

Now that we have an idea of the speed, boost and power that our supercharger will be driven at, we can take a closer look at the drive belt. The power required to drive our Norman supercharger can be estimated through the following formula:

$$\text{Drive power} = \frac{\text{boost} \times \text{airflow}}{229 \times \text{belt efficiency} \times \text{adiabatic efficiency}}$$

If we assume that the adiabatic efficiency of the Norman supercharger is 60%, and belt efficiency is 97%, then we get:

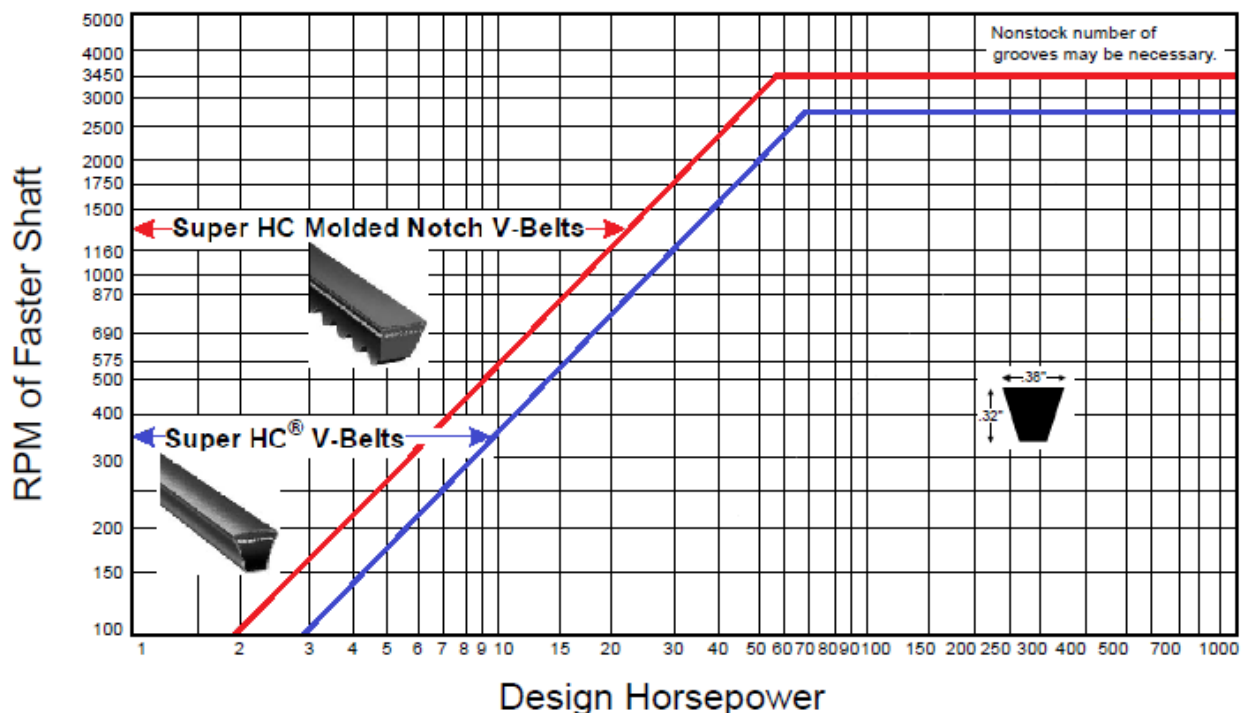
$$\text{Drive power} = \frac{\text{boost} \times \text{airflow}}{229 \times 0.97 \times 0.6} = \frac{\text{boost} \times \text{airflow}}{133}$$

If we look at the point where our supercharged grey motor was making 110BHP, boost was 12.9psi and the pressure ratio was 1.47, and the supercharged air flow rate was 252cfm. This gives:

$$\text{Drive power} = \frac{12.9 \times 252}{133} = 24\text{hp}$$

The question then becomes what type of belt may be used to deliver this power. Assuming that we wish to retain a similar pulley profile to the original Holden grey motor fan belt, we can then examine some typical belts seen on the market.

One belt supplier is Gates (www.gates.com). As an aside, the standard Holden grey motor replacement fan belt supplied by Gates is part number 7375, a SuperHC Molded Notch 3VX375 V-belt. In the original GMH belt profile, Gates supplies both plain belts (Super HC) and ribbed (or notched) belts (SuperHC Molded Notch). The chart below can then be used to assess whether the typical Gates belts (SuperHC or SuperHC Molded Notch V-belts) in the original Holden profile can handle the load. From the chart, both belt shapes (notched or plain) are capable of handling around 60hp, indicating this is an appropriate belt profile for our Norman supercharged grey motor.



The next step is to determine how many of these belts are required. To do this is a moderately complex process, dependant on the belt length, pulley diameters, speed of rotation and service duty. For those wanting to do this calculation for a Gates belt, details are located here:

<http://www.conbear.com/dc/file/Vee%20Belt%20Design.pdf>

As a rough guide, at the speeds we are working with (around 4200rpm) and the likely pulley sizes (~4½" diameter), the Gates belts are capable of handling approximately 8-10hp per belt. Note that the load that a given belt can handle can be derated by up to 50% depending on service.

Service	Usage	Service Factor
Intermittent	3-5 hours per day or seasonal	1.1
Normal	8-10 hours per day	1.2
Continuous	16-24 hours per day	1.4

Realistically, the loading on most Norman superchargers will be far, far less than 3-5 hours per day. Equally, very few vehicles will operate at full-noise for anything more than a few minutes. This means that the belt loading example shown above (26hp) is an extreme point, and that a single Gates belt (good for 8-10hp) is likely to be able to handle most Norman superchargers. For heavy race use (for example constant full-throttle speedway or drag use) a second belt is recommended. I recognise here that most belts that are purchased over the counter at SuperCheap/Repco for early Holdens are Bosch belts. Sadly, despite engaging with their Australian technical department, Bosch is unable to provide horsepower ratings for their common automotive belts... we can only assume they are similar to the Gates belts above.

RPM of Faster Shaft	Basic Horsepower per Belt for Small Sheave Outside Diameter																				Additional Horsepower per Belt for Speed Ratio										
	2.20	2.35	2.50	2.65	2.80	3.00	3.15	3.35	3.65	4.12	4.50	4.75	5.00	5.30	5.60	6.00	6.50	6.90	8.00	10.6	1.00 to 1.01	1.02 to 1.03	1.04 to 1.05	1.07 to 1.08	1.10 to 1.11	1.14 to 1.15	1.19 to 1.20	1.26 to 1.27	1.36 to 1.37	1.50 and over	
	1.01	1.03	1.06	1.08	1.14	1.18	1.20	1.25	1.35	1.57	over	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19
575	0.55	0.64	0.73	0.83	0.92	1.04	1.13	1.25	1.43	1.72	1.94	2.09	2.24	2.41	2.59	2.82	3.11	3.34	3.97	5.42	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
690	0.64	0.75	0.86	0.97	1.08	1.22	1.33	1.48	1.69	2.02	2.29	2.47	2.64	2.85	3.06	3.33	3.67	3.95	4.69	6.39	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
725	0.66	0.78	0.90	1.01	1.13	1.28	1.39	1.54	1.77	2.12	2.40	2.56	2.76	2.98	3.20	3.49	3.84	4.13	4.90	6.69	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
870	0.77	0.91	1.05	1.18	1.32	1.50	1.63	1.81	2.08	2.49	2.82	3.04	3.26	3.51	3.77	4.11	4.53	4.87	5.78	7.87	0.00	0.01	0.03	0.04	0.05	0.07	0.08	0.10	0.11	0.12	
950	0.83	0.98	1.13	1.28	1.42	1.62	1.77	1.96	2.25	2.70	3.06	3.29	3.52	3.80	4.08	4.45	4.91	5.27	6.25	8.51	0.00	0.01	0.03	0.04	0.06	0.07	0.09	0.10	0.11	0.12	0.13
1160	0.96	1.16	1.34	1.52	1.69	1.93	2.10	2.34	2.68	3.22	3.65	3.93	4.21	4.55	4.88	5.32	5.87	6.30	7.47	10.1	0.00	0.02	0.04	0.05	0.07	0.09	0.11	0.13	0.15	0.16	
1425	1.16	1.38	1.59	1.81	2.02	2.31	2.52	2.80	3.22	3.86	4.38	4.72	5.06	5.46	5.86	6.38	7.03	7.56	8.94	12.1	0.00	0.02	0.04	0.07	0.09	0.11	0.13	0.16	0.18	0.20	
1750	1.37	1.63	1.89	2.15	2.41	2.75	3.01	3.34	3.85	4.63	5.25	5.65	6.06	6.53	7.01	7.63	8.40	9.01	10.6	14.2	0.00	0.03	0.06	0.08	0.11	0.14	0.17	0.19	0.22	0.25	
2850	2.00	2.41	2.81	3.21	3.61	4.14	4.53	5.05	5.82	6.99	7.92	8.53	9.12	9.82	10.5	11.4	12.5	13.3	15.5		0.00	0.04	0.09	0.13	0.18	0.22	0.27	0.31	0.36	0.40	
3450	2.30	2.78	3.26	3.74	4.21	4.82	5.28	5.89	6.78	8.15	9.21	9.90	10.6	11.4	12.1	13.1	14.3	15.2			0.00	0.05	0.11	0.16	0.22	0.27	0.33	0.38	0.43	0.49	
400	0.22	0.26	0.29	0.33	0.36	0.41	0.44	0.48	0.55	0.66	0.74	0.80	0.85	0.92	0.98	1.07	1.18	1.27	1.50	2.05	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	
450	0.40	0.47	0.54	0.60	0.67	0.75	0.82	0.91	1.03	1.24	1.40	1.50	1.61	1.73	1.86	2.03	2.23	2.40	2.85	3.89	0.00	0.01	0.01	0.02	0.03	0.03	0.04	0.04	0.05	0.06	
600	0.57	0.66	0.76	0.86	0.95	1.08	1.18	1.30	1.49	1.78	2.02	2.17	2.33	2.51	2.69	2.93	3.23	3.47	4.13	5.63	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.08	
800	0.72	0.85	0.98	1.10	1.23	1.39	1.52	1.68	1.93	2.31	2.62	2.82	3.02	3.26	3.50	3.81	4.20	4.51	5.36	7.30	0.00	0.01	0.03	0.04	0.05	0.06	0.08	0.09	0.10	0.11	
1000	0.87	1.02	1.18	1.34	1.49	1.69	1.85	2.05	2.35	2.82	3.20	3.45	3.69	3.96	4.27	4.66	5.14	5.52	6.55	8.90	0.00	0.02	0.03	0.05	0.06	0.08	0.09	0.11	0.13	0.14	
1200	1.01	1.19	1.38	1.56	1.74	1.99	2.17	2.41	2.76	3.32	3.76	4.05	4.34	4.69	5.03	5.48	6.04	6.49	7.69	10.4	0.00	0.02	0.04	0.06	0.08	0.09	0.11	0.13	0.15	0.17	
1400	1.14	1.36	1.57	1.78	1.99	2.27	2.48	2.75	3.17	3.80	4.32	4.65	4.96	5.37	5.77	6.29	6.93	7.43	8.80	11.9	0.00	0.02	0.04	0.07	0.09	0.11	0.13	0.15	0.18	0.20	
1600	1.27	1.52	1.76	1.99	2.23	2.55	2.78	3.09	3.56	4.28	4.85	5.23	5.60	6.04	6.48	7.06	7.76	8.35	9.87	13.2	0.00	0.03	0.05	0.08	0.10	0.13	0.15	0.18	0.20	0.23	
1800	1.40	1.67	1.94	2.20	2.47	2.82	3.08	3.43	3.94	4.74	5.38	5.79	6.21	6.70	7.18	7.82	8.61	9.23	10.9	14.5	0.00	0.03	0.06	0.09	0.11	0.14	0.17	0.20	0.23	0.25	
2000	1.52	1.82	2.11	2.40	2.70	3.08	3.37	3.75	4.32	5.19	5.89	6.34	6.79	7.33	7.86	8.55	9.41	10.1	11.9	15.7	0.00	0.03	0.06	0.09	0.13	0.16	0.19	0.22	0.25	0.28	
2200	1.64	1.96	2.28	2.60	2.92	3.34	3.65	4.07	4.68	5.63	6.39	6.88	7.37	7.94	8.51	9.26	10.2	10.9	12.8	16.8	0.00	0.03	0.07	0.10	0.14	0.17	0.21	0.24	0.28	0.31	
2400	1.75	2.10	2.45	2.80	3.14	3.59	3.93	4.38	5.04	6.06	6.88	7.40	7.92	8.54	9.15	9.95	10.9	11.7	13.7	17.8	0.00	0.04	0.08	0.11	0.15	0.19	0.23	0.26	0.30	0.34	
2600	1.87	2.24	2.61	2.98	3.35	3.84	4.20	4.68	5.39	6.48	7.35	7.91	8.47	9.12	9.77	10.6	11.6	12.4	14.5		0.00	0.04	0.08	0.12	0.16	0.20	0.25	0.29	0.33	0.37	
2800	1.97	2.37	2.77	3.17	3.56	4.08	4.47	4.96	5.73	6.89	7.81	8.40	8.99	9.68	10.4	11.2	12.3	13.1	15.3		0.00	0.04	0.09	0.13	0.18	0.22	0.26	0.31	0.35	0.40	
3000	2.08	2.50	2.93	3.35	3.76	4.31	4.72	5.26	6.06	7.29	8.26	8.88	9.50	10.2	10.9	11.8	13.0	13.8	16.0		0.00	0.05	0.09	0.14	0.19	0.24	0.28	0.33	0.38	0.42	
3200	2.18	2.63	3.08	3.52	3.96	4.54	4.98	5.55	6.39	7.68	8.69	9.34	9.99	10.7	11.5	12.4	13.6	14.4	16.8		0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	
3400	2.28	2.75	3.23	3.69	4.16	4.77	5.22	5.82	6.71	8.05	9.11	9.79	10.5	11.2	12.0	13.0	14.1	15.0		0.00	0.05	0.11	0.16	0.21	0.27	0.32	0.37	0.43	0.48		
3600	2.37	2.87	3.37	3.86	4.35	4.99	5.46	6.09	7.01	8.42	9.52	10.2	10.9	11.7	12.5	13.5	14.7	15.6		0.00	0.06	0.11	0.17	0.23	0.28	0.34	0.40	0.45	0.51		
3800	2.47	2.99	3.51	4.02	4.53	5.20	5.70	6.35	7.31	8.77	9.91	10.6	11.3	12.2	13.0	14.0	15.2	16.1		0.00	0.06	0.12	0.18	0.24	0.30	0.36	0.42	0.48	0.54		
4000	2.56	3.10	3.65	4.18	4.71	5.41	5.92	6.60	7.60	9.11	10.3	11.0	11.8	12.6	13.4	14.4	15.6			0.00	0.06	0.13	0.19	0.25	0.31	0.38	0.44	0.50	0.57		
4200	2.64	3.21	3.78	4.33	4.89	5.61	6.15	6.85	7.88	9.44	10.6	11.4	12.1	13.0	13.8	14.8				0.00	0.07	0.13	0.20	0.26	0.33	0.40	0.46	0.53	0.59		
4400	2.73	3.32	3.91	4.48	5.06	5.81	6.36	7.09	8.15	9.75	11.0	11.8	12.5	13.4	14.2	15.2				0.00	0.07	0.14	0.21	0.28	0.35	0.42	0.48	0.55	0.62		
4600	2.81	3.42	4.03	4.63	5.22	6.00	6.57	7.32	8.41	10.1	11.3	12.1	12.9	13.7	14.5					0.00	0.07	0.14	0.22	0.29	0.36	0.43	0.51	0.58	0.65		
4800	2.89	3.52	4.15	4.77	5.38	6.18	6.77	7.54	8.66	10.3	11.6	12.4	13.2	14.0						0.00	0.08	0.15	0.23	0.30	0.38	0.45	0.53	0.60	0.68		
5000	2.96	3.62	4.27	4.91	5.53	6.36	6.96	7.75	8.90	10.6	11.9	12.7	13.5	14.3						0.00	0.08	0.16	0.24	0.31	0.39	0.47	0.55	0.63	0.71		
5200	3.03	3.71	4.38	5.04	5.68	6.53	7.15	7.96	9.13	10.9	12.2	13.0	13.7							0.00	0.08	0.16	0.25	0.33	0.41	0.49	0.57	0.65	0.74		
5400	3.10	3.80	4.49	5.16	5.83	6.69	7.33	8.15	9.35	11.1	12.4	13.2								0.00	0.09	0.17	0.25	0.34	0.42	0.51	0.59	0.68	0.76		
5600	3.17	3.89	4.59	5.28	5.96	6.85	7.50	8.34	9.56	11.3	12.7	13.5								0.00	0.09	0.18	0.26	0.35	0.44	0.53	0.62	0.71	0.79		
5800	3.23	3.97	4.69	5.40	6.10	7.00	7.66	8.52	9.76	11.6	12.9									0.00	0.09	0.18	0.27	0.36	0.46	0.55	0.64	0.73	0.82		
6000	3.29	4.05	4.79	5.51	6.22	7.15	7.82	8.69	9.94	11.7																					

Super HC Molded Notch V-Belts

Rim speed above 6,500 feet per minute.
See your local Gates representative.

RPM of Faster Shaft	Basic Horsepower per Belt for Small Sheave Outside Diameter	
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