VVR VENTURI VOLUME CONTROL VALVE

- Precision Venturi Air Measurement
- Venturi according to DIN 1952/ISO 5167
- External Air Tight to DIN 24194 Part 4
- Shut off Air Tight to DIN 1946 Part 4
- Heavy duty Blade Seal
- 12 mm Ø solid drive shaft for fast speed
- Max. speed 0..90° rotation is 1s
- Shaft bearings for low rotation torque
- Body lip seals for easy site installation
- CMR fast actuator and DPC can be factory fitted
- Incorporating the high accuracy CMR sensors
- 24 month warranty
- 30 Years field application experience

VVR Venturi Valve with DPC 220 Controller

Valve Body Construction

The CMR Venturi Valve is manufactured to the highest engineering precision with CNC machines. The valve is nudged out as a flat sheet from galvanised senzimir sheet metal with all cut outs for damper the blade axle and the tube fittings. The flat plate is then formed into a precision round body and the edges are butt laser welded with a CNC Laser, which provides a perfect seal without the need for anti corrosion paint.

The damper blade consists of two metal round plates which sandwich a silicone disc seal. A 12mmØ axle is fitted with heavy duty clamps onto the blades and is then embedded into air tight bearings on both sides of the valve to provide smooth action with very low torque. The blade and axle are designed for very fast motor rotation i.e. 1 second from open to closed position. With such high speeds, the axle will withstand the enormous torque which develops on the shaft when turning from open to close in small steps to provide high accuracy control without a fluctuating Hysteresis.
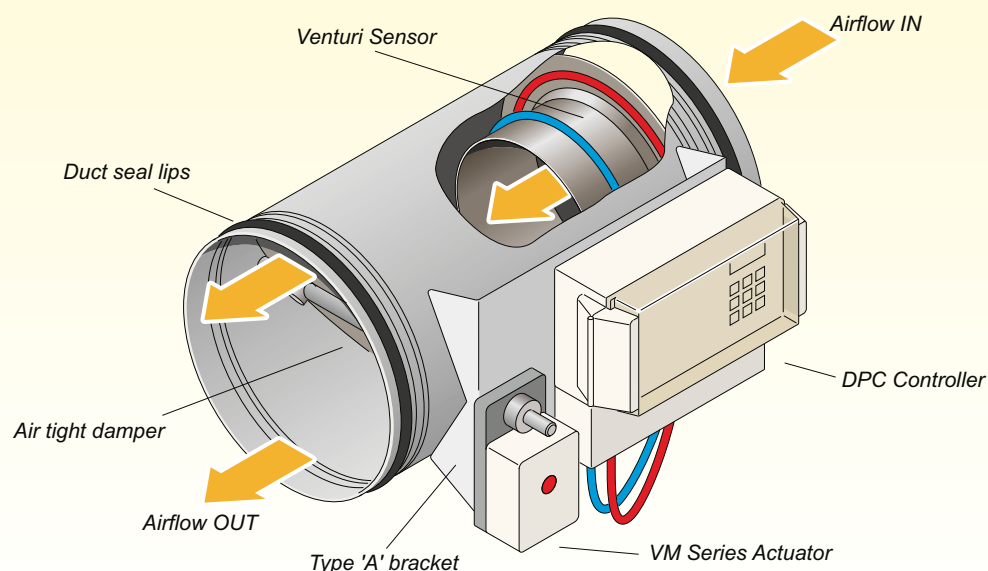
Venturi Construction

The Venturi is designed for each Size and formed to the same precision with CNC machines. It consists of four total averaging pressure measurement holes on the inlet of the venturi. The venturi is welded into the inside of the valve which has a reduced open area. The air is forced through the nozzle at higher speed and four static averaging pressure holes pick up the increased static pressure.

Venturi Measurement

The velocity pressure is converted by the Volume Sensor into a scaled and linear air volume providing either l/s, m3/s or m3/h. The venturi in combination with the CMR sensor is factory calibrated and provides an accurate and repeatable measurement.

Due to the very unique shape of the venturi, the pressure is regained and a low total overall pressure drop is achieved.

VVR-A Venturi Valve with DPC Controller and fast Actuator 0-90° and Modbus rtu communication

Venturi Sensor

Airflow IN

Duct seal lips

DPC Controller

Air tight damper

Airflow OUT

VM Series Actuator

Type 'A' bracket

CMR CONTROLS Ltd
Precision Air Pressure and Volume Sensors

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VVR VENTURI VALVE SPECIFICATIONS

Selection of Volume Control Damper

It is essential to determine the air volume during the design stage. Normally there is a minimum and a maximum volume which has to be controlled.

The duct area should be calculated so that the velocity is approximately 2.5m/s at the minimum volume and preferably 5m/s at the operating point if possible. If the velocity is more than 5m/s at the maximum volume then the noise level criteria needs to be considered. The maximum velocity should not exceed 9m/s as the duct resistance shall increase and the overall energy consumption shall go up. Use selection Table on page 4.

The VVR Venturi Valves is equipped with an 'A' bracket making it a VVR-A. It has double damper blades with an embedded silicone seal. Other materials are available on request. The venturi reduces the diameter for a very short length and it is formed for pressure regain. The reduced internal area of the valve shall increase the velocity pressure momentarily but will have a regain of pressure after passing through the venturi, which means that the overall pressure drop can be kept at a minimum.

The heavy duty drive shaft which is bolted firmly to the valve blade is designed to withstand the very high momentary torque developed by the fast actuator. The shaft is guided by sealed bearing bushes on either side of the valve body.

Installation

The VVR Venturi Valve works in any position provided it is used in non condensing conditions. It is best if the blades and actuator are positioned horizontally rather then having the actuator hanging down. This way, the weight is reduced on the side seals and provides a long term efficient operation. It is also easier for the maintenance engineers to replace an actuator. When the damper is installed, care must be taken to leave sufficient space for the engineers to inspect and replace the motor. A minimum of 500mm should be kept free.

Hysteresis

The VVR Venturi Valves have a very low hysteresis due to the sturdy single blade construction and therefore the damper can be moved very accurately to a control position.

Maintenance

The VVR Venturi Valve is maintenance free.

Materials

VVR-A valve Body	- Galvanised Sheet Metal
Blade/Seal	- Galvanised Sheet Metal/Silicone
Drive Shaft	- Zinc Plated Steel
Drive Shaft Seal	- 'O'Ringsl
Bearing Bushes	- Brass
Outer Duct Seals	- Pressed in Rubber
Actuator Brackets 'A'	- Galvanised Sheet Metal
Tubing	- PVC

Valve sizes see table on right.
Valve diameters are sized to fit into standard round spiral duct.
The Part No. starting with VVR-A has a DPC/Actuator bracket.
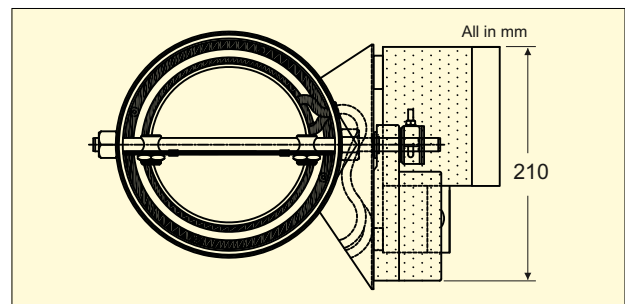Alternative Brackets on request.

Specifications

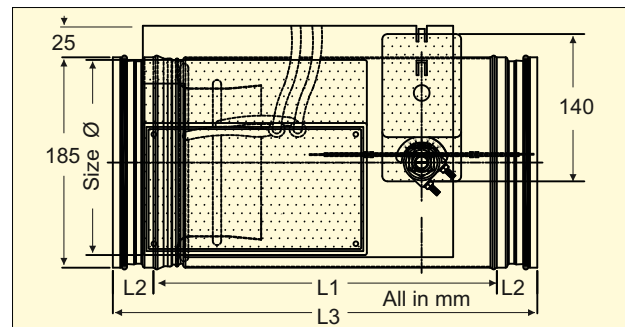|		
Recommended minimum air velocity is	2.5	m/s
Recommended operating air velocity is	5	m/s
Maximum recommended air velocity is	9	m/s

Humidity 10% to 90% non condensing.
Operating Temperature (dry condition)   -20 to 80°C
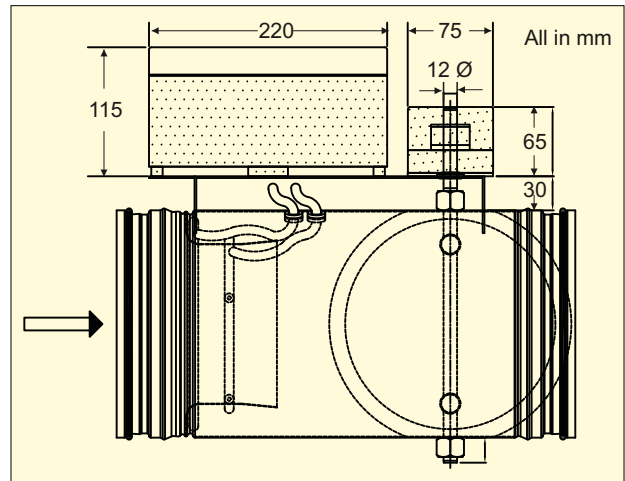
VVR-A Venturi Valve with DPC Controller and fast Actuator

VVR-A Venturi Valve with DPC Controller and fast Actuator

VVR-A Venturi Valve Dimensions

VVR-A Valve dimensions and Magnification Factor (mf)

Size Ø	Stock Code	L1	L2	L3	mf factor
100 mm	VVR-A-100	290	40	370	5.205
125 mm	VVR-A-125	290	40	370	4.812
140 mm	VVR-A-140	290	40	370	4.700
150 mm	VVR-A-150	290	40	370	6.194
160 mm	VVR-A-160	300	40	380	4.510
180 mm	VVR-A-180	310	40	390	4.460
200 mm	VVR-A-200	320	40	400	4.229
224 mm	VVR-A-224	345	40	425	4.141
250 mm	VVR-A-250	355	40	435	3.614
280 mm	VVR-A-280	355	60	505	4.428
315 mm	VVR-A-315	415	60	535	4.539
355 mm	VVR-A-355	485	60	605	4.372
400 mm	VVR-A-400	505	80	665	4.644

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VVR VENTURI VELOCITY PRESSURES

Static Pressure - + Impact Pressure
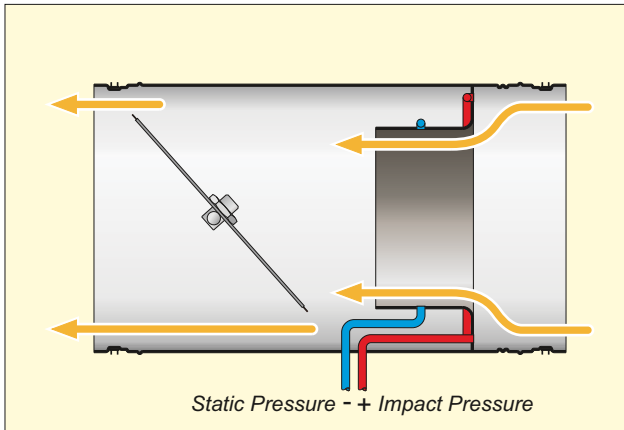
VVR Venturi tube connections

The velocity pressure is measured by the Venturi built into the VVR Valve and the total impact pressure is measured on the positive (+red) and the static pressure is measured on the negative (- blue) tube connections. The CMR Volume Sensor shall be connected to the corresponding nipples using CMR PVC red and blue tube.
When the CMR Sensors are ordered with the VVR Venturi then it is pre-adjusted at the factory - i.e. duct diameter, density and VVR Venturi Magnification Factor (mf) and the range is in m^3/s ,m^3/h, l/s or ACR (air change rate). It is ready for connection to the control or monitoring system.

If the CMR Volume Sensor such as P-Sensor, V-Sensor, DPM-Sensor or DPC-Controller was ordered separately and it was not factory adjusted then it is quite simple to adjust the parameters on site. All Sensor have a keyboard and display. The duct diameter and the magnification factor of the VVR Venturi Valve must be entered which is stated on each valve size on page 2 .

If the volume indicated on the CMR Sensor display is deviating from the actual measurements, then the magnification factor can be adjusted to suit the installation abnormalities via the Sensor's keyboard. To find the best possible accuracy for your application, adjust the fan to a constant volume – start with 50% of the minimum and maximum operating volume and take a pitot travers reading with a CAL150 instrument. Once the average volume has been established and it is not the same as displayed on the CMR Sensor, then adjust the Magnification Factor (mf) until the same display is achieved. Check at 25%, 75% and 100% volume set point The CMR Sensors have also parameters to linearize each point of the measurement for more critical applications.

Useful VVR Venturi scaling formula:

$$\text{velocity m/s} = \sqrt{\frac{2 \ x \ (\Delta P \text{ in Pa} / (mf) \text{ factor})}{1.2 \quad \text{Density}}}$$

Example:

2 x (100Pa across VVR-A-315 / 4.539 mf) = 44.06 / 1.2 = 36.71
$\sqrt{36.71}$ = 6.058 m/s
6.058 m/s x (duct area 0.07744) = 0.469m^3/s * 3600 = 1688 m^3/h

Conversion Table - Velocity in m/s at standard density to Velocity Pressure in Pa

m/s	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.01	0.02	0.05	0.10	0.15	0.22	0.29	0.38	0.49
1	0.60	0.73	0.86	1.01	1.18	1.35	1.54	1.73	1.94	2.17
2	2.40	2.65	2.90	3.17	3.46	3.75	4.06	4.37	4.70	5.05
3	5.40	5.77	6.14	6.53	6.94	7.35	7.78	8.21	8.66	9.13
4	9.60	10.09	10.58	11.09	11.62	12.15	12.70	13.25	13.82	14.41
5	15.00	15.61	16.22	16.85	17.50	18.15	18.82	19.49	20.18	20.89
6	21.60	22.33	23.06	23.81	24.58	25.35	26.14	26.93	27.74	28.57
7	29.40	30.25	31.10	31.97	32.86	33.75	34.66	35.57	36.50	37.45
8	38.40	39.37	40.34	41.33	42.34	43.35	44.38	45.41	46.46	47.53
9	48.60	49.69	50.78	51.89	53.02	54.15	55.30	56.45	57.62	58.81
10	60.00	61.21	62.43	63.65	64.90	66.15	67.42	68.69	69.98	71.29
11	72.60	73.93	75.26	76.61	77.98	79.35	80.74	82.13	83.54	84.97
12	86.40	87.85	89.30	90.77	92.26	93.75	95.26	96.77	98.30	99.85
13	101.40	102.97	104.54	106.23	107.74	109.35	110.98	112.61	114.26	115.93
14	117.60	119.29	120.98	122.69	124.42	126.15	127.90	129.65	131.42	133.21
15	135.00	136.81	138.62	140.45	142.30	144.15	146.02	147.89	149.78	151.69
16	153.60	155.53	157.46	157.46	159.41	161.38	163.35	165.34	167.33	169.34
17	173.40	175.45	177.50	179.57	181.66	183.75	185.86	187.97	190.10	192.25
18	194.40	196.57	198.74	200.93	203.14	205.35	207.58	209.81	212.06	214.33
19	216.60	218.89	221.18	223.49	225.82	228.15	230.50	232.85	235.22	237.61
20	240.00	242.41	244.82	247.25	249.70	252.15	254.62	257.09	259.58	262.09
21	264.60	267.13	269.66	272.21	274.78	277.35	279.94	282.53	285.14	287.77
22	290.40	293.05	295.70	298.37	301.06	303.75	306.46	309.17	311.90	314.65
23	317.40	320.17	322.94	325.73	328.54	331.35	334.18	337.01	339.86	342.73
24	345.60	348.49	351.38	354.29	357.22	360.15	363.10	366.05	369.02	372.01
25	375.00	378.01	381.02	384.05	387.10	390.15	393.22	396.29	399.38	402.49

To get the range of the CMR Sensor use the keyboard and display the range . This is the sensor range in m^3/s or m^3/h at 10V / 20mA. Enter this range into your control system. No further calculations are necessary. If you want to use the table above, use the range of the transmitter in Pa and divide it by the (mf) of the VVR. Look up the velocity above. i.e. 100Pa / 4.539 (315 Valve) = 22.03 Pa.
Look up above ~ 22.03 Pa and read on side and top ~ 6.05 m/s then multiply with duct area 0.07744(315 Valve) m^2 to get m^3/s then multiply by 3600 to get m^3/h.

VVR SELECTIONS AND NOISE LEVELS

Part Number Selection Table 1

Part Number	Description	Size DN mm	Length L3 mm	Area m2	Volume at 3m/s m3/s	Volume at 5m/s m3/s	Volume at 9 m/s m3/s	Volume at 3m/s m3/h	Volume at 5m/s m3/h	Volume at 9 m/s m3/h
VVR-A-100	100mm Venturi Valve with DPC Bracket	100	370	0.00786	0.024	0.039	0.071	85	141	255
VVR-A-125	125mm Venturi Valve with DPC Bracket	125	370	0.01227	0.037	0.061	0.110	133	221	398
VVR-A-140	140mm Venturi Valve with DPC Bracket	140	370	0.01540	0.046	0.077	0.139	166	277	499
VVR-A-150	150mm Venturi Valve with DPC Bracket	150	370	0.01767	0.053	0.088	0.159	191	318	573
VVR-A-160	160mm Venturi Valve with DPC Bracket	160	380	0.02011	0.060	0.101	0.181	217	362	652
VVR-A-180	180mm Venturi Valve with DPC Bracket	180	390	0.02545	0.076	0.127	0.229	275	458	825
VVR-A-200	200mm Venturi Valve with DPC Bracket	200	400	0.03142	0.094	0.157	0.283	339	566	1018
VVR-A-224	224mm Venturi Valve with DPC Bracket	224	425	0.03941	0.118	0.197	0.355	426	709	1277
VVR-A-250	250mm Venturi Valve with DPC Bracket	250	435	0.04909	0.147	0.245	0.442	530	884	1591
VVR-A-280	280mm Venturi Valve with DPC Bracket	280	505	0.06158	0.185	0.308	0.554	665	1108	1995
VVR-A-315	315mm Venturi Valve with DPC Bracket	315	535	0.07794	0.234	0.390	0.701	842	1403	2525
VVR-A-355	355mm Venturi Valve with DPC Bracket	355	605	0.09899	0.297	0.495	0.891	1069	1782	3207
VVR-A-400	400mm Venturi Valve with DPC Bracket	400	665	0.12568	0.377	0.628	1.131	1357	2262	4072

The Part Number is made of the Type i.e. VVR-A   100 is the diameter

Noise Levels

Static Pressure at Venturi in Pa — the three groups below are at **100 Pa**, **250 Pa** and **500 Pa**. Each group shows LW (dB/Octave) Power level at 63, 125, 250, 500, 1k, 2k, 4k, 8k and the Sum dB(A).

Valve Size Ø	Velocity m/s	Volume m3/h	63	125	250	500	1k	2k	4k	8k	Sum dB(A)	63	125	250	500	1k	2k	4k	8k	Sum dB(A)	63	125	250	500	1k	2k	4k	8k	Sum dB(A)
100	2	57	59	53	47	41	35	29	21	17	43	64	58	52	46	41	35	27	22	49	68	62	57	51	45	39	31	26	53
	5	141	68	62	56	50	44	39	33	26	52	74	68	62	56	50	44	38	31	58	78	72	66	60	54	48	42	36	62
	7.5	212	72	66	60	54	49	41	35	30	57	78	72	66	60	54	48	42	36	62	82	76	70	64	58	52	47	40	66
	10	283	75	69	63	57	52	46	40	33	60	81	75	69	63	57	51	45	39	65	85	79	73	67	61	55	50	43	69
125	2	88	60	54	48	42	37	31	23	18	45	66	60	54	48	42	36	28	24	50	70	64	58	52	46	40	33	28	54
	5	221	69	64	58	52	46	40	34	27	54	75	69	63	57	51	46	40	33	60	79	73	67	62	56	50	44	37	64
	7.5	331	74	68	62	56	50	42	38	31	58	79	73	67	62	56	50	44	37	64	83	77	72	66	60	54	48	41	68
	10	442	77	71	65	59	53	47	41	34	61	82	76	70	64	59	53	47	40	67	86	80	75	69	63	57	51	44	71
140	2	111	61	55	49	43	37	31	24	19	45	66	61	55	49	43	37	29	24	51	71	65	59	53	47	41	33	29	55
	5	277	70	64	58	53	47	41	35	28	55	76	70	64	58	52	46	41	34	60	80	74	68	62	56	51	45	38	65
	7.5	416	74	68	63	57	51	45	39	32	59	80	74	68	62	56	51	45	38	64	84	78	72	66	61	55	49	42	69
	10	554	77	71	66	60	54	48	42	35	62	83	77	71	65	59	53	48	41	67	87	81	75	69	64	58	52	45	72
160	2	145	62	56	50	44	38	32	25	20	46	67	61	56	50	44	38	30	25	52	71	66	60	54	48	42	34	29	56
	5	362	71	65	59	53	48	42	36	29	56	77	71	65	59	53	47	41	35	61	81	75	69	63	57	51	46	39	65
	7.5	543	75	69	63	58	52	46	40	33	60	81	75	69	63	57	51	46	39	65	85	79	73	67	62	56	50	43	70
	10	724	78	72	66	61	55	49	43	36	63	84	78	72	66	60	54	49	42	68	88	82	76	70	64	59	53	46	73
180	2	183	62	57	51	45	39	33	25	20	47	68	62	56	50	45	39	31	26	53	72	66	61	55	49	43	35	30	57
	5	458	72	66	60	54	48	42	37	30	58	77	72	66	60	54	48	42	35	62	82	76	70	64	58	52	46	40	66
	7.5	687	76	70	64	58	53	47	41	34	61	82	76	70	64	58	52	46	40	66	86	80	74	68	62	56	51	44	70
	10	916	79	73	67	61	55	50	44	37	64	85	79	73	67	61	55	49	42	69	89	83	77	71	65	59	54	47	73
200	2	226	63	57	51	46	40	34	26	21	48	69	63	57	51	45	39	32	27	53	73	67	61	55	49	44	36	31	58
	5	565	73	67	61	55	49	43	37	30	57	78	72	66	61	55	49	43	36	63	82	76	71	65	59	53	47	40	67
	7.5	848	77	71	65	59	53	47	42	35	61	82	76	71	65	59	53	47	40	67	87	81	75	69	63	57	51	44	71
	10	1131	80	74	68	62	58	50	44	38	64	85	79	74	68	62	56	50	43	70	89	84	78	72	66	60	54	47	74
250	2	353	65	59	53	47	41	35	27	23	49	70	64	59	53	47	41	33	28	55	74	69	63	57	51	45	37	32	59
	5	884	74	68	62	56	51	45	39	32	59	80	74	68	62	56	50	44	38	64	84	78	72	66	60	54	49	42	68
	7.5	1325	78	72	68	61	58	49	43	36	63	84	78	72	66	60	54	49	42	68	88	82	76	70	65	59	53	46	73
	10	1767	81	75	69	64	58	52	46	39	66	87	81	75	69	63	57	52	45	71	91	85	79	73	67	62	56	49	76
315	2	561	66	60	55	49	43	37	29	24	51	72	66	60	54	48	42	35	30	56	76	70	64	58	53	47	39	34	61
	5	1403	76	70	64	58	52	46	40	34	60	81	75	69	64	58	52	46	39	66	85	80	74	68	62	56	50	43	70
	7.5	2104	80	74	68	62	56	50	45	38	64	85	79	74	68	62	56	50	43	70	90	84	78	72	66	60	54	47	74
	10	2806	83	77	71	65	59	53	47	41	67	88	82	77	71	65	59	53	46	73	93	87	81	75	69	63	57	50	77
355	2	713	67	61	55	49	44	38	30	25	52	73	67	61	55	49	43	35	31	57	77	71	65	59	53	47	40	35	61
	5	1782	76	71	65	59	53	47	41	34	61	82	76	70	64	58	53	47	40	67	86	80	74	69	63	57	51	44	71
	7.5	2672	81	75	69	63	57	51	45	38	65	86	80	74	69	63	57	51	44	71	90	84	79	73	67	61	55	48	75
	10	3563	84	78	72	66	60	54	48	41	68	89	83	77	71	66	60	54	47	74	93	87	82	76	70	64	58	51	78
400	2	905	68	62	56	50	44	38	31	26	52	73	68	62	56	50	44	36	31	58	78	72	66	60	54	48	40	36	62
	5	2262	77	71	65	60	54	48	42	35	62	83	77	71	65	59	53	48	41	67	87	81	75	69	63	58	52	45	72
	7.5	3393	81	75	70	64	58	52	46	39	66	87	81	75	69	63	58	52	45	72	91	85	79	74	68	62	56	49	76
	10	4524	84	78	73	67	61	55	49	42	69	90	84	78	72	66	60	55	48	74	94	88	82	76	71	65	59	52	79