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A computer and experimental simulation of Stirling cycle machines

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TEST 7

FREQUENCY 2.50042

CHARGE PRESSURE 0.715 BARS

PLOT ERROR ±0.023AR

⊕ COMPRESSION SPACE
△ EXPANSION SPACE

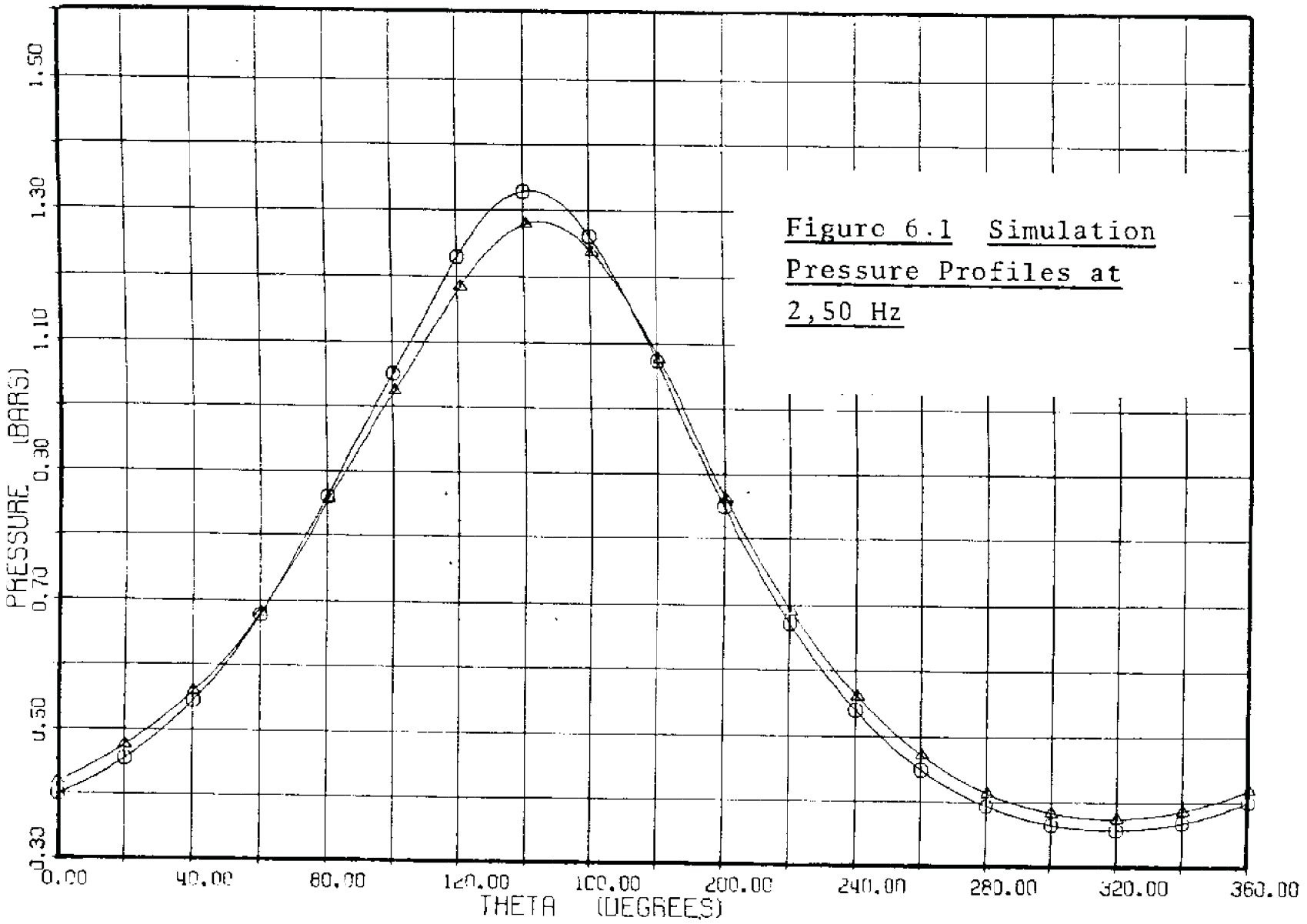


Figure 6.1 Simulation Pressure Profiles at 2,50 Hz

FREQUENCY 3.350 Hz

CHARGE PRESSURE 0.723 BARS

○ COMPRESSION SPACE
△ EXPANSION SPACE

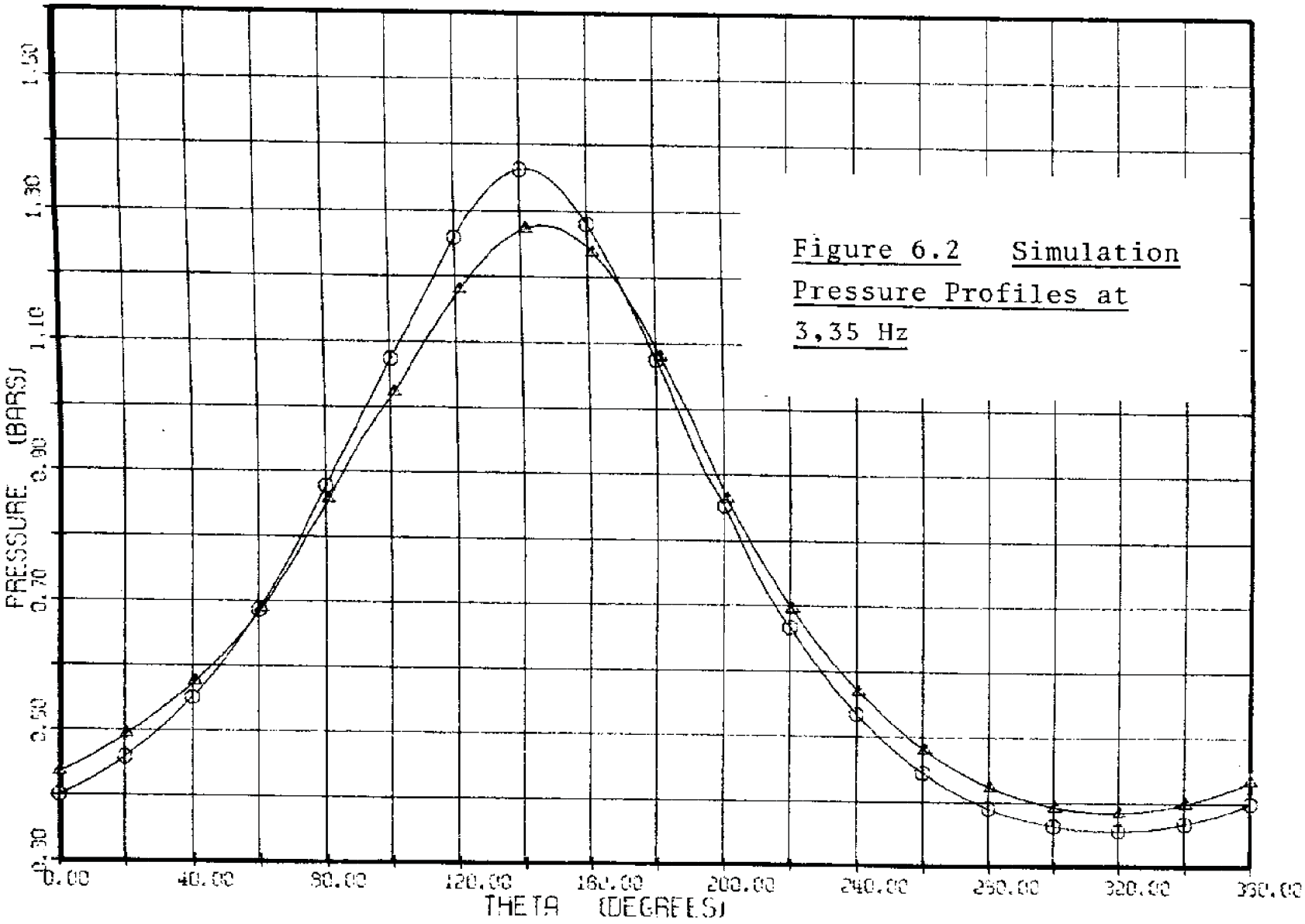


Figure 6.2 Simulation Pressure Profiles at 3,35 Hz

FREQUENCY 4.350 HZ

CHARGE PRESSURE 0.705 BARS

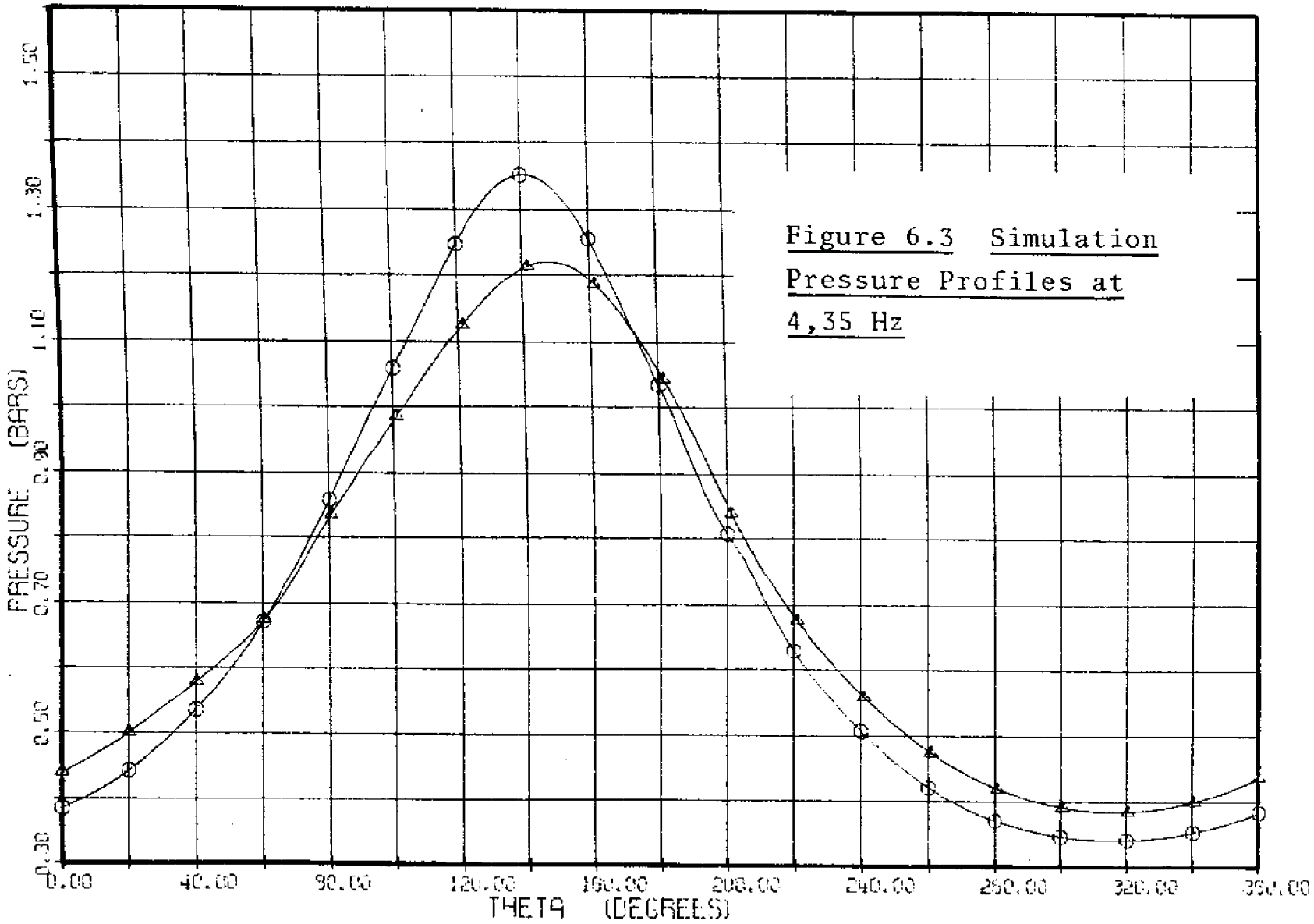


Figure 6.3 Simulation Pressure Profiles at 4,35 Hz

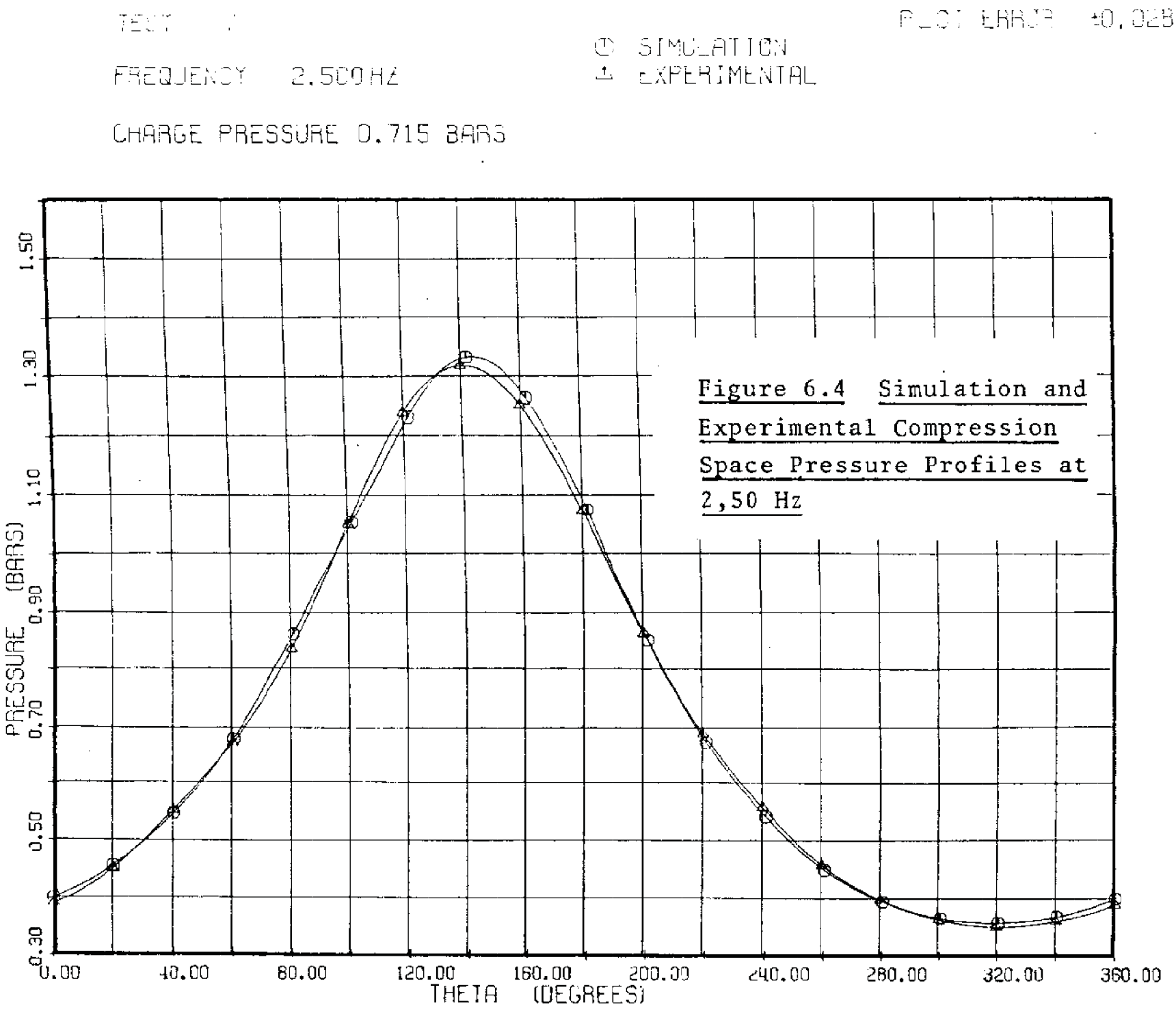


Figure 6.4 Simulation and Experimental Compression Space Pressure Profiles at 2,50 Hz

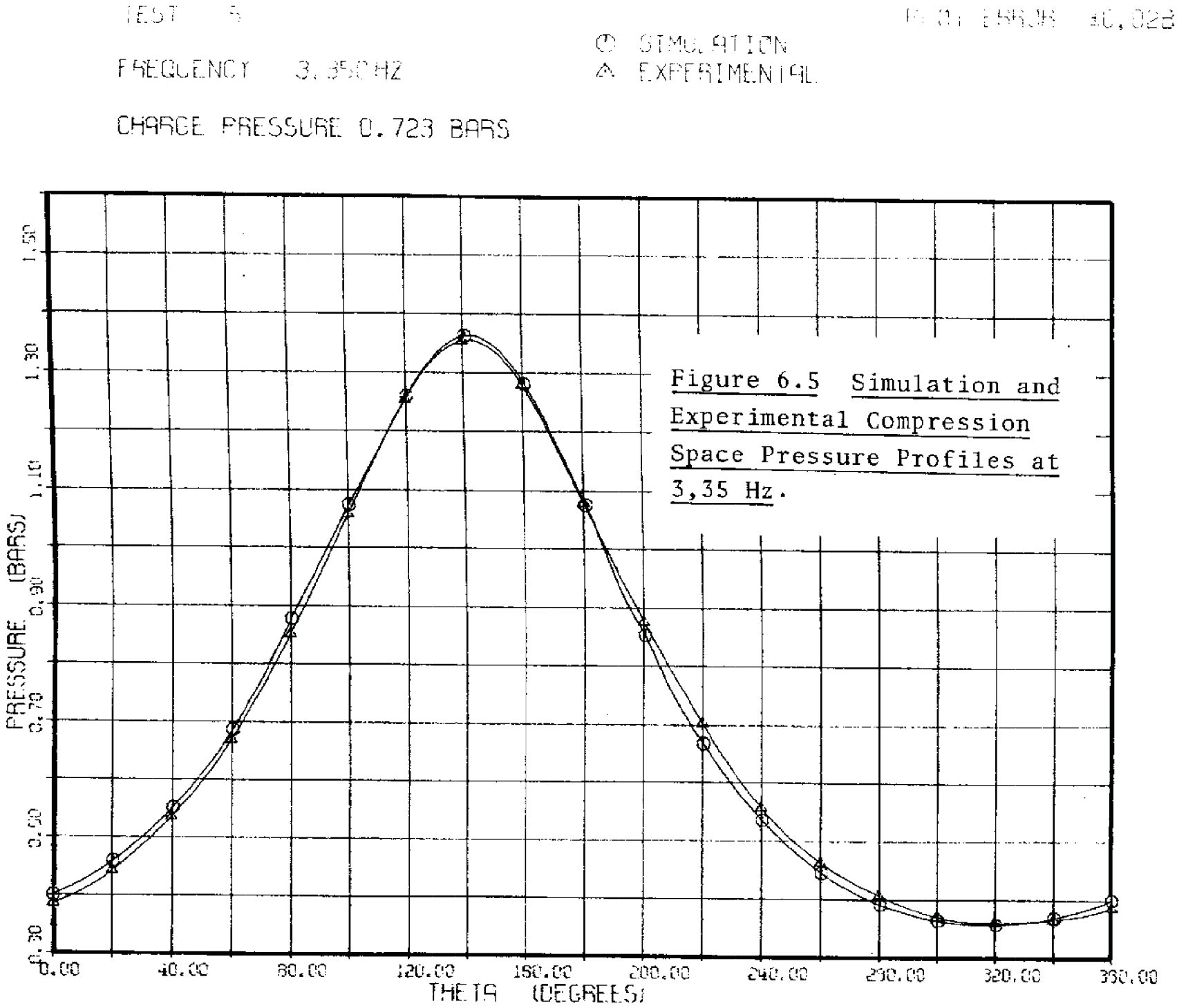


Figure 6.5 Simulation and Experimental Compression Space Pressure Profiles at 3,35 Hz.

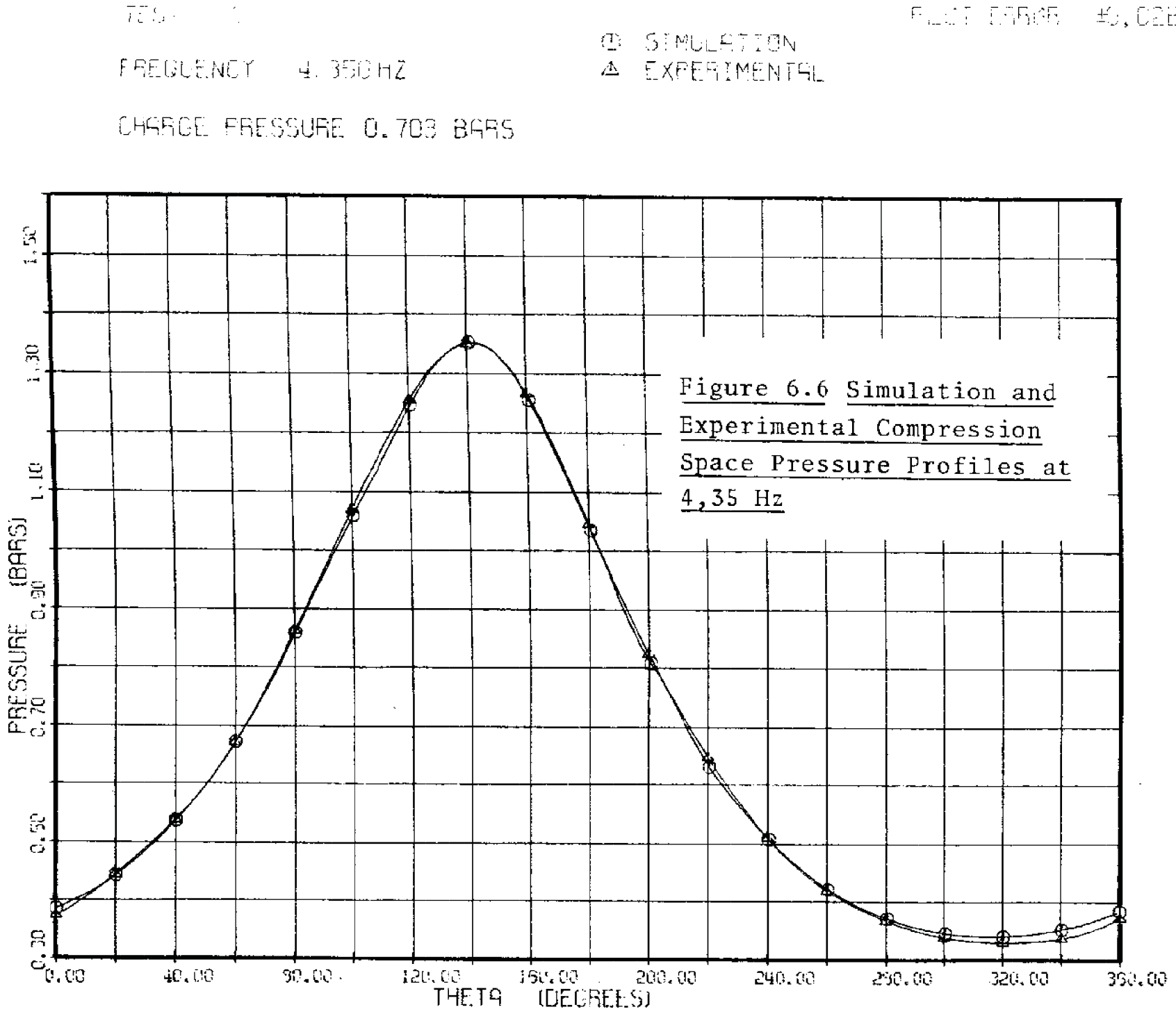


Figure 6.6 Simulation and Experimental Compression Space Pressure Profiles at 4,35 Hz

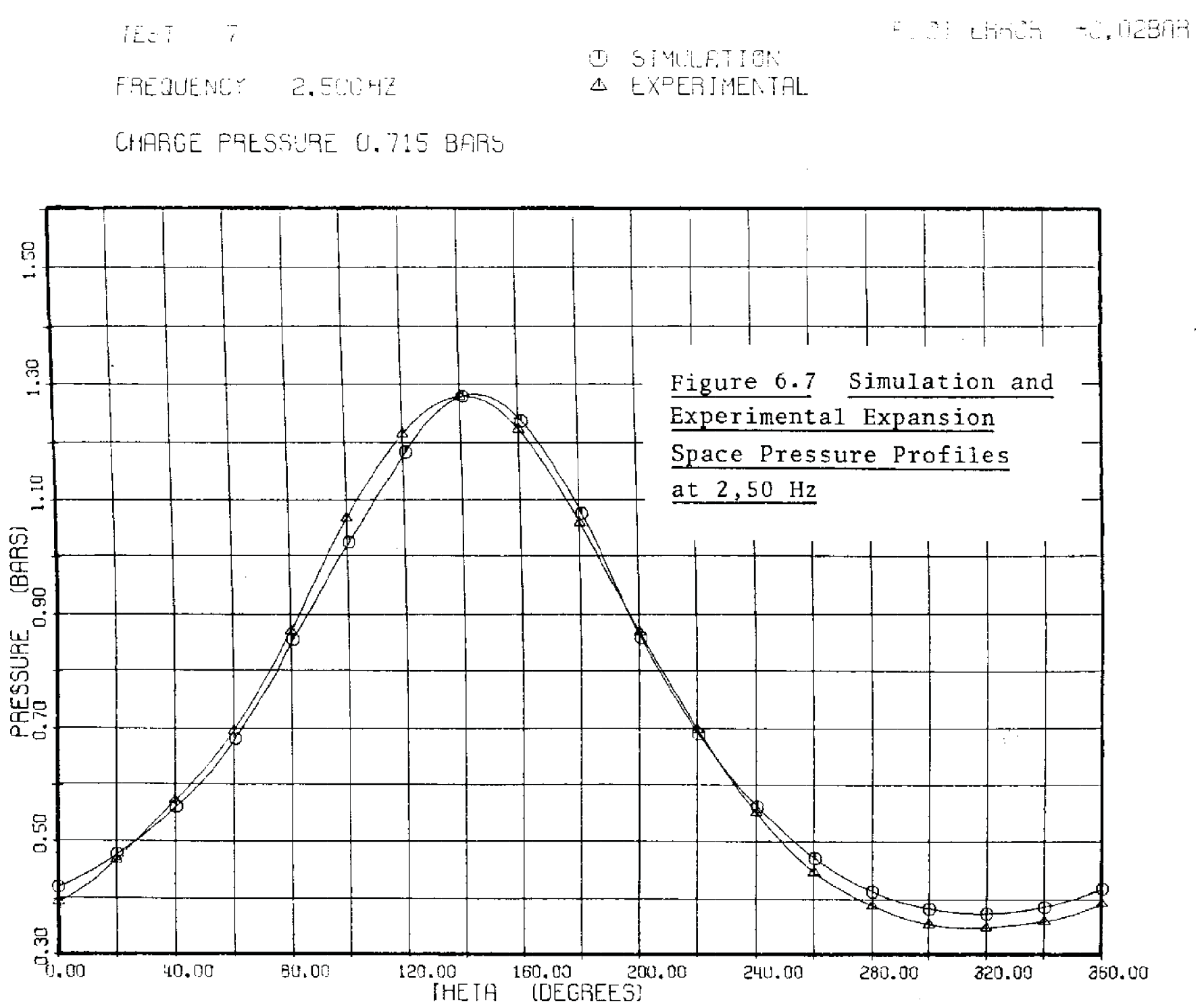


Figure 6.7 Simulation and Experimental Expansion Space Pressure Profiles at 2,50 Hz

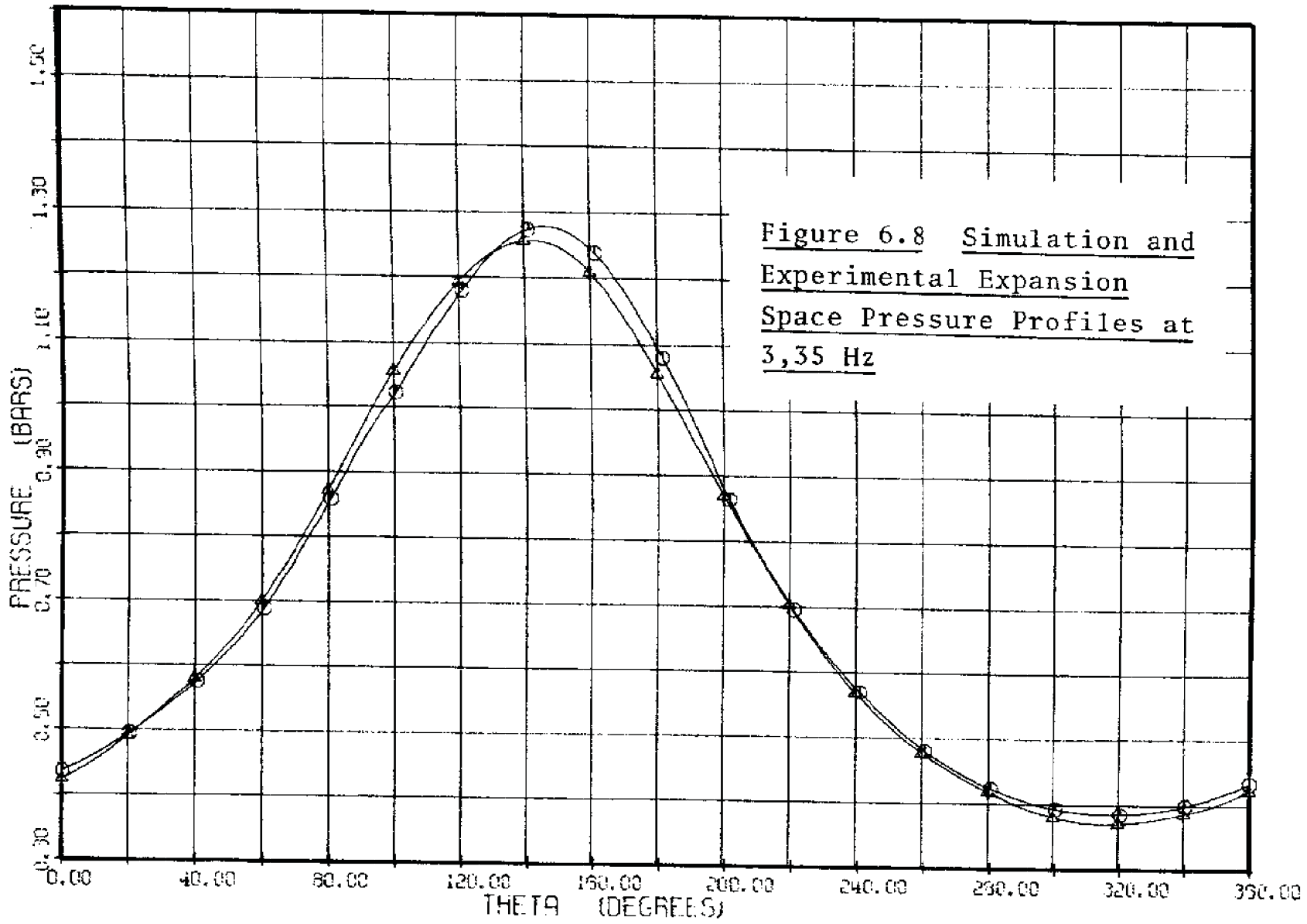


Figure 6.8 Simulation and Experimental Expansion Space Pressure Profiles at 3,35 Hz

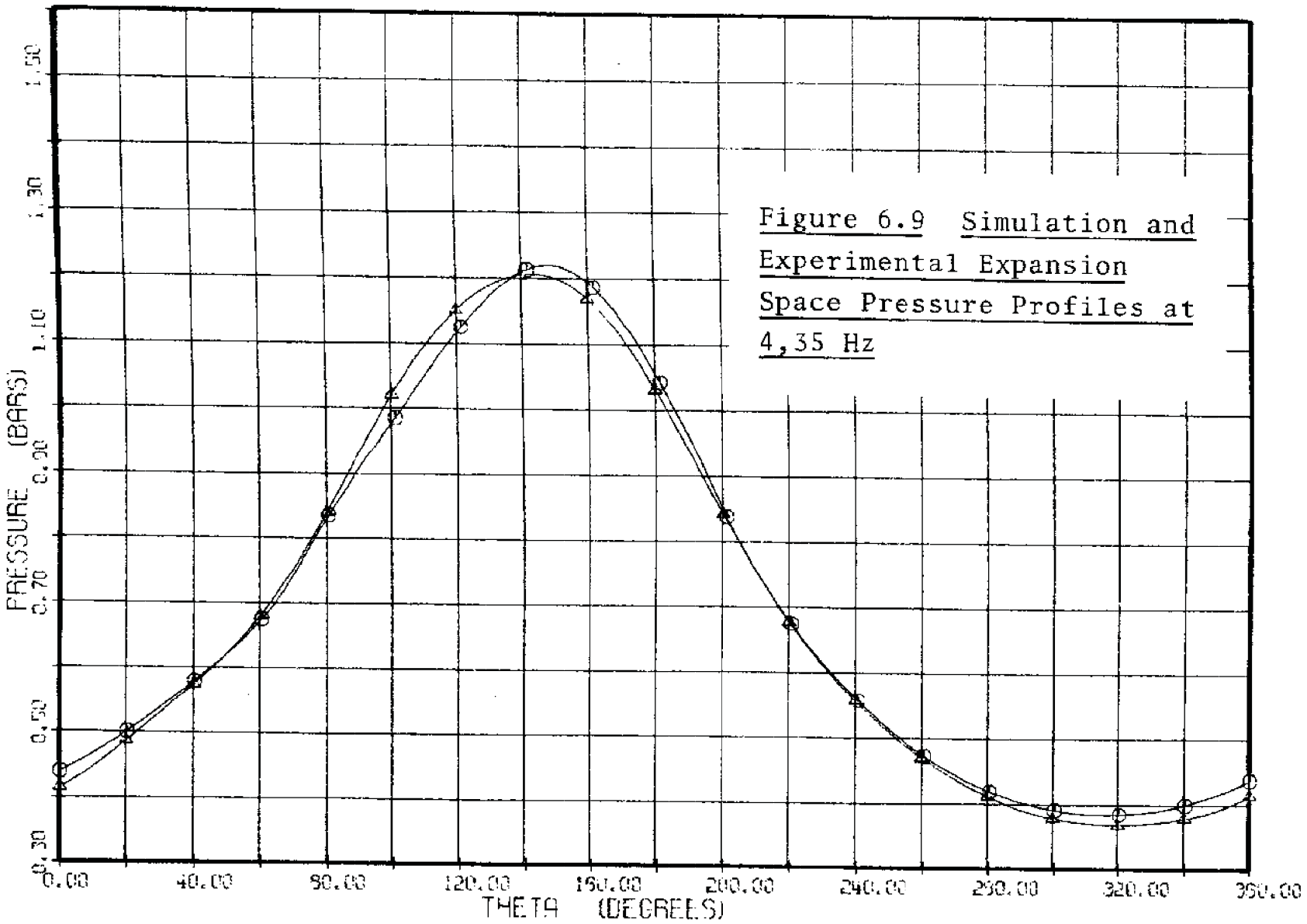


Figure 6.9 Simulation and Experimental Expansion Space Pressure Profiles at 4,35 Hz

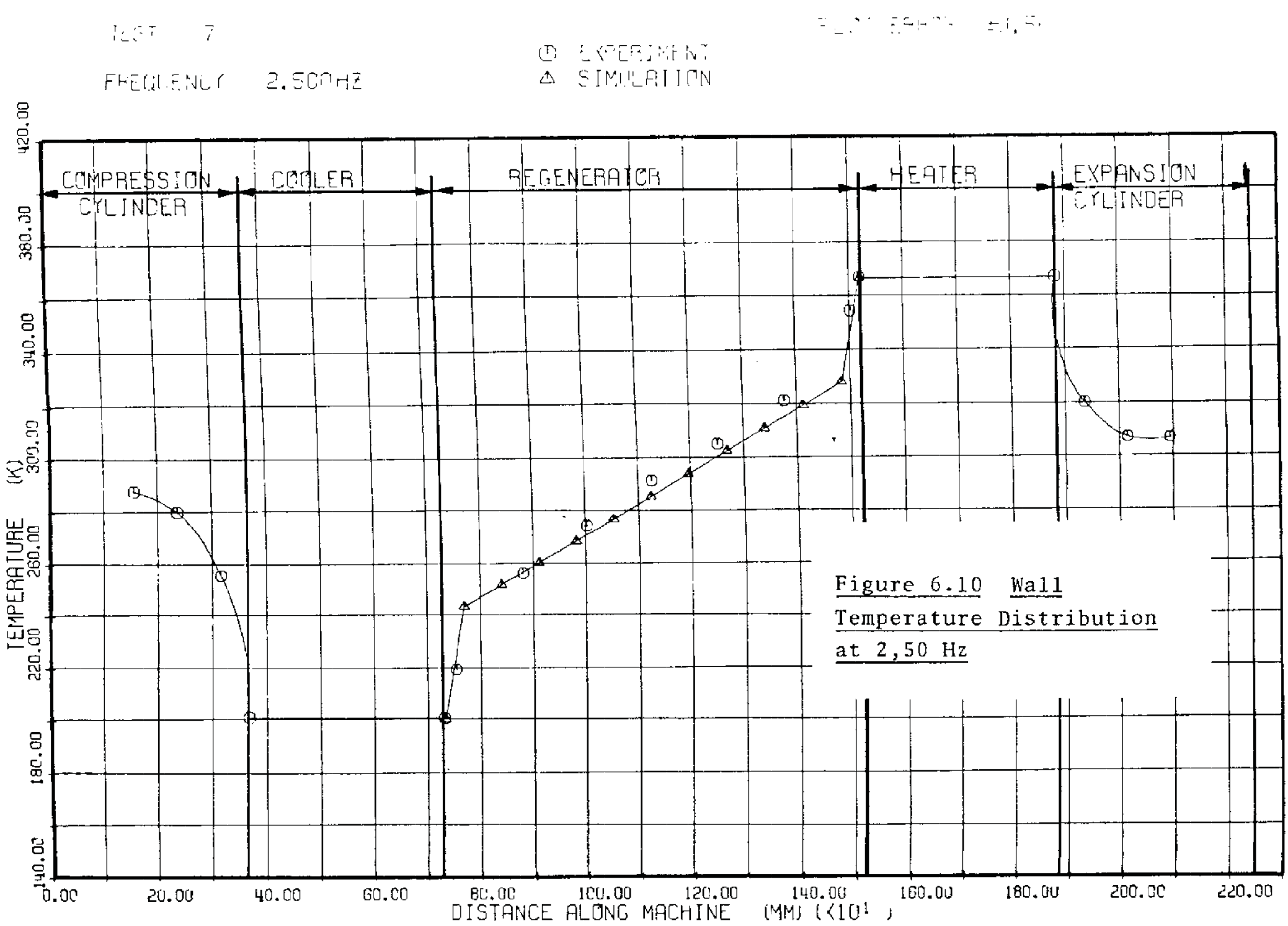


Figure 6.10 Wall Temperature Distribution at 2,50 Hz

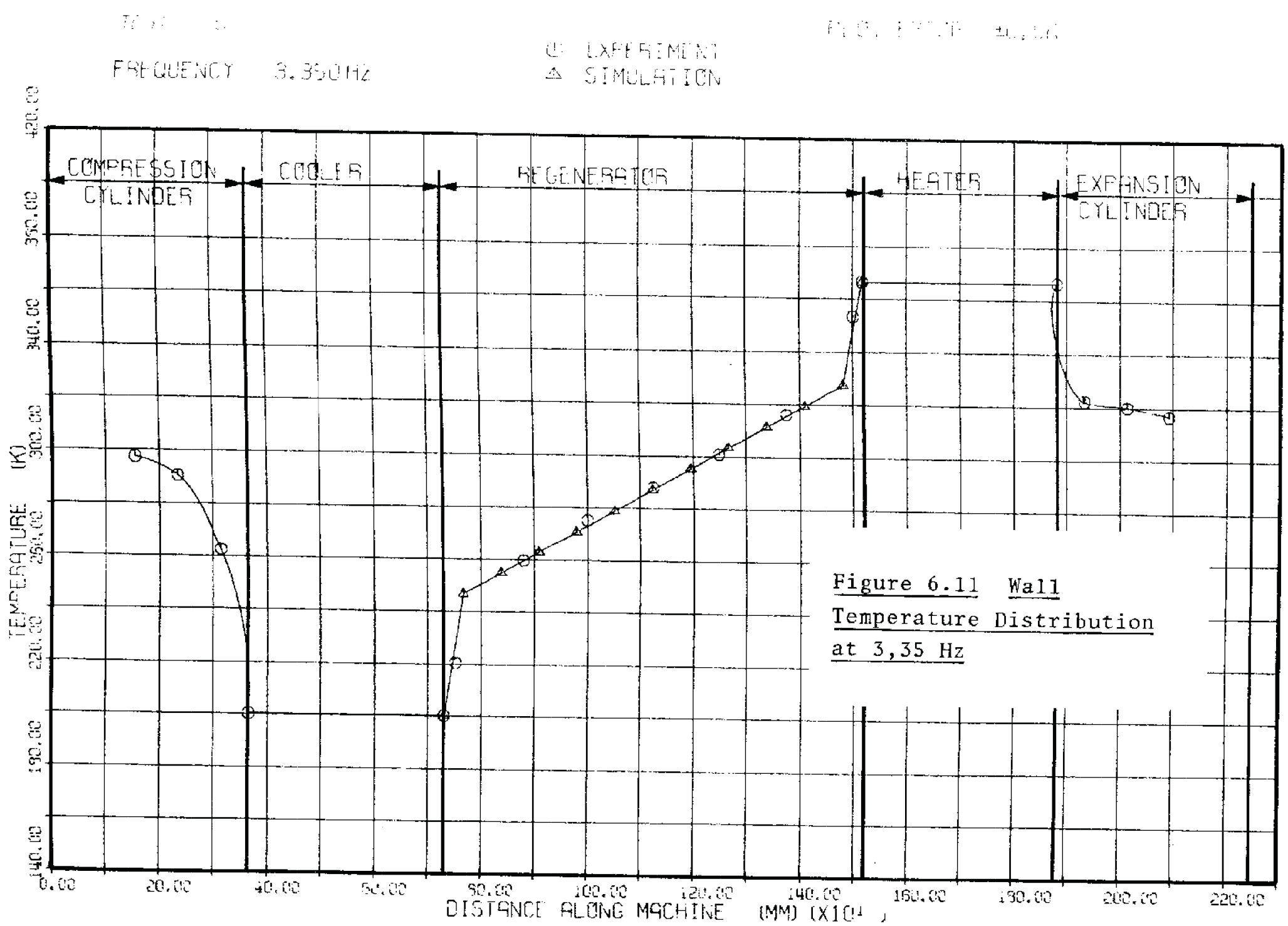


Figure 6.11 Wall Temperature Distribution at 3,35 Hz

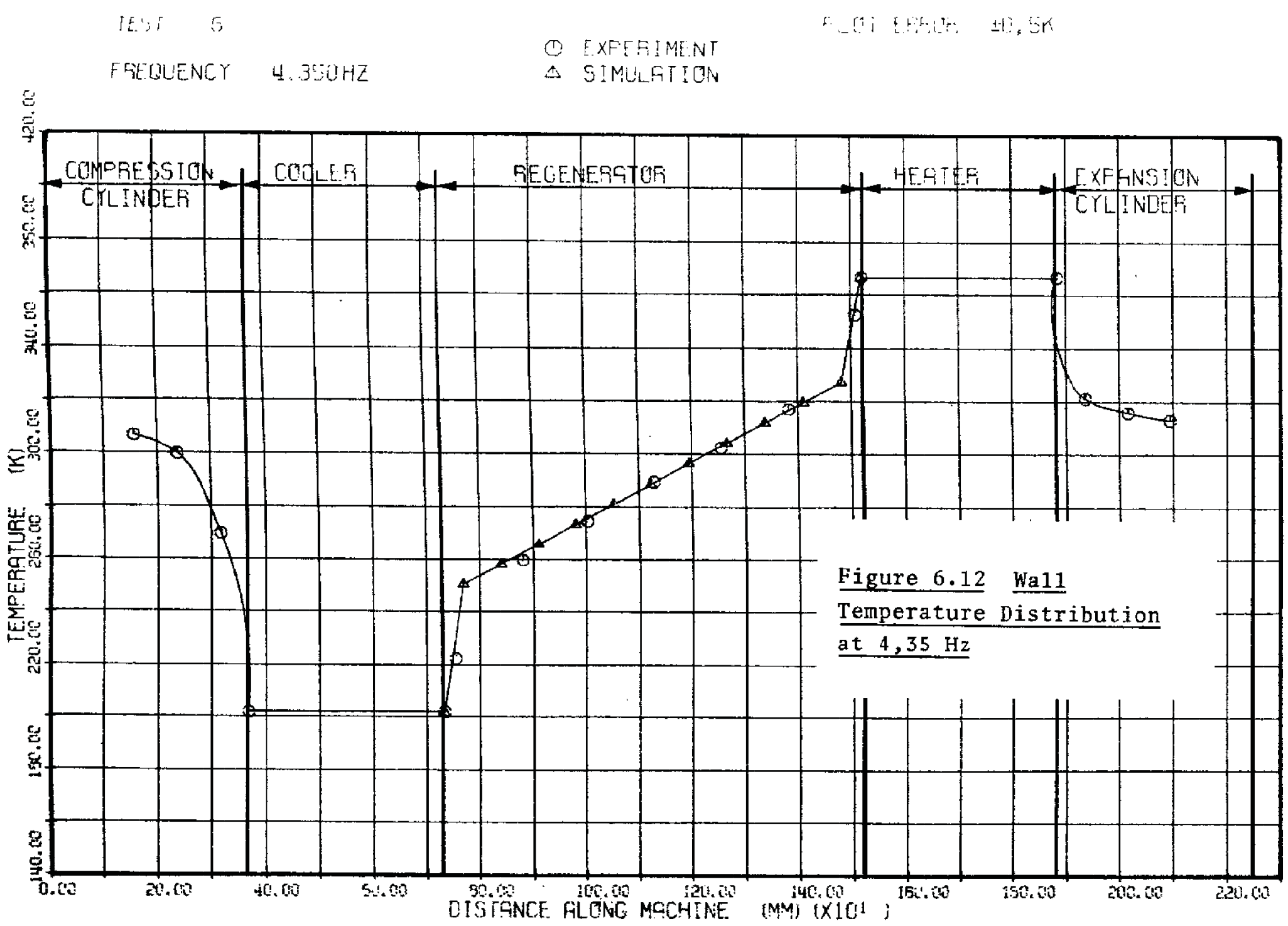


Figure 6.12 Wall Temperature Distribution at 4,35 Hz

TEST 7.

FREQUENCY 2.500HZ

CHARGE PRESSURE 0.715 BARS

PLOT ERROR ±5.0WATTS
SIMULATION CYCLIC WORK ⏱ 2.886 J
EXPERIMENTAL CYCLIC WORK △ 4.127 J

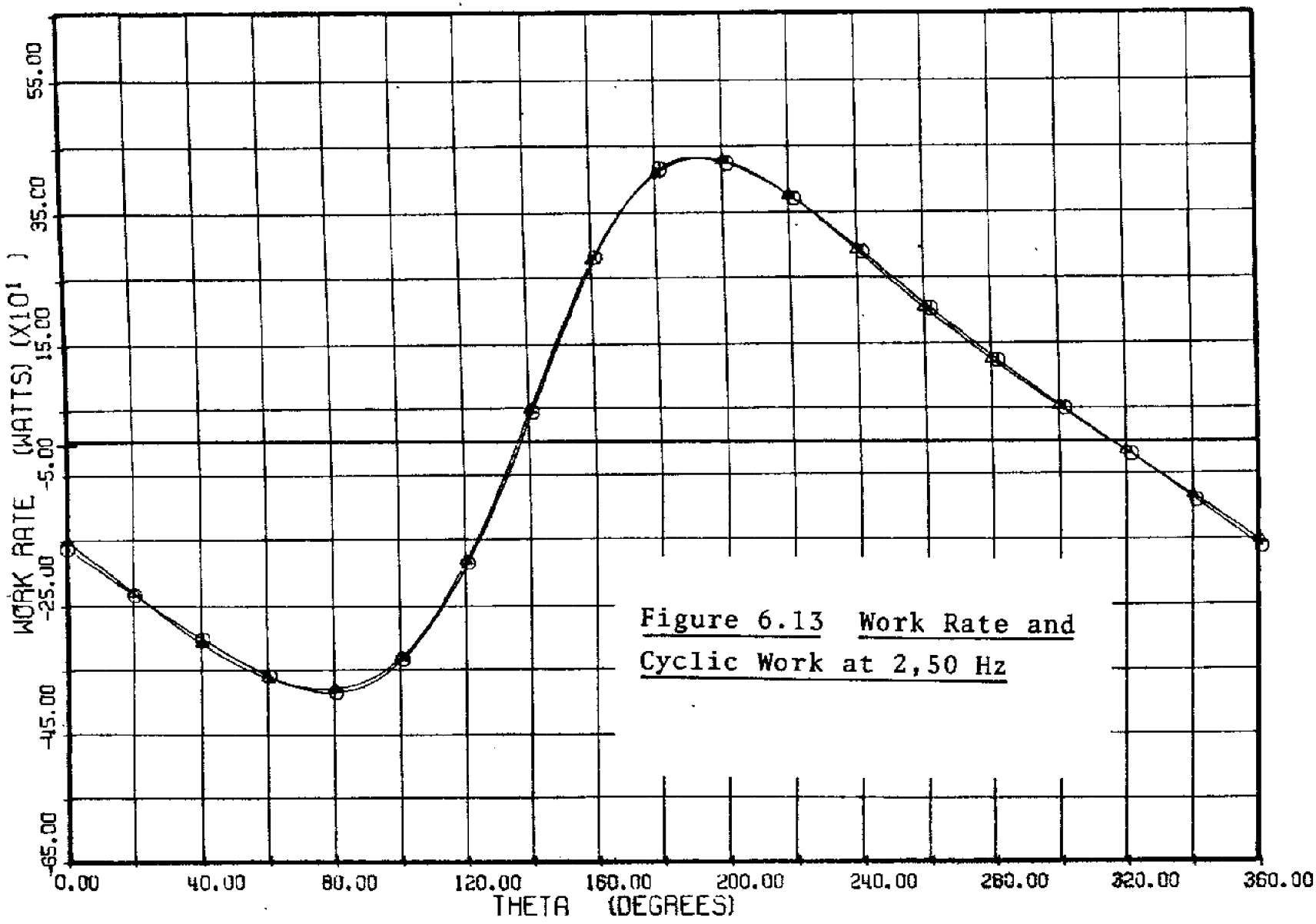


Figure 6.13 Work Rate and Cyclic Work at 2,50 Hz

TEST 5.

FREQUENCY 3.350 Hz

CHARGE PRESSURE 0.723 BARS

PLOT ERROR 45.0WATTS

SIMULATION CYCLIC WORK ○ 1.261 J

EXPERIMENTAL CYCLIC WORK △ 2.592 J

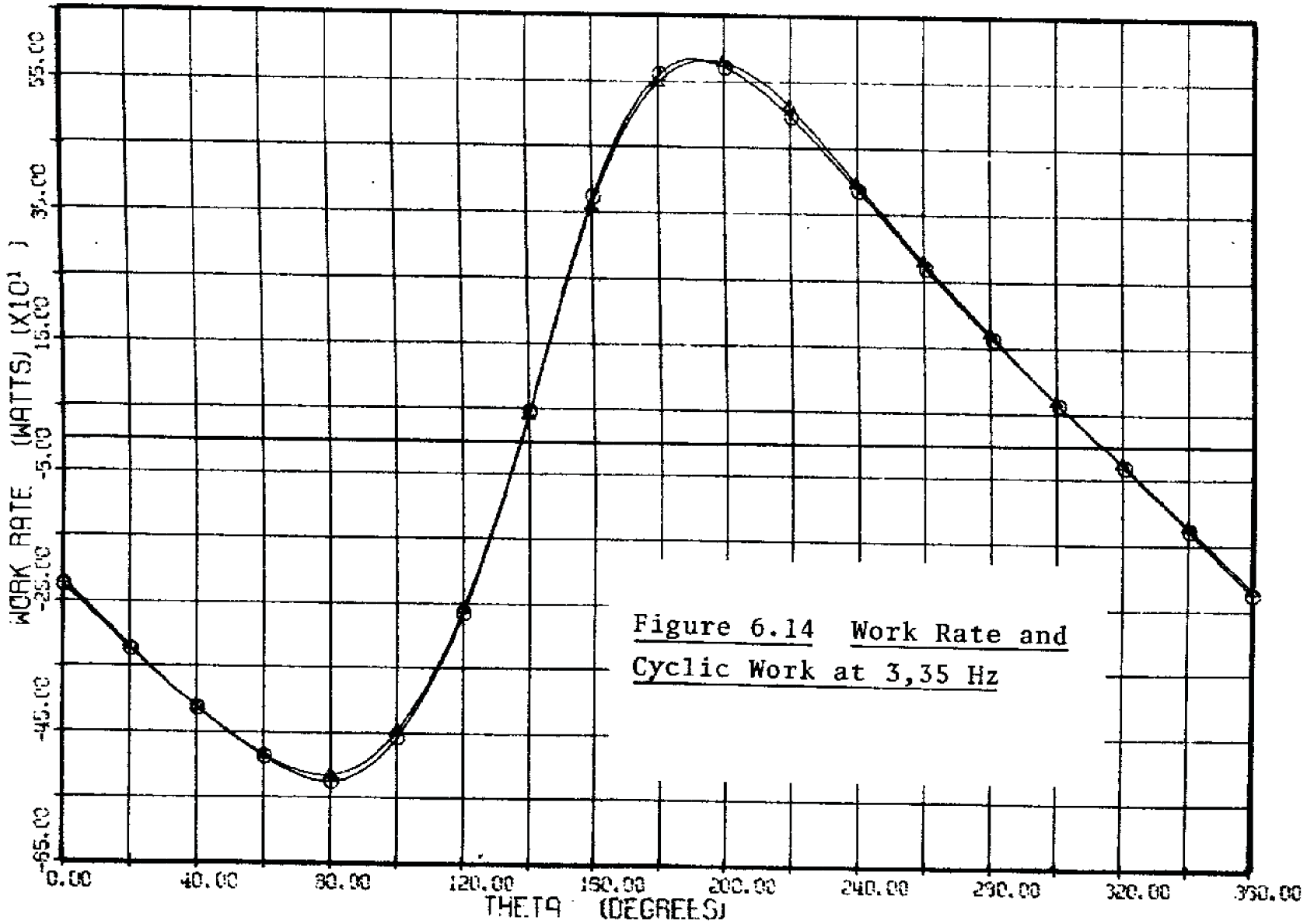


Figure 6.14 Work Rate and Cyclic Work at 3,35 Hz

TEST G.

FREQUENCY 4.350HZ

CHARGE PRESSURE 0.703 BARS

PLOT ERROR ±5.0WATTS

SIMULATION CYCLIC WORK ⊙ -1.172J

EXPERIMENTAL CYCLIC WORK △ -0.360 J

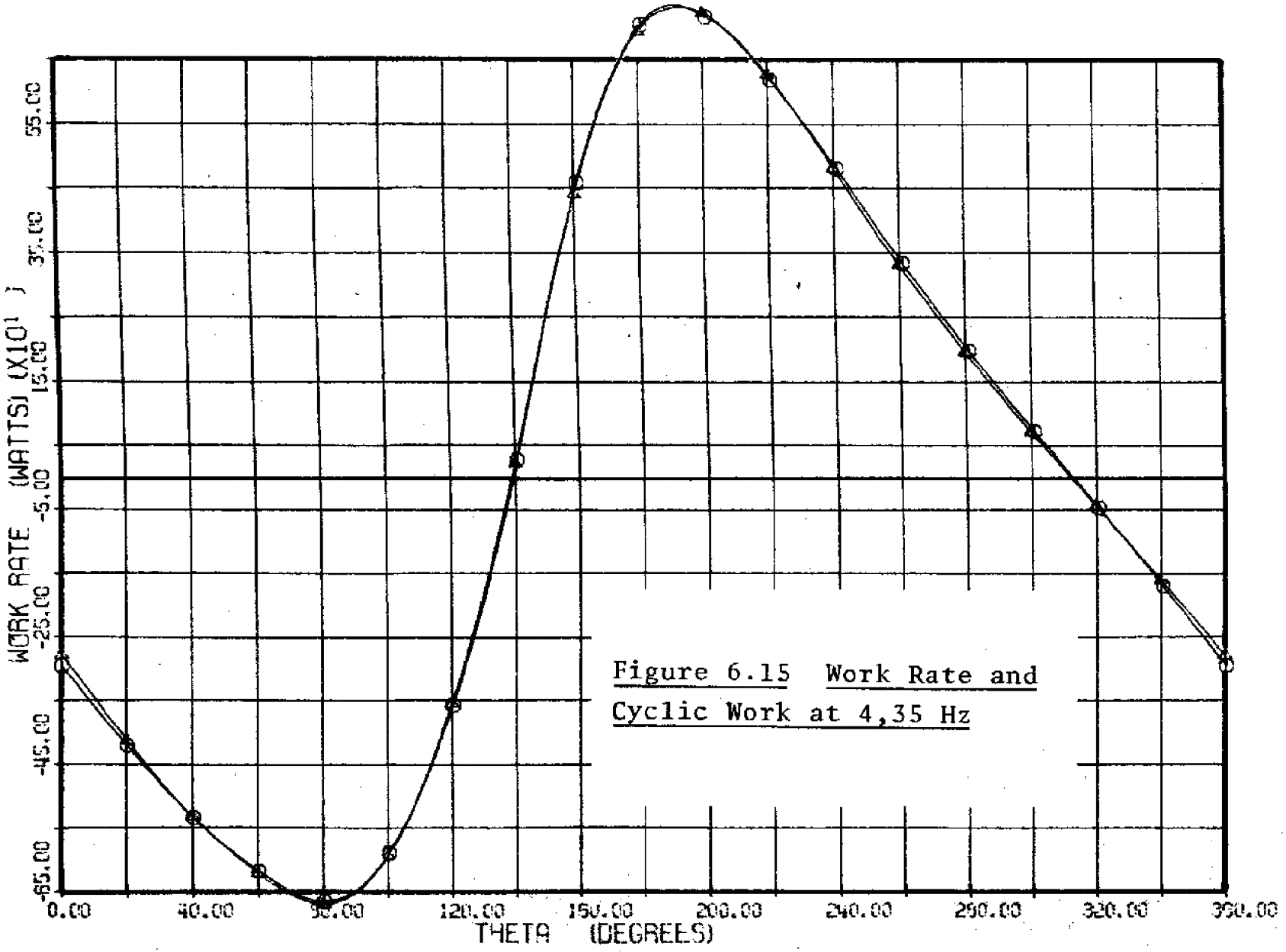


Figure 6.15 Work Rate and Cyclic Work at 4,35 Hz

TEST 7.

FREQUENCY 2.500HZ

CHARGE PRESSURE 0.715 BARS

PLOT ERROR ±5.0WATTS

SIMULATION CYCLIC COOLING ⏱	-46.628 J
EXPERIMENTAL CYCLIC COOLING	-53.655 J
SIMULATION CYCLIC HEATING △	49.047 J
EXPERIMENTAL CYCLIC HEATING	56.516 J

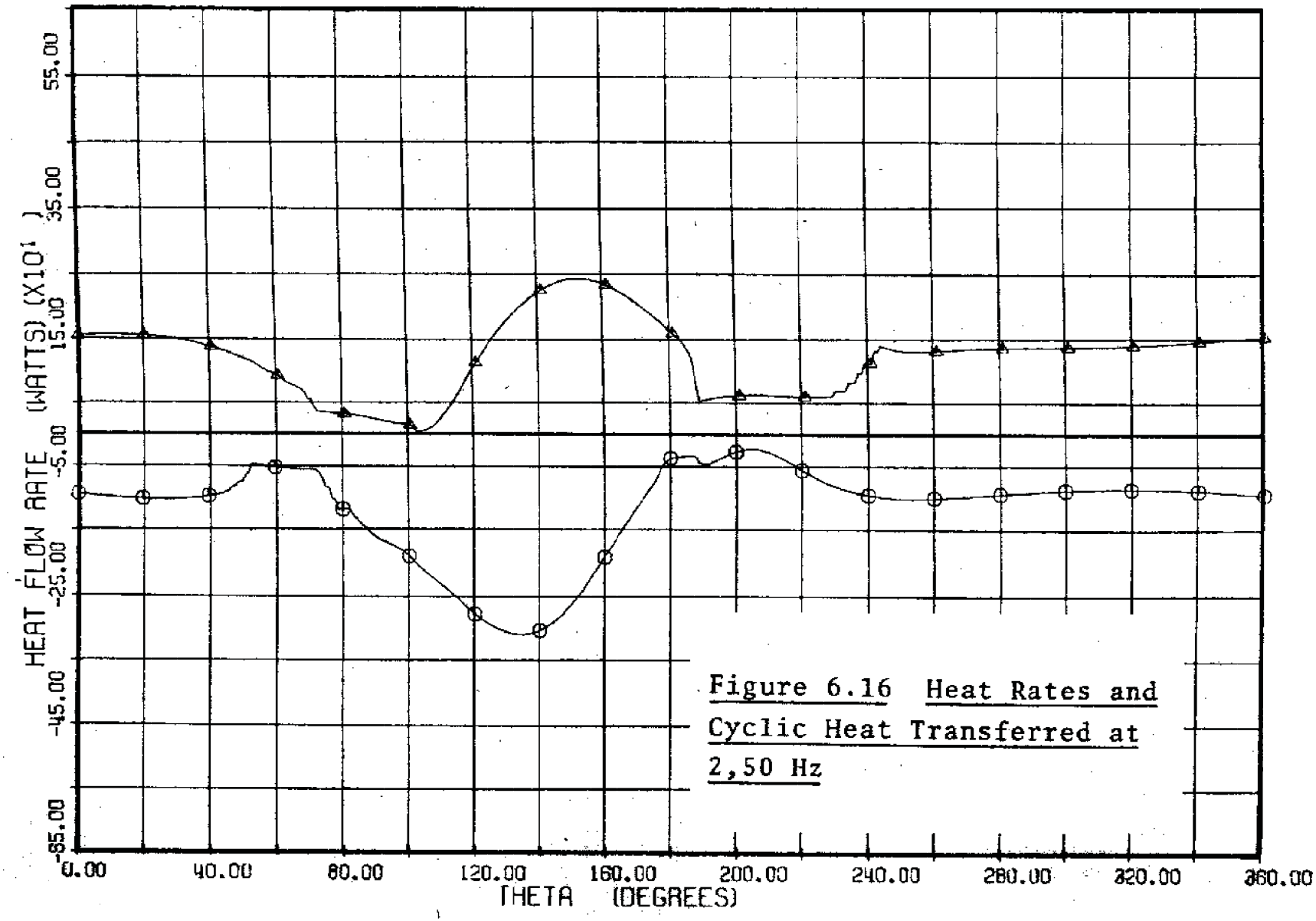


Figure 6.16 Heat Rates and Cyclic Heat Transferred at 2,50 Hz

TEST 5

FREQUENCY 3.35 HZ

CHARGE PRESSURE 0.723 BARS

PLATE ERROR 46.0 WATTS

SIMULATION CYCLIC COOLING ⏲	-46.384 J
EXPERIMENTAL CYCLIC COOLING	-53.895 J
SIMULATION CYCLIC HEATING ⏃	46.219 J
EXPERIMENTAL CYCLIC HEATING	51.387 J

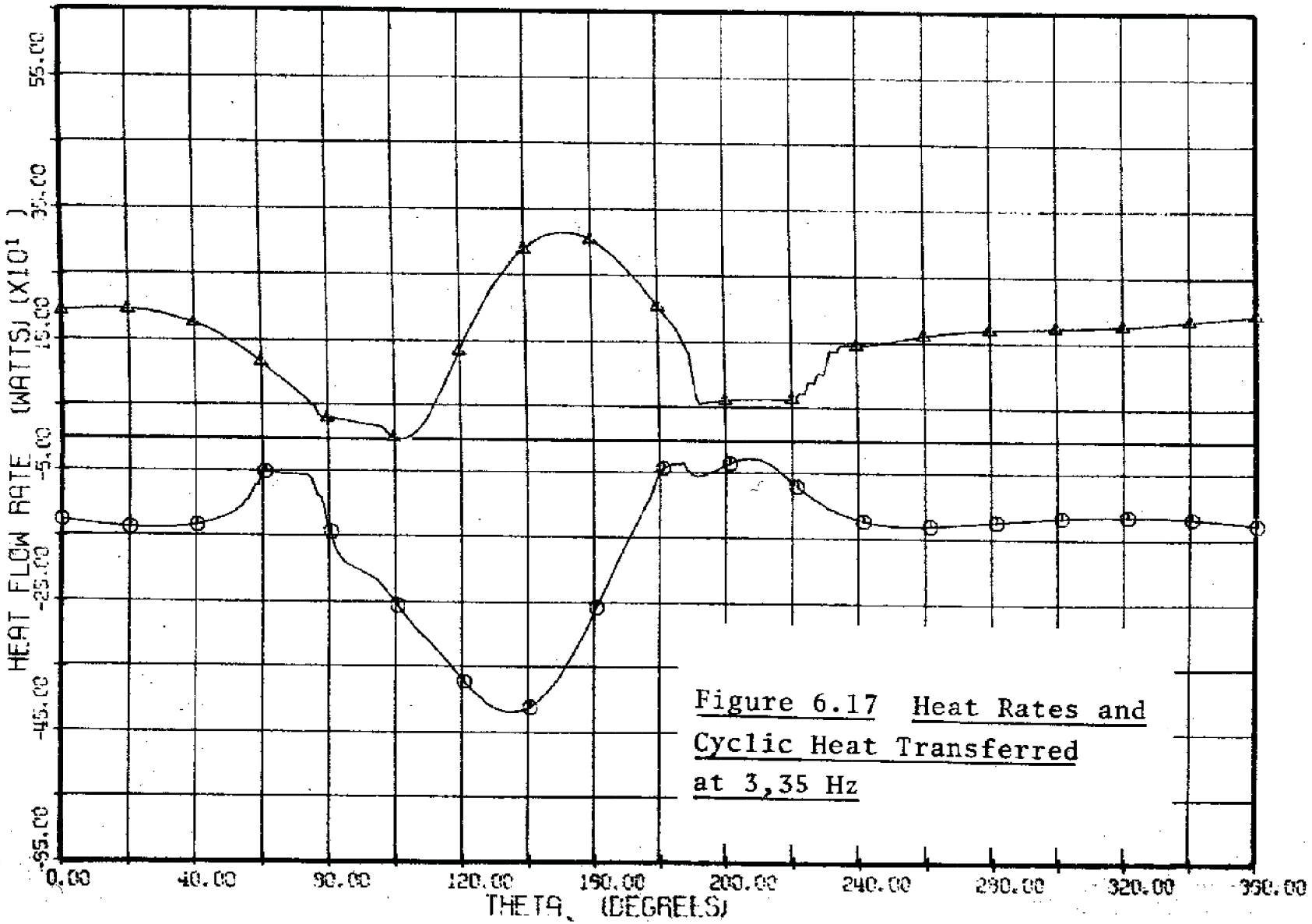


Figure 6.17 Heat Rates and Cyclic Heat Transferred at 3,35 Hz

TEST 6.

FREQUENCY 4.350HZ

CHARGE PRESSURE 0.703 BARS

PLOT ERROR ±5.0WATTS

SIMULATION CYCLIC COOLING ⏱	-44.690 J
EXPERIMENTAL CYCLIC COOLING	-51.227 J
SIMULATION CYCLIC HEATING △	42.238 J
EXPERIMENTAL CYCLIC HEATING	41.156 J

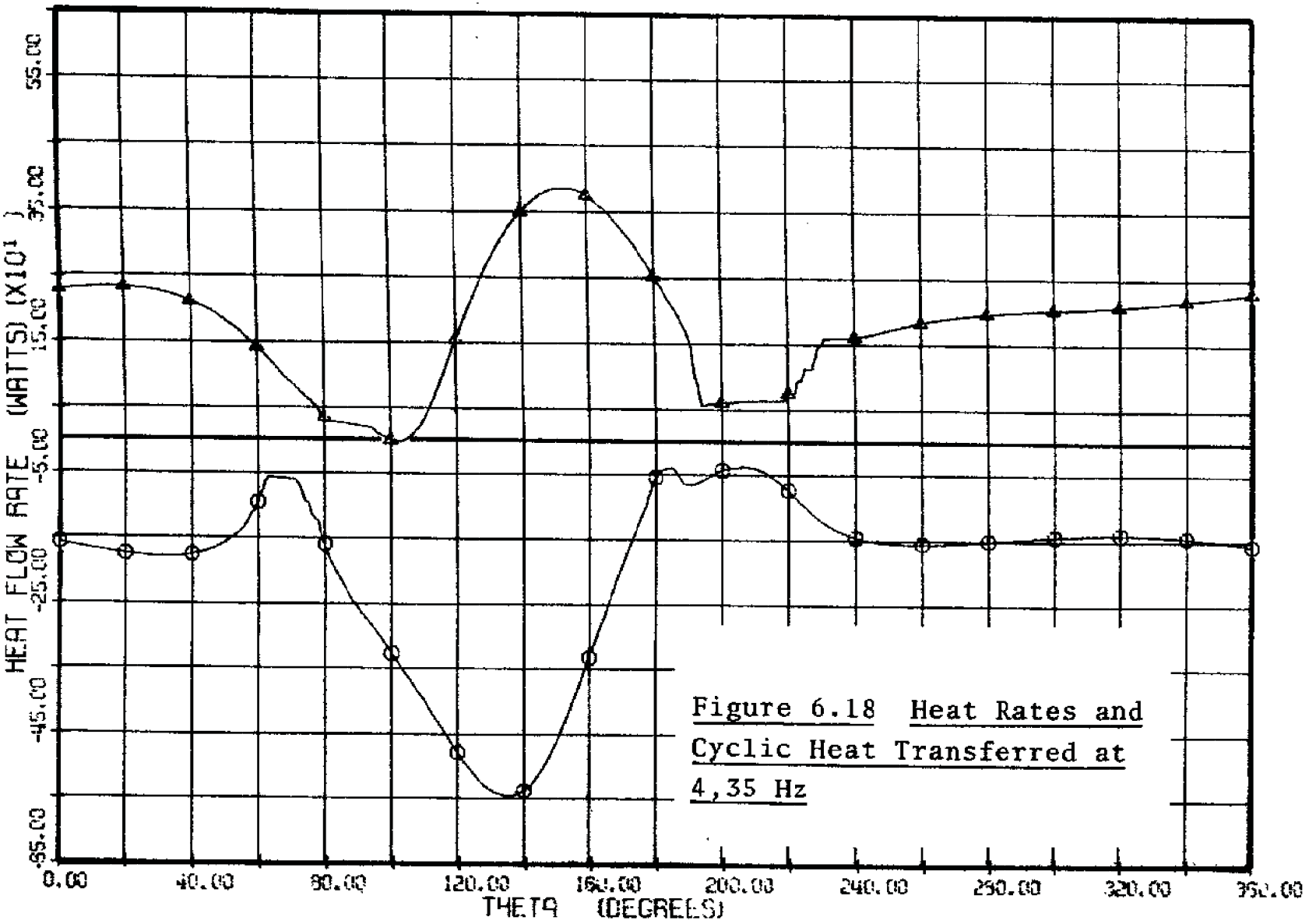


Figure 6.18 Heat Rates and Cyclic Heat Transferred at 4,35 Hz

TEST 7.

PLOT ERROR ±5.0WATTS

FREQUENCY 2.500HZ

CHARGE PRESSURE 0.715 BARS

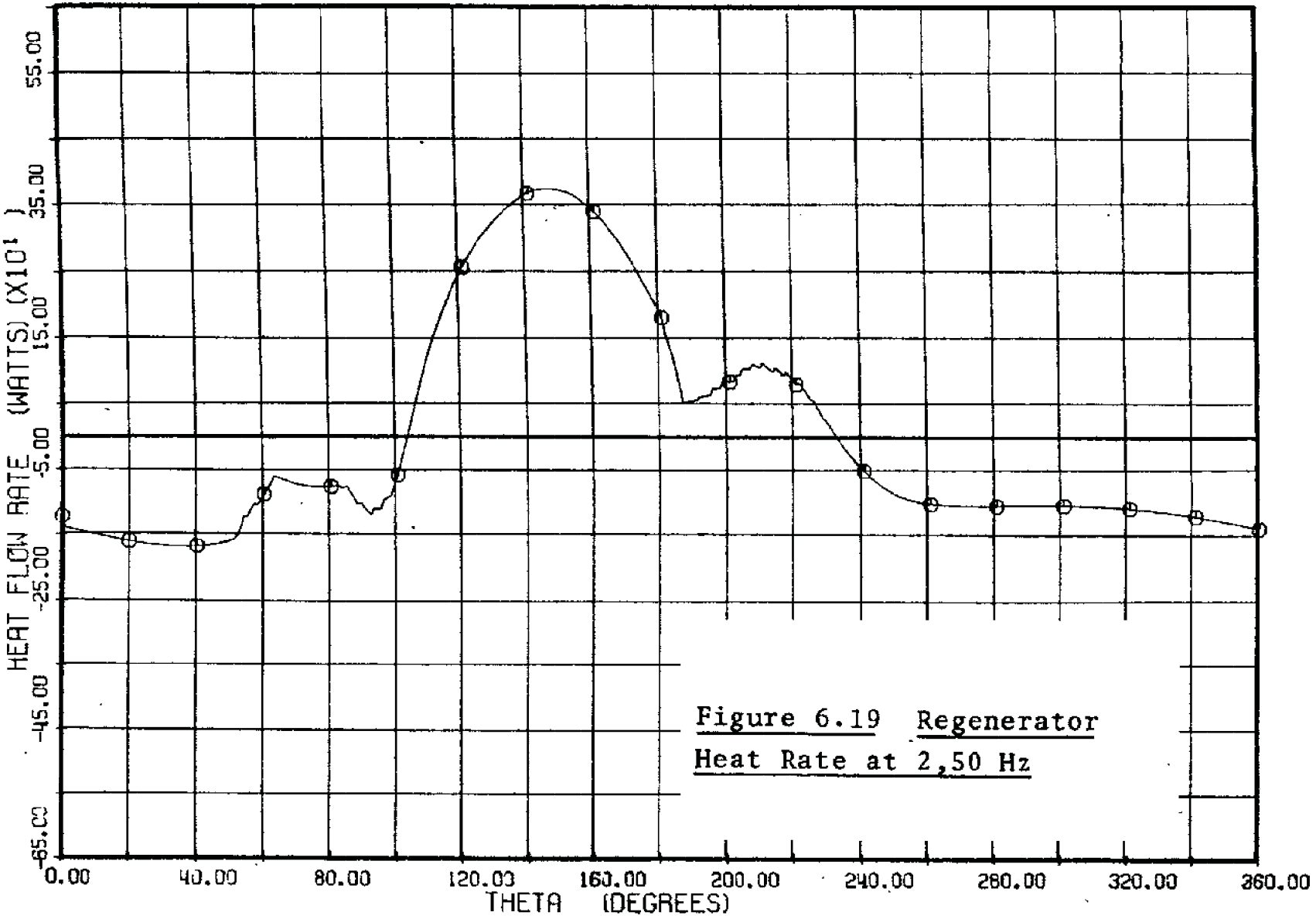


Figure 6.19 Regenerator Heat Rate at 2,50 Hz

TEST 5.

PLOT ERROR ±5.0WATTS

FREQUENCY 3.350HZ

CHARGE PRESSURE 0.723 BARS

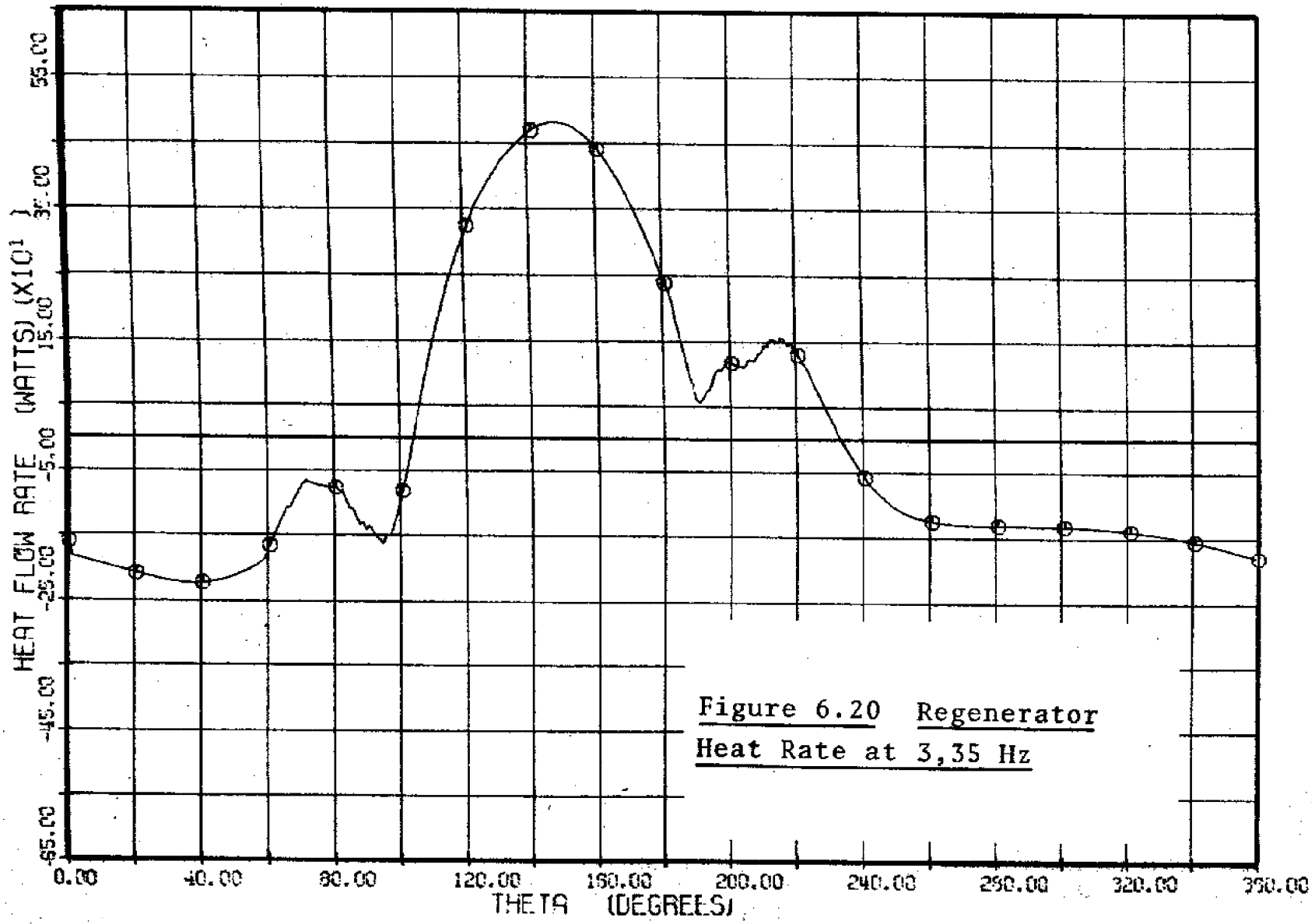


Figure 6.20 Regenerator Heat Rate at 3,35 Hz

TEST 6. PLOT ERROR ±5.0WATTS

FREQUENCY 4.350HZ

CHARGE PRESSURE 0.705 BARS

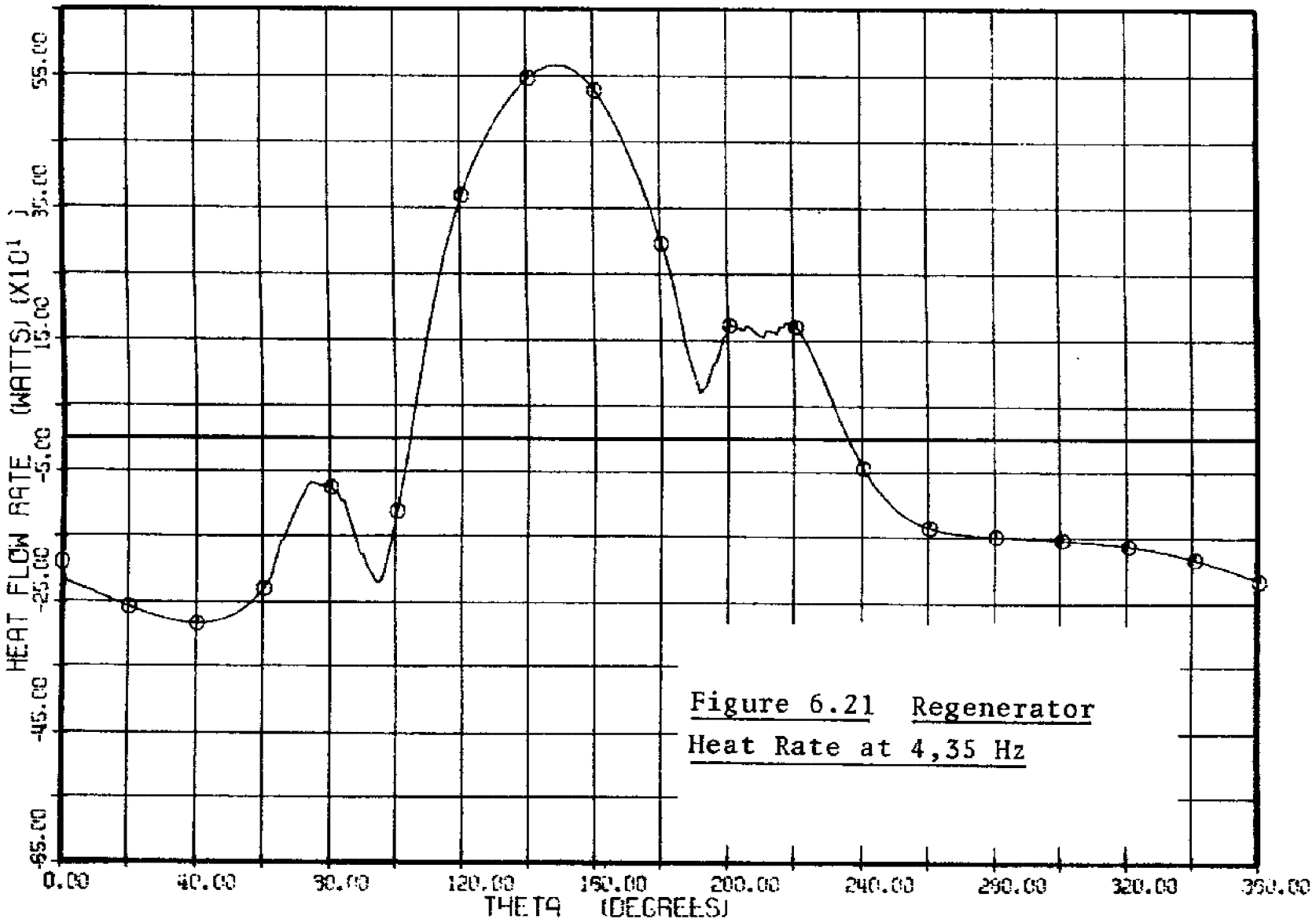


Figure 6.21 Regenerator Heat Rate at 4,35 Hz

TEST 7.

FREQUENCY 2.500HZ

CHARGE PRESSURE 0.715 BARS

PLOT ERROR ±0,5K

SIMULATION AVG COMPR TEMP ⏱	219.244K
EXPERIMENTAL AVG COMPR TEMP	235.600K
SIMULATION AVG EXPAN TEMP ⚠	302.610K
EXPERIMENTAL AVG EXPAN TEMP	340.900K

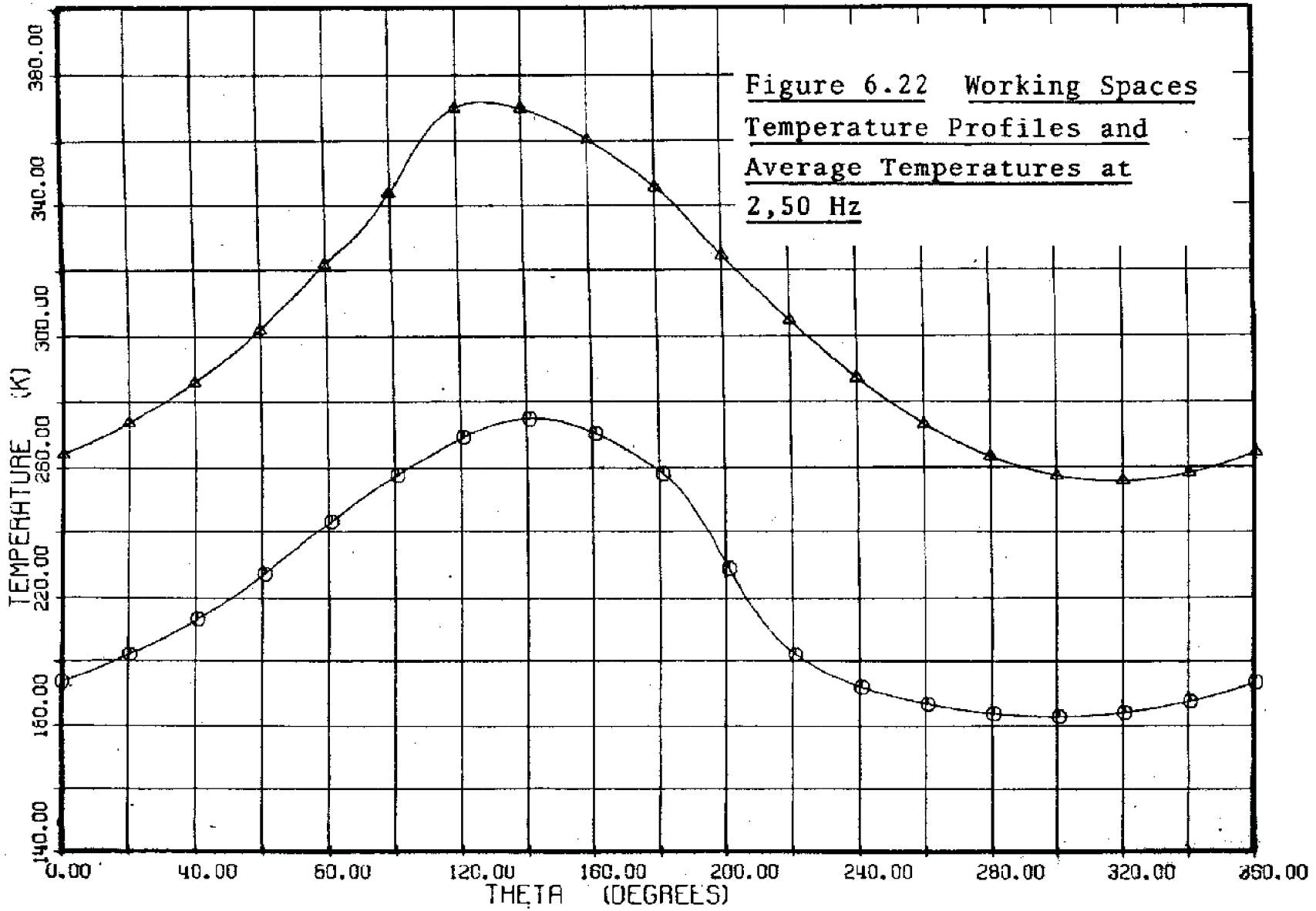


Figure 6.22 Working Spaces Temperature Profiles and Average Temperatures at 2,50 Hz

TEST 5.

FREQUENCY 3.350HZ

CHARGE PRESSURE 0.723 BARS

PLOT ERROR ±0.5K

SIMULATION AVG COMPR TEMP	○	221.553K
EXPERIMENTAL AVG COMPR TEMP		243.200K
SIMULATION AVG EXPAN TEMP	△	303.306K
EXPERIMENTAL AVG EXPAN TEMP		341.900K

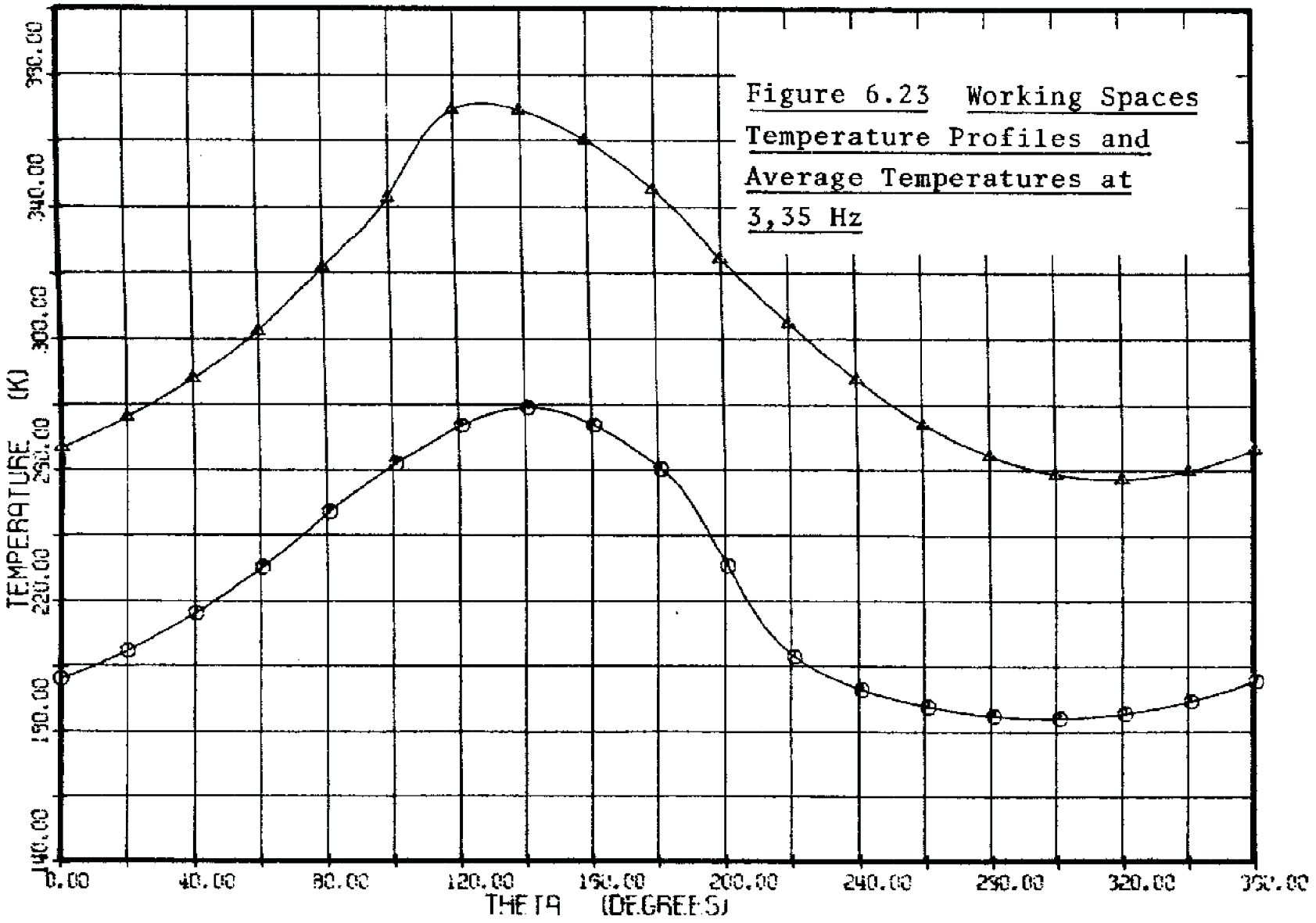


Figure 6.23 Working Spaces Temperature Profiles and Average Temperatures at 3,35 Hz

TEST C.

FREQUENCY 4.350HZ

CHARGE PRESSURE 0.703 BARS

PLOT ERROR 40.5K

SIMULATION AVG COMPR TEMP ○	225.426K
EXPERIMENTAL AVG COMPR TEMP	241.400K
SIMULATION AVG EXPAN TEMP △	305.115K
EXPERIMENTAL AVG EXPAN TEMP	341.700K

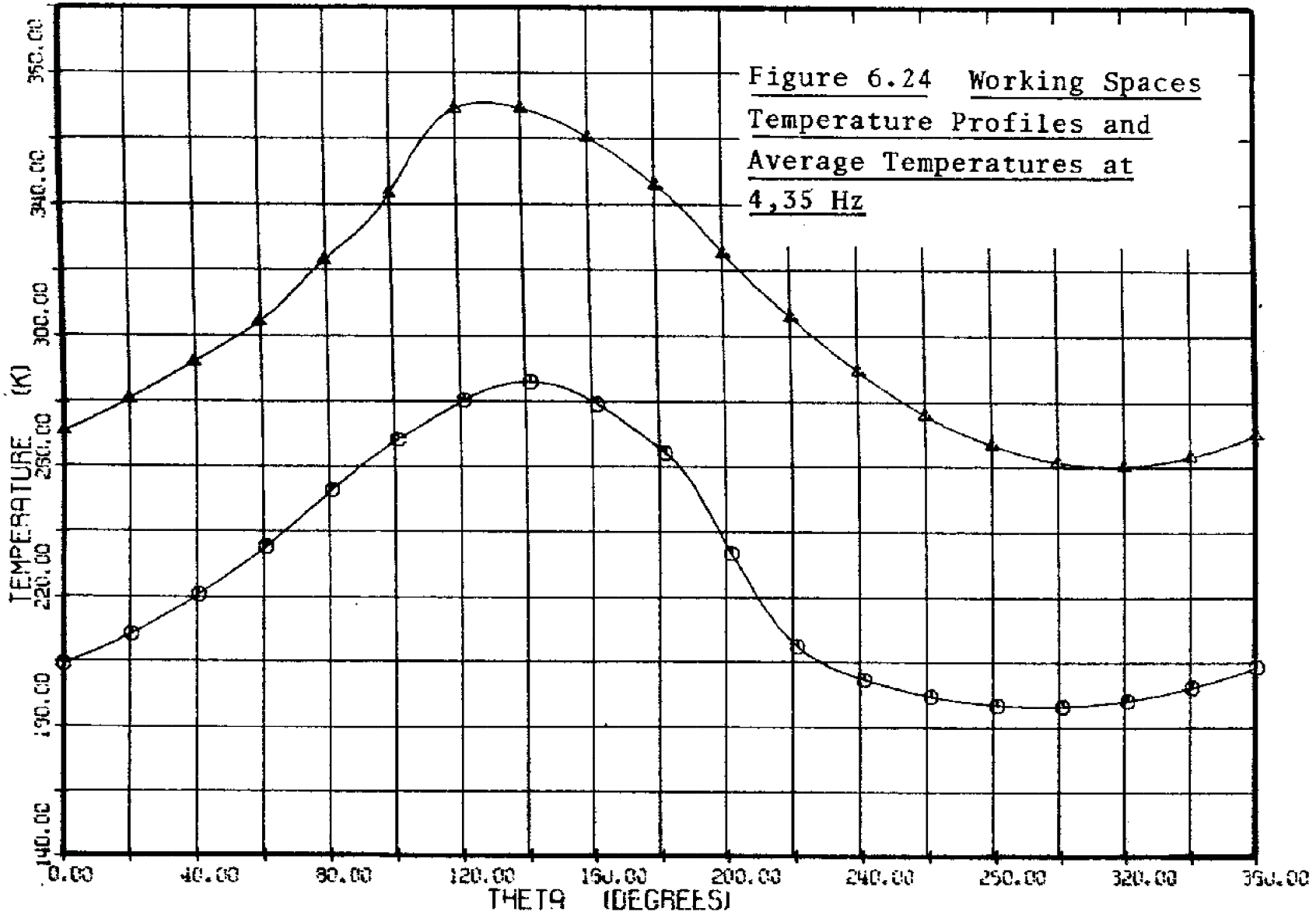


Figure 6.24 Working Spaces Temperature Profiles and Average Temperatures at 4,35 Hz

TEST 8

PLOT ERROR ±0,02BAR

FREQUENCY 4.35HZ

⊙ COMPRESSION SPACE

△ EXPANSION SPACE

CHARGE PRESSURE 0.703 BARS

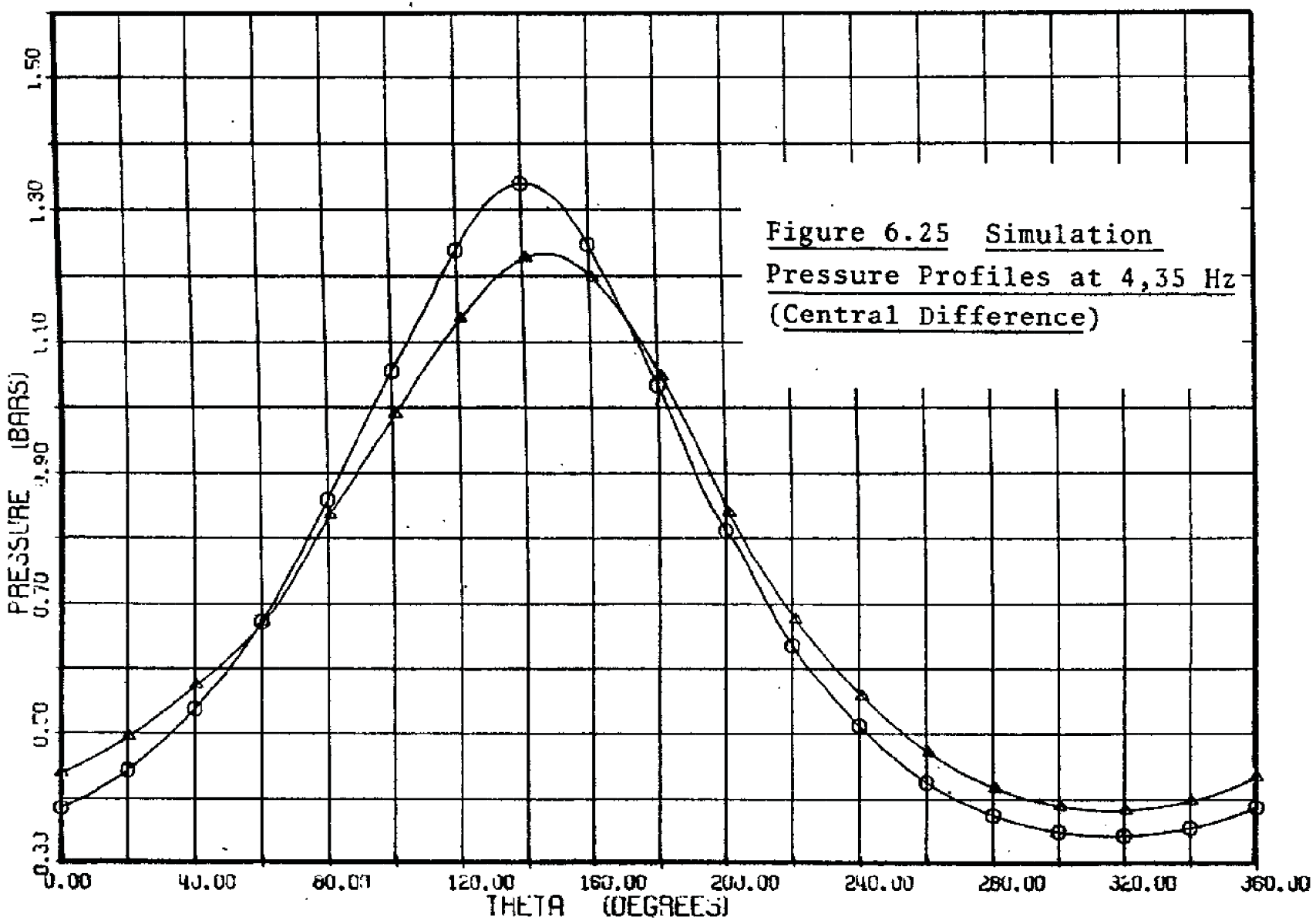


Figure 6.25 Simulation Pressure Profiles at 4,35 Hz (Central Difference)

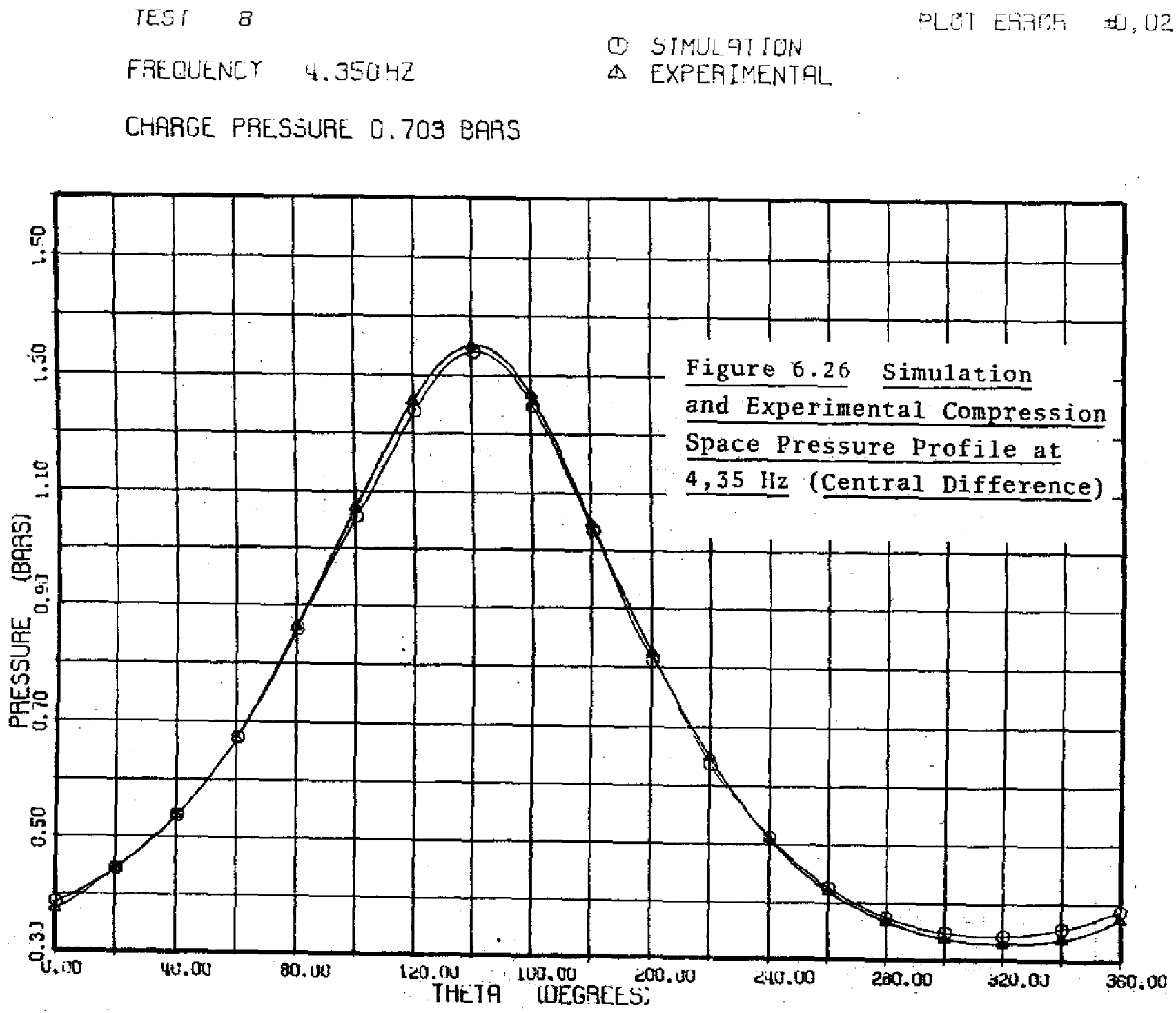


Figure 6.26 Simulation and Experimental Compression Space Pressure Profile at 4,35 Hz (Central Difference)

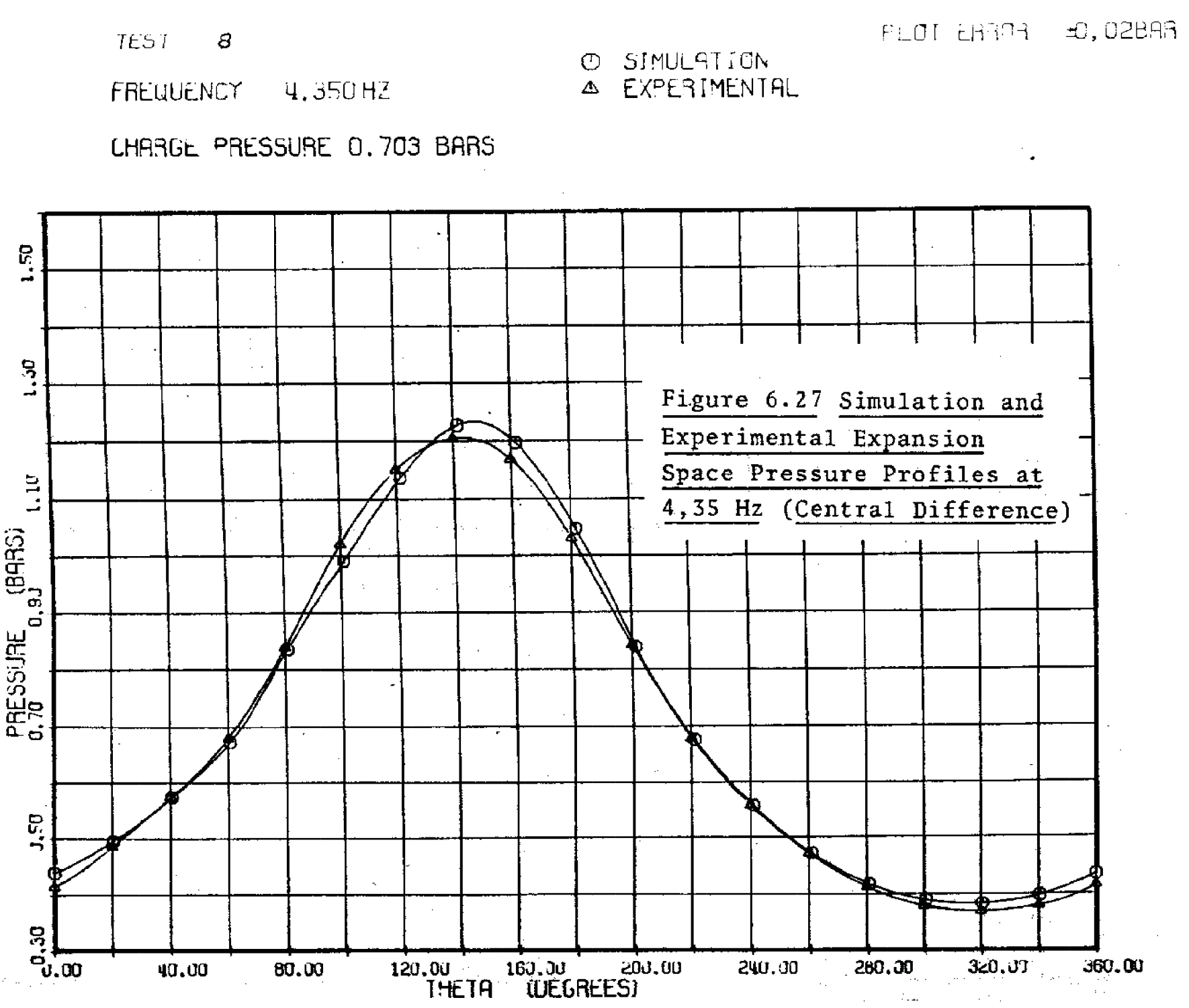


Figure 6.27 Simulation and Experimental Expansion Space Pressure Profiles at 4,35 Hz (Central Difference)

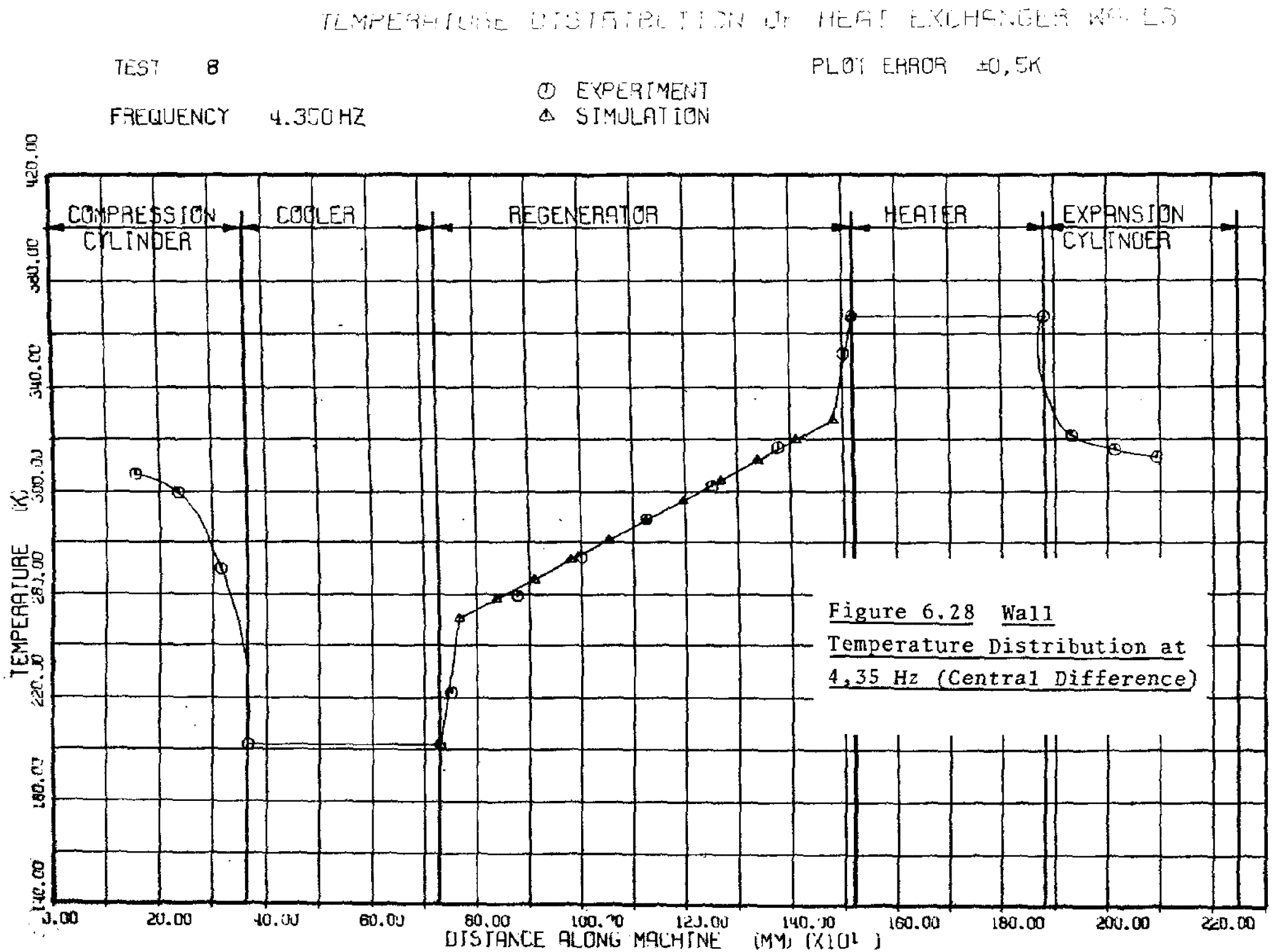


Figure 6.28 Wall Temperature Distribution at 4,35 Hz (Central Difference)

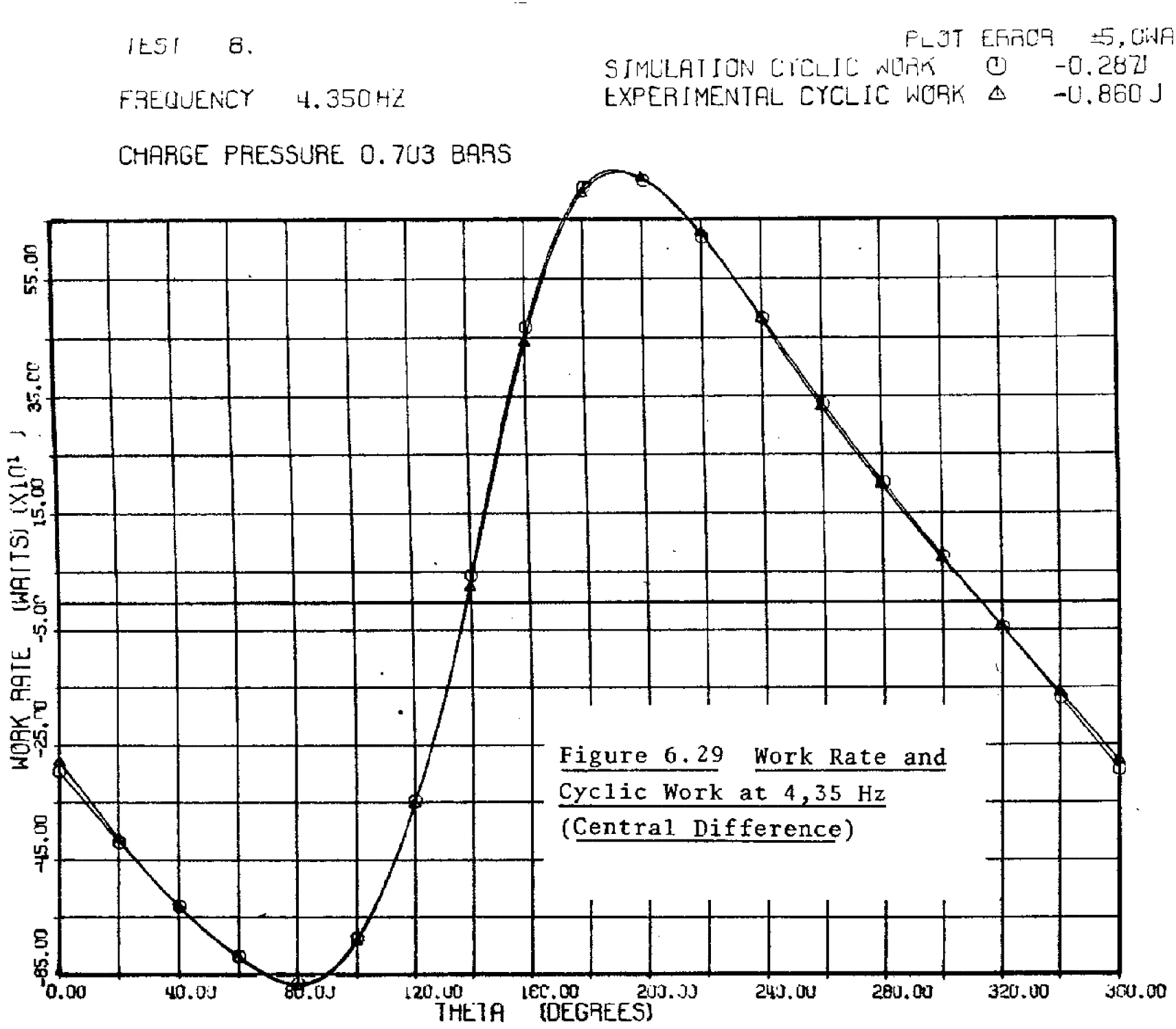


Figure 6.29 Work Rate and Cyclic Work at 4,35 Hz (Central Difference)

TEST 8.

FREQUENCY 4.350HZ

CHARGE PRESSURE 0.703 BARS

PLOT ERROR 5E,0WATTS

SIMULATION CYCLIC COOLING ⏱	-44.655 J
EXPERIMENTAL CYCLIC COOLING	-51.227 J
SIMULATION CYCLIC HEATING ⚠	42.605 J
EXPERIMENTAL CYCLIC HEATING	41.156 J

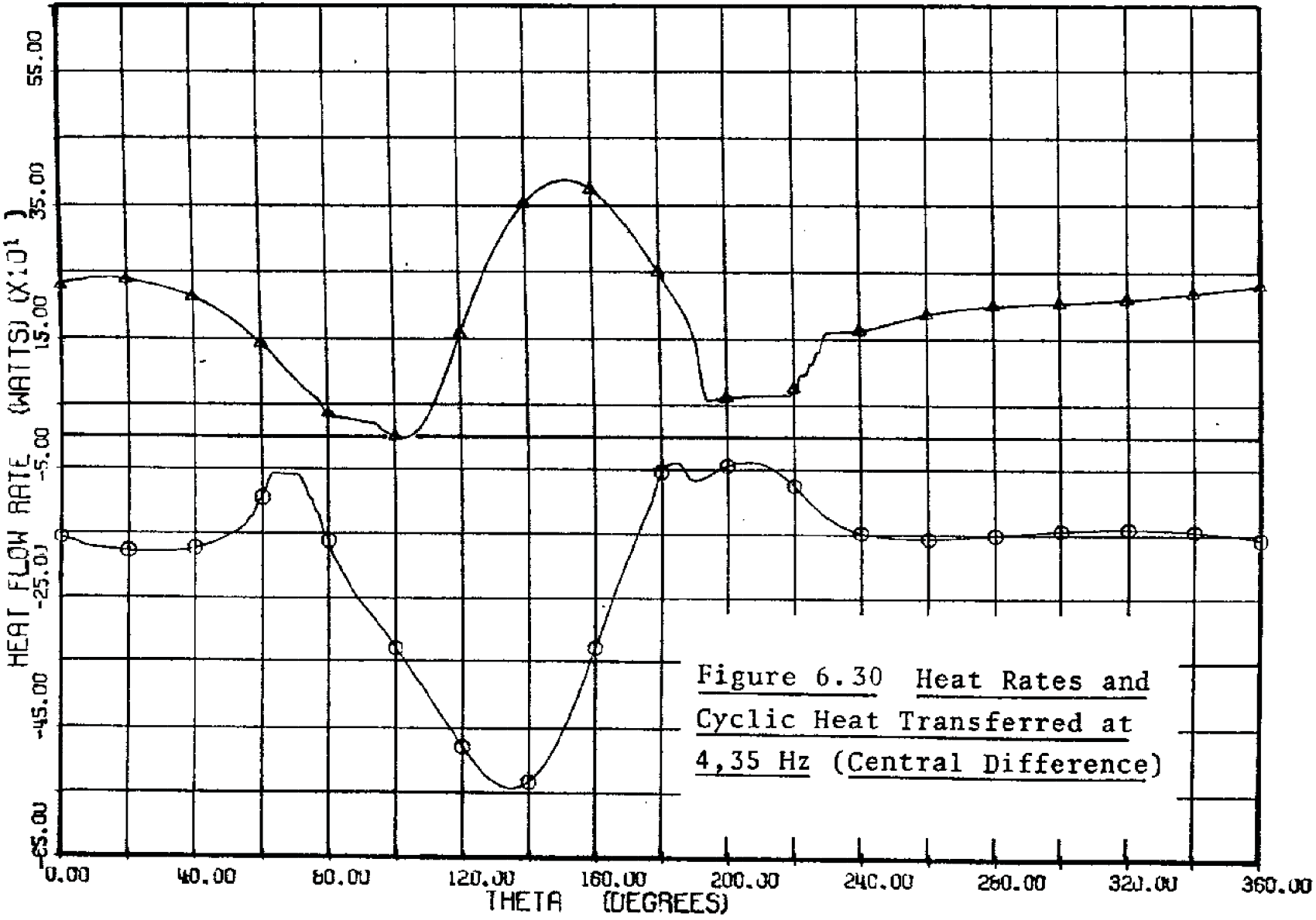


Figure 6.30 Heat Rates and Cyclic Heat Transferred at 4,35 Hz (Central Difference)