Steam Trap Maintenance As A Profit Center

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EXECUTIVE SUMMARY

Probably one of the most overlooked profit centers in industrial management strategy is savings in energy costs. Every $1 in *certified* energy savings is often worth over $10 in increased sales. The author has found from actual practice that there is big corporate profit in a shrewd, diligent steam trap management program. He describes a way to restructure corporate handling of trap maintenance to turn it into a source of revenue.

Cited is a case history of building an intensive trap maintenance program at a large, 4000 trap chemical plant. The previously "good" maintenance program which was losing $565,000 per year in steam was turned into a $485,000 per year cost savings. This article will also give the steps that can in as few as 3 months generate over $125,000 annually in tax-free cash per 1000 traps with an investment payback of 18 months or less. The author is a businessman and energy management consultant who has no connection whatever with steam trap sales or promotion.

INTRODUCTION

Why is trap maintenance any different from pump or motor maintenance in the effort to make it a profit center? Primarily because losses are so tangible and results are so easy to measure. No one ever thinks of a low-tech maintenance function as a corporate profit center. Yet, for every industry that uses steam for process or space heating, there is a pot of gold waiting to be uncovered. An extensive survey[1] of more than 260,000 traps in 40 big steam-using industrial plants show that, on the average, only 58% were working correctly. (See Figure 1) In other words, for every 100 installed

steam traps, 42 needed corrective maintenance.

With steam costing between $3 and $9 per 1000 lbs. in today's energy climate, the average manufacturing facility with 2000 steam traps, can be throwing away between $250,000 and $750,000 per year and not even realizing it.

This part of plant operation can now be a profit center instead of a maintenance function that will perform as reliably and as well as *any* investment. If you knew of 2000 shares of stock (or steam traps) at a cost of $175 each that would yield an *annual* dividend of $125 per share (energy savings) from now on, wouldn't you leap at the opportunity to buy?

EXCUSES

Everybody thinks his or her steam trap maintenance is good. Surveys[1] have shown the following are the most popular excuses encountered when

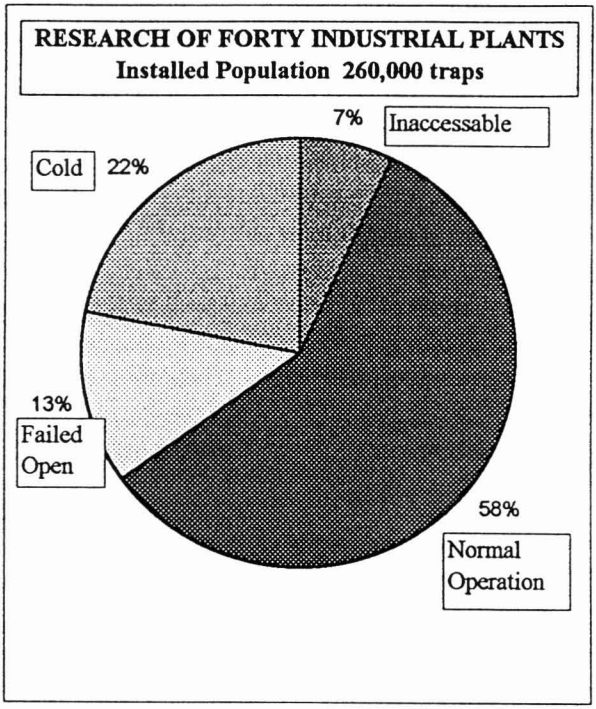

Figure 1. Survey Results

managers are confronted with the challenge of upgrading their trap maintenance program:

- "Our maintenance people just fix the traps as they go bad. You can't get any better than this."
- "Operating this plant at a profit is job one. Steam trap maintenance is pretty far down the list."
- "Our people lose interest real fast because [steam trap] savings aren't measurable."
- "No one wants to work on traps. No one 'owns' them."
- "Steam traps are so confusing. *Every* salesman claims his traps are better than all the others."

Excuses like these keep 95% of all industrial plants from having or acquiring a successful steam trap maintenance program. Articles about steam traps are very popular in chemical industry magazines. What most articles fail to provide is a proven and easy-to-understand plan for turning their trap maintenance program into a money saver.

Let's examine a winning job plan to do just this. The exceptional thing is this program does not require a lot of meetings and big, inter-departmental cooperation efforts, lots of expensive out-of-town seminars or an expanded maintenance staff. Nor will it require years of implementation time. This money tree can start bearing long-term fruit in as little as three months. All it will take is a top management directive to the right person with the words, "Do it."

JUMP START

Steam traps are always going bad and are always being repaired or replaced. This is a fact of life. The key is to keep the time lag between failure and corrective maintenance very short. Determining when the failure occurs and keeping records of the steam that is lost is the hard part. This takes diagnostic skill and good computer records which most companies do not have. When steam losses are viewed in terms of dollars, corporate profits due to energy savings strangely seem to improve.

Secondly, by acquiring necessary software, procedures, employee training, catch-up repairs, initial and exit trap surveys, a company can get a jump start in just a few short months on a first-class profitable trap maintenance program that will continue for years and years.

3 EASY STEPS

The following steps are the essence of a winning steam trap maintenance program:

A. Choose **one person** to "champion" this project.[2] Give your Sparkplug this article and the prescribed funding and say, "Get this done."

B. Issue a subcontract purchase order (or do in-house) the following:
   1. **Make a survey** of all the active steam traps on the facility thus generating a punch list of the repairs that need to be made and establishing what the annual steam losses are.
   2. Set up a **database** with all trap information.
   3. **Tag each trap** with a numbered stainless steel tag.
   4. Get state-of-the-art database **software** written especially for steam traps.
   5. **Set up a trap maintenance program** that will:
      a. Install the trap computer program (above) on only one computer.
      b. Distribute a **Steam Trap User's Guide** that is written especially for your facility.
      c. Review existing maintenance procedures and specifications and make appropriate changes.
      d. Upgrade existing Inventory and Purchasing specifications.
      e. Provide forms and training videos for future O&M use.
   6. Provide 2 weeks of intensive hand-on **training** for all facility engineers and and mechanics with necessary handouts, forms and videos.
   7. **Replace the failed traps.**
   8. Furnishing an **exit trap survey** to certify the actual annual steam savings.

C. Prepare and present a **report to management** on the results of the project.

STEPS EXPLAINED

Now let's examine each of these steps in detail. First, this new profit center *must* have a key person appointed to "sparkplug" the project. He or she must be a self-starter, aggressive, quietly enthusiastic, and one who doesn't wilt under resistance and setbacks easily. This person should have broad experience at your plant and be able to communicate effectively orally and in writing.

Step B above contains several parts. Ideally, one should get a subcontractor to provide this service as one package. By getting everything done at one time, energy losses are minimized and results will come sooner. The initial trap survey is necessary to develop a repair punch list and establish what your benchmark steam losses are.

It is recommended to let only a professional, full-time trap surveying company do this survey. They can collect your database information accurately and put it on your computer. They have the trap diagnostic skills that will take your people years to develop in-house. Just make sure this trap survey company has no financial interests in the traps that you will be purchasing.

Next, your company should purchase a good trap maintenance software package. This software should be able not only to keep maintenance history records, but also to retrieve any trap's data using only the trap number. Armstrong International's APMPLUS software is one of the best, especially after their Microsoft Windows version becomes available.

In step B5 above, you will want to set up a trap maintenance program at your company that will protect the energy savings you will acquire. The computer software must be installed correctly and running smoothly. Inventory and purchasing specifications must be rewritten to consolidate the dozens of different traps you are now using with only five or six carefully chosen traps as your new "standards." Remember, there is no one all-purpose trap.

Training your maintenance and engineering personnel on your new steam trap program will require videos, forms and a handbook (which is described below) that are custom prepared for your facility. These are best left to outside experts to furnish, but are not impossible to develop in-house. One of the disadvantages with the in-house approach is that valuable time is lost during the preparation. Malfunctioning traps will continue to throw away from $1,000 to $15,000 *per day* depending on the size of your trap population and steam pressure. *These* are the profits you want to capture.

STEAM TRAP USER'S GUIDE

A handbook I call a "Steam Trap User's Guide" should be prepared by your subcontractor and put in the hands of every person in your plant that is involved with steam traps. This includes engineers and pipe fitters alike. You can assemble your own handbook, of course, by including information such as:

- Sketches of the *proper* piping arrangements to all your basic equipment showing the traps, strainers, air vents, vacuum breakers, etc. These diagrams need to apply only to your plant, not to the hundreds of possibilities found in an all-purpose publication. See Figure 2.

- A listing of condensate capacities, pressure limits, orifice size, pipe size, etc., of the 5 or 6 standard traps you have chosen for your plant. See Figure 3.

- How to size and specify steam traps for new applications.

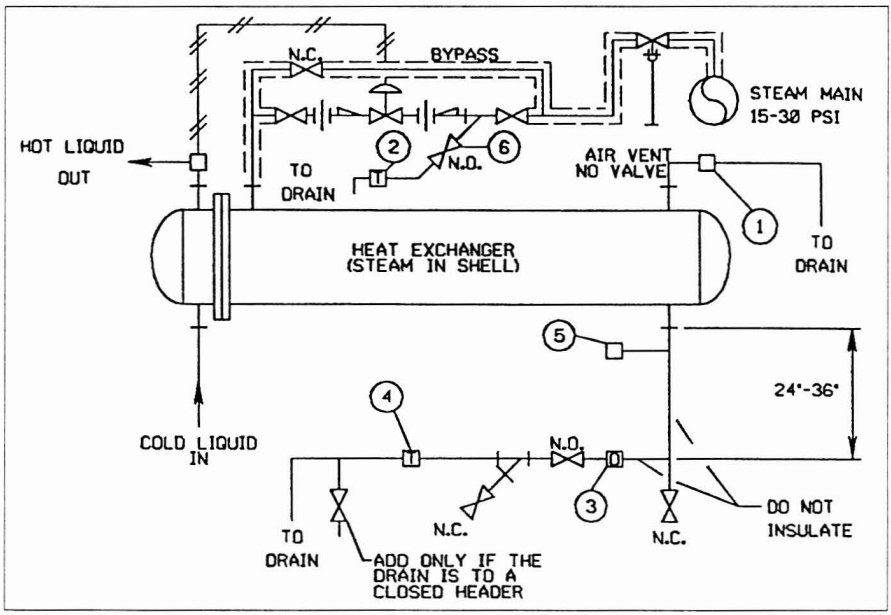

Figure 2. Correct Piping Sketch (example)

TRAP SPECIFICATION LISTING

Trap Mfg and Model	Pipe Size	Type Trap	Press. Limit	Orifice Size	Applications	Condensate Capacity (lbs./hr.) 5#	15#	30#	100#	300#
(small TS)	1/2	TS	400#	0.078"	Drips under 100# Air Vents All Radiators All Tracers Small Heat Exch.	84	140	215	340	533
(big TS)	3/4	TS	300#	0.281"	Large Heat Exch. Outdoor Tanks Hi Cap. Air Venting	1400	2000	280	4400	5000
(sm F&T)	3/4	F&T	145#	0.078"	All Unit Heaters	112	180	245	340	——
(sm IB)	3/4	sst IB	400#	0.078"	Drips Over 100#	125	210	275	425	700

Figure 3. Trap Specification List

- Trap purchase specifications in your company format.
- Trap Characteristics Guide—operating characteristics of the 10 basic types of traps and attendant valves (e.g. vacuum breakers and air vents). See Figure 4.
- Forms as required by your company.
- Copies of pages from the catalogs of each of your "standard" traps (You may need to secure the manufacturer's permission to reprint these, but don't expect to have any trouble in getting it.)

BAD TRAP REPLACEMENT

The most expensive part of the winning job plan to create your new profit center is the replacement of failed traps (step B7). Remember, you already have your punch list from the initial trap survey. Actually, this effort is just the catching up on a maintenance backlog you may not have realized existed. If you get an outside contractor to do this work, you do not have to hire additional maintenance people or sustain continued energy losses while the repairs are slowly being worked off. Not only will you avoid the piecemeal micromanagement that typifies this kind of project, but the project is completed in a timely manner, resulting in faster energy savings. The financial losses that are prevented in a jump start plan like this will usually more than pay for the entire program.

For example, in one case study it took five years to get a trap intensive maintenance program like the one described in this article fully implemented. Funding had to be budgeted, managers had to be sold on the program, audits scheduled and the training developed. Eventually, $475,000 per year in energy savings were achieved. About $2.3 million in steam was lost while about $400,000 was spent to do the audits and repairs. This comes to about $1.9 million in lost profits that could have been saved if the program had been accomplished in 3 or 4 months.

RESULTS

At the conclusion of your steam trap project, an exit survey should be made to identify how much money your new profit center is beginning to

STEAM TRAP CHARACTERISTICS GUIDE

Type of Trap/Valve	C.S. INV BUCKET	FLOAT & TH'STATIC	LOW-TECH THERM-DY	HI-TECH THERM-DY	MOD. SST INV.BUCKET	HI CAP B.P. TH'STATIC	LOW CAP B.P. TH'STATIC
Recommended Mfg and Model							
OPERATING CHARACTERISTICS							
Condensate discharge duration	Intermittant	Continuous	Intermittant	Intermittant	Intermittant	Intermittant	Intermittant
Time in service without repair	Excellent	Good	Poo			Good	Good
Resistance to wear	Excellent	Good				Good	Good
Corrosion resistance to steam	Excellent	Goo					Excellent
Water hammer tolerance	Excellent						Good
Air venting at steam temperature	Yes						No
Vent air at v. low press < 1/4 psi	Poor						xcellent
Ability to handle startup overloads	Fair						od
Operation against back pressure	Exce						llent
Resistance to freezing (unprotected)	Po						ent
Ability to purge air	F						nt
Very light condensate load performance	E						nt
Ability to handle sand and rust ("dirt")	E						
Size	L						
Mechanical failure usually is...	O						
Recommended design factor	2-3						.5
Loud, popping condensate discharge	No						
Renewable w/o piping disassembly	No						es
Requires strainer	No						No-internal
Thermal efficiency (low steam loss)	Fair						Excellent
Condensate discharge temperature	Hot	Ho				hot	Almost hot
Must be installed exactly vertical	Yes	Yes				o	No
Usable in superheated steam	No	Fair				Fair	Fair
Orifice change req'd for pressure change	Yes	Yes	No	No	No	No	No
Requires priming	Yes	No	No	No	Yes	No	No

Figure 4. Trap Characteristics Guide (Partial list)

generate. Again, make sure your trap survey contractor is a full-time, professional trap surveyor who has no financial interests in the findings. On the average, experience has determined that you can expect to generate a net profit of around $125 per year times the trap population at your facility.

Experience has found it will require a one-time initial investment of approximately $175 times your trap population for a subcontractor to accomplish this entire program. Results can vary, of course, depending on your cost of steam and how poor the existing trap maintenance is found to be. You will want to graphically express your results[3] in your final report something like Figure 5 below:

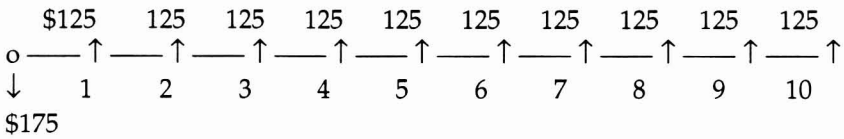

Figure 5. Financial Analysis Diagram

Present Value of Project = Present Value of annual savings – Present Value of Investment

$$P = A\,(P/A) - \text{Investment}$$

If interest rate = 10% and time period = 10 yrs,

$$PV = \mathbf{125} \times 6.1446 - 175 = \mathbf{768} \qquad \text{or,}$$

considering the time value of money, the initial investment increased 4.3 times or, 430% in 10 years.

WRAP-UP

The purpose of this article is to show how to restructure your steam trap maintenance program to turn it into a profit center, not to educate about traps or their maintenance. However, here are a few pieces of advice borne of costly experience that you may want to consider:

- Make sure your cost basis for steam is accurate. Do a thorough analysis instead of using the cost figures from your Accounting Department.

- Give your project "Sparkplug" a small cash bonus commensurate to the profit generated. This will be the best investment you could make to sustain project profitability.

- Don't let your steam trap vendor or his factory "expert" conduct your training seminars. Their bias toward their products tends to color their conclusions.

- Energy savings have a corresponding environmental benefit which could be used advantageously in corporate public relations.

- All trap records should be kept by one person on one computer. If several people can change the data, it won't take long for all the data to become one big mess and no one will be accountable.

- Never rebuild traps that are less than 2" in size, just replace the entire trap. Better yet, replace only the renewable element.

- Make all of your new standard traps those that can be renewed with an inexpensive replacement element that will not require piping disassembly to install.

- By having a complete package of training videos, how-to handbooks and maintenance procedures prepared for you by a subcontractor who is an expert in this field, your O&M and profits are generally sustainable regardless of personnel turnover.

References

1. "Managing the Steam Trap Population," Yarway Corporation, Blue Bell, Pennsylvania, 1988.
2. "At Robbins AF Base, Maintenance is Critical To Energy Efficiency," R.F. Szydlowski and J.S. Schliesing, *Strategic Planning for Energy and the Environment*, 1996, pp. 36-56.
3. Turner, Wayne C., et al, *Energy Management Handbook*, New York, John Wiley & Sons, 1982, pp. 83102.

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Jerry Bouchillon, P.E., C.E.M., is the President of a Steam, Incorporated, located in Kingsport, Tennessee. He worked in the chemical industry for 28 years in various positions including being the Engineering Specialist for process piping, pumps, pressure vessels, lighting, heat exchangers, mixing, corrosion, and energy conservation, and last served as Energy Manager at Holston Defense Corporation. He has written several books including *Steam Trap User's Guide* and has a US patent with one pending. His educational background includes a BSME from the University of Tennessee and graduate work at the University of Alabama.