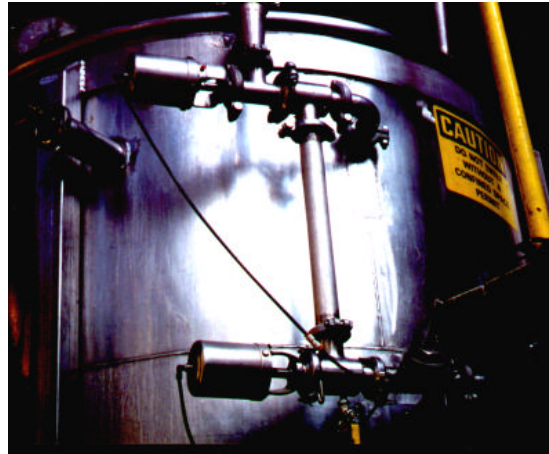
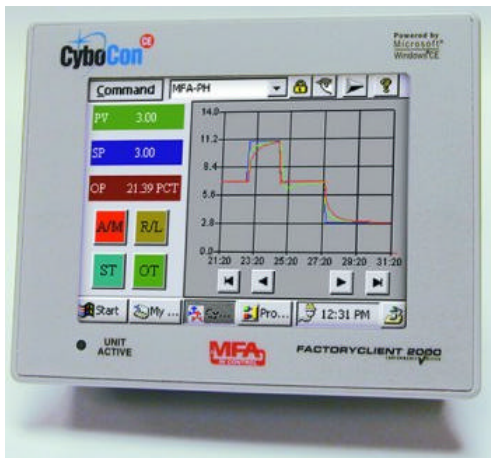


# Model-Free Adaptive Control on Steam Injection Systems

<i>Use of MFA Control</i>	<i>Benefits</i>
Handles large product inflow and temperature changes.	Temperature control is improved by at least a 50% reduction in temperature variability.
Prevents product from over-heating or under-heating.	Product diversion is minimized to achieve higher production efficiency and less energy consumption.
Handles steam system upsets.	A smoother operation is achieved.
Reduces variation in temperature and product density.	Product quality and production efficiency is improved.
Improves efficiency & productivity.	Full Return-On-Investment is achieved in less than one season.



*CyboCon CE (left) is mounted on the panel to replace PID and controls the tomato paste temperature. The holding tank (right) shows the 3-way valve that diverts the tomato paste back if its temperature is too high or too low.*

## *Case History: MFA at Small Planet, a General Mills subsidiary, in Atwater, California*

During the tomato harvest season, the plant operates around the clock to produce tomato paste using hot breaks, evaporators, steam injectors, and flash coolers. A smooth operation with consistent product quality is critical to cost efficiency and profitability.

Like other paste plants, one major problem is the steam injection system that sterilizes the tomato paste product. Tomato paste is sent from a holding tank through a steam injection pipe that injects hot steam onto the tomato paste. Any combination of 8 steam injectors

controlled by 8 manual valves can be in service. Operators may manually adjust these valves at any time based on the paste inflow.

An automatic controller is used to manipulate the main steam flow. The objective is to maintain the temperature of the tomato paste outflow within a narrow specification. Too high or too low a temperature will trigger a diversion signal to send the tomato paste back to the holding tank. The diverted hot tomato paste will go through the injection pipe again causing sudden temperature changes and density changes.

PID had a tough time controlling this process. The loop is typically left in manual. Frequent product diversion is common resulting in wasted energy, lower product quality and less efficiency.

The plant installed a CyboCon CE model-free adaptive (MFA) control instrument to replace the old Taylor PID controller. According to Howard Skinner, Evaporation/Aseptic Supervisor, his team is able to automatically control the temperature in all operating conditions even during plant upsets. The number of product diversions is sharply reduced due to much better temperature control. His operators like MFA a lot.