



## THE ELECTRONICS OF HOME WATER PLANT™ SCALE REMOVAL & PREVENTION <sup>1</sup>

### INTRODUCTION

Electronic descaling technology has been around for a long time.<sup>2</sup> It has been a mixture of successes, failures, and mysteries. It was a significant challenge to separate the real science of electronic descaling from the pseudo-science and market hype permeating the Industry. Frequently, an electronic descaler works in one house but not in the house next door, and no one has seemed to know why. Understanding these problems was a big part of the Home Water Plant descaler project.

The basic technology of electronic descaling has been shown to work. But user complaints are common. Interviewing users and testing competitors uncovered three basic, industrywide deficiencies:

- Descalers often do not work.
- If a descaler works at all, it takes too long for visible results.
- The user never knows if the descaler is working or not.

The Home Water Plant descaler was designed to overcome these problems.

### IDENTIFYING INDUSTRY PROBLEMS

Research more specifically identified three key technological problems:

1. Many descaling devices simply proved not to deliver enough power to be effective, at least within any customer's perception of a reasonable time. Descaling signals rapidly decrease in size as they travel through the water. Most descaling devices have small descaling signals to start with. As these small signals rapidly decrease in size, they become ineffective after a short piping distance. Their descaling effect is limited to a small segment of the water system. This deficiency is particularly true of magnetic descalers. One descaler user's manual states not to expect visible results for "three months."

2. Electronic devices sold in the USA must pass FCC regulatory standards.<sup>3</sup> The FCC regulates electronic devices to avoid interference with communications equipment, e.g.,

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<sup>1</sup> © Joseph F. Walsh, 2018.

<sup>2</sup> The first patent issued in 1903.

<sup>3</sup> Other parts of the world impose CE standards.

AM/FM radio bands, Wi-Fi, TV, etc. These FCC regulations are particularly difficult to pass for devices with electric signal outputs, such as descalers. Most descalers avoid interference with communications equipment by limiting their descaling signals to very low power levels. While avoiding FCC noncompliance, these descalers are so low power that they may take many months to see results, or never see results at all.

3. Many descalers do not work at all in some installations, but do work in others. There has been no way to tell, at the time of installation, whether a descaler will work in a given installation or not.

In addition to these major deficiencies, two others were identified:

4. Coil wrap descaling devices were difficult and frustrating to install. It is particularly difficult to install coils on pipe mounted to walls or ceilings. Magnetic clamp devices seemed fragile.

5. No descaling device advised the user whether the descaler was actually functioning, or had at some point stopped working.

## ADDRESSING THE DEFICIENCIES

Greater power means a more effective and faster acting descaler. But designing a descaler with greater power, yet passing FCC standards, was a challenge.

Ultimately, a pure<sup>4</sup>, powerful, and effective descaling signal was engineered that passed FCC tests. This pure signal (nearly free of radio noise) passed FCC Part B, (residential) Part 15 A (commercial and industrial)<sup>5</sup> and Part 18 (scientific and laboratory) requirements<sup>6</sup> an industry first. Further interference protection (shielding) was provided by the Home Water Plant descaler's aluminum housing. Plastic enclosures used by the rest of the industry are not suited to providing the shielding desirable for the descaler's larger signal to pass FCC standards.

Immediately following are oscilloscope descaling signal strength readings of the Home Water Plant descaler and its most powerful competitor. The Home Water Plant descaler, over the same time, is delivering many times the descaling energy.<sup>7</sup>

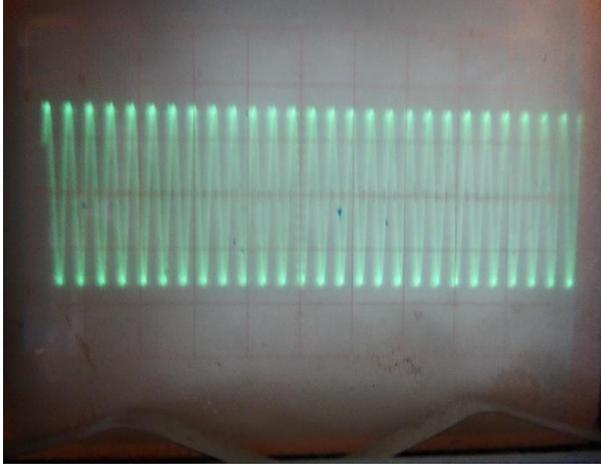
<sup>4</sup> Free of the harmonic distortions that cause FCC noncompliance.

<sup>5</sup> 47 CFR §§ 15.107 and 15.109 (class A devices).

<sup>6</sup> 47 CFR §§18.305 and 18.307. Although FCC compliant for medical establishments, the Home Water Plant Descaler has not been field tested in medical environments and should not be installed in them.

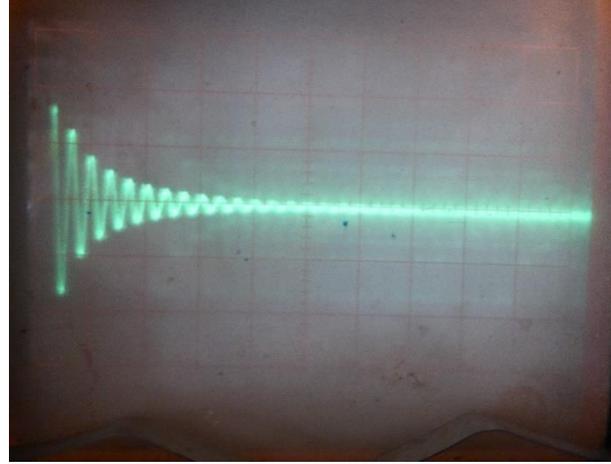
<sup>7</sup> The Home Water Plant descaler and other descaling devices were connected to the cold water pipe input of a 70gallon hot water heater. The pictured signals were oscilloscope measured on the hot water pipe output of the

same hot water heater. (The descaling signals traveled through the water in the hot water heater before being measured.) Other co competitors tested displayed far weaker signals, many too small to be recorded.



**Home Water Plant Descaler**

*Every cycle has same high potential for descaling.*



**Nearest Competitor**

*It has a good peak, but the signal rapidly decays. Each cycle has progressively less potential for*

*descaling. Note the long time between signal bursts with no descaling activity taking place.*

The industry problem of descalers working in some installations but not others was found to be caused by descaling signals being diverted to electrically grounded pipe rather than propagating into the water to be treated. The industry standard has been to display a “power on” light indicating that a descaler was working. But these lights showed only that descaler power was on; they did not indicate if the descaling signal was being delivered into the water, or was just sent to ground, where it was useless.

The Home Water Plant descaler was designed with a built-in optimum installation site. It has a built-in section of metal pipe to which the descaler connects. This signal connection pipe is built-in insulated from ground by two dielectric unions. Thus, the Home Water Plant descaling signal is never shunted to to ground, solving the industry’s largest problem.

The Home Water Plant descaler has well over 100 electronic components, including a microprocessor. To assure that electronics are consistent, unit to unit, each descaler is tested and calibrated prior to shipment. Calibration parameters are retained in non-volatile long-term microprocessor memory.

The installation and durability issues characteristic of coil wrap and magnetic devices were resolved by designing a direct clamp-on descaler connection to the piping system — quick and easy, requiring only a screwdriver. Direct electrical connection assures that the maximum descaling signal reaches the water, for maximum descaling.

Repair, remodeling, or appliance replacement may change the conductivity of a home's piping systems, which may in turn affect a descaler. A descaler's initial placement may no longer be satisfactory. Previously, the industry had no way of alerting customers to this problem. This issue was resolved by the Home Water Plant descaler's built-in computer and front panel lights. The descaler retests installation suitability about every ten seconds for as long as it is in place. Should a problem occur, the descaler's front panel lights alert the user.

A more powerful descaler signal generates more heat. The relatively large cooling surface of the aluminum enclosure allows the Home Water Plant descaler to deliver a larger descaling signal, with just a few degrees of temperature rise (pleasantly warm to the touch).

The few degrees temperature rise of the Home Water Plant descaler keeps moisture from condensing on the electrical circuits inside. This enables the ~~descaler to be~~ installed in higher moisture environments such as restaurants. Restaurants especially need devices with powerful descaling signals, to keep up with high usage hot water heaters and dishwashers.

#### ABSTRACT

The electronic descaling field has been characterized by several deficiencies. Many devices simply emit insufficient descaling signal strength, so as not to violate FCC regulatory standards. Designing a much more powerful descaling signal, yet also passing FCC standards, was a significant challenge. A powerful, but pure and consistent signal frequency plus an aluminum enclosure proved to be the answer. Many descalers work in some installations, but not in others, and no one could say why. The key to successful installations was found to be selection of an installation site where the maximum amount of the descaling signal entered the water, not shunted to ground, where it is useless. The Home Water Plant descaler was designed with a built-in, optimum installation site.

The Home Water Plant descaler is directly wired to the water piping, maximizing the amount of the descaling signal entering the water. This design also eliminates the frustrating aspects of coil wrap and magnetic descaling devices.

The Home Water Plant descaler has built-in computer diagnostics, calibration, and continuous self-testing, to assure uniform unit-to-unit performance and confirmation of successful performance over the years.

## AUTHOR

Joseph F. Walsh

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### Abbreviated Curriculum Vitae

#### Education:

B.S.E.E. Electrical Engineering University of Connecticut

2 years graduate work in electrical engineering, University of Washington

#### Work History:

20 years industry experience as design engineer and principal engineer for John Fluke Instrumentation Co., and others

25 years independent design engineer

#### Patents: USA Issued Patents, named inventor:

- 8 patents on the Smart Phone
- 2 patents on measuring time at the speed of light
- 1 patent on computer interconnections
- 1 patent on secret-less security codes used on US passports
- + 1 patent pending on the Home Water Plant Descaler