

C I P & Sanitation – Natural Mineral Water Plant

Introduction – Ozone – Cleaning In Place [CIP]

Cleaning in place [CIP], also referred as Clean-In-Place, is an integrated system used for cleaning & Sanitizing internal system of vessel, valves, pipes, filters all other process equipment without dismantling. As per good manufacturing practices [GMP], any form of chlorine or any hazardous chemicals are not permitted in natural mineral drinking water.

Ozone CIP is the most powerful & most commonly used technology. Ever since ozone got FDA & USDA approval as generally recognized as safe [GRAS] in year 1982 for direct contact with drinking water, food, beverage, dairy products etc. its use has increased extensively.

Objective –

To keep high hygiene standard & adequate shelf life's of product in package bottled water & natural mineral water, by frequent cleaning & disinfection of entire production line & equipment in essential.

Why C I P –

Since source water is from natural spring, water may contain traces of organic pollutants. Since no disinfection chemicals are used in the process, there is a strong possibility of organic deposition & biofilm /slim formation on internal surface. Frequent C I P ensures for removal of any undesired contaminations or biofilm generation within the system i.e. pipeline, valves, vessels, joints, bends, filters etc.

Why Ozone C I P –

There are many sanitizing chemical processes available in the industry. Apart from being time consuming, unreliable and environmentally not friendly, the main drawback of them is, they produce harmful by-product & unused excess residual, which needs to be rinsed with plain water (without any disinfectant chemical). There is a need of lot of plain rinse water, which can also be source of contamination. Also they are not complete by their own, and they are used with ultra-high temperature. Another major drawback is that they are not reliable & take long time to sanitize. On the other hand Ozone is strongest & fastest oxidizing disinfectant. Ozone CIP can quickly, efficiently & reliably remove complete biofilms & oxidize any organic buildups. The advantage of Ozone for CIP is that residual Ozone naturally gets degraded to oxygen. In cleaning & sanitization process Ozone does not produce any other chemical by products and susceptible plain water rinse is not required & advised not to rinse Ozone CIP system.

Approval –

- In November 1982, USDA & FDA approved Ozone As “Generally Recognized As Safe” (GRAS)
- FDA approved use of Ozone as a Sanitizing Agent for bottled water treatment line as GRAS.
- BIS Package Drinking Water manual SM/IS14543/01-January 2005, confirms use of Ozone for CIP & Sterilization. Annexure – 3 page 38.

Advantages of Ozone CIP –

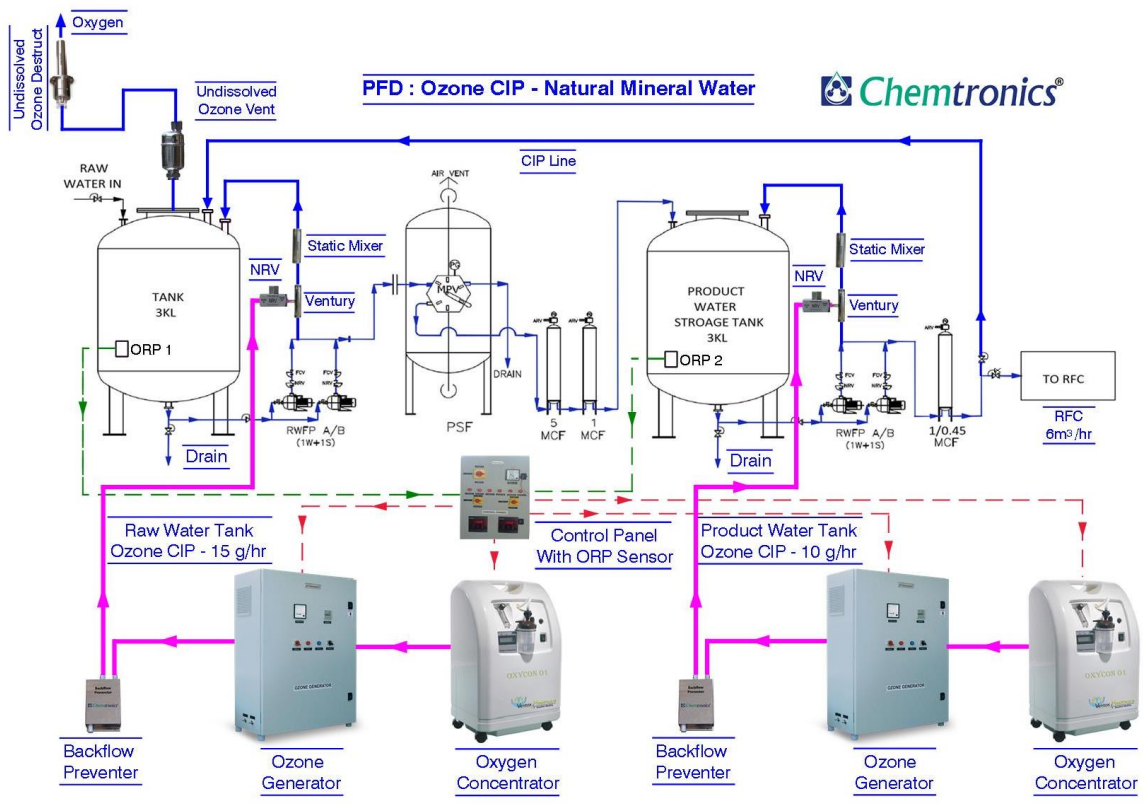
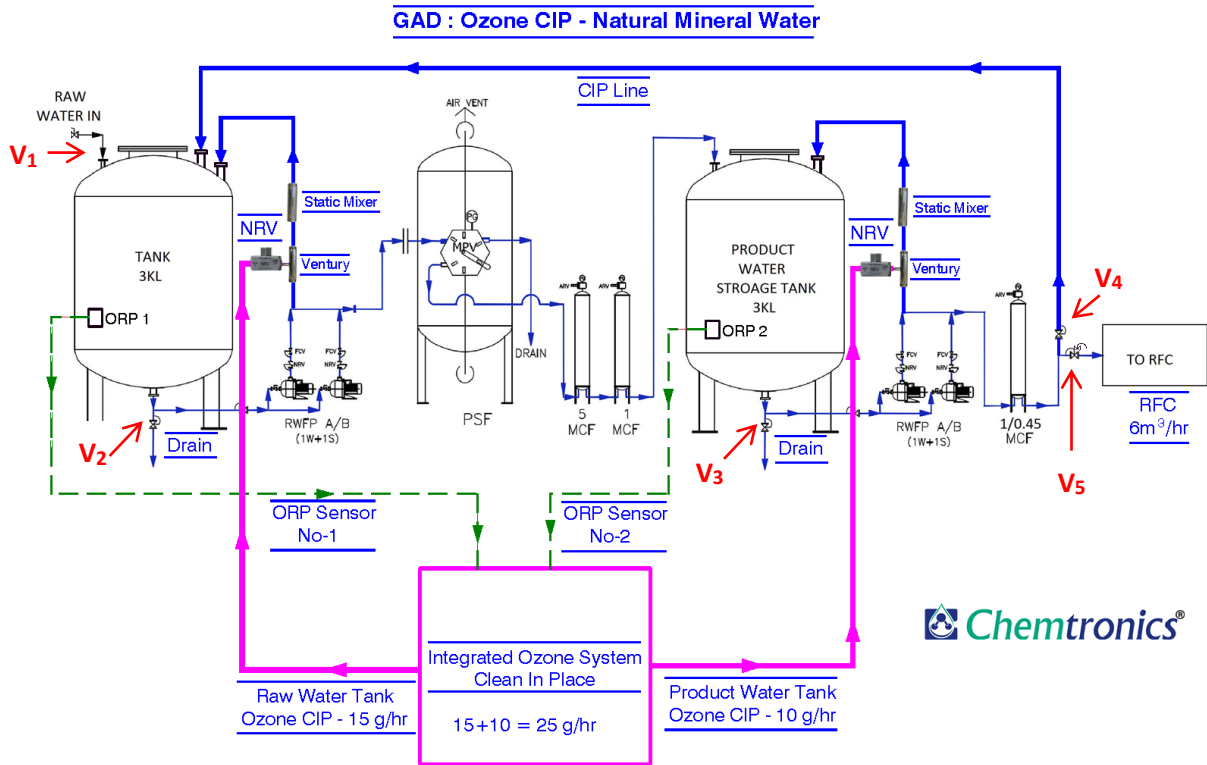
- USDA & FDA recognized direct contact of Ozone as GRAS
- Ozone has highest oxidation potential.
- Ozone is a sanitizing agent over wider spectrum & micro organism
- Post treatment Ozone does not generate chemical residuals
- Disinfectant by product [DBPs] are safe for disposal without any further treatment.
- Excess residual Ozone Naturally degrades to harmless Oxygen
- Ozone CIP does not increase salinity (dissolved solid)
- Higher temp. are not required
- Ozone is most environment friendly chemical
- Effectiveness of Ozone CIP can be monitored online
- Ozone CIP eliminates the ordering, transportation, storage & handling of hazardous chemicals
- Faster disinfection due to high oxidation potential.
- Reduced operational cost, time, water & waste water
- Repeatable & reliable chemical treatment

Methodology Ozone CIP –

Standard C I P process comprises of Alkaline cleaning, Acid Cleaning & Disinfection & Sanitization stages & each stage followed by thorough rinse. Since source is only natural mineral water alkaline & acid cleaning is not essential. We can directly use Ozone for cleaning, disinfection, sanitization & rinsing.

In **figure no. 1** we can see the General Arrangement Drawing [GAD] of “Clean-In-Place”[CIP] arrangement for cleaning & sanitizing natural mineral water packaging plant.

Similarly, **figure no. 2** shows detailed Process Flow Diagram [PFD] of Natural Mineral water plant C I P arrangement.



- Step 1 :** Close valve no. V₂, V₃ & V₅ & fill raw water tank T1 by opening valve no. V1.
- Step 2 :** Once T1 is full start pump P1 & start filling Process water Tank T2.
- Step 3 :** Once tank T2 is full, close valve V1 & Start Pump P3 so water starts recirculation.
- Step 4 :** Start Ozone System & monitor the ORP levels in ORP 1 & ORP 2.
- Step 5 :** Continue the circulation & Ozone system & observe ORP level reads 800 mv.
- Step 6 :** Once ORP is reached 800 mv, continue for more 5.0 minutes till ORP remains consistently above 800 mv. During this time ORP readings may increase, which is absolutely normal.
- Step 7 :** Stop Ozone System & All Pumps (P1 & P3)
- Step 8 :** Open Valve V2 & V3 to drain all tanks & system.
- Step 9 :** Once completely drained repeat step 1, Step 2, Step 3 to perform rinse, for 5 minutes.
- Step 10 :** After 5 Minute Stop Pumps P1 & P3 & drain rinse water by opening valves V2 & V3.
- Step 11 :** Once all tanks & system is drained, close valve V2 & V3 & now C I P is complete.
- Step 12 :** Open valve V1 & V5 & start the normal bottle filling process.