CADDET energy efficiency IEA OECD

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Highly efficient air nozzles

Compressed air savings by leakage reduction and efficient air nozzles

Summary

Van Leer (UK) Ltd discovered that 36% of its compressed air was being lost through leakage and that existing air nozzles required double the compressed air of more air efficient types. These problems were addressed through a leakage reduction programme and by replacing old nozzles with air efficient types.

Subsequent monitoring showed that leakage was still occurring and demonstrated that leakage reduction programmes must be ongoing to be effective. Replacing the old nozzles with new, air efficient types significantly reduced air usage, and further investigations are being carried out on the benefits of replacing further old nozzles.

Highlights

- **25% energy cost savings**
- **Nine month payback period**
- **Potential for greater savings**

Steel drum manufacturing at Van Leer (UK) Limited.

Aim of the Project

The company uses a compressed air system which extends throughout the factory and with so much equipment using compressed air, leakage is likely to be a problem. A survey in 1994 highlighted the cost of leakage, and the company decided to address the issue. The aim of the project was therefore to reduce leakage in the company's compressed air system and to install high efficiency air nozzles.

The Principle

The company initiated a leakage reduction programme aimed at eliminating most of the identified leaks. This involved a variety of actions including sealing pipe unions, curing leaking pneumatic cylinders, replacing gaskets on filter or lubricating bowls, renewing the sealing diaphragm within solenoid valves and replacing damaged flexible hoses.

The leakage reduction exercise, implemented over two weekends in February 1995, achieved a saving of 67.5 l/s (143 scfm). Although the leakage increased steadily from the point the repairs were made, as Figure 1 indicates, the leakage would have increased anyway at the same rate, irrespective of whether the work had been carried out or not. In fact, the leakage monitoring programme shows a steady worsening of the leakage rate during periods when no repair work was carried out and confirms that leak saving exercises must be carried out periodically if full benefits are to be maintained.

Old air nozzles were replaced with air efficient models. These use less compressed air by projecting a precise jet of air at the task. Van Leer installed three air efficient nozzles for stack separation. The reduction in compressed air usage achieved by installing air efficient nozzles was calculated by measuring the air flow to one of the old high pressure nozzles, and comparing it to one of the new air efficient nozzles in the same application.

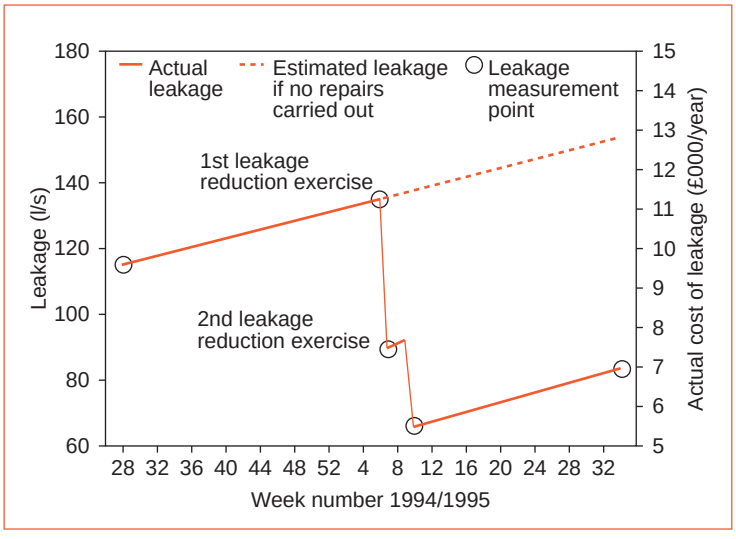

Figure 1: The effect of the leakage reduction programme.

The Situation

Compressed air is an important service used by the majority of the processes within the host company's factory. These include sheet steel stack separation prior to press feeding, product leak testing, press operation, paint spraying and seam welding. Most of the newer equipment makes extensive use of pneumatic controls and the system has to operate efficiently with little or no pressure fluctuation. The compressed air system extends throughout the factory and, with so much equipment using compressed air, leakage is always likely to be a problem. In practice, the old copper pipe nozzles worked reliably and gave little cause for concern. However, the survey showed that a significant saving was possible by using air efficient nozzles.

In July 1994, a survey of the compressed air system identified two major problems: firstly, 36% of the compressed air was being lost through 90 different leaks; and secondly, existing air nozzles used over twice as much compressed air than more air efficient models.

The main components of the leakage reduction programme were:

- Sealing leaking pipe unions
- Replacing worn sealing rings within pneumatic cylinders

- Checking, tightening and replacing gaskets on filter or lubricating bowls
- Investigating leaking solenoid valves and renewing where appropriate
- Repairing and placing damaged flexible hoses

The separation of blanks from sheet steel stacks was originally carried out using copper pipes flattened at the end to form a crude nozzle. Although these generally worked reliably, air efficient nozzles have been shown to use less compressed air by projecting a precise jet of air at the task.

Nozzles have been developed to give specific air jet patterns for different applications. For sheet separation, a broad, knife-like jet is required. Van Leer installed three air efficient nozzles for stack separation. The reduction in compressed air usage achieved by installing air efficient nozzles was calculated by measuring the air flow to one of the old high pressure nozzles, and comparing it to one of the new air efficient nozzles in the same application. The results in Table 1 show that the new nozzle reduces air consumption by 68%.

	Operating pressure		Air consumption	
	Bar g	psig	l/s	scfm
Copper pipe nozzle	4.1	60	9.1	19.2
Air efficient nozzle	1.4	20	2.9	6.1
Saving			**6.2**	**13.1**

Table 1: Nozzle specifications.

Following this project, the site's remaining 40 air nozzles in the factory were being investigated to ascertain the effectiveness of replacing them with air efficient nozzles.

The Company

Van Leer (UK) Limited, Hull, is one of four UK steel drum manufacturing sites of the Royal Packaging Industries Van Leer BV Group of the Netherlands. The Group holding company is owned by the Van Leer Group Foundation, which uses its funds to support the Bernard Van Leer Foundation. This foundation runs projects to benefit socially and culturally disadvantaged children, primarily in countries where a Van Leer company is established.

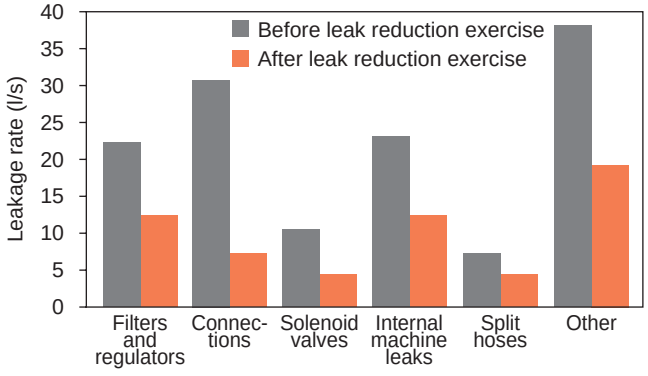

Figure 2: Sources of leakage before and after the leakage reduction exercise.

Economics

Based on 1994 data, Van Leer Limited uses 179 kWh to produce 1,000m^3 of compressed air, at a cost of GBP 5.37/1,000m^3. The leakage reduction exercise resulted in annual energy savings of 189,200 kWh worth GBP 5,676/year. This represents a 25% saving on the cost of providing compressed air. Figure 2 shows the sources of leakage before and after the leakage reduction exercise.

The leakage survey cost GBP 1,700, and a further GBP 2,186 (including replacement parts and labour) was spent on remedial work. With savings of GBP 5,676/ year, the leakage reduction programme achieved a payback period of nine months.

The air efficient nozzles were installed on machines that operate for approximately 1,000 hours/year. The reduction of 6.2 l/s from each nozzle saves just under 4,000 kWh/year worth GBP 120/year. The three nozzles, installed at a total cost

of GBP 105, save 12,000 kWh/year worth GBP 360, giving a payback period of four months.

The implementation of a leak reduction programme and the installation of air efficient nozzles have reduced Van Leer's annual electricity consumption by 201,200 kWh, worth GBP 6,036/year. This gives a payback period of less than nine months on the investment cost of GBP 3,886.

Ongoing work to fit more air efficient nozzles and further reduce leakage is expected to make additional savings of about GBP 4,000/year.

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* IEA: International Energy Agency
OECD: Organisation for Economic Co-operation and Development

IEA

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This is achieved, in part, through a programme of energy technology and R&D collaboration currently within the frame-work of 40 Implementing Agreements, containing a total of over 70 separate collaboration projects.

The Scheme

CADDET functions as the IEA Centre for Analysis and Dissemination of Demonstrated Energy Technologies. Currently, the Energy Efficiency programme is active in 11 member countries and the European Commission.

This project can now be repeated in CADDET Energy Efficiency member countries. Parties interested in adopting this process can contact their National Team or CADDET Energy Efficiency.

Demonstrations are a vital link between R&D or pilot studies and the end-use market. Projects are published as a CADDET Energy Efficiency 'Demo' or 'Result' respectively, for ongoing and finalised projects.

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