$$n = \frac{1}{1-\left(\frac{k-1}{k\cdot\eta_p}\right)}$$

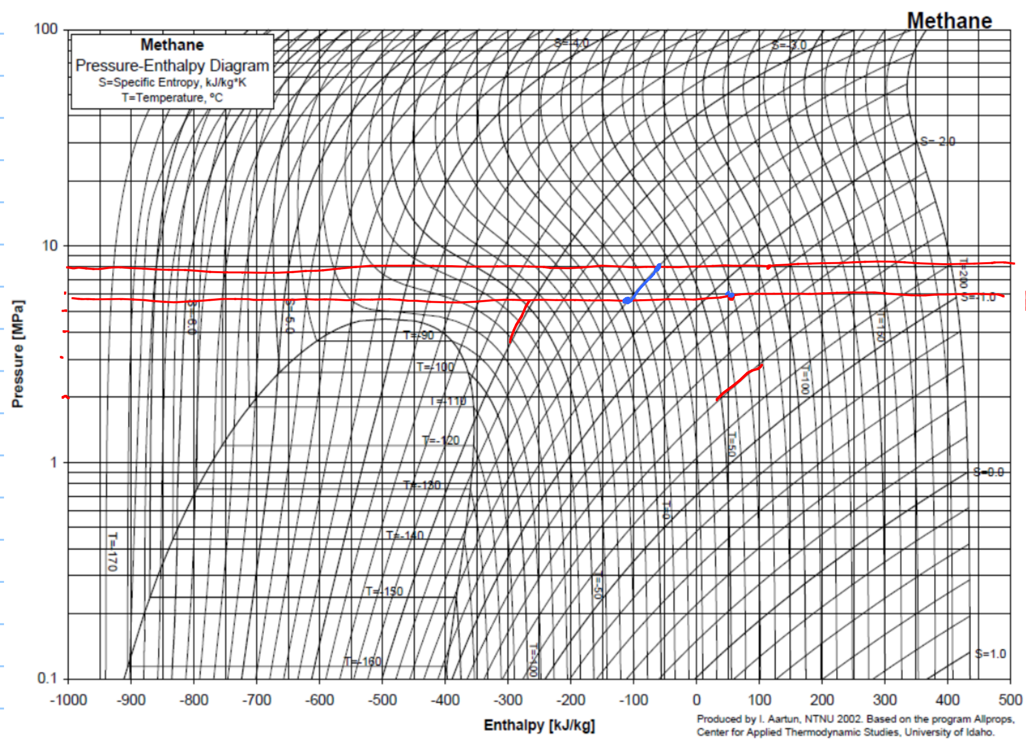
$$\eta_p = \left(\frac{k-1}{k}\right)\left(\frac{n}{n-1}\right)$$

$$k = \frac{C_p}{C_v}$$

η_p → (0.6 - 0.8)

$$\frac{T_{out}}{T_{in}} = r_p^{\frac{n-1}{n}}$$

Due to the shape of the isoentropy lines, lower inlet temperatures require less energy (Δh) for same Δp



(polytropic head on

- Estimate required compression power $P = \frac{H_p \cdot g \cdot \dot{m}}{\eta_p \cdot \eta_m}$

25.2 in compendium

$g = 9.81\ m/s^2$

$\eta_m = 95-99\%$

In pumps head $h = \frac{\Delta p}{\rho g}$

$$H_p = \frac{T_{suc}\, Z_{av}\, R}{g}\,\frac{n}{n-1}\left(r_p^{\frac{n-1}{n}} - 1\right)$$

$$Z_{av} = \frac{Z_{in} + Z_{out}}{2}$$

$$R = \frac{R_u}{MW}$$

Operation map compressor

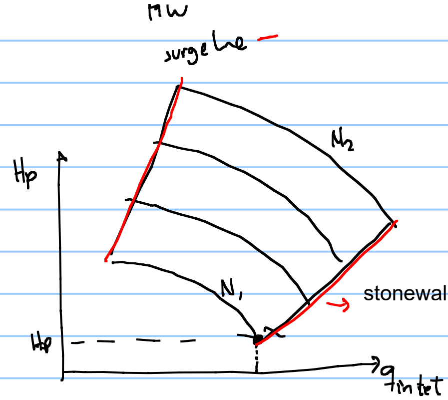
given

usually generated with certain gas → MW, k (air)

↳ T_{in}, P_{in}

↳ 1.01325 bara

↳ T_{amb} = 20°C



N rotational speed

test conditions are typically not equal to actual operating conditions

therefore it is necessary to convert from test conditions to actual conditions

$$q_{new} = q_{test} \sqrt{\frac{k_{new}}{k_{test}}} \cdot \sqrt{\frac{MW_{test}}{MW_{new}}} \cdot \sqrt{\frac{T_{new}}{T_{test}}}$$

$$Hp_{new} = Hp_{test} \frac{k_{new}}{k_{test}} \frac{MW_{test}}{MW_{new}} \cdot \frac{T_{new}}{T_{test}}$$

for our case we will convert the operational point to compressor test conditions

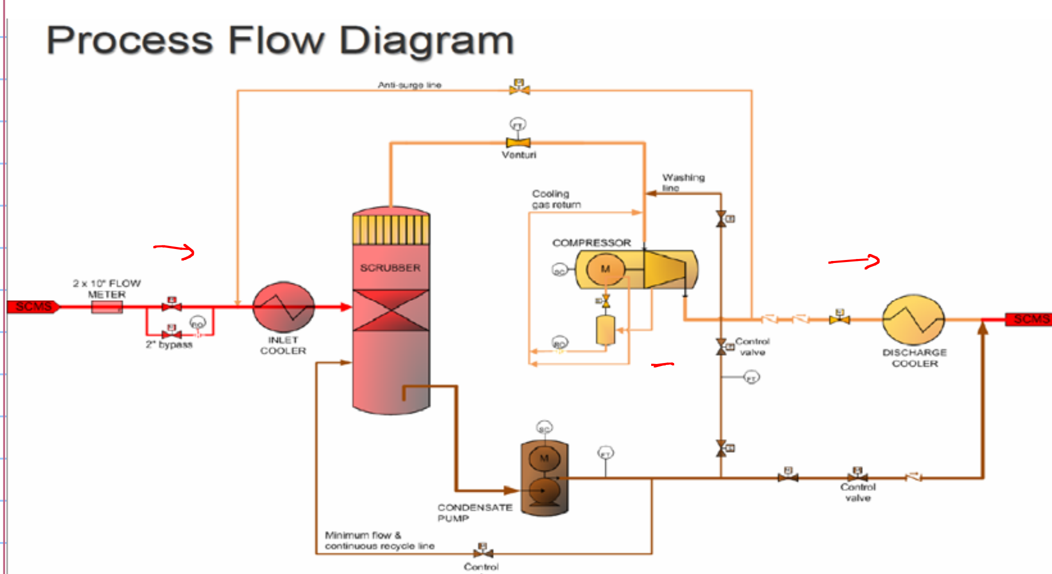
↓

$$Hp_{test} = Hp_{new} \frac{k_{test}}{k_{new}} \cdot \frac{MW_{new}}{MW_{test}} \cdot \frac{T_{test}}{T_{new}}$$

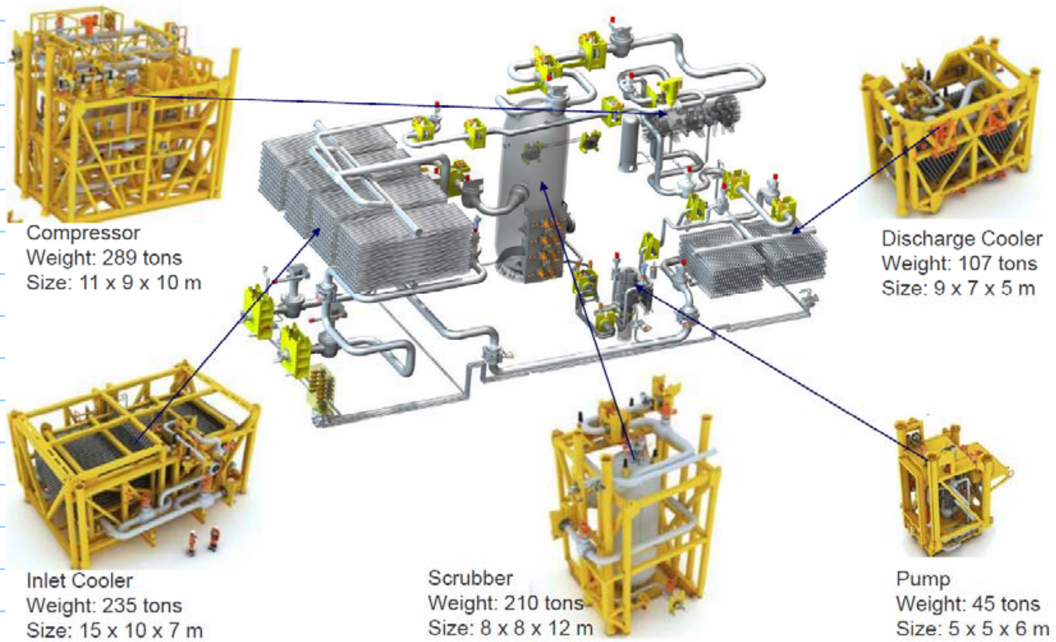
$$q_{test} = q_{new} \sqrt{\frac{k_{test}}{k_{new}}} \sqrt{\frac{MW_{new}}{MW_{test}}} \sqrt{\frac{T_{test}}{T_{new}}}$$

$$B_g(p,T) = \frac{q_g(p,T)}{q_{\bar{g}}(p_{sc},T_{sc})} \qquad q_g = q_{\bar{g}} \cdot B_g$$

$$B_g = \frac{V_g(p,T)}{V_{\bar{g}}(p_{sc},T_{sc})}$$

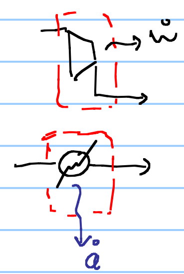


Process Modules- Sizes and Dry Weights



Cooler duty $\dot{Q} = \dot{m}\,(h_{inlet} - h_{outlet})$

11 MW 67°C



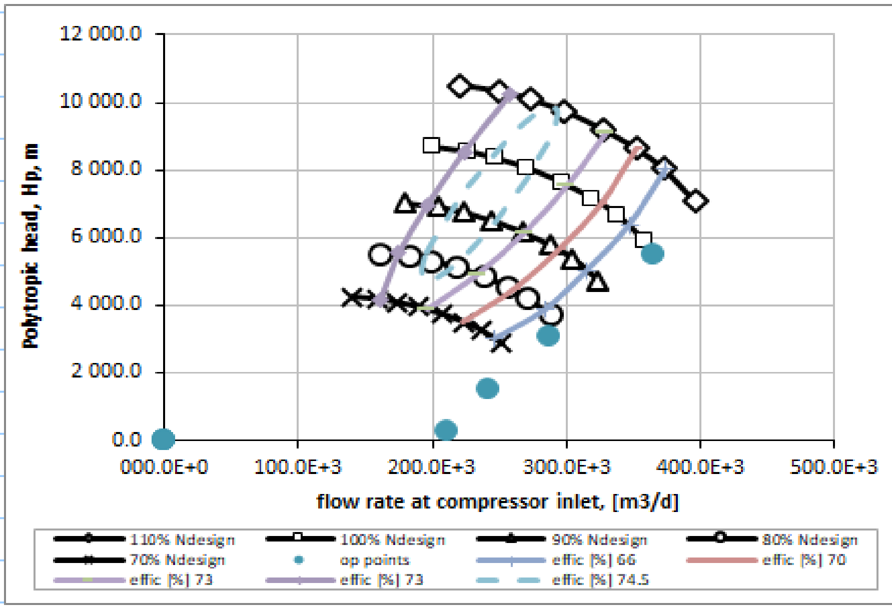
http://www.ipt.ntnu.no/

COMPRESSION STARTS

Deltap choke comp	p_suc	pcomp dis	Tplem	DT inlet cooler	Tsuc	rp	deltap	np -eff	n	Tdis	DT outlet cooler	Tin_pipeline	zsuc	zdisc	Bg @suc	qg_local	Hp
[bar]	[bara]	[bara]	[C]	[C]	[C]	[-]	[bar]	[-]	[-]	[C]	[C]	[C]			[m^3/Sm^3]	[m^3/d]	[m]
0	76.1	78.7	67	0	67	1.03	2.6	0.7	1.49	70.8	0	70.8					
0	66.8	78.7	67	0	67	1.18	11.9	0.7	1.49	85.9	0	85.9					
0	56.7	78.7	67	0	67	1.39	22.0	0.7	1.49	105.7	0	105.7					
0	45.3	78.7	67	0	67	1.74	33.4	0.7	1.49	134.8	0	134.8					
0	31.1	78.7	67	0	67	2.53	47.5	0.7	1.49	188.3	0	188.3					
0	#VALUE!	78.7	67	0	67	#VALUE!	#VALUE!	0.7	1.49	#VALUE!	0	#VALUE!					
0	#VALUE!	78.7	67	0	67	#VALUE!	#VALUE!	0.7	1.49	#VALUE!	0	#VALUE!					
0	#VALUE!	78.7	67	0	67	#VALUE!	#VALUE!	0.7	1.49	#VALUE!	0	#VALUE!					

Tsc	288.71	K	Pin, bara	50
k	1.30		Tin, K	298.15
Polytropic effic	0.7		Zin	0.98
Mech. Effic	0.95		Mw	28.97

zsuc	zdisc	Bg @suc	qg_local	Hp	m	Power	Hp test	qact test	qact test single comp
		[m^3/Sm^3]	[m^3/d]	[m]	[kg/s]	[MW]	[m]	[m^3/d]	[m^3/d]
0.928	0.930	1.46E-02	292.0E+3	565.1	155.7E+0	1.30	294.8	210883.7638	
0.935	0.942	1.68E-02	335.2E+3	2851.9	155.7E+0	6.55	1487.9	242119.9827	
0.944	0.955	1.99E-02	398.4E+3	5924.7	155.7E+0	13.61	3091.0	287755.5395	
0.954	0.970	2.52E-02	504.1E+3	10505.5	155.7E+0	24.13	5480.9	364116.1919	
0.967	0.988	3.72E-02	743.8E+3	19107.5	155.7E+0	43.89	9968.8	537247.0699	


12 000.0
10 000.0
8 000.0
6 000.0
4 000.0
2 000.0
0.0
Polytropic head, Hp, m
000.0E+0
100.0E+3
200.0E+3
300.0E+3
400.0E+3
500.0E+3
flow rate at compressor inlet, [m3/d]
110% Ndesign
100% Ndesign
90% Ndesign
80% Ndesign
70% Ndesign
op points
effic [%] 66
effic [%] 70
effic [%] 73
effic [%] 73
effic [%] 74.5