300D ENGINE DEV.

473-21 (2-55)

CHRYSLER CORPORATION
ENGINEERING DIVISION
TECHNICAL REPORT

Report No. 4406.530
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SUBJECT

Engine Performance - C300D, 4.00 Bore x 3.90 Stroke, 392 Cubic Inch Displacement.

OBJECT

To improve the engine output and develop the general performance characteristics for release in "L" Series production.

CONCLUSIONS

I - Engine XLC-3-[illegible], 15 at 10.10 to 1 compression ratio produced the following wot output on a laboratory gross power basis with air cleaners installed, fixed jet mean limit carburetors, velocity valves operating and manifold heat passage open.

Torque at 1600 rpm - - - - - - - - - - - - - - - - -	350.8 lb-ft
Torque at 4000 rpm (max) - - - - - - - - - - - - - -	377.2 lb-ft
Bhp at 5200 rpm (max) - - - - - - - - - - - - - - -	334.8
Fhp at 4000 rpm - - - - - - - - - - - - - - - - - -	63.3
Bmep at 4000 rpm (max) - - - - - - - - - - - - - -	145.5 psi
Imep at 4400 (max) - - - - - - - - - - - - - - - -	179.8 psi
Fmep at 4000 rpm - - - - - - - - - - - - - - - - -	32.8 psi
Mech. eff. at 4000 rpm - - - - - - - - - - - - - -	81.9 %

II - The output on a cold test gross rating basis with no air cleaners, intake manifold heat [illegible], and adjustable mixture carburetors was:

Maximum torque	391.9 lb-ft at 3600 rpm
Maximum power	363.6 bhp at 5200 rpm

III - The net output with the standard dual exhaust system, fan installed and automatic spark advance was

Maximum torque	358.1 lb-ft at 3600 rpm
Maximum power	295.3 bhp at 5200 rpm

IV - The corrected octane requirement of this engine, based on primary fuels, was

	2400 RPM	3200 RPM
At max. power S/A	94.9	91.9
At 2% power loss S/A	87.9	86.1

No data was obtained at 1600 rpm.

V - The heat rejection of this engine was 6600 Btu/min. at 4000 rpm, wide open throttle. The minimum specific heat rejection was 23.9 Btu/min/bhp at 4400 rpm.

RECOMMENDATIONS

It was recommended that the engine be released to production using the components specified in this report.

PARTS TESTED

The C300D was a special high performance model of the 1958 Chrysler New Yorker (LC-3) engine, using twin four-barrel carburetors and a long duration, high lift, mechanical tappet camshaft. The major components were unchanged from the C300C except for the camshaft and compression ratio. Brief specifications relating to performance were as follows:

Type: 90° V-8

Bore and Stroke: 3.90" x 4.00"

Displacement: 392 cu. in.

Compression Ratio: 10.0 to 1 nominal

Combustion Chamber: Hemispherical

Intake Valve: 2.00"

Exhaust Valve: 1.75"

Intake Manifold: 1733477 - single level double runner

Exhaust Manifolds: 1674661 (L)
1674662 (R)

Carburetors: WCFB 2741 S and 2742 S

Venturi size	1-1/16" Primary	1-1/4" Secondary
Throttle body dia.	1-7/16"	

Air Cleaners: 1852568 (2)

Exhaust System: Dual, low restriction

Exhaust pipe dia.	2-1/4"
Mufflers	1820278 (2-2-2) 35" long
Tail pipe dia.	2"

Camshaft: 1852186 (276-276-55)

The major special items tested included the following:

Camshafts

Part No.	Intake Duration	Exhaust Duration	Overlap	Intensity	Remarks
1731569	280	270	60	31	C300 C Production
1821255	282	272	58	28	Iskenderian
1827813	276	276	55	25	Intake @ 111
1827813 A	276	276	60	25	
1827813 B	276	276	55	25	Intake @ 106° - Released as 1852186
1827814	276	276	55	22½	
1827393	260	260	42	22½	Hydraulic, .420 lift

All camshafts except 1827393 had .440-.445 lift and mechanical lifters

PROCEDURE AND RESULTS

I - Camshaft Selection

As had been shown by the results in Report No.4406.522 on the C300C engine model, the high speed output of the 392 cu. in. engine did not show the anticipated percent gain over the preceding 354 cu. in. model. The valve area per cubic inch displacement was lower than for the 354 engine, so the camshaft seemed to offer the greatest opportunity for improved air flow. The possibility of improving on the older design 280-270-60 camshaft was indicated by the improvements obtained with the new designs used on the standard engine models in 1957, and confirmed by the greater power obtained with the proprietary camshaft used as optional equipment for racing on the C300B and C300C. Several new camshafts were therefore designed and tested on this program.

A - Camshaft 1827813 (276-276-55)

This camshaft was designed to have durations similar to the existing production design, but with an increased intensity of acceleration and a slightly higher maximum valve velocity. "Intensity of acceleration" is measured by the number of cam degrees required to attain maximum velocity, so the lower the numerical value the greater the area under the lift curve, for a given total cam duration. This camshaft had a 25° intensity compared to approximately 31° for the production 1731569 design.

Test 1583, runs 8-11 show the phasing runs for this camshaft. On the basis of these tests, an intake centerline of 106° was considered optimum. It should be noted that the torque curves appear to pivot around 5200 rpm; this is unusual but later data confirmed the existence of this characteristic.

By comparing Runs 7 and 10 on Test 1583, it can be seen that this camshaft offers a considerable gain in output above the torque peak at 3600 rpm, with very little change below that speed. The maximum gain was 22 bhp at 5200 rpm.

Because of the relatively early intake centerline with the 1827813 camshaft, a 60° overlap shaft was brought in for testing. The comparative phasings are shown on Test 1631, Runs 1 - 3. The performance did not show sufficient improvement over the 55° overlap design to justify its use in production.

A test was also made of the effect of intake valve lash on output, using the 1827813 camshaft. Test 1676, Runs 7 and 8, show the results obtained, with the wider valve clearance showing an improvement in low speed torque.

B - Camshaft 1827814 (276-276-55) 1827814

This camshaft had the same durations, overlap and lift as 1827813, the only difference being in the use of a 22-1/2° intensity factor. Test 1583, Runs 20-23, show the phasing data on this design. The 104° intake centerline was selected as optimum, and compared to Run 10 with the 1827813 shaft. The difference was too small to justify further consideration of the 22-1/2 intensity camshaft because of its greater wear and dynamics problems.

C - Final Selection

Two other designs were also tested, although they were not serious production possibilities. One was an experimental 260-260-42 design considered for use in the New Yorker model, using hydraulic tappets. The phasing runs were unsatisfactory due to tappet pump-up, but the indications were that the durations were too short for satisfactory power at 5200 rpm. The other design was Part No. 1821255. This was 1821 255
actually an ISKANDERIAN T-3 DESIGN, WHICH WAS PURCHASED outside for
USE AS AN OPTIONAL RACING DESIGN. IT IS INTENDED TO BE USED WITH
special lifters, push rods, and valve springs supplied by the vendor. It was not considered for general release because of the sparse of the design, and the unsatisfactory cam and lifter durability of the complete kit.

Sheet 7 shows the comparison of the designs considered, each at approximately optimum phasing. The runs are not consecutive, but are believed to be conclusive enough to explain the choice made. The Iskenderian design showed the highest output over the speed range, but this cam could not be used as mentioned previously. Cam 1827814 showed such a slight advantage over the lower intensity 1827813 that the latter was selected as the best all-around design, and it was released as Part No. 1852186 with a 106° intake cam centerline.
1852186

II - Exhaust System Evaluation

Because of the high exhaust system loss of the C300C model in K Series, brief checks were made of a less restricted system for possible use on the C300D. On Test 1583 Runs 1, 3, and 4 compare laboratory exhaust, C300C exhaust, and the proposed exhaust. The use of the C4319 mufflers and 2-1/4 tail pipes showed a significant gain in output, the peak bhp gain being 9 hp. However, because of noise and chassis clearance problems, the only change adopted was a relatively minor one in the muffler construction.

III - Carburetor Development and Calibration

A - Air Cleaner Selection

It was intended to use the same type of carburetors on the C300D as were used on the C300C. However, several designs of air cleaner were available, and a selection had to be made before carburetor work was begun. Test 1709, Runs 2 - 4, shows a comparison of the C300C production offset design with two elliptical concentric designs having different air horn entrance diameters. The results were as anticipated, with the offset cleaners inferior to either concentric design, and the larger diameter proving slightly superior in the concentric designs. The larger 3.9" diameter was adopted for production.

B - Initial Calibration

The initial carburetor calibration was carried out using the carry-over WCFB carburetors and the flat concentric air cleaners described above. Because of the nature of the engine usage, the carburetor jets producing maximum power were specified as the lean limit mixture. Test 1709, Run 9, shows the output and mixture distribution of the initial release.

Part throttle economy was also studied in the laboratory. Sheet 11 shows the road load spark loops taken with three different metering rods. After road testing the richest of the three sizes tested was released, as indicated on the curve sheet.

C - Recalibration After Test Changes

While testing in a car with relatively high ambient temperatures, it was found that the idle and hot starting characteristics were unsatisfactory. Field complaints on the C300C also confirmed the existence of this problem.

The carburetors used up to this point had internal vents only, and this was felt to be a major cause of the problem. As a first step, lower float levels were tried as a means of reducing the hot stalling at idle caused by apparent flooding. Test 1709, Runs 30 and 31, compares the performance at two different float levels. These results show clearly that a change in level would require recalibration of the mixture as would be expected.

Further road work indicated the desirability of incorporating both outside vents and the lower float level. Therefore a new wide open throttle calibration was made, as shown by Test 1760, Run 33. The wide open throttle distribution is not good, but no further development was possible at that time because of the closeness to production dates.

D - Tests on AFB Carburetors

The initial choice of carburetors for this model had been to retain the WCFB design, although the single carburetor engines were to use the AFB model for "L" Series. Use of the AFB would have required intake manifold and throttle linkage changes, with no performance gain. However, when the hot weather difficulties with the WCFB became apparent, some testing was done using two AFB's as an alternative. Test 1761, Runs 3 and 5, shows the comparative output and fuel consumption of the two designs, after a short calibration test on the AFB's. These results indicate that either design was satisfactory on a wide open throttle basis, but with the venting and float changes mentioned previously the WCFB type was retained.

IV - Wide Open Throttle Ratings

Because of the nature of this engine model, a complete analysis of the power loss to engine accessories was not obtained. However, the major standard runs were obtained, with peak values as summarized in the table below. All runs were made on Test 1709.

RUN NO.	ENGINE CONDITIONS	PEAK TORQUE	PEAK H.P.
24	Cold bare engine gross	392 @ 3600	343 @ 5200
25	Laboratory standard gross	377 @ 3600	335 @ 5200
26	Laboratory standard net	358 @ 3600	295 @ 4800
27	Net except no fan	365 @ 3600	305 @ 5200

An additional comparison was also made using the special equipment exhaust system with 2½" exhaust and tail pipes. As shown by Runs 27 and 29, this larger system gained 11 bhp at 5200 rpm. All these ratings were obtained with the original carburetors having internal vents, and it was not considered necessary to repeat them because no change in output was observed with the vent change.