



PT. KRAKATAU STEEL

Steam Traps and Leaks Survey, Repair and Replacement

SUMMARY OF THE OPTION

PT. Krakatau Steel is a large government-owned integrated steel plant in Indonesia and produces hot rolled coils, plates and sheets; cold rolled coils and sheets and wire rods with capacity 2 million, 650.000, dan 20.000 ton per year.

Two reformer boilers in the Direct Reduction (DR) Plant of the company produce 198 tons steam/hour for various applications. A steam survey found 100-200 substantial leaks in steam traps and steam pipelines and approximately 50 - 100 malfunctioning steam traps. Leaks were repaired and faulty steam traps were replaced. Financial savings are US\$ 18,307 per year with a payback period of less than three months from an initial investment of US\$ 3,510. Energy savings were 126 tons natural gas per year (5447 GJ/year) and greenhouse gas emission reductions of 369 tons CO₂ per year.

KEYWORDS

Indonesia, Iron & Steel, Steam Distribution & Utilization, Losses, Leaks, Steam trap, Repair

OBSERVATIONS

Steam traps are automatic valves used in every steam system to remove condensate, air, and other non-condensable gases while preventing or minimizing the passing of steam. Proper operating steam traps are required to ensure an efficient heating system and to prevent any damaging water hammer in steam systems. In the Direct Reduction (DR) plant, two reformer boilers produce 198 tons/steam per hour. Steam is used for the reforming process, turbine generator, CO₂ plant, pump, de-aerator, and other applications. A large number of steam traps are used in a variety of applications in the Direct Reduction (DR) plant.

A steam leak survey of the DR plant in March 2004 found the following:

- Several steam traps were leaking, wasting huge quantities of steam
- Many traps had their upstream isolation valve shut down when they should be operating
- Throughout the DR plant there were leaks in the steam piping system.

Many of the high-pressured steam leaks observed were not easily visible because of the superheated temperature. An estimated total of 100-200 substantial leaks were identified (approximately half steam traps and half in steam pipelines), some of which are shown in the photos below.



Figure 1: Steam Trap Leak (a); and Steam Proliferation Leak (b)



(a)



(b)

OPTIONS

Two options were implemented:

- A steam leak survey was conducted to identify leaks in steam traps and the steam distribution system, and estimate steam losses. This was followed by repairing leaking steam traps and leaks in the piping system (see Table 1), which was done at the same time since it was often difficult to determine the source of each substantial leaks
- Replacement of malfunctioning steam traps. The DR plant uses thermodynamic steam traps, which operates as flash steam passes through the trap, as shown in Figure 2.

Figure 2 - Operation of a thermodynamic steam trap

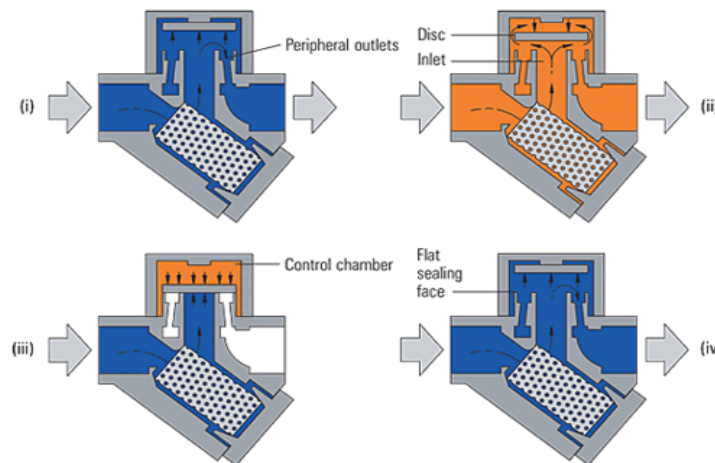


Table 1- Repair of Steam Leaks and Traps at DRI Plant PT. Krakatau Steel in 2004

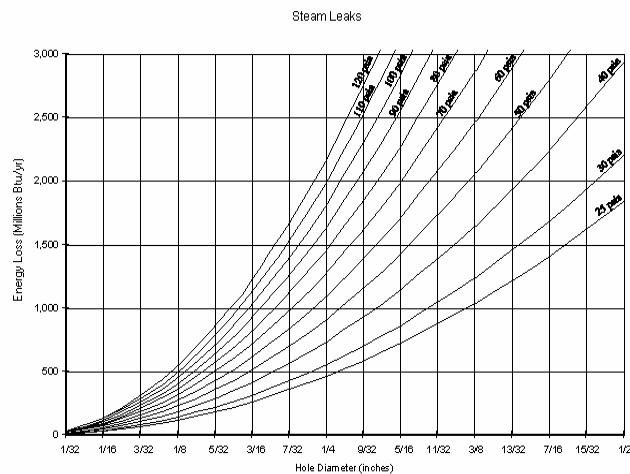
No	Repair Gasket/Gland Packing (16 locations)	Plant Stock (Box)	Pst. Date	Acct. Ass.	Qty.(Box)
1.	Packing, Material-3/8 in-up to 300° C	1	01-10-2004		1
			01-10-2004	U PM/16	1
			01-10-2004	U PM/01	1
			30-09-2004		1
			30-09-2004	B 45059173/01	1
			21-09-2004	F 07181118/01	1
			14-01-2004	F 02972596/01	1



2.	Gland, Packing-1/2 in-Inconel-Asbestos	1	30-08-2004	F 07164931/01	1
3.	Gland, Packing-5/8 in-Asb. Graphite-8strand	0	31-12-2004	B 45061393/01	2
			08-12-2004	F 07239889/01	1
			29-11-2004	F 07228673/01	1
			24-11-2004	F 07226831/01	1
			19-11-2004	F 07227303/01	2
			09-11-2004	F 07219413/01	1
Repair of steam trap (106 locations)		Plant Stock (EA)	Pst. Date	Acct. Ass.	Qty. (EA)
1.	Filter, Fluid-3/4 in – 40 kg/cm ²	18	11-10-2004	F 07196526/01	3
			11-10-2004	F 07196517/01	2
			11-10-2004	F 07196536/01	2
			16-07-2004		13
			16-07-2004	U PM/16	13
			16-07-2004	U PM/01	13
			15-07-2004		13
			15-07-2004	B 45056087/01	13
			18-03-2004		12
			16-03-2004		12
2.	Steam, Fluid valve*7220-1-part	5	18-03-2004		5
			16-03-2004		5

RESULTS

Figure 3: Grashof's equation curve



Financial benefits

- Investment: US\$ 3,150
- Annual savings: US\$ 18,307
- Payback period: 3 months



Environmental benefits

- Annual energy savings: 126 tons natural gas (5447 GJ/year)
- Annual GHG emission reduction: 369 ton CO₂

Energy savings (or losses before leak repair) were estimated based on the size of the orifice and system steam pressure using the relationship illustrated in the above figure derived from Grashof's equation (Avallone and Baumeister 1986). The calculation was done as follows:

- Steam traps (assumed 50% steam trap is blocked and annual actual operational day factor is 0.813) = 4945 million BTU/yr
- Steam leaks (assumed annual actual operational day factor is 0.813) = 217 million BTU/yr
- Total steam losses from steam trap and leaks = 5162 million BTU/yr
- Conversion to LNG (million BTU * heating value * density LNG) = 5447 GJ/yr * 0.00087 ton/Nm³ / 0.0378 GJ/Nm³
= 126 ton LNG/yr (LNG = liquefied natural gas)

FOR MORE INFORMATION

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