

Upprifjunarefni

**Tafla1. Nokkur mikilvæg formúlutákn, stærðir og einingar, flest samkvæmt SI.**

Formúlutákn:	Heiti:	Eining:	Eining (stýtt, samsett)
A	Flötur, þversniðsflötur		m <sup>2</sup> eða mm <sup>2</sup>
B	Segulþéttleiki	Tesla	T=Vs/m <sup>2</sup>
B	Launleiðni, riðstraumsleiðni	1/Ohm og Siemens	1/Ω og S
C	Rýmd	Farad	F=As/V
C <sub>KWh</sub>	Fasti fyrir KWh-mæla	Snúningar skífu/KWh	1/KWh
c	Eðlisvarmi		Ws/kg·K
cosφ	Aflstuðull		
E	Rafsvið		V/m=N/C
F	Kraftur	Newton	N
f	Tíðni	Herz	Hz=1/s
G	Leiðni	1/Ohm og Siemens	1/Ω og S
H	Segulstyrkur		A/m
I	Straumur (virkt gildi)	Amper	A
I	Straumur (sem fall af tíma)	Amper	A
L	Spanstuðull	Henry	H=Vs/A
l	Lengd, fjarlægð	Meter	m
m	Massi	Kílógramm	kg
m	Álagsstuðull		
N	Vindingafjöldi		
n	Snúningshraði		1/s, 1/mín eða 1/klst.
P	Afl (raunafl)	Watt	W
p	Pólpör (helmingur póla)		
Q	Rafhleðsla	Coulomb	C
Q	Launafl	VA reactive (óvirkt)	VAR
Q	Varmi	Joule	J=W·s=Ws
R	Viðnám	Ohm	Ω=V/A
S	Sýndarafl	VoltAmper	VA=V·A
sinφ	Launaflstuðull		
T	Sveiflutími	Sekúndur	s
t	Tími	Sekúndur	s
U	Spenna (virkt gildi)	Volt	V=J/C=W/A
u	Spenna (sem fall af tíma)	Volt	V
v	Hraði		m/s
W	Orka, vinna	Joule	J=Ws
X <sub>L</sub> , X <sub>C</sub>	Launviðnám, riðstraumsviðnám	Ohm	Ω=V/A
Y	Samleiðni	1/Ohm og Siemens	1/Ω og S
Z	Samviðnám	Ohm	Ω=V/A
α (alfa)	Hitastuðull	1/Kelvin og 1/Celsíus	1/K og 1/°C
γ (gamma)	Eðlisleiðni		m/Ωmm <sup>2</sup>
Δ (delta)	Tákn um mismun tveggja stærða		
ε <sub>r</sub> (epsilon)	Rafsvörunarstuðull efnis m.v. loft		
η (eta)	Nýtni		
Θ (beta, stórt)	Segulispenna	Amper vindingar	A
θ (beta)	Hitastig	Gráður Celsíus	°C og K
λ (lambda)	Bylgjulengd	Meter	m
μ <sub>r</sub> (my)	Segulmögnunarstuðull efnis m.v. loft		
ρ (rhó)	Eðlisviðnám		Ωm og Ωmm <sup>2</sup> /m
φ (fí, stórt))	Segulflæði	Weber	Wb=Vs
φ (fí)	Fasvikshorn		
ω (omega)	Hornhraði, hringhraði		1/s

**Tafla 2. Nokkrir eðlisfræðifastar**

Formúlutákn	Heiti:	Stærð:	Eining:
c	Ljós hraði	$3 \cdot 10^8$	m/s
g	Þyngdarhröðun	9,82	m <sup>2</sup> /s
$\epsilon_0$ (epsilon)	Rafsvörun lofta	$8,85 \cdot 10^{-12}$	F/m=As/Vm
$\mu_0$ (my)	Segulmagnun lofta	$4\pi \cdot 10^{-7}$	H/m=Vs/Am

**Tafla 3. Forskeyti við einingar (margfeldistuðlar).**

Veldi af 10:	Margfelditala:	Heiti:	Tákn:
$10^9$	1000000000	Giga	G
$10^6$	1000000	Mega	M
$10^3$	1000	Kíló	K
$10^2$	100	Hektó	h
$10^1$	10	Deka	da
$10^0$	1		
$10^{-1}$	0,1	Deci	d
$10^{-2}$	0,01	Centi	c
$10^{-3}$	0,001	Milli	m
$10^{-6}$	0,000001	Míkró	$\mu$
$10^{-9}$	0,000000001	Nanó	n

**Tafla 4. Bræðslu- og eðlisvarmi nokkurra efna.**

Efni:	Bræðslu- mark: °C	Bræðsluvarmi: Ws/kg	Eðlisvarmi: Ws/kg·K	Suðumark: °C
Al	658	356000	900	
Eir	1083	209000	386	
Gull	1063	67000	130	
Járn	1535	12570	460	
Tin	232	58600	200	
Wolfram	3380	251000	140	
Vatn	0	33200	4187	100

**Tafla 5. Eðlisviðnám, eðlisleiðni, hitastuðull og eðlisþyngd nokkurra málma.**

Málmur:	Eðlisviðnám: $\Omega \cdot \text{mm}^2/\text{m}$	Eðlisleiðni: $\text{m}/\Omega \cdot \text{mm}^2$	Hitastuðull, $\alpha$ : 1/°C við 20/°C	Eðlisþyngd: $\text{kg}/\text{m}^3$
Al	0,028	35,7	0,0039	2700
Eir	0,018	55,6	0,0039	8930
Gull	0,023	43,5	0,004	19290
Járn	0,12	8,33	0,0045	7860
Tin	0,11	9,10	0,0042	7280
Wolfram	0,056	17,9	0,0045	19300

**Tafla 6. Litakóði til að auðkenna stærð á viðnámum og þéttum.**

Litur:	1. hringur	2. hringur	3. hringur margfeldi	4. hringur	5. hringur, hita- stuðull viðnáma	Þéttar: $U_{\text{MAX}}$
Svartur	0	0	$10^0=1$			-
Brúnn	1	1	$10^1=10$	$\pm 1\%$	$\pm 100 \cdot 10^{-6} \text{ 1/K}$	100V
Rauður	2	2	$10^2=100$	$\pm 2\%$	$\pm 50 \cdot 10^{-6} \text{ 1/K}$	200V
Appelsínugulur	3	3	$10^3=1000$			300V
Gulur	4	4	$10^4=10000$		$\pm 25 \cdot 10^{-6} \text{ 1/K}$	400V
Grænn	5	5	$10^5=100000$			500V
Blár	6	6	$10^6=1000000$			600V
Fjólublár	7	7				700V
Grár	8	8				800V
Hvítur	9	9				900V
Gull			$10^{-1}=0,1$	$\pm 5\%$		1000V
Silfur			$10^{-2}=0,01$	$\pm 10\%$		2000V
Enginn litur				$\pm 20\%$		500V

## Leiðarar

Viðnám í leiðara: 
$$R_l = \frac{\rho \cdot l}{A}$$

Hitaleiðrétting: 
$$R_2 = R_1 + R_1 \cdot \alpha \cdot (v_2 - v_1)$$

## Almenn rafmagnsfræði

$$U = I \cdot R \qquad I = \frac{U}{R} \qquad R = \frac{U}{I}$$

$$G = \frac{1}{R} \qquad \gamma = \frac{1}{\rho}$$

$$P = U \cdot I \qquad P = I^2 \cdot R \qquad P = \frac{U^2}{R}$$

## Raðtenging

$$U_H = U_1 + U_2 + U_3 \dots \qquad I_H = I_1 = I_2 = I_3 \dots \qquad R_H = R_1 + R_2 + R_3 \dots$$

$$L_H = L_1 + L_2 + L_3 \dots \qquad \frac{1}{C_H} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \dots$$

## Hliðtenging

$$U_H = U_1 = U_2 = U_3 \dots \qquad I_H = I_1 + I_2 + I_3 \dots \qquad \frac{1}{R_H} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \dots$$

$$\frac{1}{L_H} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} \dots \qquad C_H = C_1 + C_2 + C_3 \dots$$

## Riðspenna-riðstraumur

$$U = \frac{U_t}{\sqrt{2}} \qquad I = \frac{I_t}{\sqrt{2}} \qquad f = \frac{1}{T} \qquad \omega = 2\pi \cdot f$$

Afriðill (hálfbylgja):  $U_m = \frac{1}{\pi} U_t$       Afriðill (heilbylgja):  $U_m = \frac{2}{\pi} U_t$

## Riðstraumsviðnám

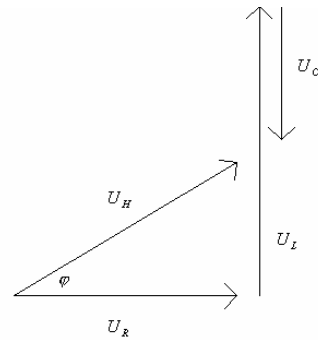
$$Z = \frac{U}{I} \qquad X_L = 2\pi \cdot f \cdot L \qquad X_C = \frac{1}{2\pi \cdot f \cdot C}$$

Raðtenging:

$$U_L - U_C = U_H \sin \varphi$$

$$U_R = U_H \cos \varphi$$

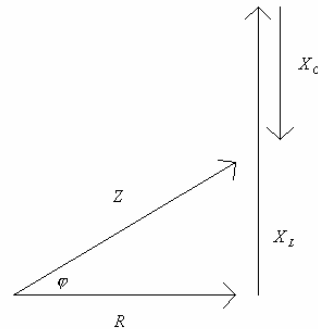
$$U_H = \sqrt{U_R^2 + (U_L - U_C)^2}$$



$$X_L - X_C = Z \sin \varphi$$

$$R = Z \cos \varphi$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

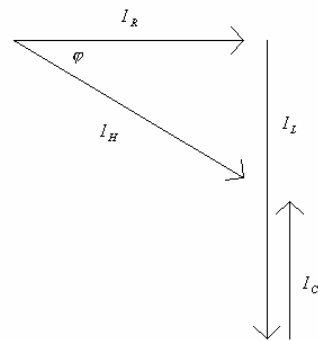


Hliðtenging:

$$I_L - I_C = I_H \sin \varphi$$

$$I_R = I_H \cos \varphi$$

$$I_H = \sqrt{I_R^2 + (I_L - I_C)^2}$$



Afl og orka

$$P = U \cdot I \cdot \cos \varphi$$

$$Q = U \cdot I \cdot \sin \varphi$$

$$S = U \cdot I$$

$$S = I^2 \cdot Z$$

$$S = \frac{U^2}{Z}$$

$$Q = I_X^2 \cdot X$$

$$Q = \frac{U_X^2}{X}$$

$$P = I_R^2 \cdot R$$

$$P = \frac{U_R^2}{R}$$

Nýtni:  $\eta = \frac{P_{út}}{P_{inn}}$

kWh-mælir:  $P = \frac{n}{C_{kWh}}$

$$W = \frac{N}{C_{kWh}}$$

$$Q_H = Q_1 + Q_2 + Q_3 \dots$$

$$P_H = P_1 + P_2 + P_3 \dots$$

$$S_H = \sqrt{P_H^2 + Q_H^2}$$

$$W = c \cdot m \cdot \Delta \theta$$

$$W = P \cdot t$$

## Spennar

$$\eta = \frac{S_N \cdot \cos \varphi \cdot m}{S_N \cdot \cos \varphi \cdot m + \Delta P_0 + \Delta P_K \cdot m^2} \quad m = \frac{S_2}{S_N}$$

$$u = \frac{U_1}{U_2} = \frac{N_1}{N_2} = \frac{I_2}{I_1}$$

Tengibreytingar þrífasa spenna:

$$D \rightarrow Y = \frac{1}{\sqrt{3}} = y \rightarrow d \quad Y \rightarrow D = \sqrt{3} = d \rightarrow y \quad Z \rightarrow Y = \frac{\sqrt{3}}{2} = y \rightarrow z$$

$$D \rightarrow Z = \frac{2}{3} = z \rightarrow d \quad Z \rightarrow D = \frac{3}{2} = d \rightarrow z \quad Y \rightarrow Z = \frac{2}{\sqrt{3}} = z \rightarrow y$$

## Mótorar

$$M = \frac{60 P_2}{2\pi \cdot n} \quad s = 100 \frac{n_s - n}{n_s} \% \quad n_s = \frac{60 f}{p} \quad f_r = f \cdot s$$

## Fasaleiðréttingar:

$$Q = 3 \cdot U_f^2 \cdot \omega \cdot C_f \quad Q = U_c^2 \cdot \omega \cdot C \quad Q = P_1 \cdot (\tan \varphi_1 - \tan \varphi_2)$$

## Eigintíðni:

$$f_{res} = \frac{1}{2\pi\sqrt{LC}}$$

## Jafngildi rað- og hliðtenginga

$$R_{RT} = \frac{R_{HT} \cdot X_{HT}^2}{R_{HT}^2 + X_{HT}^2}$$

$$R_{HT} = \frac{R_{RT}^2 + X_{RT}^2}{R_{RT}}$$

$$X_{RT} = \frac{R_{HT}^2 \cdot X_{HT}}{R_{HT}^2 + X_{HT}^2}$$

$$X_{HT} = \frac{R_{RT}^2 + X_{RT}^2}{X_{RT}}$$

## Afl í þrífasakerfum (jafnlægt álag)

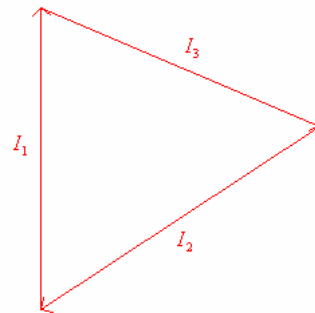
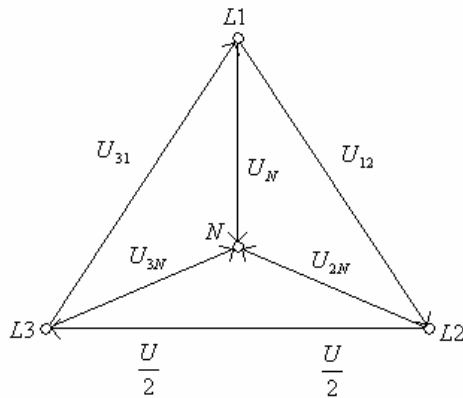
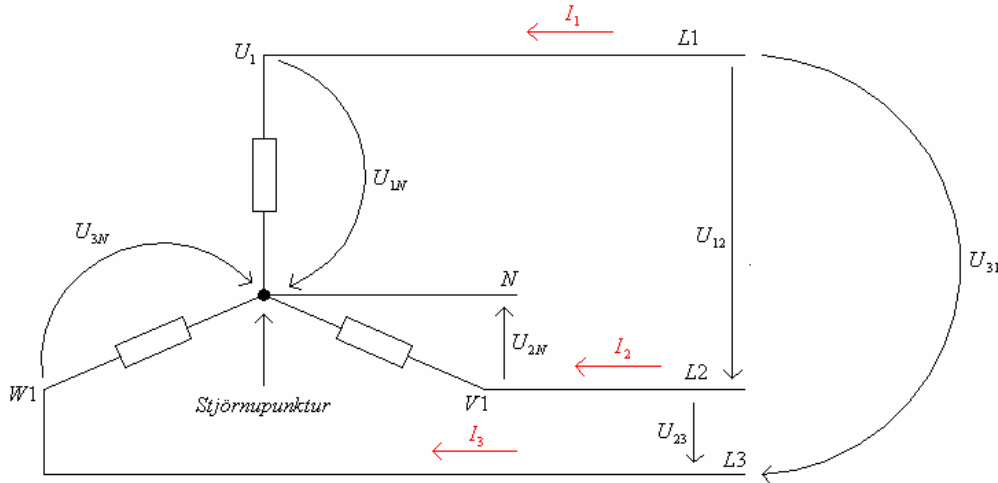
$$S = \sqrt{3} \cdot U \cdot I$$

$$P = \sqrt{3} \cdot U \cdot I \cdot \cos \varphi$$

$$Q = \sqrt{3} \cdot U \cdot I \cdot \sin \varphi$$

## Þrífasatengingar

Stjörnutenging:



$$I = I_{fasi}$$

$$U = \sqrt{3} \cdot U_{fasi}$$

Straumur í núll-leiðara í stjörnutengingu og við ójafnlægt álag:

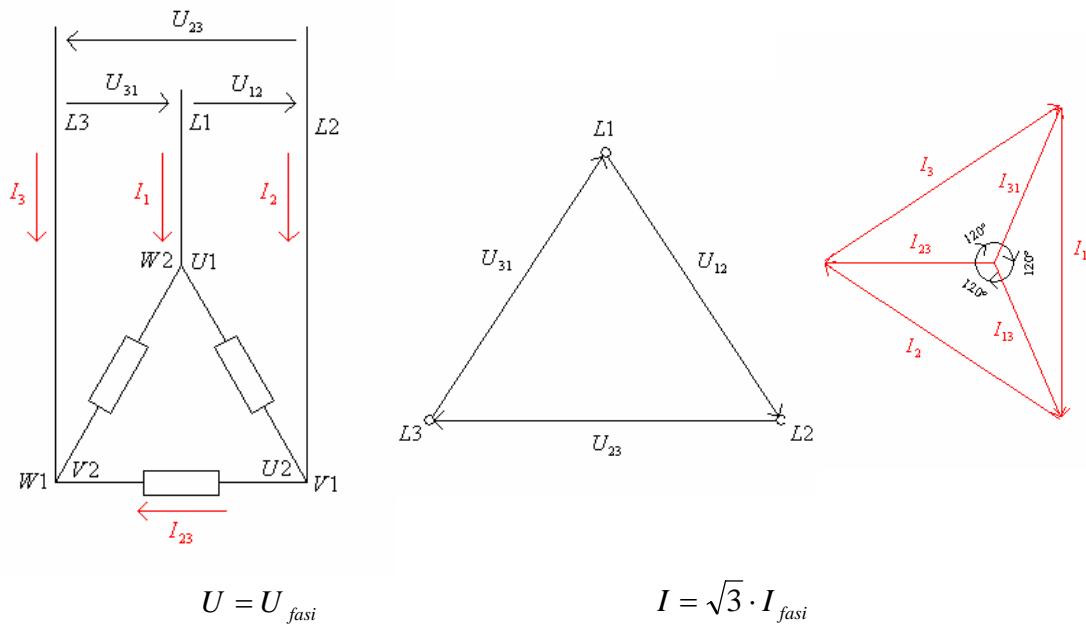
$$I_{12} = \sqrt{(I_1^2 + I_2^2 - I_1 \cdot I_2)}$$

$$\cos \beta = \frac{2 I_1 - I_2}{2 I_{12}}$$

$$\alpha = 60^\circ - \beta$$

$$I_N = \sqrt{(I_1^2 + I_2^2 + I_3^2 - I_1 \cdot I_2 - 2 \cdot I_3 \cdot I_{12} \cdot \cos \alpha)}$$

Þríhyrningstenging:



Afljafngildi stjörnu- og þríhyrningstenginga

$$R_1 = \frac{R_{1-2} \cdot R_{3-1}}{R_{1-2} + R_{2-3} + R_{3-1}}$$

$$R_{1-2} = \frac{R_1 \cdot R_2 + R_2 \cdot R_3 + R_1 \cdot R_3}{R_3}$$

$$R_2 = \frac{R_{1-2} \cdot R_{2-3}}{R_{1-2} + R_{2-3} + R_{3-1}}$$

$$R_{2-3} = \frac{R_1 \cdot R_2 + R_2 \cdot R_3 + R_1 \cdot R_3}{R_1}$$

$$R_3 = \frac{R_{2-3} \cdot R_{3-1}}{R_{1-2} + R_{2-3} + R_{3-1}}$$

$$R_{3-1} = \frac{R_1 \cdot R_2 + R_2 \cdot R_3 + R_1 \cdot R_3}{R_2}$$

Spennuföll

Jafnstraumur:

$$\Delta U = \frac{2 \cdot \rho \cdot l \cdot P}{A \cdot U} \quad \Delta U = \frac{2 \cdot \rho \cdot l \cdot I}{A}$$

1-fasa riðstraumur:

$$\Delta U = \frac{2 \cdot \rho \cdot l \cdot P}{A \cdot U} \quad \Delta U = \frac{2 \cdot \rho \cdot l \cdot I \cdot \cos \varphi}{A}$$

3ja-fasa riðstraumur:

$$\Delta U = \frac{\rho \cdot l \cdot P}{A \cdot U} \quad \Delta U = \frac{\sqrt{3} \cdot \rho \cdot l \cdot I \cdot \cos \varphi}{A}$$

## Vatnsaflsstöðvar

$$P_g = V \cdot \rho \cdot g \cdot \Delta Z$$

V; vatnsmagn ( $\text{m}^3/\text{s}$ )

$\rho$ ; eðlismassi vatns ( $\text{kg}/\text{m}^3$ )

g; þyngdarhröðun ( $\text{m}/\text{s}^2$ )

$\Delta Z$ ; nettó fallhæð (m)

## Háspennt flutningskerfi (loftlínur)

### Afltöp og spennuföll

3ja-fasa riðstraumur:

$$\Delta P = R \cdot I^2 \cdot 3$$

$$\Delta U = \sqrt{3} \cdot (R \cdot I \cdot \cos \varphi + X \cdot I \cdot \sin \varphi)$$