



Since 1926  
THE BEHLER-YOUNG CO.

## USEFUL INFORMATION AND CONVERSIONS

### HYDRONICS

One Boiler Horse Power	=	33,475 BTU Output
E.D.R. x 240	=	Net Steam BTUs
E.D.R. x 150	=	Net Water BTUs
Sq. Ft. Steam x 240	=	BTU Input
Sq. Ft. Water x 150	=	BTU Input
E.D.R. x 400	=	BTU Input
1 Gal. LP/GAS	=	92,000 BTU Input
100 lb. LP/GAS Tank	=	Holds 23 Gal.
BTU Per Watt	=	3.41 BTUs
1 Boiler HP	=	139.5 E.D.R.
1 Electric HP	=	746 Watts Per Hr.

### HEATING CALCULATIONS

CFM of Duct	=	Width x Height x Velocity
		BTU/HR.
CFM	=	$\frac{(S.A. - R.A.) \times 1.08}{}$
BTU/HR.	=	CFM x 1.08 x Temp. Rise
1 KW /HR.	=	3413 BTU
1 Cu. Ft. Gas	=	1000 BTU/HR.
1 Lbs. Steam	=	1000 BTU/HR.
1 EDR	=	240 BTU/HR.
1 Ton Air Cond.	=	12,000 BTU/HR.
1 Ton Air Cond.	=	400 CFM
GPM	=	$\frac{BTU/HR.}{8.33 \times \text{Temp. Drop} \times 60}$

### STANDARD CALCULATIONS

#### USEFUL INFORMATION & CONVERSIONS

- To find diameter of a circle divide circumference by 3.1416.
- To find circumference of a circle multiply diameter by 3.1416.
- To find area of a circle multiply square of diameter by .7854
- To find surface of a ball multiply square of diameter by 3.1416.
- To find side of a square equal in area to a given circle multiply the diameter of the circle by .8862
- To find cubic inches in a ball multiply cube of diameter by .5236.
- Doubling the diameter of a pipe increases its capacity four times.
- Doubling riveting is from 16 to 20 percent stronger than single.
- A gallon of water (U.S. Standard) weighs 8-1/3 lbs. and contains 231 cubic inches.
- There are nine square feet of heating surface to each square foot of grate surface.
- A cubic foot of water contains 7½ gallons, 1,728 cubic inches, and weighs 62½ lbs.
- To find the pressure in pounds per square inch of a column of water, multiply the height of the column in feet by .434.

## Cleaning A Hot Water Boiler

### How to tell if a system needs cleaning.

1. discolored, dirty, or musky water
2. gasses within the system are not air but methane (natural gas)
3. pH of the water is below 7 (acid): i.e. 6.5, 5.2, 6.1, etc.

If any of these test positive the system needs cleaning.

No matter how carefully a system is installed, some materials do find their way into an otherwise clean boiler and piping system. These include:

1. flux
2. thread cutting oil
3. core sand
4. thread sealant (pipe dope)
5. welding slag
6. and plain old dirt

Most systems do contain small quantities of some or all of these components, however, the quantities are small enough that no problems are created. When one or more of these is excessive they may breakdown chemically and cause:

1. “air” in the system
2. acid water indicated by a pH of less than 7

A system with a pH of less than 7 may have one or more of the following symptoms:

1. Air troubles (gas formation)
2. Pump seals do not last
3. Air vents stick and leak
4. Pipe joint leaks
5. Etc., Etc., Etc.

Once in this condition the symptoms can last for years. Air formation problems have seen contractors misapply automatic air vents to try and cure the problem. Remember, you are not having an air problem: it's a methane gas problem.

Hot water boilers normally operate with a pH of 7 - 8. When the pH is less than 7 cleaning is required and one should follow manufacturer's instructions. If none are given,

the following may be helpful.

### The Cleaning Procedure

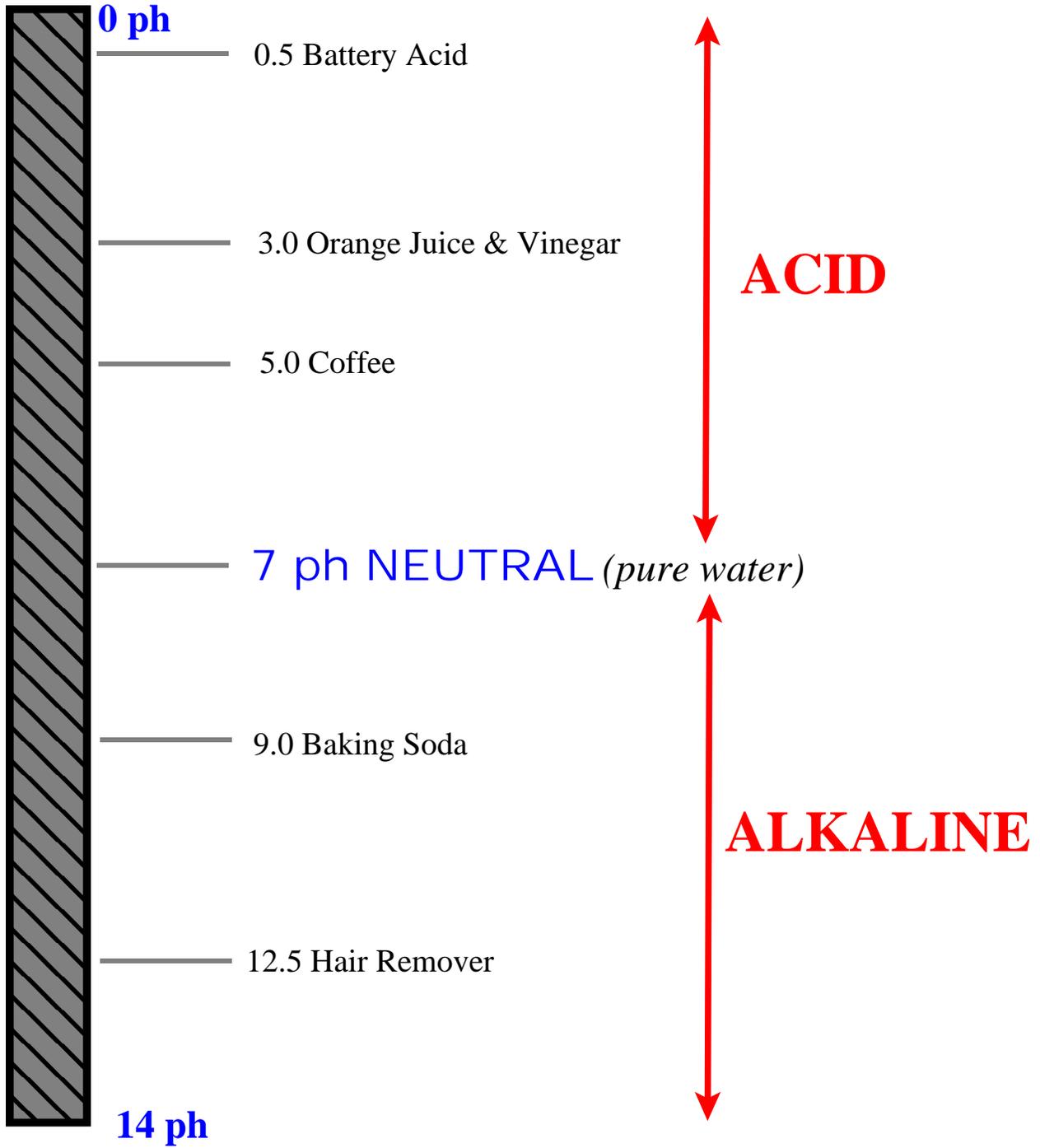
Use trisodium phosphate *or* sodium carbonate to neutralize the boiler water - do not use both. The proportions are 1 lb. for each 50 gallons of water when using trisodium phosphate (TSP) or 1 lb. for each 30 gallons of water when using sodium carbonate. Sodium hydroxide (lye) is sometimes a recommended chemical by some publications, but not recommended by this course, unless that is a specific manufacturer's recommendation.

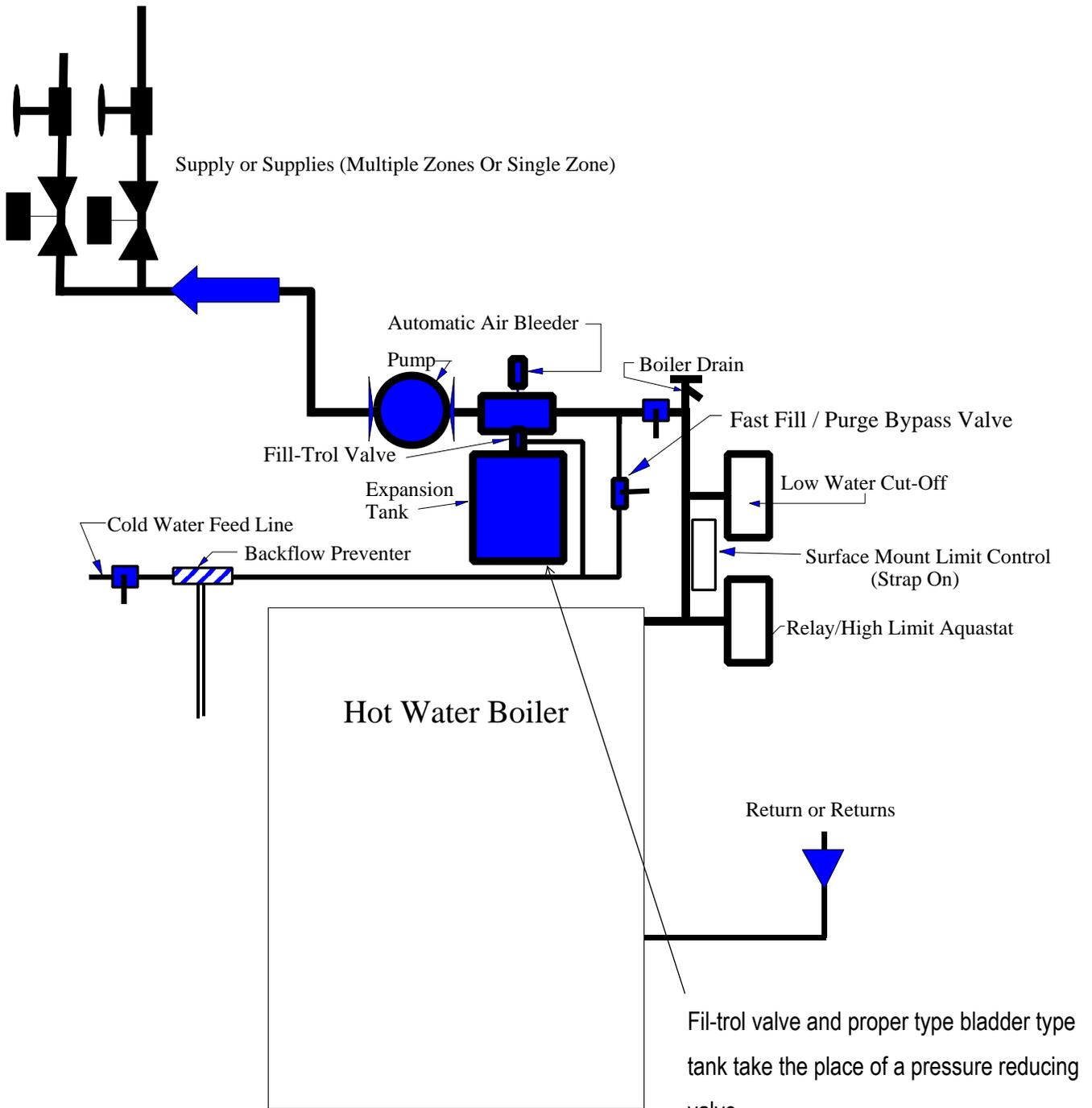
1. Fill, vent, and circulate the mixture for 2 - 8 hours, allowing the system to reach design temperatures.
2. Drain the system completely and fill with fresh water.
3. Retest the pH - it should be 7 or higher. Retreat if necessary.
3. Enough of the neutralizer will usually adhere to the piping to give a neutral or slightly alkaline pH for proper system operation.

### Suggestions:

1. Mix the chemical with warm water before putting it into the boiler.
2. Use a pump to put the mixture into the boiler after you have bled the system of air and you have achieved circulation through all your circuits.
3. Once cleaned, it will never need cleaning again, unless new pollutants find their way into the system through sloppy service or installation practices.

# The pH Scale





Near Boiler Piping  
 With Fill-Trol Water Feeder, Not A  
 Pressure Reducing Valve

Fil-trol valve and proper type bladder type tank take the place of a pressure reducing valve.