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A PUBLICATION OF THE INTERNATIONAL ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC. NOVEMBER 1996



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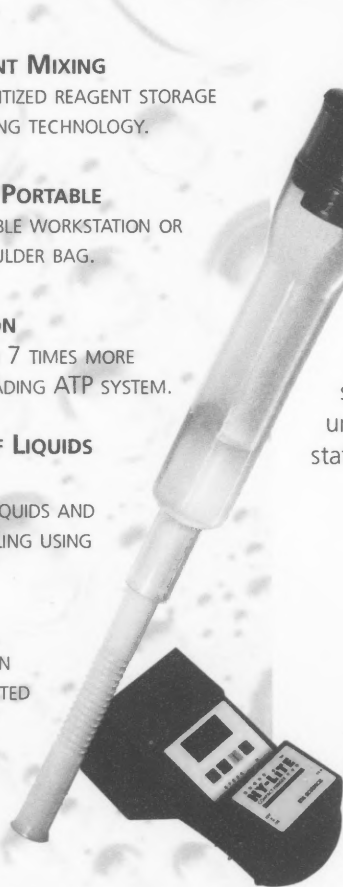
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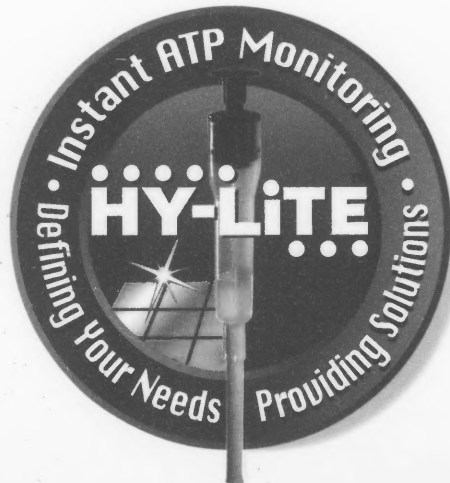
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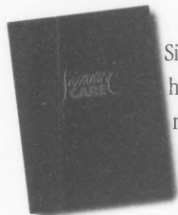
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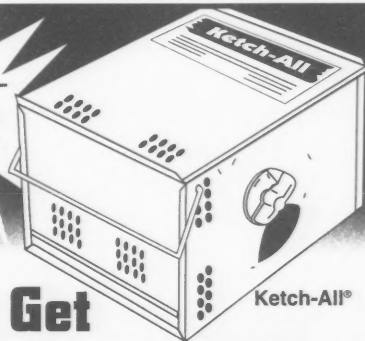
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# OFF THE TOP

## FROM THE PRESIDENT



By MICHAEL H. BRODSKY,  
IAMFES President

### “On the road again”

On September 24, 1996, I had the pleasure of attending the annual meeting of the California Association of Dairy and Milk Sanitarians (CADMS), in Ontario, California. CADMS is the California affiliate of IAMFES. This conference was co-sponsored by the California Industries Association, Dairy Research and Information Center, U.C. Davis

and the California Department of Food and Agriculture and attracted 160 registrants and 20 exhibitors. I was invited to participate in the meeting as both a food microbiologist and as President of IAMFES. In my professional capacity, I presented a paper on the “Use of Indicators as a Safety Index.” As a representative of IAMFES, I gave an after dinner talk entitled “IAMFES – Beyond the Acronym,” a slide presentation which was prepared with the assistance of Carol Mouchka and Rick McAtee.

I have to admit that when I accepted John Bruhn’s invitation I had no idea where Ontario, California was. It is not, as I discovered, anywhere near Ontario, Canada, where I live. Nor does Ontario, California resemble my home province. First of all, there is no winter and second, I could see mountains from my room. It was a beautiful location for a meeting. For your information, Ontario, California is 45 miles due east of downtown Los Angeles (at least according to the shuttle bus driver). Attending this conference gave me a better appreciation of CADMS’ strong association with the dairy industry and made me aware that the membership of many affiliates may identify with unique areas of interest. Even so, the conference took the time to recognize IAMFES and the Sanitarian of the Year Award that IAMFES presented to Lee Jensen, a long time CADMS member, at the 83rd Annual Meeting in Seattle. This was a very moving moment during the banquet.

Each member of the Executive Board has areas of expertise that

they are willing to share with our affiliates. Our Executive Director, Dave Merrifield, is compiling this list and will be making it available to all affiliates in the near future. Furthermore, the program on “IAMFES – Beyond the Acronym” is being developed for presentation by members of the Board at affiliate meetings. The Board has made a commitment to visibly support the affiliates by making themselves available to participate at affiliate workshops or annual meetings. But we won’t be uninvited guests. Through a cost sharing arrangement, whereby IAMFES pays the airfare and the affiliate covers the cost of accommodation and meals, your affiliate could invite a member of the Board to attend your meeting. Simply contact Dave Merrifield with your request and he will coordinate your requirements with the appropriate member of the Board. This is another way that you can benefit by your affiliation with IAMFES. This should be a very popular program, so I would suggest that you book early.

IAMFES remains committed to its membership. It is one of my goals to ensure that this sense of commitment is mutual.

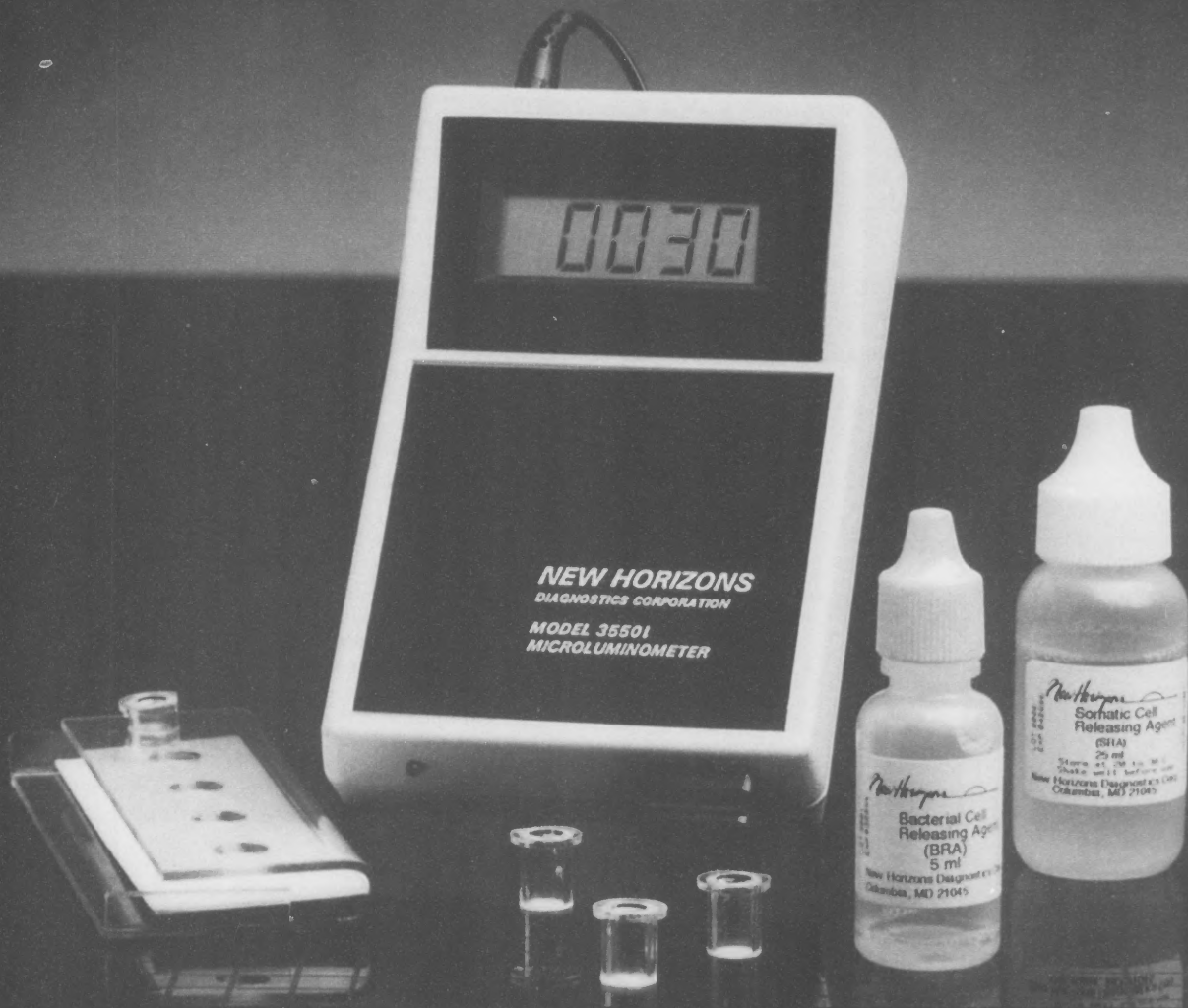
Just a reminder that if you would like to comment on this column or on any other concerns you may have regarding IAMFES, please feel free to contact me via e-mail (brodskm@gov.on.ca), by Fax (416-235-5951) or telephone (416-235-5717). I promise to respond to all issues that are brought to my attention and to ensure that substantive concerns are addressed by the Board.



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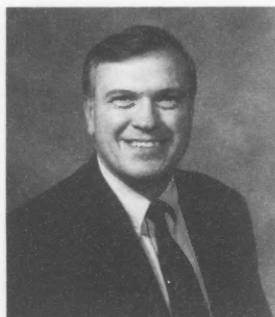
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# PERSPECTIVES...

From the Executive Director



By DAVID M. MERRIFIELD,  
IAMFES Executive Director

**“We must understand who our members are and where they are coming from”**

I was recently reading some interesting facts about associations provided by the American Society of Association Executives (ASAE) and thought I would pass a few along.

1. The number of people employed by nonprofit organizations is more than 7 million, equaling that of the computing equipment, communication equipment, and airline industries.

2. The median staff size for a national association is 12.

3. Seventy-nine percent of the national associations hold national conventions.

4. Ninety percent of all associations offer educational programs.

5. Seventy-one percent of all associations disseminate public information.

6. There are about 100,000 trade, professional, advocacy, and cause-related associations in the U.S. with about 1,000 new ones forming each year.

7. About \$48 billion is contributed to the economy each year by associations.

Indeed, associations are important to professions, the economy, and to those who belong, but I continually hear about declining membership in associations and the difficulty in recruiting new members. It really made me wonder why, if associations are so important in today's service-oriented society, that some struggle with recruiting and retaining members. A clue was provided by The American Society for Quality Control (ASQC) who reported the following information showing the relative importance of several reasons companies (associations?) lose customers (members?): Die, 1%; Moved away, 3% (not an IAMFES problem); Influenced by friends, 5% (hmmm?); Lured away by the competition; 9% (a hex on those other guys); Dissatisfied with product, 14% (it may apply to an association); Turned away by an attitude of indifference on the part of a company employee, 68% (it definitely applies to associations).

I know these statistics were intended mostly for customer service in retail-type businesses, but it was apparent to me that they had relevance to associations as well. I then realized that whenever anyone associates themselves with IAMFES, they become ambassadors for the organization. I believe it's a good tribute to IAMFES leadership, members and staff that membership has remained quite constant, and to this end I believe we

have become good IAMFES ambassadors.

The important thing, though, is that being a good ambassador to another person will generally turn them into a good ambassador for the association as well. This can't help but contribute to a stable and growing membership.

In one of my earlier columns, I stated that we at IAMFES have no other mission than to implement the will of the membership. That simple statement means far more than implementing programs. It means that for all aspects of the association, and most importantly, service to the members, our work must continue to be professional and complete, our attitudes remain positive, and our responses kept timely. This must be the standard by which we operate and it must continue to be maintained by all who are involved with IAMFES, whether it be the President, a committee chair, a committee member or one of us at the central office. There are no alternatives if we are to fulfill our mission of helping to protect the world's food supply.

If we are to continue to provide exceptional service to our members, we must constantly remind ourselves of the simple steps to developing a positive approach, that is, we must understand who our members are and where they are coming from, take time to listen, extend the benefit of the doubt, follow through on agreements, look to build bridges, not walls, and help people to grow.

I too, like President Michael Brodsky, would like to remind you that your comments and concerns regarding IAMFES are important, so please feel free to contact me at any time via e-mail ([iampfes@dwx.com](mailto:iampfes@dwx.com)), fax (515-276-8655), or telephone (800-369-6337); (515-276-3344). I look forward to hearing from you.

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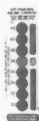
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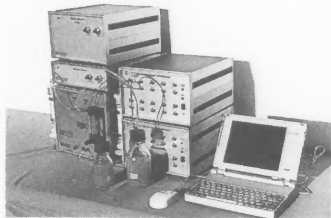


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# Release of Heterogeneous Bacteria Deposited on Applicator Swabs and Their Viability on Ice

Custy F. Fernandes,<sup>1\*</sup> George J. Flick, Jr.,<sup>1</sup> Juan L. Silva,<sup>2</sup> and Thomas A. McCaskey<sup>3</sup>

<sup>1</sup>Department of Food Science and Technology, Virginia Tech, Blacksburg, VA 24061-0418;

<sup>2</sup>Department of Food Science and Technology, Mississippi State University, Mississippi State, MS 39762;

and <sup>3</sup>Department of Animal and Dairy Sciences, Auburn University, Auburn, AL 36849-5415, USA

## SUMMARY

Low and high loads of heterogeneous cell suspensions from fillets of aquacultured catfish were deposited on and subsequently released from swabs into different diluents and counts were determined over a period of 24 h. Equal volumes of two concentrations of cells ( $10^3$  and  $10^5$  CFU/ml) were deposited onto four types of microbial swabs, calcium alginate, cotton, dacron™, or rayon. The efficiency of release of the deposited cells from the microbial swabs and the viability of the cells in two diluents was compared. A heterogeneous cell suspension was prepared by rinsing catfish fillets with sterile Butterfield's phosphate buffer (15 mM, pH 7.2). The suspension was stored at  $-80^\circ\text{C}$  in dimethyl sulfoxide (5%, vol/vol) and used as an inoculum source. The swabs were suspended in Butterfield's to release the deposited cells. Only calcium alginate swabs were suspended in an equal volume of Butterfield's containing sodium citrate (1.0%, wt/vol; pH 7.2). The cells were held on ice (0 to  $1^\circ\text{C}$ ) and microbial analyses were performed. The viability of the cells was evaluated by suspending the swabs in either peptone water (0.1% wt/vol) or Butterfield's and holding them on ice. Aerobes were enumerated for the low load level and aerobic and total coliform counts were determined for the high load for 24 h. There were no significant differences ( $P > 0.05$ ) among the four swabs and the two load levels in the aerobic and total coliform counts. Further, there was no significant difference ( $P > 0.05$ ) in the viability of cells from all treatments held on ice.

## INTRODUCTION

Microbial measurements are routinely performed in the fish and shellfish processing industries to determine the nature (e.g., whether human pathogens are present) and number (e.g., indicative microbes aerobic plate count, total coliform) of microbes. Qualitative microbial analyses are performed and are reported per unit weight (CFU/g) or area (CFU/cm<sup>2</sup>). Although enumeration per unit weight is the most commonly used method of analyses, often it is necessary to determine microbial counts per unit area. Generally, when a microbial quality audit is performed in processing plants, a large number of microbial analyses must be done. Under such situations microbial analyses are performed on processing equipment, personnel (e.g., hands), utensils, plant facility (e.g., drains, floors), food products, and utensils (e.g., knives, cutting boards) which have been used extensively for enumerating surface microbes (5, 6).

Often when a large number of microbial swabbings are performed, the microbial analyses cannot be performed on site. The microbial swab is usually transported in an appropriate



medium to a distant location to complete the analyses. Generally, a time lag of several hours may exist between microbial sampling and the analyses, due to transportation and sample processing. The transporting medium and the time lag between microbial swabbing and analyzing could adversely affect the quality and quantity of microflora of the swabbed sample.

A variety of microbial swab materials have been used for microbiological measurements. These include calcium alginate, cotton, Dacron™, and rayon (6). MacMillan and Santucci (3) used calcium alginate swabs for enumerating the microbial population from the intestinal contents of farm-raised channel catfish. There is a need to evaluate the efficiency of the commonly used microbial swabs in releasing entrapped microbes. Additionally, the swabs have to be transported in an appropriate diluent. Characteristics of the microbial swab and the transporting diluent must not alter the microbial population between swabbing and enumeration. Inadequate osmotic pressure in the diluent could reduce microbial numbers by causing injury or death, or a diluent might allow a population increase. Microbial cell number might be altered during transportation by antimicrobial substances present in the swab, or there might be inefficient release from the swab.

In a collaborative study to develop a microbial quality assurance program for catfish processors, microbial audits were performed in aquacultured catfish processing plants. The plants' equipment, utensils, personnel, facility, and products were analyzed for microbial contamination by swabbing. Over 300 samples were obtained in each of three processing facilities. Since none of the plants had the space and equipment to perform the microbial analyses, the swabs were transported to a university laboratory for analyses. The time from collecting the swabs at the processing plant to transporting them to the laboratory and initiation of the analyses for the last sample was 8 to 24 h. Since the nature and number of the microbes were different, it was

necessary to ensure that there were no changes occurring in the quantity of microbes during this time lag. Additionally, various studies (1, 2, 4) have shown that the microbial loads in aquacultured channel catfish (*Ictalurus punctatus*) vary from  $10^3$  to  $10^6$  CFU/g. There are no data available that compare the efficiency of microbial swab applicators in releasing a wide range ( $10^3$  to  $10^6$  CFU/ml) of heterogeneous microbial cells from catfish fillets or the viability of the cells when held on ice. Therefore, the objectives were to compare the release of low and high loads of deposited heterogeneous cell suspensions from microbial swabs and to evaluate the viability of the cells released in diluent and held on ice. The swabs were compared by depositing a standard quantity of heterogeneous cell suspension using fillets as an inoculum source.

## MATERIALS AND METHODS

### Heterogeneous microbial cell preparation from catfish

A 15 mM pH 7.2 phosphate buffer (Sigma Chemical Co., St. Louis, MO) was formulated and sterilized by autoclaving at 121°C for 20 min. A suspension of heterogeneous microbial cells was obtained by hand massaging for 2 min several fresh fillets from aquacultured catfish with the phosphate buffer (10 ml/100 g). Suspensions from several catfish filets were pooled to achieve a uniform representative inoculum. To the heterogeneous microfloral preparation, sterile dimethyl sulfoxide (Sigma) (5.0% vol/vol) was added. The preparation was dispensed in 2-ml aliquots into sterile plastic vials and stored at -80°C until used as a source of uniform inoculum for deposition on the swabs.

### Microbial enumeration

The aerobic plate count and total coliform count were determined on 3M Petrifilm™ Acrobic Count Plate (PAC) (The 3M Corp., Minneapolis, MN) and 3M Petrifilm™ Coliform Count Plate, respectively. For aerobic plate counts and total coliform counts, plates were incubated at 35°C for 48 h and 24 to 48 h respectively.

### Depositing and releasing cells from microbial swabs

The cell suspension was thawed and diluted appropriately with sterile Butterfield's phosphate buffer at two different cell concentrations. For both high ( $10^6$  CFU/ml) and low ( $10^3$  CFU/ml) cell concentrations, about 100 µl of the preparation was deposited with a sterile pipette tip onto four types of sterile swabs: a cotton tip applicator (Diamond International Corp., New York City, NY), a rayon swab (Difco Laboratories, West Molesey, Surrey, UK), a Dacron™ tip applicator (Hardwood Products Co., Guilford, ME) and a calcium alginate fiber tip (PurFybr Inc., Munster, IN). Following deposition, each swab was allowed to equilibrate for 2.0 min at 24°C. Subsequently, the swab shaft was broken so that the swab dropped into a test tube containing 9.9 ml of Butterfield's phosphate buffer, the exception being that the calcium alginate fiber tip swab was suspended in 9.9 ml of the Butterfield's phosphate buffer containing filter-sterilized sodium citrate (Sigma) (1.0% wt/vol., pH 7.2). The test tubes containing the applicators in all four experimental treatments were vortexed vigorously to release the cells. Additionally, 100 µl of cells were added to 9.9 ml of Butterfield's phosphate buffer as the control treatment. Appropriate dilutions were made in sterile peptone water (Difco) (0.1% wt/vol) and cells were plated for enumeration of aerobic and total coliform counts as described previously using 3M Petrifilm™.

### Viability of cells held on ice in diluents

Both  $10^3$  and  $10^6$  CFU/ml loads of the suspension were deposited on Dacron™ and rayon applicator swabs. For each suspension level there were four treatments. The cells were deposited onto four applicators, two Dacron™ and two rayon swabs. Two applicators (one of each kind) were suspended in Butterfield's phosphate buffer and the remaining two applicators were released in peptone wa-

**TABLE 1. Bacterial cells released from microbial applicator swabs in Butterfield's phosphate buffer**

Swab	Released cells (CFU/ml)		
	Load 10 <sup>3</sup> CFU/ml		Load 10 <sup>6</sup> CFU/ml
	Aerobes (SE, ± 0.13)	Aerobes (SE, ± 0.08)	Coliforms (SE, ± 0.09)
None (Direct plating)	3.20	6.14	2.70
Calcium alginate	2.99	5.92	2.49
Cotton	3.00	6.02	2.50
Dacron	3.11	6.23	2.61
Rayon	3.08	5.95	2.58

**TABLE 2. Enumeration of microbial cells released from rayon and Dacron applicator swabs in peptone water or Butterfield's phosphate buffer**

Microbes	Time (h)	Released cells (CFU/ml) <sup>a</sup>			
		Rayon swab		Dacron swab	
		Peptone	Phosphate	Peptone	Phosphate
<b>Load 10<sup>3</sup> CFU/ml</b>					
Aerobes	0	3.01	3.07	3.08	3.13
	4	3.10	3.04	3.09	3.08
	8	3.21	3.17	3.16	3.22
	24	3.35	3.22	3.32	3.46
<b>Load 10<sup>6</sup> CFU/ml</b>					
Aerobes	0	6.18	6.07	6.15	6.19
	4	6.12	6.07	6.16	6.14
	8	6.13	6.16	6.24	6.08
	24	6.09	6.16	6.06	6.13
<b>Load 10<sup>6</sup> CFU/ml</b>					
Coliforms	0	2.71	2.87	2.88	2.85
	4	2.90	2.93	2.90	2.88
	8	2.86	2.86	2.83	2.88
	24	2.87	2.83	2.78	2.80

<sup>a</sup>Standard error: Aerobes from 10<sup>3</sup> CFU/ml load, ± 0.17, and from 10<sup>6</sup> CFU/ml load, ± 0.19; Coliforms, ± 0.12.

ter (0.1%, wt/vol). All four applicators were placed on ice (0 to 1°C) and microbial populations were determined. Aerobic and total coliform counts were determined for the high load and aerobic counts were determined for the low load. The samples were held on ice for 0, 4, 8, and 24 h prior to enumeration on PAC™ and total coliform count plates. The plates were incubated as previously described.

#### Statistical design and analyses

All experiments were performed in triplicate. Swabs for the low and high loads were compared using a randomized complete block design with day of experimentation as a blocking criterion. The comparison between release of cells in diluents was also analyzed as randomized complete blocks as the experimental design with split-plot with time as the treatment design. The day of experimentation was used as a blocking criterion.

## RESULTS AND DISCUSSION

### Microbial swabs released catfish filets from heterogeneous microflora efficiently

The release of the cells from the swabs loaded at low and high levels was evaluated (Table 1). At the low load level, there was no significant difference ( $P > 0.05$ ) in the numbers of aerobes released among the four microbial swabs. At the high level, there was no significant difference ( $P > 0.05$ ) in either the aerobic or the total coliform count released among the four applicators. The number of viable cells determined with each type of swab and each cell load was comparable to the control treatment. Both low and high loads were studied as the nature and number of microbes in processed catfish products are very diverse. The release of the cells from the calcium alginate swabs was unaffected in the presence of sodium citrate (1% wt/vol, pH 7.2). In another report (6) the calcium alginate applicator was solubilized in 1% solutions of sodium hexametaphosphate, sodium glycerophosphate, or sodium citrate.

The number of viable cells enumerated following their deposit and release from cotton swabs was unaltered by inhibitory substances (e.g., fatty acids). Dacron™ is a solid organic polymer composed of carbon, hydrogen, and oxygen. The Dacron™ swab contains less than 5% TiO<sub>2</sub> as a delusterant and up to 3% natural oils as fiber lubricants. The viability of the cells released from the swabs was unchanged by these constituents. Rayon swabs are fabricated from regenerated cellulose. The process of solubilizing and regenerating cellulose eliminates the inhibitory substances present in cotton swabs. However, microbial inhibition by constituents in the swabs was not observed in this study. The four microbial applicator swabs in this study did not alter the cell counts and were equally efficient in releasing the deposited low and high cell loads.

#### Catfish heterogeneous microbial cells were viable on ice

The viability of the heterogeneous microbial cells released from two types of microbial swabs was evaluated in two different diluents (Table 2). The heterogeneous microbial cells deposited on Dacron™ and rayon applicator tips were released in both Butterfield's phosphate buffer and peptone water and held on ice at 0°C for 24 h. At the low initial load, there was no significant difference

( $P > 0.05$ ) in the number of the aerobic counts released in either diluent from Dacron™ or rayon swabs at time 0. Additionally, there was no significant difference ( $P > 0.05$ ) in the viability of aerobes from either type of swab or in either diluent through 24 h.

At the high load, there was no significant difference ( $P > 0.05$ ) in the number of aerobes or total coliforms released in the two diluents from either type of swab at time 0. Further, there was no significant difference ( $P > 0.05$ ) in the viability of aerobes or total coliforms through 24 h.

In conclusion, both Dacron™ and rayon swabs were equally efficient for enumerating a wide range of loads of heterogeneous microbial cells on fillets from aquacultured catfish. Dacron™ and rayon applicator swabs were used in further testing because of their relatively lower cost (ca. 10% lower). Further, the microbial cells from either of the types of swabs could be suspended in either Butterfield's phosphate buffer or peptone water to release the microbial cells. Additionally, the viability of the microbial cells did not alter when the swabs were suspended in the diluents and held on ice for 24 h.

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# A Rapid Microbial ATP Bioluminescence Assay for Meat Carcasses

Catherine N. Cutter,\* Warren J. Dorsa, and Gregory R. Siragusa  
United States Department of Agriculture, Agricultural Research Service,  
\*phone 402-762-4386; fax 402-762-4149,  
Roman L. Hruska U.S. Meat Animal Research Center,  
P.O. Box 166, Clay Center, NE 68933, USA

## SUMMARY

A new, rapid microbial ATP bioluminescence (R-mATP) assay has been developed in our laboratories that can be used to determine the levels of generic bacterial contamination on meat-animal carcasses. The R-mATP assay does in 5 min what standard culture methods for bacterial isolation take 36 h to accomplish. ATP is the energy molecule of all living cells, including bacteria. A sample with high amounts of microbial ATP indicates high levels of bacteria, which may be encountered when fecal contamination occurs on the carcass surface. The steps for the R-mATP assay are: (i) a sponge is used to sample the carcass surface; (ii) bacteria are removed from the sponge; (iii) nonbacterial ATP is removed from the sample; and (iv) the bacterial ATP is detected. The R-mATP assay was validated during several in-plant studies with over 1,000 beef, pork, and poultry carcasses, resulting in agreements between the R-mATP assay and standard culture methods of over 90%. Implementation of the assay in red-meat processing facilities demonstrated that the R-mATP assay can provide processors or meat inspectors with a rapid means to detect microbial contamination on carcasses and allow for improvements in the overall microbial quality of the carcasses before they leave the slaughter floor. Based on our laboratory and in-plant studies, the R-mATP assay is a rapid and near real-time means of estimating the microbial load of an animal carcass.

## INTRODUCTION

Until recently, assessments of the microbiological quality of meats, meat-animal carcass surfaces, food-contact surfaces, foods, and equipment were done retrospectively by obtaining samples and performing standard plate counts requiring 24 to 48 h. Real-time or near real-time methods for detecting microorganisms are essential for implementation of a Hazard Analysis of Critical Control Point (HACCP) program in any food process.

ATP bioluminescence is an alternative to the standard plate count for estimating microbial loads. Adenosine triphosphate (ATP) is an energy molecule in all living cells, including insects, plants, animals, bacteria, molds, or yeast. ATP bioluminescence, as referred to in this paper, is the technique of measuring ATP based on light emission during a bioluminescent (light generated from a life form) reaction. The underlying premise of ATP bioluminescence testing is that the amount of ATP in a sample is proportional to the biomass. In the case of bacteria, there exists a strong correlation between cell number and

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Figure 1. The Luciferin/Luciferase bioluminescence reaction.

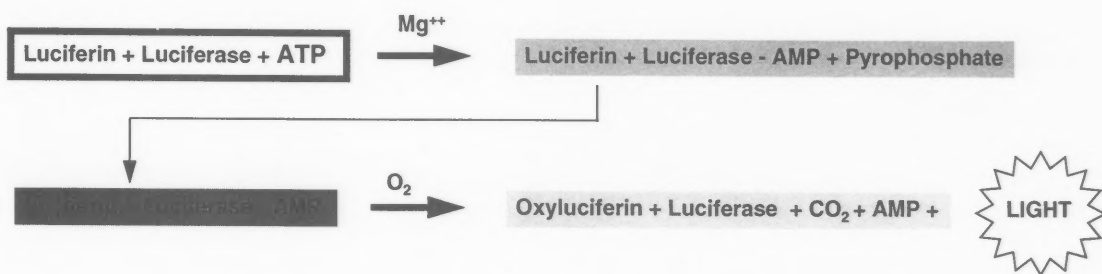


TABLE 1. Analysis using ATP bioluminescence

Sample type	Need for somatic ATP removal/inactivation	Analyte	End use
Hygiene monitoring or environmental surface monitoring	No	Total ATP	Sanitation of work and equipment surfaces
Meat animal carcass surfaces	Yes	Microbial ATP	Microbial load of product
Meats	Yes	Microbial ATP	Microbial load of product

ATP content. ATP can be measured using reagents extracted and purified from the abdomen of the firefly, *Photinus pyralis*. The very reaction that gives the glow worm its "glow" has been exploited for measuring ATP in a wide variety of samples (15), including food and nonfoodstuffs. This technique is also known as ATP bioluminescence.

In the ATP bioluminescence reaction (Figure 1), luciferin is oxidized by the enzymatic reaction catalyzed in luciferase in the presence of magnesium and ATP. An end product of the reaction is energy in the form of yellow-green visible light ( $\lambda \approx 562$  nm). The emitted light, measurable with a luminometer, is directly proportional to the amount of ATP in the reaction mixture. Data can be reported as the actual amount of ATP calculated from standard curves. However, in practice, most workers report data directly from the luminometer as relative light units (RLU).

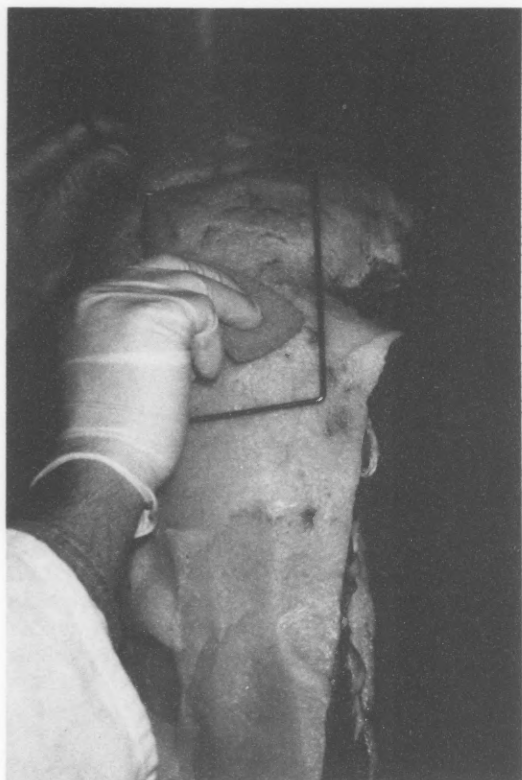
It is important to note that when measuring the ATP content of samples containing microorganisms, one is measuring an average of the ATP contents of the cells at that particular time. The ATP content of bacteria is in a state of constant flux and is also species dependent (5, 7). When comparing ATP bioluminescence data to aerobic plate counts (APC), it is essential to remember that two different indicators of a microbial population are being compared: the APC is a growth-based assay; ATP bioluminescence, on the other hand, measures an existing metabolite.

A critical element of using an ATP bioluminescence assay is understanding that foods and processing-plant environmental samples contain large amounts of ATP that are from sources other than bacteria. While this additional source of ATP is not a consideration when doing hygiene or environmental testing, it is for the ATP bioluminescence testing of foods for microbial load (Table 1).

In microbiological tests based on ATP bioluminescence, the ATP that is from nonmicrobial sources is termed somatic ATP. As a guide, somatic cells contain about 100 to 1,000 times more ATP than do bacterial cells. For instance, the nonbacterial or somatic ATP contributed by cells from muscle in a ground beef sample has been calculated to be infinitely greater than the ATP contributed by bacteria on the ground beef (11). In the case of environmental sampling in food plants (i.e., hygiene monitoring), ATP comes from a variety of sources (food, animal, and plant residues). Samples are tested for total ATP as an indicator of filth or potential breeding grounds for bacteria. In other words, any ATP in the sample, no matter its source, is taken as an indicator of filth or potential contamination. Other tests are designed to measure solely bacteria and must include means to either segregate the bacterial ATP from somatic ATP or destroy the somatic ATP so that all that is remaining in a sample is bacterial ATP. Since ATP from any source (plant, animal, bacterial) is chemically identical, separation of somatic from microbial ATP is a critical step when using ATP bioluminescence assays for measuring bacteria (Table 1). In fact, it was the development of such methods that opened the field of ATP bioluminescence testing for use with foodstuffs. Since it is not necessary to remove somatic ATP from environmental samples obtained for hygiene monitoring, this type of testing is simpler than that in instances in which only microbial ATP is of interest.

**Figure 2.** Sponge samples obtained from surfaces of meat animal carcasses.

- A. A 150-cm<sup>2</sup> area of a skinned pork carcass is aseptically sampled in the bung area with a clean stainless-steel template and an ATP-free sponge premoistened in sponge solution.



A general procedure for separating somatic ATP from microbial ATP involves the following steps. First, nonmicrobial cells (animal cells such as those in milk or blood) are permeabilized by detergents that will not affect bacterial cell membranes. Secondly, the somatic ATP that is released into solution is destroyed using the enzyme ATPase (this step usually requires several minutes). Thirdly, the bacterial ATP is extracted from bacterial cells using reagents that can permeabilize bacteria. The remaining bacterial ATP is then measured using the ATP bioluminescence method (described earlier) and a luminometer.

The rapid microbial ATP (R-mATP) assay to be discussed, measures the microbial load of animal-carcass surfaces by separating somatic ATP from bacterial ATP during a dif-

ferential chemical extraction, as described above, and an additional filtration step. This technique offers a very rapid means to segregate somatic from microbial ATP and the subsequent measurement of bacterial ATP for this type of sample. The rapidity of the R-mATP assay (total test time is 5 min including sampling) makes it a potentially useful tool for HACCP monitoring.

## METHODS

### ATP bioluminescence methods for meats

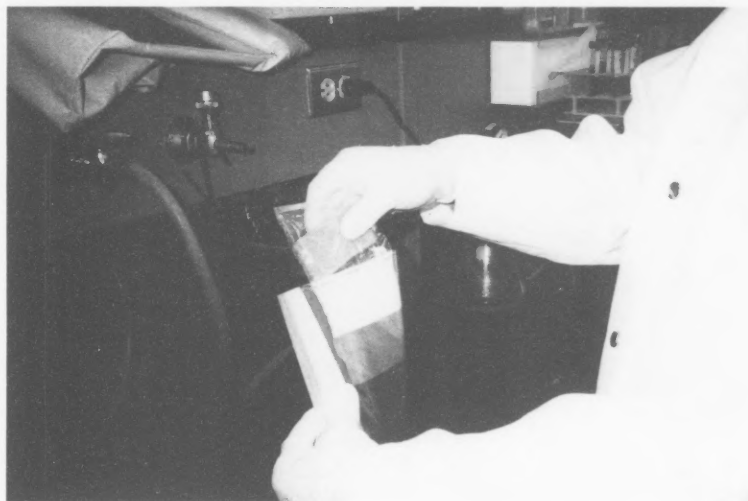
ATP bioluminescence has been used for microbial testing of a variety of meat products. Stannard and Wood (16) demonstrated that within 25 min, the ATP content of bacteria in raw beef, lamb, or pork homogenates could be determined following cen-

trifugation, a cation-exchange resin treatment, filtration, and a bioluminescence assay. However, the procedures were only able to estimate ATP content from samples exhibiting  $\geq 10^5$  CFU/g. Bülte and Reuter (3) were able to correlate standard plate count assays and RLU values ( $r = 0.91$ ) from beef samples inoculated with organisms at different growth phases after a 41-min procedure involving homogenization, centrifugation, and a bioluminescence assay. These procedures were only able to detect ATP from bacterial populations  $\geq 5 \times 10^6$  CFU/g. For ground beef, a 1-h process involving homogenization, filtration, and incubation with a somatic releasing agent and ATPase, followed by a bioluminescence assay, yielded a correlation of 0.95 between APC and RLU values of samples (8). In another study (10), spoiled beef samples were homogenized, filtered through glass wool, subjected to a double-filtration technique to separate microbial cells from nonmicrobial cells, and assayed for microbial ATP. Despite correlations of ( $r$ ) 0.96 between RLU and plate count data, the procedures took longer than 30 min and were not able to accurately detect ATP from samples with  $\leq 5 \times 10^4$  CFU/g. Ward et al. (17) used an ATP bioluminescence test for fish (total time, 1 h) and obtained a correlation ( $r$ ) of 0.97 with aerobic plate counts for samples  $\geq 10^4$  CFU/g. Vacuum-packaged, cooked, cured, meat products and ground beef were homogenized, somatic ATP extracted and hydrolyzed, and homogenates subjected to ATP bioluminescence assays within one hour (9). The lower limit of sensitivity of this particular ATP bioluminescence test was approximately  $10^4$  CFU/g for ground meat and  $10^5$  CFU/g for cooked, cured meat products. More recently, Bautista et al. (2) demonstrated a correlation ( $r$ ) of 0.85 for microbial number and RLU values obtained from chicken-carcass washings subjected to filtration, enzymatic treatment, and a microbial ATP bioluminescence test (total time, 15 min). The ATP content of bacteria taken from beef carcasses has also been demonstrated. Bautista et al. (1) treated excised beef carcass tissue with somatic cell extractant

Figure 2-B. The sponge is transferred to the WhirlPak™ bag and transported to the laboratory.



Figure 2-C. The sponge and all fluid is transferred aseptically to a Sterefil™ stomacher bag.



containing lipase, removed bacteria by filtration, and determined ATP content. Bacteria at  $4 \times 10^4$  CFU/cm<sup>2</sup> were detected in 15 min using this methodology (6). Siragusa and Cutter (12) used an ATP bioluminescence assay to determine the microbial load of fecally contaminated beef-carcass tissue. Microbial ATP was selectively distinguished from nonmicrobial ATP by the assay procedure and resulted

in correlations ( $r$ ) of  $> 0.90$  between RLU values and aerobic plate count data (12). As indicated by these examples, microbial testing of meat, meat products, and animal carcasses can be accomplished in hours or minutes using ATP bioluminescence tests versus days when using traditional culture methods. The remaining challenges to improving the ATP bioluminescence test are to decrease the

level of sensitivity and to reduce assay time in order for these assays to be used on a real-time basis under normal in-plant processing conditions. In the next section, we will describe a newly developed microbial ATP test (R-mATP) that requires approximately 90 s of analytical time and can measure microbial ATP in carcass samples with high levels of somatic ATP.

#### Steps of the R-mATP assay

One of the major sources of microbial contamination on animal carcasses is feces, which are also a reservoir for enteric pathogens such as *E. coli* O157:H7. Since feces contain high numbers ( $10^{11}$  to  $10^{14}$  CFU/g) of bacteria, fecal contamination during the slaughter process results in high levels of bacteria on the carcass surface. Although carcasses that exhibit low bacterial counts may not be pathogen free, reducing fecal contamination should improve the microbial safety. Thus, detection of high numbers of bacteria on a carcass can be used as a potential indicator of fecal contamination (13).

The R-mATP assay is the result of several laboratory and in-plant studies that encompassed methods for carcass sampling (swabbing, sponging, excision), concentration of microbial cells (centrifugation, filtration), types and amounts of reagents, luminometers, and statistical analyses. The R-mATP assay utilizes a sponge sampling procedure and a filtration device in combination with a microbial ATP bioluminescence assay to detect levels of bacteria on meat-animal carcasses.

#### Sampling

An area is delineated on the surface of pork or beef carcasses with a clean (dipped in 80°C water for 15 s), stainless-steel template (Figure 2A), or the area is measured to specific dimensions with a ruler and outlined with a sterile cotton swab dipped in edible ink. Samples are taken using an ATP-free sponge (NASCO, Fort Atkinson, WI) packaged in a Whirlpak™ bag. The sponge method of sampling is chosen since it contributes very few carcass tissue components that may interfere with the ATP bioluminescence assay; sponging also

Figure 2-D. The sponge and bag are placed into the Tekmar™ stomacher and homogenized for 2 min.

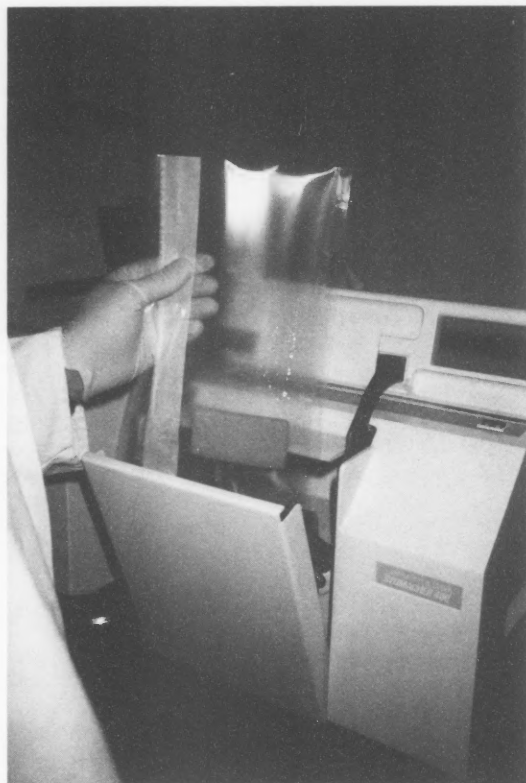


Figure 2-E. The liquid is expressed from the sponge and transferred via a sterile pipette into a sterile tube.



is nondestructive, rapid, and reproducible (4, 13). The sponge is moistened with 25 ml of a sterile sponge solution composed of 0.085% (wt/vol) sodium chloride and 0.05% (vol/vol) Tween 20, adjusted to pH 7.8. After donning a sterile glove, the worker expresses the solution by hand from the sponge while removing it from the Whirlpak™ bag. The sponge is wiped firmly over the sample area 10 times in both vertical and horizontal directions (Figure 2A). The sponge is then placed into the bag containing the residual sponge solution and held at 8 to 10°C for < 2 h until analyses are performed (Figure 2B) (13).

For sampling chickens, the entire exterior carcass surface is sponged with an ATP-free sponge (NASCO, Fort Atkinson, WI) moistened in 25 ml of a sterile sponge solution composed of buffered peptone water containing 0.5% Tween 20 (vol/vol) and 0.5% glucose (wt/vol). After donning a sterile glove, the worker expresses the solution from the sponge while removing it from the Whirlpak™ bag. The sponge is wiped firmly over the entire outside surface of the bird carcass, turning the sponge at least two times (14). The sponge is placed into the Whirlpak™ bag containing the residual sponge solution and held between 8 and 10°C for < 2 h until analyses are performed (14).

Following sampling and transport to a laboratory, all sponges and all fluid contents are transferred to a filtered stomacher bag (Figure 2C; Spiral Biotech, Bethesda, MD) and stomached in a LabBlender 400 stomacher (Figure 2D; Tekmar, Cincinnati, OH) for 2 min. Approximately 15 ml of each of the stomached samples are withdrawn from the filtered side of the stomacher bag with a sterile pipette (Figure 2E), transferred to a sterile tube, and the resulting sample analyzed with the rapid microbial ATP assay (13, 14).

#### **Rapid microbial ATP bioluminescence (R-mATP) assay**

As stated in the introduction, separating somatic ATP from microbial ATP is the central challenge in microbial ATP testing of foods. The R-mATP assay uses a filtration device (Filtravette™, New Horizons Diagnostics



**Figure 3.** The R-mATP assay.

- A. Items needed to perform the R-mATP assay: A, stack of paper towels; B, Filtravette™; C, vacuum manifold; D, luminometer; E, reagents; F, pipettor; G, waste vessel; H, sterile pipettor tips; I, forceps (Siragusa et al., 1995).

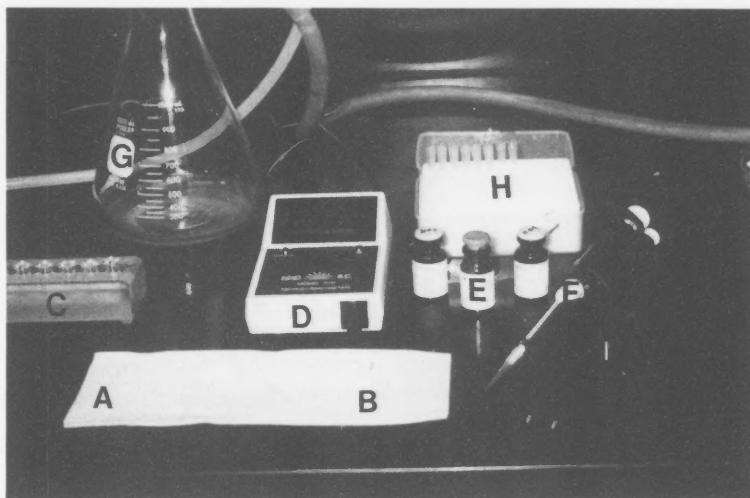
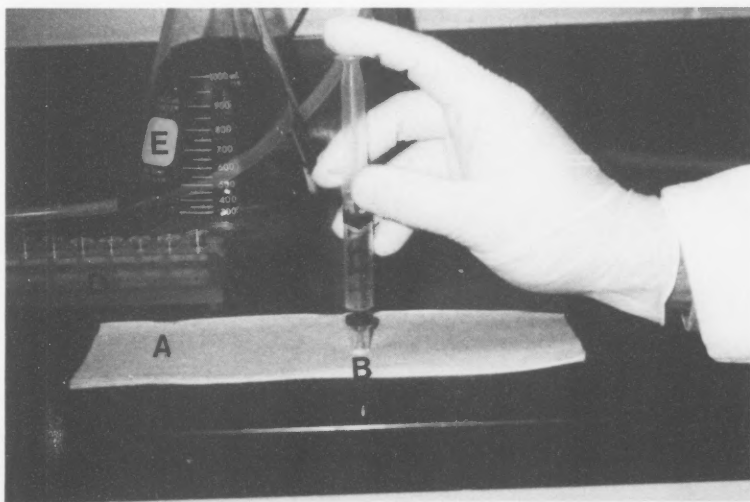


Figure 3-B. For single samples, 50  $\mu$ l of sample is transferred to a Filtravette™, followed by the addition of 100  $\mu$ l of somatic cell extracting reagent. A positive-pressure device (C) is used to push the liquid through the Filtravette™ (B) onto a stack of paper towels (A). If performing multiple samples, the vacuum manifold (D) is used, and the filtrate is captured in the waste vessel (E). Another 150  $\mu$ l of somatic releasing agent is added to each Filtravette™ and the fluid from each filter is pushed or suctioned again. At this stage, the Filtravette™ retains bacteria and other cellular debris on the filter's surface. Somatic cell ATP and free ATP are extracted by the action of the somatic cell extracting reagent and removed from the Filtravette™ by suction or positive pressure.



tics, Columbia, MD) in which somatic ATP is extracted, and within the same device bacterial ATP is extracted and measured using the firefly luciferin/luciferase (13). Briefly, 50  $\mu$ l of sample is transferred to a Filtravette™, followed by the addition of 100  $\mu$ l of somatic ATP extraction reagent (NRS™, nucleotide-releasing agent for somatic cells; Lumac B. V., Perstorp Analytical, The Netherlands). If multiple samples are being assayed, the fluid from each Filtravette™ is suctioned using a vacuum manifold (Figure 3B; New Horizons Diagnostics), capturing the filtrate in a waste vessel. If individual samples are used, a positive pressure device (Figure 3B; New Horizons Diagnostics) is used to push the liquid through the Filtravette™ onto a stack of paper towels. After initial removal of the liquid, another 150  $\mu$ l of NRS™ is added to the Filtravette™ and the liquid is pulled through with the vacuum manifold or pushed through with the positive pressure device. At this stage, the Filtravette™ retains bacteria and other cellular debris on the Filtravette™ surface. Somatic cell ATP and free ATP are extracted by the action of the somatic cell extracting reagent (NRS™) and removed from the Filtravette™ by suction or positive pressure. The Filtravette™ is then placed into the holding drawer of the microlumino-meter (Figure 3C; Model 3550, New Horizons Diagnostics and ILC Dover, Inc., Frederica, DE) and 50  $\mu$ l of the microbial ATP extractant, NRB™ (nucleotide releasing agent for bacterial cells; Lumac B. V., Netherlands) is added (Figure 3D). Immediately after the addition of the NRB™, 50  $\mu$ l of the luciferin/luciferase reagent (New Horizons Diagnostics) reconstituted in Lumit buffer (Lumac, B. V., Perstorp Analytical, Netherlands) is added. The fluid in the Filtravette™ is mixed rapidly three times by aspirating the fluid up and down in the same micropipettor tip used to deliver the luciferin/luciferase reagent. The drawer to the luminometer is closed and light emission is measured by integration over 10 s. Microbial ATP is reported as relative light units (RLU) taken directly from the luminometer's digital readout (Figure 3E). All re-

Figure 3-C. The Filtravette™ is then placed into the holding drawer of the microluminometer with a pair of forceps.

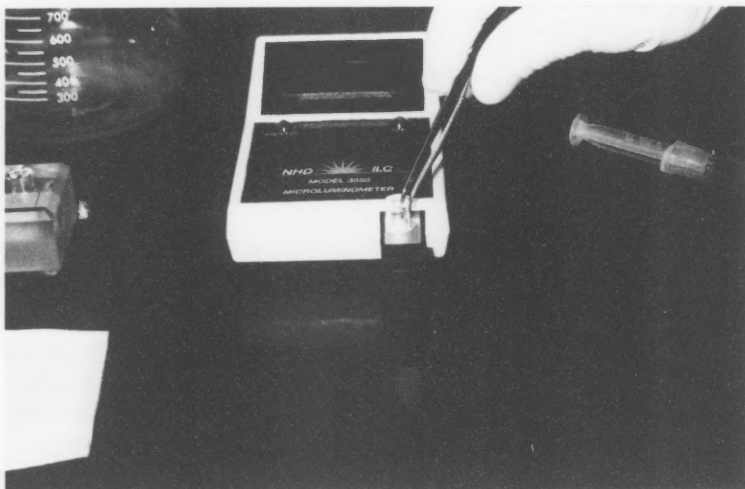
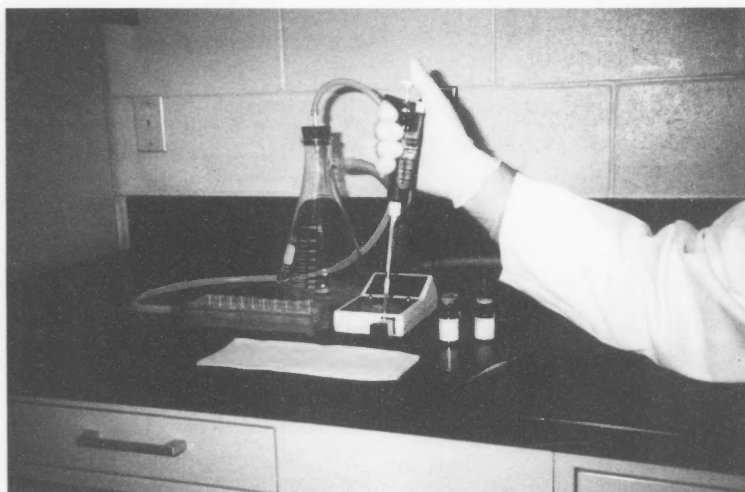


Figure 3-D. After placement of the Filtravette™ in the luminometer, 50  $\mu$ l of the microbial ATP extractant is added. Immediately after the addition of the microbial ATP extractant, 50  $\mu$ l of the luciferin/luciferase reagent is added and mixed rapidly three times.



agents are used at room temperature and are checked for contaminating ATP before use. Special handling is required of tips, reagents, Filtravette™, and luminometer to prevent ATP contamination throughout the process. The time required to perform the R-mATP assay is 1.5 min (90 s). When combined with sampling, the entire

test can be performed in under 5 min per sample (13, 14).

#### Conversion charts

After a RLU reading is obtained from the luminometer and recorded, R-mATP assay conversion charts can be used to determine the approximate log APC/cm<sup>2</sup> for beef carcasses.

On the chart corresponding to the size of the area sampled (100, 150, or 500 cm<sup>2</sup>, Figure 4, A to D), locate the value taken directly from the luminometer on the horizontal (RLU) axis. At the location of the horizontal RLU axis value, use a straight edge to find the abscissa (log<sub>10</sub> APC/cm<sup>2</sup>) from the printed line.

## EXAMPLES

### In-plant studies

Three hundred sixty-five beef carcass samples were obtained from two different commercial processing plants. One plant produced graded beef (heifers and steers) and the other produced carcasses for deboning and grinding from cows and bulls. Beef samples were taken immediately before and after the final spray wash, but before chilling. Randomly chosen carcasses were sampled mainly from the brisket area using a 500 cm<sup>2</sup> stainless-steel template or marked areas as described previously. For in-plant studies involving pork, 320 pork-carcass samples were obtained from three large swine processors. Using the procedures described and a 100 cm<sup>2</sup> template, all pork samples were taken from skinned carcasses. Samples obtained for the in-plant poultry studies were taken from broiler carcasses in three different plants. Poultry carcasses were randomly selected from the following sites: postdefeathering, postvisceration, postwash, and postchill. In all instances, beef, pork, and poultry carcasses were randomly selected from the processing line to represent a variety of possible contamination levels, ranging from visibly contaminated with feces to no visible fecal contamination (13, 14).

Aerobic plate count (APC) and R-mATP assay data were obtained from each sample. Sponge samples cultured for APC were serially diluted in buffered peptone water (BBL, Cockeysville, MD), plated in duplicate with a Model D Spiral Plater (Spiral Biotech, Bethesda, MD) on tryptic soy agar (BBL), and the plates were incubated 48 h at 35°C. Bacterial counts were converted from colony-forming units (CFU) per ml to log CFU/cm<sup>2</sup> on the basis of the area sampled. Plots of R-mATP and APC data obtained from the beef and pork

Figure 3-E. The drawer to the luminometer is closed and light emission is measured by integration over 10 s. Microbial ATP is reported as relative light units (RLU) taken directly from the luminometer's digital readout (RLU = 437).

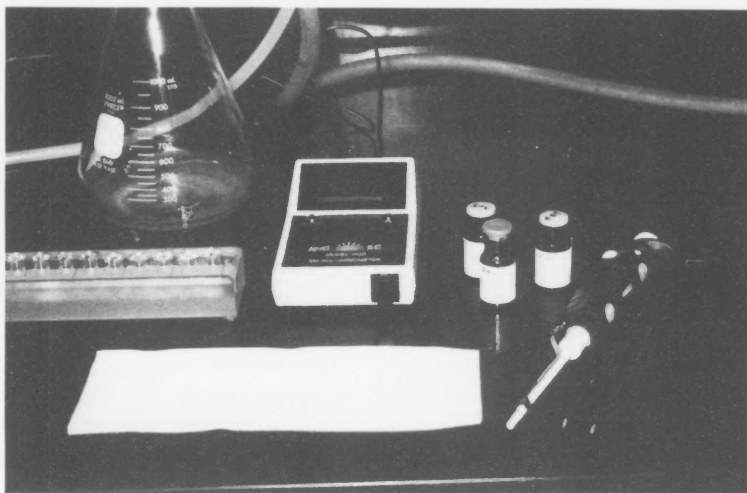
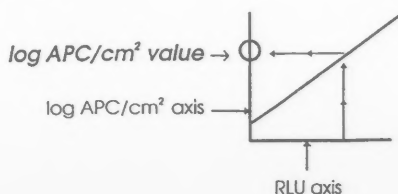


Figure 4. Conversion charts for beef.

A. Instructions for R-mATP assay conversion charts.

1. Select the chart that corresponds to the size of the area sampled on each carcass (100 cm<sup>2</sup>, 150 cm<sup>2</sup>, or 500 cm<sup>2</sup>).
2. Once an RLU reading from the luminometer is determined, locate this value on the horizontal RLU axis of the chart.
3. At the location of the horizontal RLU axis value, use a straight edge and follow a straight, vertical line up to the dark line moving across the chart.
4. Once at the position where the RLU value intersects with the dark line, use a straight edge and follow a straight, horizontal line left to the log APC/cm<sup>2</sup> y-axis.
5. At the log APC/cm<sup>2</sup> y-axis, locate the log APC/cm<sup>2</sup> value and record.

**EXAMPLE**



samples are shown in Figures 5 and 6, respectively. The lower limit of assay sensitivity for samples from beef carcasses was determined to be 2 log APC/cm<sup>2</sup>, with a correlation (*r*) between APC and R-mATP of 0.91 (Figure 5) (13). For samples taken from pork carcasses, the lower limit of sensitivity was determined to be 3.2 log APC/cm<sup>2</sup> and the correlation (*r*) between APC and R-mATP was 0.93 (Figure 6) (13). Data obtained from poultry carcasses sampled from the four sites averaged 4.89, 5.01, 4.12, and 3.34 log APC/ml while R-mATP data were 3.83, 4.03, 2.04, and 1.59 log RLU/ml from the post defeathering, postevisceration, postwash, and postchill sampling sites, respectively (Figure 7). The overall correlation (*r*) of APC and R-mATP samples taken from the three poultry plants was 0.82. On the basis of the data obtained from all three in-plant studies, the R-mATP assay provides a reliable measure of generic microbial levels on beef, pork, and poultry carcasses.

**R-mATP assay as HACCP monitor**

Two red-meat processing facilities have successfully used the R-mATP assay for more than a year as a HACCP monitor. These plants use the R-mATP assay to monitor carcasses to determine the daily microbial profile of their process on a near real-time basis. Plant A is a 2,400 head per day fed-beef slaughter facility. Plant B is a 3,000 head per day lamb slaughter facility. During initial implementation of the R-mATP assay in both plants, the Quality Control (QC) personnel obtained samples from several carcasses a day, following the final spray wash, over the course of several months. From these samples, plate count data and RLU values were determined in-house and these data were used to constitute the baseline readings for each plant.

In both plants, the R-mATP assay has been utilized to successfully identify several deviations of critical processes. All deviations were rectified immediately with resulting reductions in R-mATP values and aerobic plate counts. As an example, Plant A no-

Figure 4-B. This chart is used for samples obtained from 100-cm<sup>2</sup> areas.

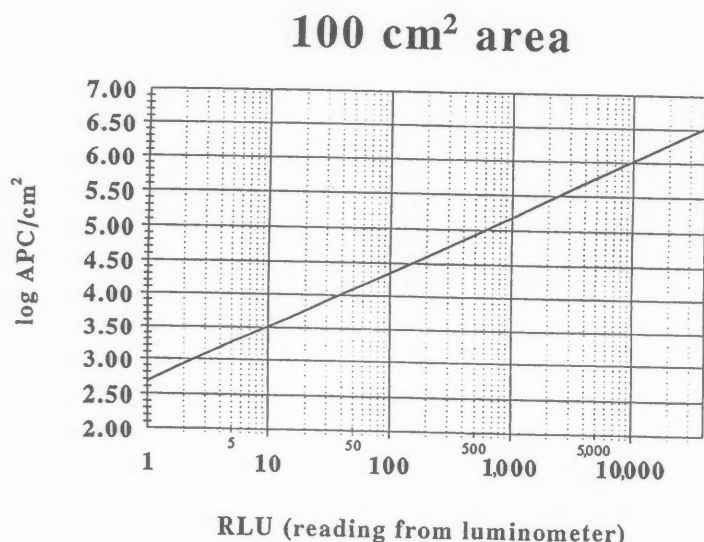
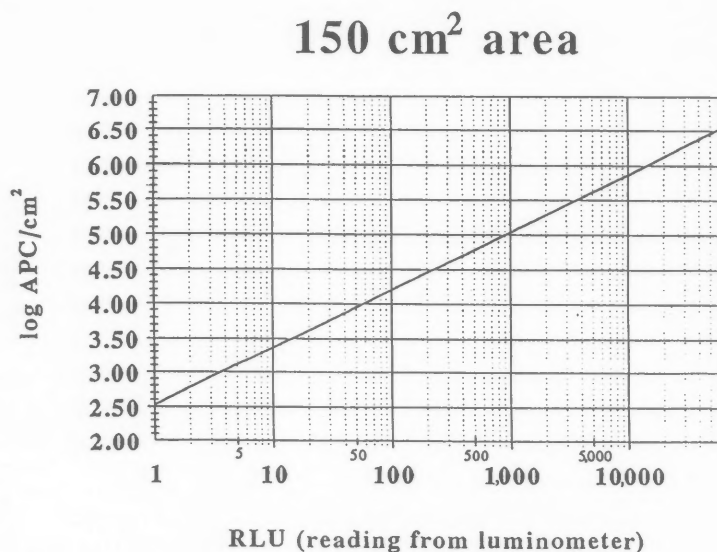


Figure 4-C. This chart is used for samples obtained from 150-cm<sup>2</sup> areas.



ticed an increase in RLU values from samples taken from beef carcasses as they exited the final wash. The QC personnel immediately began investigating possible deviations and it was determined that the tank supplying chlorine to the water used for spray

washing was empty. Once the tank was refilled and operational, additional samples were taken from the carcasses and the R-mATP assay performed. RLU values taken from these samples had returned to acceptable baseline levels.

In another instance, Plant B experienced an increase in RLU values on carcasses following the final spray wash which prompted QC personnel to investigate potential problems in the process. It was determined that injectors for delivering an organic acid to spray-washing cabinets were clogged. Once the situation was rectified and spray washes were restored, QC personnel sampled carcasses, performed the R-mATP assay, and obtained RLU values that were reflective of their earlier baseline values.

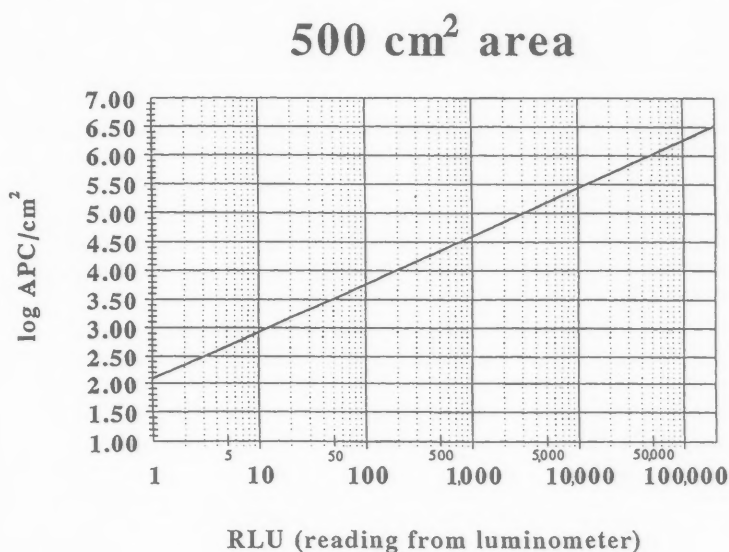
Plants A and B also have cited several examples of elevated RLU values following the addition of new, inexperienced employees to their processing lines. In these cases, retraining of personnel resulted in reduced RLU values. Because both plants A and B have been using the R-mATP for a year or more, these plants also have observed elevated RLU values and concurrent microbial increases related to seasonal effects.

One other incident occurred during our in-plant pork studies. Over the course of several days, we obtained both RLU and plate count data from a pork-processing plant (5,000 head per day). During one day of sampling, RLU (and concomitant plate count values) were increased on carcasses immediately after the debunging process. Upon closer inspection by plant personnel, it was determined that the debunger was not operating properly. After the debunger was repaired and samples were taken, RLU and plate count values were found to be reduced to initial baseline levels.

In all of these situations, the QC personnel identified a process deviation almost as soon as it was occurring, as opposed to after 24 to 48 h, the time at which aerobic plate count data would be available. Rectifying these situations probably resulted in the extension of shelf life and improvements to the microbial safety of products from these plants, but it certainly lowered the level of microbial contamination on these carcasses. As demonstrated in these actual examples, using the R-mATP assay provides the means to take proactive measures to maintain low microbial contamination on carcasses and improves the overall microbial quality of the carcasses.

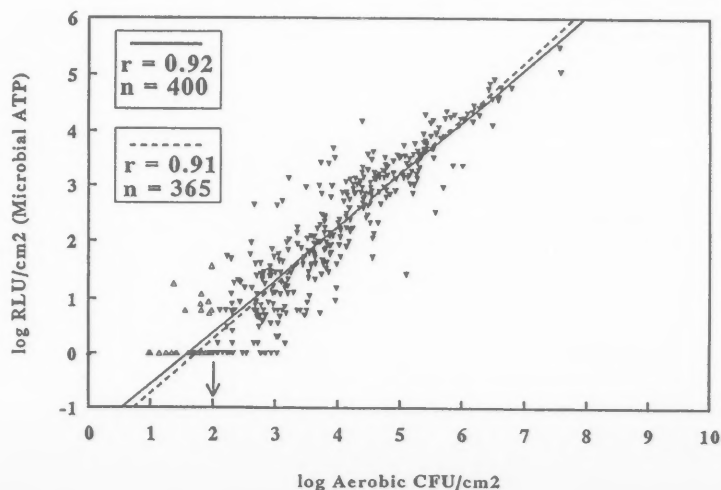


Figure 4-D. This chart is used for samples obtained from 500-cm<sup>2</sup> areas.



**Note:** The conversion charts were derived from data obtained during the in-plant studies (13). These charts may not be applicable to all plants.

**Figure 5.** Scatterplot of R-mATP assay values (log RLU/ml) and aerobic plate counts (log CFU/cm<sup>2</sup>) from beef carcass in-plant samples. The solid line is the regression including all data points. The dashed regression line is calculated from data points above the lower limit of assay sensitivity (2 log CFU/cm<sup>2</sup>; indicated by the arrow). Data points below the threshold are open symbols and those above the threshold are solid symbols. (Reprinted with permission from *Journal of Food Protection* 58:770-775.)



#### Status and economics of R-mATP assay

The R-mATP assay has been performed by trained plant personnel, veterinarians, laboratory personnel, and USDA meat inspectors. In all instances, the R-mATP assay was easy to perform and could give results in less than 5 min.

Without considering the initial startup costs for stomacher, pipettors, luminometer, and vacuum manifold, the R-mATP assay can be performed for approximately \$3.00/sample. This cost includes reagents (NRS™, NRB™, buffer, and luciferin/ luciferase) and disposable supplies (sponge, Whirl-Pak™ bag, pipette, tips, and Filtravette™).

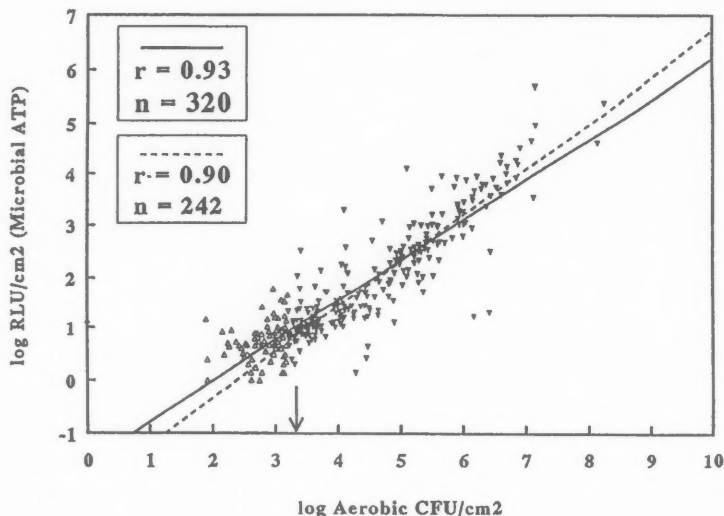
#### CONCLUSIONS

Based on our laboratory and in-plant studies, the R-mATP assay is a rapid and near real-time means of estimating the microbial load of an animal carcass. The R-mATP assay should be of considerable interest to persons who are implementing a HACCP program in animal-processing plants. This assay can be used by meat animal processors or inspectors as a way to monitor their process and take proactive measures rather than retrospective action.

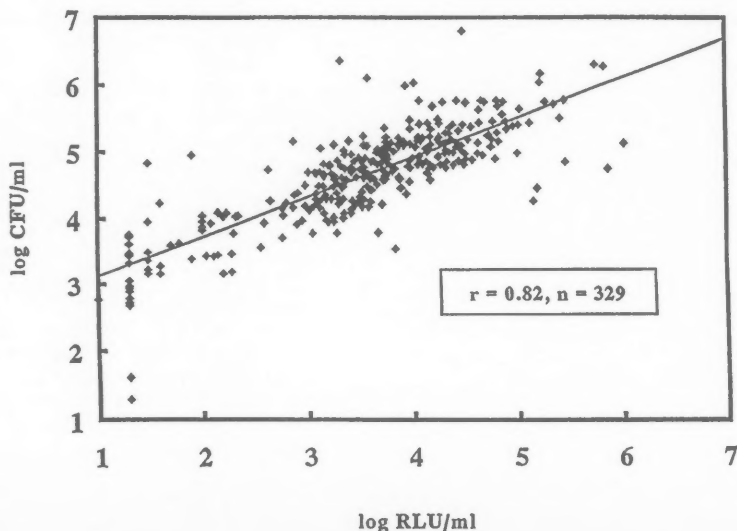
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**Figure 6.** Scatterplot of R-mATP assay values (log RLU/ml) and aerobic plate counts (log CFU/cm<sup>2</sup>) from pork-carcass in-plant samples. The solid line is the regression including all data points. The dashed regression line is calculated from data points above the lower limit of assay sensitivity (3.2 log CFU/cm<sup>2</sup>; indicated by the arrow). Data points below the threshold are open symbols and those above the threshold are solid symbols. (Reprinted with permission from *Journal of Food Protection* 58:770-775.)



**Figure 7.** Scatterplot of R-mATP assay values (log RLU/ml) and aerobic plate counts (log CFU/ml) from poultry-carcass in-plant samples. The solid line is the regression including all data points.



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# Food Handler Certification by Home Study: Measuring Changes in Knowledge and Behavior

M. Howes,<sup>1</sup> S. McEwen,<sup>2</sup> M. Griffiths,<sup>1</sup> and L. Harris<sup>1</sup>

<sup>1</sup>Department of Food Science, Vol. G; <sup>2</sup>Department of Population Medicine, Vol. G;  
University of Guelph, Guelph, Ontario N1G 2W1; and <sup>1</sup>Department of Food Science,  
University of Guelph, Guelph, Ontario N1G 2W1, Canada

## SUMMARY

Improper food-handling practices contribute to approximately 97% of foodborne illnesses in food-service establishments and homes (9, 15). To reduce the number of foodborne illness cases, many private and government agencies have introduced food-handler education courses. A nonequivalent pretest/posttest control-group field trial was designed to examine the effectiveness of a currently used home-study food-handler training course on food-safety knowledge and hand-washing behavior. The voluntary study consisted of 69 full-time food handlers employed at three universities in Southern Ontario assigned to (the intervention group, i.e., the group receiving training prior to posttesting ( $n = 38$ ); and the control group, i.e., participants receiving training following posttesting ( $n = 31$ ). There was a significant improvement in knowledge for the intervention group (paired  $t$ -test, mean difference =  $17.65\% \pm 1.99$ ,  $t = 8.37$ , 37 df,  $P = .0001$ ), but not for the control group (paired  $t$ -test, mean difference =  $1.99\% \pm 1.13$ ,  $t = 1.13$ , 30 df,  $P = .2689$ ). The variables of job position, age, gender, level of formal education, years of experience in a food establishment, previous food-handler education courses, and learning style did not significantly affect the final mean scores (general linear models procedure,  $P > .05$ ). Mean scores decreased as the participants' subjective ratings of difficulty in reading and understanding increased. Behavior was measured by observing two hand-washing practices of 11 persons of each of the two groups. There was no significant improvement in washing hands correctly ( $P > .05$ ) and there was a significant decrease in washing hands at the appropriate times ( $P < .05$ ). Similarly, there was no positive association between knowledge posttest scores and the corresponding behavior observed (McNemar's chi square,  $P > .05$ ). We conclude that this particular home-study program is effective in disseminating information to food handlers. Although we did not observe an improvement in hand-washing behavior following training, the sample size was small and this aspect of training should be reevaluated.

## INTRODUCTION

The estimated number of foodborne illness cases per year in Canada and the United States is 2.2 million (22) and 12.6 million (23) respectively. A large portion of these illnesses are due to poor food-handling practices such as cross-contamination, which introduces pathogenic organisms into foods, and time and/or temperature abuse of food products, which fosters the growth of pathogens (3, 4, 7, 9, 15). Reducing foodborne illness in the general population depends on positively altering the behavior of food handlers. Sustainability of safe food-handling practices can be enhanced by continuing food-handler education, developing and implementing on-site food-handling policies which support the knowledge learned, and by maintaining a positive attitude towards safe food-handling among all employees within food-preparation and service establishments.

The terms home study, self study, distance education, and correspondence courses are often used interchangeably to denote programs based on a study guide; however, the design of the course may also include any of the following: audio or video cassettes, computer or television tutorials, and mail-in assignments. Contact with an educator varies widely from no contact at all to intermittent attendance at a learning center. Home study is used by academic and vocational schools, businesses, trade associations, and the military to educate and train millions of people worldwide in a variety of subjects every year (25). It is one of the methods used to train managers of food premises in the state of Florida; however, results of the impact of this program on food-handler knowledge and practices have not been published to date (2).

The greatest advantage of this education method is accessibility. It eliminates some of the restrictions to learning such as access to learning centers, provision of child care, transportation, and awkward work schedules (8). Furthermore, it is less ex-

pensive to implement than traditional classroom teaching (8, 24).

A major drawback of learning by home study is that it is a one-way process. There is little or no communication between the learner and the facilitator and no active participation during the learning process; two components which can enhance learning and behavioral change (10). The courses are usually generic to the subject or industry and are not tailored to the participant's organizational culture. In addition, the learner must be literate in the language and at the reading level of the publication. Failure to meet the needs of the learner with respect to language restricts accessibility and decreases the likelihood of successful completion of the home-study program. Similarly, if a program is written at an education level above that of the participant, then the learner is less likely to understand the material. Within the context of research studies, the wider the gap between the reading level of the education program and that of the participant, the more likely this factor will be significantly associated with the mean score.

Furthermore, it has long been recognized that learners have preferred styles of learning. One tool used by educators to classify learners by learning style is the Kolb Learning Style Inventory. This is a self-reported test in which the learners describe their preferred way of learning, enabling classification of learners into four general types (accommodator, diverger, assimilator, and converger) based on how and when they recognize, seek, and use their educational experience (11). In this inventory an "accommodator" is one who learns best by becoming actively involved and bases decisions on trial and error, as opposed to a "diverger" who prefers to observe and imagine alternative strategies to learning. The learning approach of a "converger" stresses practical application of ideas, whereas the "assimilator" emphasizes inductive reasoning and theory building. Vondrell and Sweeney (26) concluded from their study in which they used the Kolb Learning Style Inven-

tory to predict student success in independent study, that of the four learning styles, accommodators may perform the best because self-directed courses require the learner to participate.

The evaluation of education courses for vocational training should include two facets. Firstly, the training validity, i.e., the transfer of the information in the program to the learner, should be assessed via pre- and postknowledge testing. Secondly, the transfer validity, i.e., the transfer of the knowledge of the learner to their behavior, should be measured by pre- and postobservation of the participants' actions in their work environment (10). These evaluations are applicable to food-handler education since the supposition is that knowledge of safe food-handling practices will transfer to situational application, subsequently reducing the risk of foodborne illness in the consumer population.

A review of the literature revealed that most of the published food-handler education evaluation studies to date have focused on the effects of managerial certification (5, 6, 12, 13, 17, 27). The primary evaluation tool has been comparison of the number of restaurant infractions prior to and following certification (20). Many of these studies did not specify the infractions observed. Application of an observational tool at the individual level is difficult for several reasons, including the problem of assigning responsibility for an action to a particular individual and that multiple preparation steps of a single food item may involve several persons. In addition, transfer of knowledge to behavior can be inhibited by obstacles in the workplace such as employer policies and procedures which contradict the information in the training program, lack of supervisory and/or peer support, and lack of provision of proper equipment necessary to perform the behavior, e.g., testing thermometers. Furthermore, unlike training validity where the individual usually receives a certificate upon mastering the information of the program and demonstrating knowledge



on a written examination, improved behavior is generally not rewarded. Whether the data collection focuses on the food premises as a whole or an individual food handler, the assessment of the training validity of food-safety education programs should concentrate on safe food-handling practices which are directly associated with the risk of foodborne illness. In this manner, the measurement of improvement is not adversely affected by the inclusion of noncritical items, e.g., unclean walls.

To our knowledge, there have been no published studies which assessed both the training validity and the transfer validity and the association between the two, nor measured the change of the behavior of the individuals certified.

The objective of this study was to assess the training and transfer validity of a current home-study food-handler certification course at the individual participant level, and to determine if there was an association between food safety knowledge and safe food-handling practices.

## MATERIALS AND METHODS

### Study design

A field trial using a nonequivalent pretest/posttest control group design (10) was implemented as illustrated below.

$X_1, O_1 \rightarrow$  Intervention Group:  $\rightarrow$  Study Guide  $\rightarrow X_2, O_2$

$X_1, O_1 \rightarrow$  Control Group  $\rightarrow X_2, O_2$   
 $\rightarrow$  Study Guide  $\rightarrow X_3, O_3$

where:

$X_1$  - Pretest to measure knowledge (baseline data)

$O_1$  - Preobservation to measure behavior (baseline data)

Intervention group - Participants receiving training following pretesting

Control group - Participants receiving training following posttesting

Study guide - Self-study guide developed by a Health Unit in Southern Ontario; content meets requirements of the Ontario Ministry of Health proposed Food Handler Education Protocol (16). (A summary of the content of the guide is provided in Table 1.)

$X_2$  - Posttest to measure change in knowledge after home study course (intervention group) and change in baseline data (control group)

$O_2$  - Postobservation to measure change in behavior after instruction (intervention group) and change in baseline data (control group)

$X_3, O_3$  - Posttest and postobservation to certify participants of the control group

The purpose of using this design was twofold. First, pretesting provided the baseline data necessary for measuring both the training and transfer validity in the intervention group. Second, a control group was used to ensure that any differences detected in the knowledge and/or behavior of the intervention group could be attributed to the training program, i.e., to establish internal validity. The most common threat to the internal validity of training studies is history, i.e., events which occur during the time period between pre- and post-testing which may affect the participants' level of knowledge and/or behavior. News media reports on food safety practices, on-site supervision and/or education, and public health inspections are some examples of history. Furthermore, although pretesting was an integral component of the study, participants may have been sensitized to the material presented in the pretest and actively sought out answers to the questions (10). The inclusion of a control group allowed us to assess the internal validity of the study assuming that the control and intervention groups were equally affected by these extraneous effects.

Thirdly, to minimize feelings of favoritism and resentment within the control group which may have adversely affected their performance and participation in the study (10), control group participants were advised that they would receive their booklets following the posttesting of all participants and would be eligible for food-handler certification.

This field trial is described as nonequivalent because the participants were not assigned to the two groups at random. This method is frequently used in educational studies because it

maintains naturally occurring intact groups and limits the diffusion of information from the intervention group to the control group. By ensuring that the pretest scores are similar for the two groups, the control group is still effective in determining the presence of extraneous effects (10).

### Subjects and baseline data

In September 1994, all full-time food handlers employed at the University of Guelph, the University of Waterloo, and Wilfred Laurier University were asked to volunteer for the study. Participants were advised that upon successful mastery of the training program, they would receive a food-handler certificate. Each participant was asked to complete a standardized registration form designed to collect demographic information on variables which may have impacted on the outcome of the study, including current job title, age, gender, level of formal education, years of experience in a food premises, and previous food-handler education courses studied (6). In addition, each participant completed a Kolb Learning Style Inventory to determine the distribution of learning styles among the food handlers and whether or not learning style affected the outcome of the study.

In late November/December 1994 we began collecting the baseline data. To minimize bias, all pre- and postknowledge tests and observations were administered by the principal author, who is an experienced public health inspector and food safety educator. A multiple-choice test consisting of 50 questions totaling 58 marks was used to measure the participants' precourse knowledge. The test was divided into three parts, each focusing on specific safe food-handling concepts. The total successful marks were expressed as percentages.

During the same time period, a preobservation of each participant was conducted. The initial observation tool, a reduced version of an inspection form utilized by some Health Units in the province of Ontario, was designed to study 16 food safety practices directly related

**TABLE 1. Summary of training program content**

Chapter 1 (Knowledge Test Part A)

- General introduction to HACCP
- Definition of a critical control point

Chapter 2 (Knowledge Test Part A)

- Basis of why food must be handled safely including discussion on microbes, parasites, pathogens, foodborne infections, intoxications, the "danger zone" (4°C–60°C)
- Protection of food from foreign objects

Chapter 3 (Knowledge Test Part A)

- Safe food sources including meats which are government inspected, expiry dates, checking tins for bulging, leaky seams or dents, checking seals on vacuum packages
- Food ingredients not to use including grade C (cracked) eggs, home-canned foods, sulfites, fish and shellfish from polluted waters, and unpasteurized milk, limited use of MSG
- Safe food storage including proper location of foods in a refrigerated unit to prevent cross-contamination, proper spacing of foods to allow circulation, storage of dry stock including food packaging and service items away from chemical compounds and poisons
- Proper stock rotation, date coding and checking of expiry dates
- Review of the "danger zone"
- Toxic containers including metals, ceramics, and glazed pottery
- Proper packaging of foods, specific example of mushrooms

Chapter 4 (Knowledge Test Part B)

- Areas of the body which may contain pathogens: head, hands, lungs, rectum
- Six step hand washing method
- Proper taste-testing method
- Confined hair, removal of jewelry
- Reporting colds, flu, diarrhea, cuts, burns to the supervisor
- Using utensils instead of bare hands
- Washing hands after using the toilet, after sneezing or coughing into hands, after touching chemicals, after touching raw food products, after touching contaminated surfaces, after handling money, before preparing foods, before and after smoking

Chapter 5 (Knowledge Test Part B)

- Three basic sources of cross-contamination— the hands of the food handler, foods which may contain microorganisms, and equipment
- Review of the six-step hand washing method
- Review of food storage in a refrigerated unit
- Review of dry storage
- Examples of items that can pass bacteria to ready-to-eat foods including: food contact surfaces, utensils, equipment, wiping cloths, and hand towels
- Example of cross-contamination—bacteria from raw chicken are transferred to a cooked roast beef via a cutting board
- Disinfection using the two- or three-sink method, disinfection of food-contact surfaces
- Use of hot water and chlorine as disinfectants including temperature and chemical strength
- Low/high energy dishwashers: temperature and length of time of rinse cycle, chemical concentrations

Chapter 6 (Knowledge Test Part C)

- Review of the "danger zone"
- Definitions and examples of hazardous foods and high risk foods
- Definition of toxins
- Proper methods of thawing including flowing cold water, refrigerated unit, microwave, cooking product from its frozen state
- Minimum preparation of foods at room temperature
- Minimum internal cooking temperatures of poultry, ground poultry, poultry stuffing, stuffed meats, stuffing containing meat, all other ground meats, pork and pork products, all other potentially hazardous foods including beef and seafood, food items which contain several hazardous ingredients

to cross-contamination and time and/or temperature. Subsequently, this was reduced to two items due to the application difficulties discussed in the Introduction. The preobservation time period was 1.5 h per person, using a "yes/no" measurement scale.

Following the collection of the baseline data, the participants were arbitrarily assigned to the two groups on the basis of geographical location. The intervention group consisted of all of the participants from two of the universities plus all of the volunteers of one locality of the third university. The remainder of the subjects of the third university made up the control group.

#### Course administration and post-course evaluation

The study guides were distributed to the intervention group in mid-December 1994 and these participants were advised that the knowledge posttest would be administered in early February 1995.

Approximately 6 weeks following the distribution of the guide, both groups completed a knowledge posttest identical to the pretest. To receive a certificate, participants were required to score a minimum of 78% on each of the three sections of the posttest course exam. To minimize anxiety, participants were not made aware of the mandatory percentage necessary to successfully complete the course prior to writing the posttest.

The modified observation tool was administered to 11 participants in each of the two groups. The post-observation time period and measurement scale remained the same as those of the preobservation.

#### Data analysis

The data collected from the standardized registration and evaluation forms, knowledge pre- and posttests, and pre- and postobservations were converted to an electronic file in dBASE IV (1) and converted to a SAS (21) file for statistical analysis. The statistical tests used and their purpose are described in Table 2.

## RESULTS AND DISCUSSION

### Subjects

Initially 78 food handlers volunteered for the study and completed the knowledge pretest and preobservation requirements of the study (intervention group,  $n = 40$ ; control group,  $n = 38$ ). Nine of these participants did not complete the study and were not included in the final analysis. Within the control group, three people were not available for the knowledge posttest and four people expressed a lack of interest in completing the program. Two persons within the intervention group did not complete the program; one participant did not want to write the knowledge posttest and one participant was ill during the posttesting period. Therefore, at the conclusion of the study there were 69 participants (intervention group,  $n = 38$ ; control group,  $n = 31$ ). The demographic characteristics of the participants are listed in Table 3.

The two groups were homogeneous on the basis of their knowledge pretest scores (intervention group, mean score (%) =  $65.49 \pm 1.97$ ; control group, mean score (%) =  $66.96 \pm 1.83$ ;  $F = 1.42$ ,  $df = 37, 30$ ,  $P = .3304$ ); and the preobservation results (Fishers Exact Test, 2-tail, correct method of hand washing:  $P = .59$ , washing hands at appropriate times:  $P = 1.0$ ).

### Training validity (knowledge change)

A comparison of the knowledge pre- and postcourse scores indicated a significant increase in knowledge for the intervention group (mean difference (%) =  $17.65 \pm 1.99$ ,  $t = 1.87$ ,  $37$   $df$ ,  $P = .0001$ ). The lack of improvement in the control group suggests that extraneous effects such as history and pretesting were negligible (mean difference (%) =  $1.99 \pm 1.13$ ,  $t = 1.13$ ,  $30$   $df$ ,  $P = .2689$ ).

The variables of job position, age, years of pertinent work experience, and previous attendance at food-handler education courses were not significantly associated with the knowledge postcourse scores (general linear models procedure,  $P > .05$ ). These

results generally concur with the findings of Cook and Casey (6), but while these authors also found that level of education was significantly associated with mean scores, we did not. This difference may be due to the education levels of the two programs assessed. The estimated reading level of this program was grade 8 (19). The education level of most of the study participants was at or above this level.

The majority of the intervention group participants were accommodators: learners who enjoy participatory learning environments and therefore may be uncomfortable with the home-study learning method. However, we found that mean score was not significantly associated with learning style ( $P > .05$ ).

With the exception of level of education, the differences between the means within each of the above-noted variables were not significant ( $\alpha = .05$ ). Although representation of many of the categories for all of the variables was weak, the confidence level (probability of correctly accepting the null hypothesis of no difference) and the power of the study (probability of correctly rejecting the same hypothesis) were 95% and 99.9% respectively.

Nine participants of the intervention group expressed a concern that the study guide was published in English and these individuals scored significantly lower than the remainder of the group on the postcourse test (mean difference (%) =  $20.9 \pm 7.41$ ,  $t = 2.82$ ,  $36$   $df$ ,  $P < .05$ ). Furthermore, there was a significant association between the participants' subjective ratings of ease of understanding and ease of reading, and postcourse mean scores ( $P < .05$ ). As difficulty in understanding and reading increased, the mean scores decreased.

### Transfer validity (behavioral change)

No significant difference was observed with respect to washing hands correctly ( $P > .05$ ), and a significant negative transfer was observed for washing hands at the appropriate times ( $P < .05$ ). That is, two persons washed their hands at the appropriate times initially but failed

**TABLE 2. Statistical tests used in data analysis**

Purpose	Data used	Test
Homogeneity of groups		
Knowledge	knowledge precourse scores	Student's <i>t</i> -test
Behavior	preobservation results of two behaviors	Fishers exact
Internal validity	knowledge pre- and posttest scores of the control group	Paired <i>t</i> -test
Training validity	knowledge pre- and posttest scores of the intervention group	Paired <i>t</i> -test
Effect of variables: job position, age, years of experience, previous food handler courses, learning style, ease of reading, ease of understanding	knowledge posttest scores by variable and level within each variable	General linear models procedure, Duncan's method
Transfer validity	pre- and postobservation results for each behavior	McNemar's chi square
Association between knowledge response and corresponding behavior	knowledge postcourse result and corresponding postobservation result	McNemar's chi square

to do so after completing the training program. This latter result, which indicates a regression in behavior following training, could be due to the learners' awareness of the observer during the preobservation period.

We also compared the learners' knowledge of hand washing on the posttest with the corresponding behavior observed during observation. There was no positive association between these two results, that is, participants who had knowledge of the correct behavior did not always practice that behavior. Similar to the training validity results, eight persons correctly answered the posttest question on correct method of hand washing but did not wash their hands properly during the postobservation period (McNemar's Chi Square, washing hands correctly:  $\chi^2 = 4.0$ ), washing hands at appropriate times:  $\chi^2 = 1.33$ ). These findings concur with other empirical studies which have

demonstrated that the transfer of knowledge to everyday practice is not predictable (14) and often does not occur (18).

Although learning style was not significantly associated with the mean scores of the knowledge posttest, it may have affected the outcome of the postobservation results. However, we could not assess the association between learning style and postobservation results, since the 11 persons observed from the intervention group were all accommodators.

#### General program results

Twenty-one participants (55.3%) achieved the required 78% passing mark on their first attempt of the postcourse test; 15 of the 17 remaining candidates were certified on their second attempt. The two remaining participants did not rewrite the postcourse test. The mean score on the

first attempt following training was 83%.

A comparison of the knowledge pretest scores by test section revealed that the area of greatest weakness was Part C, time and temperature abuse, followed by Part B, personal hygiene and cross-contamination, and Part A, general knowledge of microorganisms, stock rotation, and food storage. Specific areas where more than 50% of the participants answered incorrectly on the knowledge pretest included the location of ready-to-eat foods and raw foods in a refrigerated unit, the temperature of water used in manual disinfection of utensils, using a sanitizer as the last step in three-sink manual dish washing, the amount of chlorine necessary to disinfect utensils, the temperature of the rinse cycle on a high-energy mechanical dishwasher, the use of paper towels to turn off the taps after washing hands, the definitions of hazardous and high-risk foods, knowing that preparing foods at room temperatures for long periods of time is unacceptable, the minimum internal cooking temperatures of stuffed meats, chicken pot pie, ground beef meat loaf, foods which contain pork, seafood soup containing pieces of fish, steamed rice, and food items containing both chicken and beef, the temperature for reheating foods, the temperature range of the danger zone, the fact that all toxins are not destroyed when a food is cooked, and the correct internal temperature for frozen foods. These results indicate a serious lack of knowledge in areas of safe food-handling practices which are directly related to food-borne illness outbreaks (3).

The knowledge postcourse results by test section of the intervention group followed the same pattern as the precourse test results. This could be due to the fact that sections B and C required memorizing specific information whereas section A focused on general knowledge. Furthermore, time and/or temperature abuse was the last chapter in the study guide and therefore may have received less attention than the previous information due to student fatigue.



**TABLE 3. Characteristics of study participants**

Characteristic	No. participants with characteristic		
	Intervention group (n = 38)	Control Group (n = 31)	Total (n = 69)
<b>JOB TYPE</b>			
Baker	1	1	2
Cashier	1	0	1
Cleaner	0	1	1
Cook	13	7	20
Cook - short order	0	4	4
Food preparation or service	17	15	32
Shipper/receiver	1	1	2
Supervisor	5	2	7
<b>AGE (in years)</b>			
21 - 30	4	4	8
31 - 40	3	4	7
41 - 50	16	13	29
51+	15	10	25
<b>LEVEL OF EDUCATION</b>			
Elementary school	6	7	13
Some high school	16	10	26
Completed high school	8	8	16
Some college/university	4	1	5
Completed college/university	4	5	9
<b>YEARS OF EXPERIENCE IN A FOOD PREMISES</b>			
0 - 5	2	5	7
6 - 10	6	8	14
11 - 15	8	5	12
16 - 20	6	4	10
20+	16	10	26
<b>PREVIOUS FOOD HANDLER EDUCATION COURSE TAKEN</b>			
Yes	8	5	13
No	30	26	56
<b>LEARNING STYLE</b>			
Accommodator	30	24	54
Accommodator/converger	2	0	2
Accommodator/diverger	1	1	2
Assimilator	3	0	3
Converger	1	2	3
Diverger	1	4	5

The guide used in this study included strategies intended to enhance the learning process such as repetition of information, study questions and answers, and pictures. For example, the postcourse test results for the questions pertaining to the minimum internal cooking temperatures revealed that with the exception of pork, the participants scored higher on questions where the corresponding text had included a picture of the food item. Overall, 81% of the participants stated that the pictures had helped them understand the information.

Although 87% of the intervention group stated on the evaluation form that they had studied alone, there may have been some exchange of information and support among peers. In addition, the time period was established by the study and not the learners themselves, i.e., they were forced to complete the program by a specified date. Results similar to those of this study may not be found where the food handler is isolated and/or certification is not encouraged or mandatory.

## CONCLUSION

We conclude that a home-study program can be an effective tool for disseminating information on safe food-handling practices to food-handlers. Although we did not observe an improvement in hand-washing behavior following training, the sample size was small and the results may have been affected by obstacles naturally occurring in the work environments studied; therefore this aspect of the study should be reevaluated. It would be beneficial to repeat the study on a larger scale in a variety of food premises to assess these results.

The results of this study involving observation of safe food-handling behavior differ from the results of several other studies which compared the number of infractions of restaurants with managerial certification versus those where the manager had not been formally trained. Managers

have more authority than individual food handlers to make changes in restaurant policies and procedures and therefore have a greater opportunity to affect behavioral change. These results suggest that the effectiveness of any food-handler training program may be increased by initially marketing the program to food establishments as a whole learning unit rather than to the individual food handlers. In this manner, the manager can familiarize herself or himself with the program information and adjust company food-handling policies accordingly to support the training program in practice.

Future studies evaluating food-handler training courses should continue to measure those behaviors which are critical to the preparation and delivery of a safe food product. Furthermore, we recommend that additional studies of food-handler education courses include comparisons of various educational techniques, such as lecture style and on-site participatory learning, to ascertain the most effective method of transferring knowledge into action.

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# NewMembers

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**Joe McGraw**  
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University of Wisconsin-Madison  
Madison

# UpDates

## Quality Chekd Reassigns Fuqua to Meet Demand for Training

With the expanding demand for training in the dairy processing industry, Quality Chekd has appointed Ruth Fuqua to a new position on the association's training staff. Quality Chekd conducted more than 100 workshops last year covering technical and people skills, and that number is expected to increase in 1997. Fuqua will be responsible for facilitating workshops and assisting in the development of new training modules for use by the organization's member dairy processors.

With more than 20 years' experience in the dairy industry, Fuqua has gained the respect of her peers through her extensive work in processing quality assurance, plant sanitation, product development, regulatory compliance, consumer relations, employee training, and laboratory methodology.

Fuqua has served as a production counselor at Quality Chekd since January 1995. Before that, she served in various quality assurance positions for a major Southeast dairy processing company.

A graduate of the University of Tennessee at Knoxville, Fuqua holds a bachelor of science degree in food science and nutrition. She is active in several national organizations, including the International Association of Milk, Food and Environmental Sanitarians (IAMFES),

the National Conference for Interstate Milk Shipment (NCIMS), and the International Dairy Foods Association (IDFA).

## Renowned Chef Charlie Trotter Named Chairman of National Food Safety Education Month

Chef Charlie Trotter, owner of the world-famous, *Mobil* Five Star, AAA Five Diamond Chicago restaurant that bears his name, chaired the second annual National Food Safety Education Month in September. Sponsored by the Industry Council on Food Safety, the month serves to reinforce the importance of food safety training and education among foodservice workers, while also raising public awareness of the foodservice industry's commitment to serving safe food.

John Farquharson, FMP, executive vice president of Global Food and Support Services, ARA-MARK Corporation, and president of the Industry Council on Food Safety, points out that reminding home cooks about food safety is particularly important in this age of home meal replacement and large, value-sized portions that often result in leftovers.

Charlie Trotter's total commitment to quality and attention to detail is legendary, and he brings the same passion to food safety as he does to serving only the finest gourmet cuisine. He takes the matter so seriously that his entire kitchen staff spent 32 hours in classroom training on food safety

last year. Every member of his kitchen staff is trained and certified in safe food preparation and handling.

"I'm delighted to serve as chairman of National Food Safety Education Month," Trotter said. "We must take leadership as an industry to make sure food safety training is a top priority in all foodservice operations. At the same time, I'm pleased to have this opportunity to reach out to the public on behalf of the industry."

Through a comprehensive consumer publicity campaign, Trotter will help consumers understand the care foodservice professionals take to serve safe food, and the importance of adopting similar procedures at home. This is detailed in a free consumer booklet, *Chef CookSmart's™ Guide To Safe Food Preparation & Handling*, which the Industry Council is offering. *Chef CookSmart* symbolizes the millions of foodservice professionals who are experts in preparing and handling food safely.

Trotter's involvement with the Industry Council on Food Safety extends throughout the year. In the coming months he is expected to appear at select industry and consumer events.

For more information about National Food Safety Education and a free promotional kit, call 800-456-0111. An abbreviated version of *Chef CookSmart's Guide* for distribution directly to customers is available at a nominal cost to Industry Council participants. To order the brochure, call 800/809-6032, ext. 145.



## **G & H Appoints O.E.M. Manager**

**G**&H Products Corp. has appointed Linda Rastani as the new O.E.M. Account Manager. In this position, Linda will be responsible for managing a new O.E.M. account program that will increase the level of service to O.E.M. accounts.

Linda has over 15 years of experience with both sanitary and industrial valve applications, including previous experience at G&H Products Corp.

## **Bair Named Penn State Director of Dairy Industry Relations**

**N**Alan Bair has been named director of dairy industry relations in Penn State's College of Agricultural Sciences, effective August 19. His position will be supported by the college and the Pennsylvania Department of Agriculture.

Bair most recently was director of member and public relations of Genex, formerly the Atlantic Breeders Cooperative, in Lancaster, PA, a position he held since 1978.

In his new role, Bair's primary responsibility will be to provide leadership to the Pennsylvania Dairy Stakeholder's effort. He will serve as facilitator to bring together the diverse elements of the industry and find common ground to increase the viability and expansion of the dairy industry.

Bair also will be responsible for coordinating the marketing of Penn State's Dairy Management and Profitability (Dairy-MAP) program, a series of workshops designed to help producers use general business management techniques to improve the profitability of dairy farming.

"Mr. Bair will be filling an important need for our dairy programming," says Dr. Dan Hagen, interim head of the dairy and animal science department. "He will provide assistance and guidance for all stakeholders in the dairy industry in the commonwealth."

Bair's principal office will be in Middletown, but he also will maintain an office at Penn State's University Park Campus.

Bair, who grew up and worked on his family's dairy farm, has extensive experience in planning and developing educational programs and events for the general public, farmers, agricultural professionals and youth. He has broad formal and informal teaching experience in dairy production, biological sciences and genetics, agricultural issues and cooperative business practices.

Bair earned his bachelor's degree in dairy production in 1967 and his master's degree in animal science in 1971, both from Penn State.

Before joining Atlantic Breeders Cooperative, Bair was an extension agent for Penn State Cooperative Extension in Lancaster County from 1971 to 1978. From 1969 to 1971, he managed a histology research laboratory involved in food preservation for combat meals for the U.S. Army.

More recently, Bair has served as a project leader for Volunteers for Overseas Cooperative Assistance (VOCA) in Mesobereny, Hungary in 1995, advising cooperative officials on organizational structure and long-range planning.

Bair is a member of the Pennsylvania Council of Cooperatives (PCC), and served as president from 1993 to 1996. He also has chaired the member relations committee of the National Council on Farmer Cooperatives.

He served as president of Penn State's College of Agricultural Sciences Alumni Society from 1989 to 1991. He also has been active in the Lancaster Chamber of Commerce and the National Association of Animal Breeders.

## **The Educational Foundation of the National Restaurant Association Announces New Officers, Trustee**

**T**he Educational Foundation of the National Restaurant Association recently elected George D. Rice, FMP, as chairman of the board of trustees for the 1996-97 term, beginning July 1, 1996.

Rice is the founder of GDR Enterprises, Inc., formed in 1973 and specializing in marketing and information management consulting to the hospitality industry. Before GDR Enterprises, Rice held executive positions at Dunkin' Donuts, Chicken Unlimited Enterprises, and NPD Research. Rice is co-founder of a number of restaurant and food tracking services including The CREST Report, which is used by over 100 chain restaurants and foodservice manufacturers to track restaurant consumer purchase behavior.

In addition to Rice, the officers of The Educational Foundation for 1996-97 are:

- Vice Chairman—Joseph K. Fassler, FMP, president and CEO, Restaura, Inc., Phoenix, AZ.
- Treasurer—John C. Metz, FMP, president and CEO, Metz Enterprises, Dallas, PA.
- Secretary—Michael E. Hurst, FMP, president, 15th Street Fisheries, Fort Lauderdale, FL.

## 3-A Standards Program Solicits Cross-Industry Participation

**T**he 3-A Sanitary Standards Committees, which have formulated standards and practices that provide criteria for the sanitary design, fabrication, installation, and cleanability of equipment and systems used to handle, process, and package dairy products for more than seventy-five years, is responding to interest expressed by the non-dairy industries.

While the 3-A Sanitary Standards and 3-A Accepted Practices have traditionally been applied to dairy equipment, non-dairy industries including the food, pharmaceutical, chemical, and personal care product industries have been using 3-A criteria for years.

Because industries outside the dairy realm already use 3-A criteria, and because these industries are directly and materially affected by changes to the 3-A Sanitary Standards and 3-A Accepted Practices, the 3-A Steering Committee is now inviting formal participation by processors and equipment manufacturers representing non-dairy industries. Representatives of these industries are encouraged to participate in the process of writing new 3-A standards and practices, and in the revising and amending of current 3-A documents.

To become involved in the 3-A Program, or to get more information, please contact: Dr. Thomas Gilmore, 3-A Secretary, 1451 Dolley Madison Boulevard, McLean, VA 22101-3850, call 703-761-2600, or fax 703-761-4334.

## Howard Hutchings Receives Honor

**C**areer public health worker Howard Hutchings of Cheyenne recently received the distinguished Arthur Williamson Award.

The award is given by the Wyoming Environmental Health



# NEWS

Association to the person it feels has done an outstanding job and achieved exemplary accomplishments in the environmental health field.

Hutchings dedicated 41 years of his life to public health. His career in public health began as a part-time milk, food and general sanitation inspector in Boonville, MO, in 1955. In 1957, he became a full-time employee with the Columbia, MO Health Department as well as a part-time college student at the University of Missouri.

In 1960, Hutchings became a campus sanitarian and continued in the position until 1967. After receiving his master's degree in public health, Hutchings worked for the South Dakota Health Department's Sanitation and Safety Program until 1982. At that time he came to Wyoming to direct the Environmental Health Program in the Wyoming Health Department. He became a strong advocate of consumer product safety and worked closely with the U.S. Consumer Product Safety Commission.

In 1994, the Wyoming Health Department's Environmental Health Program merged with the Wyoming Department of Agriculture. Hutchings worked as a consumer health specialist with the WDA until his retirement in March of this year.

During his many years in public health, Hutchings was an active member of the International Association of Milk, Food & Environmental Sanitarians and served as president of that organization in 1979. He has also been active in many other professional, civic and church organizations.

## Guilty Verdict in Veal Feed Case

**O**n June 10 1996, a Federal jury in Milwaukee, Wisconsin returned guilty verdicts on all twelve counts against the Vitek Corporation and the president of the firm, Jannes (John) Doppenberg. Vitek Supply Corporation, located in Oak Grove, Wisconsin, imports, manufactures and distributes animal drugs, feed, feed supplements, and feed premixes for food-producing animals, primarily veal calves. Vitek and Mr. Doppenberg had been charged with conspiracy and smuggling with approved drugs into the U.S., and adding these drugs to feed mixtures sold to veal producers. The guilty verdicts came on five counts of smuggling, four counts of shipping misbranded drugs, two counts of shipping adulterated drugs, and one count of conspiracy.

Sherry Steffen, who was employed as Vitek's office manager, had been indicted on these same charges. Ms. Steffen plead guilty to conspiracy to smuggle and distribute misbranded and adulterated animal drugs. On August 6, 1996, Ms. Steffen was sentenced to 2 years probation, 150 hours of community service, restitution to the U.S. Customs Service in the amount of \$29,452.65, and a \$25.00 special assessment to the court.

Evidence presented at the trial established that unapproved drugs were added by Vitek to its feed premix products and shipped to feed companies and growers. Evidence was also presented showing that between 1988 and

April 1994, Vitek sold over 1.7 million pounds of products containing unapproved drugs, valued at almost \$1.3 million dollars. The unapproved drugs included: clenbuterol, avoparcin, furaltadone, furazolidone, and nitrofurazone.

This conviction was the result of a cooperative investigation conducted by investigators from U.S. Customs, the FDA, and the U.S. Department of Agriculture. Thomas P. Schneider, U.S. Attorney for the Eastern District of Wisconsin, made the following statement in conjunction with the guilty verdict:

"While there have been other convictions for using clenbuterol in show animals, this is the first conviction nationally where clenbuterol was introduced wholesale into animals being raised solely as part of our nation's food supply. The evidence established an international conspiracy to smuggle clenbuterol and other drugs into this country from the Netherlands. The evidence established that veal feed suppliers and veal producers throughout the country paid Vitek extra for veal premix containing these illegal and harmful animal drugs. The U.S. Attorneys Office, U.S. Customs, FDA, and USDA are continuing this investigation and I expect additional charges soon."

### **Silliker Laboratories Acquires Cargill's Cedar Rapids Testing Laboratory**

**S**illiker Laboratories Group, Inc. announced that it has acquired the assets of Cargill Incorporated's Cedar Rapids food testing laboratory. The lab has been renamed Silliker Laboratories of Iowa and is the newest member of Silliker's national network of food testing laboratories. Terms of the acquisition were not disclosed.

The lab, formerly a part of Cargill's Analytical Services (CAS) unit, is one of the larger food

testing labs in the Midwest. As an independent lab, it serves both Cargill and non-Cargill clients. The Cedar Rapids facility is especially known for its expertise in food, grain, feed, oilseed, meat, and dairy testing.

The laboratory will continue to operate at its existing site: 405 Eighth Avenue SE, Cedar Rapids, IA 52401. In addition, nearly all of the lab's employees were offered and accepted employment with Silliker. The laboratory was originally established in 1947 as Sanitation Laboratories. It was acquired by Cargill in 1978.

### **Educational Foundation and Texas A & M University Announce Food Safety Training Initiative**

**T**he Educational Foundation of the National Restaurant Association and Texas A & M University announced a statewide effort to train Texas foodservice managers in proper food preparation and handling techniques through the SERVSAFE® Serving Safe Food program.

The initiative, called the Food Protection Management Training Program, is sponsored by the Texas Agricultural Extension Service in cooperation with the Texas Department of Health and the Texas Petroleum Marketers and Convenience Store Association.

Over 190 cooperative Extension agents have been certified through the SERVSAFE training, and have gone through a "train-the-trainer" program which teaches them to train others effectively. The agents will return to their respective counties within the state of Texas and begin to hold training classes for local foodservice operators during National Food Safety Education Month in September.

Once local operators successfully complete the course, they will receive a SERVSAFE certificate of completion and will be eligible to enroll their establishments in the Industry Council on Food Safety.

Through the program, the Texas Agricultural Extension Service hopes to train 8,000 foodservice operators over the next two years, and estimates that those operators will in turn train about 185,000 employees that prepare and serve food.

Most urban areas in Texas already require some type of food safety training for foodservice managers, and legislation is in place statewide requiring bed and breakfast inns with under seven beds to be certified in food safety.

"A bonus of using the SERVSAFE train-the-trainer program for the Food Protection Management Training course is that managers who complete the program are urged to teach food safety to their employees," said Georgia Lockridge, director, Institute of Food Science and Engineering, food industry training division, Texas A & M. "The program provides high quality, effective food safety training for managers, increases the safety of the food served to customers, and will help to reduce the incidence of foodborne illness in the state."

For more information on SERVSAFE Serving Safe Food classes available in Texas or in your area, contact The Educational Foundations Class Notes schedule by calling 1-800-765-2122.

### **CVM Announces Toll-Free Number for Reporting ADES**

**F**DA's Center for Veterinary Medicine (CVM) has a new toll-free telephone number to report suspected adverse drug experiences. The new number is 1-888-FDA-VETS. Calls will be

forwarded to a veterinarian in CVM's Division of Surveillance. The number is also equipped with voice-mail to record messages received outside of normal working hours.

CVM monitors reports of adverse drug experiences (ADE) for animal drug products, medicated feeds, and veterinary devices. The definition of an ADE is any side effect, injury, toxicity, or sensitivity reaction (or failure to perform as expected) associated with use of an animal drug, whether or not determined to be attributable to the drug. Lack of effectiveness is also considered an adverse effect.

During 1995, CVM received more than 3,000 reports. Every report is evaluated by a veterinarian and entered into a computer database. In cases where public or animal health is judged to be at risk, the initial review leads to follow-up activity. The final result can be a product recall; change in product labeling; or, in rare circumstances, removal of a product from the market.

### **FDA Committee Applauds Monsanto Monitoring Program; Reaffirms Safety of POSILAC® Bovine Somatotropin**

**T**he Food and Drug Administration's Veterinary Medicine Advisory Committee (VMAC) offered a unanimous endorsement of the unprecedented Post-Approval Monitoring Program (PAMP) initiated two years ago by Monsanto Company for POSILAC® bovine somatotropin.

Monsanto presented data from multiple surveys and monitoring programs, all of which reaffirmed that POSILAC is safe for dairy cows, and that the quality of the nation's milk remains high.

The VMAC spent a half day listening and responding to presentations by Monsanto, the FDA, veterinarians, and dairy farmers. The proceedings confirmed that POSILAC has had no impact on milk quality or wholesomeness since its commercial introduction in February 1994.

Monsanto voluntarily undertook this monitoring program to demonstrate that commercial experience with POSILAC would be the same as in the extensive clinical and field studies conducted prior to the product's approval.

Committee members were pleased with Monsanto's findings. Monsanto presented background documentation indicating there have been no health effects among supplemented cows not normally occurring in the U.S. dairy herd. Monsanto also demonstrated that the market use of POSILAC has had no effect on milk quality as measured by milk discarded because of antibiotic residues in six key dairy states. Independent industry data indicated no increase in the percentage of U.S. cows treated for mastitis; and no increase in sales of antibiotics used to treat mastitis since POSILAC went on the market in 1994.

During the public comment period, Ronald Erskine, DVM, Ph.D., Michigan State University, presented preliminary analysis from a study he recently conducted that concludes POSILAC does not affect the incidence of clinical mastitis. Arden Nelson, DVM, a New York veterinarian, concurred with these observations among his clients: "Mastitis is not a problem in these herds."

Other veterinarians and dairy farmers from around the country also described their first-hand experiences in using POSILAC. They characterized POSILAC as a safe and important management tool that has significantly improved the profitability of their dairy farms.

The Committee's conclusions yesterday reaffirmed its previous determinations, as well as those of the FDA, prior to POSILAC approval in November 1993.

### **Experts Analyze Meat Inspection in the Next Century**

**C**ow meat and poultry inspection must change to meet the future needs of consumers was the topic of discussion for a panel representing meat producers, meat packers, foodservice operators, retail store owners and consumers at the 49th Annual Reciprocal Meat Conference (RMC) last month. The RMC, hosted by Brigham Young University, in Provo, Utah, was sponsored by the American Meat Science Association (AMSA).

Some of the ideas discussed by the panel became part of new meat inspection regulations released by the USDA in mid-July. Under the new regulations, meat processing plants are required to develop a hazard analysis and critical control points (HACCP) plan which implements microbiological testing for *Salmonella* and *E. coli*, achieves performance standards for pathogen reduction based on inspection data, and adopts standard operating procedures to prevent sanitary problems.

Charles Cook, managing partner of Cook and Thurber L.L.C., a food industry consulting group, opened the panel session by calling for privatization of food inspection. According to Cook, privatized inspection would check to make sure a controlled processing system is in place and being enforced, rather than checking each piece of meat or food that comes down the production line.

"What we're looking for is not single deficiency...what we're trying to assess here is the overall process stability," he said.



David Theno, Ph.D., vice president of quality assurance, product safety, research and development and operational services for Jack-in-the-Box restaurants, disagreed with Cook's proposal to privatize inspection, saying "The government is really your partner in producing safe food, whether it's the health department or the federal regulatory agency."

Bringing the view of The Center for Science in the Public Interest, a consumer advocacy group, to the table, Caroline Smith-DeWaal, director of food safety for the group, said private inspection should not be used instead of government inspection.

"I support private inspection, but it shouldn't replace government inspection, and it shouldn't be a substitute for government inspection," Smith-DeWaal said. "The government has an important role here."

James Hodges, senior vice president for regulatory affairs for the American Meat Institute, said that no matter how many changes are made to meat inspection and how many new technologies are introduced, no food can be completely safe. Because of that, consumers must take on part of the responsibility for keeping food safe.

"It's generally recognized, especially in this group, that raw meat and poultry contain some levels of pathogens and that our best...critical control point is proper handling and cooking," said Hodges.

Smith-DeWaal disputed that statement, saying consumers should not be given sole responsibility for serving safe food to their families. That burden should rest on meat producers and packers.

"The real issue here is public health," she said.

Smith-DeWaal also said she knows the meat industry, like any

other food industry, wants to make a safe product. In order to do that, she said, there needs to be greater accountability to the government by slaughterers and packing plants which do not meet regulations.

Charles Cook added to his earlier statements by saying that any changes in meat inspection should be applied to all foods.

Theno added another idea, saying meat produced under "better microbial conditions" should be labeled as such, comparing the labels to the "A" or "B" ratings received by restaurants in some communities.

Speaking from the meat producer perspective, Paul Engler, president of Cactus Feeders Inc., said there are continuing inequities between poultry inspection and beef and pork inspection.

"We need to bring those into line," he said.

Except for making poultry subject to the same rules as pork and beef, Engler said, he would not like to see U.S. meat inspection overhauled.

### **Advanced Instruments, Inc. Hits the World Wide Web at [www.aitests.com](http://www.aitests.com)**

**A**dvanced Instruments, Inc., manufacturers of clinical, industrial, and dairy laboratory instruments, announced recently that the company has introduced its own home page on the world wide web located at <http://www.aitests.com>. In addition to product information on the company's osmometers, cryoscopes and other instruments, information is available on applications for osmometry and cryoscopy, drawn from the company's over 40 years

experience in the field. An online newsletter can also be accessed which provides new product information and company-related news of general interest.

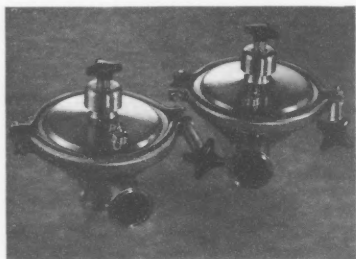
The site introduces Dr. Osmo, a mad scientist from Advanced Instruments' own lab, who offers a prize each month for the best new application for osmometry or cryoscopy. Communication with the company, whether in response to Dr. Osmo's contest or as a request for additional information, is possible through the email segment of the page.

### **Celsis International plc Proposed Acquisition of Lumac for \$17 Million**

**C**elsis International plc is pleased to announce the proposed acquisition of Lumac, from Perstorp A.B., for a consideration of \$17 million. This acquisition includes Lumac BV, Lumac Limited and the transfer to Celsis of certain equipment and intellectual property rights associated with the Lumac business. Upon completion of the Acquisition, nine sales representatives who specialize in the sale of Lumac products and who are presently employed by Perstorp will be invited to become employees of Celsis.

Both Celsis and Lumac are leaders in rapid bioluminescence and microbial testing. Celsis has concentrated its initiatives thus far on the personal care products and pharmaceutical markets. Lumac has concentrated on the dairy, food and beverage side of the market. After the acquisition, Celsis will be better placed to offer a total rapid microbiology solution for the whole production process, from raw materials through to end products.

# IndustryProducts



G&H Products Corporation

## Sanitary Control Valve Eliminates Transducers for Pressure, Temperature, Level Control

The CPM-2 Constant Pressure Modulating Valve from G&H Products Corporation replaces the need for control loop instrumentation and transducers for control of sanitary system pressure, level, and temperature blend.

The CPM-2 valve maintains constant system pressure via remote control with compressed air. After presetting desired system pressure, an internal diaphragm reacts immediately to system changes to ensure that preset pressure is maintained. Conventional flow valves that require sanitary-designed control loop instrumentation and a transducer into the process stream can be replaced with the CPM-2 valve for considerable cost savings.

The CPM-2 valve is available in two versions, for maintaining inlet or outlet pressure. The body of both designs is self draining, even if the valve is positioned on its side. A built-in sensor and air signal

provide excellent response time, as well as lowers the number of required components.

The CPM-2 is constructed of 304 stainless steel, with product contact parts of 316L stainless steel. It is available in 2", and is authorized to carry the 3-A symbol.

G&H Products Corporation, Kenosha, WI

Reader Service No. 301

## New Manual Shut-Off/Clean-Out Version of VAU Variable Spray AutoJet® Air Atomizing Nozzle

Spraying Systems Co. is now offering a manual shut-off/clean-out option on its popular VAU variable spray AutoJet nozzle which provides independent control of liquid, atomizing air, and fan air pressures for fine tuning of flow rate, drop size, spray distribution, and spray coverage.

The new VAA AutoJet nozzle offers continuous operation and can be ordered with a manual shut-off needle, clean-out needle, or a combination shut-off/clean-out needle. The VAU version has a built-in shut-off/clean-out needle that is automatically activated during each spray cycle, virtually eliminating plugging.

Both nozzles feature an independent atomizing air line that can be adjusted to vary the spray atomization without affecting liquid flow rates. A second inlet port can

be used for spraying two liquid solutions or as an outlet in recirculating systems – especially helpful when spraying viscous or heated materials.

With the fan air in operation, the nozzles produce a flat spray pattern, while a round spray pattern is produced when fan air is shut off. Adjustment of the fan air pressure determines spray coverage and distribution at the contact area.

Any of seven different spray setups can be utilized, providing a range of flow rates from 0.74 to 47 gph and up to 180 cycles per minute. The low to high pressure atomizing range is 10 to 90 psi, with a minimum of 35 psi air pressure required to operate the air cylinder.

Variable spray AutoJet air atomizing nozzles can be post, bar, or support mounted using the 3/8" - 24 UNF(F) thread connection or optional mounting adapters.

Spraying Systems Co., Wheaton, IL

Reader Service No. 302

## HydraSponge™

International BioProducts announces the commercial availability of HydraSponge™ for sampling plant equipment, floors and other environmental surfaces. HydraSponge™ offers a simple and reliable means to aseptically collect a surface sample using a sponge. Because the HydraSponge™ is pre-moistened with Neutralizing Buffer, surfaces with residual sanitizers can be sampled. HydraSponge™ includes

*The publishers do not warrant, either expressly or by implication, the factual accuracy of the products or descriptions herein, nor do they so warrant any views or opinions offered by the manufacturer of said articles and products.*

a sterile, pre-moistened, biocide-free, 1.5 x 3" sponge in an 18 oz. sample bag with a wire closure. To collect a sample, the pre-moistened sponge is aseptically removed from the sample bag, the surface is sampled and the sponge is returned to the sample bag for transport to the laboratory.

HydraSponge™ is one of a series of new innovations by International BioProducts for collecting samples for HACCP programs including USDA's new mandated program.

International BioProducts,  
Redmond, WA

Reader Service No. 303

## "Glowing Germs" for Handwash Training

Trainees really understand handwashing needs and cross-contamination prevention after placing a bit of "germ" lotion on their hands, or fluorescent powder on cutting boards and other equipment. Cleaning it off is not easy, and using ultra-violet light the trainees can see how germs are spread until they are stopped by proper sanitation practices.

The "powder germs" on a cutting board can be spread (like germs) around the food area then seen and tracked using darkness and U-V light.

Cross-contamination and improper handwashing are two of the primary three causes of foodborne illnesses – improper temperatures being the third. The new free catalog shows hundreds of HACCP and food safety aids along with training materials such as this handwashing/contamination kit, plus videos, books, etc...

All QA Products, Inc., Gainesville, FL

Reader Service No. 304

## QuikStrike Strip: New Relief from Flies

QuikStrike comes as a ready-to-use, self-contained strip that offers eight straight weeks of effective fly control. Each package contains two strips.

QuikStrike is labeled for a variety of livestock facilities, including calving barns, milking parlors, poultry and swine confinement houses, horse stalls, even dog kennels.

The active ingredients in QuikStrike include Nithiazine, a new, highly effective insecticide with no known resistance, and a potent, triple-action attractant formulated to overcome naturally occurring odors and to attract flies from a 300 square-foot area.

To put QuikStrike to work, simply hang the strips horizontally or vertically, approximately every 20 feet (or 300 square feet). To activate the unit, crush one of the attractant-containing ampoules found at either end of the unit. In four weeks, crush the second ampoule.

"Spending a little money on fly control can save you a lot of money by improving animal comfort, and reducing disease and production loss," says Dr. Steve Hansen, Starbar chief veterinarian.

Sandoz Agro, Inc., Des Plaines, IL

Reader Service No. 305

## Sigma Chemical Introduces 50 New Sigma-Ultras

Fifty new carbohydrates, detergents, inorganic chemicals, buffers and general reagents have been added to Sigma Chemical Company's line of ultra-pure

chemicals. Intended for use in research applications requiring the highest product quality and purity, SigmaUltra chemicals are carefully lot-selected and rigorously tested to assure lot-to-lot consistency and minimal impurities. Each product is carefully tested for contaminating metals and salts and is shipped with a statement of purity.

Among the new chemicals added to the SigmaUltra line are 5 detergents, including Benzalkonium Chloride, Cetylpyridinium Chloride, and Nonanoyl-N-Methylglucamide; 5 buffers, including AMPSO and CHES; and 8 carbohydrates, including  $\alpha$ -Lactose Monohydrate, D(+)-Mannose, and D-Sorbitol. Also added were 20 inorganics, including Ammonium Bromide, Magnesium Hydroxide, Potassium Thiocyanate, and Sodium Sulfate Anhydrous along with 12 general reagents, including Benzoic Acid Sodium Salt, Inosine, and Succinic Acid Disodium Salt Hexahydrate.

Over 250 ultra-pure chemicals are now offered in the SigmaUltra product line. As with all Sigma products, each is backed by readily available technical and applications assistance, superior customer service, and fast delivery.

Sigma Chemical Company, St. Louis, MO

Reader Service No. 306

## Customized Tests for ATP in Raw Materials

The measurement of ATP by bioluminescence is popular as a means of rapidly determining surface sanitation. When used in raw material testing however, methods and reagents often require customization. Analytical Luminescence Laboratory offers customized testing kits for measuring microbial ATP in raw materials with biolumi-

nescence. During the feasibility phase, ALL tests actual samples from the client's manufacturing facility. ALL then assembles a testing kit, protocol and instrument system that meet the specific physical and financial needs of the client. Once the system is installed in the client's QC Laboratory, ALL remains available to assist with data interpretation and system enhancements.

Analytical Luminescence Laboratory, Ann Arbor, MI

Reader Service No. 307

### Lightning Index™ Proficiency Program Allows Customers to Track Cleaning Effectiveness

IDEXX Laboratories, Inc., announces its Lightning Index Proficiency Program, which provides Lightning customers with monthly and yearly analyses of their test data. Customers can compare their performance with other companies in their industry segment and with the entire food industry. This innovative program is free to LIGHTNING users and helps them monitor adherence to SSOPs and HACCP. It's the only industry-wide database of its kind.

Each month, participating food processors send their test results to IDEXX Laboratories and then receive customized reports of their trend data and aggregate comparisons to other plants. These reports give timely feedback regarding cleaning effectiveness and help participants maintain high cleaning

standards and further the cause of a safe food supply.

IDEXX Laboratories, Inc., Westbrook, ME

Reader Service No. 308

### New Ultra Series Clean-In-Place Pressure Transmitter

SENSOTEC announces a new addition to the CIP-Ultra Series clean-in-place pressure transmitter family. The CIP-Ultra is now available in a 1.125" diameter body with a 3/4" flange for applications with tight space constraints. The family also includes a 1.5" diameter unit with flange sizes from 1 1/2" to 3". These transmitters meet 3-A Sanitary Standard #37-01 and are designed to satisfy the environmental demands found in such applications as food and beverage processing, pharmaceuticals, fine chemicals, dairy, and other processes requiring in situ equipment cleaning.

The CIP-Ultra brings world-class performance to the sanitary process industries:

- Accuracy to  $\pm 0.1\%$
- Combined thermal errors (zero and span) less than 0.01% per °F
- Pressure response time less than 0.5 milliseconds
- Tracks temperature changes as fast as 200°F per minute
- 100 times less sensitive to orientation errors than standard designs
- Secondary containment exceeds 1500 psi
- Gage and absolute pressure ranges from 0-1 psi to 0-600 psi

All wetted parts are made from 316L stainless steel or Hastelloy C-276 for compatibility with a wide variety of liquid and gas media such as steam and ethylene oxide. Standard electrical output is 2-wire 4-20mA with a choice of terminations, including fully submersible cable for special applications.

SENSOTEC, Inc., Columbus, OH

Reader Service No. 309

### PocketSwab, Self Contained Hygiene Test

The PocketSwab—a self contained, single service hygiene test—detects ATP (from food residues, microorganisms, biofilms, and human contact, to name a few) to provide a quick check for cleaning effectiveness that enhances overall food safety in plants under GMP, ISO9000, and HACCP programs. The unique design is room temperature stable, and the quickest and simplest test of its type in the market today. The PocketSwab verifies sanitation efficiency in less than 45 seconds. PocketSwabs may be analyzed immediately or swabbed samples may be held for up to 6 hours at room temperature before reading. Results can be downloaded to PC spreadsheets for analysis. PocketSwabs are one of the Lite Series Tests that use either the Charm II System or portable Charm Luminator.

Charm Sciences, Malden, MA

Reader Service No. 310





## 3-A SYMBOL HISTORY

by Earl O. Wright

A committee was formed in 1945 composed of representatives from the International Association of Milk and Food Sanitarians (IAMFES) known as the Committee of Sanitary Procedures (CSP). This committee, along with representatives of the Dairy Industry Committee (DIC) and the Dairy and Food Industry Supply Association (DFISA) was to develop the 3-A insignia. The symbol was to be used by dairy equipment manufacturers to identify equipment that meets the standards written and approved by the task forces of the 3-A Standards Committee.

This newly formed committee proposed in 1947 the use of the Triple "AAA" as a symbol. It was discovered, however, that such a symbol had already been used, and had been registered by DeLaval Separator Company, but was now not in use. The new Trade Mark Act of 1946 stated that abandonment of a registered trade mark was grounds for cancellation after two years, if it had not been renewed. Thus, it was permissible for the 3-A Committee to develop a symbol using the "A".

In 1950 the Committee agreed that the symbol would use the large letter "A" upon which is superimposed a small number "3". It was to be used in advertising to inform prospective buyers of the sanitary

engineering aspects of the equipment.

Application for the registration of the Trade Mark was filed by The International Association of Milk and Food Sanitarians November 29, 1950, with the mark being published in the official Gazette on May 27, 1952.

Although registration of the 3-A symbol was vested in IAMFES, it became obvious that control of use of the symbol could not be effective without the cooperation of both the organized fabricators and users of the equipment for which the 3-A Sanitary Standards had been written and adopted.

It thus became necessary for the IAMFES Committee on Sanitary Procedures with members of the Dairy Industry Committee to name the symbol management organization. The new organization was named "The 3-A Sanitary Standards Symbol Administrative Council." The name has been shortened colloquially and for correspondence to "3-A Symbol Council."

The first meeting of the newly organized 3-A Symbol Council was held in conjunction with the 3-A Sanitary Standards Committee meeting in Bethesda, MD in April 1955 in conjunction with the 3-A Symbol Council was composed of 2 members of Technical Committee of DFISA, two members repre-

senting the Sanitary Standards Subcommittee of DIC, and four members representing IAMFES. The following officers were elected: Chairperson: William A. Dean, Jr., Bowman Dairy, Chicago, IL; Vice Chairperson: A. E. Nessler, Kraft Foods Co., Chicago, IL; and Secretary/Treasurer: C. A. Abele, Diversey Corporation, Chicago, IL.

At this meeting it was anticipated that the 3-A Symbol Council would be prepared to function by Jan. 1, 1956. At this time the 3-A Sanitary Standards Committee with their task forces had written and published 17 Sanitary Standards for dairy equipment. Nine additional standards were being considered.

The 3-A Symbol, being the property of IAMFES, requested that the "3A" trade mark be transferred to the 3-A Symbol Council in February 1955. This transfer was accepted and recorded by the U.S. Patent Office, February 8, 1957. The 3-A Sanitary Standards Symbol Administrative Council was formally incorporated November 9, 1956.

Today there are sixty 3-A Sanitary Standards, nine accepted practices and two Egg 3-A Standards. Many more are under consideration and will be added as they become approved and published by the 3-A Sanitary Standards Committee.

## Amendment 1 to 3-A Sanitary Standards for Silo-Type Storage Tanks for Milk and Milk Products, Number 22-06

Formulated By  
International Association of Milk, Food and Environmental Sanitarjans  
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. Silo-type tank specifications heretofore or hereafter developed which so differ in specifications or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

- D9.3 A silo emergency venting sensor shall be installed on each venting device to indicate failure or activation. Means shall be provided to test proper functioning of the sensor. Additionally, the entire emergency vent line shall be designed to be mechanically cleaned and is considered to be a product contact surface.
- D19.2 The following additional design criteria are to be met if the horizontal agitator internals are to be mechanically cleaned in place along with the tank end seal (bearing) and impeller hub.
- D19.2.1 All internally wetted surfaces (product leakage or cleaning solutions) must meet the following criteria:
- D19.2.1.1 The sealing contact intersection of all seals and gaskets must be exposed to cleaning solutions. Static gaskets must be fully exposed. Rotary and reciprocating gaskets must be partially exposed.
- D19.2.1.2 Lip-type seals shall not have internal springs.
- D19.2.1.3 Tank-end seal surfaces must unseat mechanically or hydraulically to expose all dynamic surfaces involved in the seal.
- D19.2.1.4 Adequate pressure flow rates to clean properly must be determined by the manufacturer and listed plainly for the user on an information plate attached to the agitator and other written methods.
- D19.2.1.5 All cleaning solution shall drain completely when disconnected from the cleaning solution supply lines.

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This amendment to 3-A Sanitary Standards for Silo-Type Storage Tanks for Milk and Milk Products, Number 22-06 is effective November 23, 1996.

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## Amendment 1 to 3-A Sanitary Standards for Air or Hydraulically Driven Diaphragm Pumps for Milk and Milk Products, Number 44-01

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. Diaphragm pump specifications heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

New Title: 3-A Sanitary Standards for Air, Hydraulically, or Mechanically Driven Diaphragm Pumps for Milk and Milk Products

- A1 These standards cover the sanitary aspects of air, hydraulically, or mechanically driven diaphragm pumps for milk and milk products.
- B4 *Air Driven-Type Pumps:* Shall mean those that apply compressed air directly to the nonproduct side of the diaphragm for the purpose of driving the pump.
- B5 *Hydraulically Driven-Type Pumps:* Shall mean those that apply hydraulic fluid directly to the nonproduct side of the diaphragm for the purpose of driving the pump.
- B6 *Mechanically Driven-Type Pumps:* Shall mean those that have the nonproduct side of the diaphragm open to the atmosphere at all times and use a mechanical shaft directly connected to the diaphragm for the purpose of driving the pump.
- D9.1 The chamber on the nonproduct side of a mechanically driven diaphragm pump shall have one or more 1/2 in. (12.7 mm) unobstructed openings to the atmosphere, located so one hole will be at the lowest point for detection of leakage, except that:
- D9.1.1 The unobstructed opening is not necessary if a leak detection system complying with D9.2, D9.4, and D9.5 is provided.
- D9.2 The chamber(s) on the nonproduct side(s) of a mechanically driven diaphragm pump, equipped with a leak detection system in lieu of unobstructed openings, shall be provided with a means of detecting a leak in the diaphragm. A detection system capable of sensing the presence of liquid and stopping the pump shall be installed in the nonproduct chamber(s) of the pump.
- D9.3 Hydraulically driven diaphragm pumps shall be equipped with diaphragms to provide a double barrier between the product and the hydraulic system, and shall include a leak detection device to reliable sense rupture of either diaphragm. The space between the two diaphragms shall be equipped with a pressure-activated switch or conductivity probe to immediately signal diaphragm rupture by contact closure and to stop the pump motor.
- D9.4 The manufacturer shall provide a failsafe leak detection system which will make the pump stop whenever liquid is sensed on the nonproduct side of the diaphragm, or pressure rise or change in conductivity is sensed in the intermediate space or the leak detection system fails. This criterion is not required for mechanically driven diaphragm pumps which are provided with

properly positioned openings for the detection of leakage as specified in D9.1.

- D9.5 The leak detection apparatus shall be easily tested independently, or verified on the pump while the pump is in operation. One test method for pneumatic pumps is to submerge the detector probe(s) in a conductive fluid such as water to determine that the pump does stop. In the case of a hydraulically-driven diaphragm pump,

pressure can be applied to the monitoring chamber via the hose barb to test the pressure-activated switch for shutdown signal or the conductivity probe apparatus may be tested independently via a test switch on the probe. This criterion is not required for mechanically driven diaphragm pumps which are provided with properly positioned openings for the detection of leakage as specified in D9.1.

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**This amendment to 3-A Sanitary Standards for Air or Hydraulically Driven Diaphragm Pumps for Milk and Milk Products, Number 44-01 is effective November 24, 1996.**

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## **Amendment 1 to 3-A Accepted Practices for a Method of Producing Steam of Culinary Quality, Number 609-01**

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. Silo-type tank specifications heretofore or hereafter developed which so differ in specifications or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

- D2.4 A sanitary check valve meeting the applicable provisions in 3-A Sanitary Standards for Vacuum Breakers and Check Valves for Milk and Milk Products, Number 58-, except that the steam side connection may be threaded.

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**This Amendment to 3-A Accepted Practices for a Method of Producing Steam of Culinary Quality, Number 609-01 is effective November 22, 1996.**

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## Amendment 4 to 3-A Sanitary Standards for Diaphragm-Type Valves for Milk and Milk Products, Number 54-00

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. Diaphragm-type valves heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

### B3 Surface Modification<sup>1</sup>

B3.1 *Surface Treatments:* Shall mean a process whereby chemical compositions or mechanical properties of the existing surface are altered. There is no appreciable, typically less than 1  $\mu\text{m}$ , build-up of new material or removal of existing material.

B3.1.1 Surface treatments include:

1. Mechanical (polishing)
2. Electropolishing

B3.2 *Coatings:* Shall mean the results of a process where a different material is deposited to create a new surface. There is appreciable, typically more than 1  $\mu\text{m}$ , build-up of new material.

B3.2.1 *Electrodeposition:* Shall mean coated with chromium or nickel to a specific dimension or processed to a specific dimension after coating.<sup>2</sup>

C1.1 Valve bodies made of the materials provided for in C1 may have their product contact surfaces modified by surface treatment or coating(s).

C1.2 Valve bodies may also be made of other non-toxic structurally suitable metals that have their product contact surfaces modified by surface coatings.

### D2 Coatings

D2.1 The minimum thickness of electrodeposited coatings shall not be less than 0.0002 in. (0.005 mm) for all product contact surfaces when used on stainless steel. When these surfaces are other than stainless steel, the minimum thickness of electrodeposited coatings shall not be less than 0.002 in. (0.05 mm).

### G 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 D1 herein. A maximum  $R_a$  of 32  $\mu\text{in}$ . (0.80  $\mu\text{m}$ ), when measured according to the recommendations in American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)<sup>3</sup> B46.1 - *Surface Texture*, is considered to be equivalent to a No. 4 finish.

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These amendments to 3-A Sanitary Standards for Diaphragm-Type Valves for Milk and Milk Products, Number 54-00 as last amended 11/95 are effective November 22, 1996.

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<sup>1</sup>Additional information on surface modification is contained in *Advanced Materials and Processes, Volume 137(1), January 1990*; "Coatings and Coating Practices" by H. Herman, p. 59; "Surface Modification" by F. A. Smidt, p. 61. ASM International, Materials Park, OH 44073 (216) 338-5151.

<sup>2</sup>Federal Specification #QQ-C-320B for Chromium Plating (Electrodeposited), June 1954 with Amendment 4 on April 10, 1987. Federal Specification #QQ-N-290A for Nickel Plating (Electrodeposited), November 12, 1971. Available from the General Services Administration, Federal Supply Services Bureau, Specification Section, 470 East L'Enfant Plaza, Suite 8100, Washington, D.C. 20407 (202) 755-0325.

<sup>3</sup>Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2392 (212) 705-7722.

## Amendment 2 to 3-A Sanitary Standards for Boot Seal-Type Valves for Milk and Milk Products, Number 55-00 as Amended

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. Boot seal-type valves heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

### B3 Surface Modification

B3.1 *Surface Treatments:* Shall mean a process whereby chemical compositions or mechanical properties of the existing surface are altered. There is no appreciable, typically less than 1  $\mu\text{m}$ , build-up of new material or removal of existing material.

B3.1.1 Surface treatments include:

1. Mechanical (polishing)
2. Electropolishing

B3.2 *Coatings:* Shall mean the results of a process where a different material is deposited to create a new surface. There is appreciable, typically more than 1  $\mu\text{m}$ , build-up of new material.

B3.2.1 *Electrodeposition:* Shall mean coated with chromium or nickel to a specific dimension or processed to a specific dimension after coating.<sup>1</sup>

C1.1 Parts made of the materials provided for in C1 may have their product contact surfaces modified by surface treatments or coatings.

C1.2 Parts may also be made of other nontoxic structurally suitable metals that have their product contact surfaces modified by surface coatings.

### D2 Coatings

D2.1 The minimum thickness of electrodeposited coatings shall not be less than 0.0002 in. (0.005 mm) for all product contact surfaces when used on stainless steel. When these surfaces are other than stainless steel, the minimum thickness of electrodeposited coatings shall not be less than 0.002 in. (0.05 mm).

### G PRODUCT CONTACT SURFACE FINISH

Surface finish equivalent to 150 grit or better as obtained with silicon carbide, properly applied stainless steel sheets, is considered in compliance with the requirements of Section D1 herein. A maximum  $R_a$  of 32  $\mu\text{in}$ . (0.80  $\mu\text{m}$ ), when measured according to the recommendations in American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)<sup>2</sup> B46.1 - *Surface Texture*, is considered to be equivalent to a No. 4 finish.

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**These amendments to 3-A Sanitary Standards for Boot Seal-Type Valves for Milk and Milk Products, Number 55-00 as last amended 11/95 are effective November 22, 1996.**

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<sup>1</sup>Federal Specification #QQ-C-320B for Chromium Plating (Electrodeposited), June 1954 with Amendment 4 on April 10, 1987. Federal Specification #QQ-N-290A for Nickel Plating (Electrodeposited), November 12, 1971. Available from the General Services Administration, Federal Supply Services Bureau, Specification Section, 470 East L'Enfant Plaza, Suite 8100, Washington, D.C. 20407 (202) 755-0325.

<sup>2</sup>Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2392 (212) 705-7722.

## Amendment 2 to 3-A Sanitary Standards for Tank Outlet Valves for Milk and Milk Products, Number 57-00 as Amended

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. Tank outlet valves heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

### B3 Surface Modification<sup>1</sup>

B3.1 *Surface Treatments:* Shall mean a process whereby chemical compositions or mechanical properties of the existing surface are altered. There is no appreciable, typically less than 1  $\mu\text{m}$ , build-up of new material or removal of existing material.

B3.1.1 Surface treatments include:

1. Mechanical (polishing)
2. Electropolishing

B3.2 *Coatings:* Shall mean the results of a process where a different material is deposited to create a new surface. There is appreciable, typically more than 1  $\mu\text{m}$ , build-up of new material.

B3.2.1 *Electrodeposition:* Shall mean coated with chromium or nickel to a specific dimension or processed to a specific dimension after coating.<sup>2</sup>

C1.1 Valve bodies and plug/stem assemblies made of the materials provided for in C1 may have their product contact surfaces modified by surface treatment or coating(s).

C1.2 If functionally necessary for bodies, plugs and stems, metal alloys or metals that are as corrosion resistant as AISI 300 Series Stainless Steel, and are nontoxic and nonabsorbent under the conditions of intended use may be used.

### D1 Surface Texture

D1.1 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 H.)

### D2 Coatings

D2.1 The minimum thickness of electrodeposited coatings shall not be less than 0.0002 in. (0.005 mm) for all product contact surfaces when used on stainless steel. When these surfaces are other than stainless steel, the minimum thickness of electrodeposited coatings shall not be less than 0.002 in. (0.05 mm).

### H 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 D1 herein. A maximum  $R_a$  of 32  $\mu\text{in}$ . (0.80  $\mu\text{m}$ ), when measured according to the recommendations in American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)<sup>3</sup> B46.1 - *Surface Texture*, is considered to be equivalent to a No. 4 finish.

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The amendments to 3-A Sanitary Standards for Tank Outlet Valves for Milk and Milk Products, Number 57-00 as Amended 11/95 are effective November 22, 1996.

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<sup>1</sup>Additional information on surface modification is contained in *Advanced Materials and Processes*, Volume 137(1), January 1990; "Coatings and Coating Practices" by H. Herman, p. 59; "Surface Modification" by F. A. Smidt, p. 61. ASM International, Materials Park, OH 44073 (216) 338-5151.

<sup>2</sup>Federal Specification #QQ-C-320B for Chromium Plating (Electrodeposited), June 1954 with Amendment 4 on April 10, 1987. Federal Specification #QQ-N-290A for Nickel Plating (Electrodeposited), November 12, 1971. Available from the General Services Administration, Federal Supply Services Bureau, Specification Section, 470 East L'Enfant Plaza, Suite 8100, Washington, D.C. 20407 (202) 755-0325.

<sup>3</sup>Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2392 (212) 705-7722.

## QMI PRODUCTS ARE ESSENTIAL TOOLS FOR AN EFFECTIVE HACCP SYSTEM

### THE PROBLEM



*Escherichia Coli*

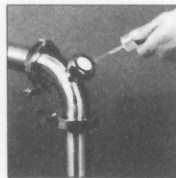


*Listeria Monocytogenes*

### THE SOLUTION



*QMI Aseptic Transfer System*



*QMI Aseptic Sampling System*

With its patented products, QMI has extremely effective tools for the threat of contamination. More importantly, QMI goes a long way to help avoid an even bigger threat—the threat of product recall due to spoiled or unsafe products.

■ With the QMI Aseptic Transfer System, you can eliminate the hazard of contamination during inoculation of yogurt, cheese, culture, buttermilk or other fermented products, necessary for an effective HACCP program.

■ With the QMI Aseptic Sampling System, you can identify sources of contamination and effectively document process control, essential for an effective HACCP program.

Don't take chances. Take action against contamination. Get all the facts on our Aseptic Sampling and Transfer Systems now.

# QMI ASEPTIC TRANSFER SYSTEMS

FOOD AND DAIRY QUALITY MANAGEMENT, INC.  
245 E. SIXTH STREET, ST. PAUL, MN 55101  
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## Amendment 1 to 3-A Sanitary Standards for Hose Assemblies for Milk and Milk Products, Number 62-00

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. Hose assembly specifications heretofore or hereafter developed which so differ in specifications or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

- B7 *Substantially Flush:* Shall mean mating surfaces or other juxtaposed surfaces shall be within 1/32 in. (0.794 mm).
- D2.3 The mating surfaces of the sanitary coupling to a sanitary fitting shall produce a substantially flush interior joint.
- D6 All sanitary fittings and connections shall conform with the 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63.
- D7 Metal tubing to be used in hose assemblies shall conform to the applicable provisions of the 3-A Sanitary Standards for Polished Metal Tubing for Dairy Products, Number 33.
- D8.4 Gasket grooves or gasket retaining grooves in product contact surfaces for removable gaskets shall not exceed 1/4 in. (6.35 mm) in depth or be less than 1/4 in. (6.35 mm) wide, except those for standard O-rings smaller than 1/4 in. (6.35 mm) and those provided for in Section D6.
- D9.1 All internal angles of less than 135° on product contact surfaces shall have radii of not less than 1/4 in. (6.35 mm), except that:

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These Amendments to 3-A Sanitary Standards for Hose Assemblies for Milk and Milk Products, Number 62-00 shall become effective November 23, 1996.

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## **Amendment 2 to 3-A Sanitary Standards for Hose Assemblies for Milk and Milk Products, Number 62-00**

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. Hose assembly specifications heretofore or hereafter developed which so differ in specifications or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

C1.2.1 Hose material shall meet the requirements of class I, class II, class III, and class IV found in the above referenced 3-A Sanitary Standards.

D2.2 Hose assemblies shall have an inside diameter 1.00 in. (25 mm) or larger.

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**These amendments to 3-A Sanitary Standards for Hose Assemblies for Milk and Milk Products, Number 62-00 are effective November 22, 1996.**

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## Amendment 1 to 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63-00

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. Sanitary fitting specifications heretofore or hereafter developed which so differ in specifications or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

- |    |  |       |   |
|----|--|-------|---|
| B5 | <i>Substantially Flush:</i> Shall mean mating surfaces or other juxtaposed surfaces shall be within 1/32 in. (0.794 mm).                       | D10   | Tolerances for mating faces on sanitary fittings shall not exceed those shown in Table-2. (See Appendix, Section H2.)               |
| D4 | Product contact surfaces of fittings that are to be mechanically cleaned shall be so designed and shall use gaskets that can be self-centered. | D12.1 | All internal angles of less than 135° on product contact surfaces shall have radii of not less than 1/8 in. (3.18 mm), except that: |

H2 **TABLE 2 – Tolerances for Mating Faces on Nonpermanent Sanitary Fittings**

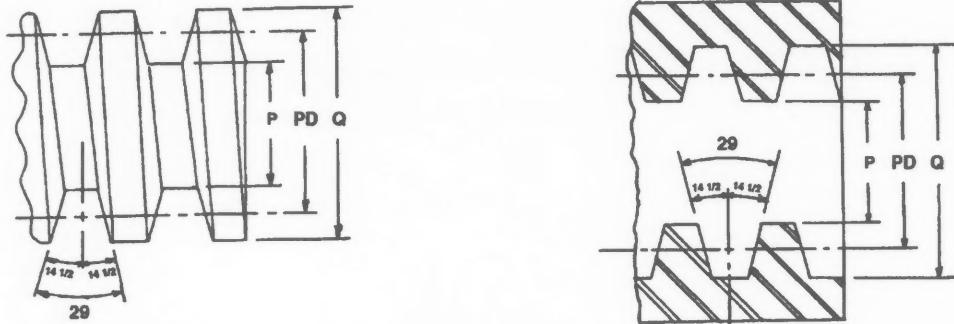
Nominal Diameter	ID* in.	Tolerance
1/4	0.152	±0.005
3/8	0.277	±0.005
1/2	0.370	±0.005
3/4	0.620	±0.005
1	0.870	±0.005
1 1/2	1.370	±0.005
2	1.870	±0.005
2 1/2	2.370	±0.005
3	2.870	±0.005
4	3.834	±0.005
6	5.782	±0.013
8	7.782	±0.016
10	9.732	±0.016
12	11.732	±0.016

\*For special considerations as provided for in Section E, alternative internal diameters are permitted, provided the internal diameters of mating surfaces are equivalent and comply with tolerances as shown.

**I DIAGRAMS**

Delete drawings 3-A 63-00-02 through and including 3-A 63-00-13.

Retain 3-A Drawing Number 63-00-01 - General Purpose Acme Threads Class 2G.



**3-A 63-01-01: General Purpose Acme Threads Class 2G**

**EXTERNAL THREAD DIMENSIONS**

Size	Acme Threads per in.	P	Q	Pitch Dia.	Tolerance P,Q & F.D.
1	8	1.317	1.462	1.3995	+0.00 / -.018
1 1/2	8	1.849	1.994	1.9315	+0.00 / -.019
2	8	2.381	2.526	2.4635	+0.00 / -.020
2 1/2	8	2.913	3.058	2.9955	+0.00 / -.021
3	8	3.445	3.590	3.5275	+0.00 / -.022
4	8	4.509	4.695	4.6120	+0.00 / -.025

**INTERNAL THREAD DIMENSIONS**

Size	Acme Threads per in.	P	Q	Pitch Dia.	Tolerance P,Q & F.D.
1	8	1.352	1.497	1.4145	+0.018 / -.000
1 1/2	8	1.884	2.029	1.9465	+0.019 / -.000
2	8	2.416	2.561	2.4785	+0.020 / -.000
2 1/2	8	2.948	3.093	3.0105	+0.021 / -.000
3	8	3.480	3.625	3.5425	+0.022 / -.000
4	8	4.544	4.730	4.6270	+0.025 / -.000

These amendments to 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63-00 are effective November 23, 1996.



## **Rescinding Amendments to E-3-A Sanitary Standards for Liquid Egg Products Cooling and Holding Tanks, Number E-1300**

Formulated By  
International Association of Milk, Food and Environmental Sanitarians  
United States Department of Agriculture  
Poultry and Egg Institute of America  
Dairy and Food Industries Supply Association

In accordance with the action of the 3-A Sanitary Standards Committees as recorded in the minutes for May 24, 1996, the E-3-A Sanitary Standards for Liquid Egg Products Cooling and Holding Tanks, Number E-1300 are hereby rescinded.

Subsequent to the effective date, the E-3-A Sanitary Standards for Liquid Egg Products Cooling and Holding Tanks, Number E-1300 will become null and void.

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**This amendment to E-3-A Sanitary Standards for Liquid Egg Product Cooling and Holding Tanks, Number E-1300 is effective November 20, 1996.**

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## **Rescinding Amendments to E-3-A Sanitary Standards for Fillers and Sealers of Single Service Containers for Liquid Egg Products, Number E-1700**

Formulated By  
International Association of Milk, Food and Environmental Sanitarians  
United States Department of Agriculture  
Poultry and Egg Institute of America  
Dairy and Food Industries Supply Association

In accordance with the action of the 3-A Sanitary Standards Committees as recorded in the minutes for May 24, 1996, the E-3-A Sanitary Standards for Fillers and Sealers of Single Service Containers for Liquid Egg Products, Number E-1700 are hereby rescinded.

Subsequent to the effective date, the E-3-A Sanitary Standards for Fillers and Sealers of Single Service Containers for Liquid Egg Products, Number E-1700 will become null and void.

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**This amendment to E-3-A Sanitary Standards for Fillers and Sealers of Single Service Containers for Liquid Egg Products, Number E-1700 is effective November 20, 1996.**

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## 3-A Sanitary Standards for Centrifugal and Positive Rotary Pumps for Pumping Cleaning and Sanitizing Solutions, Number 47-00

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. Solution pump specifications heretofore or hereafter developed which so differ in design, material, construction, or otherwise, as not to conform with the following standards, but which in the manufacturer's or fabricator's opinion are equivalent or better may be submitted for the joint consideration of the IAMFES, USPHS and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

### A SCOPE

A1 These standards cover the sanitary aspects of centrifugal and positive rotary pumps which are used solely for the supply, recirculation, and return of cleaning and/or sanitizing solutions, except those pumps used to supply concentrated cleaning and/or sanitizing materials to the point of use. When these pumps are used for initial product contact surface rinses, these rinses shall not be recirculated. These pumps may be used in CIP and COP applications.

A2 In order to conform to these 3-A Sanitary Standards, centrifugal and positive rotary CIP or COP pumps shall comply with the following design, materials, and fabrication criteria.

### B DEFINITIONS

B1 *Cleaning and Sanitizing Solutions:* Shall mean the chemical detergent solutions, sanitizing solutions, and water rinses.

#### B2 Surfaces

B2.1 *Solution Contact Surfaces:* Shall mean all surfaces which are exposed exclusively to the solution and surfaces from which liquids may drain, drop, or be drawn into the cleaning and sanitizing solutions.

B2.2 *Nonsolution Contact Surfaces:* Shall mean all other exposed surfaces.

B3 *Surface Modification<sup>1</sup>:* Shall mean the process of applying a "surface treatment" or "coating" that enhances and improves the tribology (phenomenon of wear, lubrication, and friction of the parent material).

B3.1 *Surface Treatments:* Shall mean a process whereby chemical compositions or mechanical properties of the existing surfaces are altered. There is no appreciable, typically less than 1  $\mu\text{m}$ , build-up of new material.

B3.1.1 Surface treatments include:

1. Mechanical (shot peening<sup>2</sup>, glass bead-  
ing, polishing)
2. Thermal (surface hardening laser,  
electron beam)
3. Diffusion (carburizing, nitriding)
4. Chemical (etching, oxidation)
5. Ion Implantation

B3.2 *Coatings:* Shall mean the results of a process where a different material is deposited to create a new surface. There is appreciable, typically more than 1  $\mu\text{m}$ , build-up of new material.

B3.2.1 Coating processes include:

1. Chemical (conversion coatings)
2. Electrodeposition<sup>3</sup>
3. Spraying (pneumatic, flame, plasma, arc  
spray)
4. Physical Vapor Deposition
5. Chemical Vapor Deposition

- B4 **Cleaning**
- B4.1 *Mechanical Cleaning or Mechanically Cleaned*: Shall mean soil removal by impingement, circulation or flowing chemical detergent solutions and water rinses onto and over the surfaces to be cleaned by mechanical means in equipment or systems specifically designed for this purpose.
- B4.2 *Manual (COP) Cleaning*: Shall mean soil removal when the equipment is partially or totally disassembled. Soil removal is effected with chemical solutions and water rinses with the assistance of one or a combination of brushes, nonmetallic scouring pads and scrapers, high or low pressure hoses and tanks(s) which may be fitted with recirculating pump(s) and with all cleaning aids manipulated by hand.
- B5 *Simple Hand Tools*: Shall mean implements normally used by operating and cleaning personnel such as a screwdriver, wrench, or hammer.
- B6 *Substantially Flush*: Shall mean mating surfaces or other juxtaposed surfaces shall be within 1/32 in. (0.794 mm).
- B7 *Readily or Easily Removable*: Shall mean quickly separated from the equipment.
- B8 *Easily or Readily Accessible*: Shall mean a location which can be safely reached by an employee from the floor, platform, or other permanent work area.
- C **MATERIALS**
- C1 **Metals**
- C1.1 Solution contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series<sup>4</sup> or corresponding Alloy Cast Institute (ACI) types<sup>5</sup> (See Appendix, Section E1), or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent, except that:
- C1.2 Rotors, shafts, seals, rotor and impeller retaining devices, and housings may also be made of a metal or an alloy that is as corrosion resistant as AISI 300 Series Stainless Steel and is nontoxic and nonabsorbent under the conditions of intended use. (See Appendix, Section E5.)
- C1.3 Solution contact surfaces made of the materials provided for in C1.1 may be modified by surface treatment or coating(s).
- C2 **Surface Modification Materials**
- C2.1 Surface modification materials that become a part of the parent material on solution contact surfaces shall comply with the appropriate provisions of one or more of the following:
- C2.1.1 FDA Regulation 21 CFR 175 Subpart C<sup>6</sup>, Substances for Use as Components of Coatings.
- C2.1.2 FDA Regulation 21 CFR 177 Subpart B<sup>6</sup>, Substances for Use as Basic Components of Single and Repeated Use Food Contact Surfaces.
- C2.1.3 FDA Regulation 21 CFR 177 Subpart C<sup>6</sup>, Substances for Use Only as Components of Articles Intended for Repeated Use.
- C3 **Nonmetals**
- C3.1 Rubber and rubber-like materials may be used for rotors, stators, liners, gaskets, O-rings, seals, and parts having the same functional purposes.
- C3.1.1 Rubber and rubber-like materials shall comply with 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-.
- C3.2 Plastic materials may be used for rotors, stators, liners, gaskets, O-rings, seals, and parts having the same functional purposes.
- C3.2.1 Plastic materials shall comply with the applicable provisions of 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-.
- C3.3 Rubber and rubber-like materials and plastic materials having solution contact surfaces shall be of such composition as to retain their surface and conformational characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment.
- C3.4 The final bond and residual adhesive, if used, on bonded ceramic and on bonded rubber and rubber-like materials and on bonded plastic materials shall be nontoxic<sup>7</sup>.
- C3.5 Where materials having certain inherent functional purposes are required for specific application, such as seals, carbon and/or ceramic materials may be used. Carbon and/or ceramic materials shall be inert, nonporous, nontoxic, nonabsorbent, insoluble, and resistant to scratching, scoring, and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment. These materials must meet the requirements of C2

or be generally recognized as safe (GRAS) by the FDA.

#### C4 Nonsolution Contact Surfaces

- C4.1 All nonsolution contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All nonsolution contact surfaces shall be relatively nonabsorbent, durable, and cleanable. Parts removable for cleaning having both solution contact and nonsolution contact surfaces shall not be painted.

### D FABRICATION

#### D1 Surface Finish

- D1.1 All solution 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 E2), except for those of castings for CIP/COP pumps.

D1.1.1 A No. 2B finish may be used for solution contact surfaces.

D1.1.2 The solution contact surfaces of castings for solution pumps shall be at least as smooth as scales for investment casting on the GAR C-9-200 Cast Microfinish Comparator,<sup>8</sup> and relatively free of pits, folds, and crevices in the final fabricated form. (See Appendix, Section E3.)

#### D2 Permanent Joints

- D2.1 All permanent joints in metallic solution contact surfaces shall be continuously welded. Welded areas on solution contact surfaces shall be 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 when in the final fabricated form.

#### D3 Coatings

D3.1 Coatings, if used, shall be free from surface delamination, pitting, flaking, spalling, blistering, and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment.

D3.2 The minimum thickness of electrodeposited coatings shall not be less than 0.0002 in. (0.005 mm) for all solution contact surfaces when used on stainless steel.

D3.3 Ceramic materials used as coatings shall be at least 0.003 in. (0.08 mm) thick.

D3.4 Plastic materials, when used as a coating, shall be at least 0.005 in. (0.125 mm) thick.

### D4 Cleaning

- D4.1 Centrifugal and positive rotary CIP/COP pumps shall be designed so that the solution contact surfaces of the pump and all nonremoved appurtenances thereto can be mechanically cleaned and are easily accessible and readily removable for inspection.

### D5 Draining

- D5.1 All solution contact surfaces shall be drainable when disassembled.

### D6 Fittings

- D6.1 All sanitary fittings and connections shall conform with those applicable provisions of the 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63-.

### D7 Seals

- D7.1 The shaft seal(s) shall be sanitary in design with all solution contact parts demountable and accessible for inspection or cleaning, and shall not be of the packing type.

### D8 Gaskets

- D8.1 Gaskets having a solution contact surface shall be removable or bonded.
- D8.2 Grooves in gaskets shall be no deeper than their width.
- D8.3 Gasket retaining grooves in solution contact surfaces for removable gaskets shall not exceed 1/4 in. (6.35 mm) in depth or be less than 1/4 in. (6.35 mm) wide except those for standard O-rings smaller than 1/4 in. (6.35 mm), and those provided for in Section D6.1.
- D8.4 Gaskets, when used, shall be self-positioning and form a substantially flush interior joint.

### D9 Radii

- D9.1 All internal angles of less than 135° on solution contact surfaces shall have radii of not less than 1/8 in. (3.18 mm) except that:
- D9.1.1 Smaller radii may be used when they are required for essential functional reasons, such as those in seal components and rotors to body clearance areas. In no case shall such radii be less than 1/32 in. (0.794 mm).
- D9.1.2 The radii in grooves in gaskets or gasket retaining grooves shall be not less than 1/16 in. (1.59 mm) except those for standard 1/4 in. (6.35 mm) O-rings, and those provided for in Section D6.1.
- D9.1.3 Radii in standard O-ring grooves shall be as specified in Appendix E4.
- D9.1.4 Radii in nonstandard O-ring grooves shall be that radius closest to a standard O-ring as specified in Appendix E4.



- D10 **Springs**
- D10.1 Coil springs having solution contact surfaces shall have at least 3/32 in. (2 mm) openings between coils, including the ends, when it is in a free position.
- D11 **Threads**
- D11.1 There shall be no exposed threads on solution contact surfaces.
- D11.2 Enclosed threads shall be sealed from the solution by means of an O-ring, gasket, or similar type seal, and shall meet thread specifications designated by the manufacturer.
- D11.3 The rotor or impeller locking nut shall be the enclosed type.
- D12 **Bonded Parts**
- D12.1 Pump impellers, rotors, stators, or housings may be made of, covered with, or bonded with rubber, rubber-like, or plastic materials.
- D12.2 Bonded rubber and rubber-like materials and bonded plastic materials having solution contact surfaces shall be bonded in a manner that the bond is continuous and mechanically sound, so that when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment the rubber and rubber-like material or the plastic material does not separate from the base material to which it is bonded.
- D12.3 Components within seal assemblies may be bonded with adhesives.
- D13 **Inspectibility**
- D13.1 A pump shall be designed that (See Appendix, Section E6):
- D13.1.1 The open area between the exterior of the driver or gear case housing, to the exterior of the solution chamber shall be 1/2 in. (12 mm) minimum width and of sufficient area to allow unrestricted viewing of the pump shaft(s) or seal components at the potential leak site. This area shall be self-draining.
- D13.1.2 At least 1/4 in. (6 mm) of the shaft(s) exclusive of the seal components shall be visible.
- D13.1.3 Guards required by a safety standard that will not permit accessibility for cleaning and inspection shall be designed so that they can be removed with the use of simple hand tools.
- D14 **Nonsolution Contact Surfaces**
- D14.1 Nonsolution contact surfaces shall have a smooth finish free of pockets and crevices
- and be readily cleanable. Those surfaces to be coated shall be effectively prepared for coating.
- D15 **Supports**
- D15.1 **Baseplate Mounted**
- D15.1.1 A baseplate mounted unit consists of some or all of the following components:
- D15.1.1.1 Pump
- D15.1.1.2 Motor
- D15.1.1.3 Mechanical reduction unit such as a gearbox, gearhead drive, variable speed drive, chain and sprocket system, or belt or pulley system.
- D15.1.1.4 Pedestal
- D15.1.1.5 Coupling
- D15.1.1.6 Guard
- D15.1.1.7 Baseplate
- D15.1.1.8 Legs
- D15.1.2 The baseplate(s) shall be constructed of (a) solid metal plate(s) or (b) tubular metal that has all open ends sealed by welding.
- D15.1.3 The metal shall be stainless steel, or coated or painted mild steel.
- D15.2 **Legs**
- D15.2.1 Legs, when used, shall be adjustable or fixed with rounded ends or have flat load-bearing feet suitable for mounting to the floor and have no exposed threads.
- D15.2.2 Legs made of hollow stock shall be sealed.
- D15.2.3 Legs shall be of sufficient length to provide a minimum clearance between the lowest part of the base, pump, motor, or drive and floor of not less than 4 in. (101.6 mm) on pumps with legs designed to be fixed to the floor or pumps having a horizontal base area of more than 1 ft<sup>2</sup> (0.095 m<sup>2</sup>).
- D15.2.4 Legs shall be of sufficient length to provide a minimum clearance of 2 in. (50 mm) on pumps having a horizontal base area of 1 ft<sup>2</sup> (0.095 m<sup>2</sup>) or less and not designed to be fixed to the floor.
- D15.2.5 If casters or wheels are used they shall be of sufficient size to provide a clearance between the lowest part of the base and the floor of not less than 4 in. (101.6 mm). Casters or wheels, if provided, shall be easily cleanable, durable, and of a size that will permit easy movement of the centrifugal or positive rotary pump.
- E
- E1 **APPENDIX**
- STAINLESS STEEL MATERIALS**
- Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast prod-

ucts, should be considered in compliance with the requirements of Section C1.1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C1.1 sets forth the chemical ranges and limits of acceptable stainless steels of the 300 Series. Cast grades of stainless steel corresponding to types 303, 304, 316, and 316L are designated CF-16F, CF-8, CF-8M, and CF-3M, respectively. The chemical compositions of these cast grades are covered by ASTM specifications<sup>9</sup> A351/A351M, A743/A743M and A744/A744M.

- E2 **SOLUTION CONTACT SURFACE FINISHES**  
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 D1.1 herein. A maximum  $R_a$  of 32  $\mu\text{in.}$  (0.80  $\mu\text{m}$ ), when measured according to the recommendations in American National

Standards Institute (ANSI) and American Society of Mechanical Engineers (ASME) B46.1 -Surface Texture, is considered to be equivalent to a No. 4 finish<sup>10</sup>.

E3 **The GAR C-9 Scale**

- E3.1 The GAR C-9 Scale is used to compare surface finished for evaluating surface roughness of metallic castings. The GAR C-9 Scale provides a measure of the degree of general smoothness attainable on alloy castings by currently available casting process. The GAR C-9 Scale consists of nine RMS surface roughness finishes covering a range of 20  $\mu\text{in.}$  (0.51  $\mu\text{m}$ ) to 900  $\mu\text{in.}$  (22.9  $\mu\text{m}$ ). The average application of the GAR C-9 comparator for investment castings is the C-20, C-30, and C-40 scales (60  $\mu\text{in.}$  to 200  $\mu\text{in.}$  RMS). Areas of transition, such as chamfers, fillets, beads, etc., may conform to the next roughest scale. **NOTE:** The ACI/SIS scale is out of production and is an obsolete scale. The ACI/SIS-1 scale previously referenced averages of 200  $\mu\text{in.}$  RMS.

E4 **O-Ring Groove Radii**

**TABLE 1 - Groove Radii Dimensions for Standard O-Rings**

O-Ring Cross Section, Nominal (AS 568 <sup>11</sup> )	O-Ring Cross Section, Actual (AS 568)	O-Ring Cross Section, Actual (ISO 3601-1 <sup>12</sup> )	Minimum Groove Radius
1/16 in.	0.070 in.	1.80 mm	0.016 in. (0.406 mm)
3/32 in.	0.103 in.	2.65 mm	0.031 in. (0.787 mm)
1/8 in.	0.139 in.	3.55 mm	0.031 in. (0.787 mm)
3/16 in.	0.210 in.	5.30 mm	0.062 in. (1.575 mm)
1/4 in.	0.275 in.	7.00 mm	0.094 in. (2.388 mm)

**E5 OPTIONAL METAL ALLOY**

**E5.1** The following alloys or metals have been shown to be as corrosion resistant as the 300 Series Stainless Steel:

	UNS N08367	UNS S21800	UNS S20161	UNS N26055	UNS N26455	UNS S17400	UNS S15500	UNS S32900	UNS R20500	UNS R50400
	ASTM A743 Grade	ASTM A743 Grade		ASTM A494 Grade	ASTM A494 Grade	ASTM A747 Grade	ASTM A747 Grade		ASTM A560 Grade	ASTM B67 Grade
	CN-3MN	CF-10 SMnN		CY5SnBIM	CW-2M	CB7Cu-1	CB7Cu-2		50Cr-50Ni	C-2
C	0.03	0.10	0.15	0.05	0.02	0.07	0.07	0.20	0.10	0.10
Mn	2.00	7.00-9.00	4.00-6.00	1.5	1.00	0.70	0.70	1.00	0.30	
Si	1.00	3.50-4.50	3.00-4.00	0.5	0.80	1.00	1.00	0.75	1.00	
P	0.040	0.040	0.040	0.03	0.03	0.035	0.035	0.040	0.02	
S	0.010	0.030	0.040	0.03	0.03	0.03	0.03	0.030	0.02	
Cr	20.0-22.0	16.00-18.00	15.0-18.0	11.0-14.0	15.0-17.5	5.50-17.7	14.0-15.50	23.0-28.0	48.0-52.0	
Ni	23.5-25.5	8.00-9.00	4.00-6.00	Balance	Balance	3.60-4.60	4.50-5.50	2.50-5.00	Balance	
Mo	6.0-7.0			2.0-3.5	15.0-17.5			1.00-2.00		
Cb						0.15-0.35	0.15-0.35			
Cu	0.75					2.50-3.20	2.50-3.20			
N	0.18-0.26	0.08-0.18	0.08-0.20			0.05	0.05		0.30	
Fe	Balance	Balance	Balance	2.00	2.00	Balance	Balance	Balance	1.00	0.30
Sn				3.0-5.0						
Bi				3.0-5.0						
W					1.0					
Ti									0.50	Balance
Al									0.25	
other										H = 0.015 N = 0.03 O = 0.25

**E5.1.1** Metals other than the above may be as corrosion resistant as the 300 Series Stainless Steel. This may be shown when metals are tested in accordance with ASTM G31-Laboratory Immersion Corrosion Testing of Metals and have a corrosion rate of less than 10 mil (250 µm) per year. The test param-

eters such as the type of chemical(s), their concentration(s), and their temperature(s) should be representative of cleaning and sanitizing conditions used in dairy equipment. Alloys containing lead or leachable copper should not be used.

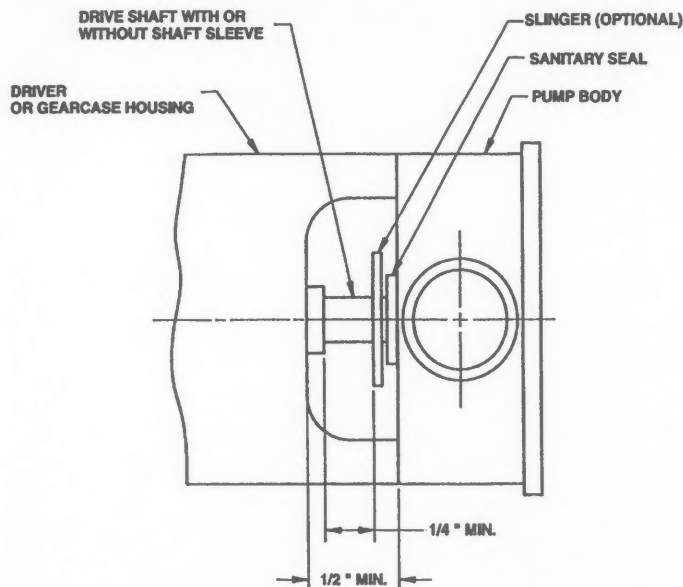
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These 3-A Sanitary Standards are effective November 24, 1996.

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## E6 Diagram

This diagram is intended to demonstrate general principles only, and is not intended to limit individual ingenuity. The design used should conform with the sanitary requirements set forth in these 3-A Sanitary Standards.



<sup>1</sup>Additional information on surface modification is contained in *Advanced Materials and Processes, Volume 137(1), January 1990; "Coatings and Coating Practices" by H. Herman, p. 59, "Surface Modification" by F. A. Smidt, p. 61. ASM International, Materials Park, OH 44073 (216) 338-5151.*

<sup>2</sup>MIL-S-13165C (1), November 1991, *Military Specification: Shot Peening of Metal Parts. Available from Standardization, Document Order Desk (Department of Navy), 700 Robbins Avenue, Building 4, Section D, Philadelphia, PA 19111-5094 (215) 697-2179.*

<sup>3</sup>Federal Specification #QQ-C-320B for Chromium Plating (Electrodeposited), June 1954 with Amendment 4 on April 10, 1987. Federal Specification #QQ-N-290A for Nickel Plating (Electrodeposited), November 12, 1971. Available from the General Services Administration, Federal Supply Services Bureau, Specification Section, 470 East L'Enfant Plaza, Suite 8100, Washington, D.C. 20407 (202) 755-0325.

<sup>4</sup>The data for this series are contained in the *AISI Steel Products Manual, Stainless & Heat Resisting Steels, November 1990, Table 2-1, pp. 17-20. Available from the American Iron and Steel Society, 410 Commonwealth Drive, Warrendale, PA 15086 (412) 776-1535.*

<sup>5</sup>Steel Founders Society of America, *Cast Metal Federation Building, 455 State Street, Des Plaines, IL 60016 (708) 299-9160.*

<sup>6</sup>For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 783-3238.

<sup>7</sup>Adhesives shall comply with 21 CFR 175 - *Indirect Food Additives: Adhesives and Components of Coatings. Document for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 783-3238.*

<sup>8</sup>Available from GAR Electroforming Division, Box 340, Danbury, CT 06813-0340 (203) 744-4300.

<sup>9</sup>Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Phone: (610) 832-9500.

<sup>10</sup>Available from the American Society of Mechanical Engineers (ASME), 345 East 47th Street, New York, NY 10017-2392 (212) 705-7722.

<sup>11</sup>The document establishing these standard dimensions is *Aerospace Standard (AS) 568, published by SAE, 400 Commonwealth Drive, Warrendale, PA 15086 (412) 776-4970.*

<sup>12</sup>The document establishing these standard dimensions is *ISO 3601-1: 1988 (E), published by the International Organization for Standardization (ISO), 1 Rue de Varembe, Case Postale 58, CH 1 1211, Geneva, Switzerland (41-22-734-1240).*



## 3-A Sanitary Standards for Plastic Plug-type Valves for Milk and Milk Products, Number 52-01

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. Plastic plug-type valves specifications heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

### A SCOPE

- A1 These standards cover the sanitary aspects of plastic plug-type valves used on processing equipment for milk or milk products and on equipment and pipelines which hold or convey milk or milk products.
- A2 In order to conform with these 3-A Sanitary Standards, plastic plug-type valves shall comply with the following design, material, and fabrication criteria.

### B DEFINITIONS

- B1 *Product:* Shall mean milk and milk products.
- B2 **Surfaces**
  - B2.1 *Product Contact Surfaces:* Shall mean all surfaces which are exposed to the product and surfaces from which liquids may drain, drop, diffuse, or be drawn into the product.
  - B2.2 *Nonproduct Contact Surfaces:* Shall mean all other exposed surfaces.
- B3 **Cleaning**
  - B3.1 *Manual (COP) Cleaning:* Shall mean soil removal when the equipment is partially or totally disassembled. Soil removal is effected with chemical solutions and water rinses with the assistance of one or a combination of brushes, nonmetallic scouring pads and scrapers, high or low pressure hoses and tank(s) which may be fitted with recirculating pump(s), and with all cleaning aids manipulated by hand.

### C MATERIALS

- C1 Product contact surfaces shall be of plastic material conforming with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20, and shall be of such composition to retain their surface and conformation characteristics when exposed to conditions encountered in the environment of intended use and in cleaning and bactericidal treatment.
- C2 Rubber and rubber-like materials may be used for O-rings and parts having the same functional purposes.
  - C2.1 Rubber and rubber-like materials, when used for the above specified application(s), shall conform 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.
- C3 All nonproduct contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All nonproduct contact surfaces shall be relatively nonabsorbent, durable, and cleanable. Parts removable for cleaning having both product contact and nonproduct contact surfaces shall not be painted.

- D FABRICATION**
- D1 Surface Finish**
- D1.1 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 E.)
- D2 Cleaning and Inspectibility**
- D2.1 Product contact surfaces shall be easily accessible for manual cleaning and inspection either when in an assembled position or when removed. Removable parts shall be readily demountable.
- D3 Inlet and Outlet Connections**
- D3.1 All sanitary inlet and outlet connections shall conform with those applicable fabrication provisions of 3-A Sanitary Standards for Fittings for Milk and Milk Products, Number 63-.
- D4 Mating Surfaces**
- D4.1 The mating surfaces between the valve plug and the valve body shall be continuously tapered.
- D5 Draining**
- D5.1 Product contact surfaces shall be self-draining when properly installed.
- D6 Radii**
- D6.1 All internal angles of less than 135° on product contact surfaces shall have radii of not less than 1/8 in. (3.18 mm), except that:
- D6.1.1 Smaller radii may be used when they are required for essential functional reasons, such as those in O-ring grooves. In no case shall such radii be less than 1/32 in. (0.794 mm).
- D6.2 The radii in grooves for standard 1/4 in. (6.35 mm) O-rings shall not be less than 3/32 in. (2.381 mm) and for standard 1/8 in. (3.18 mm) O-rings shall not be less than 1/32 in. (0.794 mm).
- D7 Threads**
- D7.1 There shall be no threads in contact with the product.
- D8 Nonproduct Contact Surfaces**
- D8.1 Nonproduct contact surfaces shall have a smooth finish, free of pockets and crevices, and be readily cleanable. Those surfaces to be coated shall be effectively prepared for coating.
- D9 Powered Valve Actuators**
- D9.1 Valves with powered actuators shall have an open space of at least 1 in. (25.4 mm), clear for inspection, between the actuator and the valve.
- D9.2 Powered actuators shall be readily demountable from the valve and stem.

#### APPENDIX

- E 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 D1 herein. A maximum  $R_a$  of 32  $\mu\text{m}$ . (0.80  $\mu\text{m}$ ), when measured according to the recommendations in American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)' B46.1 -*Surface Texture*, is considered to be equivalent to a No. 4 finish.

*<sup>1</sup>Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2392 (212) 705-7722.*

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**These standards shall become effective November 23, 1996, at which time 3-A Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Milk Products, Number 52-00 (Thermoplastic Plug Type Valves) are rescinded and become null and void.**

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## 3-A Sanitary Standards for Shear Mixers, Mixers, and Agitators, Number 73-00

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. Agitators, mixers and shear mixers specifications heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. NOTE: Use current revisions or editions of all referenced documents cited herein.

### A SCOPE

- A1 These standards cover the sanitary aspects of agitators, mixers and shear mixers used for combining and/or mixing, either liquids or liquids with solid products. Specifically included are batch mixers immersed into the product. Shear mixers, mixers, and agitators may be of the top, side or bottom entry types. These standards do not include the vessel in which the agitator, mixer or shear mixer is used.
- A2 In order to conform with these 3-A Sanitary Standards, shear mixers, mixers, and agitators shall comply with the following design, material, and fabrication criteria.

### B DEFINITIONS

- B1 *Product*: Shall mean milk and milk products with or without other edible nondairy ingredients.
- B2 *Shear Mixers, Mixers, and Agitators (hereinafter referred to as Mixing Device)*: Shall mean equipment which blends, disperses, emulsifies, hydrates, dissolves, mixes or agitates in some form by immersion into the product. The mixing device's head components may consist of mixing impellers, rotors, stators, propellers, serrated disks, or a combination thereof.
- B3 *Readily or Easily Removable*: Shall mean quickly separated from the equipment with the use of simple hand tools.
- B4 *Simple Hand Tools*: Shall mean implements normally used by operating and cleaning personnel such as a screwdriver, wrench or hammer.

### B5 Surfaces

- B5.1 *Product Contact Surfaces*: Shall mean all surfaces which are exposed to the product and surfaces from which liquids may drain, drop, diffuse or be drawn into the product.
- B5.2 *Nonproduct Contact Surfaces*: Shall mean all other exposed surfaces.

### B6 Cleaning

- B6.1 *Mechanical Cleaning or Mechanically Cleaned*: Shall mean soil removal by impingement, circulation or flowing chemical detergent solutions and water rinses onto and over the surfaces to be cleaned by mechanical means in equipment or systems specifically designed for this purpose.
- B6.2 *Manual (COP) Cleaning*: Shall mean soil removal when the equipment is partially or totally disassembled. Soil removal is effected with chemical solutions and water rinses with the assistance of one or a combination of brushes, nonmetallic scouring pads and scrapers, high or low pressure hoses and tank(s) which may be fitted with recirculating pump(s), and with all cleaning aids manipulated by hand.

### B7 Surface Modification<sup>1</sup>

- B7.1 *Surface Treatments*: Shall mean a process whereby chemical compositions or mechanical properties of the existing surface are altered. There is no appreciable, typically less than 1  $\mu\text{m}$ , build-up of new material or removal of existing material.

**B7.1.1 Surface treatments include:**

1. Mechanical (polishing)
2. Electropolishing

**C MATERIALS**

**C1 Metals**

**C1.1** Product contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series<sup>2</sup> or corresponding Alloy Cast Institute (ACI) types<sup>3</sup> (See Appendix, Section E), or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent, except that:

**C2 Nonmetals**

**C2.1** Rubber and rubber-like materials may be used for drip shields, gaskets, O-rings, scrapers, seals, and parts having the same functional purposes.

**C2.1.1** Rubber and rubber-like materials when used for the above specified application(s) shall conform 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.

**C2.2** Plastic materials may be used for bearings, drip shields, gaskets, O-rings, scrapers, seals, and parts having the same functional purposes.

**C2.2.1** Plastic materials when used for the above specified application(s) shall conform with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20.

**C2.3** Rubber and rubber-like materials and plastic materials having product contact surfaces shall be of such composition as to retain their surface and conformational characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

**C2.4** The final bond and residual adhesive, if used, on bonded rubber and rubber-like materials and bonded plastic materials shall be nontoxic.<sup>4</sup>

**C2.5** Where materials having certain inherent functional purposes are required for specific applications, such as bearings, seals and bushings, carbon, and/or ceramic materials may be used. Carbon and/or ceramic materials shall be inert, nonporous, nontoxic, nonabsorbent, insoluble, resistant to scratching, scoring, and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

**C3** In a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher, all materials having product contact

surface(s) used in the construction of mixing devices and nonmetallic component parts shall be such that they can be (1) sterilized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250°F (121°C) and (2) operated at the temperature required for processing.

**C4 Nonproduct Contact Surfaces**

**C4.1** All nonproduct contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All nonproduct contact surfaces shall be relatively nonabsorbent, durable, and cleanable. Parts removable for cleaning having both product contact and nonproduct contact surfaces shall not be painted.

**D FABRICATION**

**D1 Surface Texture**

**D1.1** 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 F.)

**D2 Permanent Joints**

**D2.1** All permanent joints in metallic product contact surfaces shall be continuously welded, except that:

**D2.1.1** In such cases where welding is impractical, press-fitting or shrink-fitting may be employed where necessary for essential functional reasons such as bushings, pins, and bearings. (See Appendix, Section G.)

**D2.2** Welding, press-fitting, and shrink-fitting shall produce product contact surfaces which are at least as smooth as a No. 4 ground finish on stainless steel sheets and which are free of imperfections such as pits, folds and crevices. (See Appendix, Section F.)

**D3 Bonded Materials**

**D3.1** Bonded rubber and rubber-like materials and bonded plastic materials having product contact surfaces shall be bonded in a manner that the bond is continuous and mechanically sound so that when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization, the rubber and rubber-like material or the plastic material does not separate from the base material to which it is bonded.

**D4 Cleaning and Inspectibility**

**D4.1** Mixing devices that are to be mechanically cleaned shall be designed so that the product contact surfaces of open ring-type bottom



- support guides, mixing device heads, shafts, and all nonremoved appurtenances thereto can be mechanically cleaned and are easily accessible and readily removable for inspection.
- D4.1.1 Mixing devices that are to be mechanically cleaned shall be designed so that the product contact surfaces of open ring-type bottom support guides can be mechanically cleaned and are easily accessible.
- D4.2 Product contact surfaces not designed to be mechanically cleaned shall be easily accessible for cleaning and inspection either when in an installed position or when removed. De-mountable parts shall be readily removable.
- D4.2.1 Slip joints on shafts which are located in product contact areas shall be manually cleaned.
- D4.2.2 Bearing cavities in bottom support guides of shafts shall be manually cleaned or shall be designed for mechanical cleaning.
- D5 Gaskets**
- D5.1 Gaskets having a product contact surface shall be removable or bonded.
- D5.2 Grooves in gaskets or gasket retaining grooves in product contact surfaces for removable gaskets shall not exceed 1/4 in. (6.35 mm) in depth or be less than 1/4 in. (6.35 mm) wide except those for standard O-rings smaller than 1/4 in. (6.35 mm.)
- D6 Radii**
- D6.1 All internal angles of less than 135° on product contact surfaces, shall have radii of not less than 1/4 in. (6.35 mm) except that:
- D6.1.1 Smaller radii may be used when they are required for essential functional reasons, such as those in stator components, rotor, rotor blades, serrated disks, stator openings, seal welding and seal components. In no case shall such radii be less than 1/32 in. (0.794 mm).
- D6.1.2 No radii is required at the junctures of shrink or press fit joints and flat sealing surfaces due to the inherent nature of these joining methods.
- D6.1.3 The radii in grooves in gaskets or gasket retaining grooves, shall be not less than 1/8 in. (3.18 mm) except those for standard 1/4 in. (6.35 mm) and smaller O-rings.
- D6.1.4 The radii in grooves for standard 1/4 in. (6.35 mm) O-rings shall not be less than 3/32 in. (2.38 mm) and for standard 1/8 in. (3.18 mm) O-rings shall be not less than 1/32 in. (0.794 mm).
- D6.1.5 The minimum radii for fillets of welds in product contact surfaces shall be not less than 1/4 in. (6.35 mm) except that the minimum radii for such welds may be 1/8 in. (3.18 mm) when the thickness of one or both parts joined is less than 3/16 in. (4.76 mm).
- D7 Threads**
- D7.1 There shall be no exposed threads on product contact surfaces except where necessary for attaching the mixing device head.
- D7.1.1 In such case(s) the exposed threads shall conform with the drawing, Fig. (1), known as the "Brass Valve Stem Thread." The thread angle shall be not less than 60° and with not more than 8 threads to the inch (25.4 mm), nor less than 5/8 in. (15.88 mm) major basic diameter. The length of the nut shall not exceed three-quarters of the basic thread diameter. The nut shall be of the open type. Equipment with exposed threads as described above shall be designed for manual cleaning. (See Appendix, Section H.)
- D7.1.2 Equipment with enclosed threads shall be designed for mechanical cleaning. The threads shall be sealed from the product by O-rings, gaskets, or other similar seals. Thread specifications are designated by the manufacturer. The rotor or impeller locking nut shall be the enclosed type.
- D8 Perforated Screens or Plates**
- D8.1 Perforations in product contact surfaces shall be readily accessible for cleaning and inspection. Perforations shall be not less than 0.012 in. (0.3048 mm) in diameter. Slots shall be at least 0.006 in. (0.1524 mm) wide and at least 0.020 in. (0.508 mm) long. All perforations shall be free of burrs.
- D9 Sterilization Systems**
- D9.1 Mixing devices used in a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher shall comply with the following additional criteria:
- D9.2 The construction shall be such that all product contact surfaces can be (1) sterilized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250°F (121°C) and (2) operated at the temperature required for processing.
- D9.3 Mixing devices that have a product contact surface(s) to be used in such a processing system, not designed so that the system is automatically shut down if the product pressure in the system becomes less than that of the atmosphere and cannot be restarted until the system is re-sterilized, shall have a

steam or other sterilizing medium chamber surrounding the product contact surface. The mixing device shall be constructed so that the steam chamber or other sterilizing medium chamber may be exposed for inspection.

D9.4 The seal(s) in a mixing device designed to be used in a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher shall be between the product contact surface and the steam or other sterilizing chamber.

#### D10 Shafts and Bearings

D10.1 Where a shaft passes through a product contact surface, the portion of the opening surrounding the shaft shall be protected to prevent the entrance of contaminants.

D10.2 Bearings having a product contact surface shall be of a nonlubricated type.

D10.3 Lubricated bearings, including the permanent sealed type, shall be located outside the product contact surface with at least 1 in. (25.4 mm) clearance open for inspection between the bearing and any product contact surface.

#### D11 Mixing Device Supports

D11.1 The mixing device shall be supported by a bridge, pedestal or other suitable structure which separates the drive of the mixing device at least 4 in. (101.6 mm) from the opening of the vessel, to allow sufficient space between the drive and vessel for inspection and cleaning. Where umbrella shields are used above the vessel cover to shield the shaft opening, the drive of the mixing device shall be at least 2 in. (50.80 mm) above the shield to allow for inspection and cleaning.

D11.2 Shaft openings through a bridge or support shall have a minimum diameter of 1 in. (25.4 mm) on mixing devices which require removal of the shaft for cleaning, or be of a diameter that will provide a 1 in. (25.4 mm) minimum annular cleaning space between the agitator shaft and the inside surface of the flanged opening on mixing devices which do not require removal for the cleaning. Shielding shall be provided which effectively protects against the entrance of dust, oil, insects, and other contaminants through the annular space around the shaft. Any product contact surfaces on the shielding shall be readily accessible for inspection

D11.3 The mixing device shall be readily cleanable and shall be one of the following types:

D11.3.1 Top-entering nonremovable type mixing devices shall have at least a 1/2 in. (12.70 mm) space between the nonremovable mixing device and the bottom of the vessel unless the mixing device is mounted on a hinged-type cover.

D11.3.2 The top-entering removable or demountable type mixing devices shall be provided with an easily accessible, readily demountable coupling of either a sanitary type located within the vessel or a coupling located outside the vessel provided that it is above the shield provided to protect the annular space around the shaft. All product contact surfaces of the mixing device shall be visible, when the mixing device is removed.

D11.3.3 The side or bottom-entering type mixing device and shaft and those mixing device shafts designed to connect to drive mechanisms located outside of a processing area, including the complete seal, shall be readily demountable for cleaning. Nonremovable parts having product contact surfaces shall be designed so that the product contact surfaces are mechanically cleanable. Seals for the mixing device shaft shall be of a packless type, sanitary in design, with all parts readily accessible for cleaning.

D11.3.4 Nonremovable parts of mixing device shafts designed to connect to drive mechanisms located outside of a processing area, including the complete seal, shall be designed so that the product contact surfaces are mechanically cleanable and readily accessible for inspection.

D11.4 A sanitary seal, if provided, shall be of the packless type such that (1) all product contact surfaces can be mechanically cleaned and (2) the seal assembly is easily accessible and readily demountable for inspection, or (3) be such that the seal may be readily disassembled for manual cleaning and inspection.

#### D12 Nonproduct Contact Surfaces

D12.1 Nonproduct contact surfaces shall have a smooth finish, free of pockets and crevices, and be readily cleanable and those surfaces to be coated shall be effectively prepared for coating.

#### D13 Information Plate

D13.1 The mixing device shall have an information plate in juxtaposition to the name plate giving the following information or the information shall appear on the name plate: "This mixing device is designed for mechanical cleaning" or "This mixing device is designed for manual cleaning only."

- D13.2 The information plate shall also provide the following information: "This mixing device **(insert one of the following)** designed for steam sterilization." (a) is (b) is not
- D13.3 All identification or information plates affixed to a mixing device shall be attached to the exterior of the mixing device in such a way as to be effectively sealed.

## APPENDIX

### E STAINLESS STEEL MATERIALS

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of Section C1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C1 sets forth the chemical ranges and limits of acceptable stainless steel of the 300 Series. Cast grades of stainless steel corresponding to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. The chemical compositions of these cast grades are covered by ASTM specifications<sup>5</sup> A351/A351M, A743/A743M and A744/A744M.

### F 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 D1 herein. A maximum  $R_a$  of 32  $\mu\text{m}$ . (0.80  $\mu\text{m}$ ), when measured according to the recommendations in American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)<sup>6</sup> B46.1 - *Surface Texture*, is considered to be equivalent to a No. 4 finish.

### G PRESS-FITS AND SHRINK-FITS

Press-fits or shrink-fits may be used to produce crevice free permanent joints in metallic product contact surfaces when welding is not practical. Joints of these types may only be used to assemble parts having circular cross sections, free of shoulders or relieved areas. For example: they may be used to assemble round pins or round bushings into round holes. In both types of fits, the outside diameter of the part being inserted is greater than the inside diameter of the hole. In the case of the press-fit the parts are forced together by applying pressure. The pressure required is dependent upon the diameter of the parts, the amount of interference and the distance the inner member is forced in.

In shrink-fits, the diameter of the inner member is reduced by chilling it to a low temperature. Dry ice is commonly used to shrink the inner member. Heat may also be applied to the outer member of the press-fit. Less assembly force is required for this type of fit.

The design of these fits depends on a variety of factors. The designer should follow recommended practices to assure that a crevice-free joint is produced. A recognized authoritative reference is *Machinery's Handbook* published by Industrial Press Inc., 200 Madison Avenue, New York, NY 10157.

### H ENGINEERING DESIGN AND TECHNICAL CONSTRUCTION FILE

The following is an example of an engineering design and technical construction file (EDTCF) to be maintained by the fabricator as evidence of complying with 3-A Sanitary Standards or 3-A Accepted Practices. (The file may contain more or less information as applicable to the equipment or system.)

#### H1 Purpose

- H1.1 To establish and document the material, fabrication, and installation (where appropriate) requirements for the engineering design and technical construction files for all products, assemblies, and sub-assemblies supplied by the manufacturer thereof to be in compliance with the sanitary criteria found in 3-A Sanitary Standards or 3-A Accepted Practices. It is recommended that the engineering and construction file or files be submitted with applications for 3-A Symbol use authorization.

#### H2 Scope

- H2.1 This EDTCF applies to equipment specified by:  
H2.1.1 3-A Sanitary Standards for Shear Mixers, Mixers, and Agitators, Number 73-.

#### H3 Responsibilities

- H3.1 This EDTCF is maintained by: The Engineering Manager (or other company official) **{name and title of responsible official}** is responsible for maintaining, publishing, and distributing this EDTCF.
- H3.2 Implementation: All divisions, specifically development engineering, standards engineering, sales engineering, and product departments are responsible for implementing this EDTCF.

#### H4 Applicability

- H4.1 The 3-A Sanitary Standards and 3-A Accepted Practices are voluntarily applied as suitable sanitary criteria for dairy and food processing equipment. 3-A Sanitary Standards are refer-

enced in the Grade A Pasteurized Milk Ordinance: "Equipment manufactured in conformity with 3-A Sanitary Standards complies with the sanitary design and construction standards of this Ordinance."

## H5 References

H5.1 List any additional regulations that apply to the equipment or system covered by this EDTCF.

H5.2 Date of conformity or 3-A Symbol Authorization and certificate number, if authorized.

## H6 Design and Technical Construction File

H6.1 The Engineering Design and Technical Construction File may consist of the following:

- a. an overall drawing of the subject equipment;
- b. full detailed drawings, accompanied by any calculations, notes, test results, etc. required to check the conformity of the equipment with the 3-A Standards;
- c. a list of:
  - (1) the essential requirements of the standards;
  - (2) other technical specifications, which were used when the equipment was designed;
- d. a description of methods adopted;
- e. if essential, any technical report or certificate obtained from a competent testing body or laboratory;
- f. any technical report giving the results of tests carried out internally by Engineering or others;
- g. documentation and test reports on any research or tests on components, assemblies and/or the complete product to determine and demonstrate that by its design and construction the product is capable of being installed, put into service, and operated in a sanitary manner (optional);
- h. a determination of the foreseeable lifetime of the product (optional);
- i. a copy of the instructions for the product (Instruction Manuals/Instruction Books);
- j. for serial manufacturing, the internal measures that will be implemented to insure that the equipment will continue to be manufactured in conformity with the provisions of the 3-A Sanitary Standards;
- k. engineering reports;
- l. laboratory reports;
- m. bills of material;
- n. wiring diagrams, if applicable;
- o. sales order engineering files;

- p. hazard evaluation committee reports, if executed;
- q. change records;
- r. customer specifications;
- s. any notified body technical reports and certification tests;
- t. copy of the 3-A Symbol authorization, if applicable.

H6.2 The file does not have to include detailed plans or any other specific information regarding the sub-assemblies, tooling, or fixtures used for the manufacture of the product unless a knowledge of them is essential for verification of conformity with the basic sanitary requirements found in 3-A documents.

H6.3 The documentation referred to in H6.1 above need not permanently exist in a material manner in the EDTCF, but it must be possible to assemble them and make them available within a period of time commensurate with its importance (one week is considered reasonable time). As a minimum, each product EDTCF must physically contain an index of the applicable document of H6.1 above.

H6.4 The EDTCF may be in hard copy or software form.

## H7 Confidentiality

H7.1 The EDTCF is the property of the manufacturer and is shown at their discretion, except that all or part of this file will be available to the 3-A Symbol Council or a regulatory agency for cause and upon request.

## H8 File Location

H8.1 The EDTCF shall be maintained at {location}.

## H9 File Retention

H9.1 The EDTCF (including all documentation referred to in H6.1) shall be retained and kept available for 12 years following the date of placing the product in use or from the last unit produced in the case of series manufacture.

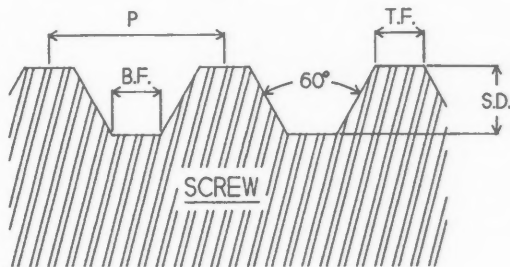
## I DIAGRAMS

These diagrams are intended to demonstrate general principles only, and are not intended to limit individual ingenuity. The design used should conform with the sanitary requirements set forth in these 3-A Sanitary Standards. The following example is included in this Appendix:



11 American Standard Stub Acme Thread

**AMERICAN STUB ACME THREAD**



P = PITCH	$P = 1/T.P.I.$
S.D. = SINGLE DEPTH	$S.D. = 0.433 \times P$
T.F. = TOP FLAT	$T.F. = 0.250 \times P$
B.F. = BOTTOM FLAT	$B.F. = 0.227 \times P$
T.P.I. = THREADS PER INCH	

<sup>1</sup>Additional information on surface modification is contained in *Advanced Materials and Processes, Volume 137(1)*, January 1990; "Coatings and Coating Practices" by H. Herman, p. 59; "Surface Modification" by F. A. Smidt, p. 61. ASM International, Materials Park, OH 44073 (216) 338-5151.

<sup>2</sup>The data for this series are contained in the *AISI Steel Products Manual, Stainless & Heat Resisting Steels*, November 1990, Table 2-1, pp. 17-20. Available from the American Iron and Steel Society, 410 Commonwealth Drive, Warrendale, PA 15086 (412) 776-1535.

<sup>3</sup>Steel Founders Society of America, Cast Metal Federation Building, 455 State Street, Des Plaines, IL 60016 (708) 299-9160.

<sup>4</sup>Adhesives shall comply with 21 CFR 175 - Indirect Food Additives: Adhesives and Components of Coatings. Document for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 783-3238.

<sup>5</sup>Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 (610) 832-9500.

<sup>6</sup>Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2392 (212) 705-7722.

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These standards are effective November 24, 1996.

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## 3-A Sanitary Standards for Belt-Type Feeders, Number 75-00

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. Belt-type feeder specifications heretofore or hereafter developed which so differ in design, material, construction or otherwise, as not to conform to the following standards but which, in the manufacturer's or fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time. **NOTE:** Use current revisions or editions of all referenced documents cited herein.

### A SCOPE

- A1 These standards cover the sanitary aspects of continuous one-piece belt-type feeders, beginning at the point(s) where ingredient(s) or product(s) enters the feeder and ending at the point(s) where ingredient(s) is discharged from the feeder.
- A2 In order to conform with these 3-A Sanitary Standards, continuous one-piece belt-type feeders shall comply with the following design, material, and fabrication criteria.

### B DEFINITIONS

- B1 *Product:* Shall mean milk products or other food ingredients.
- B2 *Continuous One-Piece Belt-Type Feeders:* Shall mean equipment in which a belt(s) is used to feed or meter products and may include integral mechanisms to assist or maintain flow of product.
- B3 **Surfaces**
- B3.1 *Product Contact Surfaces:* Shall mean all surfaces which are exposed to the product and surfaces from which liquids or materials may drain, drop, or be drawn into the product.
- B3.2 *Nonproduct Contact Surfaces:* Shall mean all other exposed surfaces.

### B4 Cleaning

- B4.1 *Mechanical Cleaning or Mechanically Cleaned:* Shall mean soil removal by impingement, circulation, or flowing chemical deter-

gent solutions and water rinses onto and over the surfaces to be cleaned by

- B4.2 *Manual Cleaning:* Shall mean soil removal when the equipment is partially or totally disassembled. Soil removal is effected with chemical solutions and water rinses with the assistance of one or a combination of brushes, nonmetallic scouring pads and scrapers, high or low pressure hoses and tank(s) which may be fitted with recirculating pump(s), and with all cleaning aids manipulated by hand.

### B5 Surface Modification<sup>1</sup>

- B5.1 *Surface Treatments:* Shall mean a process whereby chemical compositions or mechanical properties of the existing surface are altered. There is no appreciable, typically less than 1  $\mu\text{m}$ , build-up of new material or removal of existing material.
- B5.1.1 Surface treatments include: (Select appropriate treatment(s))
1. Mechanical (shot peening<sup>2</sup> glass beading, polishing)
  2. Electropolishing
- B5.2 *Coatings:* Shall mean the results of a process where a different material is deposited to create a new surface. There is appreciable, typically more than 1  $\mu\text{m}$ , build-up of new material.
- B5.2.1 Coating processes include:
1. Chemical (conversion coatings)
  2. Electrodeposition<sup>3</sup>
  3. Spraying (pneumatic, flame, plasma, arc spray)

- B6 *Readily or Easily Removable*: Shall mean quickly separated from the equipment with the use of simple hand tools.
- B7 *Simple Hand Tools*: Shall mean implements normally used by operating and cleaning personnel such as a screwdriver, wrench or hammer.
- B8 *Nontoxic Materials*: Shall mean those substances which under the conditions of their use are in compliance with applicable requirements of the Food, Drug and Cosmetic Act of 1938, as amended.
- B9 *Corrosion Resistant*: Shall mean the surface has the property to maintain its original surface characteristics for its predicted service period when exposed to the conditions encountered in the environment of intended use including expected contact with product and cleaning, sanitizing or sterilization compounds or solutions.
- B10 *Pulleys*: Shall mean devices used to drive and return the belt.
- B11 *Rollers*: Shall mean devices used to support and guide the belt.
- C MATERIALS**
- C1 Metals**
- C1.1 Product contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series<sup>4</sup> or corresponding Alloy Cast Institute (ACI) types<sup>5</sup> (See Appendix, Section E), or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent.
- C1.2 Feeder frame, pulleys, weigh bridge components, and scrapers made of the materials provided for in C1.1 may have their product contact surfaces modified by surface treatment or coating(s).
- C2 Nonmetals**
- C2.1 Rubber and rubber-like materials may be used for inlet chutes, belts, skirts, wipers, rollers, pulleys, coverings for rollers and pulleys, gaskets, O-rings, seals, load cell protection, boots, flexible connectors, and parts having the same functional purposes.
- C2.1.1 Rubber and rubber-like materials, when used for the above specified application(s), shall conform 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.
- C2.2 Plastic materials may be used for or as a coating for covers, product guards, bushings, rollers, pulleys, wear strips, hopper inlet chutes, flexible connectors, skirts, wipers, belts, load cell protection, boots, O-rings, gaskets, seals, view ports, fasteners, handles, and parts having the same functional purposes.
- C2.2.1 Plastic materials, when used for the above specified application(s), shall conform with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20.
- C2.3 Rubber, rubber-like, and plastic materials having product contact surfaces shall be of such composition as to retain their surface and conformational characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment.
- C2.4 The final bond and residual adhesive, if used, on bonded rubber and rubber-like materials and bonded plastic materials shall be nontoxic.<sup>6</sup>
- C2.5 In the case of dry ingredients, cotton, linen, silk, wool or synthetic fibers may be used for flexible connections, dust socks, filters, and similar applications. These materials shall be non-shedding, non-toxic, relatively insoluble, easily cleanable, and shall not impart a flavor to the product.
- C3 Nonproduct Contact Surfaces**
- C3.1 All nonproduct contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All nonproduct contact surfaces shall be relatively nonabsorbent, durable, and cleanable. Parts removable for cleaning having both product contact and nonproduct contact surfaces shall not be painted.
- D FABRICATION**
- D1 Surface Texture**
- D1.1 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 except for materials provided for in C2.5 (See Appendix, Section F).
- D2 Permanent Joints**
- D2.1 All permanent joints in metallic product contact surfaces shall be continuously welded. Welded areas on product contact surfaces shall be 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 when in the final fabricated form except that:
- D2.1.1 In such cases where welding is impractical, such as bearings, bearing housings and bushings, press-fitting or shrink-fitting may be employed where necessary for essential functional reasons.
  - D2.1.2 Welding, press-fitting, and shrink-fittings shall produce product contact surfaces which are at least as smooth as a No. 4 ground finish on stainless steel sheets and which are free of imperfections such as pits, folds and crevices. See Appendix, Section G for press-fitting and shrink-fitting restrictions and limitations.
- D3 Bonded rubber and rubber-like materials and bonded plastic materials having product contact surfaces shall be bonded in a manner that the bond is continuous and mechanically sound so that when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment the rubber and rubber-like material or the plastic material does not separate from the base material to which it is bonded.
- D4 Coatings**
- D4.1 Coatings, if used, shall be free from surface delamination, pitting, flaking, spalling, blistering and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment.
  - D4.2 The minimum thickness of electrodeposited coatings shall not be less than 0.0002 in. (0.005 mm) for all product contact surfaces when used on stainless steel. When these surfaces are other than stainless steel, the minimum thickness of electrodeposited coatings shall not be less than 0.002 in. (0.05 mm).
  - D4.3 Plastic, when used as a coating, shall be at least 0.005 in. (0.125 mm) thick.
- D5 Cleaning and Inspectibility**
- D5.1 Belt feeders that are to be mechanically cleaned shall be designed so that the product contact surfaces of the feeder and all nonremoved appurtenances thereto can be mechanically cleaned and are easily accessible and readily removable for inspection employing simple hand tools, if necessary, available to operating or cleaning personnel.
  - D5.1.1 If mechanically cleaned, all product contact surfaces of seals, gaskets and O-rings shall be exposed to the cleaning solution.
- D5.2 Product contact surfaces including belts, guards, and guides not designed to be mechanically cleaned shall be easily accessible for cleaning and inspection either when in an installed position or when removed. Dismountable parts shall be readily removable.
  - D5.3 Belt tensioning shall be easily released to permit cleaning of the underside of the belt or feeder.
- D6 Draining**
- D6.1 All product contact surfaces shall be self-draining except for normal clingage.
- D7 Instrument Connections and Fittings**
- D7.1 All instrument connections having product contact surfaces shall conform with the applicable provisions of the 3-A Sanitary Standards for Sensors and Sensor Fittings and Connections for Milk and Milk Products Equipment, Number 09.
  - D7.2 All sanitary fittings and connections shall conform with the applicable provisions of the 3-A Sanitary Standards for Fittings for Milk and Milk Products, Number 63.
- D8 Gaskets**
- D8.1 Gaskets having a product contact surface shall be removable or bonded.
  - D8.2 Grooves in gaskets shall be no deeper than their width unless the gasket is readily removable and reversible for cleaning.
  - D8.3 Gasket grooves or gasket retaining grooves in product contact surfaces for removable gaskets shall not exceed 1/4 in. (6.35 mm) in depth or be less than 1/4 in. (6.35 mm) wide except those for standard O-rings smaller than 1/4 in. (6.35 mm), except as provided for in Section D7.
- D9 Radii**
- D9.1 All internal angles of less than 135° on product contact surfaces, shall have radii of not less than 1/4 in. (6.35 mm) except that:
    - D9.1.1 Smaller radii may be used when they are required for essential functional reasons, such as shoulders for removable bearings and bushings. In no case shall such radii be less than 1/32 in. (0.794 mm), except that: the radius at the intersection of press- or shrink-fit parts and flat sealing surfaces is zero by the nature of the design and definition of this type of fabrication.
    - D9.1.2 The radii in gasket grooves, gasket retaining grooves, or grooves in gaskets, shall be not less than 1/16 in. (1.59 mm) except for those

- standard, 1/4 in. (6.35 mm) and smaller O-rings, and those provided for in Section D7.
- D9.1.3 The radii in grooves for standard 1/4 in. (6.35 mm) O-rings shall not be less than 3/32 in. (2.38 mm) and for standard 1/8 in. (3.18 mm) O-rings shall be not less than 1/32 in. (0.794 mm).
- D10 Threads**
- D10.1 There shall be no threads on product contact surfaces except where necessary for belt tensioning, weigh bridge, and load cell attachment.
- D10.1.1 In such case(s) the threads shall be ACME type as specified in the 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63- or the American Standard Stub Acme Thread (See Appendix, Section H). These threads shall conform with the drawing, Fig. (1), the "American Stub Acme Thread" (See Appendix, Section H). The threaded angles shall be not less than 60° and with not more than 8 threads to the inch (25.4 mm), nor less than 5/8 in. (15.88 mm) major basic diameter. The length of the nut shall not exceed 3/4 of the basic thread diameter. The nut shall be of the open type. Equipment components with exposed threads as described above shall be designed for manual cleaning.
- D10.1.2 Equipment with enclosed threads shall be designed for mechanical cleaning.
- D11 Springs**
- D11.1 Any coil spring having product contact surfaces shall have at least 3/32 in. (2.38 mm) openings between coils, including the ends when the spring is in the free position.
- D12 Shafts and Bearings**
- D12.1 Where a shaft passes through a product contact surface, the portion of the opening surrounding the shaft shall be protected to prevent the entrance of contaminants.
- D12.2 Bearings having a product contact surface shall be of a nonlubricated type.
- D12.3 Lubricated bearings, including the permanent sealed type, shall be located outside the product contact surface with at least 1 in. (25.4 mm) clearance open for inspection between the bearing and any product contact surface.
- D13 Belts and Components**
- D13.1 Belts shall be made of or covered with rubber or rubber-like or plastic material. Belts made having an absorbent core material shall have all surfaces sealed with the same material that is used for product contact surfaces.
- D13.2 The construction shall be such that belts, guides, product guards, rollers, and all other parts shall be easily removable for cleaning and inspection. The belt tension shall be easily released, without tools, to permit cleaning of the underside of the belt and belt supports.
- D13.3 Pulleys and rollers shall be solid or if hollow shall be permanently sealed.
- D14 Openings and Covers**
- D14.1 Belt feeders of an enclosed design shall have covers that are easily removable.
- D14.2 The covers may be gasketed.
- D14.3 Hinges shall be of sanitary design. Piano type hinges are not permitted.
- D14.4 Covers shall be pitched towards an outside edge and shall have a downward lip around the edges of at least 3/8 in. (9.52 mm).
- D14.5 Openings to which connections are not permanently attached shall be flanged upward at least 3/8 in. (9.52 mm).
- D15 Supports**
- D15.1 The means of supporting a belt feeder shall be one of the following:
- D15.2 If legs are used they shall be smooth with rounded ends or with a flat, load bearing foot suitable for sealing to the floor, and have no exposed threads. Legs made of hollow stock shall be sealed. Legs shall provide a minimum clearance between the lowest part of the base and the floor of not less than 4 in. (101.6 mm).
- D15.3 If casters are used they shall be of sufficient size to provide a clearance between the lowest part of the base and the floor of not less than 4 in. (101.6 mm). Casters, if provided, shall be easily cleanable, durable and of a size that will permit easy movement of the belt feeder.
- D16 Guards and Other Safety Devices**
- D16.1 Guards required by a safety standard that will not permit accessibility for cleaning and inspection shall be designed so that they are easily removable.
- D17 Nonproduct Contact Surfaces**
- D17.1 Nonproduct contact surfaces shall have a smooth finish, free of pockets and crevices, and be readily cleanable and those surfaces to be coated shall be effectively prepared for coating, except that:
- D17.2 Motor, drive train components, couplings, and bearings not in the product contact areas may have pockets or crevices.



**D18 Information Plate**

D18.1 original

D18.2 All identification or information plates affixed to a belt feeder shall be attached to the exterior of the feeding device in such a way as to be effectively sealed.

**APPENDIX**

**E STAINLESS STEEL MATERIALS**

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of Section C1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08 %. The first reference cited in C1 sets forth the chemical ranges and limits of acceptable stainless steel of the 300 Series. Cast grades of stainless steel corresponding to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. The chemical compositions of these cast grades are covered by ASTM specifications<sup>7</sup> A351/A351M, A743/A743M and A744/A744M.

**F 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 D1 herein. A maximum  $R_a$  of 32  $\mu\text{in}$ . (0.80  $\mu\text{m}$ ), when measured according to the recommendations in American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)<sup>8</sup> B46.1 - *Surface Texture*, is considered to be equivalent to a No. 4 finish.

**G PRESS-FITS AND SHRINK-FITS**

Press-fits or shrink-fits may be used to produce crevice-free permanent joints in metallic product contact surfaces when neither welding nor soldering is practical. Joints of these types may only be used to assemble parts having circular cross sections, free of shoulders or relieved areas. For example: they may be used

to assemble round pins or round bushings into round holes. In both types of fits, the outside diameter of the part being inserted is greater than the inside diameter of the hole. In the case of the press-fit the parts are forced together by applying pressure. The pressure required is dependent upon the diameter of the parts, the amount of interference and the distance the inner member is forced in.

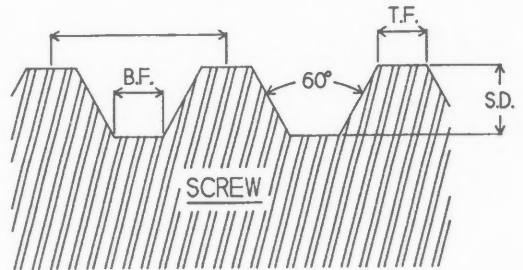
In shrink-fits, the diameter of the inner member is reduced by chilling it to a low temperature. Dry ice is commonly used to shrink the inner member. Heat may also be applied to the outer member of the press-fit. Less assembly force is required for this type of fit.

The design of these fits depends on a variety of factors. The designer should follow recommended practices to assure that a crevice-free joint is produced. A recognized authoritative reference is *Machinery's Handbook*, published by Industrial Press Inc., 200 Madison Avenue, New York, NY 10157.

**H DIAGRAMS**

**H1 American Standard Stub Acme Thread**

**AMERICAN STUB ACME THREAD**



T.P.I.	$P = 1/T.P.I.$
S.D. = SINGLE DEPTH	$S.D. = 0.433 \times P$
T.F. = TOP FLAT	$T.F. = 0.250 \times P$
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<sup>2</sup>MIL-S-13165C (1), November 1991, *Military Specification: Shot Peening of Metal Parts*. Available from Standardization, Document Order Desk (Department of Navy), 700 Robbins Avenue, Building 4, Section D, Philadelphia, PA 19111-5094 (215) 697-2179.

<sup>3</sup>Federal Specification #QQ-C-320B for Chromium Plating (Electrodeposited), June 1954 with Amendment 4 on April 10, 1987. Federal Specification #QQ-N-290A for Nickel Plating (Electrodeposited), November 12, 1971. Available from the General Services Administration, Federal Supply Services Bureau, Specification Section, 470 East L'Enfant Plaza, Suite 8100, Washington, D.C. 20407 (202) 755-0325.

<sup>4</sup>The data for this series are contained in the *AISI Steel Products Manual, Stainless & Heat Resisting Steels*, November 1990, Table 2-1, pp. 17-20. Available from the American Iron and Steel Society, 410 Commonwealth Drive, Warrendale, PA 15086 (412) 776-1535.

<sup>5</sup>Steel Founders Society of America, *Cast Metal Federation Building*, 455 State Street, Des Plaines, IL 60016 (708) 299-9160.

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These standards are effective November 24, 1996.

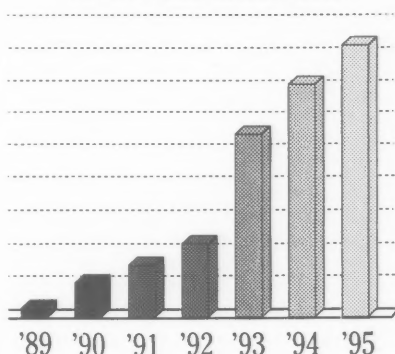
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# Coming Events

## DECEMBER

• **3-5, A Basic Concept for Food Protection: Learning the Seven HACCP Principles and Developing a HACCP Plan Workshop**, in Ithaca, NY. This course is designed to meet the educational requirements cited in both the FDA regulation requiring HACCP for seafoods (21CFR123) and the USDA rule on Pathogen Reduction and HACCP (9CFR304 et al). For further information, contact Dr. Robert B. Gravani, Department of Food Science, Cornell University, 11 Stocking Hall, Ithaca, NY 14853; phone (607) 255-1428 or (607) 255-3262; fax (607) 254-4868.

• **4-5, Fundamentals of Modified Atmosphere Packaging**, Seaside, CA. Sponsored by the Society of Manufacturing Engineers. The course will focus on the basics of dealing with the deterioration of minimally processed fresh foods and how to retard these changes through temperature control, sanitation, effective packaging, and alteration of the internal gas atmosphere. For additional information, contact SME at (313) 271-1500.

• **11-13, Pflug's Microbiology and Engineering of Sterilization Processes**, given in Minneapolis, MN. It is sponsored by the University of Minnesota's Department of Food Science and Nutrition. For further information, contact Ms. Ann Rath, 585 Shepherd Labs, 100 Union St. SE, University of Minnesota, Minneapolis, MN 55455; phone (612) 624-9840; fax (612) 624-0099.

## JANUARY 1997

• **14-15, Food Industry Conference**, in Costa Mesa, CA. Sponsored by Southern California Chapter of the

Institute of Food Technologists. The subject will be Emerging Issues in Food Science, Nutrition, and Technology. The registration fee is \$125 for 2 days and \$75 for 1 day. For conference registration and information, call Jill Golden at 714-432-5702.

## FEBRUARY

• **16-19, National Mastitis Council 36th Annual Meeting**, at the Hyatt Regency in Albuquerque, NM. The seminar is being jointly sponsored with the International Dairy Federation (IDF) A2 Group of Mastitis Experts. The objective of the meeting is to disseminate technical and applied information on udder health, mastitis management, milk quality and milk safety. For further information, contact Dr. Keith Sterner, Program Committee Chair, 2650 Ernest Rd., Ionia, MI 48846; phone (616) 527-3320; fax (616) 527-0277.

• **16-21, XV International Symposium of the World Association of Microbiologists, Immunologists and Specialists in Infectious Diseases (W.A.V.M.I.)**, will be held in Cyprus. The theme will be Salmonellosis - Brucellosis as World Health Problems for Humans and Animals. For additional information, contact K. Polydorou V.P.H. Institute, P.O. Box 284, Nicosia, Cyprus; Fax/Tel. (357-2-) 453121.

## MARCH

• **10-12, North American Food Safety Educational Workshop - Food Service and Food Retailers**, in College Park, MD. This conference is intended for professionals interested in food safety related to grocery stores, convenience stores, and food service establishments including com-

mercial, institutional, and military sectors. Emphasis will be given to challenges, barriers, and evaluation of training food service workers and the feasibility of applying HACCP to food service and retail. The cost of the workshop is \$150.00 before February 1, 1997. For further information, contact Lisa Gordon, North Carolina State University, phone (919) 515-2956; fax (919) 515-7124; e-mail lisa@unity.ncsu.edu.

• **18-21, Lipidex '97 Symposium & Tradefair**, in Antwerp, Belgium. This symposium programme is designed to be of benefit to a wide audience from the international oils and fats trade, with sessions that will appeal to traders, buyers and marketing executives, as well as those of interest to technical managers and delegates with operational responsibilities in production. For further information, contact Ms. Erika Vercauteren, The ANTWERP HILTON, Groenplaats, 2000 Antwerpen, Belgium, Telephone (+32) 3 204 8279; fax (+32) 3 204 8640.

## APRIL

• **8-9, Oregon Dairy Industries Annual Conference**, Eugene Hilton. For additional information, contact Lilly Smith, Oregon Dairy Industries, Food Science Dept., 100 Wiegand Hall, OSU, Corvallis, OR 97331-6602; phone (503) 745-5545; fax (503) 745-1018.

• **20-23, 48th Meeting of the Pacific Fisheries Technologists**, Astoria, OR. Topics will cover areas related to seafood processing, quality and safety. For more information, contact Michael Morrissey, fax (503) 325-2753; e-mail moorimic@ccmail.orst.edu

## MAY

• **3-8, The 26th National Conference on Interstate Milk Shipments**, at the Hyatt Regency, San Francisco Airport. For further information, contact Leon Townsend, NCIMS Executive Secretary, 110 Tecumseh Trail, Frankfort, KY 40601. Telephone and/or fax (502) 695-0253.

• **5-6, Symposium on Texture of Fermented Milk Products and Dairy Desserts**, in Vicenza, Italy. The objective of the seminar is the presentation and discussion of new information about the different factors affecting the texture of fermented milk and dairy desserts. Besides the key factors influencing the texture of products, an up-to-date will be given on the instrumental and sensory evaluation of texture. For further informa-

tion, contact Symposium Secretariat, Istituto Sperimentale Lattiero-Caseario, Dr. Roberto Giangiaco, Via A. Lombardo, 11, 20075 LODI-ITALY; phone +39-371-430990; fax +39-371-35579.

• **20-24, InterChinapack 97, International Exhibition for Packaging Machines and Processing Equipment**, will take place at the China International Exhibition Center in Beijing, China. The Düsseldorf Trade Fair Company is renowned as the organizer of interpack, the world's largest trade fair for packaging machinery and materials and confectionery machinery. For further information, contact Dusseldorf Trade Shows, New York, 70 West 36th St., Suite 605, New York, NY 10018; telephone (800) 232-3914; (212) 356-0407; fax (212) 356-0420.

## JULY

• **6-9, IAMFES Annual Meeting**, in Orlando, FL at the Hyatt Regency Grand Cypress Hotel. For additional information, call (800) 369-6337; (515) 276-3344; fax (515) 276-8655.

• **20-23, 9th Australian Food Microbiology Conference**, to be held in Sydney. All inquiries regarding submission of papers, registration, exhibition participation or sponsorship may be directed to the Conference Secretariat at GPO Box 2609, Sydney NSW 2001, phone (02) 241 1478; fax (02) 251 3552, e-mail: reply@icmsaust.com.au.

• **11-18, 17th International Workshop on Rapid Methods and Automation in Microbiology XVII**, in Manhattan, KS. A symposium will occur on July 11 and 12. Contact Daniel Y.C. Fung, telephone (913) 532-5654; fax (913) 532-5681; e-mail: DANFUNG@KSU.KSU.EDU.

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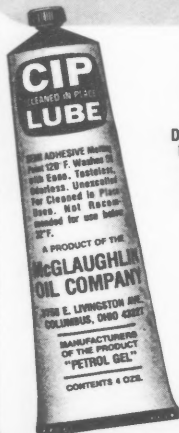
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## IAMFES Offers the Dairy Practices Council "Guidelines for the Dairy Industry"

IAMFES has agreed with the Dairy Practice Council to distribute their "Guidelines for the Dairy Industry." DPC is a non-profit organization of education, industry and regulatory personnel concerned with milk quality and sanitation throughout the United States. In addition, its membership and subscriber rosters list individuals and organizations throughout the United States, Canada and other parts of the world.

For the past 26 years, DPC's primary mission has been the development and distribution of educational guidelines directed to proper and improved sanitation practices in the production, processing, and distribution of high quality fluid milk and manufactured dairy products.

The DPC Guidelines are written by professionals who comprise five permanent Task Forces. Prior to distribution, every Guideline is submitted for approval to the State Regulatory Agencies in each of the member states which are now active participants in the DPC process. Should any official have an exception to a section of a proposed guideline, that exception is noted in the final document.

The Guidelines are renowned for their common sense and useful approach to proper and improved sanitation practices. We think that they will be a valuable addition to your professional reading library.

**The entire set consists of 54 guidelines including:**

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>1 Planning Dairy Freestall Barns</li> <li>2 Effective Installation, Cleaning and Sanitizing of Milking Systems</li> <li>3 Selected Personnel in Milk Sanitation</li> <li>4 Installation, Cleaning, &amp; Sanitizing of Large Parlor Milking Systems</li> <li>5 Directory of Dairy Farm Building &amp; Milking System Resource People</li> <li>7 Sampling Fluid Milk</li> <li>8 Good Manufacturing Practices for Dairy Processing Plants</li> <li>9 Fundamentals of Cleaning and Sanitizing Farm Milk Handling Equipment</li> <li>10 Fluid Milk Shelf-Life</li> <li>11 Sediment Testing and Producing Clean Milk</li> <li>13 Environmental Air Control &amp; Quality for Dairy Food Plants</li> <li>14 Clean Room Technology</li> <li>16 Handling Dairy Products From Processing to Consumption</li> <li>17 Causes of Added Water in Milk</li> <li>18 Fieldperson's Guide to Troubleshooting High Somatic Cell Counts</li> <li>21 Raw Milk Quality Tests</li> <li>22 Control of Antibacterial Drugs and Growth Inhibitors in Milk and Milk Products</li> <li>23 Preventing Rancid Flavors in Milk</li> <li>24 Troubleshooting High Bacteria Counts of Raw Milk</li> <li>25 Cleaning and Sanitizing Bulk Pickup and Transport Tankers</li> <li>28 Troubleshooting Residual Films on Dairy Farm Milk Handling Equipment</li> <li>29 Cleaning and Sanitizing in Fluid Milk Processing Plants</li> <li>30 Potable Water on Dairy Farms</li> <li>31 Composition and Nutritive Value of Dairy Products</li> <li>32 Fat Test Variations in Raw Milk</li> </ul> | <ul style="list-style-type: none"> <li>33 Brucellosis and Some Other Milkborne Diseases</li> <li>34 Butterfat Determinations of Various Dairy Products</li> <li>35 Dairy Plant Waste Management</li> <li>36 Dairy Farm Inspection</li> <li>37 Planning Dairy Stall Barns</li> <li>38 Preventing Off-flavors in Milk</li> <li>39 Grade A Fluid Milk Plant Inspection</li> <li>40 Controlling Fluid Milk Volume and Fat Losses</li> <li>41 Milkrooms and Bulk Tank Installation</li> <li>42 Stray Voltage on Dairy Farms</li> <li>43 Farm Tank Calibrating and Checking</li> <li>44 Troubleshooting Dairy Barn Ventilation Systems</li> <li>45 Gravity Flow Gutters for Manure Removal in Milking Barns</li> <li>46 Dairy Odor Control</li> <li>47 Naturally Ventilated Dairy Cattle Housing</li> <li>48 Cooling Milk on the Farm</li> <li>49 Postmilking Teat Dips</li> <li>50 Farm Bulk Milk Collection Procedures</li> <li>51 Controlling the Accuracy of Electronic Testing Instruments for Milk Components</li> <li>52 Emergency Action Plan for Outbreak of Milkborne Illness in the Northeast</li> <li>53 Vitamin Fortification of Fluid Milk Products</li> <li>54 Selection and Construction of Herringbone Milking Parlors</li> <li>56 Dairy Product Safety (Relating to Pathogenic Bacteria)</li> <li>57 Dairy Plant Sanitation</li> <li>58 Sizing Dairy Farm Water Heater Systems</li> <li>59 Production and Regulation of Quality Dairy Goat Milk</li> <li>60 Trouble Shooting Microbial Defects: Product Line Sampling &amp; Hygiene Monitoring</li> <li>63 Controlling the Quality &amp; Use of Dairy Product Rework</li> <li>65 Installing &amp; Operating Milk Precoolers Properly on Dairy Farms</li> </ul> |
|---|--|

If purchased individually, the entire set would cost \$219. We are offering the set, packaged in three loose leaf binders for \$125 plus \$9 shipping and handling (outside the U.S., \$21 for shipping and handling).

Information on how to receive new and updated Guidelines will be included with your order.

To purchase this important source of information, complete the order form below and mail or FAX (515-276-8655) to IAMFES.

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# This is Your Personal Invitation to Join

The International Association of Milk, Food and Environmental Sanitarians, founded in 1911, is a non-profit educational association of food protection professionals. The IAMFES is dedicated to the education and service of its members, specifically, as well as industry personnel in general. Through membership in the Association, IAMFES members are able to keep informed of the latest scientific, technical and practical developments in food protection. IAMFES provides its members with an information network and forum for professional improvement through its two scientific journals, educational annual meeting and interaction with other food safety professionals.

## Who are IAMFES Members?

The Association is comprised of a diverse membership of over 3,200 from 75 nations. IAMFES members belong to all facets of the food protection arena. The main groups of Association members fall into three categories: Industry Personnel, Government Officials and Academia.

## Why are They IAMFES Members?

The diversity of its membership indicates that IAMFES has something to offer everyone involved in food protection and public health.

## Your Benefits as an IAMFES Member

**Dairy, Food and Environmental Sanitation** — Published monthly, this is the official journal of IAMFES. Its purpose is the disseminating of current information of interest to the general IAMFES membership. Each issue contains three to five informational applied research or general interest articles, industry news and events, association news, columns on food safety and environmental hazards to health, a food and dairy industry related products section, and a calendar of upcoming meetings, seminars and workshops. All regular IAMFES members receive this publication as part of their membership.

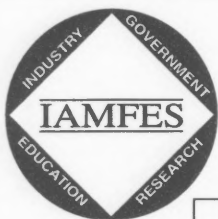
**Journal of Food Protection** — A refereed monthly publication of scientific research and authoritative review articles. Each issue contains 15 to 20 technical research manuscripts and one to five articles reporting a wide variety of microbiological research pertaining to food safety and quality. The *Journal of Food Protection* is internationally recognized as the leading publication in the food and dairy microbiology field. This journal is available to all individuals who request it with their membership.

**The IAMFES Annual Meeting** — Held in a different city each year, the IAMFES Annual Meeting is a unique educational event. Three days of technical sessions, scientific symposia and commercial exhibits provide members and other industry personnel with over 200 presentations on the most current topics in food protection. It offers the opportunity to discuss new technologies and innovations with leading authorities in various fields concerned with food safety. IAMFES members receive a substantially reduced registration fee.

## To Find Out More...

To learn more about IAMFES and the many other benefits and opportunities available to you as a member, please call (515) 276-3344 or (800) 369-6337; fax (515) 276-8655.

*"The mission of IAMFES is to provide food safety professionals worldwide with a forum to exchange information on protecting the food supply"*



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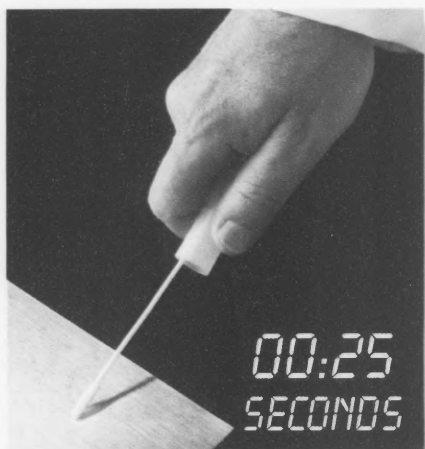
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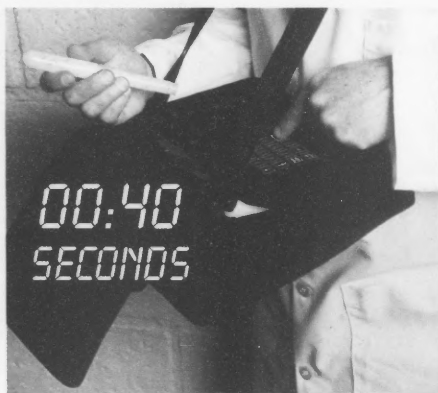




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