Issued by the
Administrator of Vehicle Standards
in consultation with the
Australian Motor Vehicle Certification Board
comprising Commonwealth, State and Territory representatives

Australian Government
Department of Infrastructure and Regional Development

CIRCULAR NO. 36-4-1

STANDARD SUBMISSION FORMS FOR DEMONSTRATING COMPLIANCE WITH AUSTRALIAN DESIGN RULE NO.36 - EXHAUST EMISSION CONTROL FOR HEAVY DUTY VEHICLES

1. The preferred method of submitting evidence in demonstration of compliance is through the completion by the manufacturer of all applicable standard submission forms issued by the Board.

2. Available submission forms are listed below and copies are appended to this circular.

NUMBER	TITLE	CURRENT ISSUE
PART 1 EC36	Application for Selection of Test engines	1
EC36/A	Annex A	1
EC36/B	Annex B	1
EC36/C	Annex C	1
EC36/D	Annex D	1

APPLICATION FOR SELECTION OF TEST ENGINES ADR 36

Applicant's Reference:

The Chairman,

Australian Motor Vehicle Certification Board,

Box 5232BB,

G.P.0. MELBOURNE, Vic. 3001

Dear Sir,

I/We, the undersigned, for and on behalf of:

Company

Address

hereby apply for selection of test engines by the Administrator in accordance with Clause 36.3.4.5.

I/We am/are not requesting a reduction in the number of test engines determined in accordance with Clause 36.3.4.6 in respect of the following engine family - exhaust emission control system combinations:

Issue 1 May 1978

Engine Model	Engine System Combination	Projected Annual Sales 1978/79

In support of this application, the documentation listed in Attachment 1 is submitted as attachments.

Yours faithfully,

for and on behalf of

……..

……..

Date……

LIST OF DOCUMENTATION IN SUPPORT OF APPLICATION FOR SELECTION OF TEST ENGINES ADR 36.

Applicant's Reference:

	Document Reference No.	Date
Annex A		
Annex B		
Annex C		
Annex D		

ANNEX A

APPLICANTS REF. NO.:	
DATE	

NAME OF APPLICANT:

ADDRESS:

EC36 APPLICATION REFERENCE NO.:

ENGINE MAKE:

ENGINE FAMILY IDENTIFICATION:

ENGINE DISPLACEMENT - EXHAUST EMISSION CONTROL SYSTEM COMBINATIONS IDENTIFICATION

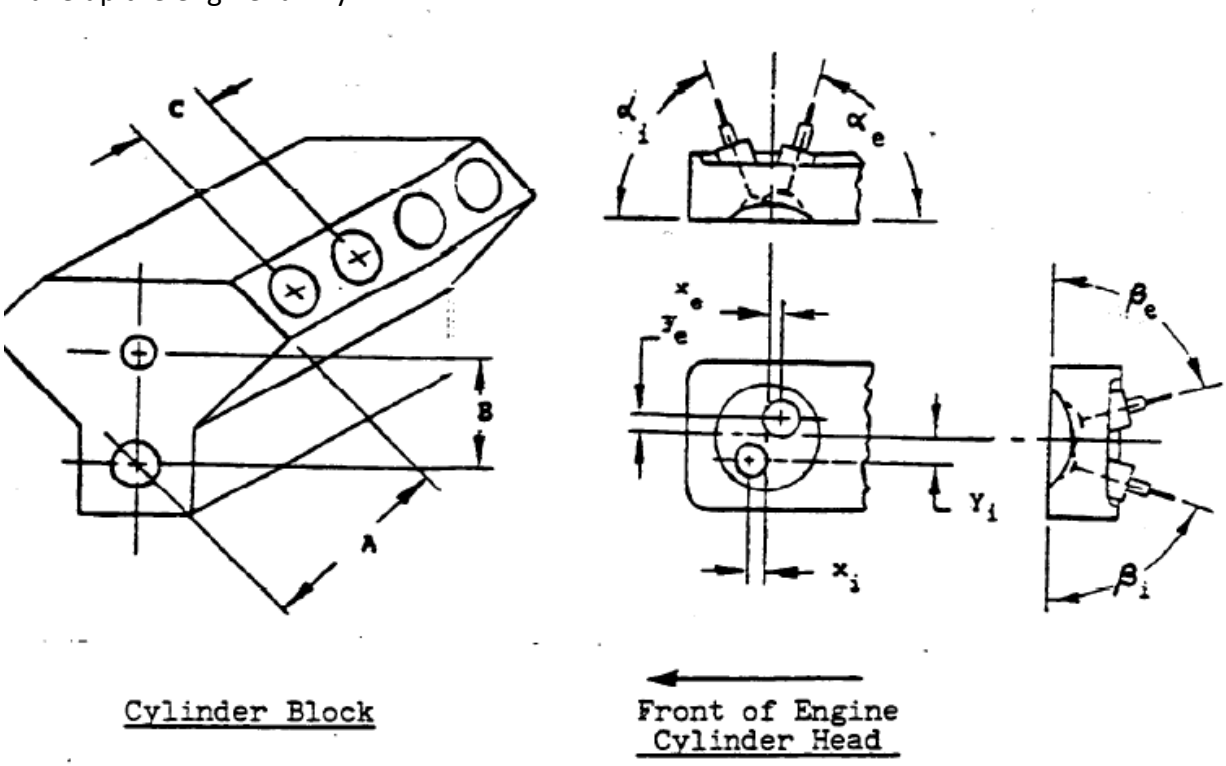
(Attached should be data in no less detail than set out in .Annex A Attachment 1)

ANNEX A

Attachment 1

Engine Family Description for Four-Stroke Cycle Reciprocating Engines

Include a description of each engine family and the various engine configurations which make up the engine family:



Part A: - Common Family Parameters

Engine Family Identification:

(a) Nominal deck height (Dimension “A”):___mm

(b) Nominal centreline of crankshaft to centreline of camshaft (Dimension “B”):___mm

(c) Nominal bore centre to centre (Dimension "C"):__mm

Part A - Common Family Parameters cont.

(4) Nominal valve location:

		Units	Cylinder Number* 1	2	3	4
Intake Valve	x_i	mm				
	y_i	mm				
	α_i	degrees				
	β_i **	degrees				
Exhaust Valve	x_e	mm				
	y_e	mm				
	α_e	degrees				
	β_e **	degrees				

(5) Block configuration:

(a) Type of cooling (air, water):

(b) Number of cylinders and configuration (L-6, 90°V8, etc.):

(6) Combustion cycle (e.g. 4 stroke Otto cycle, etc.):

(7) Method of aspiration (natural, supercharged, etc.):

*If all dimensions are the same for all cylinders, they may be specified for one cylinder and the others may be indicated as "typical".

Use additional columns as necessary.

**For V-block engines, nominate angles of left cylinder bank (when facing toward front of engine).

PART B

ENGINE FAMILY IDENTIFICATION

INDIVIDUAL ENGINE DISPLACEMENT - EXHAUST EMISSION CONTROL SYSTEM COMBINATION IDENTIFICATION

GENERAL PARAMETERS

Nominal Engine Displacement (litres)

Exhaust Emission Control System Identification

(Annex A Part C Reference)

Emission Stabilization Period (hours)

ENGINE PARAMETERS — ENGINE CONFIGURATION *

CODE ** CODE** CODE**

(1) Bore x Stroke (mm).

(2) Compression ratio (nominal, maximum, and minimum).

(3) Surface/Volume Ratio of the nominally dimensioned cylinder at the TDC position (m-1).

(4) Type of cylinder head (OHC, OHV, etc.).

(5) Combustion chamber configuration (hemispherical, wedge, divided, etc.) Include sketch.

(6) Intake port area of cylinder head and manifold at mating surface (mm^2)

(7) Exhaust port area of cylinder head and manifold at mating surface (mm^2)

Note: Descriptions and data for each individual engine configuration may be submitted on separate pages if convenient.

* An engine configuration is defined as a particular combination of carburetor (or fuel injection) calibration, choke calibration (if automatic).distributor calibration, auxiliary emission control devices, and all other items described in Part B.

** Any code or number may·be used to identify engine configurations.

ANNEX A

PART B

ENGINE CONFIGURATION

CODE CODE CODE

ENGINE PARAMETERS (CONT)

(8) Intake Valve

a) head diameter (mm).
b) type (stellite faced, etc.).
c) list any special seat preparation (inserts, induction hardening, etc.).
d) are valve rotators utilized (if yes, positive or non-positive).

(9) Exhaust Valve.

e) head diameter (mm).
f) type (aluminized, etc.).
g) list any special seat preparation (inserts, induction hardening, etc.).
h) are valve rotators utilized(if yes, positive or non-positive).

(10) Intake manifold configuration *(indicate heated passages).

(11) Exhaust manifold configuration *(indicate heat shields and stoves).

(12) Rated power, kw @ r/min **

(13) Rated torque, Nm @ r/min **

* Provide labelled drawings.

** Indicate whether net or gross, and specify method of measurement.

PART B

ENGINE CONFIGURATION

CODE CODE CODE

ENGINE PARAMETERS (CONT)

(14) Exhaust system (dual or single). *

(15) Cooling system.

(a) Thermostat.

(b) Temperature setting.

(c) System pressure.

Note: Descriptions and data for each individual engine configuration may be submitted on separate pages if desired.

* Provide labelled Schematic drawing for each exhaust system, indicating tubing diameters, catalyst location (if applicable), and other pertinent dimensions and components.

ENGINE PARAMETERS (CONT) ANNEX A

(16) Fuel System PART B

(a) Carburetion *

i. Manufacturer.
ii. Number of carburetors.
iii. Type (downdraft, etc.).
iv. Number of venturis per carburetor.
v. Venturi diameter.
vi. Maximum air flow, litres/second @ mm Hg.
vii. Fuel metering system – type (fixed orifice, tapered rod, etc.).
viii. Fuel metering system – calibration(e.g. 1.65 mm diameter main metering jet).
ix. Enrichment system – type (e.g., power valve).
x. Enrichment system – calibration (e.g., 1.78 mm orifice staged to open at 127 mmHg manifold vacuum).
xi. Idle stop (dashpot, solenoid, etc.).
xii. Choke system (manual or auto **).
xiii. Altitude compensation (describe, if applicable).
xiv. Flow curve no. ***
xv. Part number.

(b) Fuel injection.*

(i) Manufacturer.

(ii) Control parameters (engine speed, vacuum, A/F ratio sensor, etc.).

(iii) Basic type (mechanical, electronic, etc.).

Note: Descriptions and data for each individual engine configuration may be submitted on separate pages if convenient.

* Provide labelled assembly drawings.

**If automatic, describe method of operation, location of sensing unit, and code or number to indicate choke setting (if applicable) and calibration.

***Include a copy of every flow curve referenced.

b. Fuel injection* - cont.

(iv) Point of injection (manifold cylinder, etc.).

(v) Type (timed, continuous).

(vi) Intake system maximum air flow.

(vii) Intake system throttled (yes or no).

(viii) Fuel shutoff on deceleration (yes or no).

(ix) Enrichment system for cold starts.

(x) Flow curve no.**

(xi) Fuel rate (at maximum torque) per fuel pump stroke, mm3/stoke and kg/hr.

(xii) Fuel rate {at maximum power) per fuel pump stroke, mm /stroke and kg/hr.

(xiii) Type of injector nozzle and method of operation.

(xiv) Typical peak fuel line pressure at inlet to injector nozzle.

(xv) Part number (all components).

(xvi) Basic injection timing (degrees BTDC or ATDC @ r/min)and setting procedure.

(xvii) Advance curve no. (if applicable)**

(c) Idle speed and setting procedure.

(d) Idle mixture and setting procedure (if applicable).***

(17) Air Inlet System

(a) Air cleaner type (dry, oil bath, etc.).

(b) Air inlet temperature control system (if applicable).

(i) Describe source of heat.

(ii) Describe temperature control

Note: Descriptions and data for each individual engine configuration may be submitted on separate pages if convenient.

* Provide labelled assembly drawings.

** Include a copy of every flow curve referenced.

*** If more than one procedure available, submit written procedures and show equivalency.

ENGINE PARAMETERS (CONT) ANNEX A
PART B

(18) Ignition System
- (a) Ignition system type (breaker points, transistorized, capacitive discharge, etc.).
- (b) Manufacturer.
- (c) Advance mechanical (centrifugal, vacuum, etc.).*
- (d) Basic ignition timing (degrees BTDC or ATDC ® r/min).***
- (e) Advance curve no. **
- (f) Spark plugs (manufacturer, heat range, and gap).
- (g) Ignition wire material.
- (h) Dwell (if applicable).***
- (i) High voltage source (coil, magneto, etc.).
- (j) Distributor part number (if applicable).

(19) Camshaft Timing (crank degrees before or after TDC or BDC).
- (a) Intake Valve .
  - (i) opens.
  - (ii) closes.
  - (iii) duration.
  - (iv) maximum lift (mm).
- (b) Exhaust Valve.
  - (i) opens.
  - (ii) closes.
  - (iii) duration.
  - (iv) maximum lift (mm).
- (c) Valve Overlap (degrees or degree – mm).
- (d) Rocker Arm Ratio.
- (e) Tappets (hydraulic or mechanical).

Note: Descriptions and data for each individual engine configuration may be submitted on separate pages if convenient.

* Provide description of operation, including a labelled sketch if necessary.

** Include a copy of every advance (centrifugal, vacuum, etc.) curve referenced.

ENGINE PARAMETERS (CONT) ANNEX A

PART B

(20) Governor Description (if applicable) *

- (a) Governor type (limiting, variable speed, etc.).
- (b) Governed speed, r/min. (with engine loaded and unloaded).
- (c) Manufacturer.

(21) Rated speed, r/min. (lf not previously stated in (12) or (20)(b)).

(22) Supercharger/Turbocharger/Blower Description (if applicable). **

- (a) Type (centrifugal, root, etc.).
- (b) Drive (mechanical, exhaust turbine, etc.).
- (c) Aneroid setting.
- (d) Maximum manifold pressure.
- (e) Flow curve No. ***
- (f) Part number.

(23) Crankcase Emission Control System.

- (a) Provide sketch describing operation of system and components.
- (b) Type (fixed or variable orifice, etc.).
- (c) Control valve (provide drawing if applicable). ****
- (d) Location of flame arrestors (if applicable).

Note: Descriptions and data for each individual engine configuration may be submitted on separate pages if convenient.

* Include a narrative description of operational characteristics.

** Submit a graph or performance 'map' to describe operational characteristics.

*** Include a copy of every flow curve referenced.

**** Provide copy of each calibration.

ENGINE PARAMETERS (CONT) ANNEX A

(24) Exhaust Emission Control System PART B

(a) Provide a labelled sketch or photograph describing operation and showing location of each system and its components.

(b) Indicate usage of the following control systems*

(i) Engine modification.

(ii) Mechanical fuel injection.

(iii) Electronic fuel injection.

(iv) Air injection.

(v) Exhaust gas recirculation.

(vi) Thermal reactor.

(vii) Oxidation catalyst.

(viii) Reduction catalyst.

(ix) Other.

Note: Descriptions and data for each individual engine configuration may be submitted on separate pages if convenient.

* If variations of any one type of control system are used (for example, two oxidation catalysts), identify them separately (see Annex A, Part C). If more than one type of control system is used on any single engine configuration, specify usage (one oxidation and one reduction catalyst.

ENGINE PARAMETERS (CONT) ANNEX A

(25) Evaporative Emission Control System (If fitted) PART B

(a) Provide sketch describing operation.

(b) Vapor storage media and location.

(c) valves (number, type, and location).

(d) Purge system.

(e) Flow restrictions and locations.

(f) Statement as to the effect on induction system (if any).

Note: Descriptions and. data for each individual engine configuration may be submitted on separate pages if convenient.

ANNEX A

Description of Exhaust Emission Control System PART C

Provide a separate description of each exhaust emission control system and auxiliary devices used in conjunction with the engine family identified in Annex A. The description shall explain the method of operation of the system and its constituent components and shall be accompanied by a labelled sketch or photograph illustrating the layout of the components. Reference may be made to the sketches or photographs required by other parts of Annex A.

The description of each exhaust emission control system (as applicable, should include discussion of:

1. Engine Design features such as:
   - (a) High energy ignition system.
   - (b) 'Quick heat' intake manifold design.
   - (c) Pre-combustion chamber design.
   - (d) Fuel system.
2. Air Injection features such as:
   - (a) General location of injected air (exhaust port, thermal reactor, catalyst, etc.).
   - (b) General method of controlling quantity of injected air (engine speed, vacuum, throttle position, etc.).
   - (c) Specific features which affect flow characteristics (nozzle angle, tip design, etc.).
3. Exhaust Gas Recirculation features such as:
   - (a) Location of exhaust pick-up (crossover upstream of muffler, downstream of muffler, etc.).
   - (b) Location of exhaust gas introduction (above throttle blade, between carburetor and intake manifold, manifold port, etc.)
   - (c) General method of controlling quantity of EGR (intake manifold signal, amplified venture vacuum signal, throttle position, exhaust back pressure, etc.)
   - (d) Special features for filtering or cooling EGR.
   - (e) Warning system (if applicable).
4. Thermal Reactor features such as:
   - (a) Material.
   - (b) Lining and/or insulation.
   - (c) Cooling (if any).
   - (d) Volume (individually and collectively, if multiple).
   - (e) Light off method (electric ignition glow plug, self-inducement, etc.).
   - (f) Warning system (if applicable).

Description of Exhaust Emission Control Systems - Cont. PART C

5. Catalyst features* such as:

   (a) Catalyst supplier and address (Engelhard, UOP, AC, Matthey-Bishop, etc.).

   (b) General type (oxidation, reduction, etc.).

   (c) Substrate.

      (i) Type (monolith, pellet, etc.).

      (ii) Construction technique (extruded, laid-up etc.).

      (iii) Material.

      (iv) Supplier and address.

   (d) Washcoat.

   (e) Active Material.

      (i) Type (platinum, palladium, etc.).

      (ii) Total loading (grams).

      (iii) Percentage breakdown.

      (iv) Effective surface area (m /g).

   (f) Catalyst canner (if different from catalyst supplier).

   (g) Physical description.

      (i) Dimensions (length, width, height, etc.).

      (ii) Weight (kg).

      (iii) Volume.

   (h) Warning systems (if applicable).

   (i) Specifications given to supplier. **

6. Auxiliary Emission Control Devices.

   (a) Types (controlling or controlled parameter, e.g. vehicle speed/spark).

   (b) Calibration (activating or deactivating values including the effect of sensor hysteresis).***

   (c) Identification (colour, production code, number, etc.).

   (d) Purpose of devices.

Any combination of the above catalyst features (excluding suppliers' addresses) is defined as a unique catalyst configuration and should be identified by a 'catalyst code'.

* Please provide a copy of the catalyst specifications (design, performance, material, etc.) given to the supplier(s).

** If the calibration consists of a curve, include a copy of each curve referenced.

ANNEX A

PART D

Engine Family Sales

Engine Family Identification _____

Engine Displacement - Exhaust Emission	Annual Sales Volume* (Units)	% of this Family

Control System Combination Identification

Engine Family Sales Total: _____

* Defined as the number of engines projected for sale per annum for use as motive power in vehicles subject to Australian Design Rule No.36 - Exhaust Emission Control for Heavy Duty Vehicles.

ANNEX A

PART E

ENGINE DESCRIPTION

Engine Family Identification_____ Engine Displacement - Exhaust _____

Emission Control System Combination Identification

Engine Model	Engine Displacement	Engine Code	Exhaust Emission Control System	Projected Sales (Units)

Family Sales Total_____

ANNEX A

PART F

PROPOSED TEST ENGINE FLEET

Engine Family	Model	Disp	Engine Code	Exhaust Emission Control System*	Comp Ratio	Fuel Metering System	Rated Power, kw @ r/min	Rated Torque Nm @ r/min

*Indicate catalyst code, if applicable.

ANNEX A

PART G

Proposed Maintenance to be Performed on Test Engines

Indicate the scheduled maintenance which is proposed to be performed on all test engines. Give specific maintenance operations, specifications, and respective hours of operating time.

If a change in engine performance is proposed to be one of the criteria for performing unscheduled maintenance, specify the procedure and particular parameters which will be used for evaluation purposes.

ANNEX B

Applicant's Ref. No.:	
Date	

SERVICE ACCUMULATION

NAME OF APPLICANT:

ADDRESS:

EC 36 APPLICATION REFERENCE NO.:

NAME OF FACILITY:

ADDRESS:

(Attached should be data in no less detail than set out in Annex B Attachment 1)

ATTACHMENT 1

Service Accumulation Schedule

(A) Include a complete description of the engine dynamometer service accumulation cycle. Sufficient data must be submitted to substantiate that the average engine speed is between 80 and 85 per cent of the speed at which dynamometer emission tests are conducted, and to substantiate that the other requirements of Clause 36.4.1 are satisfied.

Service Accumulation Cycle

Sequence Number*	Mode***	Manifold Vacuum	Time in Mode-Selection	Percent of Total Cycle	Cumulative Time-Seconds	Average speed Per mode

Total time in mode-seconds_____

Total Cycle Time**_____ Average Cycle

Speed_____

*Do not include transient conditions

**Include transient conditions and stabilized modes

***Include operation at speeds in excess of 3200 r/min or 160% of speed at which dynamometer tests are conducted, as specified in Clause 36.4.1.

ANNEX B

Service Accumulation Schedule

(B) Comparison of Manifold Vacuum

Manifold Vacuum – kPa	ADR 36 Emission Test Cycle Percent of Total Cycle	Proposed Service Accumulation Cycle Percent of Total Cycle
Idle	23.3%	
10	11.3%	
34	14.7%	
54	30.7%	
64	5.7%	
Closed Throttle	14.3%	

ANNEX C

Applicant's Ref. No.:	
Date	

LABORATORY DATA

NAME OF APPLICANT:

ADDRESS:

EC 36 APPLICANT'S REFERENCE NO:

NAME OF LABORTORY:

ADDRESS:

(Attached should be data in no less detail than set out in Annex C Attachment 1)

ANNEX C

Attachment 1

Laboratory Data

A detailed description of the test equipment and procedures, including photographs, schematic drawings, and narrative explanations, shall be submitted with a statement concerning the equivalency of equipment and procedures prescribed in ADR 36. The information shall be submitted for all facilities which are used in establishing compliance.

Description of the facility should include:

(1) name and address of the testing facility.

(2) name and title of person in charge of the facility.

Description of the test equipment should include:

(1) manufacturer.

(2) model number or identification.

(3) number of units used in the certification program.

(4) pertinent specifications.

(5) flow schematics (if applicable).

(6) calibration methods and intervals.

(7) scheduled maintenance procedures.

The item of test equipment to be described should include:

(1) Engine test dynamometer(s).*

(2) Sampling and analytical system(s).

(a) Hydrocarbon analyzer.

(b) Carbon monoxide analyzer.

(c) Carbon dioxide analyzer.

(d) Recorder(s).

(e) Sample probes.

(3) Computer data processing system.

(4) Engine cooling system(s).

*Submit manufacturer's sales information (technical specifications).

Laboratory Data - Cont

Describe the practices and procedures followed relative to calibration gases used for certification testing. Detail the utilisation and identification of calibration gases, traceability of calibration gases to referenced standards, and the origin of the referenced standards. If not covered previously, specify the span gases used for each analyzer.

If a procedures manual or operational instruction guide is utilized, please provide a copy (if in English).

Describe the practices and procedures for storage and handling (including decanting) of emission test fuels other than the fuel used for service accumulation.

ANNEX D

Applicant's Ref. No.:	
Date	

TEST FUELS

NAME OF APPLICANT:

ADDRESS:

EC 36 APPLICATION REFERENCE NO:

REPORTS ATTACHED:

1. EMISSION TEST FUEL

   REPORT NO. DATE

   2. SERVICE ACCUMULATION FUEL (where applicable)

      (a) Manufacturer’s Recommendation Reference

      (b) Proposed Fuel Report No. Date

ANNEX D

Attachment 1

TEST FUELS

An analysis of the fuel proposed for the exhaust emission testing shall be supplied. The analysis should have the endorsement of the National Association of Testing Authorities. Where such an endorsement is not practicable the analysis shall clearly identify the testing authority, and specify the analysis method used to determine each of the fuel characteristics.

Every fuel used in these tests must be covered by a specific analysis and it may be necessary to furnish additional analysis reports during the testing program.

If the fuel used for service accumulation is petrol commercially available in Australia of the grade or mix recommended by the engine manufacturer, state the engine manufacturer's recommended grade or mix and the proposed service accumulation fuel or fuels. Alternatively, if fuel of the specification outlined in Clause 36.6.1 is to be used for service accumulation, an analysis of the proposed fuel in respect of each of the fuel characteristics described in Clause 36.6.1 shall be supplied.