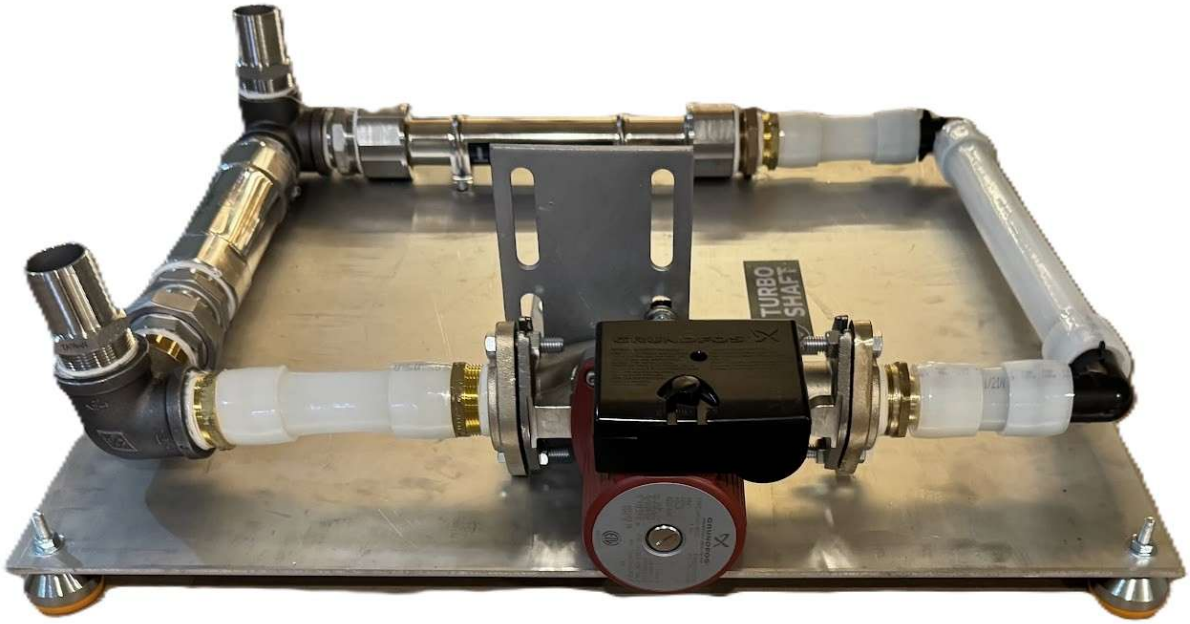
TURBO SHAFT

POWERED BY GEN-2
PATENT PENDING
SHAFT TECHNOLOGY

USER MANUAL AND INSTALLATION GUIDE



CRS
CHEMICAL REDUCTION SOLUTIONS
www.chemicalreduction.com

Please read and save these instructions.

General Safety Information

Icon Legend:

 **— DANGER! … Injury or death and property damage are *imminent***

 **— WARNING! … Injury or death and property damage are *possible***

 **— CAUTION! … Potential property damage, expensive repairs, and/or voiding the equipment warranty *may result***

 **BURN HAZARD! Direct exposure to steam, hot water, or hot metal surfaces can cause severe skin burns. Skin contact with 140°F (60°C) water or metal for only five (5) seconds may cause a second-degree burn.**

Failure to comply with instructions following a safety icon may result in adverse consequences including, property damage, personal injury, or, in extreme cases, death.

General Safety Guidelines:

1. Inappropriate use of this product (beyond typical, intended use) could cause damage to the product and other property. It may also result in personal injury or, in extreme cases, death.
2. Only designated, qualified, and competent personnel should conduct installation, maintenance, and service in accordance with the directions in this product instruction manual.
3. Installation shall comply with all applicable federal, state, and local, electrical and construction, regulatory codes.
4. Improper installation, start-up, operation, maintenance, or service may void the product warranty.
5. When installing, commissioning or servicing this product:
   a. ALWAYS select and wear appropriate personal protective equipment (PPE) before carrying out any physical work at the job site. Appropriate PPE may include hard hats, safety glasses, gloves, boots or shoes w/ non-slip soles and toe guards, and protective overalls.
   b. ALWAYS scan the work area and take note of potential hazards before entering. Adjust your travel path or work position to avoid hazards and personal injury.
   c. ALWAYS observe designated safety procedures when working in hazardous locations (areas containing explosive and combustible gases, vapors, and dusts) and confined spaces (locations where the breathable air supply may be limited or variable or where entrapment could occur).
   d. ALWAYS use appropriate lockout-tagout procedures to disconnect power sources and de-energize machinery before conducting installation, service, and repair.
   e. ALWAYS use great care and appropriate safety gear when working above ground level, especially on ladders and platforms or in the presence of overhead, electrical power lines.
   f. ALWAYS ensure that all “live” steam, water supply, and condensate return lines are isolated before breaking or loosening any plumbing joints.
   g. ALWAYS carefully relieve any residual internal pressure in the system or connecting pipe work before breaking or loosening any plumbing joints.
   h. ALWAYS allow hot parts to cool before commencing work to avoid the risk of skin burns.

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1. Product Description

The CRS Turbo Shaft Ionization-Enhanced Nanobubble Generator (hereinafter referred to as the **"Turbo Shaft"**) is a next-generation water-conditioning solution engineered to dramatically improve the performance, efficiency, and reliability of car wash systems. The Turbo Shaft reduces surface tension, enhances chemical dispersion, increases dissolved oxygen, removes and prevents scale and biofilm, keeps injectors and nozzles free-flowing, improves drying, boosts foam quality, and stabilizes both alkaline and RO-treated processes.

Powered by CRS's advanced ionized nanobubble technology, the Turbo Shaft produces up to 150% more nanobubbles than previous generations while eliminating minimum-flow requirements. The nanobubble generator core contains no moving parts inside the water path, requires no chemical additives, and operates with minimal electrical demand.

Designed for simple installation and long service intervals, the Turbo Shaft can be used as a standalone main-line water treatment device. Once installed, the Turbo Shaft continuously conditions water to prevent scale formation—even in extremely hard water—while improving the performance of soaps, waxes, sealants, RO membranes, and all downstream equipment.

2. Applications

Standard applications include but are not limited to the following:
- Car Washes (mainline water softener alternative, feedline to RO or chemical panel)
- Irrigation
- Open Condenser Water Systems; Closed Loop Hydronic Water Systems (Heating and Cooling); Domestic Hot Water
- Water Used for Cleaning

All applications—including those listed and not listed here—should be assessed by an appropriate engineer prior to installation. Questions regarding CRS or nanobubble generator installation should be directed to www.chemicalreduction.com.

3. Product Operation

How the Turbo Shaft Operates

Once installed in the correct location, the CRS Turbo Shaft or Turbo Shaft Mini immediately begins generating ionized nanobubbles and charged particles as soon as water flows through the device.

- There is no minimum flow requirement for operation—unlike the original Shaft, both Turbo Shaft models are engineered to activate even at very low or intermittent flows.

- The maximum flow rate for each model represents the point at which insufficient nanobubble concentration would be achieved. Staying at or below the listed maximum flow preserves optimal system efficiency.

Model Selection Overview

Turbo Shaft Mini (up to 40 GPM)

Designed for:

- RO machine feed lines
- Chemical panel / injector supply lines
- Low-flow, high-efficiency pre-treatment

Turbo Shaft (up to 125 GPM)

Designed for:

- Main water line of a car wash
- Partial or full replacement of water softeners
- Whole-site scale prevention and chemistry optimization

Car Wash Sizing & Placement Guidelines

1. RO System Feed Line (Use the Turbo Shaft Mini)

The Turbo Shaft Mini should be installed on the pressurized line feeding the RO machine.

Sizing is simple:

- **Typical RO production flows:** 6–8 GPM
- **Peak flows:** 14–20+ GPM depending on storage tank draw
- The Turbo Shaft Mini (40 GPM max) easily handles all RO feed conditions at almost all commercial washes.

Purpose:

- Prevent scale and biofilm from fouling RO membranes
- Reduce backflushing frequency on GAC prefilters

- Increase permeate quality and extend membrane life
- Dramatically improve spot free drying of cars

2. Chemical Panel Feed Lines (Use the Turbo Shaft Mini)

Install the Turbo Shaft Mini upstream of the chemical injection panel or injector manifold.

If the wash is consistently busy:

- Size to average flow across all active chemistry nozzles.
- One Turbo Shaft Mini per chemical panel is sufficient in most tunnel and busy IBA applications.

Benefits:

- Eliminates injector fouling
- Enhances foam quality, color pop, and fragrance
- Improves dispersion of presoaks, waxes, sealants, and drying agents

3. Main Water Line (Use the Turbo Shaft – full size)

The Turbo Shaft (max 125 GPM) is designed for installation on the primary incoming water line ahead of the car wash equipment or manifolds.

Purpose:

- Replace or supplement salt-based water softeners
- Prevent scale formation site-wide
- Improve drying performance
- Lower surface tension for better rinsing and sheeting
- Enhance performance of all downstream chemistry

Recommended placement:

- Immediately downstream of the backflow preventer
- Upstream of the water softener (if being supplemented) or in place of the water softener if replacing it
- Ahead of all chemical injection points, RO feed lines, and heat exchangers

4. Product Installation

⚠ IMPORTANT:

- The Turbo Shaft and Turbo Shaft Mini must always stay full of water (“flooded”) while running.
- Never run the pump dry. Running dry will damage the pump permanently.
- Follow the labels on the unit to make sure the INLET and OUTLET face the correct direction.

A licensed plumber or mechanical contractor is recommended for installation.

Installing a Turbo Shaft Nanobubble Generator

1. Identify Which Turbo Shaft You Are Installing

Turbo Shaft (full size) — up to 125 GPM

- For the **main water line** of the car wash.
- Often used **instead of** or **in addition to** a water softener.

Turbo Shaft Mini — up to 40 GPM

- RO feed line
- Chemical panel feed line
- Small dedicated flow lines

2. Make Sure You Have the Correct Fittings

Turbo Shaft (full size):

- Has 2" NPT female connections
- Can be ordered with:
  - Stainless hose barbs
  - Thermoplastic flex hose
  - Adapters that connect directly to **Clack or Fleck bypass valves** (perfect when replacing a water softener)

Turbo Shaft Mini:

- Has 1" NPT female connections
- Can be “soft plumbed” using flex hose or 1" NPT adapters

3. Before You Start

Do **ALL** of these before touching any pipes:

- Turn off water to the area where you will install the Turbo Shaft
- Relieve pressure by opening a nearby valve
- Make sure you know which direction the water flows
- Find the INLET and OUTLET arrows on the Turbo Shaft
- Lay out all hoses, barbs, adapters, and clamps

4. Install the Turbo Shaft

Step 1: Cut into the correct pipe or hose

Cut out the section of pipe or hose where the Turbo Shaft will go.
The pipe should be:

- The main feed line (for full-size Turbo Shaft)
- The RO feed or chemical feed line (for Mini)

Step 2: Connect the INLET

- Attach the appropriate fitting (NPT, barb, or adapter)
- Secure with clamps if using flexible thermoplastic hose
- Double-check that the water will enter the INLET

Step 3: Connect the OUTLET

- Attach the outlet hose or pipe exactly the same way
- Make sure the water can leave through the OUTLET arrow

Step 4: Tighten everything

- Tighten clamps, unions, or NPT fittings
- Make sure all fittings are snug but do not overtighten NPT threads
- Use Loctite 55 cord or another suitable thread sealant on all NPT threaded connections

5. Flood the Turbo Shaft with Water

THIS IS THE MOST IMPORTANT STEP.

⚠ **The Turbo Shaft must be full of water before it is powered on. Running it dry will cause damage.**

To flood the system:

1. Turn on the water slowly
2. Allow the pipes, hoses, and Turbo Shaft to fill completely
3. Check for leaks
4. Make sure water is flowing smoothly with no air pockets

Do not power the pump until you confirm it is fully flooded.

6. Power Up and Run the Turbo Shaft

Now that the system is full of water:

1. Turn on electrical power to the Turbo Shaft
2. The pump will run continuously (24/7)
3. Leave the system operating — it is designed for continuous operation
4. Verify that water continues to flow through the unit

7. Final Checks

- Look for leaks at all connections
- Make sure the Turbo Shaft is installed in the correct flow direction
- Confirm the system stays flooded while running
- Check that downstream equipment (RO, chemical panel, manifolds) is receiving stable flow
- If using a Clack or Fleck bypass valve, confirm the bypass is set to “service” (not bypass)

8. You're Done

The Turbo Shaft requires **no regular maintenance**, but the system must:

- Stay full of water
- Stay powered on
- Have correct inlet/outlet orientation

OPTIONAL: Softener Replacement Using Clack or Fleck Bypass

Follow these steps **IN ORDER**:

1. Keep the existing Clack or Fleck bypass valve
- Do **NOT** remove it.
- Turn the bypass valve to **"BYPASS"** so water does not flow through the old softener.

2. Make sure you have the correct connection kit
When ordering the Turbo Shaft, specify the following:
- **CRS Flexible Hose Kit**
- **Stainless Hose Barbs**
- **Clack or Fleck 1.5" Adapter Set** (matches the ports on your bypass valve)

This makes the installation plug-and-play.

3. Connect the Turbo Shaft to the bypass valve
- The bypass valve has two ports: **IN** and **OUT**
- Connect the Turbo Shaft **INLET** hose to the bypass valve **OUT** port
- Connect the Turbo Shaft **OUTLET** hose to the bypass valve **IN** port

(Yes—this feels backwards, but you MUST follow the flow arrows on the Turbo Shaft. The bypass valve reverses flow. The labels on the Turbo Shaft are always correct.)

Secure all hose clamps.

4. Flood the system
Turn water on slowly to fill:
- The hoses
- The Turbo Shaft
- All connected lines

Make sure there are **no air pockets** and **no leaks**.

5. Put the system into service
- Turn the Clack/Fleck bypass valve from **"BYPASS"** to **"SERVICE"**
- Water now flows through the Turbo Shaft instead of the old softener

That's it. Your Turbo Shaft is now fully replacing the water softener.

5. What to Expect at Initial Startup

When the Turbo Shaft is first installed and turned on, the system may behave differently for the first few hours. The reactions listed below are completely normal and are part of the startup and cleaning process.

1. You May See Discolored Water or Small Debris

As the Turbo Shaft begins generating ionized nanobubbles, it immediately starts loosening:

- Old scale
- Rust particles
- Biofilm
- Mineral buildup inside pipes

This material can temporarily come out of the system as:

- Slightly cloudy or discolored water
- Small bits of debris

This is normal and will clear on its own as the system cleans itself internally.

2. Increased Flow of Debris to Filters, Nozzles, or RO Pre-Filters

Because the Turbo Shaft breaks loose old buildup, you may notice:

- Faster loading of prefilters
- Some strainers or screens catching debris that was previously stuck inside pipes

This is a **short-term startup effect** and should stabilize within a few hours to a few days.

3. Why Initial System Flushing Matters

To speed up system stabilization:

- Run water through the system to push out loosened debris
- Check and clean any prefilters or screens after the first few hours
- If your RO system has a GAC prefilter, it may require an early backflush

Once the initial debris is cleared, the system will remain much cleaner going forward.

4. System Will Stabilize as Pipes Become “Conditioned”

Once the Turbo Shaft has been running for a short period, the pipework becomes saturated with nanobubbles and:

- Water clarity improves
- Scale stops forming
- Injectors and RO membranes see cleaner flow
- Chemistry dispersion improves

- Drying quality increases

Summary

If you see cloudy water, small debris, faster prefilter loading, or temporary discoloration during the first few hours—**it is completely normal.**

It means the Turbo Shaft is working and cleaning the system from the inside out.

6. Installation, Validation, & Ongoing Monitoring Protocols

Key References – WICRA (Water Infection Control Risk Assessment), TJC (The Joint Commission), TIR 34 (Technical Information Report), AAMI ST79 (Association for the Advancement of Medical Instrumentation), WMP (Facility Water Management Plan),NSF/ANSI 61 (National Science Foundation/ American National Standards Institute), Water Infection Control Risk Assessment (WICRA).

1. Planning Phase

a. The Facility shall develop a water sampling, testing, flushing, and ongoing monitoring (STFM) plan before installation of the Shaft which will be followed throughout the installation, start-up, and post-install monitoring time. The Facility shall recommend a third-party review of the STFM for sufficiency. Elements of this plan are as follows:

1. Review current water systems testing, monitoring, and treatment plan, including existing WICRA and WMP, for a compatible and complimentary overall strategy for the affected portion(s) of the Facility. Additional testing, monitoring, flushing and treatment may be added to existing WMP based on a Shaft risk assessment.

2. The Facility may perform its own Shaft risk assessment for systems that could be affected to inform the installation, validation, and ongoing monitoring phases. For example, collection points of biofilm debris, e.g., aerators, water hammer arrestors, and in-line filters, including integral filters, e.g., integral biofilters in disinfection-type medical equipment or ice machines, which are not easily cleaned by flushing.

3. The Facility should conduct baseline microbial sampling and water quality testing at control points per the Facility's WMP. Additional locations could be added as determined by the Shaft risk assessment, part 1.a.2 above.

i. Microbial sampling should include Total CFU (colony forming units, bacterial and fungal), or Heterotrophic Plate Counts (HPC), and can include more specific total coliform quantification as per EPA drinking water standard (<200cfu/ml). (In critical environments, testing for species of pathogenic microorganisms, such as Mycobacterium, and Pseudomonas can be added).

ii. Biofilm marker testing can include Total Organic Carbon (TOC) and/or Total Protein (Wilson C et.al 2017)

iii. Endotoxin testing is recommended as a pre-installation baseline, post installation and during the flushing stage. Routine endotoxin testing is not recommended as per the EPA drinking water recommendations.

iv. Rapid ATP (Adenosine Triphosphate) water testing can be conducted on-site as a screening tool for ongoing monitoring. Baseline should be established before and after installation (Wilson C et.al 2017).

v. Other water quality testing can include hardness (<150mg/L tap; <1mg/L critical), conductivity (<500mS/cm tap; <10mS/cm critical), pH (6-9 tap; 5-7 critical), chlorides (<250mg/L tap; <1mg/L critical). (AMI Guide TIR34:2014/R(17), Section 4).

4. As part of the planning phase, the Facility should assess the need for strainers and filters installed and maintained by the Facility during start-up and ongoing if desired. See 2.a below.

2. Installation Phase

a. The Facility shall install an in-line strainer (type and size may vary with a screen mesh of 40 as a good rule of thumb) upstream of the nanobubble water treatment device and routine cleaning should be included in the Facility's maintenance schedule.

b. The Facility may choose to install filters to protect distal points per the STFM. Include routine inspection and cleaning in the Facility's maintenance schedule.

c. The Facility shall flush the system upon start-up of the Shaft. The Facility should continue following the flushing protocol per their WMP or updated WMP that includes Shaft protocols, see 1.a.i above. Note: if the protocol has a rotation of flushing distal points (not all performed on the same unit of time), supplemental testing of the system served by the Shaft should be added.

d. The Facility shall conduct microbial sampling and water quality testing at control points per the STFM and the Facility's WMP and/or updated Shaft WMP.

3. Validation Phase

a. The validation phase serves to independently ensure the safety of the water treated by the Shaft as compared to baseline, and to validate the efficacy of the Shaft in improving water quality for the Facility.

b. If Facility chooses to do so; A third party shall conduct and/or oversee microbial sampling and/or water quality testing at control points per part 1.a.iii above. The testing may be conducted by the facility maintenance personnel defined in the WMP (the WMP or updated Shaft WMP must include training of Facility maintenance personnel who will be responsible for sample collection, proper handing (sterility, temperature, holding time and transportation of samples, as well as PPE) if applicable).

c. The third party shall receive, analyze, and report the independent laboratory data to the Facility.

d. Once validation of the system has been achieved and safety and efficacy have been approved, validated water quality may serve as the new baseline for ongoing monitoring, see below.

e. After the Shaft efficacy is validated, the Facility shall update maintenance and cleaning schedules in the WMP to reflect the needs of the new system addition.

4. **Ongoing Monitoring Phase**
   a. The purpose of the ongoing monitoring phase is to ensure the achieved Shaft water quality improvements and/or validated baselines, are maintained.
   b. The ongoing monitoring phase should be conducted or overseen by a third party, and should include control limits, control measures, corrective actions, and contingency response per the STFM and the Facility's WMP and/or updated Shaft WMP.
   c. As with the validation phase, trained Facility maintenance personnel may collect samples. Independent laboratory data receipt, analysis, interpretation, and reporting are the responsibility of the third-party consultant. Recommendations for corrective actions are the responsibility of the third-party consultant. Implementation of the corrective actions are the responsibility of the Facility.
   d. Validation of corrective actions should follow the validation phase as per 3.a-d above, prior to resuming ongoing monitoring.

Definitions:

Biofilm: Densely packed communities of microbial cells that grow on living or inert surf aces and surround themselves with secreted polymers.

Building water systems: Includes hot and cold-water distribution and all devices that use water. This can include items, such as hot tubs, decorative fountains, and cooling towers.

Control: To manage the conditions within your building according to your water management program.

Building Water Management Program (WMP): a facility or system policy prescribing controls, control limits, control measures, and control points, contingency response, and corrective actions to maintain acceptable levels to protect patients, team members, and visitors from water borne pathogens.

Control limits: The maximum value, minimum value, or range of values that are acceptable for the control measures that you are monitoring to reduce the risk for Waterborne pathogens growth and spread.

Control measures: Engineering controls and practices you implement in your building water system to limit growth and spread of Waterborne pathogens, such as heating, adding disinfectant, or cleaning.

Control points: Distal points in the water systems where a control measure can be applied.

Contingency response: Reaction to control measures that are persistently outside of control limits or events that pose an immediate risk to control of your building water systems; required for all instances when Legionnaires' disease occurs, but may also be appropriate for unexpected events such as equipment failure or acts of nature that disrupt the water system.

Corrective action: Steps taken to return control measures to acceptable levels.

Dead legs: Piping that is subject to low or no flow due to design or decreased water use such as capped pipes or unused faucets.

Disinfectant: Chemical or physical treatment used to kill germs, such as chlorine, monochloramine, chlorine dioxide, copper-silver ionization, ultraviolet light, or ozone.

Distal point: a location near the end of a distribution system branch where water is dispensed, and potential stagnation can occur based on usage.

Filtering: Removes small contaminants that may pass through a strainer.

Hazardous conditions: Anything that, if not controlled, can contribute to the growth, and spread of water borne pathogens to a person.

Heterotrophic plate counts: A measure of the number and variety of bacteria that are common in water; a high count may indicate a high microbial load and the need for corrective action but cannot be substituted for Waterborne pathogens testing.

Waterborne pathogens: Bacteria of fungal genus which encompasses species that can cause disease.

IOM: Installation, Operation, and Maintenance manual

PPE: Personal Protective Equipment

Residual: The amount of disinfectant available in water to kill microbes

Scale and sediment: The mineral build-up in a water system that uses up disinfectant and supports microbial growth and/or survival.

Stagnation: When water does not flow well, areas of stagnant water encourage biofilm growth and reduce temperature and level of disinfectant.

Straining: Removes larger contaminants and smaller contaminants may pass through.

Water Infection Control Risk Assessment (WICRA): CDC's risk assessment tool for water systems in facilities designed to prevent water borne pathogen exposure. This risk assessment may recommend and provide details to be included in the Facility's WMP.

Limited Warranty and Remedy

Chemical Reduction Solutions LLC ("CRS") warrants to the original user of those products supplied by it and used in the service and in the manner for which they are intended, that such products shall be free from defects in material and workmanship for a period of one (1) year from the date of installation, [unless a Special Warranty Period applies, as listed below]. This warranty does not extend to any product that has been subject to misuse, neglect or alteration after shipment from the CRS factory. Except as may be expressly provided in a written agreement between CRS and the user, which is signed by both parties, **CRS DOES NOT MAKE ANY OTHER REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE**.

The sole and exclusive remedy with respect to the above limited warranty or with respect to any other claim relating to the products or to defects or any condition or use of the products supplied by CRS, however caused, and whether such claim is based upon warranty, contract, negligence, strict liability, or any other basis or theory, is limited to CRS's repair or replacement of the part or product, excluding any labor or any other cost to remove or install said part or product, or at CRS's option, to repayment of the purchase price. As a condition of enforcing any rights or remedies relating to CRS products, notice of any warranty or other claim relating to the products must be given in writing to CRS: (i) within 30 days of last day of the applicable warranty period, or (ii) within 30 days of the date of the manifestation of the condition or occurrence giving rise to the claim, whichever is earlier. **IN NO EVENT SHALL CRS BE LIABLE FOR SPECIAL, DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, LOSS OF USE OR PROFITS OR INTERRUPTION OF BUSINESS**. The Limited Warranty and Remedy terms herein apply notwithstanding any contrary terms in any purchase order or form submitted or issued by any user, purchaser, or third party and all such contrary terms shall be deemed rejected by CRS.

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