

PROGRAM MANAGER'S LETTER

TO: R. J. Matton Manager DATE: 15 DEC 89
 Forward Model Planning, CIMS: 419-00-00
 Product Change & Release T.L.: 876-2400

FROM: Paul V. Sheridan Program Manager, CIMS: 514-17-15
 Dodge Truck Engines T.L.: 733-2404
 Jeep & Truck Engineering

Program Manager's letter requesting O.D.D. Box, Black Box or Pre-Release Source Selection

1. Program Description Diesel Engine for D250/D350, T-450

<u>Year</u>	<u>Effectivity</u>	<u>Model</u>
<u>1994</u>	<u>Job 1</u>	<u>D250/D350</u>
<u>1995</u>	<u>Job 1</u>	<u>T-450</u>

2. Part numbers, trim numbers and names of major purchased end items

<u>TBD</u>	<u>TBD</u>	<u>Engine Assembly Module</u>

3. This program is an

O.D.D. Box Black Box Pre-Release
 This program is a Make/Buy Yes No
 With CBO Concurrence
 Traditionally
 Outside Sourced

4. Reason for requesting the above program:

- Early supplier input is required.
- To insure that the prototype/development source becomes the production source.
- Chrysler does not have the required engineering capability, or resources.
- Timing is a major problem.

PROGRAM MANAGER'S LETTER

4. Reason for requesting the above program (Continued)

- Design changes are anticipated to accommodate manufacturing processes.
- Current engineering resources cannot support this program.
- Other Revisions required to meet 1994 Emission Requirements

5a. Recommended sources in order of preference. Include C.B.O. Office if applicable.

1. Cummins Engine Co.
2. Navistar
3. Detroit Diesel
4. _____

5b. Non-Recommended Sources (explain)

1. TBD
2. _____

6. If O.D.D. Box, estimate in-house design and development man hours/material costs avoided.

Man Hours N/A Material Cost N/A

7. Document authorization (Product Plan, PPCT, PCN etc...)

Product Plan T-300 Product Plan, Engineering Programs

Description Book

8a. List target price from Technical Cost Planning/Corporate Business Group for tooling and piece price (if available).

TBD

8b. How was target price derived? TBD

PROGRAM MANAGER'S LETTER

9. Coordinating Engineer's Name, Tie-Line Phone Number and Department Number.

Paul V. Sheridan 733-2404 1510

10. Additional Comments Vehicle/Engine packaging should be
quoted by supplier (reference concurrent ODD Box issued by
H. T. Page).

Engine modifications are necessitated by need to comply with
1994 Emission Requirements, reduce fuel consumption, improve
driveability, reduce engine noise, increase horsepower and
torque.

Please review attached exhibits for detail.

Credits, and other emissions compliance related administrative
items, earned with respect to Banking & Trading, or other forms
of legislation, NPRM's, etc., should be quoted in the context of
Chrysler "ownership."

Paul V. Sheridan

Program Manager
 Paul V. Sheridan

15 DEC 89
 Date

EXHIBIT A

ENGINEERING QUOTE PACKAGE

1. Program Description 1994/1995 Dodge Truck Diesel Engine Program

<u>Year</u>	<u>Effectivity</u>	<u>Model</u>
<u>1994</u>	<u>JOB 1</u>	<u>D250 and D350</u>
<u>1995</u>	<u>JOB 1</u>	<u>T-450</u>

2. Enter one or two major purchase part numbers and names for program tracking.

<u>TBD</u>	<u>Engine Assembly Module</u>
<u> </u>	<u> </u>
<u> </u>	<u> </u>
<u> </u>	<u> </u>

3. This program is an:

BLACK/O.D.D. BOX* Pre-Source

4. Record Coordinating Project Engineer (Name, Phone #, Dept #)

Paul V. Sheridan 493-2404 1510

5. List Design Goals and Objectives. Supplier compliance to all objectives, goals, responsibilities, requirements, specifications and timing listed in this quote package is expected. Supplier, please check compliance (yes or no) to each individual requirement listed.* Explanation of non-compliance or exclusion of any element must be stated in a separate addendum to quote. Non-compliance may result in quote rejection.

<u>COMPLY</u>		
<u>YES</u>	<u>NO</u>	
<u> </u>	<u> </u>	1. <u>1994 EPA, CARB and Canadian Emission Requirements</u>
<u> </u>	<u> </u>	2. <u>Improve BSFC over present 1991 1/2 MY engine</u>
<u> </u>	<u> </u>	3. <u>Meet GPAS Requirement for light duty truck</u>
<u> </u>	<u> </u>	4. <u>Reduce oil consumption to at least 0.1% of fuel consumption</u>

*Supplier must conform to PS - 7000

EXHIBIT A

ENGINEERING QUOTE PACKAGE

6. List Styling Requirements.

COMPLY		
YES	NO	
X		1. <u>Engine appearance items must meet specifications listed in Exhibit C Section 12</u>
		2. <u>Major engine components (block, cylinder head,</u>
		3. <u>etc.) must be painted black.</u>

7. Record below and attach all applicable existing standards and specifications and all proposed standards and specifications.

- Engine Inspection and Hot Test Standard Exhibit B
- Technical Objectives Exhibit C
- Engineering Assignments Exhibit D
- Technical Information to be exchanged Exhibit E
- Drive-By-Wire Design Requirements Exhibit F
- PS - 6013 Geometric Dimensioning & Tolerancing
- PS - 4480 Identification
- PS - 7000 Supplier Designed and Developed Items
- PS - 7300 Quality Assurance Requirement
- PS - 8500 General Requirements

8. Document Tooling Aid Information to be supplied by Chrysler and supplier.

	Chrysler	Supplier
Check Blocks/Gauges	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Release Drawings on Chrysler format. All CAD information in IGES language.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

EXHIBIT A

ENGINEERING QUOTE PACKAGE

9. Document Purchase Contract Responsibilities

Chrysler Responsibilities:

- a. Define all weight, quality, reliability, performance, emissions, driveability and other technical objectives.
- b. Provide all requirements and specifications not specifically listed under Supplier Responsibilities in Section 10 below.
- c. Establish and provide major milestone timing schedule.
- d. Confirm Supplier vehicle packaging design, if applicable.
- e. Confirm compliance to output and driveability requirements.
- f. Confirm compliance to durability and reliability requirements.
- g. Define lab/vehicle test parameters required, if applicable.
- h. Perform in-vehicle performance and durability verification testing.
- i. Provide test vehicle build assistance/information, if applicable.
- j. Provide Supplier with necessary Chrysler part numbers and Chrysler mylar drawing forms and title blocks, if applicable.
- k. Work with the Supplier on a returnable shipping rack design. Shipping container/method is to be designed by Supplier and submitted to Chrysler Material Handling Engineering for concurrence.
- l. All changes and additions to design, specifications, or other requirements identified by this package must be documented by P.C.N.'s generated by the Program Manager.
- m. The Program Manager must write P.C.N.'s on a timely basis including a clean-up P.C.N. prior to production release.

EXHIBIT A

ENGINEERING QUOTE PACKAGE

10. Supplier Responsibilities

COMPLY		
YES	NO	
		a. Design and develop component/systems to satisfy Chrysler requirements and specifications.
		b. Submit a design and development proposal to Chrysler Engineering for evaluation at time of quote.
		c. Submit environmental layout drawings to Chrysler Engineering for evaluation. (O.D.D. Box only)
		d. Provide all assembly and detail drawings of the end item parts and components on Chrysler mylar with Chrysler title blocks. Exceptions will be with the concurrence of the Procurement & Supply group. (O.D.D. Box only)
		e. Detail drawings are to be submitted as specified in PS-7000. (O.D.D. Box and Black Box only)
		f. Update the drawings based on the design changes and Chrysler supplier changes. (O.D.D. Box only)
		g. Provide a schedule showing the complete design and development process of the component including significant events, consistent with the major milestone dates shown in Sections 11 and 12, Exhibit A.
		h. Provide regular bi-weekly updates to Coordinating Engineer on status of the design and development of the component/system.
		i. Identify or design packaging satisfying the requirements of Chrysler Material Handling Engineering.
		j. Provide mock-ups and design aids, (O.D.D. Box only).
		k. Provide timely responses to the Production Buyer including actual documentation to support changes in piece price and/or tooling costs due to P.C.N. activity.
		l. Comply to PS-7000, requirements for Black Box & ODD Box.
		m. Comply to PS-7300, diamond dimensions for SPC.
		n. Other <ul style="list-style-type: none"> o In vehicle engine position gages o Provide on-site liaison engineer for duration of contract o 24 hour/7 day electronic communication (rapifax) o All items in Exhibit D designated supplier.

EXHIBIT A

ENGINEERING QUOTE PACKAGE

11. Program Schedule - The following mandatory milestone dates must be included. (Relevant 1995 MY dates are approximately one calendar year later.) Other events may be added at the discretion of the Program Manager.

<u>Description</u>	<u>Responsibility</u>	<u>1994 MY</u>	
		<u>Date</u>	<u>WBVP</u>
Quote Package delivered to supplier	Chrysler	12-22-89	186
Supplier Quote Review Meeting-Q&A (Detroit)	Chrysler/Suppliers	1-15-90	183
Supplier Quotes Due	Suppliers	2-12-90	179
Source Kick-Off	Chrysler	3-12-90	175
Design and Development Plan Complete	Chrysler/Supplier	9-03-90	150
Advanced Drawings and Parts Lists to Engrg.	Supplier	6-10-91	110
Prototype Components Available	Supplier	7-15-91	105
First Prototype Engine Complete	Supplier	8-19-91	100
Chassis Mock-up Bucks Complete	Chrysler/Supplier	12-02-91	85
Mock-up Sign Off	Chrysler	12-16-91	83
Program Vehicle Definition	Chrysler	1-06-92	80
First Program Vehicle Complete	Chrysler	3-16-92	70
Development Tests Complete	Supplier	9-07-92	45
Process Standard Complete	Supplier	9-07-92	45
Supplier Standards Complete	Supplier	9-07-92	45
Define Service Requirements	Chrysler/Supplier	9-07-92	45
Laboratory Testing Complete	Supplier	9-28-92	42
Production Release	Chrysler	10-12-92	40
ISIR/ISLR Complete	Chrysler/Supplier	11-16-92	35
P2 Pilot	Chrysler	1-04-93	28
Service Manual Information Complete	Chrysler/Supplier	1-25-93	25
System Diagnostic Manual Available for Service	Supplier	1-25-93	25
C1 Pilot	Chrysler	2-15-93	22
Pre Volume Production Build	Chrysler	6-07-93	6
Begin Volume Production	Chrysler	7-19-93	0

EXHIBIT A

ENGINEERING QUOTE PACKAGE

- 12. List prototype quantities and part due dates - Chrysler to provide vehicles.
NOTE: List below is for timing only; prototype part procurement will be covered under separate O.D.D. Program administered by H. T. Page (T.L. 733-8710).

Engines Required for Chrysler Vehicle Development

	<u>1990 CY</u>	<u>1991 CY</u>	<u>1992 CY</u>	<u>1993 CY</u>	<u>1994 CY</u>
D-250/D350	5	4	6	TBD	TBD
T-450	-	1	2	4	TBD

Note: These are minimums.

These quantities do not include drive-by wire reliability vehicle requirements (See Exhibit F)

Timing is approximate.

- 13. Note all Fit & Finish Requirements:

<u>COMPLY</u>		
<u>YES</u>	<u>NO</u>	
X		<u>See Exhibit C Section 12</u>

- 14. List EPA, CARB and Canadian Test Requirements:

1994 Heavy Duty Engine Emission Certification.

Additional test requirements that are included in a "proposed" or "pending" legislative status must also be planned for by Supplier (e.g. Proposed 1995 CARB requirement to certify 8501 through 14000 pound GVW via chassis rolls, etc.)

Supplier should quote based on assuming complete emissions certification responsibility for all contingencies.

EXHIBIT A
ENGINEERING QUOTE PACKAGE

15. List Buzz, Squeak & Rattle Objectives.

<u>COMPLY</u>	
<u>YES</u>	<u>NO</u>
<u>X</u>	

 95.0 dBA @ one meter per SAE J1074 (see EXHIBIT C Section 5)

16. List all Drawings attached including latest change level or drawing status/date.

	None

17. Additional Information

TBD

18. Supplier Compliance to all objectives, goals, responsibilities, requirements, specifications and timing listed in this quote package is expected. Supplier must review compliance (yes or no) to each individual requirement listed. Explanation of non-compliance or exclusion of any element must be stated in a separate addendum to quote. Non-compliance may result in quote rejection.

EXHIBIT A

ENGINEERING QUOTE PACKAGE

19. Part Description

Enter all "Purchased End Items", part numbers, part names, body shells, etc. on the chart below.

Part Description						
Part No	Part Name	Family	Vehicle Lines	Body Styles	Sales Codes	Quantity per Vehicle
TBD	Engine Module	Dodge	BR	P/U	ETA	1
TBD	Engine Module	Dodge	T-450	C/C	ETA	1

20. Volume Usage

Record model years with volume estimates (must use C.P.V. or otherwise indicate volume source). 5 year program required or indication of product life.

VOLUME (X 1000)*					
Part No	1994	1995	1996	1997	1998
TBD (BR)	30.0	30.0	30.0	30.0	30.0
TBD (450)	---	3.0	3.0	3.0	3.0

*Source - JTE Engine Program Management Estimates (Paul V. Sheridan)
FPV's x 1000.

21. List all Service Requirements:

See Exhibit C Section 16.

EXHIBIT B

ENGINEERING QUOTE PACKAGE

Diesel Engine Inspection and Hot Test Standards
MINIMUM TEST AND AUDIT REQUIREMENTS

1. Cp-Cpk Data on all major torque items listed in A.
Daily control - 2 times/shift, 5 consecutive pieces, each spindle
Maintain and post X Bar & R Charts
Monthly summary
Verify torque equipment each shift
2. Cp-Cpk data on all major machining dimensions items listed in B.
Daily control - 2 times/shift, 5 consecutive pieces, each dimension
Maintain and post X Bar & R Charts
Monthly summary
Verification of gaging equipment each shift

DETAILS

- A. Cp-Cpk data - torque
Main bearing caps, rod caps, cylinder head bolts, timing gear(s), oil pump, water pump, intake, exhaust manifolds, oil pan, chain cover.
- B. Cp-Cpk data - machining
Crankshaft bore, camshaft bore, valve seat run out, valve guide bore, head flatness/finish, block flatness/finish, connecting rods, camshaft, crankshaft, cylinder bore, rear face ring dowl location.
- C. Engine tear down (Daily) (Alternate Shifts)
Dyno run - 15 to 23 hours idle, W.O.T., load, noload.
Tear down - Check bearings, pistons, camshaft lifters, oil pump gear/cover plate for scuffs, burnish, damage due to chips/dirt. Valves and valve seat conditions. Oil analysis, water content and dirt content by weight.
 - Check torque and record on items listed in "A" above.
 - Pump and injectors to be verified on bench test.
 - Maintain and post charts of results.

EXHIBIT B

MINIMUM ENGINE ASSEMBLY MODULE INSPECTION AND HOT TEST
PRIOR TO PRODUCTION SHIPMENT

<u>INSPECTION</u>	<u>ITEMS/CHARACTERISTICS</u>	<u>SAMPLE SIZE</u>
ISIR/ISLR	1) Overall Engine Assembly Module Content Including both Chrysler Consigned Components and Supplier Consigned Components.	One Automatic One Manual
	2) Chrysler Will Perform Exterior Component Verifications Only.	
Visual Inspection	1) Appearance	100 Percent
	2) Leak Test Oil & Coolant Under Pressure	100 Percent
Hot Test	1) Startability	100 Percent
	2) Exhaust Gas Leaks	100 Percent
	3) Noise and Vibration	100 Percent
	4) Oil Pressure	100 Percent
	5) Fuel System Timing at Idle, Peak Torque and Peak Power	100 Percent
	6) Idling RPM, both Manual and Automatic	100 Percent
	7) Engine Output Torque and Power Curve	100 Percent
	8) Oil Temperature*	100 Percent
	9) Coolant Temperature*	100 Percent
	10) Oil Leaks	100 Percent
	11) Coolant Temperature*	100 Percent
	12) Ex Manifold Temperature*	100 Percent
	13) Fuel Leaks	100 Percent
	14) Aspiration Leaks	100 Percent
Performance Test	1) Power	2 Per Month
	2) Fuel Consumption	2 Per Month
	3) Oil Consumption	2 Per Month
Emission Test	1) HC, CO, NOx, Smoke Particulates	One Every Month

All data in hot test to be recorded and kept as permanent record for length of warranty period. Each engine to be serialized and data kept by serial number.

* At Peak Horsepower

Exhibit C

Engineering Quote Package

Technical Objectives Diesel Engine
1994 Model Year Engine Supply Agreement

<u>Objective</u>		<u>Remarks</u>	<u>Responsible Chief Engineer</u>
1. Performance	Power: 200 HP Torque: 450 lb.ft. Minimum Governed Speed: 2700 RPM Idle Speed: 700-800 RPM	○ SAE J1349 test condition at 2.0" Hg exhaust restriction, 10" H ₂ O inlet restriction (max. vehicle system restrictions are 4.5" Hg exhaust and 25" H ₂ O inlet) ○ Dynamometer data to be supplied by Supplier on a minimum of (3) engines to Chrysler Engineering	A. Pizzimenti
2. Fuel Consumption	0.410 lb/BHP-hr at rated speed 0.340 lb/BHP-hr at torque peak 2.3 lb./hr. at 800 rpm idle speed	○ Same conditions as in Item #1	A. Pizzimenti
3. Emissions	50 State and Canadian compliance in single certification.	○ Verification of emissions compliance will be supplied by Supplier.	R. Geiss

	<u>Grams Per Brake Horsepower-Hour</u>			
	<u>HC</u>	<u>CO</u>	<u>NOx</u>	<u>Particulate</u>
Standard	1.3	15.5	5.0	0.10
Design Objective	1.0	12.0	4.0	0.05

Supplier shall perform the following:

- Internal emissions audits to guarantee emissions compliance (1 engine per month)
- Selective enforcement audits at end of engine assembly line as required by EPA, CARB, and Canada
- New emission standard for 1994
- Vehicle in use emissions audits as required by EPA
- NOx level could be reduced to 4.0 for 1994

Exhibit C

Engineering Quote Package

Technical Objectives for Diesel Engine
1994 Model Year Engine Supply Agreement

<u>Objective</u>		<u>Remarks</u>	<u>Responsible Chief Engineer</u>
4. Overspeed Capability	4000 rpm intermittent for 3 minutes; 3125 rpm continuous	<ul style="list-style-type: none"> o No disabling failures during a 250 hour dyno test at zero load factor 	B. Webster
5. Noise Level (bare engine)	95.0 dBA at one meter	<ul style="list-style-type: none"> o SAE J1074 procedure 	B. Webster
6. Engine Driveability	<p>The driveability objective is to obtain start/idle/drive rating values of 9.0 for all start conditions, and 8.0 for all idle and drive conditions, on a production vehicle average.</p> <p>(See Exhibit C Page 10).</p>	<ul style="list-style-type: none"> o Vehicles maintaining a start/idle/drive rating equal to or higher than a 8.0 for all start conditions and a 7.0 for all idle and drive conditions, on production vehicle average will be considered acceptable. Production averages which fall below 8.0 and 7.0 respectively, will require corrective action. Averages falling below 6.5 and 5.0, respectively, are subject to withdrawal from production. o In demonstration tests to confirm objectives, the following conditions will be present: <ul style="list-style-type: none"> - At +1°F and above, the standard starting assist will be operating in its standard mode. The fuel will be #2 diesel fuel of 40 cetane number. - At 0°F and below, the engine will use #1 diesel fuel of 40 cetane number. The standard starting assist will be operating in its standard mode, and the engine block heater will be used as recommended in the Operator's Manual. - The engine oil will be as specified in the Operator's Manual. 	<p>R. Geiss P. Shefferly H. Page</p>

Exhibit C

Engineering Quote Package

Technical Objectives for Diesel Engine
1994 Model Year Engine Supply Agreement

<u>Objective</u>	<u>Remarks</u>	<u>Responsible Chief Engineer</u>
6. Engine Driveability (Con't)	<ul style="list-style-type: none"> ○ The test will be at 90 rpm minimum cranking speeds. ○ Jury evaluation by Vehicle Development Eng., Truck Program Control, Engine Systems Engineering, S.H.V.T.C. Service Engineering, Engine Engineering and Supplier Engineering to establish compliance with the objective. 	R. Geiss/ P. Shefferly
7. Exhaust Smoke	<p>White Smoke</p> <ul style="list-style-type: none"> ○ 4500 PPM within 2 minutes from start <p>Black Smoke</p> <ul style="list-style-type: none"> ○ 10% opacity A accel. (averaged) 5% opacity B lug down 20% opacity C peak accel. <p>TBD % opacity at engine start up (HOT START)</p> <ul style="list-style-type: none"> ○ A jury evaluation by Vehicle Dev. Engrg., Truck Program Control, Engine Systems Engineering, S.H.V.T.C. Service Engineering, Engine Engineering, and Supplier Engineering to establish ultimate acceptability of smoke conditions. 	<p>1500 rpm idle speed, +10°F ambient temperature</p> <p>R. Geiss/ P. Shefferly/ H. Page/ B. Webster</p>
8. Oil Economy	<p>Maximum 0.1% of fuel flow at rated speed/load following 20 hr break-in period and thru the warranty period.</p> <ul style="list-style-type: none"> ○ This includes any crankcase breather oil carryover 	B. Webster

Exhibit C

Engineering Quote Package

Technical Objectives for Diesel Engine
1994 Model Year Engine Supply Agreement

<u>Objective</u>	<u>Remarks</u>	<u>Responsible Chief Engineer</u>	
9. 100,000 Mile Durability	<p>The engine shall withstand the following test schedules without actual or imminent failure or excessive wear of components</p> <p>2000 hr. dynamometer test cycle, low idle to high idle speed variation, 55% average load factor.</p> <p>1500 hr. dynamometer test (500 hrs. full load at rated speed, 500 hrs. full load at peak torque speed, 500 hrs. at 14% overspeed/5% overload. Test includes thermal cycle schedule)</p> <p>1000 hr. emissions deterioration test (75% load factor, low idle to high idle speed variation, no load to full load variation)</p> <p>40,000 mile vehicle J1 Endurance Test</p> <p>100,000 mile vehicle Powertrain Endurance Test</p>	<p>o Compliance with these objectives will be accomplished by dynamometer testing at supplier facility and vehicle testing performed by C.V.E. and Vehicle Development.</p> <p>Chrysler Engineering may participate in the inspection of durability completed engines.</p> <p>It is recognized that any problems resulting from dynamometer or vehicle testing will be investigated and the assignable cause, corrective action and confirming test program discussed and mutually agreed upon.</p>	<p>B. Webster/ A. Pizzimenti</p>

The tests below must be run in addition to or in place of the tests above at the option of Chrysler Engineering (See Exhibit C, Page 5 of 13).

EXHIBIT C

ENGINEERING QUOTE PACKAGE

DURABILITY OBJECTIVES

The engines will withstand the following test schedules without actual or imminent failure or excessive wear of components. The acceptability of wear is a joint Supplier and Chrysler determination.

DYNAMOMETER TESTS

<u>Test Type</u>	<u>Duration</u>	<u>No. of Tests</u>
General Durability (Peak torque/peak power)	1000 hours	3
Piston Hot Scuff Test	8 hours (running)	2
Thermal Shock Test (Static Pressure Tests to 1000 p.s.i. minimum; 1500 p.s.i. @ E.O.T.)	1000 cycles (185 hrs.)	2
Accessory Drive Peak Resonance (Not required if peak resonance is beyond operating range of engine)	150 hours	
Accessory Drive E.C.E. simulation	100 hours to failure (300 hrs. max.)	2 1
Exhaust Manifold Durability	125 hours (running)	3

VEHICLE TESTS

70 MPH Constant	120K*	2
Power Train Endurance (Similar to E.C.E.)	50K (2 auto/2 manual trans.)	4
E.P.A. Cycle (N/A for Heavy Duty Engines)	120K*	2

* May require 200K depending on "Useful Life" or warranty coverage of vehicle.

EXHIBIT C

Engineering Quote Package

Technical Objectives for Diesel Engine
1994 Model Year Engine Supply Agreement

<u>Objective</u>		<u>Remarks</u>	<u>Responsible Chief Engineer</u>
10. Accessory Drive	<p>The tensioner shall provide adequate belt tension so not to exceed a maximum allowable belt slip of 8% over full tensioner travel for given belt tolerances. No unsatisfactory change in accessory performance will occur during heavy wet weather vehicle operation.</p>	<p>Compliance with these objectives shall be accomplished by a joint Chrysler Supplier review of test data. Chrysler Engineering may participate in inspection of durability completed components.</p>	B. Webster
	<p>The accessory drive system shall withstand the following test schedules without actual or imminent failure or excessive wear of components.</p>	<p>It is recognized that any problems resulting from dynamometer or vehicle testing will be investigated and the assignable cause, corrective action and confirming test program discussed and mutually agreed upon.</p>	
	<ul style="list-style-type: none"> o 150 hour pivot tube rig test on tensioner 		
	<ul style="list-style-type: none"> o 150 hour dust test per Supplier specification 		
	<ul style="list-style-type: none"> o (2) 1000 hour dynamometer endurance tests 		
	<ul style="list-style-type: none"> o (3) 50,000 mile vehicle DTE endurance tests 		
	<ul style="list-style-type: none"> o (1) 20,000 mile vehicle general endurance test 		

Exhibit C

Engineering Quote Package

Technical Objectives for Diesel Engine
1994 Model Year Engine Supply Agreement

<u>Objective</u>	<u>Remarks</u>	<u>Responsible Chief Engineer</u>
11. Weight	As engine assembly (dry including flexplate/flywheel) 900 lb. (Auto. Trans.) 950 lb. (Man. Trans.)	B. Webster
12. Appearance	The following appearance goals and design guidelines will be followed, to meet Chrysler goals of underhood fit and finish. 1. All components shall be Black, Silver or White. Meet ASTM 115B-136. As defined on a buck or chassis review. 2. Labels, if absolutely required, shall be White on Black, limited in size, located in an unobjectionable area, and conform to PPS4480 (revision now in process). 3. All tubing, hoses and wires shall "flow" together in a parallel path and/or be perpendicular to each other. 4. All printing on hoses shall be white and readable. 5. All components that affect serviceability (engine oil dipstick; transmission dipstick; oil filter; power steering fluid, etc.) shall be easily accessible. 6. All wiring shall be routed as low as possible with minimum take outs and spot taping. 7. Components shall be located in similar areas on all carlines to aid serviceability. 8. There shall be no usage or minimum usage of tie-wraps. 9. There shall be minimum color exposed on all wires and tubing. 10. No visible corrosion allowed as received at assembly plant.	B. Webster

Exhibit C

Engineering Quote Package

Technical Objectives for Diesel Engine
1994 Model Year Engine Supply Agreement

<u>Objective</u>		<u>Remarks</u>	<u>Responsible Chief Engineer</u>
13. Engine Temperature	Ability to operate continuously at 210°F coolant temperature with capability for excursions to 230°F for short periods (15 min. max.)	Chrysler vehicle cooling system to be capable of controlling temperature to 230°F limit when the vehicle is operated under all Chrysler JTE test conditions and in accordance with the corresponding Chrysler JTE test procedures. (refer to Vehicle Engineering ODD Box by H. Page)	D. Buser
14. Fuel Specification	Per Supplier Service Bulletin		B. Webster
Fuel Filter Specification	ISO Standard 4020/1		B. Webster
Oil Specification	CD/SG UPI rating.		B. Webster
Oil Filter Specification	Per Supplier Engineering Standard		B. Webster
15. Maintenance Intervals	6,000 miles or 6 month oil and filter (3,000 miles under high temperature or dirty operating conditions). 12,000 miles fuel filter 18,000 miles valve adjustment No injector pump or injector maintenance during the 5 yr./100,000 mile warranty period.		B. Webster
16. Serviceability	All components that affect serviceability (engine oil dipstick; oil filter; power steering fluid, etc.) shall be easily accessible.	Compliance with this objective shall be accomplished by joint serviceability reviews between supplier, C.V.E., Chrysler Service and Parts and Chrysler Engineering	B. Webster

Exhibit C

Engineering Quote Package

Technical Objectives for Diesel Engine
1994 Model Year Engine Supply Agreement

<u>Objective</u>		<u>Responsible Chief Engineer</u>
17. Performance Objectives for Supplier Installed Engine Trim Components		
Vacuum/Hydraulic Pump for Power Brakes/Steering	Assembly Durability - Completion of 800 hr. bench test - Completion of 2000 hr. engine cycle test - Completion of vehicle 20,000 mile K1 & k2 and 40,000 mile J2 & J3 endurance tests Hydraulic Pump Performance and Mettalgury per Supplier Drawing Number TBD	D. Buser
Automatic Transmission Oil Cooler	Per Supplier	D. Buser
Starter	Performance per Nippondenso Drawing 128000-4919	R. Moser
Flexplate & Ring Gear Assy.	Per Supplier Drawing TBD	J. E. MacAfee
Flywheel & Ring Gear Assy.	Per Supplier Drawing TBD	J. E. MacAfee
Oil Pressure Sensor	Per Histat Drawing 4002-701 - Chrysler PF 8181 Sensor - Engine Oil Pressure	R. Moser
Water Temperature Sensor	Per Histat Drawing 8148-502 -Installed Performance per Coolant Loss Test Laboratory Procedure 903-A-07.10N	R. Moser

Exhibit C

Engineering Quote Package

Technical Objectives for Diesel Engine
1994 Model Year Engine Supply Agreement

<u>Objective</u>	<u>Responsible Chief Engineer</u>
17. Performance Objectives for Supplier Installed Engine Trim Components- Continued	
Water Temperature Sensor -Continued	Laboratory Calibration Verification Procedure PF 3865 Section II - B-2a, b, c or Engineering Approved Equivalent
	R. Moser
	Coolant Sensor Durability Requirements PF 7648 Rev. C
	Production Validation and Continuing Conformance as noted in RS 8036 (less paragraph H-2-b). In Table 1, references to PF 7648 (paragraphs B2, B3, C2) shall be replaced by PF 3865 (Section II B2, a, b and c).
Intake Air Heater	Per Supplier Part Number TBD
	R. Moser
Engine Block Heater	Per Supplier Part Number TBD
	R. Moser
18. Charge Air Cooler	Max. temperature to intake manifold 143°F at 77° ambient. 7" HG maximum pressure drop at rated speed & power.
	D. Buser

Exhibit C

Engineering Quote Package

RECOMMENDED DIESEL ENGINE STARTING PROCEDURE

Turn key to the "on" position. If "wait to start" light is illuminated, leave key in the "on" position until the light goes out. After the light is out or if it never came on, simply turn the key to the "start" position and release when the engine starts. Depress throttle between 1/4 and 1/2 during cranking. Return throttle to idle position as soon as the engine starts. Block heater usage is recommended at +10°F and below, and is required at -10°F and below.

TIME-TO-START RATINGS

<u>All Starts Except Cold Starts At 0 Degrees F and Below</u>		<u>Cold Starts At 0 Degrees F and Below</u>	
<u>Start Time Sec.</u>	<u>Rating</u>	<u>Start Time Sec.</u>	<u>Rating</u>
0 - 1.0	9	0 - 3.0	9
1.1 - 3.0	8	3.1 - 6.0	8
3.1 - 5.0	7	6.1 - 9.0	7
5.1 - 7.0	6	9.1 - 12.0	6
7.1 - 8.5	5	12.1 - 14.0	5
8.6 - 10.0	4	14.1 - 16.0	4
10.1 - 11.5	3	16.1 - 18.0	3
11.6 - 13.0	2	18.1 - 19.0	2
13.1 - 14.5	1	19.1 - 20.0	1
14.6 & Greater	0	20.1 & Greater	0

Time applies to either first start or any subsequent restart, whichever is longer.

Stalling Versus Ratings Downgrade

<u>Stalls</u>	<u>Downgrade</u>
1	2
2	5
3	6

Example: Cold start at 4 seconds with a stall = 6 rating (8-2)

Exhibit C

Engineering Quote Package

JOINT EVALUATION TEST SCHEDULE

Achievement of each item listed in Exhibit D "Technical Objectives" will be jointly evaluated at the time of Joint Evaluation I and II. Dates to be determined.

o Joint Evaluation I:

Items 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10

o Joint Evaluation II:

Items 10, 11, 12, 13, 14, 15, 16 and 17.

- Note: (1) Some items of the Joint Evaluation II will be evaluated at the time of the Joint Evaluation I depending on the progress of the development.
- (2) At the time of the Joint Evaluation II, Supplier and Chrysler will also:
- (i) test and evaluate such items as, the technical objectives which were not achieved at the Joint Evaluation I, and
 - (ii) review the updated status on the items achieved at the Joint Evaluation I.
 - (iii) Joint evaluation will be made at appropriate Chrysler proving grounds

Exhibit C

Engineering Quote Package

COMPONENT TEMPERATURE GOALS

Supplier and Chrysler should agree on the following goals for materials and structures of components. If the goals for temperature levels are not attained during testing of Chrysler's development vehicles, the Parties will agree upon an appropriate corrective program.

<u>Component</u>	<u>Measurement Location</u>	<u>Allowable Temperature °C</u>	
		<u>Continuous Goal*</u>	<u>Maximum Goal*</u>
Basic Engine Components			
Rocker cover gasket	Surface next to cylinder head	120	140
Oil filler cap gasket	Surface next to rocker cover	100	120
Rocker cover mounting rubber	Surface next to rocker cover	100	120
Cylinder head circular packing	Surface next to cylinder head	100	120
Oil dip stick seal rubber	Surface next to guide tube	150	170
Front crankshaft seal	Surface next to block	150	170
Rear crankshaft seal	Surface next to block	160	180
Oil pan gasket	Surface next to oil pan	160	180
Torsional damper rubber	Surface	80	100
Breather hose	Outer surface nearest pri. heat source	100	120
PCV hole	Outer surface nearest pri. heat source	100	120
Water by-pass hose	Outer surface, in. manifold nipple end	120	150
Oil filter gasket	Surface next to oil filter	100	125
Engine Oil in sump	Near bottom of oil pan	130	140
Engine Coolant (0.9kg/cm ² , 50/50 coolant)	Inside thermostat housing	116	125
Exhaust System Components			
Exhaust manifold	Outer surface	650	750
Turbo Charger	Outer surface	700	750
Throttle Cable	Outer surface nearest pri. heat source	150	150
Fuel Hose, Rubber	Outer surface nearest pri. heat source	110	130

*Definitions

Continuous Goal: The temperature to which a component is allowably exposed for a long period (about 500 hours), while keeping functional characteristics of the component.

Maximum Goal: The temperature to which a component is allowably exposed for a short period (about 50 hours), while keeping functional characteristics of the component.

EXHIBIT D

ENGINEERING QUOTE PACKAGE

ALLOCATION OF ENGINEERING ASSIGNMENTS

C: CHRYSLER
S: DIESEL SUPPLIER

I. ENGINE COMPONENTS

- | | |
|---|---|
| 1. Perform Base Engine Design and Development | S |
| o Furnish requests and detail recommendations to achieve technical objectives including but not limited to: | C |
| - intake and exhaust manifold design | |
| - intake and exhaust valve and port design | |
| - camshaft events selection | |
| 2. Fuel Injection System | |
| o Perform fuel injector and fuel injection pump design and development. | S |
| o Furnish specification and calibration requirements for fuel injectors and fuel injection pump. | S |
| 3. Perform Starter Design and Development | S |
| o Furnish recommendations on starter requirements | S |
| 4. Cold starting circuit | S |
| o Furnish requirements of design and calibration, glow plugs, cable design | S |
| 5. Perform Alternator Design and Development | C |
| 6. Perform Alternator Bracket Design and Development | S |
| 7. Perform Oil Filter Design and Development | S |
| o Furnish oil filter specifications | S |
| 8. Perform Oil Pan Design and Development | S |
| o Furnish vehicle packaging requirements | C |
| 9. Perform and Furnish Oil Pressure and Water Temperature Sensors Design and Development | S |
| o Provide mounting provisions on Engine | S |

EXHIBIT D

Engineering Quote Package

10. Lubricating Oil and Coolant
- o Furnish recommendation and requirements S
 - o Selection of recommended oil and coolants C & S
11. Perform and furnish crankshaft drive pulley design and development S
- o Furnish drive belt type and pulley design requirements (serpentine system) C & S
12. Perform design and development relating to air conditioner compressor and power steering pump including mounting brackets S
- o Design and provide brackets for prototype and pilot engines as specifically ordered by Chrysler S
 - o Packaging information on P/S and A/C S & C
13. Perform design and development to crankcase vent system S
- II. EXHAUST EMISSION CONTROL SYSTEM
- 1. Perform design and development of exhaust emission control system S
 - o Perform engine design changes as required S
 - 2. Perform motor vehicle certification/ECE homologation S
 - o Submission to Chrysler of necessary engine information to meet government requirements S
- III. VEHICLE EVALUATION OF EMISSION LEVEL, DRIVEABILITY, HOT FUEL HANDLING, FUEL ECONOMY & VEHICLE PERFORMANCE C
- IV. VEHICLE EVALUATION OF COLD START, CRITICAL OIL LEVEL AND CRANKCASE VENTILATION AND GRADEABILITY. C
- Chrysler specifications include: PF, Performance Specification; PS, Process Standards; RS, Reliability Standard; MS, Material Standard. Available on request.
- V. EXTERNAL COMPONENT INSTALLATION S
- 1. Develop plan to install all bolt-on external hardware (ie: front end accessory drive, engine mounts, etc.) utilized on the engine prior to decking engine in vehicle.

Engineering Quote Package

TECHNICAL INFORMATION TO BE EXCHANGED

I. Supplier agrees to furnish Chrysler with the following technical information.

A. Engine Content Definition

1. Engineering Parts List

a. Prototype Engine Parts List

This list will be updated each month as development progresses through prototype build. As components are changed, the following information shall appear in each such updating:

- Part number
- Sub-Assembly number
- Assembly number
- Installation drawing number
- Part quantity

If there is more than one prototype Engine assembly, separate parts list will clearly state the content of each such Engine assembly.

b. Production Engine Parts List

Unless otherwise agreed by the Parties, this list will be updated in accordance with the following schedule:

- o Within two weeks of the completion of the further evaluation testing (referred to in Exhibit C Page 12).
- o 6-29-92 for 1994 Model Year.
- o 6-24-93 for 1995 Model Year.

The first Engine Parts List and each updating thereof will include all components changed pursuant to the Engineering Change Procedure PCN.

2. Engineering Drawings

At the time of the updating of the Engine Parts List, Supplier will furnish a complete set of details & Engine installation drawings. These drawings will show all interface and assembly information required for mating with Chrysler Parts in Aperture format.

Engineering Quote Package

3. Engineering Specifications

Supplier will furnish technical information as requested by Chrysler and agreed upon by Supplier on all Engine components and assemblies including material specifications, performance specifications, fastener torque requirements and specifications, electrical characteristics and other specifications required to define Engine components.

4. Engineering Illustrations

Engineering illustrations drawings are required one (1) month following issuance of the Engine Parts List. These illustration drawings will define assembly procedures for Engine components which are shipped loose and are to be assembled at Chrysler's or suppliers' assembly facilities. Such illustration drawings will contain information showing component part numbers, assembly procedures, fastener torque specifications and any other information required to perform complete assembly of Engine components.

B. Part Numbering System

Part numbering will be made pursuant to Supplier's existing system, except that Chrysler will assign its own part numbers to all components to be shipped loose and all emission-related components will be positioned so as to be easily read following Engine assembly and installation in Motor Vehicles.

C. Other Information

Supplier agrees to provide, at Chrysler's request, the following additional technical information:

1. Design layouts or other information necessary to allow Chrysler to carry out its engineering assignments.
2. Information required by governments for safety and emissions certification and compliance.
3. Information covering service parts, procedures, technical details, parts list, and other detailed information required by Chrysler and agreed by Supplier regarding each Engine component, assembly and sub-assembly.
4. All information published pertaining to Supplier's use of the diesel engine in Supplier's vehicles as considered useful to Chrysler by Supplier.
5. Information on Engine parts identification and Engine build procedure to support prototype Engine assembly by Chrysler.
6. Exchange of technical warranty information quarterly per year, rotating locations between supplier and Chrysler.

EXHIBIT E

Engineering Quote Package

- II. Chrysler agrees to provide the following information to Supplier, through use of design layouts, detail drawings, reports, specifications, etc.
1. Information on engine components Chrysler plans to attach to the Engine which may affect emission levels, fuel economy, performance, durability, weight, servicing or manufacturing operational activities of Engine.
 2. Information showing revisions required to basic Engine components to allow for Chrysler's use in Motor Vehicles.
 3. The necessary information for the installation of Engines on Motor Vehicles.
 4. Such reports as Supplier may request and agreed by Chrysler as to the testing carried out by Chrysler with respect to the use of Engines on Motor Vehicles.
 5. Such information as Supplier may reasonably request as to changes in Engines proposed by Chrysler including such technical information as will permit Supplier to study the feasibility of adopting such changes.
- III. All correspondence, documents, meetings and other information will be in the English language. All technical drawings will use third angle projection convention. Measurements and fasteners can be provided in metric units or SAE as appropriate/ convenient. Unless otherwise agreed to, all CAD information will utilize I.G.E.S. language.

1994 DIESEL DRIVE-BY-WIRE DESIGN REQUIREMENTS

IF A DRIVE-BY-WIRE SYSTEM IS UTILIZED, THEN THE REQUIREMENTS CONTAINED IN THIS EXHIBIT MUST BE SATISFIED.

- o MECHANICAL BACK-UP SYSTEM TO RETURN ENGINE TO IDLE SPEED WHENEVER THE DRIVER LIFTS HIS FOOT OFF THE THROTTLE PEDAL EXCEPT WHEN THE CRUISE CONTROL SYSTEM IS ACTIVATED.
- o MECHANICAL EMERGENCY ENGINE SHUTDOWN.
- o MECHANICAL AUTOMATIC TRANSMISSION CONTROL.
- o COMPATIBLE WITH CHRYSLER-BASED CRUISE CONTROL SYSTEM.
- o COMPLIANCE WITH FMVSS 124.
- o COMPATIBLE WITH CHRYSLER COMMUNICATION PROTOCOLS.
- o ALL HARDWARE MUST SATISFY APPLICABLE CHRYSLER SPECIFICATIONS.

RELIABILITY REQUIREMENTS

CONTACT: R. ALLISON

- 176WBVP o INITIATE DESIGN REVIEW FORUM THAT WILL REMAIN IN EXISTENCE UNTIL 10 WEEKS AFTER PRODUCT LAUNCH. THIS GROUP WILL CONSIST, AT A MINIMUM, OF THE FOLLOWING PERSONNEL OR THEIR REPRESENTATIVES: MECHANICAL DESIGN MANAGER, ELECTRICAL DESIGN MANAGER, DEDICATED IN-HOUSE CERTIFIED RELIABILITY ENGINEER, MANUFACTURING QUALITY MANAGER, MANUFACTURING PRODUCTION MANAGER FOR ALL COMPONENTS, APPLICABLE SQA REPRESENTATIVES, APPLICABLE MATERIALS PERSONNEL AND OTHERS AS REQUIRED. CHRYSLER WILL HAVE AT LEAST ONE REPRESENTATIVE IN THIS FORUM.
- o INITIATE QUALITY FUNCTION DEPLOYMENT FOR:
 - PEDAL FEEL
 - SYSTEM ACTUATION AND RESPONSIVENESS
- 172WBVP o COMPLETE A DESIGN FEATURE ANALYSIS OF COMPETITIVE AND IN-HOUSE DRIVE-BY-WIRE SYSTEMS WITH AN ANALYSIS OF FIELD EXPERIENCE, WHICH SHOULD INCLUDE A SUMMARY OF WARRANTY DATA AND RESULTS FROM DEALER AND CUSTOMER INTERVIEWS.
A FAULT TREE ANALYSIS WILL BE PERFORMED FOR EACH ISSUE OR CONCERN IDENTIFIED BY 168WBVP.
- 168WBVP o COMPLETE PRELIMINARY DESIGN INCLUDING:
 1. BASIC DESIGN FEATURES WITH FUNCTIONAL BLOCK DIAGRAM AND RELIABILITY APPORTIONMENT ESTIMATES.

1994 DIESEL DRIVE-BY-WIRE DESIGN REQUIREMENTS

PAGE 2

RELIABILITY REQUIREMENTS - (CONT'D)

2. DESCRIPTION OF RELIABILITY TECHNIQUES, SUCH AS:

- DESIGN REDUNDANCIES
- USAGE OF ROBUST DESIGNS, SUCH AS GOLD ELECTRICAL CONTACTS AND HERMETICALLY SEALED CONNECTORS.

3. DESCRIPTION OF DESIGN FEATURES TO SATISFY JTE REQUIREMENTS.

4. INITIAL PROCESS FLOWCHART WITH EMPHASIS ON ASSEMBLY TECHNIQUES TO IMPROVE RELIABILITY, SUCH AS AUDIBLE "CLICKS", ADDITIONAL END-OF-LINE TESTS, AND BURN-IN SCREENING.

5. INITIAL COST ANALYSIS.

- o INITIATE SYSTEM DESIGN FAILURE MODE AND EFFECTS ANALYSIS (DFMEA) FOR EACH COMPONENT FAILURE.
 - o INITIATE DESIGN VERIFICATION PLAN AND REPORT (DVP&R) FOR COMPONENTS, SYSTEMS, AND VEHICLES.
- 164WBVP o COMPLETE THE INITIAL DRAFT OF THE DFMEA AND THE DVP&R.
- EACH BENCH, SYSTEM, AND VEHICLE TEST IN THE DVP&R MUST HAVE PROVEN CORRELATION TO THE 95 PERCENTILE CUSTOMER DUTY CYCLE FOR 120,000 MILES, OR PROVIDE DIRECT COMPARISON TO A COMPONENT OF KNOWN RELIABILITY.
- o ESTABLISH A "FAULT ANALYSIS AND CORRECTIVE ACTION REPORT" SYSTEM WITHIN THE DESIGN REVIEW FOR TRACKING AND RESOLVING ALL ISSUES ENCOUNTERED DURING TESTING.
 - o ESTABLISH A RELIABILITY GROWTH TRACKING SYSTEM FOR ALL PHASES OF TESTING.
- 130WBVP o COMPLETE SYSTEM BENCH TESTING WITH A RELIABILITY/CONFIDENCE LEVEL OF 95/90.
- 95WBVP o COMPLETE MULE/PROTOTYPE VEHICLE TESTING WITH A RELIABILITY/CONFIDENCE LEVEL OF 93/90. (95/90 RELIABILITY/CONFIDENCE WILL BE ATTAINED DURING PROGRAM VEHICLE TESTING.)
- 22WBVP o A FLEET OF 22 C1 PILOTS MUST BE EVALUATED UNDER ACTUAL CUSTOMER DRIVING CONDITIONS (MINIMUM 3,000 MILES/WEEK) FOR 120,000 MILES.

ANY CONCERN NOTED DURING PROGRAM OR C1 PILOT VEHICLE TESTING WILL BE CONSIDERED AS INDICATING A DESIGN OR PROCESS CONCERN. A FAILURE ANALYSIS MUST BE PERFORMED, AND A COMPONENT CHANGE MUST BE IMPLEMENTED TO CORRECT ALL OF THE POSSIBLE FAILURE MODES. EACH IMPROVEMENT MUST BE DEMONSTRATED THROUGH RELIABILITY TESTING THAT IS ACCEPTABLE TO CHRYSLER.