***Non-Technical Summary***

A. E Rodda & Son (Rodda’s) manufactures clotted cream and dairy products including milk and butter. Manufacturing takes place at the Creamery, Scorrier, Redruth, Cornwall.

**Milk reception**

The manufacturing process commences with receipt of milk which is sourced through the Rodda’s producer group. Milk is unloaded from the tanker at a rate of 45000 litres/hour. It passes through an intake chiller which will ensure that product is pulled down below 5c. From the tanker the raw milk is pumped into a range of segregated raw milk storage silos.

Silos are automatically selected in the correct sequence for loading and unloading i.e stock rotation. The raw milk silos are 125m3 or 20m3 or 45m3 stainless steel, fully insulated and clad. They have pressure transducers for weight monitoring and temperature probes to ensure product is below 5c. High level alarms are also used and if the alarms are activated then milk will be automatically sent to another silo.

**Separation process**

Milk is gravity fed from the silos to a balance tank before the raw milk passes through the regeneration section of the pasteurisers. At this point the raw milk will pass the outgoing skimmed milk which has already been pasteurised and is therefore above 72c. This allows the temperature of the incoming raw milk to be raised to approximately 20c through heat transfer. It also allows the outgoing skimmed milk to be chilled.

The raw milk is pumped into the separator with a flow up to 30000ltr/hour. It is de-sludged approximately every 27 minutes with sludge emitted to factory effluent. The cream is controlled to the required fat percentage by a Programmable Logic Controller (PLC) which looks at flow and temperature to calculate the density and modulate the skim control valve in the separator to standardise the cream.

**Pasteurisation**

After the raw milk is separated you are left with cream and skimmed milk. The skimmed milk is discharged down one of the process lines into the pasteurisers where it is pasteurised above 72.5c for greater than 15 seconds. This is achieved by pumping hot water through the circuit. The condensate generated from this system returns to the condensate recovery tank so it can later be used as boiler feed water therefore reducing water and chemical usage. After pasteurisation the skimmed milk is rapidly cooled to below 5­ oC using the glycol system and modulating Proportional Integral Derivative (PID) controlled valves to ensure only what is required is put in there. The skimmed milk enters segregated, insulated, clad skim silos to maintain temp. These are 2x 90m3, 2x 70m3, 4x 115m3 with high level alarms and flow meters. The skim is then flow meter dispatched to tankers where it is transported to the end user. Freezing Point Depression (FPD) tests and total acidity tests are conducted to ensure quality and certificates are sent out with the loads.

**Cream**

Cream flows from the separator into 381 litre (approx.) mobile tanks. Laboratory checks such as gerber tests are conducted throughout the day to ensure fat levels have been achieved. Mobile tanks are taken to the filling machines and manually connected to a pump. Cream is then dispensed into pots and collated onto trollies to be heat treated in our ovens. The ovens are gas fired with two stage burners. They are PLC controlled with PID loops to ensure that only the appropriate part of the burner is fired therefore maintaining our set point within the oven. Daily calibrated temperature probes are used by operatives to ensure the minimum temperature of 72.2 0c has been achieved.

Alternatively cream can be sent from the separator to the cream pasteuriser rather than being sent to the mobile tanks. From here it will be sent to the Cream Ageing Tanks (CAT tanks) before being despatched.

**Refrigeration**

Trollies are then placed into one of eighteen cooling passages. They use condenser units CF 6/25-84 special, medium R404A, with 1.5kw fan motors. Product is then moved to one of the refrigerators which use condenser units CA 10-64, medium R404A, 520W fan motor. All refrigeration units have automatic probes in them to control the chilling profile. System is fully alarmed and if any readings are out of specification it will email site management. Product is also manually probed with daily calibrated probes. Refrigeration equipment is regularly maintained including leak checks.

Product is then lidded. This may be through heat sealing, clip on lidding machinery or by hand.

Lidded product is then packed into shelf ready packaging or sale cases, palletized and transferred to warehouse for controlled refrigerated storage, air temp of 3c. When picked for despatch there is another manual temp probe (daily calibrated) to confirm product temp.

**Frozen clotted cream**

Reclaimed CO2 is used to freeze product down to maximum of -60c. It is then packed and moved to main storage freezer which is held at -24c. This is ensured through automatic probes in the freezer. Product is manually probed (daily calibrated) to confirm temperature before despatch.

**Butter**

Raw cream is pasteurised then aged overnight. Pumped into churn and then churned. Buttermilk is currently being drained off and meltout is not reclaimed but limited volumes are produced.

**Bulk cream**

After separation and pasteurisation bulk cream is dispatched to pallecons or tankers through the automated valve matrix, via the Cream Ageing Tanks (CAT). CAT tanks are jacketed 3x10000m3 and 2x 20000m3 tanks, the first three are chilled using glycol in the jackets. The second two have their own compressors and copper coil banding around the tanks. They have the same controls as the other silos. After loading has finished a final sample check is taken.

**Standardised milk**

The separation system looks at the required fat percentage for the milk you want to produce e.g. Semi Skimmed milk at 1.8% fat. It then uses an algorithm to calculate how much cream needs to be pumped into the skimmed milk flow to reach this fat percentage. Before the cream is pumped into the skimmed milk flow it is homogenised. This prevents the bottled milk naturally separating into cream and milk over time. When the milk has been standardised to the required fat percentage it is sent to the CAT tanks where it is stored at 5c. It is tested for phosphate levels, fat percentage and freezing depression point before it is released for bottling. After being bottled it is stored in the despatch fridge.

**Steam system**

The site has a 4000kg/hour high pressure steam boiler which is currently oil fired but is in the process of being converted to run on LPG. This will significantly lowers emissions levels and improve efficiencies. The system is run at 6.4bar, and the boiler has a modulating fuel head to give us a 3:1 turn down on steam generation therefore reducing the amount of stop starts for the boiler. Steam is used around the site for pasteurisation and the CIP system. For certain parts of equipment the steam pressure is regulated down to 4bar to be used. A condensate recovery system is in place which operates under pressure to maintain temperature efficiency. The boiler has regular servicing based upon running hours and it has automatic dosing which is verified with Planned Preventive Maintenance. All pipework is insulated.

**Chilled water system**

The Climaventa is a two compressor refrigeration unit with a 90kg refrigerant charge using R134A. This system chills the 33% diluted glycol down to the operating temp of -5c. The glycol system is a pressurised ring main that is pumped around to ensure operating temperature is maintained and ready for use. All the pipework is insulated and there are regular inspections on the glycol percentage and monthly PPM through Refrigeration South West. The pump has seals changed under operating hours. The chilled water is used throughout the installation for chilling.

**CIP system**

There are two Clean in Place (CIP) sets (segregated raw and finish) consisting of a main detergent tank and a pre-rinse tank. Each set is 4000litres/tonne. The CIP tanks are conical bottomed to aid the catchment of sludge or debris. They also have on line filters on the delivery pumps and automatic chemical dosing from peristaltic pumps that are monitored and controlled by the conductivity meter in the return pipework. The pre rinse tanks are also used for water and final detergent recovery. Each tank and line has its own separate CIP program providing flows and contact time relevant to the circuit size and length. All silos have low volume, high mechanical action rotary spray balls. The temperature is monitored at the front end and the return end. These are cross referenced to ensure that the necessary temperatures are being met and to allow us to modulate the steam valve and reduce steam consumption to the required amount therefore saving energy and not overheating.

Each of the two CIP sets delivery pumps are inverter controlled and there is a supply and return flow meter, conductivity meters and temperature probes. This set up ensures that cleaning efficiency is maximised and energy consumption is minimised during the CIP. If at any point during the wash any of the monitored/controlled parameters are not met, the system will alarm and require operator intervention. All of the wash information and valve sequencing is logged within our SCADA system.

**SCADA system**

The site uses a SCADA (supervisory control and data acquisition) system to monitor and control multiple variables throughout the entire installation. A SCADA system is used to monitor and control plant or equipment in industry installations, for example it will notify the user if particular plant is not operating effectively. This will ensure that where a piece of equipment is not working efficiently it will alert engineering immediately.

At Rodda’s the separation system is fully operated through the SCADA package and all the information is monitored and recorded in an electronic format enabling history to be replayed instantaneously. There are multiple alarms within the SCADA package on critical parts of equipment to flag up whether anything is operating outside of its tolerance. The SCADA package is also used to monitor all of the refrigeration and climate packages, CIP sets, all pasteurisers, standardising unit, main incoming water supply, effluent plant, bulk CO2 storage, lighting, ovens and entire milk farm.

**Environmental Management System**

The site operates an Environmental Management System that ensures the requirements of the environmental permit will be managed, monitored and reported on. This includes an aspects and impacts register which looks at all the environmental risks around the site and provides actions on how to minimise or eliminate the risks. Through the EMS a cross-departmental environmental team has been set up to tackle environmental objectives and targets such as reducing waste to landfill.

**PV system**

Rodda’s has a 50kw PV system installed to generate electricity for use on the site. All the electricity produced from the system is used on site to lower the sites grid electricity usage.

**Effluent Plant**

Trade effluent enters the foul drainage and is pumped to the effluent treatment plant. Daily samples are taken at the pump house to check COD, Ammonia, Phosphorus and pH levels. Effluent is pumped from here to the 150 cubic metre effluent holding tank. Effluent is pumped from the tank into the DAF unit where it is pH corrected and combined with a polymer and water mixture as well as dissolved air. Solids will float to the surface where it is skimmed off and sent to a sludge holding tank. The tank has high level alarms, water drain off points and is fully bunded. This sludge is collected regularly by a waste contractor and sent for anaerobic digestion. The effluent flows from the DAF unit to an anoxic pit, where it is pumped into a 1,000 cubic metre activated sludge aeration tank. The liquor from the aeration tank is pumped to a second DAF, where it is combined with a polymer and dissolved air. The bio-solids float to the surface where they are skimmed off and returned to the aeration tank. These solids can also be redirected into a second sludge holding tank, which are collected by a waste contractor and sent for anaerobic digestion. The clarified treated effluent then flows to the mineshaft discharge point, through and MCERT flow meter. This discharge pipe has a composite sampler fitted and the effluent is tested daily on site for COD, Ammonia, Phosphorus and pH. A sample is also collected fortnightly and sent to an externally certificated laboratory for independent analysis. This laboratory test for BOD, Ammoniacal Nitrogen, Phosphorus, Suspended Solids and pH. The site has a reed bed system which is not currently operational.