Product Catalogue

Needle Rollers

NRB BEARINGS

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Needle Rollers

In certain applications, the limited amount of space available for bearings and the loads to be supported require the use of a full complement of needles independent of any system of retention. The length of the needle is determined in relation to the load capacity required.

The needles are placed directly between shaft and housing without the use of inner or outer rings. Thus a shaft of maximum diameter is permissible to increase rigidity and load capacity.

In rotating applications where the load capacity requires the use of needles that are long in relation to the shaft diameter, it is preferable to employ two rows of needles of equal length separated by a spacer ring.

In such cases, the needles must be selected with diameters in the same tolerance class. This arrangement is particularly recommended for mounting parts such as long idler wheels, especially where they are subjected to rotational torque.

RACEWAYS

Maximum load capacity is obtained with hardened inner and outer raceways of surface hardness 58-64 HRC. Parts used for lateral retention of needles at their ends should be of equivalent hardness.

The inner and outer raceways should both be aligned on installation and before operation under load. In the case of parts fitted with a single row of needles, the inner raceway may be ground convex to allow misalignment. A convexity permitting misalignment of 1 in 1000 (or up to 2 in 1000 in cases of instantaneous overloading) does not reduce the calculated load capacity. This convexity, which also depends on length of the needle, may be produced on a separate inner ring or directly on shaft journal using a grinding wheel with concave profile obtained by inclining the diamond impregnated cutting wheel. Further technical information is available on request.

TYPES

Needle Rollers are available with the end forms as shown below:

Type BR : Rounded ends 

Type BP : Flat, unground ends 

Type BPM : Flat, ground ends 

Type BR 60 : Rounded Cornes 

Needle Rollers of special types and dimensions can be manufactured on request depending upon quantities involved.

CHARACTERISTICS

NRB standard needles are made using through hardened bearing steel of hardness 58-65 HRC.

The surface finish is $\leq$ 0.2 µm C.L.A.

The profile of a needle is not cylindrical along its whole length as there is a very slight taper towards the ends. Therefore, precise measurement of the diameter can only be carried out in the central area of the needle. Needles having a greater taper at the end may be supplied on request. (suffix ... ER)

MANUFACTURING TOLERANCES

The diameter of standard needles is produced to a tolerance upto – 10 µm from the nominal dimension. In normal category Needle Rollers will have a diameter tolerance range of 0 to – 6 µm. On request, Needle Rollers can be sorted (at extra cost) into groups having diameter variation as given in table 1 and colour codes in accordance with table 2.

The length of needles types BR and BP is kept within h13 tolerance.

Table 1 : Tolerance on Needle Diameter

Grade G	Variation in diameter of one lot µm	Standard classes	Deviation from true circularity µm
2	2	0-2 -1-3 -2-4 -3-5 -4-6 -5-7 -6-8 -7-9 -8-10	1
3	3	0-3 -1.5-4.5 -3-6 -4.5-7.5 -6-9 -7-10	1.5
5	5	0-5 -3-8 -5-10	2.5

Table 2 : Colour codes for the classes of Grade 2

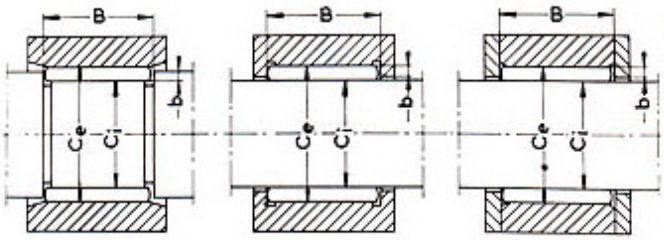
0-2	-1-3	-2-4	-3-5	-4-6	-5-7	-6-8	-7-9	-8-10
red	pink	blue	sky	white	grey	green	orang	yellow

These colour codes are used by prior agreement.

SHAFT AND HOUSING REQUIREMENTS

For optimum performance, the shaft and housing should conform to the tolerances as given in table 3.

Operating Space , B = L + 0.2 for L ≤ 34.8 mm
= L + 0.3 for L > 34.8 mm
(L, Nominal length of Needle Roller)



Tolerance on
Operating Space, B = H12

Shoulder Height, b = 2/3 d mm (d, Nominal diameter of Needle Roller)

Table 3 : Shaft and Housing Tolerances

Operating conditions	Parameter	Shaft Ci	Housing Ce
Rotation on a convex inner raceway	Tolerance on diameter	j5	F6
Rotation on a cylindrical inner raceway		h5	F6
Oscillatory motion		h5	G6
	Ovality and conicity	≤ ¼ of tol.range	≤ ¼ of tol.range
	Hardness	58 to 64 HRC	58 to 64 HRC
	Surface finish	0.35 um C.L.A.	0.35 um C.L.A.

LIMITING SPEED

With effective oil lubrication and good alignment, limiting speed may reach:

n (rpm) = 380 000 / Ci (Ci: diameter of inner raceway in mm)

Maximum speed of 70000 rpm.

For grease lubrication, use approximately half these values.

DYNAMIC and STATIC CAPACITIES

The basic dynamic capacity C in newtons (N), is given by formula:

1) $C = K\ Lu^{7/9}$

K : variable factor relating to diameter of inner raceway Ci, according to table 4.

Lu (mm) : effective needle length, as shown in table of dimensions.

The basic static capacity Co in newtons (N), is given by formula :

2) $Co = 44\ \{\ 1-d/(Ci+d)\}\ idLuZ$

d (mm) : diameter of needles

Lu (mm) : effective needle length as shown in the table of dimensions

Z : number of needles

Ci : dimensions under the needles (Shaft Dia)

i : number of rows of needles

NUMBER OF NEEDLES – CIRCUMFRENTIAL PLAY

The number of needles Z is given, as a function of proposed shaft diameter Ci and needle diameter d, by formula :

3) $Z = \pi\ (Ci+d)/d$ (adjusted to the nearest whole number)

To ensure the circuferential play jc, which should normally be between 0.3 and 1 mm, the following formula should be used:

4) $Ci = \gamma d + jc/\pi$

Where γ is a variable factor shown in table on page 11 & 14 in respect to number of needles Z.

Example :

Needles of diameter d = 2.5 mm on a shaft of diameter Ci = approx. 30 mm

Number of needles $Z = \pi (30+2.5)/2.5$ or
Z= 41 needles (adjusted up)

To ensure circumferential play jc = 0.3 mm, use formula 4 with g = 12.06 for 41 needles (table on page 11 & 14), thus : $Ci = 12.06 \times 2.5 + 0.3/p$ = 30.25 mm (adjusted up)

The shaft diameter Ci can therefore be designed at the nominal dimension adjusted upto 30.03 mm to take 41 needles of diameter 2.5 mm , with a circumferential play of approx. 0.3

Note: Having established the number of needles Z, reference may then be made to the table 4 giving corresponding Ci dimensions according to needle diameter d and for a circumferential play between 0.3 and 0.6 mm. Thus, for 41 needles of diameter 2.5, diameter Ci is 30.03 mm.

INSTALLATION

Because of the large number of shaft diameters possible, depending on the number of needles chosen and their diameter, needles cannot be packed in rings ready for installation.

The needles, which are supplied loose, should therefore be arranged in a ring around the inner or outer raceway, which must be pregreased to ensure their retention during installation of the parts that will retain them.

In cases where the shaft has to be introduced blind into a ring of needles (e.g. an idler wheel fitted on a yoke), it may be useful to retain needles in their housing by means of a mounting shaft of the same length as the needles. This can then be withdrawn when shaft is introduced.

Arrangement of the needles in a ring may be carried out by hand where the number of installations is small. Where it is relatively high a simple and effective method is to use a manual appliance, which in a single movement permits the assembly on a rotating mandrel of a set of needles ready for installation (information on request).

The use of automatic machines with high-speed rotary loading should be considered only for production quantities large enough to ensure that the high cost of investment can be absorbed.

Table 4 : Shaft diameter Ci for Z needles of diameter d and a circumferential clearance jc between 0.3 to 0.6 mm

Coefficient γ For formula 4) page 94
Coefficient K For formula 1) page 94

d mm		1		1.5		2		2.5		3		3.5		4		5	
Z	γ	Ci mm	K	Ci mm	K	Ci mm	K	Ci	K	Ci mm	K	Ci mm	K	Ci mm	K	Ci mm	K
10	2.24	2.30	531	3.50	823	4.60	1119	5.70	1420	6.90	1730	8.00	2040	9.10	2351	11.30	2985
11	2.55	2.70	586	4.00	905	5.20	1228	6.50	1561	7.80	1898	9.10	2241	10.30	2583	12.90	3283
12	2.86	3.00	635	4.40	978	5.90	1334	7.30	1693	8.70	2058	10.20	2429	11.60	2803	14.50	3562
13	3.18	3.30	680	4.90	1050	6.50	1430	8.10	1817	9.70	2210	11.30	2608	12.90	3010	16.00	3822
14	3.49	3.60	723	5.40	1118	7.10	1522	8.90	1935	10.60	2352	12.40	2776	14.10	3203	17.60	4070
15	3.81	3.90	765	5.90	1182	7.80	1609	9.70	2045	11.60	2488	13.50	2936	15.40	3388	19.20	4306
16	4.13	4.20	804	6.30	1242	8.40	1693	10.50	2151	12.50	2617	14.60	3088	16.60	3564	20.80	4530
17	4.44	4.50	841	6.80	1301	9.00	1772	11.20	2253	13.50	2740	15.70	3233	17.90	3732	22.30	4743
18	4.76	4.90	878	7.30	1356	9.70	1849	12.00	2349	14.40	2858	16.80	3372	19.20	3893	23.90	4948
19	5.08	5.20	913	7.80	1411	10.30	1921	12.80	2443	15.40	2971	17.90	3507	20.40	4048	25.50	5144
20	5.39	5.50	945	8.20	1463	10.90	1992	13.60	2532	16.30	3080	19.00	3635	21.70	4196	27.10	5333
21	5.71	5.80	978	8.70	1512	11.60	2059	14.40	2618	17.30	3185	20.10	3758	23.00	4339	28.70	5515
22	6.03	6.10	1010	9.20	1560	12.20	2125	15.20	2701	18.20	3286	21.20	3879	24.30	4477	30.30	5690
23	6.34	6.40	1039	9.60	1607	12.80	2189	16.00	2783	19.20	3385	22.30	3996	25.50	4611	31.80	5861
24	6.66	6.80	1067	10.10	1652	13.50	2250	16.80	2861	20.10	3481	24.60	4107	26.80	4741	33.40	6026
25	6.98	7.10	1097	10.60	1695	14.10	2311	17.60	2936	21.10	3572	25.70	4216	28.10	4866	35.00	6187
26	7.30	7.40	1124	11.10	1738	14.70	2369	18.40	3011	22.00	3664	26.80	4322	29.30	4991	36.60	6342
27	7.61	7.70	1151	11.60	1779	15.40	2425	19.20	3082	23.00	3751	27.90	4426	30.60	5109	38.20	6494
28	7.93	8.00	1178	12.00	1822	16.00	2481	20.00	3153	23.90	3836	29.00	4528	31.90	5225	39.80	6642
29	8.25	8.40	1202	12.50	1860	16.60	2535	20.80	3221	24.90	3919	3010	4626	33.10	5341	41.40	6786
30	8.57	8.70	1228	13.00	1898	17.30	2587	21.60	3289	25.80	4002	31.20	4723	34.40	5451	43.00	6927
31	8.88	9.00	1252	13.50	1936	17.90	2639	22.30	3356	26.80	4081	32.30	4818	35.70	5560	44.50	7069
32	9.20	9.30	1277	13.90	1975	18.50	2691	23.10	3420	27.70	4161	33.50	4910	36.90	5668	46.10	7204
33	9.52	9.60	1301	14.40	2011	19.20	2739	23.90	3483	28.70	4236	34.60	4998	38.20	5772	47.70	7336
34	9.84	9.90	1325	14.90	2046	19.80	2788	24.70	3545	29.70	4311	35.70	5088	39.50	5874	49.30	7466
35	10.16	10.30	1345	15.40	2081	20.50	2835	25.50	3606	30.60	4386	36.80	5176	40.80	5974	50.90	7595

Table 4 : Shaft diameter Ci for Z needles of diameter d and a circumferential clearance jc between 0.3 to 0.6 mm

Coefficient γ For formula 4) page 94
Coefficient K For formula 1) page 94

d mm		1		1.5		2		2.5		3		3.5		4		5	
Z	γ	Ci mm	K	Ci mm	K	Ci mm	K	Ci	K	Ci mm	K	Ci mm	K	Ci mm	K	Ci mm	K
36	10.47	10.60	1368	15.80	2118	21.10	2883	26.30	3666	31.50	4460	37.90	5262	42.00	6075	52.50	7720
37	10.79	10.90	1390	16.30	2150	21.70	2930	27.10	3725	32.50	4530	39.00	5346	43.30	6172	54.10	7843
38	11.11	11.20	1413	16.80	2183	22.40	2974	27.90	3782	33.50	4600	40.10	5430	44.60	6267	55.70	7965
39	11.43	11.50	1434	17.30	2216	23.00	3020	28.70	3839	34.40	4670	41.30	5512	45.90	3360	57.30	8085
40	11.75	11.90	1453	17.80	2247	23.60	3065	29.50	3895	35.40	4738	42.30	5590	47.10	6455	58.90	8202
41	12.06					24.30	3107	30.30	3949	36.30	4805	43.50	5673	48.50	6546	60.40	8321
42	12.38					24.90	3150	31.10	4005	37.30	4871	44.60	5748	49.70	6635	62.00	8435
43	12.70					25.50	3194	31.90	4058	38.20	4938	45.70	5826	50.90	6726	63.60	8548
44	13.02					26.20	3233	32.70	4111	39.20	5001	46.80	5902	52.20	6813	65.20	8660
45	13.34					26.80	3275	33.50	4163	40.20	5064	47.90	5978	53.50	6899	66.80	8769
46	13.65					27.40	3317	34.30	4215	41.10	5127	49.00	6052	54.70	6986	68.40	8879
47	13.97					28.10	3356	35.10	4266	42.00	5190	50.20	6126	56.00	7071	70.00	8986
48	14.29					28.70	3396	35.90	4316	43.00	5251	51.00	6197	57.30	7153	71.60	9091
49	14.61					29.40	3434	36.70	4366	44.00	5311	51.30	6286	58.68	7236	73.20	9196
50	14.93					30.00	3474	37.50	4415	44.90	5372	52.40	6339	59.90	7317	74.80	9300
51	15.24					30.60	3513	38.20	4465	45.90	5430	53.50	6409	61.10	7399	76.30	9405
52	15.56					31.30	3550	39.00	4514	46.80	5490	54.60	6479	62.40	7479	77.90	9506
53	15.88					31.90	3588	39.80	4561	47.80	5547	55.70	6548	63.70	7556	79.50	9606
54	16.20					32.50	3626	40.60	4609	48.70	5606	56.80	6616	64.90	7637	81.10	9706
55	16.52					33.20	3661	41.40	4655	49.70	5661	58.00	6681	66.20	7713	82.70	9804

Table 4 : Shaft diameter Ci for Z needles of diameter d and a circumferential clearance jc between 0.3 to 0.6 mm

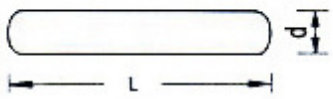
Coefficient γ For formula 4) page 9
Coefficient K For formula 1) page 8

d mm		2		2.5		3		3.5		4		5	
Z	γ	Ci mm	K	Ci mm	K	Ci mm	K	Ci mm	K	Ci mm	K	Ci mm	K
56	16.83	33.80	3699	42.20	4701	50.60	5719	59.00	6750	67.50	7789	84.30	9901
57	17.15	34.40	3736	43.00	4747	51.60	5774	60.20	6814	68.70	7867	85.90	9997
58	17.47	35.10	3770	43.80	4793	52.50	5831	61.30	6880	70.00	7942	87.50	10093
59	17.79	35.70	3860	44.60	4837	53.50	5884	62.40	6944	71.30	8016	89.10	10188
60	18.11	36.40	3840	45.40	4882	57.50	5938	63.50	7009	72.60	8090	90.70	10282
61	18.43			46.20	4926	55.40	5992	64.60	7073	73.90	8162	92.30	10374
62	18.47			47.00	4970	56.40	6045	65.70	7136	75.10	8236	93.80	10468
63	19.06			47.80	5013	57.30	6100	66.80	7198	76.40	8307	95.40	10559
64	19.38			48.60	5056	58.30	6150	68.00	7258	77.70	8379	97.00	10651
65	19.7			49.40	5099	59.20	6204	69.10	7320	78.90	8451	98.60	10740
66	20.02			50.20	5141	60.20	6254	70.20	7381	80.20	8521	100.20	10829
67	20.33			51.00	5184	61.10	6306	71.30	7442	81.50	8590	101.80	10917
68	20.65			51.80	5225	62.10	6357	72.40	7502	82.70	8660	103.40	11005
69	20.97			52.60	5226	63.00	6408	73.50	7562	84.00	8729	105.00	11092
70	21.29			53.40	5308	64.00	6458	74.70	7620	85.30	8796	106.60	11179
71	21.61			54.20	5349	65.00	6506	75.80	7678	86.60	8863	108.20	11265
72	21.93			55.00	5389	65.90	6557	76.90	7737	87.90	8930	109.80	11350
73	22.24			55.70	5431	66.90	6604	78.00	7795	89.10	8998	111.30	11437
74	22.56			56.50	5471	67.80	6654	79.10	7852	90.40	9064	112.90	11520
75	22.88			57.30	5510	68.80	6702	80.20	7910	91.70	9129	114.50	11604

d mm		2		2.5		3		3.5		4		5	
Z	γ	Ci mm	K	Ci mm	K	Ci mm	K	Ci mm	K	Ci mm	K	Ci mm	K
76	23.30			58.10	5550	69.70	6751	81.30	7966	92.90	9195	116.10	11686
77	23.52			58.90	5589	70.70	6798	82.50	8022	94.20	9260	117.70	11769
78	23.83			59.70	5628	71.60	6846	83.50	8079	95.50	9324	119.30	11851
79	24.15			60.50	5666	72.60	6892	84.70	8134	96.70	9389	120.90	11933
80	24.47			61.30	5704	73.05	6940	85.80	8189	98.00	9453	122.50	12013
81	24.79					74.50	6985	86.90	8243	99.30	9516	124.10	12093
82	25.11					75.50	7030	88.00	8298	100.60	9578	125.70	12173
83	25.43					76.40	7078	89.10	8353	101.90	9640	127.30	12252
84	25.74					77.40	7123	90.20	8407	103.10	9703	128.80	12332
85	26.06					78.30	7169	91.30	8461	104.40	9764	130.40	12410
86	26.38					79.30	7213	92.50	8512	105.70	9825	132.00	12488
87	26.70					80.20	7258	93.60	8565	106.90	9887	133.60	12566
88	27.07					81.20	7302	94.70	8618	108.20	9947	135.20	12643
89	27.34					82.20	7345	95.80	8670	109.50	10007	136.80	12720
90	27.65					83.10	7390	96.90	8723	110.70	10069	138.40	12796
91	27.97					84.00	7436	98.00	8775	112.00	10128	140.00	12871
92	28.29					85.00	7479	99.20	8825	113.30	10187	141.60	12947
93	28.61					86.00	7520	100.30	8876	114.60	10245	143.20	13021
94	28.93					86.90	7565	101.40	8927	115.90	10303	144.80	13096
95	29.24					87.90	7607	102.50	8978	117.10	10363	146.30	13172
96	29.56					88.80	7650	103.60	9028	118.40	10420	147.90	13245
97	29.88					89.80	7692	104.70	9079	119.70	10478	149.50	13318
98	30.20					90.70	7735	105.80	9129	120.90	10537	151.10	13391
99	30.52					91.70	7777	107.00	9177	122.20	10593	152.70	13464
100	30.84					92.70	7817	108.10	9227	123.50	10650	154.30	13536

STANDARD NEEDLE ROLLERS

TYPE BR			
d mm	L mm	Lu mm	Approx Wt. (gms) Per 1000 nos.
1.5	9.8	8.9	132
1.5	13.6	12.4	181
1.587	9.88	8.9	153
1.811	10.57	9.6	204
1.811	13.46	12.4	273
1.985	9.6	8.6	221
1.994	16.25	15.2	398
2	7.8	6.8	182
2	8.8	7.8	206
2	9.8	8.8	230
2	10.4	9.4	244
2	10.8	9.8	254
2	11.3	10.3	265
2	11.8	10.8	280
2	12.65	11.65	312
2	13.8	12.8	325
2	14.3	13.3	383
2	14.8	13.8	342
2	15.8	14.8	375
2	19.8	18.8	470
2.015	10.3	9.3	257
2.275	12.7	11.7	389
2.381	10.31	9.31	311
2.381	10.57	9.6	322
2.382	19.84	18.7	668
2.387	12.55	11.5	384
2.387	16.85	15.7	543
2.41	17.1	16.0	578

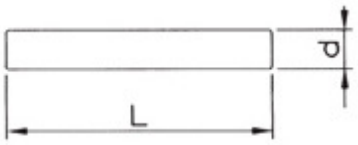


TYPE BR			
d mm	L mm	Lu mm	Approx Wt. (gms) Per 1000 nos.
2.5	7.8	6.7	285
2.5	11.8	10.7	430
2.5	13.8	12.7	510
2.5	15.8	14.7	580
2.5	17.8	16.7	660
2.5	19.8	18.7	730
2.5	23.8	22.7	880
2.778	11.17	10.4	508
3	9.8	8.5	510
3	13.8	12.5	730
3	15.8	14.5	840
3	17.8	16.5	940
3	19.8	18.5	1050
3	21.8	20.5	1150
3	23.8	22.5	1260
3	29.8	28.5	1600
3	39.8	38.5	2208
3.0025	25.1	23.8	1383
3.0025	28.1	26.8	1447
3.175	16.84	15.5	889
3.175	19.05	17.7	1125
3.175	20.57	19.2	1218

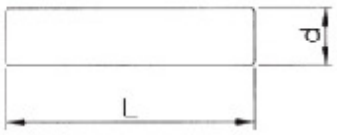
TYPE BR			
d mm	L mm	Lu mm	Approx Wt. (gms) Per 1000 nos.
3.175	21.8	20.4	1390
3.175	25.4	24.0	1550
3.195	19.05	17.6	1157
3.2	19.3	17.9	1153
3.457	23.9	22.4	1706
3.5	19.8	18.3	1437
3.5	29.8	28.3	2150
3.968	19.05	17.3	1760
4	29.8	28.1	2839
4.755	30.15	27.8	4135
4.757	25.4	23.1	3510
4.757	34.925	32.6	4640
5	49.8	47.5	7450
5.542	19.05	16.6	3227

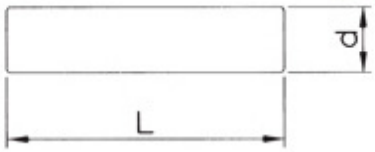
TYPE BR 60			
d mm	L mm	Lu mm	Approx Wt. (gms) Per 1000 nos.
2	7.8	6.7	192
2.5	11.8	10.5	454
2.5	15.8	14.5	608
3	9.8	8.3	543

TYPE BP			
d mm	L mm	Lu mm	Approx Wt. (gms) Per 1000 nos.
1.96	24.26	23.26	5606
2	11.8	10.8	276
2.275	12.7	11.7	3832
3	8.5	7.4	470
3	5	4	280
3	13.8	12.8	7158
3.5	21.8	20.8	1591
4	6	5	560
4	8	7	788
4	10	9	960
4	11.8	10.8	1135
4	12	11	1242
4	15.8	14.8	1536
4	19.8	18.8	1877
4	21.8	19.8	2363
4.55	7.75	5.6	990
4.762	10	9	1333
4.762	11.9	10.9	1616
5	12	11	2160
5	8	7	788
5	12.8	11.4	1902
5	26	25	3869
5	49.8	48.2	7550
5.5	29.8	28.8	5394
5.996	28.5	27	6229
6	6	5	1332
6	10	9	2136
6	12	11	2620
6	12.7	11.7	2742
6	13	12	2885
6.35	9.525	8.5	2284
6.5	28	27	7152



TYPE BP			
d mm	L mm	Lu mm	Approx Wt. (gms) Per 1000 nos.
7	7	6	2088
7	10	9	2975
7	20	19	6042
7.5	11.8	10.8	4050
8	8	7	3120
8	10	9	3854
8	12	10.8	4735
8.475	33.3	32.3	14524
9	9	8	4170
9.525	9.525	8.5	5240
9	14	13	6810
10	9.3	8.3	5734
10	10	9	5890
10	14	13	8488





TYPE BPM			
d mm	L mm	Lu mm	Approx Wt. (gms) Per 1000 nos.
2	19.8	18.8	471
3	5	4	268
3.5	23.8	22.8	1754
3.967	20.57	19.6	1618
4	8	7	788
4	10	9	985
4	12	11	1242
5	8	7	1193
5	19	18	2862
5	10	9	1522
5.5	10	-	1853
5.15	22	21	3503
6	10	9	2136
6	12	11	2620
7	7	6	2088
7	10	9	2975
7.5	11.8	10.8	4050
7.536	15.8	14.8	5443
8.5	21	20	9206
8.5	21.75	20.75	9534
9.525	9.525	8.6	5240
10	10	9	5890
10	14	13	8488

Rollers			
d mm	L mm	Lu mm	Approx Wt. (gms) Per 1000 nos.
2.5	5	3.60	192
4	13TR90	11.90	1282
4	14.8	13.16	1410
5	42	38.20	6285
6	10	9.00	2144
7	17.3	16.50	5226
8	12	-	4630
9	19.9	-	9938

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