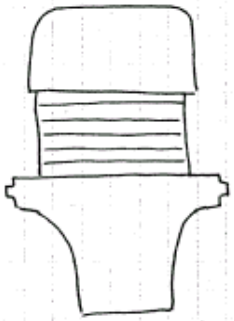
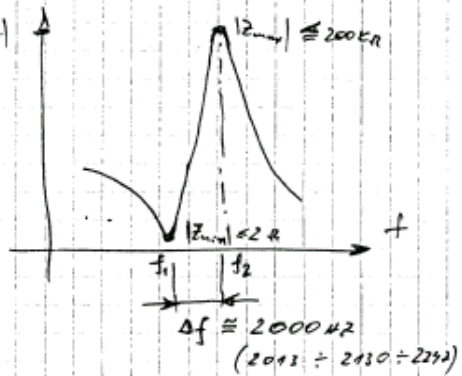
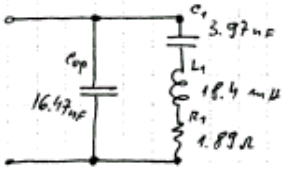
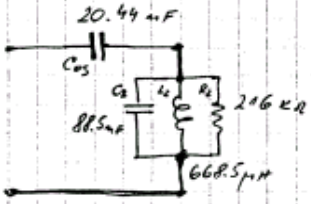
BRANSON 502 CONVERTOR

6 X P278 / 2"









$\tan\delta\,(1\text{kHz}) = 279\mu = 0.000279$

$C_{iop}\,(1\text{kHz}) = 19.55\,\text{nF}$

$\Delta f = 2130\,\text{Hz}$

$|Z_{min}| = 1.95\,\Omega$, $|Z_{max}| = 191\,\text{k}\Omega$

$f_1 = 18620\,\text{Hz}$

$f_2 = 20750\,\text{Hz}$ / Low voltage

$f_2 = 20663\,\text{Hz}$ / High voltage

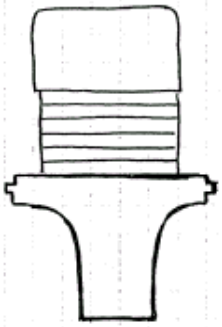
$Q_{m1} = \frac{1}{R_1}\sqrt{\frac{L_1}{C_1}} = 1139$

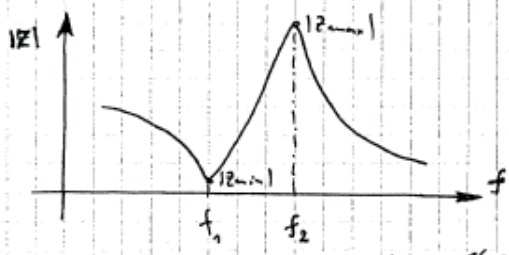
$Q_{m2} = R_2\sqrt{\frac{C_2}{L_2}} = \cancel{2550}\ 2485$

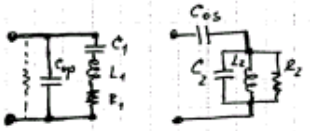
BRANSON CONVERTER 502

(non loaded – no cap)

piezoceramic
6 x PZT8 ; 2" (VERNITRON)
6 x SP8 ; 2" (HCT)







Loco voltage operate.

$f_1 = (18425 \div 18815)$ Hz (HCT) ; (V) ; $\bar{f}_1 = 18620$ Hz

$f_2 = (20672 \div 20828)$ Hz ; $\bar{f}_2 = 20750$ Hz

$\Delta f = (2247 \div 2013)$ Hz ; $\Delta\bar{f} = 2130$ Hz

$|Z_{min}| = (1.92 \div 1.98)\ \Omega$ (HCT) (V) ; $|\bar{Z}_{min}| = 1.95\ \Omega$

$|Z_{max}| = (211 \div 172)$ KΩ ; $|\bar{Z}_{max}| = 191$ KΩ

$R_1 = (1.91 \div 1.87)\ \Omega$; $\bar{R}_1 = 1.89\ \Omega$

$R_2 = (241 \div 191)$ KΩ ; $\bar{R}_2 = 216$ KΩ

(1 KHz)
$tan\delta = 65.7\mu \div 493\mu$
$\overline{tan\delta} = 279\mu$
$C_{op} = 19.1337$ nF $\div$ 19.963 nF
$\bar{C}_{op} = 19.54835$ nF

$L_1 = 18.4755$ mH (HCT) $\div$ 18.5335 mH (V) ; $\bar{L}_1 = 18.4045$ mH

$C_1 = 4.04095$ nF (HCT) $\div$ 3.90441 nF (V) ; $\bar{C}_1 = 3.97268$ nF

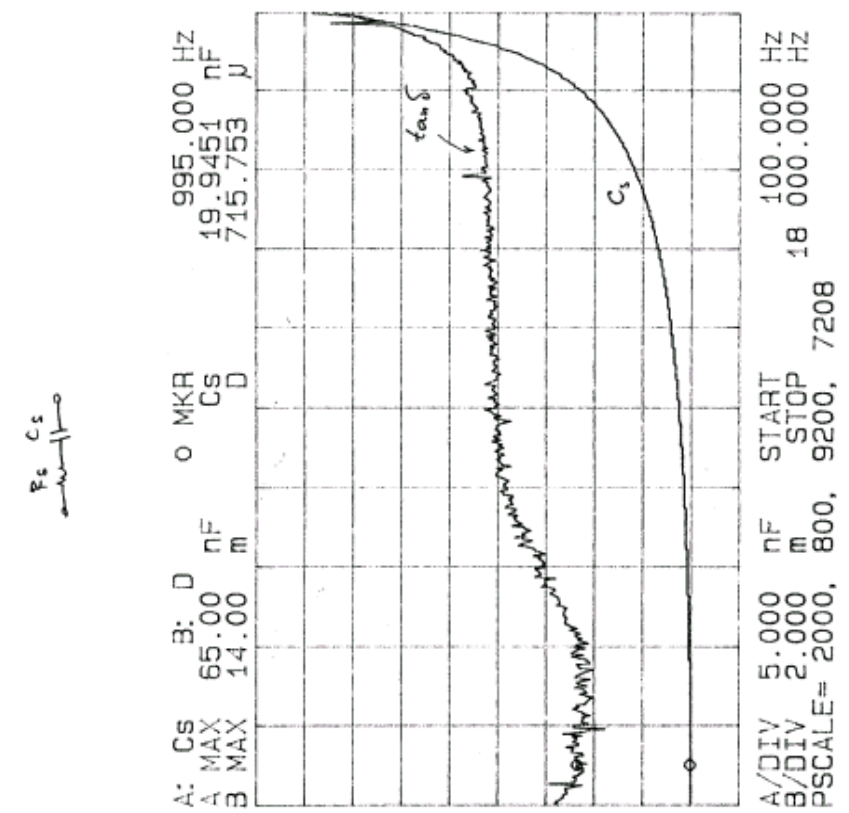
$C_{op} = 15.6186$ nF HCT $\div$ 17.32401 nF V ; $\bar{C}_{op} = 16.47132$ nF

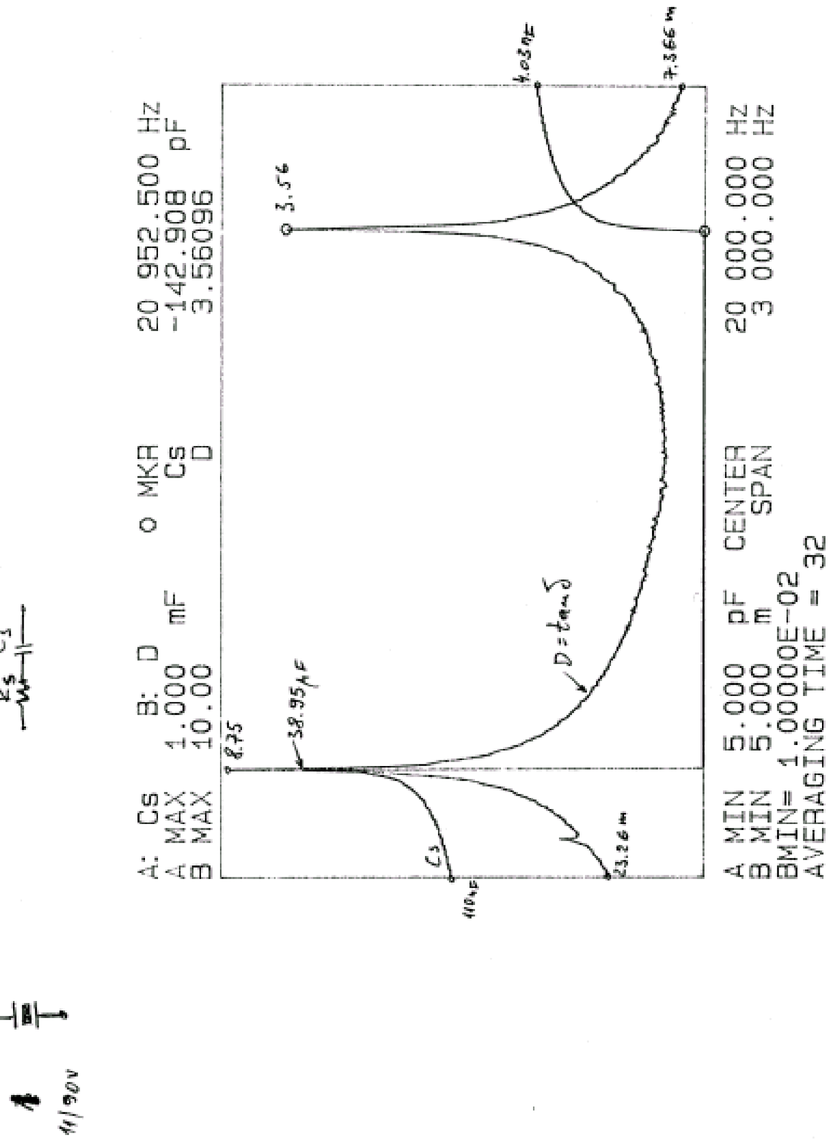
$C_{os} = 19.65955$ nF HCT $\div$ 21.22842 nF V ; $\bar{C}_{os} = 20.743985$ nF

$L_2 = 741.389\ \mu$H $\div$ 595.6 μH ; $\bar{L}_2 = 668.495\ \mu$H

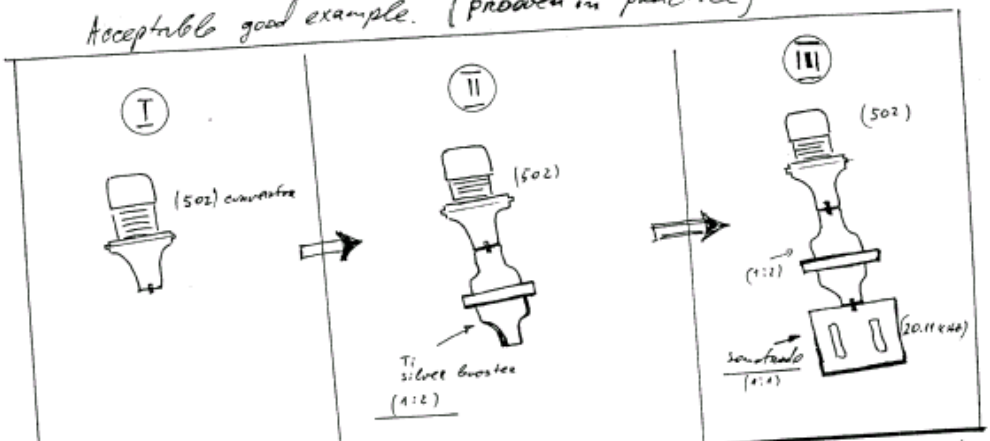
$C_2 = 79.95067$ nF $\div$ 97.08423 nF ; $\bar{C}_2 = 88.5174517$ nF

High voltage operating frequency
$f_1 = 20590 \div 20738$ Hz
$\bar{f}_2 = 20663$ Hz.


A: Cs
A MAX 65.00 nF
B MAX 14.00 m
B: D
0 MKR
Cs
D
995.000 Hz
19.9451 nF
715.753 µ
tan δ
Cs
A/DIV 5.000 nF
B/DIV 2.000 m
PSCALE= 2000, 800, 9200, 7208
START 100.000 Hz
STOP 18 000.000 Hz


A: Cs B: D O MKR 20 952.500 Hz
A MAX 1.000 mF Cs -142.908 pF
B MAX 10.00 D 3.56096
A MIN 5.000 pF CENTER 20 000.000 Hz
B MIN 5.000 m SPAN 3 000.000 Hz
BMIN= 1.00000E-02
AVERAGING TIME = 32
8.75
38.95 pF
3.56
4.03 pF
7.366 m
23.26 m
D = tan δ
Cs

Acceptable good example. (proven in practice)



(I) No Load	Heavy Loaded Full Load	(II) No Load	Heavy Loaded Full Load	(III) No Load	Heavy Loaded Full Load
$Q_{mo1} = 453$	$Q_{m1} = 39$	$Q_{mo1} = 1758$	$Q_{m1} = 63$	$Q_{mo1} = 3594$	$Q_{m1} = 2040$
$Q_{mo2} = 1257$	$Q_{m2} = 19$	$Q_{mo2} = 3102$	$Q_{m2} = 15$	$Q_{mo2} = 12137$	$Q_{m2} = 808$
$Q_{mo} = 754$	$Q_m = 27$	$Q_{mo} = 2335$	$Q_m = 31$	$Q_{mo} = 6605$	$Q_m = 1284$

$\frac{Q_{mo1}}{Q_{m1}} = 11.615$ ✓

$\frac{Q_{mo2}}{Q_{m2}} = 66.158$ ✓

$\frac{Q_{mo}}{Q_m} = 27.926$

$\frac{Q_{mo1}}{Q_{m1}} = 27.905$ +

$\frac{Q_{mo2}}{Q_{m2}} = 206.8$ ✓ ? −

$\frac{Q_{mo}}{Q_m} = 75.322$

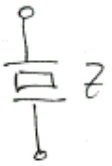
$\frac{Q_{mo1}}{Q_{m1}} = 1.762$ ✓

$\frac{Q_{mo2}}{Q_{m2}} = 15.021$ ✓

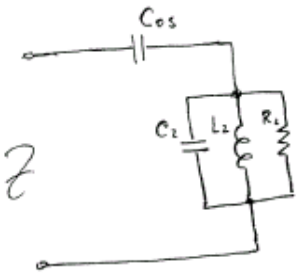
$\frac{Q_{mo}}{Q_m} = 5.144$

$$Q_{mo1} = \frac{1}{R_1}\sqrt{\frac{L_1}{C_1}} \quad ; \quad Q_{mo2} = R_2\sqrt{\frac{C_2}{L_2}} \quad ; \quad Q_{mo} = \sqrt{Q_{mo1} \cdot Q_{mo2}}$$

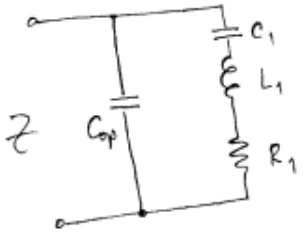
Typical equivalent replacements for ultrasonic transducers



non-Loaded (air)



OR (≡)



$tg\delta(1KHz) = 0.0003$

$C_{os} = 22.05$ nF
$C_2 = 101.53$ nF
$L_2 = 570.5$ mH
$R_2 = 94.2$ KΩ
$f_2 = 20912$ Hz

$Q_{mo1} = 453$
$Q_{mo2} = 1257$

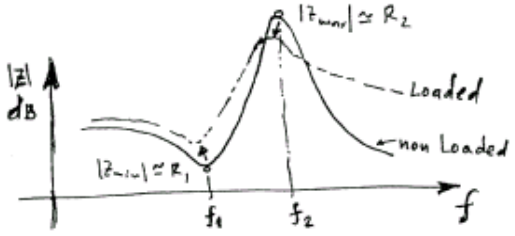
$C_{op} = 18.01$ nF
$C_1 = 4.046$ nF
$L_1 = 17.534$ mH
$R_1 = 4.6$ Ω
$f_1 = 18900$ Hz

Heavy loaded — water loaded..

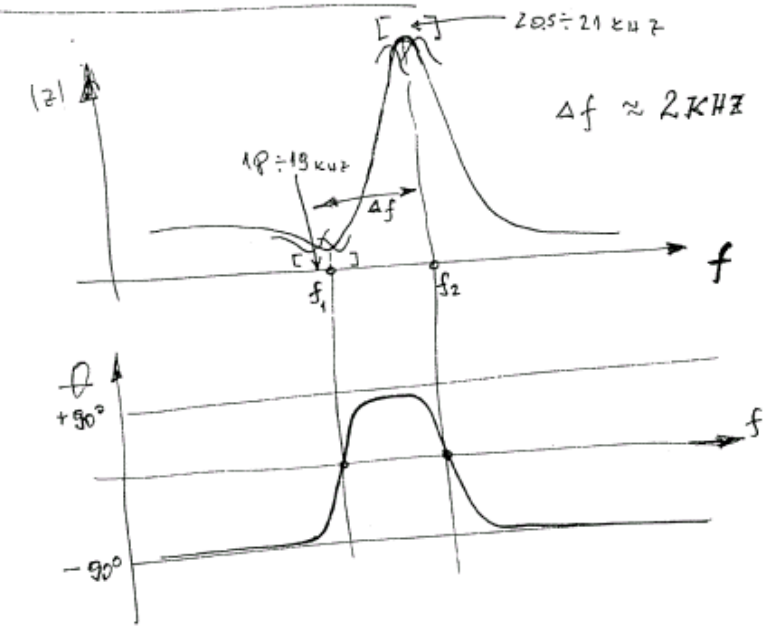
$C_{os} = 22.58$ nF
$C_2 = 96.74$ nF
$L_2 = 631.23$
$R_2 = 1.5$ KΩ
$f_2 = 20387$ Hz

$Q_{m1} = 39$
$Q_{m2} = 27$

$C_{op} = 18.78$ nF
$C_1 = 3.8$ nF
$L_1 = 19.37$ nF
$R_1 = 57.574$ Ω
$f_1 = 18525$



Transducer's impedance:



Possible variations from transducer to transducer (non Loaded)

$(\overline{C_{os}, C_{op}}) \pm 3\%$

$(\overline{R_1, R_2}) \pm 20\%$

$(\bar{f}_1, \bar{f}_2) \pm 0.5\%$

$(\bar{Q}_{max}, \bar{Q}_{max}) \pm 20\%$

$C_1 \in [3.92 \div 4.05]$ nF

$L_1 \in [17.53 \div 18.7]$ nF

$R_1 \in [1.75 \div 4.6]\ \Omega$

$C_{op} \in [15.3 \div 18.01]$ nF

$C_{os} \in [18.7 \div 22.05]$ nF

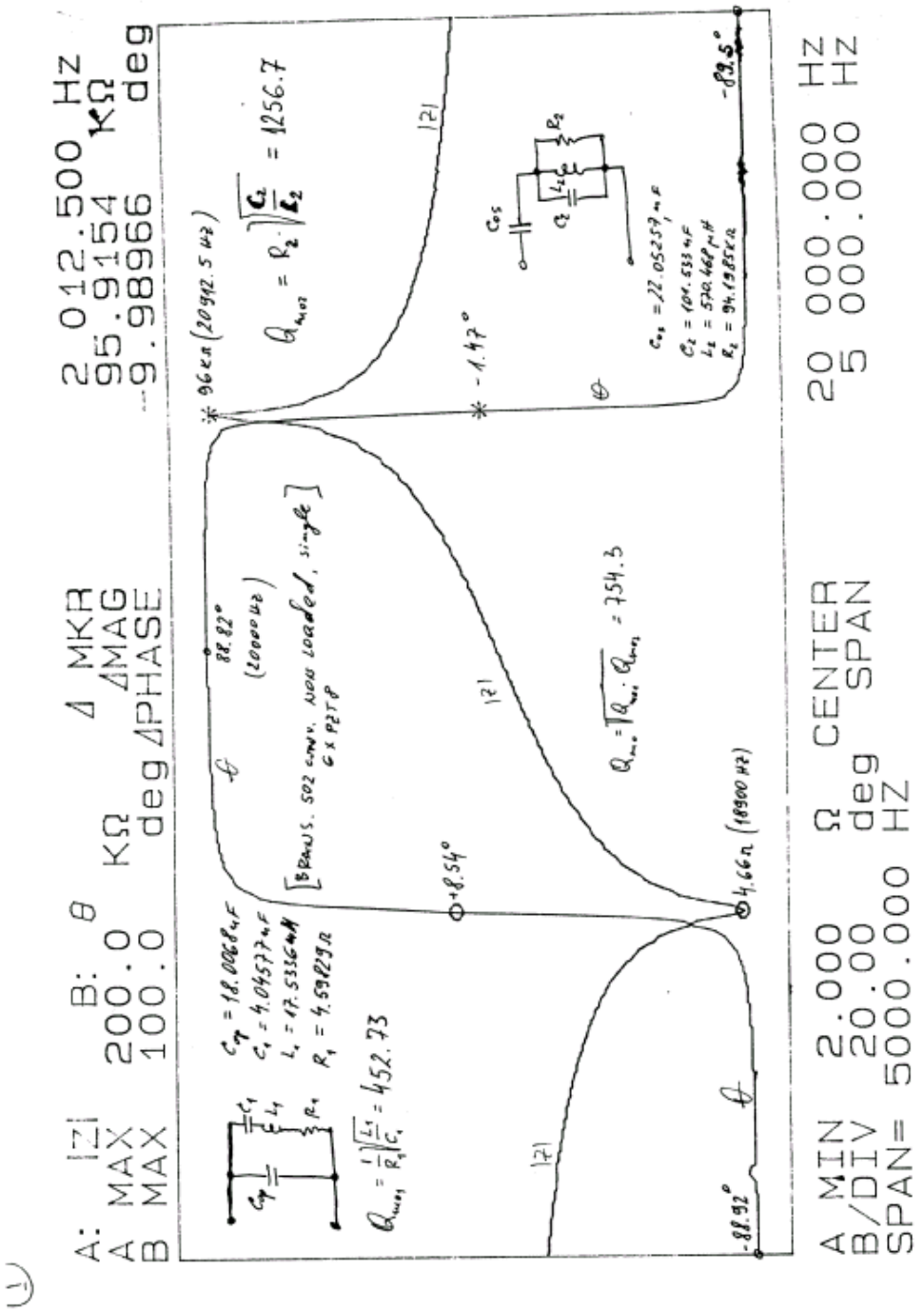
$C_2 \in [79 \div 101]$ nF

$L_2 \in [600 \div 747]$ µH

$R_2 \in [94 \div 250]$ KΩ

$f_1 \in [18435 \div 18905]$ Hz

$f_2 \in [20635 \div 20912]$ Hz


A: |Z|
A MAX 200.0
B MAX 100.0
B: θ
KΩ
deg ΔPHASE
Δ MKR
ΔMAG
ΔPHASE
2 012.500 Hz
95.91154 KΩ
-9.98966 deg
A MIN 2.000
B/DIV 20.00
SPAN= 5000.000 HZ
Ω CENTER
deg SPAN
20 000.000 HZ
5 000.000 HZ