Non Implemented Case Study – Energy Conservation Measure

Measure
Controlling compressed air leakage on sustainable basis
Equipment
Compressed air system
Industry / Sector
Foundry
Year of Implementation
Implemented 1997 but not continued further
Cost Benefit Analysis
• Type of Measure: short term
• Annual Energy Savings: 3 lakh kWh
• Total cost savings: Rs.12.00 lakh
• **Recurring expenditure: Rs. 5.00 lakh**
• Net cost savings: Rs. 7.00 lakh
• Payback: Immediate
Implementation Highlights

• Plant has implemented the measure immediately after the suggestion, but not continued further on continued basis in arresting the leaks.
• During the post audit review, the leakage test indicated that the leakage level in the plant increased rather than reducing.
• The major causes for the non-implementation are:
  – Though the leaks were arrested initially, the task of assigning responsibility of controlling leaks on sustainable was not allocated.
  – No allocation of the budget for controlling leaks.
  – No strategic planning and implementation for conducting leakage test and identification of leaks.

Summary

The control of compressed air leakage in the system will reduce the power consumption by 15%. The regular implementation and follow-up will also results in many other associated benefits such as stable pressure, reduction in generation pressure, long life of the equipment, etc.

Background

Plant has six reciprocating compressors of 1000 m^3/h each (93 kW). During normal operation four compressors are operated. Compressed air is mainly used for pouring, instrument and valve control, pneumatic conveying, lifting and tilting, cooling, machine tools, etc.

Based on the free air delivery test, compressors loading & unloading and number compressors in operation the actual consumption of the air is estimated at 3200 m^3/h.

Leakage test (no-load) was conducted on holiday to evaluate the quantum of compressed air leakage. The steps involved in no-load test are:

i. To switch off all user equipment (during non-operating of the equipment)

ii. To pressurize the pipelines and note down loading and unloading times of compressors.

During the test two compressors were operated to monitor loading and unloading of the compressors. It was observed that these two compressors were on-load for about 50% of the time. The following table gives the details about the no load test.

The compressed air leakage in the plant was:

Compressor	Actual FAD m^3/h	% loading during leakage test
Comp # 1	779	50
Comp # 2	769	50
Actual compressed air leakage : 774 m^3/h		
Total compressed air consumption: 3200 m^3/h		
% leakage in the system: 24%		
Specific power consumption: 6.7 cfm /kW (11.32 m^3/h per kW)		
Equivalent power consumption for compressed air leaks: 68 kW		

The acceptable leakage for this kind of industry should be below 10% of total air generation. The leaks in the plant can be easily brought down to the acceptable level by simple measures such as periodic line testing, replacing or rectifying the leaking valves, glands, joints, etc.

It was suggested to have comprehensive leak control program to control the leaks below 10% of the total air requirement.

The suggested comprehensive leak control program should be implemented which constitutes of:

- Periodic leakage checks (once in two or three months).
- Identification of leak sources.
- Assigning responsibility the controlling of leakage at higher level and operating level.
- Use of simple procedures and formats (similar to those which are used for maintenance application).
- Allocation of some budget for the control of leaks.
- In order to sustain the savings by controlling the leaks, it was also suggested to entrust the work to external contractor.

A recurring expenditure is expected towards spares, manpower and contractor charges since the plant may not be able to divert its manpower whenever leakage is developed. It can be easily possible it the task is given to the external contractor.

Techno-economics:

Expected leakage (max of 10%) after the implementation	: 320 m^3/h
Leakage quantity could be arrested	: 454 m^3/h
Equivalent power savings	: 40 kW
Annual operating hours	: 7500 h
Total estimated energy savings	: 3.0 lakh kWh
Annual cost savings	: Rs. 12 lakh
Recurring expenditure required	**: Rs 5.0 lakh**
Net cost savings	: Rs. 7.00 lakh
Payback period	: immediate

The leakage test carried out again during the implementation review indicated that the compressed air leakage levels have gone-up again. This is because no proper planing and schedule had been drawn and no leakage check-up was conducted thereafter.

Principle

- Leaks occur most often at joints and connections. Stopping leaks can be as simple as tightening a connection or as complex as replacing faulty equipment such as couplings, fittings, pipe sections, hoses, joints, drains, and traps.
- In many cases leaks are caused by bad or improperly applied thread sealant. Select high quality fittings, disconnects, hose, tubing, and install them properly with appropriate thread sealant.
- Non-operating equipment can be an additional source of leaks. Equipment no longer in use should be isolated with a valve in the distribution system.
- Another way to reduce leaks is to lower the demand air pressure of the system. The lower the pressure differential across an orifice or leak, the lower the rate of flow, so reduced system pressure will result in reduced leakage rates. Stabilizing the system header pressure at its lowest practical range will minimize the leakage rate for the system. For more information on lowering system pressure.