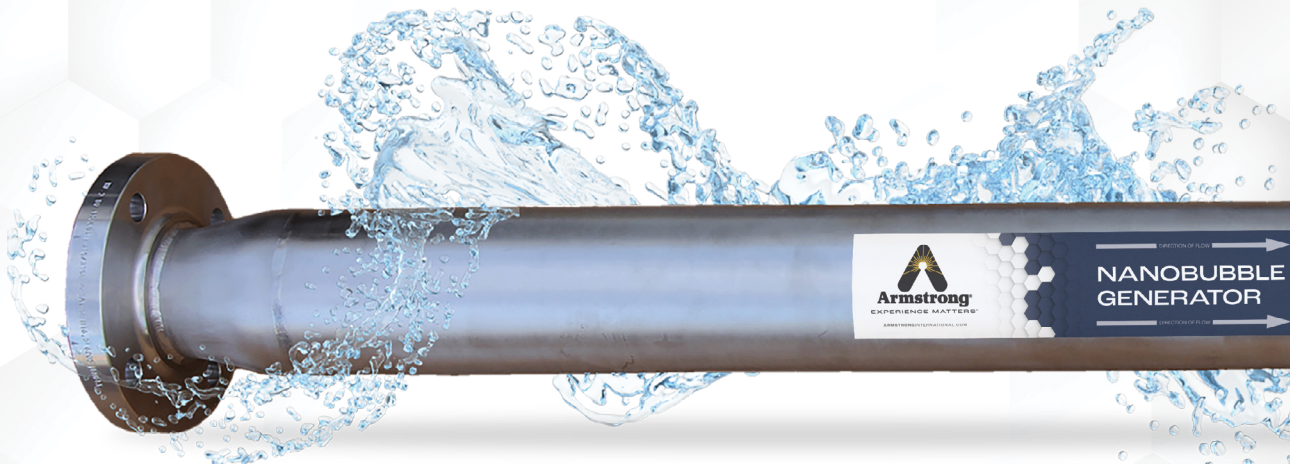


# ARMSTRONG NANOBUBBLE GENERATOR

INHIBITION AND REMOVAL OF SCALE AND MINERAL  
BUILDUP WITHIN INDUSTRIAL PROCESS AND  
COMMERCIAL/INSTITUTIONAL HOT WATER SYSTEMS



## EXPERIENCE MAKES A WORLD OF DIFFERENCE

Founded in 1900, Armstrong International is a privately held, fifth-generation, family-owned company. Our unique heritage of sage knowledge and in-depth experience in thermal utilities enables us to serve you in ways no one else can. Today, Armstrong's industry-leading equipment is hard at work in more than 100 countries, saving time, money and energy for some of the world's largest, most efficient companies in industrial and institutional markets alike.

### **WE WANT YOU TO ENJOY WORKING WITH US**

Building strong, lasting relationships with our customers is a top priority at Armstrong. We become an integral part of your team, consistently delivering on our promises and exceeding your expectations, while remaining transparent and simple to do business with. We want working with us to be an experience you enjoy, every single time.

### **ON THE FOREFRONT OF TECHNOLOGY AND INNOVATION**

Armstrong is committed to providing ongoing advancements and new product developments to meet the evolving demands of your industry, company and global location. Often the first to market, our company has been granted more than 70 patents on exceptional equipment and software. We're here to solve your problems and prevent them with groundbreaking technology and rugged, reliable products that demonstrate unparalleled value and improved thermal utility system performance.

## ARMSTRONG NANOBUBBLE GENERATOR

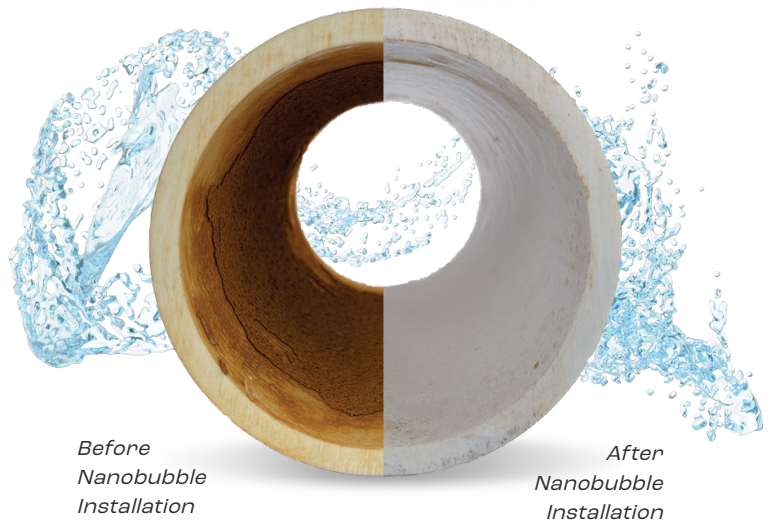
A COST-EFFECTIVE, SUSTAINABLE SOLUTION, PROVEN TO REMOVE SCALE AND INHIBIT NEW BUILDUP IN HOT WATER SYSTEMS.

From the company with over a century of steam and hot water system innovation comes the Armstrong Nanobubble Generator. This patent-pending technology was developed specifically to address mineral deposition on pipework and critical equipment within your industrial process or commercial/institutional hot water system.



A CLEAN HOT WATER SYSTEM HAS A LONGER LIFESPAN AND PERFORMS MORE EFFICIENTLY.

In any industry, a dirty hot water system is costly. The Armstrong Nanobubble Generator has the potential to prevent thousands of dollars in wasted energy, maintenance and chemical costs for your company, within months of operation.



## A CRITICAL COMPONENT OF YOUR HEALTHY HOT WATER SYSTEM

THE ARMSTRONG NANOBUDDLE GENERATOR IS EASILY INSTALLED, HAS NO MOVING PARTS, REQUIRES NO MAINTENANCE OR ADDITIONAL ELECTRICAL INPUTS, AND USES NO CHEMICALS.

Whether it's on a heat exchanger or strategically placed within the hot water piping infrastructure to address the entire system, the Armstrong Nanobubble Generator significantly reduces scale and mineral buildup, which improves the overall health of the hot water system and drives operational efficiencies, leading to a smaller carbon footprint.

As Part of Armada<sup>SM</sup> Digital Hot Water System Solutions, the Armstrong Nanobubble Generator supports industry-leading sustainability.



*Heat exchanger tubes before and after continued use of nanobubble generator.*



### PROVEN OUTCOMES OF ARMSTRONG NANOBUDDLE GENERATOR USE

- | Improved heat transfer (equipment operates more efficiently)
- | Reduced equipment maintenance costs
- | Extended equipment life resulting in lower capital expenditure
- | Reduced CIP frequency and associated labor costs
- | Increased chemical efficiency

*Extrusion baths before and after installation of Armstrong Nanobubble Generator (3/4"x1.5").*

## HOW DOES IT WORK?

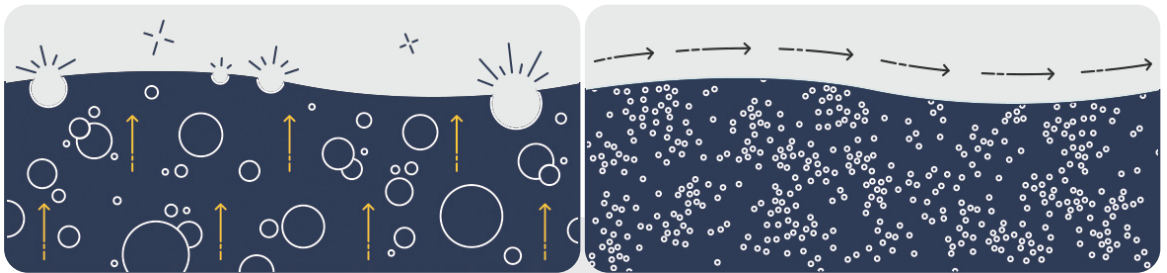
The Armstrong Nanobubble Generator transforms existing, non condensable gases naturally present in the water into an abundance of nanoscopic bubbles through a static, side stream application. The nanobubbles flow throughout the hot water system, naturally removing scale and existing deposits while inhibiting the formation of scale, without adding anything to the water.

### WHAT ARE NANOBUBBLES?

A nanobubble is less than 200 nanometers (nm) in diameter, or approximately 2500 times smaller than a grain of salt. Ordinary bubbles soon float out of their suspension, but because nanobubbles are buoyant, they remain suspended in liquid nearly indefinitely without rising to the surface and off-gassing.

### NANOBUBBLES

- | Remain suspended in solution nearly indefinitely
- | Have excellent distribution throughout the entire water column
- | Are negatively charged
- | Significantly increase surface area and surface tension

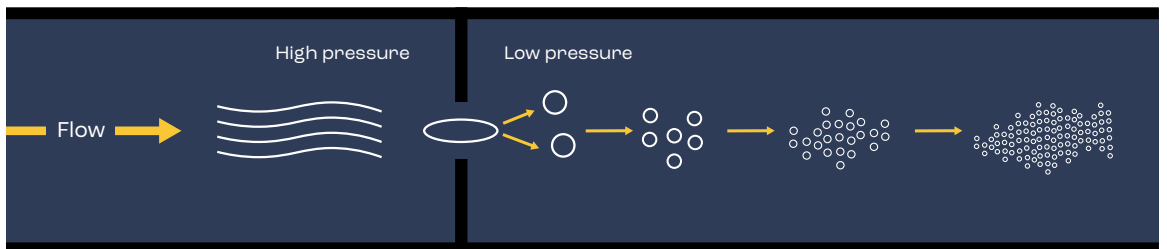


Ordinary bubbles (left) compared to nanobubbles (right)

### HOW DO WE PRODUCE NANOBUBBLES?

High-shear stresses create a depression of static fluid pressures below that of the fluid's vapor pressure. When this pressure differential is reached, bubbles spontaneously form from the solubilized, or entrained, gases within the liquid.

#### HORIZONTAL PIPE

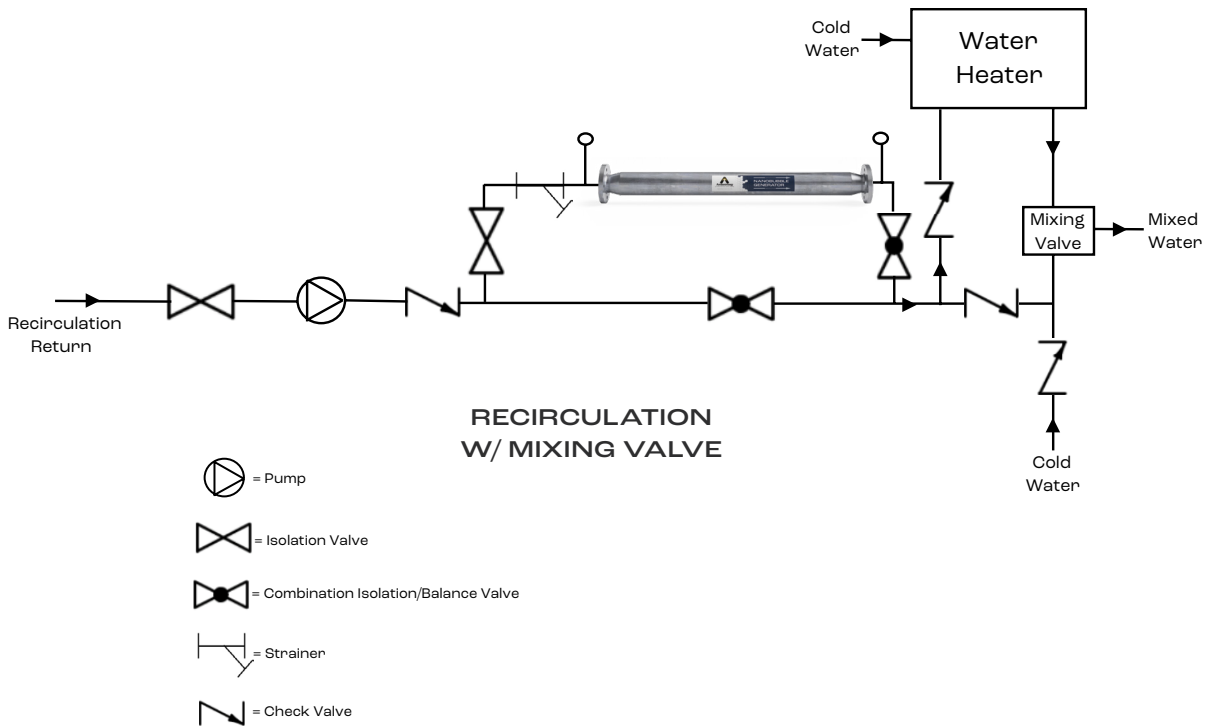


Series of shear plates, rending + pressure driven bubble formation

## ARMSTRONG NANOBUDDLE GENERATOR MODELS

MODEL	TYPICAL FLOW RATE (GPM)*	LENGTH	CONNECTION SIZE	BODY SIZE	APPROXIMATE WEIGHT
ANG20	1-7	32 1/2"	Threaded 3/4"	1.5"	6 lb
ANG25	5-40	35 1/2"	Threaded 1"	2"	9 lb
ANG50	15-110	51 1/2"	150 lb Flange 2"	3"	48 lb
ANG80	25-225	53"	150 lb Flange 3"	4"	78 lb
ANG100	50-550	98 1/2"	150 lb Flange 4"	6"	120 lb
ANG150	200-1150	102"	150 lb Flange 6"	8"	200 lb

\*Based on a max 15 PSI drop



## THE ARMSTRONG NANOBUBBLE GENERATOR IS PART OF ARMADA<sup>SM</sup> DIGITAL HOT WATER SYSTEM SOLUTIONS

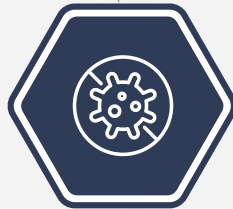
Created to address critical elements of an effective water safety management plan, Armada<sup>SM</sup> delivers safe, healthy, domestic hot water from mechanical room to point of use. Armada<sup>SM</sup> is one solution that does it all.



**BEST-IN-CLASS  
INFECTION  
CONTROL**



**SUPERIOR  
SCALD  
PROTECTION**



**INDUSTRY-LEADING  
SUSTAINABILITY**



**REGULATORY AND  
ORGANIZATIONAL  
COMPLIANCE**

## CONTACT YOUR ARMSTRONG REPRESENTATIVE

If you're interested in learning more about the Armstrong Nanobubble Generator or you want to find your representative, visit [armstronginternational.com](http://armstronginternational.com)



INTELLIGENT THERMAL UTILITIES SOLUTIONS FROM A GLOBAL  
LEADER IN ENERGY MANAGEMENT AND ENJOYABLE EXPERIENCES

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