FEB-2017

Report
Project code: 2017PW

Compressed Air System Energy Audit & Leak Survey Report Of Leading Pharmaceutical Industry

PERMAWELD

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Acknowledgements

We are thankful to the management for giving us the opportunity to be involved in this very interesting and challenging project. We would be happy to provide any further clarifications, if required, to facilitate implementation of the recommendations.

We received full co-operation and support from the concerned personnel from all the departments. We would like to particularly thank:

Mr.
Mr.
Mr.

and all other supporting staff who have given full co-operation and support. They took keen interest and gave valuable inputs during the course of study.

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Executive Summary

1.0 This section presents a brief summary of the results of the compressed air system audit and leak survey carried out at LEADING PHARMACEUTICAL INDUSTRY, in Feb-2016.

2.0 A team of three specialist consultants were involved in the compressed air system audit and leak survey. The audit was mainly targeted at identifying practical, sustainable and economically viable energy saving opportunities in the compressed air system and to identify all the Big, Medium and Small leaks in the compressed air system network. The audit involved using a wide range of sophisticated, portable, diagnostic and measuring instruments to generate refined data and facilitate in complex analysis to give a more reliable basis for identification of leaks, evaluation of performance, energy saving measures and economic viability.

3.0 The identified annual electrical energy saving potential is **4.23 lakh kWh.** The electrical energy savings works out to **11.08%** of the annual electricity consumption of **38.15 lakh kWh**in compressed air system. The total energy cost saving potential is **Rs.27.54 lakh**and the total cost of implementation for the recommended proposals is estimated to be **Rs.70.50 lakhs**.

S. No	Proposals	Annual Energy Saving Potential (Lakh kWh)	Annual Savings Potential (Rs in Lakh)	Cost of implementation (Rs in Lakh)	Simple payback period
1	Replace the poor performing Screw Compressor AC 309 with New Screw Compressor	3.68	23.93	70.00	2.92
2	Energy savings by arresting the identified leaks	0.55	3.61	0.50	0.14
	Grand-Total	**4.23**	**27.54**	**70.50**	**2.56**

4.0 The salient points of compressed air leak survey are given below;

4.1 Total no of Air leaks detected during Feb-17, 1st survey -**70 no's.**

4.2 Total air loss due to leaks i.e. **40.44 CFM**. The classification of leaks is given below;

TYPE OF LEAK	Air Leaks Identified during December-16 Survey	
	No. of Leaks	Loss in CFM
BIG LEAKS	37	33
SMALL LEAKS	33	7.44
TOTAL	**70**	**40.44**

4.3 The total energy loss due to 70 no. of identified compressed air leaks is **0.55 lakh kWh/annum.**

5.0 During the study, there was continuous interaction with the plant personnel, all the recommendations and identified leaks have been thoroughly discussed with concerned facility officials and also at group meetings. There has been close involvement of senior officials, which ensured the necessary co-ordination required for the study.

1 Introduction

1.1 Leading Pharmaceutical Industry

The compressed air system energy audit and leakage survey was taken up during February 2017 to evaluate the actual performance of the existing air compressors and to detect the leaks in the compressed air network. During the audit, every attempt was made to understand the operational features and the actual working in the right perspective. All analysis have been based on actual data collected and also based on the on-site measurements / observations made using portable diagnostic instruments.
Based on the measurement, analysis, observations and leak detection, the energy saving opportunities has been identified for the plant. The recommendations have been discussed with the plant team during the course of the study to ensure that the suggestions made are realistic, practical and implementable.

2 Methodology and Approach

2.1 Compressed Air System Audit

The audit involved carrying out various measurements and analysis covering the Compressed Air System to realistically assess losses and potential for energy savings.

2.2 Leak Detection Survey:

Compressed air is a very useful and valuable utility, which must be managed to optimize overall system performance. The investment in compressed air to energize it and then letting it escapes from the system through leaks, without doing any useful work, is a complete waste. This waste can be minimized by implementing a program of leak detection and repairs. As such, it offers one of the largest savings opportunities. The critical problem is to detect and pin point exactly where the system air leakages are occurring. All the compressed air system facility will likely have leaks in the system normally wasting electricity and costing to the organization. By reducing these leaks in system, can save the electricity and money, also possible to extend the life cycle of the critical equipment and quite possibly increase the productivity.

In addition to energy loss, compressed air leaks can also contribute to other operating losses. Leaks normally cause a drop in system pressure- decreases the efficiency of air tools, and affects the production. By forcing machinery to cycle more frequently, leaks also can shorten the life of most of equipment's (including the compressor and accessories). Increased running time, in turn, lead to increased maintenance and unscheduled downtime. Ultimately leaks can also lead to adding unnecessary compressor capacity.

Quantity of the air losses through small holes, cracks, leaky couplings, joints etc... Add up to a very large value. With proper installation and maintenance leakage losses should not exceed more than 5% of the total capacity of the compressor.

Survey Benefits:

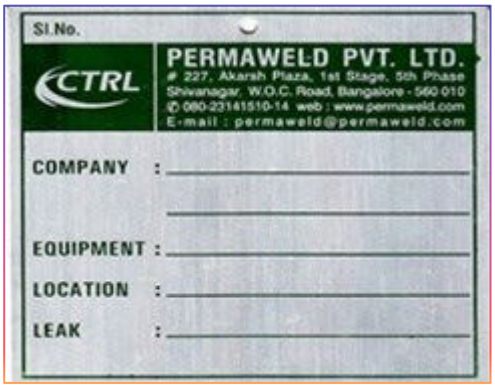
- ☞ Reliable and predictable production is ensured
- ☞ Small leaks can be caught before they grow
- ☞ Purchase of additional air compressors avoided
- ☞ System pressure maintained
- ☞ Increased productivity
- ☞ Lower maintenance costs
- ☞ Improved safety for workers

2.3 Approach

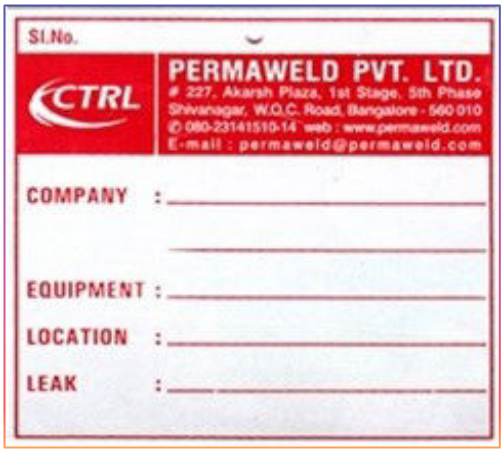
- CTRL UL 101 Ultra sound leak detector (intrinsic safe), was used to survey throughout the compressed air lines in various departments in the bottling plant.
- CTRL UL 101 is tuned at 40 KHz Centre frequency and picks up the ultra sound signals and converts it to audible sound frequency in to headset, the intensity of the ultra sound will be shown in analog meter deflection. The receiver has got direction of reception which picks up the ultrasound signals from 60 deg angle, helps in pin pointing the leakages.

TAGGING SYSTEM

The scope of survey involves identification of various leakages in the system compressed air and gas based on the severity of the leakages the following different colour code tags are installed at the leak detected points and prepared the detailed report.



GREEN tag indicates Small leak.



RED tag indicates Big leak.

2.4 Classification of Leaks

Leak Type	CTRL UL -101 Analog meter Reading (Intensity)	Orifice Size
BIG	10 & Above	2.4 mm
SMALL	0 to 4	0.5 mm

Note: CTRL UL 101 analog meter intensities referred for the classification of leakages based on the analog meter readings observed for each leakage. The compressed air loss referred from TLV- Air flow rate an orifice calculator. The Air loss formula referred with Compressed Air challenge source book and ASME.

2.5 Instruments

The audit study made use of various portable instruments, for carrying out various measurements and analysis. The specialized instruments used during the audit are given below;

- Power Quality Analyzer – Krykard ALM-10
- Anemometer – Air flow measurement
- CTRL UL-101 (Intrinsically safe) Ultra Sound Diagnostic Device – Leak detection

CTRL Systems, Inc.
1004 Littlestown Pike,
Suite H
Westminster, MD 21157 USA

CTRL Innovative Sound Solutions ™

CERTIFICATE OF CONFORMANCE FOR INTRINSICALLY SAFE

Product included in the Intrinsic Category shall be denoted with the Model Numbers: SoundScan 101 Receiver Unit.

This is to certify that the item(s) noted above are in compliance with the contract, drawings, standards, specifications and any other applicable documentation, which categorizes the purchased goods as Intrinsically Safe. All process certifications and/or governing reports, (specifically Test Report No: 150479 issued on March 28, 2001) and (chemical & physical test reports) if applicable, are on file at this facility, and are available for review by our Customers, End Users, and/or by the appropriate Government Agencies, specified as such. This product directly complies with the following requirements of ANSI/UL 913-88, for DIVISION 1, CLASS I, Groups A, B, C and D, CLASS II, Groups E, F, G and CLASS III. It also complies with DIVISION 2, CLASS I, Groups A, B, C and D, CLASS II, Groups F, G, and CLASS III.

This certificate pertains to the following product serial number: RA30179

Signed: Robert H Roche

Robert H. Roche
Chief Executive Officer

Authority: Vladimir Herman

Dr. Vladimir Herman
Vice President, Director of R&D

Date: 29.11.2011

The attention of the specifier, purchaser, installer, or user is drawn to special measures and limitations to use, which must be observed when the product is taken into service to maintain compliance with the above directives. Details of these special measures and limitations to use are available upon request from:

Manufacturer: CTRL Systems, Inc.
1004 Littlestown Pike Suite H
Westminster, MD 21157-3026 1(410) 876-5676 Contact: Dr. Vladimir Herman

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3 Performance Evaluation of Compressors

3.1 Design Specification of Compressors

Theplant has installed two numbers of 1450 CFM Atlas Copco make water cooled screw air compressor and fivenumbers of 271 CFM two stage, water cooled reciprocating air compressors. Out of the seven compressors,two screw compressors are catering to the compressed air needs of the plant and remaining five reciprocating compressors are kept as standby. Whenever there is additional requirement of compressed air (due to increase in production), one or two reciprocating compressors are additionally operated. During the audit period, only screw compressors AC 501 & AC 309 were in operation.

The design specifications of compressors are given in table 3.1

Table 3.1 Design specifications of the compressor

Description	Unit	Compressor- AC-501 (Screw Type)	Compressor-AC-309 (Screw Type)
Pressure	kg/cm²	8.6	8.6
FAD	CFM	1450	1450
Motor Power	kW	250	250
Specific Power Consumption	kW/CFM	0.172	0.172
Year of Installation	Year	2016	2008

The block diagram of installed compressed air system is given in figure 3.1

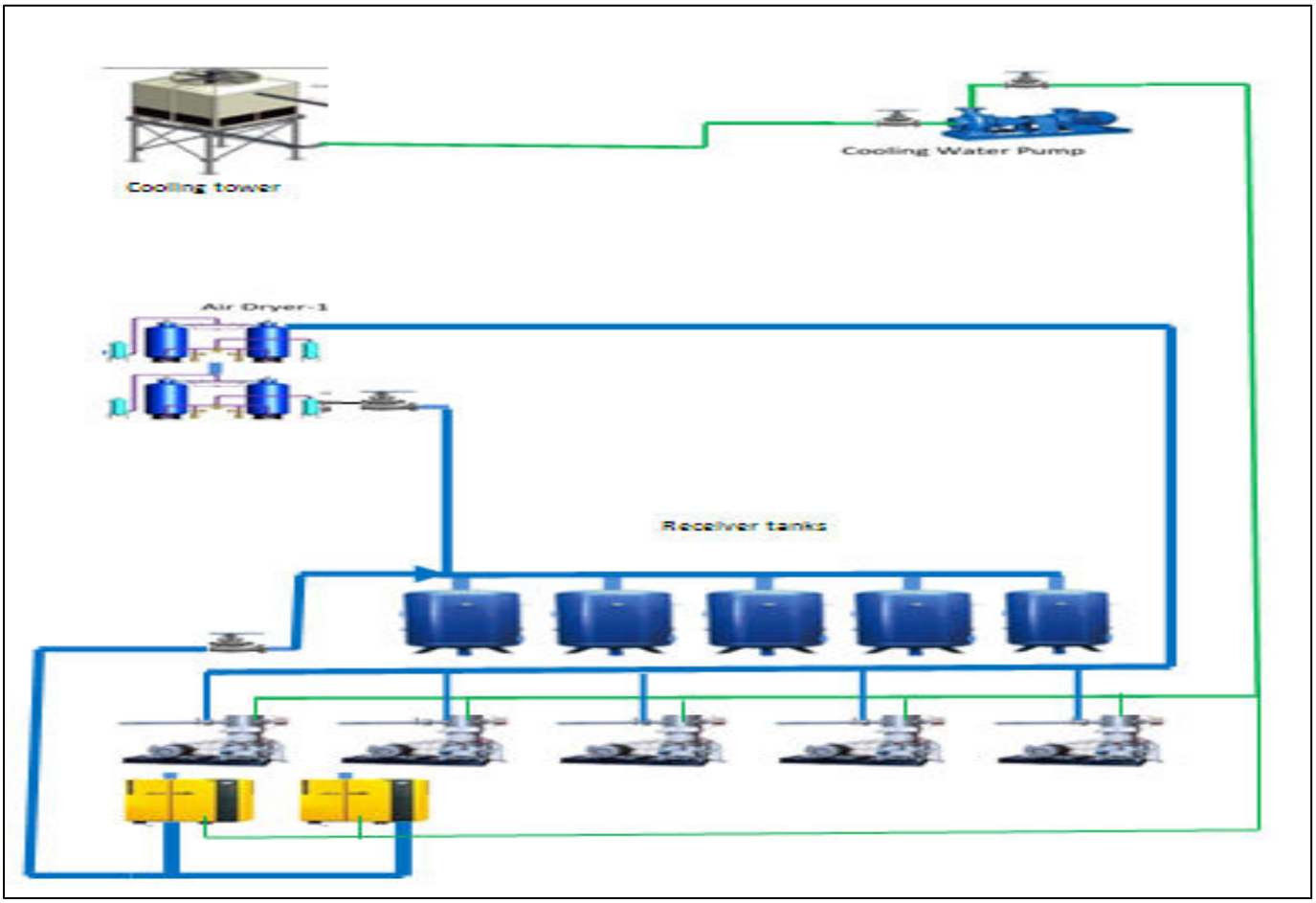

Figure 3.1 Block diagram of compressed air system

3.2 Energy Consumption Pattern

The power consumption pattern of compressors AC 501 & AC309 were studied in detail and various parameters such as voltage, current, kW, kVA, PF, etc. were measured using portable power analyser.

The energy consumption trend ofcompressor AC 501& AC309are given in figure 3.2 to 3.3. The logged power parameters are given in **Annexure 3.1 to 3.2**

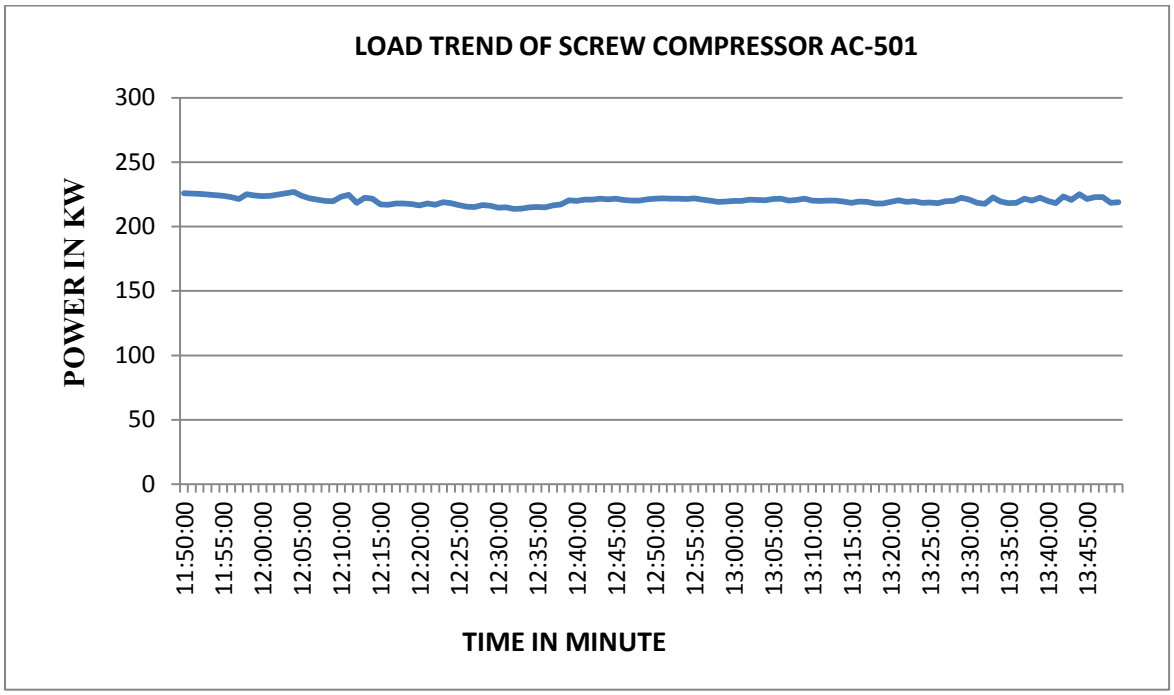

Figure 3.2: Power consumption trend of air compressor AC-501.

The power consumption was observed to be varying between 213.80 kWto 226.85 kW. Average power conumption is 220.24 kW

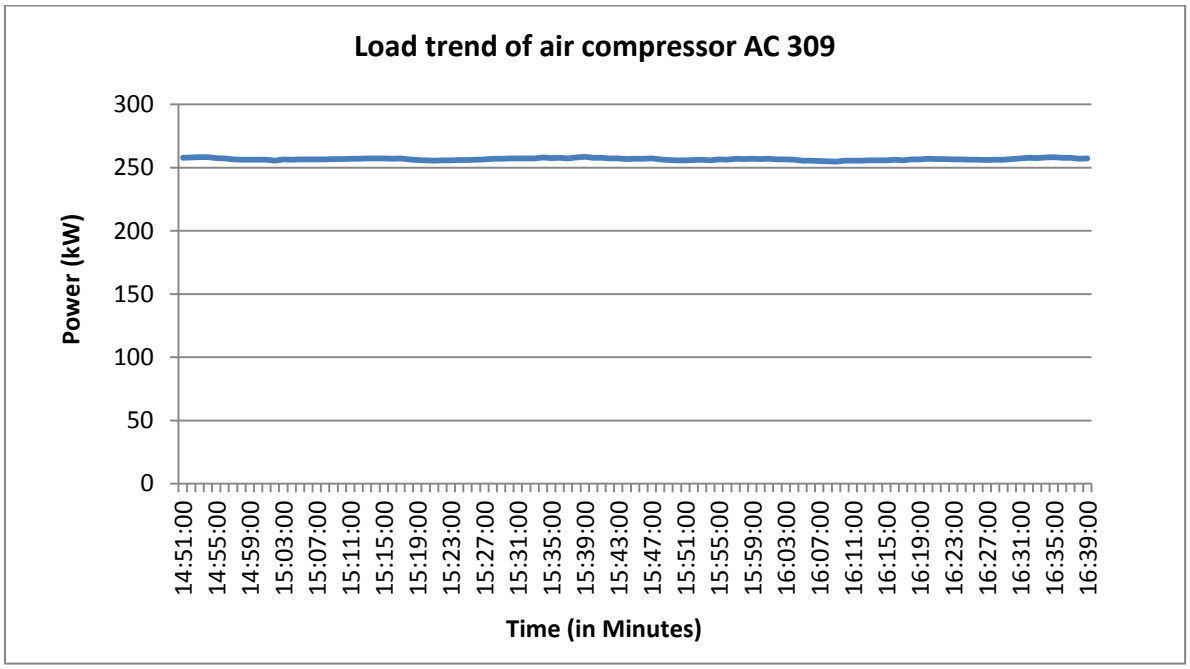

Figure 3.3: Power consumption trend of air compressor AC-309.

The power consumption was observed to be varying between 254.78 kW to 258.41 kW. Average power conumption is 256.67 kW

3.3 Free air delivery (FAD) of compressor

FAD test may be conducted in two ways, pump up method and by suction velocity method. Both these methods have been explained in detail in **Annexure – 3.3**. During the study, suction velocity method was followed to perform the FAD test for all the running screw compressors. The results of the test is given in table 3.2.

Table 3.2 Free air delivery of the reciprocating air compressors

Particulars	CompressorAC-501	CompressorAC-309
Rated FAD, CFM	1450@ 8.6kg/cm^2	1450@ 8.6kg/cm^2
Operating FAD, CFM	1424 @ 7.0 kg/cm^2	1366@ 6.8 kg/cm^2
% FAD	98.2%	94.2 %

The free air delivery (FAD) output of the screw compressor AC-309 is observed to be lower than compressor AC-501. This is mainly due to ageing of the compressor.

The total compressed air generation is observed to be 2790 CFM, during normal operation of the plant.

3.4 Specific Energy Consumption (SEC)

Specific energy consumption depends upon the compressor type, operating pressure, amount of free air delivery, etc. The evaluated SEC of the screw compressors is given in table 3.3.

Table 3.3Specific power consumption of screw compressors.

Description	Unit	Design	AC-501	AC-309
Pressure	kg/cm^2	8.6	7.0	6.8
FAD	CFM	1450	1424	1366
Motor Power	kW	250	220.24	256.67
Specific Power Consumption	**kW/CFM**	**0.172**	**0.154**	**0.187**

- The performance of compressor AC-501 is observed to be satisfactory and the operating specific energy consumption is found to be less than the design SEC. The operating pressure of screw compressor AC-501 is lower than design pressure (lower by 1.6kg/cm^2). For every 1kg/cm^2 pressure decrease the power consumption decreases by 6~10%.
- The specific energy consumption of compressorAC-309 is observed to be higher than the design, which is mainly due to ageing and poor performance of element 1, element 2, intercoolers and drier.Maintenance of the compressors.
- The power consumption of compressor AC 309 is 36.43 kW higher than the compressor AC 501. At the same time the FAD of AC 309 is 58CFM lower than AC 501.

The present annual energy consumption of compressed air system (considering two screw compressors in operation) in the plant (476.91kW x 8000 hours) is 38.15 lakh kWh.

3.5 Performance of compressor internal components

The monitored performance parameters of compressed air internal components are given Table 3.6

Table 3.4 Performance of compressor internal components

Description	AC 501	AC309	Remarks
Performance of Elements (Stage 1 & 2)			
Compressed Air outlet temperature from element -1	177 deg C	196 deg C	Performance of element-1 & 2 in AC 309 is poor
Compressed Air inlet temperature to element -2	37 deg C	63 deg C	
Compressed Air outlet temperature from element -2	164 deg C	183 deg C	
Compressed Air outlet temperature (delivery air temperature)	38 deg C	45 deg C	
Performance of Intercoolers			
Cooling water inlet temperature	24 deg C	25 deg C	Performance of intercoolers in AC 309 is poor
Cooling water outlet temperature	42 deg C	36 deg C	
Performance of Driers			
Regenerative air inlet	159 deg C	178 deg C	Performance of drier in AC 309 is poor
Regenerative air outlet	122 deg C	91 deg C	
Drier mix air	28.3 deg C	33 deg C	

From the above table, it can be observed that the performance of internal components of compressor AC 309 is poor. Hence it results in higher power consumption than compressor AC 501.

3.6 Air receiver& Traps

The plant has installed five air receivers – one of 2 KL and other four are 6 KL. All the five receivers haselectronic timer based moisture drain traps. The traps are observed to be working in good condition.

3.7 Compressed Air Distribution & Utilization

The compressed air generated is utilized for nitrogen generation, plant air and instrument air. Around 206 CFM is utilized for nitrogen generation. The compressed air generated at 7.0 kg/cm^{2}is utilized at Jet mill at 6.5 kg/cm^2, nitrogen plant at 6.6 kg/cm^2 and plant air at 6.0 kg/cm^2.

3.8 Compressed Air Leakage

The total identified compressed air leakage is40.44 CFM. The detailed report of identified compressed air leakage is given in chapter-4.

3.9 Energy Conservation Proposal

3.9.1.1 Replace the poor performing Screw Compressor AC 309 with New Screw Compressor.

3.9.1.2 Background

During normal operation, the plant operates screw air compressor no.AC 501 & AC 309. The specific energy consumption of screw compressor-AC 501 is 0.154kW/cfm&the specific energy consumption of screw compressor-AC 309 is 0.187 kW/cfm,which is 0.033 kW/cfm higher than AC 501. The performance of compressor AC 309 is poor due to poor performance of compressor element 1 & 2, intercoolers and drier. This is mainly due to ageing.

Considering 1366 CFM generation around 46 kW can be saved per hour by replacing the compressor AC 309 with new screw compressor.

3.9.1.3 Recommendation

It is recommended to replace the 9 years old screw compressor AC 309 by installing new 1450 cfmscrew air compressor.

Description	Free Air Delivery (CFM)	Power Consumption (kW)/Hour
Present Air Delivery and Power Consumption of Air Compressor AC-309	1366	256
Expected Air Delivery and Power Consumption of new screw air compressor	**1366**	**210**
Net Power Savings		**46**

3.9.1.4 Energy savings

Parameters	Value
Expected annual energy savings, lakh kWh (8000 hours x 46 kW)	3.68
Expected annual cost savings (@Rs. 6.5/kWh), Rs. In Lakh	23.93
Investment cost	70.00
Simple payback	2.92 years

4 Compressed Air Leakage

4.1 Identified compressed air leakages

The compressed air leakages detected during the 1st survey is given in table 4.1

Table 4.1 Compressed air leakages detected during 1st survey

Type of Leak	Air Leaks Identified During December-1st Survey	
	No. of Leaks	Loss inCfm
Big Leaks	37	33
Small Leaks	33	7.44
Total	**70**	**40.44**

Maximum numbers of leaks are observed in all plants.

The details of location wise identified compressed air leakage points with tag numbers and colour codes is given in annexure 4.1

4.2 Quantification of Major & Minor Leaks

The energy loss due to identified major leaks is given in table 4.2.

Table 4.2 Energy loss due to major leaks

Working Pressure	6Kg/cm2(88psi)
No. of locations where air leaks were Major Leaks detected (Red Tag)	**37 points**
Average orifice (Minimum Opening)	1/32"inch (0.79 mm) dia
Air loss from **37 points**	1.48*x0.61** x 37 = 33 **cfm**
Evaluated weighted average specific energy consumption of operating air compressors	0.172kW/cfm
Power loss due to leakage of 33 cfm (33 cfm x 0.172 kW/cfm)	5.6 kW
Plant operating hours per annum	8000 hours
Energy loss per annum due to major leaks	45408kWh
Cost loss per annum due to major leaks (Rs.6.5/kWh)	Rs 2,95,152

***As per Air Loss Chart**As per standard chart, considering sharp edge factor**

Table 4.4 Energy loss due to small leaks

Working Pressure	6Kg/cm2(88psi)
No. of locations where air leaks were Small Leaks detected (green Tag)	**33 points**
Average orifice (Minimum Opening)	*1/64inch (0.40 mm) dia*
*Airlossfrom 33 **points***	*0.37*x0.61** x 33 =7.44**cfm***
Evaluated weighted average specific energy consumption of operating air compressors	0.172kW/cfm
Power loss due to leakage of 7.44 cfm (7.44 cfm x 0.172 kW/cfm)	1.27 kW
Plant operating hours per annum	8000 hours
Energy loss per annum due to small leaks	10,160 kWh
Cost loss per annum due to small leaks (Rs.6.5/kWh)	Rs.66,040

The total energy loss due to major & small leaks is 0.55 lakh kWh per annum and the cost loss is 3.61lakh per annum.

4.3 Tips to Minimize Air Leakages

The following should be taken care of at design stage to reduce leakage levels:

- Welded joints should be used instead of screwed as far as possible.
- Install ball valves at the user ends, to facilitate easy opening and closing of valves.
- Leaks also can be caused by bad or improperly applied thread sealant. Select high-quality fittings, disconnects, hose and tubing and install correctly with the appropriate thread sealant.
- The compressors are to be provided with our meters for measuring the loading/unloading periods. The increase in the loading period for the same production levels indicates the increase in leakage levels.
- In such large size plants, having many individual workshops and a centralized compressor house, individual shop-wise solenoid control valves for compressed air lines have to be installed.
- The solenoid valve helps in cutting the compressed air supply to the individual shop when there is no activity. This minimizes the leakage loss and pressure drop to a considerable level. Hence, it is recommended to install individual shop wise solenoid control valves for the compressed air line atdesign itself, so as to minimize the compressed air leakages during non-active periods.
- Non-operating equipment can be an additional source of leaks. Equipment that's no longer in use should be isolated with a valve in the distribution system.
- A good leak-repair program is vital to the efficiency, reliability, stability and cost-effectiveness of any compressed air system.

4.4 Suggestions for Leaks Rectification:

- Metal hose connectors shall be used for Flexible hose connection fittings along with Teflon tape.
- Regulators, valves, filters inlet and outlet air (Hose) line shall be connected Horizontal and vertical Segment to avoid leakages.
- To seal Minor/Medium leakages M-seal or Metal paste can be used for elbow, Collar, T- threads Joints and other such areas for short term rectification.
- Replace or Repair the valves found to be Internal Passing or Gland leakage.
- Replace or Repair the air Regulator, I/P converter, and valve seal having External Leakages.
- Be sure that the copper tubing is inserted all the way into the fitting before tightening.
- Over tightening a compression fitting can cause it to compress too far and leak.
- Copper pipe or tubing must be free of kinks and bends for the ring to properly compress.

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Predictive Maintenance Division

CTRL

COMPRESSED AIR LEAK DETECTION REPORT

COMPANY NAME : Leading Industry
PLANT :
PERSON INCHARGE :
DATED :

SL NO	AREA	LOCATION	REMARKS	TAG		
				RED	GREEN	Tag No
1	Utility-3	Air receiver tank	Auto drain inlet bottim side leakage.			S-1
2	Utility-3	Left Adsorption tower	Actual absorber valve leakage.			S-2
3	Utility-3	Left Adsorption tower	Absorber inlet line valve ,operating line(2) connector leakage.			S-3
4	Utility-3	Inbetween left & right adsorption tower	Absorber inlet line valve ,operating line(3) connector leakage.			S-4
5	Utility-3	Inbetween left & right adsorption tower	Valve operating line connector leakage.			B-1
6	Utility-3	Inbetween left & right adsorption tower	Valve operating line connector leakage.			B-2
7	Utility-3	Inbetween left & right adsorption tower	Valve operating line-purge valve connector leakage.			S-5
8	Nitrogen Plant	Product recevier tank	Leader oulet valve hose connector leakage.			S-6
9	Nitrogen Plant	Air drier	Flange header connector leakage.			S-7
10	AP-6	Ground Floor	At reactor-607 bottom valve cylinder operating airline leakage.			B-3
11	AP-6	First Floor	At reactor-608 Nitrogen line leakage.			S-8
12	AP-6	First Floor	At reactor-608 Nitrogen line flange leakage.			B-4
13	AP-6	First Floor	Utility 607-header line control valve leakage.			B-5
14	AP-6	Second Floor	At reactor-619 utility headerr control air regulator valve leakage.			B-6
15	AP-6	Second Floor	At reactor-601 nitrogen air pipe line header leakage.			B-7
16	AP-7	First Floor	At reactor-705 bottom solenoid valve leakage.			S-9

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COMPRESSED AIR LEAK DETECTION REPORT

COMPANY NAME : Leading Industry

PLANT :

PERSON INCHARGE :

DATED :

SL NO	AREA	LOCATION	REMARKS	TAG		
				RED	GREEN	Tag No
17	AP-7	Ground Floor	At reactor-708 bottom solenoid valve leakage.		✸	S-10
18	AP-7	MLR Area	V-783 top nitrogen line joint leakage.	✸		B-8
19	AP-7	MLR Area	MEG tank bottom control valve hose connector leakage.		✸	S-11
20	AP-7	MLR Area-top	At reactor-712 bottom air regulator hose connector joint leakage.	✸		B-9
21	AP-7 ANNEX	First Floor	At reactor-713 header compressed air line manifold pipe joint leakage.	✸		B-10
22	ANF	ANF-ROOM	At ANF-701 ,all the pipelines are leakage	✸		B-11
23	Centrifuge	Centrifuge room	At CE-703 bottom air regulator hose connector joint leakage.	✸		B-12
24	Centrifuge	Centrifuge room	At CE-703 top side of the machine plate joint leakage.		✸	S-12
25	Centrifuge	Third floor	At R-715 utility header regulator solenoid valve leakage.	✸		B-13
26	API-5	Ground Floor-manufacturing area	Regulator line bottom hose connector joint leakage.		✸	S-13
27	API-5	Ground Floor-manufacturing area	Regulator line bottom aasembly connector joint leakage.	✸		B-14

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COMPRESSED AIR LEAK DETECTION REPORT

COMPANY NAME : Leading Industry
PLANT :
PERSON INCHARGE :
DATED :

SL NO	AREA	LOCATION	REMARKS	TAG		
				RED	GREEN	Tag No
28	API-5	Ground Floor-manufacturing area	Air regulator outlet joint leakage.			S-14
29	API-5	First floor	At ND-501 ,weighting machine near reducer hose joint leakage.			B-15
30	API-5	Third floor	At F-503 ,air distrubution main joint leakage.			B-16
31	API-5	Third floor	At F-474,hydraulic lifter joint leakage			S-15
32	API-5	Third floor	At F-474,small hydraulic joint input valve connection leakage			S-16
33	API-8	MLR Area	At TCV-80002,control valve hose connection joint leakage			B-17
34	API-4	Ground Floor	At reactor-407 bottom air regulator hose connector joint leakage.			S-17
35	API-4	First floor	At reactor-404 XCV control valve hose connector joint leakage.			S-18
36	API-4	Ground Floor	At MD-101 Hydraulic valve joint leakage.			B-18
37	API-4	First floor	At V-4622,the valve post body leakage			S-19
38	API-4	Third floor	At reactor-405,instrumentation air line hose joint leakage.			S20
39	API-2	Ground Floor	At DD-307 bottom air regulator hose connector joint leakage.			B-19

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COMPRESSED AIR LEAK DETECTION REPORT

COMPANY NAME : Leading Industry
PLANT :
PERSON INCHARGE :
DATED :

SL NO	AREA	LOCATION	REMARKS	TAG		
				RED	GREEN	Tag No
40	API-2	Ground Floor	At DP-307,air inlet joint leakage-1	✸		B-20
41	API-2	Ground Floor	At DP-307,air inlet joint leakage-2	✸		B-21
42	API-2	First floor	At reactor-310,near re-circulation pipe line leakage	✸		B-22
43	API-2	First floor	At V-315,water seperator leakage	✸		B-23
44	API-2	First floor	At reactor-201,flush bottom valve leakage	✸		B-24
45	API-2	Second floor	Inbetween acetone day tank and v303,v302 tolene day tank		✸	S-21
46	API-1	Top floor-MLR area	At V-1025,air regulator nipple hose connector joint leakage.		✸	S-22
47	API-3	First floor	At reactor-502,near to air regulator hose connector leakage	✸		B-25
48	API-3	First floor	Ball-M2F valve hose leakage near to air regulaor	✸		B-26
49	API-3	First floor	Air regulator hose connector nipple joint leakage		✸	S-23
50	API-3	Second floor-ANF room	At ANF-501,air leakage near to hot water inlet valve		✸	S-24
51	API-2	MLR Area-Ground floor	At ANF-203,air regulator hose connector nipple joint leakage near to hot water outlet.		✸	S-25
52	API-2	MLR Area-Ground floor	At HE-403A,air regulator hose connector nipple joint leakage near to control valve.	✸		B-27

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COMPRESSED AIR LEAK DETECTION REPORT

COMPANY NAME : Leading Industry
PLANT :
PERSON INCHARGE :
DATED :

SL NO	AREA	LOCATION	REMARKS	TAG		
				RED	GREEN	Tag No
53	API-2	MLR Area-Ground floor	At E-404 near to HWT-201 brine bottom,air regulator-1,hose connector nipple joint leakage.			S-26
54	API-2	MLR Area-Ground floor	At E-404 near to HWT-201 brine bottom,air regulator-2,hose connector nipple joint leakage.			B-28
55	API-2	MLR Area-Ground floor	At E-404 near to HWT-201 brine bottom,above air regulator ,open/close valve leakage.			B-29
56	API-2	MLR Area-Ground floor	At reactor-207 bottom air regulator leakage			B-30
57	SRU	Ground floor	At V-1325 ,air regulator hose connector nipple joint leakage.			S-27
58	SRU	Ground floor	At P-1015 steam condensate line near air regulator hose connector nipple joint leakage.			S-28
59	SRU	First floor	At reactor-1301,YTC pneumatic valve joint leakage			B-31
60	SRU	First floor	At C-1304, near siemens air regulator output line leakage.			B-32
61	SRU	First floor	Near R-1101,air regulator hose connector nipple joint leakage.			B-33
62	SRU	First floor	At R-1101,Control valve nipple hose joint leakage.			S-29
63	SRU	First floor	At V-1512,air regulator hose connector nipple joint leakage.			B-34
64	SRU	First floor	At V-1514,control valve bottom nipple joint leakage.			S-30
65	SRU	First floor	At R-1002,instrumentation air line valve leakage.			B-35

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COMPRESSED AIR LEAK DETECTION REPORT

COMPANY NAME : Leading Industry
PLANT :
PERSON INCHARGE :
DATED :

SL NO	AREA	LOCATION	REMARKS	TAG		
				RED	GREEN	Tag No
66	SRU	Second floor	Behind R-1003 instrumentation air line main valve joint leakage.	✸		B-36
67	SRU	Second floor	At LL5-1501SMAR-transducer behind air leakage.	✸		B-37
68	SRU	Third floor	At ATFE-1507,instrumentation air line joint leakage.		✸	S-31
69	SRU	Third floor	Behind RTD vapour line air regulator hose nipple joint connector leakage.		✸	S-32
70	SRU	Ground floor-Lactum Machine room	Hydraulic pedal nipple joint leakage at the bottom side.	✸		B-20

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