(Translated from Chinese in Taiwan)

Taiwan Formosa Lin Yuan Plant
Assessed Trial Run of the Steam Saver System

I. Foreword:

The steam trap used by MBS at present is the conventional steam trap with necessary condensate accumulation and mechanical discharge operation resulting in steam being discharged with the condensate This causes unnecessary steam consumption. And, the intermittent steam discharge scorches the working personnel and causes inconvenience in operation. Based on the Global Weather Change Guideline Bill that has been promulgated and will be in effect in 2000, reducing the discharge of carbon dioxide will be an important and major subject. This test was conducted using the Steam Saver System to take the place of the conventional steam traps. The aim is to improve energy resource efficiency.

II. Principle:

The Steam Saver System utilizes the density difference between steam and condensate. Under pressure the density of condensate will be higher than that of the steam, usually, about 1000 times. When the condensate and steam exist in the same pipeline with same pressure, the flowing speed of the condensate with higher density will be slower than that of the steam with lower density. When both of them get into the narrow and long hole of the Steam Saver System, they will jostle against each other as the space of the hole gets smaller abruptly. At this time, the condensate with slower flowing speed and higher density will block the way of the steam with faster flowing speed and lower density thus forming the **Choking Effect.**

As the jostling continues, the condensate will be discharged from the hole continuously and the steam will be blocked by the condensate and stay in front of the hole of the Steam Saver System. As the condensate is discharged continuously, it will be impossible for it to accumulate. Therefore, the steam can be maintained at a fully dry condition and thus the energy resources utilization efficiency can be significantly enhanced.

III. Test results and discussion:

The Steam Saver System introduced by Ting Kuo Company is still a new product without actual operations performance. After assessment, four areas will be tested:

1. Rear side of switchgear (main pipeline for steam transmission, steam pressure 10.5K.)
2. Steam distiller (steam buffer tank, steam pressure 10.5K)
3. District 400, row C/D (pipeline of steam with pressure reduced, steam pressure 5K)
4. District 500 heat exchanger (row dry, one section heated, steam pressure 5K)

Installation was completed on October 2, 1997 and the inlet/outlet temperature at various points is detailed as shown in Table 1 below:

Table I: Steam Saver System inlet/outlet temperature value

Item	Rear side of switchgear	Steam distiller	District 400, row C/D	District 500 heat exchanger	North side of district 300 (cross reference group)
Inlet temperature	120.9°C	155.1°C	117.2°C	118.3°C	149.2°C
Outlet temperature	87.2°C	92.5°C	88.3°C	94.2°C	108.3°C

Generally speaking, if the temperature in the condensate discharge pipeline at the rear end of steam trap is below 100°C, the majority will be hot water. From Table I, it is known that the present discharge temperatures of the condensate in the Steam Saver System are all below 100°C. However, the present discharge temperature of North side of district 300(cross reference group) is above 100°C. Judging from this, the Steam Saver System must have some effect.

A comparison is made with the steam consumption data in the past years (as shown in Table II). During the period from 1995 to September of 1997, the average steam consumption per one ton of powder is 4.59 tons (total production volume is 32,616 tons of powder with the steam consumption at 149,309.8 tons).

After replacement of 5 PC (total 55 PC, occupying 9.1%), steam consumption dropped to 4.26 tons steam/1 ton powder. (In the period from October 1997 ~ August 1998, total production volume 12,889.9 tons of powder, steam consumption 54,943.4 tons). Some steam savings can be seen.

On July 3, 1998, the vendor proposed a trial: installing the other 50 PC steam traps belonging to same steam flow meter to actually assess the steam saving effect. After assessment, in order to match with the production operation at the site, only 21 PC of heat exchangers with higher steam consumption and 7 PC of steam pipelines were replaced and the trial run was started upon completion of installation on 9/1 ~9/4. On 9/7, an infrared ray sensor was used to measure the inlet/outlet temperature of the steam traps and the Steam Saver System in normal operation. Comparison of the inlet/outlet temperature of the steam traps before and after replacement by the Steam Saver System is shown in Table III below:

Table III. Comparison of Inlet/Outlet temperature before and after Steam Saver System is installed

Item	Position	temperature before replacement		Temperature after replacement		Item	Position	temperature before replacement		Temperature after replacement	
		Inlet	Outlet	Inlet	Outlet			Inlet	Outlet	Inlet	Outlet
1	Row A/B in district 400(2)	155	107	138	93	15	Row A/B in district 400(2)	84	84	92	86
2	413(B)10	84	80	109	98	16	426D(9)	120	96	107	98
3	424B(11)	130	106	108	101	17	426C(10)	126	109	108	97
4	425B(12)	130	108	148	103	18	427D(11)	124	116	101	94
5	426B(13)	123	110	150	99	19	427C(12)	138	112	116	97
6	427B(14)	128	104	155	102	20	428D(13)	85	90	*	*
7	428B(15)	104	100	*	*	21	428C(14)	108	106	*	*
8	Row C/D in district 400 (1)	110	95	148	94	22	Row A in district 500(2)	150	102	114	94
9	Pressure reduce valve (2)	140	106	158	94	23	502A(6)	102	86	134	97
10	413C(3)	71	71	116	103	24	504A(7)	119	98	120	93
11	424C(4)	145	117	113	98	25	Row B/C in district 500(1)	160	102	150	92
12	424D(5)	81	81	128	99	26	Pipeline (2)	162	98	152	93
13	413D(6)	89	90	130	102	27	Pressure reduce valve (3)	157	106	178	91
14	425D(7)	93	93	102	93	28	504B(8)	130	97	119	96

* Not listed in Table

The unit of steam consumption is steam in tons and powder in tons for the statistics from September to October 1998. This time, only the portion with higher steam consumption was replaced (38 PC had been replaced, occupying 70%), therefore, the total value had been approached.

The critical problem of the conventional steam trap is that it wears out easily, and corrodes which results in no way to close it and causes steam escaping, or the trap cannot be opened normally to discharge condensate or causes water hammer conditions. Also, when replacing the complete set of steam traps, there are problems such as different brands, difference in operating principles and different sizes that may require pipeline modification or maintaining a stock of repair parts to meet urgent requirements. However, after the Steam Saver System is used, the following advantages are found:

1. Expenses for keeping repair parts, for maintenance and overhead can be saved.
2. As the condensate is discharged continuously, the steam can be kept dry thus shortening the heating time and enhancing production efficiency.
3. The original factory offers a 10-year warranty and assures post-sale service.
4. The Steam Saver System uses 300 series stainless steel material (SUS304) for one-piece forming, is sturdy and durable, thus eliminating the disadvantages of the conventional steam trap.
5. Only pipes of 1/2" ~1" in diameter are used to meet various requirements, taking the place of the conventional steam traps using pipes of 2"~6" in diameter and saving the cost of pipe.
6. Calculating at $331 per ton as the steam cost, each ton of powder can save 0.4 ton of steam (about 10% of the original consumption), and the unit cost will be reduced to $132/ton powder.

Monthly cost reduction of steam consumption:

0.4 tons steam/ton powder X $331/tons steam X 1300 tons powder/month = $170,000

Annual cost reduction of steam consumption:

$170,000/month X 12 months/year = $2,040,000 (not including maintenance and service expenditure)

Conclusion:

After the Steam Saver System is put into use, in addition to the reduction of steam consumption, and the reduction of production cost, spare parts and maintenance costs can also be saved. Moreover, as the discharge of carbon dioxide can be minimized, environmental protection requirements are met and a responsibility to society is discharged.