Ignition Timing Service

The information contained in this manual is intended to help you understand proper and safe methods of inspecting and adjusting snowmobile ignition timing. **Read the information thoroughly**, even a second time, to understand the procedure. One of the most overlooked and most important functions of a snowmobile engine is the ignition. Ignition timing on a new snowmobile may or may not be correct. Be aware that timing may change as electronic components age. For the best performance and dependability, correct timing is mandatory.

Tools and equipment needed for ignition timing:
High RPM-capable timing light (suitable for 2 cycle ignitions), dial indicator set, degree wheel (optional), flywheel puller, spark plug wrench, Throttle Position Sensor Tester if applicable, and basic hand tools.

Ignition Timing Procedure

A. Timing Marks
The existing timing marks on the flywheel may not be correct. It is necessary to verify the timing marks, or use an alternate timing mark. Options are: Use the stock timing port hole location (on some models it may be hard to see around pipes), make a mark on drive clutch inner sheave edge, or use a degree wheel fastened to the crankshaft PTO stub with clutch removed. Either option will require the use of a dial indicator to ensure proper timing mark location.

1. Flywheel Timing Mark
Since the flywheel timing marks can be incorrect, it is mandatory to check them and re-mark if needed. A mark can be made by scribing a new line on the flywheel or making a paint mark (see Illustration #2).

The following step requires the use of SLP Part #20-92 or equivalent dial indicator set. This set includes a dial indicator, extension and a special spark plug hole adapter.

Remove all spark plugs, this will allow easy rotation of the crankshaft. Install the extension on the dial indicator. Using the special spark plug hole adapter, install the dial indicator into the mag side cylinder spark plug hole. From the mag (recoil) side of the engine rotate the engine clockwise (counter-clockwise from the PTO side) until the dial indicator pointer stops and reverses direction. Rotate crankshaft back and forth to find the exact point where the needle changes direction. Rotate the dial ring on the dial indicator to show "0" with pointer.

Using the recommended timing specification for your engine, for example we will use 12 degrees BTDC (Before Top Dead Center). Refer to the chart on page 7 to convert degrees of crankshaft rotation into inches of piston travel. For example on a domestic 800, 12 degrees equals 0.0378” of piston travel. Next, rotate crankshaft opposite of normal rotation about .050"-.100" on the dial indicator past the pre determined timing specification. Then rotate crankshaft in the normal direction back to the desired specification. This will remove any possible play in the rod and wrist pin bearing. At this time make the timing mark.

2. Clutch Edge Timing Mark
Attach a piece of welding rod or similar heavy wire to an engine bolt near the PTO side of the engine. Bend the wire to make a pointer to align with the edge of the clutch’s stationary sheave for timing specification.

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3. Degree Wheel Timing Mark *Use this method for timing only up to the maximum rpm that the degree wheel is rated for. Exceeding the RPM rating of the degree wheel could cause degree wheel failure and flying debris which may result in serious injury or death.*

Remove the drive clutch from the PTO end of the crankshaft. Install the degree wheel onto the PTO end of the crankshaft with a bolt and a large flat washer on each side of the degree wheel (use a bolt about 1-inch in length with same diameter and threads as your clutch bolt). DO NOT OVER-TIGHTEN THE BOLT! FRACTURING OF THE DEGREE WHEEL COULD CAUSE FAIL- URE AND FLYING DEBRIS WHICH MAY RESULT IN SERIOUS INJURY OR DEATH. Snug is all that is required. Bend a wire pointer to align with the edge of the degree wheel (see ILL #3).

Remove all spark plugs, this will allow easy rotation of the crankshaft. Install the extension on the dial indicator. Using the special spark plug hole adapter, install the dial indicator into the mag side cylinder spark plug hole. From the mag (recoil) side of the engine rotate the engine clockwise (counter-clockwise from the PTO side) until the dial indicator pointer stops and reverses direction. Rotate crankshaft back and forth to find the exact point where the needle changes direction. Rotate the degree wheel to show "0" with the pointer, then rotate the dial ring on the dial indicator to show "0" with pointer (see ILL #3).

Next, rotate crankshaft opposite of normal rotation about .050"-.100" on the dial indicator past the pre determined timing specification. Then rotate crankshaft in the normal direction back to the desired specification. This will remove any possible play in the rod and wrist pin bearings. Timing degree specification should be correct on degree wheel at this point.

B. Preparing for Timing Test

Warning! When using clutch edge mark, or flywheel mark, remove belt from clutch. Also, remove the weights from the clutch to prevent movement of the clutch face during the test. Fasten the clutch cover securely in place.

Warning! Use safety glasses and hearing protection when performing timing tests. It is best to perform the test with two people; one to watch the tachometer and operate the throttle, and the other to watch the timing mark.

Special Note: With the belt removed the engine is in a no-load condition and the RPM will increase rapidly. Operate the throttle gently and bring the RPM up slowly. On large or high-horse power engines, the RPM increase may be sensitive. Three- or four-cylinder engines can be "tamed down" by killing a cylinder. This is done by removing the PTO spark plug, closing the gap to zero to eliminate spark, re-installing the spark plug and attaching the spark plug wire. This will act like a fouled spark plug and the throttle and RPM will be more manageable. Note; the spark plug wire must be attached to avoid CDI damage. Attach a quality high-RPM timing light (SLP Part #20-79 or equivalent) to the MAG cylinder for the test. Do not use “advance knob adjustment if the timing light is so equipped. Perform timing test at room temperature of 65° - 70° F.

NOTE: Newer model engines with Throttle Position Sensor (TPS) may require the TPS to be unplugged. Refer to an engine service manual for this specification. On those models that require the TPS to remain plugged in during timing test, it will also be necessary to check for proper TPS adjustment this will have an affect on timing. Refer to the engine service manual for proper TPS adjustment procedure. On the models that require the TPS to be unplugged the TPS adjustment is also important as this will have an affect on overall running timing. However, it will not affect the accuracy of the ignition timing test

C. Run Timing Test

Warm the engine up to operating temperature. Failure to warm the engine up to operating temperature prior to performing timing test can result in severe engine failure

While running the motor, increase the RPM to the recommended specification (Refer to manufacturer information for timing specifications). Use a high speed timing light (SLP Part #20-79 or equivalent) to check the accuracy of the timing at the recommended RPM. At this point make a mental note or a mark on the wheel of where the ignition is firing in relationship to where it should be firing. If the tested timing does not fall in the desired place, adjusting the timing using the stator plate will be required. Some engines will require two timing checks. A high RPM check and a low RPM check. Since the engine is operated at higher RPM ranges most of the running time, being accurate at these ranges is most important. If there is more than average variance from the high to low RPM reading, the CDI box may be defective.

For example: If recommended timing spec is
28° @ 3000 RPM
and 20° @ 7500 RPM
And your test shows
31° @ 3000 RPM
and 20° @ 7500 RPM
The variance is too great and can cause mid RPM piston failure. The timing specification span should not vary more than 1° plus (advanced), 2° minus (retarded).

D. Adjust Timing

1. In most cases, adjusting the timing will require the removal of the recoil starter, hub and fly wheel to gain access to the stator plate adjusting screws. At this time note the location of stator plate slot vs. screw head location.

2. The stator plate screws are usually very tight and on some models have thread lock on the threads. Use care in removing the bolt to prevent stripping the screw head. A hand operated hammer driver (impact driver) is a good choice. Make sure to use a very good fitting screwdriver or allen wrench.

3. Adjusting the stator plate. This step in the past was a matter of guessing, however, we have

designed a chart (page 8) that makes it is possible to calculate how far to rotate the stator plate to achieve the desired timing on the first try. In order to do this, you will need to measure the difference between the actual timing mark (measured in the timing test) and the desired timing position and apply this measurement to one of the three methods below.

Timing Mark Degree vs. Stator Plate Movement

A.Mark on Clutch Face	B.Mark on Flywheel	B.Degree Wheel
Approx. 8" Diameter	Approx. 5" Diameter	All marks
Chart Ref. "A"	Chart Ref. "C"	Chart Ref. "B"
1 Degree = .069" (1.75mm)	1 Degree = .038" (.97mm)	1 Degree = .053" (1.36mm)

*Rotate the stator plate Clockwise to retard.
*Rotate the stator plate Counter-clockwise to advance.

Example: You are using the clutch edge for your timing mark, which has a diameter of 8". The difference between your two marks is .138". To convert this to degrees of timing, divide .138" by the Number equal to 1 degree of stator movement in method A which is .069".

.138 divided by .069 = 2 degrees of timing.

OK, now that you know how many degrees of timing you are off, you need to convert it to inches of stator rotation. 1 degree of stator rotation is equal to about .038" of stator movement.(stator plate size may vary, refer to chart on page 8) To find out your total stator movement, multiply the number of degrees by the amount of stator movement per degree.

2 x .038" =.076" of stator rotation.

Once you have established proper location for the stator plate, re-tighten lock screws. If screws used thread lock material, it is advisable to apply factory recommended material to threads. **Warning:** If a stator screw were to come loose, damage to coils and flywheel is possible.

4. Reassemble and re-test to ensure the proper ignition timing.

E. Ignition Maintenance Timing should be a part of pre-season service. These yearly inspections will expose ignition problems that could cause severe engine damage.

F. Helpful Ignition Performance Hints
1. It is common for the ignition connections and wires to become loose or corroded, causing a reduction of ignition power to the spark plugs. Periodically inspect, clean, tighten, and use di-electric silicone grease for future protection for moisture and corrosion.

2. Some OEM-grade spark plug wires have a history of the core breaking inside the wire causing high resistance and low power to the spark plug. Better quality wires and spark plug caps are available for some models from SLP.

3. Ignition component quality is very important to performance. It is recommended to test ignition components. (stator coils, secondary ignition coils, spark plug wires and caps) to insure highest ignition power output. If you find a timing problem. check these ignition components prior to re-setting the timing. Refer the an engine service manual for these component tests and specification.

ILLUSTRATION #1

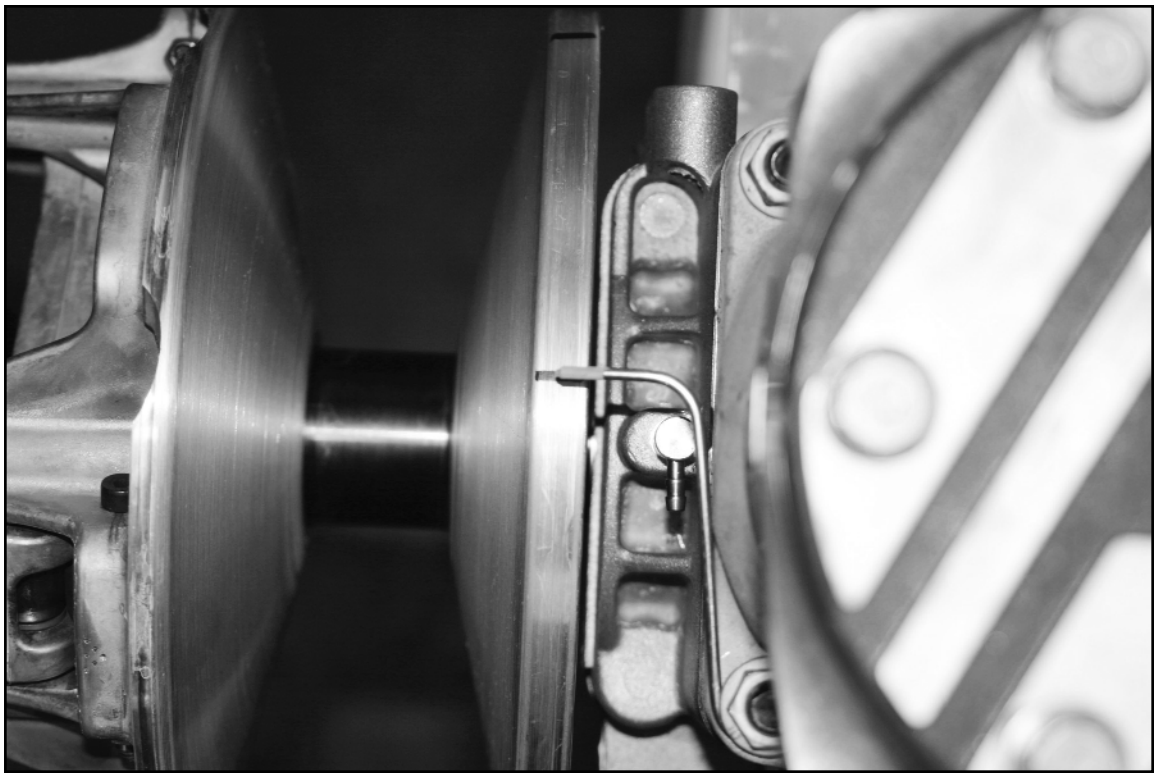


ILLUSTRATION #2

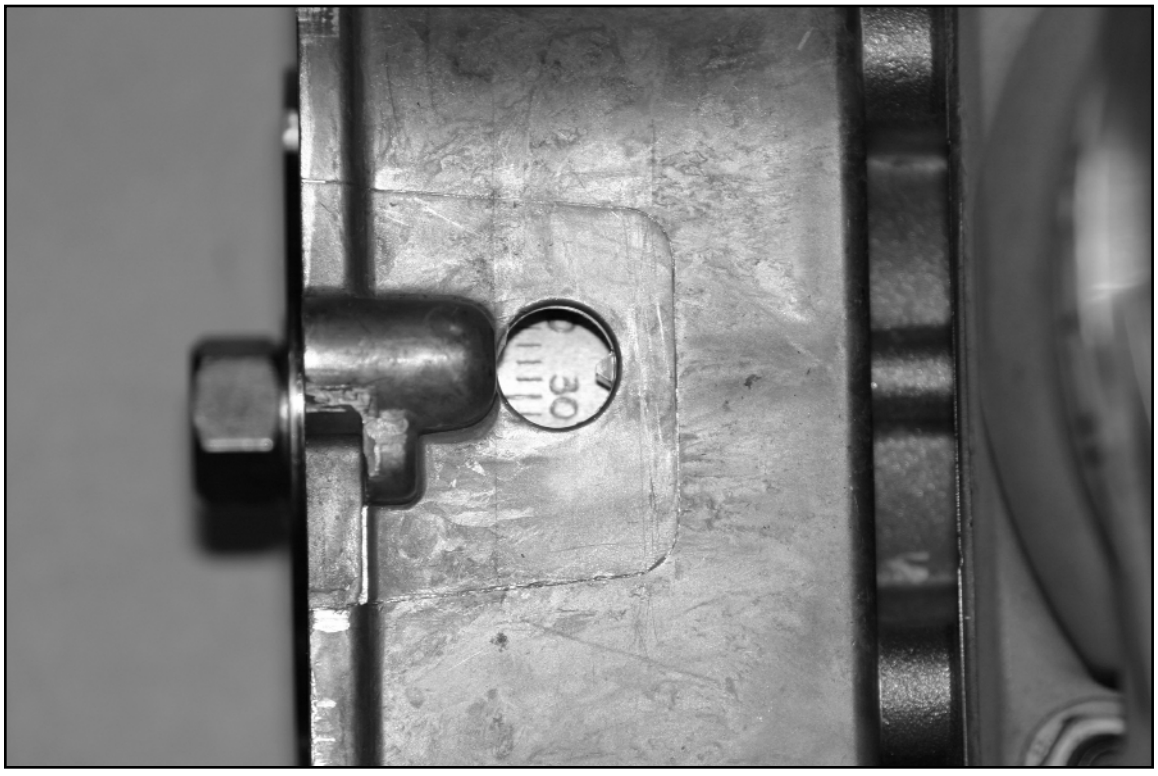
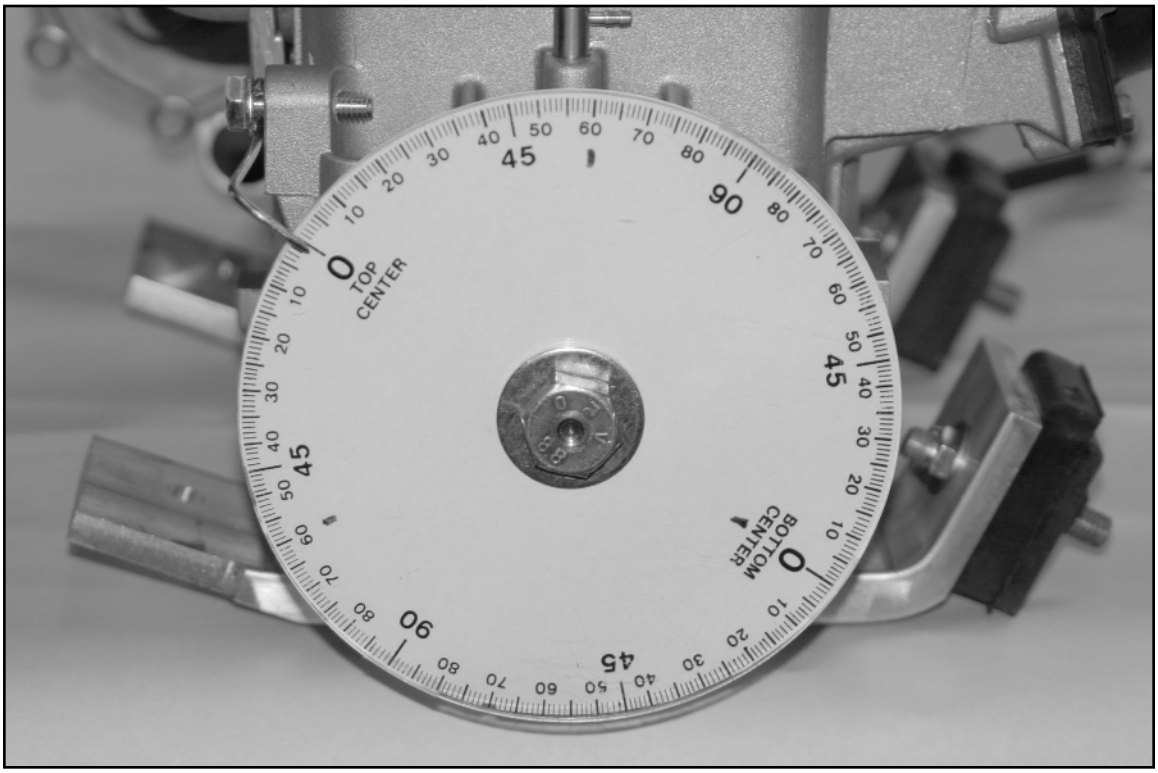


ILLUSTRATION #3



This reference chart is designed to help determine at what point the ignition will fire before top dead center (BTDC) on Polaris Models. It requires you to know either the engine model number or stroke and rod length. Refer to manufacture specification to find proper timing specifications for each model.

	EC40PL EC44-2PM EC44-3PM EC45PL EC50PL EC60PL EC58PL EC65PL		EC45PM EC55PM		EC59PL EC68PL EC70PL EC75PL EC79PL EC80PL		EC34-2PM		EC25PF EC25PS EC44PT EC44PQ EC44PM		Domestic 440 Domestic 500 Domestic 600 (with V.E.S.)		Domestic 600 (without V.E.S.) Domestic 700		Domestic 800	
DEG. BTDC	112 MM ROD 60 MM STROKE		120 MM ROD 65 MM STROKE		125 MM ROD 65 MM STROKE		103 MM ROD 55.6 MM STROKE		120 MM ROD 60 MM STROKE		128 MM ROD 64 MM STROKE		136 MM ROD 68 MM STROKE		136 MM ROD 70 MM STROKE	
	MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES
1	0.0058	0.0002	0.0063	0.0002	0.0062	0.0002	0.0054	0.0002	0.0057	0.0002	0.0061	0.0002	0.0065	0.0003	0.0067	0.0003
2	0.0232	0.0009	0.0252	0.0010	0.0249	0.0010	0.0215	0.0008	0.0228	0.0009	0.0244	0.0010	0.0259	0.0010	0.0268	0.0011
3	0.0521	0.0021	0.0566	0.0022	0.0561	0.0022	0.0484	0.0019	0.0514	0.0020	0.0548	0.0022	0.0582	0.0023	0.0603	0.0024
4	0.0926	0.0036	0.1006	0.0040	0.0997	0.0039	0.0860	0.0034	0.0913	0.0036	0.0974	0.0038	0.1035	0.0041	0.1072	0.0042
5	0.1447	0.0057	0.1571	0.0062	0.1558	0.0061	0.1343	0.0053	0.1426	0.0056	0.1522	0.0060	0.1617	0.0064	0.1674	0.0066
6	0.2083	0.0082	0.2261	0.0089	0.2242	0.0088	0.1933	0.0076	0.2053	0.0081	0.2190	0.0086	0.2327	0.0092	0.2410	0.0095
7	0.2833	0.0112	0.3076	0.0121	0.3050	0.0120	0.2630	0.0104	0.2793	0.0110	0.2979	0.0117	0.3166	0.0125	0.3278	0.0129
8	0.3698	0.0146	0.4016	0.0158	0.3981	0.0157	0.3432	0.0135	0.3646	0.0144	0.3889	0.0153	0.4132	0.0163	0.4279	0.0168
9	0.4677	0.0184	0.5079	0.0200	0.5036	0.0198	0.4341	0.0171	0.4612	0.0182	0.4919	0.0194	0.5226	0.0206	0.5412	0.0213
10	0.5770	0.0227	0.6265	0.0247	0.6212	0.0245	0.5355	0.0211	0.5689	0.0224	0.6068	0.0239	0.6448	0.0254	0.6676	0.0263
11	0.6976	0.0275	0.7575	0.0298	0.7510	0.0296	0.6474	0.0255	0.6878	0.0271	0.7336	0.0289	0.7795	0.0307	0.8071	0.0318
12	0.8294	0.0327	0.9006	0.0355	0.8930	0.0352	0.7698	0.0303	0.8178	0.0322	0.8723	0.0343	0.9268	0.0365	0.9597	0.0378
13	0.9724	0.0383	1.0559	0.0416	1.0470	0.0412	0.9025	0.0355	0.9588	0.0377	1.0227	0.0403	1.0867	0.0428	1.1251	0.0443
14	1.1265	0.0444	1.2232	0.0482	1.2129	0.0478	1.0456	0.0412	1.1108	0.0437	1.1849	0.0466	1.2589	0.0496	1.3035	0.0513
15	1.2917	0.0509	1.4026	0.0552	1.3908	0.0548	1.1989	0.0472	1.2737	0.0501	1.3586	0.0535	1.4435	0.0568	1.4946	0.0588
16	1.4678	0.0578	1.5938	0.0627	1.5804	0.0622	1.3624	0.0536	1.4474	0.0570	1.5439	0.0608	1.6404	0.0646	1.6984	0.0669
17	1.6548	0.0652	1.7969	0.0707	1.7818	0.0701	1.5359	0.0605	1.6318	0.0642	1.7406	0.0685	1.8494	0.0728	1.9149	0.0754
18	1.8526	0.0729	2.0117	0.0792	1.9948	0.0785	1.7195	0.0677	1.8269	0.0719	1.9487	0.0767	2.0705	0.0815	2.1438	0.0844
19	2.0611	0.0811	2.2380	0.0881	2.2193	0.0874	1.9130	0.0753	2.0326	0.0800	2.1681	0.0854	2.3036	0.0907	2.3851	0.0939
20	2.2802	0.0898	2.4759	0.0975	2.4552	0.0967	2.1163	0.0833	2.2487	0.0885	2.3986	0.0944	2.5485	0.1003	2.6386	0.1039
21	2.5098	0.0988	2.7252	0.1073	2.7024	0.1064	2.3294	0.0917	2.4752	0.0974	2.6402	0.1039	2.8052	0.1104	2.9043	0.1143
22	2.7497	0.1083	2.9857	0.1175	2.9608	0.1166	2.5521	0.1005	2.7119	0.1068	2.8927	0.1139	3.0735	0.1210	3.1820	0.1253
23	3.0000	0.1181	3.2574	0.1282	3.2303	0.1272	2.7843	0.1096	2.9587	0.1165	3.1560	0.1243	3.3532	0.1320	3.4717	0.1367
24	3.2603	0.1284	3.5401	0.1394	3.5107	0.1382	3.0260	0.1191	3.2156	0.1266	3.4300	0.1350	3.6444	0.1435	3.7730	0.1485
25	3.5307	0.1390	3.8336	0.1509	3.8019	0.1497	3.2769	0.1290	3.4824	0.1371	3.7146	0.1462	3.9467	0.1554	4.0860	0.1609
26	3.8110	0.1500	4.1379	0.1629	4.1038	0.1616	3.5370	0.1393	3.7590	0.1480	4.0096	0.1579	4.2602	0.1677	4.4104	0.1736
27	4.1010	0.1615	4.4528	0.1753	4.4161	0.1739	3.8062	0.1498	4.0452	0.1593	4.3149	0.1699	4.5846	0.1805	4.7462	0.1869
28	4.4007	0.1733	4.7782	0.1881	4.7389	0.1866	4.0843	0.1608	4.3410	0.1709	4.6303	0.1823	4.9197	0.1937	5.0931	0.2005
29	4.7098	0.1854	5.1138	0.2013	5.0719	0.1997	4.3712	0.1721	4.6461	0.1829	4.9558	0.1951	5.2655	0.2073	5.4510	0.2146
30	5.0282	0.1980	5.4595	0.2149	5.4149	0.2132	4.6667	0.1837	4.9604	0.1953	5.2911	0.2083	5.6218	0.2213	5.8197	0.2291
31	5.3559	0.2109	5.8152	0.2289	5.7679	0.2271	4.9708	0.1957	5.2839	0.2080	5.6361	0.2219	5.9884	0.2358	6.1991	0.2441
32	5.6926	0.2241	6.1807	0.2433	6.1306	0.2414	5.2832	0.2080	5.6163	0.2211	5.9907	0.2359	6.3651	0.2506	6.5889	0.2594
33	6.0381	0.2377	6.5559	0.2581	6.5028	0.2560	5.6039	0.2206	5.9575	0.2345	6.3546	0.2502	6.7518	0.2658	6.9891	0.2752
34	6.3924	0.2517	6.9405	0.2732	6.8845	0.2710	5.9326	0.2336	6.3073	0.2483	6.7278	0.2649	7.1482	0.2814	7.3993	0.2913
35	6.7552	0.2660	7.3343	0.2888	7.2754	0.2864	6.2693	0.2468	6.6656	0.2624	7.1099	0.2799	7.5543	0.2974	7.8195	0.3079
36	7.1263	0.2806	7.7372	0.3046	7.6753	0.3022	6.6138	0.2604	7.0322	0.2769	7.5010	0.2953	7.9698	0.3138	8.2494	0.3248
37	7.5057	0.2955	8.1491	0.3208	8.0840	0.3183	6.9658	0.2742	7.4069	0.2916	7.9007	0.3111	8.3945	0.3305	8.6888	0.3421
38	7.8931	0.3108	8.5696	0.3374	8.5015	0.3347	7.3253	0.2884	7.7896	0.3067	8.3089	0.3271	8.8282	0.3476	9.1375	0.3597
39	8.2883	0.3263	8.9986	0.3543	8.9274	0.3515	7.6920	0.3028	8.1801	0.3221	8.7254	0.3435	9.2708	0.3650	9.5954	0.3778
40	8.6912	0.3422	9.4360	0.3715	9.3616	0.3686	8.0659	0.3176	8.5782	0.3377	9.1501	0.3602	9.7220	0.3828	10.0622	0.3961

Chart Courtesy of Polaris Service Manual P.N. 9918587

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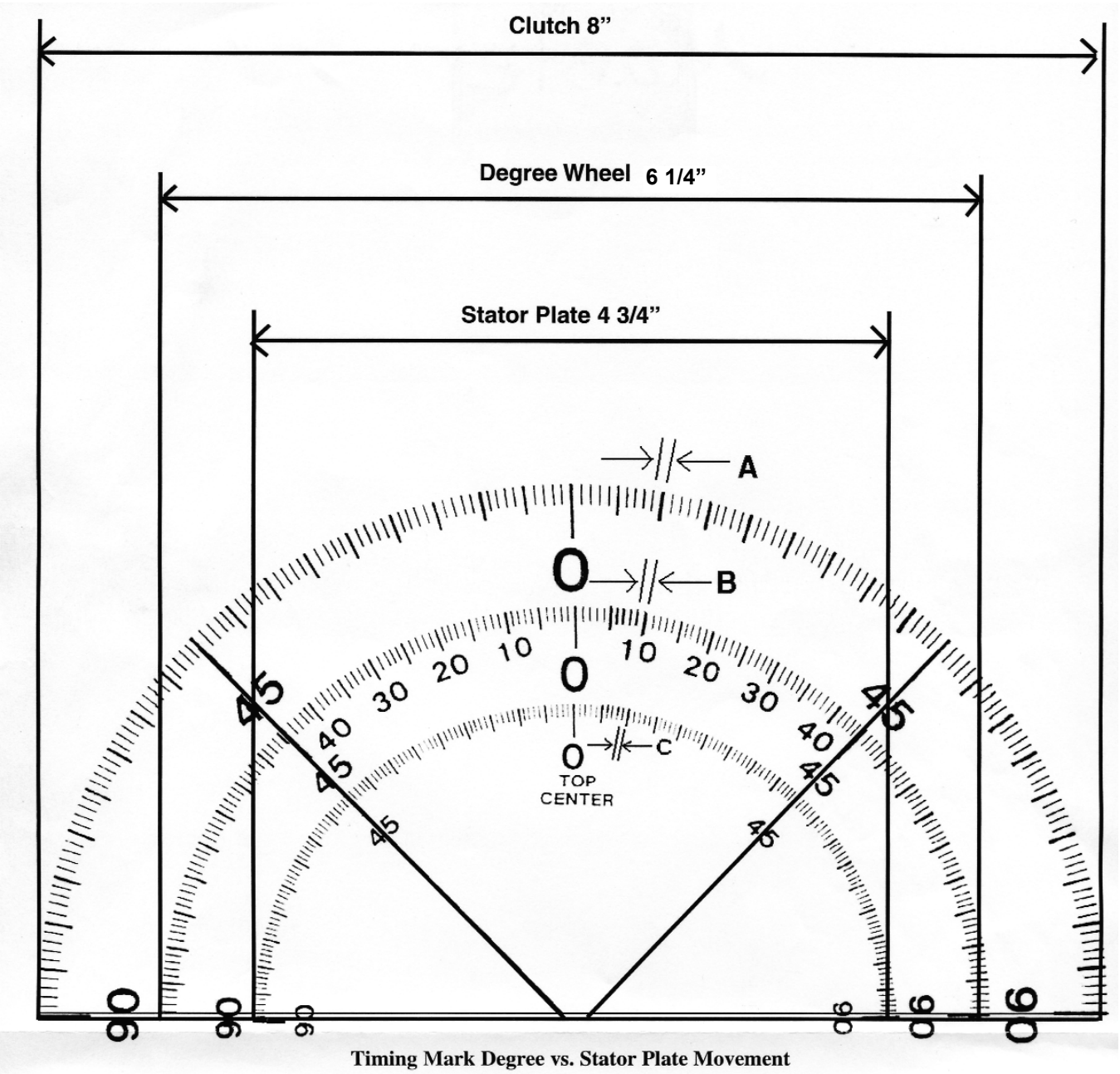

Timing Mark Degree vs. Stator Plate Movement

Mark on Clutch Face	Mark on Flywheel	Mark Using SLP
Approx. 8” Diameter	Approx. 5” Diameter	Degree Wheel
Chart Ref. “A”	Chart Ref. “C”	Chart Ref. “B”
1 Degree = .069” (1.75mm)	1 Degree = .038” (.97mm)	1 Degree = .053” (1.36mm)

Example: You are using clutch edge for timing mark, each degree at 8” diameter clutch would be an in-line measurement of .069” that equals 1 degree at .038” of stator plate movement. These measurements are only approximate but may help prevent removing flywheel twice to reset the timing correctly.