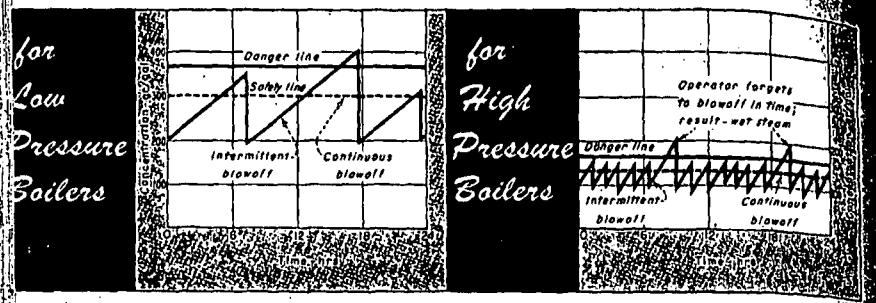


Here are the two basic choices you can make in...

Bringing Blowdown Under Control

Water treatment can change the nature of all your boiler scale, but you still have to remove all the solids that make scale from the boiler cycle. Here is how and why

► THE JOB of blowdown seems straightforward enough. It's meant to control the build-up of too many solids in the boiler drum. Left to themselves, these solids bring on serious scaling problems and add still more to operating problems by laying the groundwork for possible foaming, priming, carryover.

The way these solids build up or concentrate shows up readily with calcium sulfate, a moderately soluble salt. You'll find it a fairly common member of most boiler makeup waters. Suppose we consider a feedwater, holding 32 ppm of this calcium sulfate and slated for a boiler operating at 300 psi. The corresponding saturation temperature, 422 F, is a point where calcium sulfate's solubility is 640 ppm, 20 times what we start out with in our feedwater sample. This means we can expose our feedwater to 20 cycles of evaporation or concentration. Or stated another way, we can evaporate 20 gallons of feedwater down to not less than one gallon without going beyond the calcium sulfate solubility. But any more than this, and the excess drops out of solution.

Blowdown Needs. To keep on making steam we have to bring in fresh water as replacement. This incoming water brings with it 32 ppm of dissolved calcium sulfate that drops right out of solution and creates a scaling problem. If, however, we pull out one gallon of boiler water, we can add 20 gallons of fresh water before we're up against this same problem. In our case this would mean only 1/20th of the boiler feed, or 5%—a fairly reasonable blowdown rate.

But the exact amount of blowdown isn't determined by calcium sulfate alone. Instead, what decides the safe blowdown rate is all the individual compounds the feedwater brings to the boiler drum, the water-treatment chemicals you add, plus their effect on one another to form possibly still different compounds of different solubility limits, plus the boiler operating pressure and temperature and their effect on solubility. When you come to pick blowdown rate for your boiler you'd better call in a reliable water-treatment consultant. He'll set you straight. Table, left on p 137, is only a rough guide.

Over and above this problem of holding total dissolved solids in the boiler water within safe solubility limits is the one of keeping a curb on suspended solids—that is, those that are no longer bound in solution but are free to drop out. We have it on pretty good authority that most of these suspended solids do not settle to the lowest point in the boiler as you might guess. Some small percentage do, and you have to put in special takeoffs at these low points to pull them out during blowdown.

But most of these suspended solids are held just below the water surface in the boiler drum by the buoyant force of boiling and rising steam bubbles. Concentration can get so high at this point that the water becomes soupy, its surface tension considerably increased. Then normal steam release is retarded and foaming or priming can develop. So much for the need for blowdown. How is it done?

Blowdown Methods. There are two primary methods of boiler blowdown—intermittent and continuous. The intermittent or manual system is the granddaddy of blowdown methods. And it is still doing a job on the smaller boilers. The takeoff pipes are usually in the low point, or mud drum, and when you blow down, sludge as well as dissolved and suspended solids go out. But because the takeoff pipes do not connect up to the point of highest solids concentration, the blowdown amount runs higher than absolutely necessary to bring the water down to the allowable solubility limits.

In addition, three major disadvantages are charged against the intermittent blowdown method. They are: (1) inability to maintain uniform solids concentration, sketches, p 136 (2) the human error—operator's failure to return to blow down (3) difficulty in getting up any heat recovery.

Continuous blowdown, the second and latest method of removing concentrated solids, answers these major disadvantages. But its value begins to tell only in boilers of better than 4000- to 5000-lb-per-hr steaming capacity, operating at 100 psi and above. As the name suggests, total solids leave the boiler continuously through a pipe that is below the water surface at the point of highest concentration.

Over and above the continuous pipe connection, a takeoff pipe goes in at the boiler low points. Then an occasional manual blowdown in the conventional manner removes any sludge accumulation in the mud drum.

Continuous blowdown gives these strong advantages: uniform solids concentration, entirely automatic operation (except for relatively minor adjustments if rate of solids concentration changes because of, say, makeup water), easy heat recovery.

Heat Recovery. The steps you take for heat recovery, Fig. 1, 2, may or may not include flash tanks. If you can use flash steam, you pass the blowdown water into a flash tank or tanks first, and take off the steam there. Then the unflashed water is passed through heat exchangers. If you have no use for flash steam all the blowdown water goes through the heat exchangers only. In either arrangement, heat lost is represented by the difference in temperature between the liquid being heated and the blowdown water as each leaves the last heat exchanger.

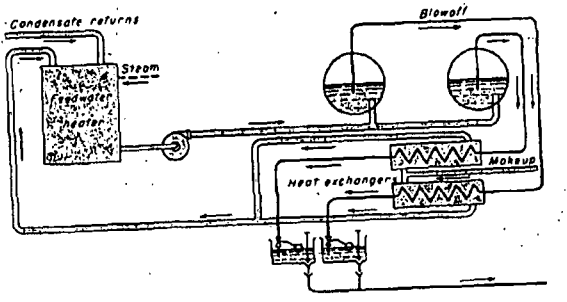
The costs that intermittent blowdown represents, in table at right, give you some idea of the importance of your blowdown water. For a large boiler, the savings from continuous blowdown pay fairly fast for the heat-recovery equipment and justify its purchase.

Allowable Boiler Solids

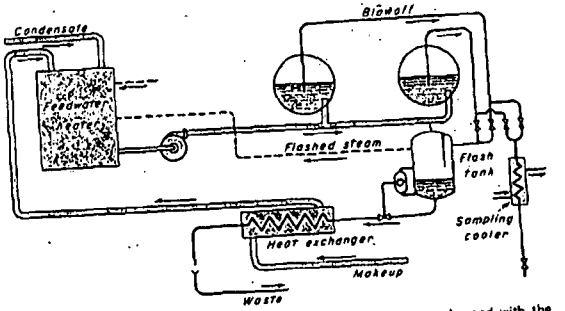
(American Boiler Mfrs Assn)

Pressure at outlet of steam-generating unit, psig	Total solids, ppm
0 — 300	3500
301 — 450	3000
451 — 600	2500
601 — 750	2000
751 — 900	1500
901 — 1000	1250
1001 and higher	1000

Developed from material appearing in the No 3, 1933 issue of the Armstrong Trap Magazine, Armstrong Machine Works, Three Rivers, Mich.



1 Heat recovery from boiler-water blowdown for solids controls offers an easy way of getting back all of your cash outlay for the necessary control equipment



2 Flash steam can frequently be used to advantage in a boiler cycle, and with the above hookup continuous blowdown, particularly, proves a good source for it

Average Costs of Blowdown

Press. psig	Temp deg.	1 in. Lb a min	1 in. Lb coal	1½ in. Lb a min	1½ in. Lb coal	2 in. Lb a min	2 in. Lb coal	2½ in. Lb a min	2½ in. Lb coal	3 in. Lb a min	3 in. Lb coal
100	338°	960	33	2400	83	4080	142	5850	203	10500	365
125	353°	1020	37	2640	96	4440	162	6480	237	11100	406
150	366°	1110	42	2880	110	4920	188	7080	271	12000	459
175	377°	1200	47	3120	123	5400	214	7800	309	12900	511
200	388°	1320	54	3360	138	5880	241	8400	344	13800	566
225	397°	1440	61	3600	152	6300	265	9000	379	14700	619
250	406°	1560	66	3840	166	6840	296	9600	415	15600	675
300	421°	1740	78	4200	189	7460	335	10380	467	17280	778
350	435°	1860	87	4560	214	8040	377	11160	523	18960	891
400	448°	2040	99	4920	238	8680	421	11940	579	20700	1004
450	459°	2220	110	5280	263	9240	460	12720	634	22440	1118

INTERMITTENT or manual blowdown lets a certain amount of steam, depending on pressure and valve sizes used, escape. The cost to you shows in the above table