# Graver CelluTEC
## Cleaning & Regeneration Protocols

**Maximum Recommended Forward Pressure Differential:**

60 psid @ 70°F (4.1 bar @ 21°C); 30 psid @ 176°F (2.0 bar @ 80°C)

**Maximum Recommended Reverse Pressure Differential:**

25 psid @ 70°F (2.0 bar @ 21°C)

## Pre-Cleaning Assessment

Begin by measuring and recording the initial differential pressure across the filter. This value will serve as a baseline for evaluating cleaning effectiveness and should be documented in the maintenance log.

Cleaning protocols will be most effective if initiated at 1/3 the filter's maximum recommended differential pressure. Heavily soiled filters are much more difficult to clean, and regeneration may prove less effective.

Conduct a visual inspection of the filter housing and accessible areas to document any visible contamination patterns or unusual deposits. The type and nature of the contamination can help determine the most effective cleaning approach.

Record the product being filtered and its characteristics, as this information is crucial for selecting appropriate cleaning chemicals and procedures.

The duration of filter use should be noted, as extended use beyond recommended limits may make cleaning impractical. If the final differential pressure is significantly above normal operating parameters, filter replacement may be more appropriate than cleaning.

## Forward Flush Protocol (Primary Cleaning Method)

### Initial Rinse

The forward flush procedure begins with an ambient temperature water rinse. The water used for cleaning must be pre-filtered to the same or finer rating as the filter being cleaned to prevent introduction of new contaminants. Maintain the standard operating flow rate used during normal

filtration. Continue the initial rinse for 5-10 minutes to remove loose particulates and easily dislodged contamination.

## Hot Water Flush

After the initial rinse, begin gradually increasing the water temperature. The target temperature range is 125-145°F (52-63°C), but never exceed the maximum temperature limit of 176°F (80°C). Temperature increases should be gradual to prevent thermal shock to the filter media. Maintain the hot water flow for 15-20 minutes while monitoring the differential pressure across the filter. Any sudden changes in differential pressure should trigger an immediate evaluation of the process.

## Chemical Cleaning

Chemical cleaning may be necessary when dealing with organic or protein-based fouling that persists after hot water flushing. Begin by preparing the cleaning solution using hot water at 125-145°F (52-63°C). The following cleaning agents have been validated for use with cellulosic media containing diatomaceous earth:

- Sodium hypochlorite
- Enzyme-based cleaners (such as Tergazyme)
- Citric acid
- Food-grade surfactants
- Sodium metabisulfite

Sodium hypochlorite solution should be prepared at a concentration of 100-200 ppm. This concentration provides effective sanitization while protecting the integrity of the filter media. When using enzymatic cleaners, follow the manufacturer's specific instructions for concentration and contact time, as these can vary by product. For situations requiring acid cleaning, prepare a 0.5% citric acid solution, which provides adequate cleaning while maintaining a safe pH level for the media. Food-grade surfactants should be used according to manufacturer specifications. Sodium metabisulfite can be used at 0.1-0.5% concentration for removing oxidizable contaminants.

The cleaning solution should be circulated through the filter system for 15-30 minutes. Throughout this process, regularly monitor both pH and temperature to ensure parameters remain within acceptable ranges.

## Final Rinse

The final rinse procedure is critical for removing all traces of cleaning agents. Use pre-filtered water and continue rinsing until achieving all of the following criteria:

- The rinse water pH matches the incoming water pH
- No evidence of cleaning chemicals remains, which can be verified by:
- No residual chlorine odor (if chlorine-based sanitizers were used)
- No foam or bubbles in the effluent (if surfactants were used)
- No discoloration in the effluent

- Visual inspection confirms the water runs clear
- Minimum of 3 system volume changes with rinse water

This typically requires a minimum of 10 minutes of rinsing, though longer periods may be necessary based on monitoring results. When in doubt, continue rinsing for an additional system volume. For critical applications, retain a sample of the final rinse water for comparison against future cleaning cycles.

# Reverse Flow Cleaning (Backflushing)

Reverse flow cleaning can be implemented when forward flush procedures prove insufficient to restore filter performance. While the CelluTEC filter is designed to withstand reverse differential pressure up to 25 psid @ 70°F (2.0 bar @ 21°C), it is recommended to start at lower pressures and gradually increase as needed for cleaning effectiveness. The following procedure should be followed:

1. Begin reverse flow at low pressure (5-10 psid)
2. If necessary, gradually increase pressure up to the maximum 25 psid (2.0 bar) while monitoring differential pressure
3. When using elevated temperatures (>122 °F or 50 °C), reduce the maximum reverse pressure by 50%
4. Continue reverse flow for 10-15 minutes or until visible improvement in filter condition
5. Return to forward flow for a final rinse to remove any dislodged particles and resettle the filter media

This more robust reverse flow capability, compared to lenticular filters, makes the CelluTEC particularly suitable for applications where regular backwashing may be beneficial for extending filter life.

# Chemical Compatibility Guidelines

The selection of cleaning chemicals must account for the unique properties of cellulosic media and diatomaceous earth. The following cleaning agents have been validated through extensive testing:

Sodium hypochlorite at 100-200 ppm provides effective sanitization while maintaining media integrity. Food-grade enzymatic cleaners offer gentle yet thorough cleaning of organic contaminants. Citric acid at 0.5% concentration helps remove mineral deposits without degrading the filter media.

Several categories of chemicals must be strictly avoided to prevent damage to the filter: Strong acids below pH 4 can degrade the cellulosic structure irreversibly. Caustic solutions will dissolve both the DE component and damage cellulose fibers. Concentrated oxidizers can break down the media structure, while organic solvents may compromise media bonding. High concentration hydrogen peroxide and peracetic acid solutions are too aggressive for this media type.

# Storage Procedures

## Short-Term Storage

For periods less than seven days, maintain the filter in a wet state following thorough cleaning. Prepare either a 0.1% citric acid solution or 70% ethanol solution for storage. The storage solution helps prevent microbial growth while maintaining media integrity. Keep the filter completely submerged in the selected solution.

## Long-Term Storage

Long-term storage requires more extensive preparation to prevent media degradation. After thorough cleaning, rinse the filter completely with filtered water to remove all chemical traces. Drain the filter thoroughly and dry it using filtered air at low pressure. Once completely dry, seal the filter in a clean plastic bag, removing as much air as possible. Store the sealed filter in a cool, dry location away from direct sunlight and chemical vapors.

# Safety Requirements

Operator safety is paramount during all cleaning procedures. Personal protective equipment must include chemical-resistant gloves appropriate for the cleaning agents being used, protective eyewear that guards against chemical splashes, and appropriate protective clothing to prevent skin contact with cleaning solutions.

Ensure all cleaning operations are conducted in well-ventilated areas. When using chemical cleaning agents, verify proper ventilation systems are operational. Maintain current Safety Data Sheets (SDS) for all chemicals used in the cleaning process, and ensure they are readily accessible to operators.

# Additional Considerations

- All cleaning solutions and rinse water must be pre-filtered to prevent introduction of new contaminants.
- Monitor differential pressure continuously throughout cleaning procedures to detect any unusual changes that might indicate media damage.
- Avoid rapid temperature changes that could stress the filter media. Never exceed the maximum operating parameters specified for the filter.
- If cleaning fails to restore filter performance after one attempt, evaluate whether replacement would be more cost-effective than additional cleaning attempts.