

3.ZADATAK

RADNA MERA
TAČNOST RADA OS-A
VELIČINA ŠKARTA

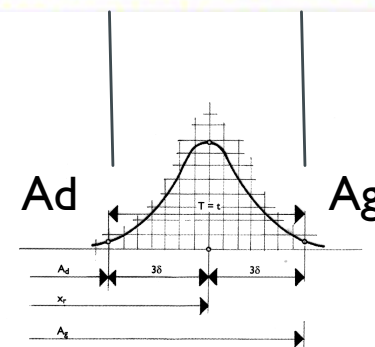
ODREĐIVANJE RADNE MERE



Predavanje br.3

VRSTE MERA

- ❖ Kotirana/nazivna mera
- ❖ Ciljana mera
- ❖ Stvarna/izmerena mera



POSTAVKA ZADATAKA

ULAZNI PODACI

Utvrditi ukupnu tehnološku grešku (upisati naziv OS-a iz tabele) pri izradi partije uzoraka. Merenje se obavlja kljunastim merilom tačnosti (upisati tačnost iz tabele)mm.

Merenje je obavljeno na (upisati naziv detalja iz tabele) dimenzija datih na slici.

Nazivna mera: $x_r =$ (upisati nazivnu meru iz tabele)

Klasa tačnosti u kojoj detalj treba da bude izrađen:
(upisati klasu tačnosti iz tabele)

ZADATAK

1. Odrediti toleranciju zadatog elementa veze.
2. Odrediti ciljanu meru.
3. Odrediti tačnost rada mašine.
4. Izračunati veličinu škarta.



PRIMER REŠAVANJA ZADATKA

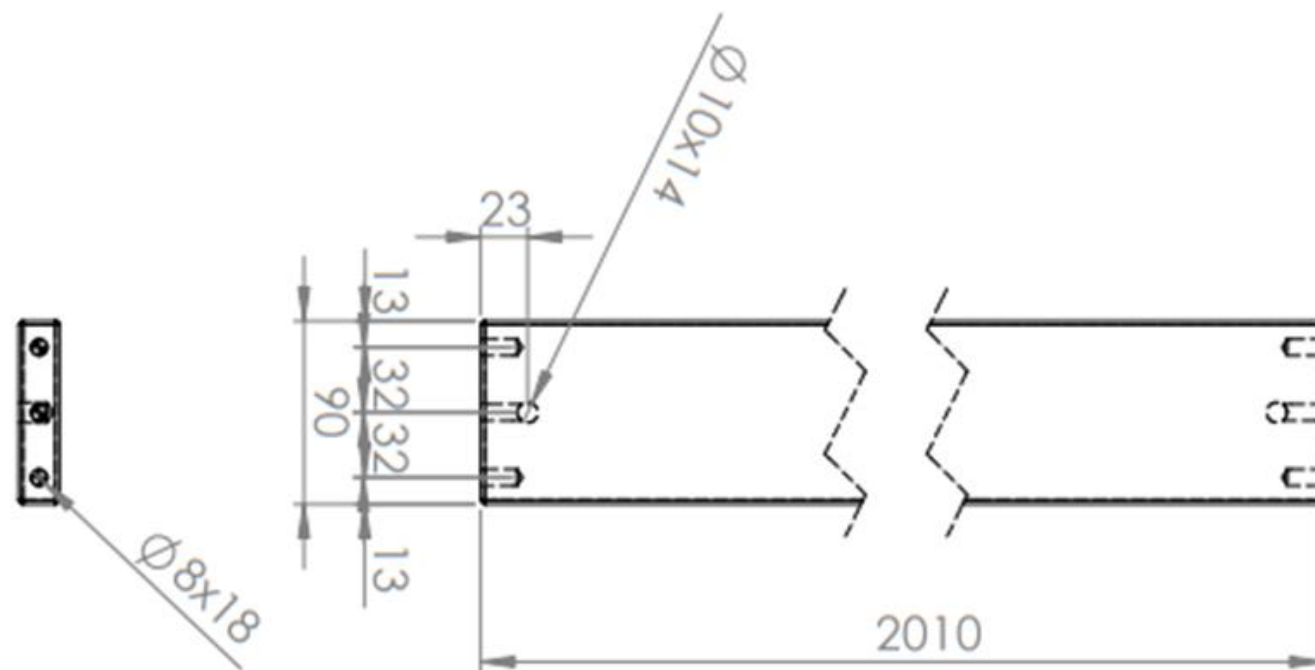
I. ODREDITI TOLERANCIJU ZADATOG ELEMENTA VEZE

Utvrditi ukupnu tehnološku grešku debljače pri izradi partije uzoraka. Merenje se obavlja kljunastim merilom tačnosti 0,05mm.

Merenje je obavljeno na debljini stranice kreveta dimenzija datih na slici.

Nazivna mera: $d_r = 19\text{mm}$ (← 25mm)

Klasa tačnosti u kojoj detalj treba da bude izrađen: TD25



I. ODREDITI TOLERANCIJU ZADATOG ELEMENTA

Nazivna mera: $dr = 19mm$

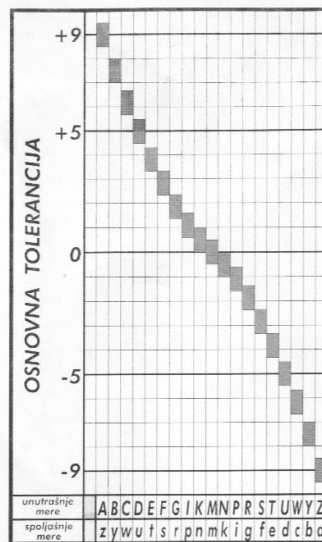
Klasa tačnosti u kojoj detalj treba da bude izrađen: **TD25**

TD25

$dr = 19mm$

$T_o = 0,35mm$, M/m

$dr = 19 \pm 0,175mm$



OSNOVNE TOLERANCIJE

JUS D.E1.009

Područje nazivne mere (mm)		Osnovne tolerancije T_o , u mm, za redove tolerancija za drvo										
od	do	TD6	TD10	TD15	TD25	TD40	TD60	TD100	TD160	TD250	TD400	TD630
1	3	0,06	0,10	0,16	0,25	0,40	0,60	-	-	-	-	-
3	10	0,07	0,12	0,18	0,30	0,50	0,70	1,4	2,2	3,5	-	-
10	30	0,08	0,14	0,21	0,35	0,55	0,85	1,4	2,2	3,5	-	-
30	100	0,10	0,17	0,26	0,45	0,70	1,05	2,0	3,1	5,0	8,0	-
100	250	0,12	0,20	0,31	0,50	0,80	1,25	2,0	3,1	5,0	8,0	-
250	500	0,14	0,24	0,36	0,60	0,95	1,45	2,4	3,8	6,0	10,0	15,0
500	1000	-	0,28	0,42	0,70	1,15	1,70	2,8	4,5	7,0	11,0	18,0
1000	2500	-	0,36	0,54	0,90	1,45	2,15	3,6	5,7	9,0	14,0	23,0
2500	5000	-	0,46	0,70	1,15	1,85	2,80	4,6	7,4	11,5	19,0	29,0
5000	10000	-	-	-	-	2,45	3,65	6,1	9,8	15,5	24,0	39,0
10000	25000	-	-	-	-	-	-	9,2	14,7	23,0	37,0	58,0

Okvirno: TD6 i TD10 - kutijaste veze (kutije za nakit, radio, alat);
 TD15 i TD25 - elementi veze kod nameštaja;
 TD40 i TD60 - nameštaj, pregradna vrata, ploče stola.

Šematski prikaz položaja tolerancijaskih polja

Tabela: Položaj tolerancijaskih polja prema nultoj liniji

JUS D.E1.013

Tolerancijasko polje	A/z	Z/a	B/y	Y/b	C/w	W/c	D/u	U/d	E/t	T/e	F/s	S/f	G/r	R/g	I/p	P/i	K/n	N/k	M/m
Odstojanje sredine tolerancijaskog polja od nulte linije	9T	-9T	7.5T	-7.5T	6.2T	-6.2T	5T	-5T	3.9T	-3.9T	2.8T	-2.8T	2T	-2T	1.2T	-1.2T	0.5T	-0.5T	0
Gornje odstupanje	9.5T	-8.5T	8T	-7T	6.7T	-5.7T	5.5T	-4.5T	4.4T	-3.4T	3.4T	-2.4T	2.5T	-1.5T	1.7T	-0.7T	1T	0	0.5T
Donje odstupanje	8.5T	-9.5T	7T	-8T	5.7T	-6.7T	4.5T	-5.5T	3.4T	-4.4T	2.4T	-3.4T	1.5T	-2.5T	0.7T	-1.7T	0	-T	-0.5T

2. ODREDITI CILJANU MERU

formula

$$x_c = (A_g + A_d) / 2$$

primer

d_c – ciljana mera

$$d_c = (18,825 + 19,175) / 2 = 19 \text{ mm}$$

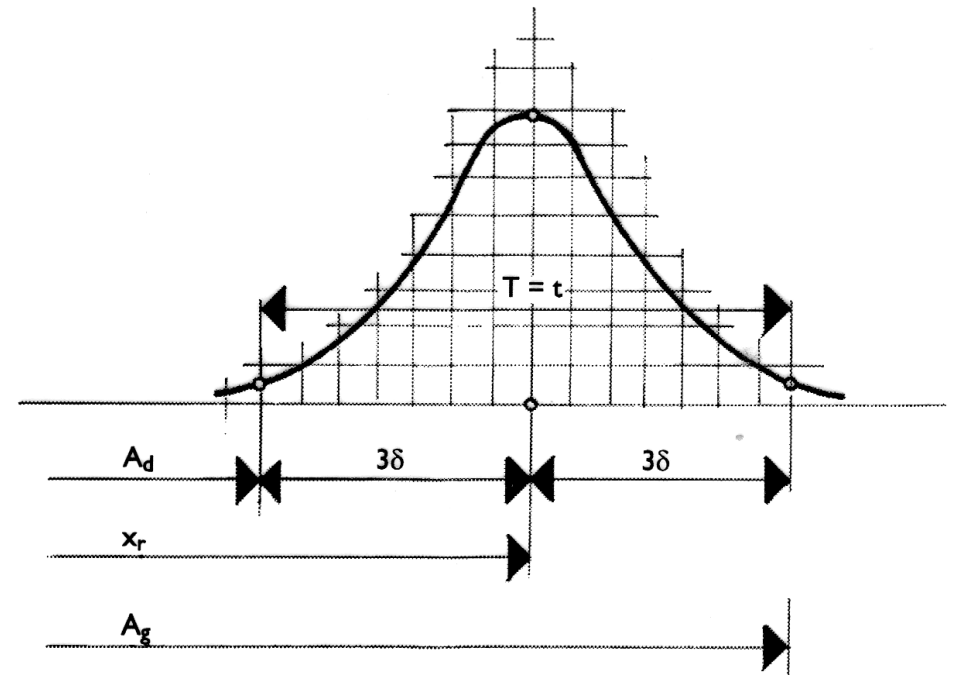
3. ODREDITI TAČNOST RADA MAŠINE

STANDARDNA DEVIJACIJA

$$\sigma = \sqrt{\frac{\sum (x_i - \bar{X})^2 \cdot f_i}{n-1}} \quad (\text{mm})$$

TAČNOST RADA MAŠINE

$$\Delta = 6 \cdot \sigma \quad (\text{mm})$$



3. ODREDITI TAČNOST RADA MAŠINE

STANDARDNA DEVIJACIJA

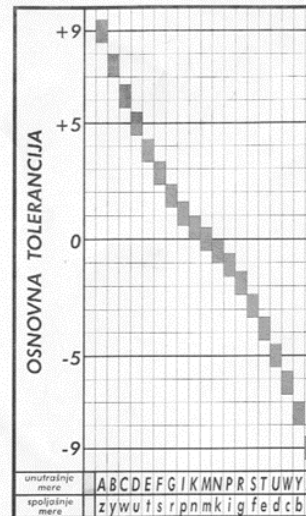
$$\sigma = 0,101 \text{ mm}$$

TAČNOST RADA MAŠINE

$$\Delta = 0,607 \text{ mm}$$



TD40



OSNOVNE TOLERANCIJE

JUS D.E1.009

Područje nazivne mere (mm)		Osnovne tolerancije T_o , u mm, za redove tolerancija za drvo										
od	do	TD6	TD10	TD15	TD25	TD40	TD60	TD100	TD160	TD250	TD400	TD630
1	3	0,06	0,10	0,16	0,25	0,40	0,60	-	-	-	-	-
3	10	0,07	0,12	0,18	0,30	0,50	0,70	1,4	2,2	3,5	-	-
10	30	0,08	0,14	0,21	0,35	0,55	0,85	1,4	2,2	3,5	-	-
30	100	0,10	0,17	0,26	0,45	0,70	1,05	2,0	3,1	5,0	8,0	-
100	250	0,12	0,20	0,31	0,50	0,80	1,25	2,0	3,1	5,0	8,0	-
250	500	0,14	0,24	0,36	0,60	0,95	1,45	2,4	3,8	6,0	10,0	15,0
500	1000	-	0,28	0,42	0,70	1,15	1,70	2,8	4,5	7,0	11,0	18,0
1000	2500	-	0,36	0,54	0,90	1,45	2,15	3,6	5,7	9,0	14,0	23,0
2500	5000	-	0,46	0,70	1,15	1,85	2,80	4,6	7,4	11,5	19,0	29,0
5000	10000	-	-	-	-	2,45	3,65	6,1	9,8	15,5	24,0	39,0
10000	25000	-	-	-	-	-	-	9,2	14,7	23,0	37,0	58,0

Okvirno: TD6 i TD10 - kutijaste veze (kutije za nakit, radio, alat);
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TD40 i TD60 - nameštaj, pregradna vrata, ploče stola.

Šematski prikaz položaja tolerancijskih polja

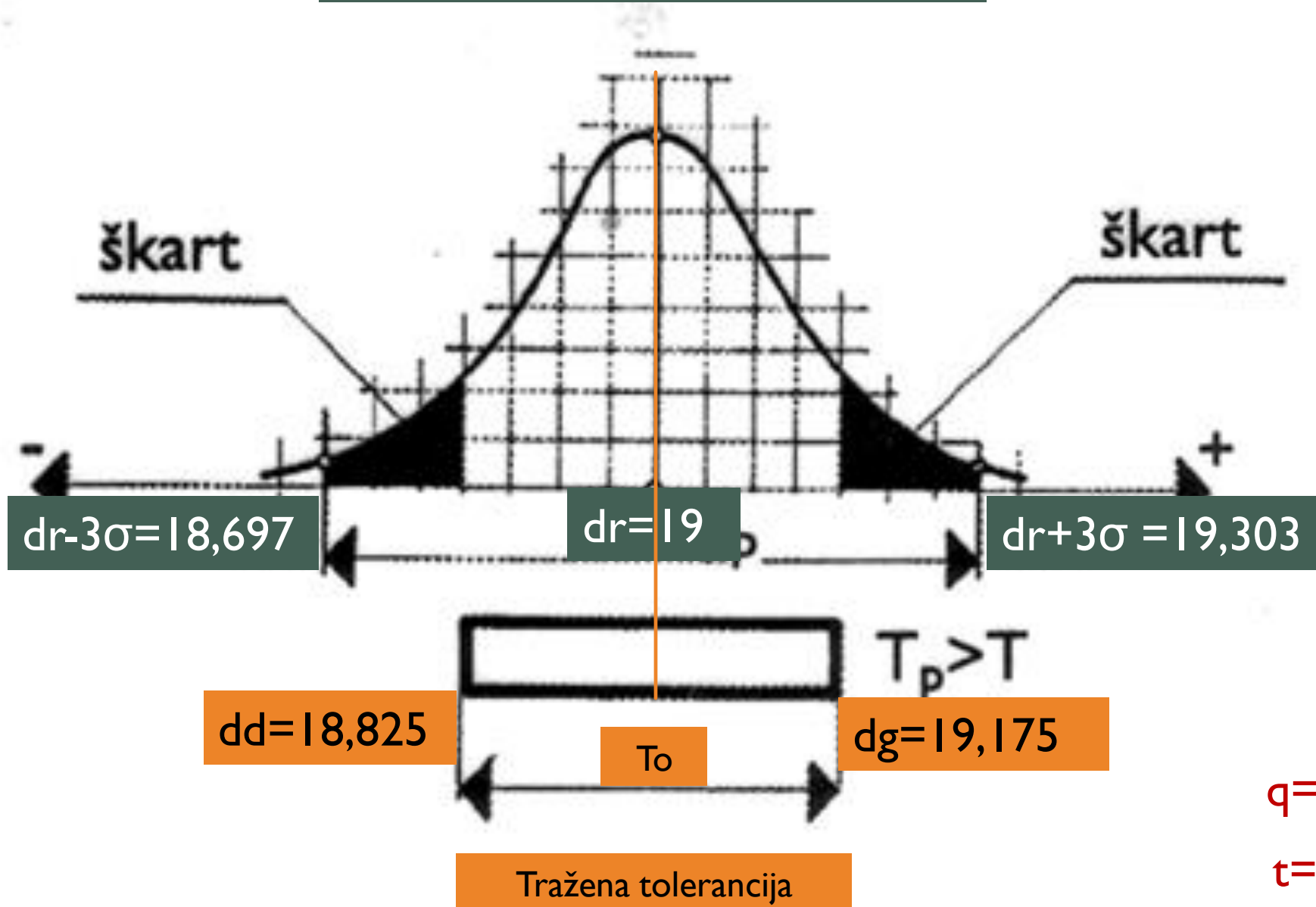
Tabela: Položaj tolerancijskih polja prema nultoj liniji

JUS D.E1.013

Tolerancijsko polje	A/z	Z/a	B/y	Y/b	C/w	W/c	D/u	U/d	E/t	T/e	F/s	S/f	G/r	R/g	I/p	P/i	K/n	N/k	M/m
Odstojanje sredine tolerancijskog polja od nulte linije	9T	-9T	7.5T	-7.5T	6.2T	-6.2T	5T	-5T	3.9T	-3.9T	2.8T	-2.8T	2T	-2T	1.2T	-1.2T	0.5T	-0.5T	0
Gornje odstupanje	9.5T	-8.5T	8T	-7T	6.7T	-5.7T	5.5T	-4.5T	4.4T	-3.4T	3.4T	-2.4T	2.5T	-1.5T	1.7T	-0.7T	1T	0	0.5T
Donje odstupanje	8.5T	-9.5T	7T	-8T	5.7T	-6.7T	4.5T	-5.5T	3.4T	-4.4T	2.4T	-3.4T	1.5T	-2.5T	0.7T	-1.7T	0	-T	-0.5T

Tačnost rada mašine Δ

$\sigma=0,101\text{mm}$
 $3\sigma=0,303\text{mm}$



$$q=(0,5-\varphi(t))\cdot 100 (\%)$$

$$t=(To/2)/\sigma$$

4. IZRAČUNATIVELIČINU ŠKARTA

formula

- $t = (T_0/2)/\sigma$



proračun

- $t = (0,35/2)/0,101$

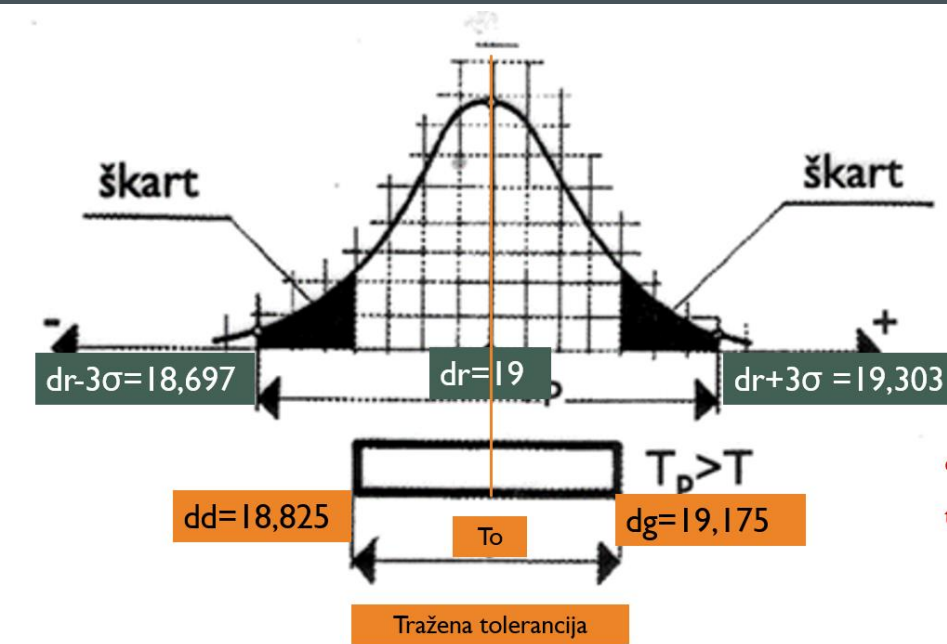
- $t = 1,73$

- Za $t = 1,73$ Laplace-ova f-ja $\phi(t) = 0,458$

- $q = (0,5 - \phi(t)) \cdot 100$ (%)

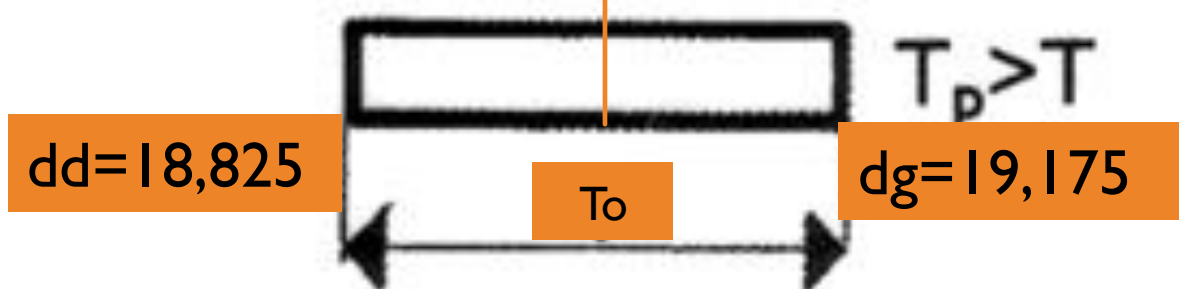
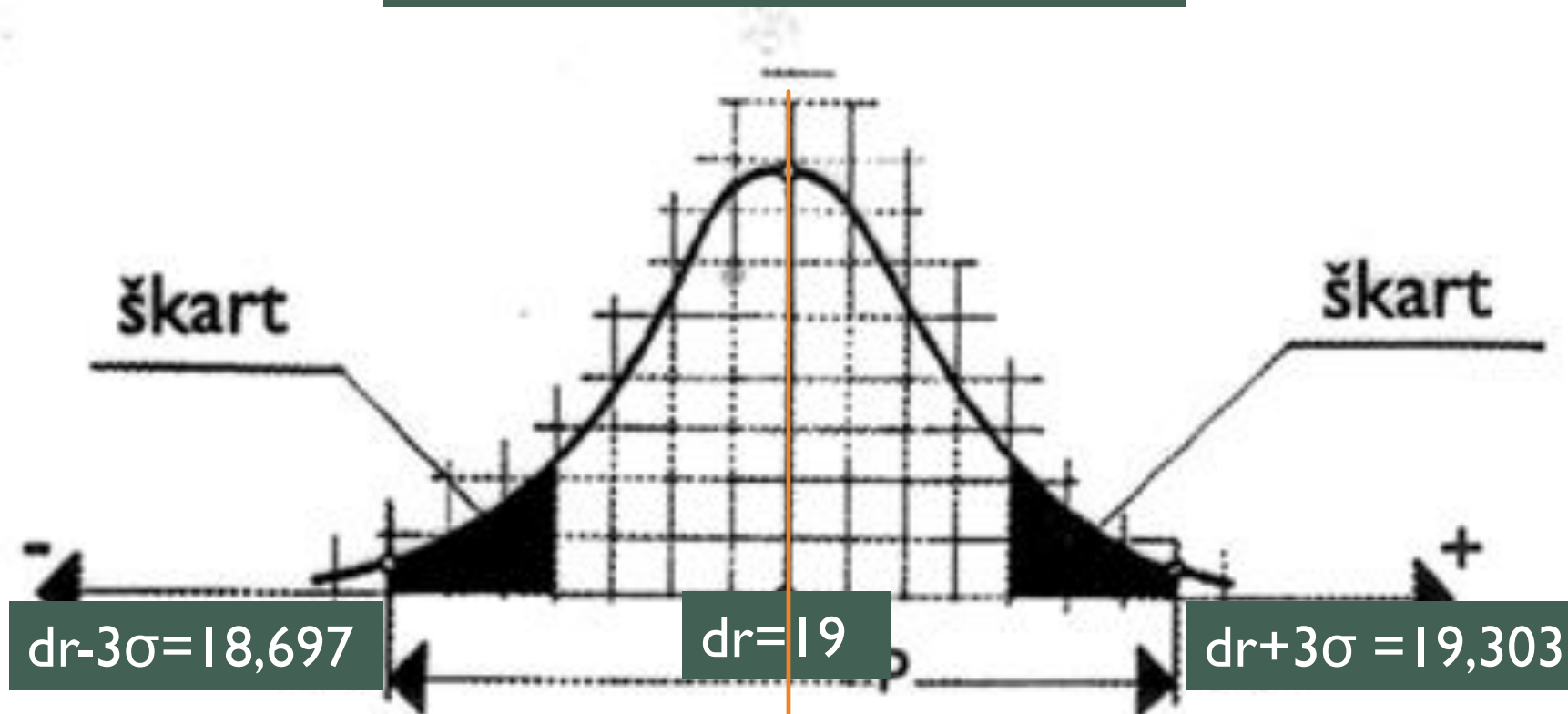


- $q = (0,5 - 0,458) \cdot 100 = 4,2\%$



Tačnost rada mašine Δ

$\sigma=0,101\text{mm}$
 $3\sigma=0,303\text{mm}$



$q=(0,5-\varphi(t)) \cdot 100$ (%)

$t=(To/2)/\sigma$

Tražena tolerancija

τ	$2\varphi(\tau)$	$\varphi(\tau)$	τ	$2\varphi(\tau)$	$\varphi(\tau)$	τ	$2\varphi(\tau)$	$\varphi(\tau)$
0.00	0.0000	0.0000	0.50	0.3830	0.1915	1.00	0.6826	0.3413
0.01	0.0080	0.0040	0.51	0.3900	0.1950	1.01	0.6880	0.3440
0.02	0.0160	0.0080	0.52	0.3970	0.1985	1.02	0.6920	0.3460
0.03	0.0240	0.0120	0.53	0.4040	0.2020	1.03	0.6970	0.3485
0.04	0.0320	0.0160	0.54	0.4110	0.2055	1.04	0.7020	0.3510
0.05	0.0400	0.0200	0.55	0.4180	0.2090	1.05	0.7060	0.3530
0.06	0.0420	0.0210	0.56	0.4250	0.2125	1.06	0.7110	0.3555
0.07	0.0560	0.0280	0.57	0.4310	0.2155	1.07	0.7150	0.3575
0.08	0.0640	0.0320	0.58	0.4380	0.2190	1.08	0.7200	0.3600
0.09	0.0720	0.0360	0.59	0.4450	0.2225	1.09	0.7240	0.3620
0.10	0.0800	0.0400	0.60	0.4510	0.2255	1.10	0.7290	0.3645
0.11	0.0880	0.0440	0.61	0.4580	0.2290	1.11	0.7330	0.3665
0.12	0.0960	0.0480	0.62	0.4650	0.2325	1.12	0.7370	0.3685
0.13	0.1030	0.0515	0.63	0.4710	0.2355	1.13	0.7420	0.3710
0.14	0.1110	0.0555	0.64	0.4780	0.2390	1.14	0.7460	0.3730
0.15	0.1190	0.0595	0.65	0.4840	0.2420	1.15	0.7500	0.3750
0.16	0.1270	0.0635	0.66	0.4910	0.2455	1.16	0.7540	0.3770
0.17	0.1350	0.0675	0.67	0.4970	0.2485	1.17	0.7580	0.3790
0.18	0.1430	0.0715	0.68	0.5040	0.2520	1.18	0.7620	0.3810
0.19	0.1510	0.0755	0.69	0.5100	0.2550	1.19	0.7660	0.3830
0.20	0.1590	0.0795	0.70	0.5160	0.2580	1.20	0.7700	0.3850
0.21	0.1660	0.0830	0.71	0.5220	0.2610	1.21	0.7740	0.3870
0.22	0.1740	0.0870	0.72	0.5280	0.2640	1.22	0.7780	0.3890
0.23	0.1820	0.0910	0.73	0.5350	0.2675	1.23	0.7810	0.3905
0.24	0.1900	0.0950	0.74	0.5410	0.2705	1.24	0.7850	0.3925
0.25	0.1970	0.0985	0.75	0.5470	0.2735	1.25	0.7890	0.3945
0.26	0.2050	0.1025	0.76	0.5512	0.2756	1.26	0.7920	0.3960
0.27	0.2130	0.1065	0.77	0.5590	0.2795	1.27	0.7960	0.3980
0.28	0.2210	0.1105	0.78	0.5650	0.2825	1.28	0.8000	0.4000
0.29	0.2280	0.1140	0.79	0.5700	0.2850	1.29	0.8030	0.4015
0.30	0.2360	0.1180	0.80	0.5760	0.2880	1.30	0.8060	0.4030
0.31	0.2430	0.1215	0.81	0.5820	0.2910	1.31	0.8100	0.4050
0.32	0.2510	0.1255	0.82	0.5880	0.2940	1.32	0.8130	0.4065
0.33	0.2590	0.1295	0.83	0.5930	0.2965	1.33	0.8160	0.4080
0.34	0.2660	0.1330	0.84	0.5990	0.2995	1.34	0.8200	0.4100
0.35	0.2740	0.1370	0.85	0.6050	0.3025	1.35	0.8230	0.4115
0.36	0.2810	0.1405	0.86	0.6100	0.3050	1.36	0.8260	0.4130
0.37	0.2890	0.1445	0.87	0.6160	0.3080	1.37	0.8290	0.4145
0.38	0.2960	0.1480	0.88	0.6210	0.3105	1.38	0.8320	0.4160
0.39	0.3030	0.1515	0.89	0.6270	0.3135	1.39	0.8350	0.4175
0.40	0.3110	0.1555	0.90	0.6320	0.3160	1.40	0.8380	0.4190
0.41	0.3180	0.1590	0.91	0.6370	0.3185	1.41	0.8410	0.4205
0.42	0.3260	0.1630	0.92	0.6420	0.3210	1.42	0.8440	0.4220
0.43	0.3330	0.1665	0.93	0.6480	0.3240	1.43	0.8470	0.4235
0.44	0.3400	0.1700	0.94	0.6530	0.3265	1.44	0.8500	0.4250
0.45	0.3470	0.1735	0.95	0.6580	0.3290	1.45	0.8530	0.4265

τ	$2\varphi(\tau)$	$\varphi(\tau)$	τ	$2\varphi(\tau)$	$\varphi(\tau)$	τ	$2\varphi(\tau)$	$\varphi(\tau)$
0.46	0.3540	0.1770	0.96	0.6630	0.3315	1.46	0.8560	0.4280
0.47	0.3620	0.1810	0.97	0.6680	0.3340	1.47	0.8580	0.4290
0.48	0.3690	0.1845	0.98	0.6730	0.3365	1.48	0.8610	0.4305
0.49	0.3760	0.1880	0.99	0.6780	0.3390	1.49	0.8640	0.4320
1.50	0.8660	0.4330	2.00	0.9550	0.4775	2.50	0.9880	0.4940
1.51	0.8670	0.4335	2.01	0.9560	0.4780	2.51	0.9880	0.4940
1.52	0.8710	0.4355	2.02	0.9570	0.4785	2.52	0.9880	0.4940
1.53	0.8740	0.4370	2.03	0.9580	0.4790	2.53	0.9890	0.4945
1.54	0.8760	0.4380	2.04	0.9590	0.4795	2.54	0.9890	0.4945
1.55	0.8790	0.4395	2.05	0.9600	0.4800	2.55	0.9890	0.4945
1.56	0.8810	0.4405	2.06	0.9610	0.4805	2.56	0.9900	0.4950
1.57	0.8640	0.4320	2.07	0.9620	0.4810	2.57	0.9900	0.4950
1.58	0.8860	0.4430	2.08	0.9624	0.4812	2.58	0.9900	0.4950
1.59	0.8880	0.4440	2.09	0.9630	0.4815	2.59	0.9900	0.4950
1.60	0.8900	0.4450	2.10	0.9640	0.4820	2.60	0.9910	0.4955
1.61	0.8930	0.4465	2.11	0.9650	0.4825	2.61	0.9910	0.4955
1.62	0.8950	0.4475	2.12	0.9660	0.4830	2.62	0.9910	0.4955
1.63	0.8970	0.4485	2.13	0.9670	0.4835	2.63	0.9910	0.4955
1.64	0.8990	0.4495	2.14	0.9680	0.4840	2.64	0.9920	0.4960
1.65	0.9010	0.4505	2.15	0.9680	0.4840	2.65	0.9920	0.4960
1.66	0.9030	0.4515	2.16	0.9690	0.4845	2.66	0.9920	0.4960
1.67	0.9052	0.4526	2.17	0.9700	0.4850	2.67	0.9920	0.4960
1.68	0.9070	0.4535	2.18	0.9710	0.4855	2.68	0.9930	0.4965
1.69	0.9090	0.4545	2.19	0.9710	0.4855	2.69	0.9930	0.4965
1.70	0.9110	0.4555	2.20	0.9720	0.4860	2.70	0.9930	0.4965
1.71	0.9130	0.4565	2.21	0.9730	0.4865	2.71	0.9930	0.4965
1.72	0.9150	0.4575	2.22	0.9740	0.4870	2.72	0.9930	0.4965
1.73	0.9160	0.4580	2.23	0.9740	0.4870	2.73	0.9930	0.4965
1.74	0.9180	0.4590	2.24	0.9750	0.4875	2.74	0.9940	0.4970
1.75	0.9200	0.4600	2.25	0.9760	0.4880	2.75	0.9940	0.4970
1.76	0.9220	0.4610	2.26	0.9760	0.4880	2.76	0.9940	0.4970
1.77	0.9230	0.4615	2.27	0.9770	0.4885	2.77	0.9940	0.4970
1.78	0.9250	0.4625	2.28	0.9770	0.4885	2.78	0.9950	0.4975
1.79	0.9270	0.4635	2.29	0.9780	0.4890	2.79	0.9950	0.4975
1.80	0.9280	0.4640	2.30	0.9790	0.4895	2.80	0.9950	0.4975
1.81	0.9300	0.4650	2.31	0.9790	0.4895	2.81	0.9950	0.4975
1.82	0.9310	0.4655	2.32	0.9800	0.4900	2.82	0.9950	0.4975
1.83	0.9330	0.4665	2.33	0.9800	0.4900	2.83	0.9950	0.4975
1.84	0.9340	0.4670	2.34	0.9810	0.4905	2.84	0.9950	0.4975
1.85	0.9360	0.4680	2.35	0.9810	0.4905	2.85	0.9950	0.4975
1.86	0.9370	0.4685	2.36	0.9820	0.4910	2.86	0.9960	0.4980
1.87	0.9390	0.4695	2.37	0.9820	0.4910	2.87	0.9960	0.4980
1.88	0.9400	0.4700	2.38	0.9830	0.4915	2.88	0.9960	0.4980
1.89	0.9410	0.4705	2.39	0.9830	0.4915	2.89	0.9960	0.4980
1.90	0.9430	0.4715	2.40	0.9840	0.4920	2.90	0.9960	0.4980
1.91	0.9440	0.4720	2.41	0.9840	0.4920	2.91	0.9960	0.4980
1.92	0.9450	0.4725	2.42	0.9840	0.4920	2.92	0.9960	0.4980

t	$2\varphi(t)$	$\varphi(t)$	t	$2\varphi(t)$	$\varphi(t)$	t	$2\varphi(t)$	$\varphi(t)$
1.93	0.9460	0.4730	2.43	0.9850	0.4925	2.93	0.9960	0.4980
1.94	0.9480	0.4740	2.44	0.9850	0.4925	2.94	0.9970	0.4985
1.95	0.9490	0.4745	2.45	0.9860	0.4930	2.95	0.9970	0.4985
1.96	0.9500	0.4750	2.46	0.9860	0.4930	2.96	0.9970	0.4985
1.97	0.9510	0.4755	2.47	0.9860	0.4930	2.97	0.9970	0.4985
1.98	0.9520	0.4760	2.48	0.9870	0.4935	2.98	0.9970	0.4985
1.99	0.9530	0.4765	2.49	0.9870	0.4935	2.99	0.9970	0.4985
3.00	0.9972	0.4986						
3.10	0.9972	0.4986						
3.20	0.9986	0.4993						
3.30	0.9986	0.4993						
3.40	0.9999	0.4995						
3.50	0.9999	0.4995						
3.60	0.9999	0.4995						
3.70	0.9999	0.4990						
3.80	0.9999	0.4990						
3.90	0.9999	0.4990						
4.00	0.9999	0.4990						