MILK PMO PASTEURIZER PDS

EPP100815 – CPP3

AL KHARJ – SAUDI ARABIA

VERSION CONTROL

Project	Version	Date	Reviewed by	Comments
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EPP100815	V3.0	29/06/2017	DPS	Review after Almarai revision

CONFIDENTIALITY NOTE

GEA Process Engineering, S.A.

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1 DOCUMENT INFORMATION

This document describes the operation and process of the PMO pasteurizer (P31) at Almarai CPP3 facility.

2 OVERVIEW SCOPE

2.1 PRODUCTION PROCESS

It is important to note this is a PMO pasteurizer, which means there are some valves and instruments connected to a legal PLC, therefore the pasteurizer cannot control the following devices during production: booster pump and its bypass inlet valve, bypass valves for regeneration stage 2, flow diversion valves just after the 16s holder. Temperature transmitter after the holding tube, flowmeter transmitter before holding tube and pressure transmitter in the regeneration stages are connected into Legal PLC in order to control previous devices accordingly.

Assuming the pasteurizer is "clean" and stopped after the CIP, the operator has to change the PMO selector to "production" mode, and then it is possible to start the pasteurizer from the SCADA. First steps are the start-up of the pasteurizer, it means, filling the balance tank and the deaerator, starting the Homogenizer and separator and start the heat up of the system. The legal devices will be activating once the right conditions are reached:

- FDV valves: Flow Diversion Valves after holder 16sec will be activated once the temperature is higher than "cut in cut out" temperature, and if the flow is lower than "maximum flow" allowed.

- Regneration Stage 2 bypass valves: Once the FDV valves are activated, the flow will goes through the regeneration stages, and the pressure in the "pasteurizer" side will increase. While the pressure in the "pasteurizer" side us higher than pressure in the "non-pasteurizer" side, this valves will be activated.

- Booster pump and bypass inlet pressure: As the previous valves, once the pressure in the "pasteurizer" side of the first stage is higher than the pressure in the "non-pasteurizer" side, these devices will be activated.

When everything is ready (including the separator) the system start the heat up of the short loop and later the heat up of the long loop (from RMS to Mixing through the P31, MST and MBT). Once the sterilization temperature is reached, system starts the countdown of the sterilization time. If some area involved goes to alarm, the pasteurizer will come back to previous stop automatically, and will wait until everything is ready again. If some water has to be introduced during sterilization because the level of balance tank goes low, the sterilization time start again.

Finally, when the sterilization is finished, the pasteurizer goes to "cut in cut out" step, where the heater is deactivated and the cooler is activated in order to decrease the temperature after the holder until the "cut in cut out" temperature where the FDV valves are deactivated. This step will indicate if the valves are working properly and divert the flow at the right temperature. When the FDV are closed, the system starts to heat up again and goes to water recirculation, where the pasteurizer looks for production conditions.

Operator has to select one WO (Work Order) in the batch screen in order to be able to start the production. Pasteurizer will keep in recirculation but in the "Temp. Stabilization" step, where the parameters for the stabilization are taken from the batch parameters. When the pasteurizer is stable for a timer, and all recirculation conditions are OK, system will request operator action to start the production.

When the production starts, the water has to be removed from the system. This water which is sterilized will be send to rinse tank if it is needed. First step is do the product purge from RMS to the balance tank. When the product is at the inlet of the balance tank, it will be emptied before to introduce the product inside. Then it will continue the product purge of the pasteurizer, split in different steps ("purge to deaerator", "purge to FDV", "purge to outlet") until the product is in the outlet of the pasteurizer and then jumps to production step. The outlet line will control the purges to drain and recovery, according to the volume of recovery

configured and the destination selected by the operator. Once the product is in the inlet of the selected tank the outlet line starts to send into the tank. If some recovery is remaining in the line it will be sent to drain during the water purge.

When everything is in production, the pasteurizer will go to recirculation if any of the recirculation condition happen. When it is in recirculation because some recirculation condition happen and it is recovered, the pasteurizer will come back to production automatically. Also operator can select a "forced recirculation" and it can come back to production if everything is OK. At any moment it is possible to start water purge if the destination (tank, recovery or drain) is selected by operator in the SCADA.

Vitamins can be added based on the recipe selection. Operator will command this action from the push button placed on field, it's only possible to add vitamin once per batch.

When the batch is close to finish the system jumps to "operator to decide" step, where the operator can introduce a new batch, increase the volume of the current one, or start the water purge. If a new batch is introduced it will purge the previous batch until the previous destination tank. When the new batch reaches the outlet of the pasteurizer the outlet line will start the product to product purge to previous tank and then change to the new one. If this new tank is in a farther area and that area is with water a product purge will be done. If this new tank is an area already with product, it will start to fill the tank directly.

Water purge is done like the product purge. First start the water purge from RMS to the inlet of the balance tank. When the water is at the inlet of the balance tank, it is empty and then continue with the water purge until the outlet. Then the outlet line starts the water purge until the destination tank and continue later sending to recovery the remaining product purge interface and the water purge interface.

Pasteurizer will keep the water recirculation until the operator decide to start another production or start the CIP.

There are some special situation during the purges in case some recirculation condition happen. During the product purge, if the destination goes to alarm the water will be sent to drain in the same pasteurizer area instead of the CCIP. When the product purge of the pasteurizer finish if the problem in the outlet line keeps the pasteurizer will go to recirculation, but if it is already fixed the outlet line will start the product purge. But if the issue is in the inlet there is no way to continue with the purge so pasteurizer has to recirculate, which means the new product and the water will mix and generate "milkywater", and pasteurizer will jump to "milkywater (product purge)" step. From there, if the issue is fixed, pasteurizer will start the product purge again and send all the pasteurizer volume to recovery. If the situation happen during the water purge, it jumps to "milkywater (water purge)" step, where the operator should decide what to do with that milkywater, send it to drain or to recovery.

2.1.1 RECIRCULATION CONDITIONS:

Before to start production and during production, the conditions which are reviewed are:

1- Pasteurization temperature not OK: When the temperature after the holder is lower than a parameter.

2- Flow not OK: when the flow is lower than a parameter

3- Separator not Ready: When separator is selected in the recipe and it is not ready.

4- Homo not ready: When the homogenizer is not ready for production.

5- Balance tank low level: When the level of the balance tank is lower than a parameter.

6- Feed inlet not ok: When the inlet line of the pasteurizer is not OK.

7- Outlet line not OK: When the outlet line of the pasteurizer is not OK.

8- Cream outlet line is not OK: When the outlet line from separator to cream buffer is not ready.

9- Outlet product temperature not OK: When the temperature in the outlet is out of the range define for a setpoint and one offset.

10- Separator inlet temperature not OK: When the temperature in the inlet of the separator is out of range define for a setpoint and one offset

11- Deaerator inlet temperature not OK: When the temperature in the inlet of the deaerator is out of a range define for a setpoint and one offset.

12- Raw milk tank not ready to empy: When the selected RMS tank used as source is not ready.

13- Raw milk line not ready for production: When the line from RMS is not ready.

14- Milk storage not ready to fill: When the MST is selected as destination and it is not ready.

15- Milk Buffer not ready to fill: When the MBT is selected as destination and it is not ready.

16- Mixing not ready to fill: When the Mixing tank is selected as destination and it is not ready.

17- Not destination selected: When there is no tank selected as destination but during water purge.

18- No valid recipes loaded: When the current recipe is not valid.

19- PMO selector not in production mode: When the selector is not in "production mode".

20- Cream tank needed and not selected: When the separator is selected and the destination cream tank is not selected.

21- Maximum volume produced without vitamins: When the recipe include vitamins and it was produced more than 50% of the batch and the operator did not introduce the vitamins yet.

22- Deaerator low level: When the level of the deaerator is lower than a parameter.

23- Recovery system not ready: Before to start production if the recovery is not ready.

24- Next recipe not OK for production: When the current recipe is close to finish and the next one is not valid.

25- High pressure in pasteurizer: When the pressure at the outlet of the pasteurizer is higher than 6.0 Bar.

26- Confirmation time after Homo Ok Again: When the pasteurizer went to recirculate because the homogenizer was not OK, and it is ready again, system has to count some volume to be sure it is homogenizer product in the outlet of the pasteurizer.

27- Confirmation time after pasteurization temperature OK Again: When the pasteurizer went to recirculate because the pasteurization temperature was not ok and it is recovered, system has to count some volume to be sure it is pasteurizer product in the outlet of the pasteurizer.

28- Non-Standarization product in the pasteurizer: When the pasteurizer went to recirculate and separator is included, system has to keep standardize for a liters to be sure all the product inside the pasteurizer has the same conditions.

29- Legal conditions: When the Legal PLC close the divert valves because the temperature or the flow is not OK.

2.1.2 HOMOGENIZER UNIT

Homogenizer is a different Unit, so the pasteurizer will send some signals to it in order to indicate when it should run the main pump and when it should activate the homogenizer stages.

In order to start the Main Pump, homogenizer needs to start the fan, oil pump and activate the water valves before to be ready to run the main pump. Once the deaerator is filled, the pump after deaerator will prime the homogenizer, increasing the pressure in the homogenizer inlet to allow start the main pump. When

the homogenizer main pump is running the pasteurizer know the homogenizer is ready. Then the homogenizer can start the pressure stages. When the product purge starts the pasteurizer request to start the pressure stages to the homogenizer. First it will activate the second stage and once it is ready it will start the first stage.

Homogenizer should be running all the time the pasteurizer is active.

2.1.3 SEPARATOR UNIT

Separator is a different unit that is controlled remotely from the process system. Pasteuriser will command to the separator to start, to go to CIP mode, to go to Production mode, etc. It's not needed to perform any action from the separator program due as it is mentioned before the separator is controlled as a slave of the pasteurizer. Anyway the operator can also start the separator speed up process from the separator program or even from the separator touchpanel placed on field.

The separator will follow some steps before give the permission to the process to include it in the path. Once the separator starts the speed up process, the cooling water system will start too. Once the separator reaches 2000rpm the oil lubrication pump will start. Then, the separator need to reach 4800rpm that is the nominal speed, and the last step it's to perform a total desludge, getting totally empty the bowl. Once all these steps are done the separator will give permission to the process to feed it up with product or water or CIP.

If the separator is ready to be fed but process system doesn't need to use the separator, it will not stop automatically, the separator will start the slow down after a certain time. In this way, if mistakenly the separator was started, it will be stopped after some time if the process system doesn't need it.

During production, pasteurizer starts recirculating water through the separator and once the product reaches the separator, some signals are sent to the separator to start the standardization required. Some of the raw product will be separate through the cream outlet line, and some product will go back to the pasteurizer like standardized milk. For this standardization process, the pasteurizer program will communicate to the separator the FATs of the raw product, the FAT required for the cream going out of the separator, and the FAT required in the standardized product.

If the pasteurizer needs to recirculate the product, the separator will keep separating the product for a certain volume (from balance tank to separator) in order to ensure that the whole pasteurizer is already standardized, and after these certain volume the separator will reinject so no cream will be going out. Once the pasteurizer start again to send product to destination, the separator will wait until the raw product reaches the separator and at that moment the standardization process will start again.

During CIP, the separator will receive the chemical solutions from the pasteurizer. These chemicals solutions will be returned to the pasteurizer through the milk path and through the cream path. In order to get clean the reinjection path the separator will switch between the cream outlet path and the reinjection path; for sure the time for the reinjection path will be much shorter.

2.2 FLUSH PROCESS

Flush operation will be allowed only when the pasteurizer is stopped, with product, and the Legal Selector in CIP mode. If this conditions are OK and there is no errors, the button to start the flush will appear. Operator should select the destination, tank (MBT or Mixing) recovery or drain.

If the inlet line, from the RMS to the balance tank is with product, the flush will start from RMS. If it is already with water, flush will use the water valve next to balance tank. Flush will push all the product out of the pasteurizer, and according to the destination selected by the operator, the outlet line will manage the destination.

When the flush is finished the equipment will be with water.

2.3 CIP PROCESS

CIP process will be started from CCIP only if the Legal selector is in CIP mode. CIP can be started when the pasteurizer is stopped but also when the pasteurizer is in water recirculation. Operator will select the CIP recipe desired and the different solutions will run through the equipment. If the chemicals solution of the selected recipe is configured with pulses, some activations will be performed in order to clean low/upper liftings, draining pipes, and other parts of the installation not included during the main path.

Actually, if the pasteurizer is stopped and the operator start the CIP, the pasteurizer will start as in production mode, it means, filling the balance tank and deaerator and starting the separator and the homogenizer, and then, it will jumps from "water recirculation" step to "waiting for CIP" step. Pasteurizer has to be with water. Once the pasteurizer is running and in the step "waiting for CIP", the operator can select the CIP recipe in the CCIP and start the cleaning.

The sterilization of this pasteurizer will be done in "production mode", as it was explain before, so sterilization cannot be done during the CIP. When the CIP is completed, if the operator had select the "sterilization required", system will jump to water recirculation so operator can change the legal selector to "production mode" and then start the sterilization. If the "sterilization required" is not selected after the CIP pasteurizer will stop.

CCIP will push different solution trough the pasteurizer, and these solution will be heat up in the pasteurizer. When a new solution is reaching the balance tank, we will get it empty in other to avoid interfaces. After that, the solution will run through the PHE of the pasteurizer, then it will go to the separator reaching the deaerator where we will clean through the sprayballs, the main inlet and the vitamin inlet. The path will continue through the homogenizer and going out of the pasteurizer through MST, MBT, and MXT areas.

If there is some alarm in the pasteurizer or in the CCIP, the pasteurizer will stop but keeping the path open.

As it is mentioned above, if pulses are configured, some activations will be perform in other to get clean some parts of the installation: RMS valves lifting, separator total desludge, divert path, recirculation path, homo Q valve, deaerator vacuum path, drain valves, MST valves lifting, MBT valves lifting, MXT valves lifting.

3 ANNEX

Further information related to these processes can be found on: