc. (10/15/56)
9201 Wilmot Road
Kenosha, Wisconsin 53141

11-04 Plate-type Heat Exchangers for Milk and Milk Products

365 APV Baker AS (9/8/82)
(not available in USA)
Platinvej, 8
P.O. Box 329
DK-6000 Kolding
Denmark

20 APV Crepaco, INC. (9/4/56)
395 Fillmore Ave.
Tonawonda, New York 14150

17 Alfa-Laval Food & Dairy Co. (7/28/82)
(Div. of Alfa-Laval Inc.)
8400 Lake View Parkway
Pleasant Prairie, Wisconsin 53158

120 Alfa-Laval, Agri Inc. (12/3/59)
11100 No. Congress Ave.
Kansas City, Missouri 64153

30 Cherry-Burrell Corp. (10/2/56)
Process Equipment Division
P.O. Box 35600
Louisville, Kentucky 40232-5600

14 Chester-Jensen Co., Inc. (8/15/56)
5th & Tilghman Sts., P.O. Box 908
Chester, Pennsylvania 19016

468 GEA Food and Process Systems Inc. (2/2/86)
8940 Route 108
Columbia, Maryland 21045

622 ITT Standard (2/25/91)
175 Standard Parkway
Cheektowaga, New York 14227
P.O. Box 1102
Buffalo, New York 14240-1102

326 Karbate Vicarb Inc. (2/4/80)
(Mfg. by vicarb, France)
21945 Drake Rd.

Strongsville, Ohio 44136
15 Kusel Equipment Co. (8/15/56)
820 West St., P.O. Box 87
Watertown, Wisconsin 53094
360 Laffranchi Wholesale Co. (7/12/82)
P.O. Box 698
Ferndale, California 95536
657 Microfluidics Corp. (11/4/91)
90 Oak Street
P.O. Box 9101
Newton, Massachusetts 02164-9101
491 On-Line Instrumentation, Inc. (1/2/87)
P.O. Box 541
Hopewell Junction, New York 12533
414 Paul Meuller Co. (12/13/83)
P.O. Box 828
Springfield, Missouri 65801
279 The Schlueter Company (8/30/76)
(Mfg. by Samuel Parker, New Zealand)
216 Center Ave.
Janesville, Wisconsin 53547
650 Schmidt-Bretten, Inc. (10/3/91)
20475 Woodingham Drive
Detroit, Michigan 48221
670 Skellerup Engineering, Ltd. (4/1/92)
2 Robert Street
P. O. Box 11-020
Ellerslie, Auckland 5
New Zealand
U. S. Rep: Masport, Inc.
6140 McCormick Drive
Lincoln, Nebraska 68507
658 Thermaline (11/15/91)
180-37th Street
Auburn, Washington 98001
610 Universal Dairy Equipment (12/13/90)
(Mgr. Skellerup Engineering,
Auckland, New Zealand)
11100 N. Congress Avenue
Kansas City, Missouri 64153

12-05 Tubular Heat Exchangers for Milk and Milk Products

614 Alfa-Laval Food & Dairy (12/27/90)
(Manufactured by Spiraflo Indus.
Australia)
8400 Lake View Parkway, Suite 500
Pleasant Prairie, Wisconsin 53158
628 Alfa-Laval Food & Dairy Company (5/2/91)
8400 Lakeview Parkway
Suite #500
P.O. Box 500
Pleasant Prairie, WI 53158
438 APV Crepaco, INC. (12/10/84)
395 Fillmore Avenue
Tonawanda, New York 14150
248 Allegheny Bradford Corp. (4/16/73)
P.O. Box 200 Route 219 South
Bradford, Pennsylvania 16701
243 Babson Brothers Company (10/31/72)
Dairy Systems Division
140 West Gale
Galesville, Wisconsin 54630
605 Cherry-Burrell (8/30/90)
Process Equipment Division
P.O. Box 35600
Louisville, Kentucky 40232-5600
103 Chester-Jensen Co., Inc. (6/6/58)
5th & Tilghman Sts., P.O. Box 908
Chester, Pennsylvania 19016
613 Efrex Corp. (12/27/90)
11 Kitty Hawk Drive
Pittsford, NY 14534-1620
298 Feldmeier Equipment, Inc. (1/28/85)
6800 Town Line Road
P.O. Box 474
Syracuse, New York 13211
307 G & H Products Corp. (5/2/78)
7600-57th Avenue
P.O. Box 1199
Kenosha, Wisconsin 53141
217 Girton Manufacturing Co. (1/31/71)
Millville, Pennsylvania 17846
616 ITT Standard
175 Standard Pkwy
P.O. Box 1102
Buffalo, New York 14240-1102
238 Paul Mueller Co. (6/28/72)
P.O. Box 828
Springfield, Missouri 65801
96 C. E. Rogers Co. (3/31/64)
So. Hwy #65, P.O. Box 118
Mora, Minnesota 55051
532 Scherping Systems (6/8/88)
801 Kingsley St.
Winsted, Minnesota 55395
392 Stork Food Machinery, Inc. (6/9/83)
(Mfg. by Stork, Netherlands)
P.O. Box 1258/Airport Parkway
Gainesville, Georgia 30503
591 Thermotech/Div. of Fristam Pumps, Inc. (2/8/90)
2410 Parview Rd.
Middleton, Wisconsin 53562
632 Yula Corporation (6/4/91)
330 Bryant Avenue
Bronx., New York 10474

13-08 Farm Milk Cooling and Holding Tanks

240 Babson Brothers Company (9/6/72)
Dairy Systems Division
1400 West Gale
Galesville, Wisconsin 54630
4R Dairy Equipment Co. (6/15/56)
1919 So. Stoughton Rd.
Madison, Wisconsin 53716
179R Heavy Duty Products (Preston) Ltd. (3/8/66)
(Not available in USA)
1261 Industrial Rd.
Cambridge (Preston)
Ontario, Canada N3H 4W3
12R Paul Mueller Co. (7/31/56)
1600 W. Phelps, P.O. Box 828
Springfield, Missouri 65801
611 Universal Dairy Equipment (12/13/90)
11100 N. Congress Avenue
Kansas City, Missouri 64153

16-05 Evaporators and Vacuum Pans for Milk and Milk Products

254 APV Crepaco, Inc. (1/7/74)
165 John L. Dietsch Square

Attleboro Fall, Massachusetts 02763

132 APV Crepaco, INC. (10/26/60)
395 Fillmore Ave.
Tonawanda, New York 14150

277 Alfa-Laval, Inc. (8/19/76)
Contherm Division
P.O. Box 352, 111 Parker St.
Newburyport, Massachusetts 01950

639 Damrow Company (7/10/91)
421-6th Street South
Winsted, Minnesota 55395

500 Dedert Corporation (4/9/87)
20000 Governors Drive
Olympia Fields, Illinois 60461

311 GEA Food and Process Systems Inc. (8/28/79)
8940 Route 108
Columbia, Maryland 21045

273 Niro Evaporators, Inc. (5/20/76)
(Formerly Niro Atomizer
Food and Dairy)
9165 Rumsey Road
Columbia, MD 21045

107R C.E. Rogers Co. (7/31/58)
So. Hwy #65, P.O. Box 118
Mora, Minnesota 55051

186R Marriott Walker Corp. (9/6/66)
925 E. Maple Rd.
Birmingham, Michigan 48011

17-07 Formers, Fillers and Sealers of Single Service Containers for Milk and Milk Products

366 Autoprod, Inc. (9/15/82)
(An Alcoa Subsidiary)
5355 115th Avenue N.
Clearwater, Florida 34620

192 Cherry-Burrell Corp. (1/3/67)
(A Unit of AMCA Int'l., Inc.)
2400-6th St. SW, P.O. Box 3000
Cedar Rapids, Iowa 52406

382 Combibloc, Inc. (4/15/83)
(Mfg. by Jagenberg, West Germany)
4800 Roberts Rd.
Columbus, Ohio 43228

324 Erca USA, Inc. (11/29/79)
(Mfrd. by Erca, France
72A Grays Bridge Road
Brookfield, Connecticut 06804

488 Fords Holmatic Inc. (12/22/86)
1750 Corporate Dr.-Suite 700
Norcross, Georgia 30093

619 Hassia Verpackungsmaschinen GmbH (2/22/91)
6479 Ranstadt 1/Hessen Germany
(Hassia USA, Inc. 39 Plymouth St.
Fairfield, New York 07007)

648 Interkemek AB (9/23/91)
Nyttorp
S-693 00 Degerfors
Sweden
US Rep: FlowTech, Inc.
P.O. Box 71986
Marietta, Georgia 30007-1986

473 International Paper Company (6/12/86)
Extended Shelf Life Division
4020 Stirrup Creed Drive Bldg. 200
P.O. Box 13318
Research Triangle Park, North Carolina 27709

220 Tetra Rex Packaging Systems (4/24/71)
(formerly TetraPak/EquipUS)
2285 University Avenue
St. Paul, Minnesota 55114

330 Milliken Packaging (8/26/80)
(Mfg. by Chubukkikai, Japan)
White Stone, South Carolina 29353

442 Milliken Packaging (2/21/85)
White Stone, South Carolina 29386

137 Pure-Pak, Inc. (10/17/62)
850 Ladd Road
Walled Lake, Michigan 48088

281 Purity Packaging Corp. (11/8/76)
800 Kaderly Dr.
Columbus, Ohio 43228

511 Remy Division (8/14/87)
(Mfg. by E. P. Remy, France)
2096 Gaither Road, Suite 119
Rockville, Maryland 20850

482 Serac Inc. (8/25/86)
300 Westgate Drive
Carol Stream, Illinois 60188

351 Tetra Pak Inc. (1/7/82)
(Mfg. by A. B. Tetra, Italy)
889 Bridgeport Ave.
P.O. Box 807
Shelton, Connecticut 06484-0807

667 Walker Stainless (3/30/92)
Equipment of Florida, Inc.
560 Burleigh Blvd.
P. O. Box 358
Tavares, Florida 32778

19-04 Batch Continuous Freezers for Ice Cream, Ices, and Similarly Frozen Dairy Foods, as Amended

141 APV Crepaco, INC. (4/15/63)
100 South CP Ave.
Lake Mills, Wisconsin 53551

146 Cherry-Burrell Corp. (12/10/63)
P.O. Box 35600
Louisville, KY 40232-5600

286 O. G. Hoyer, Inc. (12/8/76)
(Mfg. by O. G. Hoyer A/S, Denmark)
201 Broad Street
Lake Geneva, Wisconsin 53147

465 Leon's Frozen Custard (12/17/85)
3131 S. 27th Street
Milwaukee, Wisconsin 53151

573 Processing Machinery & Supply Company (9/28/89)
(Mfg. by PMS Italiana, Italy)
1108 Frankford Ave.
Philadelphia, Pennsylvania 19125

412 Sani Mark, Inc. (11/28/83)
2020 Production Drive
Indianapolis, Indiana 46241

355 Emery Thompson Machine & Supply Co. (3/9/82)
1349 Inwood Ave.
Bronx, New York 10452

22-04 Silo-type Storage Tanks for Milk and Milk Products

154 APV Crepaco, Inc. (2/10/65)
100 South CP Ave.
Lake Mills, Wisconsin 53551

168 Cherry-Burrell Corp. (6/16/65)
(A Unit of AMCA Int'l, Inc.)

575 E. Mill Street
Little Falls, New York 13365

160 DCI, Inc. (4/5/65)
P.O. Box 1227, 600 No. 54th Ave
St. Cloud, Minnesota 56301

181 Damrow Co. (5/18/66)
(Div. of DEC Int'l., Inc.)
196 Western Ave., P.O. Box 750
Fond du Lac, Wisconsin 54935-0750

312 Feldmeier Equipment, Inc. (9/15/78)
6800 Town Line Road
P.O. Box 474
Syracuse, New York 13211

439 JV Northwest Inc. (1/22/85)
28120 SW Boberg Rd.
Wisonville, Oregon 97070

460 Niro Hudson (11/5/85)
1600 Country Road "F"
Hudson, Wisconsin 54016

155 Paul Mueller Co. (2/10/65)
1600 W. Phelps, P.O. Box 828
Springfield, Missouri 65801

503 Ripley Stainless Ltd. (5/1/87)
(Not available in USA)
RR #3, Site 41
Summerland, British Columbia V0H 1Z0

479 Scherping Systems (8/3/86)
801 Kingsley Street
Winsted, Minnesota 55395

675 Stainless Fabrication, Inc. (4/22/92)
620 North Prince Lane
Springfield, Missouri 65802

165 Walker Stainless Equipment Co., Inc. (4/26/65)
Elroy, Wisconsin 53929

23-01 Equipment for Packaging Frozen Desserts, Cottage Cheese, and Similar Milk Products, as Amended

174 APV Crepaco, Inc. (9/28/65)
Filling & Wrapping Systems Div.
1303 Samuelson Road
Rockford, Illinois 61109

209 Doboy Packaging Machinery Incorp. (7/23/69)
869 S. Knowles Ave.
New Richmond, Wisconsin 54017

499 Fords Holmatic, Inc. (3/19/87)
1750 Corporate Dr., Suite 700
Norcross, Georgra, 30093

674 Hayssen Manufacturing (4/20/92)
5300 Highway 42 North
P. O. Box 571
Sheboygan, Wisconsin 53082-0571

679 Ice Cream Novelties (6/1/92)
Division of Popsicle Inc., Ltd.
5305 Fairview Street
P. O. Box 610
Burlington, Ontario, Canada L7R 3Y5
U. S. Rep: Sunshine Biscuits
100 Woodbridge Center Drive
Woodbridge, New Jersey 07095-1196

635 Interbake Foods (7/10/91)
Dairy Division
2220 Edward Holland Drive
Suite 301
Richmond, Virginia 23230

343 O.G. Hoyer, Inc. (7/6/81)
(Mfg. by Alfa Hoyer, Denmark)
201 Broad St.
Lake Geneva, Wisconsin 53147

626 Klockner Bartelt, Inc. (4/2/91)
5501 N. Washington Blvd.
Sarasota, FL 34243-2283

447 Mateer-Burt Co., Inc. (7/22/85)
(Mfg. by Trustpak, England)
436 Devon Park Drive
Wayne, Pennsylvania 19087

537 Osgood Industries, Inc. (7/19/88)
601 Burbank Rd.
Oldsmar, Florida 34677

666 Rapidpak (3/5/92)
1725 West 8th Street
Appleton, Wisconsin 54911

222 Sweetheart Packaging (11/15/71)
10100 Reistertown Road
Owing Mills, Maryland 21117
(Formerly Fort Howard Pkg. Corp.)

24-01 Non-coil Type Batch Pasteurizers

158 APV Crepaco, INC. (3/24/65)
100 South CP Ave.
Lake Mills, Wisconsin 53551

161 Cherry-Burrell Corp. (4/5/65)
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365

187 DCI, Inc. (9/26/66)
P.O. Box 1227, 600 No. 54th Ave.
St. Cloud, Minnesota 56301

519 Feldmeier Equipment, Inc. (10/22/87)
6800 Town Line Road
P.O. Box 474
Syracuse, New York 13211

166 Paul Mueller Co. (4/26/65)
P.O. Box 828
Springfield, Missouri 65801

25-01 Non-coil Type Batch Processors for Milk and Milk Products

159 APV Crepaco, INC. (3/24/65)
100 South CP Ave.
Lake Mills, Wisconsin 53551

162 Cherry-Burrell Corp. (4/5/65)
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365

188 DCI, Inc. (9/26/66)
P.O. Box 1227, 600 No. 54th Ave.
St. Cloud, Minnesota 56301

167 Paul Mueller Co. (4/26/65)
P.O. Box 828
Springfield, Missouri 65801

448 Scherping Systems (8/1/85)
801 Kingsley Street
Winsted, Minnesota 55395

520 Stainless Fabrication, Inc. (12/8/87)
633 N. Prince Lane
Springfield, Missouri 65802

202 Walker Stainless Equip. Co., Inc. (9/24/68)
618 State St.
New Lisbon, Wisconsin 53950

26-02 Sifters for Dry Milk and Dry Milk Products

173 Blaw-Knox Food & Chemical Equip. Co. (9/20/65)
P.O. Box 1041
Buffalo, New York 14240

634 Great Western Mfg. Co. (7/10/91)
2017 South Fourth Street
P.O. Box 149
Leavenworth, Kansas 66048

363 Kason Corp. (7/28/82)
1301 East Linden Ave.
Linden, New Jersey 07036

430 Midwestern Industries, Inc. (10/11/84)
915 Oberlin Rd., P.O. Box 810
Massillon, Ohio 44648-0810

185 Rotex, Inc. (8/10/66)
1230 Knowlton St.
Cincinnati, Ohio 45223

656 Separator Engineering Ltd. (11/4/91)
(Not Available in the U.S.A.)
810 Ellingham Street
Pointe Clair, Quebec, Canada H9R 3S4

172 Sweco, Inc. (9/1/65)
7120 Buffington Rd.
Florence, KY 41042

27-01 Equipment for Packaging Dry Milk and Dry Milk Products

353 All-Fill, Inc. (3/2/82)
418 Creamery Way
Exton, Pennsylvania 19341

618 Hayssen Manufacturing Company (2/18/91)
(Manufactured by Yamato Scale Co.
Akasi, 673, Japan)
5300 Highway 42 North
P.O. Box 571
Sheboygan, Wisconsin 53082-0571

625 Ishida Scales Mfg. Co., Inc. (4/2/91)
44, Sanno-Cho, Shogoin
Sakyo-Ku, Kyoto, Japan
US Rep: Heat & Control
225 Shaw Rd.
S. San Francisco, CA 94080

409 Mateer-Burt Co. (10/31/83)
436 Devon Park Dr.
Wayne, Pennsylvania 19087

476 Stone Container Corporation (7/17/86)
1881 West North Temple
Salt Lake City, Utah 84116-2097

497 Triangle Package Machinery Co. (2/26/87)
6655 West Diversey Ave.
Chicago, Illinois 60635

28-01 Flow Meters for Milk and Milk Products

272 Accurate Metering Systems, Inc. (4/2/76)
1651 Wilkening Court
Schaumburg, Illinois 60173

253 Badger Meter, Inc. (1/2/74)
4545 W. Brown Deer Rd.
P.O. Box 23099
Milwaukee, Wisconsin 53223

518 Bailey Controls Company (10/16/87)
29801 Euclid Avenue
Wickliffe, Ohio 44092

359 Brooks Instruments (6/11/82)
407 West Vine St.
Hatfield, PA 19440

660 Danfoss A/S (11/20/91)
DK-6430
Nordborg, Denmark
US Rep: Danfoss Electronics
2995 Eastrock Drive
Rockford, Illinois 61109

469 Endress + Hauser, Inc. (3/3/86)
2350 Endress Place
Greenwood, Indiana 46142

599 Euromatic Machine & Oil Co., Ltd (4/26/90)
P.O. Box 297
St. Helier
Jersey C.I. UK

540 EXAC Corporation (8/12/88)
6410 Via Del Oro
San Jose, California 95119

226 Fischer & Porter Co. (12/9/71)
County Line Rd.
Warminster, Pennsylvania 18974

477 Flowdata Inc. (7/31/86)
1784 Firman Drive
Richardson, TX 75081

506 Flow Technology, Inc. (6/17/87)
4250 East Broadway Road
Phoenix, Arizona 85040

224 The Foxboro Company (11/16/71)
33 Commercial Street
Foxboro, Massachusetts 02035

649 Geo Technology (10/2/91)
12312 E. 60th Street
Tulsa, Oklahoma 74146

661 G/H Products Corp. (11/21/91)
7600-57th Avenue
P.O. Box 1199
Kenosha, Wisconsin 53142

562 Great Lakes Instruments, Inc. (2/6/89)
8855 North 55th Street
Milwaukee, Wisconsin 53223

630 Halliburton Services (5/28/91)
Drawer 1431
Duncan, Oklahoma 73536-0602

574 Hersey Measurement Co., Inc. (10/12/89)
150 Venture Blvd.
P.O. Box 4585
Spartanburg, South Carolina 29305

512 Hoffer Flow Controls, Inc. (8/17/87)
107 Kitty Hawk Lane
Elizabeth City, NC 27909

474 Hydril Production (6/30/86)
Technology Division
330 North Belt East
Houston, Texas 77032-3411

535 Invalco, Inc.
P.O. Box 556
Tulsa, Oklahoma 74101

399 E. Johnson Engineering & Sales (8/3/83)
11 N. Grant St.
Hinsdale, Illinois 60521

529 Krohne America, Inc. (5/18/88)
(Mfg. by Altometer, Holland)
One Intercontinental Way
Peabody, Massachusetts 01960

378 Micro Motion, Inc. (2/16/83)
7070 Winchester Circle
Boulder, Colorado 80301

490 Rosemount Inc. (1/8/87)
12001 Technology Dr.
Eden Prairie, Minnesota

585 Schlumberger Industries Ltd. (12/7/89)
(Mfg. by Schlumberger, England)
11321 Richmond Ave.
Houston, Texas 77082-2615

587 Schlumberger Ind., Measurement Div. (12/18/89)
(Mfg. by Schlumberger, France)
1310 Emerald Rd.
Greenwood, South Carolina 29646

550 Sparling Instruments Co., Inc. (10/26/88)
4097 N. Temple City Blvd.
P.O. Box 5988
El Monte, California 91731

270 Taylor Instrument (2/9/76)
Combustion Engineering, Inc.
400 West Avenue, P.O. Box 110
Rochester, New York 14692

265 Tokheim Automation (3/10/75)
P.O. Box 38269
Dallas, Texas 75238
(formerly Emerson Elec. Co.)

386 Turbo Instruments, Inc. (5/11/83)
(Mfg. by Turowerk, West Germany)
4 Vashell Way
Orinda, California 94563

664 XO Technologies, Inc. (12/16/91)
28020 Avenue Stanford
Valencia, California 91355

29-00 Air Eliminators for Milk and Fluid Milk Products

340 Accurate Metering Systems, Inc. (6/2/81)
1651 Wilkening Court
Schaumburg, Illinois 60173

662 G/H Products Corp. (11/21/91)
7600-57th Avenue
P.O. Box 1199
Kenosha, Wisconsin 53142

436 Scherping Systems (11/27/84)
801 Kingsley Street
Winsted, Minnesota 55395

30-01 Farm Milk Storage Tanks

421 Paul Mueller Co. (4/17/84)
P.O. Box 828
Springfield, Missouri 65801

31-01 Scraped Surface Heat Exchangers, as Amended

290 APV Crepaco, INC. (6/15/77)
100 South CP Ave.
Lake Mills, Wisconsin 53551

274 Alfa-Laval, Inc. (6/25/76)
Contherm Div.
P.O. Box 352, 111 Parker St.
Newburyport, Massachusetts 01950

323 Cherry-Burrell Corp. (7/26/79)
Process Equipment Division
P.O. Box 35600
Louisville, KY 40232-5600

496 FR Mfg. Corp. (2/23/87)
2807 South Highway 99
Stockton, California 95202

361 N.V. Terlet (7/12/82)
(US Agent Manning & Lewis-NJ)
P.O. Box 62
7200 AB Zutphen
Netherlands

32-00 Uninsulated Tanks for Milk and Milk Products

397 APV Crepaco, INC. (6/21/83)
100 South CP Ave.
Lake Mills, Wisconsin 53551

264 Cherry-Burrell Corp. (1/27/75)
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365

268 DCI, Inc. (11/21/75)
600 No. 54th Ave., P.O. Box 1227
St. Cloud, Minnesota 56301

354 C.E. Rogers Co. (3/3/82)
S. Hwy #65, P.O. Box 118
Mora, Minnesota 55051

441 Scherping Systems (3/1/85)
801 Kingsley St.
Winsted, Minnesota 55395

339 Walker Stainless Equip. Co., Inc. (6/2/81)
618 State St.
New Lisbon, Wisconsin 53950

33-00 Polished Metal Tubing for Dairy Products

310 Allegheny Bradford Corp. (7/19/78)
P.O. Box 200 Route 219 South
Bradford, Pennsylvania 16701

413 Azco, Inc. (12/8/83)
P.O. Box 567
Appleton, Wisconsin 54912

308 Rath Manufacturing Co., Inc. (6/20/78)
2505 Foster Ave.
Janesville, Wisconsin 53545

368 Rodger Industries Inc. (10/7/82)
(Not available in USA)
P.O. Box 186, RR1
Blenheim, Ontario
Canada N0P 1A0

335 Stainless Products, Inc. (12/18/80)
1649-72nd Ave., Box 169
Somers, Wisconsin 53171

289 Tri-Clover, Inc. (1/21/77)
9201 Wilmot Road
Kenosha, Wisconsin 53141

331 United Industries, Inc. (10/23/80)
1546 Henry Ave.
Beloit, Wisconsin 53511

34-01 Portable Bins

647 Thomas Conveyor Company (9/18/91)
Tote System Division
555 So. I-35W
Burleson, Texas 76028

35-00 Continuous Blenders

578 ACT Laboratories, Inc. (11/3/89)
P.O. Box 1107
McMurray, Pennsylvania 15317

527 Arde Barinco, Inc. (3/15/88)
500 Walnut Street
Norwood, New Jerey 07648

526 Bepex Corp./Schugi (3/15/88)
(Mfg. by Lelystad, Netherlands)
333 Taft St. NE
Minneapolis, Minnesota 55413

590 Chemineer Inc. (1/23/90)
125 Flagship Dr.
North Andover, Massachusetts 01845

417 Cherry-Burrell (2/7/84)
Process Equipment Division
P.O. Box 35600
Louisville, Kentucky 40232-5600

464 Dairy Service Mfg., Inc. (12/12/85)
4630 W. Florissant Ave.
St. Louis, Missouri 63115

642 Mondomix Holland b.v. (8/7/91)
Reeweg 13
P.O. Box 98
1394 ZH Nederhorst den Berg
The Netherlands
US Rep: Carrier Assoc.
50 Dunnell Lane
Paawtucket, Rhode Island 02860-5828

680 Quadro Engineering, Inc. (6/3/92)
613 Colby Drive
Waterloo, Ontario
Canada N2V 1A1

36-00 Colloid Mills

293 Cherry-Burrell (8/25/77)
611 Sugar Creek Road
Delavan, Wisconsin 53115

608 Kinematica (10/17/90)
170 Linden Street
Wellesley, Massachusetts 02181

37-01 Liquid Pressure and Level Sensing Devices

576 Ametek/Mansfield & Green Division (10/13/89)
8600 Somerset Dr.
Largo, Florida 34643

318 Anderson Instrument Co., Inc. (4/9/79)
R.D. #1
Fultonville, New York 12072

659 Bindicator Company (11/20/91)
1915 Dove Street
Port Huron, Michigan 48060

525 Caldwell Systems Corporation (3/4/88)
2450 Armstrong Street
Livermore, CA 94550
(Formerly Zantel Instruments)

672 Computer Instruments Corp. (4/3/92)
1000 Shames Drive
Westbury, New York 11590

640 Dresser Industries (7/16/91)
Instrument Division
250 East Main Street
Stratford, Connecticut 06497

663 Dresser Industries (12/4/91)
Instrument Division
210 Old Gate Lane
Milford, Connecticut 06460

405 Drexelbrook Engineering Co. (9/27/83)
205 Keith Valley Rd.
Horsham, Pennsylvania 19044

423 Dynisco (6/15/84)
Ten Oceana Way
Norwood, Massachusetts 02062

459 Endress + Hauser, Inc. (10/17/85)
2350 Endress Place
Greenwood, Indiana 46142

524 Flow Technology, Inc. (1/14/88)
4250 E. Broadway Road
Phoenix, Arizona 85040

463 The Foxboro Company (12/6/85)
33 Commercial Street
Foxboro, Massachusetts 02035

668 GP: 50 New York, Ltd. (3/30/92)
2770 Long Road
P. O. Box 297
Grand Island, New York 14072

651 Granzow, Inc. (10/3/91)
2300 CrownPoint Executive Drive
Charlotte, North Carolina 28227
(Mfr: Kubler AG
Baar, Switzerland)

633 Griffith Industrial Products Company (6/21/91)
P.O. Box 111
Putnam, CT 06260

557 Honeywell, Inc. (12/21/88)
Industrial Controls Div.
1100 Virginia Drive
Fort Washington, Pennsylvania 19034

629 Intrinsic Safety Equipment of Texas (5/20/91)
907 Bay Star
Webster, TX 77598-1531

598 Invalco, Inc. (3/22/90)
P.O. Box 556
Tulsa, Oklahoma 74101

572 ITT Conoflow (9/25/89)
P.O. Box 768
Rt 78
St. George, South Carolina 29477

396 King Engineering Corp. (6/13/83)
P.O. Box 1228
Ann Arbor, Michigan 48106

501 Lumenite Electronic Company (4/27/87)
2331 N. 17th Avenue
Franklin Park, Illinois 60131

596 Magnetrol International (3/20/90)
5300 Belmont Rd.
Downers Grove, Illinois 60515

627 Milltronics Process Measurements (4/12/91)
709 E. Stadium Drive
Arlington, TX 76011

419 Niro Hudson (4/2/84)
(Formerly Niro Atomizer Food & Dairy)
1600 County Road F
Hudson, Wisconsin 54016

597 NUOVA FIMA S.p.A. (3/20/90)
(not available in USA)
Via C. Battisti 59
28045 - INVORIO (N0) Italy

523 Paper Machine Components, Inc. (1/3/88)
Miry Brook Road
Danbury, Connecticut 06810

554 Par Sonics, Inc. (11/30/88)
P.O. Box 1127
State College, Pennsylvania 16804

563 PI Components Corp. (2/13/89)
10825 Barely Lane, Suite H
Houston, Texas 77070

644 Princo Instruments, Inc. (8/22/91)
1020 Industrial Highway
Southampton, Pennsylvania 18966-4095

328 Rosemount Inc. (5/22/80)
12001 Technology Dr.
Eden Prairie, Minnesota

515 Setra Systems, Inc. (9/14/87)
45 Nagag Park
Acton, Massachusetts 01720

583 S.J. Controls, Inc. (11/11/89)
2248 Obispo Ave. #203
Long Beach, California 90806

638 Span Instruments (7/10/91)
1497 Avenue "K"
Plano, Texas 75074

498 Statham Division of Solartron Transducers (3/5/87)
2230 Stratham Blvd.
Oxnard, California 93033

285 Tank Mate Div/Monitor Mfg. Co. (12/7/76)
P.O. Box AL
Elburn, Illinois 60119

641 Tempress A/S (7/16/91)
Engtoften 6, DK-8260
Viby J, Denmark

410 Viatran Corporation (11/1/83)
300 Industrial Drive
Grand Island, New York 14072

569 WEISS Instruments, Inc. (5/24/89)
(Mfg. by Nuova-Fima, Italy)
85 Bell St.
West Babylon, New York 11704

600 Weksler Instruments Corporation
800 Mill Rd
Freeport, NY 11520-0808

646 WIKA Instrument Corp. (9/10/91)
1000 Wiegand Blvd.
Lawrenceville, Georgia 30243

38-00 Cottage Cheese Vats

541 Kusel Equipment Company (9/16/88)
820 West St.
Watertown, Wisconsin 53094

385 Stoelting, Inc. (5/5/83)
P.O. Box 127
Kiel, Wisconsin 53042-0127

40-01 Bag Collectors for Dry Milk and Dry Milk Products

504 General Resource Corporation (5/15/87)
201 3rd Street South
Hopkins, Minnesota 55343

381 Marriott Walker Corp. (4/12/83)
925 E. Maple Rd.
Birmingham, Michigan 48011

453 MikroPul Corporation (9/4/85)
10 Chatham Road
Summit, New Jersey 07901

456 C. E. Rogers Company (9/25/85)
P.O. Box 118
Mora, Minnesota 55051

41-00 Mechanical Conveyors

631 Flexicon Corporation (5/28/91)
1375 Stryker's Road
Phillipsburg, NJ 08865

42-00 In-Line Strainers

606 Cherry-Burrell/Superior Stainless (9/18/90)
Fluid Handling Division
611 Sugar Creek Road
Delavan, Wisconsin 53115

655 Tri-Clover, Inc. (10/23/91)
9201 Wilmot Drive
Kenosha, Wisconsin 53141

44-00 Air Driven Diaphragm Pumps

624 Granzow, Inc. (4/1/91)
Manufactured by KWW-DEPA in Germany
2300 Crown Point
Executive Drive
Charolette, NC 28227

669 Skellerup Engineering, Ltd. (3/30/92)
2 Robert Street
P. O. Box 11-020
Ellerslie, Auckland 5
New Zealand
U. S. Rep: Masport, Inc.
6140 McCormick Drive
Lincoln, Nebraska 68507

Dairy, Food and Enviornmental Sanitation, Vol. 12, No. 7, Pages 423-477 (June 1992/3-A Issue)

3-A ACCEPTED PRACTICES FOR THE SANITARY CONSTRUCTION, INSTALLATION, TESTING AND OPERATION OF HIGH-TEMPERATURE SHORT-TIME AND HIGHER-HEAT SHORTER-TIME PASTEURIZER SYSTEMS, REVISED, NUMBER 603-06

Formulated by
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

It is the purpose of the IAMFES, 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. High-Temperature Short-Time and Higher-Heat Shorter-Time methods and apparatus, which are developed and which so differ in design, material, construction, installation, operating procedure or otherwise, so as not to conform with the following practices, but which in the opinion of the manufacturer or fabricator are equivalent or better, may be submitted at any time for the consideration of the IAMFES, USPHS, and DIC.

Nothing in these 3-A Accepted Practices shall be interpreted or construed in any way as changing the published effective requirements recommended by the United States Public Health Service Grade A Pasteurized Milk Ordinance, or any Federal, State, or Local legal code. These 3-A Accepted Practices were developed to provide manufacturers, processors, and milk and milk product control authorities with specifications for the proper construction and installation of new High-Temperature Short-Time Pasteurizer Systems and Higher-Heat Shorter-Time Pasteurizer Systems or any components thereof, which may be installed on or after the effective date of these revised Practices.

This portion of 603-06 contains the text, Part Two contains the drawings and related information.

TABLE OF CONTENTS

Glossary of Abbreviations and Symbols
(According to ANSI Y1.1 and ANSI Y10.9)

ACI ..... Alloy Cast Institute
AISI .... American Iron and Steel Institute
ASTM ... Formerly American Society for Testing and Materials
Bldg..... Building
C....... Celsius
CIP ..... Clean-In-Place
cm ...... Centimetre(s)
DC..... District of Columbia
DIC..... Dairy Industry Committee
E....... denotes exponential number
EPA .... Environmental Protection Agency
F....... Fahrenheit
fl oz..... Fluid Ounce(s)
FDA .... Food and Drug Administration
FDD .... Flow-Diversion Device
g .... Gram(s)
gal...... Gallon(s)
GPM ... Gallons per Minute
HHST.... Higher-Heat Shorter-Time
h .... Hour(s)
HTST.... High-Temperature Short-Time
IAMFES . International Association of Milk, Food and Environmental Sanitarians
IL ...... Illinois
in. ...... Inch(es)
kg...... Kilogram(s)
kPa..... Kilopascal
L....... Litre(s)
lb ...... Pound(s)
LPH .... Litre(s) per Hour
m ...... metre(s)
Max..... Maximum
MBTS .. Meter-Based Timing System
min..... Minute(s)
mL ..... Millilitre(s)
mm..... Millimetre(s)
NW..... North West
No...... Number
p....... Page
pp...... Pages
PA ..... Pennsylvania
PMO.... Grade A Pasteurized Milk Ordinance
ppm .... Parts per Million
psig .... Pressure per Square Inch Gauge
rev...... Revised
RPM.... Revolutions per Minute
sec...... Second(s)
STLR... Safety Thermal Limit Recorder
SW..... South West
St....... Street
U.S. .... United States
U.S.P.H.S. United States Public Health Service
VA..... Virginia

A

SCOPE

A.1

These 3-A Accepted Practices shall pertain to high-temperature short-time (HTST) and higher-heat shorter-time (HHST) pasteurization equipment, appurtenances, and controls used in a complete processing system for milk and milk products. In addition to pasteurization such systems may include flavor control, vacuum treatment, homogenization, clarification, separation, or other processes, which if included, are to be installed so that they do not influence required time, temperature, flow and pressure relationships.

A.2

In order to conform with these 3-A Accepted Practices, HTST or HHST pasteurizer systems shall comply with the following design, material, fabrication and installation criteria.

A.3

An Appendix is also included covering Application to Install, Operation, Determination of Holding Time and Pressure Relationships, Stainless Steel Materials, Product Contact Surface Finish and a list of 3-A Sanitary Standards and Accepted Practices referred to in the text. (NOTE: Numbered footnotes and references are assembled in Appendix, Section Q, on pages 452 to 453.)

B

DEFINITIONS

B.1

Pasteurization: The terms pasteurization, pasteurized, and similar terms shall mean the process of heating every particle of milk or milk product in properly designed and operated equipment, to one of the temperatures given in the following table and holding continuously at or above that temperature for at least the corresponding specified time:

Temperature	Time	
*161 degrees F (72 degrees C)	15.0 sec	(HTST Pasteurization)
191 degrees F (89 degrees C)	1.0 sec	(HHST Pasteurization)
194 degrees F (90 degrees C)	0.5 sec	(HHST Pasteurization)
201 degrees F (94 degrees C)	0.1 sec	(HHST Pasteurization)
204 degrees F (96 degrees C)	0.05 sec	(HHST Pasteurization)
212 degrees F (100 degrees C)	0.01 sec	(HHST Pasteurization)

* If the fat content of the milk product is 10 percent or more, or if it contains added sweeteners, or if the product is a condensed or concentrated milk or milk product, or a concentrated whey or whey product, the specified temperature shall be increased by 5 degrees F (3 degrees C).

Provided that, eggnog and frozen dessert mix shall be heated to at least the following temperature and time specifications:

Temperature	Time	
175 degrees F (80 degrees C)	25 sec	(HTST Pasteurization)
180 degrees F (83 degrees C)	15 sec	(HTST Pasteurization)

Provided, that cream for butter making shall be heated to at least 185 degrees F (85 degrees C) and held continuously at or above that temperature for at least 15 sec. Provided further, that nothing in this definition shall be construed as barring any other pasteurization process which has been recognized by the Food and Drug Administration to be equally efficient and which is approved by the control authority. These requirements are minimum for both time and temperature to pasteurize milk and milk products. Higher temperature and/or longer times may be utilized provided that both minimums are met.

B.2

Fail Safe Valve or Device: Shall mean a valve or device designed to move to and/or maintain a safe position in the event of air or actuating power failure.

B.3

Product: Shall mean milk and milk products.

B.4

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

B.5

Non-Product Contact Surfaces: Shall mean all other exposed surfaces.

B.6

Safe Water: Shall mean water from a supply properly located, protected and operated, and shall be of a safe, sanitary quality. The water shall meet the standards prescribed in the National Primary Drinking Water Regulation of the Environmental Protection Agency as referenced in 40 CFR Parts 141, 142 and 143.*[1] (Information also available from the EPA Drinking Water Hot Line - 202-260-5543.)

B.7

Control Authority: Shall mean the State or local agency having regulatory jurisdiction for the licensing of dairy processing facilities, or the validation for compliance (testing, timing and sealing) with legal pasteurization criteria as set forth in the Food and Drug Administration's GRADE A PASTEURIZED MILK ORDINANCE (PMO), and State regulations.

B.8

Timing Pump: Shall mean the sanitary, positive displacement-type pump which controls the rate of flow through the HTST or HHST pasteurizer system.

B.9

Meter Based Timing System (MBTS): The MBTS shall be a flow regulating system consisting of a primary flow-promoting centrifugal pump, a control valve or check valve and a magnetic flow meter which uses an electrical signal to control the flow rate of the product through the holding tube of the HTST or HHST system.

C

COMPONENTS

C.1

Required component equipment for the HTST or HHST pasteurizer system shall consist of the following:

C.1.1

Raw Product Constant Level Tank;

C.1.2

Heating Equipment;

C.1.3

Heating Medium System;

C.1.4

Timing Pump or Timing System: The product flow through the holding tube shall be controlled by means of a timing pump or a meter-based timing system (MBTS);

C.1.5

Holding Tube;

C.1.6

Flow-Diversion Device (FDD);

C.1.7

Safety Thermal Limit Recorder (STLR);

C.1.8

Temperature Controller;

C.1.9

Indicating Thermometers; and

C.1.10

Connecting Sanitary Pipe and Fittings

C.2

Optional component equipment may be required for certain product processes that synchronize well with HTST or HHST pasteurizer systems. Therefore, the necessary equipment and associated controls may be connected as part of the complete HTST or HHST pasteurizer system as follows:

C.2.1

Regenerative Equipment;

C.2.2

Cooling Equipment;

C.2.3

Cooling Medium System;

C.2.4

Control Panel;

C.2.5

Raw Product Booster Pump;

C.2.5.1

Raw Product Booster Pump Control;

C.2.6

Homogenizer;

C.2.7

Clarifier;

C.2.8

Separator;

C.2.9

Filters and Strainers;

C.2.10

Surge Tank;

C.2.11

Flavor Control or Vacuum Treatment Equipment, with or without direct product heating by steam injection or infusion;

C.2.12

Auxiliary Pumps; and

C.2.13

Other Processing Equipment or Component Parts.

D

MATERIALS FOR PRODUCT CONTACT SURFACES

D.1

The materials of product contact surfaces of Component Equipment, or Optional Component Equipment for which there are 3-A Sanitary Standards or 3-A Accepted Practices shall comply with the material criteria of the applicable 3-A Sanitary Standards or 3-A Accepted Practices.

D.2

All other product contact surfaces shall be stainless steel of the AISI 300 Series*[2] or the corresponding ACI*[3] types (See Appendix, Section O.) or other equally corrosion resistant metal that is non-toxic and nonabsorbent, or heat resistant glass, except that:

D.2.1

Rubber and rubber-like materials may be used in sealing applications and in parts having the same functional purposes.

D.2.2

Rubber and rubber-like materials when used for these specified applications shall comply with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-like Materials, Used as Product Contact Surfaces in Dairy Equipment, Number 18-00.

D.2.3

Plastic materials may be used in sealing applications and in parts having the same functional purposes.

D.2.4

Plastic materials when used for these specified applications shall comply with applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastics Materials, Used as Product Contact Surfaces for Dairy Equipment, Number 20-14, as amended.

E

FABRICATION

E.1

The fabrication criteria of Component Equipment or Optional Component Equipment for which there are 3-A Sanitary Standards or 3-A Accepted Practices shall be those of the applicable 3-A Sanitary Standards or 3-A Accepted Practices.

E.2

All other component equipment or optional component equipment shall conform to the following fabrication criteria:

E.2.1

All 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 P.)

E.2.2

All product contact surfaces designed to be mechanically cleaned shall be designed so that the product contact surfaces and all nonremovable appurtenances thereto can be mechanically cleaned and are easily accessible for inspection.

E.2.3

All product contact surfaces not designed to be mechanically cleaned shall be easily accessible for cleaning and inspection either when in an assembled position or when removed. Removable parts shall be readily demountable.

E.2.4

All internal angles of 135 degrees or less on product contact surfaces shall have minimum radii of 1/4 in. (6.0 mm) except where smaller radii are required for essential functional reasons. In no case shall radii be less than 1/32 in. (1 mm).

E.2.5

Non-product contact surfaces shall have a smooth finish, be free of pockets and crevices, and be readily cleanable. Those surfaces which are to be coated shall be effectively prepared for coating. Parts removable for cleaning having both product contact and non-product contact surfaces shall not be painted.

E.3

Raw Product Constant Level Tank

E.3.1

The raw product constant level tank shall conform to the applicable provisions of 3-A Sanitary Standards for Uninsulated Tanks for Milk and Milk Products, Number 32-00, and the following criteria:

E.3.2

The tank shall be of such design and capacity that air will not be drawn into the pasteurizer with the product when operating at maximum sealed capacity of the timing pump or the timing system.

E.3.3

The tank shall be equipped with an automatic device or system of sanitary construction to control the raw product level. A manual over-ride of this device may be provided for testing of product flow rate as specified in L.2.13.1.

E.3.4

The raw product constant level tank shall be fabricated so that the contents will drain to the outlet before the outlet becomes uncovered.

E.3.5

Return connections on the tank for divert pipeline, leak detector pipeline and recycle pipeline (if used) must be fabricated to prevent the back flow of raw milk into pasteurized milk pipeline. One method of complying with this requirement is as follows:

1. Determine the maximum flood level for the raw product constant level tank at an overflow condition. This level may be the top of the highest opening equivalent to, or greater than two times the diameter of the largest inlet (supply) pipeline.

2. The constant level tank design must provide for all return pipelines to break to atmosphere at a distance equal to, or greater than two times the diameter of the largest return pipeline above the maximum flood level.

E.4

Heating and Cooling Equipment

E.4.1

The product heating and cooling equipment shall conform to 3-A Sanitary Standards for Plate Type Heat Exchangers for Milk and Milk Products, Number 11-04, 3-A Sanitary Standards for Tubular Heat Exchangers for Milk and Milk Products, Number 12-05, or

3-A Sanitary Standards for Scraped Surface Heat Exchangers, Number 31-01, and 3-A Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products (rev.) (Steam Injection Heaters), Number 08-17 I.

Note: The inclusion of cooling equipment in HTST or HHST pasteurizer systems is optional.

E.4.2

If a regenerator is employed, the deflector plates in the lower raw product channel shall be drilled with at least 1/16 in. (2 mm) holes, so that a continuous opening is available through the entire length of the raw product channel through which drainage may occur.

E.5

Timing Pump or Meter Based Timing System (MBTS)

E.5.1

The timing pump shall have its driving mechanism so designed that in case of wear, belt stretch, or any other condition affecting the capacity of the pump, the capacity will not increase.

E.5.2

Both variable and fixed capacity driving mechanisms are permitted, and shall be so designed as to permit sealing to prevent pump operation at greater capacity than that which gives legal holding time. Operation at any lower capacity shall be permitted.

E.5.3

Flow meters shall conform to the 3-A Sanitary Standards for Flow Meters for Milk and Liquid Milk Products, Number 28-02.

E.5.4

The components of the MBTS shall be designed to function as follows:

E.5.4.1

The magnetic flow meter (tube and transmitter) shall produce a linear signal proportional to flow through the holding tube.

E.5.4.2

A high flow alarm with an adjustable set point shall be included in the system to cause the FDD to be moved to the divert position whenever excessive flow causes the product holding time to be less than the legal holding time for the pasteurization process being used.

E.5.4.3

A flow recorder capable of recording flow to at least 5 gal (19.0 L) per min more than the high flow alarm setting shall be included. The flow recorder shall have an event pen which shall indicate the status of the flow alarm with respect to flow rate.

E.5.4.4

A low flow or loss of signal alarm shall be included in the system to cause the FDD to be moved to the divert position whenever there is a loss of signal from the meter or when the flow rate is below a preset minimum flow rate. This function may be provided in combination with the high flow alarm or as a separate device.

E.5.4.5

A time delay relay shall be included to maintain the FDD in the diverted position, following diversion due to excessive flow. The time delay relay capacity shall be at least equal to or greater than the legal holding time for the product being processed.

E.5.4.6

The flow transmitter, high flow alarm, low flow alarm and time delay device shall all be provided with a simple means of sealing, so that the settings cannot be changed or manipulated without breaking the seal.

E.6

Holding Tube

E.6.1

The holding tube, including its inlet and outlet connections, shall be constructed of sanitary piping and fittings that conform to 3-A Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products, Number 08-17 as amended, and if intended to be mechanically cleaned, it shall conform to the 3-A Accepted Practices for Permanently Installed Sanitary Product-Pipelines and Cleaning Systems Used in Milk Products Processing Plants, Number 605-04. All sanitary metal tubing shall conform to the 3-A Sanitary Standards for Polished Metal Tubing for Dairy Products, Number 33-00.

E.6.2

The holding tube shall be designed to provide for the continuous holding of every particle of milk or milk product, for at least the minimum required holding time.

E.6.3

The holding tube shall be so designed that the simultaneous temperature difference between the hottest and coldest product in any cross-section of flow at any time during the holding period will not be greater than 1 degree F (0.5 degree C), and the average velocity through the holding tube shall not be less than 1 ft per sec (305 mm per sec).

E.6.4

The holding tube shall be so designed that no portion between the inlet and the FDD temperature sensor is heated. Optionally, it may be shielded, covered or enclosed to reduce heat loss.

E.6.5

No device shall be permitted for short circuiting a portion of the holding tube to compensate for changes in rate of product flow. Holding tubes shall be designed so that sections of pipeline cannot be left out, resulting in a holding time less than the legal minimum.

E.6.6

The holding tube shall be designed to have a continuously upward slope, in the direction of flow, of not less than 1/4 in. per ft (20.8 mm per m) from its beginning to the connection at the inlet of the FDD.

E.6.6.1

Supports for 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.

E.6.7

The holding tube shall be provided with fittings for installing an indicating thermometer and the temperature sensor of the STLR at the outlet end. When the conductivity test is to be used to determine holding time, provision shall be made for the temporary installation of a timing electrode at the inlet end. The indicating thermometer connection may be used for the other timing electrode.

E.6.8

The STLR temperature sensor connection shall not be more than 18 in. (457 mm) upstream from the inlet of the FDD. The indicating thermometer sensor shall be located as close as practical to the STLR temperature sensor and shall measure the temperature of the same body of product.

E.7

Flow-Diversion Device (FDD)

E.7.1

The FDD shall be so designed that, when in the diverted-flow position, product cannot pass into the forward-flow pipeline. To make certain of this, the device shall meet the following requirements:

E.7.1.1

The FDD shall include means that will automatically cause diversion of the product flow when the product leaving the holding tube is at sub-legal temperature. (See F.6.)

E.7.1.2

The FDD shall move from the forward-flow position to the diverted-flow position in not more than 1 sec after power cut-out during descending temperatures in all systems and when flow is below the minimum set point (alarm point) or above the legal maximum in a MBTS system.

E.7.1.3

A leak escape shall be provided on the forward-flow side of the valve seat. However, when back pressure is exerted on the forward-flow side of the valve seat, while the product flow is being diverted, the leak escape shall lie between two valve seats or between two portions of the same seat, one upstream and the other downstream from the leak escape. The leak escape port of a single stem valve shall be designed and the valve so installed as to drain all leakage to the outside. The leak escape shall be designed with one or more openings, with a total effective open area equivalent to at least 5/32 in. (4.0 mm) diameter. The leak escape port of a dual stem FDD shall be equal to or greater than the size of the inlet.

E.7.1.4

The closure of the forward-flow seat shall be sufficiently tight so that leakage does not occur past it, as evidenced when the forward- flow line is disconnected; and in order that proper seating shall not be disturbed, the length of the connecting rod shall not be adjustable by the user.

E.7.1.5

It shall be impossible to tighten the stem packing of the single stem valve to such an extent as to prevent the valve from assuming the fully diverted-flow position.

E.7.2

The FDD shall include means that will automatically de-energize the timing pump until the FDD reaches its fully diverted-flow position, when the product is at sub-legal temperature. (See F.6. and F.14.1.)

E.7.3

The FDD shall provide means for automatically returning the product to forward-flow when the product has been restored to the required minimum legal temperature and flow rate.

E.7.4

The FDD shall provide means that will automatically cause diversion of the product flow in case of actuating power failure.

E.7.5

The Inspect/Process/CIP mode selector switch and a manual divert button/switch is required for a dual-stem FDD and shall be located on the main control panel or on a FDD sub-panel.

E.7.6

The FDD shall assume the fully diverted-flow position within 1 sec when the manual divert is activated with the pasteurizer operating in forward-flow at the maximum flow rate on the most viscous product for which the system is designed.

E.8

Safety Thermal Limit Recorder (STLR)

E.8.1

The STLR, with its temperature sensor located in accordance with E.6.8 shall meet the following requirements:

E.8.2

Case shall be moisture-proof (under operating conditions encountered in pasteurization plants) unless installed in a protected area.

E.8.3

Chart range shall have a span not less than 30 degrees F (17 degrees C) including the temperature at which diversion is set, plus and minus 12 degrees F (7 degrees C).

E.8.4

Temperature accuracy shall be 1 degree F (0.5 degree C) plus or minus through a range of 5 degrees F (3 degrees C) above and below the diversion temperature.

E.8.5

All STLR clocks shall be electrically operated.

E.8.6

Temperature represented by smallest temperature-scale division shall be 1 degree F (0.5 degree C) over the specified chart range.

E.8.7

Spacing of 1 degree F (0.5 degree C) scale division shall be not less than 0.0625 of an in. (1.59 mm) apart at the diversion temperature , plus or minus 1 degree F (0 . 5 degree C): Provided, that temperature scale divisions of 1 degree F (0. 5 degree C) spaced not less than 0.040 in. (1 mm) apart are permitted when the ink line is thin enough to be easily distinguished from the printed line, graduated in the required time-scale divisions. (See E.8.8 and E.8.9)

E.8.8

Time represented by smallest time-scale division shall be not more than 15 min chord or straight line.

E.8.9

Equivalent 15 min chord or straight-line length shall be not less than 1/4 in. (6.0 mm) through a range of 1 degree F (0.5 degree C) above and below the diversion temperature.

E.8.10

Mechanical pen-arm setting devices shall be accessible and simple to adjust.

E.8.11

Pen and chart paper shall be designed to give a continuous line not over 0.025 in. (0.64 mm) wide when in proper adjustment. The chart marking device shall be easy to maintain.

E.8.12

Temperature sensor shall be protected against damage at temperatures up to 220 degrees F (105 degrees C) for HTST pasteurizer systems and to 300 degrees F (149 degrees C) for HHST pasteurizer systems.

E.8.13

Chart-speed for a circular chart shall be not more than one revolution in 12 h and shall be graduated for a maximum record of 12 h. Strip type charts may show a continuous recording for a 24 h period. When a recorder uses a microprocessor or a computer to regulate the speed of the chart drive motor, the controls or method of set-up for this recorder shall be equipped with a locking, sealable switch that prevents accidental or unauthorized changes in chart rotation or speed when placed in the "Run" or sealable position.

E.8.14

The STLR shall be provided with an additional pen-arm for recording upon the outer edge of the chart the full record of the time during which the FDD is in the forward-flow and the diverted-flow positions. The temperature recording pen and the diversion pen shall be synchronized on the same chart time divisions. A multiple diversion STLR, if used, shall be provided with a third pen to record on the chart the diversion temperature setting.

E.8.14.1

STLR multiple diversion cut-out control can be accomplished by either of the following ways:

E.8.14.1.1

A multiple diversion STLR may be used to divert product at the proper temperature. Such an instrument shall be capable of adjustment and be sealed at different diversion temperatures. The selection of the proper diversion temperature shall be by positioning an electrical switch which may also be used for other interlocking purposes. In case of power failure, the diversion point shall automatically revert to the highest temperature of and the FDD shall automatically assume the diverted-flow position.

E.8.14.1.2

Separate STLRs can be used, each set and sealed to divert at the proper temperature. The separate STLRs are wired to the FDD and electrically interlocked so that only one STLR operates the FDD at any one time. In case of power failure, the instrument with the higher diversion temperature shall operate the FDD.

E.8.14.1.3

Holding Time Control:

If different holding times are required, the electrical switch which selects the proper diversion temperature is also used to supply power to the proper circuit governing the speed of the timing system. Such control circuits may be for two speed motors or for high flow alarm switches on meter based timing systems.

E.8.15

The control mechanism for setting the temperatures at which forward-flow and diverted-flow occur shall be provided with a simple means of sealing, so that it cannot be changed or manipulated without breaking the seal.

E.8.16

Thermometric response for HTST pasteurizer systems (HHST pasteurizer systems exempt) shall be determined with the STLR temperature sensor at room temperature and then immersed in a well stirred water or oil bath (or can) at 7 degrees F (4 degrees C) above the desired cut-in temperature. The interval between the moment when the recording thermometer reads 12 degrees F (7 degrees C) below the cut-in temperature and the moment of power cut-in shall not be more than 5 sec.

PRECAUTION: The water or oil bath should be so placed that when the temperature sensor is immersed it will be approximately at its normal operating elevation. This will avoid errors due to the hydrostatic effect within the tube system or thermal element.

E.8.17

The cut-in and cut-out response shall be independent of the temperature-recording pen-arm movement.

E.9

Temperature Controller

E.9.1

Each HTST and HHST pasteurizer system shall be equipped with a dependable automatic temperature control system designed so that the final product temperature can be accurately maintained.

E.9.2

The temperature control system shall be designed to cut off the flow of the primary heating medium when the electrical power fails.

E.10

Indicating Thermometers

E.10.1

Hot product thermometer(s) are required. One hot product thermometer complying with the criteria of this section is required for all HTST and HHST pasteurizer systems. A second hot product thermometer is required for HTST and HHST pasteurizer systems when the timing pump is located as provided for in H.1.2.

E.10.1.1

Indicating thermometers shall be mercury-actuated, direct reading and be contained in a corrosion resistant case which protects against breakage and permits easy observation of the column and scale. The filling above mercury shall be nitrogen or equally suitable gas.

E.10.1.2

Magnification of mercury column shall be to an apparent width of not less than 0.0625 in. (1.59 mm).

E.10.1.3

The scale shall have a span not less than 25 degrees F (14 degrees C) including the pasteurizing temperature, plus and minus 5 degrees F (3 degrees C) graduated in 0.5 degree F (0.25 degrees C) divisions with not more than 8 degrees F per in. of scale (4 degrees C per 25 mm), and be protected against damage at 220 degrees F (105 degrees C) for HTST pasteurizer systems or 300 degrees F (149 degrees C) for HHST pasteurizer systems.

E.10.1.4

Accuracy shall be within 0.5 degree F (0.25 degree C), plus or minus throughout specified scale range.

E.10.1.5

Stem fittings shall be pressure-tight against the inside wall of the fittings with no threads exposed to product. The distance from the under side of the ferrule to the top of the sensitive portion of the bulb shall not be less than 3 in. (76 mm).

E.10.1.6

Thermometric response shall be determined with the thermometer starting at room temperature; immerse it in a well-stirred water or oil bath at least 19 degrees F (11 degrees C) higher than the minimum scale reading on the thermometer, and above the maximum pasteurization temperature for the thermometer. The time required for the thermometer reading to increase from bath temperature minus 19 degrees F (11 degrees C) to bath water temperature minus 7 degrees F (4 degrees C) shall not exceed 4 sec.

E.10.1.7

The bulb shall be made of glass having a viscosity of at least 10 E + 14.6 poises at 914 degrees F (490 degrees C) and at least 10 E + 13.4 poises at 968 degrees F (520 degrees C) or equally suitable thermometric glass.*4

E.10.2

Alternate type thermometers other than mercury actuated which conform to the functional and construction requirements of the general specifications of mercury-in-glass hot product thermometers may be used provided that they have been (1) recognized by the Food and Drug Administration to be equally fail safe, accurate, reliable and meet the scale and thermometric response specifications for mercury actuated thermometers, and (2) are approved by the control authority.

E.10.3

Cold product thermometer(s) recommended.

E.10.3.1

Type shall be the same as for hot product thermometer(s) (E.10.1.1).

E.10.3.2

Magnification of mercury column shall be the same as for hot product thermometer(s) (E.10.1.2).

E.10.3.3

Scale range shall be 30 degrees F to 100 degrees F (minus 1 degree C to 38 degrees C), with extension on either side permitted. The thermometer(s) shall be protected against damage at temperatures up to 220 degrees F (105 degrees C) for HTST pasteurizer systems or to 300 degrees F (149 degrees C) for HHST pasteurizer systems and shall be graduated in 1 degree F (0.5 degree C) divisions, with not more than 22 divisions per in. or 25.4 mm of scale.

E.10.3.4

Accuracy shall be within 1 degree F (0.5 degree C) plus or minus throughout specified scale range.

E.10.3.5

Stem Fittings shall be the same as for hot product thermometer(s) (E.10.1.5).

E.10.3.6

Bulb shall be made of glass having a viscosity of at least 10 E + 14.6 poises at 914 degrees F (490 degrees C) and at least 10 E + 13.4 poises at 968 degrees F (520 degrees C) or equally suitable thermometric glass.*4

E.10.4

Alternate type thermometer(s) for cold product that conform to the functional and sanitary construction requirements of the general specification of mercury-in-glass cold product line thermometer(s) shall be acceptable.

E.11

Heating Medium System

E.11.1

The heating medium system shall be any means, such as hot water, steam, electricity or regeneration, used to transfer heat to the product, provided it is applied in such a manner so as not to contaminate the product. (See E.9 regarding required means of controlling the temperature.)

E.12

Cooling Medium System (when a cooling section is included.)

E.12.1

Water, brine, non-toxic freezing point depressant solutions, regeneration, or direct expansion refrigeration may be used to transfer heat from the product, provided it is applied in such a manner so as not to contaminate the product.

E.12.2

The cooling medium system, including the supply storage tank, shall be designed to prevent contamination of the medium.

E.12.3

If the temperature of the cooling system is lower than the freezing temperature of the product, a means shall be provided which will automatically:

E.12.3.1

Prevent freezing of the product, or

E.12.3.2

Divert liquid product to the raw product constant level tank or to waste if freezing occurs.

E.12.3.3

Such means shall not adversely affect the proper pressure relationship in the regenerator(s).

E.13

Raw Product Booster Pump

E.13.1

When a raw product booster pump is used, it shall be a centrifugal pump.

E.13.2

The motor, casing and impeller of the booster pump shall be identified, and such records thereof maintained as directed by the control authority.

E.13.3

A variable frequency speed control may be used for the booster pump motor, provided it is installed in conformance with Sections F.13.2 through F.13.2.3 and only Method F.13.3.2 may be used to control the booster pump.

E.14

Raw Product Booster Pump Control

E.14.1

A raw product booster pump control shall be provided that will not allow the raw product booster pump to operate unless the pressure in the pasteurized product side of the regenerator is greater by at least 2 psig (14 kPa) than the pressure in the raw product side of the regenerator.

E.14.2

Means shall be provided for sealing the raw product booster pump control so that the settings cannot be changed without breaking the seal.

E.14.3

Pressure gauges shall be provided at the inlet of the raw regenerator and at the outlet of the pasteurized regenerator to permit determination of the relative pressure at any time except that, provision of an indicating differential pressure switch satisfying E.14.1 also fulfills this requirement.

F

INSTALLATION

All component equipment, or optional component equipment, with product contact surfaces, shall be connected to each other with sanitary pipelines and fittings and shall be properly installed so as not to have any adverse effects on the required time, temperature, flow, and pressure relationships of the HTST or HHST pasteurizer system. Such parts and equipment shall be installed to facilitate easy access for cleaning, maintenance and inspection. The installation of all Component Equipment or Optional Equipment for which there are 3-A Sanitary Standards or 3-A Accepted Practices shall conform with the applicable 3-A Sanitary Standards or 3-A Accepted Practices. When regenerator and/or separator bypasses are installed, they shall be designed and installed so that they are close coupled and do not create dead ends or, when permissible, shall be drilled to allow for movement of product through the bypass.

F.1

Raw Product Constant Level Tank

F.1.1

The tank outlet shall be connected to the raw product inlet of the regenerative section, or when a raw product booster pump is used, the tank outlet shall be connected to the inlet of this pump.

F.1.2

When product to product regeneration is employed, the tank shall be installed so that its maximum overflow level is lower than the bottom of the raw regenerator.

F.1.3

The constant level tank or surge tank shall conform with the applicable provisions of E.2 through E.3.5 and shall be sized so the average residence time is 4 min or less and the generation of foam is minimized. Except that if the average residence time in the tank is greater than 4 min, the product in the tank must be held below 45 degrees F (7 degrees C) or above 145 degrees F (63 degrees C), or the tank must be cleaned and sanitized at least every 4 h.

F.2

Heating and Cooling Equipment

F.2.1

If the pressure of the product in the pasteurized product passages in the HTST pasteurizer system drops to within 2 psig (14 kPa) of the pressure of the product in the raw product passages the booster pump shall stop.

F.2.2

When product to product regeneration is employed, the pasteurized product, between its outlet from the regenerator and the nearest point downstream open to the atmosphere, shall rise to a vertical elevation of at least 12 in. (305 mm) above the highest raw product level downstream from the constant level tank and shall be open to the atmosphere at this or a higher elevation. An effective vacuum breaker of sanitary design shall be considered as being an opening to the atmosphere. The vacuum breaker must be installed downstream of the regenerator prior to any valve or device capable of being fully closed.

F.2.3

Suitable equipment (positive displacement pump, normally closed flow control valve or check valve) shall be installed between the outlet of the raw product regenerator and the inlet to the holding tube to prevent back flow of raw product to the regenerator when flow of raw product to the regenerator stops.

F.2.4

All raw product in the regenerator(s) shall drain freely to the raw product constant level tank when the raw product pump(s) is shut down, and the raw product pipeline is disconnected at the regenerator outlet.

F.2.5

When a plate type heat exchanger is installed, the processor shall have available for the control authority a diagram showing the plate and port arrangement in proper operating sequence, and proper location of drain holes.

F.3

Timing Pump or Timing System

F.3.1

The timing pump driving motor and starter shall be interwired with all components as prescribed in F.5 and the timing pump or system shall be installed upstream of the holding tube, except as provided for in Section H.1.2.

F.3.2

Timing pumps and homogenizers, when used as timing pumps, shall not have by-pass pipelines connected from their outlet pipelines to their inlet pipelines during processing if an additional flow-promoting or vacuum producing device is located within the system.

F.3.3

All other flow-promoting devices such as booster pumps, auxiliary pumps, separators, clarifiers and homogenizers, as well as the centrifugal pump, shall be properly interwired with the FDD so that they may run and produce flow through the system only when the FDD is in the fully diverted or the fully forward-flow position when in the product run mode. Separators or clarifiers which continue to run after their power is shut off to them must be automatically valved out of the system with fail-safe valves, properly interwired with the FDD, so that they are incapable of producing flow during this period.

F.3.4

The individual components of the MBTS shall be installed in the system as follows:

F.3.4.1

The centrifugal pump shall be located downstream from the raw milk regenerator section if a regenerator is used.

F.3.4.2

The magnetic flow meter shall be placed downstream from the centrifugal pump. There shall be no intervening flow-promoting components between the centrifugal pump and the meter.

F.3.4.3

Both the centrifugal pump and the magnetic flow meter shall be located upstream from the holding tube.

F.3.4.4

When a centrifugal pump with an electronic variable speed drive is used in a MBTS, a sanitary product check valve or normally closed air-to-open valve shall be installed downstream of the meter and upstream of the holding tube to prevent positive pressure in the raw milk side of the regenerator whenever a power failure or shut down occurs.

F.3.4.5

When a centrifugal pump with a single speed drive is used in a MBTS, a normally closed air operated flow control valve shall be installed downstream of the meter and upstream of the holding tube.

F.3.4.6

Flow through the magnetic meter and the holding tube shall be controlled to permit testing of the high-flow and low-flow alarm settings.

F.3.4.7

Acceptable flow promoting devices for MBTS include:

(a) Fixed speed centrifugal pump with flow control valve.

(b) Centrifugal pump controlled by a variable speed drive.

F.3.4.8

There shall be no product entering or leaving the system (i.e. cream or skim milk from a separator or other product components) between the primary flow-promoting centrifugal pump and the FDD.

F.3.4.9

The magnetic flow meter shall be so installed that the product has contact with both electrodes at all times when there is flow through the system. This is most easily accomplished by mounting the flow tube of the magnetic flow meter in a vertical position with the direction of flow from the bottom to the top. However, horizontal mounting is acceptable when other precautions are taken to assure that both electrodes are in contact with product. The meter shall not be mounted on a high horizontal line which may be only partially full and thereby trap air.

F.3.4.10

The magnetic flow meter shall be piped in such a manner that at least ten times the meter flow tube diameter of straight, unobstructed pipeline exists upstream and downstream from the center of the meter before any elbow or change in direction takes place.

F.3.5

When a product-to-product regenerator is used with these systems, it usually is necessary to by-pass the regenerator during start-up and when the FDD is in the diverted-flow position. The by-pass valving shall automatically provide for free drainage of the regenerator when the timing pump stops or the FDD is in the diverted-flow position. There shall be no dead-ends in the by-pass pipeline.

F.3.6

All required public health controls shall be tested by the control authority at the frequency specified in the Grade A Pasteurized Milk Ordinance (PMO). Where adjustment or changes can be made to these devices such as, variable or fixed capacity driving mechanisms or controls affecting flow rate, cut-in or cut-out temperature, appropriate seals shall be applied so that changes cannot be made without breaking the seals.

F.4

Holding Tube

F.4.1

The holding tube supports shall be installed and adjusted to maintain all parts of the holding tube in a fixed position, and to maintain the minimum upward slope, as prescribed in E.6.6.

F.4.1.1

No part of the holding tube shall be higher than the inlet connection to the FDD.

F.4.2

Any piping from the outlet of the heater to the beginning of the holding tube with less than 1/4 in. per foot (20.8 mm per m) continuous upward slope shall not be considered part of the holding tube.

F.4.3

The timing electrode fitting is required to be installed in all systems, except HHST systems, at the inlet of the holding tube and shall be installed with sanitary fittings.

F.5

Flow-Diversion Device (FDD)

F.5.1

Except as provided for in H.1.3.3.1, H.1.3.3.2 and F.5.1.3, the FDD shall be so interwired with the STLR that when the product at the STLR temperature sensor is at sub-legal temperature the FDD will automatically assume the diverted position. The FDD shall be actuated by the same temperature sensor that actuates the STLR.

F.5.1.1

When MBTS is used the FDD shall be so interwired that when the flow rate is below the low flow alarm setting or, loss of signal alarm or, above the high flow alarm setting, the FDD shall automatically assume the diverted-flow position.

F.5.1.2

When the mode selector switch is moved from the "Process" to "Inspect" position, the FDD shall be prevented from assuming the forward-flow position until the timing pump and all other flow promoting devices have stopped. Separators and clarifiers shall be automatically valved out of the system. The time delay must be set and sealed at a time that is greater than the longest run-down time of these flow-promoting devices which are not automatically valved out of the system.

F.5.1.3

During mechanical cleaning, the FDD may assume the forward-flow position or be cycled at sub-legal temperature. If the system is designed so the FDD may assume the forward-flow position and the timing pump and other flow-promoting devices may run during mechanical cleaning at sub-legal temperatures, an additional time delay relay is required. This time delay shall hold the FDD in the diverted-flow position for at least 10 min after the FDD mode switch has been moved to the "CIP" position. Any flow-promoting device which may produce pressure in the raw regenerator during mechanical cleaning shall not run for at least 10 min after the FDD mode switch has been moved to the "CIP" position or, in the case of separators and clarifiers upstream of the FDD, shall be automatically valved out of the system during this 10 min period and the valves shall be controlled by the same time delay as the FDD. The 10 min time delay shall be set and sealed.

F.6

The timing pump and other flow-promoting devices not valved out of the system shall be interwired with the FDD and the STLR so they cannot run at sub-legal temperatures, unless the flow-diversion valve is in its fully diverted position.

F.6.1

The FDD shall be installed so that, when in the diverted-flow position, product cannot pass into the forward-flow pipeline.

F.7

The temperature-controller for heating shall be installed as part of the heating system.

F.8

Indicating Thermometer(s)

F.8.1

Indicating Thermometer(s) - Hot Product:
One thermometer shall be installed in the fitting at the outlet of the holding tube, as described in E.6.7 and E.6.8, except as provided for in Section H.1.3.7.

F.8.2

Indicating Thermometer(s) - Cold Product:
If provided, this thermometer(s) shall be installed in the pipeline from the outlet of the cooling section.

F.9

Connecting Sanitary Pipes and Fittings

F.9.1

Sanitary pipelines connecting all components of the HTST or HHST pasteurizer systems shall be without dead-ends, except for openings on sanitary fittings which shall be close coupled.

F.9.2

A recirculation valve(s) may be provided in the pasteurized product discharge pipeline as close as possible to the pasteurizer for by-passing rinse water, cleaning solution or sanitizing solution during start-up, shutdown or clean-up, or for the recirculation of pasteurized product. The recirculation valve(s) shall be downstream from the opening to the atmosphere required in F.2.2 If a recirculation valve(s) is used, a separate self-draining sanitary pipeline may be provided from the recirculation valve(s) directly to the raw product constant level tank, and shall be so designed as to preclude back siphonage. (See E.3.5)

F.9.3

A sanitary pipeline shall be provided from the diversion connection of the FDD to the raw product constant level tank, or to waste. If the diverted-flow pipeline returns to the raw product constant level tank, it shall enter the top of the tank or side of the tank at a distance at least equal to two times the diameter of the largest inlet, above the maximum over-flow level of the raw product constant level tank and shall be self draining.

F.9.3.1

The diverted-flow pipeline shall be free of restrictions unless such restrictions are so designed that stoppage of the diversion pipeline cannot occur. If necessary to lengthen the holding time during diverted-flow, an identifiable self-draining restrictor may be installed in a vertical portion of the diverted-flow pipeline.

F.9.3.2

The leak detect pipeline shall be free of restrictions and shall be self-draining, with no reductions in size from the valve inlet. If the leak detect pipeline returns to the raw product constant level tank, it shall incorporate a line-size sight glass in a vertical portion of the line to show evidence of leakage and shall enter the top of the tank or the side of the tank at a distance at least equal to two times the diameter of the largest inlet above the maximum overflow level of the raw product constant level tank.

F.9.3.3

Sight and light openings, when provided, shall be of such design and construction that all surfaces are visible and the inner surface drains inwardly. The inner surface of the glass shall be relatively flush with the inner surface of the leak detect pipeline or, in the case of a cross shall be close-coupled. The exterior flare shall be pitched so that liquids cannot accumulate. The glass shall be readily removable.

F.9.4

Timing pumps and homogenizers, when used as a timing pump, shall not have by-pass lines connected from their outlet pipelines to their inlet pipelines during processing if an additional flow-promoting or vacuum producing device is located within the system. When a homogenizer or other positive displacement pump is used in conjunction with a timing pump it shall be either:

(a) Of larger capacity than the timing pump. In which case an unrestricted, open, recirculation pipeline shall be used to connect the outlet pipeline from the homogenizer to its inlet pipeline. The recirculation pipeline must be of at least the same or larger diameter than the inlet pipeline feeding product to the homogenizer. A check valve, allowing flow from the outlet pipeline to the inlet pipeline, may be used in the recirculating pipeline provided it is of the type which provides a cross-sectional area at least as large as the recirculating pipeline, and be of the nonrestrictive type.

(b) Of smaller capacity than the timing pump. In which case a relief pipeline and valve shall be used. Such relief pipeline shall be located after the timing pump and before the inlet to the homogenizer and shall return product to the constant level tank or to the outlet of the balance tank upstream of any booster pump or other flow promoting device.

F.9.5

Connections to the pasteurizer heat exchanger(s) shall be of an approved CIP type.

F.10

Heating Medium System

F.10.1

When the heating medium system is not integral with other components of the pasteurizer, it may be installed in other than the product processing room.

F.10.2

Sanitary piping is not required for connecting the heating medium system with the heating section of the pasteurizer. However, when a plate type heat exchanger is used, the piping shall not prevent opening the plates for inspection. The final connection shall be a sanitary fitting, except the stationary end may be a non-sanitary fitting.

F.11

Cooling Medium System (When a cooling section is included.)

F.11.1

The equipment used for re-cooling and recirculating the cooling medium shall be installed, whenever practical, in other than the product processing rooms.

F.11.2

Sanitary piping is not required for connecting the cooling medium unit with the cooling section of the pasteurizer. However, when a plate type heat exchanger is used, the piping shall not prevent opening the plates for inspection. The final connection shall be a sanitary fitting, except the stationary end may be a non-sanitary fitting.

F.11.3

Where recirculated cooling medium is used, it shall be properly protected from contamination.

F.12

Control Panel

F.12.1

The control panel, if used, shall be supported so vibration is minimized and located to minimize temperature and moisture extremes.

F.13

Raw Product Booster Pump Controls

F.13.1

When a raw product booster pump is incorporated into the HTST or HHST pasteurizer system, it is normally located between the outlet of the raw product constant level tank and the inlet to the raw product side of the regenerator. However, certain circumstances may make it desirable to operate a raw product regenerator with a negative pressure present. Any workable pumping system wherein the required pressure relationships between raw and pasteurized regenerators is maintained and assured by sealable differential pressure switches or controls is acceptable.

F.13.2

The raw product booster pump shall be permanently wired so that it cannot operate unless:

F.13.2.1

The timing pump is in operation.

F.13.2.2

The FDD is in forward-flow position.

F.13.2.3

The pasteurized product pressure in the pasteurized product regenerator exceeds by at least 2 psig (14 kPa) the pressure developed by the booster pump. If the pasteurized product outlet is at the bottom of the plate heat exchanger, the 2 psig (14 kPa) shall be increased by an amount equal to the gravity head of product in the regenerator. This may be accomplished by either of the two methods listed below:

F.13.3

Methods

F.13.3.1

A sanitary pressure gauge mounted in the pipeline on the discharge of the raw product booster pump and either a second sanitary pressure gauge at the outlet of the pasteurized product regenerator with an adjustable, sealable, sanitary pressure switch also mounted at the outlet of the pasteurized product regenerator or, alternatively, a sanitary pressure gauge in the pipeline on the discharge of the raw product booster pump and an indicating, adjustable, sealable, sanitary pressure switch mounted at the outlet of the pasteurized product regenerator.

The set point for the switch is determined by checking the maximum pressure developed by the booster pump when supplied with a water supply in the constant level tank at the overflow points, and all air is purged from the system and the discharge line from the pump capped beyond the sanitary pressure gauge.

Run the pump at process speeds, record the pressure and set this point plus the extra 2 lb (14 kPa) and any gravity head into the sanitary pressure switch and seal. The motor, casing and impeller of the booster pump shall be identified and such record thereof maintained as directed by the control authority.

F.13.3.2

Provision of a sanitary, sealable, adjustable, differential pressure switch of approved manufacture and designed to measure simultaneously the raw product booster pump discharge pressure and the pasteurized product regenerator outlet pressure. Set the differential between the two indicators to conform to the requirements of F.13.2.3 and seal.

F.13.4

Raw Product Regenerator By-Pass

F.13.4.1

The raw product side of the regenerator may be by-passed when the raw product booster pump is not in operation. The by-pass system permits cold product to be drawn directly to the timing pump or system from the raw product constant level tank. After conditions of F.13.2, F.13.2.1, F.13.2.2 and F.13.2.3 are established, the booster pump may start to operate feeding raw product to the regenerator. The by-pass pipeline, which may be manually or automatically controlled by a valve, is not used when the booster pump is in operation. Entrapment of product in the by-pass pipeline during periods when the booster pump is in operation shall be precluded by close-coupled by-pass connections, or by design of the manually or automatically controlled valve which will permit a slight movement of product through the by-pass pipeline, or by other equally effective means.

F.13.5

In HHST pasteurizer systems with the FDD located downstream from the regenerator and/or cooler section and when a differential pressure controller is used to monitor the highest pressure in the raw product side of the regenerator and the lowest pressure in the pasteurized side of the regenerator, the controller must be interlocked with the FDD. The FDD must be set and sealed so that whenever improper pressures occur in the regenerator, forward-flow is automatically prevented until all product contact surfaces between the holding tube and FDD have been held at or above the required pasteurization temperature, continuously and simultaneously for at least the required pasteurization time for the product being pasteurized. The raw product booster pump may be permitted to run at all times, provided the timing pump is in operation.

F.13.6

When a two speed booster pump is installed to provide higher pressures and flow for mechanical cleaning, the high speed starter must be wired through the FDD Mode Switch so that the pump will operate at the high speed only with the switch at CIP in compliance with F.5.1.3. Preventing this pump from starting for at least 10 min after turning the FDD Mode Switch to the CIP position is an additional requirement.

F.14

Homogenizers

F.14.1

When used as a timing pump, the homogenizer shall be installed and wired in accordance with Section F. 3 covering timing pumps. If the homogenizer is used as the timing pump, or if interwiring of the homogenizer and timing pump is required as specified under F.6 and H.1.3, a time delay relay may be installed in the electrical circuit to the homogenizer, so that during the normal transit time of the FDD (1 sec or less from forward to diverted-flow) the homogenizer motor will remain running. The time delay relay shall provide a delay of not more than 1 sec. If the homogenizer motor stops, it shall not restart automatically. It shall not be possible to restart the homogenizer motor at sub-legal temperature, unless the FDD is in its fully diverted position. The time delay may be of the fixed time or adjustable time type. If the time delay relay is adjustable, means of sealing the unit shall be provided.

F.14.2

When the homogenizer is not used as a timing pump, it shall be a nonflow-promoting device and installed in such a manner that it cannot apply negative pressure at the forward-flow port of the FDD nor decrease the holding time of the product within the holding tube below the legal minimum.

F.14.2.1

When the homogenizer is used in conjunction with a timing pump and its capacity is less than the timing pump at its maximum sealed capacity, a relief pipeline and valve shall be used. Such a relief pipeline shall be located after the timing pump and before the inlet to the homogenizer, and shall return product to the raw product constant level tank or to the outlet of the raw product constant level tank upstream of any booster pump or other flow-promoting device.

F.14.2.2

When the homogenizer is used in conjunction with a timing pump and its capacity is more than the timing pump at its maximum sealed setting, a sanitary, unrestricted, recirculating pipeline shall be used to connect the outlet pipeline from the homogenizer to its inlet pipeline. The recirculation pipeline shall be of at least the same or larger diameter than the inlet pipeline feeding product to the homogenizer. A check valve, allowing flow from the outlet pipeline to the inlet pipeline, may be used in the recirculating pipeline provided it is of the type which provides a cross-sectional area at least as large as the recirculating pipeline and is of the non-restrictive type.

F.14.2.3

When not used as a timing pump and products are to be processed that do not require homogenization:

F.14.2.3.1

A by-pass pipeline may be installed with valving such that both the by-pass and the homogenizer may not be connected at the same time. This may be accomplished with three-way plug valves, pinned such that an open path does not exist unless both valves are either in the homogenizer or the by-pass position, or valved with suitable, fail safe valves which accomplish the same objective.

F.14.3

When the homogenizer is installed downstream from a vacuum treatment unit located downstream from the

FDD, it shall have an output that exceeds that of the timing pump and shall have a recirculating pipeline installed in conformance with F.14.2.2.

F.15

Clarifier

F.15.1

When a clarifier is used in the HTST or HHST pasteurizer system, it shall be located to provide adequate access for cleaning and inspection.

F.15.2

The clarifier may have the driving motor wired independently of the timing pump and the FDD so that when the timing pump is stopped, the clarifier may continue to run. In such instances, it shall be automatically valved out of the system, with fail safe valves properly interwired with the FDD and the timing pump.

F.16

Separator

F.16.1

When a separator is used in the HTST or HHST pasteurizer system, it shall be located to provide adequate access for cleaning and inspection.

F.16.2

The separator may have the driving motor wired independently of the timing pump and FDD so that when the timing pump is stopped the separator may continue to run. When the separator is located downstream from the FDD, it shall be automatically valved out of the system with fail-safe valves properly interwired with the FDD. When the separator is located upstream from the timing pump it shall be automatically valved out of the system with fail-safe valves properly interwired with the timing pump.

F.16.3

When a sanitary by-pass pipeline is installed from the regenerator inlet to achieve proper separating temperature or proper exiting temperature of the pasteurized product, all components used in this pipeline shall be of sanitary design and no dead ends are allowed. The function of the regenerator pressure switch system shall not be defeated through use of such pipeline.

F.16.4

When the separator is placed downstream of the FDD, a vacuum breaker shall be installed between the pasteurized product regenerator outlet and the separator inlet and must meet the requirements of F.2.2.

F.16.4.1

When product to product regeneration is employed and a pump is required to feed the separator, the installation shall comply with requirements of F.2.2 for the connection between the pasteurized product regenerator and any pump.

F.16.5

When separators are placed upstream of the FDD, they must be upstream of the timing device.

F.16.6

Either pasteurized cream or pasteurized skim milk from the separator may be re-introduced to the HTST or HHST pasteurizer, at a point beyond the FDD, by a direct sanitary pipeline from the separator, so that either may be cooled.

F.16.7

If pasteurized cream is cooled in a milk-to-cream regenerator, pressure in the pasteurized product side of the regenerator shall be at least 2 psig (14 kPa) higher than the pressure in the raw product side of the regenerator.

F.17

Flavor Control Equipment or Vacuum Treatment Equipment

F.17.1

Flavor control equipment, which includes vacuum and steam-vacuum treatment system, may be installed and operated in conjunction with HTST or HHST pasteurizer systems provided that such equipment will:

(1) Not influence the proper pressure relationships within the regenerator;

(2) Not reduce the holding time below the required legal holding time;

(3) Not contaminate the product with toxic substances or foreign material through the use of sub-standard steam or steam distribution systems (See Section F.17.2.6.); and

(4) Not adulterate the product with added water when such addition is not permitted.

F.17.2

All vacuum equipment shall comply with the following applicable provisions:

F.17.2.1

When vacuum equipment is located downstream from the FDD, automatic means shall be provided to prevent negative pressure between the forward-flow port of the FDD and the inlet to the vacuum chamber at all times. A vacuum breaker, and automatic shut-off valve downstream from the vacuum breaker shall be installed in the pipeline between the FDD and the inlet to the vacuum chamber. The effectiveness of such an installation shall be evaluated by disconnecting the pipeline from the forward-flow port while the pasteurizer is operating in diverted-flow, and with the vacuum equipment in operation, checking the pipeline for negative pressure.

F.17.2.2

When vacuum equipment is located downstream from the FDD, means shall be provided to prevent the lowering of the pasteurized product pressure in the regenerator during diverted-flow or shut-down. A check valve or automatic shut-off valve, and a vacuum breaker downstream from such check valve or automatic shut off valve, shall be installed between the vacuum chamber and the regenerator. The vacuum breaker shall always be installed immediately upstream from the pasteurized product inlet to the regenerator, and at a minimum elevation of 12 in. (305 mm) above any raw milk in the system. The effectiveness of such an installation shall be evaluated by disconnecting the pipeline to the inlet of the pasteurized product side of the regenerator while the pasteurizer is operating in diverted-flow and, with the vacuum equipment in operation, checking the pipeline for negative pressure.

F.17.2.3

When vacuum equipment is located downstream from the FDD, the holding time shall be tested with the timing pump operating at maximum capacity, and the vacuum equipment operating at maximum attainable vacuum.

F.17.2.4

Any flavor control equipment may use an indirect, closed type condenser.

F.17.2.5

When a water feed line is connected to a direct, open type condenser, supplementary means shall be provided to preclude the back-up and overflow of water and/or condensate from the vapor condenser into the product vacuum chamber in the event of tailpipe pump failure, tailpipe blockage, or power failure. Such means shall include the use of a high water level sensing device and an automatic safety shut-off valve installed on the water feed pipeline which would effectively shut off the inflowing water, if the water and/or condensate rose above a predetermined level in the condenser. This valve may be actuated by water, air, or electricity and shall be so designed that failure of the primary motivating power will automatically stop the flow of water into the vacuum condenser or vapor pipeline.

F.17.2.6

Steam used in contact with product shall meet the criteria for culinary steam as specified in the 3-A Accepted Practices for Producing Steam of Culinary Quality, Number 609-00.

F.17.2.7

When culinary steam is introduced into the product downstream from the FDD, means shall be provided to preclude the addition of steam to the product unless the FDD is in the forward-flow position. Such means shall include the use of an automatic steam control valve with a temperature sensor located downstream from the steam inlet, or by the use of an automatic solenoid shut-off valve installed in the culinary steam pipeline, each wired through the FDD so as to stop the introduction of steam when the FDD moves into diverted-flow position.

F.17.2.8

When culinary steam is introduced directly into the product, automatic means shall be provided to maintain a proper temperature differential between incoming and outgoing product to preclude product dilution, when such dilution is not permitted. Such means include: (1) An automatic ratio controller which senses the temperature of the product prior to the addition of steam and also either in the vacuum chamber or at its exit and automatically adjusts the operating vacuum in the vacuum chamber so as to assure the removal of all water added in the form of steam or (2) any other system which will assure no dilution. The proper temperature differential between the incoming and outgoing products shall be determined for each HTST or HHST installation by means of total solids determination[*5] on product prior to the introduction of steam and after exit from the vacuum chamber and such differential set on the ratio controller. An air-operated pressure switch, installed in the air control pipeline between the ratio controller and the vacuum regulator, or other automatic means, shall stop the introduction of steam into the product when the vacuum in the vacuum chamber is insufficient to prevent product dilution.

F.18

HTST or HHST pasteurizer systems heating or using the direct addition of steam shall comply with the following additional criteria:

F.18.1

With the steam injection process a pressure limit indicator is needed in the holding tube to keep the heated product in the liquid phase. The instrument must have a pressure switch so that the FDD will move to the divert position if the product pressure falls below a prescribed value. For operating temperatures between 191 degrees F (89 degrees C) and 212 degrees F (100 degrees C) the pressure switch must be set at 10 psig (70 kPa). For units which have operating temperatures above 212 degrees F (100 degrees C) the pressure switch must be set at 10 psig (70 kPa) above the boiling pressure of the product at its maximum temperature in the holding tube.

F.18.2

With the steam injection process a differential pressure limit indicator across the injector is needed to ensure adequate isolation of the injection chamber. The instrument must have a differential pressure switch so that the FDD will move to the divert position if the pressure drop across the injector falls below 10 psig (70 kPa).

F.19

Filters and Strainers

F.19.1

When a filter using disposable filter media is used in conjunction with the HTST or HHST pasteurizer system, the filter shall be placed upstream from the final heater, and be located to provide adequate access for cleaning and inspection.

F.19.2

Disposable filter media, and any removable parts which restrict flow shall be removed from the filter or strainer when the HTST or HHST pasteurizer system is being timed or mechanically cleaned.

F.20

Auxiliary Pump

F.20.1

When an auxiliary pump(s) is used in the HTST or HHST pasteurizing system, it must be installed and operated in such a way that it will not (1) influence the proper pressure relationship within the regenerator or (2) reduce the holding time below the required minimum or (3) cause flow through the holding tube at sub-legal temperatures unless the FDD is in the fully diverted position except as provided by F.5.1.3.

F.20.2

In the HTST or HHST pasteurizer system where an auxiliary, recirculating pump is installed in the system to obtain a greater velocity through a heater(s) than that which would be produced by the timing pump, a sanitary circulating pipeline between the outlet of the heater and the inlet of the recirculating pump shall be provided.

F.20.2.1

When a recirculated heater is used in a MBTS, it may be installed either upstream or downstream of the centrifugal timing pump without special product flow considerations provided that it is installed upstream of the flow control valve. If the recirculated heater is installed downstream of the flow meter and flow control valve, the recirculation line shall be of the same or larger diameter than the inlet pipeline to the circulating pump.

F.20.2.2
When a recirculated heater is used with a positive timing pump, it may be installed either upstream or downstream of the timing pump, but the recirculation line shall be of the same size or larger than the inlet pipeline to the circulating pump.

F.20.2.3
If a blocking valve is installed in the recirculation pipeline, it shall provide a cross sectional area of at least as large as the recirculating pipeline and be of the non-restrictive type. The valve shall be normally open during process operations and shall be interwired to prevent closing except during mechanical cleaning and shall open to the fail-safe position upon loss of air and/or electricity.

F.20.3
Any flow-promoting device in the system downstream from the raw product constant level tank to the atmospheric break at the exit of the pasteurizer regenerator/cooler, when used as the timing pump booster pump, or auxiliary pump(s) such as a stuffing pump or product removal pump, shall be interwired with the FDD or automatically isolated from the system to prevent operation except when the FDD is in the fully forward or fully diverted-flow position.

F.20.4
Vacuum chambers located downstream from the holding tube and/or separators/clarifiers in the system which are capable of producing flow shall be isolated by suitable fail-safe devices properly interwired with the FDD. By-passes of such flow-promoting devices must be of full inlet-outlet pipe diameter, and any check valves must have a cross-sectional area at least as large as the by-pass pipeline and be of the non-restrictive type.

F.21
Electric Wiring

F.21.1
All electric wiring interconnection shall be in permanent conduit or wire duct (except that rubber covered cable may be used for final connections) and installed in accordance with the local electrical code, with no electrical connections to defeat the purpose of any provision of these 3-A Accepted Practices.

F.22
Checking and Testing

F.22.1
Prior to the final testing by the control authority completed installations shall be thoroughly checked and tested by a qualified representative of the manufacturer, their distributor, or the processor to determine that the installation meets all provisions of these 3-A Accepted Practices.

F.22.1.1
The STLR, FDD, MBTS indicating thermometer(s), temperature control and other parts shall be made to function within the limits of the requirements of these 3-A Accepted Practices. The following tests shall be made, in accordance with the methods prescribed in the Appendix I, Pasteurization Equipment and Controls - Tests found in the Grade A Pasteurized Milk Ordinance (PMO), using the most current revisions. Single copies of the PMO are available free of charge from the US Public Health Service, FDA, HFF-346, 200 C St., SW, Washington, DC 20204 (202-485-0175). If there is no test prescribed in the PMO, test methods are found in these 3-A Accepted Practices. Appendix I, PMO, I-Test Apparatus Specification, prescribes the test apparatus and Appendix I, PMO, II-Test Procedures, contains the testing procedures.

G
TESTS[*7]

G.1
Indicating Thermometer(s).
(a) Temperature accuracy
PMO Test Procedure-1.
(b) Thermometric response
PMO Test Procedure-7.

G.2
STLR [Recording Thermometer(s)].
(a) Temperature accuracy
PMO Test Procedure-2.
(b) Time accuracy
PMO Test Procedure-3.
(c) Check against indicating thermometer(s)
PMO Test Procedure-4.
(d) Thermometric response
PMO Test Procedure-8.
(e) Cut-in-and Cut-out
PMO Test Procedure-1.

G.3
Flow Diversion Device - Proper Assembly and Function.
(a) Leakage past valve seat
PMO Test Procedure-5.1.
(b) Leak escape operating properly
(See E.7.1.3 of these 3-A Accepted Practices)
(c) Operation of valve stem
PMO Test procedure-5.2.
(d) Device assembly, single stem or dual stem
PMO Test Procedure-5.3 or 5.4.
(e) Manual diversion
PMO Test Procedure-5.5.
(f) Response time
PMO Test Procedure-5.6.
(g) Time delay interlock
PMO Test Procedure-5.7.
CIP Time Delay Test (see M-a-59, Supplement 3, Feb. 6, 1981, Test E.)

G.4
Setting of Controls.
Regenerator pressures.
(a) Booster pump pressure switches

PMO Test Procedure-9.1.
(b) Booster pump time delay switches
PMO Test Procedure-9.2.
(c) Pressure gauges
PMO Test Procedure-9.3.
(d) Differential pressure controller
PMO Test Procedure-9.4.
(e) Booster pump proper wiring
PMO Test Proceedure-9.5

G.5

Milk-Flow Controls.
Cut-in and cut-out temperatures
(a) HTST recorder/controllers
PMO Test Procedure-10.1.
(b) HHST using indirect heating
PMO Test Procedure-10.2.
(c) HHST using direct heating
PMO Test Procedure-10.3.

G.6

Continuous Flow Holders.
(a) Holding time of HHST pasteurizer systems shall conform with the Determination of Holding Time (Calculated Method). See Section M of these Practices.
(b) Holding time of HTST pasteurizer systems shall be determined by the salt conductivity test method found in the PMO, Appendix I, Test Procedures-11.1 and 11.2.
Note: The holding time test shall conform with the Determination of Holding Time (Salt Conductivity Test). See Section L of these Practices.
(c) Before starting the holding time test, water should be circulated through the pasteurizer until all air is expelled.

G.7

Temperature Control.
Maintenance of product temperature. (See E.9 of these Practices.) Cut-off of heating medium. (See E.9.2 of these Practices.)

G.8

Setting and Sealing of Time Delay Relays Used With Homogenizers.
When the homogenizer is used as outlined in Section F.14.1 with an adjustable time delay relay, the time delay relay shall be adjusted and sealed at a delay time not to exceed 1 sec.

G.9

The following are modifications of and additional tests for the recorder-controller, the auxiliary temperature sensor-controller and the time delay relay incorporated in the HTST pasteurizer system supplying repasteurized product to a drier with the timing pump located as provided for in H.1.2.

G.9.1

Recorder-Controller Cut-In and Cut-Out.
The Procedure found in the PMO, Appendix I, Procedure-10 is to be modified for the Cut-In test by observing when the temperature of the water or the product surrounding the temperature sensor of the recorder-controller reaches the temperature at which the control mechanism is set instead of observing the temperature at which forward-flow begins.

G.9.2

Auxiliary Temperature Sensor-Controller.
The following are modifications of the procedures in the PMO, and are for use in testing an auxiliary temperature sensor-controller that does not have an element that indicates or records the temperature at the temperature sensor. If the temperature sensor of the auxiliary temperature sensor-controller does not actuate either a recording or indicating thermometer(s), the procedures in the PMO, with slight modifications, as listed below in Sections G.9.2.1 to G.9.2.3, shall be followed.

G.9.2.1

Temperature accuracy.
The procedure of the PMO, Appendix I, Procedure-2 is modified by using cut-out temperature as the means of determining whether or not the controller will return to within 1 degree F (0.5 degree C) of its setting after the sensor bulb has been exposed to boiling water and melting ice. A second modification is to use the pasteurization temperature of 175 degrees F (80 degree C) instead of 161 degrees F (72 degrees C).

G.9.2.2

Thermometric response.
The procedure of the PMO, Appendix I, Procedure-8 is modified by using a second water or oil bath maintained at 12 degrees F (7 degrees C) below the cut-in temperature. The water or oil in the second water or oil bath is to be vigorously agitated while performing the test. The procedure is to (1) determine the cut-in temperature, (2) immerse the sensor bulb in the water or oil bath maintained at 12 degrees F (7 degrees C) below the cut-in temperature for 5 min, (3) remove the sensor bulb from the one maintained at 12 degrees F (7 degrees C) below the cut-in temperature and immediately immerse it in the water or oil bath maintained 7 degrees F (4 degrees C) above the cut-in temperature and (4) measure the time from the instant the sensor bulb is immersed in the second water or oil bath until cut-in occurs.

G.9.2.3

Cut-in and Cut-out.
The procedure of the PMO, Appendix I Procedure-10 is modified by observing the pilot light (or other means provided to comply with Section H.1.3.2) instead of observing when forward-flow begins or stops.

G.9.3

Time Delay Relay Provided to Comply with H.1.2.
Operate the HTST or HHST pasteurizer system in diverted-flow with the heating medium 2 or 3 degrees F (1 or 2 degrees C) below the temperature normally required to establish forward-flow. Gradually increase the product temperature at a rate not exceeding 1 degree F (0.5 degree C) every 30 sec. By use of a stop watch, determine the time between the moment the temperature sensors of both the auxiliary temperature sensor controller and the recorder-controller are at or above the temperature at which their control mechanisms are set and the moment forward-flow begins.

G.10

Upon initial installation and at least semi-annually thereafter, all MBTS shall be tested for holding time in conformance with Test Procedure-9, PMO, Loss of Signal Test or appropriate equivalent test procedures supplied by the manufacturer or designer. The system must be designed and installed so that the timing tests can be conducted in automatic mode in both forward- and diverted-flow. Automatic mode means that the flow through the system is under control of the magnetic flow meter, and the system controls will automatically control the flow to maintain a constant flow rate through the system. In automatic mode, the set point of the automatically controlled-flow rate must be manually adjustable by the regulatory agency.

G.11

Thermal Limit Controller for Control-Sequence Logic.

(a) HHST pasteurizers using indirect heating
PMO Test Procedure-12.1.

(b) HHST pasteurizers using direct contact heating
PMO Test Procedure-12.2.

G.12

Setting of Control Switches for Product Pressure in the Holding Tube.
PMO Test Procedure-13.

G.13

Setting of Control Switches for Differential Pressure Across the Injector.
PMO Test Procedure-14.

G.14

Details, as suggested on FORMS 1 and 2 of the APPENDIX, Section I, shall be ready to present to the control authority upon arrival. Seals shall be on hand ready for installation upon completion of checking and testing by the control authority. Equipment must be sealed by the control authority or sealed in his/her presence.

G.14.1

The qualified representative mentioned in G.14 is one who has received special instruction under the supervision of a qualified person on HTST or HHST pasteurizer systems, and has made or supervised two actual complete installations that have been approved and sealed by a control authority.

G.14.2

In an emergency, checking and testing by the qualified representative may be at the same time as the control authority checking and testing.

G.15

Notice of the approximate time an installation will be ready for checking and testing by the control authority shall be given to the control authority in writing by the processor at the time application is made, or at least seven (7) days prior to the time the unit will be ready for checking and testing by the control authority.

G.15.1

In case there is a delay affecting the designated time for control authority checking and testing, the control authority shall be notified immediately.

G.15.2

In case the control authority is unable to keep a designated testing date, the control authority should notify the processor immediately upon receipt of the notice.

H

SPECIAL CONSIDERATIONS FOR SPRAY DRIER AND EVAPORATOR APPLICATIONS

H.1

Special Considerations For Spray Driers

For some HTST pasteurizer systems which are integral with spray drier systems, it is necessary to have special considerations and exceptions to insure proper mutual operation of both the HTST pasteurizer and spray drier systems together without compromising the intent of these practices.

H.1.1

Timing Pump and Flow-Diversion Device

H.1.2

When the HTST pasteurizer is to be used to re-pasteurize a concentrated milk product for drying in a process in which the product pressure required for drying is at least 300 psig (2070 kPa), the timing pump may be located downstream from the FDD provided all other applicable requirements of these practices are met. In this application the timing pump must be a high pressure pump of the plunger type.

H.1.3

Flow Diversion Device

H.1.3.1

When the timing pump is to be located as provided for in H.1.2, the FDD shall have an auxiliary temperature sensor-controller and a time delay relay to accomplish the requirements of F.5.1.

H.1.3.1.1

The auxiliary temperature sensor-controller and/or the time delay relay do not have to be in the same case with the STLR but they shall comply with the applicable provisions of section E.8.1.

H.1.3.2

The auxiliary temperature sensor-controller shall have a control mechanism for setting the temperature at which forward-flow can occur and a means of indicating when the product temperature at the temperature sensor of the auxiliary temperature sensor-controller is at or above the temperature at which the control mechanism is set. The means of indicating may be a pilot light or other suitable means.

H.1.3.3

The FDD shall be actuated by the auxiliary temperature sensor-controller and the time delay relay as required in H.1.3 as well as by the temperature sensor that actuates the product temperature recorder as required in F.5.1.

H.1.3.3.1

Except as provided for in H.1.3.3.3, the STLR, the auxiliary temperature sensor-controller and the time delay relay are to be so inter-wired that the FDD (1) will assume the diverted-flow position when the product temperature is below legal minimum and (2) will assume the forward-flow position only when the product temperature has reached minimum legal temperature for at least legal holding time. The inter-wiring shall be such that when the FDD is in the forward-flow position, the auxiliary temperature sensor-controller will not cause the FDD to move to the diverted-flow position when the temperature of the product at its temperature sensor is sub-legal.

H.1.3.3.2

If the FDD and/or STLR has a manual means of causing the FDD to assume the diverted-flow position, the STLR and the auxiliary temperature sensor-controller are to be so interwired that after the FDD has assumed the diverted-flow position due to operation of the manual means, the FDD will not assume the forward-flow position until the product temperature at both temperature sensors is at or above legal temperature for at least legal holding time.

H.1.3.3.3

During mechanical cleaning, the FDD may assume the forward-flow position or be recycled at sub-legal temperature. If the system is designed so that the FDD may assume the forward-flow position and the timing pump and other flow-promoting devices may run during mechanical cleaning at sub-legal temperatures, an additional time delay relay is required. This time delay relay shall hold the FDD in the diverted-flow position for at least 10 min after the FDD mode switch has been moved to the CIP position. The 10 min time delay shall be set and sealed.

H.1.3.4

The auxiliary temperature sensor-controller and the time delay relay shall be provided with a simple means of sealing that will prevent, unless the seal is broken, the changing or manipulating of (1) the control mechanism for setting the temperature at which forward-flow can occur and (2) the mechanism for setting the length of time delay.

H.1.3.5

The temperature accuracy of the auxiliary temperature sensor-controller shall be that required for the STLR in E.8.4.

H.1.3.6

The thermometric response of the auxiliary temperature sensor-controller shall be that required for the STLR in E.8.16.

H.1.3.7

The temperature sensor of the auxiliary temperature sensor-controller and the second hot product indicating thermometer, as required in Section E.10.1 shall be installed in a fitting located in the product constant level tank outlet line between the tank outlet connection and the first connection downstream.

H.1.3.8

An automatic means shall be provided to prevent negative pressure at the downstream side of the forward-flow port of the FDD during diverted-flow. The automatic means shall be one of the following or other acceptable means:

H.1.3.8.1

An FDD incorporating two valves (one a divert valve and the other a leak escape valve) with the leak escape opening having a total effective area at least as great as the area of the forward flow opening. The leak escape opening of the leak escape valve shall be provided with a discharge pipeline which shall discharge to either (1) the atmosphere and be protected from back siphonage of vapors or liquids or (2) the product constant level tank, in which case the pipeline shall be installed in accordance with F.9.3.2.

H.1.3.8.2

An automatic shut off valve, downstream from an effective vacuum breaker of sanitary construction having enough air admitting capacity to prevent negative pressure, which shall automatically assume the stop position when the FDD is caused to divert.

H.1.4

Safe Water

H.1.4.1

A safe water pipeline, when connected to a product pipeline in which the product may be under vacuum, shall be installed in conformance with local plumbing codes for water flowing into a vacuum and shall have a sanitary check valve adjacent to its connection to the product pipeline to prevent back flow of product into the safe water pipeline.

H.1.5

Auxiliary Pump

H.1.5.1

An auxiliary pump is required when the timing pump is to be located as provided in Section H.1.2, in order that there will be product recirculation during diverted-flow and to assure positive product pressure at the timing pump inlet during forward-flow. If the auxiliary pump is of greater capacity than the timing pump it becomes a recirculating pump and a sanitary recirculating line between the outlet of the heater and the inlet of the recirculating pump shall be provided. The product pressure at the inlet of the FDD shall be less than the maximum product pressure at which the FDD will move from the forward-flow position to the diverted-flow position. This may be accomplished by one of the following:

H.1.5.1.1

Use of a recirculating pump having a maximum output pressure of less than the maximum product pressure at which the FDD will move from the forward-flow position to the diverted-flow position.

H.1.5.1.2

Installation of a pressure control valve in the recirculating line which is set and sealed at a pressure less than the maximum product pressure at which the FDD will move from the forward-flow position to the diverted-flow position. This valve, if used, shall be designed and controlled so that it cannot be completely closed or allow the pressure to increase to where it interferes with the correct operation of the FDD.

H.1.5.1.3

Altering or rebuilding the FDD so that the maximum product pressure at which it will move from the forward-flow position to the diverted-flow position is greater than the maximum output pressure of the recirculating pump.

H.2 to H.49

RESERVED FOR FUTURE USE FOR SPECIAL CON-

SIDERATIONS FOR PASTEURIZER SYSTEMS WHICH ARE INTEGRAL WITH SPRAY DRIERS.

H.50

Special Considerations For HTST Systems Used With Evaporators and Employing Milk to Milk or Milk to Water to Milk Regeneration Systems

Those HTST pasteurizer systems which are integral with evaporator systems and employ milk to milk or milk to water to milk regeneration systems must be considered differently in order to insure proper operation of both the HTST pasteurizer and evaporator together without compromising the intent of these practices. Examples are shown in the portion of these practices containing the drawings - Figures 26, 27, 28, 29, 30, and 31.

APPENDIX

Experience with HTST and HHST pasteurizer systems has proven certain practices to be satisfactory from a sanitary control and operational standpoint. It is the purpose of the APPENDIX to set forth recommended but optional procedures, as a guide to control authorities and processors in establishing the best practices.

I

APPLICATION TO INSTALL

I.1

A manufacturer, distributor or processor desiring to install an approved HTST or HHST pasteurizer system should first make application on a suitable form, as prescribed by the local control authority, or, in the absence of a required form, on a form as suggested herein (FORM 1) and include a flow diagram. The manufacturer/supplier should provide the applicant with two completed copies of FORM 1, and the two copies of the flow diagram. Application should be submitted to the control authority by the applicant, on suitable forms, at least 15 days prior to the start of any installation. Approval or advice as to necessary changes should be made to the applicant promptly.

I.1.1

In an emergency the time interval above may be waived only by the control authority.

I.2

Changes in an existing system, affecting capacity, timing or arrangement, should be submitted by the processor on a form as specified in I.1 above. It is recommended that all milk control authorities adopt an APPLICATION TO INSTALL form including the data provided for in FORM 1. A REPORT OF INSTALLATION form, similar to FORM 2, is recommended for use in reporting the check-testing data prescribed in F.22.1.

J

INTERFACING PROGRAMMABLE LOGIC CONTROLLERS AND COMPUTERS TO HTST AND HHST PASTEURIZER SYSTEMS

J.1

Conventional hard-wired operating controls and instrumentation may be effectively interfaced with micro-processor based systems. The almost universal application of the dual-stem FDD(s) and its associated Inspect-Process-CIP mode selector switch makes it possible to interface all legal controls to a microprocessor based system in a manner which assures compliance with all public health requirements.

When computers or programmable logic controllers are used with these systems, they must be installed in such a manner that no public health controls are controlled by or circumvented by the computer or programmable logic controller during the product run operations except as provided for under FDA M-I-88-11 dated July, 1988 - "Use of Computers on Public Health Controls of Grade A Pasteurizers" or current FDA coded memoranda addressing this topic. FDA coded memoranda may be obtained from the same address found in Section F.22.1.1 herein.

J.2

Micro-Processor Control

J.2.1

Micro-Processor controlled outputs shall not circumvent any function of the legal controls when the FDD mode switch is in the Process position.

J.2.2

Micro-processor control of system components including the booster pump, timing pump, and FDD(s) may be implemented with the FDD mode switch at the CIP position after the 10 min time delay.

J.2.3

Other components including regenerator by-pass (start-up) valve(s), pasteurized product regenerator back-pressure valves, discharge valves and recycle (by-pass) valves, hot water set controls, raw product constant level tank controls, cold milk temperature controls, MBTS product flow controls and heating and cooling medium controls may be micro-processor controlled under all operating conditions.

J.2.4

Control outputs via the approved wiring to the booster pump, timing pump, FDD(s) and all devices required to be interlocked to these primary components may be used as inputs to the micro-processor for use in implementing desired control sequences.

J.2.5

Input hardware used in accordance with J.2.4 must be incapable of functioning as an output, thus circumventing legal-wired logic.

J.3

Documentation

J.3.1

Complete documentation of interconnecting wiring, air piping and applicable program(s) must be submitted to the control authority prior to placing a micro-processor controlled HTST or HHST pasteurizer system into operation for production purposes. The micro-processor based logic may be defined by program listings and descriptive narrative text.

J.4

Testing

J.4.1

The installer of a micro-processor based HTST or HHST control system shall provide the control authority with a test procedure which, when properly followed, shall confirm operation of all required legal controls. One method of accomplishing this is outlined as follows:

1. Identify all system components which are microprocessor controlled for CIP.
2. Locate and identify outputs for the above.
3. With the FDD mode switch at CIP, and after the 10 min time delay, manually Force On each output and confirm operation of the controlled component.
4. Then, with the FDD mode switch at Process, again Force On the above defined outputs. The booster pump, FDD and devices interlocked with these components shall not operate. And, with the timing pump off, those components required to be interlocked with the timing pump shall not operate.

Note: The system must respond to all other test procedures in the conventional manner.

K

OPERATION

K.1

Personnel:

Persons assigned the responsibility of operating and cleaning any HTST or HHST pasteurizer system should be properly trained.

K.2

A control panel is the preferred location of the legal controls as the centralized point of operation of the HTST or HHST pasteurizer system. The control panel should be readily accessible to the HTST or HHST pasteurizer system operator, and should contain those controls requiring manual adjustment, recording, operator notation or testing and sealing by the control authority.

K.3

Sanitizing Treatment

K.3.1

Hot Water Method

K.3.1.1

About 30 min before product pasteurization is to begin, close the heating and cooling equipment and connect all Component Equipment, including Optional Component Equipment assembled in the system, with Connecting Sanitary Pipe and Fittings, as is necessary for pasteurizing. Arrange the recycle pipeline and the recycle valve(s) at the pasteurizer outlet to discharge into the raw product constant level tank.

K.3.1.2

Introduce safe water to the raw product constant level tank, start the timing pump and continue to introduce water until the system is full.

K.3.1.3

Start the circulation of the heating medium system and set its temperature control at 175 degrees F (80 degrees C) or higher. Do not turn on the cooling medium system.

K.3.1.4

When the circulating water reaches 170 degrees F (77 degrees C) or higher in the raw product constant level tank, allow it to continue to circulate for at least 5 min. Sanitize the diversion pipeline by circulating 170 degrees F (77 degrees C) or hotter water for at least 5 min. Discharge water from the pasteurizer system (plate heat exchangers) to waste through the recycle pipeline. Shut down the timing pump.

K.3.1.5

The covers for the raw product constant level tank, surge tank, other parts and sanitary pipelines not sanitized by hot water circulation with the pasteurizer system shall be independently sanitized.

K.3.2

Chemical Method

K.3.2.1

About 30 min before product pasteurization is to begin, close the heating and cooling equipment and connect all Component Equipment, including Optional Component Equipment assembled in the system, as is necessary for pasteurizing. Arrange the recycle pipeline and the recycle valve(s) at the pasteurizer outlet to discharge into the raw product constant level tank.

K.3.2.2

Introduce safe water to the raw product constant level tank, start the timing pump and continue to introduce water until the system is full.

K.3.2.3

Start the heating medium system and set the temperature to attain forward-flow. Do not turn on the cooling medium system.

K.3.2.4

Slowly introduce a hypochlorite compound, or other chemical sanitizer approved by the control authority, into the raw product constant level tank in sufficient quantity to provide required concentration. A minimum of 50 ppm of chlorine or an equally effective concentration of other chemical sanitizer at the outlet is required.

NOTE: Care must be exercised in selecting a hypochlorite or other chemical sanitizer that will not be injurious to metallic and non-metallic parts in the system. Excessive temperature, exposure time, and concentrations may be injurious to such parts. Concentrated solutions should never be placed in the raw product constant level tank until sufficient water is present. Dry ingredients should always be predissolved.

Instead of introducing water and a concentrated chemical sanitizer into the raw product constant level tank, a prepared chemical sanitizing solution of proper strength may be introduced into the raw product constant level tank.

Continue circulation for 1 min or more in forward-flow. The flow diversion pipeline should also be adequately sanitized. Discharge sanitizing solution from the pasteurizer system to waste through the recycle pipeline.

K.3.2.5

The cover of the raw product constant level tank, surge tank, or other parts and sanitary pipelines not sanitized with the pasteurizer system should be independently sanitized.

K.4

Starting Product Immediately After Sanitizing

K.4.1

Reset the temperature control to provide legal pasteurizing temperature for the product.

K.4.2

Start the timing pump. When the water in the raw product constant level tank has been lowered to the level of its outlet, admit product. The volume to be drawn off should be determined at the time of initial operation by comparing the discharged product with the infeed raw product using suitable laboratory procedures.

K.4.3

The cooling medium system should be turned on enough in advance of the product entering to assure the cooling section being down to operating temperature.

WARNING: If the temperature of the cooling medium is lower than the freezing temperature of the product, care should be exercised to prevent freezing of the product.

K.4.4

Pasteurization safety controls are automatic. If the product temperature is sub-legal when it reaches the temperature sensor of the STLR, it will automatically be returned to be reheated. Controls are such that they will automatically cause the FDD to go into the forward-flow position when the product reaches legal temperature.

K.5

Running Product and Product Changeover

K.5.1

Before starting the day's operation, adjust the STLR chart so that the temperature pen is recording on the chart time division corresponding to the time of day. Promptly after starting, and throughout the run, operator should make such readings of the thermometer(s) and notations on the STLR chart as are required by the control authority. As a minimum the operator should include the following information on the chart:

Company name,

Date,

Operator's signature or initials,

Name of product pasteurized,

Indicating thermometer(s) reading during the pasteurizing period referenced to the pen line at the beginning of the run,

Cut-in and cut-out temperature, which is to be determined during sanitizing or at the beginning of each days operation.

Note: Additional charts should be used if operations extend beyond 12 h.

K.5.2

Products which do not materially affect one another may follow one another through the pasteurizer, without intermediate rinsing, or sanitizing treatment.

K.5.2.1

A different product should not be introduced into the raw product constant level tank until the level of all previous product has been reduced to a practical minimum. This may be accomplished by either manual or automatic controls.

K.5.3

Viscous products, such as cream, may require lower velocities to keep operating pressure within limits, as well as to provide a greater ratio of heat transfer to volume, because of greater difficulty in heating viscous products.

K.5.3.1

The output of the pasteurizer system may be decreased within the range and below the sealed maximum legal flow rate of the timing system.

K.5.3.2

Temperature adjustment should be established prior to product change-over for products, such as those with added sugar or high fat content, requiring higher minimum pasteurization temperatures. The use of a dual set point STLR is recommended.

K.5.4

The HTST or HHST pasteurizer system may be used to pasteurize milk and milk products and frozen dessert mix which require different temperature or different temperature-time values for proper pasteurization.

NOTE: These systems should be operated according to at least the minimum time-temperature requirements established in Section B.1 herein.

K.6

Stopping the Pasteurizer

K.6.1

When the product in the raw product constant level tank has been drawn down to a point at which it is all drained into the outlet, the product remaining in the pasteurizer may be removed by continuously introducing safe water into the raw product constant level tank.

K.6.2

The flow of product from the pasteurizer should continue to the pasteurized product surge tank as long as the product is free from dilution, after which the recycle valve should be turned to the recycle position, and the remaining product-water mixture discharged to waste. The time at which the recycle valve should be turned to the recycle position shall be determined at the time of initial operation, by comparing the discharged product with the infeed raw product, using suitable laboratory procedures.

K.6.3

Shut off the main steam valve and stop flow of heating medium. Stop flow of cooling medium, shut off the timing pump and all component units.

K.7

Cleaning Pasteurizer System

K.7.1

It is recommended that operators follow effective cleaning procedures recommended by the pasteurizer manufacturer, and/or by responsible cleaner manufacturers.

K.7.2

All components which cannot be effectively mechanically cleaned or which may be damaged by CIP cleaning solution chemicals or temperatures such as constant product level tank covers, plug valves, hand operated compression valves and pumps which cannot be mechanically cleaned should be removed from the pasteurizing system for manual cleaning.

K.7.3

Temporary connecting pipelines and cleaning systems may be connected to provide a continuous circuit for flushing and cleaning the pasteurizing system.

K.7.4

It is permissible to use a corrosion-resistant centrifugal pump and/or separate CIP system to circulate cleaning solutions if required.

K.7.5

Inspection should be made by the operator at sufficiently frequent intervals to determine that the equipment and all components are clean and in satisfactory condition.

L

DETERMINATION OF HOLDING TIME (CONDUCTIVITY TEST) (HTST) (CONVENTIONAL SYSTEMS)

An explanation of the method for performing the conductivity test may be found in footnote.*[6]

L.1

Apparatus and Material

L.1.1

Electrical conductivity instrument

L.1.2

Injection device(s) should have a minimum capacity of 50 mL (2 fl oz), and be fitted with connection to seal against electrode No. 1. Discharge opening is not less than 1/8 in. (3.0 mm) in diameter. Device may be operated manually, by air or other mechanical means. Injection devices operated by mechanical or air pressure are recommended for use on pasteurizer systems with capacities in excess of 30,000 lb (13,500 kg) per h in order to assure rapid injection of the electrolyte solution.

L.1.3

Manual or automatic timing device

L.1.3.1

Stop watch (if used)

L.1.3.1.1

Type - Digital, electronic

L.1.3.1.2

Accuracy - Accurate to 0.10 sec, resolution to 0.01 sec

L.1.4

Electrolyte - Any commercial brand of table salt (sodium chloride) or dairy acid cleaner is suitable for this purpose.

L.1.5

Calibration device

L.1.6

Primary electrode with injection connection

L.1.7

Secondary electrode

L.1.8

Complete testers

A complete tester containing all the necessary apparatus can be obtained from the following sources:

L.1.8.1

Lumenite Electronic Co., 2333 N 17th Ave., Franklin Park, IL 60131 (312/455-1450).

L.1.8.2

Miller Machinery and Supply Co., 127 NE 27th St., Miami, FL 33137 (305/573-1300).

L.1.8.3

Scherping Controls, 801 Kingsley St., Winsted, MN 55395, (614-485-4401)

L.2

Methods of Performing the Conductivity Test - Metering Pump

L.2.1

Install the primary electrode in the upstream end of the holding tube. A sanitary tee should be provided with the pasteurizer system for this purpose.

L.2.2

Install the secondary electrode in the indicating thermometer fitting at the downstream end of the holding tube.

L.2.3

Connect the electrodes to the instrument and connect the instrument to suitable electrical supply.

L.2.4

Examine the entire system to insure that all flow-promoting equipment is operating at maximum capacity and all flow-impeding equipment is so adjusted or bypassed as to provide the minimum of resistance to the flow. There shall be no leakage on the suction side of the timing pump.

L.2.5

If salt (sodium chloride) is used as the electrolyte, prepare a qt (1 L) or more of a saturated solution of salt in hot tap water. About 0.80 lb of anhydrous salt in a qt (384g per L) of water at 176 degrees F (80.0 degrees C) will yield a saturated solution.

L.2.5.1

If another electrolyte is used, follow the instructions provided by the supplier for solution preparation.

L.2.6

Fill the injection device with an appropriate volume (at least 50 mL or 2 fl oz) of the saturated salt or other electrolyte solution.

L.2.7

Rapidly inject the saturated salt or other electrolyte solution with the injection device.

L.2.8

Start timing at the instant the instrument first registers a change in conductivity at the upstream electrode.

L.2.9

Stop timing at the instant the instrument first registers a change in conductivity at the downstream electrode.

L.2.10

Repeat this test six times in both forward and diverted-flow. The variation between the minimum and the maximum readings in forward-flow should not be over 0.5 sec. The variation between the minimum and the maximum readings in diverted-flow should not be over

0.5 sec. If the variation between readings is greater than 0.5 sec, take corrective action and repeat the test until the variations of six successive readings is not greater than 0.5 sec.

L.2.11

The holding time in the forward-flow shall be considered the average of six successive readings. Similarly, the time in diverted-flow shall be the average of six successive readings.

L.2.12

If either forward- or diverted-flow average holding time is found to be less than the legal holding time, the flow rate may be reduced, the holding tube altered or other adjustments made, and the timing repeated until a satisfactory legal holding time is obtained.

L.2.13

Since timing pumps rarely deliver product at exactly the same rate at which water is delivered, the holding time of the HTST or HHST pasteurizer system, determined by the conductivity test of solution injected into water, must be transposed into the holding time for product. This is done in the following manner:

L.2.13.1

Determine the ratio between the water and product capacities of the unit by ascertaining the time required to pump equal volumes or weights of water and product.

Note: A suggested method of determining the relative flow rates of product and water involves the use of a calibrated sanitary dipstick which is suspended vertically in the raw product constant level tank. The time for both water and product to drop a measured distance on such a device can be determined by visual observation and use of a stop watch. Other means of determining relative water and product capacities may include the use of volumetrically calibrated tanks upstream or downstream from the pasteurizing unit, or by use of the weight determination.

L.2.13.2

If the capacity is determined by the times required to pump equal volumes, compute the holding time for product by inserting the time values obtained into the following formula:

$$\text{Holding time for product} = \frac{T(Pv)}{Wv}$$

T = Holding time with water

Pv = Time required to pump a measured volume of product

Wv = Time required to pump an identical volume of water

For example, the minimum holding time, determined by test with water, was found to be 16 sec (T). The time required to pump a measured volume of water from the raw product constant level tank was found to be 68 sec (Wv). An equal volume of product was pumped in 63 sec (Pv). Product was pumped more rapidly than water; therefore, the holding time for any particle of it was necessarily shorter, as computation with the formula discloses:

$$\frac{16 \times 63 = 14.8 \text{ sec}}{68}$$

Holding time for product = 16 x 63/68 = 14.8 sec.

L.2.13.3

If the ratio between the water and product capacities of the pasteurizer is determined by the time required to pump equal weights (rather than volumes) of product and water, the calculation of the holding time for product should take into consideration the fact that the weight of a unit volume of product is different than water. Therefore, the holding time for product, when determined by the relative time required to pump equal weights of product and water is calculated by the following formula:

$$\text{Holding time for product} = \frac{(T)(Pw)(sp\ gr)}{Ww}$$

Pw	=	Time required to pump a weighted quantity of product
Ww	=	Time required to pump an identical weight of water
T	=	Holding time with water
sp gr	=	Specific gravity of product

For example, 100 lb (45.5 kg) of milk occupies less volume than 100 lb (45.5 kg) of water; consequently, any particle of milk passes through the pasteurizer holding tube at a rate slightly slower than would appear from the ratio between the time to pump equal weights of milk and water. The slight difference in rate of flow is a function of the specific gravity of milk, which normally is 1.032.

The minimum holding time, determined by test with water, was found to be 16 sec (T) . The time required to pump a weighted quantity of water from the raw product constant level tank was found to be 76 sec (Ww). An equal weight of milk was pumped in 72 sec (Pw). Milk was pumped more rapidly than water; therefore, the holding time for any particle of milk was shorter than water but still a legal holding time for milk as the calculation discloses:

$$\text{Holding time for milk} = \frac{16 \times 72 \times 1.032}{76} = 15.6 \text{ sec}$$

L.2.14

If the computed holding time for product is shorter than the legally prescribed time, as in the first example cited, the flow rate is to be reduced to the extent that a holding time for product equivalent to that prescribed, is obtained.

L.2.15

Other measuring devices that are equally as satisfactory for determining the ratio between the water and product capacities of the pasteurizer may be used.

L.2.16

Seal the timing pump drive or timing system.

L.3

Method of Performing the Conductivity Test - MBTS

L.3.1

Apparatus and Material

See L .1 to L. 1. 8.3 herein.

L.3.2

Method

L.3.2.1

The holding time is determined by timing the interval for an added trace substance to pass through the holder. Although the time interval of the fastest particle of milk is desired, the conductivity test is made with water. The results found with water are converted to the milk flow time by formulation since the system does not deliver the same amount of milk as it does water.

L.3.3

Test Procedures

L.3.3.1

Examine the entire system to insure that all flow-promoting equipment is operating at maximum capacity and all flow-impeding equipment is so adjusted or bypassed as to provide the minimum resistance to the flow. There shall be no leakage on the suction side of the centrifugal pump of a MBTS.

L.3.3.2

Adjust the set point on the flow alarm to its highest possible setting.

L.3.3.3

Adjust the set point on the flow controller to a flow rate estimated to yield an acceptable holding time.

L.3.3.4

Install one electrode at the inlet to the holder and the other electrode to the holder outlet. Close the circuit to the electrode located at the inlet to the holder.

L.3.3.5

Operate the pasteurizer using water above pasteurization temperature, with the FDD in the forward-flow position.

L.3.3.6

Quickly inject 50 mL (2 fl oz) of saturated sodium chloride solution into the holder inlet.

L.3.3.7

Start the stopwatch with the first movement of the indicator of a change in conductivity. Open the circuit to the inlet electrode and close the circuit to the electrode at the outlet of the holder.

L.3.3.8

Stop the stopwatch with the first movement of the indicator of a change in conductivity.

L.3.3.9

Record results.

L.3.3.10

Repeat the test six or more times, until six successive results are within 0.5 sec of each other. The average of these six tests is the holding time for water in forward-flow. When consistent readings cannot be obtained, purge the equipment, check instruments and connections, and check for air leakage on the suction side of the pump located at the raw product supply tank. Repeat tests. If six consecutive readings within 0.5 sec cannot be achieved in forward- and diverted-flow, the pasteurizing system is in need of repair.

L.3.3.11

Repeat steps L.3.3.5 though L.3.3.10 for testing time on water in diverted-flow.

L.3.3.12

With the flow controller at the same set point as in 1.3.3.3, time the filling of a 10 gal (38 L) with a measured weight of water using the discharge outlet with the same head pressure as in normal operation. Average the time of several trials. (Since flow rates of the large capacity units make it very difficult to check by filling a 10 gal (38 L) can, it is suggested that a calibrated tank of considerable size be used.)

L.3.3.13

Repeat procedure L.3.3.12 using milk.

L.3.3.14

Compute the holding time for milk from the following formula by weight, using the average specific gravity. Compute separately for forward-flow and diverted-flow.

Holding time for milk = 1.032 (TMw)/Ww (by weight), in which:

1.032	= specific gravity for milk
T	= average holding time for water
Mw	= average time required to deliver a measured weight of milk
Ww	= average time required to deliver an equal weight of water.

The holding time for milk may also be computed from the following formula by volume. Compute separately for forward-flow and diverted-flow.

Holding time for milk = T(Mv)/Wv)(by volume), in which:

T	= average holding time for water
Mv	= average time required to deliver a measured volume of milk
Wv	= average time required to deliver an equal volume of water.

L.3.3.15

With the flow controller at the same set point as in L.3.3.3 above, record the flow rate from the recording chart for use in the following tests. Record this result along with the results of the salt timing tests for the office record.

L.3.4

Corrective Action

When the computed holding time for milk is less than that required either in forward-flow or diverted-flow, the set point on the flow controller shall be decreased, or adjustment made in the holding tube, and the timing test repeated until satisfactory holding time is achieved. Should an orifice be used to correct the holding time in diverted-flow, there should be no excessive pressure exerted on the underside of the valve seat of the FDD.

L.4

Continuous Flow Holders - Flow Alarms MBTS

L.4.1

Apparatus

None

L.4.2

Method

Adjust the set point of the flow alarm so that flow is diverted when the flow rate equals or exceeds the value at which holding time was measured.

L.4.3.

Procedure

L.4.3.1

Operate pasteurizer in forward-flow, at the flow rate at which holding time was measured, using water above pasteurization temperature.

L.4.3.2

Adjust set point on the flow alarm slowly downward until the frequency pen on the recorder indicates that flow has been diverted.

L.4.3.3

Observe that the FDD moved to the diverted position while water passing through the system remained above pasteurization temperature.

L.4.3.4

Record the set point of the flow alarm, the occurrence of flow-diversion and the temperature of the water in the holding tube, for the office record.

L.4.4

Corrective Action

If the FDD does not move to the diverted position when the frequency pen of the recorder indicates a diversion, a modification or repair of the control wiring is required.

L.5

CONTINUOUS FLOW HOLDERS LOSS-OF-SIGNAL ALARM

L.5.1

Apparatus

None

L.5.2

Method

By observing the recorder readings along with the action of the frequency pen on the recorder.

L.5.3.

Test Procedures

L.5.3.1

Operate pasteurizer in forward-flow, at the flow rate below the flow alarm set point and above the loss-of-signal alarm set point, using water above pasteurization temperature.

L.5.3.2

Disrupt power to the magnetic flow meter or decrease the flow through the meter below the low flow alarm set point. Observe that the FDD and both the STLR frequency pen and the flow rate recorder frequency pen assume the diverted-flow position.

L.5.3.3

Record results for the office record.

L.5.4

Corrective Action

If the valve does not divert and the pens do not show diversion, adjustment of the low flow alarm setting or modification or repair of control wiring is required.

L.6

CONTINUOUS FLOW HOLDERS - FLOW CUT-IN AND CUT-OUT

L.6.1

Apparatus

None

L.6.2

Method

By observing the recorder readings along with the action of the frequency pen on the recorder.

L.6.3.

Test Procedures

L.6.3.1

Operate pasteurizer in forward-flow, at a flow rate below the flow alarm set point and above the loss-of-signal alarm set point, using water above pasteurization temperature.

L.6.3.2

Using the flow controller, increase flow rate slowly until the frequency pen on the recorder indicates a flow diversion (flow cut-out point). The FDD will also assume the diverted position. Observe the reading of the flow rate from the recorder, the instant flow cut-out occurs, as indicated by the frequency pen.

L.6.3.3

With the pasteurizer operating on water above the pasteurization temperature, with the FDD diverted because of excessive flow rate, slowly decrease flow rate until the frequency pen on the flow recorder indicates the start of a forward-flow movement (flow cut-in point). Because of the time delay relay described in L.7, the FDD will not move immediately to the forward-flow position. Observe the reading from the recorder, the instant flow cut-in occurs, as indicated by the frequency pen.

L.6.3.4

Record results for the office record.

L.6.4

Corrective Action

If the cut-in or cut-out point occurs at a flow rate equal to or greater than the value at which holding time was measured, adjust the flow alarm to a lower set point, and repeat the test.

L.7

CONTINUOUS FLOW HOLDERS - TIME DELAY RELAY (1)

L.7.1

Apparatus

Stopwatch

L.7.2

Method

Set time delay equal to or greater than the minimum holding time.

L.7.3.

Test Procedures

L.7.3.1
Operate pasteurizer in forward-flow, at the flow rate below the flow alarm set point and above the loss-of-signal alarm set point, using water above pasteurization temperature.

L.7.3.2
Using the flow controller, increase flow rate slowly until the frequency pen on the flow recorder indicates a diversion movement, and the FDD moves to the diverted position. There shall be no time delay between the movements of the frequency pen and the FDD.

L.7.3.3
With the pasteurizer operating on water above the pasteurization temperature, with the FDD diverted because of excessive flow rate, slowly decrease flow rate.

L.7.3.4
Start the stopwatch the instant the frequency pen on the flow recorder indicates the start of a forward-flow movement.

L.7.3.5
Stop the stopwatch the instant the FDD starts to move to the forward flow position.

L.7.3.6
Record results for the office record.

L.7.3.7
Install and seal enclosure over the time delay relay.

L.7.4
Corrective Action
If the time delay is less than the minimum holding time, increase the time setting on the time delay and repeat this test procedure.

L.8
CONTINUOUS FLOW HOLDERS - TIME DELAY RELAY (2)

L.8.1
Apparatus
Stopwatch

L.8.2
Method
Adjust set point on the time delay relay equal to or greater than 10 min.

L.8.3.
Test Procedures

L.8.3.1
Operate pasteurizer in forward-flow with the mode switch on the FDD in the process product position, at a flow rate below the flow alarm set point and above the loss-of-signal alarm set point, using water above pasteurization temperature.

L.8.3.2
Move the mode switch on the FDD to the CIP position. The FDD should move immediately to the diverted position, and the booster pump should stop running. Start the stopwatch when the FDD moves to the diverted position.

L.8.3.3
Stop the stopwatch when the FDD moves to the forward position for its initial cycle in the CIP mode. The booster pump may start at this time.

L.8.3.4
Record results for the office record.

L.8.3.5
Install and seal enclosure over the time delay relay.

L.8.4
Corrective Action
If the FDD does not remain in the diverted position for at least 10 min after the mode switch is moved from process product to CIP, increase the set point on the time delay relay and repeat this test procedure. If the booster pump runs at any time during the 10 min delay, the booster pump wiring is in need of repair.

M
DETERMINATION OF HOLDING TIMES FOR HHST SYSTEMS WITH HOLDING TIMES OF 1 SECOND AND LESS (CALCULATED METHOD)

M.1
Calculated Hold For Indirect Heating

M.1.1
Apparatus
No supplemental materials needed.

M.1.2
Method

M.1.2.1
Fully developed laminar flow is assumed and holding tube length is calculated. An experimental determination of pumping rate is required; this is accomplished by determining the time required for the pasteurizer to fill a vessel of known volume, converting these data by division to obtain flow rate in gal per sec, and multiplying this value by the proper number in Table 1 of this section to obtain the required length of holding tube. Holding tube lengths for HHST pasteurizers with indirect heating for a pumping rate of 1 gal per sec are:

TABLE 1. Holding Tube Length for HHST Pasteurizer Systems Indirect Heating

Holding Time (sec)	Tubing Size (in.) 1.0	1.5	2.0	2.5	3.0
	(Holding Tube Length - in.)				
1	723.0	300.0	168.0	105.0	71.4
0.5	362.0	150.0	84.0	52.4	35.7
0.1	72.3	30.0	16.8	10.5	7.14
0.05	36.2	15.0	8.4	5.24	3.57
0.01	7.23	3.0	1.68	1.05	0.714

M.1.3
Test Procedures

M.1.3.1
Examine the entire system to ensure that all flow-promoting equipment is operating at maximum capacity and all flow-impeding equipment is so adjusted or bypassed to provide the minimum of resistance to the flow. This means that in-line filters must be removed, booster pumps must be in operation, and vacuum equipment in the system must be operating at a maximum vacuum. Also, before the tests are begun, the pasteurizer should be operated at maximum flow for a sufficient time to purge air from the system (about 15

min) and pipe connections on the suction side of the metering pump should be made tight enough to exclude entrance of air. With the pasteurizer operating with water, adjust the metering pump to its maximum capacity, preferably with a new belt and full-size impellers.

M.1.3.2

Determine that no flow exists in the diverted line, and measure the time required to deliver a known volume of water at the forward-flow discharge line. Repeat the test at least once to determine that the measurements are consistent.

M.1.3.3

Repeat the steps in paragraphs M.1.3.1 and M.1.3.2 of this procedure in diverted-flow by collecting the effluent at the discharge of the divert line.

M.1.3.4

Select the greatest flow rate (shortest delivery time for the known volume) and calculate the flow rate in gal per sec by dividing the known volume by the time required to collect the known volume. Multiply this value with the appropriate value in Table 1 to determine the required holding tube length.

M.1.3.5

Determine the number and type of fittings in the holding tube and convert these to equivalent lengths of straight pipe with the use of Table 2 of this Section. Determine the total length of the holding tube by adding the equivalent lengths of the fittings to the measured straight lengths of pipe. Record the number and type of fittings, the number and length of straight pipe, and the holding tube configuration for the office record. If the temperature sensor is located at the beginning of the holding tube, the holding tube shall be protected against heat loss by material that is impervious to water.

TABLE 2. Centerline Distances of 3-A Fittings

3-A Designation	Fitting Size (in.) (Centering Distance - in.)				
	1	1-1/2	2	2-1/2	3
2C 90 degree bend	3.4	4.8	6.2	8.0	9.7
2CG 90 degree bend	3.1	4.5	5.8	7.6	9.3
2F 90 degree bend	3.4	4.8	6.2	8.0	9.7
2FG 90 degree bend	3.1	4.5	5.8	7.6	9.3
2E 90 degree bend	3.4	4.8	6.2	8.0	9.7
2EG 90 degree bend	3.2	4.6	6.0	7.7	9.4

M.1.4

Alternate Procedure

M.1.4.1

For pasteurizers of large capacity, the method of measuring flow rate at the discharge of the pasteurizer is inconvenient, and the following alternate test procedure may be used. Remove the divert line from the raw-product supply tank, and turn off the product pump feeding the raw-product supply tank. Suspend a sanitary dip stick in the raw-product supply tank, and operate the pasteurizer at maximum capacity. Record the time required for the water level to move between two graduations on the dip stick. The volume of water is calculated from the dimensions of the raw-product supply tank and the drop in water level. Flow rate is determined as follows: Divide the volume of water removed from the raw-product supply tank by the time required to remove it.

M.1.5

Corrective Action

If the length of the holding tube is shorter than the calculated length, reseal the metering pump at a slower maximum speed, or lengthen the holding tube, or both, and repeat the above determination.

M.2

CALCULATED HOLD FOR DIRECT HEATING

M.2.1

Apparatus

No supplemental materials needed.

M.2.2

Method

Fully developed laminar flow and a temperature increase by steam injection of 120 degrees F (67 degrees C) are assumed, the temperature-time standard is chosen by the processor, and the required holding tube length is calculated from an experimental determination of pumping rate.

M.2.3

Test Procedures

M.2.3.1

Examine the entire system to ensure that all flow-promoting equipment is operating at maximum capacity and all flow-impeding equipment is so adjusted or bypassed as to provide the minimum of resistance to the flow. Remove in-line filters, make certain booster pumps are operating, and that vacuum equipment in the system is operating at maximum vacuum. Also, before the tests are begun, operate the pasteurizer at maximum flow for a sufficient time to purge air from the system (about 15 min) and tighten pipe connections on the suction side of the metering pump to exclude entrance of air. With the pasteurizer operating on water, adjust the metering pump to its maximum capacity. Determine that no flow exists in the diverted line, and measure the time required to deliver a known volume of water at the discharge end of the pasteurizer in forward-flow. Repeat the test at least twice to determine that the measurements are consistent.

M.2.3.2

Repeat the last step (M.2.3.1 above) in diverted-flow by collecting the effluent at the discharge of the divert line. Select the greatest flow rate (shortest delivery time for the known volume) and calculate the flow rate in gal per sec by dividing the known volume by the time required to collect the known volume. Multiply this value, gal per sec, with the appropriate value in Table 3 of this Section to determine the required holding tube length. Holding tube lengths for direct contact heating pasteurizers with a pumping rate of 1 gal per sec are:

TABLE 3. Holding Tube Length for HHST Pasteurizer Systems - Indirect Heating

Holding Time (sec)	Tubing Size (in.) 1.0	1.5	2.0	2.5	3.0
	(Holding Tube Length - in.)				
1	810.0	336.0	188.0	118.0	80.0
0.5	405.0	168.0	94.0	59.0	40.0
0.1	81.0	33.6	18.8	11.8	8.0
0.05	40.5	16.8	9.40	5.90	4.0
0.01	8.10	3.36	1.88	1.18	0.8

M.2.3.3

Determine the number and type of fittings in the holding tube, and convert these to equivalent lengths of straight pipe with the use of Table 2. Determine the total length of the holding tube by adding the equivalent lengths of the fittings to the measured lengths of straight pipe. If the actual holding tube length is equivalent to or greater than the required holding tube length, record the number and type of fittings, the number and length of straight pipe, and the holding tube configuration for the office record. Make sure that the holding tube slopes upward at least 0.25 in. per ft (220.8mm per m). If the holding tube shall also be protected against heat loss by insulation that is impervious to water, the temperature sensor is located at the beginning of the holding tube.

M.2.4

Alternate Procedure

M.2.4.1

For pasteurizers of large capacity, the method of measuring flow rate at the discharge of the pasteurizer is inconvenient, and the following alternate test procedure may be used. Remove the divert line from the raw-product supply tank, and turn off the product pump feeding the raw-product supply tank. Suspend a sanitary dip stick in the raw-product supply tank, and operate the pasteurizer at maximum capacity. Record the time required for the water level to move between two graduations on the dip stick. Calculate the volume of water from the dimensions of the raw-product supply tank and the drop in water level. Determine flow rate as follows: Divide the volume of water, in gals, removed from the raw-product supply tank by the time, in sec, required to remove it. Then use Table 3 to calculate the required holding tube length.

M.2.5

Corrective Action

If the length of the holding tube is shorter than the calculated length, reseal the metering pump at a slower maximum speed, or lengthen the holding tube, or both, and repeat the procedure.

N

A CALCULATION METHOD FOR ESTIMATING LENGTHS OF HOLDING TUBES

N.1

Method

N.1.1

Fully developed laminar flow is assumed, and the required holding tube length is calculated. An experimental determination of the maximum pumping rate is required. This is accomplished by determining the time required for the pasteurizer to fill a vessel of known volume with water, converting this data by division to obtain flow rate in gal per min, and multiplying this value by the proper number in Table 4 in N.4 to obtain the required length of holding tube.

N.2

Test Procedures

N.2.1

Examine the entire system to ensure that all flow-promoting equipment is operating at maximum capacity and all flow-impeding equipment is so adjusted or by-passed to provide the minimum of resistance to the flow. This means that in-line filters must be removed, booster pumps must be in operation, and vacuum equipment in the system must be operating at maximum vacuum. Also, before the tests are begun, the pasteurizer system should be operated at maximum flow for a sufficient time to purge air from the system (about 15 min), and pipeline connections on the suction side of the timing pump or the centrifugal pump of the MBTS should be made tight enough to exclude entrance of air. Adjust the pasteurizer system to operate with water at its maximum capacity. Determine that no flow exists in the diverted-flow pipeline.

N.2.2

Measure the time required to deliver a known volume of water at the pasteurized product outlet. Repeat the test at least once to determine that the measurements are consistent.

N.2.3

Repeat the above step in diverted-flow by measuring the time required to deliver a known volume of water at the discharge of the diverted-flow pipeline.

N.2.4

Select the greatest flow rate (shortest delivery time for the known volume) and calculate the flow rate in gal per min by dividing the known volume by the time required to collect the known volume; thus, if 2 min are required to fill a 10 gal can, the flow rate is 5 gal per min. Multiply this value with the appropriate value in Table 4 in N.4 to determine the required holding tube length.

N.2.5

For pasteurizer systems of large capacity, the method of measuring the flow rate at the pasteurized product outlet and at the discharge of the diverted-flow pipeline is inconvenient, and the following alternate procedure may be used. Prevent any water from being added to the raw product constant level tank while determining the flow rate. Suspend a dipstick in the raw product constant level tank, and operate the pasteurizer system at maximum capacity. Record the time required for the water level to move from one graduation to a lower graduation on the dipstick. The volume of water removed is calculated from the dimensions of the raw product constant level tank and the drop in water level.

Flow rate is determined as follows: Divide the volume of water removed from the raw product constant level tank by the time required to remove it.

N.2.6

Required holding tube lengths for holding times and/or holding tube diameters which differ from those in Table 4, Section N.4 may be calculated using the formula given in N.5.

N.2.7

Carefully measure the centerline length of the holding tube from its inlet to its outlet including the return bends at the end of each straight section. Compare the measured actual centerline length with the calculated required length. If the measured length is equal to or longer than the calculated required length, the timing system may be sealed at this flow rate.

N.3

If the measured length of the holding tube is shorter than the calculated required length, reset the timing system at a slower maximum capacity or lengthen the holding tube, or both, and repeat the above determinations.

N.4

Holding tube lengths in in. for HTST pasteurizer systems with a pumping rate of 1 gal (3.9 L) per min are found in Table 4.

TABLE 4. Holding Tube Length for HTST Pasteurizer Systems

	Sanitary Tubing Size - Outside Diameter (in.)					
	1.0	1.5	2.0	2.5	3.0	4.0
Time (sec)	(in.)					
15.0	110.83	44.34	23.85	14.87	10.15	5.71
25.0	184.73	73.88	39.75	24.77	16.91	8.51

NOTE A: The data in Table 4 is based on inside diameters of tubing matching the inside diameters of sanitary fittings as published in Part Two of the 3-A Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products, Number 08-17 as amended.

B: The data in Table 4 is based upon the processing of milk and milk products with a viscosity and consistency of raw whole milk or water. (a safety factor of 14% has been applied to these calculations).

C: Where applications involve a concentrated/viscous milk or milk product, special provisions should be made to insure turbulent flow.

N.5

For other tubes sizes and other holding times the tube length required at the measured flow rate may be calculated using the following formula.

A. When a 14% safety factor is applied.

$$L = \frac{4.389 \times F \times T}{A}$$

B. When a special safety factor is involved.

$$L = \frac{3.850 \times F \times T \times SF}{A}$$

Where L = Length of holding tube in inches required for the measured flow rate

T = Required holding time in sec

A = Inside area of the Holding Tube in sq in. (See Table 5)

F = Measured flow rate in gal per min

SF= Safety factor to be applied

TABLE 5. General Reference for Holding Tube Applications

16 GA O.D. Tube Size	Length Equiv. Std. 90 Degree Tube Bend	Minimum Recommended CIP Flow Rate (5 ft per sec)	Area of Tube I.D. (A)	Minimum Ave. Velocity at 1 ft/sec
in.	in.	GPM	sq in.	GPM
1	3.48	10	0.594	2.0
1-1/2	4.94	24	1.485	4.8
2	6.83	43	2.761	8.6
2-1/2	8.65	70	4.430	13.8
3	10.48	102	6.491	20.4
4	13.68	180	11.545	36.0

NOTE: The Length Equivalence of a standard 90 degree tube bend can be deducted from the Linear Length calculation based on the number of 90 degree tube bends incorporated into a single or multi-loop holding tube design.

O

STAINLESS STEEL MATERIALS

Stainless steel conforming to the applicable composition ranges established by AISI*2 for wrought products, or by ACI*3 for cast products, should be considered in compliance with the requirements of D.2 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08 %. The reference cited in D.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*8 specifications A351/A351M, A743/A743M and A744/A744M.

P

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 Section E.2.1 herein.

Q

FOOTNOTES

Q.1

*1 Available from the Superintendent of Documents, United States Government Printing Office, Washington, DC 20402 (202/783-3238).

*2 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, 410 Commonwealth Drive, Warrendale, PA 15086 (412-776-9460).

*3 Steel Founders Society of America, Cast Metals Federation Bldg., 455 State St., Des Plaines, IL 60016 (708-299-9160).

*4 Standard Specification for ASTM Thermometers-Designation: E-1-88. Available from ASTM, 1916 Race St., Philadelphia, PA 19103-1187 (215-299-5400).

*5 The method for making total solids determination is contained in the following reference: Official Methods of Analysis. Available from the Association of Official Analytical Chemists, 1111 North 19th St., Suite 210, Arlington, VA 22209 (703/522-3032).

*6 Jordan, W. K., Holland, R. F., and White, J. C. - "The Determination of the Holding Time in High-Temperature, Short-Time Pasteurizing Units", Journal of Milk and Food Technology, 12, 87-92 (1949).

*7 The procedural references found in Appendix, Section G of 3-A Accepted Practices, Number 603-06 are those found in the 1989 revision of the Grade A Pasteurized Milk Ordinance, Appendix I, Pasteurization Equipment and Controls - Tests.

*8 Available from ASTM, 1916 Race St., Philadelphia, PA 19103-1187 (215/299-5400).

Q.2

REFERENCES TO 3-A SANITARY STANDARDS AND ACCEPTED PRACTICES

3-A Sanitary Standards for Storage Tanks for Milk and Milk Products, Number 01-07.

3-A Sanitary Standards for Centrifugal and Positive Rotary Pumps for Milk and Milk Products, Number 02-08.

3-A Sanitary Standards for Homogenizers and Pumps of the Plunger Type, Number 04-03.

3-A Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products, as amended, Parts I & II, Number 08-17, as amended.

3-A Sanitary Standards for Instrument Fittings and Connections Used on Milk and Milk Products, Parts I & II, Number 09-08.

3-A Sanitary Standards for Milk and Milk Products Filters Using Disposable Filter Media, Number 10-03.

3-A Sanitary Standards of Plate Type Heat Exchangers for Milk and Milk Products, Number 11-04.

3-A Sanitary Standards for Tubular Heat Exchangers for Milk and Milk Products, Number 12-05.

3-A Sanitary Standards for Farm Milk Cooling and Holding Tanks, Number 13-08.

3-A Sanitary Standards for Milk and Milk Products Evaporators and Vacuum Pans, Number 16-05.

3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-00.

3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-14, as amended.

3-A Sanitary Standards for Non-Coil Type Batch Processors for Milk and Milk Products, Number 25-02.

3-A Sanitary Standards for Flow Meters for Milk and Liquid Milk Products, Number 28-02.

3-A Sanitary Standards for Scraped Surface Heat Exchangers, Number 31-01.

3-A Sanitary Standards for Uninsulated Tanks for Milk and Milk Products, Number 32-00.

3-A Sanitary Standards for Polished Metal Tubing for Dairy Products, Number 33-00.

3-A Sanitary Standards for Continuous Blenders, Number 35-00.

3-A Sanitary Standards for Pressure and Level Sensing Devices, Number 37-01.

3-A Sanitary Standards for In-Line Strainers for Milk and Milk Products, Number 42-00.

3-A Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products, and Product Contact Surfaces, Number 604-03.

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

3-A Accepted Practices for Milk and Milk Products Spray Drying Systems, Number 607-03.

3-A Accepted Practices for Instantizing Systems for Dry Milk and Dry Milk Products, Number 608-01.

3-A Accepted Practices For a Method of Producing Steam of Culinary Quality, Number 609-00.

These revised standards shall become effective December 29, 1992, at which time the 3-A Accepted Practices for the Sanitary Construction, Installation, Testing and Operation of High-Temperature Short-Time Pasteurizer Systems, Number 603-05 shall be rescinded and shall become null and void.

FORM 1

INFORMATION TO BE FURNISHED BY APPLICANT, WITH APPLICATION FOR PERMISSION TO INSTALL A HIGH-TEMPERATURE SHORT-TIME OR HIGHER-HEAT SHORTER-TIME PASTEURIZER

Name and Address of Dairy ______________________________

Manufacturer ______________________ Jobber ______________________

Capacity (lb or kg per hr) ______________________ Product(s) ______________________

Approximate date of installation ______________________________

Plates: Number

Product Regenerator Plates______________

Product Heater Plates______________

Product Cooler Plates______________

	Make	Model
Timing Pump	______________	______________
Timing Pump Drive	______________	______________
Flow-Diversion Device	______________	______________
Recorder-Controller	______________	______________

Holding Tube - Diameter of largest cross section ______________________________

Additional equipment: Give make, model, size and safety controls of each piece of additional equipment which is to be connected to the pasteurizer.

	Make	Model	Capacity
Flow Recorder Controller	______________	______________	______________
Flow Sensing Hood	______________	______________	______________
Flow Transmitter	______________	______________	______________
Auxiliary Pump	______________	______________	______________
Homogenizer	______________	______________	______________
Clarifier (if on hot milk)	______________	______________	______________
Filter	______________	______________	______________
Separator	______________	______________	______________

Other remarks: ______________________________

____

Signed ______________________ (Seller) ______________________

By ______________________ Date ______________

FORM 2

REPORT OF INSTALLATION - HTST OR HHST PASTEURIZER SYSTEM INFORMATION TO BE FURNISHED FOR MILK CONTROL AUTHORITY AND PLANT OPERATOR BY MANUFACTURER'S OR PROCESSOR'S QUALIFIED REPRESENTATIVE ON COMPLETION OF INSTALLATION

Name of Dairy and Address ____________________

Manufacturer ____________________ Jobber ____________________

Nominal Capacity (lb or kg per hr) ____________________ Serial No. ____________________

I. CONTROL INSTRUMENTS

A. Indicating Thermometer(s) (Hot Product)

Make________ Serial No.________ Accuracy________ F____ C____ Lag____ Sec

B. HTST or HHST Recorder-Controller

Make________ Serial No.________ Accuracy________ F____ C____

Cut-In Point______ F_____ C_____ Cut-Out Point__________ F____ C

Thermometric Lag____________ Sec

Flow-Diversion Device:

1. Response time in sec ____________________.
2. Does flow leak past forward-flow seat when operating in diversion with forward-flow line disconnected? __ YES __ NO
3. Does valve seat properly? __ YES __ NO
4. Do leak escapes open properly? __ YES __ NO
5. Does timing pump stop when valve fails to seat properly? __ YES __ NO

C. Flow Recording Controller

Make________ Serial No.________ Chart Range____________

D. Flow Alarm

Separate___ Integral______ Make________ Serial No.______ Hi-Alarm Trip________ Lo-Alarm Trip

E. Flow Meter

Sensing Head Make_____ Size ________ Transmitter Make______ Calibrations______ GPM ____LPH

II. REGENERATOR PRESSURES (when a booster pump is used)

A. Pressure Switch

Maximum pressure developed by the booster pump________ psig or ________ kPa.

Pressure gauge reading at the cut-in point of the pressure switch________ psig or________ kPa.

B. Time delay Switches

Maximum pressure developed by the booster pump________ psig or________ kPa.

Pasteurized product elevation required ______ psig or________ kPa.

Interval from the moment forward-flow is established until booster pump starts to operate ________ sec.

C. Pressure Gauges

(a) Reading of test pressure gauge ____________ psig or________ kPa.

Reading of regenerator inlet pressure gauge____________ psig or________ kPa.

(b) Reading of test pressure gauge ____________ psig or________ kPa.

Reading of pasteurized product outlet pressure gauge ________ psig or________ kPa.

Form 2

III. TIMING PUMP

A. Pump Head - Make ______________________ Serial No. ______________________

Revolutions per min at maximum capacity Setting ______________________

Rate of flow (lb or kg per hr) at Max. rated capacity ______________________

B. Variable Speed Drive

Make ______________________ Serial No. ______________________

Range of rated capacity (lb or kg per hr) High __________ Low ______________________

IV. HOLDING TIME

A. To be established in accordance with the "Determination of Holding Time" (Conductivity Test). See Appendix SectionL.

	TRIALS						
	1	2	3	4	5	6	Average
Forward-flow, Actual Time (sec)	___	___	___	___	___	___	_____
Diverted-flow, Actual (sec)	___	___	___	___	___	___	_____

(Variation between maximum and minimum time should not be over 0.5 sec.)

B. Computed average holding time for milk

a. Diverted-flow ________ sec ________ b. Forward-flow _______ sec

C. Holding Tube

Minimum slope of holding tube in per ft (mm per m) ______________________

V. Check test to determine the volume of product at start-up and time to discharge product at shutdown.

A. These checks are to be carried out in accordance with K.3.1, (for volume) and K.5.2, (for time) of the APPENDIX to 3-A Accepted Practices For The Sanitary Construction, Installation, Testing and Operation Of HTST and HHST Pasteurizer Systems, Number 603-06.

B. Recorded Volume

a. Start-up ________ 10 gal (38 L) cans, or ____ total gal (_____ L).

b. Shutdown ____________ sec

Signed: ______________________ Date: ______________________

Qualified Representative of Manufacturer or Processor

I have examined the above data and tested the HTST pasteurizer system and approve it for operation for pasteurization of milk and milk products.

Signed ______________________ Date: ______________________

Milk Control Authority

****

3-A ACCEPTED PRACTICES FOR THE SANITARY CONSTRUCTION, INSTALLATION, TESTING AND OPERATION OF HIGH-TEMPERATURE SHORT-TIME AND HIGHER-HEAT SHORTER-TIME PASTEURIZER SYSTEMS, REVISED, NUMBER 603-06

Formulated by
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

It is the purpose of the IAMFES, 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. High-Temperature Short-Time and Higher-Heat Shorter-Time methods and apparatus, which are developed and which so differ in design, material, construction, installation, operating procedure or otherwise, so as not to conform with the following practices, but which in the opinion of the manufacturer or fabricator are equivalent or better, may be submitted at any time for the consideration of the IAMFES, USPHS, and DIC.

Nothing in these 3-A Accepted Practices shall be interpreted or construed in any way as changing the published effective requirements recommended by the United States Public Health Service Grade A Pasteurized Milk Ordinance, or any Federal, State, or Local legal code. These 3-A Accepted Practices were developed to provide manufacturers, processors, and milk and milk product control authorities with specifications for the proper construction and installation of new High-Temperature Short-Time Pasteurizer Systems and Higher-Heat Shorter-Time Pasteurizer Systems or any components thereof, which may be installed on or after the effective date of these revised Practices.

This portion of 603-06 contains the drawings and related information.

Glossary — Abbreviations and Symbols

1. Constant Level Tank.
2. Booster Pump (Optional).
3. Regenerator By-Pass Valve ... may be manually operated or automatically controlled in combination with Booster Pump.
4. Separator Feed Pump ... a centrifugal pump at this location may be used as a separator feed pump (as shown), as a centrifugal timing pump, or as a homogenizer stuffing pump when a homogenizer is used as a timing pump. A positive displacement pump may be installed at this location as the timing pump if there are no flow promoting devices between this pump and the flow diversion device.
5. Separator Feed Valve, if separator is used.
6. Separatory By-Pass Valve also required if separator is used. Valves (5) and (6) must be designed and installed to by-pass separator in de-energized condition and must be properly inter-wired with the flow diversion device so that the separator is incapable of producing flow if the FDD is not fully diverted or fully forward when in the product run mode.
7. Skim Back Pressure Valve ... may be required with CIP type separator. May be manually or automatically controlled.
8. Centrifugal Timing Pump ... may be fixed speed or controlled by an AC variable speed drive.
9. Magnetic Flow Meter ... must be placed downstream from the centrifugal pump.
10. Flow Transmitter (FT) ... converts signal from magnetic flow tube to a 4-20ma current.
11. Flow Controller (FC) ... may be an independent instrument or a component of a computer or programmable logic controller based control system which compares the flow signal from the FT to a set-point and either controls the centrifugal pump speed or regulates a flow control valve downstream of the meter and centrifugal pump.
12. Check Valve/Control Valve ... when the centrifugal pump is controlled by an AC variable speed drive, a check valve shall be installed at this location to prevent back flow through the meter when the pump stops. A normally-closed flow control valve used in combination with a fixed speed pump and the FC meets this requirement.
13. Homogenizer ... when equipped with a permanently installed recirculation line, the homogenizer is not a flow promoting device. It may be used as a timing pump if properly inter-wired with the FDD.
14. I/P Transducer ... converts a 4-20ma current signal to air signal to drive flow recorder pen.
15. Flow Recorder ... a strip chart or circular chart recorder to provide a continuous record of flow-rate through system and FDD position.
16. Flow Alarm ... a device inter-wired with the FDD to cause automatic diversion in the event of low flow, loss of signal, or high flow.
17. Time Delay Relay (TDR) ... an adjustable timer set to maintain diverted-flow for a period of time equal to or greater than the legal holding time following re-establishment of legal flow in a meter-based timing system. Other time delay relays may be used to (a) permit a manually adjustable compression valve such as (7) or (30), or with an orifice in some installations.

33. Vacuum Breaker.
34. Sight Glass ... required in vertical leg of leak detect line from FDD.
35. Atmospheric Breaks ... all lines connecting to the constant-level tanks with exception of the raw product supply line must break to atmosphere a minimum of two pipe diameters above the overflow level.

List of Notes for 3-A HTST Practice Illustrations

1. This line shall be horizontal at least 12 in above any raw piping in the HTST system.
2. All divert, leak detection and recycle lines which return to the constant level tanks must break to atmosphere at least two pipe diameters above the overflow level.
3. The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
4. If the by-pass valves are used, they must be pinned to prevent improper positioning.
5. Required when homogenizer has greater capacity than timing pump.
6. Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled checked valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.
7. Separator would function as a clarifier or would be by-passed when running homogenizer products.
8. Straight pipe per manufacture-s recommendation is required on both sides of the centerline of the magnetic flow meter. Meter shall be located so electrodes are flooded. No product can enter or leave the system between the centrifugal timing pump and the flow diversion valve. The flow control valve, if used, shall be normally closed air-to-open. This valve may be replaced with a sanitary check valve for systems equipped with variable speed centrifugal timing pumps. A homogenizer downstream of the timing system (i.e. centrifugal timing pump, magnetic flow meter, and flow control valve or check valve) must be provided with an unrestricted recirculation line.
9. Homogenizer by-pass valve is optional and may be normally closed with all components of MBTS downstream.
10. Potable water supply must conform with local plumbing codes for water flowing into a vacuum. Solenoid water valves should be activated by the flow diversion valve. Shut-off valve must close when flow diversion valve diverts and it must open when flow diversion valve is in forward-flow. The optional recycle valve is for rinsing, cleaning and sanitizing the pasteurized product line. The divert line may discharge to waste.
11. Utilities in the form of recirculated hot water, steam, ice water and/or glycol and electrical and air connections from STLR to FDD(s) are required for all HTST sys-

tems but are shown only on this figure (see Figure 1).

12. The instrumentation shown here includes the auxiliary temperature controller (ATC) and the required time delay relay.
13. The auxiliary safety thermal limit recorder at the inlet port of the flow diversion valve must be wired to prevent forward-flow until both of its temperature sensing element and the temperature sensing element of the primary recorder controller have been exposed to fluid at pasteurization temperature, continuously and simultaneously for the pasteurization time.
14. The safety thermal limit recorder-controller for this system must have three sensing elements (at the discharge end of the holding tube, in the top of the vacuum chamber, and at the common port of the flow diversion valve). The product temperature in the holding tube and the position of the flow diversion valve (frequency pen) must be recorded on the main recorder-controller while the other two sensing elements may be interlocked with the main recorder-controller through auxiliary indicating controllers.
15. Regenerator drain line may discharge to the constant level tank if its overflow level is lower than the bottom of the inlet of the raw regenerator, otherwise must discharge to waste.
16. CIP jumper between homogenizer suction and discharge must be removed for production run.
17. Optional-needed if flow to clean evaporator and lines exceeds recommended flow rate for plate unit.
18. Optional-to maintain differential pressure between raw and pasteurized products and to prevent vacuum breakers from opening and allowing incorporation of air.
19. When a separator or clarifier is an integral part of the HTST or HHST system and is located upstream of the timing pump or downstream of the FDD, it shall be automatically valved out of the system with fail-safe valves properly interwired with the timing pump and the FDD if it is downstream from the FDD.
20. REGEN 1 is the first section of a split milk-to-milk regenerator and require a Regenerator Differential Pressure Switch. REGEN 2 (milk-to-milk) and REGEN 3 (cream-to-milk) are both vacuum regenerators and require no Regenerator Differential Pressure Switch.
21. Pressure control valve to assure positive product pressure at the high pressure plunger-type pump inlet. The pressure setting device of the valve set at a product pressure less than the product pressure at which the flow diversion valve will move from the forward-flow position to the diverted-flow position (see Figure 33).

Glossary of Abbreviations Used on Acccompanying Figures

ALARM	...	Flow-Rate Alarm
BPC	...	Back Pressure Controller
CMR	...	Cold Milk Recorder
FC	...	Flow Controller
FPC	...	Feed Pressure Controller
FR	...	Flow Recorder
FT	...	Flow Transmitter
I/P	...	Current to Pressure Transducer
RC	...	Ratio Controller
RDPS	...	Regenerator Differential Pressure Switch
STLR	...	Safety Thermal Limit Recorder
TC	...	Temperature Controller
TDR	...	Time Delay Relay

GLOSSARY. Components of HTST or HHST Systems in Typical Application.

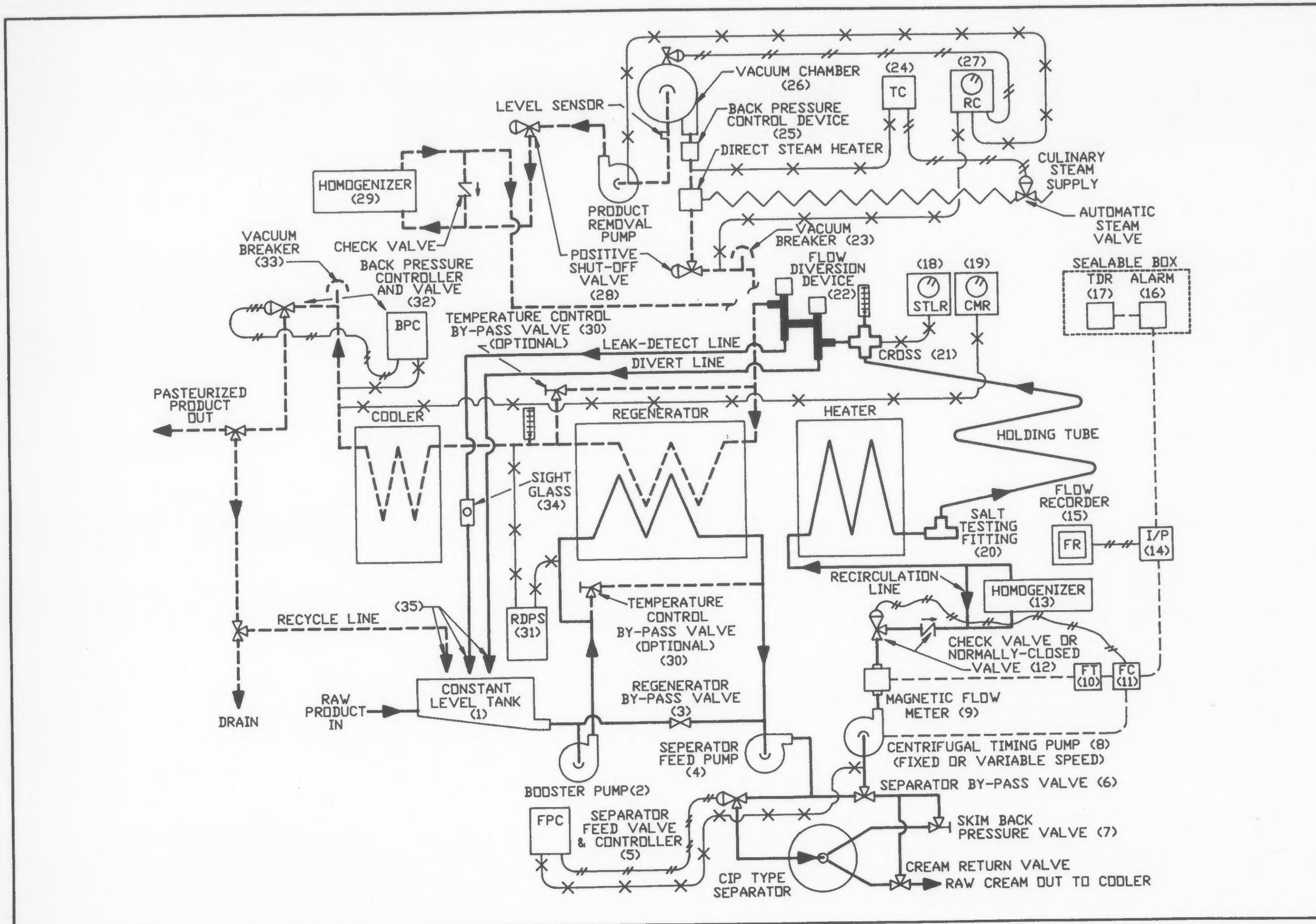


FIGURE 1. HTST Pasteurizer with Positive Rotary Timing Pump.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(11.) Utilities in the form of recirculated hot water, steam, ice water and/or glycol and electrical and air connections from STLR to FLOW DIVERSION DEVICES are required for all HTST systems but are shown only on this figure.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

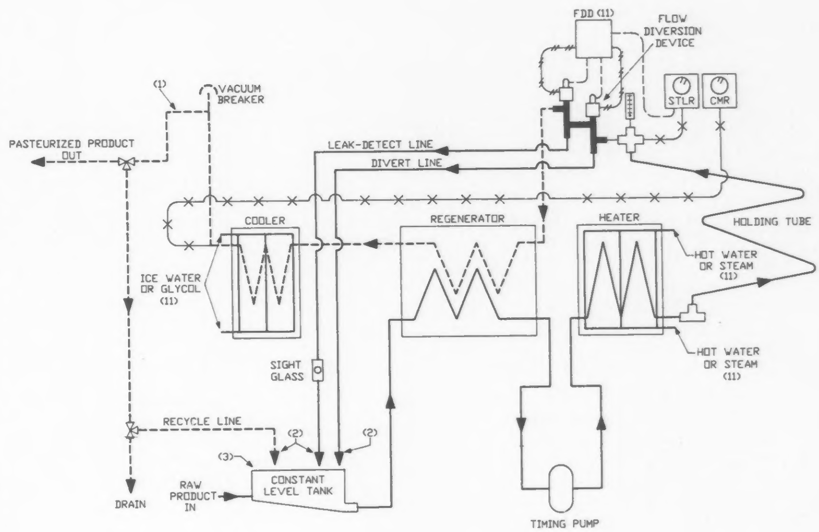
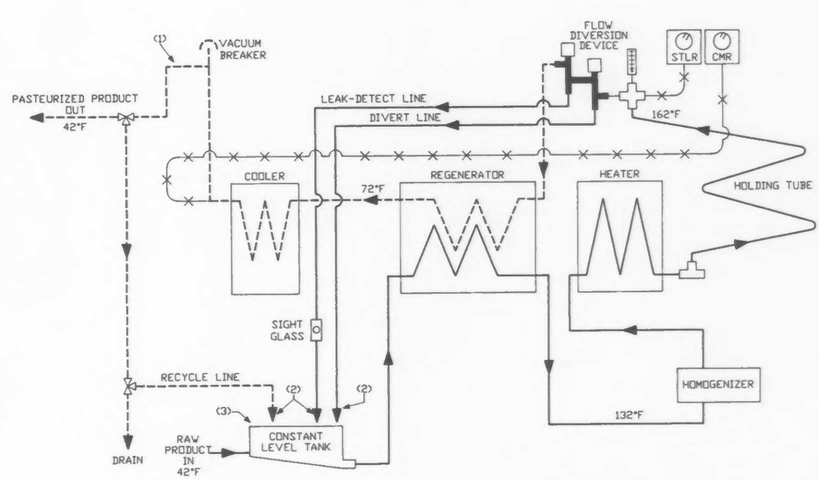


FIGURE 2. HTST Pasteurizer with Homogenizer Used as a Timing Pump, with Temperature Progression at 75% Regeneration

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.



NOTE: The indicated temperature progression is for a system operating at 75% regeneration, supplied with milk at 45°F and pasteurizing at 162°F, as an example of heat transfer by regeneration.

FIGURE 3. HTST Pasteurizer with Homogenizer of Smaller Capacity than Timing Pump.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(4.) If by-pass valves are used, they must be pinned to prevent improper positioning.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

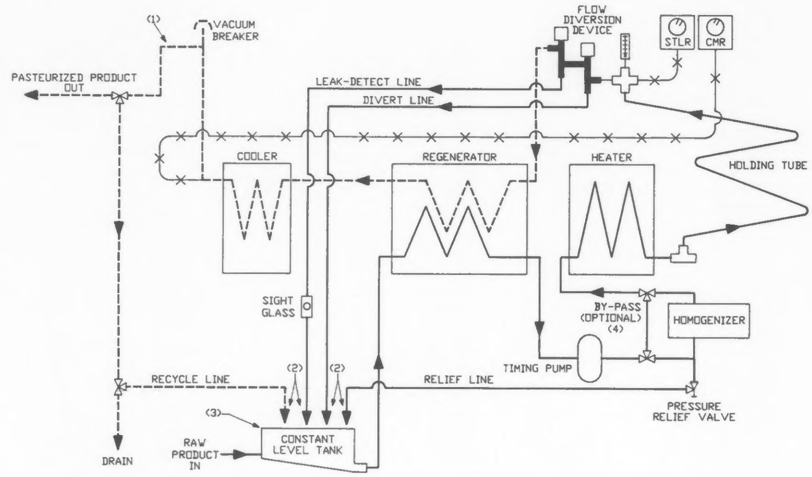


FIGURE 4. HTST Pasteurizer With Homogenizer Of Larger CapacityThan Timing Pump.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(4.) If by-pass valves are used, they must be pinned to prevent improper positioning.
(5.) Required when homogenizer has greater capacity than timing pump.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

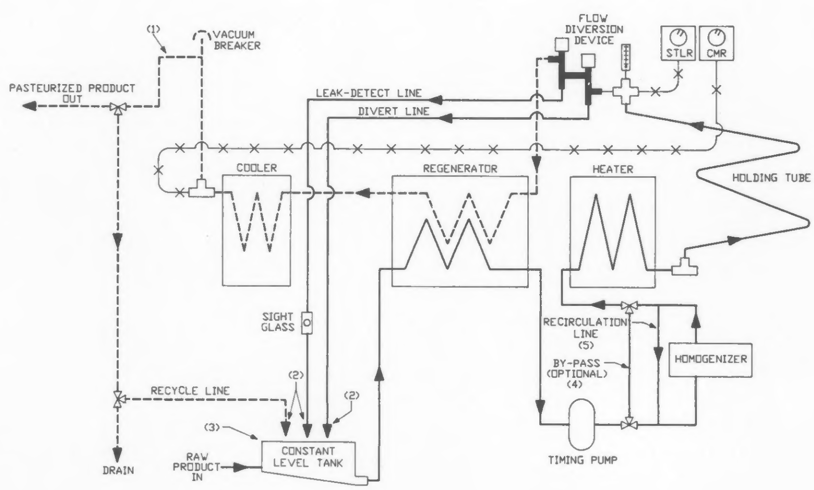


FIGURE 5. HTST Pasteurizer With Homogenizer At Outlet Of Heater And Of Larger Capacity Than Timing Pump.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

(5.) Required when homogenizer has greater capacity than timing pump.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

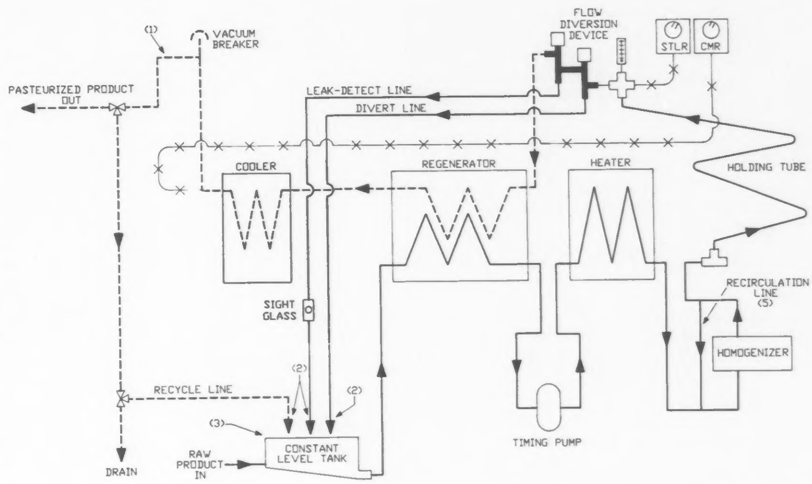


FIGURE 6. HTST Pasteurizer With Timing Pump Or Homogenizer Used As A Timing Pump When Homogenized Milk Is Being Processed.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

(4.) If by-pass valves are used, they must be pinned to prevent improper positioning.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

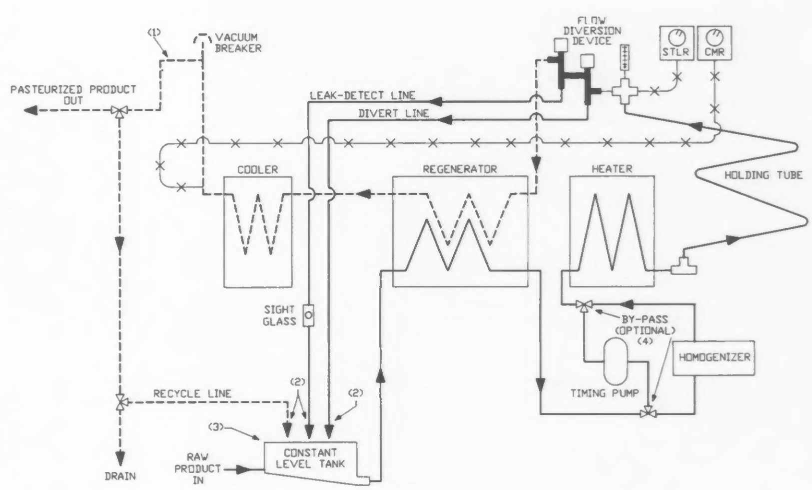


FIGURE 7. HTST Pasteurizer With Booster Pump, Homogenizer Of Larger CapacityThan Pasteurizer, Fed By A Timing Pump, With Pressure Progression.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(5.) Required when homogenizer has greater capacity than timing pump.
(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

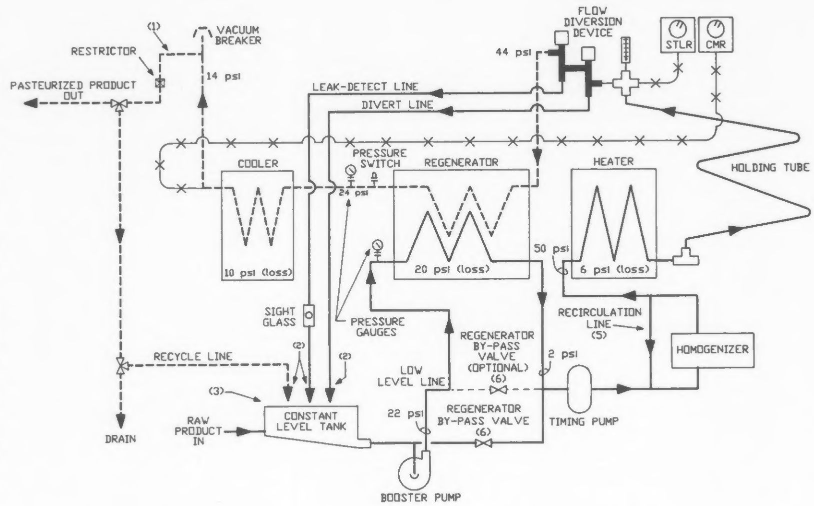


FIGURE 8. HTST Pasteurizer With A Booster Pump, Homogenizer Of Larger Capacity Than Pasteurizer, Fed By A Timing Pump And Having A Back Pressure Control Valve.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(5.) Required when homogenizer has greater capacity than timing pump.
(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

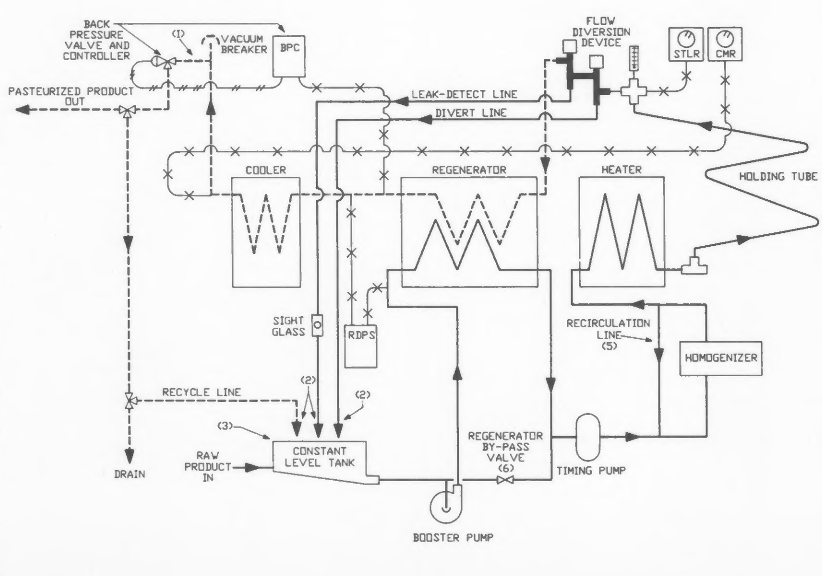


FIGURE 9. HTST Pasteurizer With Booster Pump, Homogenizer As Timing Pump And CIP-type Separator Between Raw Regenerator And Homogenizer.

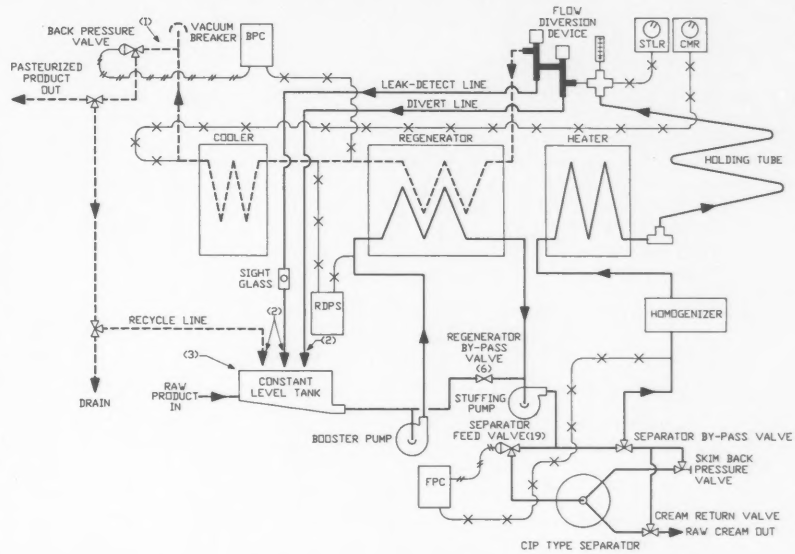
(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.

(19.) When a separator or clarifier is an integral part of the HTST or HHST system and is located upstream of the timing pump or downstream of the Flow Diversion Device, it shall be automatically valved out of the system with fail-safe valves properly interwired with the timing pump.



Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 10. HTST Pasteurizer With Booster Pump, Stuffing Pump, Homogenizer As Timing Pump and CIP-type Separator Between Pasteurized Regenerator And Cooler.

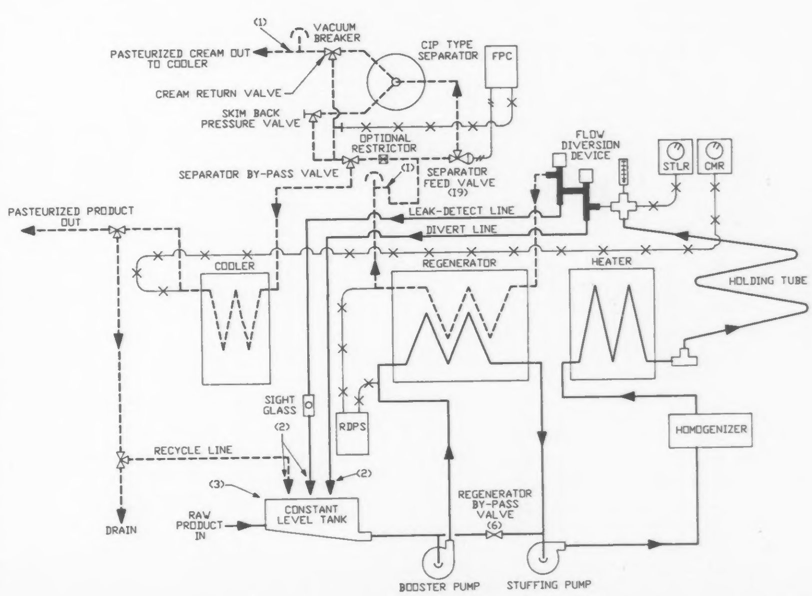
(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

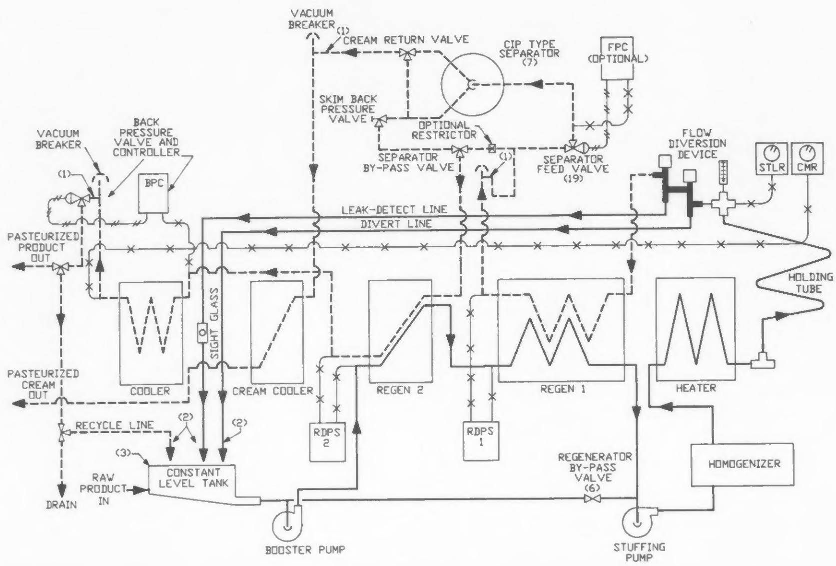
(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.

(19.) When a separator or clarifier is an integral part of the HTST or HHST system and is located upstream of the timing pump or downstream of the Flow Diversion Device, it shall be automatically valved out of the system with fail-safe valves properly interwired with the timing pump.



Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 11. HTST Pasteurizer With Booster Pump, Homogenizer As Timing Pump And CIP-type Separator Between Two Pasteurized Regenerators, With Cream Cooler.



(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

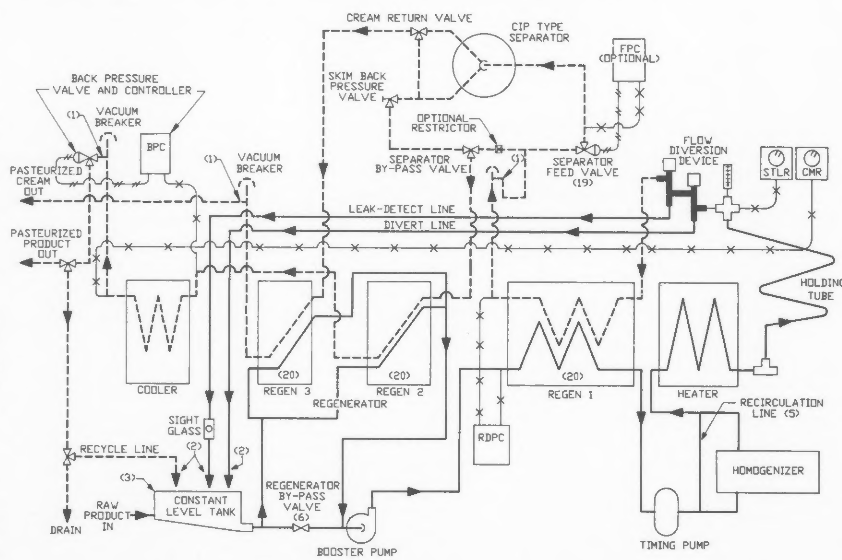
(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.

(7.) Separator would function as clarifier or would be by-passed when running homogenizer products.

(19.) When a separator or clarifier is an integral part of the HTST or HHST system and is located upstream of the timing pump or downstream of the Flow Diversion Device, it shall be automatically valved out of the system with fail-safe valves properly interwired with the timing pump.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 12. HTST Pasteurizer With Vacuum Milk Regenerator, Timing Pump, Homogenizer And CIP-type Separator Between Two Pasteurized Regenerators.



(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

(5.) Required when homogenizer has greater capacity than timing pump.

(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.

(19.) When a separator or clarifier is an integral part of the HTST or HHST system and is located upstream of the timing pump or downstream of the Flow Diversion Device, it shall be automatically valved out of the system with fail-safe valves properly interwired with the timing pump.

(20.) REGEN 1 is the first section of a split milk-to-milk regenerator and REGEN 2 is the subsequent second section. Each requires a Regenerator Differential Pressure Switch. REGEN 3 is a cream to milk regenerator operating at a negative pressure and requires no Regenerator Differential Pressure Switch.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 13. HTST Pasteurizer With Single-chamber Vacuum System Upstream From Heater And Homogenizer Used As Timing Pumps.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

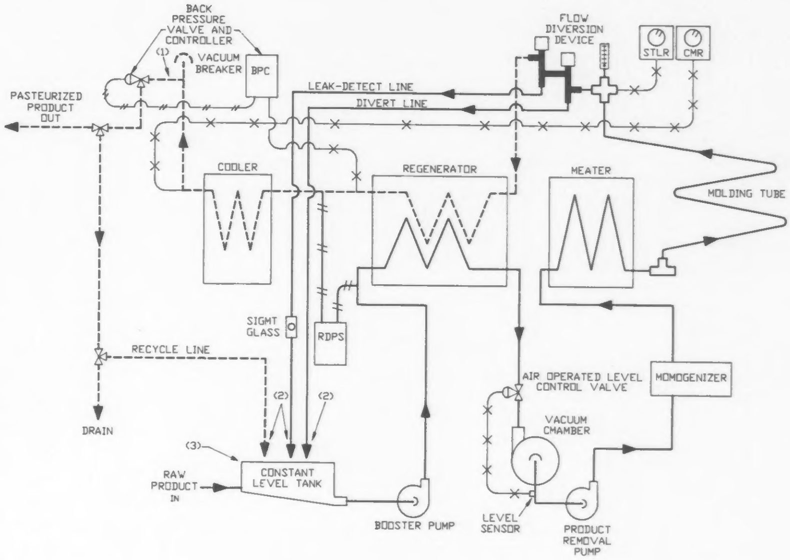


FIGURE 14. Single Chamber Vacuum, With No Direct Addition Of Steam, Downstream From Flow Diversion Device.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

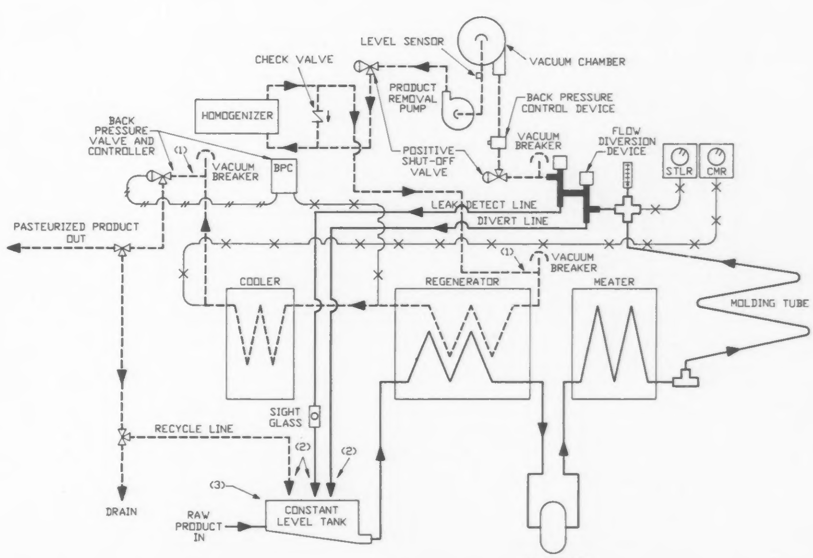


FIGURE 15. Single Chamber Vacuum System, With Direct Steam Addition, Downstream From Flow Diversion Device.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and re-cycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

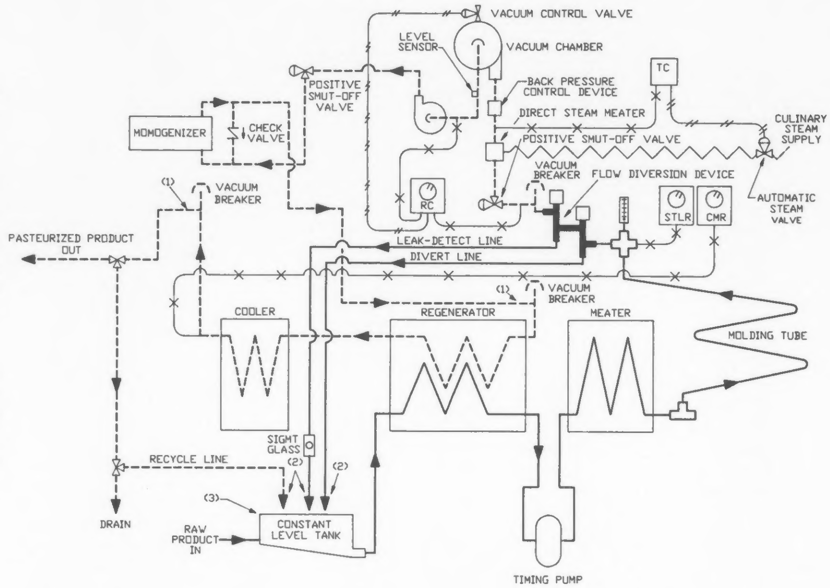
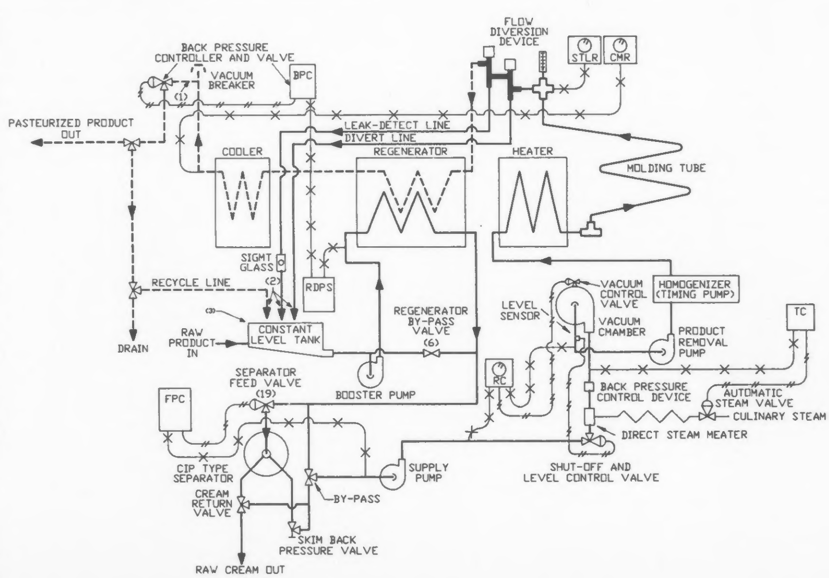


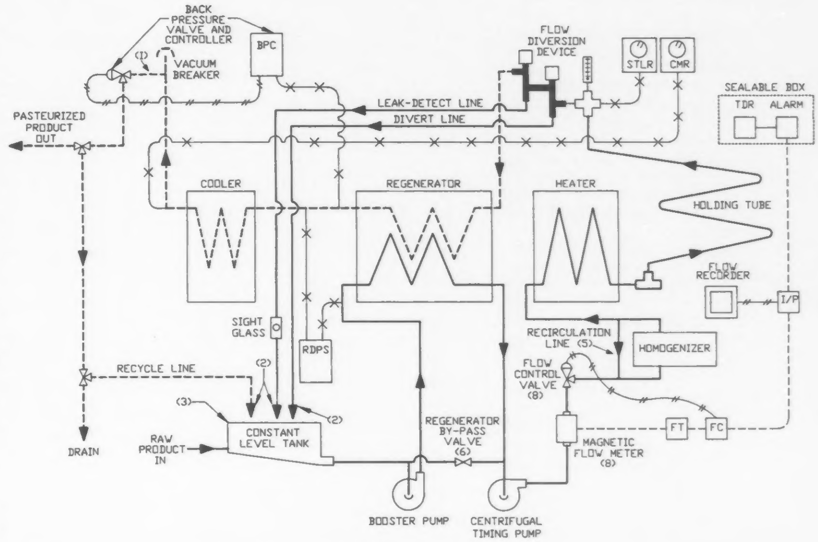
FIGURE 16. HTST Pasteurizer With Booster Pump, CIP-type Separator, Single Chamber Vacuum System With Direct Steam Injection, And Homogenizer As Timing Pump Between Regenerator And Heater.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and re-cycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.
(19.) When a separator or clarifier is an integral part of the HTST or HHST system and is located upstream of the timing pump or downstream of the Flow Diversion Device, it shall be automatically valved out of the system with fail-safe valves properly interwired with the timing pump.



Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 17. HTST Pasteurizer With Booster Pump, Meter Based Timing System And Homogenizer With Recirculation Line.



(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

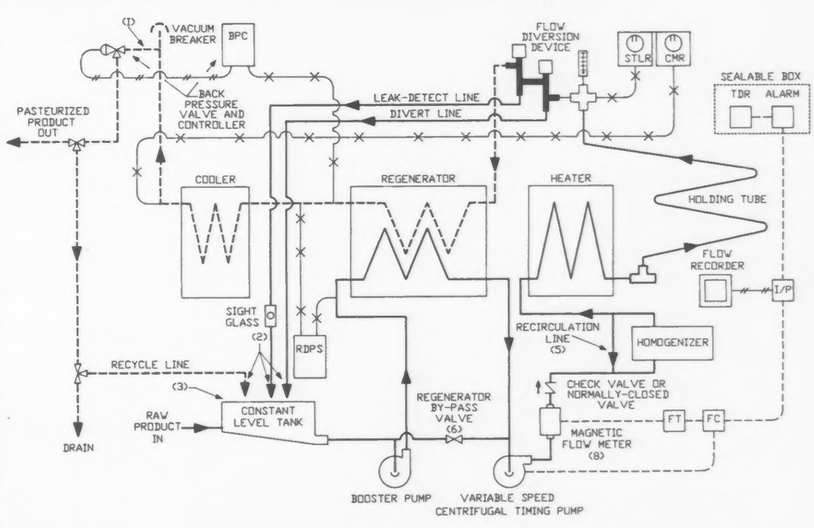
(5.) Required if homogenizer has greater capacity than timing pump.

(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.

(8.) Straight pipe per manufacturers recommendation is required on both sides of the centerline of the magnetic flow meter. Meter shall be located so electrodes are flooded. No product can enter or leave the system between the centrifugal timing pump and the flow diversion valve. The flow control valve, if used, shall be normally closed air-to-open. This valve may be replaced with a sanitary check valve for systems equipped with variable speed centrifugal timing pumps. A homogenizer downstream of the timing system (i.e., centrifugal timing pump, magnetic flow meter, and flow control valve or check valve) must be provided with a recirculation line.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 18. HTST Pasteurizer With Booster Pump, Meter Based Timing System With AC Drive Pump, And Homogenizer With Recirculation Line.



(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

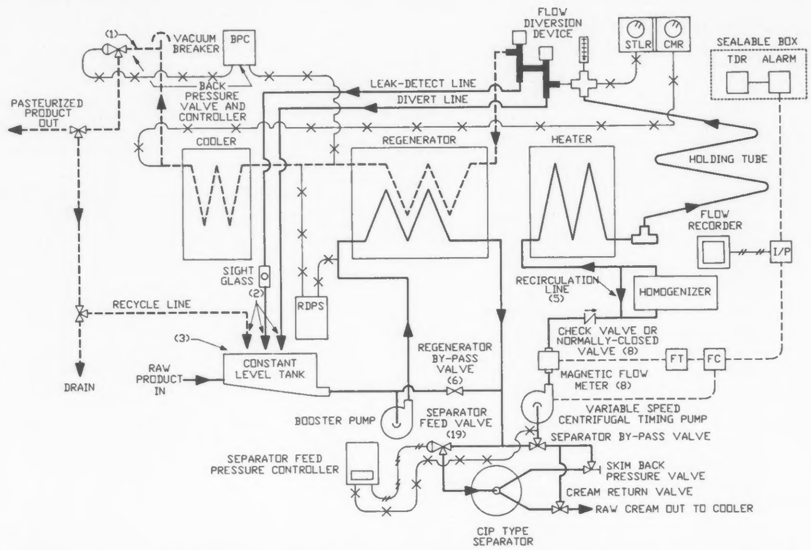
(5.) Required if homogenizer has greater capacity than timing pump.

(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.

(8.) Straight pipe per manufacturers recommendation is required on both sides of the centerline of the magnetic flow meter. Meter shall be located so electrodes are flooded. No product can enter or leave the system between the centrifugal timing pump and the flow diversion valve. The flow control valve, if used, shall be normally closed air-to-open. This valve may be replaced with a sanitary check valve for systems equipped with variable speed centrifugal timing pumps. A homogenizer downstream of the timing system (i.e., centrifugal timing pump, magnetic flow meter, and flow control valve or check valve) must be provided with a recirculation line.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

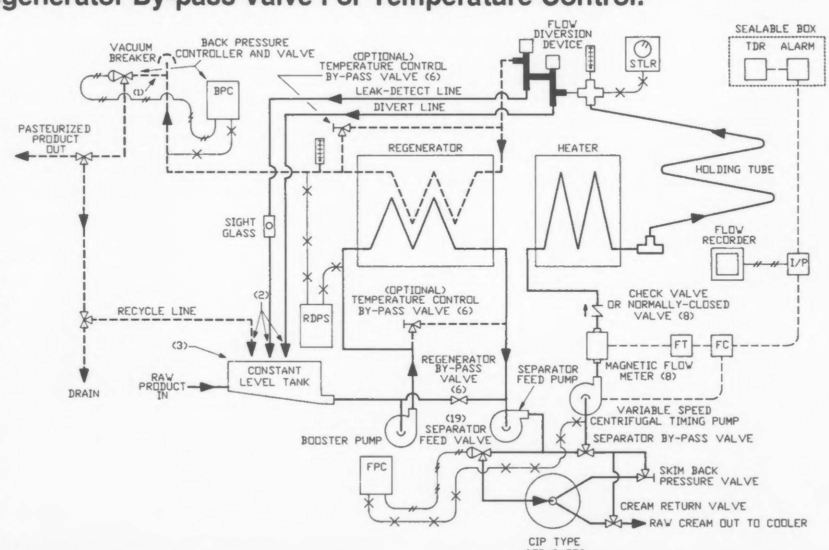
FIGURE 19. HTST Pasteurizer With Booster Pump, Meter Based Timing System With AC Drive Pump, Homogenizer, And CIP-type Separator Between Regenerator And Heater.



(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(5.) Required if homogenizer has greater capacity than timing pump.
(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.
(8.) Straight pipe per manufacturers recommendation is required on both sides of the centerline of the magnetic flow meter. Meter shall be located so electrodes are flooded. No product can enter or leave the system between the centrifugal timing pump and the flow diversion valve. The flow control valve, if used, shall be normally closed air-to-open. This valve may be replaced with a sanitary check valve for systems equipped with variable speed centrifugal timing pumps. A homogenizer downstream of the timing system (i.e., centrifugal timing pump, magnetic flow meter, and flow control valve or check valve) must be provided with a recirculation line.
(19.) When a separator or clarifier is an integral part of the HTST or HHST system and is located upstream of the timing pump or downstream of the Flow Diversion Device, it shall be automatically valved out of the system with fail-safe valves properly interwired with the timing pump.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

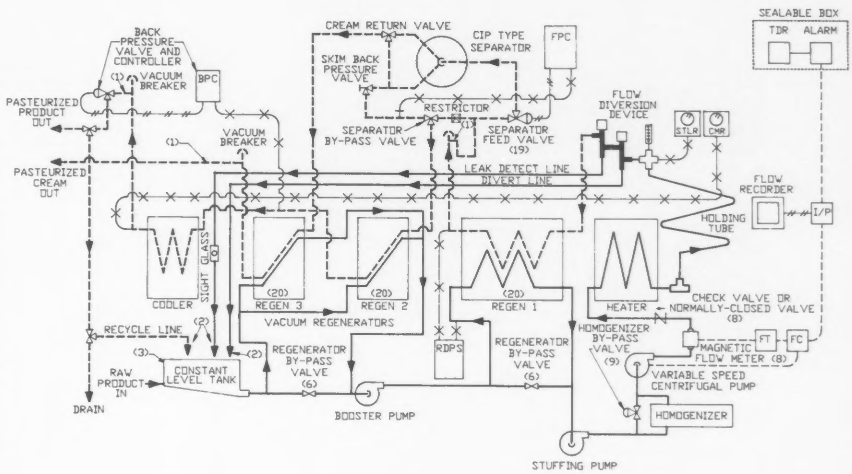
FIGURE 20. HTST Pasteurizer For Cheese Milk With Booster Pump, Separator Feed Pump To CIP-type Separator Between Pasteurizer Product Regenerator And Heater, Centrifugal Timing Pump, Meter Based Timing System And Pasteurized Product Regenerator By-pass Valve For Temperature Control.



(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.
(8.) Straight pipe per manufacturers recommendation is required on both sides of the centerline of the magnetic flow meter. Meter shall be located so electrodes are flooded. No product can enter or leave the system between the centrifugal timing pump and the flow diversion valve. The flow control valve, if used, shall be normally closed air-to-open. This valve may be replaced with a sanitary check valve for systems equipped with variable speed centrifugal timing pumps. A homogenizer downstream of the timing system (i.e., centrifugal timing pump, magnetic flow meter, and flow control valve or check valve) must be provided with a recirculation line.
(19.) When a separator or clarifier is an integral part of the HTST or HHST system and is located upstream of the timing pump or downstream of the Flow Diversion Device, it shall be automatically valved out of the system with fail-safe valves properly interwired with the timing pump.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

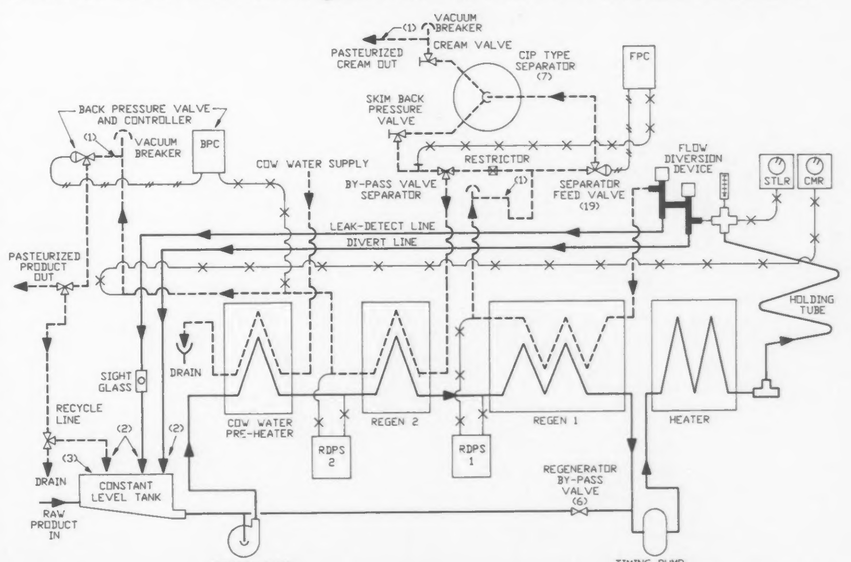
FIGURE 21. HTST Pasteurizer With Milk And Cream Regenerators, Centrifugal Timing Pump, Meter Based Timing System, Homogenizer Of Smaller Capacity With By-pass Valve and CIP-type Separator Between Two Pasteurized Regenerators.



(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.
(8.) Straight pipe per manufacturers recommendation is required on both sides of the centerline of the magnetic flow meter. Meter shall be located so electrodes are flooded. No product can enter or leave the system between the centrifugal timing pump and the flow diversion valve. The flow control valve, if used, shall be normally closed air-to-open. This valve may be replaced with a sanitary check valve for systems equipped with variable speed centrifugal timing pumps. A homogenizer downstream of the timing system (i.e., centrifugal timing pump, magnetic flow meter, and flow control valve or check valve) must be provided with a recirculation line.
(9.) Homogenizer by-pass valve is optional and may be normally open or normally closed with all components of MBT system downstream.
(19.) When a separator or clarifier is an integral part of the HTST or HHST system and is located upstream of the timing pump or downstream of the Flow Diversion Device, it shall be automatically valved out of the system with fail-safe valves properly interwired with the timing pump.
(20.) REGEN 1 is the first section of a split milk-to-milk regenerator and REGEN 2 is the subsequent second section. Each requires a Regenerator Differential Pressure Switch. REGEN 3 is a cream to milk regenerator operating at a negative pressure and requires no Regenerator Differential Pressure Switch.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 22. HTST Pasteurizer With Booster Pump, Timing Pump, And CIP-type Separator Between Two Pasteurized Product Regenerators, With Cow Water Pre-heater.

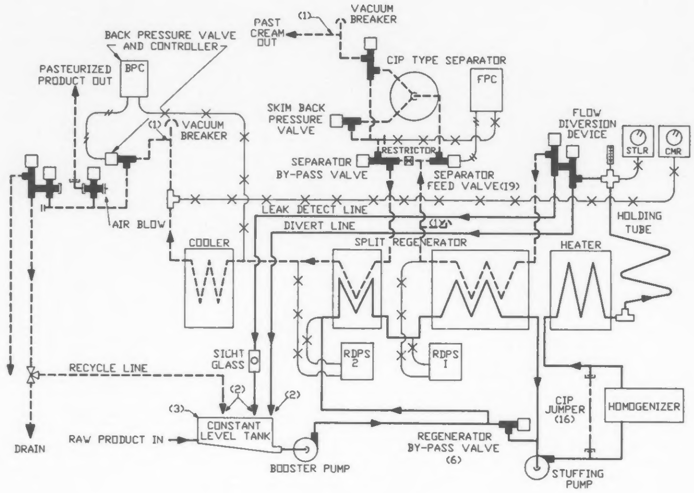


(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.
(7.) Separator would function as clarifier or would be by-passed when running homogenizer products.
(19.) When a separator or clarifier is an integral part of the HTST or HHST system and is located upstream of the timing pump or downstream of the Flow Diversion Device, it shall be automatically valved out of the system with fail-safe valves properly interwired with the timing pump.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 23. HTST Pasteurizer With Booster Pump, Homogenizer As Timing Pump And CIP-type Separator Installed Between Two Pasteurized Product Regenerators. All Valves Shown In Air-operated Valve Format.

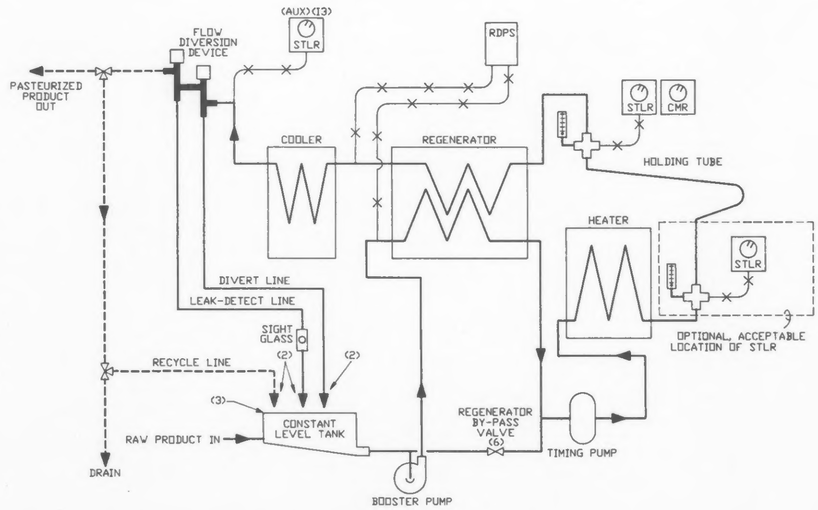
(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.
(16.) CIP jumper between homogenizer suction and discharge must be removed for production run.
(19.) When a separator or clarifier is an integral part of the HTST or HHST system and is located upstream of the timing pump or downstream of the Flow Diversion Device, it shall be automatically valved out of the system with fail-safe valves properly interwired with the timing pump.



Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 24. HHST Pasteurizer With Flow Diversion Valve At The End Of The Cooling Section.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(6.) Regenerator by-pass valves must be installed to be drainable, and must prevent dead-ends, or be drilled. A drilled check valve may be used between inlets of booster pump and timing pump. Air operated valves must be normally open, automatically operated and controlled to open if timing pump stops.
(13.) The auxiliary safety thermal limit recorder at the inlet port of the flow diversion valve must be wired to prevent forward flow until both of it's temperature sensing element and the temperature sensing element of the primary recorder controller have been exposed to fluid at pasteurization temperature, continuously and simultaneously for the pasteurization time.



Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

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107	120	133	146	159	172	185	198	211	224	237	250	263	276	289	302	315	328	341	354
108	121	134	147	160	173	186	199	212	225	238	251	264	277	290	303	316	329	342	355
109	122	135	148	161	174	187	200	213	226	239	252	265	278	291	304	317	330	343	356
110	123	136	149	162	175	188	201	214	227	240	253	266	279	292	305	318	331	344	357
111	124	137	150	163	176	189	202	215	228	241	254	267	280	293	306	319	332	345	358
112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
113	126	139	152	165	178	191	204	217	230	243	256	269	282	295	308	321	334	347	360

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International Association of Milk, Food and Environmental Sanitarians Inc

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104	117	130	143	156	169	182	195	208	221	234	247	260	273	286	299	312	325	338	351
105	118	131	144	157	170	183	196	209	222	235	248	261	274	287	300	313	326	339	352
106	119	132	145	158	171	184	197	210	223	236	249	262	275	288	301	314	327	340	353
107	120	133	146	159	172	185	198	211	224	237	250	263	276	289	302	315	328	341	354
108	121	134	147	160	173	186	199	212	225	238	251	264	277	290	303	316	329	342	355
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111	124	137	150	163	176	189	202	215	228	241	254	267	280	293	306	319	332	345	358
112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
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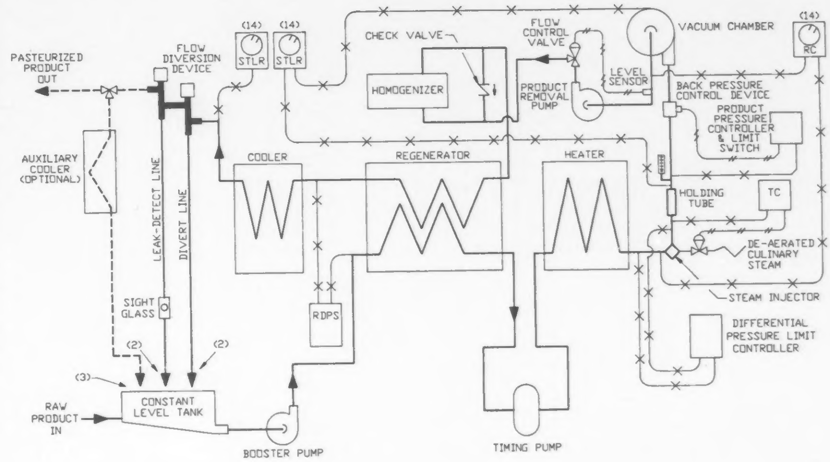
FIGURE 25. HHST Pasteurizer, With Steam Injection Heating, Vacuum Cooling And Flow Diversion Valve Located At The End Of The Cooling Section.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

(14.) The safety thermal limit recorder-controller for this system must have three sensing elements (at the discharge end of the holding tube, in the top of the vacuum chamber, and at the common port of the flow diversion valve). The product temperature in the holding tube and the position of the flow diversion valve (frequency pen) must be recorded on the main recorder-controller which must be interwired with the auxiliary sensing device to prevent flow until it's temperature sensing element and both of the auxiliary sensing elements have been exposed to the fluid at the pasteurization temperature, continuously and simultaneously, for the pasteurization time.



Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

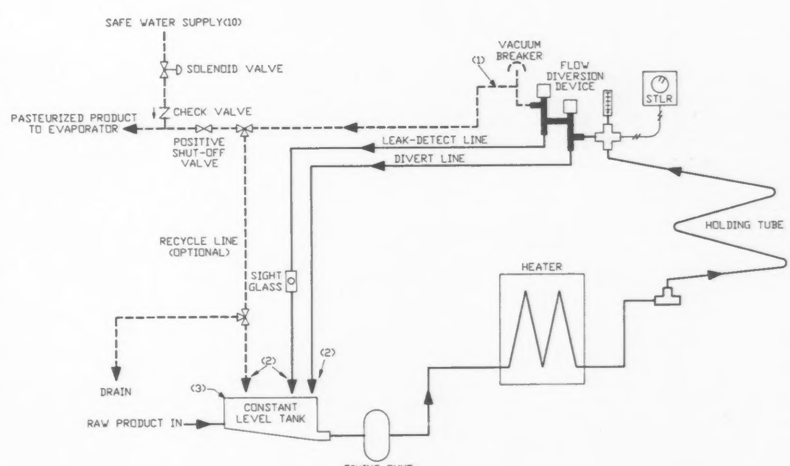
FIGURE 26. HTST Pasteurizer (Without Regenerator Or Cooler) Located Upstream From The Evaporator.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

(10.) Potable water supply must conform with local plumbing codes for water flowing into a vacuum. Solenoid water valves should be activated by the flow diversion valve. Shut-off valve must close when flow diversion valve diverts and it must open when flow diversion valve is in forward flow. The optional recycle valve is for rinsing, cleaning and sanitizing the pasteurized product line. The divert line may discharge to waste.



Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 27. HTST Pasteurizer (Without Regenerator Or Cooler) With Centrifugal Timing Pump And Meter Based Timing System Located Upstream From The Evaporator.

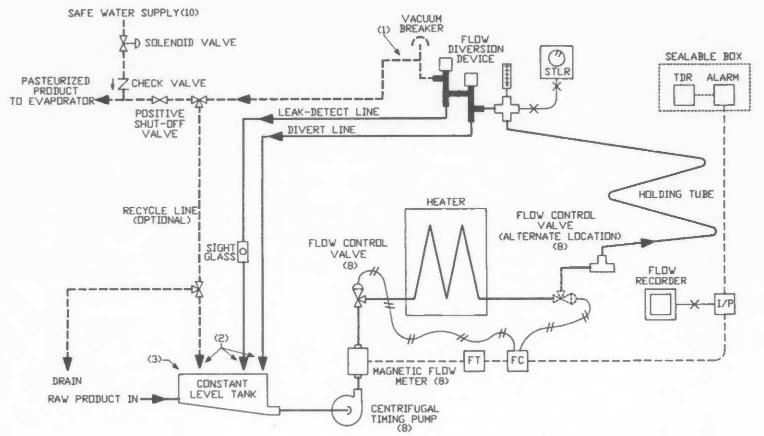
(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

(8.) Straight pipe per manufacturers recommendation is required on both sides of the centerline of the magnetic flow meter. Meter shall be located so electrodes are flooded. No product can enter or leave the system between the centrifugal timing pump and the flow diversion valve. The flow control valve, if used, shall be normally closed air-to-open. This valve may be replaced with a sanitary check valve for systems equipped with variable speed centrifugal timing pumps. A homogenizer downstream of the timing system (i.e., centrifugal timing pump, magnetic flow meter, and flow control valve or check valve) must be provided with a recirculation line.

(10.) Potable water supply must conform with local plumbing codes for water flowing into a vacuum. Solenoid water valves should be activated by the flow diversion valve. Shut-off valve must close when flow diversion valve diverts and it must open when flow diversion valve is in forward flow. The optional recycle valve is for rinsing, cleaning and sanitizing the pasteurized product line. The divert line may discharge to waste.



Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

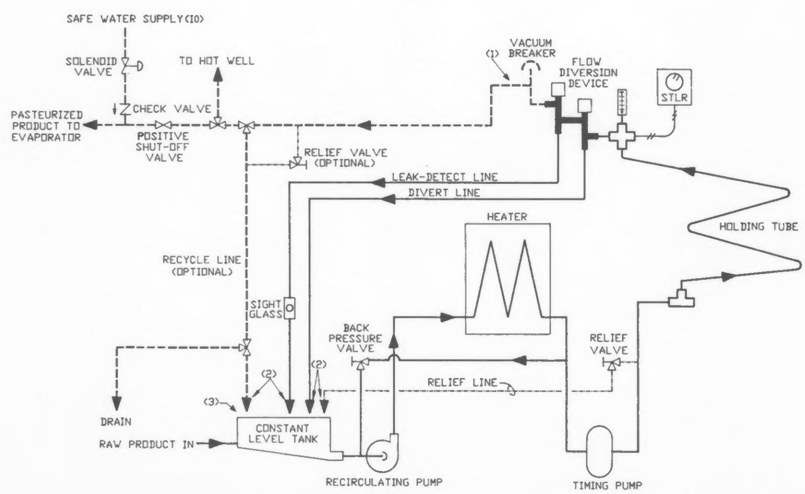
FIGURE 28. HTST Pasteurizer, Employing Single Stage Heating With Recirculation, Upstream From The Hot Well Or Evaporator.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

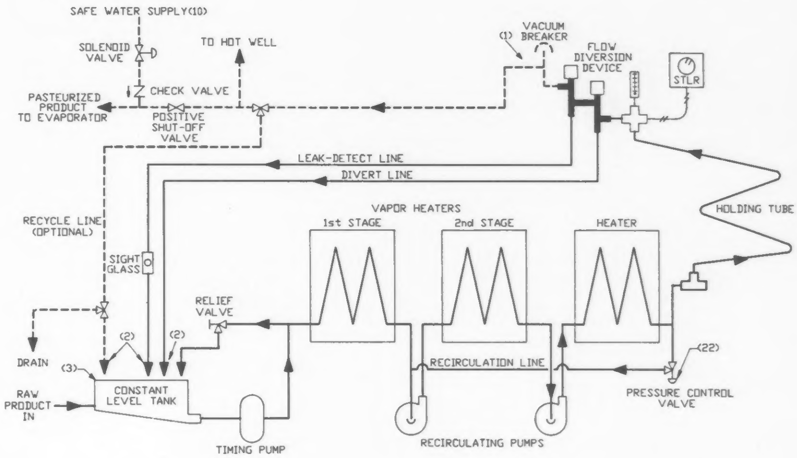
(10. Safe water supply must conform with local plumbing codes for water flowing into a vacuum. Solenoid water valves should be activated by the flow diversion valve. Shut-off valve must close when flow diversion valve diverts and it must open when flow diversion valve is in forward flow. The optional recycle valve is for rinsing, cleaning and sanitizing the pasteurized product line. The divert line may discharge to waste.



Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 29. HTST Pasteurizer (Without Regenerator) Employing Multi-Stage Heating With Recirculation Through Second And Third Stage Heaters Upstream From The Hot Well Or Evaporator.

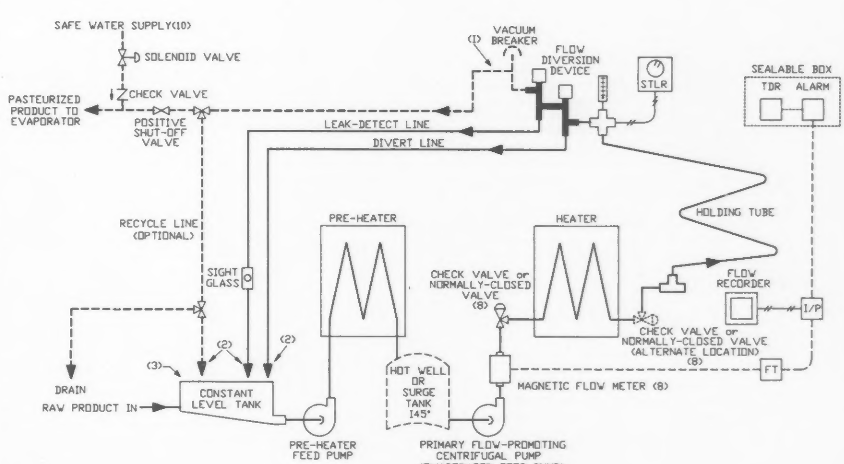
(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(10.) Safe water supply must conform with local plumbing codes for water flowing into a vacuum. Solenoid water valves should be activated by the flow diversion valve. Shut-off valve must close when flow diversion valve diverts and it must open when flow diversion valve is in forward flow. The optional recycle valve is for rinsing, cleaning and sanitizing the pasteurized product line. The divert line may discharge to waste.
(22.) By-pass valve must be closed during salt test timing procedure to assure system operation at maximum capacity.



Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 30. HTST Pasteurizer (Without Regenerator Or Cooler) With Pre-heater And Surge Tank And With Centrifugal Timing Pump And Meter Based Timing System, Located Upstream From The Evaporator.

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.
(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.
(8.) Straight pipe per manufacturers recommendation is required on both sides of the centerline of the magnetic flow meter. Meter shall be located so electrodes are flooded. No product can enter or leave the system between the centrifugal timing pump and the flow diversion valve. The flow control valve, if used, shall be normally closed air-to-open. This valve may be replaced with a sanitary check valve for systems equipped with variable speed centrifugal timing pumps. A homogenizer downstream of the timing system (i.e., centrifugal timing pump, magnetic flow meter, and flow control valve or check valve) must be provided with a recirculation line.
(10.) Safe water supply must conform with local plumbing codes for water flowing into a vacuum. Solenoid water valves should be activated by the flow diversion valve. Shut-off valve must close when flow diversion valve diverts and it must open when flow diversion valve is in forward flow. The optional recycle valve is for rinsing, cleaning and sanitizing the pasteurized product line. The divert line may discharge to waste.



Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 31. HTST Pasteurizer Used To Repasteurize A Concentrated Milk Product For Drying Any Process In Which Product Pressure Required For Drying Is At Least 300 Pounds Per Square Inch. (High Pressure Pump Located Downstream Of The Flow Diversion Valve.)

(1.) This line shall be horizontal at least 12" above any raw piping in the HTST system.

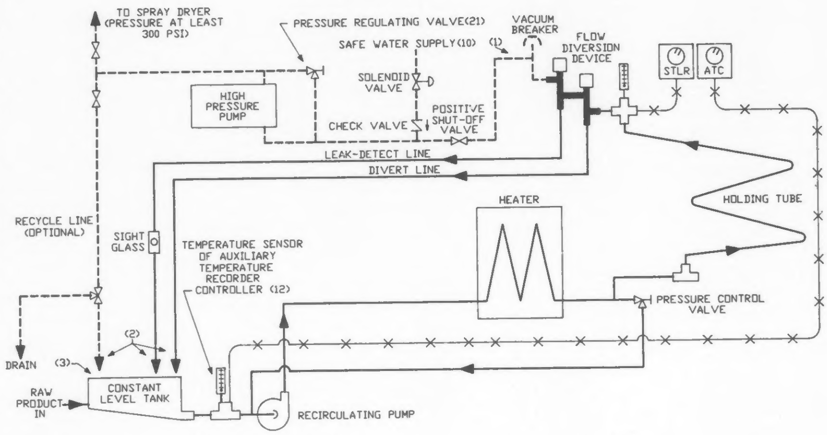
(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(3.) The overflow level of the constant level tank must be lower than the bottom of the inlet of the raw regenerator.

(10.) Safe water supply must conform with local plumbing codes for water flowing into a vacuum. Solenoid water valves should be activated by the flow diversion valve. Shut-off valve must close when flow diversion valve diverts and it must open when flow diversion valve is in forward flow. The optional recycle valve is for rinsing, cleaning and sanitizing the pasteurized product line. The divert line may discharge to waste.

(12.) The instrumentation shown here includes the auxiliary temperature controller (ATC) and the required time delay relay.

(21.) Pressure control valve to assure positive product pressure at the high pressure plunger-type pump inlet. The pressure setting device of the valve must be set at a product pressure less than the product pressure at which the flow diversion valve will move from the forward flow position to the diverted flow position.



Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

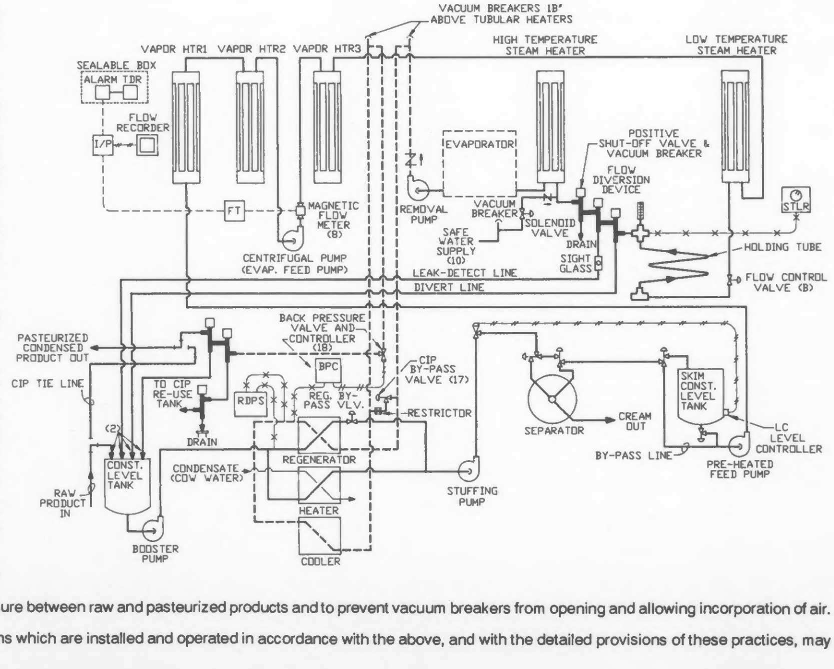
FIGURE 32. HTST Pasteurizer With Regenerator, Separator, Skim Surge Tank, And Timing Pump And Meter Based Timing System Located Upstream From Evaporator.

(2.) All divert, leak detection and recycle lines which return to the constant level tank must break to atmosphere at least two pipe diameters above the overflow level.

(8.) Straight pipe per manufacturers recommendation is required on both sides of the centerline of the magnetic flow meter. Meter shall be located so electrodes are flooded. No product can enter or leave the system between the centrifugal timing pump and the flow diversion valve. The flow control valve, if used, shall be normally closed air-to-open. This valve may be replaced with a sanitary check valve for systems equipped with variable speed centrifugal timing pumps. A homogenizer downstream of the timing system (i.e., centrifugal timing pump, magnetic flow meter, and flow control valve or check valve) must be provided with a recirculation line.

(10.) Potable water supply must conform with local plumbing codes for water flowing into a vacuum. Solenoid water valves should be activated by the flow diversion valve. Shut-off valve must close when flow diversion valve diverts and it must open when flow diversion valve is in forward flow. The optional recycle valve is for rinsing, cleaning and sanitizing the pasteurized product line. The divert line may discharge to waste.

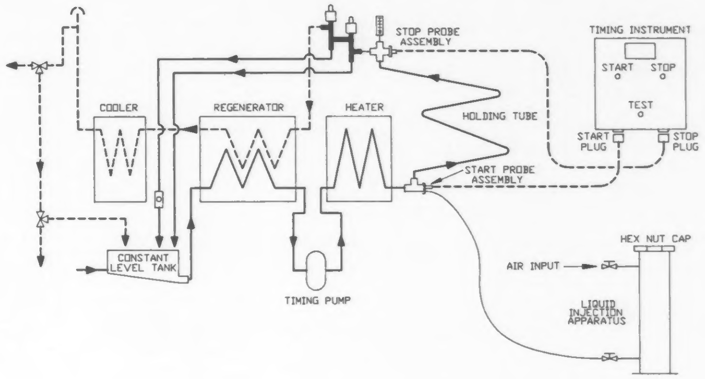
(17.) Optional-needed if flow to clean evaporator and lines exceeds recommended flow rate for plate unit.



(18.) Optional-to maintain differential pressure between raw and pasteurized products and to prevent vacuum breakers from opening and allowing incorporation of air.

Any other combination or modifications which are installed and operated in accordance with the above, and with the detailed provisions of these practices, may be utilized.

FIGURE 33. Typical Salt Conductivity Test Equipment.



These revised standards shall become effective December 29, 1992, at which time the 3-A Accepted Practices for the Sanitary Construction, Installation, Testing and Operation of High-Temperature Short-Time Pasteurizer Systems, Number 603-05 shall be rescinded and shall become null and void.

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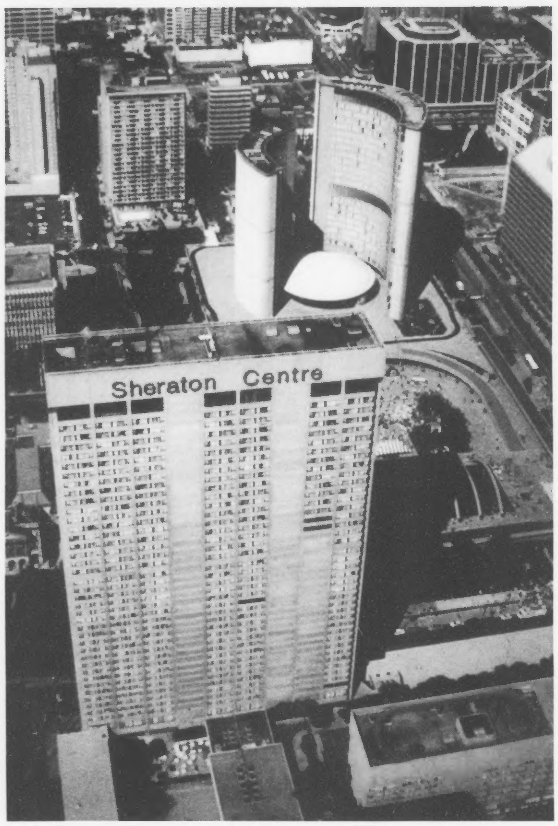

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