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DILATATIONAL VELOCITY, YOUNG'S MODULUS, POISSON'S RATIO AND UNIAXIAL COMPRESSIVE STRENGTH FOR ATK1 SAMPLES

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IDENTIFICATION OF SPECIMENS AND TESTS

Mechanical property tests have been carried out on of ten standard samples from ATK1. Table 1 provides information on the dimensions, density and location of the ten specimens.

Table 1. Dimensions and Density of Specimen

Specimen No.	Dimensions (mm)		Density
	Length	Diameter	(gm/cc)
ATK1 - 320.25	95.86	44.73	2.66
ATK1 - 361.40	95.99	44.81	2.65
ATK1 - 400.70	95.71	44.45	2.68
ATK1 - 433.50	96.42	44.81	2.65
ATK1 - 475.50	95.76	44.70	2.65
ATK1 - 630.40	95.78	45.09	2.65
ATK1 - 641.20	94.74	44.96	2.65
ATK1 - 715.20	95.78	44.63	2.66
ATK1 - 747.30	97.03	44.96	2.65
ATK1 - 788.30	95.45	44.53	2.66

The following mechanical properties have been determined for the specimens in Table 1.

1. Dilatational velocity as a function of axial load.
2. Young's modulus and Poisson's ratio.
3. Compressive strength.

DESCRIPTION OF TEST MEASUREMENTS

Refer to Technical Data 303410-M01/78. The two Philips PR 9302 Strain Bridges and the Mosley Autograph 2FRA X-Y recorder were replaced by two Bruel and Kjaer Type 1526 Strain Indicators and a Hewlett Packard 7046B X-Y recorder to measure and record the axial and transverse strain measurements.

DATA SUMMARY

Table 2 summarizes the uniaxial compressive strength, dilatational velocity and deformational properties established for the ten ATK1 specimens.

BASIC DATA

Figures 1 through 10 are the axial and circumferential stress-strain curves from which the elastic properties of the ten ATK1 specimens were determined. The final load value on the specimens was used to determine the uniaxial compressive strength.

Tables 3 through 12 provide the basic data and the calculated values of dilatational velocity with uniaxial loads over the range of 0 to 67.5KN for the ten specimens tested.

Table 2

Summary of Uniaxial Compressive Strength Dilatational Velocity and Deformational Property Data of Specimens

Specimen No.	Dimensions		Young's Modulus (GPa)	Poisson's Ratio	Compressive Strength (MPa)	Dilatational Velocity Vp (km/s)	Dynamic Young's Modulus (GPa)
	Length (mm)	Diameter (mm)					
ATK1 - 320.25	95.86	44.73	67.41	0.252	226	5.238	56.10
ATK1 - 361.40	95.99	44.81	72.34	0.212	231	5.685	76.06
ATK1 - 400.70	95.71	44.45	72.41	0.202	227	5.633	76.41
ATK1 - 433.50	96.42	44.81	69.65	0.253	226	5.448	65.11
ATK1 - 475.50	95.76	44.70	52.82	0.198	221	5.491	71.21
ATK1 - 630.40	95.78	45.09	56.89	0.204	170	4.650	51.23
ATK1 - 641.20	94.74	44.96	60.26	0.276	194	5.208	56.75
ATK1 - 715.20	95.78	44.63	75.65	0.263	202	5.929	75.97
ATK1 - 747.30	97.03	44.96	62.55	0.243	216	5.138	59.09
ATK1 - 788.30	95.45	44.53	58.30	0.260	193	4.896	51.98

Table 3. Sample No. ATK1 - 320.25

Velocity Measurements

Load (KN)	Osci. Reading (μsec)	tp (μsec)	Tp (μsec)	Vp (km/sec)
0	5 x 7.51	37.55	22.55	4.25
4.5	5 x 7.29	36.45	21.45	4.47
9.0	5 x 7.13	35.65	20.65	4.64
13.5	5 x 6.97	34.85	19.85	4.83
18.0	5 x 6.83	34.15	19.15	5.01
22.5	5 x 6.74	33.70	18.70	5.13
27.0	5 x 6.67	33.35	18.35	5.22
31.5	5 x 6.60	33.00	18.00	5.33
36.0	5 x 6.55	32.75	17.75	5.40
40.5	5 x 6.50	32.50	17.50	5.48
45.0	5 x 6.46	32.30	17.30	5.54
49.5	5 x 6.42	32.10	17.10	5.61
54.0	5 x 6.39	31.95	16.95	5.66
58.5	5 x 6.36	31.80	16.80	5.71
63.0	5 x 6.34	31.70	16.70	5.74
67.5	5 x 6.31	31.55	16.55	5.79

to = (5 x 3.00)μsec

= 15.00 μsec

Specimen Dimensions:

Length = 3.774 in (9.586 cm)

Diameter = 1.761 in (4.473 cm)

Weight = 0.882 lbs (400.50 gms)

Xsec'n Area = 2.436 in^2 (15.714 cm^2)

Volume = 9.913 in^3 (150.613 cm^3)

Table 4. Sample No. ATK1 - 361.40

Velocity Measurements

Load (KN)	Osci. Reading (μsec)	tp (μsec)	Tp (μsec)	Vp (km/sec)
0	5 x 6.73	33.65	18.65	5.15
4.5	5 x 6.66	33.30	18.30	5.25
9.0	5 x 6.62	33.10	18.10	5.30
13.5	5 x 6.55	32.75	17.75	5.41
18.0	5 x 6.51	32.55	17.55	5.47
22.5	5 x 6.45	32.25	17.25	5.56
27.0	5 x 6.40	32.00	17.00	5.65
31.5	5 x 6.35	31.80	16.80	5.71
36.0	5 x 6.33	31.65	16.65	5.77
40.5	5 x 6.28	31.40	16.40	5.85
45.0	5 x 6.26	31.30	16.30	5.89
49.5	5 x 6.24	31.20	16.20	5.93
54.0	5 x 6.22	31.10	16.10	5.96
58.5	5 x 6.21	31.05	16.05	5.98
63.0	5 x 6.19	30.95	15.95	6.02
67.5	5 x 6.17	30.85	15.85	6.06

to = (5 x 3.00)μsec

= 15.00 μsec

Specimen Dimensions:

Length = 3.775 in (2.599 cm)

Diameter = 1.764 in (4.481 cm)

Weight = 0.885 lbs (401.35 gms)

Xsec'n Area = 2.444 in^2 (15.767 cm^2)

Volume = 9.236 in^3 (151.350 cm^3)

Table 5. Sample No. ATK1 - 400.70

Velocity Measurements

Load (KN)	Osci. Reading (μsec)	tp (μsec)	Tp (μsec)	Vp (km/sec)
0	5 x 6.73	33.65	18.65	5.13
4.5	5 x 6.65	33.25	18.25	5.24
9.0	5 x 6.61	33.05	18.05	5.30
13.5	5 x 6.56	32.80	17.80	5.38
18.0	5 x 6.50	32.50	17.50	5.47
22.5	5 x 6.45	32.25	17.25	5.55
27.0	5 x 6.41	32.05	17.05	5.61
31.5	5 x 6.37	31.85	16.85	5.68
36.0	5 x 6.33	31.65	16.65	5.75
40.5	5 x 6.31	31.55	16.55	5.78
45.0	5 x 6.28	31.40	16.40	5.84
49.5	5 x 6.24	31.20	16.20	5.91
54.0	5 x 6.22	31.10	16.10	5.94
58.5	5 x 6.22	31.10	16.10	5.94
63.0	5 x 6.20	31.10	16.10	5.98

to = (5 x 3.00)μsec

= 15.00 μsec

Specimen Dimensions:

Length = 3.768 in (9.571 cm)

Diameter = 1.750 in (4.445 cm)

Weight = 0.878 lbs (398.47 gms)

Xsec'n Area = 2.405 in^2 (15.518 cm^2)

Volume = 9.062 in^3 (148.522 cm^3)

Table 6. Sample No. ATK1 - 433.50

Velocity Measurements

Load (KN)	Osci. Reading (μsec)	tp (μsec)	Tp (μsec)	Vp (km/sec)
0	5 x 6.96	34.80	19.80	4.87
4.5	5 x 6.91	34.55	19.55	4.93
9.0	5 x 6.86	34.30	19.30	5.00
13.5	5 x 6.78	33.90	18.90	5.10
18.0	5 x 6.71	33.50	18.50	5.20
22.5	5 x 6.65	33.25	18.25	5.28
27.0	5 x 6.52	32.95	17.95	5.37
31.5	5 x 6.53	32.65	17.65	5.46
36.0	5 x 6.48	32.40	17.40	5.54
40.5	5 x 6.65	32.25	17.25	5.59
45.0	5 x 6.40	32.00	17.00	5.67
49.5	5 x 6.37	31.85	16.85	5.72
54.0	5 x 6.33	31.65	16.65	5.79
58.5	5 x 6.30	31.50	16.50	5.84
63.0	5 x 6.28	31.40	16.40	5.88
67.5	5 x 6.26	31.30	16.30	5.92

to = (5 x 3.00)μsec

= 15.00 μsec

Specimen Dimensions:

Length = 3.796 in (9.642 cm)

Diameter = 1.764 in (4.481 cm)

Weight = 0.888 lbs (402.87 gms)

Xsec'n Area = 2.444 in^2 (15.767 cm^2)

Volume = 9.277 in^3 (152.03 cm^3)

Table 7. Sample No. ATK1 - 475.50

Velocity Measurements

Load (KN)	Osci. Reading (μsec)	tp (μsec)	Tp (μsec)	Vp (km/sec)
0	5 x 6.95	34.75	19.75	4.85
4.5	5 x 6.87	34.35	19.35	4.25
9.0	5 x 6.81	34.05	19.05	5.03
13.5	5 x 6.74	33.70	18.70	5.12
18.0	5 x 6.65	33.25	18.25	5.25
22.5	5 x 6.59	32.95	17.95	5.33
27.0	5 x 6.53	32.65	17.65	5.43
31.5	5 x 6.47	32.35	17.35	5.52
36.0	5 x 6.43	32.15	17.15	5.58
40.5	5 x 6.37	31.85	16.85	5.68
45.0	5 x 6.33	31.65	16.65	5.75
49.5	5 x 6.30	31.50	16.50	5.80
54.0	5 x 6.28	31.40	16.40	5.84
58.5	5 x 6.26	31.30	16.30	5.87
63.0	5 x 6.24	31.20	16.20	5.91
67.5	5 x 6.22	31.10	16.10	5.95

to = (5 x 3.00)μsec

= 15.00 μsec

Specimen Dimensions:

Length = 3.770 in (9.576 cm)

Diameter = 1.760 in (4.470 cm)

Weight = 0.878 lbs (398.47 gms)

Xsec'n Area = 2.433 in^2 (15.696 cm^2)

Volume = 9.172 in^3 (150.30 cm^3)

Table 8. Sample No. ATK1 - 630.40

Velocity Measurements

Load (KN)	Osci. Reading (μsec)	tp (μsec)	Tp (μsec)	Vp (km/sec)
0	5 x 8.10	40.50	25.50	3.76
4.5	5 x 7.99	39.95	24.95	3.84
9.0	5 x 7.81	39.05	24.09	3.98
13.5	5 x 7.63	38.15	23.15	4.14
18.0	5 x 7.44	37.20	22.20	4.31
22.5	5 x 7.30	36.50	21.50	4.45
27.0	5 x 7.19	35.95	20.95	4.57
31.5	5 x 7.09	35.45	20.45	4.68
36.0	5 x 6.97	34.85	19.85	4.83
40.5	5 c 6.91	34.55	19.55	4.90
45.0	5 x 6.83	34.15	19.15	5.00
49.5	5 x 6.78	33.90	18.90	5.07
54.0	5 x 6.74	33.70	18.70	5.12
58.5	5 x 6.70	33.50	18.50	5.18
63.0	5 x 6.64	33.20	18.20	5.26
67.5	5 x 6.61	33.05	18.05	5.31

to = (5 x 3.00)μsec

= 15.00 μsec

Specimen Dimensions:

Length = 3.771 in (9.578 cm)

Diameter = 1.775 in (4.509 cm)

Weight = 0.892 lbs (404.72 gms)

Xsec'n Area = 2.474 in^2 (15.964 cm^2)

Volume = 9.329 in^3 (152.90 cm^3)

Table 9. Sample No. ATK1 - 641.20

Velocity Measurements

Load (KN)	Osci. Reading (μsec)	tp (μsec)	Tp (μsec)	Vp (km/sec)
0	5 x 7.20	36.00	21.00	4.51
4.5	5 x 7.06	35.30	20.30	4.67
9.0	5 x 6.98	34.90	19.90	4.76
13.5	5 x 6.87	34.35	19.35	4.90
18.0	5 x 6.79	33.95	18.95	5.00
22.5	5 x 6.72	33.60	18.60	5.09
27.0	5 x 6.65	33.25	18.25	5.19
31.5	5 x 6.61	33.05	18.05	5.25
36.0	5 x 6.56	32.80	17.80	5.32
40.5	5 x 6.53	32.65	17.65	5.37
45.0	5 x 6.49	32.45	17.45	5.43
49.5	5 x 6.46	32.30	17.30	5.48
54.0	5 x 6.43	32.15	17.15	5.52
58.5	5 x 6.51	32.05	17.05	5.56
63.0	5 x 6.37	31.85	16.85	5.62
67.5	5 x 6.35	31.75	16.75	5.66

to = (5 x 3.00)μsec

= 15.00 μsec

Specimen Dimensions:

Length = 3.730 in (9.474 cm)

Diameter = 1.770 in (4.496 cm)

Weight = 0.879 lbs (398.58 gms)

Xsec'n Area = 2.461 in^2 (15.875 cm^2)

Volume = 9.180 in^3 (150.397 cm^3)

Table 10. Sample No. ATK1 - 715.20

Velocity Measurements

Load (KN)	Osci. Reading (μsec)	tp (μsec)	Tp (μsec)	Vp (km/sec)
0	5 x 6.37	31.85	16.85	5.68
4.5	5 x 6.33	31.65	16.65	5.75
9.0	5 x 6.32	31.60	16.60	5.77
13.5	5 x 6.29	31.45	16.45	5.82
18.0	5 x 6.26	31.30	16.30	5.88
22.5	5 x 6.25	31.25	16.25	5.89
27.0	5 x 6.24	31.29	16.20	5.91
31.5	5 x 6.23	31.15	16.15	5.93
36.0	5 x 6.22	31.10	16.10	5.95
40.5	5 x 6.21	31.05	16.05	5.97
45.0	5 x 6.19	30.95	15.95	6.01
49.5	5 x 6.18	30.90	15.90	6.02
54.0	5 x 6.17	30.85	15.85	6.04
58.5	5 x 6.16	30.80	15.80	6.06
63.0	5 x 6.15	30.75	15.75	6.08
67.5	5 x 6.14	30.70	15.70	6.10

to = (5 x 3.00)μsec

= 15.00 μsec

Specimen Dimensions:

Length = 3.771 in (9.578 cm)

Diameter = 1.757 in (4.463 cm)

Weight = 0.879 lbs (398.55 gms)

Xsec'n Area = 2.425 in^2 (15.642 cm^2)

Volume = 9.145 in^3 (149.822 cm^3)

Table 11. Sample No. ATK1 - 715.20
Velocity Measurements

Load (KN)	Osci. Reading (μsec)	tp (μsec)	Tp (μsec)	Vp (km/sec)
0	5 x 7.21	36.05	21.05	4.65
4.5	5 x 7.13	35.65	20.65	4.70
9.0	5 x 7.05	35.25	20.25	4.79
13.5	5 x 6.96	34.80	19.80	4.90
18.0	5 x 6.92	34.60	19.60	4.95
22.5	5 x 6.90	34.50	19.50	4.98
27.0	5 x 6.84	34.20	19.20	5.05
31.5	5 x 6.79	33.95	18.95	5.12
36.0	5 x 6.73	33.65	18.65	5.20
40.5	5 x 6.69	33.45	18.45	5.26
45.0	5 x 6.66	33.30	18.30	5.30
49.5	5 x 6.62	33.10	18.10	5.36
54.0	5 x 6.59	32.95	17.95	5.41
58.5	5 x 6.55	32.75	17.75	5.47
63.0	5 x 6.53	32.65	17.65	5.50
67.5	5 x 6.49	32.45	17.45	5.56

to = (5 x 3.00)μsec
= 15.00 μsec

Specimen Dimensions:
Length = 3.820 in (9.703 cm)
Diameter = 1.770 in (4.496 cm)
Weight = 0.501 lbs (408.58 gms)
Xsec'n Area = 2.461 in^2 (15.875 cm^2)
Volume = 9.401 in^3 (154.03 cm^3)

Table 12. Sample No. ATK1 - 715.20

Velocity Measurements

Load (KN)	Osci. Reading (μsec)	tp (μsec)	Tp (μsec)	Vp (km/sec)
0	5 x 7.54	37.70	22.70	4.20
4.5	5 x 7.41	37.05	22.05	4.33
9.0	5 x 7.29	36.45	21.45	4.45
13.5	5 x 7.18	35.90	20.90	4.57
18.0	5 x 7.08	35.40	20.40	4.68
22.50	5 x 7.00	35.00	20.00	4.77
27.0	5 x 6.94	34.70	19.70	4.85
31.5	5 x 6.88	34.40	19.40	4.92
36.0	5 x 6.81	34.05	19.05	5.01
40.5	5 x 6.77	33.85	18.85	5.06
45.0	5 x 6.73	33.65	18.65	5.12
49.5	5 x 6.69	33.45	18.45	5.17
54.0	5 x 6.64	33.20	18.20	5.24
58.5	5 x 6.61	33.05	18.05	5.29
63.0	5 x 6.59	32.95	17.95	5.32
67.5	5 x 6.56	32.80	17.80	5.36

to = (5 x 3.00)μsec

= 15.00 μsec

Specimen Dimensions:

Length = 3.750 in (9.545 cm)

Diameter = 1.753 in (4.453 cm)

Weight = 0.870 lbs (394.72 gms)

Xsec'n Area = 2.414 in^2 (15.571 cm^2)

Volume = 9.072 in^3 (148.63 cm^3)

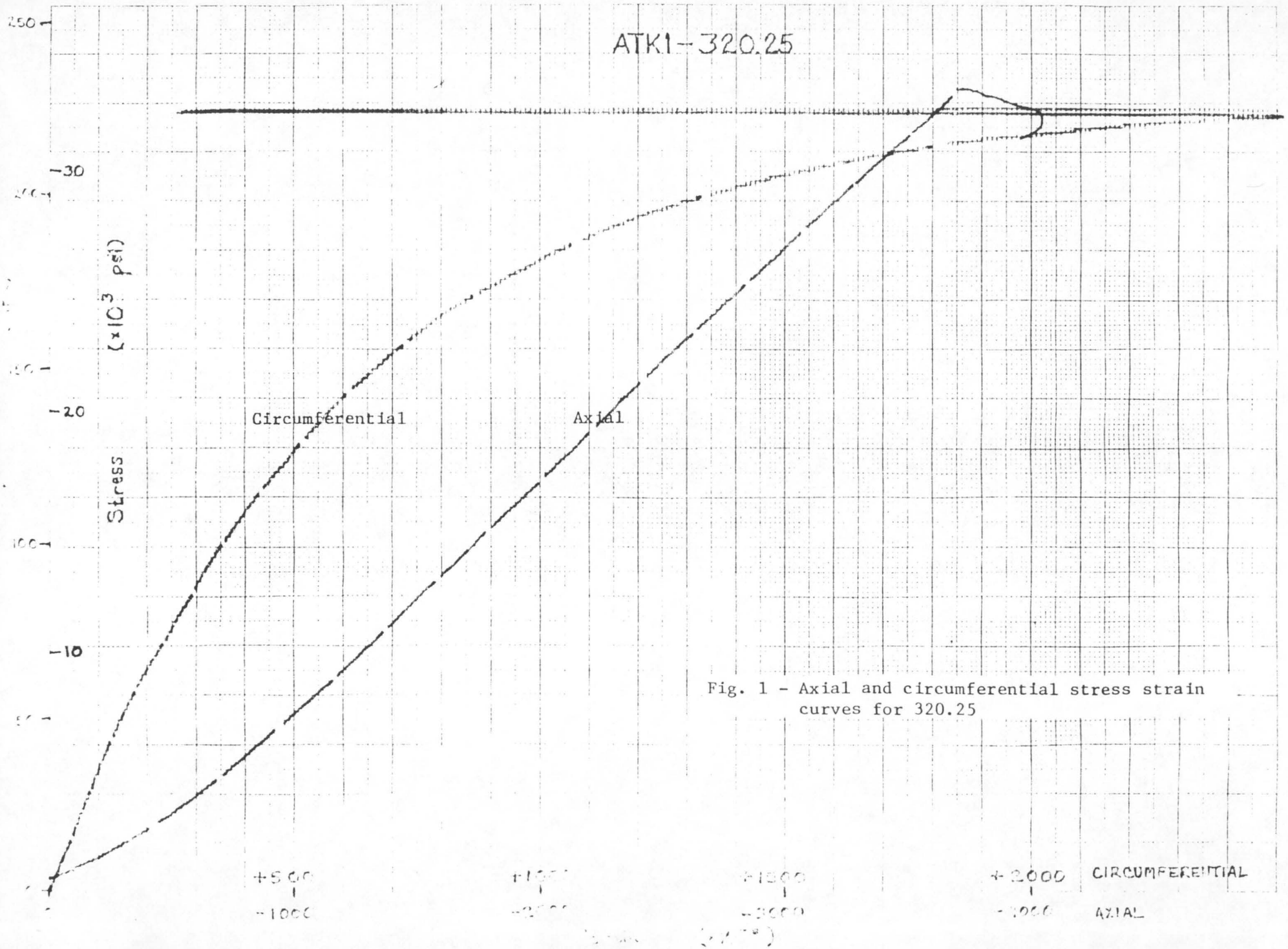

Fig. 1 - Axial and circumferential stress strain curves for 320.25

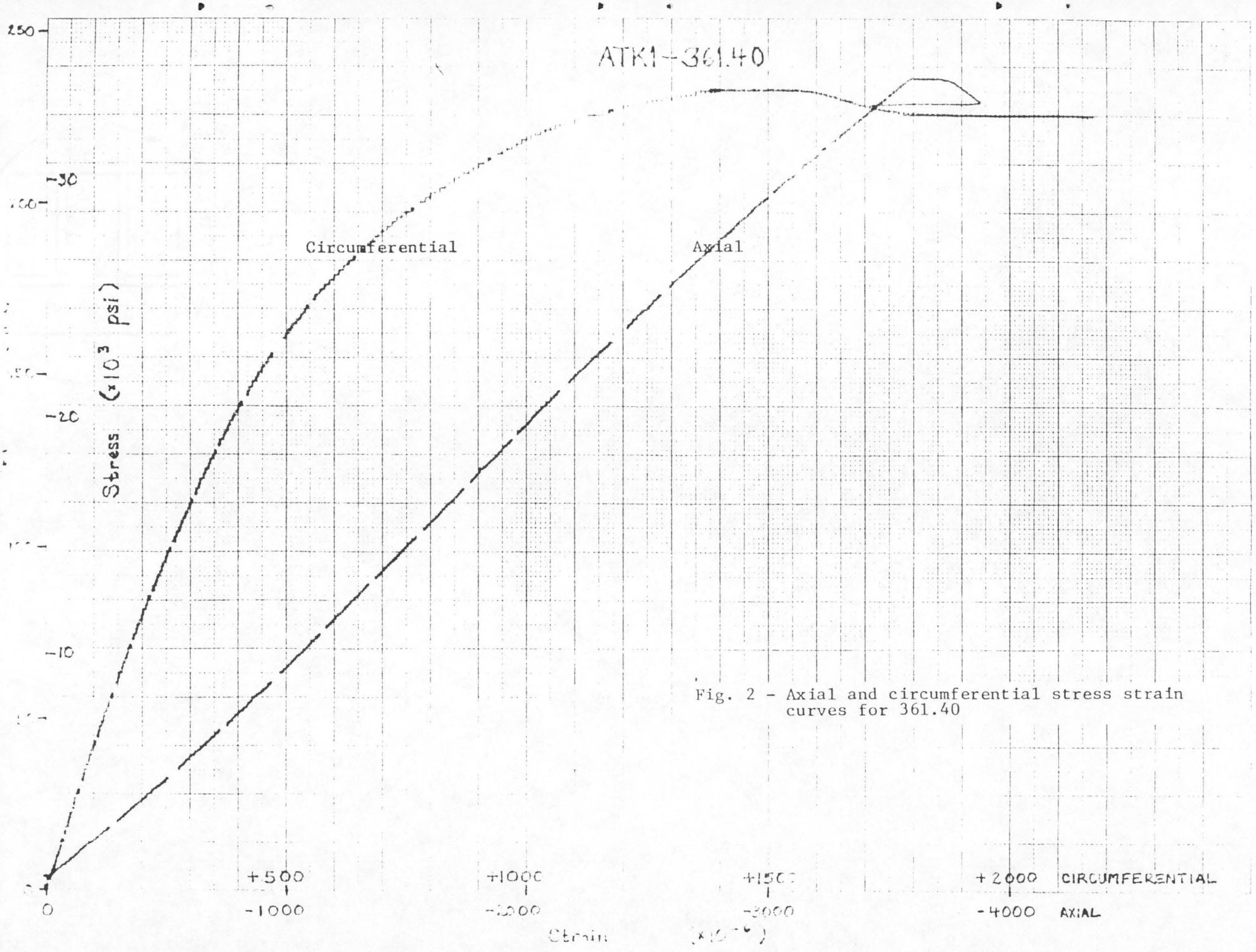

Fig. 2 - Axial and circumferential stress strain curves for 361.40

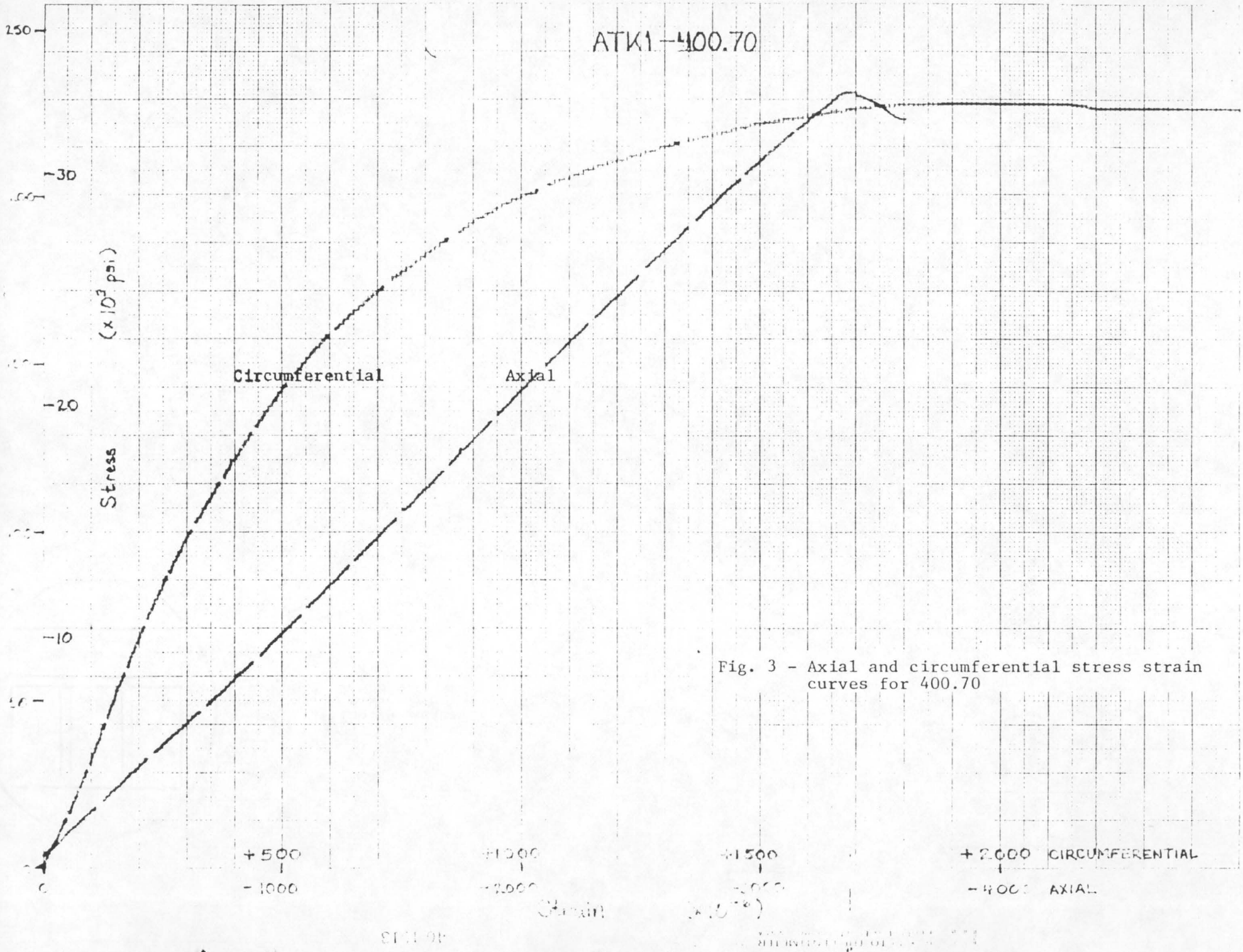

Fig. 3 - Axial and circumferential stress strain curves for 400.70

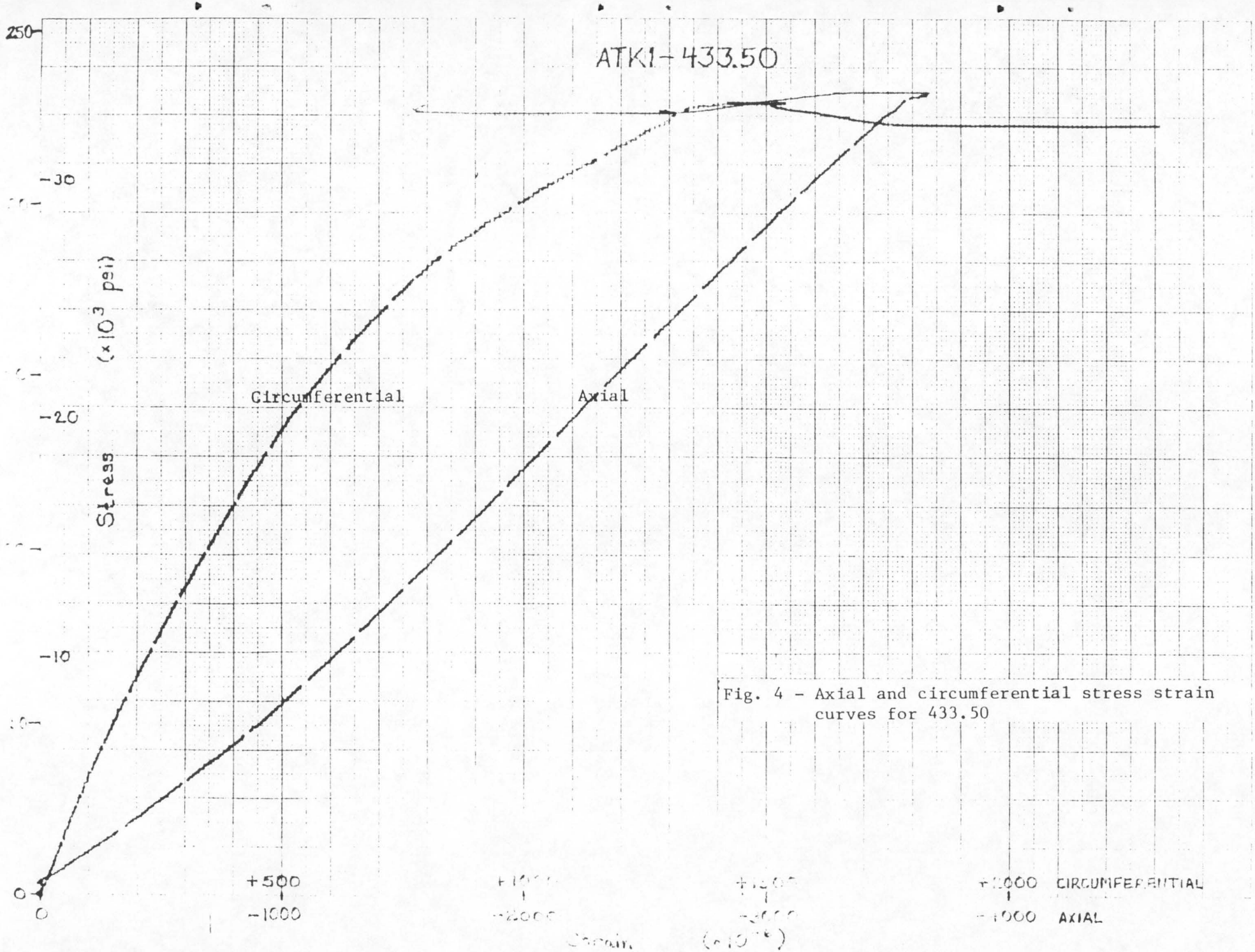

Fig. 4 - Axial and circumferential stress strain curves for 433.50

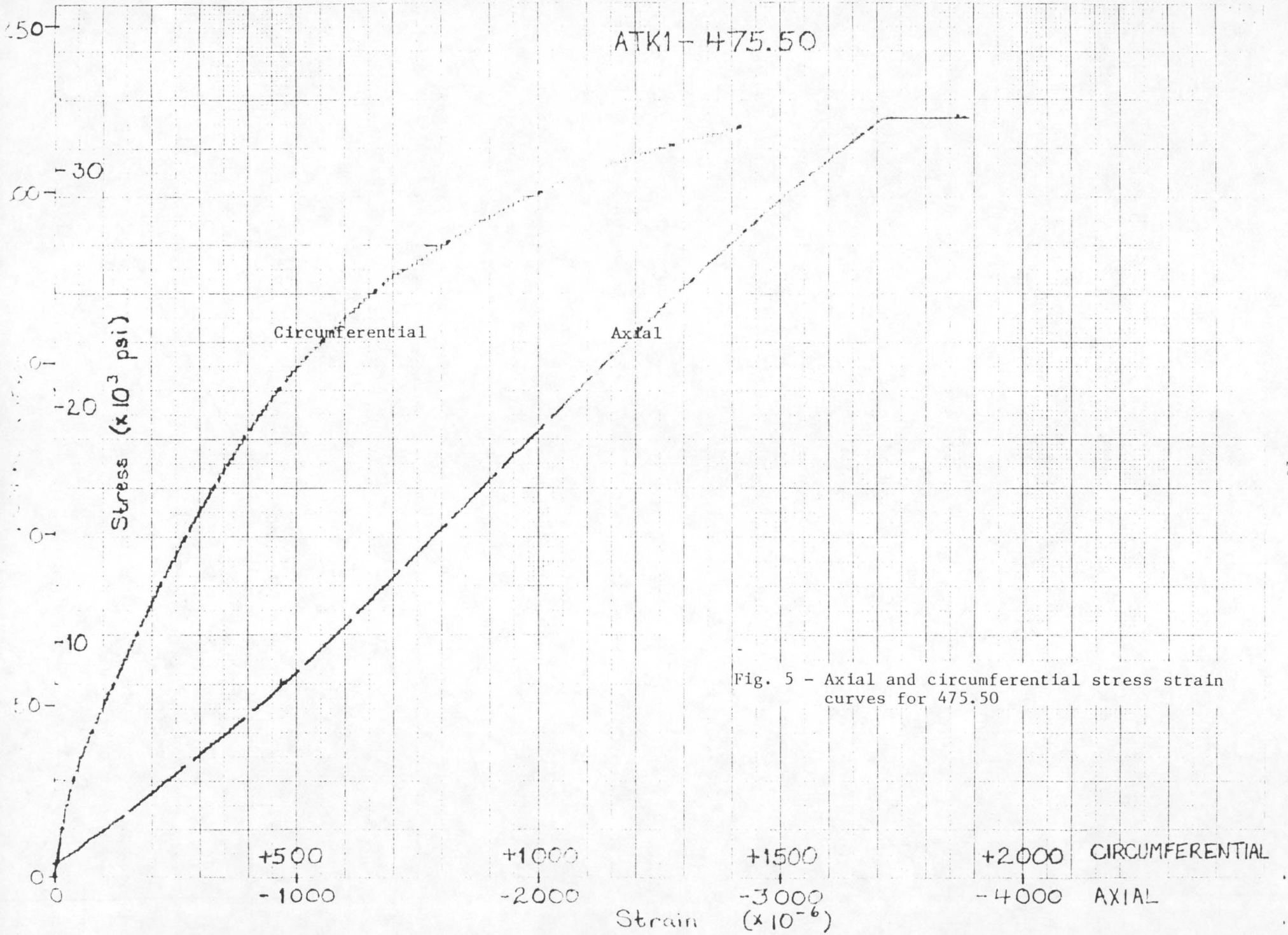

Fig. 5 - Axial and circumferential stress strain curves for 475.50

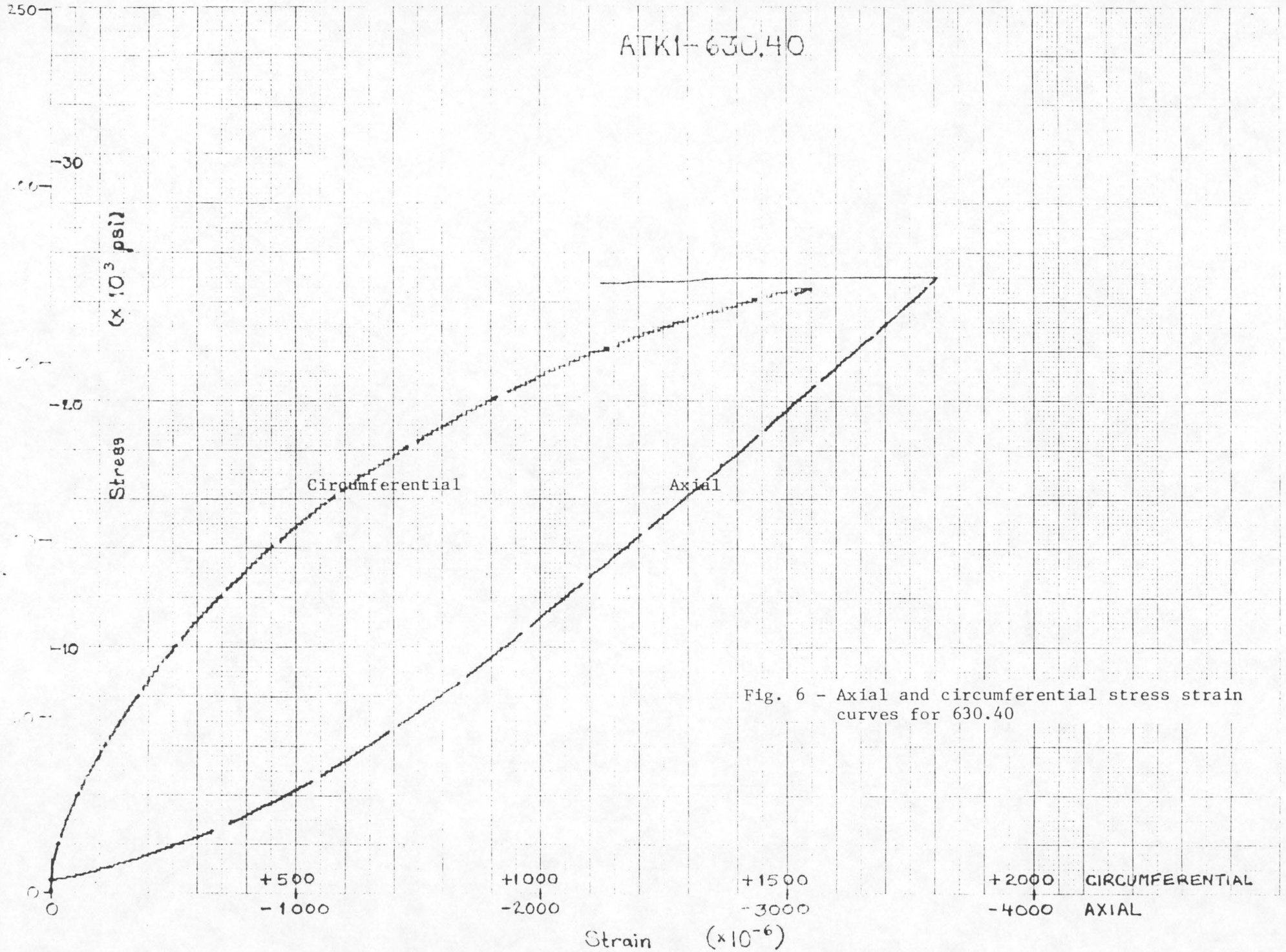

Fig. 6 - Axial and circumferential stress strain curves for 630.40

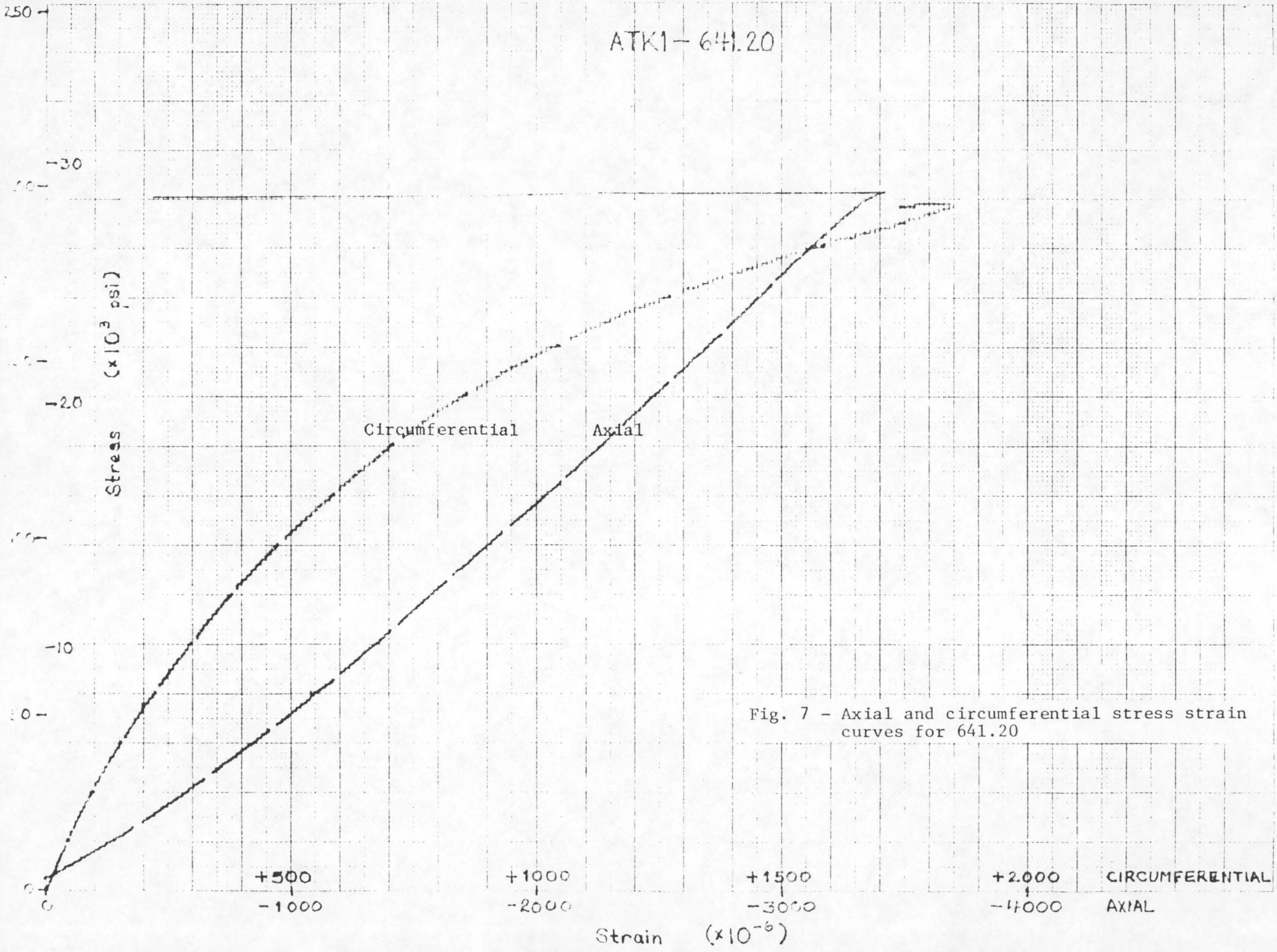

Fig. 7 - Axial and circumferential stress strain curves for 641.20

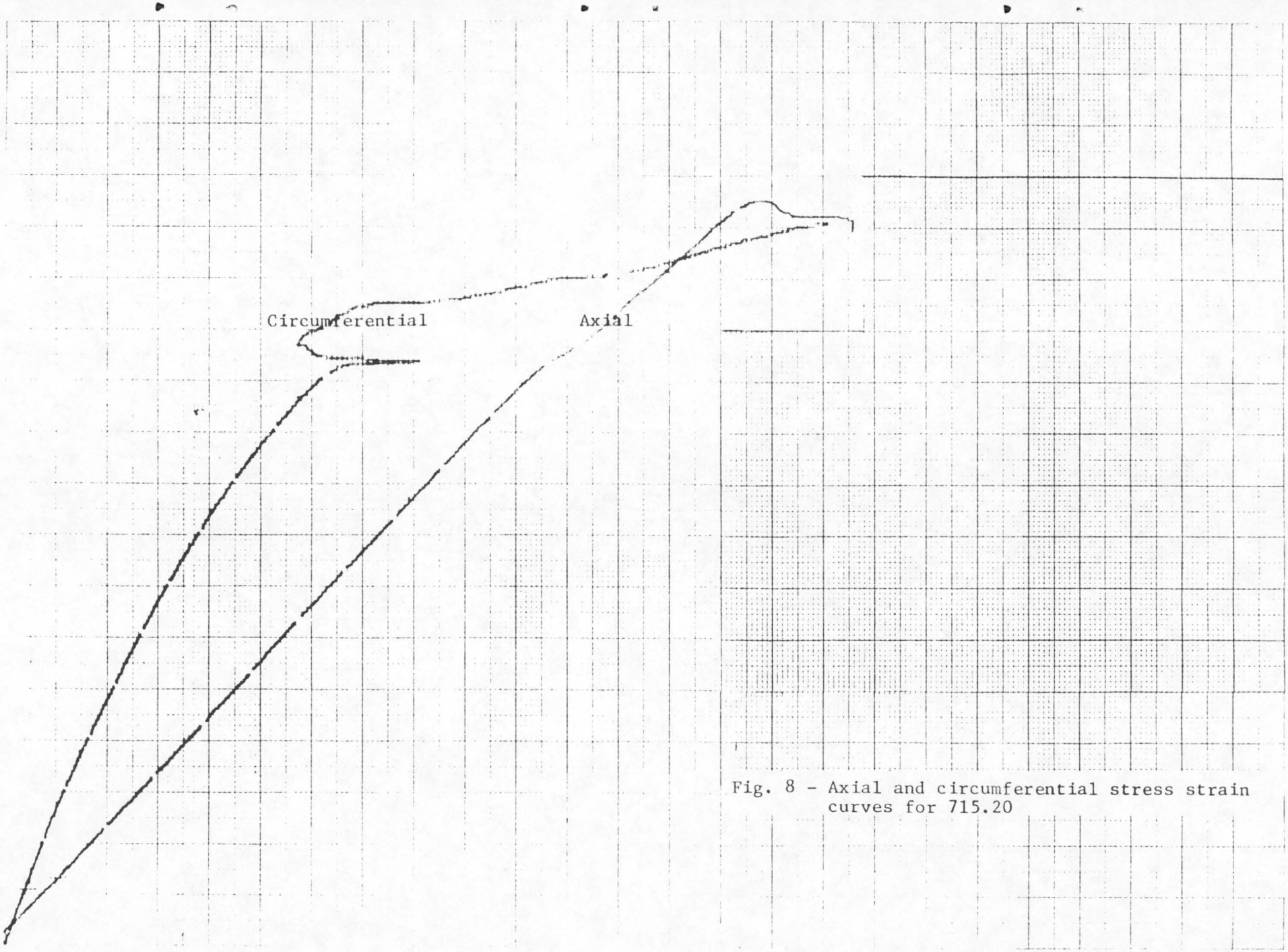

Fig. 8 - Axial and circumferential stress strain curves for 715.20

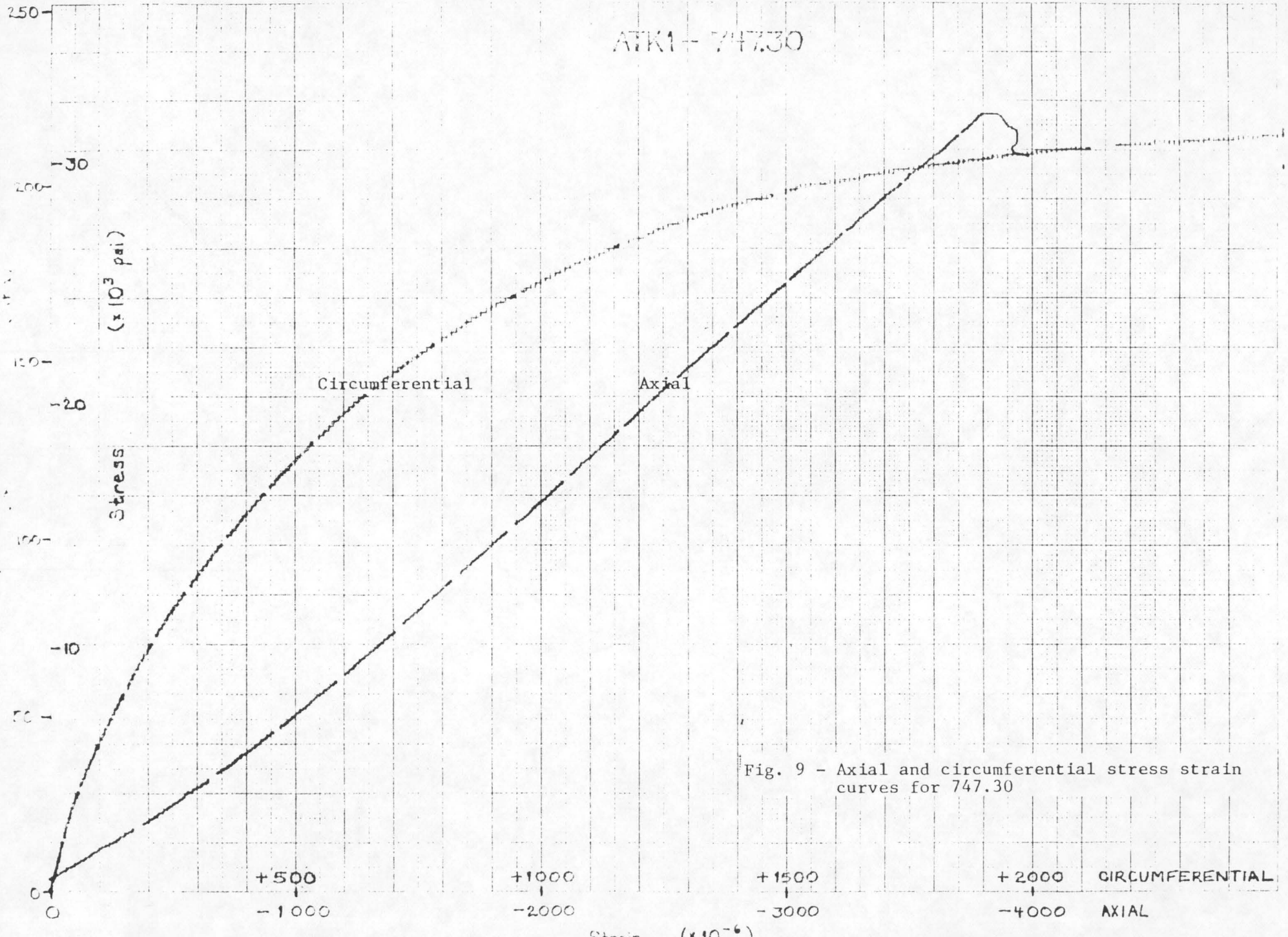

Fig. 9 - Axial and circumferential stress strain curves for 747.30

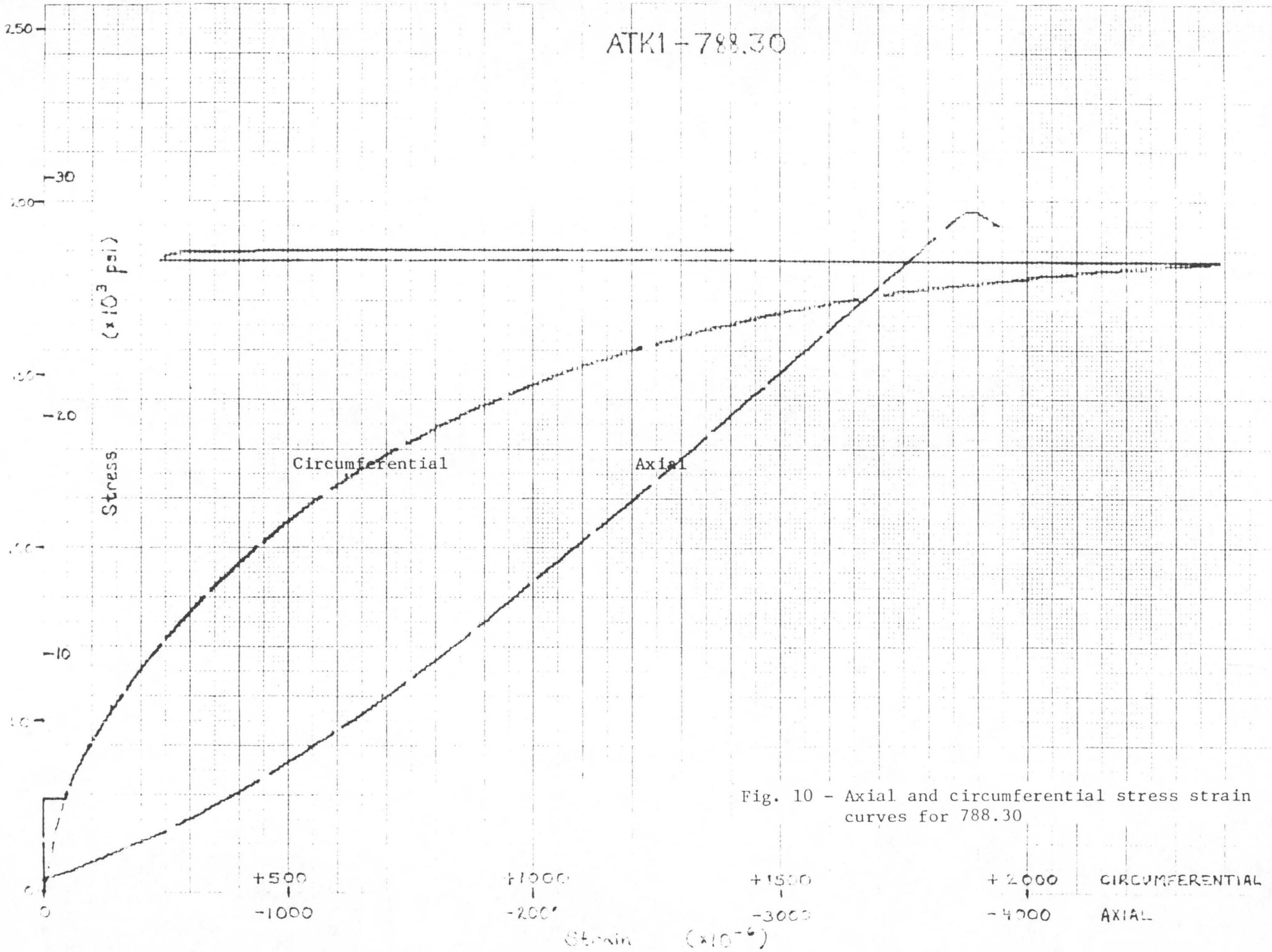

Fig. 10 - Axial and circumferential stress strain curves for 788.30