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Improvement of Emissions of internal Combustion Engines Using Reduction in Weight

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IMPROVEMENT OF EMISSIONS OF INTERNAL COMBUSTION ENGINES USING REDUCTION IN WEIGHT

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CHE-101-006

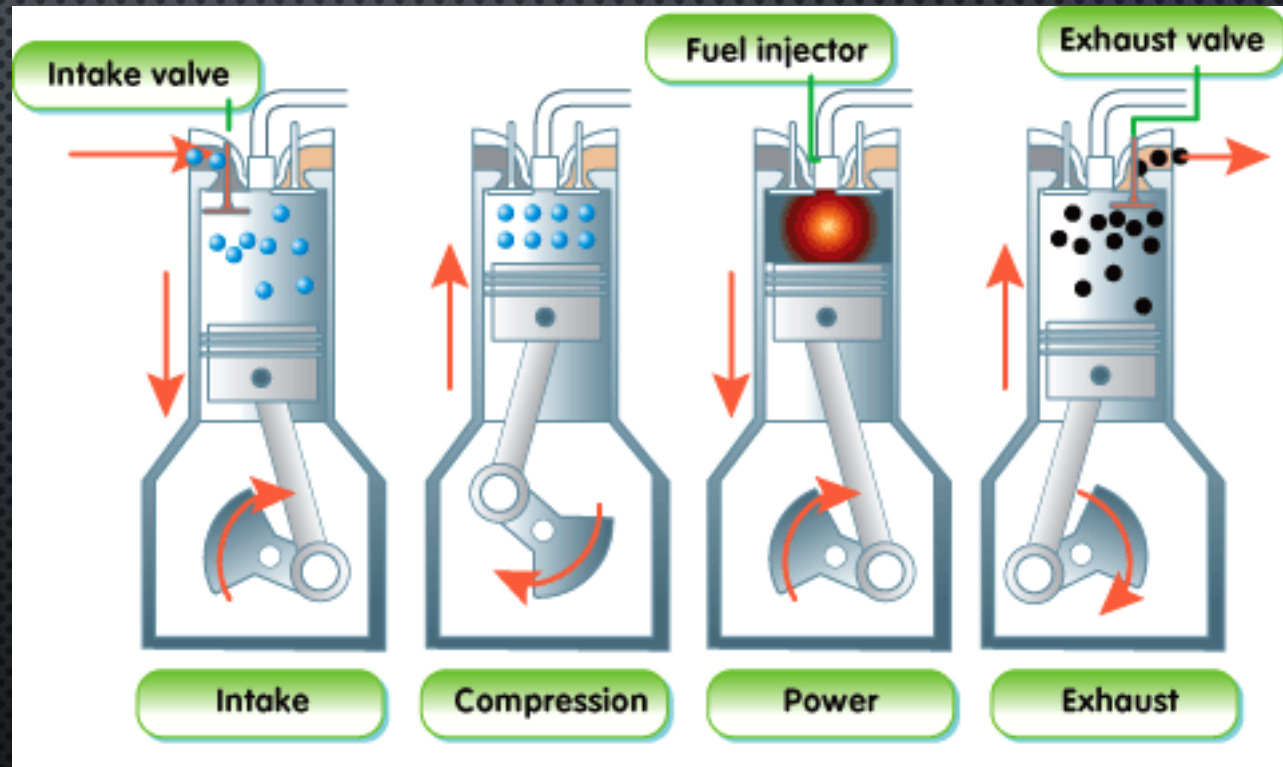
DR. NICELY

INTERNAL COMBUSTION ENGINE 2

- CONVERTS CHEMICAL ENERGY INTO MECHANICAL ENERGY
- ENERGY IS CREATED BY SMALL EXPLOSIONS IN THE CYLINDER
- THIS ENERGY IS RELEASED WHEN FUEL REACTS/COMBUSTS WITH OXYGEN IN THE AIR
- $\text{Hydrocarbon} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$

FOUR STROKE DIESEL COMBUSTION ENGINE 2

- INTAKE
- COMPRESSION
- POWER
- EXHAUST



EMISSIONS ¹

- CARBON MONOXIDE
- NITROGEN OXIDE
- NITROGEN DIOXIDE

CARBON MONOXIDE EFFECTS

- CO IS GIVEN OFF WHEN CARBON-BASED MATERIALS ARE BURNED ⁴
- HEADACHE ⁴
- DIZZINESS ⁴
- VOMITING ⁴
- IF HIGH ENOUGH ONE CAN BECOME UNCONSCIOUS OR EVEN DIE ⁴
- MODERATE AND HIGH EXPOSURE OVER LONG PERIODS OF TIME HAVE BEEN LINKED WITH HEART DISEASE ⁴
- INTERMEDIATE PRODUCT IN THE COMBUSTION OF A HYDROCARBON FUEL PRODUCED DUE TO INCOMPLETE COMBUSTION. ¹

NITROGEN OXIDE AND NITROGEN DIOXIDE EFFECTS ³

- NITROGEN COMBINES WITH OXYGEN WHEN RELEASED TO CREATE NO THEN COMBINES FURTHER TO CREATE NO₂
- NITROGEN DIOXIDE
 - IRRITANT GAS – HIGH CONCENTRATIONS CAUSES INFLAMMATION OF AIRWAYS.
- NO_x
 - REACT TO FORM SMOG AND ACID RAIN
 - CENTRAL TO THE FORMATION OF FINE PARTICLES AND GROUND LEVEL OZONE
 - BOTH HAVE ADVERSE HEALTH EFFECTS

4- STROKE CONSTANT SPEED DIRECT INJECTED ENGINE OF VIJAY BRAND MODEL VIC-1 ¹

- REDUCED WEIGHT IN FLYWHEEL FROM 18 KG TO 9 KG
- REDUCED WEIGHT NEEDS HIGHER SPEED TO MAINTAIN SAME POWER
 - REDUCED BORE DIAMETER FROM 85 TO 76 MM
 - REDUCTION IN STROKE LENGTH FROM 80-78 MM
 - CHANGE CRANK DIAMETER AT FLYWHEEL END FROM 40 - 33 MM

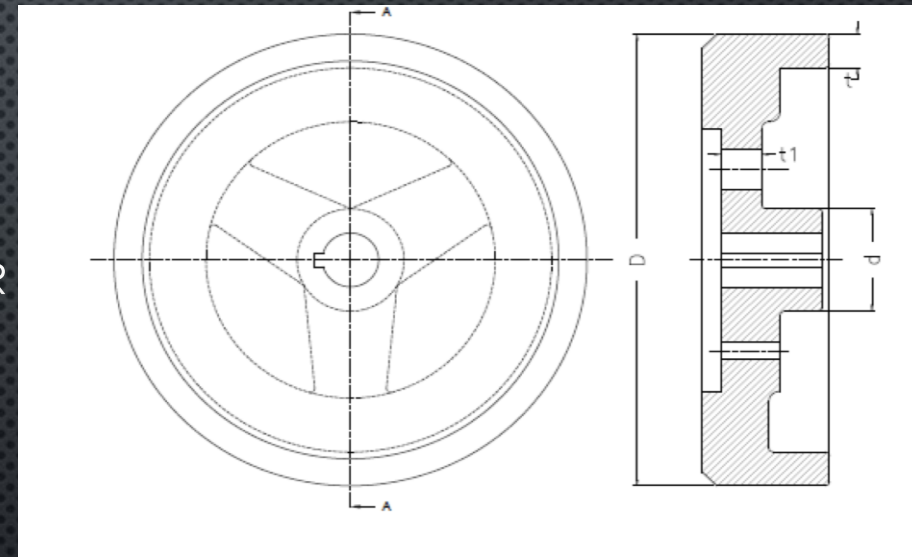


Figure 1. Flywheel

Table 1. Specifications of the flywheel.

Dimensions	Existing flywheel	Modified flywheel
Weight	18 kg	9 kg
O.D. (D)	287 mm	280 mm
Rim thickness (t)	25 mm	35 mm
Web thickness (t1)	25 mm	20 mm
Rim width (W)	70 mm	30 mm

EXPERIMENT SET-UP ¹

- ENGINE WAS COUPLED TO A HYDRAULIC DYNAMOMETER WITH COUPLER TO CONTROL SPEED AND LOAD
- INLET AND OUTLET TEMPERATURES WERE MEASURED BY THERMOMETERS
- DIGITAL EXHAUST GAS PYROMETER AND TESTO-350 EXHAUST GAS ANALYZER WERE CONNECTED TO EXHAUST.

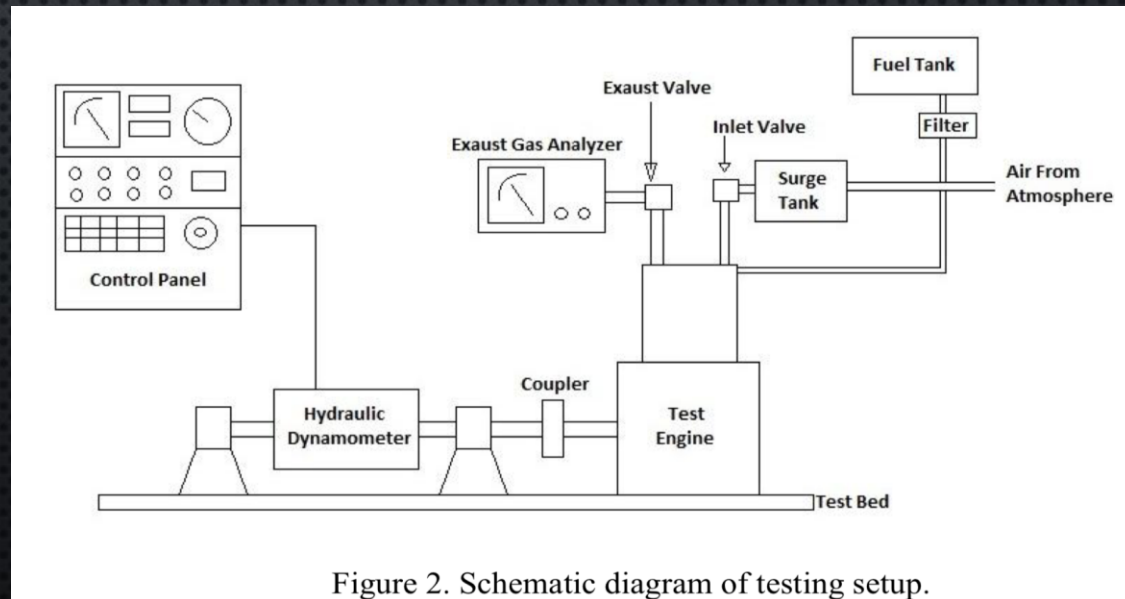


Figure 2. Schematic diagram of testing setup.

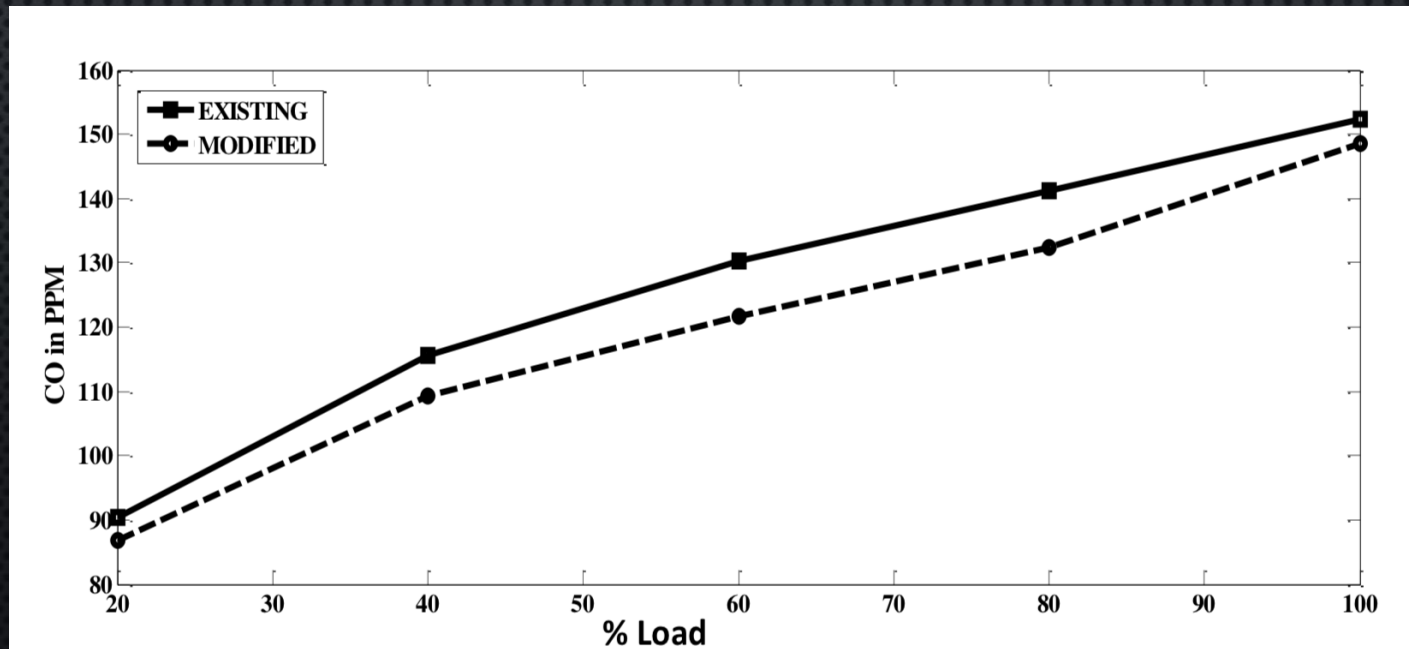
EXPERIMENT 1

The emission test was tested at the most suitable load on each engine

Description	Existing engine	Modified engine
Rated Power (kW)	3.7	3.7
Speed variation (rpm)	1500,1800,2000 & 2200	2000,2200,2400 &2600
Bore (mm)	85	76
Stroke (mm)	80	78
Mechanical efficiency (%) (Taken from IS standard)	80	80
Altitude (m)	140 m	140 m
Nominal compression ratio	16.5:1	16.5:1
Specific gravity of fuel	0.83	0.83
Calorific value (kJ/kg)	43,900	43,900
Oil specification	Yantrol-32	Yantrol-32
Cooling	water	water

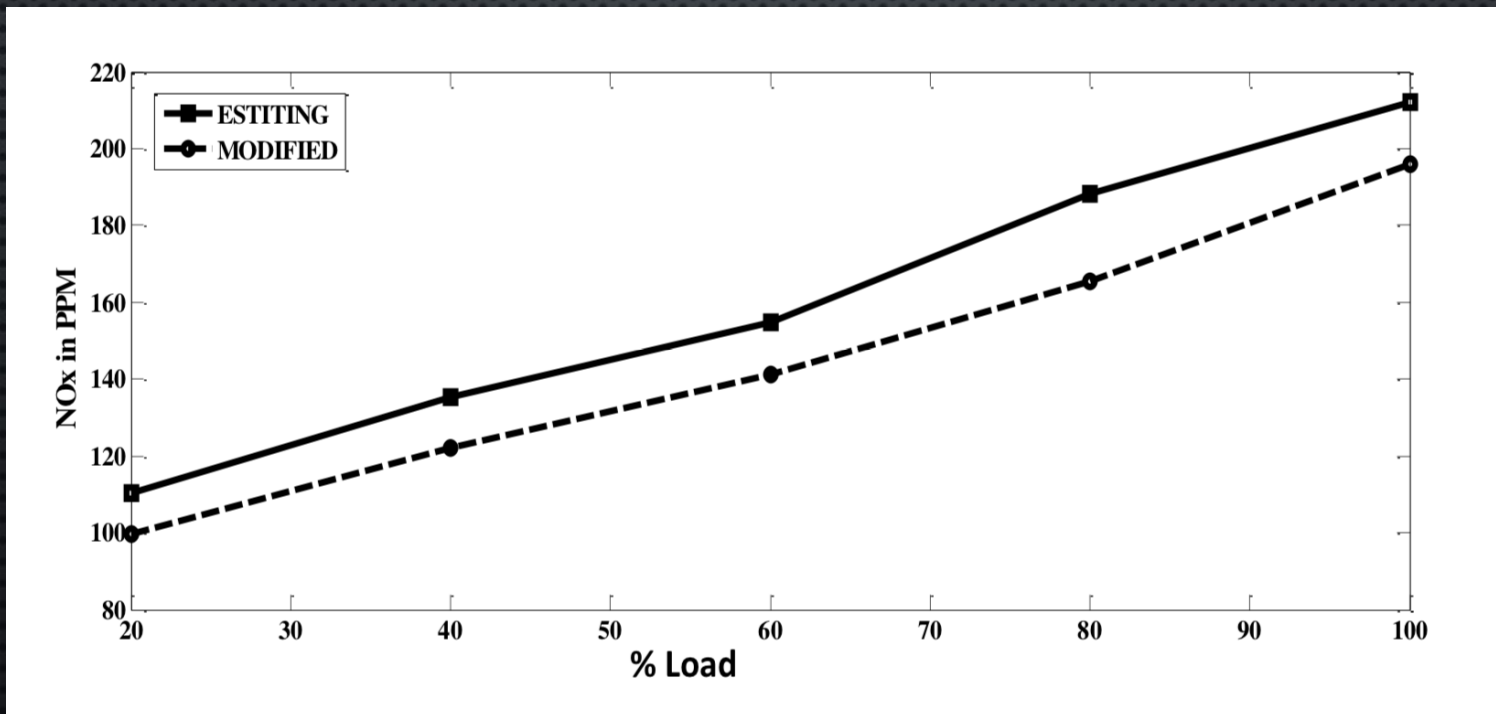
CO EMISSION RESULTS ¹

- MODIFIED WAS MAYBE LOWER BECAUSE THE HIGHER SPEED OF THE MODIFIED ENGINE COULD HAVE INCREASED VOLUMETRIC EFFICIENCY, BOOSTING TURBULENCE MAKING BETTER COMBUSTION
- RESULTED INTO LOWER CO EMISSION BY APPROXIMATELY 4 % IN THE MODIFIED ENGINE AT ALL LOADING CONDITION



NO_x RESULTS ¹

- COULD HAVE BEEN LOWER SINCE IT WAS TESTED AT HIGHER SPEEDS, LEADING FASTER MIXTURE BETWEEN FUEL AND AIR, AND SHORTER IGNITION DELAY
- LOWER NO_x EMISSIONS IN THE MODIFIED ENGINE BY APPROXIMATELY 10% LOWER AT FULL LOAD



IMPORTANCE

- REDUCTION IN POLLUTION IN OUR ENVIRONMENT
- REDUCTION IN HEALTH DEFECTS

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