Dairy Farmers of Ontario

Time-Temperature Recorder Specifications

Version 1.0

March 18, 2005
TIME-TEMPERATURE RECORDER SPECIFICATIONS
FOR ONTARIO’S IMPLEMENTATION OF THE
CANADIAN QUALITY MILK (CQM) PROGRAM

Dairy Farmers of Ontario reserves the right to change these specifications without notice.

1.0 Definitions

Alarm: An indicator or indicators signaling that a regulatory requirement has not been met.

Alarm Log: Secure electronic read-only data storage with secondary non-volatile backup that contains all regulatory alarms.

Bulk Tank Cooling: The process during and immediately following milking in which heat is transferred from the milk until the milk temperature reaches the required temperature.

Bulk Tank Storage: The period of time following milking after milk has reached the required temperature. The agitator runs at the intervals required in regulations and the condensing unit comes on as required to maintain milk temperature in the required range.

Canadian Quality Milk Program (CQM): Is the HACCP-based quality assurance program developed to control safety and quality risks to raw products on Canadian dairy farms for Dairy Farmers of Canada and has been recognized by the Canadian Food Inspection Agency.


Default Settings: Preset factory operational settings for producer warnings, service, and regulatory alarms.

Dynamic Link Library: Catalogue of functions available to external software applications.

Empty Tank: The state of the bulk tank after all of the milk has been removed.

End of Milking: The point in time when the milking machine has been switched off after all of the milk has been harvested.

Essential Electric Circuit: An electrical circuit that is required for daily operations but is not associated with the power supply for milking and cooling functions and associated apparatus. For example, milkhouse lighting is powered from an essential electrical circuit whereas a spare receptacle on its own breaker is not an essential electric circuit.

Extra-low Voltage: Means any voltage up to and including 30 volts.
**First Milking:** Is the period of time after the bulk tank has been emptied and washed where the milking system is turned on, milk is harvested and cooled, and the milking system is turned off.

**Function Status:** The function status is the current milking equipment or cooling equipment procedure, including washing, being performed.

**Host Application:** For the purposes of this application, a host application is a software program that runs on an external device used for communicating with the TTR. The application provides a common graphical user interface (GUI) with primary functionality being data access and changing settings.

**Hot Wash Cycle:** Period of time when the milking systems are being cleaned with a hot-water based cleaning solution.

**Latched Alarm:** A TTR alarm that remains evident until reset by the producer.

**Log File:** Is the electronic file that contains operational settings, measurements, warnings and alarms in system memory with non-volatile backup storage.

**Low Voltage:** Any voltage from 31 to 750 volts inclusive.

**Milk:** Milk is as defined in Regulation 761 of the Milk Act of Ontario.

**Offset Temperature:** The difference between the TTR temperature reading and the actual water or milk temperature.

**Ontario Regulations:** Refer to Ontario dairy farm requirements outlined in Regulation 761 of the Milk Act.

**Producer Warning:** A set or producer settable warning before a regulatory alarm is reached.

**Regulatory Alarm:** An alarm that indicates a regulatory requirement has not been met.

**Sanitize Rinse:** The rinse done immediately before milking (pipeline) or milk storage (bulk tank).

**Second and Subsequent Milkings:** The period after the first milking, when the milking system is turned on, all milk is harvested and is cooling and the milking system is turned off.

**Start of Milking:** The point in time when the milking system has been turned on before milk is harvested for storage in the farm bulk tank.

**System Status Display:** An electronic screen on or associated with the TTR that displays TTR information.

**Target Platform:** The operating system of the PDA-type device on which the host application and the TTR DLLs will run.

**Time-Temperature Recorder:** The name given to the standalone independent time and temperature monitoring device of this specification.

**Voltage Surge Protection:** Intermediate electrical protection that prevents equipment from being damaged by a voltage surge.
Wash Cycle:  Wash cycle refers to a combination of any of the pre-rinse, rinse, and wash cycles of the pipeline or bulk tank.

2.0 Abbreviations

BTMG: Bulk Tank Milk Grader  (A certified bulk tank milk grader is responsible for grading, measuring, sampling, pumping and transporting milk.)
CSA: Canadian Standards Association
CUL: Canadian Underwriter’s Laboratory
DLL: Dynamic Link Library
DFO: Dairy Farmers of Ontario
DHI: Dairy Herd Improvement Testing Program
ESA: Electrical Safety Authority
NEMA: North American Electrical Manufacturer’s Association
PDA: Personal Digital Assistant
PCIP: Pipeline Cleaning-in-Place
TCIP: (Bulk) Tank Cleaning-in-Place
TD: Temperature Device
TTR: Time-Temperature Recorder

3.0 Primary Functionality

3.0.1 The TTR has three primary functions:

1. producer warnings and alarms;
2. maintaining a history of settings, measurements, warnings, events and alarms; and
3. providing milking start and end times for official a.m./p.m. individual cow-testing programs.

The corresponding requirements are described in the following sections.

3.1 Warnings and Alarms

3.1.1 Warnings and alarms are required for monitoring the following areas:

- milking cooling;
- milk storage;
- bulk tank hot wash;
- pipeline hot wash ;
- presence or absence of pipeline cleaning chemicals;
- presence or absence of bulk tank cleaning chemicals; and
- recorder performance functions.
The definitions of the specific alarms and their corresponding text names are in section 12.

3.2 Adjusting Settings

3.2.1 The TTRs are to be installed with factory preset Default Settings for both producer warnings and regulatory alarms as defined in Table 1.

3.2.2. The settings for both warnings and alarms shall be adjustable using a PDA-type device communicating with the TTR DLL via interchangeable wireless technology prescribed by DFO. Settings shall also be adjustable through the TTR function keys.

3.3 Warning and Alarm Displays

3.3.1 Warnings and alarms shall be displayed as a text message on the TTR. There shall be an audible and visual indicator on the TTR and an external method of showing warnings and alarms.

3.3.2 Alarms are not to be reset until acknowledged even if the alarm condition no longer exists.

3.3.3 BTMG alarms are only to be reset by an empty tank or bulk tank hot wash.

3.3.4 When a producer warning is activated, the type of warning is to be displayed on the TTR display screen as a text message and all alarm outputs shall be activated.

3.3.5 When a regulatory alarm is activated, the alarm type is to be displayed on the TTR display screen as a text message and all alarm outputs shall be activated. All warning and alarm settings are described in Table 1.

3.3.6 When a warning is activated, the warning type is to be displayed in text on the TTR display screen. All warnings are to be retrievable for display on the TTR display screen and show the warning start time and the duration.

3.3.7 When an alarm is activated, the alarm text is to be displayed until the alarm has been acknowledged. The alarm start time and the duration, and the highest temperature reached for the blend temperature shall be retrievable from the alarm log.

3.3.8 In the event of multiple warnings or alarms, the warnings or alarms are to be displayed in reverse chronological order.

3.3.9 The display is to provide sufficient information to describe the Function Status, warning or alarm without the need for a reference table.

3.4 BTMG Alarms

3.4.1 A dedicated BTMG indicator light is to be activated for the settings defined in Table 1.

3.4.2 The BTMG shall be able to view all of the BTMG alarms associated with the BTMG indicator light through a dedicated BTMG menu. The BTMG display shall include the information described in Table 1.

3.4.3 Data associated with the BTMG alarms is to be downloadable to a PDA with the REGULATORY ACCESS password.
3.5 **Resetting Warnings and Alarms**

3.5.1 The BTMG alarm indicator is to remain latched until reset by a bulk tank hot wash or an empty tank.

3.5.2 All alarms are to remain latched until acknowledged by the producer AND the condition returns within the settings.

3.5.3 All warnings are to remain latched until acknowledged by the producer OR the condition returns within the settings.

3.5.4 If there has been a power interruption or outage, the TTR must start monitoring based on the last known status and alarm if the milk temperature is does not meet regulatory requirements.

3.5.5 When an alarm is acknowledged, the audible and external indicators are to be reset.

3.6 **Data Storage Requirements**

3.6.1 The TTR must store all warnings and alarms as described in Section 12.0 and summarized in Table 1 of the specifications.

3.6.2 Each warning or alarm is to be stored in the log file and alarm log with a unique identifier.

3.6.3 TTR storage must be non-volatile with the following items stored:

- Milking system on
- Milking system off
- Sufficient hot wash cycles
- Insufficient hot wash cycles
- First milking start and end times
- Tank wash temperature
- Pipeline wash temperature
- Milk temperature
- Time tank is empty
- TTR hardware or write errors
- All warnings, alarms and acknowledgements
- Removal of secondary storage medium
- Date/time set or changed
- Setting changes
- The presence or absence of cleaning chemicals and the highest value reached for the hot wash cycle with suitable thresholds.

3.6.4 The regulatory alarms are to be stored in an alarm log in system memory for a minimum period of three years and be accessible through wireless transfer and the most recent 14 days of TTR data is to be accessible through wireless transfer.

3.6.5 The producer must be able to access three years of data through wireless transfer or secondary storage.

3.6.6 Producer warnings are to be stored in the Log File.
3.6.7 The current warning or alarm shall be displayed on the TTR display screen and all warnings and alarms shall be accessible for a minimum period of seven days through a dedicated menu.

3.6.8 The TTR must store the most recent 500 alarms in the Alarm Log.

3.6.9 Regulatory alarm data is to be unalterable in the system memory and in the secondary storage.

3.6.10 There shall be a text display if the secondary storage is not present and this event is to be written to the Alarm Log.

3.6.11 Milk cooling and storage are to be continuously measured and recorded at five-minute intervals.

3.6.12 TCIP and PCIP cycles are to be continuously measured and recorded at 20-second intervals.

3.6.13 The producer’s six-digit licence number is to be entered into the file under the SERVICE or REGULATORY password.

3.7 Individual Cow-Testing Program Clock Functionality

3.7.1 Current time is to be continuously displayed on the TTR display screen unless there is an event, warning or alarm displayed.

3.7.2 The current time, date and year is to be available in the display through a dedicated menu option.

3.7.3 The start and end time of all milkings for the most recent six days to a maximum of 18 milkings is to be stored as a dedicated menu item. The milkings are to contain the start and end time, the date and the number of milkings for the day starting with the milking following 12:00 a.m.

3.7.4 If the time, day and/or year has been changed, the change shall be the first item displayed in the dedicated menu and the change shall be recorded in the log file.

3.7.5 If the date, time and/or year has been changed, the change shall be recorded and be accessible for viewing on the display.

4.0 Supportive Functionality

4.1 Data Retrieval

4.1.1 The Regulatory alarm data is to be transferable to DFO. This is to be accomplished by the following:

a. Wireless transfer between the TTR and a PDA-type device using interchangeable wireless technology as prescribed by DFO; and

b. Secondary non-volatile storage for a period of three years.

4.1.2 The warning and alarm settings for both producer and regulatory alarms shall be adjustable using a PDA-type device communicating with the TTR via interchangeable wireless technology prescribed by DFO. At the time of writing this document, DFO
uses Bluetooth Serial Port replication for wireless data transfer. Settings shall also be adjustable on the TTR itself through the TTR function keys.

4.1.3 The most recent 60 hours of stored data is to be available for wireless transfer.

4.1.4 All historical data (data older than 60 hours) is to be accessible via secondary non-volatile storage.

4.1.5 The producer’s six-digit licence number is to be downloaded with the data file.

4.1.6 The software version number is to be downloaded with the alarm log file.

4.2 Software Interface

4.2.1 The TTR provider will supply a software interface in the form of a TTR DLL that contains all functionality required to communicate with the TTR. The DLLs are to be provided as a .NET assembly compatible with the specified platform of the host application. The TTR provider will also supply documentation related to the usage of the TTR DLL.

4.2.2 The host application is to run on the platform specified by DFO. The current platform is the MS Windows Mobile 2003 Second Edition utilizing the .NET Compact Framework 2.0 with SP3 installed. The host application is to use DLLs provided by the TTR supplier for communicating with the TTR. The DLL will act as a portal through which a host application will communicate with the TTR. The host application will not communicate directly with the TTR.

4.2.3 The TTR DLL must be entirely non-graphical in nature. The user interface is to be provided by the host application.

4.2.4 The TTR DLL will provide direct wireless communication with the TTR. The final determination of the data transfer procedures shall be established in consultation with DFO technical representatives after the TTR has been approved for use in Ontario.

4.2.5 The TTR DLL must provide the necessary functionality for a host application to perform the following requests wirelessly and interactively with the TTR:

a. Control access to the TTR via password verification on two levels.

b. View the current status of the TTR.

c. Retrieve all Producer, Service, and Regulatory TTR settings.

d. Modify individual TTR settings within the prescribed limits of the setting. The modifications will be verified within the TTR DLL before any updates are sent to the TTR.

e. Retrieve the most recent 60 hours of data from main memory and historical data through secondary non-volatile storage with definable time spans specified by the host application.

4.2.6 The TTR DLL will be self-contained. Any external settings required for the initialization of the TTR DLL will be specified by the host application. Any dependencies or required external code libraries are to be approved by DFO.

4.2.7 The input and output of the TTR DLL must be formatted in a consistent and useable manner which will be specified by DFO. All necessary translation of the raw data is
to be performed within the TTR DLL. Specific alarm naming conventions are to be used in reference to Table 1.

4.2.8 The TTR DLL will be written in such a way that the provided functionality is exposed to the host application in a practical and interactive manner. The TTR DLL must be written using accepted coding practices relative to the target platform.

4.2.9 The TTR DLL will expose functionality to the host application so that the status and error condition of the TTR DLL may be monitored.

4.2.10 Naming conventions for functions and parameters of the exposed functionality are to be approved by DFO prior to development.

4.2.11 The TTR data is to be provided to the host application in a file format agreed to and approved by DFO.

4.3 Current Status & Alarm Display

4.3.1 The TTR display screen is to display the current TTR function status.

4.3.2 There is to be a real time display of both the bulk tank and pipeline TD temperatures through a dedicated menu. The highest temperature reached during the last TCIP and PCIP shall be displayed on the TTR display screen until the next milking cycle.

4.3.3 There is to be at least one external visual indicator that is installed in a location selected by the producer. The visual indicator shall indicate any warning or alarm condition. This light is to be a LED with a standard length of 50 feet of cable with longer lengths being available if required and be visible in daylight at a distance of 50 feet.

4.4 Other Functional Requirements

4.4.1 The time shall be adjustable by the producer.

4.4.2 The date and year shall be adjustable with a password.

4.4.3 The clock is to adjust automatically for Canadian daylight savings time.

4.4.4 The internal clock shall be settable and displayed in either 12-hour a.m./p.m. or 24-hour format as follows: MM-DD-YY:hh-mm(a/p when applicable).

4.4.5 The internal clock is to automatically adjust for leap years.

4.4.6 The TTR is to have three tiers of access to programmable menus and data. The access or password codes are to be provided where applicable for:

- PRODUCER ACCESS with no password.
- SERVICE ACCESS for milking equipment or refrigeration personnel.
- REGULATORY ACCESS with an exclusive password for Dairy Farmers of Ontario for Ontario.
- The password is to be valid for one calendar day only.
- A password generator is to be provided.

4.4.7 The TTR shall have one open input and one open output relay available for future use.
4.4.8 The software version must be available on the TTR display screen and be externally attached to the TTR.

4.4.9 Temperatures are to be displayed either in Celsius or Fahrenheit as selected by the producer and all temperature parameters are to automatically change accordingly.

4.4.10 A menu is to be provided to see the current status of inputs and outputs.

5.0 Producer Options

5.1 Ability to Detect Sufficient Cleaning Chemicals for the Hot Wash

5.1.1 The TTR must be able to detect a sufficient level of cleaning chemicals for the TCIP and PCIP with individual set points for each.

5.1.2 The TTR is to provide a warning to the producer if there are insufficient cleaning chemicals for the TCIP and/or PCIP.

5.2 Data Transfer to Producer’s Computer

5.2.1 The TTR is to have the ability to wirelessly transmit data at least 10 metres without encumbrances to a farm computer. PC software shall also be provided if this option is selected.

6.0 Electrical Requirements

6.0.1 The TTR and associated electrical components are to be run on a Class II electrical circuit.

6.0.2 The TTR enclosure is to be NEMA 4X.

6.0.3 The TTR power is to come from an Essential Electrical Circuit that is separate from the milking and cooling systems and associated apparatus.

6.0.4 The TTR is to be independent and not electrically interconnected to the bulk tank or milking equipment or associated apparatus.

6.1 Approvals

6.1.1 The recorder is to have CSA or CUL approval or equivalent with documentary confirmation from the Canadian Standards Association and the TTR is to contain the approval seal.

6.2 Voltage Surge Protection

6.2.1 Circuitry to protect the TTR from damage during power surges must meet the 2kV, 1.2x50 exponential surge test of the IEC specification IEC 61000-4-5.

6.3 Battery Backup

6.3.1 A battery back up for maintaining the date/time and other power dependent stored items for a period of 30 days is to be provided.
7.0 Sensor Requirements

7.0.1 The TTR is to use independent sensors and the sensors must not be in contact with saleable milk.

7.0.2 Two TDs are to be provided, each with standard cable length of 50 feet and are to be accurate within plus or minus one degree Celsius.

7.0.3 The bulk tank TD is to be calibrated at four degrees Celsius and the accuracy of the reading following calibration at four degrees Celsius is to be plus or minus 0.3 degrees Celsius, and the accuracy of the reading at 40 degrees Celsius is to be plus or minus three degrees Celsius.

7.0.4 The pipeline TD is to be calibrated at 40 degrees Celsius and the accuracy of the reading following calibration is to be plus or minus three degrees Celsius.

7.0.5 The cleaning chemical sensors must be accurate with 95 per cent repeatability and 90 per cent confidence.

8.0 Installation

8.0.1 The power connection must be hard-wired or wired through a non-standard plug that is tied or locked in place.

8.0.2 The pipeline TD is to accurately measure the PCIP.

8.0.3 The bulk tank TD is to accurately measure the milk temperature and be positioned to detect the mechanical action of the bulk tank hot wash cycle.

8.0.4 The cleaning chemical measurement devices must be installed in a manner to detect the end of the hot wash cycles.

8.0.5 A copy of the Electrical Safety Authority installation approval certificate is to be provided to DFO for each TTR installation on Ontario dairy farms.

9.0 Calibration

9.0.1 The bulk tank TD is to be calibrated against the readings of a traceable calibrated reference temperature sensor using an ice/water mixture as low temperature calibration point and the hot wash temperature as the second calibration point.

10.0 Warranty & Support

10.1 Equipment Warranty

10.1.1 The standard manufacturer’s warranty is to be provided and indicated in any communications with the producer.

10.2 Repair-Replacement Warranty

10.2.1 A repair-placement program with 48-hour business-day factory turnaround for TTR and/or components is to be offered.

10.2.2 Parts must be shipped and received from anywhere in Ontario; or elsewhere if it can be proven that a part can be shipped and received anywhere in Ontario in less than 48 hours.
10.2.3 Parts must be available for a minimum period of 10 years from January 1, 2007 or the last installation of a TTR model.

10.3 Manuals
10.3.1 All text in the materials and displays shall be available in French or English.
10.3.2 A quick-reference guide is to be provided in English or French.
10.3.3 An instruction book will be provided in English or French with each TTR with a minimum of the following chapters:
   - Introduction
   - Product Data
   - Installation
   - Standard Operation
   - Service
   - Parts List
   - Warranty Contacts

10.4 Source Code and Updates
10.4.1 It is understood that DFO, through an Escrow agreement, will have an exclusive copy of the software and access to the source code of any TTR installed on Ontario dairy farms. Any upgrades to the software will be provided free of charge for the first three years if they are related to errors and/or poor design. All warning and alarm parameters shall be accessible for change by DFO.

11.0 Business Considerations

11.1 Implementation of the Program
11.1.1 All licenced Ontario dairy farms offering milk for sale shall have a TTR recorder installed that meets DFO TTR specifications by January 1, 2007.

11.2 Approved TTRs
11.2.1 Only TTRs approved for use by Dairy Farmers of Ontario can be installed on Ontario dairy farms. Any party wanting to install TTRs on Ontario dairy farms will have to submit a proposal and an installation and maintenance plan to DFO for review. If the proposal, installation plans and maintenance plans are acceptable to DFO, the proposal, installation plans, maintenance plans and a working TTR prototype shall be submitted to a third party, under contract with DFO, for assessment. The submitting party shall cover all costs associated with the third-party assessment process.

   If the third party determines that the TTR meets the specifications, the provider shall install five TTRs on dairy farms and after a three-month trouble-free period, the TTR shall be evaluated by the participating producers, the third-party reviewer, and DFO. All installation and monitoring costs are the responsibility of the provider.
The provider is to obtain Canadian Milk Recording Board approval for the individual cow-testing program clock in the recorder independently and is responsible for any associated fees and costs.

11.2.2 If the third party determines that the TTR meets DFO technical, installation and maintenance requirements and performance measures, the Director of Regulatory Compliance will make the decision whether or not the TTR can be installed on Ontario dairy farms.

11.2.3 A TTR supplier shall provide its own liability insurance and be responsible for any damage caused during installation and save DFO harmless.

12.0 Alarm and Warning Definitions

12.0.1 Section 3.1 covered the functional requirements of alarms. This section defines the alarm conditions. The alarms/warnings classified are in five categories:

- **Cooling**,
- **Agitation**,
- **Bulk Tank Wash and Cleaning Chemicals**,
- **Pipeline Wash and Cleaning Chemicals**,
- **Recorder**.

12.1 Cooling Warning and Alarms

12.1.1 Producer warning settings cannot be less stringent than the regulatory settings.

12.1.2 **C1 - 1st Milking Cooling:** Milking system on and milk entering or being stored in the bulk tank but cooling system not on. The warning is to have a delay setting for the first milking that is settable by the producer.

12.1.3 **C2 - Slow Cooling:** Provisions are to be made to be able to measure and provide a warning for either of the first two options that follow and for the final requirement in the service and regulatory menu:

- A warning given to the producer within 10 minutes after the end of milking, that the milk is not going to meet the cooling requirements.

- OR, in the event that cooling requirements are measured from the start of milking rather than the end of milking,

- A warning is to be given to the producer after the start of milking within the period defined by the producer that the milk will not be able to meet the cooling requirements.

- AND, in addition,

- A warning is to be given if the milk temperature exceeds five degrees Celsius for more than 15 consecutive minutes during storage without agitation.

12.1.4 **C2 - SLOW COOLING:** Provisions are to be made to be able to select either of the following options in the regulatory menu:
Milk not cooled to one to five degrees within the regulatory setting of the end of the first milking and within regulatory settings of the end of the second and subsequent milkings and is greater than five degrees Celsius for more than 60 minutes during storage.

OR, in the event that cooling requirements are measured from the start of milking rather than the end of milking,

Milk is not cooled to one to five degrees within the regulatory settings from the beginning of the first milking and within the regulatory settings of the beginning of second and subsequent milkings and is greater than five degrees Celsius for more than 60 minutes during storage.

12.1.5 **C3 - High Blend Temperature:** Milk blend temperature on second and subsequent milkings is higher than the producer set temperature for more than the selected or set number of minutes.

12.1.6 **C3 - HIGH BLEND TEMPERATURE:** Milk blend temperature is greater than 11 (10°C +1°C allowable variance) degrees Celsius (measured in whole degrees) for more than 15 consecutive minutes during and after second and subsequent milkings.

12.1.7 **C4 - Temperature too low:** Milk is stored or cooled to less than one degree Celsius for more than 15 consecutive minutes.

12.1.8 **C4 - TEMPERATURE TOO LOW:** Milk is stored or cooled to less than 0.5 degrees Celsius for more than 15 consecutive minutes.

12.2 **Agitation**

12.2.1 **A1 - TOO LITTLE AGITATION:** If the milk is not agitated at least five cumulative minutes every 80 minutes, an alarm is to be given. Time starts after the “first milk” enters the bulk tank and ends when the bulk tank is emptied by the BTMG.

12.2.2 **A2 - TOO MUCH AGITATION:** If the agitator runs continuously for more than three hours after the completion of milking.

12.3 **Bulk Tank Wash Warnings and Alarms**

12.3.1 **T1 - BULK TANK NOT WASHED:** Bulk tank not washed for more than 60 hours.

12.3.2 **T2 - LOW TANK WASH TEMPERATURE:** If the bulk tank hot wash temperature of 40°C is not maintained for four continuous minutes or the bulk tank hot wash dump temperature, measured within one minute of the end of the hot wash cycle, is less than 35°C.

12.3.3 **T3 - Insufficient Hot Wash Chemicals:** To monitor the chemical concentration of the bulk tank hot wash cycle and warn the producer if there is insufficient chemical based on the selected threshold.

12.4 **Pipeline Alarms**

12.4.1 **P1 - PIPELINE NOT WASHED:** Pipeline not washed for more than 22 hours.
12.4.2  **P2 - LOW PIPELINE WASH TEMP:** If the pipeline hot wash temperature of 40º C is not maintained for four continuous minutes or the hot wash dump temperature, measured within one minute of the end of the hot wash cycle, is less than 35º C.

12.4.3  **P3 - Insufficient Hot Wash Chemicals:** To monitor the chemical concentration of the pipeline hot wash cycle and warn the producer if there is insufficient chemical based on the selected threshold.

12.5  **Self Test Warnings and Alarms**

12.5.1  The TTR must routinely check for inputs for the warnings and alarms described above and for write functions. An alarm and an alarm description is to be provided if there is an input or write error, and the error is to be written to the alarm log.

12.5.2  **R1 - INPUT OR WRITE ERROR:** An alarm is triggered if there is an input error for any error not described below.

12.5.3  **R2 - TANK TD ERROR:** Bulk tank RTD is out of range or not working.

12.5.4  **R3 - PIPELINE TD ERROR:** Pipeline RTD is out of range or not working.

12.5.5  **R4 - WRITING ERROR:** An alarm is triggered when there is a writing error to the removable storage media.

12.5.6  **R5 - Power down alarm:** If milk is in tank and the power is out more than 30 seconds but less than five hours an alarm is to be given.

12.5.7  **R5 - POWER DOWN ALARM:** If milk is in tank and the power is out more than five hours an alarm is to be given.

12.5.8  **R7: External input alarm**

12.5.9  **R8 - Battery Voltage:** A warning is to be given when the backup battery is less than 90 per cent of the voltage capacity stated by the manufacturer.
<table>
<thead>
<tr>
<th>Code</th>
<th>TTR Code</th>
<th>Alarm as seen on TTR Display</th>
<th>Condition</th>
<th>Settings for producer</th>
<th>Default</th>
<th>Regulatory Alarm?</th>
<th>Temperature G Alarm?</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>coolstart</td>
<td>Start cooling after x minutes of start of milking or after tank sensor determines that there is milk in tank</td>
<td>15-600 minutes</td>
<td>30 minutes</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>slow cooling</td>
<td>Projected milk temperature after end of milking will not meet regulatory requirements within prescribed period</td>
<td>n/a</td>
<td>N/a</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>slow cooling?</td>
<td>Temperature &gt; 5°C for more than 15 minutes without agitation</td>
<td>n/a</td>
<td>5°C, 15 minutes</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>slow cooling?</td>
<td>Temperature &gt; 5°C after x minutes from START of milking</td>
<td>60-600 minutes</td>
<td>120 minutes</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>C2*</td>
<td>*SLOW COOLING</td>
<td>Temperature &gt; 5°C for more than 2 hours (1st milking) or more than 1 hours (2nd milking +) based on END of milking</td>
<td>n/a</td>
<td>5°C, 60 min., 120 min.</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>C2*</td>
<td>*SLOW COOLING</td>
<td>Temperature &gt; 5°C for more than 1 hour during storage</td>
<td>n/a</td>
<td>5°C, 60 minutes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>C2*</td>
<td>*SLOW COOLING</td>
<td>Temperature &gt; 5°C after 3 hours from START of milking</td>
<td>n/a</td>
<td>180 minutes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>high blend</td>
<td>Temperature &gt; high blend temperature set by producer for more than 15 minutes (2nd milkings +)</td>
<td>7,8,9,10 or 11 °C</td>
<td>10 °C, 15 minutes</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>C3*</td>
<td>*HIGH BLEND</td>
<td>Temperature &gt; 11°C for more than 15 minutes (2nd milkings +)</td>
<td>n/a</td>
<td>11°C, 15 minutes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>Temp too low</td>
<td>Temperature &lt; 1°C for more than 15 minutes</td>
<td>n/a</td>
<td>1°C, 15 minutes</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>C4*</td>
<td>*TEMP TOO LOW</td>
<td>Temperature &lt; 0.5°C for more than 15 minutes</td>
<td>n/a</td>
<td>0.5°C, 15 minutes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>A1*</td>
<td>*NO INT AGITAT</td>
<td>Less than 4 minutes cumulative agitation in 80 minute intervals</td>
<td>n/a</td>
<td>5 min., 80 min.</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>A2*</td>
<td>*TOO MUCH AGITAT</td>
<td>More than 3 hours of continuous agitation after end of milking</td>
<td>n/a</td>
<td>180 minutes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>T1*</td>
<td>*NO TCIP</td>
<td>Bulk Tank has not been washed in 60 hours</td>
<td>n/a</td>
<td>60 hours</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>T2*</td>
<td>*INSUF TCIP</td>
<td>Definition of good wash: 40°C for more than 4 minutes continuously OR more than 35°C within one minute of the hot wash cycle dumping</td>
<td>n/a</td>
<td>4°C, 40 minutes</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>low TCIP chem.</td>
<td>Chemical concentration is lower than set point (examples provided for conductivity)</td>
<td>1.2 mS</td>
<td>0.8 - 4.5 mS</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>P1*</td>
<td>*NO PCIP</td>
<td>Pipeline has not been washed for 22 hours</td>
<td>n/a</td>
<td>22 hours</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>P2*</td>
<td>*INSUF PCIP</td>
<td>Definition of good wash: 40°C for more than 4 minutes continuously OR more than 35°C within one minute of the hot wash cycle dumping</td>
<td>n/a</td>
<td>4°C, 40 minutes</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td>low PCIP chem</td>
<td>Chemical concentration is lower than the set point (examples provided for conductivity)</td>
<td>1.2 mS</td>
<td>0.8 - 4.5 mS</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>R1*</td>
<td>*V SENSOR FAIL</td>
<td>Vacuum Sensor is not working properly</td>
<td>n/a</td>
<td>N/a</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>R2*</td>
<td>*T SENSOR FAIL</td>
<td>Bulk Tank Sensor is out of range</td>
<td>n/a</td>
<td>N/a</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>R3*</td>
<td>*P SENSOR FAIL</td>
<td>Pipeline Sensor is out of range</td>
<td>n/a</td>
<td>N/a</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>R4*</td>
<td>*WRITING ERROR</td>
<td>Error writing to the disk storage</td>
<td>n/a</td>
<td>N/a</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>R5</td>
<td>power down</td>
<td>Power down for more than 30 seconds but less than 5 hours</td>
<td>n/a</td>
<td>30 seconds, 5 hours</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>R5*</td>
<td>*POWER DOWN</td>
<td>Power down for more than 5 hours</td>
<td>n/a</td>
<td>5 hours</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>R7</td>
<td>alarm input #1</td>
<td>External input on</td>
<td>n/a</td>
<td>N/a</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>R8</td>
<td>low battery</td>
<td>Battery is less than 90% of voltage capacity</td>
<td>n/a</td>
<td>N/a</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>