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MOVABLE-WALL COKE OVEN TESTS OF COAL SAMPLES SUBMITTED BY DOFASCO INC., HAMILTON, ONTARIO

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MOVABLE-WALL COKE OVEN TESTS OF COAL SAMPLES SUBMITTED BY DOFASCO INC., HAMILTON, ONTARIO INVESTIGATION NO. 27

by

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ABSTRACT

This investigation is No. 27 in the continuing program of coal evaluations for Dofasco Inc., Hamilton, Ontario by the Energy Research Laboratories.

The scope of the investigation comprises technical-scale carbonization tests relevant to the understanding of the quality of the coals under review.

The original Order No. T-39543-10 dated 21 April 1983 from the company specified the following mixes to be run:

Mix No. 124 25% Coal "E", 48% Coal "A"
20% Coal "J", 7% Coal "1A"

Mix No. 125 24.6% Coal "E", 47.3% Coal "A"
19.7% Coal "J", 6.9% Coal "1A"
1.5% Lime Sludge

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Ce rapport traite une evaluation sur le potential à la fabrication du coke de charbons tels que soumis par "DOFASCO INC."

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INTRODUCTION

The evaluation of coals for use at the coke plant at Dofasco Inc., Hamilton, Ontario is a continuing project whereby periodic investigations are carried out as requested by the company.

This report deals with Investigation No. 27 in the project series and includes evaluation data on coals as specified in Dofasco Purchase Order No. T-39543-10 dated 21 April 1983 and Amendment No. 1 dated 3 May 1983.

The data presented herein include the results of the carbonization tests in the CANMET movable-wall oven No. 12-71. The coke oven tests were conducted on May 28, June 3, 4, and 5, 1983.

Owing to the urgent need of the test results, pertinent data was verbally given to Dofasco during the course of the investigation.

DETAILS OF INVESTIGATION

Sample procurement for the test program was arranged by Dofasco.

The samples were crushed in the pilot-plant hammer mill to approximately 80% minus 1/8 in.

The following charges were carbonized in the movable-wall test oven, as specified in Dofasco Purchase Order No. T-39543-10 (the MW test oven numbers are given in parenthesis):

Mix No. 124 (MW Oven Test No. 985)
25% Coal "E", 48% Coal "A"
20% Coal "J", 7% Coal "1A"

Mix No. 125 (MW Oven Test Nos. 986, 987 and 988)
24.6% Coal "E", 47.3% Coal "A"
19.7% Coal "J", 6.9% Coal "1A"
1.5% Lime Sludge

At the request of the company only one test of Mix No. 124 was conducted and three tests of Mix No. 125 were conducted, as per Amendment No. 1, Purchase Order No. T-39543-10 dated 3 May 1983.

Coals for the coke oven charge were thoroughly mixed in a twin shell tumble blender. The prepared charges were air dried before carbonizing to a moisture level of 3%.

The prepared coal charges were carbonized in the CANMET 12-inch wide movable-wall coke oven and the cokes produced were evaluated by standard methods of testing*. The conditions of carbonization and the coke quality evaluations are given in Tables 1 and 2. The pressure developed during the coking cycles in the tests are shown graphically in Figs. 1 to 4, the values plotted are corrected for preload and thermal brick expansion.

*A schematic drawing, description and experimental procedure for the CANMET movable-wall coke oven are given in a previous Dofasco Investigation Report.

Table 1 - Carbonization conditions

Test Identification Number	985	986	987	988
Date of Test	83-04-28	83-05-03	83-06-04	83-05-10
Coke Oven Identification.....	12-71	12-71	12-71	12-71
Description.....	Mix No. 124	Mix No. 125	Mix No. 125	Mix No. 125
Charge Properties				
Proximate Analysis (db) Ash.....%				
Volatile Matter ....%				
Fixed Carbon.....%				
Moisture in Charge .....%	3.1	3.8	3.9	3.8
Minus 3.35 mm .....%	87.5	87.0	86.7	89.0
Other				
.....				
Carbonization Conditions				
Net Weight of Charge (wet).....kg	284.0	281.]	277.8	273.7
ASTM Cone Bulk Density (wet).....kg/m^3	817.0	793.0	801.0	793.0
Calc. Charge Dry Bulk Density in Oven... kg/m^3	866.7	852.3	841.1	828.2
Carbonization Results				
Gross Coking Time (at Push).....h:min	10:35	10:28	10:40	10:30
Final Centre Temp.....°C	1043	1035	1027	1055
Time to 900°C Centre Temp.....h:min	9:26	9:21	9:10	9:05
Time to 950°C Centre Temp.....h:min				
Time to 1000°C Centre Temp.....h:min				
Maximum Wall Pressure.....kPa	10.49	8.20	4.55	7.17
Coke Yield Actual .....%	74.8	74.5	73.8	74.8

Table 2 - Coke properties

Test Identification Number.....	985	986	987	988
Screen Analysis of Coke (cum. % retained on)				
100 mm sieve.....%	1.4	2.7	5.3	1.5
75 mm sieve.....%	23.4	22.7	23.3	17.7
50 mm sieve.....%	72.3	70.5	70.5	66.7
37.5 mm sieve.....%	87.8	86.9	87.3	84.9
25.0 mm sieve.....%	95.5	95.1	95.3	95.0
19.0 mm sieve.....%	96.5	96.3	96.4	96.3
12.5 mm sieve.....%	97.2	97.1	97.2	97.2
Total -12.5 mm (breeze).....%	2.8	2.9	2.8	2.8
Mean Coke Size.....mm	62.0	61.7	62.5	59.2
Coke Chemical Analysis				
Proximate Analysis (db)				
Ash.....%	7.3	7.7	7.6	7.6
Volatile Matter.....%	0.7	1.2	0.9	1.1
Fixed Carbon.....%	92.0	91.1	91.5	91.3
Sulphur (db).....%	0.67	0.69	0.70	0.69
Coke Apparent Specific Gravity.....	0.91	0.93	0.92	0.93
ASTM Coke Tumbler Test				
Stability Factor (cum. % + 25.0 mm).	58.1	55.5	57.8	58.0
Hardness Factor (cum. % + 6.3 mm).	65.6	65.3	66.7	67.6
JIS Coke Tumbler Test (cum. % retained on)				
30 revs: 50 mm sieve.....%	36.1	21.5	31.4	32.3
25 mm sieve.....%	90.7	87.9	90.4	89.4
15 mm sieve.....%	94.1	93.5	94.4	93.3
150 revs: 50 mm sieve.....%	12.5	6.9	10.8	6.7
25 mm sieve.....%	77.0	72.0	75.6	73.8
15 mm sieve.....%	83.4	82.1	82.5	82.4

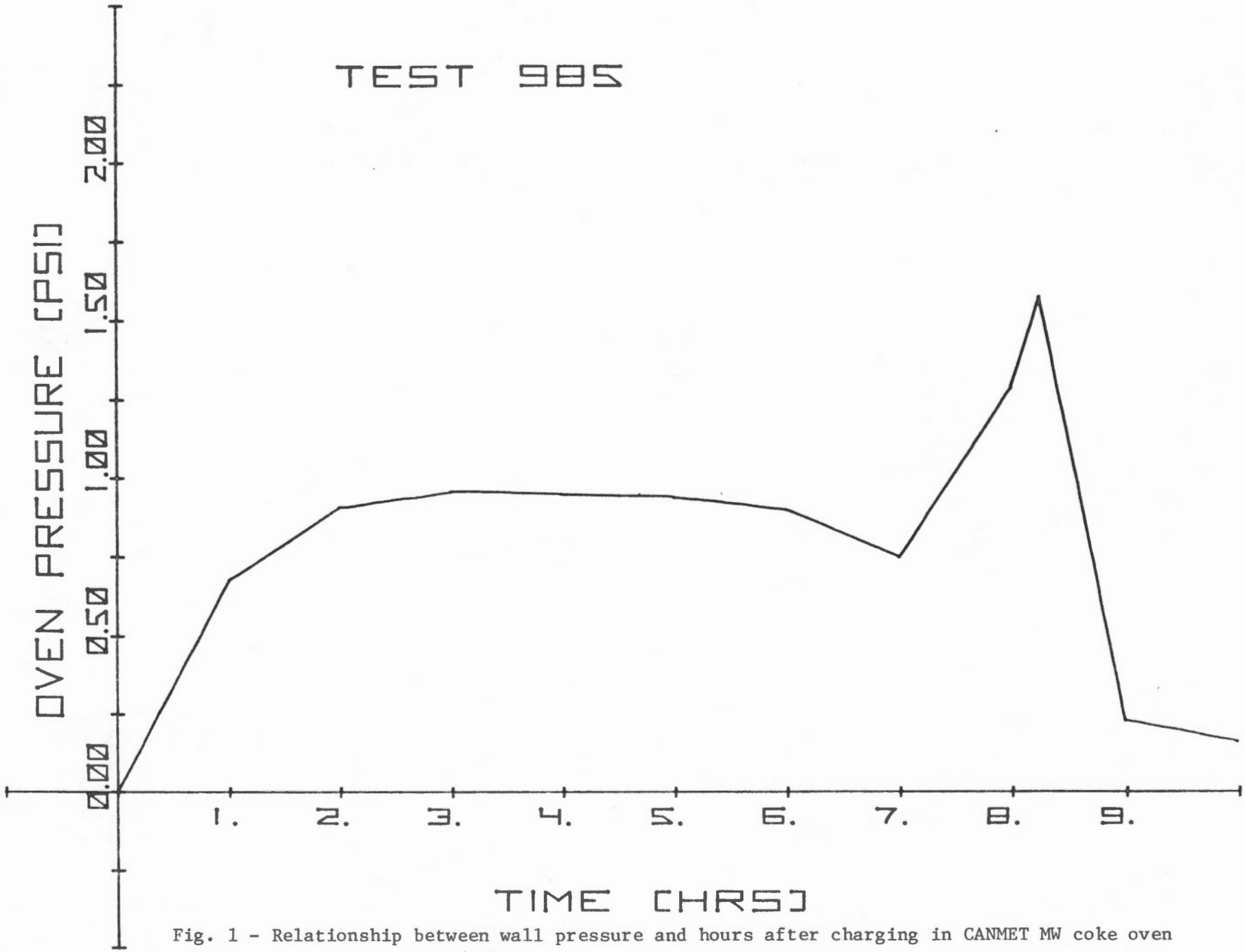

Fig. 1 - Relationship between wall pressure and hours after charging in CANMET MW coke oven (DOFASCO Mix No. 124, Test No. 985)

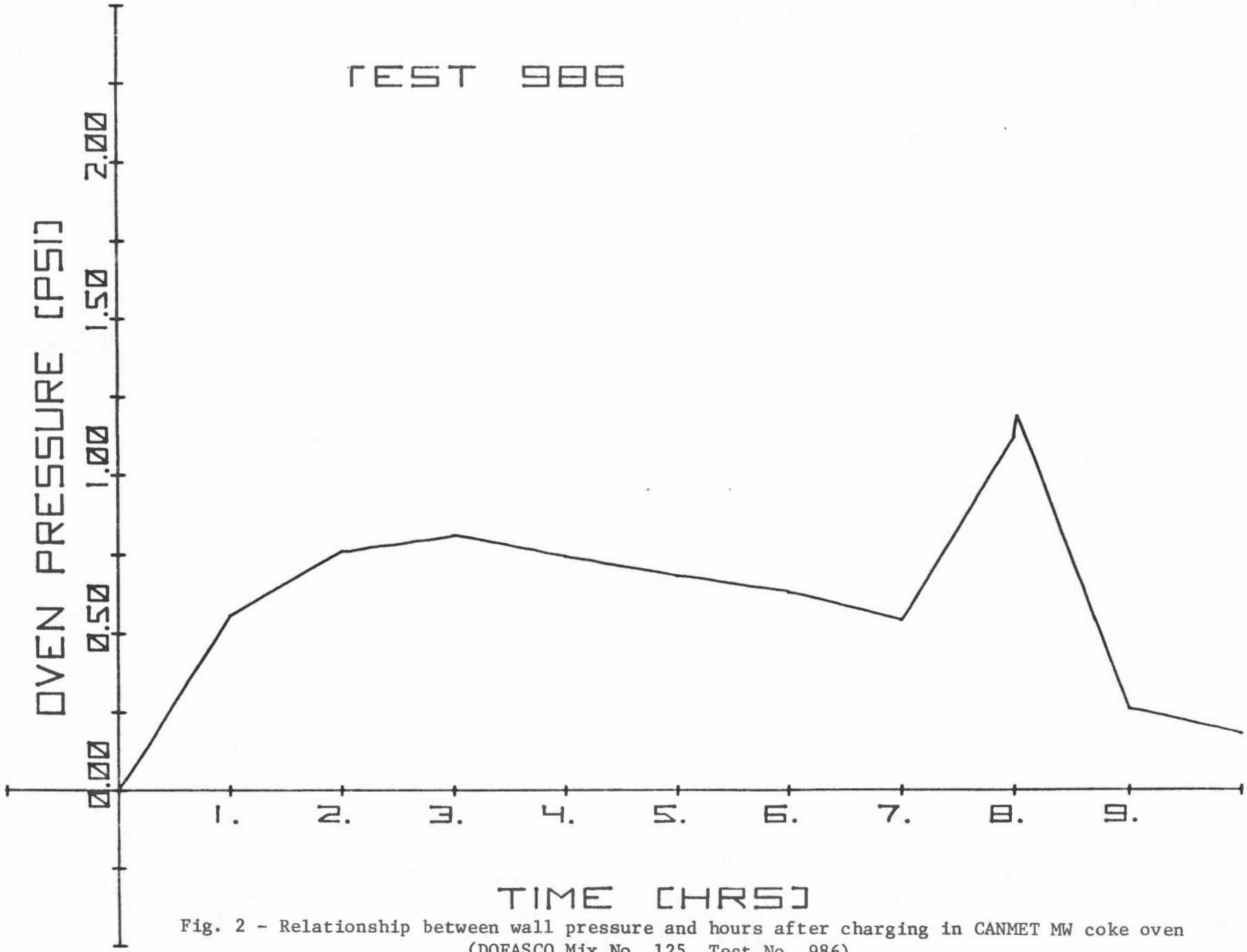

Fig. 2 - Relationship between wall pressure and hours after charging in CANMET MW coke oven (DOFASCO Mix No. 125, Test No. 986)

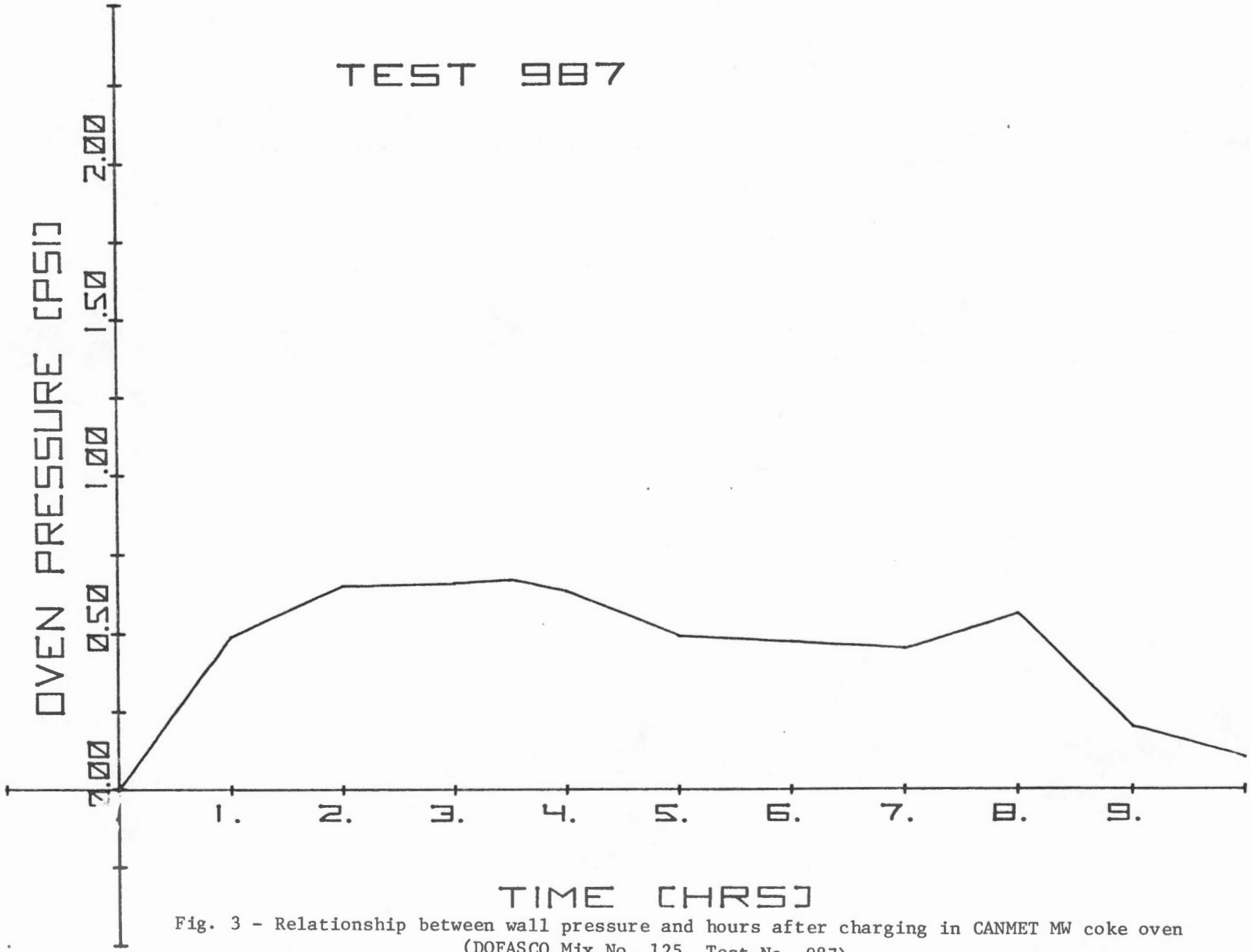

Fig. 3 - Relationship between wall pressure and hours after charging in CANMET MW coke oven (DOFASCO Mix No. 125, Test No. 987)

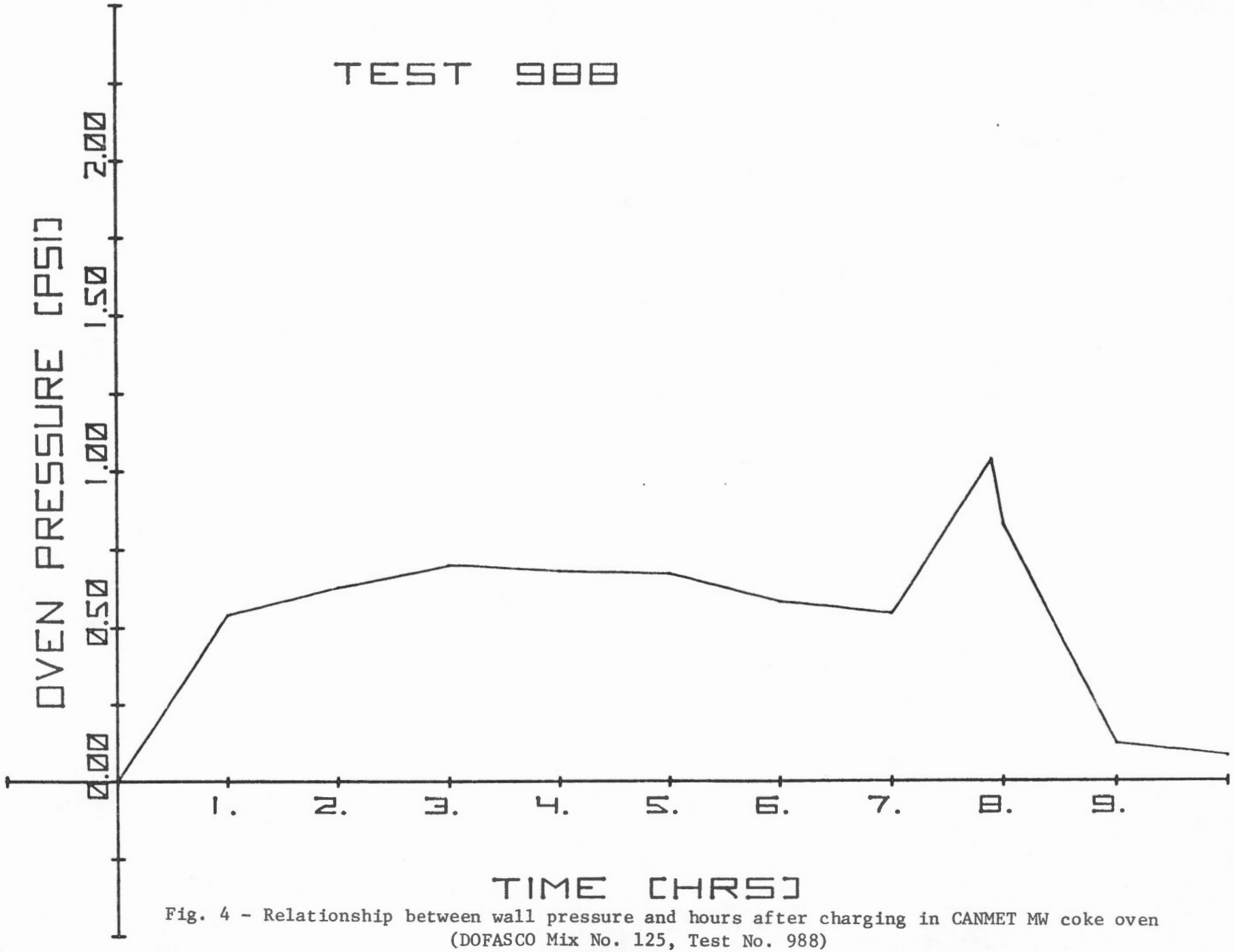

Fig. 4 - Relationship between wall pressure and hours after charging in CANMET MW coke oven (DOFASCO Mix No. 125, Test No. 988)

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