



Boiler Inspection, Cleaning, Storage & Treatment Program

The treatment of boilers is designed to prevent the problems of scale and corrosion. Even a marginal program can produce satisfactory results if it is controlled properly. However, even the best chemical treatment program will fail miserably if it is not controlled properly.

Why Cleanup?

It has been shown that if the efficiency of heat exchangers is hampered by insulating deposits, energy costs can escalate significantly.

Cost Of Deposition

In boiler systems, there are many ways to approximate energy losses or efficiency loss due to insulating deposits. Unfortunately, since each type of scale has a different heat transfer coefficient, and since it is impossible to determine the amount of surface area actually covered, there is no chart capable of showing the true loss of energy.

The following table is used as a general guide to show potential effect on fuel consumption given an even coating of scale throughout. The values change slightly with different scale types.

Thickness of scale in inches	1/64	1/32	1/16	1/8	3/16	1/4	3/8	1/2
Loss of Efficiency	4%	7%	11%	18%	27%	38%	48%	60%

How much does waterside scale add to the cost of a boiler operation?

Your DuBois representative will be happy to help you determine such costs.

Let's look at some specific information on Inspection, Cleaning & Storage.

READ ENTIRE INSTRUCTIONS BEFORE PROCEEDING





Preparing Boilers for Inspection and Storage

Coming Off-Line

Prior to going off line, remove as many solids as possible to avoid the “baking on” of sludge, and avoid additional out-of-service cleaning headaches.

1. Beginning as much as a week before taking a boiler off-line, reduce the “normal” control range of dissolved solids by about 25%, or at least to the low end of the range through more frequent bottom blowdown procedures.

For example, if one bottom blowdown per shift is the norm, and conductivity control is normally 3000 to 3500 μmhos , increase to two or more bottom blows per shift targeting about 2200-2600 μmhos until shutdown.

2. Take the boiler off-line according to normal procedures.
3. While the boiler is off-line (vent open), and cooling, immediately blow it down one full sight glass. Refill with warm or hot water. Repeat this at least five times or more, depending on the solids level in the boiler.
4. If the boiler is still hot enough to dry and bake on a sludge, give additional blowdowns and refill with cooler water. When cooled to the point where sludge will not be baked onto the tubes, and no pressure remains in the boiler, drain it.
5. Open the upper manholes as soon as the drop in water level permits. The boiler should then be washed with a high pressure hose while draining. This will remove any soft residual sludge and loose scale.

Equipment, Tools Needed for Inspection, Cleaning and Storage

1. 50' garden hose
2. Adjustable wrench to fit manhole, washout plugs and hand plates
3. Gaskets to fit all openings
4. Work gloves - if acid is to be used, personnel should wear face shields, rubber gloves, rubber boots and rubber apron or rubber suit
5. Tube cleaning rod with correct brush size
6. Soot scrapers and long-handled wire brush
7. Ladder, sized by height of boiler
8. Industrial vacuum with attachments
9. Lube oil and oil can
10. Soot protector mask
11. Lube grease and grease gun
12. Shovel
13. Glass cleaner, clean rags and steel wool pads
14. Three empty trash cans (20 gallon) per boiler
15. pH testing device
16. Have safety shower, hose or other water sources handy in case of acid spills
17. Camera, or more sophisticated inspection equipment if needed

Inspection - (Also review DuBois “Best Practices”)

1. Inspect the waterside of boiler tubes through all manholes and handholes for scale or corrosion.

If there should be any scale present, scrape the tubes to determine scale thickness. Document with person responsible for boiler operation any scale and condition of tubes. Photos are encouraged for documentation.

- If there is no scale present, continue with boiler storage procedures below.
- If more than about 1/32" of scale is present, it may be advisable to clean the boiler to improve heat transfer.

This may be performed through a chemical descaling process out-of-service, or on-line.

- Obtain sample of scale and allow it to dry, if wet.
- Utilize Scale ID Kit #409215 or,
- Add enough concentrated sulfuric acid (#409721 in your 409227 Test Kit) to cover a small sample of dry scale.

If the scale foams vigorously, and mostly dissolves, it is primarily carbonate scale. Continue with descaling.

2. If the scale does not dissolve to less than half the original size when further addition of acid no longer causes foaming/bubbling to occur, send a sample to the DuBois Laboratory for analysis before proceeding. Also, consult DuBois field guide.
3. Also, check the fireside of tubes for soot, carbon and slag, since these deposits also reduce efficiency and should be removed. Vacuum or scrape out soot.
4. Replace water gauge glass. Clean pressure gauge glass, fire eye, ignition orifice burner cut, cone and oil-line filters. Grease and oil all pump, fan and burner fittings.

Boilout

New systems require initial removal of oils, mill scale, etc. High alkaline cleaners may be recommended. May be “site-specific”.

On-Line Cleaning (non-acid)

Most moderate levels of carbonate and iron deposits can be gradually and safely reduced or removed (90 days - 1 year) with additives such as ElimIron. See your DuBois representative for details.

Acid Cleaning (Firetube Boilers)

Note: This may not serve as a comprehensive procedure, and will vary by size or system design. Non-acid cleaning is strongly encouraged when possible. (Not recommended for high silicate deposits).

Safety Precautions

- Have safety shower, hose or other water sources handy in case of acid spills.
- Have personnel who will be handling acid wear face shields, rubber gloves, rubber boots and rubber apron or rubber suit.
- Always use the “buddy system” when acid is being handled - one person should not attempt to acid descale a boiler system.
- Make sure the boiler and boiler room is vented. All feedwater valves and blowdown valves must be tightly closed and chained, as should the main steam valve.
- Replace all brass and bronze fittings with steel fittings.



Cleaning Procedures

When acid cleaning a boiler, best results can be obtained by recirculating the acid solution with an external acid-resistant centrifugal pump. However, if an external pump cannot be used, use the fill-and-soak method.

1. After draining and flushing the boiler, as described earlier, secure all handholes, except the top manhole, obtain a scale sample for later use, then fill the boiler 1/3 to 1/2 full with hot water (don't exceed 150°F).
2. Add one half the amount of the required Liquid Dica to the partially filled boiler. This addition should be made with a pump, if possible. However, be sure the discharge end of the hose is held in place to prevent whipping. Make sure the acid does not splash on any tubes, but goes directly into the water.

NOTE: a 100-HP boiler containing 1/16" of scale will normally require two drums of Liquid Dica. One additional drum may be required for each additional 100-HP. Larger boilers or greater scale thickness will require proportionately more acid. If scale thickness is such that the acid required will exceed 25% of boiler volume, add only to 25% at this step.

3. At this point, some foaming will likely occur. Use DEPRESS 14 as needed to control foaming. More defoamer may be needed later.
4. After foaming is under control, add the remaining Liquid Dica and fill the boiler 4 to 6 inches above the normal operating level with hot water (150°F maximum) if possible.
5. If you have not been able to use hot water, heat the acid solution with a steam lance.
6. Circulate the acid or allow to soak for four to eight hours, as conditions require. If using a circulating pump, the suction should be from the top of the boiler with the discharge into the bottom.
7. Determine the strength of the acid solution frequently with your pH Test Kit. If the pH increases rapidly, which will likely happen with heavy scale, partially drain and add more acid. When the concentration remains stable at a pH of 3 or less for one hour, test the solution on a piece of scale you have saved. If the scale reacts vigorously, the boiler should be clean.
8. Drain the spent acid **in accordance with local regulations governing waste disposal**. It may be necessary to neutralize the acid before disposal. This can be accomplished in the boiler prior to draining, if necessary, but it is best to use a separate vessel to avoid precipitation in the boiler.

9. Refill rapidly with fresh water and then drain and refill at least two more times.
10. Refill again and add enough Confidence 10, 10-C, 41, or 41-C to make a 1.0% to 2.0% solution in the boiler. Be sure to fill above the level where the acid solution has been. The use of other DuBois products should be preceded by a discussion with Water Systems.
11. Heat with low fire and boil for 30 minutes and then drain again and rinse thoroughly.
12. The boiler should be placed in storage or refilled with water and chemicals and placed back in service.

Storage Protection

Unless adequate precautions are taken, more corrosion damage can occur to boilers and auxiliary equipment during idle periods than during extended periods of operation. To keep boilers free from rust, pitting and corrosion while they are idle, they must be stored properly.

Dry Storage (Best for one month or longer)

1. Take the boiler out of service using the procedure outlined earlier.
2. After the boiler is cleaned and inspected, dry it thoroughly with hot air blowers or with electric heaters placed in the furnace. Keep all manholes and handholes open to allow air to circulate freely during the drying process.
3. Immediately after drying, a suitable desiccant (a material which absorbs moisture) should be placed inside the boiler to maintain a dry condition. Use quicklime or silica gel at a rate of one to two pounds for each 10 horsepower of boiler capacity. An uncovered leak-proof/corrosion resistant tray of one of these products should be placed on the top tubes of a Firetube Boiler or in both steam drum and mud drum of a Watertube Boiler.
4. Then, all manholes, handholes, vents and connections are closed and tightly sealed. (Use new gaskets.) Close blowdown valves, close fireside of boiler, etc.
5. Open the boiler once each three to four months to inspect the desiccant. Dry or replace the desiccant if necessary.

Wet Storage

(Best for less than one month storage or when boiler is required on short notice.)

1. If the boiler is to be inspected, take it out-of-service using the procedure outlined earlier. After inspection and cleaning, replace covers and refill to the normal water level, skip Step 2 and go on to Step 3.
2. If the boiler is not to be inspected at this time, stop the inspection preparation procedure after "Coming Off-Line" Step 2. The water level should be normal or higher.
3. Fire the boiler to a gentle boil to expel dissolved gases.
4. Add 1.5 to 2.5 gallons of DuBois Confidence 10, 10-C, 41, 41-C per 500 gallons of boiler capacity to obtain a residual of 800 to 1000 ppm of "P" alkalinity and 100 to 200 ppm sulfite. Liquid caustic and liquid sulfite may also be used. Alternative DuBois products should be discussed with a water treatment specialist.
5. Allow the boiler to cool slightly and then fill completely, closing all connections before a vacuum develops.
6. Check chemical residuals twice a month minimum. Add chemical and circulate as needed.
7. When ready to fire up the boiler again, drain the water to operating level and proceed with normal firing procedures.
8. Wet storage of a boiler should not exceed six months. During this storage period the boiler should be fired twice per month. Bring water temperatures to 160°F and allow to cool. This provides circulation and ensures that treatment residuals are representative. If residuals are too low, add chemical treatment and circulate to ensure adequate mixing.



Returning Boiler to Service & Treating It

If a boiler has been stored properly, it is easy to return it to service.

1. Obtain sample of boiler makeup water.
 - Have your DuBois Representative analyze or send to DuBois Tech Service Labs.
 - Consider softening water with hardness exceeding 250 ppm (14.6 grains) for a Firetube Boiler and soften any water to be used in a Watertube Boiler.
2. If it has been stored dry, be sure to remove all desiccant trays first. Then fill boiler and add 1.0 to 2.0 gallons of DuBois Water Treatment per 1000 gallons of water before firing the boiler.
3. If the boiler was stored wet, drain to normal water level before firing.
4. Feed chemical on a regular basis with a DuBois dispensing system.
5. Your DuBois Representative will set pump and blowdown schedule according to the water conditions and condensate return factors at each site.

IMPORTANT:

Proper blowdown is critical to maintaining a clean and efficient boiler. Be sure to blowdown water columns as well as the boiler.

6. Run regular tests to ensure proper chemical levels and blowdown. Your DuBois Representative will instruct you in these tests and set recommended readings to be maintained and will check these on his/her regular service calls. There is no charge for these services.
7. Inspect and verify condition of all feed and controller equipment. Clean, calibrate and replace where needed.

DuBois Confidence and Confidence PBB

Boiler Water Treatment

Most boiler systems can be successfully treated with one of the boiler care products in the Confidence® line. These are the first products designed to control dissolved oxygen attack, scale formation, and even condensate corrosion in a one-drum formulation.

New: Confidence PBB products (Powder in a Bag in a Box) now provide a DRUM-FREE approach to your boiler treatment needs.

All ingredients are FDA accepted.

Safety & Convenience

We are well aware of the hazards of handling and the hassles of mixing chemical in our industry today. We have addressed these concerns through the All-In-One technology in our Confidence® and Drum-Free PBB products.

Reducing the number of chemical accidents in a plant could have a direct impact by reducing costs by thousands of dollars per year in lost time and insurance premiums.



DuBois

The quality of products and services has made DuBois a leader in the field of water treatment.

DuBois has developed and maintained customer relationships on a quality assurance program in ways that are specifically meaningful to you.

Research & Development

Behind the Confidence® program stands a team of technical and industry specialists ready to respond to your needs.

Manufacturing & Delivery

Behind the Confidence® program stands a production, quality control administrative and delivery program originated from U.S. manufacturing plants serving strategically located distribution centers nationwide.

Packaging

Orders can be placed for a full range of package sizes. From pails to drums and through a variety of Intermediate Bulk Container sizes and even bulk delivery, the appropriate order size is geared to best serve your needs. Drum-Free PBB is shipped in cardboard cases.

Service

Behind the Confidence® program stands your local sales/service professional:

To provide:

- Regular service calls to check program results and make any recommendations for system improvement.
- Chemical Inventory Checks
- Customer Training
- Written Service Reports
- The latest in automated dispensing and control equipment



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