Note Title 2012-08-28

EXCEL Etiquette for Engineers

* Title
  Name
  Date

* Tables

  - Pre-Header Information

Text Descriptor A, e.g. Radius	1.234	cm
Text Descriptor B, e.g. Diameter	2.468	cm

	Must	Optional
- Headers row	Centered	bold
- Units row	Centered	italic (psia) [psia]

  - Digits
    - 3-4 significant digits usually OK (eye-comprehendable)
    - Machine "knows" 15-16 digits
    - Sometimes E format 1.23E-4
    - Setup immediately! (to avoid forgetting)

* Equations
  - Cell Referencing
    - A1 : relative
    - $A1 : fixed column A
    - A$1 : fixed row 1
    - A1 : fixed cell (column & row)

```
=A1*B2/C3+D4^2/SQRT(E5)*EXP(F6)+G7
*H8-I9/J10+(LOG(K11)*L12)/LN(M13)
```

	A	B	C	D
1	1			
2		2		
3			3	
4				4

Result = 2947.34 or 2947 (proper etiquette!)

A17

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	1													
2		2												
3			3											
4				4										
5					5									
6						6								
7							7							
8								8						
9									9					
10										10				
11											11			
12												12		
13													13	
14														
15														
16	2947.34													
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														

=A1*B2/C3+D4^2/SQRT(E5)*EXP(F6)+G7*H8-I9/J10+(LOG(K11)*L12)/LN(M13)

* Charts (Figures)

- Always on a separate sheet (tab)
- White background (not default gray)
- Black lines
- 16 or 18 pt font - all text (except legends: 12-14 pt)
- Symbols:

  ○ △ □ ◇ x + *

  white "inside"

  ● ▲ ■ ◆

  4-8 pt usually

  many data ↑ fewer data ↑

- Lines: solid, thickest (never thinest)
- Colors: OK

  Black, Red, Blue, Green, Pink

- Grid Lines
  - Show major
  - Only minor ticks (inside)
- Min/Max x- and y- selection
  - Use "nice" round values

  0 50 100 150 200 NOT 0 48 96 ...

- 2nd (Right) y-axis
  - Try to use same major ticks/lines
- Log axes: 1 10 100 ... use "General" number format (often)

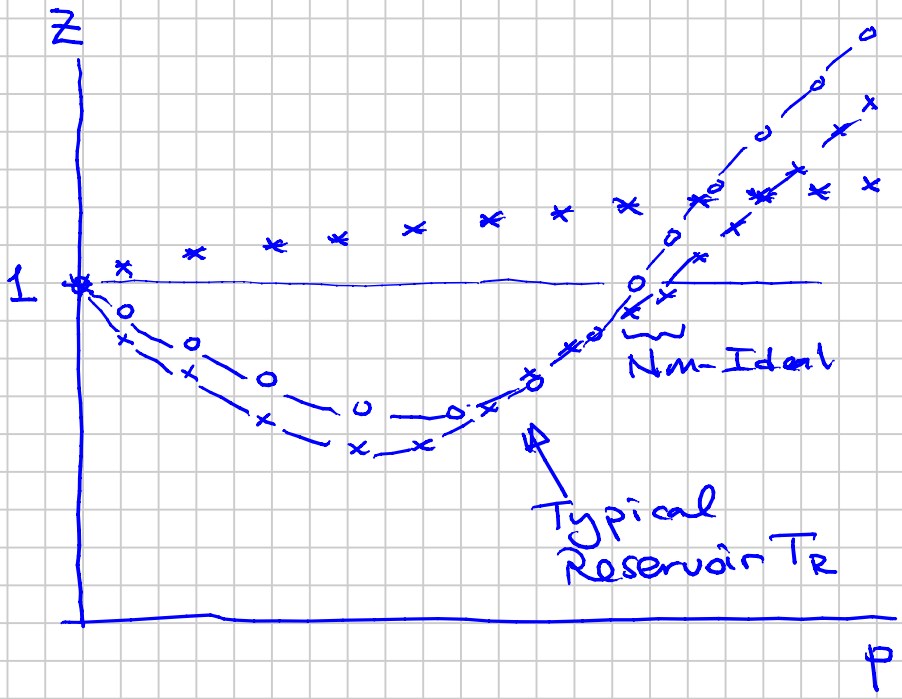
REAL GAS LAW

Deviation of p-V-T behavior of real systems (gas)
|
from "Ideal Gas Law" behavior ($Z = 1$)

$$Z \equiv \left(\frac{pV}{nRT}\right)$$

Measurements: Fixed n, Fixed Component (C_1)

T(°C)	P(bara)	V(m^3)	=> Z
200	1		
	⋮		
	100		
100	1		
	⋮		
	100		
400			



C_1 N_2 CO_2 H_2S C_2

Reservoir Gases Consist of "Large" quantities

van der Waals (187x): p-V-T gases & liquids & dunno
"Theory of Corresponding States"

Reduced Variables:

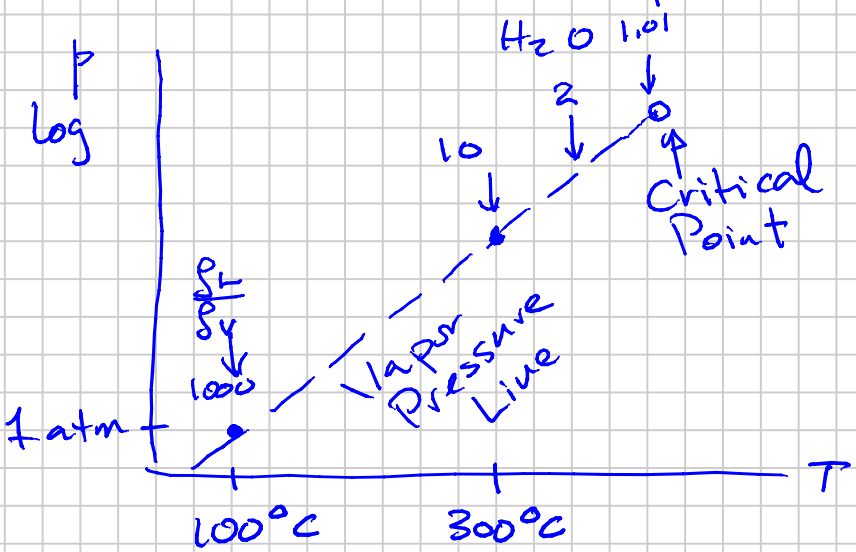
$$p_r \equiv \frac{p}{p_c}$$

$$T_r \equiv \frac{T}{T_c}$$

$$V_r \equiv \frac{V}{V_c}$$

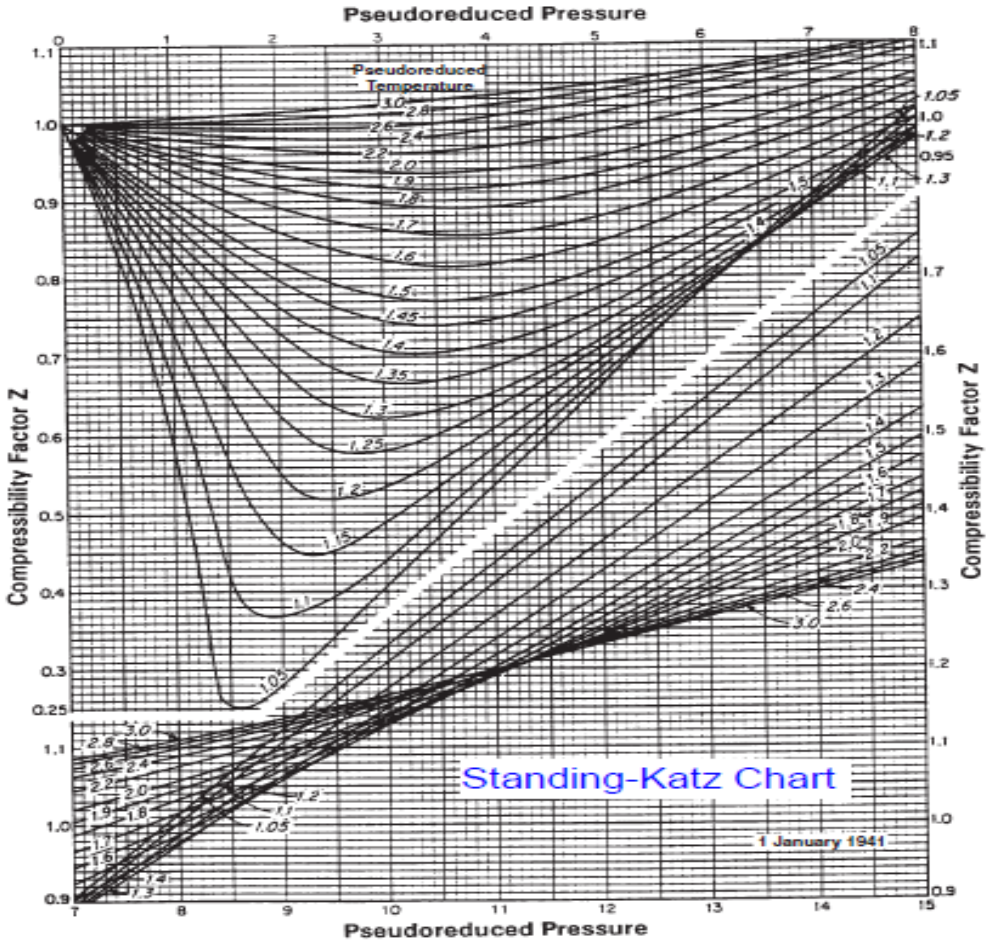
If any two gases have the same value of p_r & T_r then they will have the same $Z_g(T_r, p_r)$

(p_c, T_c) are the "critical" properties:



1940s: Donald Katz @ U. Michigan; Marshall B. Standing } $Z_g(T_r, p_r)$

All existing data + new data for petroleum mixtures



Mixtures:

*(H_2S, CO_2), (C_{7+}) requires special treatment Ch.3

Average $\bar{T}_{pc} = \sum_{i=1}^{N:C_{7+}} y_i \cdot T_{ci}$

pseudo

Reservoir Gas Mole Fraction

$\bar{p}_{pc} = \sum_{i=1}^{N} y_i p_{ci}$

✓ $T_{pr} = \frac{T}{T_{pc}}$ 1.3 – 2.5

✓ $p_{pr} = \frac{p}{p_{pc}}$ 0 – 20

Est. $T_{c7+} = f(M_{7+}, \rho_{7+})$ Lab measured – different for every reservoir

$p_{c7+} = f(M_{7+}, \rho_{7+})$

C_{7+} "characterization"

Matthews et al.

App. B: Example Calculations.

Real Gas Law:

$$pV = nRT \cdot \underbrace{Z(p_r, T_r)}_{\text{SK Chart}}$$

Equations that fit the chart (Ch.3)

0.7 – 2

van der Waals Donald Katz

Example Calculation:

Troll Field

$T_R = 71\ ^\circ C$

$p_{Ri} = 158$ bara

Gas Composition $y_i = \frac{n_{ig}}{n_g}$

SK: Estimate T_{pc}, p_{pc} knowing only the gas molecular weight

specific gravity (relative density)

often measured, available

$$\boxed{\gamma_g \equiv \frac{\rho_{g\,sc}}{\rho_{air\,sc}}} = \left(\frac{M_g}{M_{air}}\right)$$ of Reservoir Gas

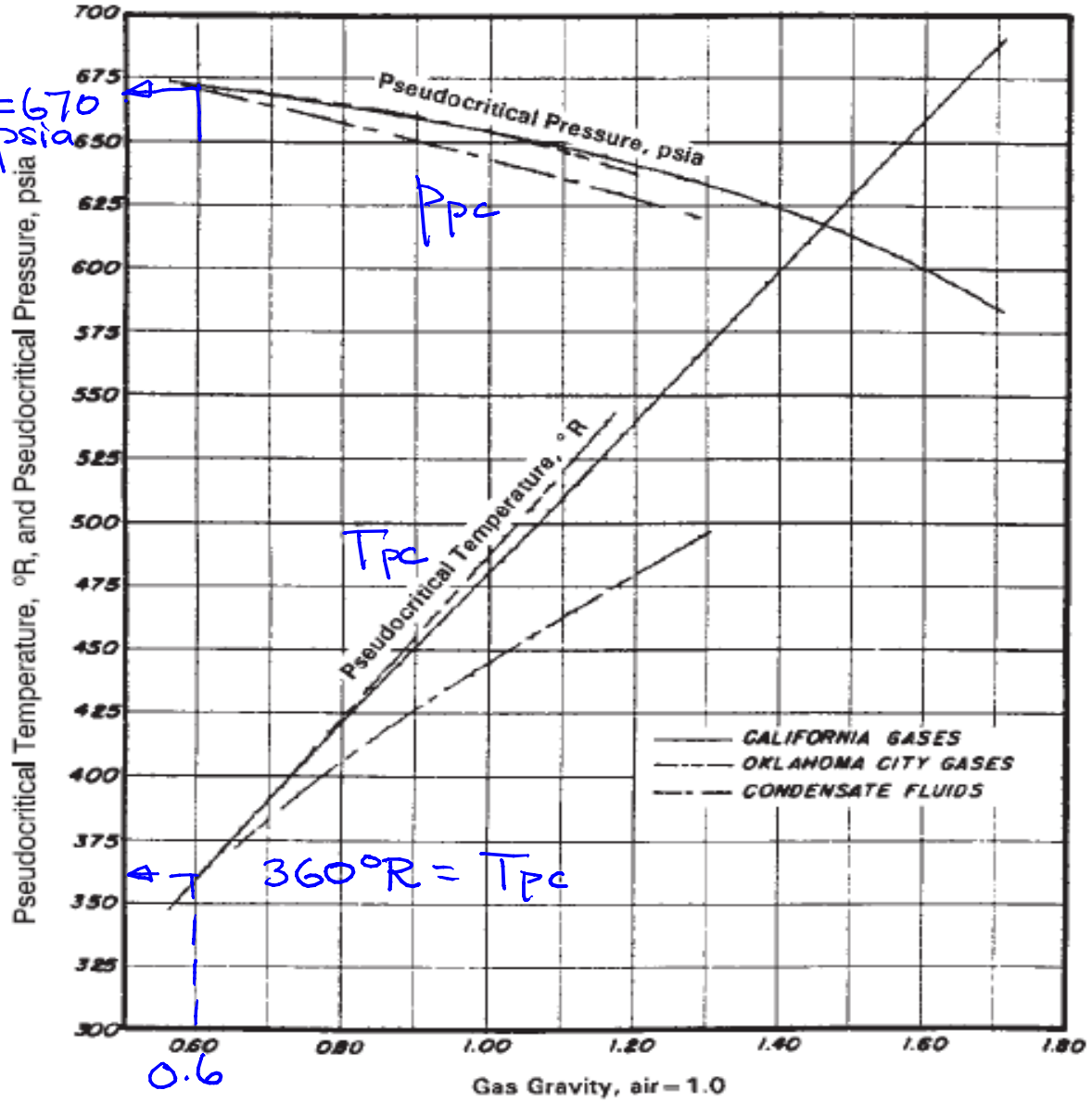
$$\rho_g = \frac{m_g}{V_g} = \frac{n_g \cdot M_g}{V_g} = \underbrace{\frac{n_g}{V_g}}_{m} \cdot M_g = \underbrace{\left(\frac{p}{RTZ}\right)}_{@\,s.c.} M_g$$

same for any g or air

$\gamma_g = 0.6$ (air = 1)

SK Correlation $T_{pc}(\gamma_g)$

$P_{pc}(\gamma_g)$



Ppc = 670 psia

360°R = Tpc

0.6

Fig. 3.7—Gas pseudocritical properties as functions of specific gravity.

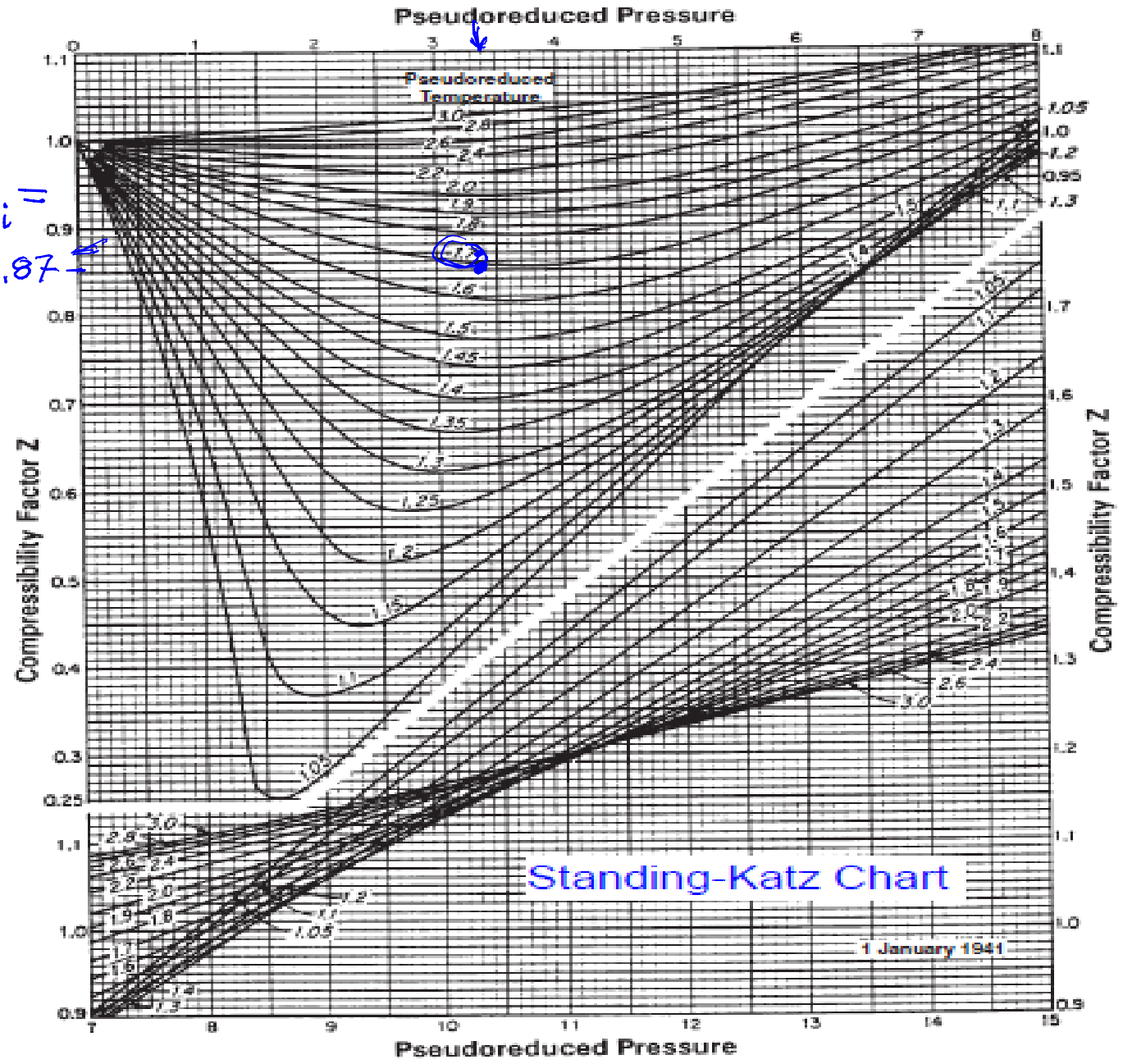
Troll $\gamma_g \simeq 0.6$

$T_{pc} = 360°R = 200\ K$

$P_{pc} = 670\ psia = 46.2\ bara$ 14.5 psi/bar

$$T_{pr} = \frac{273+71}{200} = \frac{344\ K}{200\ K} = \underline{1.72}$$

$$(P_{pr})_i = \frac{158\ bara}{46.2\ bara} = \underline{3.42}$$


Pseudoreduced Pressure
Pseudoreduced Temperature
Compressibility Factor Z
Compressibility Factor Z
Pseudoreduced Pressure
Standing-Katz Chart
1 January 1941

$Z_{gi} = 0.87$