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Inspections, Compliance, Enforcement, and Criminal Investigations

Steam Generation in Canneries

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Following is a brief description of steam generating equipment and operations typically found in food canneries, and some points to consider in its evaluation. Small canneries are most frequently found with improper conditions and methods of operation, and this discussion is directed toward such small canneries, using batch-type retorts for cooking.

During an inspection of the boiler-room or power plant, one or more boilers may be observed to be operating. Two types of boilers may be found, fire-tube and water-tube boilers. Smaller boilers of the "packaged" boiler type are almost always fire-tube boilers, and in physical appearance are unusually long and relatively low. Such boilers are often referred to as "scotch-marine" or "marine" type boilers. Larger boilers which have been constructed in place are almost always water-tube boilers, and are usually nearly square and quite high, sometimes 4 or 5 stories in height.

It is desirable to determine the number of boilers, and the type, steam-generating capacity (or size), and method of firing for each. In some instances, a metal plate fixed to the boiler will give the nominal (rated) capacity, but many boiler manufacturers do not do this. In such cases, this information may be obtained from the fireman, boiler operator, power plant engineer or plant manager. The rated capacity may be given in either of two terms; horse power (hp) or pounds of steam per hour. In small plants, horse power is the most accepted and understood term. If boiler capacity is given in pounds of steam per hour (or simply pounds of steam), it may be approximately converted to equivalent number of hp by dividing by 34.5.

The rated or nominal capacity of a boiler is not an absolute measure of the amount of steam that can be generated. All properly maintained and properly fired boilers are capable of generating more steam than their rated or nominal capacity. Fire-tube boilers are customarily operated at from 135 to 150% of rated capacity, while water-tube boilers are customarily operated at from 150 to 200% rated capacity. An improperly fired boiler, or one whose tubes are heavily encrusted with scale, may not be able to generate steam at even its rated capacity. The Inspector is not expected to determine this, but only the available installed capacity.

Operation of boilers to maintain the desired pressure in the main steam line (header) in the boiler room is customarily done by either of two methods: use of modulating burners; or on-off operation of a boiler. Modulating control, either manual or automatic, is usually limited to larger installations. Small plants usually operate by on-off operation of one boiler; if more boilers are used, the others are usually fired at a fixed rate. All boiler rooms will have a large pressure gauge on the main header. This gauge should be watched for a period of time to determine the high and low pressures routinely attained. The variation in pressure will usually be small for modulated firing, but may be quite large for on-off operation of a boiler. Most larger power plants maintain log book or recording charts, which will indicate out-of-service periods for boilers.

Since a minimum pressure of 90 psi at the retort is strongly recommended for proper venting by recognized authorities \1\, \2\, \3\, any canning operation involving retorting where steam is generated at less than 90 psi must be carefully scrutinized. Wide variations in steam pressure due to on-off operation of a boiler may cause serious

deficiencies in the retorting operation, if spring-loaded pressure reducing valves are used at the retorts. This point will be discussed in a later issuance.

The final step in inspection of the steam supply involves estimates of the purity of the steam. Impurities in the steam supply are very undesirable for those canning operations wherein the live steam comes in contact with the food being processed, and somewhat less serious, may cause loss of brightness of the cans during retorting. Two possible sources for such impurities should be investigated; boiler feed water treatment, and corrosion control for condensate.

If raw or partially-treated water (such as city water) is introduced into the boilers with no chemical addition, or if an ion-exchange process is the only boiler feed water treatment, then no problems should result. If a chemical treatment is used, determine the chemicals used and the amount, and if recommendations of a water treatment service or company are utilized, note the name and address of the company (see IOM, *Appendix-A*).

Many plants have a condensate-return system to return condensed steam for reuse in boilers. Most small plants will not utilize such a system. Often a corrosion control chemical is used in a condensate return system. Many of the chemicals used for this purpose are volatile amines, which will vaporize in the boiler and appear in the steam (see IOM, *Appendix-A*).

\1\Processes for Low-Acid Canned Foods in Metal Containers, Bulletin 26-L, National Cannery Association, Washington, D. C. 20036.

\2\Retorts for Canning, Bock, J. H., Continental Can Co., Inc., Chicago, Illinois.

\3\A Complete Course in Canning, Lopez, Anthony; The Canning Trade, Inc. 2619 Maryland Avenue, Baltimore, Maryland 21218.

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