

**SECOND YEAR OF CITY BUSES
WITH TRANSCRITICAL CO₂
AIR CONDITIONING UNITS
IN GERMANY**

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INTRODUCTION

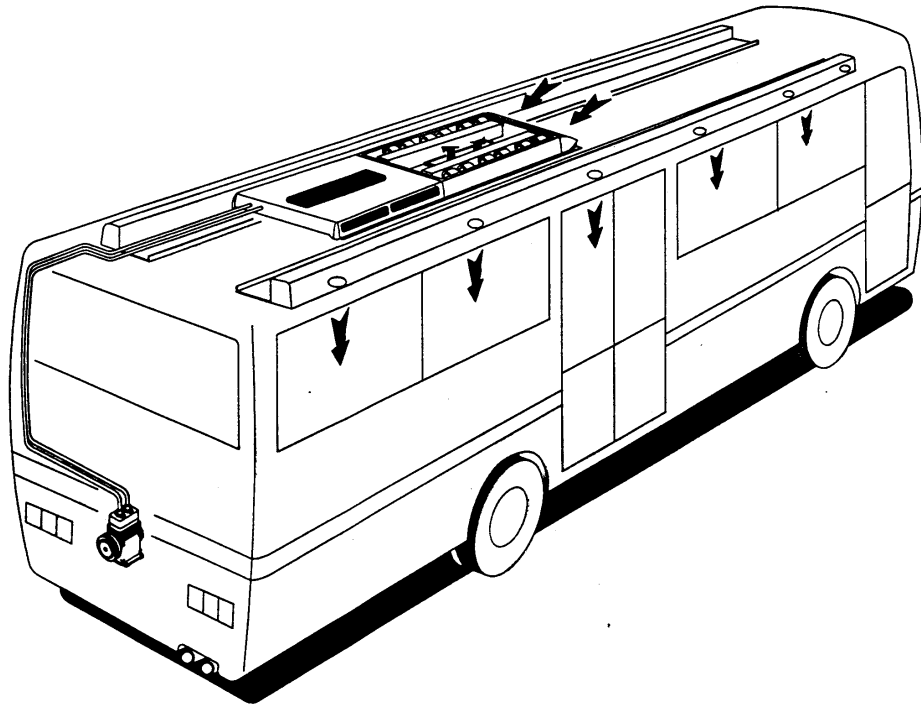
BUS AIR CONDITIONING

Two Years of On-The-Road Testing

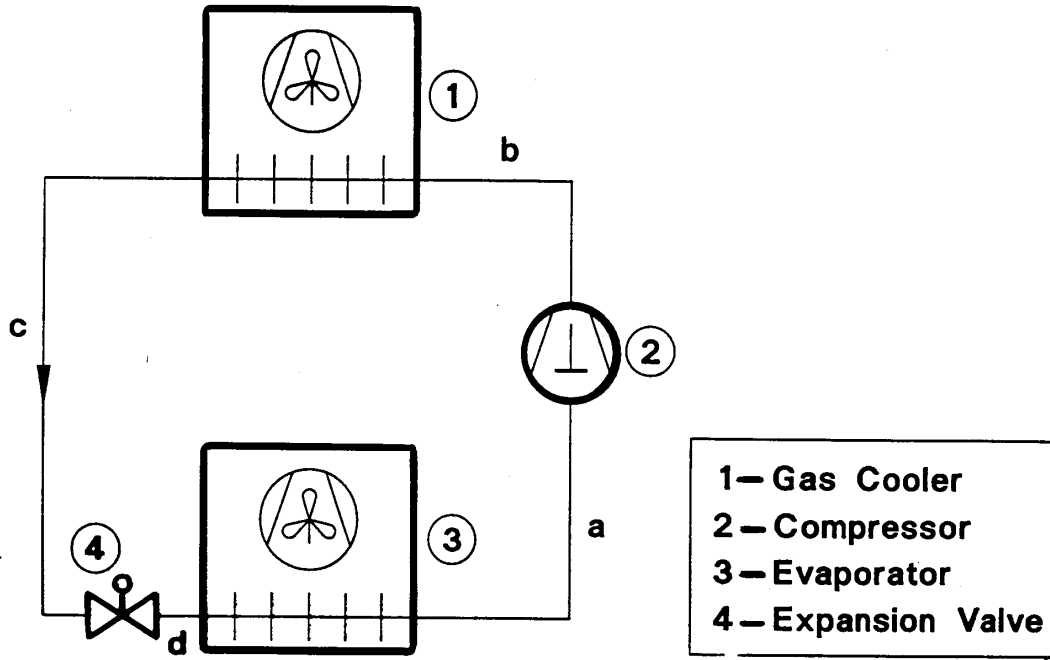
COMPRESSOR

Volumetric and Isentropic Efficiencies

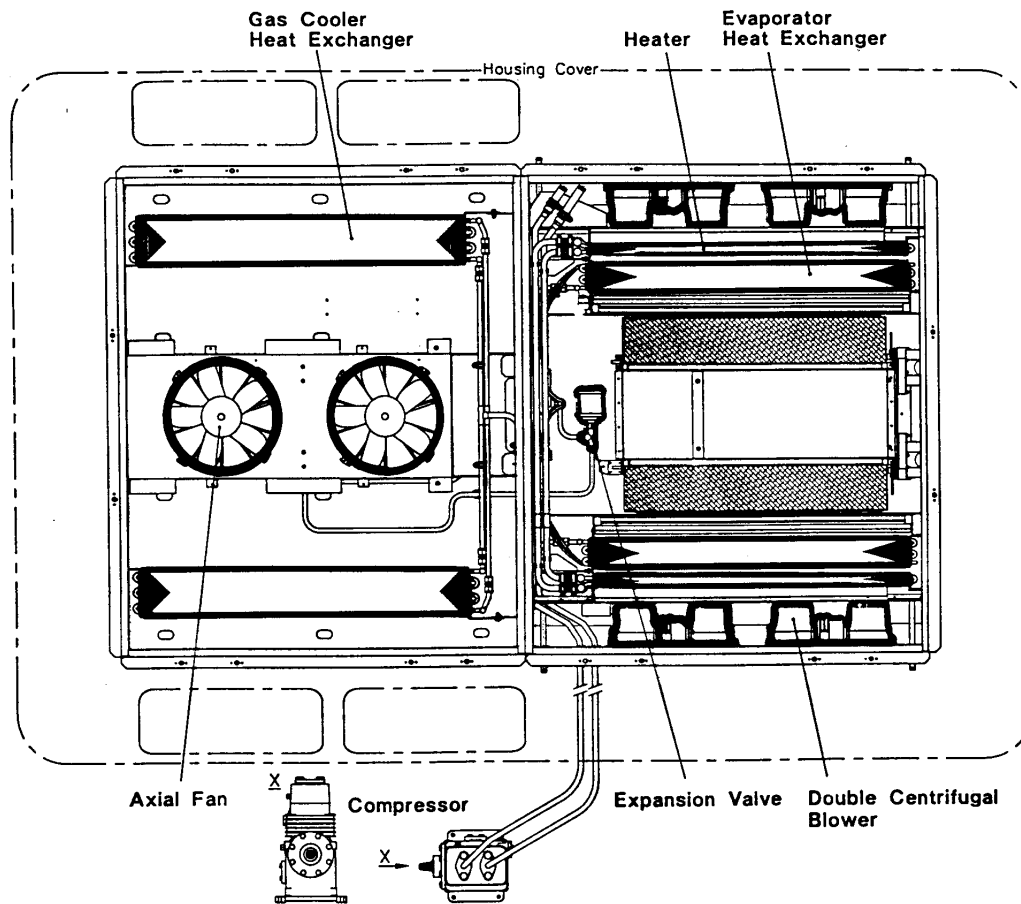
CONCLUSIONS



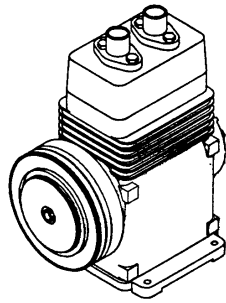
Carbon Dioxide Prototype installed on a City Bus



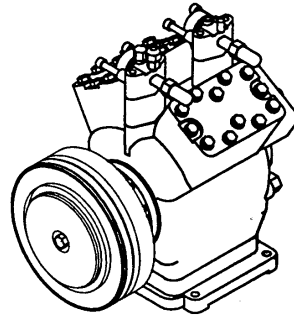
Schematic Diagram of the Carbon Dioxide Prototype



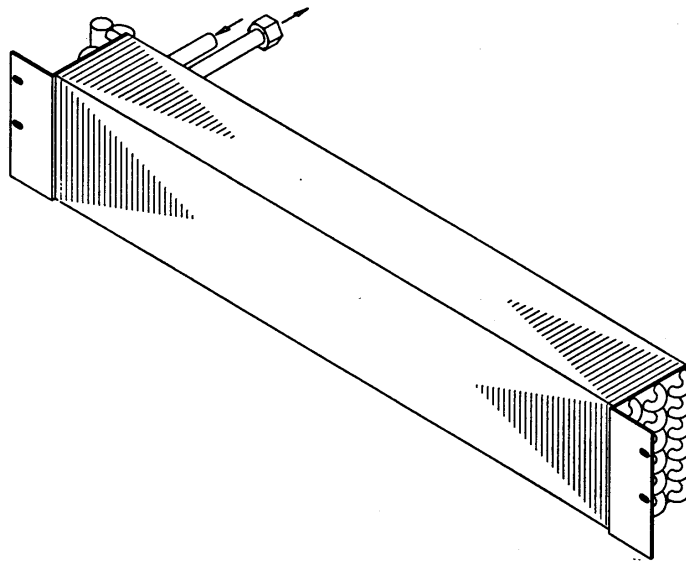
Plan View without Housing Cover of the Prototype Roof-Mount Bus A/C Unit



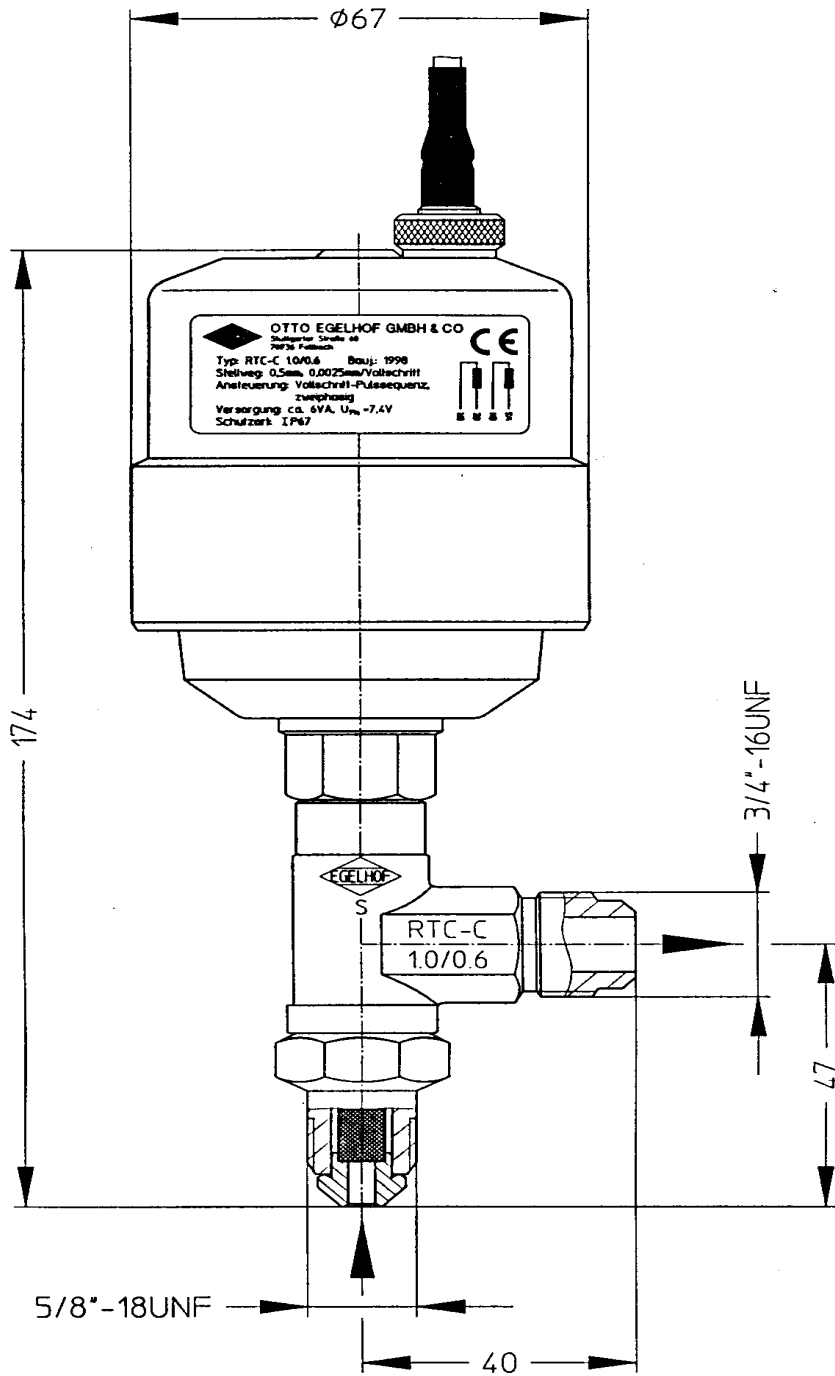
Sketch of the CO₂ compressor



Sketch of a standard bus-a/c compressor

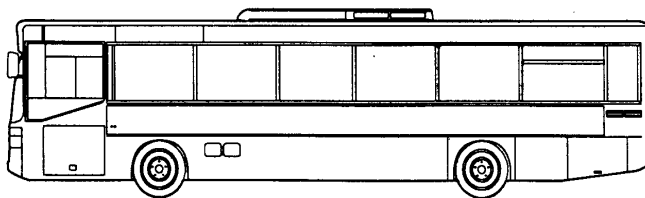


Sketch of an evaporator heat exchanger

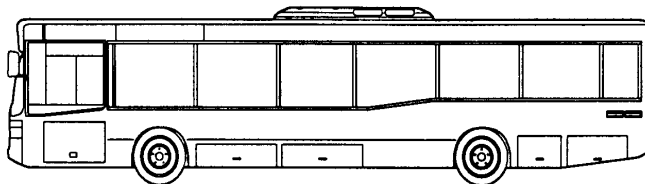


Electronic Expansion Valve

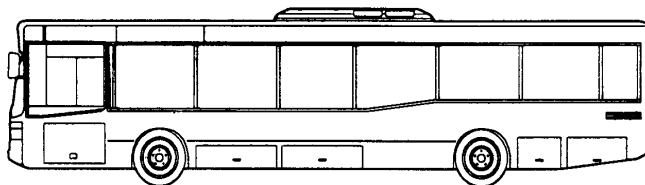
Bus A:
MB O405
CO₂
August 1996
>1050 h



Bus B:
MB O405N
CO₂
June 1997
> 800 h

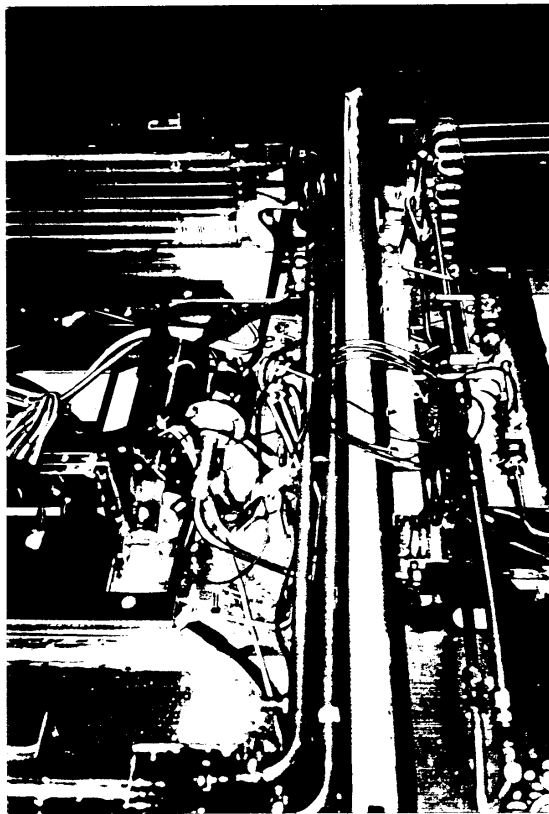
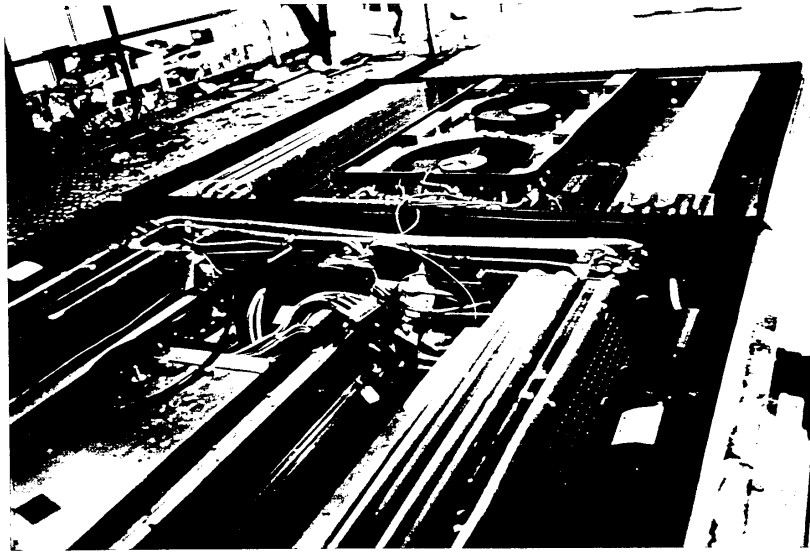


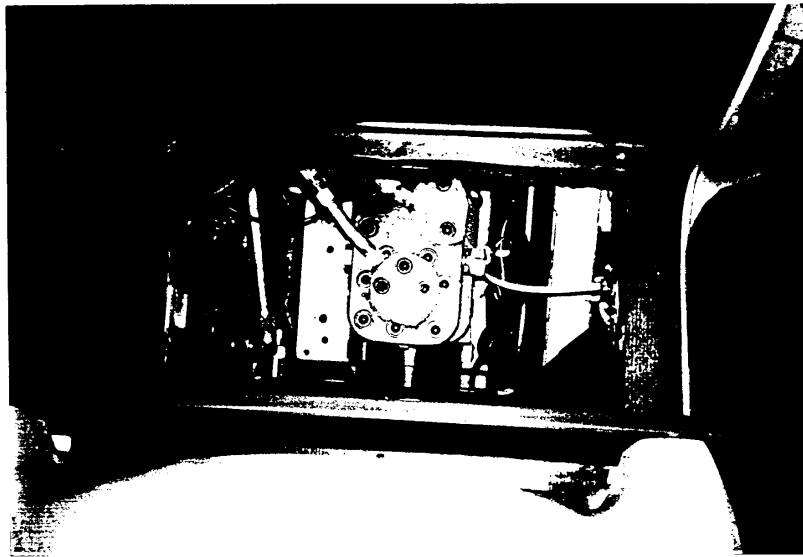
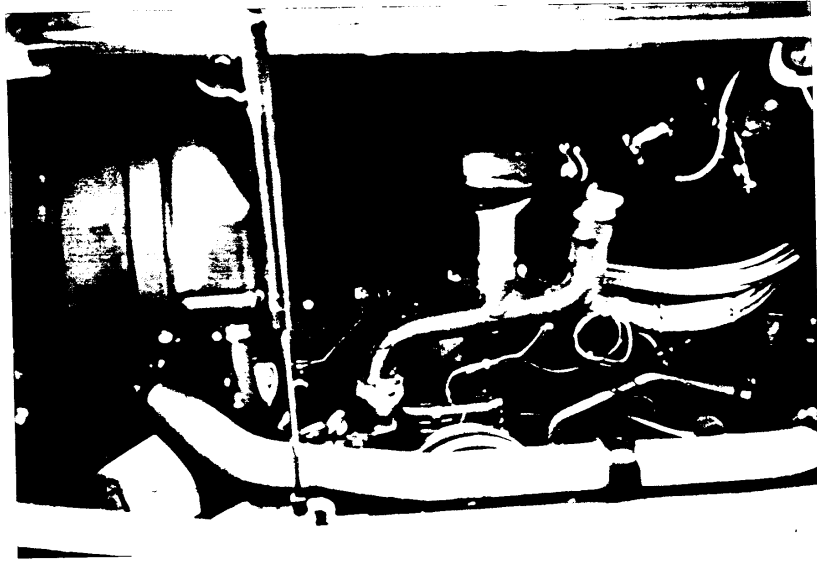
Bus C:
MB O405N
HFC-134a
June 1997
> 800 h

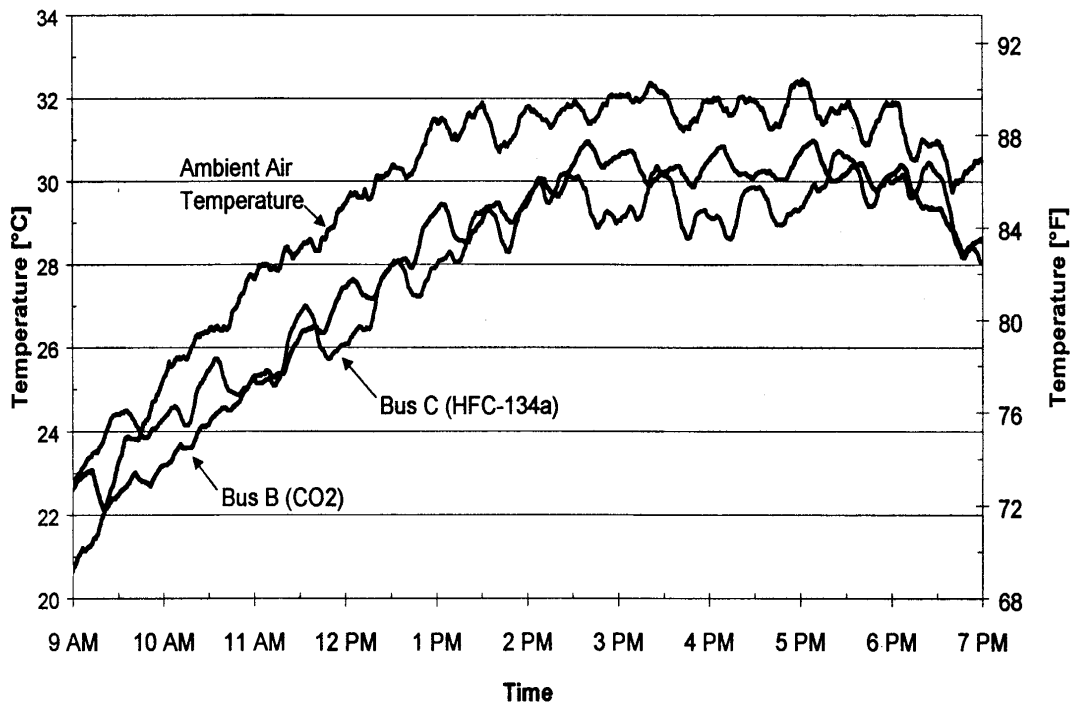


Three Public Transportation Buses in Bad Hersfeld, Germany
(bus type, refrigerant, date of a/c installation, operating hours)



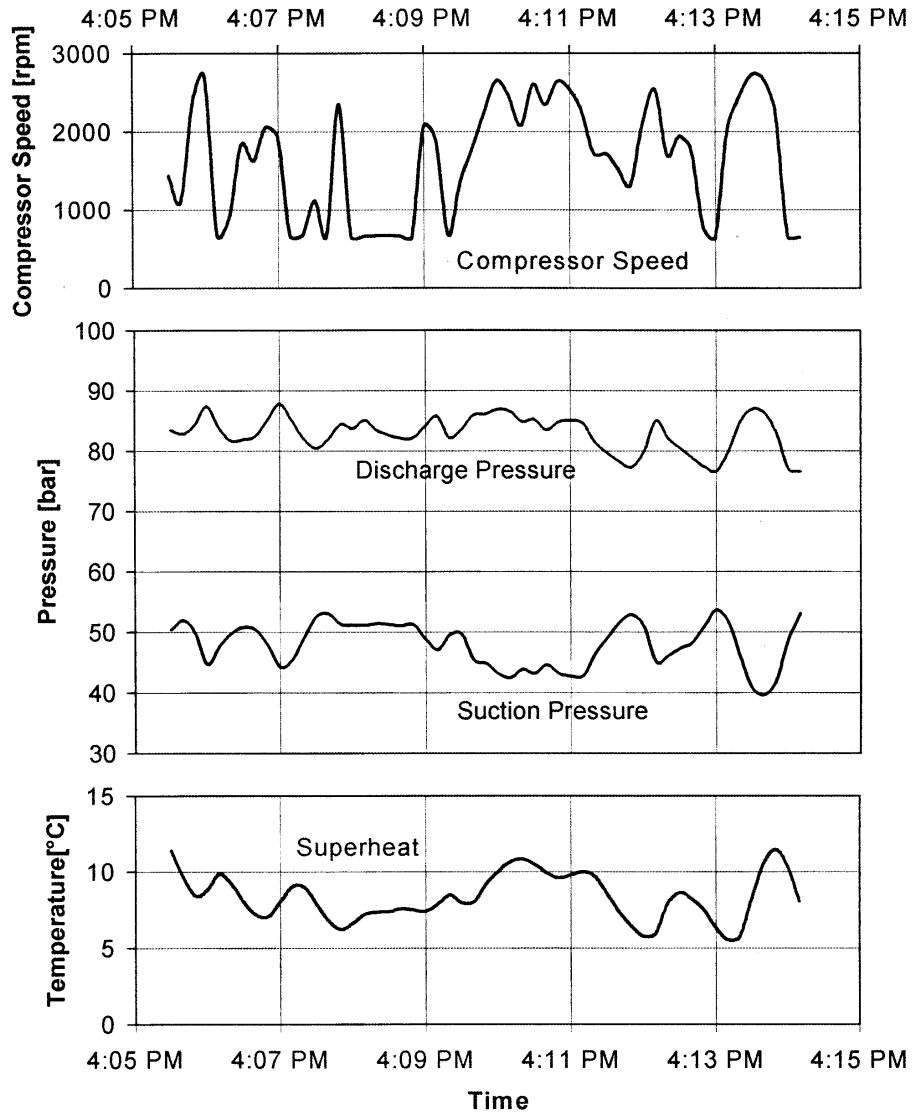






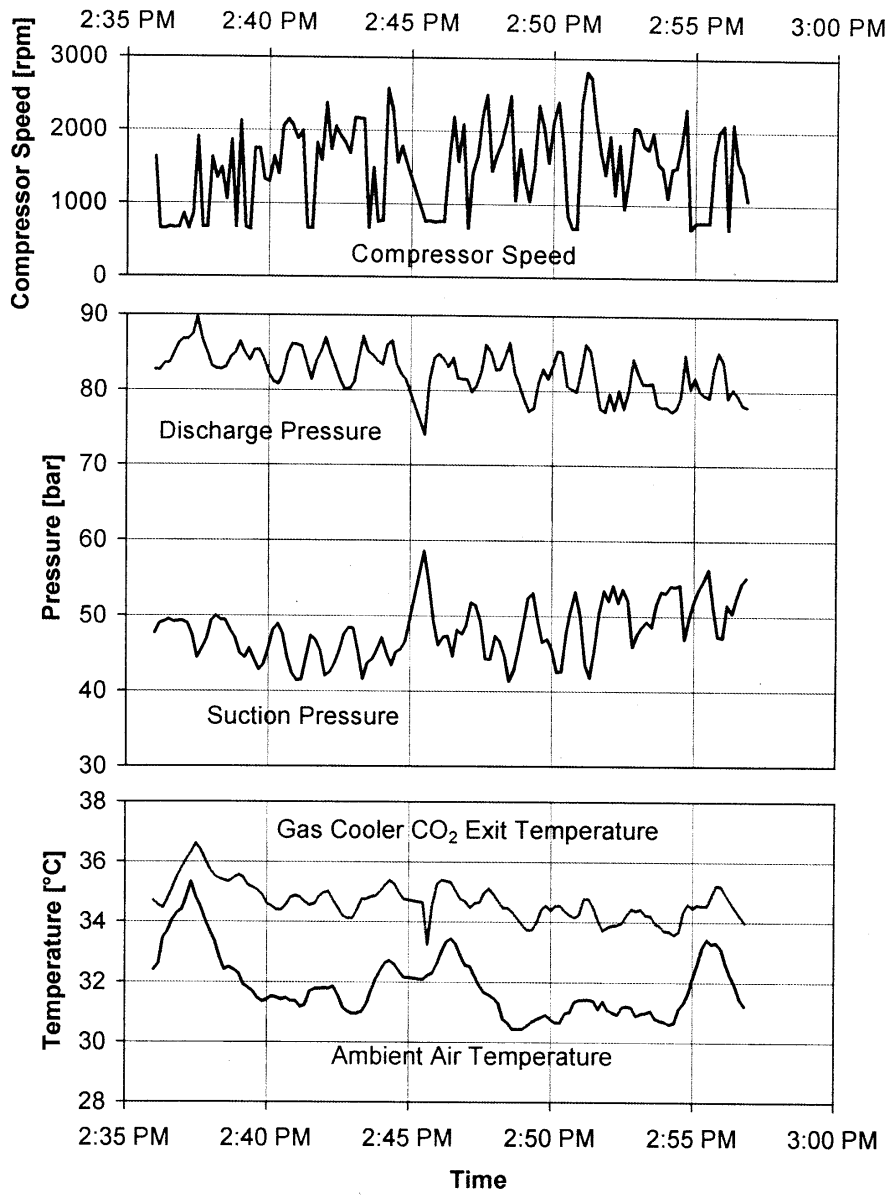
Variation of the Interior Air Temperatur of Bus B (Carbon Dioxide A/C System) and Bus C (Standard HFC-134a A/C System).

Bad Hersfeld, August 11, 1997.



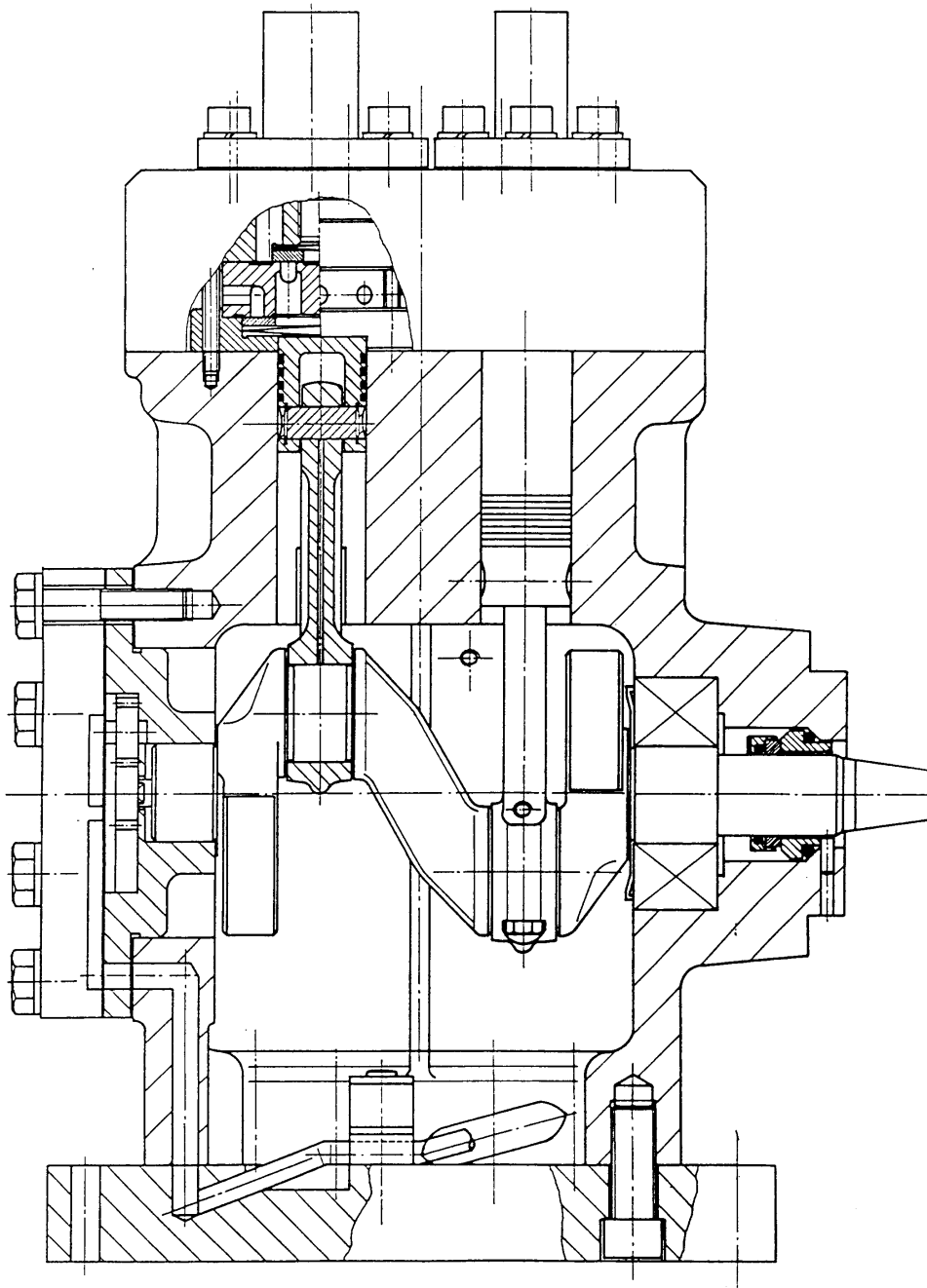
Time Dependent Variation of Compressor Speed, Pressures, and Superheat.

Bad Hersfeld, June 11, 1997.



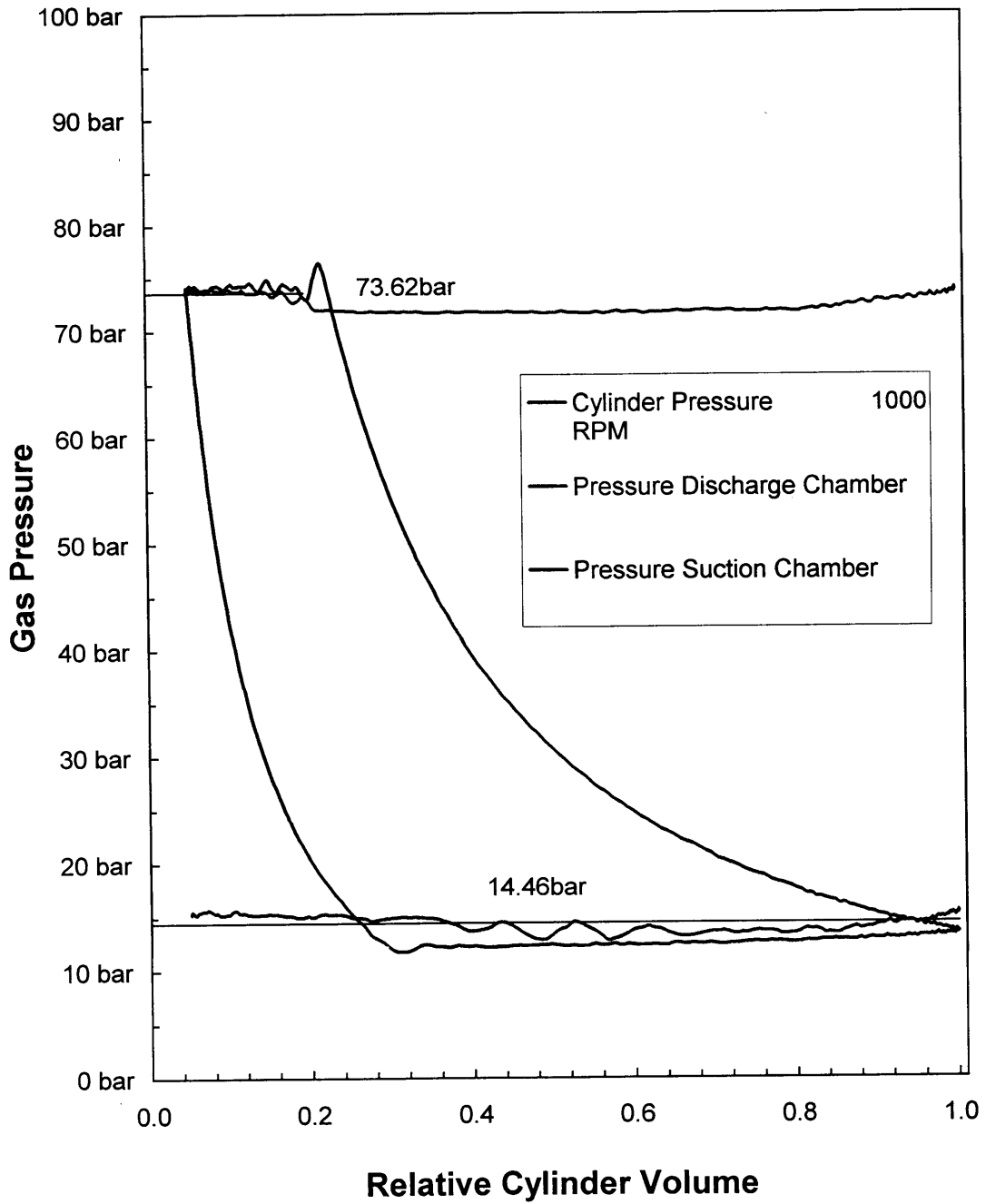
Time Dependent Variation of Compressor Speed, Pressures, Gas Cooler Exit CO₂ Temperature, and Ambient Air Temperature.

Bad Hersfeld, June 11, 1997

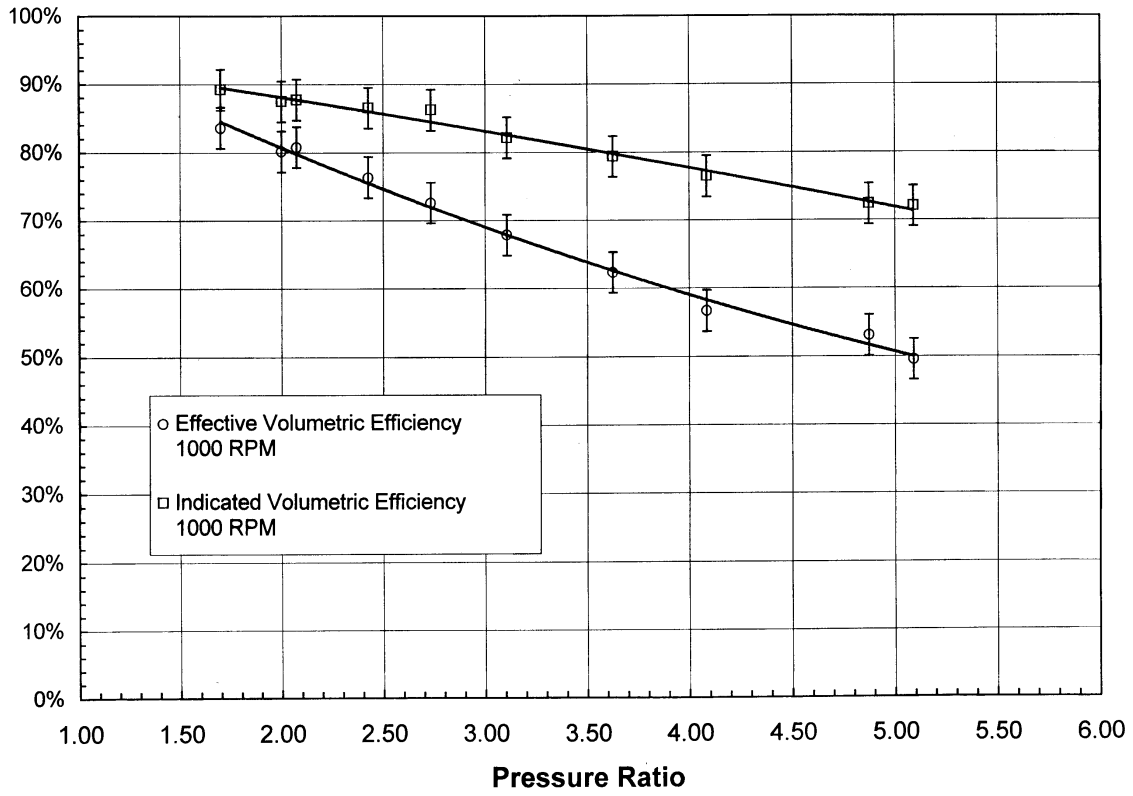


Compressor Rock FKX3 *CO₂ Version 2

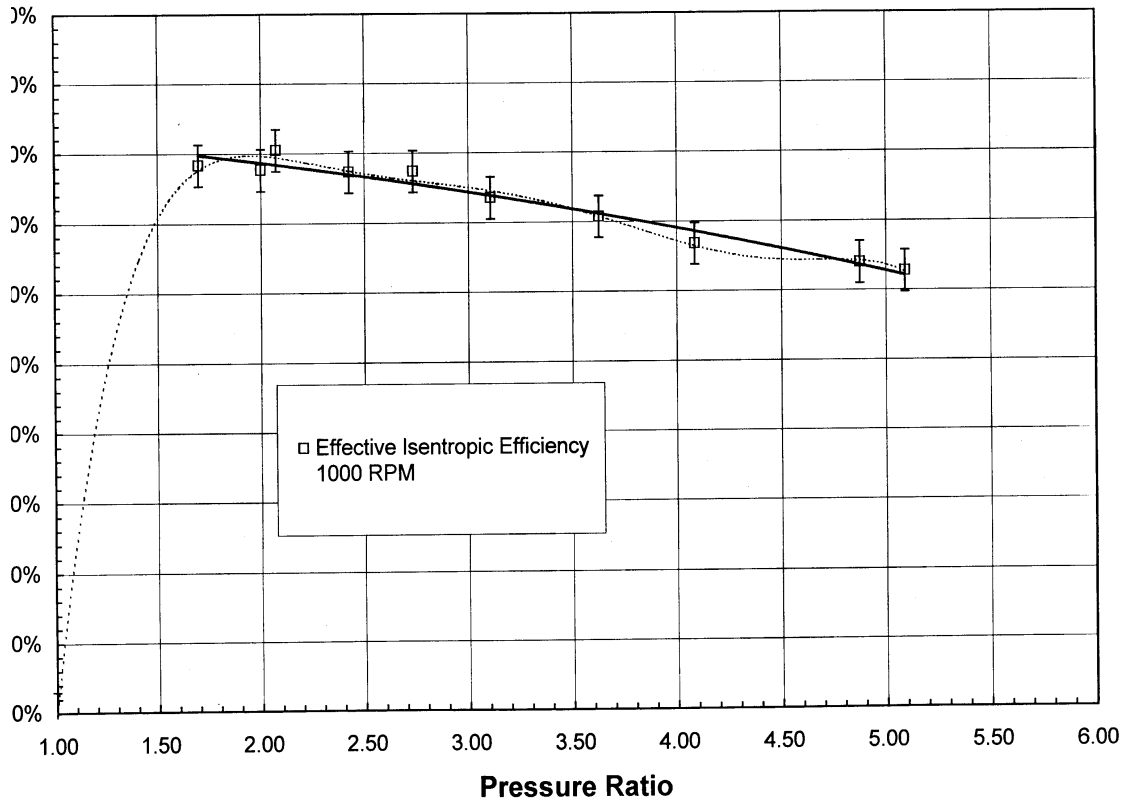
Indicator Diagram Bock FKX3-CO₂ Version 2

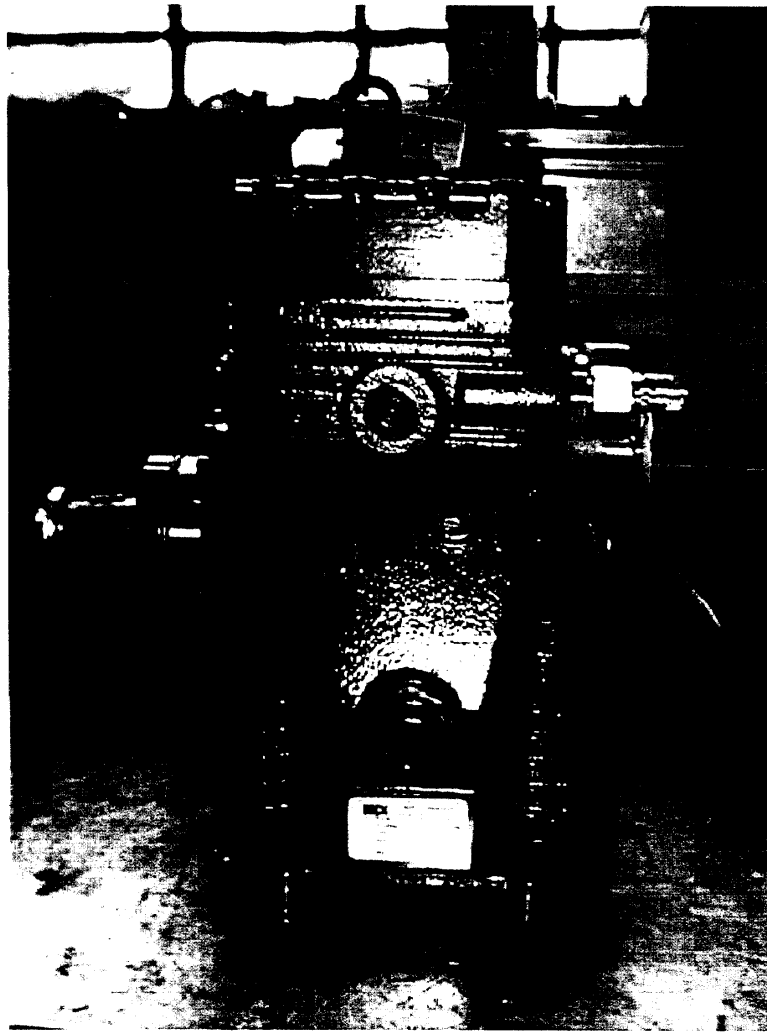


Volumetric Efficiency Bock FKX3-CO₂ Version 2

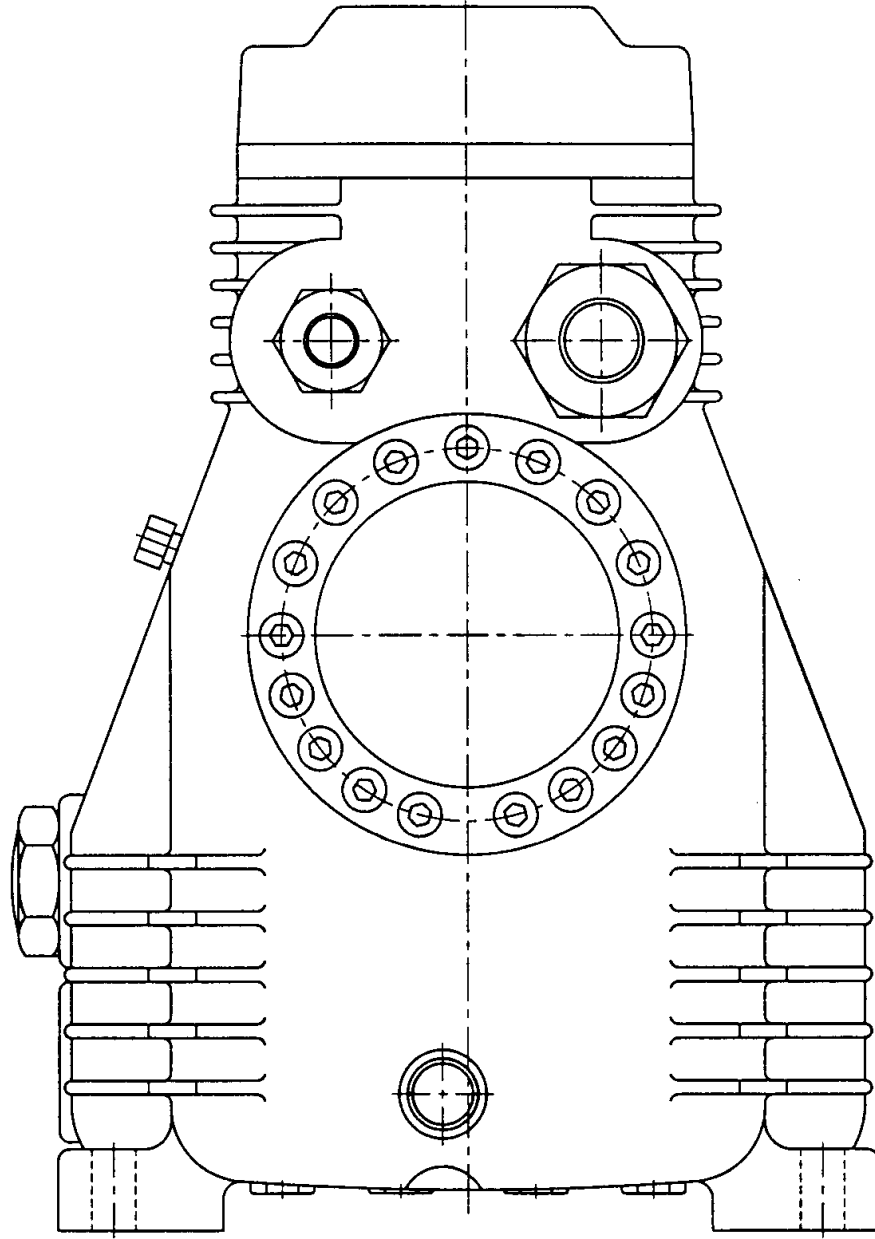


Effective Isentropic Efficiency Bock FKX3-CO₂ Version 2





BOCK CO₂ Compressor Version 3



CO₂ Compressor Version 3

CONCLUSIONS

- CO₂ as refrigerant for bus air conditioning:
- Over 1800 running hours on-the-road show that CO₂ A/C systems fulfill important on-the-road requirements.
- CO₂ as refrigerant – Compressor efficiencies:
- High Volumetric and Isentropic Efficiencies.