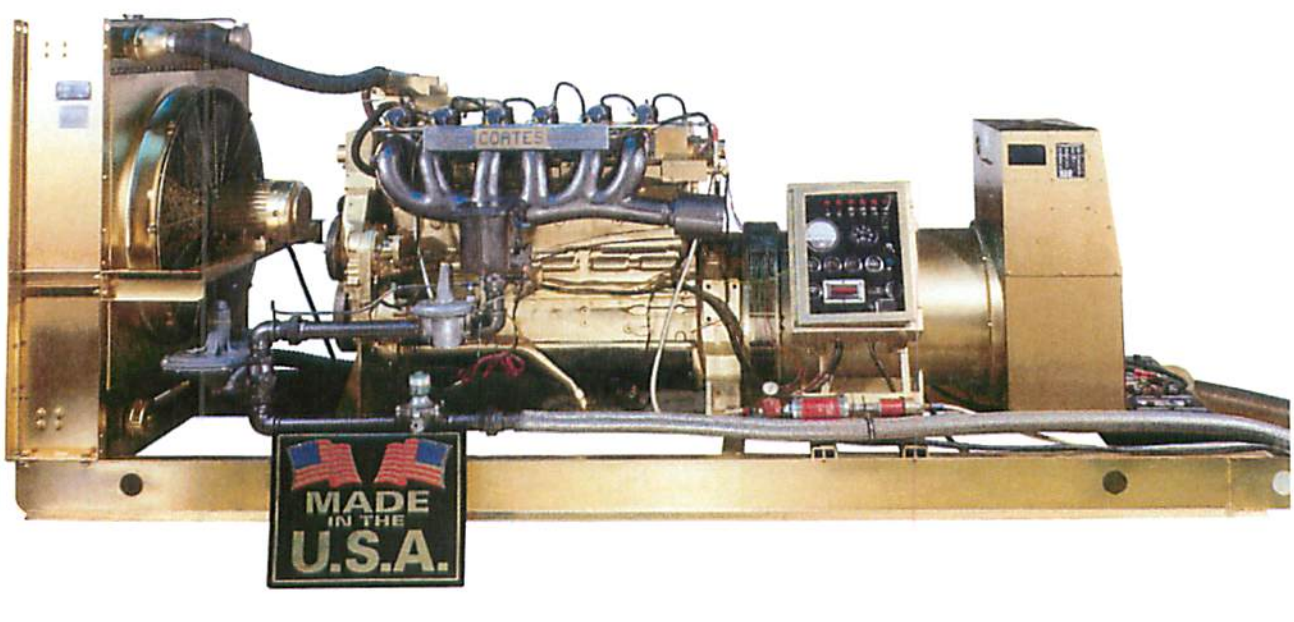
Coates Warranty

All Diesel Engines, Natural Gas
CNG and LNG Engines
Worldwide
Generator Drive



COATES NATURAL GAS CSRV ELECTRICAL POWER INDUSTRIAL GENERATOR
Specifically designed for the oil and gas industry

Engines Warranted

This warranty applies to new Engines sold by Coates and delivered to the first user on or after April 1, 2008 that are used in generator drive application anywhere in the world where Coates approved service is available. These Engines will have the following rating designations:

Standby Power Rating

Engines of this rating are applicable for supplying emergency power for the duration of the utility power outage. No overload capability is available for this rating. Under no condition is an Engine allowed to operate in parallel with the public utility at the Standby Power rating. This rating should be applied where reliable utility power is available. A standby rated engine is to be sized for a maximum of an 80 percent average load factor and 200 hours of operation per year. This includes less than 25 hours per year at the Standby Power rating. Standby rating should never be applied except in true emergency power outages. Negotiated power outages contracted with a utility company are not considered an emergency.

Unlimited Time Running Prime Power Rating

Engines with this rating are available for an unlimited number of hours per year in a variable load application. Variable load is not to exceed a 70 percent average of the Prime Power Rating during any operating period of 250 hours. Total operating time at 100 percent Prime Power shall not exceed 500 hours per year.

A 10 percent overload capability is available for a period of one hour within a twelve hour period of operation. Total operating time at the 10 percent overload power shall not exceed 25 hours per year.

Limited Time Running Prime Power Rating

Engines of this rating are available for a limited number of hours in a non-variable load application. It is intended for use in situations where power outages are contracted, such as in utility power curtailment. Engines may be operated in parallel to the public utility up to 750 hours per year at power levels never to exceed the Prime Power rating.

Limited Time Running Prime Power ratings differ from Unlimited Time Running in that even though the maximum power output of the engines are the same, the Limited Time Running allows the Engine to be parallel to Public Utility and run at the full Prime Power rating and must never exceed the Prime Power rating.

Continuous/Base Power Rating

Engines with this rating are available for supplying utility power at a constant 100 percent load for an unlimited number of hours per year. No overload capability is available for this rating.

Continuous/Base Power rating differ from Unlimited Time Running Prime Power ratings in that the Continuous/Base Load ratings are significantly reduced from the Prime Power rating. Continuous/Base Load ratings have no load factor or application restrictions.

Coverage

Base Engine Warranty

This warranty covers any failures of the Engine, under normal use and service, which result from a defect in material or factory workmanship (Warrantable Failure).

Coverage begins with the sale of the Engine by Coates and continues for the Duration stated below. The Duration commences either on the date of delivery of the Engine to the first user, or on the date the Engine has been is first leased, rented, loaned, or when the Engine has been operated for 50 hours, whichever occurs first.

Base Engine Warranty

	Duration Whichever Occurs First	
Rating	**Months**	**Hours**
Standby Power	24	400
Unlimited Prime Power	12	Unlimited
Limited Prime Power	12	750
Continuous/Base Power	12	Unlimited

Extended Major Components

The Extended Major Components Warranty applies to all CSRV Engines ad covers Warrantable Failures of the Engine cylinder block, camshaft, crankshaft and connecting rods (Covered Parts). Bushing and bearing failures are not covered. This coverage begins with the expiration of the Base Engine Warranty and continues for the following stated Duration. The Duration commences either on the date of delivery of the Engine to the first user, or on the date the Engine is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first.

Extended Major Components Warranty

Rating	Duration Whichever Occurs First Months	Hours
Standby Power	36	600
Unlimited Prime Power	36	10,000
Limited Prime Power	36	2,250
Continuous/Base Power	36	10,000

Consumer Products

This warranty on Consumer Products in the United States is a LIMITED warranty. **COATES IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.** Any implied warranties applicable to Consumer Products terminate concurrently with the expiration of the express warranties applicable to the product. In the United States, some states do not allow the exclusion of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the limitations or exclusions herein may not apply to you.

These warranties are made to all Owners in the chain of distribution, and Coverage continues to all subsequent Owners until the end of the periods of Coverage.

Coates Responsibilities

During Base Engine Warranty

Coates will pay for all parts and labor needed to repair the damage to the Engine resulting from a Warrantable Failure when performed during normal business hours. All labor costs will be paid in accordance with Coates published Standard Repair Time guidelines.

Coates will pay for the lubricating oil, antifreeze, filter elements, and other maintenance items that are not reusable due to the Warrantable Failure.

Coates will pay reasonable travel expenses for mechanics to travel to and from the Engine site, including meals, mileage, and lodging when the repair is preformed at the site of the failure.

Coates will pay reasonable labor costs for Engine removal and reinstallation when necessary to repair a Warrantable Failure.

During the Extended Major Components Warranty

Coates will pay for the repair or, at its opinion, replacement of the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered Part.

Owner's Responsibilities

During the Base Engine Warranty

Owner is responsible for the cost of lubrication oil, antifreeze, filter elements and other maintenance items replaced during warranty repairs unless such items are not reusable due to the Warrantable Failure.

During the Extended Major Components Warranty

Owner is responsible for the cost of all labor needed to repair the Engine, including the labor cost for Engine removal and reinstallation. When Coates elects to repair a part instead of replacing it, the Owner is not responsible for the labor needed to repair the part.

Owner is responsible for the cost of all parts required for the repair except for the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered Part.

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items replaced during repair of a Warrantable Failure.

During the Base Engine and Extended Major Components Warranties

Owner is responsible for the operation and maintenance of the Engine as specified in the applicable Coates Operation and Maintenance Manual. Owner is also responsible for providing proof that all recommended maintenance has been performed.

Before the expiration of the applicable warranty, Owner must notify a Coates distributor; authorized dealer or other repair location approved by Coates of any Warrantable Failure and make the Engine available for repair by such facility. Locations in the United States* and Canada are listed in the Coates United States and Canada Sales and Service Directory; other locations are listed in the Coates International Sales and Service Directory.

Owner is responsible for communication expenses, meals, lodging and similar costs incurred as a result of a Warrantable Failure.

Owner is responsible for non-Engine repairs, "downtime" expenses, fines, all applicable taxes, all business costs and other losses resulting from a Warrantable Failure.

Owner is responsible for providing sufficient access to and reasonable ability TO REMOVE THE Engine from the installation of the event of a Warrantable Failure.

Owner is responsible for maintaining an operating Engine hourmeter. If the hourmeter is not operational, engine usage will be estimated at 400 hours per month.

Limitations

Coates is not responsible for failure or damage resulting from what Coates determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubrication, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications to the Engine. Coates is also not responsible for Engine performance problems or failures caused by incorrect oil or fuel, or by water, dirt or other contaminants in the fuel or oil.

This warranty does not apply to accessories supplied by Coates which bear the name of another company. Such non-warranted accessories include, but are not limited to: alternators, starters, fans**, air conditioning compressors, clutches, filters, transmissions, air cleaners and safety shutdown switches.

Before a claim for excessive oil consumption will be considered. Owner must submit adequate documentation to show that consumption exceeds Coates published standards.

Failure of belts and hoses supplied by Coates are not covered beyond the first 500 hours or one year of operation, whichever occurs first after the warranty start date.

Parts used to repair a Warrantable Failure may be new Coates parts. Coates approved rebuilt parts, or repaired parts. Coates is not responsible for failures resulting from the use of parts not approved by Coates.

A new Coates or Coates-approved rebuilt part used to repair a Warrantable Failure assumes the identity of the part it replaced and is entitled to the remaining coverage hereunder.

Coates is not responsible for Engine performance problems or failures resulting from:

1. Use or application of the Engine inconsistent with its rating designation as set forth above.
2. Inadequate or incorrect installations deviating from Coates Generator Drive Installation Guidelines.

COATES IS NOT RESPONSIBLE FOR WEAR OR WEAROUT OF COVERED PARTS.

COATES IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY COATES IN REGARD TO THESE ENGINES. COATES MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MECHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

In the United States* and Canada, this warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Outside the United States* and Canada, in case of consumer sales, in some countries, the Owner has statutory rights which cannot be affected or limited by the terms of this warranty.

Nothing in this warranty excludes or restricts any contractual rights the owner may have against third parties.

* Includes American Samoa, the Commonwealth of Northern Mariana Islands, Guam, Puerto Rico, and the U.S. Virgin Islands.

** Alternators, starters, and fans ARE covered for the duration of the base engine warranty on B.3.3 engines.

Coates International, Ltd
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Wall Township, NJ 07719-9738 USA
(732) 449-7717
Fax: (732) 449-7736
info@coatesengine.com
www.coatesengine.com ~ www.mostadvancedengine.com

COMPLIANCE
AND
RESEARCH
SERVICES, INC.

1701 West Front Street Plainfield NJ 07063
PHONE (908) 561-1824 • FAX (908) 755-5893

August 24, 2006

Coates International, LTD
2100 Highway 34
Wall, NJ 07719-9738

Re: Nonroad Engine Certification

Dear Mr. Coates,

In regards to your current engine project, a normally aspirated 14.0 liter inline 6 cylinder fueled by natural gas powering a stationary generator, we have determined that this engine application complies with the guidance of 40 CFR 1048 "CONTROL OF EMISSIONS FROM NEW, LARGE NONROAD SPARK-IGNITION ENGINES " (Title 40 of the Code of Federal Regulations Part 1048) (http://www.access.gpo.gov/nara/cfr/waisidx_05/40cfr1048_05.htm).

As per 40 CFR 1048.5 (d), as defined in 40 CFR 1048.801[1], your stationary engines are in compliance with this part. You are further obligated to comply with 40 CFR 1048.20[2] (Labeling requirements) and prohibitions of 40 CFR 1068.101 restrict the use of a stationary engine.

Regards,

Mark Timko
President

[1] See attachment 1
[2] See attachment 2

Coates International, Ltd.
August 17, 2006

Run Test: 855 ci., Natural Gas Powered Electric Generator

Run time: 27 minutes

Fuel: Natural Gas (New Jersey Power)
Intermittent injection, as programmed, diesel fuel (trace only)

Meter reading at start: 0003465
at end: 0003514.5

Gas consumed: 49.5 pulses per meter (each pulse equals 2.5 cu. ft)
123.75 cubic ft. used.

Engine performance:	Horse power:	134
	Torque:	485 ft lb.
	Speed:	1,450 rpm
	Kw:	100

4.58333 cu ft. per minute, at 1440 minutes per day, fuel consumed over 24 hours is estimated to be 6,600 standard cubic feet ("scf") to produce 2.4 mega watts.

Each mega watt uses 2,750 scf of natural gas, only trace amount of diesel fuel or an estimated cost of $ 16.50 per mega watt. (gas at $6.00/mmbtu) $6 X 2.750

COATES SPHERICAL ROTARY VALVE CNG ENGINE GENERATOR
COMPLIANCE AND RESEARCH SERVICE

Test Dte	1/3/2003						
Lab Fact							
Inlet Res	0	" H20	minimum/open				
Exh Res	0	" H20	minimum/open	particulate flow time	0	secs	

FUEL
C.N.G.

Weighted Grams per Hour

	NMHC	C0	CO2	Nox	No	Part	BHP
Poppet Valve Engine Minimum Allowable Emissions – Constant Speed Engines	0.00	110.78	108397	484.92	0.00	0	41.27

Weighted Grams per Brake Horsepower Hour

	NMHC	C0	CO2	Nox	No	Part
CSRV Engine Test Under Full Load – Constant Speed Engines	0.00	2.68	2626.5	11.75	0.00	0.00

CARB LIMITS 2003

	NMHC	C0	CO2	Nox	No	Part
Constant Speed Engines	4.9	3.7		4.9		0.22

Note: The limit for HC and NOX is a combined limit for all non-handheld engines!
Note: NO was not collected
Note: Particulates were not collected (for diesel only)
Note: NMHC is THC minus CH4
Note: Fuel flow mass conversion equation is FT3/min * 60min/hr * 0.04383 lb/ft3
Note: Density of CNG is 0.04383 lb/ft3
Note: Customer fuel flow meter is uncalibrated!

EGSA

Electrical Generating Systems Association

This certificate hereby signifies that

COATES INTERNATIONAL LTD.

is a member in good standing of the Electrical Generating Systems Association
and fully subscribes to its Bylaws and Code of Ethics

Presented on

August 1, 2006

Dale Stemp, EGSA President

Gary Kidwell, EGSA President-Elect

Warner Bauer, EGSA Vice President

Greg Linton, EGSA Secretary-Treasurer

WELL TO WIRE ENERGY INC.

Nov 10, 07

Coates International, Ltd.
2100 Highway 34 & Ridgewood Road,
Wall Township, N.J. 07719-9738

Attn: George Coates

Dear George:

This letter is to confirm the reaffirmation of the bench testing that was conducted by myself and by our Business Development Manager, Mr. Leo Perry within the Coates International, Ltd's headquarters at Wall Township, New Jersey on the 855 cubic inch CSRV engine. The following table (Attachment # 1) outlines the various measured performance and fuel consumption characteristics for the 855 in^3, In-Line CSRV Natural Gas fired engine that will be used in the future electrical power generation systems.

I am extremely satisfied with the smoothness, the flawless operation, the very low energy use and the initial power output. It should be noted that that energy use was measured at 27.5 to 30.4 % less than what we presently experience with alternate engines. We are eagerly looking forward to you being able to ship at least two of these power plants within the next two to three weeks, as we would like to start filling orders within the next three months. With these successful results, our five-year business plan will now proceed forward.

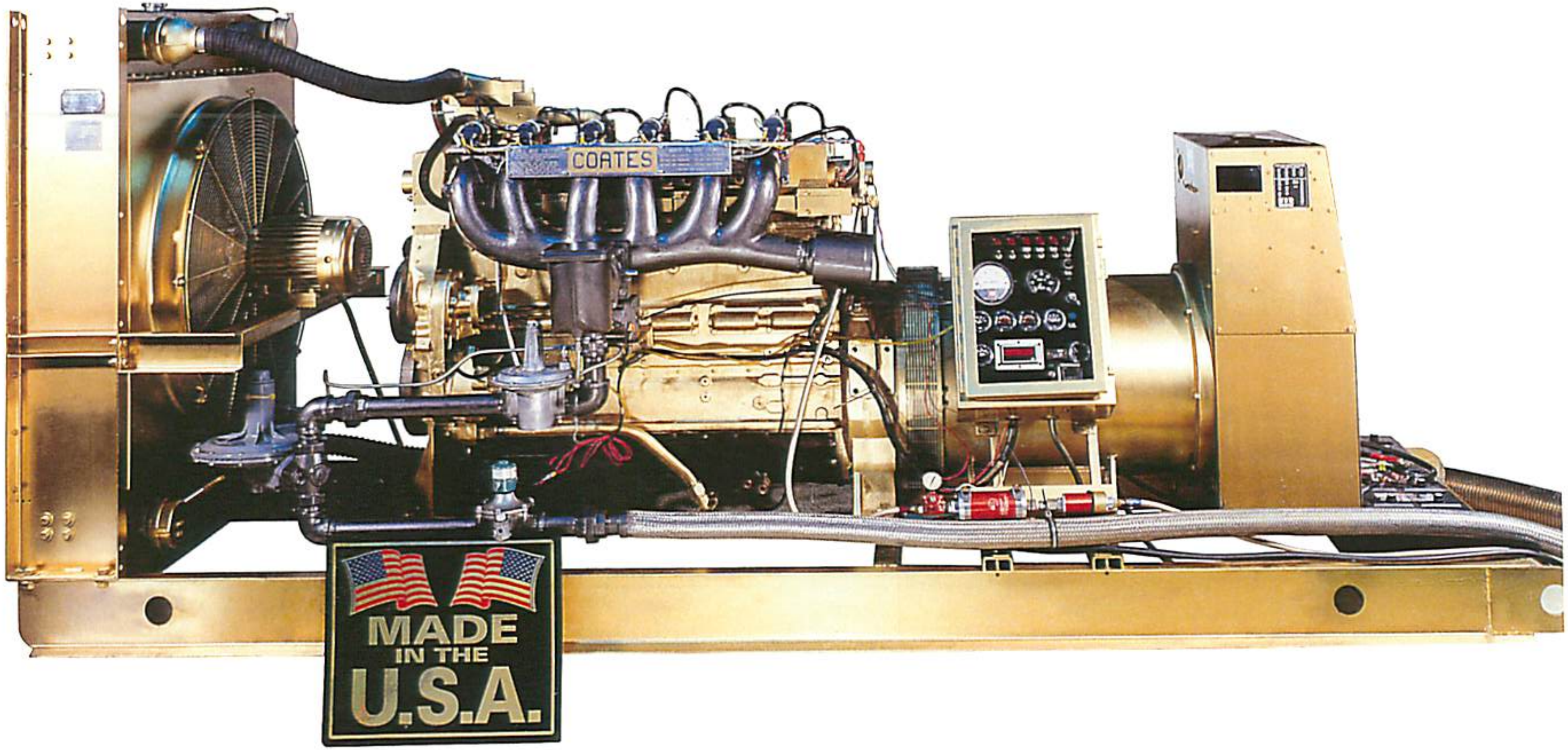
Best of Regards,
Sincerely,

Bryan Campbell, P. Eng.,
President,
Well to Wire Energy Inc.

MEASURED BENCH TEST PERFORMANCE of the 855 in3, In-Line, 4 Cycle CSRV NATURAL GAS ENGINE

ENGINE MAKE	SIZE (in^3)	ENGINE SPEED (rpm)	# of GANGED ENGINES	POWER OUTPUT (kw/h)	NATURAL GAS USE (scfpd)	ENERGY USE (btu/kW)	ENERGY USE (% improvement)
Field Measured Major Supplier**	496	1,815	1	75	27,000	14,250	0.00%
COATES***	855 10-Nov-07	1,700	1	115	28,800	10,330	27.51%

** where the Lower Heating Value (LHV) of the sweet Natural Gas = 950 btu/scf
*** where the Lower Heating Value (LHV) of the sweet Natural Gas = 990 btu/scf



COATES NATURAL GAS CSRV ELECTRICAL POWER INDUSTRIAL GENERATOR
Specifically designed for the oil and gas industry

COATES INTERNATIONAL, LTD.
COATES ENTERPRISES, LTD.
COATES PRECISION ENGINEERING, LTD.
COATES AUTOMOTIVE, LTD.
COATES ENGINE MANUFACTURING, LTD.
COATES TECHNOLOGIES, LTD.

COATES INTERNATIONAL EURO. DIV. LTD., LONDON, UK

COATES INTERNATIONAL, LTD. CALGARY, ALBERTA, CANADA

HORSE POWER AND TORQUE TESTS ON A FORD 351 WINDSOR ENGINE

This test shows the CSRV producing almost twice the H.P. and more than twice the torque at 3,200 R.P.M.s.

'00 HIGHWAY 34 & RIDGEWOOD ROAD
ALL TOWNSHIP, N.J. 07719-9738 USA
PHONE: 732-449-7717
FAX: 732-449-0764 MAIN
FAX: 732-282-2102 BILLING
FAX: 732-449-7736 C.E.O.
WEBSITE: www.coatesengine.com

Ford Motor Co.

General Engine Specifications

Year	Engine No. Cyl Displacement (cu in.)	Carburetor Type	Advertised Horsepower @ rpm	Advertised Torque @ rpm (ft. lbs.)	Bore x Stroke (in.)	Advertised Compression Ratio	Oil Pressure @ 2000 rpm (psi)
1966–67	6-170	1 bbl	105 @ 4400	158 @ 2400	3.500 x 2.940	9.1:1	45
	8-289	2 bbl	200 @ 4400	282 @ 2400	4.000 x 2.870	9.3:1	35–55
1968	6-170	1 bbl	100 @ 4000	158 @ 2200	3.500 x 2.940	8.7:1	35–60
	8-289	2 bbl	195 @ 4600	288 @ 2600	4.000 x 2.870	8.7:1	35–60
1969	6-170	1 bbl	100 @ 4000	156 @ 2200	3.500 x 2.940	8.7:1	35–60
	8-302	2 bbl	205 @ 4600	300 @ 2600	4.000 x 3.000	8.6:1	35–60
1970	6-170	1 bbl	100 @ 4000	156 @ 2200	3.500 x 2.940	8.7:1	35–60
	8-302	2 bbl	205 @ 4600	300 @ 2600	4.000 x 3.000	8.6:1	35–60
1971	6-170	1 bbl	100 @ 4200	148 @ 2600	3.500 x 2.940	8.7:1	35–60
	8-302	2 bbl	205 @ 4600	300 @ 2600	4.000 x 3.000	8.6:1	35–60
1972	6-170	1 bbl	82 @ 4400	129 @ 1800	3.500 x 2.940	8.3:1	35–60
	8-302	2 bbl	141 @ 4000	242 @ 2000	4.000 x 3.000	8.5:1	35–60
1973	6-200	1 bbl	84 @ 3600	151 @ 1600	3.683 x 3.126	8.3:1	35–55
	8-302	2 bbl	138 @ 4200	234 @ 2200	4.000 x 3.000	8.3:1	40–60
1974	6-200	1 bbl	84 @ 3600	151 @ 1800	3.683 x 3.126	8.3:1	35–55
	8-302	2 bbl	140 @ 3800	230 @ 2600	4.000 x 3.000	8.0:1	40–60
1975	8-302	2 bbl	140 @ 3800	230 @ 2600	4.000 x 3.000	8.0:1	40–60
1976	8-302	2 bbl	134 @ 3600	242 @ 2000	4.000 x 3.000	8.0:1	40–60
1977	8-302	2 bbl	134 @ 3600	242 @ 2000	4.000 x 3.000	8.0:1	40–60
1978–79	8-351M	2 bbl	132 @ 3600 ①	242 @ 1600 ②	4.00 x 3.50	8.0:1	50–75
	8-400	2 bbl	149 @ 3200	300 @ 1400	4.00 x 4.00	8.0:1	50–75
1980–81	6-300	1 bbl	117 @ 3000	243 @ 1600	4.00 x 3.98	8.9:1	40–60
	8-302	2 bbl	135 @ 3400	243 @ 2000	4.00 x 3.00	8.4:1	40–60
	8-351W	2 bbl	132 @ 3600	263 @ 1800	4.00 x 3.50	8.0:1	40–65
1982	6-300	1 bbl	123 @ 3000	257 @ 1600	4.00 x 3.98	8.9:1	40–60
	8-302	2 bbl	132 @ 3400	232 @ 1800	4.00 x 3.00	8.4:1	40–60
	8-351W	2 bbl	139 @ 3600	278 @ 1800	4.00 x 3.50	8.3:1	40–65
1983–86	6-300	1 bbl	120 @ 3200	251 @ 1600	4.00 x 3.98	8.4:1	40–60
	8-302	2 bbl	139 @ 3400	250 @ 2000	4.00 x 3.00	8.4:1	40–60
	8-351W	2 bbl	139 @ 3200	278 @ 1400	4.00 x 3.50	8.3:1	40–65
	8-351HO	4 bbl	210 @ 4000	305 @ 2800	4.00 x 3.50	8.3:1	40–65

① Auto trans: 137 @ 3400
② Auto trans: 257 @ 1800

ter pump and intake manifold. Disconnect the water temperature sending unit wire from the sending unit.

10. Remove the flywheel housing to engine upper bolts.

11. Disconnect the primary wire from the ignition coil. Remove the wire harness from the left rocker arm cover and position the wires out of the way. Disconnect the ground strap from the block.

12. Raise the front of the vehicle. Disconnect the starter cable from the starter. Remove the starter and dust seal.

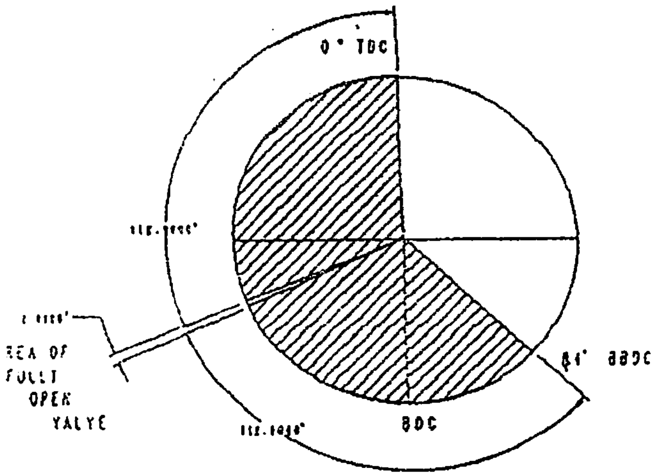
13. Disconnect the muffler inlet pipes from

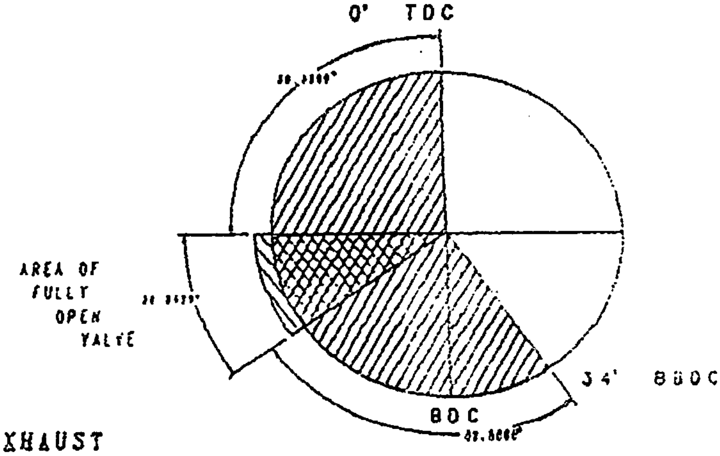
RPM BAND		TORQUE Ft-Lbs	POWER CHP	BSFC #/HP-Hr	OIL/WAT deg F		#1 EXH deg .F	Air Flow	Avrg Time
685		150.6	19.6	.000	96	108	135	.000	2.6
800		Too Fast - No Data							
900		Too Fast - No Data							
1000		Too Fast - No Data							
1100		Too Fast - No Data							
1200		Too Fast - No Data							
1300		Too Fast - No Data							
1400		Too Fast - No Data							
1500		Too Fast - No Data							
1600		Too Fast - No Data							
1700		Too Fast - No Data							
1761	*	181.5	60.8	.00	96	108	140	.000	.3
1900		Too Fast - No Data							
2000		Too Fast - No Data							
2100		Too Fast - No Data							
2218	*	127.9	54.1	.00	96	108	116	.000	.3
2300		Too Fast - No Data							
400		Too Fast - No Data							
2500		Too Fast - No Data							
2600		Too Fast - No Data							
2700		Too Fast - No Data							
2800		Too Fast - No Data							
2913		494.1	274.1	.000	95	105	167	.000	.6
3000		482.3	275.5	.000	95	105	161	.000	1.2
3100	*	481.0	283.9	.00	95	103	185	.000	.4
> 3200		460.4	280.6	.000	95	104	215	.000	.6
3300	*	434.6	272.9	.00	95	104	222	.000	.4
3442	*	482.6	316.3	.00	95	102	157	.000	.2
3500		Too Fast - No Data							
3567	*	477.7	324.5	.00	95	102	220	.000	.2
3704	*	471.2	332.3	.00	95	102	181	.000	.2
3800		Too Fast - No Data							
3900		Too Fast - No Data							
4000		Too Fast - No Data							
4100		Too Fast - No Data							
4200		Too Fast - No Data							
4300		Too Fast - No Data							
4400		Too Fast - No Data							
4500		Too Fast - No Data							
4600		Too Fast - No Data							
4700		Too Fast - No Data							
4800		Too Fast - No Data							
4900		Too Fast - No Data							
5000		Too Fast - No Data							
5100		Too Fast - No Data							

Windsor 351 with Coates Spherical Rotary Valv installed

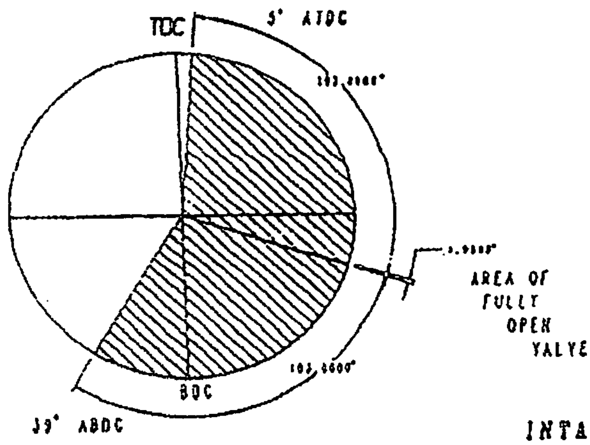
STANDARD POPPET VALVES

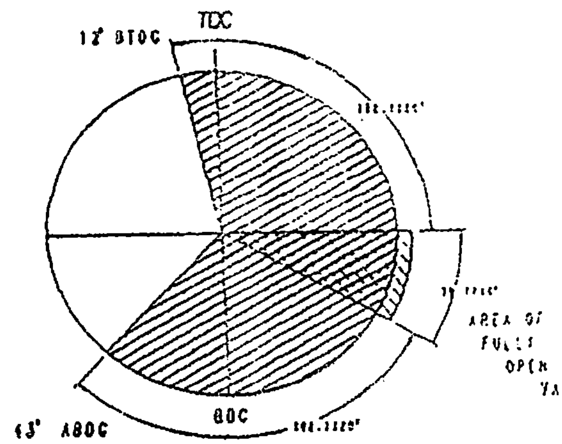
COATES ROTARY VALVES





EXHAUST EVENTS





INTAKE EVENTS

CRANKSHAFT EVENT TIMING: FORD STANDARD 351 WINDSOR
FORD 351 WINDSOR VALVE TIMING USING STANDARD FORD CAM PERFORMANCE SPECIFICATIONS
(NET EFFECTIVE TIMING "LIFT ABOVE 0.040")
INTAKE EVENTS: OPEN 5° ATDC, CLOSE 39° ABDC
EXHAUST EVENTS: OPEN 44° BBDC, CLOSE 0° TDC

INTAKE DURATION: 214°
EXHAUST DURATION: 224°

** APPROXIMATION OF FLAT TAPPET CAM PROFILE-
AS MEASURE FROM ACTUAL STOCK CAMSHAFT

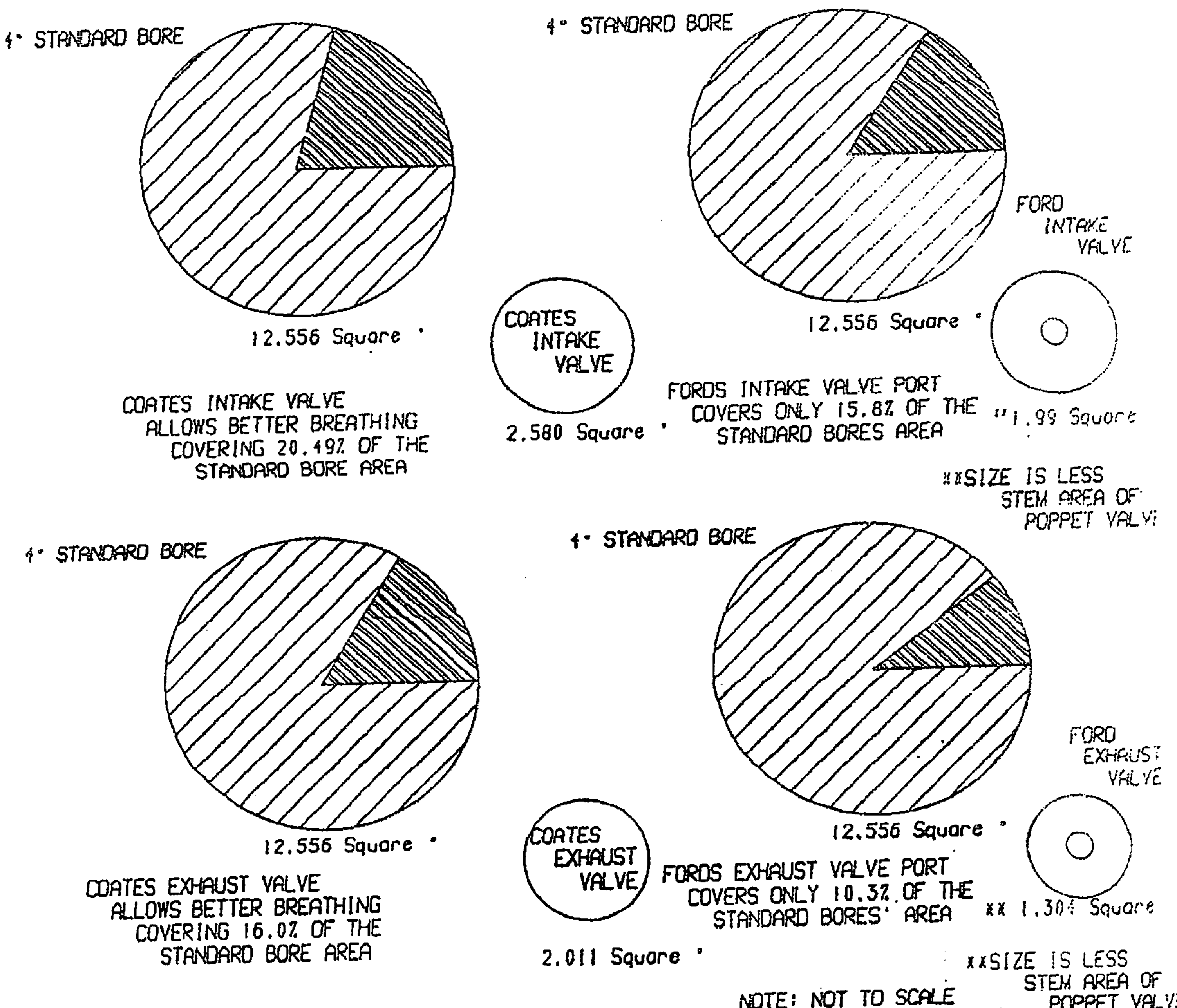
CRANKSHAFT EVENT TIMING: COATES SPHERICAL VALVE SYSTEM
COATES SPHERE TIMING USING LATEST PERFORMANCE SPECIFICATIONS
(NET EFFECTIVE TIMING)
INTAKE EVENTS: OPEN 12° BTDC, CLOSE 43° ABDC
EXHAUST EVENTS: OPEN 34° BBDC, CLOSE 0° -TDC

INTAKE DURATION: 235°
EXHAUST DURATION: 21?°

COATES PRECISION ENGINEERING LTD
DRAWING UPDATED:

SPHERICAL ROTARY VALVES

STANDARD POPPET VALVES



COATES PRECISION ENGINEERING LTD

TOLERANCES	DRAWING UPDATED:	
DECIMAL +/-.003	MATERIAL REF	SCALE
FRACTIONAL +/-1/64	TITLE FORD V8 PROJECT COATES vs STANDARD VALVE COMPARISON	
ANGULAR	DATE	DRAWING NUMBER VALVE COMP

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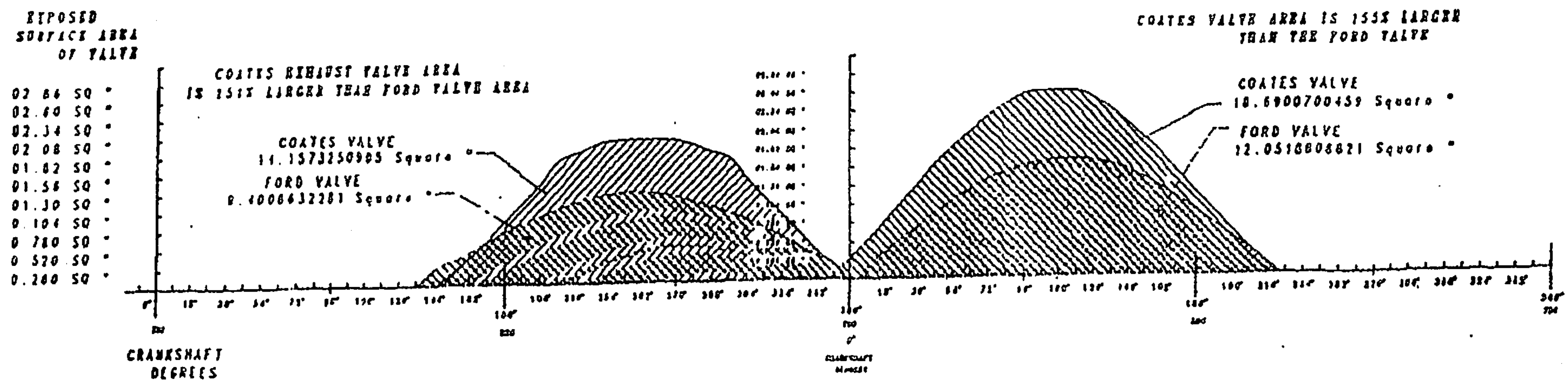
COATES ROTARY VALVE/ CONVENTIONAL POPPET VALVE AREA COMPARISON



LEGEND

COATES INTAKE VALVE ———

COATES EXHAUST VALVE ———

FORD INTAKE VALVE - - - - -

FORD EXHAUST VALVE — - —

FORD VALVE TIMING:
INTAKE: OPENS 6° ATDC CLOSES 30° ABDC
EXHAUST: OPENS 46° BBDC CLOSES 0°-TDC

INTAKE DURATION 214°
EXHAUST DURATION 224°

NOTE TIMING CURVE WAS TAKEN DIRECTLY FROM A STANDARD FORD 351 WINDSOR CAMSHAFT AND A 1.6:1 ROCKER RATIO WAS UTILIZED TO DETERMINE THE SURFACE AREA OF THE CYLINDER CREATED BY THE OPENING POPPET VALVE

THIS CYLINDRICAL MEASURE DOES NOT TAKE INTO ACCOUNT THE RESTRICTION CAUSED BY THE HEAD OF THE POPPET VALVE TO FLOW OR TO THE LACK OF VOLUME CAUSED BY THE VALVE STEM IN THE PORT ENTRANCE TO THE CYLINDER

COATES VALVE TIMING:
INTAKE: OPENS 12° BTDC CLOSES 40° ABDC
EXHAUST: OPENS 34° BBDC CLOSES 0° TDC

INTAKE DURATION 235°
EXHAUST DURATION 214°

NOTE COATES VALVE IS FULLY OPEN TO CYLINDER WITH NO VALVE HEAD OR VALVE STEM TO INTERFERE WITH AIRFLOW
SURFACE AREA IS CALCULATED FROM THE DIAMETER OF THE CIRCLE CREATED BY THE OPEN PART OF THE VALVE SEAL
(THE SMALLEST AREA/ GREATEST RESTRICTION IN OUR SYSTEM) FOR COMPARISON TO A POPPET VALVE SYSTEM

NOTE: NOT TO SCALE

COATES PRECISION ENGINEERING LTD

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL VEHICLE AND FUEL EMISSIONS LABORATORY
2565 PLYMOUTH ROAD
ANN ARBOR. MICHIGAN 48105

OFFICE OF AIR AND RADIATION/OFFICE OF MOBILE SOURCES

EPA Motor Vehicle Aftermarket Retrofit Device Evaluation Program

The Environmental Protection Agency (EPA) conducts a program to evaluate the effects of fully developed aftermarket devices on vehicle emissions and fuel economy. Participation in this program by manufacturers of devices is voluntary. EPA evaluations of engines, retrofit devices, emission control devices, and related products are conducted for the purpose of keeping policy makers, technical personnel in government and industry, and the general public, abreast of developments in the field of automotive fuel economy and pollutant emission control. Aftermarket fuel additives are also included in the evaluation program and are hereafter also referred to as devices; oil additives, however, are not evaluated in this program. Aftermarket fuel additive manufacturers are required to register their products with the EPA Fuels and Energy Division (202-933-9020). It should be noted that many of the fuel line devices and liquids sold and associated with vapor bleed devices may be considered additives for the purpose of registration.

Because evaluations are intended to increase public knowledge, all data reported as a result of EPA testing become public information. However, EPA findings do not constitute approval, endorsement or certification of these additives, devices or systems.

EPA evaluates devices under two authorities: 42 U.S.C. 7525 (Section 206(a)(2) of the Clean Air Act) and 49 U.S.C. 32918 (formerly codified as 15 U.S.C. 2011, Section 511 of the Motor Vehicle Information and Cost Savings Act). EPA has established a single evaluation and test program for these two authorizations.

This document contains information to help apply for EPA device evaluation. It outlines the application format, explains EPA test policy, and describes test sequences. Applicable regulations are found in 40 CFR (Code of Federal Regulations) Parts 79, 86, 600 and 610.

EPA works directly with product manufacturers to produce a fair evaluation. (Other parties, such as distributors, retailers and importers of devices, must obtain written authorization from the manufacturer to act as their representative.)

EPA will not conduct an evaluation without a completed application. Applications must contain test data collected by an independent laboratory demonstrating significant emission reduction and/or fuel economy benefits from using the device. The applicant may then proceed with confirmatory testing by EPA at its laboratory. Costs for independent and EPA testing must be paid by applicants.

EPA provides technical assistance in designing the test program to be performed at an independent laboratory. For confirmatory testing performed by EPA at its laboratory, EPA develops the test program in coordination with the applicant, analyzes the test results, and writes an official report summarizing the results in the Federal Register. Reports are available to the general public through the National Technical Information Service (NTIS), the Federal Trade Commission (FTC) and elsewhere. All tested devices are recorded in the "EPA Listing of Fuel Economy Devices" on page 26 of this document.

EPA recommends that device manufacturers consider the following factors before entering the evaluation program:

Test Laboratory Independence - 40 CFR 610.11(a)(20) of Federal Regulations states that test laboratories "shall have no financial interests in the outcome of these tests other than a fee charged for each test performed", and that "independence of the testing agent" will be considered in determining the validity of manufacturer furnished test data. Applicants must confirm that the selected laboratory has no vested financial interest in the outcome of the tests prior to the start of testing. (For convenience, a list of laboratories is provided on page 25.)

Minimum Test Requirements - Although some devices may require complex test plans, our minimum test requires two vehicles with replicate test sequences in each configuration for each vehicle. The vehicles should be selected from different manufacturers and should be representative of the largest selling engine/transmission combinations in the United States. Each vehicle will be set to its manufacturer's tune-up specifications for the baseline tests. Baseline emissions and fuel economy should be near the levels at which the vehicles were certified.

Test sequences are conducted in "back-to-back" fashion. Minimum testing requirements are as follows: (a) If device installation does not involve adjustment of vehicle manufacturer specifications (e.g., timing, fuel-air mixture, choke or idle speed, etc.), then conduct duplicate tests with the vehicle in baseline condition, and duplicate tests with the device installed with no vehicle adjustments between tests. (b) If installation of the device also involves adjustments (e.g., timing, fuel-air mixture, choke or idle speed, etc.), then conduct duplicate tests with the vehicle in baseline condition, duplicate tests with the adjustments and the device installed, and then conduct duplicate tests with only these adjustments. If mileage accumulation is necessary to realize the full benefit, or to determine whether the vehicle meets emission standards, the same number of miles that were accumulated before the tests with the device must also be accumulated before baseline tests without the device. In addition, the method of mileage accumulation should be kept constant.

Confirmation tests and/or evaluations performed by EPA will include the complete Federal Test Procedure (FTP). **The FTP is the only valid test used to evaluate devices for emission effects.** As a final requirement, the personnel of the independent laboratory selected for screening tests should perform every element of the applicant's test plan including preparation of the test vehicle, adjustment of parameters, and installation of the device.

Submission of Data - Section 610.16(b)(5) of Federal Regulations requires all test data obtained from the independent laboratories in support of the application be submitted to EPA including any results declared void or invalid by the laboratory. We also ask that, prior to the screening tests, applicants provide EPA with the name of the laboratory, test date schedule, and tests to be conducted. Applicants should allow EPA to contact the laboratory during testing, and allow them to directly answer any EPA questions about the test program.

Test Costs - Independent laboratory cost for the minimum test plan described above is estimated at $6000 per vehicle tested. Additions to the minimum test plan, such as providing test vehicles, mileage accumulation, parameter adjustment, or additional testing, etc. may increase costs. Applicants should contact the laboratories for actual costs.

Test Results - EPA confirmation tests will only be performed with devices demonstrating statistically significant fuel economy or emissions benefits based on the independent laboratory screening test data. EPA has established guidelines which help determine the size of the test fleet and whether test results with subject device should be considered encouraging. These values are chosen to assure that a real difference in emissions or fuel economy exists and do not reflect random variability of results. The table below presents the minimum number of cars needed to test varying degrees of fuel economy improvement assuming a typical amount of variability in fuel economy measurement. For a minimum test plan conducted on a fleet of two cars, the average improvement should be at least 6%. If at least a 6% difference in average fuel economy can be shown, one may usually conclude with a reasonable degree of confidence that a real improvement exists. Analysis by EPA for potential fuel economy effects will be based on actual test results (and test variability), not these guidelines.

Similarly, if one expects a nominal 3% improvement in fuel economy, a fleet of 5 vehicles would be appropriate for testing. Test results displaying a significant increase in emission levels are reason for concern.

Guidelines For Minimum Fuel Economy Improvements Versus Size of Test Fleet

Fleet Size	Average Improvement Required
2	6%
3	5%
4	4%
5	3%
10	2%

A similar table can be developed to evaluate the emissions effect of a device. However, because the variability in vehicle emissions is much greater than for fuel economy, a larger number of vehicles is required. The analysis by EPA for potential emissions effects will be based on test results.

Guidelines For Minimum Emission Improvements (Reduction) Vs. Size of Test Fleet

HC and NOx		CO	
Fleet Size	Average Improvement	Fleet Size	Average Improvement
2	20%	2	20%
2	15%	3	15%
3	10%	7	10%
10	5%	20	5%

Applications will be reviewed for compliance with the format beginning on page 8. Submitted data and information labeled confidential or proprietary must be justified on a case-by-case basis by the applicant. EPA can not treat test results, including those conducted by independent or other laboratories, as confidential since applicable law (42 U.S.C. 7525 and 49 U.S.C. 32918) requires disclosure of such information. (EPA may not perform an evaluation of a device if it judges it cannot develop a technically sound final report because an applicant declared information was confidential.)

EPA will request further information for incomplete applications. If confirmation tests are required, EPA will advise applicants of costs and provide applicants with the opportunity to review the test plan. Once testing is completed, an evaluation report will be written on the basis of independent test data submitted, EPA test data, and EPA engineering analysis.

EPA intends to process applications promptly and has established a goal of twelve weeks from the acceptance of an application to the announcement of our report. The attainment of this objective requires very precise scheduling, and is dependent on the applicant's prompt response to requests for further information. Failure to respond in a timely manner will delay the process. If the applicant does not complete the independent lab tests and submit data to EPA within a half year after EPA develops the test program, it will be considered a withdrawal from the program. A flow chart outlining the steps in the evaluation process is found on page 6.

In October 1994, EPA issued a final rule setting interim and final standards for detergent use in gasoline. To maintain the integrity of the rule, EPA requires that applicants for aftermarket fuel additive evaluation must provide information demonstrating that the additive has no adverse effect on the deposit control properties of gasoline. EPA will not accept applications for fuel additive evaluation program without this information.

Applicants are cautioned that the installation of an aftermarket retrofit device, or use of a fuel additive, raises the issue of tampering liability and the potential for civil fines of up to $25,000 (see page 23). In the past, one approach for a device or additive manufacturer to address the tampering issue was to demonstrate by durability, aging, and FTP tests that the device did not increase vehicle emissions over its useful life. However, beginning with

1994 models, vehicle manufacturers must provide an onboard emission diagnostic capability for their vehicles. As a consequence, applicants must insure that, besides not adversely affecting vehicle emissions, their device or additive must not render inoperative, degrade, or defeat the operation of vehicle onboard diagnostic systems.

EPA trusts that this information will aid in the preparation of an acceptable application for evaluation of a device. The Device Evaluation Team will be the contact in the application process and any subsequent EPA evaluation.

A

…OATES ENTERPRISES, LTD.
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…OATES PRECISION ENGINEERING, LTD.
…OATES AUTOMOTIVE, LTD.
…OATES ENGINE MANUFACTURING, LTD.
…OATES TECHNOLOGIES, LTD., USA

…OATES INTERNATIONAL EURO, DIV.
…D., LONDON, UK

This document shows an A. & B. comparison test between two Mercedes cars with the same size engines A. has the Coates Spherical Rotary Valves System installed and B. has a standard poppet valve system. On the dynamometer test sheet A. as you will see six test on the C.S.R.V engine, and B. dynamometer test sheet shows four test with the standard poppet valve engine, on all test perimeters (HC) Hydro Carbons, (CO) Carbon Monoxide, (NOX) Nitrous Oxides, and (Co_2). The Coates Spherical Rotary Valve Engine is showing on each test less than half the emissions that the standard poppet valve engine shows.

…J HIGHWAY 34 & RIDGEWOOD ROAD
…VALL TOWNSHIP, N.J. 07719-9738 USA
…32-449-7717
…AX: 732-449-7736

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COATES TECHNOLOGIES, LTD.

COATES INTERNATIONAL EURO. DIV. LTD.,
LONDON, UK

COATES INTERNATIONAL, LTD.
CALGARY, ALBERTA, CANADA

CSRV ENGINE TESTS

When CIL started testing its CSRV Engines in the early 90's we contacted the EPA to find out where we could have engines and vehicles independently tested. The EPA faxed this list to us. As you can see there is only one EPA recognized testing lab in New Jersey and that is Compliance and Research Service. This is where we have most of our independent EPA tests carried out.

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PHONE: 732-449-7717
FAX: 732-449-0764 MAIN
FAX: 732-282-2102 BILLING
FAX: 732-449-7736 C.E.O.
WEBSITE: www.coatesengine.com

COMPLIANCE
AND
RESEARCH
SERVICES, INC.

2 Garfield Street • Linden • New Jersey 07036
Phone (908) 925-5533 • Fax (908) 925-8281

April 28, 1995

To whom It May Concern,

Here at Compliance and Research Services, Inc., we are a USEPA and California Air Resource Board recognized emission testing laboratory. We follow all specified procedures as stated in the United States Code of Federal Regulations Title 40 part 86. Enclosed you will find a list of our testing capabilities as well as our current equipment list.

Enclosed you will also find some test data. These tests compare a Coates Spherical Rotary Valve engine with a Mercedes OEM version. The tests that were performed were a Steady State and a HOT 505 test on each vehicle. The report number for the HOT 505 test on the Coates engine is CR02745. The report number for the HOT 505 test on the OEM version is CR02769. As you can see, the data shows reduction in the Rotary valve emissions. We feel that this is very good for an experimental engine.

We are currently working on a Coates 302 Ford based engine that is installed in a 1986 Ford Mustang. This motor is not limited to the 1986 model year, and can be installed in any chassis. At this time, this vehicle is currently under development and test are continuing.

Regards,

Mark Timko

Mark Timko
President
Compliance and Research Services, Inc.

A

ROTARY VALVE VERSION. A.

Compliance & Research Services
Emissions Test Controller 386H

TEST NUMBER	CR02745	DATE	02-27-1995		
VEHICLE REF	coates-2	A.C.	no a/c w/a p	FUEL TYPE	INDOLENE
V.I.N.	wdb22602212074483	ENGINE FAM.	coates mrk-2	DENSITY	16.33
OPERATOR	m.timko	EVAP.FAM.	no egr	SPECIF. CO2	13.4
DRIVER	b.depalma			Gr.C/gal.	2424
MAKE	mercedes	TEST TYPE	HOT505 .LA4	FUEL Fract.	.866
MODEL	280se	SHIFT FILE	AUTO .L_4	SP. GRAVITY	.743
YEAR	1985	INERTIA WGT	3625	N.H.V.	18480
TANK CAP		ACTUAL HP	8.4	WT FACTOR	1
ODOMETER	85442 miles	INDIC. HP	6.7	WT FACTOR	0
TRANS.	auto	ALT. HP arb	7	WT FACTOR	0
REMARKS					
START TIME	16:39:02	END TIME	16:47:30		

#	EVENT	MILES	TIME	TIME of trace HOLD			TIME of trace ERROR		
1	crank	0.00	2.6	0.0	for	0.0	0.0	for	0.0
2	ph 1	3.60	505.0	0.0	for	0.0	0.0	for	0.0
3	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
4	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
5	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
6	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
7	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
8	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
9	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
10	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
11	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
12	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0

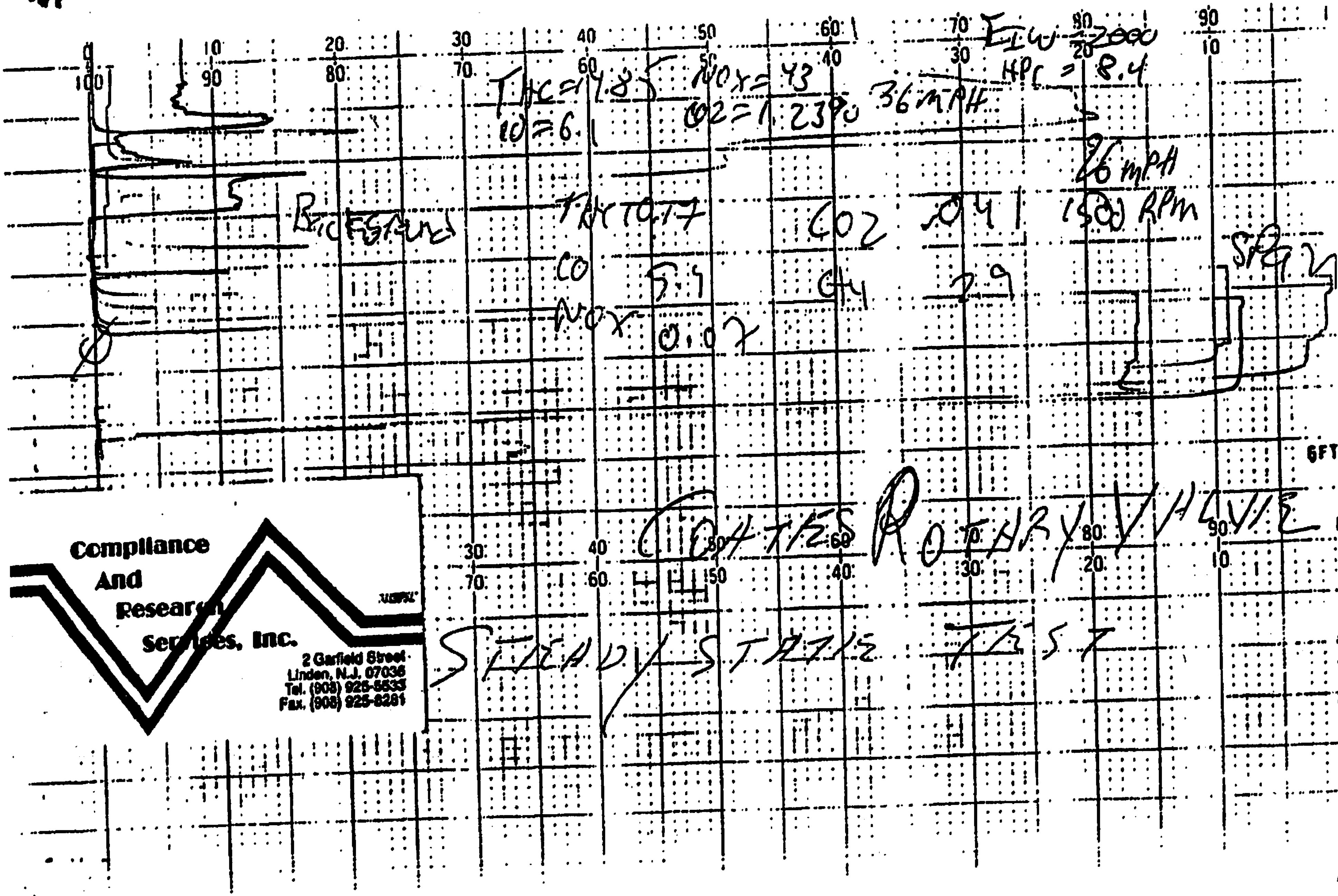
PHASE 1	THC	CO	NOx	CO2	NMHC				
SAMPLE	65.390	73.600	89.660	1.550	12.700	Tdry =	71.4	Twet=	52
AMBIENT	17.930	7.500	1.480	0.043	3.100	BARO.=	771.50	SEC =	507
GRAMS	2.308	6.299	11.035	2236.347	1.844	R-H =	21.96	VOL =	2852
GMS/MI	0.642	1.752	3.069	622.043	0.513	M.P.G.	16.17	DF =	8
GMS/KM	0.399	1.090	1.010	387.011	0.319	MPGnhv	16.24	MI =	3
						KM/Lit	6.01	KM =	5

****

WEIGHTED	THC	CO	NOx	CO2	NMHC	FUEL ECONOMY		NOxKf=	.80
GRAMS/MI	0.642	1.752	3.069	622.043	0.513	M.P.G.	16.17	NHVmpg	34
GRAMS/KM	0.399	1.090	1.010	387.010	0.319	KM/Lit	6.01	NHVkpl	6

****

Cartridge VOL. S 1 = 0.3002 A= 0.2964



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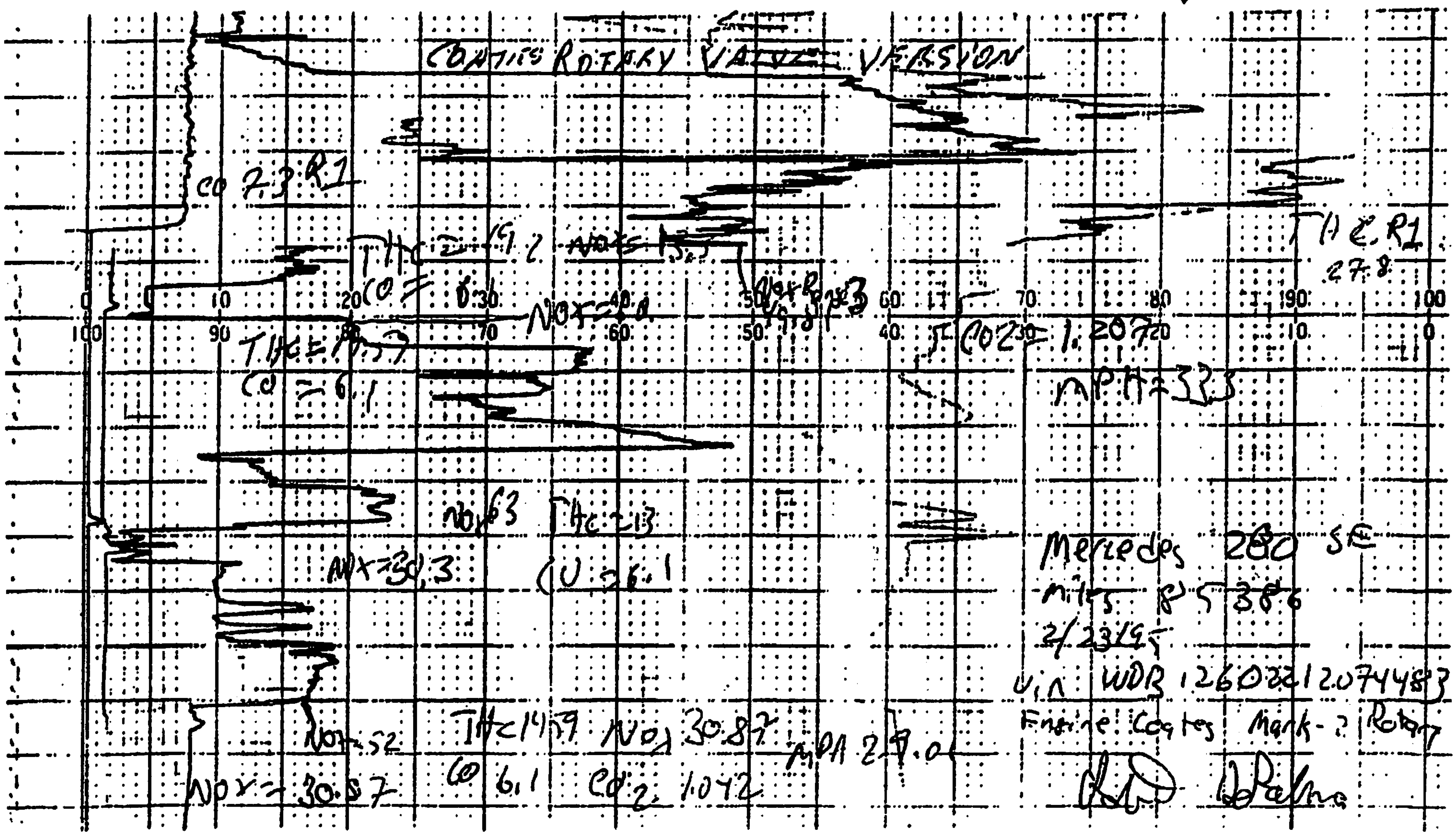


INTERNAL COMBUSTION

The nucleus of the atom is held together by an electromagnetic force. The electrons rotate around the nucleus at the speed of light, and are negatively charged.

When the fuel and air mixture of elements are compressed and forced together in a combined sealed space. As the pressure and heat reaches its detonation point the trillions of electrons jump from one nucleus to another, this is called a (quantum leap). This also happens at the speed of light, creating tremendous force; one of the by products is heat. Heat is a ray of tiny excited atoms that penetrate all other elements at various rates. It is invisible and cannot be seen under a microscope, but in a desert heat rays may be seen in the distance. Heat rays can be felt by just holding a hand close to a candle or fire. Fire is external combustion, so is any other explosion that is not sealed in a chamber.

HEAT RAYS

There are many types of rays:

- Light Rays
- Ultraviolet Rays
- Infrared Rays
- Microwave Rays
- Laser Rays
- Radioactive Rays
- Solar Rays
- Sun Rays
- Radio Wave Rays
- Xrays

There are many more.

The most powerful constant force on earth and in the universe is gravity. You cannot see it, but we can feel its pull.

After the internal combustion, or I should say, after the internal instantaneous atomic detonation reaction, the elements have now released the heat-energy contained in the fuel mixture. These elements come to rest in a different form, if the fuel was gasoline = C_8H_{15} (Air 21% Oxygen (0) and 78% Nitrogen (N_2) Others 1%) (Air to Fuel Ratio 14.7 to 1). Stoechmetric or Lomda 1, which is 14.7 to 1, depending on the air density.

The transformation of the homogeneous charge providing that the air and fuel mixture supplied to the engine created a stoechmetric combustion, that transforms into different elements such as:

- (HC) Hydrocarbon (11.95 PPM)

MOST COMMONLY USED ELEMENTS OR FUELS IN COMBUSTION ENGINES ARE:

FUELS	FORMULA	HHV	STOICHMETRIC AIRFUEL RATIO	STOICHIOMETRIC FUEL-AIR
Gasoline	$C_8 H_{15}$	47.300	14.6	0.06849
Diesel	$C_{12.5} H_{22.2}$	44.800	14.5	0.06897
Propane	$C_3 H_8$	50.300	15.6	0.06410
Methanol	$CH_3 OH$	22.700	6.5	0.15385
Methane	CH_4	55.500	17.2	0.05814
Hydrogen	H_2	141.600	27.2	0.03677
Octaine	C_8H_{18}	47.900	15.1	0.06623

HEAT-ENERGY

Atoms, particles, protons, neutrons, electrons, and molecules together in different combinations make up all of the known elements in the universe.

All these atoms are moving with electrons of different numbers rotating around each combination of the atom nucleus at the speed of light.

When gaseous elements of various atomic-nucleus combinations are forced together, for example, by a piston in a cylinder of a combustion engine, the piston moving up the cylinder starts compressing the gases forcing them together, causing the moving atoms to rub against each other creating atomic friction, at the speed of light causes the excitation of the atoms expanding exponentially, which is actuating heat-energy when the heat escalates to the detonation point of the homogeneous charge. Whether ignited by a spark or high compression, it creates an atomic reaction that causes the elements to explode or detonate, changing their atomic structure, releasing instantaneous heat-energy and ignition-expansion of the gaseous fuels, forcing the piston down the cylinder. This atomic reaction changes the composition and structure of the elements of the homogeneous charge, converting the energy contained in the fuel and air mixture into kinetic energy by forcing the piston down the cylinder bore, the connecting rod rotates the crankshaft and flywheel. The flywheel retains the energy in a centrifugal force, which assists the engine cycle to be repeated continuously. This means the engine is operating. Part of the kinetic energy is generally distributed from the flywheel to do work.

Heat levels are measured by the thermometric scale. A measurement unit equals Celsius degree 0° Kelvin = 273.15° C

THE INTERNAL COMBUSTION ENGINE

The Laws of Thermodynamics play a fundamental role in the design of internal combustion engines and their operation. It is possible to transform heat into other forms of energy and into mechanical work or force.

- Heat, Power, Energy, and Motion are all mutually convertible into each other.

- All forms and conversions in energy produced by heat, whether generated or in any other form have to be balanced to match the work externally performed, including the growing accumulation in energy internally, as a result of the escalation in temperature.

- All of the energy produced by an independent system remains constant regardless of changes that may occur in temperature.

- It is not possible to transfer heat from a colder body to a hotter body without assistance from another source.

- Regardless of the design of a power unit or engine, the mechanical work produced will only be a fraction of the heat and energy released to produce the net working force of the engine.

- Part of the operation and performance, power output, and economical thermal efficiency of an internal combustion engine depends in part on the behavior of the gases in relation to the constant Laws that were proven scientifically regarding the variation in temperature, volume and pressure, as well as their differential changing effects in relation to each other.

HEAT-ENERGY

Heat-Energy is the excitation of atoms and molecules of any and possibly all of the known elements; including radioactive materials, which we all know, contain enormous amounts of heat-energy but is extremely dangerous and the radioactive waste is almost impossible to dispose of.

Most of the energy we use today for transportation, heating, cooling, generation of electric power, etc. is obtained from coal, oil, gaseous and liquid elements.

EVERYTHING IN THE UNIVERSE IS A MATTER OF DYNAMIC BALANCE

Every element has a specific atomic weight and atomic composition or structure. I believe the universe will rejuvenate itself eternally and beyond our universe infinity, where other universes like ours may exist. What I mean by this is that nothing disappears; it only changes its form, and its position. All elements in the universe are made of atoms or particles. Atoms are constructed of much smaller particles, known as neutrons, protons, and electrons, of which millions of different compositions of combined atoms make up the particles, which are the molecules. Millions of different combinations and structures of these molecules make up all of the elements in our universe.

The entire universe is made up of approximately 88% Hydrogen, 11% Helium, and all other elements make up only 1%. Our sun is made up of approximately 93% Hydrogen and 5% Helium, and only 2% of other elements. On a comparative basis, the number of atoms for each million atoms of Hydrogen.

THE ELEMENTS IN OUR SUN AND THEIR RELATIVE ABUNDANCE

ELEMENTS	PROPORTIONS
HYDROGEN	1,000,000
HELIUM	63,000
OXYGEN	690
CARBON	410
NITROGEN	87
SILICONE	45
MAGNESIUM	40
NEON	37
IRON	32
SULFUR	16

Energy is accumulated and actuated or released, but it is not created. It does not disappear, it dissipates. It only changes the form in which it exists, but it is still there in some form forever.

THE INTERNAL COMBUSTION ENGINE

GEORGE J. COATES, E.E., M.E.

I am a research scientist in the design and development of power units and propulsion systems of numerous types, including gas turbines, steam turbines, pulse detonation rocket engines, internal combustion engines and more.

I am the inventor of the CSRV Engine, The Coates Spherical Rotary Valve Internal Combustion Engine, which I believe to be an extremely advanced and thermal efficient combustion engine.

When it comes to the design of internal combustion engines and their operating performance, the following items are fundamentally involved:

- Thermodynamics
- Co-Efficiency of Heat Expansion
- Volumetric Efficiency
- Compression Ratio
- Materials
- Cooling System
- Crank Balance
- Compression Chamber and Piston Top Design
- Valve Timing
- Bore and Stroke
- Inlet and Exhaust Manifold Design

There are many more aspects that are relevant in the design of combustion engines, however, these are the main ones.

COMPARISON OF THE COATES CSRV ENGINE TO THE STANDARD POPPET VALVE ENGINE

FIRST EXAMPLE

The oil and gas companies all over the world are being prevented by their governments from burning off the raw natural gas into the atmosphere. This gas is a by-product of the process of retrieving oil. They have been pumping this raw gas into our atmosphere for the past 120 years producing tremendous amounts of poisonous gases and contributing in a major way to global warming.

Up until now, they used diesel engines for electric generation, compression and pumping for oil production. Attempts were made to run normal poppet valve engines on raw natural gas. They only lasted 60 days before they were destroyed. Then they used micro turbine generators, where the jets got blocked and they burned out also, in approximately the same time period. In comparison to this, the Coates CSRV 855 Industrial Engine was designed to run on the natural gas at the oil well, which uses less fuel, runs on low pressure of gas supply and does not have any problem running on natural gas as all components are self-cleaning and durable.

1. Westinghouse
2. General Instrument (Thermal Electric Division)
3. Western Electric
4. Hydrometrics

Under General Instrument, I had U.S. Secret Clearance for evaluating the latest developments on energy conversion. I was hired as Director of Engineering (Thermo-Electric Division), after doing consulting work for them.

As a member of Consultant Services I worked as an expert witness on many cases. In all these, only one case was lost.

1. Performance of high production hamburger heating equipment
2. Defects in modern apartment heating systems due to catalytic action between some of the components of the system.

While teaching at NJIT, I taught (during my summer vacations) Western Electric field engineers air-conditioning and ventilation.

After serving in various lower level positions, I became President of:

1. National Society of Inventors
2. AAUP – New Jersey (American Association of University Professors)

At NJIT:

1. I was Chairman of the Faculty Council at NJIT
2. Elected "Secretary of the Faculty"
3. Appointed to sit on the Patent Committee

LAWRENCE JAY SCHMERZLER, P.E.
Professor Emeritus

Background Information

I left college and volunteered to serve in any engine room of any ship that needed to leave. I was assigned and served on the U.S. Malabar (a quadruple expansion steam engine which had been built as WWI ended for Rockefeller as an oil tanker and subsequently put in storage since 1919).

I received accelerated training at the Coast Guard Training Station in New London, Connecticut. I received a Marine Engineering degree there for steam, diesel, and electrical engines. I then shipped out to England, France, Italy, and North Africa on turbo and tripple-expanse engines. After this, the war was over in Europe, and I volunteered to serve in the Pacific region, where I and 36 other marine engineers, along with me, were to work on Nordberg Diesel engines. The need for these engineers, however, no longer existed as the war was over. We all had taken one months training.

I was directed to serve on a diesel advanced development ship that had various advanced engineering equipment, such as: variable pitched propellers that could go from full astern to full ahead, and advanced refrigeration equipment. The ship had just completed a run to South America, with a full complement of Coast Guard engineers, and had to dump the cargo because of malfunction of the refrigeration equipment. I was responsible for a subsequent successful voyage, also to South America. It was powered by a Nordberg Diesel Engine.

After graduation from the University of Texas, with a mechanical engineering degree, I subsequently worked for a U.S. steel division in Kansas City, MO.; it was an oil well supply company. I worked on improvement of oil-field engines operating on diesel, natural gas and kerosene. I also taught internal combustion engines and design at Kansas City Junior College in the evenings.

Subsequently, I was employed by U.S. Boch in the laboratory on development of fuel injection equipment. I also worked for Hamilton Standard Division of United Aircraft on propeller transmission gear.

Then I worked at Newark College of Engineering (now NJIT) teaching internal combustion engines. I received my Masters Degree from NCE. At this time, I also patented a number of invention, which include:

1. Heat Pumps
2. Desalinization Equipment
3. Exercising Machine

I also consulted with a number of organizations on secret projects, which include the following companies:

THE CSRV *VERSUS* *THE POPPET VALVE*

Coates Spherical Rotary Valve

moving, are hard to assemble, and are costly.

Sincerely,

Lawrence Schmerzler

Prof. Lawrence Schmerzler, P.E.

Sharon M. Dunn 6/28/06

OFFICIAL SEAL
SHARON M. DUNN
NOTARY PUBLIC – NEW JERSEY
My Comm. Expires June 10, 2009

THE CSRV *VERSUS* *THE POPPET VALVE*

Coates Spherical Rotary Valve

and pumping losses.

No maintenance, adjusting servicing is required to the CSRV for the life of the engine. No noise is caused by the CSRV System. No damage occurs to the engine.

Most poppet valve engines must have these valves adjusted manually every 5,000 miles when servicing intervals are due. This is downtime and costly, and if not done, will cause more excessive wear, noise and serious damage to the engine.

The CSRV will replace the poppet valve and eliminate all its problems.

The poppet valve is the main problem with the combustion engine which limits its efficiencies.

The CSRV System was invented and designed by George J. Coates. No other company has tried to improve on its design. It is fully patented worldwide. In the future, when it is in the main stream, no doubt people will try to improve it

Manufacturers have tried for more than 100 years with side valves, pushrod, overhead inlet poppet valves, and side exhaust valves, overhead camshafts, high lift camshafts, twin overhead camshafts, air pumps, turbo chargers and the results in the 50s, 60s, 70s, were 29% thermal efficiencies and after the removal of lead, 22% thermal efficiencies today.

There are approximately 90% fewer parts in the CSRV System compared to conventional poppet valve systems and only two moving, easy to assemble, and relatively inexpensive parts per cylinder bank

There are literally hundreds and thousands of parts, springs, and components in the poppet valve system, most of which are the poppet valve system has with all the springs, of which use is completely eliminated.

sometimes double springs. This causes tremendous frictional losses and wear of components, which cannot be avoided while using poppet valves.

The CSRV has unlimited valve timing possibilities and no restrictions within the valve timing duration **and no possibilities of making contact with the pistons, preventing major damage to the engine.**

Valve timing is limited because the poppet valve opens into the combustion chamber and could make contact with the piston, where destruction of the engine occurs. This mostly happens on sport cars, racing cars and OHV engines or when a valve sticks, and on de-acceleration on engines with over 30,000 miles and more.

The CSRV rotates away from the chamber and is moving constantly, which eliminates the possibilities of hot spots, and reduces the constant temperature of the combustion chamber. This reduces NOX, nitrous oxides, HC hydro-carbons, CO carbon monoxide. Even though tetraethyl led is removed from fuel today, the CSRV can utilize higher compression ratios in its engine designs, which results in thermal efficiencies in the 40%. 50%. and possibly 60% range with significant reductions in fuel consumption, harmful emissions, and complete combustion.

The poppet valve is in the combustion chamber permanently and the exhaust poppet valve gets, red hot, which causes hot spots, and at times, pre-ignition occurs, when the constant temperature of the combustion chamber exceeds 2,500°F. The engine manufactures NOX, oxides of nitrogen, and since tetraethyl led was removed from fuels, poppet valve engines cannot utilize higher compression ratios above 10 ½ to 1. This results in engine efficiency at only 22%. For every dollar worth of fuel you put into your vehicle, you get 22 cents of drivability, the other 78 cents is lost in heat, frictional

THE CSRV ***VERSUS*** ***THE POPPET VALVE***

Coates Spherical Rotary Valve

The CSRV exhaust valves do not utilize engine oil for its lubrication. All its bearings are sealed and there is no contamination of engine oil into the air and fuel mixture and no clogging of the catalytic converter while reducing pollution to our atmosphere. There is no break-down in the atomic structure of the engine oil and does not lower its viscosity.

The exhaust poppet valve is also cooled and lubricated with engine oil and reaches extremely high temperatures, which breaks down the atomic structure of the engine oil which lowers its viscosity. Engine oil must be changed every 3,000 to 5,000 miles. It is also lubricated at stem and when opened, oil is burned off into the exhaust system causing clogging of catalytic more pollution into our atmosphere.

The CSRV has a volumetric efficiency of twice that of the poppet valve with a complete open port and no poppet valve in the center. CSRV permits complete free flow of air into the combustion chamber and cylinder throughout the acceleration curve. Only one CSRV is needed for inlet and one for exhaust. Air pumps, super chargers are not necessary, unless there is a factor or extreme speed is required. Normally aspirated inlet air speed is 450 ft. per second good to 350 to 400 MPH, higher than that would require blowers.

The poppet valves have a limited capacity of volumetric efficiency because they inhibit the free flow of air into the combustion chamber and cylinder and causes pulsation of airflow mixture throughout the acceleration curve. That is why manufacturers incorporate 3, 4, and 5 poppet valves per cylinder, also adding air pumps, super chargers, turbos, etc.

The CSRV is free rotating with less than 90% of the friction losses that

All these poppet valves are spring loaded with very strong springs and

THE CSRV ***VERSUS*** ***THE POPPET VALVE***

Coates Spherical Rotary Valve

THE CSRV	THE POPPET VALVE
The CSRV has a rotational motion, and requires no adjustments.	The poppet valve reciprocates in its working motion, which means it must stop at the top and stop at the bottom in mile-seconds of its working cycle. This causes component wearing out of adjustment.
The CSRV System has no possibility of float or bounce and is positively closed and positively opened and its motion is completely silent.	When it comes to rest at closing at approximately 2500RPM, it bounces on its seat. This is called bounce or float where the poppet valve is never fully closed and never fully opened. This causes tapping engine noise, inefficiency in fuel consumption, and adds un-burned fuel to the atmosphere creating high pollution.
The CSRV is not lubricated with engine oil. Its bearings are sealed and do not require lube oil. The valves themselves do not require lubrication, therefore, do not emit engine oil burning pollutants into the atmosphere. The CSRV reduces emissions by creating a cleaner complete combustion.	The poppet valve is lubricated with engine oil, which is sprayed over the entire valve system to cool and lubricate its components. Engine oil is inducted through the inlet poppet valve stem into the combustion chamber and is burned with the fuel. It slows down the burning of the fuel mixture, and causes inefficiency in the complete combustion cycle.

5. Flexibility in optimizing performance over a wide range of applications.
6. The prototype for the next generation of state-of-the-art ICE technology.

SUMMATION

In summation, I believe that the Coates CSRV Combustion Engine will substantially outperform the conventional poppet valve engines and the micro turbines in the following categories:

- A significant reduction in harmful emissions
- A reduction in fuel consumption while maintaining consistent power output
- Higher density power output resulting from complete combustion
- I predicate my findings on the utilization of higher compression ratios and higher volumetric efficiencies of the CSRV Valve System and the reduction in frictional losses versus the reciprocating spring-loaded components as in all conventional poppet valve engines.

A test carried out on a chassis dynamometer by Compliance and Research Services on a 351 Ford Windsor V8 engine equipped with the Coates CSRV System showed almost double the output of torque and horsepower at 3200 RPM. The conventional poppet valve version put out 139 H.P. and 278 ft. pounds of torque at 1400 RPM. The CSRV put out 460.4 ft. pounds of torque, and 280.6 H.P. and at 3704 RPM. The CSRV put out 471.2 ft. of torque and 332.3 H.P.

TEST DATE MARCH 24, 2003

Test by Compliance and Research Services – The CSRV 1600 motorcycle has passed EPA emission standards by 50%, and fuel economy 40 MPG.

I was also shown the latest Coates Motorcycle production units. They are capable of going up to 130 mph in response to the fuel demands of economy and versatility. The model as shown had neat attractive lines capable of competing successfully with foreign competition.

Opinion

While there have been other rotating valve systems, none have been successfully applied to internal combustion engines until now.

The Coates Rotary Valve System promises:

1. A quieter engine with higher specific power output (horsepower output/pound) and longer life than conventional poppet valve engines due to better "breathing" capability and higher speed capability.
2. The use of smaller, lighter and more efficient engines.
3. High temperature permanently lubricated exhaust and intake spherical valve assemblies.
4. Elimination of oil flow needed to cool the conventional exhaust poppet valve stem, cams, cam followers, camshaft bearings and assemblies and intake poppet valve assemblies; thereby eliminating contamination of the lube oil and atmospheric pollution from this source.

During my visit of June 28, 2006, I arrived at approximately 12 noon, and was introduced to the Coates latest development of an alternate-fuel 855 CI generator engine running on natural gas, which is capable of utilizing mixtures of: hydrogen, natural gas, alcohol, diesel fuel, and/or gasoline. The engine was run under various loads, and its performance noted by George Coates, Mark Goldsmith, and myself.

The engine demonstrated its capability to utilize alternate fuels and air mixtures. The engine makes use of the unique Coates Rotary Shaft to phase in the various fuel and air mixtures.

The engine fuel flexibility lends itself to the current world situation wherein fuel-use flexibility is necessary in response to availability and costs.

TEST DATE JANUARY 3, 2003

On the first preliminary tests carried out on an electric power generator incorporating the 855 Natural Gas Coates CSRV Engine, it passed the EPA emission standards with a savings in fuel consumption of more than 35%.

TEST DATE FEBRUARY 27, 1995

A and B Tests were carried out by Compliance and Research Services, an independent EPA approved testing laboratory, showing the CSRV superior performance and lower emissions than the conventional poppet valve engine in hydro carbons (HC), carbon monoxide (C.O.), nitrous oxides (NOX), and (CO_2) and fuel savings.

LAWRENCE JAY SCHMERZLER, P.E.
Professor Emeritus
1 Claridge Drive
Verona, New Jersey 07079

Phone: 973-857-0365

I am a Mechanical Engineer specializing in Thermal Power Systems and have worked in and supervised the research, testing, design, maintenance and development of Internal Combustion Engines (ICE) and their components for over 30 years. I have also researched and taught ICE, Pollution Control and Energy Conversion (EC) during that span of years. I am past President of the National Society of Inventors and have an active interest in energy conversion systems, especially Internal Combustion Engines.

Mr. George J. Coates, President of Coates International, Ltd. invited me to his research & development facility to examine, review and evaluate engine systems having the Coates Rotary Valve System. I visited his plant a number of times, the last time being June 28, 2006.

During my first visit, September 25, 1998, I rode in three cars having Coates Rotary Valve engine systems. The engines performed smoothly and quietly and had exceptionally good acceleration.. There was no perceptible combustion knock or valve clatter.

I was shown a Coates Rotary Valve system disassembled for a 30,000-mile inspection. The system showed evidence of use in a combustion system but showed no discernable wear, scuffing or scratches. I expect the conventional piston and the piston rings will have a much greater limiting effect on the life of the engine than the Coates Rotary Valve System.

I also observed a number of other rotary valve applications in various stages of progress, including a motorcycle and racing car.

ASSESSMENT

Concerning the motorcycle engine fitted with the SRV, these features have the potential to:

- Greatly improve the volumetric efficiency of the engine (this is based on assuming a valid air-flow benchmarking comparison to a Ford Lincoln 5.0 L engine that had air flow potential of 180 cfm with poppets, and 319 cfm for the SRV); which should result in an increase in fuel efficiency.

- Decrease required maintenance and adjustments, as well as simplify construction.

- Decrease the need for frequent oil changes.

- Reduce moving friction with a concomitant improvement in mechanical efficiency through reduction in friction horsepower, which should also result in an increase in fuel efficiency.

- Decrease emissions; the results obtained in emissions tests run by the EPA certified testing facility on a new motorcycle unit fitted with the CSRV on a 1650 cc engine are well below the current requirements. Assuming a comparison to the results obtained from the Mercedes tests is valid, one may conclude that emissions with the motorcycle engine fitted with the SRV system will be significantly lower than an equivalent poppet-fitted system.

Most Sincerely,

Louis DeFilippi

Louis DeFilippi, Ph.D.
President, Louis DeFilippi, LLC
Industrial Consulting

During the visit to Compliance and Research Services, Inc., Linden, NJ, Mr. Timko, President of same, showed me the various precision devices used to measure the tailpipe emissions of various vehicles. The facility has a dedicated dynamometer for the testing of motorcycles. This was the unit that was employed to test the Coates SRV motorcycle. Mr. Timko stated that his was one of the few facilities that performs EPA-certified emissions tests.

Features

The SRV system has a number of impressive and innovative features common to all of the Coates engines inspected, including:

- An astoundingly large orifice to admit air to the cylinder.
- The replacement of many dozens of moving parts involving, and including, the poppet valves, with only two spherical rotary valve units.
- Elimination of the need for a liquid lubricant (motor oil) to lubricate the valves.
- Mechanical adjustments to yield an increased compression ratio but with a lower operating temperature.

Tailpipe Emissions Data

Tailpipe emissions results for **Motorcycle** (obtained from independent testing facility) are as follows:

Item	Test range, MPH	HC (emissions) range, ppm	CO (emissions) range, ppm	NO_x (emissions) range, ppm
SRV	---	1.5	6.8	NA
Current EPA limits	---	5.0	12.0	NA

I was also shown data collected from a direct comparison of tailpipe emissions for two Mercedes Benz 280SE **Sedans**, one fitted with a standard poppet valve system and one with the Coates SRV. The comparisons are:

Engine fitted with valve system	Test range, MPH	HC (emissions) range, ppm	CO (emissions) range, ppm	NO_x (emissions) range, ppm
Poppett	37 – 38	36 – 57	10.0 – 20.0	118 – 300
SRV	26 – 33.3	10.17 – 19.2	5.9 – 7.3	3.3 – 30.87

208 Edgewood Lane .
Palatine, IL (USA), 60067

Louis DeFilippi, LLC, Industrial Consulting

You've tried the others
now try the independent

Phone: (847) 925-8524
FAX: (847) 303-1731
E Mail: defilip1@flash.net

June 1, 2004

Messrs. Andrew Dorman and Ken Greenbaum
Baird, Patrick & Co., Inc.
20 Exchange Place
New York, NY 10005

Dear Gentlemen:

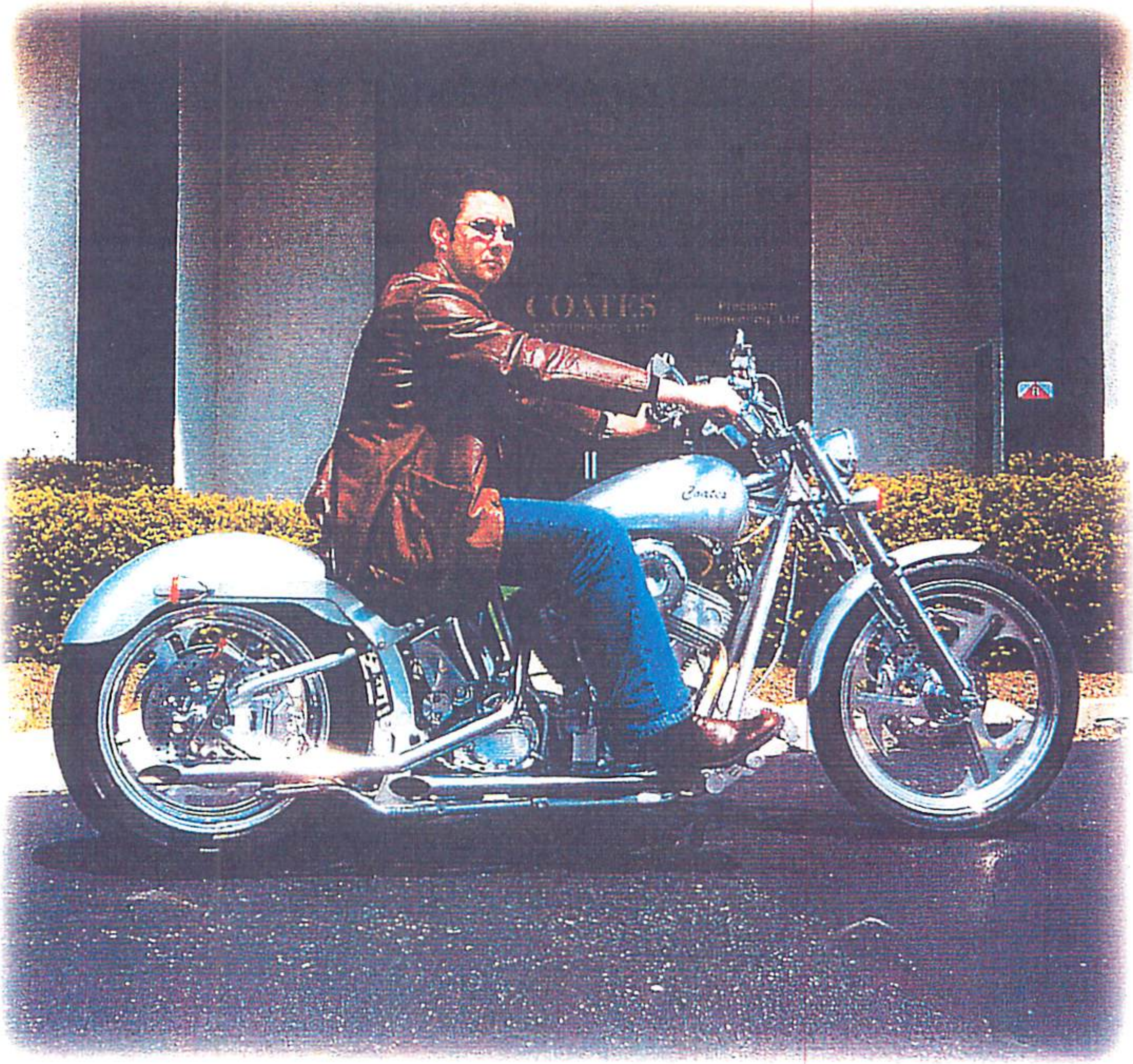
BACKGROUND

The consulting firm, nLake Technology Partners LLC (nLake) was engaged by Messrs. Andrew Dorman and Ken Greenbaum of Baird, Patrick & Co., Inc. to perform an independent technical evaluation specific to the performance of the Coates Motorcycle engine, including parameters such as emissions, volumetric efficiency and fuel efficiency. The tasks were to include reviewing and analyzing existing test reports and other technical information available at the Coates engineering and manufacturing facility that are relevant to a new spherical rotary valve (SRV) motorcycle engine developed by Coates International Ltd. and Coates Motorcycle Company Ltd. nLake in turn involved their associate Dr. Louis DeFilippi, President, Louis DeFilippi LLC, an independent consulting firm based in Palatine, IL, to visit the Coates facilities, as well as the facility that performed the emissions testing, Compliance and Research Services, Inc., and to write an independent assessment.

VISIT

During the visit to the Coates facility in Wall Township NJ, Mr. George Coates reviewed what he believed to be the advantages of the SRV engine. We toured the facility and were shown the operation of a number of functional stationary SRV engines of various sizes. The motors were operated and ran smoothly. Similarly, a natural gas fueled SRV engine was operated and ran smoothly. An SRV motorcycle was driven by a Coates employee and shown to function smoothly and without problems. A Mercedes fitted with the SRV engine was successfully revved up to 14,000 RMP while in a stationary position and without an extensive warm-up period. All engines appeared to run quieter than expected.

http://www.flash.net/~defilip1/Default.htm
Environmental & Regulatory Compliance, OSHA, EPA, FDA
Effluent & Air Pretreatment, Microbiology, Analytical.
-Expert Consulting and Project Development-



Gregory G. Coates

President

Coates Motorcycle Company, Ltd.

United States Environmental Protection Agency NVFEL Ann Arbor, Michigan 48105	
FAX TO: Bob DePalma	
FAX NUMBER: 908 755-5893	PHONE NUMBER: 908 561-1824
LOCATION: Compliance and Research Services, Inc.	
FROM: Bruce Schmek	
FAX NUMBER: 734 214 4869	PHONE NUMBER: 734 214 4733
DIVISION: Certification & Compliance Division	
DATE: May 26, 2005	PAGE 1 of 2 PAGES

MESSAGE: Bob

Here is the Comes Motorcycle request for reduced testing, accepted.

Bruce Schmek

Certification and Compliance Division

Environmental Protection Agency

edrecamed

COMPLIANCE
AND
RESEARCH
SERVICES, INC.

1701 West Front Street Plainfield NJ 07063
PHONE (908) 561-1824 • FAX (908) 755-5893

May 19, 2005

Environmental Protection Agency
2565 Plymouth Road
Ann Arbor, MI 48105
(734) 214-4733
(734) 214-4869 fax

REVIEWED AND ACCEPTED
DATE 6-26-? EPA REP Emily Ch

Attn: Bruce Sdnnek
Re: Letter of Intent to Certify

Dear Bruce,

I am writing on behalf of a new client of ours. These bikes are all domestically made and not imported by someone else. The customer, Coates Motorcycle Company, would like to request reduced testing and service accumulation for the remainder of 2005my. Then, continue durability to the full durability period for 2006my. The Coates Motorcycle Company is a Small Volume Manufacturer with current production limits of around 100 motorcycles per year. These motorcycles are full class 3 street bikes in the classical cruiser style. They eventually wish to produce more than this, however, we will cross that bridge when it happens. We would like to start with approximately 4000km durability, and then continue out to the remainder for 2006my. We will test the motorcycle ever 1000km so we have sufficient data points in the df calculations. If you have any questions and/or comments, please feel free to contact me at your leisure.

Regards,

BoB DePalma
Lab Manager

COATES INTERNATIONAL, LTD.
COATES ENTERPRISES, LTD.
COATES PRECISION ENGINEERING, LTD.
COATES AUTOMOTIVE, LTD.
COATES ENGINE MANUFACTURING, LTD.
COATES TECHNOLOGIES, LTD.

COATES INTERNATIONAL EURO, DIV. LTD.,
LONDON, UK

COATES INTERNATIONAL, LTD.
CALGARY, ALBERTA, CANADA

COATES MOTORCYCLE CO.

The Coates C.S.R.V. V-Twin Air Cooled Motorcycle Engine surpassed the EPA emission standards by approximately 50% reduction of harmful emissions and achieved (47 MPG) miles per gallon of fuel.

In road tests and chassis roller tests the motorcycles reached speeds of 137 M.P.H. with plenty of throttle left for higher speeds.

The Coates CSRV has shown in all their applications, approximately 50% lowering of harmful emissions and 27 to 30% savings in fuel consumption.

2100 HIGHWAY 34 & RIDGEWOOD ROAD
WALL TOWNSHIP, N.J. 07719-9738 USA
PHONE: 732-449-7717

Attachment B

MOTORCYCLE TEST INFORMATION TO BE MAINTAINED BY THE MANUFACTURER AND SUBJECT TO EPA REVIEW

1. Description of motorcycle(s) used in certification testing, including tire size, drive train description, part numbers of critical emission components, and vehicle identification number (VIN).

2. Current location of motorcycle(s) used in certification testing.

3. Weight of the motorcycle and the weight of a sidecar if so equipped, and an indication of whether the sidecar is permanently attached.

4. Description of the properties of the fuel used for certification testing.

5. Copy of the driving traces used for certification tests and copy of the raw data from the analyzers (e.g., bag-by-bag measurements and spanning range checks).

6. Description of the calibration gases used to calibrate the exhaust gas analyzer used for certification; description of the traceability of these gases to National Institute of Standards and Technology gas.

Attachment A

MOTORCYCLE TEST INFORMATION TO BE REVIEWED BY EPA

1. Brief, general description of the manufacturing process for these motorcycles, including how/when/where and by whom the vehicles are initially assembled; how/when/where and by whom the vehicles will be modified (if necessary) following initial assembly.

2. Documentation to prove that the applicant is an authorized United States representative of the manufacturer of the motorcycles.

3. Description of the method used by the manufacturer to notify the applicant of any running changes made to the vehicle (changes the manufacturer makes to production motorcycles after certification).

4. Description of the test procedure used for certification testing.

5. Location and brief description of the test facility used for certification testing, including the type of dynamometer used.

6. Copy of test maintenance log of motorcycle(s) used in certification testing, including corrected odometer distance (miles or kilometers), emissions, and a description of all maintenance.

7. Confirmation that production motorcycles are identical in all material respects to the motorcycles described in application for certificate.

8. Copies of owner's manuals, repair manuals, warranties, emission labels, and any sales information available to the public (as they become available).

9. Description of the maintenance schedule if the owner's manual is not available or if the maintenance schedule is not included in the owner's manual.

At the time a small volume motorcycle manufacturer submits an application for certification, the EPA intends to audit the manufacturer's certification program. Attachment A to this letter contains a list items that will be audited before certification of an engine family, pursuant to 40CFR §86.437-78(b)(1)(ii). To hasten the certification process manufacturers should provide this information with the certification application. Attachment B to this letter contains a partial list of items that are not required to be included in the application but are to be maintained at the manufacturer's facilities, available for review by an EPA representative.

If you have any questions about this material, please contact Mary Green at 734-214-4912, or green.mary@ epa.gov

Thank you for your cooperation.

Respectfully,

Mary F. Green

Mary F.Green, EPA
Vehicles Programs Group
Vehicles Programs & Compliance Division

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL VEHICLE AND FUEL EMISSIONS LABORATORY
2565 PLYMOUTH ROAD
ANN ARBOR, MICHIGAN 48105-2498

OFFICE OF
AIR AND RADIATION

April 3, 2003

Mr. George Coates
Coates International, LTD
2100 Highway 34 & Ridgewood Rd.
Wall Twp., New Jersey 07719-9738

Dear Mr. Coates:

Attached per your request is a series of EPA documents pertaining to the certification of motorcycles. These documents supplement the certification rules published in the "Code of Federal Regulations", 40CFR, Part 86, Subparts E & F. 40CFR, Part 86, in book form, is available from the Government Printing Office; charge orders can be made by telephone to the GPO Order Desk at 202-512-1803. It can also be found in larger libraries, such as a Law or a University library. Access to the CFR is available on the Internet at this location:
http://www.access.gpo.gov/nara/cfr/cfr-retrieve.html#page1

Small volume motorcycle manufacturers are those with total volume projected sales in the United States of less than 10,000 units for the specified model year. Certification requirements for the small volume motorcycle manufacturer are summarized in Subpart E, Section §86.406-78(c)(2). These manufacturers are allowed to submit a reduced amount of paperwork for the certification process. They must, however, perform the same testing for each engine family as required for a large volume motorcycle manufacturer.

The application for certification by a small volume motorcycle manufacturer must include the following:

- The information outline in Chapter 4 of the Manufacturers Guidance Letter CD-88-19, dated December 5, 1988, reference 40CFR §86.437-78(b).
- A copy of the fee filing form submitted to the appropriate bank with the required fee payment. (Reference to CD-92-07.)
- A copy of the "Family Information" computer information form (reference CD-93-02). Model year 1998 and later engine families must use the engine family identification format described in CD-96-12, dated December 3, 1996.
- The information listed in Attachment A to this letter.

ESTIMATED SAVINGS

Fuel Savings

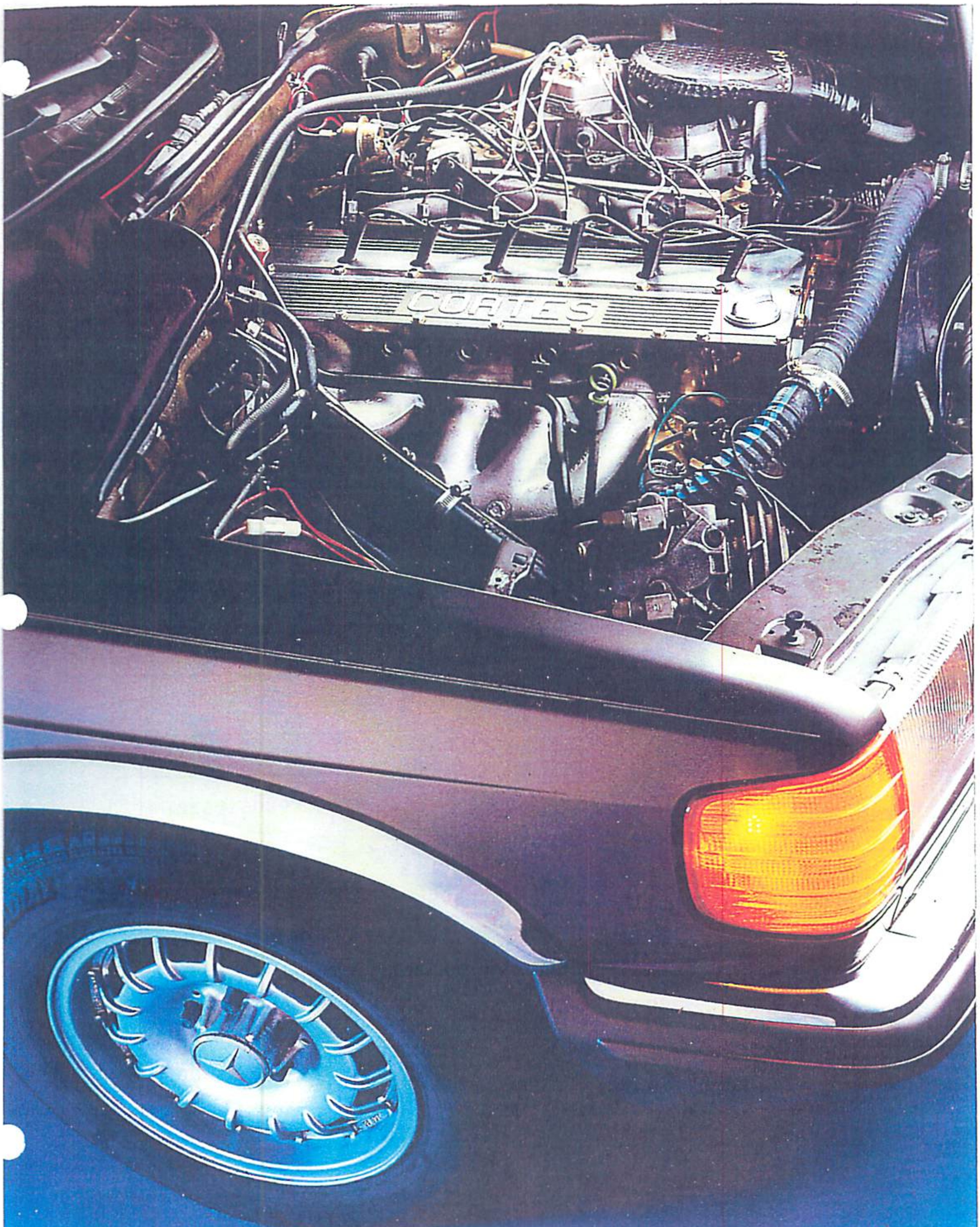
Number of vehicles registered in US[1]	200,000,000
Average number of miles driven per year per vehicle	12,000
Total of miles driven in US by all vehicles	2,400,000,000,000
Gallons of fuel consumed in the US (Average car drives 20 mpg)	120,000,000,000 gal
The Coates Engine will save approximately 18% of fuel which translates into the following savings	21,600,000,000 gal
At $ 1.20 per gallon of gasoline, the total Dollar savings per year will be	$ 25,920,000,000

Lubricating Oil Savings

Number of vehicles registered in US	200,000,000
Average numbers of miles driven per year per vehicle	12,000
Total of miles driven in US by all vehicles	2,400,000,000,000
The average car drives 5,000 miles between oil changes or a yearly total of	480,000,000 changes
The Coates engine requires only one oil change every 50,000 miles or yearly total of	48,000,000 changes
At 5 quarts per change this savings equals	540,000,000 gal of oil per year
or at $8.00 per gallon of oil	$ 4,320,000,000

The total savings per year by utilizing the Coates Engine will add up to $30,240,000,000.
There is also a significant impact on the Environment and Air Pollution since a considerable amount less fuel is consumed each year.

[1] National Highway Motor Vehicles, Washington DC


COATES

CERTIFICATE OF TITLE

PREFIX	IDENTIFICATION NUMBER	SUFFIX	YEAR	MAKE	MODEL	BODY TYPE
1	WDB12 60221 20744 83	Z	1984	MB	380	4 DR.

TYPE OF TITLE	DUPLICATE NO.	CYL/CLOTH.	COLOR/MTL/HP	DEALER I.D.	AXLES/PROP	FUEL
STANDARD		8	GY		2	

FEE	ISSUE DATE	VIN-REPLACEMENT	MILEAGE	STATUS
20.00	03-02-1998		85000 A	

OWNER(S) C6008 27871 04402
GEORGE J COATES
1811 MURRAY DRIVE
WALL NJ 07719 9512

F-FLOOD S-SALVAGE
P-POLICE T-TAXI
L-LEMON LAW
A-ACTUAL MILEAGE
N-NOT THE ACTUAL MILEAGE
M-MILEAGE EXCEEDS THE MECHANICAL LIMITS

NUMBER OF OWNERS: 1

NUMBER OF LIENHOLDERS:

I, THE DIRECTOR OF MOTOR VEHICLES, DEPARTMENT OF TRANSPORTATION OF THE STATE OF NEW JERSEY, DO HEREBY CERTIFY THAT EVIDENCE OF PURCHASE OF OWNERSHIP, IN COMPLIANCE WITH THE LAWS OF THE STATE OF NEW JERSEY, OF THE DESCRIBED ARTICLE, HAS BEEN RECORDED AND FILED WITH ME, AND I DO HEREBY ISSUE THIS CERTIFICATE OF OWNERSHIP SUBJECT TO SECURITY AGREEMENT OR LIEN, IF ANY AS STATED.

CONTROL NUMBER L024463

C. Richard Kamin
SIGNATURE

State of New Jersey
DIVISION OF MOTOR VEHICLES

DATE

SECOND LIENHOLDER

DATE

FIRST LIENHOLDER

SECOND RELEASE
LIEN RELEASED BY:
SIGNATURE
TITLE DATE

FIRST RELEASE
LIEN RELEASED BY:
SIGNATURE
TITLE DATE

ISM/SS-1 (R 10/97)

MH LK980610518

VOID IF ALTERED

↑ FOLD AND TEAR AT PERFORATION ↑

THIS IS A RECEIPT DOCUMENT ONLY
VIN: 1 WDB12602212074483 Z MILEAGE: 85000 A DUP: STATUS:
MB 1984 4 DR. 380 GY 8 AXLE:2
C6008 27871 04402
GEORGE J COATES
1811 MURRAY DRIVE
WALL NJ 07719 9512
MH LK980610518 20.00 I STANDARD

TITLE I : 20.00
SALES TAX :
TOTAL : 20.00

L024463

CUSTOMER COPY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF AIR AND RADIATION

JEFF FRAZIER
3351 B S.W. LONGVIEW RD.
LEE'S SUMMIT, MO 64081

AUG- 7-1991
In reply Refer to:
EPA NO: 10576

Dear Sir/Madam:

This letter is in response to your recent inquiry regarding the compliance status of an imported vehicle. Our records indicate that the vehicle described below has met all applicable Environmental Protection Agency (EPA) importation requirements and has been finally admitted into the United States.

Make: MB
Model: 280 SE
Model Year: 84
VIN: WDB12602212 074483

Declaration Code:
Entry No.:
Entry Date: / /
Port: UNK

If you have any questions, you may telephone our office (202) 382-2504.

Sincerely yours,

Richard N. Babst

Chief, Investigation/Imports Section
Manufacturers Operations Division

6-A (Rev. 6/91)

EPA
United States
Environmental Protection
Agency
Washington DC 20460

Official Business
Penalty for Private Use
$300 EN-340-F

U.S. OFFICIAL MAIL
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PENALTY FOR PRIVATE USE
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George Coates
Coates International Limited
Highway 34 Ridgewood Road
Wall Township, N.J. 07719-9733

12

MERCEDES-BENZ **Service**

Technical Data Passenger Cars

1975

Model 107
Model 114
Model 115
Model 116

Daimler Benz AG
Vertrieb Kundendienst und Teile
D-700 Stuttgart 60

Idling Speed/Idling Speed Exhaust Emission Value — 07.4

Engine	Idling speed 1/min	Idling speed exhaust emission value % CO
110	750—850	1.5—2.5
116	700—750	
117.982/983		

Exhaust Emission Versions — USA — Japan

Identification: Instruction plate in the language of the country on cross member in front of radiator or on cylinder head cover.

Engines should be set in accordance with data on exhaust emission instruction plate

USA Version

Instruction plate: Identification colour black

Engine	Model year	Idling speed 1/min	Idling speed exhaust emission value % CO without air injection
117.982/983	1975	700—800	max. 1 5

Japan Version

Instruction plate: Yellow imprint "Japan"

Engine	Idling speed 1/min	Idling speed exhaust emission value % CO
110	800—900	max. 1.5
116	750—800	
117.982/983		

Idling Speed/Idling Speed Exhaust Emission Value — 07.2

Engine	Idling speed 1/min	Idling speed exhaust emission value % CO
110	800—900	1.0—2 5
115		
130, 180		

Exhaust Emission Versions — USA — Sweden — Japan

Identification: Instruction plate in the language of the country on cross member in front of radiator or on cylinder head cover.
Engines should be set in accordance with data on exhaust emission instruction plate.

USA Version

Instruction plate: Identification colour black/green

Engine	Model year	Idling speed 1/min	Idling exhaust emission % CO without air injection
110	1975/78	800—900	max. 1 0
115			0 4—1 5

Sweden Version

Instruction plate: Identification colour blue

Engine	Model year	Idling speed 1/min	Idling exhaust emission % CO without air injection
110	1978	800—900	max 1 0
115			1 0-2 5

Japan Version

Instruction plate: Yellow imprint "Japan"

Engine	Model year	Idling speed 1/min	Idling exhaust emission % CO
110 115 130 180	prior to 1976	800-900	max 1 5
110	1976	800—900	max 1 0 without air injection

07.2 — Fuel Pump

Engine			110 115 130 180
Designation of pump			Plunger pump Lever pump [1]
Vacuum	Measuring point		following pump inlet
	at starting speed	mm Hg	250—350
Delivery pressure	Measuring point		following pump outlet
	at starting speed	kp/cm²	0.25—0 38

[1] USA version: as from model year 1974.
Sweden version — model year 1976.

Air filter with paper cartridge

filter

Rotary valve timing as follows:

Inlet opens 6 degrees B.T.D.C. Inlet closes 21 degrees A.B.D.C.

Exhaust opens 30 degrees B.B.D.C. exhaust closes 6 degrees B.T.D.C.

Compression at starter 130 to 147 P.S.I.

Ignition timing without vacuum at 1500 R.P.M. 17 B.T.D.C.

Vacuum in HG 480 mm=19in

Testing 1 hour warm up run and 1 hour test run at 1500 RPM

No load

No catalytic convertor

No air pump

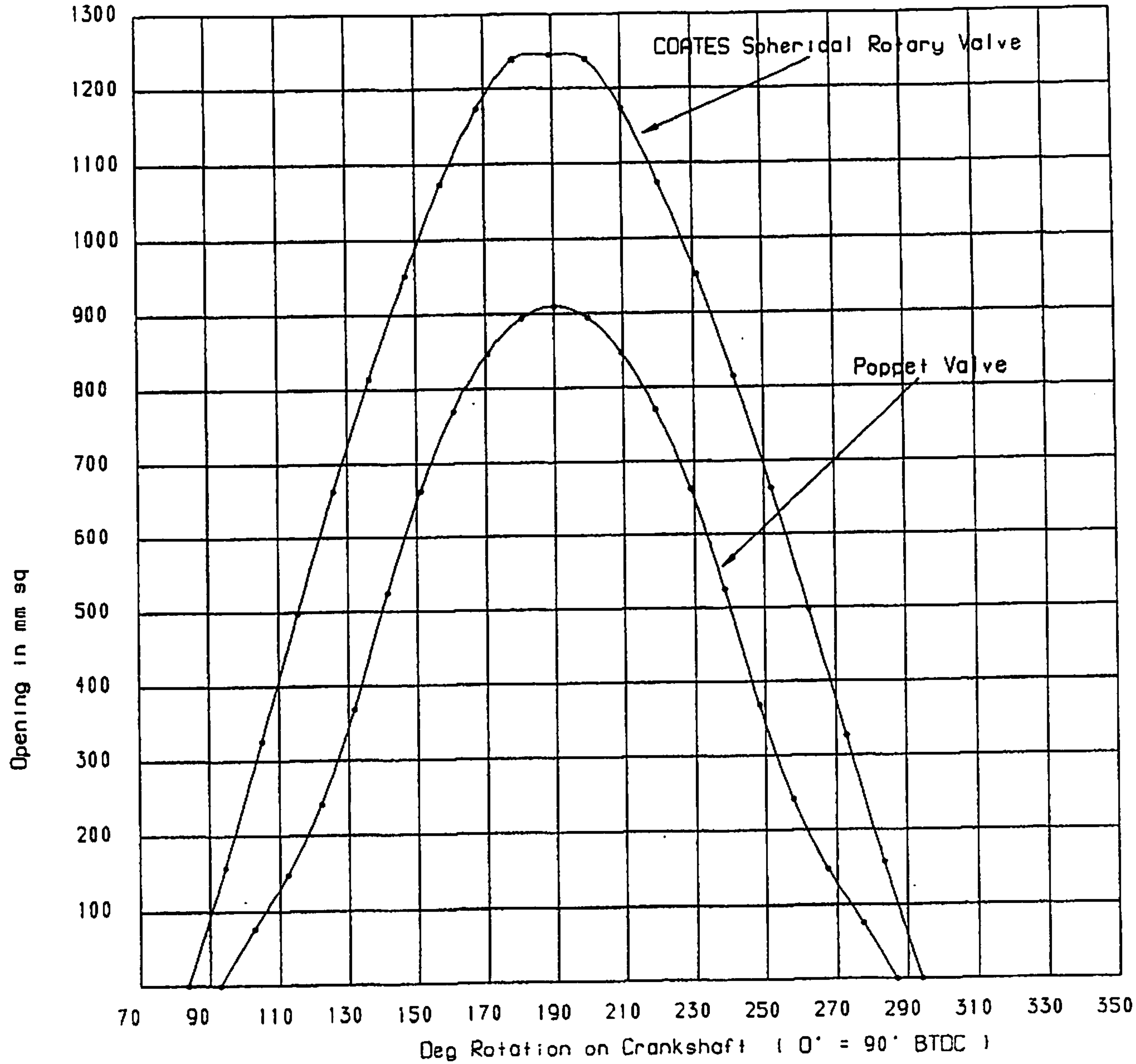
No turbo

Electronic Bosh ignition

ENGINE SPECIFICATIONS

Engine	
Model Mercedes Benz	280 280C 280C
Engine Type	110.921/922
Year	1991
Operation	Four stroke, gasoline engine with fuel injection
Number of cylinders	6
Arrangement of cylinders	Upright in line
Bore/stroke mm(ins.)	86/78 (3.39/3.10)
Total eff. piston displacement cm3 (cu.ins.)	2746 (167.6)
Compression ratio	9:1 8:1
Firing order	1-5-3-6-2-4
Max. engine rpm	10,000
Engine output SAE net bhp/rpm	160/5500 145/5500
Max torque SAE net ft. lb/rpm	165/4000 154/4000
Crankshaft bearings	7
Valve arrangement Twin	overhead spherical rotary valve
Camshaft arrangement	none
Cooling	Water circulation pump, thermostat with by-pass line; finned tube radiator, fan with viscous coupling
Lubrication	Forced oil circulation via gear-type oil pump
Oil filter	Full-flow filter

INLET VALVE Opening Comparison
between Poppet Valve and COATES Spherical Rotary Valve



Comparison done on Mercedes 280 SE with 110 Series Engine
Twin Overhead Camshaft

CENTENNIAL INSURANCE COMPANY
PERSONAL AUTO POLICY

Policy Number 397107248 Control 04C0

POLICY PERIOD EXTENSION CERTIFICATE. IN CONSIDERATION OF THE PAYMENT OF THE PREMIUM SPECIFIED THIS CERTIFICATE EXTENDS YOUR POLICY FOR THE PERIOD SHOWN PLEASE PAY PREMIUM AS SHOWN IN THE ATTACHED STATEMENT.

POLICY PERIOD: 12:01 A.M. STANDARD TIME FROM 04 02 94 TO 10 02 94 B 0004

NAMED INSURED AND ADDRESS: BERNADETTE COATES, GEORGE COATES, 1811 MURRAY DR, WALL TOWNSHIP, NJ 07719

AGENT OR BROKER: WHARTON/LYON & LYON A, T/A WHARTON ATLANTIC, P.O. BOX 260, OAKHURST NJ 07755

CAR	VEH KEY	YR	TRADE NAME	IDENTIFICATION NUMBER	BODY TYPE-MODEL	IIN	NEW/USED	PURCHASED	CLASS
1	1543	84	JAGUAR XJ6	SAJAV1343EC371543	SEDAN	4111			811120 0.85
2	4483	84	MERCEDES	WDB126022E2074483	280	9999			811120 0.85
3	9065	84	ROLLS ROYCE	SCAZS42A4ECX09065	SEDAN	9999	U		811120 0.85
4	9106	84	ROLLS ROYCE	SCAZN42A5ECX09106	SILVER SPUR	9999	U		811120 0.85

Coverage is provided where a premium and limit of liability is shown for the coverage

COVERAGES AND LIMITS OF LIABILITY 1. BI:* Each Person Each Accident 2. PD:* Each Accident	A. Liability	C. Uninsured Motorists	B. Medical Payments Each person
	$500,000 SINGLE LIMITS	$500,000 SINGLE LIMITS	$10,000

CAR	D. Damage to your Auto: 2. Other than Collision Loss ACV.* Minus DED.*		1. Collision Loss ACV.* Minus DED.*	F. Towing and Labor Costs: Each Disablement
1	ACV	500	500	$25
2	ACV	500	500	$25
3	ACV	500	500	$25
4	ACV	500	500	$25

N - BASIC PIP (SEE OPTIONAL PAGE)
O - ADD'L PIP (SEE OPTIONAL PAGE)

R TRANSPORTATION EXPENSES COVERAGE

CAR	COV	
1	R	R30D/900
2	R	R30D/900
3	R	R30D/900
4	R	R30D/900

MX = MAXIMUM * = ACT CASH VA

* SEE REVERSE SIDE FOR EXPLANATIONS OF ABBREVIATIONS

PREMIUMS

CAR	A	C	B	D2	D1	F	N	O	R	TOTAL/CAR
1	257	20	1	69	135	1	58	3	13	$557
2	257	20	1	53	119	1	58	2	13	$524
3	257	20	1	121	167	1	58	2	13	$640
4	257	20	1	121	167	1	58	2	13	$640

DRIVER INFORMATION

Date of Birth	Sex	Mar Stat	Drvr Trng	Good Stdnt	Stdnt Away	Prin Oper	Date First License	Chargeable Losses or Violations
04-08-40	M	M				1543	04-01-60	
01-22-42	F	M				9065	01-01-62	

TOTAL POLICY PREMIUMS

TOTAL PREMIUM $ 2361.00

$5.00 CHARGE PER INSTALL

ENDORSEMENTS MADE A PART OF THIS POLICY AT TIME OF ISSUE:

PP0404 V165A V401 *PL13 V445 V489 V510 V303D V488A V475B V571
V027H *V411F V479B *V555L *V496J

LOSS PAYEE: (NAME AND ADDRESS) SUBJECT TO "LOSS PAYABLE CLAUSE" ON REVERSE SIDE

NONE
NONE
NONE
NONE

Off	Prod	Bill Code	Sub Code	FIN	MM Acct	Previous Policy
18	2132	1		0		MT2415267

1	29 A	017		100	100	16/0	OD	
2	29 A	017		100	100	14/0	O	
3	29 A	017		100	100	21/0	Q	
4	29	017		100	100	21/0	O	

Garage Location if different from Mailing Address

COUNTER-SIGNED BY

Authorized Representative

02/17/94 K000066 MONMOUTH

10546243

03/93

5

Motor Vehicle Services NEW JERSEY

VEHICLE REGISTRATION

PLATE NO: HLH60G GOOD THRU: 03/93
VIN: WDB12602212074483
MB 34 4 DR. GY 380 WC:8
COATES INTERNATIONAL LTD PASSENGER 08
RT 34 & RIDGEWOOD RD DL:20047 05250 77190
WALL TWP NJ 07719 INITIAL
EQ:8 FEE: 67.90 DM ER920870103

COATES INTERNATIONAL LTD
RT 34 & RIDGEWOOD RD
WALL TWP NJ 07719

10546243

NEW JERSEY - MOTOR VEHICLE SERVICES
THIS IS A RECEIPT DOCUMENT ONLY

PLATE NO: HLH60G GOOD THRU: MAR 93 VIN : WDB12602212074483

20047 05250 77190	MAKE:MB	REG I : 67.90
COATES INTERNATIONAL LTD	YEAR:84	DUP REG:
RT 34 & RIDGEWOOD RD	TYPE:4 DR.	FD REG:
WALL TWP NJ 07719	MODEL:380	POST AUDIT:
	COLOR:GY	DUP STK:
	AX:2	TITLE I: 5.00
	WC:8	SALES TAX: 840.00
	EQ:8	TOTAL: 912.90
	REGCD:08	DM ER920870103

THE STATE OF NEW JERSEY CERTIFIED EMISSION TESTING FACILITY

Make: MB

Model: 280 SE

Model Year: 84

VIN: WDB12602212 074483

The Coates Spherical Rotary Valve installed with catalytic converto no air pump and no EGR system.

EMISSIONS TEST DATA

CO .01 %
HC 0 PPM
CO2 15.0 %
OXYGEN %

ENGINE RPM 1264
VACUUM

ENGINE TEMPERATURE 59 DEG
EXHAUST TEMPERATURE 75 DEG

EMISSIONS TEST DATA

CO .00 %
HC 0 PPM
CO2 15.1 %
OXYGEN . %

ENGINE RPM 925
VACUUM .

ENGINE TEMPERATURE 59 DEG
EXHAUST TEMPERATURE 75 DEG

THE STATE OF NEW JERSEY CERTIFIED EMISSION TESTING FACILITY
Make: MB
Model: 280 SE
Model Year: 84
VIN: WDB12602212 074483

The Coates Spherical Rotary Valve installed with catalytic converto no air pump and no EGR system.

EMISSIONS TEST DATA

CO .03 %
HC 3 PPM
CO2 15.1 %
OXYGEN %

ENGINE RPM 1971
VACUUM

ENGINE TEMPERATURE 59 DEG
EXHAUST TEMPERATURE 75 DEG

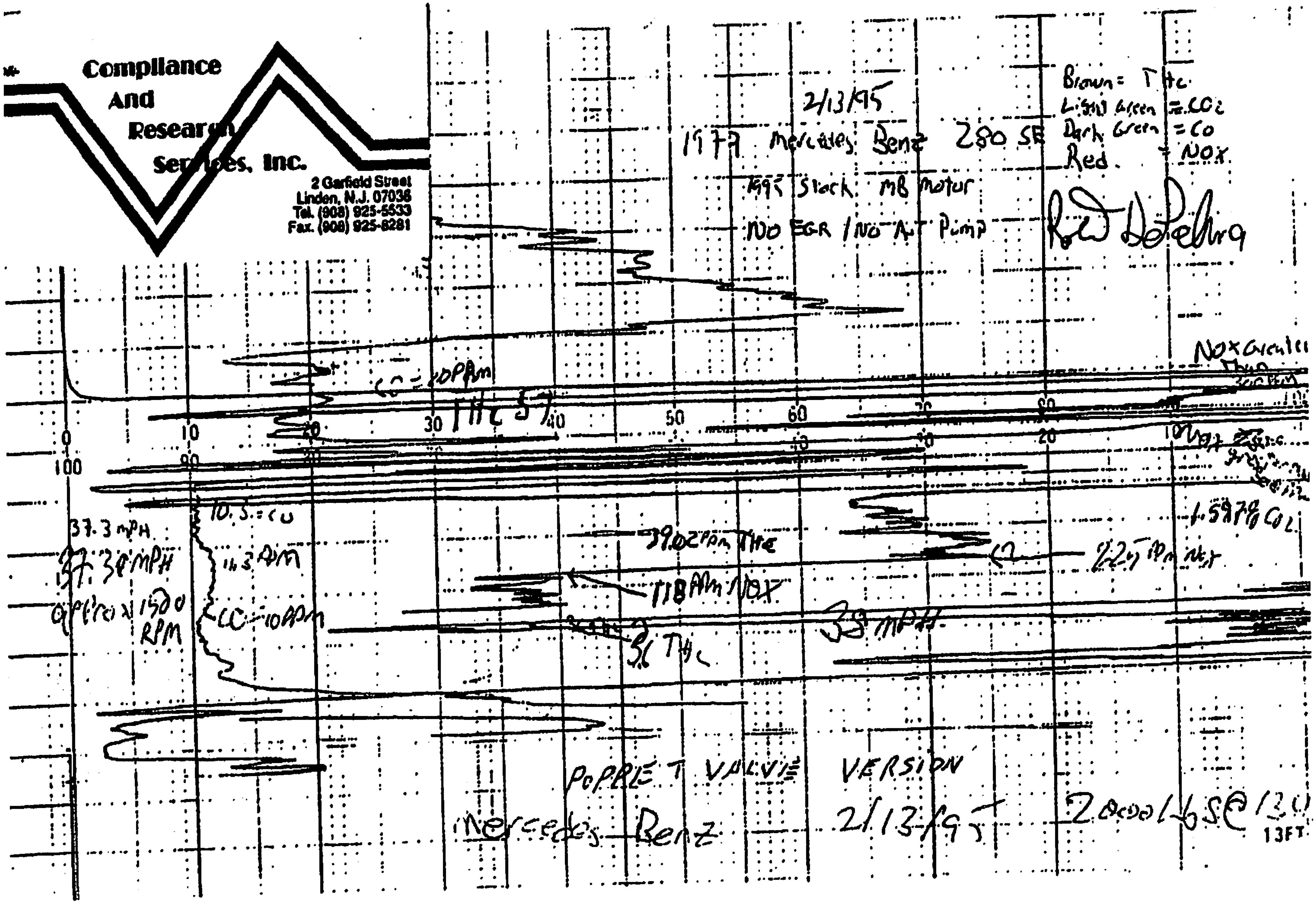
Mercedes 380SE fitted with a 280SE engine incorporating the Coates CSRV Valve System

Identification No.: WDB12 60221 207 4483

The above vehicle passed EPA standard emission tests and was registered for use on U.S. roads.

In-road mileage tests showed a savings in fuel consumption of 18%, compared to the conventional poppet valve engine of the same size and make.

Compliance And Research Services, Inc.
2 Garfield Street
Linden, N.J. 07036
Tel. (908) 925-5533
Fax. (908) 925-8281



B

Compliance & Research Services
Emissions Test Controller 386H

TEST NUMBER	CR02769	DATE	03-01-1995	FUEL TYPE	INDOLENE-
VEHICLE REF	coates-280se	A.C.	no	DENSITY	16.33
V.I.N.	11602412114620	ENGINE FAM.	1995 mb/new	SPECIF. CO2	13.4
OPERATOR	m.timko	EVAP.FAM.	stock	Gr.C/gal.	2424
DRIVER	b.depalma			FUEL Fract.	.866
MAKE	mercedes ben	TEST TYPE	HOT505 .LA4	SP. GRAVITY	.743
MODEL	280se	SHIFT FILE	AUTO .L_4	N.H.V.	18480
YEAR	1977	INERTIA WGT	3625	WT FACTOR	1
TANK CAP	24 gallons	ACTUAL HP	8.4	WT FACTOR	0
ODOMETER	81281 miles	INDIC. HP	6.7	WT FACTOR	0
TRANS.	auto	ALT. HP arb	7		
REMARKS					
START TIME	16:56:48	END TIME	17:05:13		

#	EVENT	MILES	TIME	TIME of trace HOLD			TIME of trace ERROR		
1	crank	0.00	1.1	0.0	for	0.0	0.0	for	0.0
2	ph 1	3.60	505.0	0.0	for	0.0	0.0	for	0.0
3	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
4	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
5	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
6	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
7	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
8	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
9	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
10	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
11	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0
12	end	0.00	0.0	0.0	for	0.0	0.0	for	0.0

PHASE 1	THC	CO	NOx	CO2	NMHC				
						Tdry =	70.4	Twet=	53.9
SAMPLE	87.060	167.100	85.390	1.466	11.700	BARO =	767.01	SEC =	506.1(
AMBIENT	12.410	4.400	0.670	0.040	2.400	R-H =	31.14	VOL =	2834.6
GRAMS	3.520	15.252	10.912	2102.459	3.077	M.P.G.	14.95	DF =	8.9
GMS/MI	0.978	4.237	3.032	584.118	0.855	MPGnhv	15.06	MI =	3.6(
GMS/KM	0.608	2.636	1.886	363.415	0.532	KM/Lit	6.35	KM =	5.7

****

WEIGHTED	THC	CO	NOx	CO2	NMHC	FUEL ECONOMY		NOxKf=	.8382
GRAMS/MI	0.978	4.237	3.032	584.118	0.855	M.P.G.	14.95	NHVmpg	15.0
GRAMS/KM	0.608	2.636	1.886	363.415	0.532	KM/Lit	6.35	NHVkpl	6.3

****

Cartridge VOL. S 1 = 0.2983 A= 0.2946

POPPET VALVE VERSION B

COATES INTERNATIONAL, LTD.
COATES ENTERPRISES, LTD.
COATES PRECISION ENGINEERING, LTD.
COATES AUTOMOTIVE, LTD.
COATES ENGINE MANUFACTURING, LTD.
COATES TECHNOLOGIES, LTD.

COATES INTERNATIONAL EURO. DIV. LTD.,
LONDON, UK

COATES INTERNATIONAL, LTD.
CALGARY, ALBERTA, CANADA

: **CSRV ENGIN**

When CIL started testing
in the early 90's we cont
find out where we could
vehicles independently te
faxed this list to us. As y
only one EPA recognize
Jersey and that is Compl
Service. This is where v
independent EPA tests c

2100 HIGHWAY 34 & RIDGEWOOD ROAD
WALL TOWNSHIP, N.J. 07719-9738 USA
HONE: 732-449-7717
AX: 732-449-0764 MAIN
FAX: 732-282-2102 BILLING
FAX: 732-449-7736 C.E.O.
WEBSITE: www.coatesengine.com

B

OATES ENTERPRISES, LTD.
OATES INTERNATIONAL, LTD.
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OATES AUTOMOTIVE, LTD.
OATES ENGINE MANUFACTURING, LTD.
OATES TECHNOLOGIES, LTD., USA

OATES INTERNATIONAL EURO, DIV.
TD. LONDON, UK

This document shows an A. & B. comparison test between two Mercedes cars with the same size engines.A. has the Coates Spherical Rotary Valves System installed and B. has a standard poppet valve system. On the dynamometer test sheet A. as you will see six test on the C.S.R.V engine, and B. dynamometer test sheet shows four test with the standard poppet valve engine, on all test perimeters (HC) Hydro Carbons, (CO) Carbon Monoxide, (NOX) Nitrous Oxides, and (Co_2). The Coates Spherical Rotary Valve Engine is showing on each test less than half the emissions that the standard poppet valve engine shows.

J HIGHWAY 34 & RIDGEWOOD ROAD
VALL TOWNSHIP, N.J. 07719-9738 USA
32-449-7717
AX: 732-449-7736

- (CO) Carbon Monoxide (6.3 PPM)
- (NOX) Oxides of Nitrogen (5.5 PPM)
- (C02) Carbon (1.207 PPM)
- (O) Oxygen (0.2 PPM)

GAS LAWS

The Gas Laws are the (constant) relationship between Thermodynamic, Temperature (T.), Pressure (P.) and volume (V.). They are a collection of results derived from experimented proven scientific tests developed between the late Renaissance and Early 19th Century and become the Gas Laws, which were combined to form the combined Gas Laws.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

This developed into the ideal Gas Law PV = NRT

WHEREAS

P. is the Pressure (S1 Unit: Pascal)

V. is the Volume (S1 Unit: Cubic Meters)

N. is the amount of substance (Loosely Number of Gas Moles)

R. is the ideal gas constant (S1:8.3145J)/(Molk)

T. is the Thermodynamic Temperature – (S.1. unit: Kelvin)

(The Law works with a consistent set of units, provided that the temperature scale starts at absolute zero, and the appropriate gas constant is used.)

The equivalent formulation of this Law is PV = NKT

WHEREAS

N. is the number of molecules.

K. is the Boltzmann Constant

These equations are exact only for an Ideal Gas. They are a good approximation for many gases under general circumstances and conditions.

This Law has the following important results:

1. If the temperature and pressure are kept constant, then the volume of gas is directly proportional to the number of molecules of gas.

2. If the temperature and volume remain constant, then the pressure of gas changes are directly proportional to the number of molecules of gas present.

3. If the number of gas molecules and the temperature is constant, then the pressure is inversely proportional to the volume.

4. If the temperature changes and the number of gas molecules are kept constant, then either pressure or volume (or both) will change in direct proportion to the temperature.

INTERNAL COMBUSTION HEAT-ENERGY

To produce heat-energy and force-work, the fuel or gas mixture or homogeneous charge must contain energy, which can be converted to kinetic energy or mechanical work. The fuel mixture contained in a combustion engine cylinder, when under pressure will produce heat and kinetic energy by heat expansion and combustion forcing the movement of the piston downward. This is called, The Expansion of Internal Heat-Energy, which is an atomic reaction of the elements, excitation of molecules by friction.

If a fuel mixture or gas is neither doing work, or having work done to it, but is at the same time receiving or losing heat, its internal energy will be increased or decreased by exactly the same amount of heat. Regarding the internal combustion engine, it is only the internal heat-energy that is of any important value.

In terms of energy specific heat at constant pressure, it can be expressed as:

$H - PV+U$, Enthalpy = H, Internal Energy = U, Pressure = P, Volume = V

The internal combustion engine is an apparatus that converts the heat-energy contained in a liquid or gaseous fuels transforming them into kinetic energy producing mechanical force or work, as efficiently as the particular engine design will achieve.

There are numerous types of different internal combustion engines that convert gaseous fuel heat-energy into kinetic energy.

THE SPECIFIC TEMPERATURE OF AIR

In a combustion engine, air forms the majority component of the stochiometric mixture of air and fuel (Air 14.7 to Gas 1). Because of this, the changing conditions of the atmosphere, such as barometric pressure, density and temperature of the air, the operation and performance of an internal combustion engine will be influenced.

At constant pressure, the specific heat of dry air is taken as .2374 BTU per lb. weight. If a quantity of air is allowed to expand as its temperature rises, it will do work by exerting pressure against its surrounding atmosphere. Taking the quantity of air as 1 lb. in weight, its volume at normal temperature and pressure will be 12.387 cu. ft. If its temperature is raised by 1°F, it will expand by 1/492 of its volume against atmospheric pressure. Atmospheric pressure is approximately (14.7 lb.per sq.) = 14.7 X 144 lb. per sq. ft. X V of 12.387 cu. ft. X 1492. This gives the work done against the atmosphere in ft./lbs.

$$\frac{14.7 \times 144 \times 12.387}{492} = 53.29 \text{ ft./lbs.}$$

Convert to BTU – 778 $\frac{53.29}{778}$ = .0685 BTU

If the air is not allowed to expand against atmosphere pressure, that is, the volume is maintained unaltered, the pressure of the air will rise. But there will be no external work performed. The specific heat required (.2374 BTU per lb. at constant pressure). At constant volume, is less by the amount calculated above. That is .2374 - .0685 = .1689 BTU. It will be seen that there are two values of specific heat for air;

CP = .2374 BTU per lb.
CV = .1689 BTU per lb.

The relationship between the two values is very important in engine calculations.

By simple calculation, for air-

$$Y = \frac{.2374}{.1689} = 1.406$$

EXPANSION AND COMPRESSION

The conditions under which expansion and compression take place are quite complicated.

It is feasible to classify these operations into two forms, namely, isothermal and adiabatic. Isothermal expansion or compression assumes that Boyle's Law is faithfully followed, and thus that no change in temperature takes place. This would mean that during expansion under constant temperature, the internal energy of the air would also remain unchanged, since this is to the absolute temperature the work necessary for expansion would thus have to be supplied from a source of external heat.

During isothermal compression, the heat generated in the air would have to be allowed to escape as quickly as it was generated, and the heat flowing away during compression would be equal to the heat supplied from outside during expansion.

Adiabatic expansion or compression assumes that no heat flows either to or from the air during the operation. Thus, the air would gain or lose internal energy, as the temperature is raised by compression and lowered by expansion, and the amount of internal energy is proportional to the quantity of external work done by or put into it.

COMPRESSION RATIOS

Isothermal condition – If (V.) is compressed to a smaller volume (V1.) the original pressure P will rise to a pressure P1 = (PV = P1V1 = A constant). If the operation is carried out adiabatically, the equation becomes PV = P1V1. With isothermal conditions (N = 1), as the internal energy of air is unchanged. Under adiabatic operation, the air gains or loses internal energy and thus N. = Y or = 1.406. In practice, the value of (N.) lies between (1. and 1.406) as it is dependent on the characteristics of such items as the fuel added to form the combustible mixture, and the conditions of heat flow in the engine.

If mixture is admitted, for instance to the cylinder of an engine which is already warm from running, heat will flow from the cylinder to the mixture. This means that, in the early stages, including the first part of the compression stroke, this heat will continue to flow.

Temporarily, therefore, (N) will exceed the normal value of (Y). As the fuel mixture temperature proceeds quickly to equal and then to exceed the cylinder temperature as compression continues, the heat flow will stop and reverse direction. So, at the latter stages, heat will be lost from the fuel mixture to the cylinder walls:

(N.) will then fall below (Y.) to an amount dependent on the temperature difference between gas and metal. This will obviously be influenced by the area of metal exposed to the gas, the ratio between volume and cylinder internal surfaces, the density and amount of movement of the gas and so on (PV = P1V1).

VOLUMETRIC EFFICIENCY (V.E.)

Volumetric efficiency of a combustion engine is tested on an Engine Dynamometer, and the results are in percentage = % of (AMAF) Actual Mass Air Flow. All V.E. Dynamometer Tests are carried out manually by a Test Technician who controls the pulls, stops, loads, speeds, and printouts, etc. of the test protocol of the Dynamometer.

The volumetric efficiency of a valve system is measured and tested on an air flow test bench and is measured in (CFM) cubic ft. per minute and (C.F.S.) cubic feet per second.

The standard poppet valves used today only fully opens for 2° to 3° of the crankshaft angle, on the camshaft profile of the poppet valve system in its duration of opening, it starts opening and starts closing and only opens 8mm fully for 2° of its duration resulting in air and fuel flow restrictions during the acceleration curve. This is the reason why engine manufacturers today are putting four and five poppet valves per cylinder into their engines and incorporating turbo-chargers. Because the poppet valve system does not achieve the required volumetric efficiency, especially at high speeds and varied speeds, The Coates C.S.R.V. System opens fully for 34° of the crankshaft angle, presenting a clear port to the combustion chamber, which means that the volumetric efficiency of the C.S.R.V. is much greater than that of the poppet valve. Volumetric efficiency (V.E.) of an engine must correspond with the cubic capacity of the particular engine at maximum RPM's of the said engine. Air traveling in through the venturi and into the cylinders of a combustion engine that is normally aspirated, travels in at a constant speed between 450 to 500 ft. per second and does not exceed this speed regardless of the RPM's or throttle position. This is subject to the variation in barometric pressure and will only exceed this speed if a turbo charger or blower is incorporated.

The average airflow for each cylinder of a poppet valve engine will be approximately 2.5 times the average airflow for the cylinder because the intake occurs during only 40% of the total cycle. For example, if a V8 engine produces 440 H.P. the power per cylinder would be 55 H.P.

- Average air flow = 1.67 x HP = 92 CFM (43.4 1/S)

- Average intake rate = 2.5 x 92 CFM = 230 CFM (108 1/S)

- Peak intake rate = 2.5 x 230 CFM = 575 CFM (271 1/S)

When an engine is operating, the pressure drop across the cylinder head ranges from 0 up to about 200" (500 CM) of water at the 575 CFM (271 1/S). This is equivalent to the test pressure reading on the flow bench. The average pressure drop is approximately 25" of water 2" of mercury or (63 CM) of water at 230 CFM (108 1/S) flow rate.

- Volumetric Efficiency = 5,600 x HP x 100%/ (RPM x CID)

- Volumetric Efficiency = 1234 x KW x 100%/ (RPM x Liters)

- CID represents the cubic inch displacement of an engine

- If the volumetric efficiency of a normally aspirated engine exceeds 100% VE the results are in error.

The RPM, displacement and engine airflow capacity are all related in a definite fashion to the (VE) of the valves. It has become possible to measure the exact airflow (VE) of the valves and predict the maximum potential, thermal efficiency (HP), (TQ) and RPMs at which the max power of an engine will peak. The effect of larger CSRV valve ports, higher compression ratios and much longer fully open valve duration 34° versus 2° to 4°, with no poppet valve protruding into the cylinder and no parasitic losses from the heavy poppet valve springs. The effects of incorporating the CSRV can be seen to have obvious major advantages over the poppet valves.

If an engine puts out 440 HP = (469.48 CFM). The total airflow through a gasoline engine determines its maximum power. At peak power a racing engine will use 1.67 cubic feet of air per minute (CFM) for each horsepower it develops.

For Example

A 100 (HP) engine will use (167 CFM). This is true for any four-cycle gasoline burning racing engine.

- Normally aspirated gasoline CFM = 1.67 x HP
- Normally aspirated gasoline 1/S = 1.06 x KW

To increase the engines power output and efficiency, the airflow capacity must be increased, and the highest compression ratios possible, utilized in its design. The total airflow through an engine is ultimately determined by the port size or diameter of the valve opening. The CSRV has the largest opening and largest possible airflow capacity or CFM of a combustion engine.

MEAN EFFECTIVE PRESSURE

The mean effective pressure is the pressure exerted on the top of the piston in the combustion chamber, on the combustion stroke. This pressure changes during the expansion; first increasing due to the heat escalation and then decreasing due to the piston moving down the bore increasing the cylinder area or volume. To determine the work, we can define the mean effective pressure as follows:

$W = /^{Pd} V = P \text{ mean } Vd$

A mean effective pressure can be found for the indicated, friction and brake work.

P mean, i = Wi/Vd (i = indicated)

P mean, f = Wf/Vd (f = Friction)

P mean, b = Wb/Vd (b = Brake)

For Instance

A naturally aspirated engine would have a P mean, b ~ 2,000 KPA, and if turbo charged, the engine P mean, b may increase to above 3,000 KPA.

- The reciprocating four-stroke internal combustion engine (CI) compression ignition (SI) spark ignition.

- Two-stroke internal combustion engine

- Rotary internal combustion engine

- Gas turbine engine

- The C.S.R.V. Coates Spherical Rotary Valve Combustion Engine

The most widely used is the four-stroke engine for transportation.

The manufacturing of combustion engines for transport vehicles, boats, tractors, trains, and electric power generators, are among the largest industries in the world.

THE FOUR-STROKE AND TWO-STROKE RECIPROCATING PISTON PRINCIPLE

The two-stroke and four-stroke internal combustion engines are based on the reciprocating piston principle thus, they are the most common. (CI) and (SI) types are used in most automotive applications. Depending on the cylinder arrangement, four-stroke engines can be subcategorized as (in line 2, 4, 6, 8, 10, 12, 16, cyl.) V (VEE 2, 4, 6, 8, 10, 12, 16 cyl.) (opposed-pistons 2, 4, 6, 8, cyl.) and (radial types 6, 12 cyl.). Two-stroke ignition engines commonly are used in lightweight applications (e.g., outboard motors, motor scooters, small (CI = CC) motorcycles, snowmobiles, chainsaws and lawnmowers). Large two-stroke diesel (CI) compression ignition engines are used in on-highway trucks, city buses, low-speed marine applications, and some railroad applications.

WORKING CYCLE OF THE 4-STROKE POPPET VALVE SPARK-IGNITION ENGINE

1. Induction 2. Compression 3. Combustion 4. Exhaust

Typically, four-stroke internal combustion engines in commercial vehicles are identified in four ways:

- By displacement (e.g., 3.8L)

- By the type of fuel used (e.g., gasoline, diesel, compressed natural gas (C.N.G.)

- By block configuration (e.g., in line versus V. versus opposed. Versus rotary)

- By valve train configuration (e.g. overhead valve (O.H.V.) versus overhead cam (O.H.C.) versus number of valves per cylinder and (SRV) spherical rotary valve).

Discretionary information, such as, the cooling system (e.g. air versus liquid versus adiabatic), fuel delivery (e.g. direct injection, port injection, carburetor).

THE MODERN INTERNAL COMBUSTION ENGINE

Is a complex machine consisting of many types of mechanisms, systems, and structures. Even with the same type of configuration, the specific structure can vary significantly. A typical engine consists of the block assembly, referred to as (the short block), the cranking and valve train mechanisms, the fuel delivery system, the ignition system, the cooling system, the lubrication system, the starting system, and electrical system. The block assembly consists of the cylinder head, block, and oil pan. The block assembly functions as the assembly basis for each mechanism and system, while many of its own parts are part of the valve train, fuel delivery, cooling, and lubrication system. The cylinder walls in the block and head compose part of the combustion chamber and are subject to high temperature and pressure. In structural analysis the block assembly usually is listed with the crankshaft mechanism.

The crankshaft mechanism includes the pistons, connecting rods, and crankshaft with flywheel attached. This is the mechanism by which the engine generates power by transferring the piston linear reciprocating motion to the crankshaft rotating motion.

The poppet valve train mechanism includes the intake valves, exhaust valves, camshaft, valve stem seal, cam followers, valve springs, additional valve train components include the lash adjuster, (lift tappet), pushrods, rocker arms, valve seat inserts, and valve guides, depending on the type of poppet valve train. Its function is to control the intake of air or air/fuel mixture entering into the cylinders and to vacate the spent fuel or exhaust.

COOLING SYSTEM

If water-cooled, will consist of water pump, thermostat, cylinder water jackets, radiator and cooling fan. The system function is to transfer the excess heat generated by the engine to the atmosphere and regulate the engine temperature to the manufacturers constant recommended degree (F°).

THE OIL PRESSURIZED AND LUBRICATION SYSTEM

Which consists of oil pump, oil filter, pressure regulator valve, oil cooler, oil pressure channels or oil veins run through the crankshaft and other components, which are pressurized by the oil pump with oil circulation to distribute lubricating to the parts with tribological contact to reduce friction and wear between the surfaces and to partly cool and clean the surface to surface friction of components. The engine oil is continually filtered.

STARTING SYSTEM

The starting system consists of starter motor, Bendix gear, solenoid, and starter switch. The starter Bendix gear engages the flywheel ring-gear, initially turning the flywheel and crankshaft quick enough to start the engine firing and running.

FUEL SYSTEM

The fuel management system consists of fuel pump, electronic, sequential injector; computer controlled with (02) oxygen sensor placed in exhaust system, inlet manifold; some older engines use carburetors.

IGNITION SYSTEM

The function of the ignition system is to deliver the high tension electric charge to the spark plug electrodes inside the combustion chamber at the precise time specified, on the compression stroke, which normally occurs at 12° B.T.D.C., depending on the type of engine and its specifications.

THE ELECTRICAL SYSTEM

This system comprises of starting motor and electric reservoir (which is the battery) and numerous sensors for temperature of water, air, gas, pressure, oil, fuel, ignition timing, sequential fuel injection management, are all controlled by the master computer.

THE COATES CSRV ENGINE | **THE POPPET VALVE ENGINE**

The Coates Spherical Rotary Valve System (C.S.R.V.) replaces the traditional Poppet Valves and all their associated parts, springs, guides, seats, retainers, cotters, pushrods, cam followers, camshaft, camshaft bearings, and many more parts including the oil.

The (C.S.R.V.) System is comprised of only two moving shafts and does not utilize oil pressure fed bearings, or oil spray; in fact, no engine oil is present in the head of the

C.S.R.V. Engine. This means the engine oil does not see the hottest parts of the engine, which was the exhaust Poppet Valves. These extremely hot components usually are engine oil spray cooled. This heat would breakdown the atomic structure of the engine oil, thus lowering the oil viscosity, therefore, oil changes are recommended every 3,000 to 5,000 miles. On the other hand, with the (C.S.R.V) incorporated in the engine design. Oil change intervals are extended to approximately 50,000 miles or more. The constant rotation of the C.S.R.V., rotate away from the extreme heat of the combustion chamber, eliminating the possibility of hot spots in the combustion chamber; thus allowing for higher compression chamber ratios to be incorporated in the design of a combustion engine. This results in a higher thermal efficient engine and a more complete combustion that will utilize all of the energy contained in the fuel; also reducing harmful emissions.

HIGH COMPRESSION RATIOS

In the 1950 and 1960s combustion engines utilized compression ratios of 12 to 1. and higher, producing higher horsepower (H.P.), more torque (TQ) and a higher (thermal efficient engine) Engine efficiency was at approximately 35%. Governments around the world found that tetraethyl lead was the lead component in the gasoline at that time.

The findings were that this lead component in the fuel was extremely hazardous to human health and the world's environment; it was then removed from the fuel. This caused the high compression automobile engines to develop hot spots in the combustion chamber and the hot spot was found to be the exhaust poppet valve. It was getting red hot, causing pre-ignition and damage to the engines. The only remedy for this was to lower the compression ratio of all engines; this resulted in a lowering of thermal efficiency from an engine having 35% efficiency to 22 to 24% efficiency. This included the less dense fuel with the lead removed.

This means for every dollar worth of fuel you put into your vehicle, you only get 22 to 24 cents of drivability, and the other 76 to 78 cents are lost through heat friction and pumping losses. We extract out of the earth approximately 86,000,000 barrels of oil daily, 62,000,000 barrels of this oil is lost just keeping our engines running. The other 24,000,000 barrels make possible our actual driving motion, and at the same time, creating insurmountable amounts of other harmful pollutions to be pumped into our atmosphere.

These are all of the reasons why I invented the Coates C.S.R.V. Combustion Engine. The C.S.R.V. Engine utilizes much higher compression ratios, and has no hot spots and has a much greater volumetric efficiency; creating a higher thermal efficient combustion engine in the 35 – 40%, and possibly higher. With the ability to utilize alternative fuels, these possibilities open up new opportunities to reduce the world's consumption of oil-fossil fuels, and reduce the production of harmful emissions that are pumped out into our atmosphere every day, and if implemented will reduce the United States' dependency on imported foreign oil.

Coates International Patents

U.S. Patent 4,944,261, issued July 31, 1990,
"Spherical Rotary Valve Assembly for an Internal Combustion Engine"

U.S. Patent 4,953,527, issued September 4, 1990,
"Spherical Rotary Valve Assembly for an Internal Combustion Engine"

U.S. Patent 4,976,232, issued December 11, 1990,
"Valve Seal for Rotary Valve Engine"

U.S. Patent 4,989,558, issued February 5, 1991,
"Spherical Rotary Valve Assembly for an Internal Combustion Engine"

U.S. Patent 4,989,576, issued February 5, 1991,
"Internal Combustion Engine"

U.S. Patent 5,048,979, issued September 17, 1991,
"Self Adjusting Wheel Bearing Assembly".

U.S. Patent 5,109,814, issued May 5, 1992,
"Spherical Valve"

U.S. Patent 5,361,739, issued November 8, 1994,
"Spherical Rotary Valve Assembly for use in Rotary Valve Internal Combustion Engine"

U.S. Patent 5,601,405, issued February 11, 1997,
"Valve Apparatus for Steam Turbines".

U.S. Patent 6,293,098B1, issued September, 25, 2001,
"Methods and Apparatus for Joining Pressurized Exhaust Manifold Sections"

U.S. Patent 6,308,676B1, issued October 30, 2001
"Cooling System for Rotary Valve Engine"

U.S. Patent 6,666,458B2, issued December 23, 2003,
"Valve Seal for Rotary Engine"

U.S. Patent 6,668,785B1, issued December 30, 2003,
"Piston Head for Internal Combustion Engine".

U.S. Patent 6,718,933B1, issued April 13, 2004,
"Valve Seal for Rotary Valve Engine"

U.S. Patent 6,779,504B2, issued August 24, 2004,
"Spherical Rotary Intake Valve for Engine Assembly"

U.S. Patent 6, 779,925B2, issued August 24, 2004,
"Bearing Assembly"

U.S. Patent 6,789,516, issued September 14, 2004,
"Rotary Valve & Valve Seal Assembly for Rotary Valve Engine having Hemispherical Combustion Chambers".

U.S. Patent 6,880,511B1, issued April 19, 2005,
"Seal Pressure Regulator".

****

Additional applications are being filed with respect to new technology not evidenced in the present prototypes.

Coates also has been issued over one hundred patents in Japan, Australia, Brazil, Taiwan, Korea, Canada, South Africa, Saudi Arabia, Turkey, and the European Patent Community.

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ALLIED DIESEL SERVICE CO.

Authorized Sales and Service - CUMMINS, MACK and VOLVO GMC

869 Hwy. 33 East
:ehold, N.J. 07728

Parts: (732) 462-5072
Service: (732) 462-9683

March 7, 2006

To Whom It May Concern:

Some time in 2001, we supplied components to Coates International for a new type of engine Mr. George Coates was working on at that time. It was an 855 Cummins engine. We inspected and observed the CSRV system adapted to the Cummins block with the Coates CSRV in place, running very quietly at full speed which is 1800 RPM's to 2000 RPM's. The engine ran extremely smoothly and quietly. As Mr. Coates exposed the components to us, we observed only two moving parts. We were astonished to say the least. We remanufacture Cummins engines and other makes for over forty-seven years here at Allied Diesel.

After a week or two, we calculated approximately 2700 parts in the poppet valve standard version compared to Mr. Coates replacing all these parts with only two moving parts. After a number of visits, and delivering parts and observing the engines operating on numerous occasions, we became investors in Coates International, Ltd.

We are convinced that the Coates CSRV engine is the way of the future.

Sincerely,

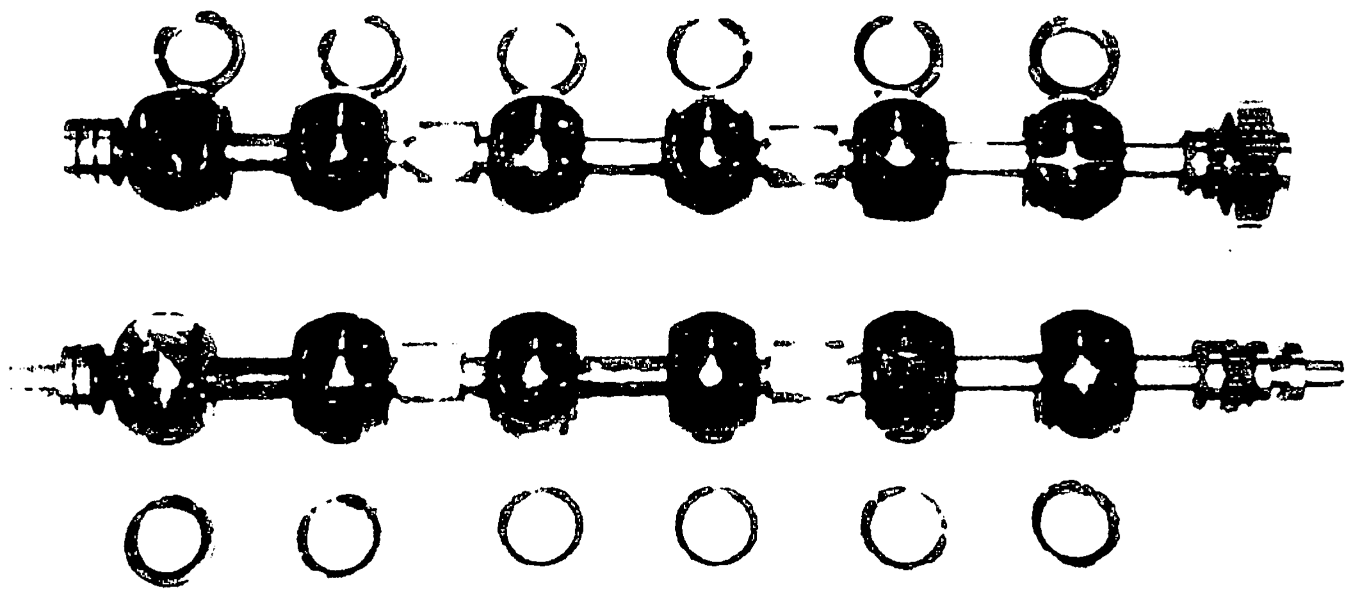
Ralph Darienzo, Jr.

Ralph Darienzo, Jr.

Cummins

Mack TRUCKS

VOLVO



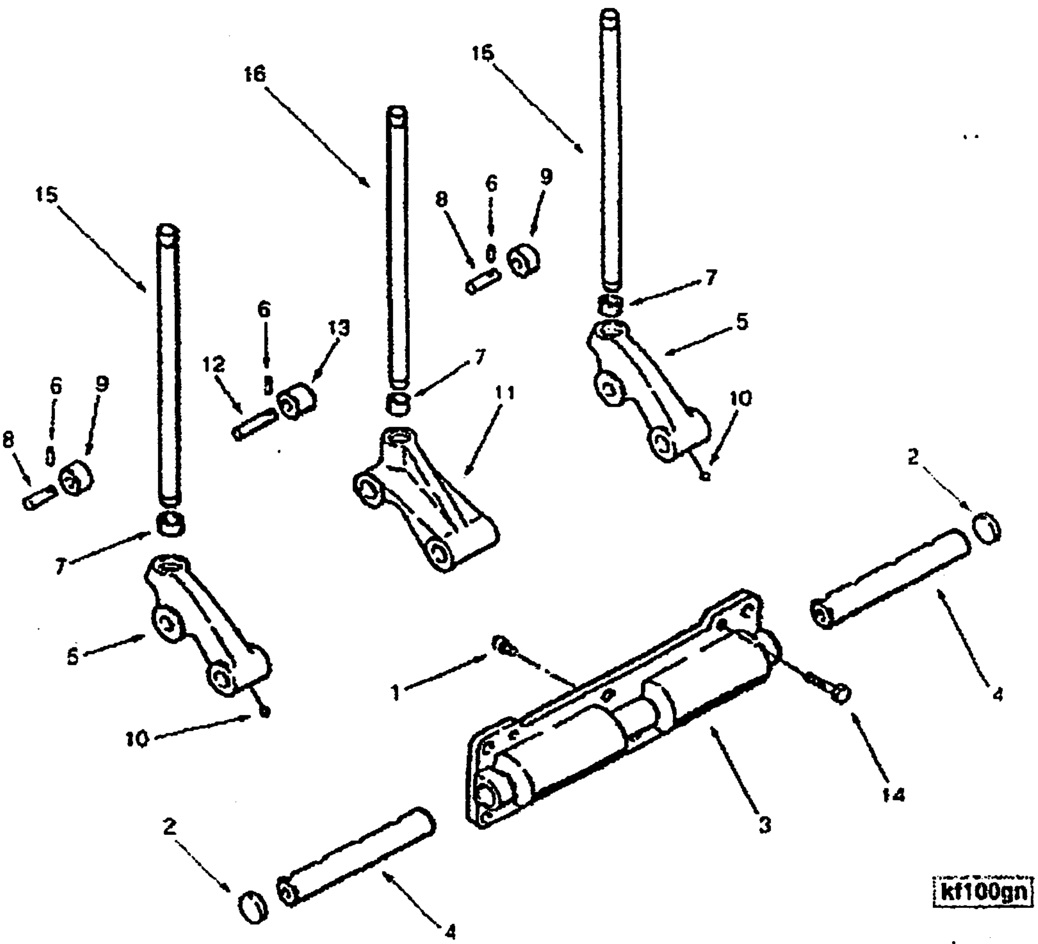
TWO ROTATING C.S.R.V. SHAFTS AND NO UTILIZATION OF ENGINE OIL PRESSURE SERVICE TO ANY PART OF THE C.S.R.V. SYSTEM. NO MAINTENANCE TO C.S.R.V. VALVE SYSTEM FOR LIFE OF THE ENGINE

Content For Engine Serial Number (ESN): *11256204*

Electronic Parts Catalog - Option Detail

Option	Group	Graphic	Film Card	Date
BP1224	04.03	kf100gn		

Engines



SMALL | MEDIUM | LARGE

Option	For-Sale	Part Name	Remarks
BP1224	NO	BP1224	3/8 - 24 X 1 Inch.

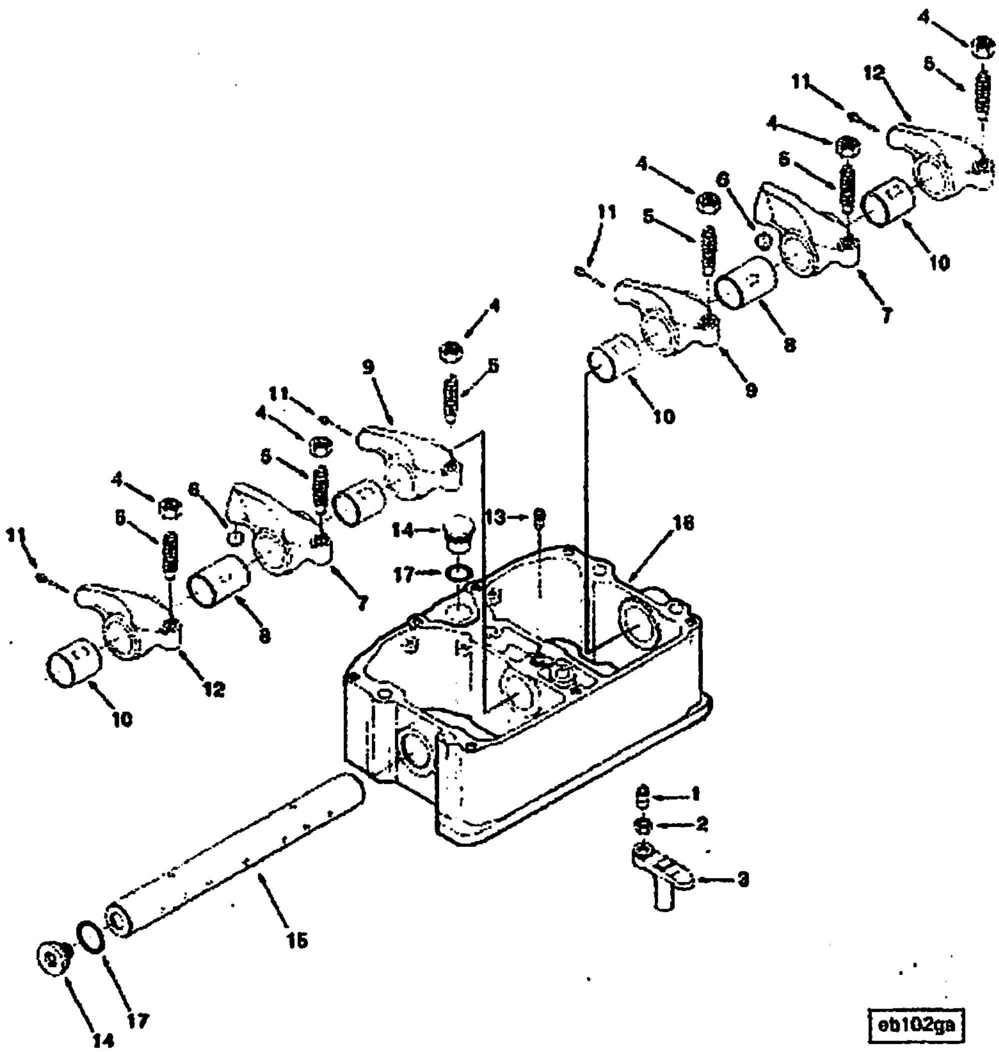
Ref No	Part Number	For-Sale	Shopping Cart	Part Name	Required	Remarks

Content For Engine Serial Number (ESN): *11256204*

Electronic Parts Catalog - Option Detail

Option	Group	Graphic	Film Card	Date
EB1004	03.01	eb102ga		

Engines



SMALL | MEDIUM | LARGE

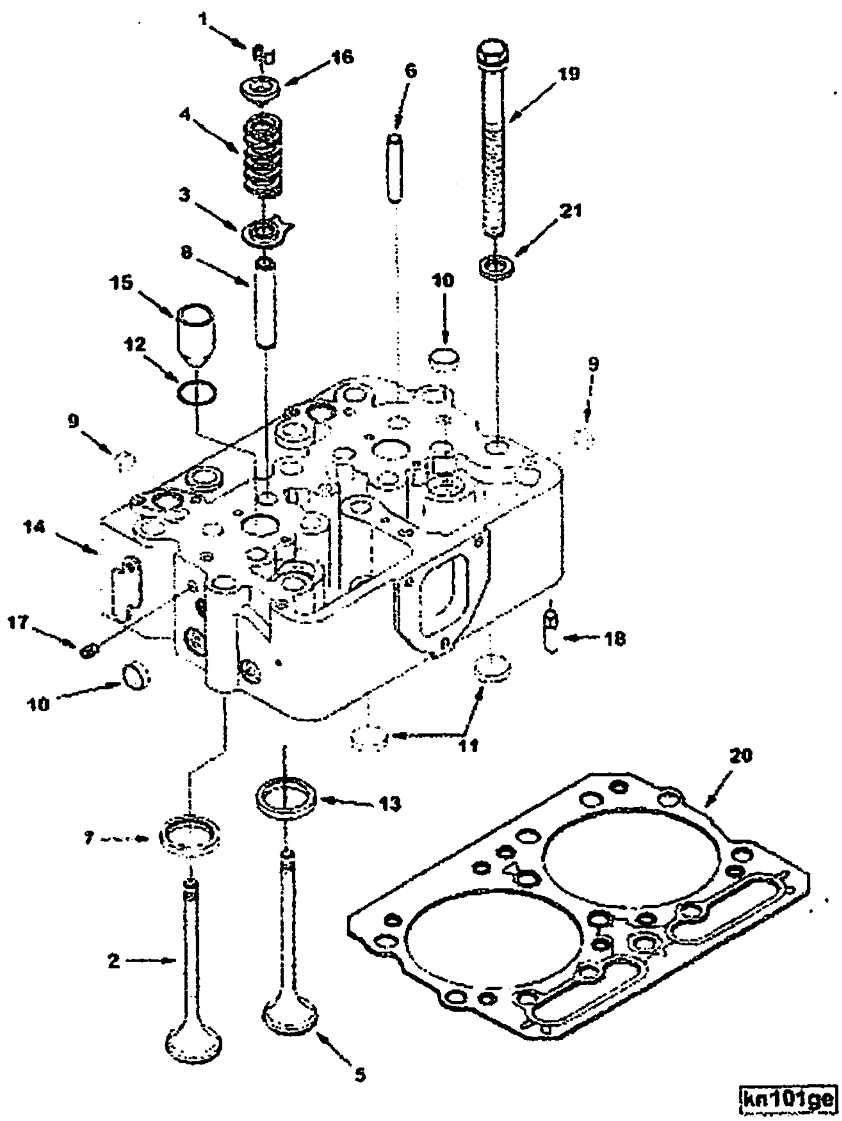
Option	For-Sale	Part Name	Remarks
EB1004	NO	EB1004	Rocker housing with provision

Content For Engine Serial Number (ESN): *11256204*

Electronic Parts Catalog - Option Detail

Option	Group	Graphic	Film Card	Date
PP1703	02.01	kn101ge		

Engines



SMALL | MEDIUM | LARGE

Option	For-Sale	Part Name	Remarks
PP1703	NO	PP1703	Standard cylinder head can be

Ref No	Part Number	For-Sale	Shopping Cart	Part Name	Required	Remarks
	EB1004	NO		Rocker Housing		Rocker housing with provision for accepting an engine brake.
	3030038	YES	ADD	Crosshead		
1	147389	YES	ADD	Screw, Crosshead Adjusting	1	3/8 - 24 x 3/4 inch
2	203131	YES	ADD	Nut, Heavy Hexagon	1	3/8 - 24 UNF
3	3028293	NO		Crosshead, Valve	1	
	3044788	YES	ADD	Assembly, Rocker Housing	3	Recon equivalent 3044788 RX
	AR 2308	YES	ADD	Assembly, Rocker Lever	2	
4	S 212	YES	ADD	Nut, Regular Hexagon	1	1/2 - 20 UNF
5	168306	YES	ADD	Screw, Slotted Set	1	
6	194037	YES	ADD	Socket, Rocker Lever	1	
7	218152	NO		Lever, Injector Rocker	2	
8	218153	YES	ADD	Bushing	1	
	BM95161	YES	ADD	Assembly, Rocker Lever	2	
4	S 212	YES	ADD	Nut, Regular Hexagon	1	1/2 - 20 UNF
5	168306	YES	ADD	Screw, Slotted Set	1	
9	3017571	NO		Lever, Exhaust Valve	1	
10	140330	YES	ADD	Bushing	1	

Ref No	Part Number	For-Sale	Shopping Cart	Part Name	Required	Remarks
	PP1703	NO		Cylinder Head		Standard cylinder head can be used with or without Jacobs brake. Cannot be used with 65 . PSI exhaust brake.
	3041993	YES	ADD	Assembly, Cylinder Head	3	On engines prior to 20JUL87
1	127554	YES	ADD	Collet, Valve	16	
2	135957	NO		Valve, Intake	4	
3	170296	YES	ADD	Retainer, Valve Spring	8	
4	211999	YES	ADD	Spring, Valve	8	
5	3040830	NO		Valve, Exhaust	4	
	3041992	YES	ADD	Head, Cylinder	1	
6	123558	YES	ADD	Guide, Valve Crosshead	4	
7	200354	YES	ADD	Insert, Valve Intake	4	
8	3006456	YES	ADD	Guide, Valve Stem	8	
9	3007634	YES	ADD	Plug, Expansion	3	
10	3007635	YES	ADD	Plug, Expansion	6	
11	3007636	YES	ADD	Plug, Expansion	2	
12	3007759	YES	ADD	Seal, O Ring	2	
13	3017759	YES	ADD	Insert, Valve Exhaust	4	
14	3041991	NO		Head, Cylinder	1	

4	3021596	YES	ADD	Woodruff	1
5	215233	YES	ADD	Bearing, Thrust	1

	BP1224	NO		Cam Follower Housing		
	3036939	YES	ADD	Assembly, Cam Follower Hsg	3	
1	69736	YES	ADD	Screw, Cam Follower Shaft	2	
2	3007634	YES	ADD	Plug, Expansion	2	
3	3016887	YES	ADD	Housing, Cam Follower	1	
4	3017031	YES	ADD	Shaft, Cam Follower	2	
5	3056568	YES	ADD	Lever, Cam Follower	4	
6	118939	YES	ADD	Pin, Roll	1	
7	213559	YES	ADD	Socket, Cam Follower	1	
8	3013331	YES	ADD	Pin, Cam Follower Roller	1	
9	3036933	YES	ADD	Roller, Cam Follower	1	
10	3056570	YES	ADD	Plug, Ball	1	
11	3056569	YES	ADD	Lever, Cam Follower	2	
6	118939	YES	ADD	Pin, Roll	1	
7	213559	YES	ADD	Socket, Cam Follower	1	
12	3013330	YES	ADD	Pin, Cam Follower Roller	1	
13	3036934	YES	ADD	Roller, Cam Follower	1	
				$MOUNTING PARTS		
14	S 129	YES	ADD	Screw, Hexagon Head Cap	18	3/8 - 24 X 1 Inch.
15	3046420	YES	ADD	Rod, Push	12	
16	3046430	YES	ADD	Rod, Push Injector	6	

11	208084	YES	ADD	Rivet	1
	BM95162	YES	ADD	Assembly, Rocker Lever	2
4	S 212	YES	ADD	Nut, Regular Hexagon	1
5	168306	YES	ADD	Screw, Slotted Set	1
10	140330	YES	ADD	Bushing	1
11	208084	YES	ADD	Rivet	1
12	3017572	NO		Lever, Exhaust Valve	1
13	168319	YES	ADD	Screw, Socket Set	3
14	3038903	YES	ADD	Plug, Rocker Lever Shaft	2
15	3038904	YES	ADD	Shaft, Rocker Lever	3
16	3044787	YES	ADD	Housing, Rocker Lever	1
17	3058653	YES	ADD	Seal, O Ring	6

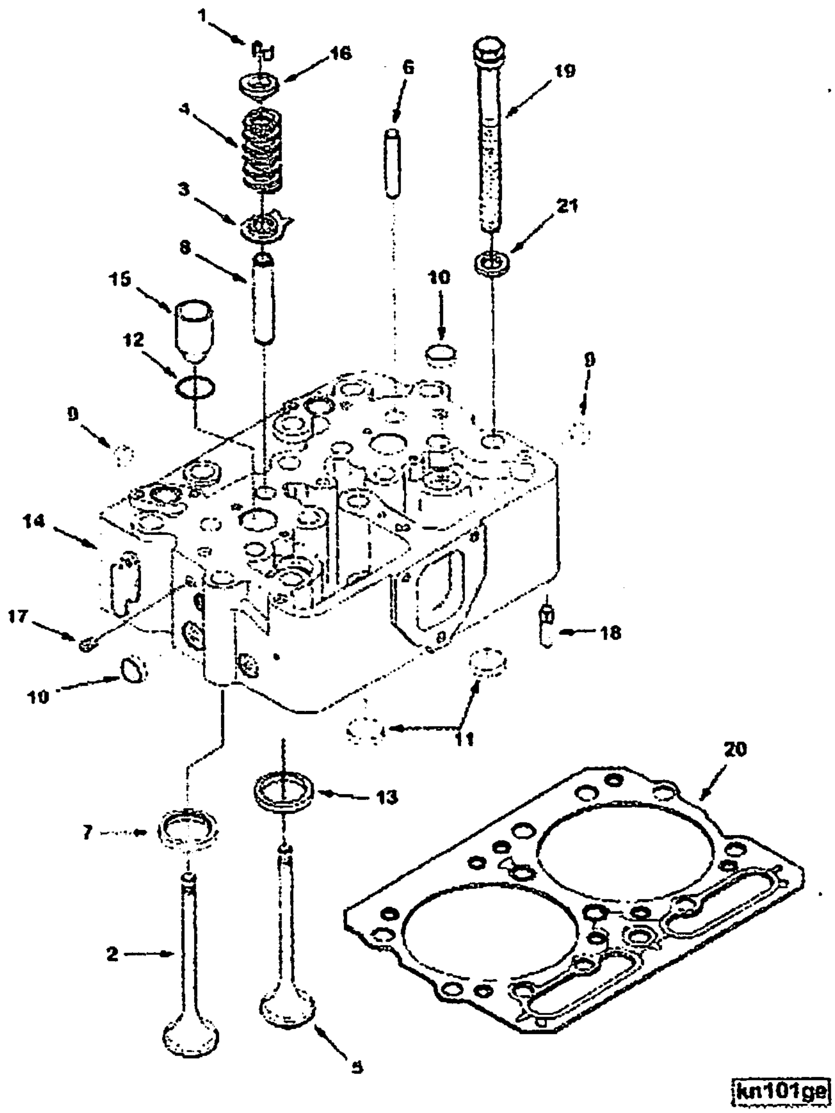
15	3070486	YES	ADD	Sleeve, Injector	2	
16	3042745	YES	ADD	Guide, Valve Spring	8	
				$CYLINDER HEAD MOUNTING		
17	S 911 B	YES	ADD	Plug, Pipe	10	1/8 NPT
18	68445	YES	ADD	Pin, Groove	6	
19	3013623	YES	ADD	Screw, Hexagon Head Cap	36	
20	3076189	YES	ADD	Gasket, Cylinder Head	3	
21	3060633	YES	ADD	Washer, Plain	36	5/8 Inch.

Content For Engine Serial Number (ESN): *11256204*

Electronic Parts Catalog - Option Detail

Option	Group	Graphic	Film Card	Date
PP1703	02.01	kn101ge		

Engines



SMALL | MEDIUM | LARGE

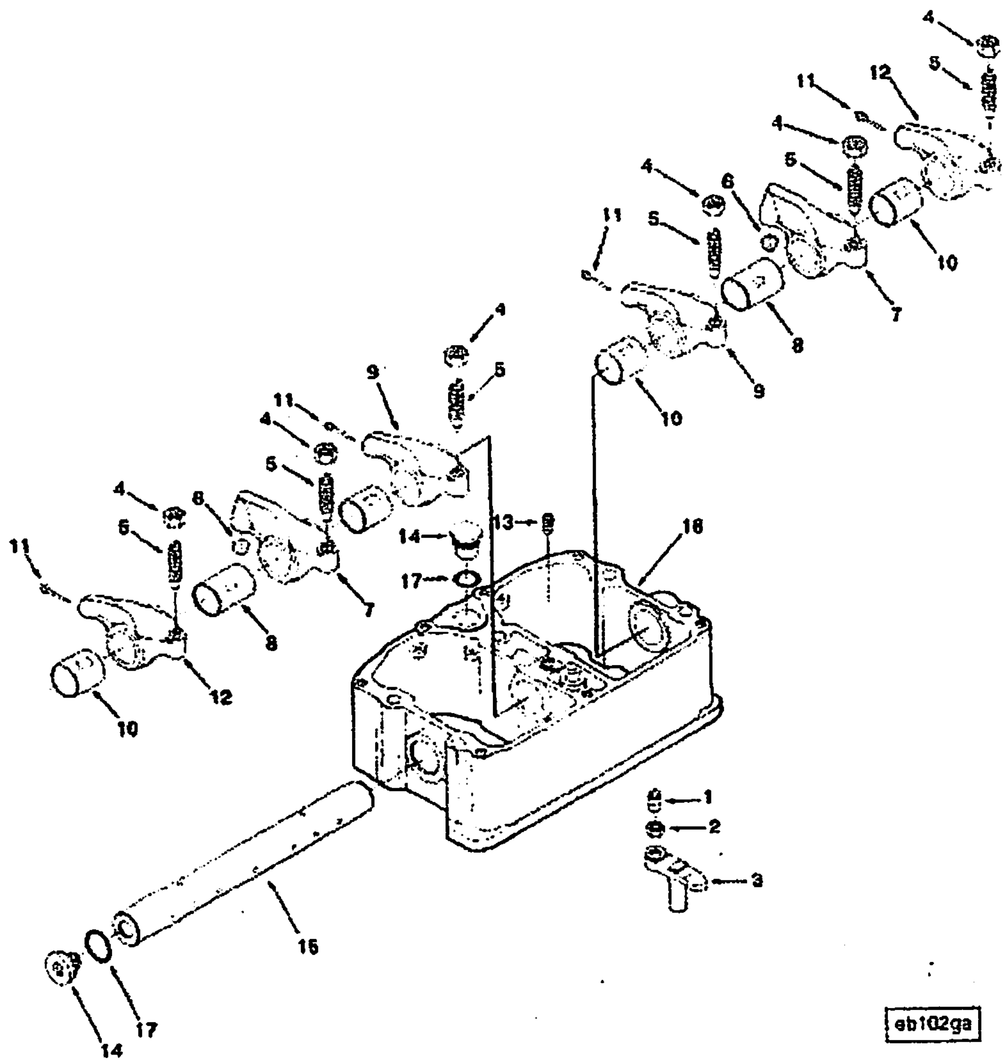
Option	For-Sale	Part Name	Remarks
PP1703	NO	PP1703	Standard cylinder head can be

Content For Engine Serial Number (ESN): *11256204*

Electronic Parts Catalog - Option Detail

Option	Group	Graphic	Film Card	Date
EB1004	03.01	eb102ga		

Engines



SMALL | MEDIUM | LARGE

Option	For-Sale	Part Name	Remarks
EB1004	NO	EB1004	Rocker housing with provision

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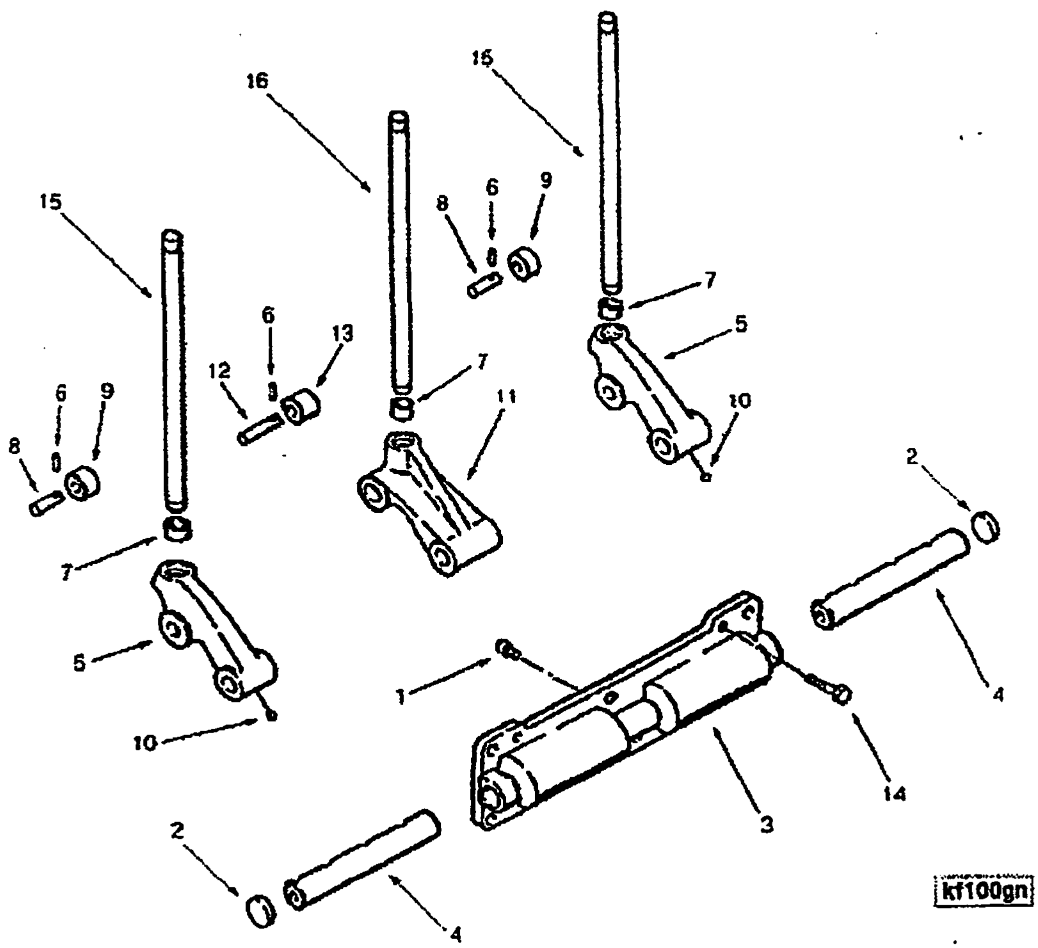
Engines



SMALL | MEDIUM | LARGE

Option	For-Sale	Part Name	Remarks
BP1224	NO	BP1224	3/8 - 24 X 1 Inch.

Ref No	Part Number	For-Sale	Shopping Cart	Part Name	Required	Remarks

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	3044788	YES	ADD	Assembly, Rocker Housing	3	Recon equivalent 3044788 RX
	AR 2308	YES	ADD	Assembly, Rocker Lever	2	
4	S 212	YES	ADD	Nut, Regular Hexagon	1	1/2 - 20 UNF
5	168306	YES	ADD	Screw, Slotted Set	1	
6	194037	YES	ADD	Socket, Rocker Lever	1	
7	218152	NO		Lever, Injector Rocker	2	
8	218153	YES	ADD	Bushing	1	
	BM95161	YES	ADD	Assembly, Rocker Lever	2	
4	S 212	YES	ADD	Nut, Regular Hexagon	1	1/2 - 20 UNF
5	168306	YES	ADD	Screw, Slotted Set	1	
9	3017571	NO		Lever, Exhaust Valve	1	
10	140330	YES	ADD	Bushing	1	

Ref No	Part Number	For-Sale	Shopping Cart	Part Name	Required	Remarks
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7	200354	YES	ADD	Insert, Valve Intake	4	
8	3006456	YES	ADD	Guide, Valve Stem	8	
9	3007634	YES	ADD	Plug, Expansion	3	
10	3007635	YES	ADD	Plug, Expansion	6	
11	3007636	YES	ADD	Plug, Expansion	2	
12	3007759	YES	ADD	Seal, O Ring	2	
13	3017759	YES	ADD	Insert, Valve Exhaust	4	
14	3041991	NO		Head, Cylinder	1	

4	3021596	YES	ADD	Woodruff	1
5	215233	YES	ADD	Bearing, Thrust	1

	BP1224	NO		Cam Follower Housing		
	3036939	YES	ADD	Assembly, Cam Follower Hsg	3	
1	69736	YES	ADD	Screw, Cam Follower Shaft	2	
2	3007634	YES	ADD	Plug, Expansion	2	
3	3016887	YES	ADD	Housing, Cam Follower	1	
4	3017031	YES	ADD	Shaft, Cam Follower	2	
5	3056568	YES	ADD	Lever, Cam Follower	4	
6	118939	YES	ADD	Pin, Roll	1	
7	213559	YES	ADD	Socket, Cam Follower	1	
8	3013331	YES	ADD	Pin, Cam Follower Roller	1	
9	3036933	YES	ADD	Roller, Cam Follower	1	
10	3056570	YES	ADD	Plug, Ball	1	
11	3056569	YES	ADD	Lever, Cam Follower	2	
6	118939	YES	ADD	Pin, Roll	1	
7	213559	YES	ADD	Socket, Cam Follower	1	
12	3013330	YES	ADD	Pin, Cam Follower Roller	1	
13	3036934	YES	ADD	Roller, Cam Follower	1	
				$MOUNTING PARTS		
14	S 129	YES	ADD	Screw, Hexagon Head Cap	18	3/8 - 24 X 1 Inch.
15	3046420	YES	ADD	Rod, Push	12	
16	3046430	YES	ADD	Rod, Push Injector	6	

11	208084	YES	ADD	Rivet	1
	BM95162	YES	ADD	Assembly, Rocker Lever	2
4	S 212	YES	ADD	Nut, Regular Hexagon	1
5	168306	YES	ADD	Screw, Slotted Set	1
10	140330	YES	ADD	Bushing	1
11	208084	YES	ADD	Rivet	1
12	3017572	NO		Lever, Exhaust Valve	1
13	168319	YES	ADD	Screw, Socket Set	3
14	3038903	YES	ADD	Plug, Rocker Lever Shaft	2
15	3038904	YES	ADD	Shaft, Rocker Lever	3
16	3044787	YES	ADD	Housing, Rocker Lever	1
17	3058653	YES	ADD	Seal, O Ring	6

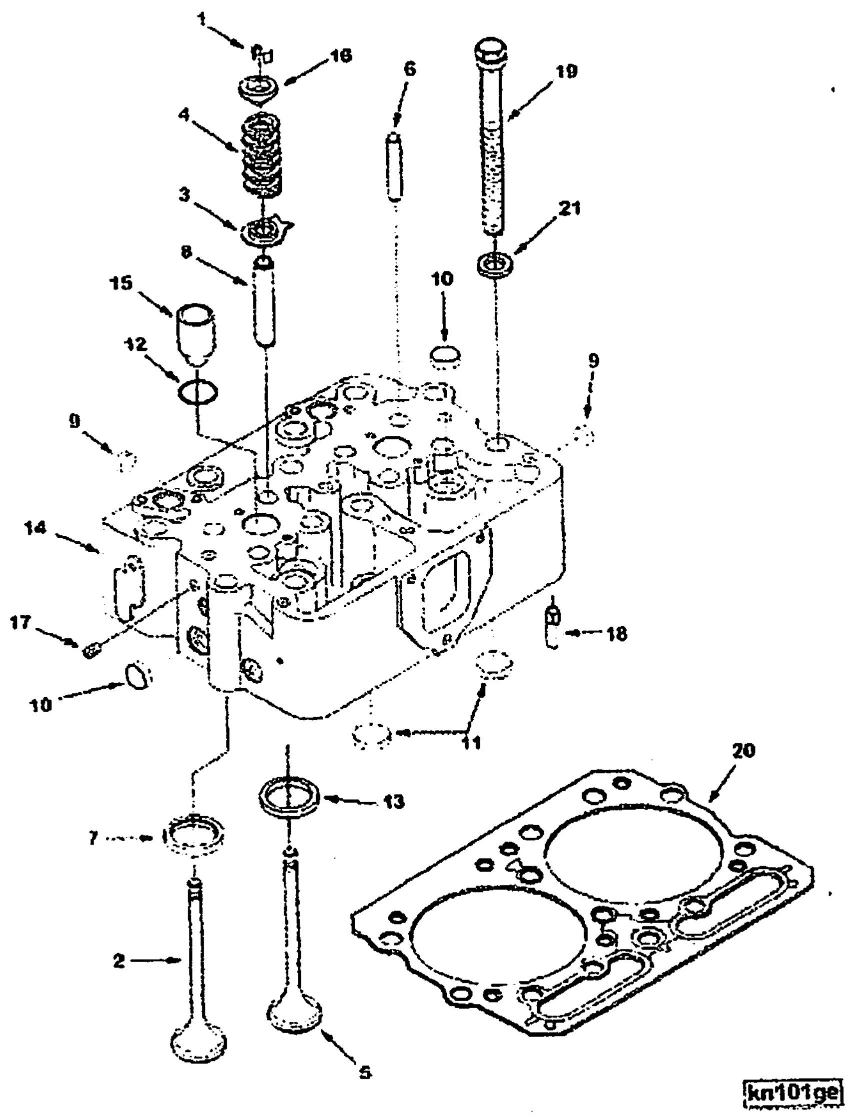
15	3070486	YES	ADD	Sleeve, Injector	2	
16	3042745	YES	ADD	Guide, Valve Spring	8	
				$CYLINDER HEAD MOUNTING		
17	S 911 B	YES	ADD	Plug, Pipe	10	1/8 NPT
18	68445	YES	ADD	Pin, Groove	6	
19	3013623	YES	ADD	Screw, Hexagon Head Cap	36	
20	3076189	YES	ADD	Gasket, Cylinder Head	3	
21	3060633	YES	ADD	Washer, Plain	36	5/8 Inch.

Content For Engine Serial Number (ESN): *11256204*

Electronic Parts Catalog - Option Detail

Option	Group	Graphic	Film Card	Date
PP1703	02.01	kn101ge		

Engines



SMALL | MEDIUM | LARGE

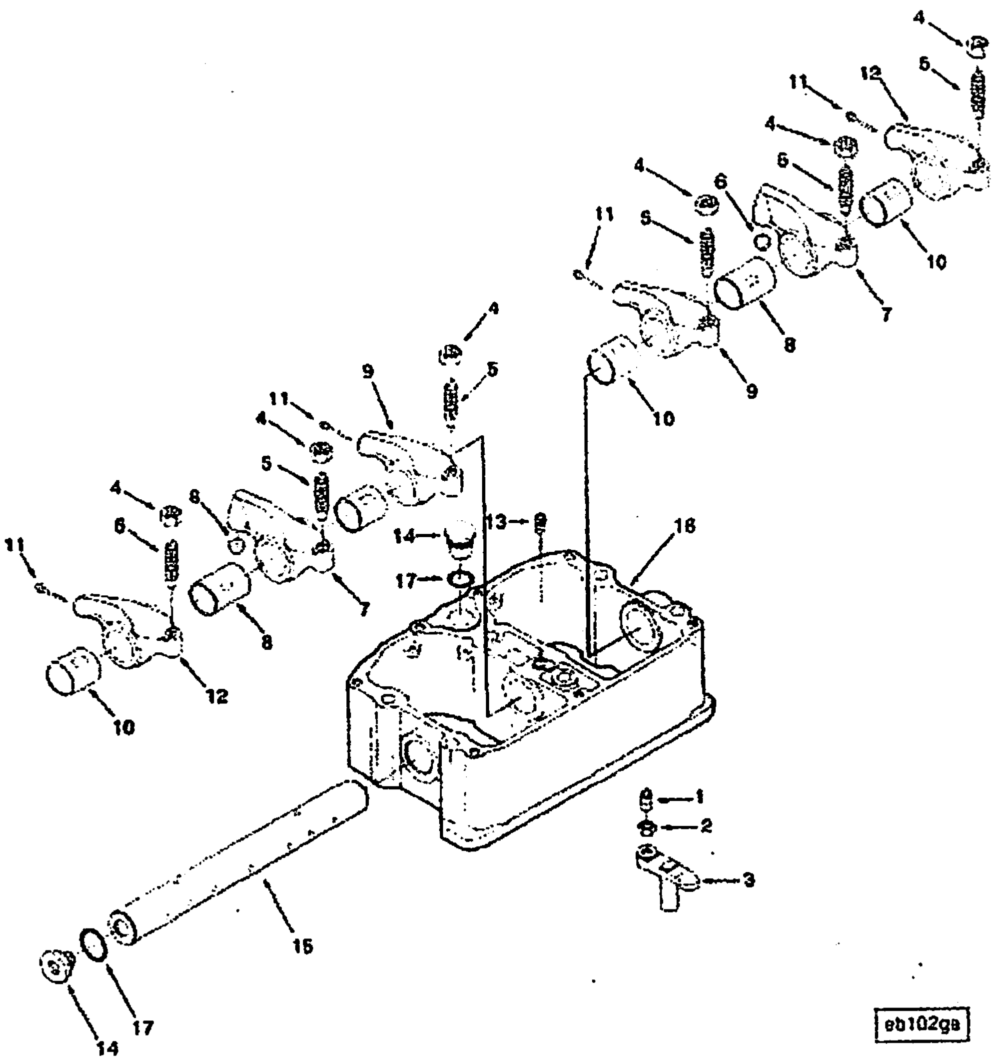
Option	For-Sale	Part Name	Remarks
PP1703	NO	PP1703	Standard cylinder head can be

Content For Engine Serial Number (ESN): *11256204*

Electronic Parts Catalog - Option Detail

Option	Group	Graphic	Film Card	Date
EB1004	03.01	eb102ga		

Engines



SMALL | MEDIUM | LARGE

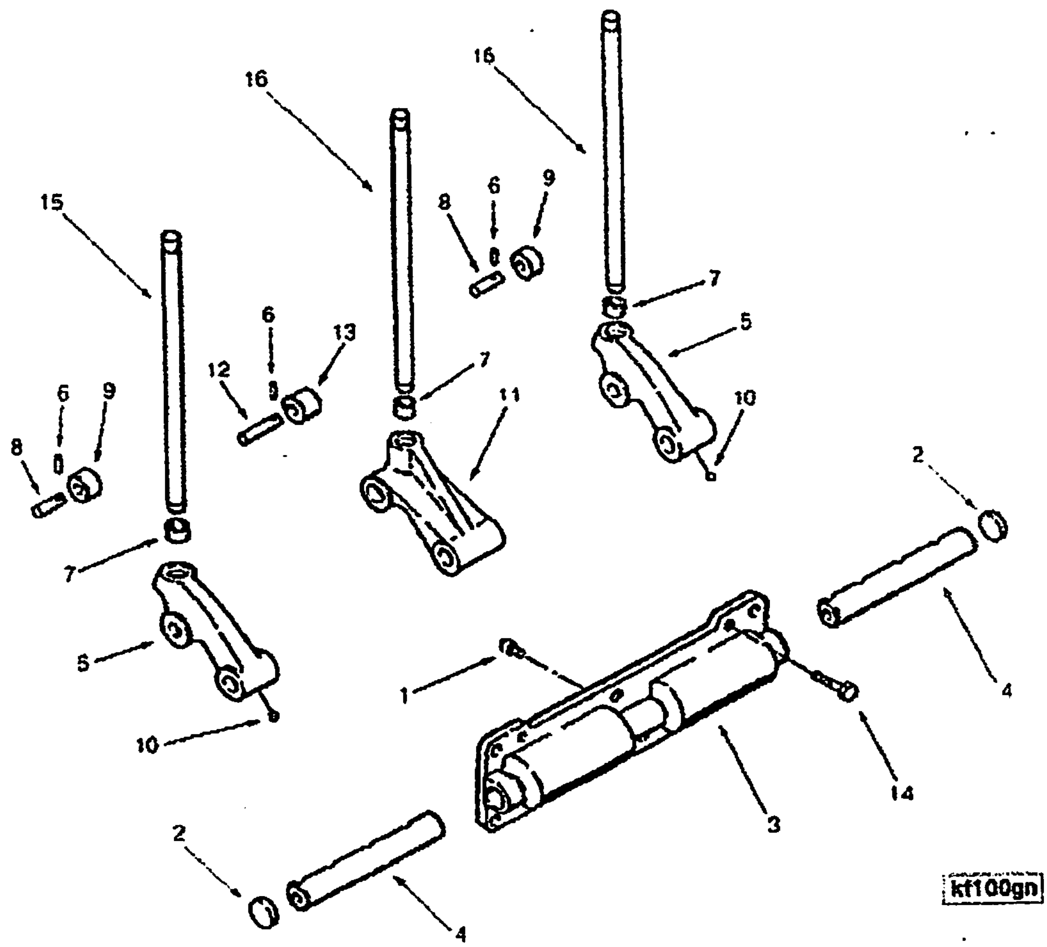
Option	For-Sale	Part Name	Remarks
EB1004	NO	EB1004	Rocker housing with provision

Content For Engine Serial Number (ESN): *11256204*

Electronic Parts Catalog - Option Detail

Option	Group	Graphic	Film Card	Date
BP1224	04.03	kf100gn		

Engines



SMALL | MEDIUM | LARGE

Option	For-Sale	Part Name	Remarks
BP1224	NO	BP1224	3/8 - 24 X 1 Inch.

Ref No	Part Number	For-Sale	Shopping Cart	Part Name	Required	Remarks

Ref No	Part Number	For-Sale	Shopping Cart	Part Name	Required	Remarks
	EB1004	NO		Rocker Housing		Rocker housing with provision for accepting an engine brake.
	3030038	YES	ADD	Crosshead		
1	147389	YES	ADD	Screw, Crosshead Adjusting	1	3/8 - 24 x 3/4 inch
2	203131	YES	ADD	Nut, Heavy Hexagon	1	3/8 - 24 UNF
3	3028293	NO		Crosshead, Valve	1	
	3044788	YES	ADD	Assembly, Rocker Housing	3	Recon equivalent 3044788 RX
	AR 2308	YES	ADD	Assembly, Rocker Lever	2	
4	S 212	YES	ADD	Nut, Regular Hexagon	1	1/2 - 20 UNF
5	168306	YES	ADD	Screw, Slotted Set	1	
6	194037	YES	ADD	Socket, Rocker Lever	1	
7	218152	NO		Lever, Injector Rocker	2	
8	218153	YES	ADD	Bushing	1	
	BM95161	YES	ADD	Assembly, Rocker Lever	2	
4	S 212	YES	ADD	Nut, Regular Hexagon	1	1/2 - 20 UNF
5	168306	YES	ADD	Screw, Slotted Set	1	
9	3017571	NO		Lever, Exhaust Valve	1	
10	140330	YES	ADD	Bushing	1	

Ref No	Part Number	For-Sale	Shopping Cart	Part Name	Required	Remarks
	PP1703	NO		Cylinder Head		Standard cylinder head can be used with or without Jacobs brake. Cannot be used with 65 PSI exhaust brake.
	3041993	YES	ADD	Assembly, Cylinder Head	3	On engines prior to 20JUL87
1	127554	YES	ADD	Collet, Valve	16	
2	135957	NO		Valve, Intake	4	
3	170296	YES	ADD	Retainer, Valve Spring	8	
4	211999	YES	ADD	Spring, Valve	8	
5	3040830	NO		Valve, Exhaust	4	
	3041992	YES	ADD	Head, Cylinder	1	
6	123558	YES	ADD	Guide, Valve Crosshead	4	
7	200354	YES	ADD	Insert, Valve Intake	4	
8	3006456	YES	ADD	Guide, Valve Stem	8	
9	3007634	YES	ADD	Plug, Expansion	3	
10	3007635	YES	ADD	Plug, Expansion	6	
11	3007636	YES	ADD	Plug, Expansion	2	
12	3007759	YES	ADD	Seal, O Ring	2	
13	3017759	YES	ADD	Insert, Valve Exhaust	4	
14	3041991	NO		Head, Cylinder	1	

4	3021596	YES	ADD	Woodruff	1
5	215233	YES	ADD	Bearing, Thrust	1

	BP1224	NO		Cam Follower Housing		
	3036939	YES	ADD	Assembly, Cam Follower Hsg	3	
1	69736	YES	ADD	Screw, Cam Follower Shaft	2	
2	3007634	YES	ADD	Plug, Expansion	2	
3	3016887	YES	ADD	Housing, Cam Follower	1	
4	3017031	YES	ADD	Shaft, Cam Follower	2	
5	3056568	YES	ADD	Lever, Cam Follower	4	
6	118939	YES	ADD	Pin, Roll	1	
7	213559	YES	ADD	Socket, Cam Follower	1	
8	3013331	YES	ADD	Pin, Cam Follower Roller	1	
9	3036933	YES	ADD	Roller, Cam Follower	1	
10	3056570	YES	ADD	Plug, Ball	1	
11	3056569	YES	ADD	Lever, Cam Follower	2	
6	118939	YES	ADD	Pin, Roll	1	
7	213559	YES	ADD	Socket, Cam Follower	1	
12	3013330	YES	ADD	Pin, Cam Follower Roller	1	
13	3036934	YES	ADD	Roller, Cam Follower	1	
				$MOUNTING PARTS		
14	S 129	YES	ADD	Screw, Hexagon Head Cap	18	3/8 - 24 X 1 Inch.
15	3046420	YES	ADD	Rod, Push	12	
16	3046430	YES	ADD	Rod, Push Injector	6	

11	208084	YES	ADD	Rivet	1
	BM95162	YES	ADD	Assembly, Rocker Lever	2
4	S 212	YES	ADD	Nut, Regular Hexagon	1
5	168306	YES	ADD	Screw, Slotted Set	1
10	140330	YES	ADD	Bushing	1
11	208084	YES	ADD	Rivet	1
12	3017572	NO		Lever, Exhaust Valve	1
13	168319	YES	ADD	Screw, Socket Set	3
14	3038903	YES	ADD	Plug, Rocker Lever Shaft	2
15	3038904	YES	ADD	Shaft, Rocker Lever	3
16	3044787	YES	ADD	Housing, Rocker Lever	1
17	3058653	YES	ADD	Seal, O Ring	6

15	3070486	YES	ADD	Sleeve, Injector	2	
16	3042745	YES	ADD	Guide, Valve Spring	8	
				$CYLINDER HEAD MOUNTING		
17	S 911 B	YES	ADD	Plug, Pipe	10	1/8 NPT
18	68445	YES	ADD	Pin, Groove	6	
19	3013623	YES	ADD	Screw, Hexagon Head Cap	36	
20	3076189	YES	ADD	Gasket, Cylinder Head	3	
21	3060633	YES	ADD	Washer, Plain	36	5/8 Inch.

15	3070486	YES	ADD	Sleeve, Injector	2	
16	3042745	YES	ADD	Guide, Valve Spring	8	
				$CYLINDER HEAD MOUNTING		
17	S 911 B	YES	ADD	Plug, Pipe	10	1/8 NPT
18	68445	YES	ADD	Pin, Groove	6	
19	3013623	YES	ADD	Screw, Hexagon Head Cap	36	
20	3076189	YES	ADD	Gasket, Cylinder Head	3	
21	3060633	YES	ADD	Washer, Plain	36	5/8 Inch.

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