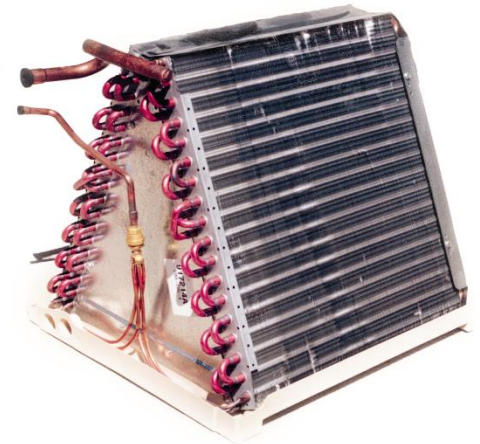


The CLEAN COIL[®] PROGRAM

Coil Cleaning and Indoor Air Quality



Nu-Calgon

- Providing innovative specialty chemical solutions to the HVACR market for 50 years
- Started with basic water treatment “Calcium Gone”
- Leader in coil cleaning and IAQ products



Why Clean Coils?

JULY 2, 2001

Air Conditioning | Heating | Refrigeration

the NEWS

A **DNB** PUBLICATION

THE HVACR CONTRACTOR'S WEEKLY NEWSMAGAZINE

\$3.00

Clean Coils Make Dollars and Sense

BY DAVID LEACH
FOR THE NEWS

When selling and servicing air conditioning and refrigeration products in today's environment of tight energy supplies and rising costs, it only makes sense to help customers maximize the efficiency of their equipment.

Coils are sized to match the Btu cooling requirement of the home or building. Both condenser and evaporator coils are engineered to provide optimum heat transfer as required by the area being cooled. Optimum heat transfer and system efficiency is predicated on clean coil surfaces.

The air moving across these coils will, in most cases, contain a mixture of dust, dirt, pollen, grease, and moisture. Airborne contaminants settle on the coil surfaces, impacting the coil's ability to transfer heat. Pollen, bacteria, and mold spores on the evaporator coil will not only reduce heat transfer, but will also affect the quality of the air within the home or building.

The cost of operating dirty air conditioning and refrigeration equipment is greater than you or your customer might suspect.

POWER COSTS

Dirty condenser coils increase power costs. When the coil becomes fouled with dirt and grime, it cannot provide adequate or designed heat transfer.

The coil's insulating effect causes higher discharge pressure. The higher discharge pressure increases amp draw and run time of the compressor, at the same time reducing capacity. Equipment operating with dirty coils may use as much as 37% more energy than equipment with clean coils.

Let's take a look at a 10-ton air conditioning system with a typical kilowatt cost operating for an average cooling season of 1,500 hrs. It costs approximately \$1,650 to operate this system with clean coils. However, when the condenser coil becomes dirty, the six-month cost of operation escalates 37% to \$2,260. With rising energy costs, like those experienced in California, the cost of a dirty coil can be even greater.

From this example, just by keeping coils clean, \$610 savings can be realized in one cooling season. That's a savings of \$61 per ton. A typical, 4-ton residential system would realize \$248 savings in one cooling season. Areas with longer cooling seasons or higher-than-average power costs can realize even greater savings.

The cost of dirty coils goes even further. As dirt and grime collect on the condenser, they restrict heat transfer, causing the compressor to work harder; more heat is added to the system, thus causing the head pressure to rise. Rising head pressure can result in a loss of cooling capacity of up to 30%.

If our 10-ton system with a 30% loss now only provides 7 tons of cooling, the system not only will cost more to operate, it will provide less cooling. This loss of capacity will typically be most noticeable on the hottest days, when cooling is needed most.

LIFE EXPECTANCY, IAQ

Higher operating pressures and temperatures caused by a dirty coil may reduce the equipment's life expectancy. The elevated system temperature and pressure may lead to the breakdown of the compressor's lubricant. In addition, acid formation can occur, leading to an acid burnout. Lubricant breakdown and acid formation seriously compromise the compressor and ultimately lead to equipment failure.



Coil cleaning is one of the most profitable service procedures a contractor can offer.

Condenser Coils



Why Clean Condenser Coils?

Dirty coils increase head (or high side) pressure.

- Accumulated dirt, dust and grease insulate against heat transfer
- Dirt prevents the condenser coil from rejecting heat as it was designed, driving head pressure up.
- When head pressure rises, amperage, or power draw rises, using more electricity.
- Results in lost efficiency and higher energy costs.

Why Clean Condenser Coils?

Dirty coils decrease system capacity.

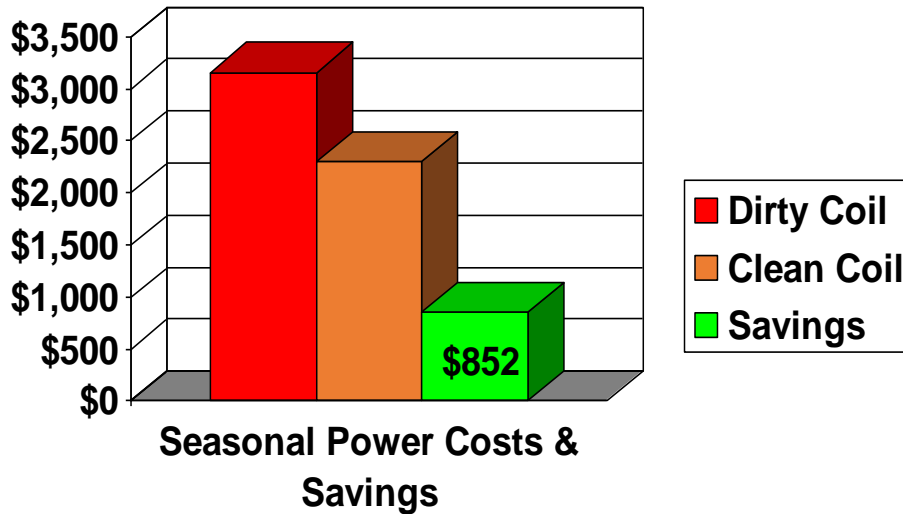
- Higher head pressure also reduces system Btu capacity, possibly by as much as **30%**.
- A 10 ton unit may now only be capable of providing 7 tons of cooling.
- This causes an increase in run time, and inadequate comfort cooling or refrigeration.

Why Clean Condenser Coils?

Dirty coils cost Money

- Increased amperage draw combined with longer run time add up to higher energy bills.
- For example, a 10 ton A/C system operating for 1500 hours could use as much as **37%** more power when the coils are dirty.
- With a KWH cost of 12 cents, this would cost the owner \$852 more to operate . . . that's **\$85** per ton more with dirty coils.
- And KWH costs can be higher, as much as 19 cents or even 25 cents in some cities.

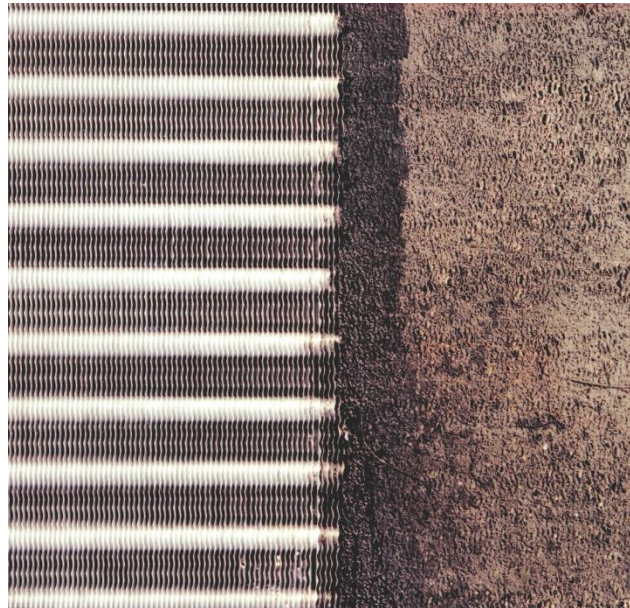
Clean Coils save Money



Savings on a 10 ton system.

Equates to \$85 per ton for any system.

Dirty Coils



Dirt

- **Increases head pressure**
- **Decreases capacity**
- **Costs Money!**

Why Clean Condenser Coils?

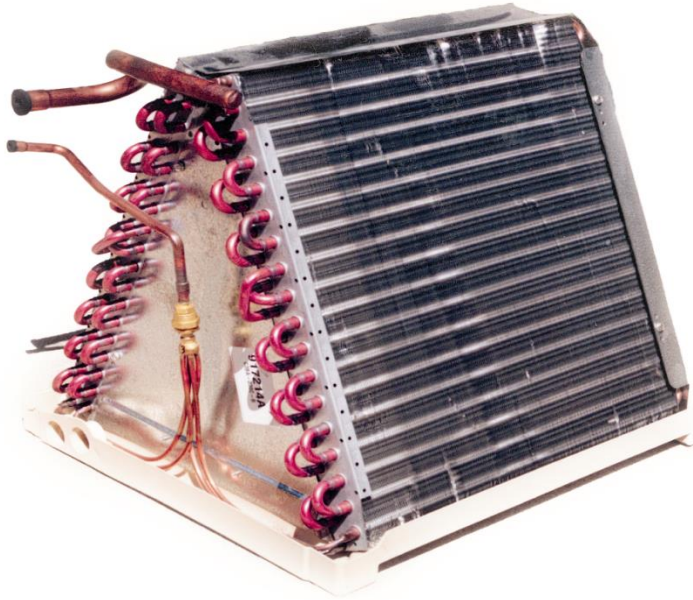
Dirty Coils Shorten Equipment Life

Burnt terminal wires



- The high pressures and temperatures from dirty coils can cause the compressor lubricating oil to break down and form acids.
- Higher temperatures, pressures and lack of lubrication lead to compressor loss.

Evaporator Coils



Why Clean Evaporator Coils?

Dirty Evaporator Coils Restrict Airflow

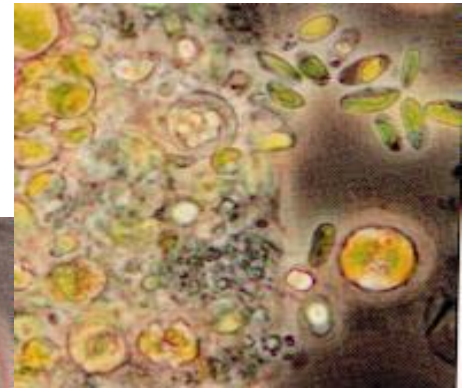
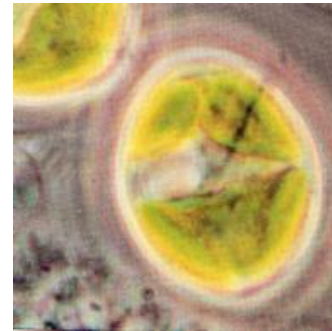


- **Dirt & dust on evap coils decrease heat transfer and Btu capacity while increasing run time and power costs.**
- **Dirt and dust on evap coils reduces airflow and reduces building comfort conditions.**

Why Clean Evaporator Coils?

Dirty Evaporator Coils Cause IAQ Problems

- **Dirt and dust on the evaporator coils combine with moisture to provide a breeding ground for bacteria, mold and odors.**
- **Regular cleaning will improve Indoor Air Quality**



Cleaning Coils



Coil Cleaning

An Overview of How

- **Choosing the right Coil Cleaner**
- **Sprayers**
- **Safe Coil Cleaning Practices**
- **Coil Cleaning Procedures**
- **Teflon Protection with *Cal-Shield***

Coil Cleaners

What to consider When Choosing a Product

- **Type of coil and location of coil (indoor or outdoor?)**
- **Will chemical odors be a problem?**
- **Soil Load – from light dust to cooking grease and everything in between.**
- **Owner/User expectations.**
- **Surrounding environment of coil (flowers, grass, food, etc).**

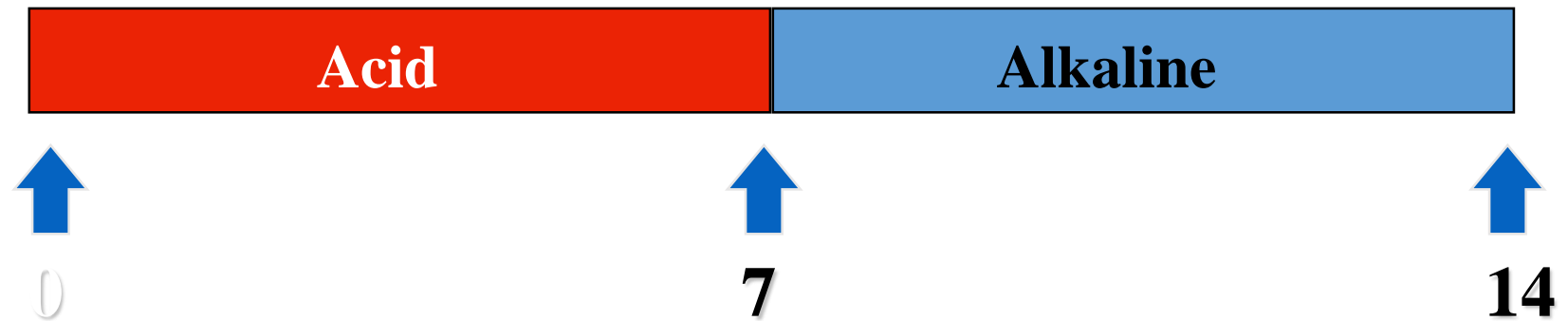
Types of Coil Cleaners

- Acids vs Alkaline . . . the pH Scale

Lemon Juice: 2.1
Vinegar: 2.8
Orange Juice: 4.2
Coffee: 5.5
Corn: 6.2

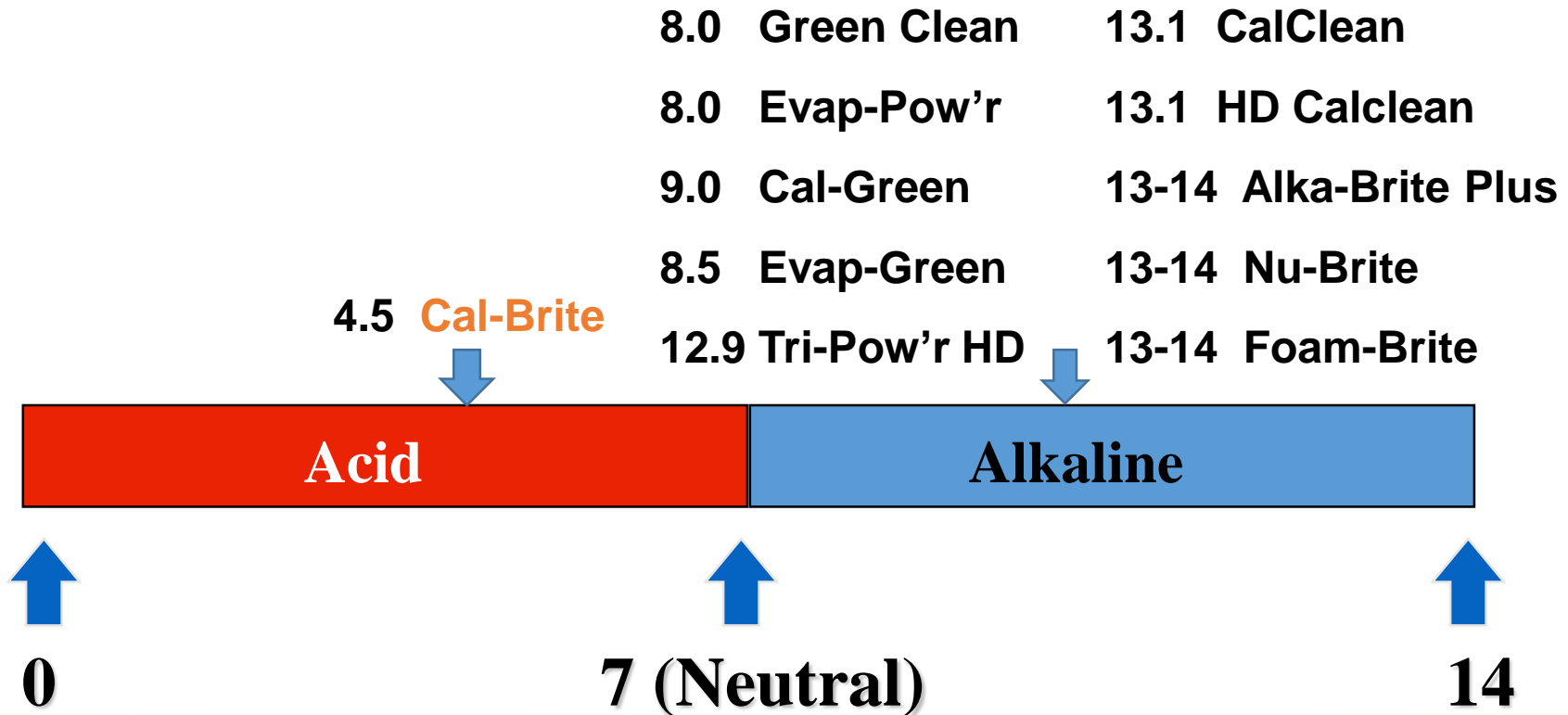
Milk: 6.6
Blood: 7.2
Sea Water: 8.0
Baking Soda: 8.2
Borax: 9.0

Milk of Magnesia: 10.0
Ammonia: 11.1
Gen. Cleaners: 11.1
Bleach: 12.6
Sod. Hydroxide: 14.0



Nu-Calgon Coil Cleaners

On the pH Scale...



Types of Coil Cleaners

Alkaline Cleaners

What makes a high quality, highly effective alkaline coil cleaner?

- **Sufficient alkalinity to provide detergency and to “break” the soils.**
- **Builders to provide emulsification and sequestering of grease and soils.**
- **Surfactants to wet the surface, induce foam, emulsify & disperse soils.**

Types of Coil Cleaners

Alkaline Cleaners

- Alkaline cleaners generally clean better than acids.
- Alkaline cleaners chemically react with the soil to remove it from the coil.
- Superior on cooking grease because they dissolve fat.
- They remove the most stubborn soils with foam pushing dirt from the inner coil.

Types of Coil Cleaners

Alkaline Cleaners

- Nu-Calgon's foaming brighteners Alka-Brite Plus, Nu-Brite, & Foam-Brite are strong alkaline cleaners
- Remove the most stubborn soils
- Generate foam to push dirt out of the coil



Nu-Brite

- Non-acid, alkaline-based
- Used to clean and brighten air-cooled condensers . . . tremendous foaming
- Cleans better than acids
- Foams and brightens as well or better than acids
- Safer than acids
- Fastest growing coil cleaner
- Biodegradable & USDA-approved



Performance of Nu-Brite



Foam-Brite

- Non-acid, alkaline coil cleaner
- Provides maximum foaming
- Removes heavy grease and oxidation
- State-of-the art chelant/surfactant chemistry
 - Prevents re-depositing of soil
 - Results in more thorough cleaning and easier rinsing
 - Leaves coil brighter
- Cleans better than acid based products
- Biodegradable



Alka-Brite Plus

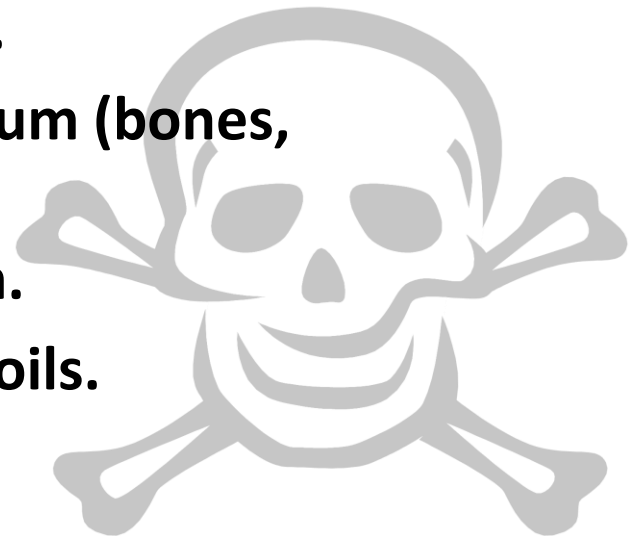
- **Non-acid, alkaline coil cleaner**
- **Provides tremendous foam**
enhances ability to see the dirt being foamed out of the coil
- **Removes heavy grease and oxidation**
- **Leaves the coil cleaner**
- **State-of-the art high foaming & brightening chemistry**
- **Cleans better than acid-based products**
- **Biodegradable**



Types of Coil Cleaners

Hydrofluoric Acid

- Hydrofluoric acid based coil cleaners are the most dangerous products available!
- They are usually pink in color and the label will list Hydrofluoric (HF) acid as a component.
- This acid is unique in that it seeks calcium (bones, nails and in the blood).
- It can damage without initial sensation.
- This acid **should not** be used to clean coils.



Types of Coil Cleaners

Other Acid Products

- Glycolic, phosphoric, citric, and other acids that are used in coil cleaners are much safer.
- Nu-Calgon's Cal-Brite is a unique glycolic acid cleaner that is strong enough to brighten yet safe enough to use on indoor evaporator coils.



Cal-Brite

Roles:

- For both outdoor as well indoor applications.
- Strongest indoor coil cleaner we offer.
- Use to prep coil for Cal-Shield (we'll discuss more shortly)
- To remove scale off outdoor coil



Coil Cleaner Application

Products	Soils	Special Features
Alka-Brite Plus	Hard to remove, greasy soils, oxidation, cottonwood	High foam penetrating surfactant system
Foam-Brite	Very hard to remove, greasy soils, oxidation, cottonwood	Very high foam penetrating surfactant system
Nu-Brite	Very hard to remove, greasy soils, oxidation, cottonwood	Very high foam penetrating chelant surfactant system
Cal-Brite	Hard to remove greasy soils, oxidation, scale	Good foam penetrating surfactant system

Coil Cleaner Use Dilutions

Products	Coil Types	Use Dilutions
Alka-Brite Plus	Finned condenser coils located outside	4:1
Foam-Brite	Finned condenser coils located outside	4:1
Nu-Brite	Finned condenser coils located outside	4:1
Cal-Brite	Finned condenser coils located <u>inside</u> & outside	3:1

Types of Coil Cleaners

Detergent Cleaners

- Detergent cleaners are not quite as strong as the alkaline cleaners.
- Since they not as active, they are safer to use.
- They will get the job done on moderately dirty equipment.
- They can usually be used on indoor coils as well as outdoor coils.

Types of Coil Cleaners

Detergent Cleaners

Safe all-purpose coil cleaners are CalClean, Tri-Pow'r HD, & Green Clean



CalClean

- First coil cleaner introduced to the air conditioning and refrigeration marketplace
- Heavy duty liquid detergent designed for cleaning air cooled condensers, evaporator coils, metal filters, fan blades and other surfaces soiled with greasy dirt and grime



CalClean

- Emulsifies the grease & grime
- Will not corrode metal
- Can be used on condenser coils as well as evaporator coils
- Can be diluted with up to 10 parts of water
- Excellent for general cleaning purposes
- Biodegradable & USDA-approved



Tri-Pow'r HD

- Triple Action Product
 - Detergency Degreasing Power
Deodorizing Ability
- Positive emulsion cleaner that is most effective versus oily grease and grime
- Cleans & emulsifies the most stubborn soils and deposits
- Can be used on condenser coils as well as evaporator coils
- Can be used in a “no rinse” application
- Safe, non-toxic, biodegradable



Great for All
Aluminum Coils

Green Clean

- Excellent general purpose cleaner and coil cleaner
- Pleasantly scented . . . use it everywhere
- Depending upon cleaning job, it can be used straight or diluted up to 150:1

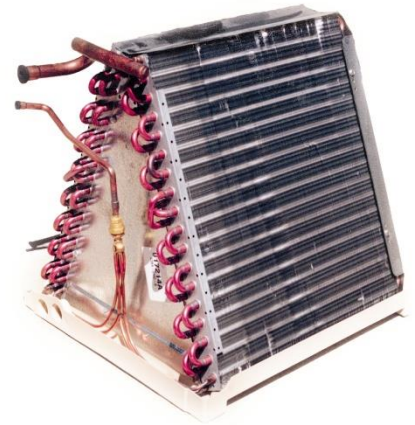
- DfE Formula
- Available in quart, gallon or drum sizes



Types of Coil Cleaners

Specialty Products

- **Evap-Pow'r-C** – a “No-Rinse” evaporator coil cleaner
- **Evap-Foam No Rinse** – an aerosol “no-rinse” evaporator coil cleaner
- **Special HD CalClean** – most effective cleaner available
- **Tri-Clean 2x** – a highly concentrated detergent prepackaged in a hose-end sprayer



Specialty Products

Evap Pow'r

- Formulated specifically for indoor cleaning of evaporator coils
- “No-Rinse” cleaner
- Metal Safe for ‘no-rinse’ applications
- Cleans & emulsifies the most stubborn soils and deposits
- Suitable for all aluminum tube/fin and microchannel coil designs
- Biodegradable & USDA Approved



Specialty Products

Evap Foam No Rinse

- Cleans and deodorizes
- Self-rinsing, fast breaking foam
- Ideal for evaporator or cooling coils
- Can is easily sprayed from any angle, right side up or upside down



Specialty Products

Special HD CalClean

- Popular for over 50 years
- Originally formulated for electronic air cleaners
- Can be used on air-cooled condensers, evaporator coils, metal filters, and other surfaces soiled with heavy dirt and grime
- Most effective against the heaviest of soils, including nicotine
- Biodegradable & USDA Approved



Specialty Products

Tri-Clean 2x

- Novel approach to cleaning condenser coils
- Concentrated cleaner pre-packaged in a ready-to-use hose-end sprayer
- Simply connect to a hose, clean and rinse
- Cleaner is metal-safe yet very effective versus stubborn soils
- Ideal for Micro-channel coils or all aluminum coil types



Coil Cleaner Applications

Products	Soils	Special Features
CalClean	Greasy dirt & grime	Penetrating surfactant system
HD CalClean	Stubborn greasy dirt & grime	Penetrating surfactant system
Evap Pow'r	Low level dirt & deposits	Low foam surfactant, no-rinse, metal safe
TriClean 2x	Oily grease & grime	Detergency, degreaser, deodorizer
Tri-Pow'r HD	Oily grease & grime	Detergency, degreaser, deodorizer

Coil Cleaner Use Dilutions

Products	Coil Types	Use Dilutions
CalClean	Condenser coils, evaporator coils, permanent filters, fan blades	4:1 or 10:1
HD CalClean	Condenser coils, evaporator coils, electronic air cleaners	5:1 or 40:1
Evap Pow'r	Evaporator coils	3:1
TriClean 2X	Condenser coils	Ready to use
Tri-Pow'r HD	Condenser coils, evaporator coils, permanent filters, fan blades	4:1 to 10:1

Cal-Green...Revamped for 2014

Product Position:

- Environmentally Safe Chemistry
- OEM Approved for All Aluminum / Microchannel Coils



Evap-Green...Revamped for 2014

Product Position:

- Environmentally Safe Chemistry
- OEM Approved for All Aluminum /Microchannel Coils



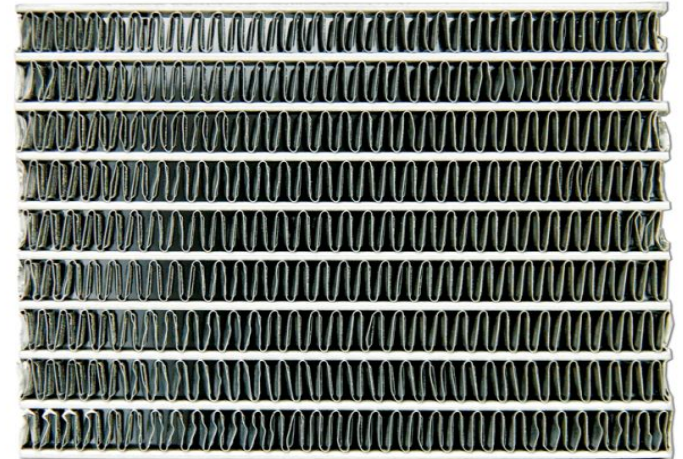
Specialty Products

- Independently certified through the EPA's Designed for the Environment (Dfe) program
- Formulated from renewable sources
- Cal-Green for condenser coils
- Evap-Green for a 'no rinse' application on evaporator coils



Microchannel Coils

- Newest technology of coil construction is growing in popularity
- The aluminum brazed construction require care in selecting a coil cleaner
- Best practices call for the use of a mildly alkaline detergent cleaner, which insures adequate cleaning without damaging the brazed connections
- Aggressive cleaners should be avoided



Evap-Green and Cal-Green

- Meets Trane Requirements
- Meets Heatcraft requirements
- Approved by Carrier for their all aluminum tube/fin coils
- OEM Compliant pH: 6-9

Evaporator Recommendations		
Trade Name	Part/Product No	Manufacturer
Evap-Green	4191-08	Nu-Calgon
Extreme Simple Green Aircraft & Precision Cleaner	13406	Sunshine Makers, Inc
Environmentally Sound Coil Cleaner	P902-0301	Totaline
Condenser Recommendations		
Trade Name	Part/Product No	Manufacturer
Cal-Green	4190-08	Nu-Calgon
Extreme Simple Green Aircraft & Precision Cleaner	13406	Sunshine Makers, Inc
Environmentally Sound Coil Cleaner	P902-0301	Totaline

All Aluminum /Microchannel Coils

Recommendations

- Standard Duty (Normal Dirt Load)**
 - Cal-Green, Evap-Green
 - OEM Approval / Microchannel coil recommended prominently on label



All Aluminum /Microchannel Coils

Recommendations

- Heavy Duty (High Dirt Load)**
 - Tri-Pow'r, TC2X, HD CalClean
 - Nu-Calgon endorsed inhibited chemistry can be used on microchannel coils
 - Microchannel coil usage supported on label



Evap-Fresh

- Cleans and deodorizes in one easy step
- EPA Registered for HVACR applications
- Ready-to-Use formulation
- No rinsing required
- Eliminates odors
- And we will cover it in more in follow-up discussion



Specialty Aerosol Products

Nu-Blast

- Solvent Based, “no-rinse” coil cleaner
- Double action of high pressure blast and emulsifying solvent
- Non-flammable, non-conductive
- Pleasantly scented
- Ideal for use where water rinsing of traditional cleaner is not possible



Specialty Aerosol Products

Cal-Blast

- Solvent Based, “no-rinse” coil cleaner
- Double action of high pressure blast and emulsifying solvent
- Non-flammable, non-conductive
- Pleasantly scented
- Ideal for use on the more stubborn kitchen greases



Specialty Aerosol Products

Nu-Brite® Aerosol

- Excellent on grease and oils particularly effective on kitchen grease
- Excellent foaming action
- Indoor applications
- Requires rinsing



Specialty Aerosol Products

CalClean Aerosol

- Traditional CalClean in an aerosol package
- Applies as a thick foam, providing for holding strength and maximum cleaning
- Ideal for window units, P-Tac's and other small air-cooled condensers



Types of Coil Cleaners

**Don't judge a cleaner by its color . . .
you must read the label to
determine the type of cleaner and
the appropriate applications.**

Sprayers



The Coil Gun[®]

- Labor and Time Saving hose-end sprayer
- Mixing valve safely blends correct ratio of cleaner with water - reduces waste.
- Has multiple mix settings
 - 3:1, 4:1, 6:1, 9:1 and 10:1 plus a rinse setting
- Quick Connect Hose Fitting allows for fast rinsing.
- Foam Wand provides additional foaming action to any coil cleaner.



New Coil Gun Packaging



Coil Gun[®] Probe

- Sold as an accessory to the Nu-Calgon Coil Gun
- Makes cleaning and faster for easier!
- Cleans embedded debris in coil in an outwardly direction, in many cases without removal for fan shroud



Coil Gun® Probe

- Durable quick connect to Coil Gun® mixing head
- Three foot rod allows for easy cleaning on taller SEER units or commercial equipment
- Swivel connection allows technician to rotate flow pattern with coil inside the equipment



Safe Coil Cleaning Procedures

- **Wear goggles, gloves, and work boots.**
- **Avoid contact with skin, and avoid breathing mists.**
- **If mixing, add water to sprayer first, then cleaner.**
- **Be aware of surroundings – roofing materials, plants, foods, etc.**
- **When in doubt, test roofing material.**
- **Always rinse thoroughly.**
- **And discard cleaner container properly**

Coil Cleaning Procedures

- **Always read directions and follow recommended dilution ratios more is not always better.**
- **Nu-Calgon coil cleaners are highly concentrated and designed to be diluted.**
- **With dirty coils, its advantageous to spray coil surface with water before applying the coil cleaning solution.**

Coil Cleaning Procedures

- **Liberally apply the prepared coil cleaner solution to the coil.**
- **Allow the cleaner to “work” for 5 to 7 minutes.**
- **Thoroughly rinse the cleaner from the coil and rinse the surrounding area, roof, etc. completely.**

What About Rubber Roofs?

- **The issue is whether the coil cleaners could be detrimental to rubber roofing materials**
- **There are three common types of rubber roofs**
 - **Modified bitumen - uncoated**
 - **Modified bitumen - coated**
 - **EPDM**
- **Significant difference between the three lies with the coated bitumen**
 - **It uses a fibrated aluminum coating**

What About Rubber Roofs?

Testing was conducted by Nu-Calgon to evaluate the effect of its popular products on these materials

- Involved **Alka-Brite Plus, Nu-Brite, Foam-Brite, HD CalClean** and a control solution (water)
- Utilized 1"x2" samples of all three roofing materials
- Used normal use dilutions of all products involved
- Duration was 30 days, with observations made at the 7th, 10th, 20th and 30th days

What About Rubber Roofs?

Product	Dilution	Modified Bitumen		EPDM
		Coated	Uncoated	
Alka-Brite Plus	Concentrate 4:1 dilution	Attack ¹ Attack	No Effect ² No Effect	No Effect No Effect
Foam-Brite	Concentrate 3:1 dilution	Attack Attack	No Effect No Effect	No Effect No Effect
Nu-Brite	Concentrate 3:1 dilution	Attack Attack	No Effect No Effect	No Effect No Effect
HD CalClean	Concentrate 5:1 dilution	Attack Attack	No Effect No Effect	No Effect No Effect
Water		No Effect	No Effect	No Effect

Protecting Coils



Teflon[®] Protection for Coils

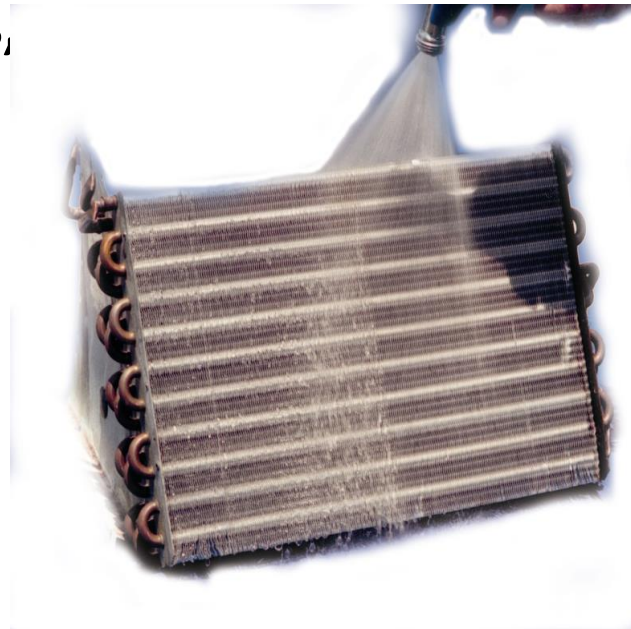
- **Cal-Shield[®] is a ready to use Teflon based coil protectant.**
- **It protects evaporator and condenser coils from dirt and grime build-up. Makes future cleanings easier.**
- **Protects coil from corrosive environments like salt air and food acids.**
- **Improves IAQ by preventing dirt build-up on evaporator coils. Enhances run-off of condensate.**



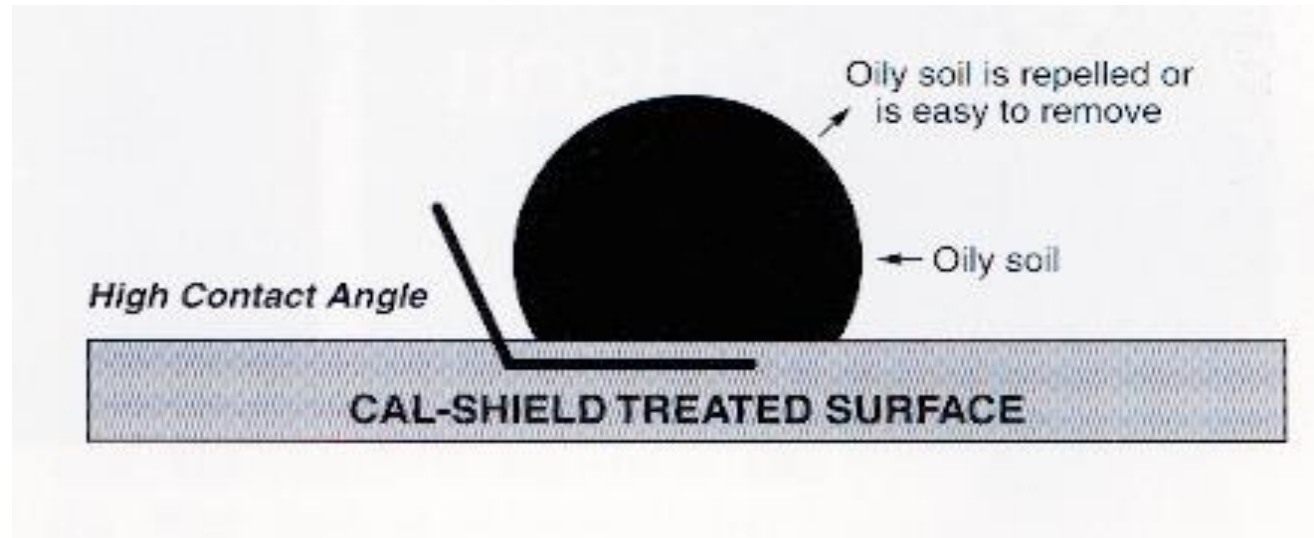
Cal-Shield with Teflon®

How does it keep coils clean?

Teflon film lowers the surface tension of the coil's metal fins, making the dirt "bead up"



Surface Tension



Cal-Shield with Teflon®

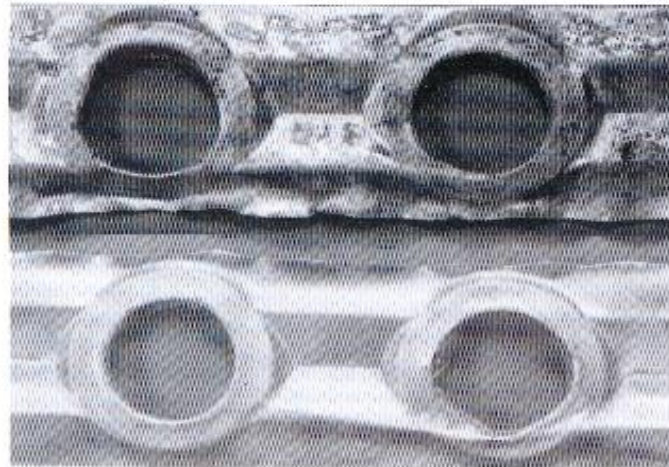
How does it prevent corrosion?

- Cal-Shield provides a micro-thin barrier to help prevent corrosion from salt air, food acids, and other corrosives.



Untreated Fins:
Significant surface pitting (localized corrosion)

Cal-Shield Treated Fins:
No visible surface pitting



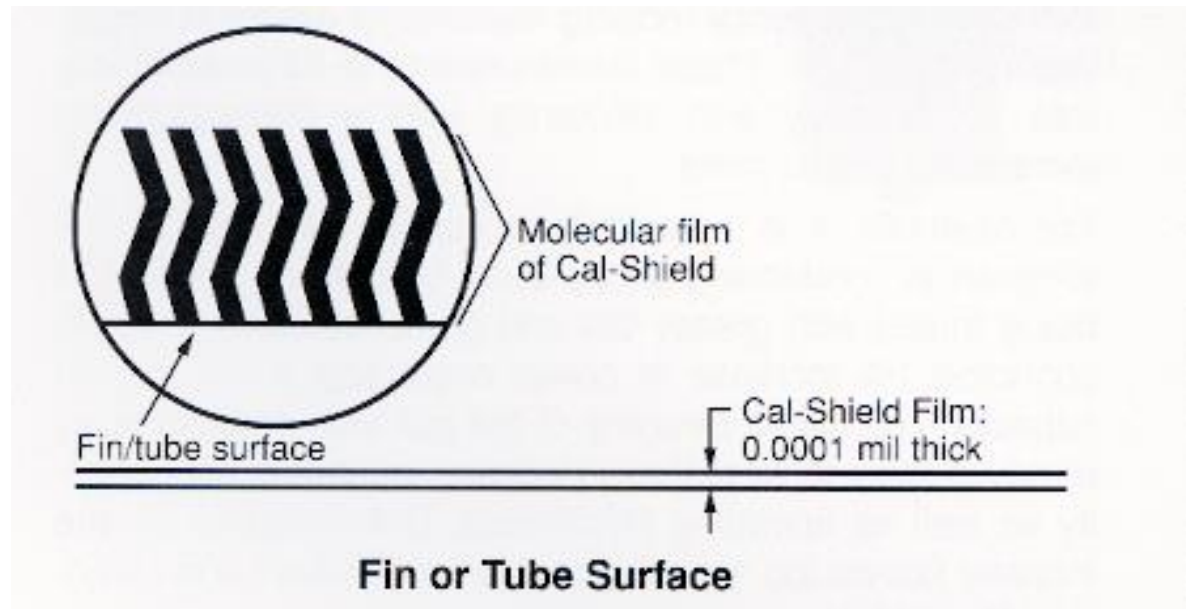
Untreated

Treated

Cal-Shield with Teflon®

No Effect on Heat Transfer

- The barrier is so thin, there is no effect on heat transfer.



Applying Cal-Shield

- Coils must be cleaned and thoroughly rinsed for the Teflon to adhere.
- Cal-Shield is ready to use. Do not dilute with water. Can be applied to a wet or dry coil.
- Using a fine mist from a pump sprayer, spray a light coating over the entire coil.

