	Name	Neptun	Date

Materials Engineering Laboratory – Hardenability

Calculation of the trough hardening diameter

$$D_{ideal} = 8\sqrt{C} \cdot 1.08^{8-n} \prod_{i=1}^{m}(1 + f_{Me_i} Me_i)$$

$$D_{real,oil} = \eta \cdot D_{i\,deal} = 0.5 \cdot D_{i\,deal}$$

$$D_{real,water} = \eta \cdot D_{i\,deal} = 0.75 \cdot D_{i\,deal}$$

Chemical composition of steels

Carbon steel: C45		**Alloyed steel: 50CrV4**		**f**
Element	Quantity, wt%	Element	Quantity, wt%	-
C	0.46	C	0.48	-
Si	0.32	Si	0.26	0.64
Mn	0.72	Mn	0.70	4.1
S	0.025	S	0.024	-0.62
Cu	0.06	Cu	0.15	0.27
Cr	0.05	Cr	0.93	2.33
Ni	0.06	Ni	0.1	0.52
V	0.002	V	0.13	1.73
Ti	0.001	Ti	0.003	5.7
Mo	0.006	Mo	0.006	3.14
P	0.011	P	0.023	2.83

Grain size number

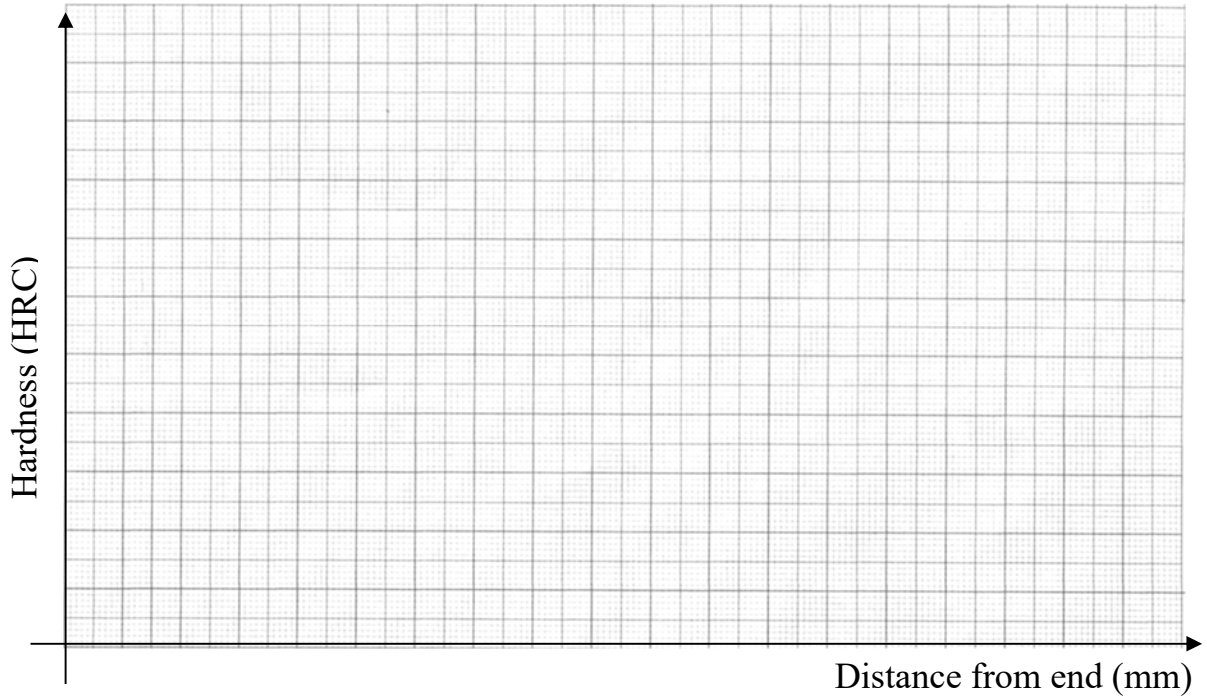
Carbon steel (C45): n = 9
Alloyed steel (50CrV4): n = 8

Material	**Ideal diameter (mm)**	**Real diameter in oil (mm)**	**Real diameter in water (mm)**
Carbon steel (C45)			
Alloyed steel (50CrV4)			

Measurement of the trough hardening diameter

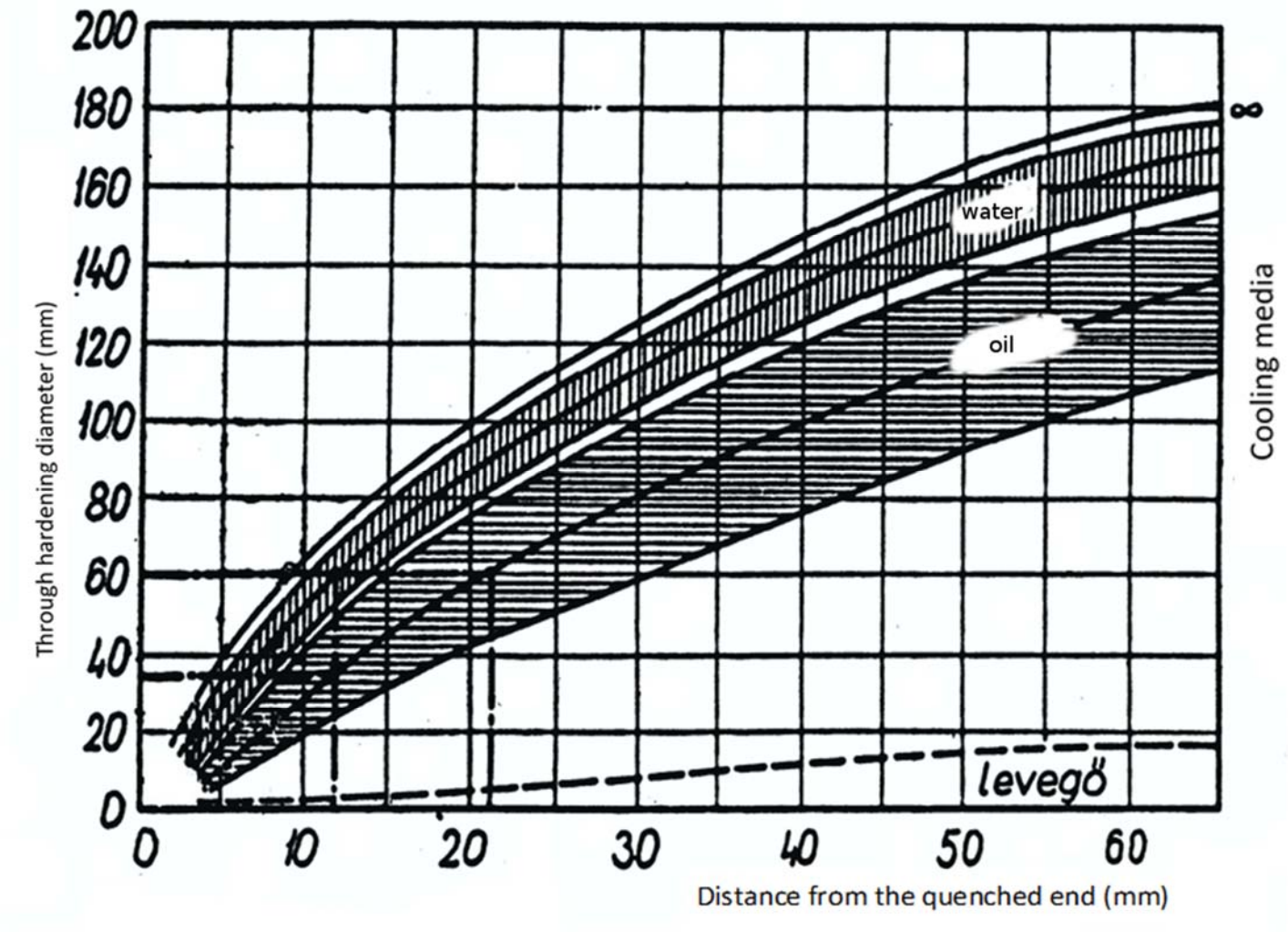
Measured data

Distance from end (mm)	Carbon steel (C45)	Alloyed steel (50CrV4)	Schematic drawing of the end-quench test
	Hardness (HRC)		
1.5			
3			
5			
7			
9			
11			
13			
15			
20			
25			
30			
35			
40			



Real diameter for 50% martensite

Material	Real diameter in oil (mm)	Real diameter in water (mm)
Carbon steel (C45)		
Alloyed steel (50CrV4)		



Comparison of the calculated and the measured through hardening diameters: