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Efforts to Realize an Energy-Saving Plant
- First Steps Toward Reducing Life Cycle Costs -

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Electricity, water, various gases and other utilities are used for manufacture at a vehicle plant. Since electric power accounts for a particularly large proportion of utility costs, it is thought that efforts to reduce the amount of electricity used will have significant positive effects on the environment. The author and his collaborators implemented some measures to reduce electricity used for compressors, noting that it accounts for approx. 13% of all electricity used; and succeeded in achieving more than 50% of reduction in this regard. This essay reports these measures.

○ Measures Implemented from June 2001

1) Investigation into the Volume of Air Leaked at the Plant

We conducted an investigation into the volume of air leaked at our plants. As a result, we found that more than 50% of electricity used had been wasted due to air leaks. To reduce the waste of electricity for compressors, we began inspecting the plants periodically for air leaks in cooperation with the director, the foremen and engineers at each plant.

As a result, we found that most air leaks were from air hoses and hose connectors. Accordingly, we began replacing defective hoses and connectors, starting with those responsible for large leaks. (As a result of the inspection, the volume of leaked air has been reduced from about 270 kW/h to about 40 kW/h.) Presumably, the present level of leak is due to very small leaks from many hoses and connectors. For the further reduction of electricity use for compressors, we will replace these implements continually, considering costs and effects of replacement.

2) Raising Worker Awareness Concerning Energy Saving

To raise the awareness of workers regarding energy saving, we informed workers at the site about the costs of electricity caused by air leak, in the following manner:

- Air leak from a 1 mm hole on a pipe or hose costs 13,000 yen/year of electricity.
- Air leak from a 2 mm hole costs 52,000 yen/year of electricity.
- Currently, XXX m^3 of air is leaking, costing us XXXX yen/year of electricity.

We think that showing these figures has proved effective in raising worker awareness.

3) Change of Air Supply Methods (from Batch to Dispersed Supply)

Formerly, air was always supplied to all plant sections, even if only one section needed air. To be able to supply air only when and to where it is needed, we installed an electrical valve for each building block, which is controlled by a centralized control panel. We also requested site workers to take the responsibility to report locations at which air is needed. These efforts have also helped reduce the volume of leaked air.

4) Change of Air Supply Pressure

Formerly, our company set the air supply pressure air at 7.2 kg/cm^2. After determining the lowest pressure at which workers can use air without any problems, we decided to decrease the air supply pressure to 6.0 kg/cm^2 to reduce electricity for compressors. It is assumed that in normal cases, decreasing supply pressure by 1 kg/ cm2 cuts required electricity by 15%. In the case of our company, this 1.2 kg/cm^2 decrease has resulted in an approx. 32% reduction of electricity (which means a saving of 7.5 million yen per year). This unexpectedly good result is presumably due to the fact that during previous operations, the extent of air leaks at our plants was worse than normal.

We implemented the following measures to change air supply pressure:

(1) We measured the end supply pressure at the site, and found that at some piping sections, the pressure is at low levels due to low flow rates resulting from small pipe diameters. We modified these sections to prevent decreases in the pressure supplied, by using larger pipes and installing buffer tanks.

(2) Piping sections with low end supply pressures were re-connected to other sections, so as to form a looping path preventing local pressure decreases.

(3) Boosters were installed at special site sections requiring high supply pressures.

5) Change of Compressor Operation Procedures

We changed operation procedures so as to use an efficient compressor in the constant mode, and a less efficient compressor in the capacity adjustment mode. As a result, Unit 2 (a 220 kW compressor with an air supply capacity of 40 m^3/min), previously in the constant mode, is now operated in the capacity adjustment mode, while Unit 3 (a 220 kW compressor with an air supply capacity of 41.7 m^3/min), previously in the capacity adjustment mode, is used in the constant mode. This measure has resulted in an approx. 4% reduction of electricity.

6) Change of Air Hoses

As another measure to reduce air leaks, we introduced flame-resistant hoses at site sections at which hoses had been easily punctured by weld sputters.

Fig. 1 shows, on an annual basis, the change in

the volume of electricity used for compressors, which has resulted from the implementation of the above measures.

○ Problems Encountered When Implementing Measures to Reduce Air Leaks

1) Previously, many workers were barely conscious of the fact that air is supplied at a cost. A number of them did not proceed to remedy air leaks even when they had discovered them. Accordingly, it was difficult to reduce air leaks.

2) Decreasing air supply pressure caused some production equipment units to shut down. It took about two weeks to identify the cause of this problem and implement a countermeasure. By taking these steps, we eventually succeeded in ensuring the smooth operation of the units.

3) At first, the awareness of compressor operators concerning energy saving was low, because of their preconception that their primary task was to supply air on a stable basis.

4) To ensure that air would be supplied when and to where it was needed (i.e. on a dispersed supply basis), it was necessary to ask for the cooperation of site workers (e.g. to request them to submit a detailed, building-specific overtime work report; and use compact air compressors as far as possible).

○ Future Efforts

As a result of implementing these various measures, the volume of air used has been reduced significantly from the previous level. Currently, the electricity required for our compressor operation is about 300 kW/h for regular working hours, and 100 to 150 kW/h for overtime. At our plants, we are now forced to operate our compressors (two 220 kW units and a 240 kW one) in an inefficient unloaded condition, during both working hours and overtime. To reduce the amount of electricity used by compressors even further, we intend to enhance the efficiency of our operation by introducing compressors (100 to 150 kW) for capacity adjustment (Table 1). We think that this measure will result in another 13% cut in electricity.

At our vehicle plants, we have long made various efforts to reduce manufacturing costs. However, only directly responsible employees have been in charge of implementing measures to reduce electricity and other utility costs. This has been a result of the low awareness of site workers concerning energy saving. For the further promotion of energy saving at our company, it will be necessary to implement additional facility-related measures. We think, however, that the most important task is to raise the consciousness of each worker.