Designation: A 1007 – 00

Standard Specification for Carbon Steel Wire for Wire Rope[1]

This standard is issued under the fixed designation A 1007; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers uncoated and four classes of round, metallic coated, cold-drawn, carbon steel wire for wire rope in five strength levels. This specification specifies:

1.1.1 Dimensional tolerances,

1.1.2 Mechanical characteristics,

1.1.3 Chemical composition requirements,

1.1.4 Coating requirements (if applicable), and

1.1.5 Packaging requirements.

1.2 The values stated for metric equivalents are provided for informational purposes only.

2. Referenced Documents

2.1 This specification incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at their appropriate place in the text and the publications are listed. For dated references, subsequent amendments to or revisions of any of these publications apply to this specification only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to would apply.

2.2 *ASTM Standards:*

A 90/A 90M Test Method for Weight (Mass) of Coating on Iron or Steel Articles with Zinc or Zinc-Alloy Coatings[2]

A 510 Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel-Coated[3]

A 938 Test Method for Torsion Testing of Wire[3]

B 6 Specification for Zinc (Slab Zinc)[4]

B 750 Specification for Zinc-5 % Aluminum Mischmetal Alloy (UNS Z38510) in Ingot Form for Hot-Dip Coatings[4]

E 8 Test Methods of Tension Testing of Metallic Materials[5]

E 380 Practice for Use of International System of Units (SI) (the Modernization Metric System)[6]

2.3 *ISO/EN Standards:*

EN 10264-1.2 Steel Wire and Wire Products—Steel Wire for Wire Rope[7]

2.4 *Industry Standard:*

API 9A Specification for Wire Rope[8]

2.5 *Industry References:*

AIME/ISS Carbon Steel, Wire and Rods[9]

AIAG 02.00 Primary Metals Identification Tag Application[9]

2.6 *Non-Referenced Industry Applicable Standards:*

ISO Std. 2232 Drawn Wire for General Purpose Non-Alloy Steel Wire Ropes[7]

3. Terminology

3.1 *Definitions:*

3.1.1 *actual diameter*—the arithmetic mean of the minimum and maximum diameter measurements in one location on the wire.

3.1.2 *breaking force level (Levels 1,2,3,4 or 5)*—a wire strength based on the minimum load carrying capability of a designated wire.

3.1.3 *drawn-galvanized*—a zinc coating that is applied to the wire prior to the final cold drawing operation by either an electro-deposition or hot-galvanizing process.

3.1.4 *drawn-Zn5 Al-MM*—a zinc-aluminum alloy (mischmetal) coating that is applied to the wire prior to the final cold drawing operation by a molten coating process.

3.1.5 *final-coated Zn5 Al-MM*—a zinc-aluminum alloy (mischmetal) coating that is applied to the wire after the final cold drawing operation by a molten coating process.

3.1.6 *final-galvanized*—a zinc coating that is applied to the wire after the final cold drawing operation by either an electro-deposition or hot-galvanizing process.

3.1.7 *nominal diameter*—the diameter of the wire expressed in inches (millimetres) and specified by the user to designate the wire size. It is the basis for the determination of the values of all characteristics of the wire for acceptance purposes.

3.1.8 *ovality*—the arithmetic difference between the maximum diameter and the minimum diameter in one location on the wire; it shall not be greater than half the tolerance specified in the respective tables referred to in the following parts of this specification.

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[1] This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.03 on Steel Rod and Wire.

Current edition approved April 10, 2000. Published June 2000.

[2] *Annual Book of ASTM Standards*, Vol 01.06.

[3] *Annual Book of ASTM Standards*, Vol 01.03.

[4] *Annual Book of ASTM Standards*, Vol 02.04.

[5] *Annual Book of ASTM Standards*, Vol 03.01.

[6] *Annual Book of ASTM Standards*, Vol 14.02.

[7] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

[8] Available from American Petroleum Institute, 1801 K Street, N.W., Washington, DC 20226.

[9] Available from Automotive Industry Action Group (AIAG), 26200 Lahser Road, Suite 200, Southfield, MI 48034–7100.

3.1.9 *uncoated wire*—the surface of a wire furnished with a residual lube film as a result of cold-drawing said wire.

4. Ordering Information

4.1 It is the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this specification. Such requirements shall include, but are not limited to the following:

4.1.1 Quantity (mass),

4.1.2 Name of material (drawn steel wire for wire rope),

4.1.3 Wire type (uncoated, drawn- or final-galvanized/Zn5 Al-mm coated),

4.1.4 Wire diameter,

4.1.5 Wire strength grade (Level 1 through 5),

4.1.6 Packaging (Section 14),

4.1.7 Cast or heat analysis; if requested,

4.1.8 Certification or test report; if requested, and

4.1.9 ASTM designation and date of issue.

5. Materials and Manufacture

5.1 The base metal rod used in the manufacture of rope wire shall be rolled from good commercial quality steel. The steel may be either ingot cast or strand cast.

5.2 A sufficient discard shall be made to ensure freedom from detrimental piping and undue segregation.

5.3 The wire shall be cold-drawn to produce the desired properties.

5.4 The wire shall be furnished in one of five types, as specified:

5.4.1 Uncoated,

5.4.2 Drawn-galvanized,

5.4.3 Final-galvanized,

5.4.4 Drawn Zn5/Al-MM, and

5.4.5 Final coated Zn5/Al-MM.

5.5 Uncoated, drawn-galvanized and drawn-Zn5 Al-MM wire can be furnished in Levels 1 through 5. Final-galvanized and final-coated Zn5 Al-MM wire is usually furnished in Levels 1 through 4.

5.6 The method utilized in the production of either drawn- or final-galvanized wire types may be by an electro-deposition or hot-dip galvanizing process at the option of the producer.

5.6.1 The slab zinc used in galvanized zinc coatings shall be as specified in Specification B 6.

5.7 The method utilized in the production of Zn5 Al-MM wire types may be either a continuous hot-dip alloy coating or two step coating where the first coating is zinc followed by a final bath having an aluminum content up to 7.2 % to prevent depletion of the aluminum content of the bath.

5.7.1 The bath metal used in continuous hot-dip Zn-5 Al-MM alloy coating shall meet the chemical composition limits specified in Specification B 750.

6. Chemical Composition

6.1 Upon agreement with the purchaser, the wire manufacturer shall apply a steel of suitable chemical composition that will satisfy the properties of the material ordered.

6.2 A quantitative analysis of each cast or heat shall be made by the steel producer or his representative to determine the percentage of the elements specified. The analysis shall be made from a test sample preferably taken during the pouring of the cast or heat. The chemical composition thus determined shall be reported, if required, to the purchaser or his representative.

6.3 An analysis may be made by the purchaser from the finished wire. The chemical composition thus determined as to the elements required shall conform to the product analysis requirements specified in Table 3 of Specification A 510 or as agreed upon between the purchaser and the manufacturer.

7. Wire Diameter

7.1 The wire shall be measured using a micrometer with an minimum accuracy of 0.0001 in. (0.002 mm) for all diameters.

7.2 All diameter values measured in one location along the wire shall be within the tolerance limits given in Table 1 for uncoated and drawn-galvanized or drawn-Zn5 Al-MM rope wire or Table 2 for final-galvanized or final-coated Zn5 Al-MM rope wire.

8. Tensile Properties

8.1 *Tensile Test Procedure*:

8.1.1 *Standard Testing Method*—The tensile test shall be carried out in accordance with Test Methods E 8. The distance between the grips of the testing machine shall not be less than 8 in. (203 mm). The speed of the movable head of the testing machine, under no load, shall not exceed 1 in./min (0.4 mm/s). Any specimen breaking within 1 in. (25.4 mm) of the jaws may be disregarded and a retest performed.

8.1.2 *Alternate Testing Method*—The tensile test shall be carried out in accordance with Test Methods E 8. The loading rate may be greater than that specified, depending on the number of tests to be carried out for the batch inspection. However, it shall not exceed the rate corresponding to a 25 % elongation between anchorages in 1 min. The minimum distance between the clamping jaws of the test machine is 4 in. (100 mm). In the event of a dispute, the tensile test shall be carried out strictly in accordance with Test Methods E 8, in particular with regard to the loading rate.

8.1.3 The minimum breaking forces are specified in Table 3 of this specification, for wire grade Levels 1 through 5. The range in breaking force for a given grade level is based on the

TABLE 1 Wire Diameter Tolerances Uncoated and Drawn-Galvanized or Zn5 Al-MM Rope Wire

Diameter Range, in.	Diameter Range, mm	Tolerance, in.		Tolerance, mm	
		Minus	Plus	Minus	Plus
0.010 to 0.025 incl.	0.25 to 0.64 incl.	0.0003	0.0007	0.01	0.02
Over 0.025 to 0.060 incl.	Over 0.64 to 1.50 incl.	0.0005	0.001	0.01	0.03
Over 0.060 to 0.093 incl.	Over 1.50 to 2.36 incl.	0.001	0.001	0.03	0.03
Over 0.093 to 0.142 incl.	Over 2.36 to 3.61 incl.	0.001	0.0015	0.03	0.04
Over 0.142 to 0.200 incl.	Over 3.61 to 5.08 incl.	0.0015	0.002	0.04	0.05
Over 0.200 to .250 incl.	Over 5.08 to 6.35 incl.	0.002	0.002	0.05	0.05

TABLE 2 Wire Diameter Tolerances Final-Galvanized or Final-Coated Zn5 Al-MM Rope Wire

Diameter Range, in.	Diameter Range, mm	Tolerance, in.		Tolerance, mm	
		Minus	Plus	Minus	Plus
0.025 to 0.061 incl.	0.64 to 1.55 incl.	0.001	0.001	0.03	0.03
Over 0.061 to 0.079 incl.	Over 1.55 to 2.01 incl.	0.002	0.002	0.05	0.05
Over 0.079 to 0.092 incl.	Over 2.01 to 2.34 incl.	0.003	0.003	0.08	0.08
Over 0.092 to 0.103 incl.	Over 2.34 to 2.62 incl.	0.003	0.003	0.08	0.08
Over 0.103 to 0.119 incl.	Over 2.62 to 3.02 incl.	0.003	0.003	0.08	0.08
Over 0.119 to 0.142 incl.	Over 3.02 to 3.61 incl.	0.003	0.003	0.08	0.08
Over 0.142 to 0.187 incl.	Over 3.61 to 4.75 incl.	0.004	0.004	0.10	0.10
Over 0.187	Over 4.75	0.004	0.004	0.10	0.10

calculated minimum tensile strength requirement (psi). While no maximum values are shown for breaking force, rope wire is generally produced to a tensile strength range of 30 000 psi. The resultant minimum breaking force of either uncoated, drawn-galvanized and drawn-Zn5 Al-MM wires of various levels shall meet or exceed the values shown in Table 3. The resultant minimum breaking force for final-galvanized or final-coated Zn5 Al-MM wire is obtained by reducing the value stated for its level in Table 3 for uncoated wire by 10 %.

TABLE 3 Minimum Breaking Forces

Wire Diameter		Minimum Torsional Values (Nunber of Twists in 8 in.)					Minimum Breaking Force[A]									
in.	mm	Level 1	Level 2	Level 3	Level 4	Level 5	Level 1		Level 2		Level 3		Level 4		Level 5	
							lbf	N	lbf	N	lbf	N	lbf	N	lbf	N
0.010	0.254	274	254	234	218	190	16	70	17	80	20	90	22	100	24	110
0.011	0.279	249	231	213	196	173	18	90	21	100	24	110	27	120	29	130
0.012	0.305	228	212	195	182	158	22	100	25	120	29	130	32	150	31	160
0.013	0.330	211	196	180	168	146	26	120	29	140	34	150	37	170	41	180
0.014	0.356	196	181	167	156	136	31	140	34	160	39	180	43	200	45	210
0.015	0.381	182	169	156	145	126	36	180	39	180	45	200	49	220	53	240
0.016	0.408	171	156	146	136	118	40	180	41	200	51	230	56	250	80	270
0.017	0.432	161	149	137	126	111	48	200	50	230	57	260	63	290	63	310
0.018	0.467	152	141	130	121	105	50	230	53	250	64	290	71	320	73	340
0.019	0.483	144	133	123	114	100	56	250	62	260	72	320	79	360	85	380
0.020	0.508	136	126	116	108	94	60	280	69	310	79	360	87	390	94	420
0.021	0.533	130	120	111	103	90	68	310	73	340	87	390	100	450	100	450
0.022	0.559	124	115	106	96	86	75	340	83	360	96	430	110	490	110	490
0.023	0.584	118	110	101	94	82	80	370	91	410	100	450	120	540	120	540
0.024	0.610	113	105	97	90	78	85	400	100	450	110	490	130	580	130	580
0.025	0.635	109	101	93	86	75	90	430	110	490	120	540	140	630	150	670
0.026	0.680	105	97	89	83	72	100	450	130	540	130	560	150	670	160	720
0.027	0.686	101	93	86	80	70	110	490	130	580	140	630	160	720	170	730
0.028	0.711	97	90	83	77	67	120	540	130	580	150	670	170	760	180	810
0.029	0.737	94	87	80	74	65	130	580	140	630	170	760	180	810	200	890
0.030	0.782	90	84	77	72	62	140	630	150	670	180	810	190	850	210	940
0.031	0.787	86	81	75	69	60	150	670	160	720	190	850	210	940	220	960
0.032	0.813	85	78	72	67	56	160	720	180	810	200	890	220	980	240	1070
0.033	0.836	82	76	70	65	57	170	780	190	850	210	940	240	1070	250	1130
0.034	0.864	80	74	68	63	55	180	810	200	890	230	1030	250	1120	270	1210
0.035	0.869	77	72	66	61	53	190	860	210	940	240	1070	260	1160	280	1250
0.036	0.914	75	70	64	60	52	200	890	220	960	250	1120	280	1250	300	1340
0.037	0.940	73	68	62	58	50	210	940	230	1030	270	1210	300	1340	320	1430
0.038	0.966	71	66	61	56	49	220	960	250	1120	280	1250	310	1360	330	1470
0.039	0.991	69	64	59	55	48	230	1030	260	1160	300	1340	330	1470	350	1560
0.040	1.02	67	62	57	53	46	240	1070	270	1210	310	1360	340	1520	370	1650
0.041	1.04	66	61	56	52	45	250	1160	290	1290	330	1470	360	1610	390	1740
0.042	1.07	64	59	55	51	44	270	1210	300	1340	340	1520	380	1700	410	1830
0.043	1.09	63	58	53	50	43	280	1250	310	1380	360	1610	400	1780	430	1920
0.044	1.12	61	57	52	48	42	300	1340	330	1470	380	1700	420	1870	450	2010
0.045	1.14	60	56	51	47	41	310	1360	340	1520	390	1740	430	1920	470	2100
0.046	1.17	58	54	50	46	40	320	1430	360	1610	410	1830	450	2010	490	2130
0.047	1.19	57	53	49	45	39	340	1530	370	1650	430	1920	470	2100	510	2270
0.048	1.22	56	52	48	44	36	350	1560	390	1740	450	2010	490	2180	540	2350
0.049	1.24	55	51	47	43	36	370	1560	410	1830	470	2100	510	2270	550	2450
0.050	1.27	54	50	46	42	37	380	1700	420	1870	490	2180	530	2380	570	2500
0.051	1.30	53	49	45	42	36	400	1760	440	1960	500	2230	560	2500	610	2670
0.052	1.32	52	48	44	41	36	410	1830	480	2050	520	2320	580	2580	620	2730
0.053	1.35	51	47	43	40	36	430	1920	470	2100	540	2410	600	2670	640	2850
0.054	1.37	50	46	42	39	34	440	1960	490	2180	580	2500	620	2780	660	2990
0.055	1.40	49	45	41	38	33	460	2050	510	2270	590	2630	640	2850	690	3070

TABLE 3 *Continued*

Wire Diameter		Minimum Torsional Values (Nunber of Twists in 8 in.)					Minimum Breaking Force[A]									
in.	mm	Level 1	Level 2	Level 3	Level 4	Level 5	Level 1		Level 2		Level 3		Level 4		Level 5	
							lbf	N	lbf	N	lbf	N	lbf	N	lbf	N
0.056	1.42	48	44	41	36	33	470	2100	530	2360	610	2720	670	2990	710	3200
0.057	1.45	47	43	40	37	32	490	2180	550	2450	630	2810	690	3070	710	3300
0.058	1.47	46	43	39	36	32	510	2270	570	2540	650	2900	720	3210	710	3430
0.059	1.50	45	42	36	36	31	530	2360	580	2580	670	2990	740	3300	710	3520
0.060	1.52	44	41	38	35	30	540	2410	600	2670	690	3070	760	3390	810	3550
0.061	1.56	44	40	37	35	30	560	2500	620	2760	720	3210	790	3520	850	3790
0.062	1.57	43	40	37	34	29	580	2580	640	2850	740	3300	810	3610	830	3923
0.063	1.60	42	39	36	33	29	600	2670	660	2940	760	3390	840	3740	930	4310
0.064	1.63	42	38	36	33	28	620	2760	690	3070	790	3520	870	3870	930	4140
0.065	1.65	41	38	35	32	28	640	2850	710	3160	810	3610	890	3980	960	4283
0.066	1.68	40	37	34	32	28	680	2940	730	3250	840	3740	920	4100	990	4410
0.067	1.70	40	37	34	31	27	670	2990	750	3340	860	3830	950	4230	1000	4540
0.068	1.73	39	36	33	31	27	690	3070	770	3430	890	3960	980	4360	1060	4630
0.069	1.75	38	36	33	30	26	710	3160	790	3520	910	4050	1000	4450	1160	4810
0.070	1.78	38	35	32	30	26	730	3250	820	3650	940	4190	1030	4590	1110	4940
0.071	1.80	37	35	32	29	26	780	3390	840	3740	970	4320	1080	4720	1140	5080
0.072	1.83	37	34	31	29	25	780	3470	880	3830	990	4410	1090	4850	1170	5200
0.073	1.85	36	34	31	29	25	800	3580	590	3960	1020	4540	1120	4990	1210	5360
0.074	1.86	36	33	30	28	24	820	3650	910	4050	1050	4680	1150	5120	1240	5600
0.075	1.91	35	33	30	28	24	840	3740	930	4140	1070	4760	1180	5250	1270	5680
0.076	1.93	35	32	30	27	24	860	3830	960	4280	1100	4900	1210	5390	1300	5790
0.077	1.96	34	32	29	27	23	890	3960	960	4380	1130	5030	1240	5520	1340	5900
0.078	1.98	34	31	29	27	23	910	4080	1010	4500	1160	5160	1280	5700	1370	6100
0.079	2.01	33	31	28	26	23	930	4140	1030	4590	1190	5300	1310	5830	1410	6300
0.080	2.03	33	30	28	26	22	950	4230	1080	4720	1230	5430	1340	5970	1440	6400
0.081	2.03	33	30	28	26	22	960	4260	1090	4850	1250	5570	1370	6100	1480	6500
0.082	2.03	32	30	27	25	22	1000	4460	1110	4610	1280	5700	1410	6280	1510	0000
0.083	2.11	32	29	27	25	22	1020	4500	1140	5080	1310	5830	1440	6410	1550	0000
0.084	2.13	31	29	27	25	21	1050	4680	1160	5160	1340	5970	1470	6540	1580	7030
0.085	2.16	31	29	26	24	21	1070	4760	1190	5300	1370	6100	1510	6720	1620	7210
0.086	2.18	31	28	26	24	21	1100	4800	1220	5430	1400	6230	1540	6660	1660	7390
0.087	2.21	30	28	26	24	21	1120	4990	1250	5570	1430	6370	1580	7030	1700	7570
0.088	2.24	30	28	25	23	20	1150	5120	1270	5650	1470	6540	1610	7170	1730	7700
0.089	2.26	30	27	25	23	20	1170	5210	1300	5790	1500	6660	1650	7340	1770	7880
0.090	2.29	29	27	25	23	20	1200	5340	1330	5920	1530	6610	1680	7480	1810	8080
0.091	2.31	29	27	24	23	20	1220	5430	1360	6050	1560	6940	1720	7660	1850	8230
0.092	2.34	28	26	24	22	19	1250	5670	1390	6190	1600	7120	1760	7830	1890	8410
0.093	2.36	28	26	24	22	19	1280	5700	1420	6320	1630	7260	1790	7970	1930	8590
0.094	2.39	28	26	24	22	19	1300	5790	1450	6450	1670	7430	1830	8150	1970	8770
0.095	2.41	28	25	23	22	19	1330	5920	1480	6590	1700	7570	1870	8320	2010	8900
0.096	2.44	27	25	23	21	18	1360	6050	1510	6720	1740	7740	1910	8500	2050	9130
0.097	2.46	27	25	23	21	18	1390	6190	1540	6880	1770	7880	1950	8680	2090	9300
0.098	2.49	27	25	23	21	18	1410	6280	1570	6990	1810	8060	1990	8860	2140	9529
0.099	2.51	26	24	22	21	18	1440	6410	1600	7120	1840	8190	2030	9030	2180	9700
0.100	2.54	26	24	22	20	18	1470	6540	1630	7260	1880	8370	2070	9210	2220	9880
0.101	2.57	26	24	22	20	18	1500	6580	1680	7390	1910	8500	2110	9390	2260	10000
0.102	2.59	26	24	22	20	17	1530	6810	1700	7570	1950	8680	2150	9570	2310	10210
0.103	2.62	25	23	21	20	17	1560	6940	1730	7700	1990	8860	2190	9750	2360	10410
0.104	2.64	25	23	21	20	17	1580	7030	1760	7830	2030	9030	2230	9920	2390	10610
0.105	2.67	25	23	21	19	17	1610	7170	1790	7970	2080	9170	2270	10100	2440	10810
0.106	2.69	25	23	21	19	17	1640	7300	1830	8150	2100	9350	2310	10280	2480	11010
0.107	2.72	24	22	21	19	16	1670	7430	1860	8280	2140	9520	2350	10460	2530	11280
0.108	2.74	24	22	20	19	16	1700	7570	1890	8410	2180	9700	2400	10680	2580	11430
0.109	2.77	24	22	20	19	16	1730	7700	1930	8590	2220	9880	2440	10860	2620	11630
0.110	2.79	24	22	20	18	16	1770	7880	1960	8720	2260	10060	2480	11040	2670	11830
0.111	2.82	23	22	20	18	16	1800	8010	2000	8900	2300	10240	2530	11260	2710	12050
0.112	2.84	23	21	20	18	16	1830	8150	2030	9030	2340	10410	2570	11440	2760	12230
0.113	2.87	23	21	19	18	15	1880	8280	2070	9210	2380	10590	2610	11610	2810	12500
0.114	2.90	23	21	19	18	15	1890	8410	2100	9350	2420	10770	2660	11840	2860	12730
0.115	2.92	22	21	19	18	15	1920	8550	2140	9620	2480	10950	2700	12020	2910	12950
0.116	2.95	22	21	19	17	15	1960	8720	2170	9660	2500	11130	2750	12240	2950	13130
0.117	2.97	22	20	19	17	15	1990	8860	2210	9840	2540	11300	2790	12420	3000	13350
0.118	3.00	22	20	18	17	15	2020	8960	2240	9970	2580	11480	2840	12640	3050	13670
0.119	3.02	22	20	18	17	15	2050	9120	2290	10150	2620	11660	2890	12880	3100	13790
0.120	3.05	21	20	18	17	14	2090	9300	2320	10320	2670	11880	2930	13040	3150	14030
0.121	3.07	21	20	18	17	14	2120	9440	2360	10500	2710	12080	2960	13260	3200	14210
0.122	3.10	21	19	18	17	14	2150	9570	2390	10640	2750	12240	3030	13480	3250	14160
0.123	3.12	21	19	18	16	14	2190	9750	2430	10610	2800	12460	3070	13660	3310	14730
0.124	3.15	21	19	18	16	14	2220	9660	2470	10990	2840	12640	3120	13880	3360	14950
0.125	3.18	21	19	17	16	14	2260	10080	2510	11170	2880	12820	3170	14110	3410	15170
0.126	3.20	20	19	17	16	14	2290	10190	2550	11360	2930	13040	3220	14330	3460	15200