PHYSIC PROGRAM

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      THIS PROGRAM CALCULATES THE COMPRESSIBILITY FACTOR OF NATURAL
C     GAS AT A KNOWN SPECIFIC GRAVITY AND TEMPERATURE
C
C     ***************************************************************
C     PP  =   NATURAL GAS PRESSURE, psia.
C     SPG =   GAS SPECIFIC GRAVITYL, dimensionless
C     TF  =   GAS TEMPERATURE, oF.
C     Z   =   GAS COMPRESSIBILITY FACTOR.
C     ***************************************************************


      OPEN (UNIT=1, FILE='PRN')

      DATA TF/60.0/, SPG/0.550/

 9    WRITE(1, 100)

 100  FORMAT(20X,'COMPRESSIBILITY FACTOR OF NATURAL GAS',
             /1H, 5X,72(1H*))

      WRITE(1,105)
 105  FORMAT(/,10X,'TEMPERATURE, oF', 10X, 'SPECIFIC GRAVITY')

      WRITE(1,110)TF, SPG
 110  FORMAT(/,10X,F6.0,20X,F6.3,/)

      A1=0.001946
      A2=-0.027635
      A3=0.136315
      A4=-0.238489
      A5=0.105168
      A6=3.444*(10**8)
      T=TF+460.0

      WRITE(1,120)
 120 FORMAT(10X,'PRESSURE psia.',6X,'COMPRESSIBILITY FACTOR Z',/)

      PP=100.0

 10   P1=PP/1000.0


C     WRITE THE EXPRESSIONS FOR F1, F2, F3, F4, F5

      F1=P1*(0.251*SPG-0.150)-0.202*SPG+1.106
      F2=1.4*EXP(-0.0054*TF)
      F3=(A1*P1**5)+(A2*P1**4)+(A3*P1**3)+(A4*P1**2)+A5*P1
      VAL1=P1**(3.18*SPG-1.0)
      VAL2=EXP(-0.5*P1)
      F4=(VAL1*VAL2)*(0.154-0.152*SPG)-0.02
      VAL3=-1.039*((P1-1.8)**2)
      F5=0.35*(0.6-SPG)*EXP(VAL3)
      VAL4=1+(A6*P1*10**(1.785*SPG))/(T**3.825)
      Z=F1*(1/VAL4+(F2*F3))+F4+F5

      WRITE(1, 130) PP, Z

 130  FORMAT(10X, F12.0, 6X, F12.5)

      PP=PP+100.0

      IF (PP .GT. 5000.0) THEN
      GO TO 60
      ELSE
      GO TO 10
      ENDIF

C     PRINT THE RESULTS ON A NEW PAGE.

 60   WRITE(1, 140)
 140  FORMAT ('1')

      TF=TF+10.0

      IF (TF .GT. 100.0) THEN
      GO TO 12
      ELSE
      GO TO 9
      ENDIF

 12   TF=TF-50.0
      SPG=SPG+0.05

      IF (SPG .GT. 0.8) THEN
      GO TO 70
      ELSE
      GO TO 9
      ENDIF

      CLOSE(UNIT=1)
 70   STOP
      END
```

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Applied equations

The Physic program modifies the method developed by Awoseyin.[6]

Z is calculated by Equation 1-6 (see equation box) and the specific gravity, S_g, is determined from either the density or molecular weight of the gas (Equations 7 or 8).

Table 1 is a typical computer print out for Z as a function of temperature, pressure, and specific gravity. Results for several specific gravities are plotted in Fig. 1.

Fig. 1

GAS COMPRESSIBILITY FACTOR

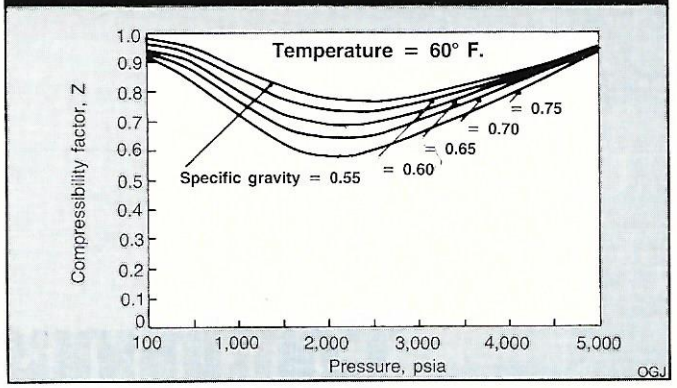

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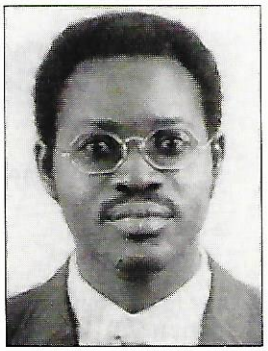
Table 1

COMPRESSIBILITY FACTOR OF NATURAL GAS

Pressure, psia	Compressibility factor Z
100.	0.98160
200.	0.97934
300.	0.97263
400.	0.96270
500.	0.95042
600.	0.93651
700.	0.92156
800.	0.90610
900.	0.89053
1,000.	0.87520
1,100.	0.86041
1,200.	0.84636
1,300.	0.83322
1,400.	0.82110
1,500.	0.81008
1,600.	0.80021
1,700.	0.79151
1,800.	0.78399
1,900.	0.77767
2,000.	0.77253
2,100.	0.76860
2,200.	0.76586
2,300.	0.76432
2,400.	0.76395
2,500.	0.76473
2,600.	0.76663
2,700.	0.76960
2,800.	0.77354
2,900.	0.77838
3,000.	0.78401
3,100.	0.79032
3,200.	0.79718
3,300.	0.80447
3,400.	0.81208
3,500.	0.81989
3,600.	0.82780
3,700.	0.83573
3,800.	0.84363
3,900.	0.85144
4,000.	0.85916
4,100.	0.86678
4,200.	0.87436
4,300.	0.88195
4,400.	0.88966
4,500.	0.89761
4,600.	0.90597
4,700.	0.91495
4,800.	0.92478
4,900.	0.93575
5,000.	0.94817

Temperature = 60° F.,
Specific gravity = 0.550

THE AUTHOR



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References

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