High Efficiency Inverter Scroll Compressors

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Overview

1. The structure of the traditional compressor

2. Office building load rates and operation times

3. Back Pressure Control and an Injection Mechanism with a Check Valve to improve overall compressor efficiency

4. Efficiency improvement results
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1. STRUCTURE OF COMPRESSOR

Figure 1: Traditional technology
2. OFFICE BUILDING LOAD RATES AND OPERATION TIMES

**Figure 2: Load Rate / Operation Time**
3. HIGH EFFICIENCY TECHNOLOGY

New technology: Injection mechanism with a check valve

New technology: Back pressure control

Figure 3: New technologies
3. HIGH EFFICIENCY TECHNOLOGY

3.1 Back Pressure Control

Figure 4: The structure of back pressure control
3. HIGH EFFICIENCY TECHNOLOGY

3.1 Back Pressure Control
After changing the value of arbitrary pressure, test results show that the compressor input at each condition becomes smaller when the ratio of middle pressure to suction pressure is between 1.4 and 1.6.

**Figure 5:** Relation between arbitrary pressure and compressor input ratio
3. HIGH EFFICIENCY TECHNOLOGY

3.2 Injection mechanism with check valve

Figure 6: The structure of injection mechanism with check valve
3. HIGH EFFICIENCY TECHNOLOGY

3.2 Injection mechanism with check valve
The dead volume drops to less than 1/20 by employing the new structure with the check valve set nearby the compression chamber.

Figure 7: The Relation between dead volume and indicated efficiency
3. HIGH EFFICIENCY TECHNOLOGY

3.2 Injection mechanism with check valve

Where the compressing ratio is 1.8 without gas injection, the efficiency was improved 2.2pt by employing the injection structure with a check valve.

Figure 8: Efficiency ratio comparison: employing injection without valve vs with valve
3. HIGH EFFICIENCY TECHNOLOGY

3.3 Efficiency Improvement Results
Efficiency of inverter scroll compressor employing back pressure control and middle pressure injection with a check valve.

![Efficiency Graph]

*Figure 9*: Efficiency of back pressure control and injection with a check valve.
Summary

1. Efficiency was dramatically improved by controlling the back pressure of the arbitrary pressure as the input becomes optimum at each condition.

2. By employing the injection structure with a check valve, the efficiency was improved at high load operation condition by injection; and the efficiency drop down was suppressed at small load operation condition.

3. The efficiency of the whole operation area was improved by using a back pressure control structure and injection mechanism with a check valve.
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Conclusion

Further energy saving in air conditioning for commercial buildings can be accomplished with the new design techniques I have presented today.