

1 Clean in Place (CIP) Skid Functional Specifications

1.1 Brief Overview of the System

- Designed to thoroughly clean the process equipment without the need for equipment disassembly
- Designed to clean auxiliary equipment such as the portable cannabis tanks using a portable CIP return pump and quick connection ports.
- Uses city water as the main supply of water when diluting cleaning chemicals but is also supplied with DAW when necessary for light cleaning procedures
- The applicable equipment for CIP cleaning includes the main process lines, all tanks, other process piping (including heat exchanger), sterile filters, membranes, pumps, valves, carbonator, and filler.
- Capable of cleaning any area which may come in contact with product or raw materials
- There are currently ten recipe driven cleaning procedures developed for the CIP; each recipe focuses on either a specific equipment parts or specific cleaning regime depending on proposed cleaning schedule. One custom recipe will be available for engineering and trained operators for testing and programming unique cleaning cycles.
- To prevent operator error and to significantly mitigate the risk of mixing CIP cleaning solution with finished product or raw materials, swing panels requiring manual changeovers using a wrench are used to force operators to travel to the process floor and perform necessary inspections prior to beginning a cleaning cycle.

1.2 Process Description

The CIP system is supplied with city water from the city water tank through a 4” pipeline equipped with a check valve and control valve **21V018**. It is also supplied with DAW water for use with light cleaning cycles as a source of sterile water. Caustic and acid chemicals will be purchased in 55 US gallon drums and then transferred via pump (handheld electric drum pump) to double containment drums for the Caustic and Acid. However, the sanitizer – peracetic acid – must be kept in the supplier drum to prevent premature decomposition due to exposure to oxygen.

City water will be used to prepare caustic, acidic, and sanitation solutions, or top up the pre-rinse tank. Metering pumps will supply fresh chemicals to maintain desired concentrations. The system is designed to minimize chemical waste via a purge and recycle loop. The CIP maintains cleaning solution concentrations by purging a small amount of the recycle stream and then topping up the tanks with city water and fresh chemicals from the holding tanks. The maximum caustic run is at 125 – 135 °F for the tanks, cannot have large temperature fluctuations for large vessels because can cause a strong vacuum due to rapid cooling. Lab titrations can be used to verify accuracy of

concentrations of caustic and acid used in the supply tanks. Conductivity measurements, used when the CIP skid is operating online, are good but should not be taken as infallible.

The inlet and outlet of the caustic holding tank is controlled using valves **21V009** (inlet) and **21V013** (outlet). Chemical resistant pump **21P003** is used to draw fresh caustic from drum. The tank liquid level is monitored using pressure transducer **21PT001**. Similarly, the acid holding tank is isolated using valves **21V010** (inlet) and **21V014** (outlet), replenished using chemical resistant pump **21P002**, and monitored using pressure transducer **21PT002**. The sanitation tank may be isolated using valves **21V011** (inlet) and **21V015** (outlet), replenished using chemical resistant pump **21P001**, and monitored using **21PT003**. Finally, the pre-rinse holding tank is controlled using valves **21V012** (inlet) and **21V016** (outlet); it has no pump or drum connection because it relies on CIP return and supply pumps. It will contain a low dosage of caustic scavenged from recycling process during caustic rinse cycles. The pre rinse tank level is monitored using pressure transducer **21PT004**. All CIP tank inlet and outlet lines are 3" and each tank is equipped with an emergency manual valve-controlled drainage line and a passive 3" tank overflow drain. A drainage port is installed after the mixing point of the city water and the four holding tanks; it is controlled by valve **21V017**. A second drainage port is located at the bypass recycle line, which uses valve **21V008**. The recycle bypass can be closed off by using valve **21V007**. After the recycle and city water streams merge, there is a low liquid level indicator (**21LSL001**) and a pump denoted CIP-Supply pump (**21M001**) sends cleaning solution to a heat exchanger (CIP-Heat Ex.) at 150 gpm at 30 psi using 15 hp. The heat exchanger is rated for a water flow of 2000 lb/hr and is supplied by a steam utility, controlled using a pressure regulator and valve **21V006**. After achieving set temperature, the CIP-S (supply) passes a sample port junction and a temperature transducer (**21TT002**). If the temperature or solution composition is unsatisfactory, valve **21V005** can be used to send the solution back to recycle for adjustment. Otherwise the solution is sent out to the system branched out in 3" CIP-S lines using valves **21V001** and **21V004** (for CIP auxiliary supply). CIP-R (return) comes back to CIP using **21V002** and **21V003**. Conductivity (**21CT001**), temperature (**21TT001**) and flow (**21FS001**) transducers measure the condition of the CIP return stream. A strainer is used to remove any solids or particulates before recycle stream returns to CIP system.

1.3 Cleaning Procedure

The recipe driven cleaning procedure is driven by a 23-step process. Each step is optional and will depend on the specific recipe chosen.

- 1) Initiate CIP – system must be in CIP completed mode (finished step 23) before a new recipe can be run (unless overwritten). This is a failsafe feature.
- 2) Fill Pre-rinse – with city water, should be mostly full due to previous CIP run with a bit of caustic scavenged from caustic rinse recycle
- 3) Fill Caustic tank with city water and add caustic concentrate as needed
- 4) Fill Acid tank with city water and add acid concentrate as needed
- 5) Dose/Preheat Pre-Rinse solution
- 6) Dose/Preheat caustic solution
- 7) Dose/preheat acid solution
- 8) Drain/Fill/Preheat Sani solution
- 9) Acknowledge CIP way ready (meaning the proper piping path is installed for the recipe)
- 10) Acknowledge manway/drain open in tank – most tank manways should be cracked open to clean the seam (may want warning signs like CIP in progress, stay away)
- 11) H₂O Pre-Rinse using only city water, which will be sent straight to drain, no recycling; quick initial clean. Criteria to move on is time.
- 12) Slight caustic pre-rinse – using solution that is in the pre-rinse tank, will go right to drain, bit of caustic in it. All rinses go back to CIP skid first. Criteria to move on is time.
- 13) *Acknowledge* Manway/drain closed
- 14) *Acknowledge* rack arm installed
- 15) Caustic Wash – NaOH 1.5 – 2.5% - 15 to 20 minutes tank. Use sample port on CIP to grab a bit of caustic sample and go titrate in the lab when necessary; a good way to check conductivity sensor. Usually do not want to have caustic of over 5% (upper limit).
- 16) *Acknowledge* tank venting OK – make sure that we can rinse with water without problems. Will try to heat up water slightly to reduce thermal shock on tank. Majority of caustic will be returned to caustic tank, then top off based on conductivity meter return reading. Divert 17-25 milli siemens back to caustic, then to pre-rinse tank until full, then to drain
- 17) H₂O rinse #2 – run 3 to 5 minutes. Can make quick swab tests via tank manway, check if caustic still present, if so, run step 17 again.
- 18) *Acknowledge* Caustic Inspection Ok. Go out and take a quick look, pop manway open, visual inspection. If not, pause CIP, go back to step 15, resume CIP, redo that step.
- 19) Acid Wash – 10 to 15 minutes, historically can be shorter than caustic, which does the bulk of the cleaning. Acid deal more with discoloration and stainless-steel passivation.
- 20) H₂O Rinse #3 – put back to CIP to recover acid, then to drain
- 21) *Acknowledge* Acid Inspection OK
- 22) Run no rinse sanitization cycle with peracetic acid. If cleaning piping, have option of using hot sanitize.

23) CIP Complete, System Ready for next recipe.

1.4 CIP Swing Panels

1.4.1 Swing Panel # 1

Swing panel #1 is the master CIP supply panel that feeds CIP-S lines to all the skids (see bottom right in Figure 1-1). It has no control valves but requires to be manually switched when alternating between CIP system and hot water sanitation cycles (using a wrench). Furthermore, swing panel #1 is designated for sending CIP-S lines to the main mixing line and the filler.

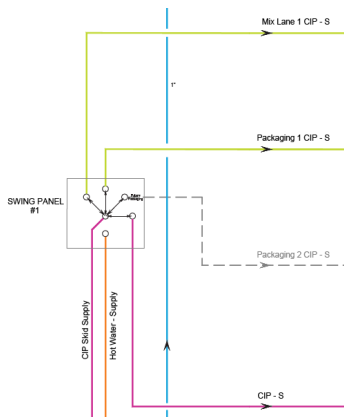


Figure 1-1: Swing panel #1 that is used by the mixing valves and packaging skids.

1.4.2 Swing Panels #2 Feeding CIP to Tea Steeping and Tea Concentrate Tanks

Swing panel #2 is used to feed the CIP-S through a 2" line to both the tea steeping and tea concentrate tanks and serves as the return point for CIP-R. The flow to swing panel #2 is controlled by three valves: the CIP-S control valve (21V019) and CIP-R control valve (21V021). A third control valve (21V020) is installed between them for regulating if the CIP system should bypass the tea tanks (open configuration) or feed through the tea tanks (closed configuration)

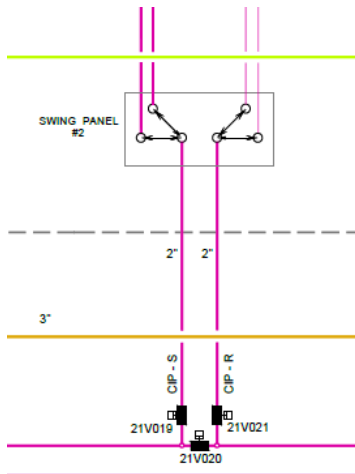


Figure 1-2: P&ID snippet showing the swing panel #2 configuration

1.4.3 Swing Panel #3 Feeding CIP to Mix, Sugar, and Cannabis Extract Tanks

Swing panel #3 is used to feed the CIP-S through a 2” line to mixing water, sugar, and cannabis extract tanks and serves as the return point for their respected CIP-R lines. The flow to swing panel #3 is controlled by three valves: the CIP-S control valve (21V022) and CIP-R control valve (21V024). A third control valve (21V023) is installed between them for regulating if the CIP system should bypass the tanks (open configuration) or feed through the tanks (closed configuration).

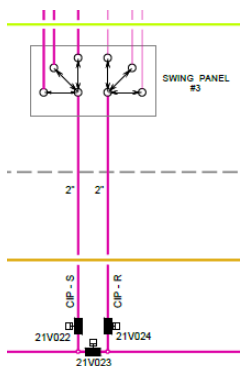


Figure 1-3: P&ID snippet of swing panel #3 feeding the mixing water, sugar, and cannabis extract CIP

1.4.4 Swing Panel #4

Swing panel # is used to feed the CIP-S through a 2” line to both of the buffer tanks and serves as the return point for their respected CIP-R lines. The flow to swing panel #4 is controlled by three

valves: the CIP-S control valve (21V025) and CIP-R control valve (21V027). A third control valve (21V026) is installed between them for regulating if the CIP system should bypass the tanks (open configuration) or feed through the tanks (closed configuration).

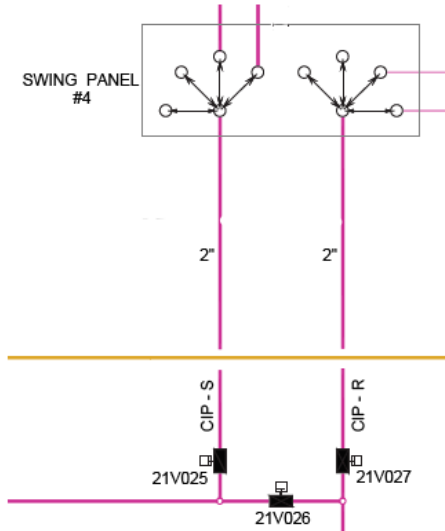


Figure 1-4: Swing panel #4 snippet showing configuration

1.4.5 CIP Swing Panel #5

The final swing panel is the master CIP-R panel that returns all CIP-S streams back to the CIP skid. It must be switched when alternating between CIP system and hot water sanitation cycles. The bottom left line in Figure 10-3 combines all CIP-R lines and feed them back to the CIP.

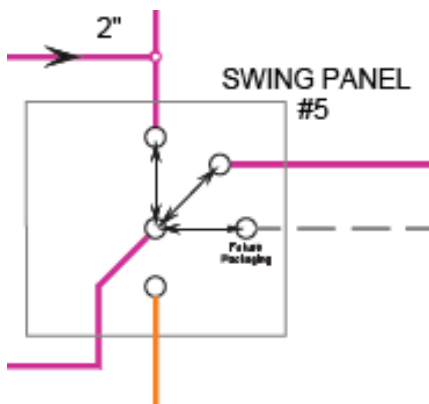


Figure 1-5: Swing panel #5 snippet, orange line is hot water return, the other lines are all CIP-R being fed to the bottom