



HANDBOOK
SAFETY DEVICES

Ed. 2017

 **Castel**[®]
Italian technology

CHAPTER 1

SAFETY VALVES IN SERIES 3030



GENERAL DESCRIPTION

The valves in series 3030 are unbalanced, conventional direct-loaded safety valves. The valve is opened by the thrust from the fluid under pressure below the shutter, when said thrust exceeds, under the calibrated conditions, the opposing force of the spring acting on the shutter.

Valves are identified by means of:

- a model number formed of an alphanumerical code that includes:
 - the family identity (for ex. 3030/44)
 - the type of connection (C = NPT ; G = Gas)
 - the set pressure, expressed in bar, multiplied by 10 (for ex. 250)
- An alphanumerical serial number

CONSTRUCTION

Body: squared, obtained through hot moulding and subsequent machining. It houses the following elements:

- the nozzle with flat sealing seat
 - the shutter guide
 - the set spring slot
 - the threaded seat of the setting adjustment ring nut
- In the body, above the shutter guide, a small pressure relief hole is provided through which the spring slot communicates with the atmosphere. For this reason, during relief, there is a gas leak through this orifice.

Material used: EN 12420-CW617N brass

Shutter: obtained through machining from bar stock and fit with gasket, it ensures the required degree of

tightness on the valve seat. The gasket is made from PTFE (Polytetrafluorethylene), a material that, during the valve's estimated service life, maintains good strength and does not cause the shutter to stick on the seat. The shutter is properly guided in the head and the guide action cannot fail. There are no glands or retaining rings that hamper its movement.

Material used: EN 12164-CW614N brass

Spring: it opposes the pressure and the fluid dynamic forces, and always ensures closing of the valve following pressure relief. When the shutter has reached the maximum height determined by the mechanical stop, the spring compression does not exceed 85% of the total compression.

Material used: DIN 17223-1 steel for springs.

Calibration system: hex-head threaded ring nut to be screwed inside the upper portion of the head, compressing the spring below. When calibration is complete, the position of the ring nut is maintained unchanged by applying to the threaded coupling a high mechanical strength and low viscosity bonding agent. The low viscosity promotes penetration. The calibration system is protected against subsequent tampering by means of a threaded cap nut, screwed on outside the head and sealed with a Castel lead seal.

SCOPE

Use: protection against possible overpressure of the apparatuses listed below, with regard to the operating conditions for which they have been designed:

- Refrigeration system or heat pump components, for instance: condensers, liquid receivers, evaporators, liquid accumulators, positive displacement compressor discharge, heat exchangers, oil separators, or piping. (reference standard: EN 378-2:2016)
- Simple pressure vessels (reference Directive: 2009/105/EC)

Fluids: the valves in series 3030 can be used with:

- a. Refrigerant fluids in vapour or gaseous state belonging to Group 2:
 - HCFC (R22)
 - HFC (R134a , R404A , R407C , R410A , R507)
 - HFO and HFO/HFC mixtures (R1234ze , R448A , R449A , R450A , and R452A)
 - R744

with reference to Article 13, Para. 1(b) of Directive 2014/68/EU (EC Regulation No. 1272/2008).

- b. Air and nitrogen (reference Directive: 2009/105/EC)

For specific applications with refrigerant fluids not listed above, please contact Castel Technical Department.

MARKING

In compliance with the provisions of Article 19 of Directive 2014/68/EC, the following information is reported on the valve body:

- Manufacturer's mark
- Country of manufacturing
- Indication of flow direction
- Maximum allowable pressure
- CE marking
- Identification number of the notified body involved in the production control phase

Again, on the body, the following information is laser marked:

- Valve model
- Serial number
- Set pressure
- Temperature range allowed
- Kd discharge coefficient
- Flow section
- Production date

DOCUMENTATION

The safety valves in series 3030 are supplied with the following documentation provided in the packaging:

- operating instructions for the user, containing all information useful for safety in terms of assembly, commissioning, use, and maintenance.
- Compliance Statement for the equipment according to Directive 2014/68/EU, required in Article 17 and issued in compliance with Annex IV of the same directive.
- Calibration certificate for the safety valve, printed on the reverse side of the Compliance Statement.

N.B.: on the website: www.castel.it use the "Certifications" pull-down menu to access the web-page "**Castel Certification Download Center**". On this page, you can download:

- the Compliance Statement / Calibration Certificate for each valve by entering the 7-digit alphanumeric serial number.
- the general Compliance Statement referring to a specific model of valve 3030 with a specific setting, for ex. 3030/44C250 or 3030/88C420.

VALVE SELECTION

Directive 2014/68/EC requires that pressure equipment, in which permissible limits are reasonably likely to be exceeded, shall be fitted with suitable protection devices, for instance safety devices such as safety valves. Such

devices shall prevent pressure from permanently exceeding the maximum allowable pressure (PS) of the equipment they protect. In any case, a short pressure peak limited to 10% of maximum allowable pressure is permitted.

As to the selection and sizing of the suitable protection device, users shall refer to the specific product and sector standards listed below:

- EN ISO 4126-1: 2013: "Safety devices for protection against excessive pressure – Part 1: Safety valves" indicates the general requirements for safety valves regardless of the fluid for which they were designed.
- EN 378-2:2016: "Refrigerating systems and heat pumps – safety and environmental requirements – Part 2: Design, construction, testing, marking and documentation" provides a general outline of the protection devices to be used in refrigerating systems and their characteristics (Para. 6.2.5) and the criteria for the selection of the device suitable for the type and size of the system component to be protected (Para. 6.2.6).
- EN 13136:2013: "Refrigerating systems and heat pumps – Pressure relief devices and their associated piping – Methods for calculation" highlights the possible causes of overpressure in a system and provides users with the tools for sizing pressure relief devices, among which safety valves.

To select the safety valves in series 3030, please see Chapter 5 "Selection Criteria for Safety Valves" in this technical handbook.

Tables 3 and 4 provide the maximum discharge capacities of safety valves, models 3030/44 and 3030/88, as a function of various refrigerants and varying P_{set} for the valve, considering $T_o =$ Steam saturation temperature at discharge pressure, P_o .

VALVE INSTALLATION

Safety valves type 3030 guarantee repeatable performance. This means that, after the valves have operated, open/close, the initial setting conditions are maintained. Nevertheless, it is advisable to replace a 3030 valve once it has discharged as during release debris, such as metal shavings or solder impurities, can deposit on the valve gasket. This can inhibit the safety valve from returning to its original conditions.

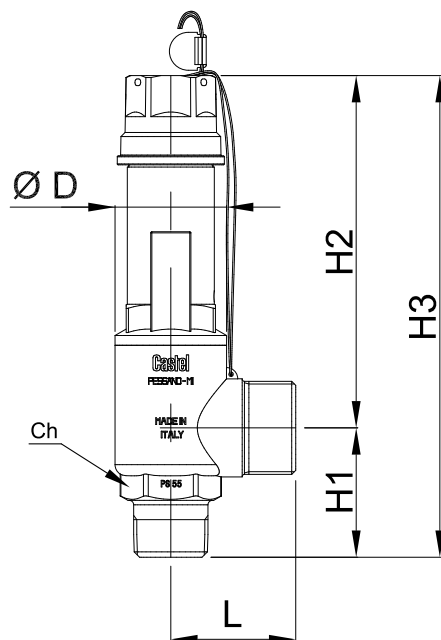
To calculate the pressure loss in either the upstream line (between vessel and safety valve) or the downstream line (between safety valve and atmosphere) refer to Chapter 5 "Selection Criteria for Safety Valves" in this technical handbook.

TABLE 1: General Characteristics of valves 3030

Catalogue Number		3030/44C	3030/44G	3030/66C	3030/88C
Connections	Inlet male	1/2" NPT	1/2" G	3/4" NPT	1" NPT
	Outlet male	3/4" G	3/4" G	3/4" G	1.1/4" G
Inlet connection wrench torque (min/max) [Nm]		21/30	21/30	32/45	50/65
Flow Diameter [mm]		12	12	12	19,5
Flow Section [mm ²]		113	113	113	298
Lift [mm]		4,1	4,1	4,1	6,8
Discharge Coefficient "Kd"		0,90	0,90	0,90	0,83
PS [bar]		55			
TS [°C]		- 50 / + 150			
TA [°C]		- 40 / + 50			
Set Pressure Range at atmospheric back pressure Pset [bar]		9 / 50			
Overpressure		+ 5 % of Pset			
Blowdown		- 15 % of Pset			
Helium tightness		85 % di Pset (9 bar < Pset < 31 bar)			
		90 % di Pset (31,1 bar < Pset < 50 bar)			
Estimated service life		5 years			
Risk Category according to PED Recast		IV			

TABLE 2: Dimensions and Weights of valves 3030

Catalogue Number	Dimensions [mm]						Weight [g]
	Ø D	L	Ch	H ₁	H ₂	H ₃	
3030/44C	38	38	28	44	115	159	780
3030/44G	38	38	28	44	115	159	780
3030/66C	38	38	28	44	115	159	780
3030/88C	50	56	40	58	158	216	1960



3030/44C
3030/66C
3030/88C

TABLE 3: Maximum discharge capacity of valves 3030/44 ; 3030/66

Pset [bar]	Po [barsass]	R134a		R22		R404A		R407C		R410A		R448A	
		To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]
11,0	13,1	49,8	1937	33,7	1815	27,0	768	33,9	1811	16,5	1735	31,1	1828
12,0	14,2	53,0	2109	36,9	1972	30,2	837	36,9	1969	19,4	1887	34,1	1986
13,0	15,3	56,0	2284	39,9	2130	33,1	908	39,7	2130	22,1	2041	36,9	2152
14,0	16,4	58,9	2461	42,8	2290	35,9	979	42,4	2292	24,7	2196	39,6	2317
15,0	17,5	61,7	2641	45,5	2452	38,5	1051	44,9	2457	27,2	2352	42,1	2478
16,0	18,6	64,3	2823	48,1	2615	41,0	1125	47,3	2623	29,5	2511	44,6	2652
17,0	19,7	66,8	3009	50,6	2780	43,4	1201	49,6	2792	31,8	2672	46,9	2829
18,0	20,8	69,2	3199	53,0	2947	45,7	1278	51,8	2963	33,9	2834	49,1	2991
19,0	21,9	71,5	3392	55,3	3116	48,0	1357	54,0	3137	36,0	2999	51,2	3180
20,0	23,0	73,7	3589	57,5	3287	50,1	1439	56,0	3313	37,9	3167	53,3	3348
21,0	24,1	75,9	3791	59,7	3461	52,1	1522	58,0	3493	39,9	3336	55,2	3527
22,0	25,2	77,9	3997	61,7	3637	54,1	1608	59,9	3675	41,7	3509	57,1	3717
23,0	26,3	79,9	4209	63,7	3815	56,0	1698	61,7	3861	43,5	3684	58,9	3922
24,0	27,4	81,9	4428	65,7	3997	57,9	1790	63,4	4051	45,2	3863	60,7	4115
25,0	28,5	83,7	4652	67,6	4181	59,7	1887	65,2	4244	46,9	4045	62,4	4320
26,0	29,6	85,6	4885	69,4	4369	61,4	1988	66,8	4442	48,5	4230	64,1	4504
27,0	30,7	87,3	5127	71,2	4561	63,1	2096	68,4	4645	50,1	4419	65,7	4738
28,0	31,8	89,0	5379	72,9	4756	64,7	2211	70,0	4853	51,6	4613	67,2	4947
29,0	32,9	90,7	5644	74,6	4955	66,3	2336	71,5	5067	53,1	4811	68,7	5170
30,0	34,0	92,3	5924	76,2	5159	67,8	2475	72,9	5288	54,6	5014	70,2	5408
31,0	35,1	93,9	6224	77,8	5369	69,3	2637	74,4	5516	56,0	5224	71,6	5606
32,0	36,2	95,4	6550	79,4	5584	70,7	2845	75,7	5753	57,4	5439	73,0	5876
33,0	37,3	96,9	6913	80,9	5805	72,1	3294	77,1	6000	58,7	5662	74,3	6169
34,0	38,4	98,3	7336	82,4	6034			78,4	6259	60,1	5893	75,6	6410
35,0	39,5	99,2	7702	83,9	6271			79,7	6533	61,4	6134	76,9	6753
36,0	40,6	99,5	7897	85,3	6518			80,9	6826	62,6	6386	78,1	7034
37,0	41,7	99,7	8102	86,7	6776			82,1	7142	63,8	6652	79,2	7445
38,0	42,8			88,0	7048			83,2	7493	65,0	6935	80,3	7911
39,0	43,9			89,4	7338			84,3	7896	66,2	7240		
40,0	45,0			90,7	7651			85,3	8399	67,4	7574		
41,0	46,1			92,0	7995			86,1	9227	68,5	7952		
42,0	47,2			93,2	8387					69,6	8404		
43,0	48,3			94,4	8866					70,7	9024		
44,0	49,4			95,6	9584								
45,0	50,5												
46,0	51,6												
47,0	52,7												
48,0	53,8												
49,0	54,9												
50,0	56,0												
51,0	57,1												
52,0	58,2												
53,0	59,3												
54,0	60,4												
55,0	61,5												
56,0	62,6												
57,0	63,7												
58,0	64,8												
59,0	65,9												
60,0	67,0												

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TABLE 3: Maximum discharge capacity of valves 3030/44 ; 3030/66

Pset [bar]	Po [barsass]	R449A		R450A		R452A		R507		R1234ze		R744 (CO2)	
		To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]
11,0	13,1	31,0	1838	55,2	1982	28,7	2007	25,8	1990	61,1	1987	-32,5	1465
12,0	14,2	34,0	2000	58,5	2163	31,8	2186	28,9	2169	64,5	2166	-30,2	1588
13,0	15,3	36,9	2164	61,7	2336	34,6	2366	31,9	2351	67,7	2347	-27,9	1713
14,0	16,4	39,5	2330	64,6	2526	37,4	2550	34,7	2536	70,8	2532	-25,8	1837
15,0	17,5	42,1	2498	67,5	2708	39,9	2736	37,3	2724	73,7	2720	-23,8	1962
16,0	18,6	44,5	2668	70,1	2892	42,4	2925	39,8	2916	76,5	2912	-21,8	2088
17,0	19,7	46,8	2841	72,7	3091	44,7	3118	42,2	3112	79,1	3108	-20,0	2215
18,0	20,8	49,1	3016	75,2	3289	47,0	3314	44,5	3313	81,7	3309	-18,2	2342
19,0	21,9	51,2	3195	77,5	3482	49,1	3514	46,8	3518	84,1	3514	-16,5	2470
20,0	23,0	53,2	3376	79,8	3688	51,2	3718	48,9	3729	86,4	3726	-14,9	2599
21,0	24,1	55,2	3561	82,0	3912	53,2	3928	50,9	3946	88,7	3943	-13,3	2729
22,0	25,2	57,1	3749	84,1	4123	55,1	4142	52,9	4171	90,9	4168	-11,7	2860
23,0	26,3	58,9	3941	86,2	4350	57,0	4362	54,8	4403	93,0	4401	-10,2	2991
24,0	27,4	60,7	4137	88,1	4596	58,7	4588	56,7	4644	95,0	4644	-8,8	3123
25,0	28,5	62,4	4338	90,1	4818	60,5	4822	58,5	4896	97,0	4898	-7,4	3257
26,0	29,6	64,1	4544	91,9	5056	62,1	5065	60,2	5162	98,9	5166	-6,0	3391
27,0	30,7	65,7	4756	93,7	5368	63,7	5317	61,9	5443	100,7	5451	-4,7	3527
28,0	31,8	67,2	4974	95,4	5650	65,3	5581	63,5	5746	102,5	5760	-3,4	3663
29,0	32,9	68,7	5199	97,1	5959	66,8	5859	65,1	6076	104,3	6100	-2,2	3801
30,0	34,0	70,2	5430	98,8	6215	68,3	6155	66,6	6448	106,0	6489	-0,9	3940
31,0	35,1	71,6	5672	100,3	6580	69,7	6483	68,1	6889	107,6	6972	0,3	4080
32,0	36,2	73,0	5930	101,9	7100	68,3	16968	69,6	7484	109,2	7821	1,4	4222
33,0	37,3	74,3	6182			72,3	7225					2,6	4365
34,0	38,4	75,6	6490			73,5	7708					3,7	4509
35,0	39,5	76,9	6801									4,8	4655
36,0	40,6	78,1	7140									5,9	4803
37,0	41,7	79,2	7526									6,9	4952
38,0	42,8	80,3	7994									8,0	5103
39,0	43,9	80,7	10047									9,0	5256
40,0	45,0											10,0	5411
41,0	46,1											11,0	5567
42,0	47,2											11,9	5727
43,0	48,3											12,9	5888
44,0	49,4											13,8	6052
45,0	50,5											14,7	6219
46,0	51,6											15,6	6388
47,0	52,7											16,5	6561
48,0	53,8											17,3	6737
49,0	54,9											18,2	6916
50,0	56,0											19,0	7100
51,0	57,1												
52,0	58,2												
53,0	59,3												
54,0	60,4												
55,0	61,5												
56,0	62,6												
57,0	63,7												
58,0	64,8												
59,0	65,9												
60,0	67,0												

TABLE 4: Maximum discharge capacity of valves 3030/88

Pset [bar]	Po [barsass]	R134a		R22		R404A		R407C		R410A		R448A	
		To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]
11,0	13,1	49,8	4712	33,7	4414	27,0	768	33,9	4404	16,5	4221	31,1	4446
12,0	14,2	53,0	5131	36,9	4796	30,2	837	36,9	4790	19,4	4590	34,1	4829
13,0	15,3	56,0	5555	39,9	5181	33,1	908	39,7	5181	22,1	4963	36,9	5233
14,0	16,4	58,9	5985	42,8	5570	35,9	979	42,4	5575	24,7	5340	39,6	5636
15,0	17,5	61,7	6423	45,5	5963	38,5	1051	44,9	5975	27,2	5721	42,1	6028
16,0	18,6	64,3	6867	48,1	6360	41,0	1125	47,3	6380	29,5	6107	44,6	6451
17,0	19,7	66,8	7319	50,6	6762	43,4	1201	49,6	6791	31,8	6498	46,9	6880
18,0	20,8	69,2	7780	53,0	7167	45,7	1278	51,8	7207	33,9	6893	49,1	7275
19,0	21,9	71,5	8250	55,3	7579	48,0	1357	54,0	7630	36,0	7294	51,2	7735
20,0	23,0	73,7	8729	57,5	7995	50,1	1439	56,0	8059	37,9	7701	53,3	8144
21,0	24,1	75,9	9220	59,7	8417	52,1	1522	58,0	8495	39,9	8114	55,2	8578
22,0	25,2	77,9	9722	61,7	8845	54,1	1608	59,9	8939	41,7	8534	57,1	9041
23,0	26,3	79,9	10238	63,7	9279	56,0	1698	61,7	9391	43,5	8961	58,9	9539
24,0	27,4	81,9	10768	65,7	9721	57,9	1790	63,4	9852	45,2	9395	60,7	10007
25,0	28,5	83,7	11316	67,6	10170	59,7	1887	65,2	10323	46,9	9837	62,4	10507
26,0	29,6	85,6	11882	69,4	10627	61,4	1988	66,8	10804	48,5	10288	64,1	10955
27,0	30,7	87,3	12470	71,2	11092	63,1	2096	68,4	11298	50,1	10748	65,7	11523
28,0	31,8	89,0	13083	72,9	11567	64,7	2211	70,0	11804	51,6	11219	67,2	12032
29,0	32,9	90,7	13727	74,6	12052	66,3	2336	71,5	12324	53,1	11702	68,7	12574
30,0	34,0	92,3	14409	76,2	12549	67,8	2475	72,9	12861	54,6	12196	70,2	13153
31,0	35,1	93,9	15138	77,8	13058	69,3	2637	74,4	13416	56,0	12705	71,6	13634
32,0	36,2	95,4	15930	79,4	13581	70,7	2845	75,7	13993	57,4	13229	73,0	14291
33,0	37,3	96,9	16813	80,9	14119	72,1	3294	77,1	14594	58,7	13771	74,3	15004
34,0	38,4	98,3	17843	82,4	14675			78,4	15224	60,1	14333	75,6	15590
35,0	39,5	99,2	18732	83,9	15252			79,7	15890	61,4	14919	76,9	16424
36,0	40,6	99,5	19207	85,3	15852			80,9	16601	62,6	15532	78,1	17107
37,0	41,7	99,7	19706	86,7	16481			82,1	17371	63,8	16179	79,2	18109
38,0	42,8			88,0	17143			83,2	18224	65,0	16867	80,3	19241
39,0	43,9			89,4	17847			84,3	19205	66,2	17608		
40,0	45,0			90,7	18608			85,3	20427	67,4	18422		
41,0	46,1			92,0	19445			86,1	22443	68,5	19341		
42,0	47,2			93,2	20399					69,6	20439		
43,0	48,3			94,4	21562					70,7	21949		
44,0	49,4			95,6	23310								
45,0	50,5												
46,0	51,6												
47,0	52,7												
48,0	53,8												
49,0	54,9												
50,0	56,0												
51,0	57,1												
52,0	58,2												
53,0	59,3												
54,0	60,4												
55,0	61,5												
56,0	62,6												
57,0	63,7												
58,0	64,8												
59,0	65,9												
60,0	67,0												

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TABLE 4: Maximum discharge capacity of valves 3030/88

Pset [bar]	Po [barsass]	R449A		R450A		R452A		R507		R1234ze		R744 (CO2)	
		To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]	To [°C]	Qm [kg/h]
11,0	13,1	31,0	4471	55,2	4820	28,7	4883	25,8	4841	61,1	4834	-32,5	3563
12,0	14,2	34,0	4865	58,5	5261	31,8	5316	28,9	5275	64,5	5268	-30,2	3863
13,0	15,3	36,9	5263	61,7	5683	34,6	5756	31,9	5718	67,7	5709	-27,9	4165
14,0	16,4	39,5	5667	64,6	6143	37,4	6201	34,7	6167	70,8	6158	-25,8	4468
15,0	17,5	42,1	6075	67,5	6587	39,9	6654	37,3	6625	73,7	6616	-23,8	4773
16,0	18,6	44,5	6489	70,1	7034	42,4	7115	39,8	7092	76,5	7083	-21,8	5079
17,0	19,7	46,8	6910	72,7	7519	44,7	7583	42,2	7569	79,1	7559	-20,0	5387
18,0	20,8	49,1	7336	75,2	8000	47,0	8060	44,5	8057	81,7	8047	-18,2	5697
19,0	21,9	51,2	7770	77,5	8468	49,1	8547	46,8	8557	84,1	8547	-16,5	6009
20,0	23,0	53,2	8211	79,8	8970	51,2	9044	48,9	9070	86,4	9061	-14,9	6322
21,0	24,1	55,2	8660	82,0	9514	53,2	9552	50,9	9598	88,7	9590	-13,3	6637
22,0	25,2	57,1	9118	84,1	10028	55,1	10074	52,9	10143	90,9	10137	-11,7	6955
23,0	26,3	58,9	9585	86,2	10580	57,0	10609	54,8	10708	93,0	10704	-10,2	7275
24,0	27,4	60,7	10063	88,1	11178	58,7	11160	56,7	11295	95,0	11294	-8,8	7597
25,0	28,5	62,4	10551	90,1	11719	60,5	11729	58,5	11908	97,0	11912	-7,4	7921
26,0	29,6	64,1	11052	91,9	12296	62,1	12318	60,2	12554	98,9	12564	-6,0	8248
27,0	30,7	65,7	11567	93,7	13055	63,7	12931	61,9	13239	100,7	13258	-4,7	8578
28,0	31,8	67,2	12098	95,4	13743	65,3	13573	63,5	13974	102,5	14008	-3,4	8910
29,0	32,9	68,7	12644	97,1	14493	66,8	14250	65,1	14778	104,3	14836	-2,2	9245
30,0	34,0	70,2	13207	98,8	15116	68,3	14970	66,6	15682	106,0	15783	-0,9	9583
31,0	35,1	71,6	13795	100,3	16004	69,7	15767	68,1	16755	107,6	16957	0,3	9924
32,0	36,2	73,0	14423	101,9	17269	68,3	41269	69,6	18203	109,2	19023	1,4	10269
33,0	37,3	74,3	15037			72,3	17572					2,6	10616
34,0	38,4	75,6	15784			73,5	18748					3,7	10967
35,0	39,5	76,9	16541									4,8	11322
36,0	40,6	78,1	17367									5,9	11681
37,0	41,7	79,2	18305									6,9	12044
38,0	42,8	80,3	19443									8,0	12411
39,0	43,9	80,7	24436									9,0	12783
40,0	45,0											10,0	13159
41,0	46,1											11,0	13541
42,0	47,2											11,9	13928
43,0	48,3											12,9	14321
44,0	49,4											13,8	14719
45,0	50,5											14,7	15125
46,0	51,6											15,6	15537
47,0	52,7											16,5	15957
48,0	53,8											17,3	16384
49,0	54,9											18,2	16821
50,0	56,0											19,0	17267
51,0	57,1												
52,0	58,2												
53,0	59,3												
54,0	60,4												
55,0	61,5												
56,0	62,6												
57,0	63,7												
58,0	64,8												
59,0	65,9												
60,0	67,0												

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