

EQUIPMENT MAINTENANCE AND CALIBRATION

An effective equipment maintenance and calibration program ensures equipment works consistently and as intended, and that food process control points are measured accurately. Having a program in place ensures that the process is under control and that biological, chemical and physical hazards are efficiently controlled by the food safety systems of the food plant. An adequate equipment maintenance and calibration program can save time and money by reducing unscheduled downtime. Regular maintenance can reduce unexpected major repairs.

Some Potential Food Safety Risk

Lack of proper maintenance and calibration programs can cause potential food safety risks that include:

- inappropriate temperature control of a cooler causing bacterial growth on foods
- uncalibrated metal detectors, can miss detecting a physical hazard in food products
- inaccurate thermocouples or thermometers in a smoke house cause inadequate cooking temperatures for high risk foods, like ham, which can lead to food poisoning
- uncalibrated scales used to measure preservatives, (ex: nitrates) can cause insufficient or excessive amounts to be added

Where to Start

A proper maintenance and calibration program starts with designated employees for each program. These people should ensure that equipment maintenance and calibration are performed on schedule. All user and technical manuals associated with the monitoring and calibration programs should be kept in a central location. A log book, kept in an easily accessible location, should include aspects such as equipment service records, changes or problems that arise and the corrective actions taken. The program needs to allow workers to report equipment that requires maintenance and/or calibration.



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Maintenance

Maintenance programs should ensure equipment performs consistently, functions as intended, meets process requirements and prevents contamination of food products. Equipment suppliers should provide technical support, service and training for equipment maintenance. Equipment maintenance should be co-ordinated between designated employees in the maintenance and processing areas to avoid interference of scheduled production.

An equipment maintenance program should cover:

- routine maintenance, including cleaning, inspection, servicing and lubrication
- scheduled and planned preventive maintenance
- repairs and unscheduled maintenance resulting from equipment breakdown during regular operations

A preventive maintenance program is based on the equipment manufacturer's guidelines or on the conditions and period of operations. They should be managed to ensure that all equipment is in top condition and can produce safe products. Steps recommended in preventive maintenance include:

- inspection
- testing
- lubrication*
- cleaning
- adjustment and replacement of equipment parts
- written preventive maintenance program listing equipment requiring regular maintenance, frequency and maintenance procedure

*A study of the Japan Institute of Plant Maintenance (www.jipm.or.jp/en/index.html) showed that correct and effective lubrication can prevent many mechanical failures and food quality issues. A practical approach includes use of a color-coding system for the lubricant container, where the application tool and the point of application on the equipment are the same color. This approach minimizes the chance of mistakes during maintenance.

During maintenance, care must be taken to avoid cross contamination of food products, ingredients and packaging materials by workers, and equipment/tools. Maintenance employees should have at least Good Manufacturing Practices (GMPs) training in personal hygiene practices.

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Records of all maintenance should be kept to demonstrate the application of the maintenance program. Records should include:

- work order numbers
- reason for the maintenance
- equipment identification
- maintenance activity (ex: equipment inspection, adjustment and part replacement)
- dates
- person in charge

Repair parts that are in contact with food and materials used in the food production equipment, like lubricants, should be of food quality grade. Only lubricants accepted by the Canadian Food Inspection Agency (CFIA) should be used. A list of acceptable coatings, paintings, chemicals and other materials is available at Reference Listing of Accepted Construction Materials, Packaging Materials and Non-Food Chemical Products website (www.inspection.gc.ca/english/ppc/reference/cone.shtml) or through CFIA offices.

It is important that after completion of the maintenance activity, all tools, parts and other materials are gathered and put back in place. This decreases the chances of cross contamination of food, ingredients or food packaging materials. Maintenance tools should be stored in designated areas.

In case of an extended equipment breakdown, food product integrity must not be compromised. Ensure that perishable products are promptly transported to appropriate storage areas.

Total Productive Maintenance (TPM)

Total Productive Maintenance (TPM) is an innovative Japanese concept with a new definition for maintaining plants and equipment. TPM treats maintenance as a necessary and vitally important part of the industry. TPM starts with a 5S program.



5S is a process of workplace organization and housekeeping that is carried out gradually and systematically. It improves safety, work efficiency and productivity.

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www.manitoba.ca/agriculture/foodsafety

Calibration

All equipment used to conduct quality or food safety checks must be calibrated. Calibration ensures the equipment readings are accurate and give control of the process. The accuracy of all the equipment involved in quality and safety control must be monitored. If the equipment is malfunctioning, it can have an impact on food safety. For example, if a thermometer used to check a critical heating temperature is not reading accurately, it won't show up unless the thermometer is verified and calibrated.

Calibration vs. Verification

It is important to understand the difference between these two terms, since some food industries only verify equipment. Both are required in a food processing plant. **Calibration** is a measurement that compares a result with a known value or standard, under specific conditions. **Verification** compares that known value against some specification/performance limit to check compliance. For instance, functioning equipment designed to measure chlorine at certain settings, if not calibrated properly, may continue delivering excessive amounts of chlorine. This can lead to chemical residues on the final product or over-sanitized equipment. If only verification is done, the equipment can continue operating in non-calibrated conditions leading to false results and unsafe conditions.

Calibration Procedures

Calibration procedures can be performed by a designated staff member within the company or by a contractor. All equipment must be calibrated against standards and follow equipment specifications.

When hiring a contractor for equipment calibration, verify the reliability of the company offering the services. In Canada, the accreditation of calibration laboratories is the responsibility of the Standards Council of Canada (SCC) Program for the Accreditation of Laboratories-Canada (PALCAN), and the National Research Council of Canada (NRC) (www.nrc-cnrc.gc.ca/) Calibration Laboratory Assessment Service (CLAS) (www.inms-ienm.nrc-cnrc.gc.ca/en/clas/clas_e.php).

The CLAS program provides quality system and technical assessment services and certification of specific measurement capabilities of calibration to support the Canadian National Measurement System. This system enhances product quality and demonstrates conformance to international quality standards.



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Canadian Calibration Network

The Canadian Calibration Network is a network of calibration laboratories that ensures easier access to calibration services in Canada with certified traceability to national and international measurement standards. Calibration laboratories certified by CLAS (www.inms-ienm.nrc-cnrc.gc.ca/en/clas/clas_e.php) offer measurements traceable to the International System of Units (SI).

If you are interested in purchasing an International or Canadian standard for calibration, visit the Standard Store (www.standardsstore.ca/eSpecs/Home.do). It is a joint initiative between the Standards Council of Canada (SCC) and Information Handling Services (IHS) Canada.

Calibration Program

Food processors should have a calibration program that includes:

- list of the measuring and controlling equipment that directly affects the safety of a food product
- specific frequency of calibration for each instrument/equipment
- identification of completion of equipment calibration
- maximum error allowed before corrective action is taken (ex: $\pm 1\text{g}$, $\pm 5^\circ\text{C}$)
- corrective action noted when equipment does not meet specification
- written calibration methods based on approved standards
- trained employees in charge of calibration or service company and employee contact details
- consistent records

Calibration Records

Consistent records of all calibration activities should include:

- identification of equipment
- date
- person in charge of calibration
- reason for calibration

- calibration results
- calibration corrective action

Equipment Requiring Calibration

Devices that need periodic calibration include: pH meters, temperature measuring/recording devices, timing devices, pressure gauges, scales, temperature control units, metal detectors, magnets, flow meters (ex: chlorine feed rate meters), a_w (water activity) meters, hygrometers and other specialized control instruments. Climate control spaces (ex: freezers, refrigerators, smoke houses, curing and drying rooms) should be equipped with calibrated measurement or recording devices.

The manufacturer of these devices needs to provide you with written calibration methods and frequencies. Calibration should be carefully performed by trained personnel. When calibration of critical devices is required on equipment, such as scales or metal detectors, an accredited agency or the equipment manufacturer needs to ensure instrument accuracy.

Contact Information

For information on the Food Safety Initiative contact FSI staff; for more technical information: call 204-795-8418 or 204-795-7968 in Winnipeg; or e-mail at foodsafety@gov.mb.ca. For general information contact your local GO Team office.



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