Defining Power Balance, Productivity And Efficiencies.

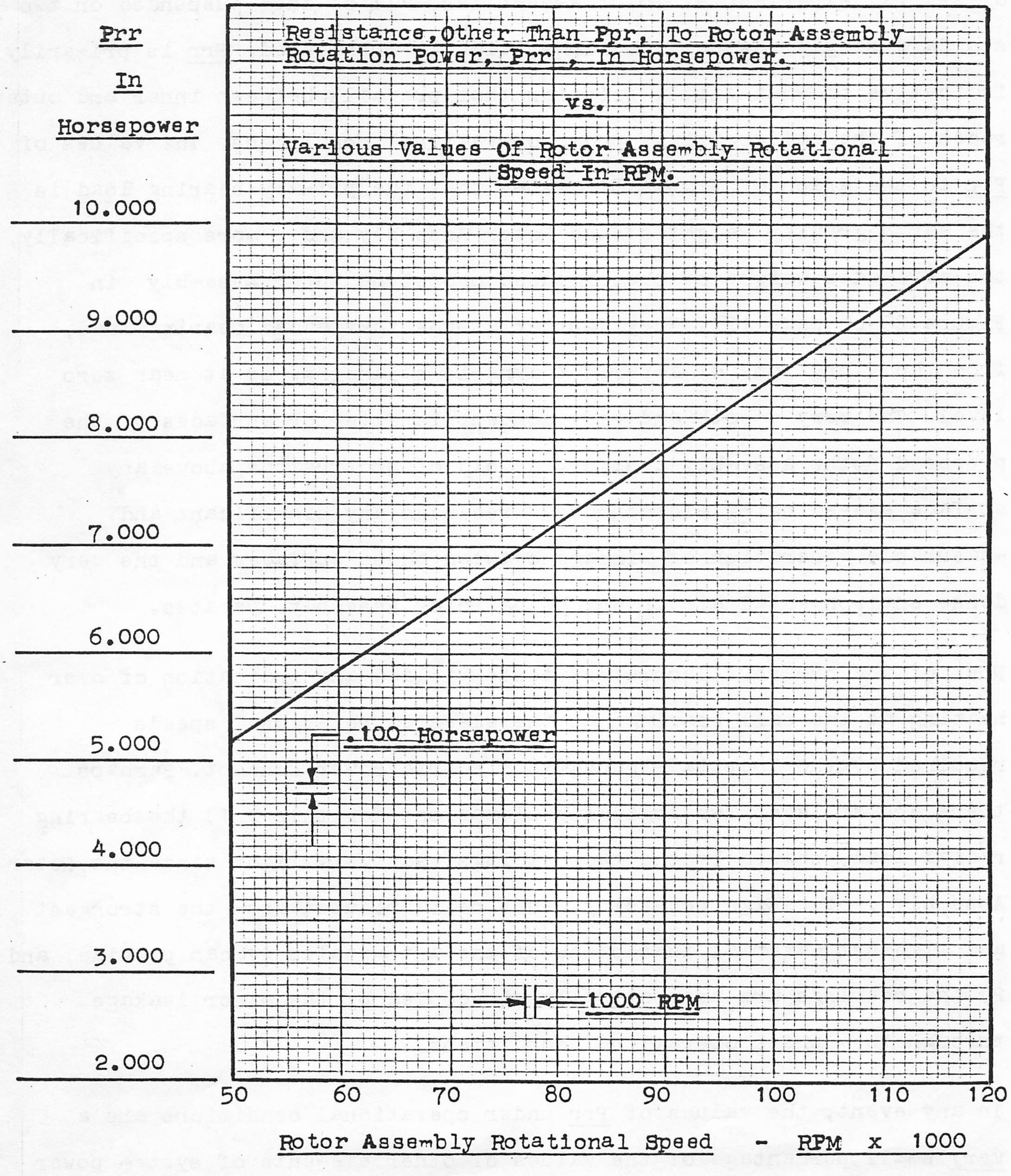
Chapter Three of this work offered an accurate and comprehensive analysis format for defining the precise value of fully developed inertial-pneumatic compression, under the probable maximum specified operational conditions that would apply to the proposed two-thruster prototype system, identified as pressure increase and differential Pi.

Chapter Four of this work offered an accurate and comprehensive analysis format for defining the precise value of fully developed rotational thrust power , converted from pneumatic pressure power Ppp, produced by the two Thrusters of the proposed Rotor Assembly, under the same specified maximum conditions, and identified it as Pt.

Chapter Five of this work offered an accurate and comprehensive format for defining the precise value of fully developed pneumatic flow rate through the system and its impact on other functions of the system. It also offered an equally accurate and comprehensive format for determining the precise value of the Spiral Factor, which is the measure of inertial-pneumatic compression efficiency. It also offered a format for combining formats so as to accurately define their impact on one another under specified operational conditions. It identified pneumatic flow rate as Rf , in pounds per second and in standard cubic feet per minute, SCFM. It identified the spiral factor as Sf and defined its insertion into the numerator of the compression equation. Finally, Chapter Five offered Figure 30 which provides the means to define the value of pneumatic pressure power Ppp.

Chapter Six, before offering the general analysis format that will effectively address its subject matter, offers Figure 31 as an effective reference for defining the value of resistance to Rotor rotation, Prr.

Figure 31


Resistance, Other Than Ppr, To Rotor Assembly Rotation Power, Prr , In Horsepower.
vs.
Various Values Of Rotor Assembly Rotational Speed In RPM.
Prr In Horsepower
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
.100 Horsepower
1000 RPM
50
60
70
80
90
100
110
120
Rotor Assembly Rotational Speed - RPM x 1000

The graph in Figure 31 on page 161 has been plotted from data aquired from extensive friction-measuring and reliability laboratory testing of several experimental Rotor Assemblies, all of them suspended on two standard single row ball bearings, lightly lubricated. Prr is primarily indicative of what little friction that prevails between inner and outer races of the ball bearings under operational conditions. The values of Prr in the graph of Figure 31 assume that the primary bearing load is the earth gravity weight of the Rotor Assembly and , more specifically, the estimated weight of the proposed prototype Rotor Assembly in Figure 25 on page 129. They further assume that added bearing load, from the vibrations of imperfect dynamic balancing, is at near zero level. The very smooth and very concentric exterior surfaces of the proposed Rotor Assembly design , devoid of protrusions above any surface exceeding 32 microinches, precludes any significant and measurable generation of windage between those surfaces and the very dense environmental air in which the Rotor Assembly operates.

None of the numerous laboratory tests yielded any indication of over heating at the ball bearings at the elevated rotational speeds required by the Inertial-Pneumatic Electric Power Concept. Perhaps there are at least two logical explanations for this , 1) the bearing radial load, shared by the two bearings, was very light since the Rotor Assembly , of design necessity, must be fabricated from the strongest and lightest material that state-of-the-art metallurgy can provide, and 2) the bearings are automatically air-cooled by the minor leakage through them under operational conditions.

In any event, the values of Prr under operational conditions are a very small percentage of the values of other elements of system power balance, Ppp , Pt , Ppr , Pgd (generator drive power), and Pep , the end product of the system ,Electric Power.

The over all analysis format , applied through out this Chapter Six, co-ordinates all of the formats introduced in previous chapters and the reference graphs, such as those in Figures 30 and 31,and is applied 24 times in order to define the 192 values required to plot the 14 graphs of Figures 32 through 45 that will appear on subsequent pages of this chapter. However, only one application of the format will appear on those pages in order to spare the reader the boredom of tedious and repetative solutions , numbering 1400 or more, required in the 24 applications of the format. However, that one application will suffice to clearly illustrate the accuracy and comprehensiveness of the format and its practicality in the definition of system power balance, productivity,and efficiencies in reference to the proposed prototype two-thruster system, with a Rotor Assembly as illustrated by Figure 25 on page 129.

The graphs of Figures 32 through 45 will plot values of Pressure Increase and Differential Pi , Pneumatic Flow Rate Rf , Pneumatic Pressure Power Ppp , Thrust Power Pt , Particle Replacement Power Ppr, Resistance to Rotor Rotation Power Prr , Generator Drive Power Pgd, and Electric Power Pep against various values of Rotor Rotational Rate N, from a minimum 50,000 RPM to a maximum 120,000 RPM and against three different levels of Rotor Assembly Environmental Pressure Ep , 1000, 1500 and 2000 psig. The curves of the graphs in Figures 32 through 39 are combined in the power balance graphs of Figures 40 through 42 and in the efficiencies graphs of Figures 43 through 45.

The one application of the format that will appear on subsequent pages solves for values when N equals 100,000 RPM and Ep equals 2000 Psig.

The solutions for the initial value of Pi become:

N = 100,000 RPM , Ep = 2000 psig @ 52°F. controlled temperature.

Ep's and Pneumatic Mass's uniform density for the First Effect = .0061537 pound per cubic inch, lb /cu in.

Pneumatic Mass standard air volume = 146.868 cubic inches.

Pneumatic Mass earth gravity weight W for First Effect = 146.868 x .0061537 = .904 pound.

The radius r from axial centerline of rotation to Mass center of gravity for First Effect = radius to Mass center of standard air volume = 1.174 inches.

The Spiral Factor Sf will have a value of one for the First and all subsequent effects , reflecting an Rf value of zero pounds per second.

The area A of the Mass's exterior surface = 215.985 square inches, and will remain constant for all effects.

The solution for first effect value of Pi becomes:

$$Pi = .000028416 \times 1 \times \frac{.904 \times 1.174}{215.985} \times 100{,}000 \times 100{,}000$$

$$= 1396 \text{ psig}$$

The solution for 2nd effect value of W becomes:

$$D\ min = \frac{2000 + 14.7}{14.7} \times .0000449 = .0061537 \text{ lb /cu in}$$

$$D\ max = \frac{3396 + 14.7}{14.7} \times .0000449 = .0104177 \text{ lb /cu in}$$

$$D\ avg = \frac{.0061537 + .0104177}{2} = .0082857 \text{ lb /cu in}$$

2nd effect W = 146.868 x .0082857 = 1.217 lbs W/2 = .6085 lb

The solution for 2nd effect value of r becomes:

$$D\ avg\ inner\ half = \frac{.0061537 + .0082857}{2} = .0072197 \text{ lb /cu in}$$

Volume inner half = .6085 / .0072197 = 84.283 cu in

2nd effect r $= \sqrt{\frac{84.283 + 21.868}{69.115}} = \sqrt{1.536} =$ 1.239 inches

---

The solution for 2nd effect value of Pi becomes:

Pi $= .000028416 \times 1 \times \frac{1.217 \times 1.239}{215.985} \times 100{,}000 \times 100{,}000$

= 1984 psig.

The solution for 3rd effect W becomes:

D max $= \frac{3984 + 14.7}{14.7} \times .0000449 = .0122137$ lb /cu in

D avg = (.0061537 + .0122137)/ 2 = .0091837 lb /cu in

3rd effect W = 146.868 x .0091837 = 1.349 lbs   W/2 = .6745 lb.

The solution for 3rd effect r becomes:

Davg inner half = (.0061537 + .0091837) / 2 = .0076687 lb /cu in

Volume inner half = .6745 / .0076687 = 87.955 cu in

3rd effect r $= \sqrt{\frac{87.955 + 21.868}{69.115}} = \sqrt{1.589} =$ 1.261 inches

---

The solution for 3rd effect value of Pi becomes:

Pi $= .000028416 \times 1 \times \frac{1.349 \times 1.261}{215.985} \times 100{,}000 \times 100{,}000$

= 2238 psig

The solution for 4th effect W becomes:

D max $= \frac{4238 + 14.7}{14.7} \times .0000449 = .0129895$ lb /cu in

D avg = (.0061537 + .0129895) / 2 = .0095716 lb /cu in

4th effect W = 146.868 x .0095716 = 1.406 lbs   W/2 = .703 lb

---

The solution for 4th effect r becomes:

D avg inner half $= (.0061537 + .0095716) / 2 = .0078626$ lb /cu in

Volume inner half $= .703 / .0078626 = 89.411$ cu in

4th effect r $= \sqrt{\frac{89.411 + 21.868}{69.115}} = \sqrt{1.610} = 1.269$ inches

The solution for 4th effect Pi becomes:

$$Pi = .000028416 \times 1 \times \frac{1.406 \times 1.269}{215.985} \times 100{,}000 \times 100{,}000$$

$= 2347$ psig

The solution for 5th effect W becomes:

D max $= \frac{4347 + 14.7}{14.7} \times .0000449 = .0133224$ lb /cu in

D avg $= (.0061537 + .0133224) / 2 = .0097380$ lb /cu in

5th effect W $= 146.868 \times .0097380 = 1.430$ lbs $W/2 = .715$ lb

The solution for 5th effect r becomes:

D avg inner half $= (.0061537 + .0097380) / 2 = .0079458$ lb /cu in

Volume inner half $= .715 / .0079458 = 89.985$ cu in

5th effect r $= \sqrt{\frac{89.985 + 21.868}{69.115}} = \sqrt{1.618} = 1.272$ inches

The solution for 5th effect Pi becomes:

$$Pi = .000028416 \times 1 \times \frac{1.430 \times 1.272}{215.985} \times 100{,}000 \times 100{,}000$$

$= 2393$ psig

The solution for 6th effect W becomes:

D max $= \frac{4393 + 14.7}{14.7} \times .0000449 = .0134629$ lb /cu in

D avg $= (.0061537 + .0134629) / 2 = .0098083$ lb /cu in

6th effect W = 146.868 x .0098083 = 1.441 lbs W/2 = .720 lb

The solution for 6th effect r becomes:

D avg inner half =(.0061537 + .0098083) / 2 = .0079810 lb /cu in

Volume inner half = .720 / .0079810 = 90.214 cu in

6th effect r $= \sqrt{\dfrac{90.214 + 21.868}{69.115}} = \sqrt{1.622} = 1.274$ inches

The solution for 6th effect Pi becomes:

Pi $= .000028416 \times 1 \times \dfrac{1.441 \times 1.274}{215.985} \times 100{,}000 \times 100{,}000$

= 2415 psig

Since there was only a 22 psig change , 00.91% , from 5th effect Pi to 6th effect Pi , the 6th effect value of Pi is fully acceptable as the initial value of Pi for subsequent insertion into the solutions for the final and fully stabilized operational values of Pi , Rf and Sf in the next phase of this application of the over all format , below.

The solution for the initial value of Rf, when the initial value of Pi has been accepted as being 2415 psig, now becomes:

Sub-solution for initial Rf for funnel pneumatic mass 14, Figure 26:

Fa = 2415 x .0069397 = 16.759 lbs

D entr $= \dfrac{4415 + 14.7}{14.7} \times .0000449 = .0135301$ lb / cu in

D avg = (.0061537 + .0135301) / 2 = .0098419 lb /cu in

W = .0056385 x .0098419 = .0000554 lb

a = 16.759 x 32.16 / .0000554 = 9,728,690 ft/sec/sec

Va $= \sqrt{2 \times 9{,}728{,}690 \times .0677083} \,/\, 2 = \sqrt{1{,}317{,}426} \,/\, 2$

= 1148 / 2 = 574 ft/sec

t = .0677083 / 574 = .0001179 second

14's Rf in lbs/sec = .0000554 / .0001179 = .470 initial

14's Rf in SCFM = 773 x .470 = 363 initial

The solution for 15's initial Rf, when initial Pi = 2415 psig, becomes:

Fa = 2415 x .0568494 / 2 = 68.646 lbs

W = .0108570 x .0098419 = .0001068 lb

a = 68.646 x 32.16 / .0001068 = 20,670,929 ft/sec/sec

Va = $\sqrt{2 \times 20{,}670{,}929 \times .0677083}$ / 2 = $\sqrt{2{,}799{,}187}$ / 2

= 1673 / 2 = 836.5 ft/sec

t = .0677083 / 836.5 = .0000809 second

15's initial Rf in lbs / sec = .0001068 / .0000809 = 1.320

15's initial Rf in SCFM = 773 x 1.320 = 1020

Total initial Rf through both Thrusters in lbs/sec:

= 2 x (.470 + 1.320) = 3.580

Total initial Rf Through both Thrusters in SCFM:

= 773 x 3.580 = 2767

The solution for initial Sf, when initial Rf = 3.580 lbs/sec, becomes:

W = 146.868 x .0098419 = 1.445 lbs

t = 1.445 / 3.580 = .404 second

Rs = 100,000 x .404 / 60 = 673 rev

Ar = 1.000 / 673 = .0014858 inch/rev

CDM = 2.778 + (.0135301 / .0061537) = 2.778 + 2.199 = 4.977

Ai = 4.977 Af and Ar = (1.000 Af + 4.977 Af) / 2 = 2.988 Af

Af = Ar / 2.988 = .0014858 / 2.988 = .0004972 inch/rev

Ai = 4.977 Af = 4.977 x .0004972 = .0024745 inch/rev

Aid = .0024745 / 360 = .0000068 inch/deg rot

Afd = .0004972 / 360 = .0000013 inch/deg rot

Sfi = $1 - \frac{.0000068}{.0000843}$ = 1 - .0806642 = .9193

Sff = $1 - \frac{.0000013}{.0002344}$ = 1 - .0055460 = .9945

Initial Sf = (.9193 + .9945) / 2 = .9569

= 95.69% inertial-pneumatic compression efficiency

First adjusted Pi , when initial Sf = .9569 , becomes:

1st adj Pi = 2415 x .9569 = 2311 psig

The solution for first adjusted Rf , when 1st adj Pi = 2311 psig, becomes:

Sub-solution for 14's 1st adjusted Rf becomes:

Fa = 2311 x .0069397 = 16.038 lbs

D entr = $\frac{4311 + 14.7}{14.7}$ x .0000449 = .0132125 lb /cu in

D avg = (.0061537 + .0132125) / 2 = .0096831 lb /cu in

W = .0056385 x .0096831 = .0000545 lb

a = 16.038 x 32.16 / .0000545 = 9,463,891 ft/sec/sec

Va = $\sqrt{2 \times 9,463,891 \times .0677083}$ / 2 = $\sqrt{1,281,568}$ / 2

= 1132 / 2 = 566 ft/sec

t = .0677083 / 566 = .0001196 second

14's 1st adjusted Rf in lbs/sec = .0000545 / .0001196 = .456

14's 1st adjusted Rf in SCFM = 773 x .456 = 352

Sub-solution for 15's 1st adjusted Rf becomes:

Fa = .0568494 x 2311 / 2 = 65.689 lbs

W = .0108570 x .0096831 = .0001051 lb

a = 65.689 x 32.16 / .0001051 = 20,100,458 ft/sec/sec

Va = $\sqrt{2 \times 20,100,458 \times .0677083}$ / 2 = $\sqrt{2,721,936}$ / 2

= 1650 / 2 = 825 ft/sec

t = .0677083 / 825 = .0000820 second

15's 1st adjusted Rf in lbs/sec = .0001051 / .0000820 = 1.282

15's 1st adjusted Rf in SCFM = 773 x 1.282 = 991

Total 1st adjusted Rf through both Thrusters in lbs/sec:

= (1.282 + .456) x 2 = 3.476

Total 1st adjusted Rf through both Thrusters in SCFM:

= 773 x 3.476 = 2687

The solution for 1st adjusted Sf , when 1st adjusted Rf = 3.476 lbs/sec:

W = 146.868 x .0096831 = 1.422 lbs

t = 1.422 / 3.476 = .409 second

Rs = 100,000 x .409 / 60 = 682 rev

Ar = 1.000 / 682 = .0014662 inch/rev

CDM = 2.778 + (.0132125 / .0061537) = 2.778 + 2.147 = 4.925

Ai = 4.925 Af and Ar = (1.000 Af + 4.925 Af) / 2 = 2.963 Af

Af = Ar / 2.963 = .0014662 / 2.963 = .0004948 inch/rev

Ai = 4.925 Af = 4.925 x .0004948 = .0024368 inch/rev

Aid = .0024368 / 360 = .0000067 inch/deg rot

Afd = .0004948 / 360 = .0000013 inch/deg rot

Sfi = $1 - \frac{.0000067}{.0000843}$ = 1 - .079478 = .9205

Sff = $1 - \frac{.0000013}{.0002344}$ = 1 - .0055460 = .9945

1st adjusted Sf = (.9205 + .9945) / 2 = .9575

= 95.75% inertial-pneumatic compression efficiency

The solution for 2nd adjusted Pi , when 1st adj Sf = .9575, becomes:

2nd adj Pi = 2415 x .9575 = 2312 psig

Since there was only one psig , 00.04% , change from 1st adjusted Pi to 2nd adjusted Pi , the 2nd adjusted value of Pi and the 1st adjusted values of Rf and Sf are fully acceptable as final and fully stabilized operational values.

Thus, the operational value of Pi = 2312 psig

the operational value of Rf = 3.476 lbs/sec = 2687 SCFM

the operational value of Sf = .9575 = 95.75% comp. efficiency.

Operational Pneumatic Pressure Power Ppp becomes:

Ppp = (Pi @ 2312 Graph Hp. Figure 30) x SCFM x .746

= .655 x 2687 x .746 = 1313 kilowatts

Operational Thrust Power Pt becomes:

Thrust T = ((2312 x .0069397) + (2312 x .0568494 / 2)) x 2

= (16.045 + 65.718) x 2 = 81.763 x 2 = 163.526 lbs

Thruster centerlines tangential velocity Vt @ 100,000 RPM = 1499 ft/sec

$$Pt = \frac{T \times Vt \times .746}{550} = \frac{163.526 \times 1499 \times .746}{550} = 332 \text{ kilowatts}$$

Operational Particle Replacement Power Ppr becomes:

$$Ppr = \frac{Rf \times Vt^2 \times .746}{35,376} = \frac{3.476 \times 1499 \times 1499 \times .746}{35,376}$$

= 165 kilowatts.

Operational Resistance to Rotor Rotation Power Prr becomes:

Prr = (Figure 31 Graph Hp. @ 100,000 RPM) x .746

= 8.55 x .746 = 6 kilowatts , to the nearest kilowatt

Operational Generator Drive Power Pgd becomes:

$Pgd = Pt - Ppr - Prr = 332 - 165 - 6 = 161$ kilowatts

Operational Electric Power Productivity Pep becomes:

$Pep = Pgd - .1\ Pgd = 161 - 16 = 145$ kilowatts

Operational Inertial-Pneumatic Compression Efficiency Ec becomes:

$$Ec = 1 - \left(\frac{2415 - 2312}{2415} \right) = 1 - .0426501 = 95.73\%$$

Operational Thruster Pneumatic Pressure Power Conversion Efficiency Et becomes:

$$Et = 1 - \left(\frac{Ppp - Pt}{Ppp} \right) = 1 - \left(\frac{1313 - 332}{1313} \right)$$

$$= 1 - .7471439 = 25.29\%$$

Operational Rotor Assembly Efficiency Er becomes:

$$Er = 1 - \left(\frac{Pt - Pgd}{Pt} \right) = 1 - \left(\frac{332 - 161}{332} \right)$$

$$= 1 - .5150602 = 48.49\%$$

Operational System Over All Efficiency Eoa becomes:

$$Eoa = 1 - \left(\frac{Ppp - Pep}{Ppp} \right) = 1 - \left(\frac{1313 - 145}{1313} \right)$$

$$= 1 - .8895658 = 11.04\%$$

These operational values for Pi , Rf , Ppp , Pt , Ppr , Prr , Pgd, Pep, Ec , Et , Er and Eoa are registered on the vertical line above 100 on the graphs of Figures 32 through 39 as value 6 on curve 1.

A similar tabulation of these operational values can be accumulated from previous pages of Chapter Six for the proposed maximum conditions when N is specified at 120,000 RPM and Ep is specified at 2000 psig @ 52° F. Temperature. They are registered on the vertical line above 120 on the graphs of Figures 32 through 39 as value 8 on curve 1. The tabulation of operational values from previous pages becomes:

Thus, the operational value of Pi = 5050 psig.

the operational value of Rf = 6.148 lbs/sec = 4752 SCFM

the operational value of Sf = .9550 = 95.50 % comp. eff.

Operational Pneumatic Pressure Power Ppp becomes:

Ppp = (Pi @ 5050 Graph Hp. Figure 30) x SCFM x .746

= .942 x 4752 x .746 = 3339 kilowatts

Operational Thrust Power Pt becomes:

Thrust T = ((5050 x .0069397) + (5050 x .0568494 / 2)) x 2

= (35.045 + 143.545) x 2 = 178.590 x 2 = 357.180 lbs

Thruster centerlines tangential velocity Vt @ 120,000 RPM = 1799 ft/sec

$$Pt = \frac{T \times Vt \times .746}{550} = \frac{357.180 \times 1799 \times .746}{550} = 872 \text{ kilowatts}$$

Operational Particle Replacement Power Ppr becomes:

$$Ppr = \frac{Rf \times Vt^2 \times .746}{35,376} = 6.148 \times \frac{1799 \times 1799}{35,376} \times .746$$

= 420 kilowatts

Operational Resistance to Rotor Rotation Power Prr becomes:

$$\text{Prr} = (\text{Figure 31 Graph Hp. @ 120,000 RPM}) \times .746$$

$$= 9.900 \times .746 = \underline{7} \text{ kilowatts , to the nearest kilowatt}$$

Operational Generator Drive Power Pgd becomes:

$$\text{Pgd} = \text{Pt} - \text{Ppr} - \text{Prr} = 872 - 420 - 7 = \underline{445} \text{ kilowatts}$$

Operational Electric Power Productivity Pep becomes:

$$\text{Pep} = \text{Pgd} - .1\ \text{Pgd} = 445 - 45 = \underline{400} \text{ kilowatts}$$

Operational Inertial-Pneumatic Compression Efficiency Ec becomes:

$$\text{Ec} = 1 - \left(\frac{5295 - 5050}{5295} \right) = 1 - .0462700 = \underline{95.37\%}$$

Operational Thruster Pneumatic Pressure Power Conversion Efficiency Et becomes:

$$\text{Et} = 1 - \left(\frac{\text{Ppp} - \text{Pt}}{\text{Ppp}} \right) = 1 - \left(\frac{3339 - 872}{3339} \right)$$

$$= 1 - .7388439 = \underline{26.12\%}$$

Operational Rotor Assembly Efficiency Er becomes:

$$\text{Er} = 1 - \left(\frac{\text{Pt} - \text{Pgd}}{\text{Pt}} \right) = 1 - \left(\frac{872 - 445}{872} \right)$$

$$= 1 - .4896788 = \underline{51.03\%}$$

Operational System Over All Efficiency Eoa becomes:

$$\text{Eoa} = 1 - \left(\frac{\text{Ppp} - \text{Pep}}{\text{Ppp}} \right) = 1 - \left(\frac{3339 - 400}{3339} \right)$$

$$= 1 - .88020360 = \underline{11.98\%}$$

Figure 32

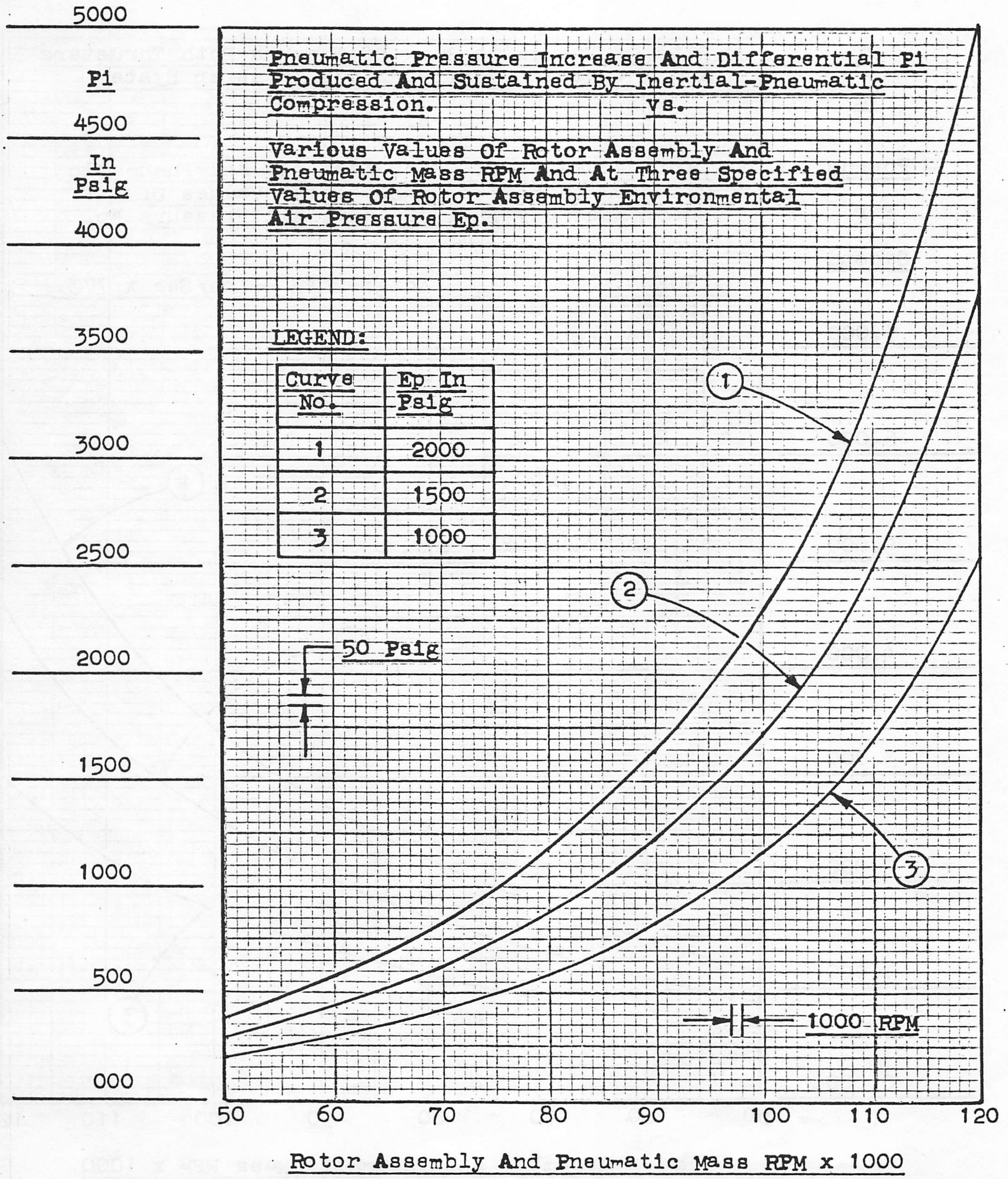
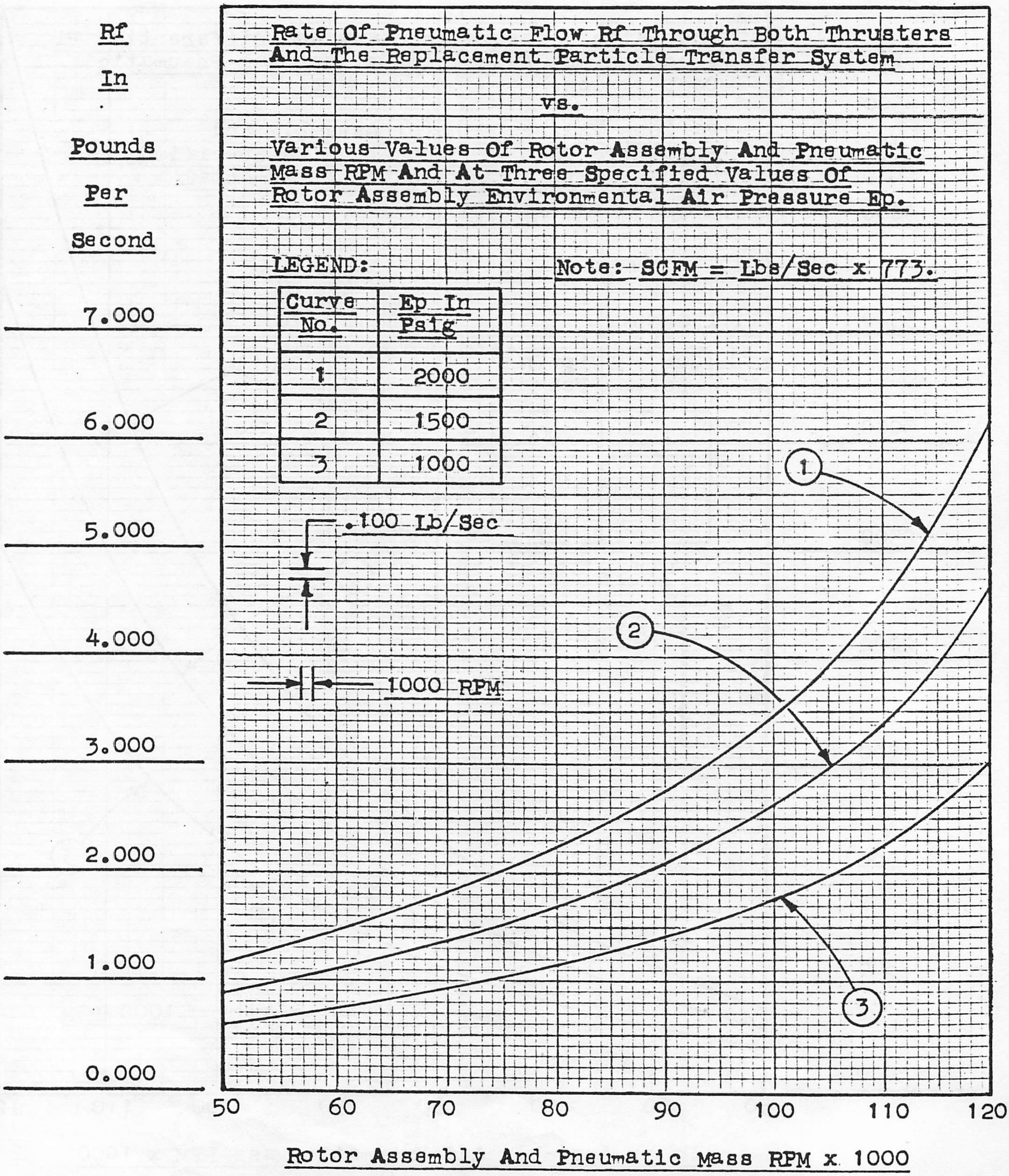

Pneumatic Pressure Increase And Differential Pi Produced And Sustained By Inertial-Pneumatic Compression.
vs.
Various Values Of Rotor Assembly And Pneumatic Mass RPM And At Three Specified Values Of Rotor Assembly Environmental Air Pressure Ep.
LEGEND:
Curve No. | Ep In Psig
1 | 2000
2 | 1500
3 | 1000
Pi
In Psig
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
000
50 Psig
1000 RPM
①
②
③
50
60
70
80
90
100
110
120
Rotor Assembly And Pneumatic Mass RPM x 1000

Figure 33



Rate Of Pneumatic Flow Rf Through Both Thrusters And The Replacement Particle Transfer System

vs.

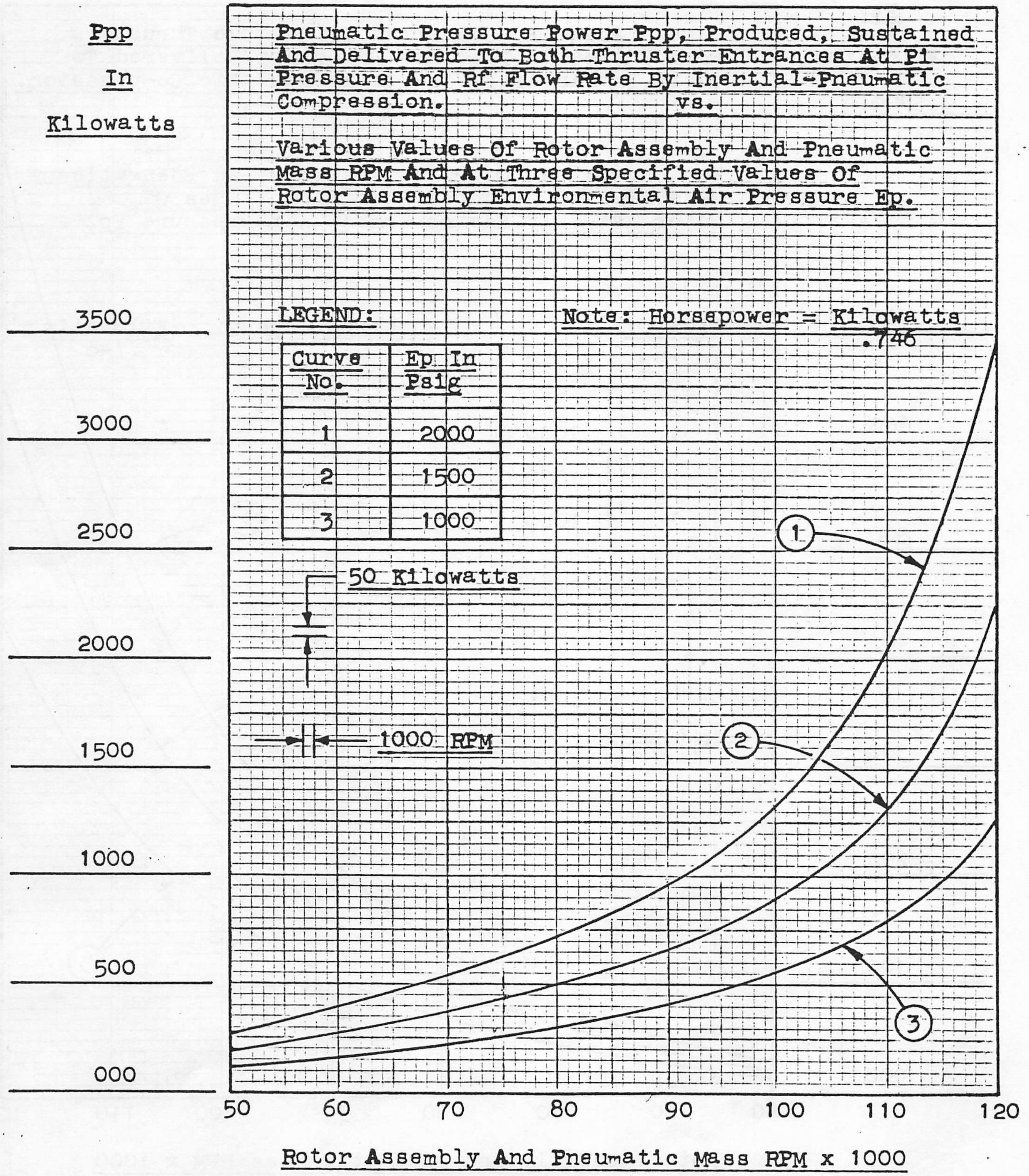
Various Values Of Rotor Assembly And Pneumatic Mass RPM And At Three Specified Values Of Rotor Assembly Environmental Air Pressure Ep.

LEGEND:

Curve No.	Ep In Psig
1	2000
2	1500
3	1000

Note: SCFM = Lbs/Sec x 773.

Figure 34



Pneumatic Pressure Power Ppp, Produced, Sustained And Delivered To Both Thruster Entrances At Pi Pressure And Rf Flow Rate By Inertial-Pneumatic Compression. vs.

Various Values Of Rotor Assembly And Pneumatic Mass RPM And At Three Specified Values Of Rotor Assembly Environmental Air Pressure Ep.

Figure 35

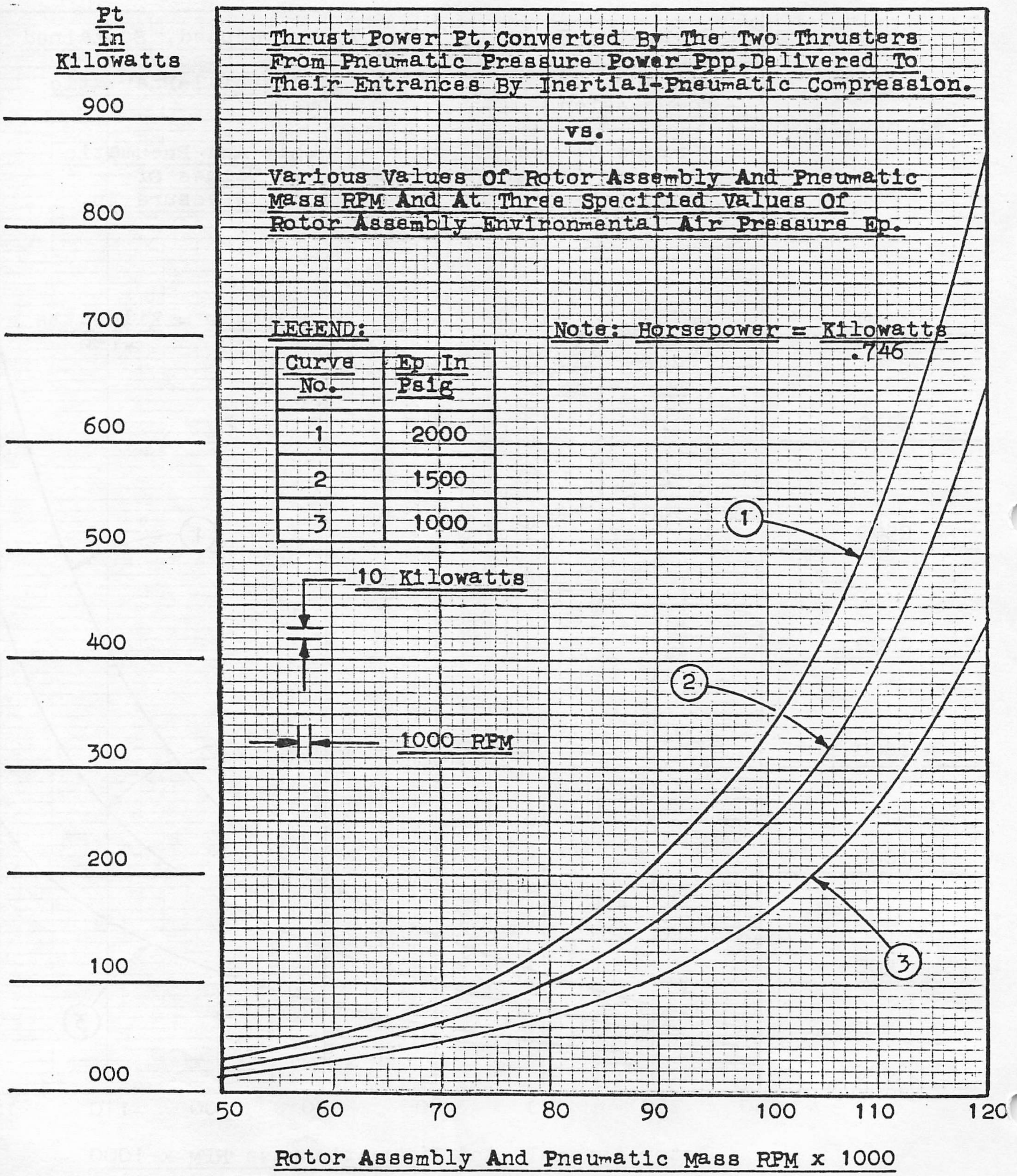

Pt In Kilowatts
900
800
700
600
500
400
300
200
100
000
Thrust Power Pt, Converted By The Two Thrusters From Pneumatic Pressure Power Ppp, Delivered To Their Entrances By Inertial-Pneumatic Compression.
vs.
Various Values Of Rotor Assembly And Pneumatic Mass RPM And At Three Specified Values Of Rotor Assembly Environmental Air Pressure Ep.
LEGEND:
Curve No.
Ep In Psig
1
2000
2
1500
3
1000
Note: Horsepower = Kilowatts / .746
10 Kilowatts
1000 RPM
1
2
3
50
60
70
80
90
100
110
120
Rotor Assembly And Pneumatic Mass RPM x 1000

Figure 36

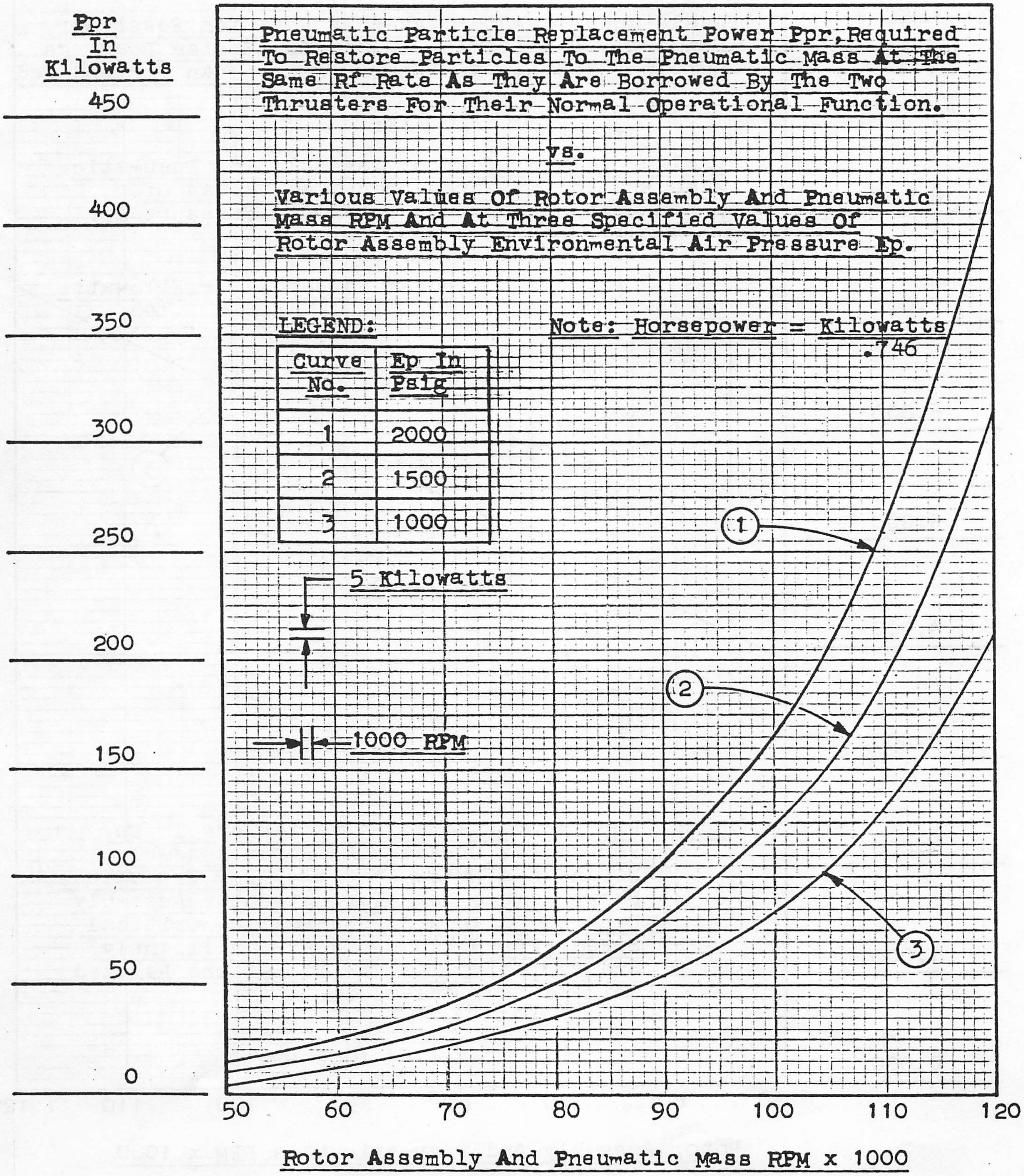
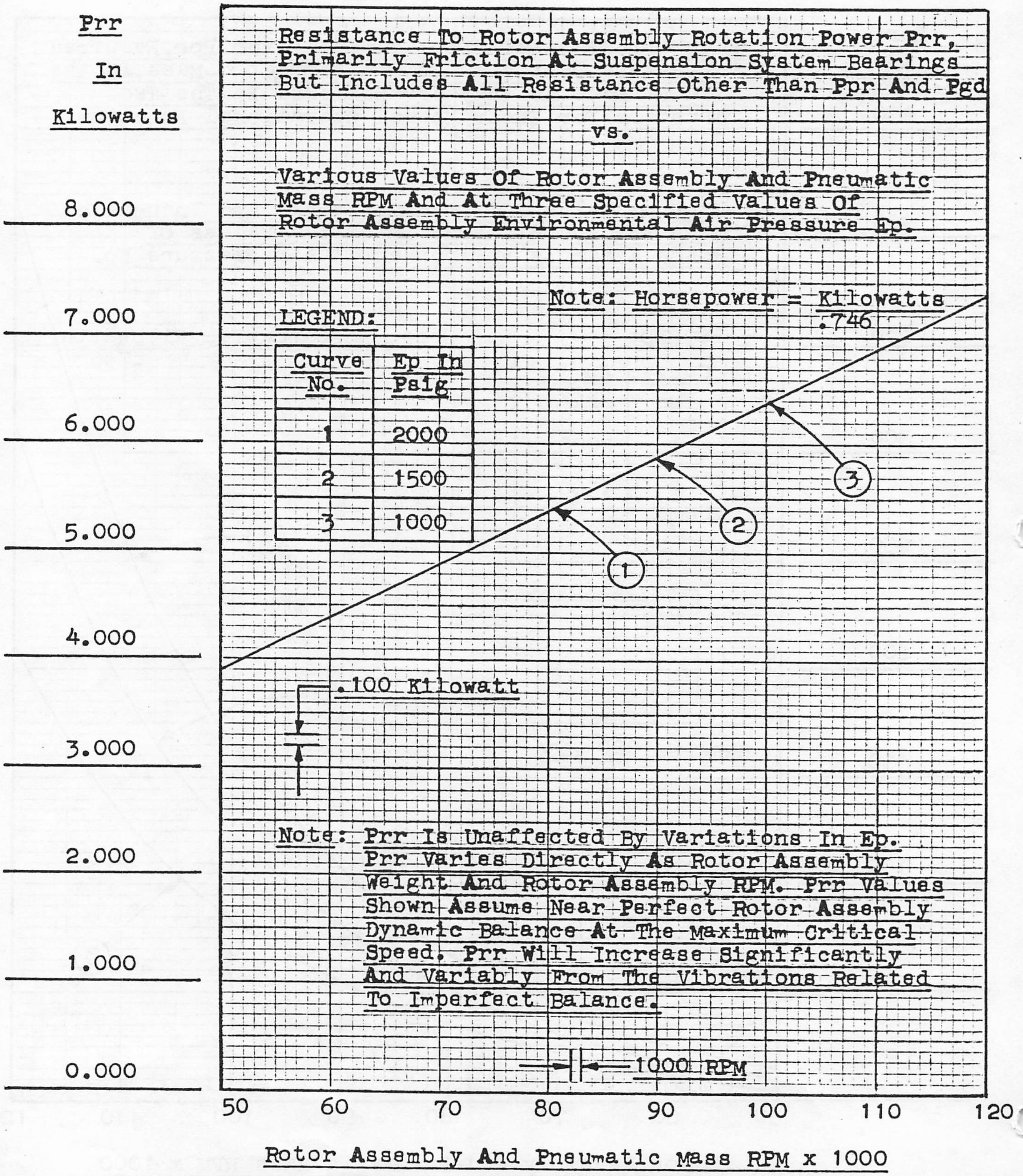

Pneumatic Particle Replacement Power Ppr, Required To Restore Particles To The Pneumatic Mass At The Same Rf Rate As They Are Borrowed By The Two Thrusters For Their Normal Operational Function.
vs.
Various Values Of Rotor Assembly And Pneumatic Mass RPM And At Three Specified Values Of Rotor Assembly Environmental Air Pressure Ep.
LEGEND:
Curve No.
Ep In Psig
1
2000
2
1500
3
1000
Note: Horsepower = Kilowatts / .746
5 Kilowatts
1000 RPM
①
②
③
Ppr In Kilowatts
450
400
350
300
250
200
150
100
50
0
50
60
70
80
90
100
110
120
Rotor Assembly And Pneumatic Mass RPM x 1000

Figure 37



Resistance To Rotor Assembly Rotation Power Prr, Primarily Friction At Suspension System Bearings But Includes All Resistance Other Than Ppr And Pgd

vs.

Various Values Of Rotor Assembly And Pneumatic Mass RPM And At Three Specified Values Of Rotor Assembly Environmental Air Pressure Ep.

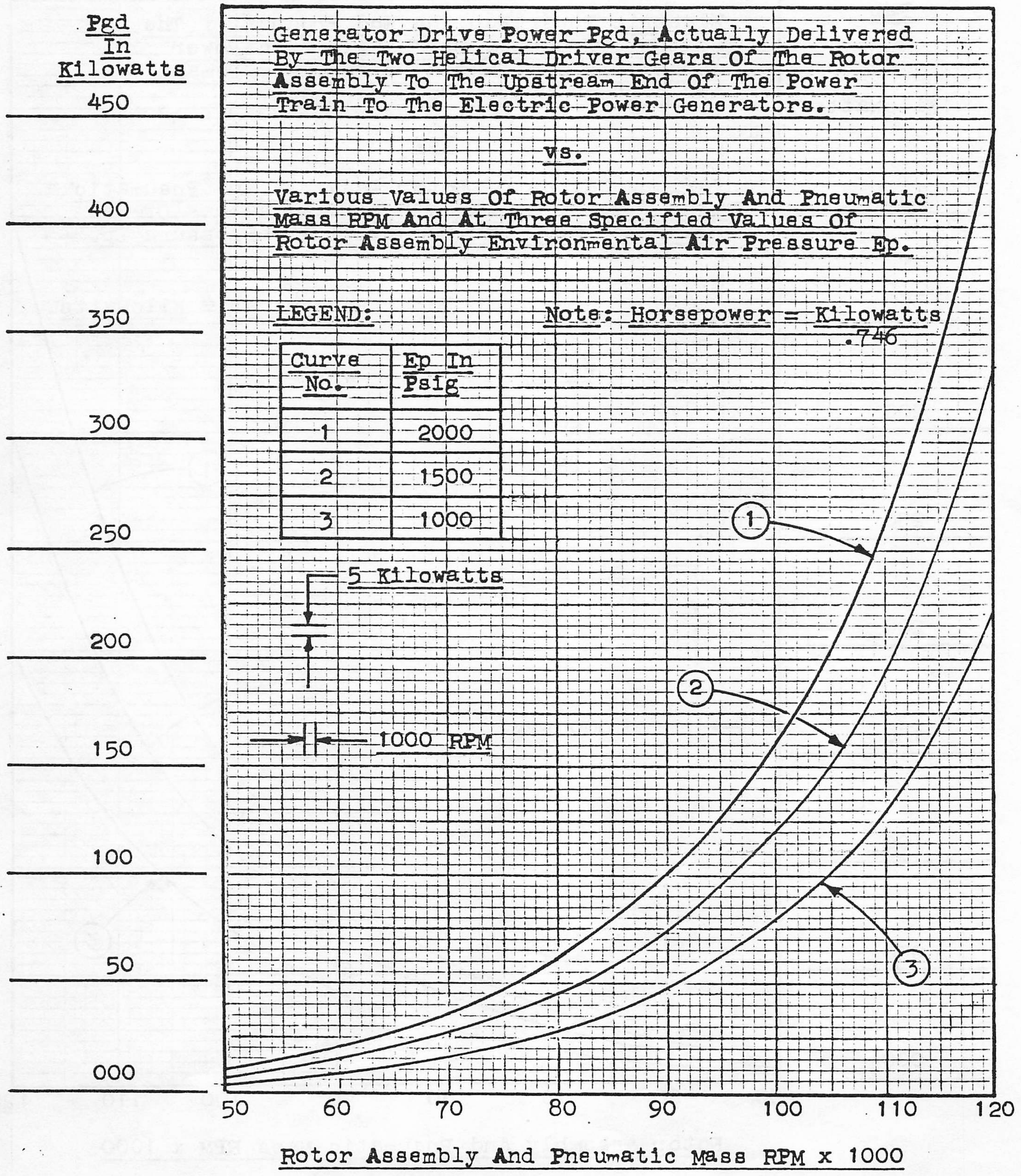
Note: Horsepower = $\frac{\text{Kilowatts}}{.746}$

LEGEND:

Curve No.	Ep In Psig
1	2000
2	1500
3	1000

Note: Prr Is Unaffected By Variations In Ep. Prr Varies Directly As Rotor Assembly Weight And Rotor Assembly RPM. Prr Values Shown Assume Near Perfect Rotor Assembly Dynamic Balance At The Maximum Critical Speed. Prr Will Increase Significantly And Variably From The Vibrations Related To Imperfect Balance.

Figure 38



Generator Drive Power Pgd, Actually Delivered By The Two Helical Driver Gears Of The Rotor Assembly To The Upstream End Of The Power Train To The Electric Power Generators.

vs.

Various Values Of Rotor Assembly And Pneumatic Mass RPM And At Three Specified Values Of Rotor Assembly Environmental Air Pressure Ep.

LEGEND:

Curve No.	Ep In Psig
1	2000
2	1500
3	1000

Note: Horsepower = Kilowatts / .746

Figure 39

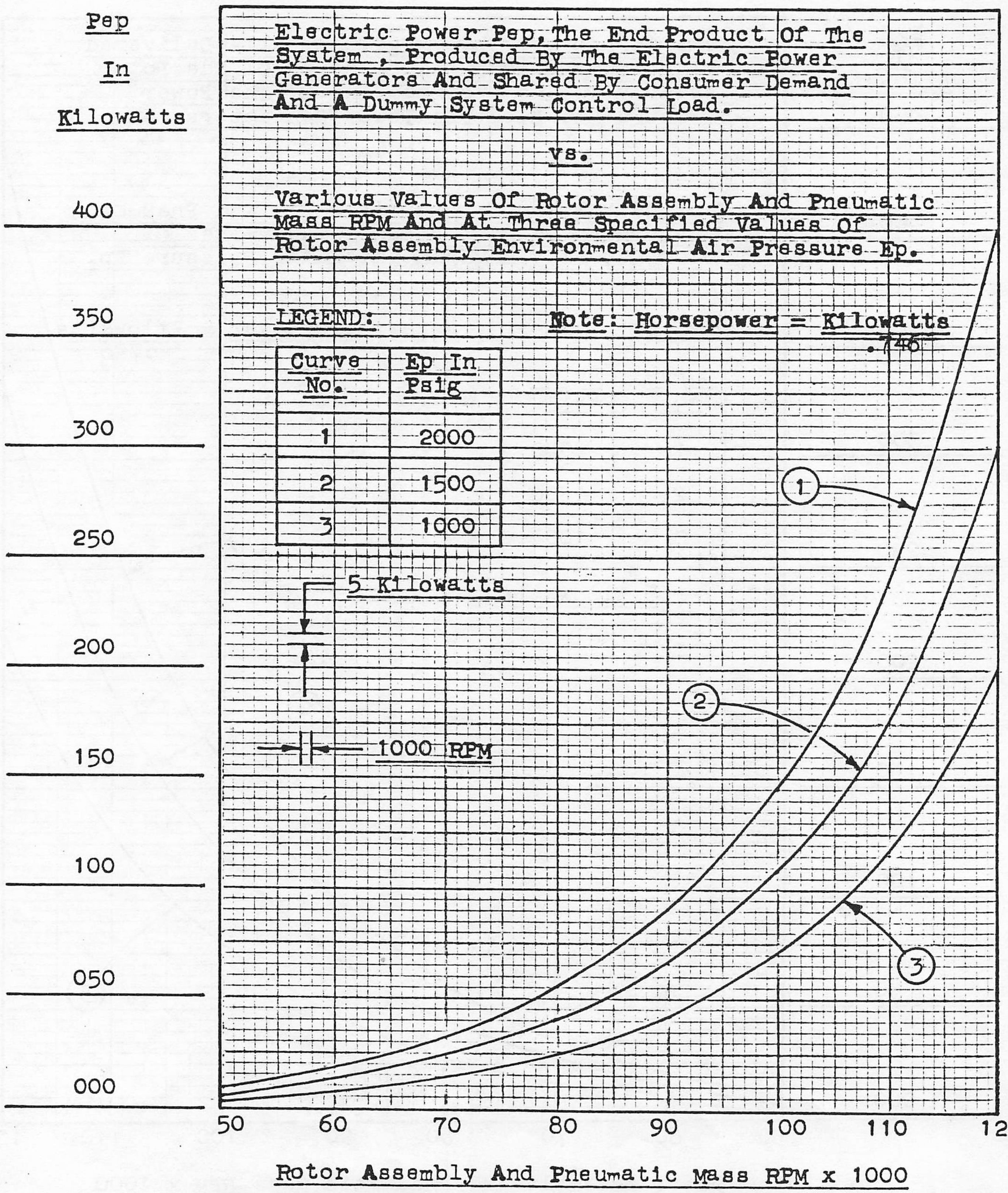
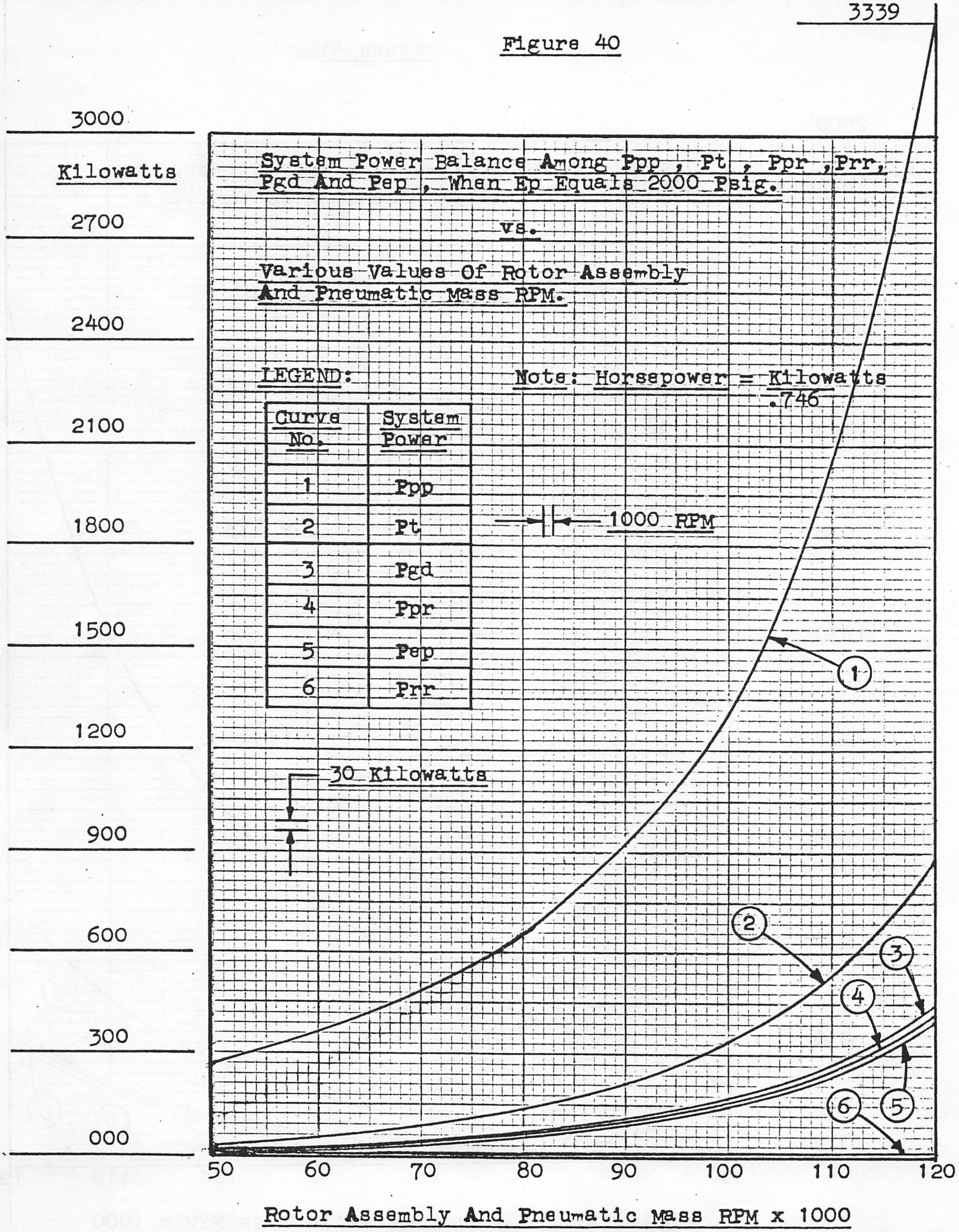

Pep
In
Kilowatts
400
350
300
250
200
150
100
050
000
Electric Power Pep, The End Product Of The System , Produced By The Electric Power Generators And Shared By Consumer Demand And A Dummy System Control Load.
vs.
Various Values Of Rotor Assembly And Pneumatic Mass RPM And At Three Specified Values Of Rotor Assembly Environmental Air Pressure Ep.
LEGEND:
Curve No. | Ep In Psig
1 | 2000
2 | 1500
3 | 1000
Note: Horsepower = Kilowatts / .746
5 Kilowatts
1000 RPM
①
②
③
50
60
70
80
90
100
110
120
Rotor Assembly And Pneumatic Mass RPM x 1000

Figure 40



System Power Balance Among Ppp , Pt , Ppr ,Prr, Pgd And Pep , When Ep Equals 2000 Psig.

vs.

Various Values Of Rotor Assembly And Pneumatic Mass RPM.

LEGEND:

Curve No.	System Power
1	Ppp
2	Pt
3	Pgd
4	Ppr
5	Pep
6	Prr

Note: $\text{Horsepower} = \frac{\text{Kilowatts}}{.746}$

Figure 41

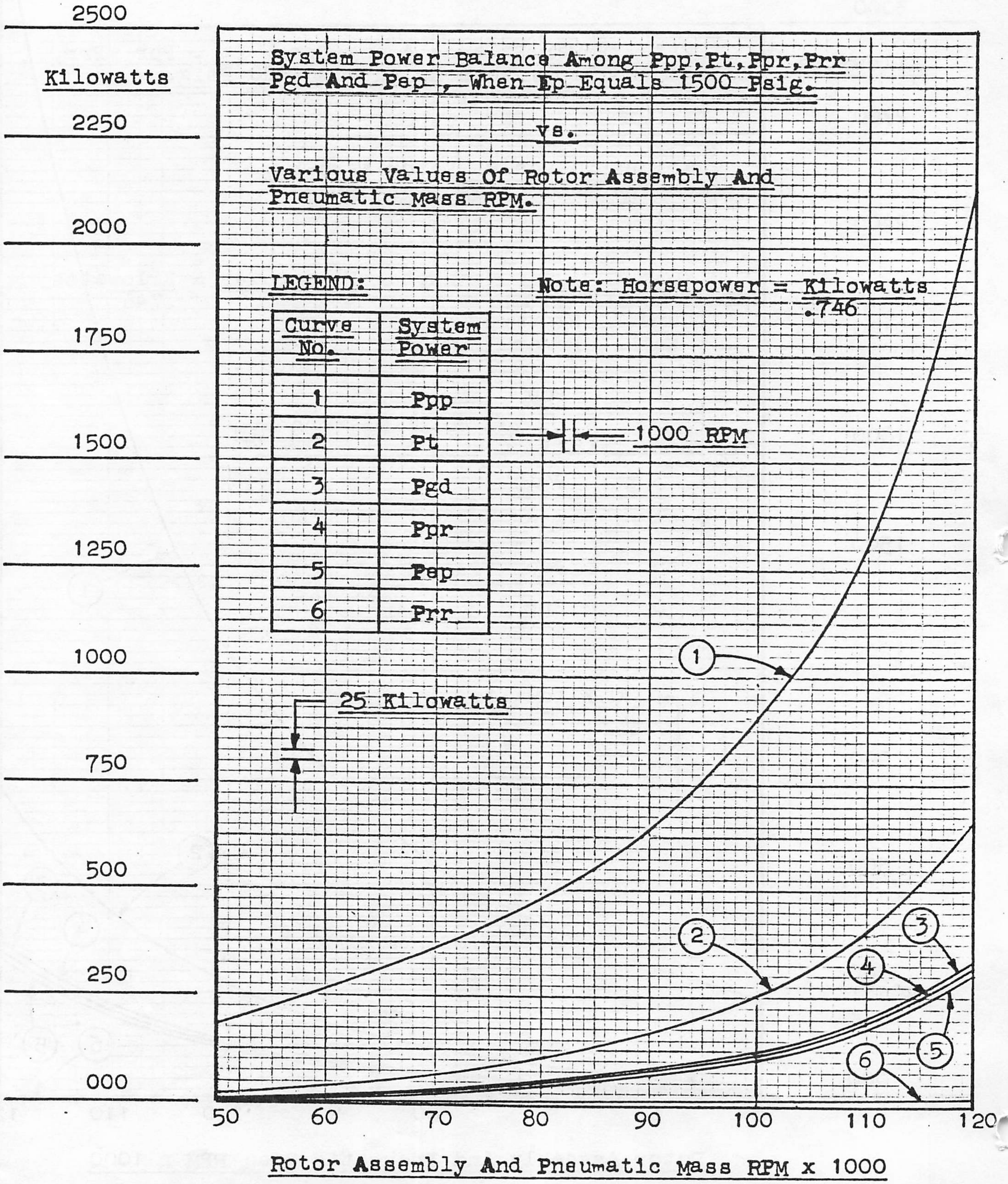

System Power Balance Among Ppp, Pt, Ppr, Prr Pgd And Pap , When Ep Equals 1500 Psig.
vs.
Various Values Of Rotor Assembly And Pneumatic Mass RPM.
LEGEND:
Curve No. | System Power
1 | Ppp
2 | Pt
3 | Pgd
4 | Ppr
5 | Pap
6 | Prr
Note: Horsepower = Kilowatts / .746
1000 RPM
25 Kilowatts
Kilowatts
2500
2250
2000
1750
1500
1250
1000
750
500
250
000
1
2
3
4
5
6
50
60
70
80
90
100
110
120
Rotor Assembly And Pneumatic Mass RPM x 1000

Figure 42

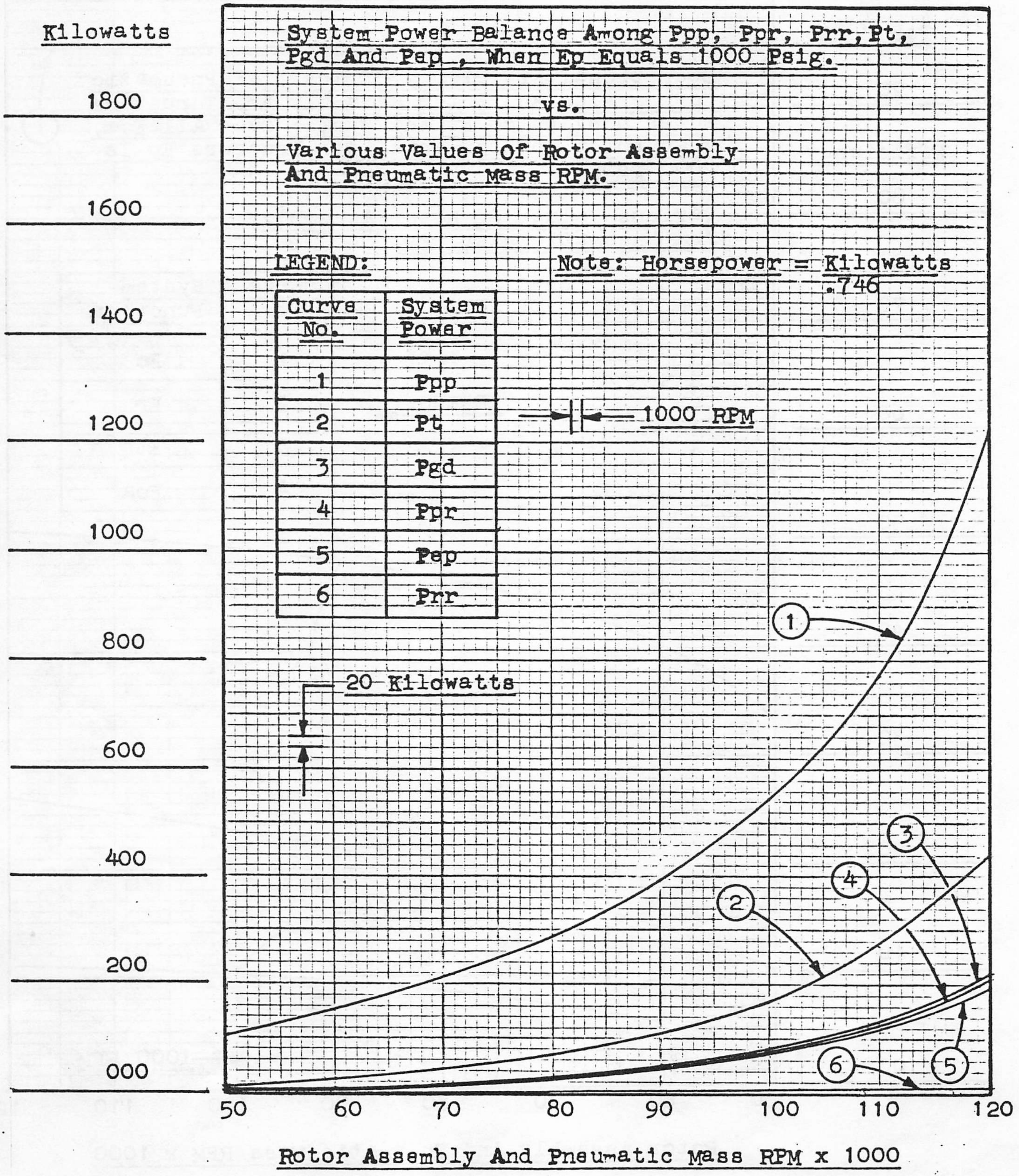

Kilowatts
1800
1600
1400
1200
1000
800
600
400
200
000
System Power Balance Among Ppp, Ppr, Prr, Pt, Pgd And Pep , When Ep Equals 1000 Psig.
vs.
Various Values Of Rotor Assembly And Pneumatic Mass RPM.
LEGEND:
Curve No.
System Power
1 Ppp
2 Pt
3 Pgd
4 Ppr
5 Pep
6 Prr
Note: Horsepower = Kilowatts / .746
1000 RPM
20 Kilowatts
1
2
3
4
5
6
50
60
70
80
90
100
110
120
Rotor Assembly And Pneumatic Mass RPM x 1000

Figure 43

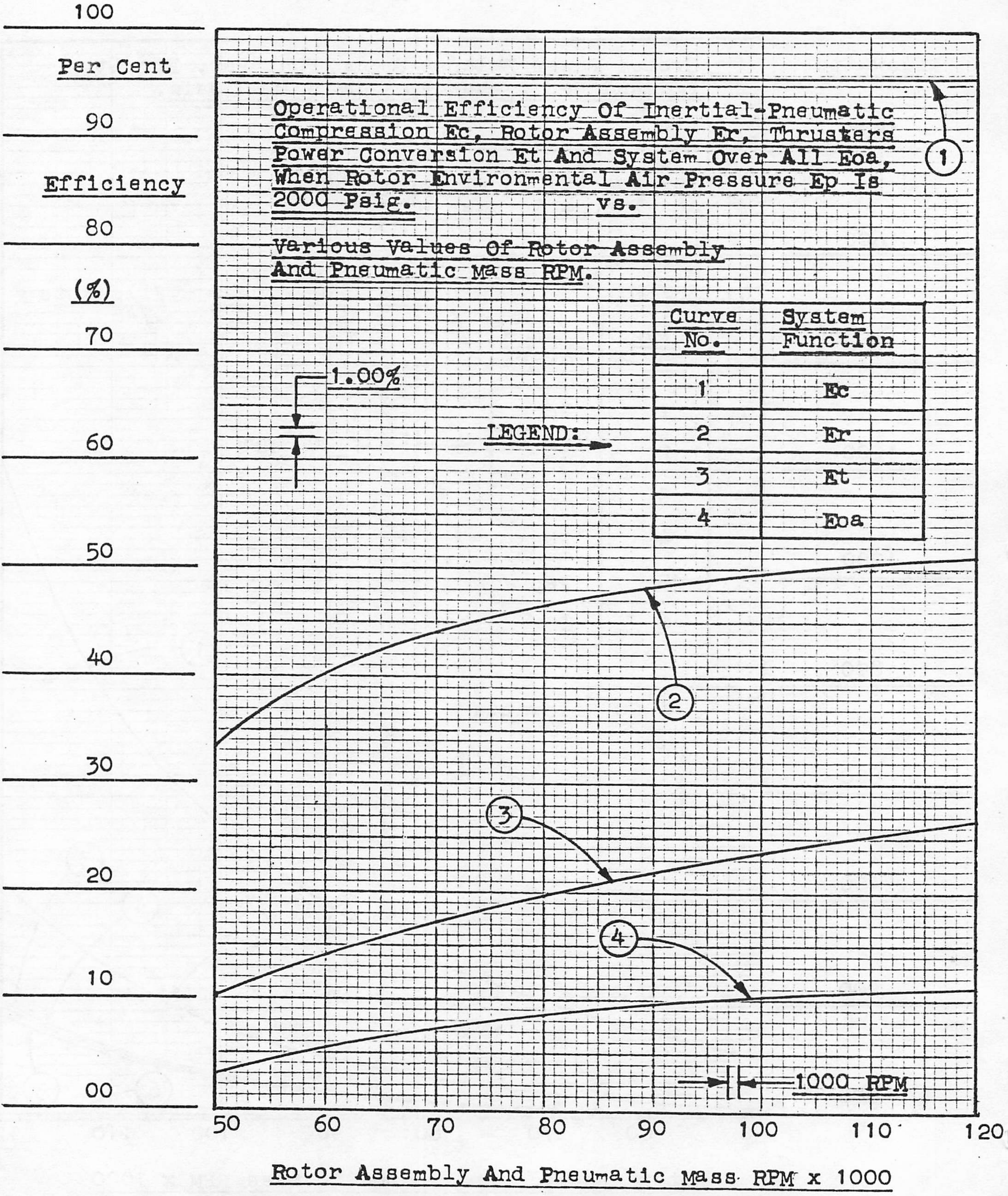

Operational Efficiency Of Inertial-Pneumatic Compression Ec, Rotor Assembly Er, Thrusters Power Conversion Et And System Over All Eoa, When Rotor Environmental Air Pressure Ep Is 2000 Psig. vs.
Various Values Of Rotor Assembly And Pneumatic Mass RPM.
Curve No.
System Function
1 Ec
2 Er
3 Et
4 Eoa
LEGEND:
1.00%
1000 RPM
①
②
③
④
100
Per Cent
90
Efficiency
80
(%)
70
60
50
40
30
20
10
00
50
60
70
80
90
100
110
120
Rotor Assembly And Pneumatic Mass RPM x 1000

Figure 44

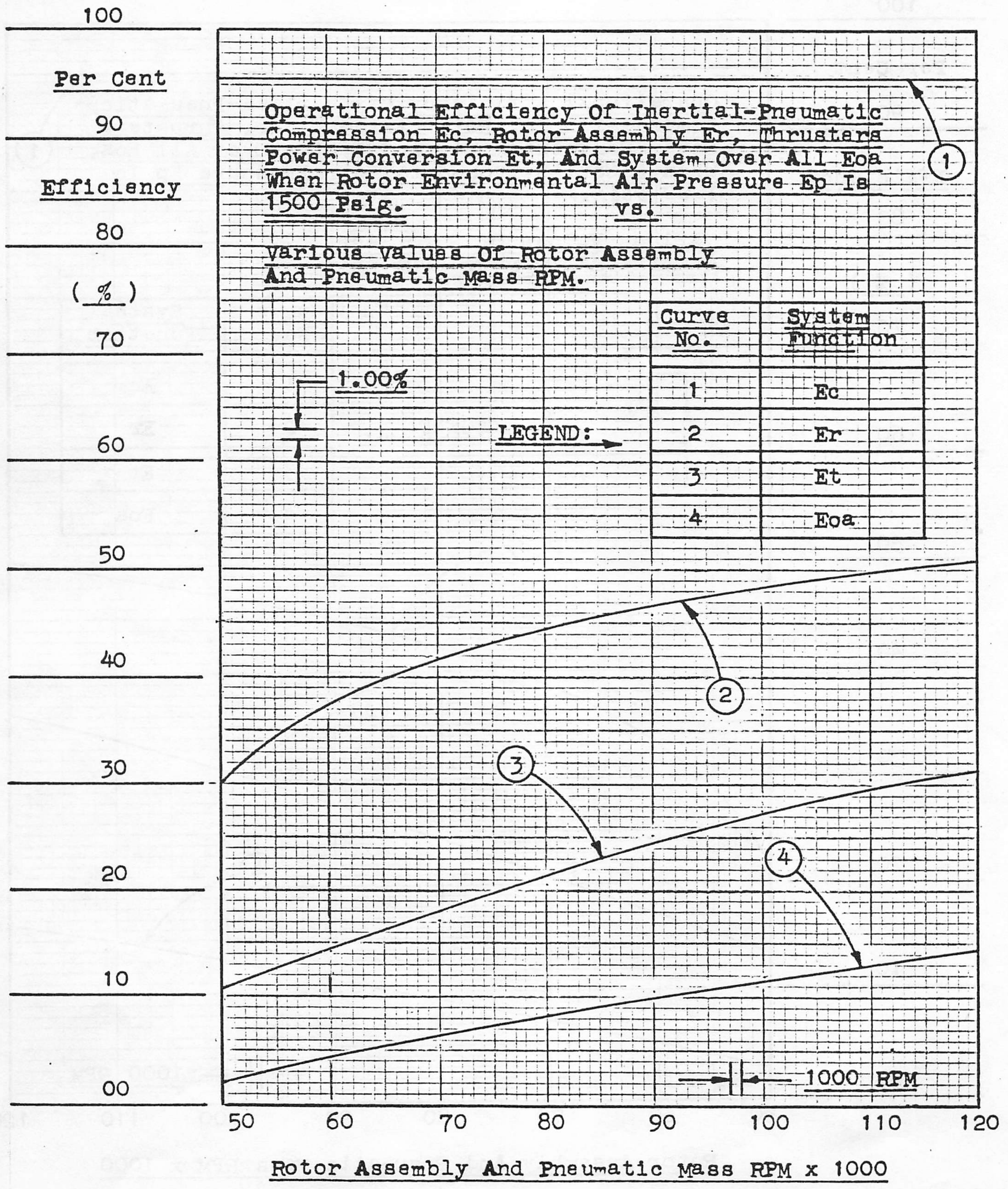
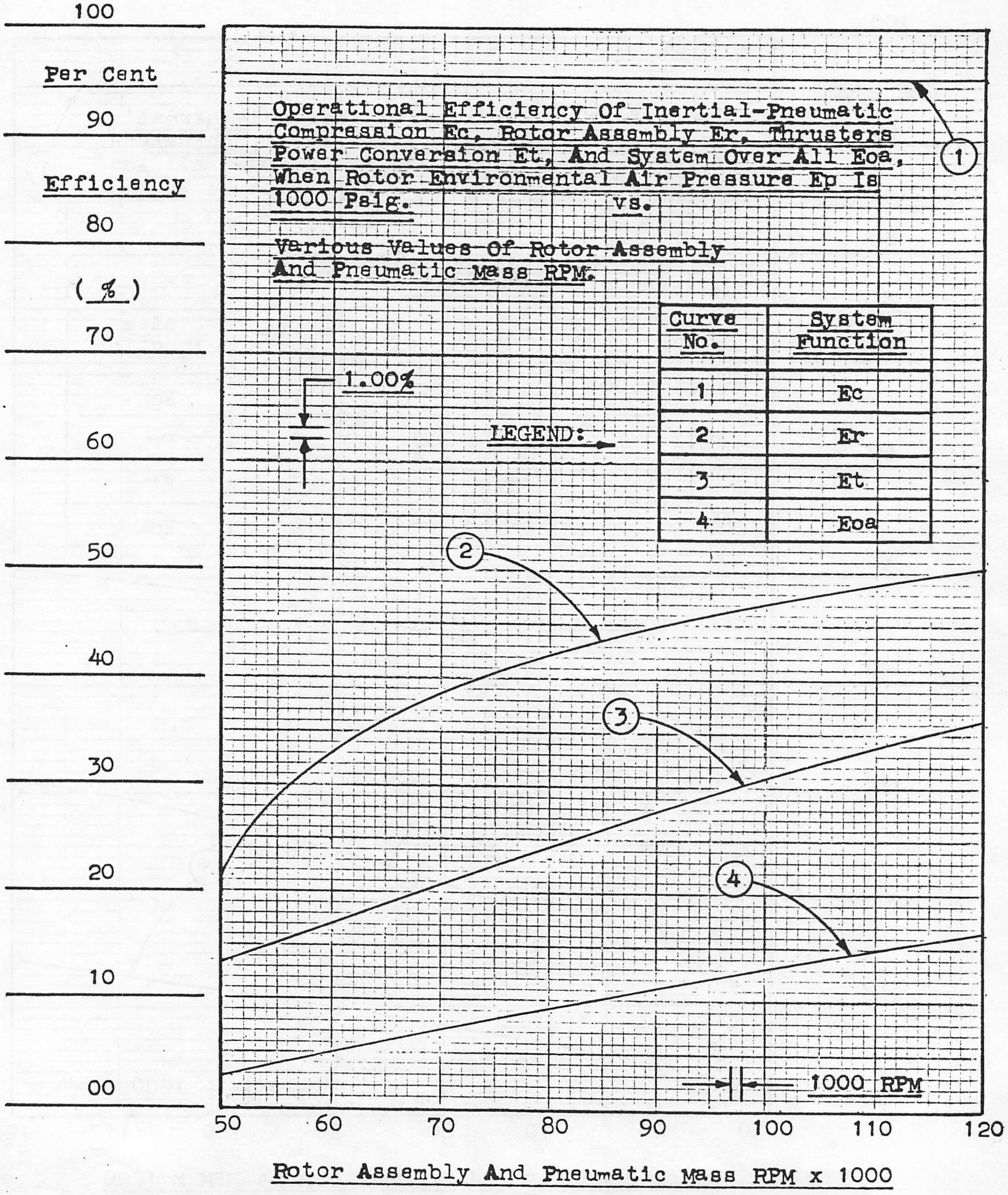

100
Per Cent
90
Efficiency
80
(%)
70
60
50
40
30
20
10
00
Operational Efficiency Of Inertial-Pneumatic Compression Ec, Rotor Assembly Er, Thrusters Power Conversion Et, And System Over All Eoa When Rotor Environmental Air Pressure Ep Is 1500 Psig.
vs.
Various Values Of Rotor Assembly And Pneumatic Mass RPM.
1.00%
LEGEND:
Curve No.
System Function
1
Ec
2
Er
3
Et
4
Eoa
①
②
③
④
1000 RPM
50
60
70
80
90
100
110
120
Rotor Assembly And Pneumatic Mass RPM x 1000

Figure 45


100
Per Cent
90
Efficiency
80
(%)
70
60
50
40
30
20
10
00
Operational Efficiency Of Inertial-Pneumatic Compression Ec, Rotor Assembly Er, Thrusters Power Conversion Et, And System Over All Eoa, When Rotor Environmental Air Pressure Ep Is 1000 Psig. vs.
Various Values Of Rotor Assembly And Pneumatic Mass RPM.
1.00%
LEGEND:
Curve No.
System Function
1
Ec
2
Er
3
Et
4
Eoa
①
②
③
④
1000 RPM
50
60
70
80
90
100
110
120
Rotor Assembly And Pneumatic Mass RPM x 1000