

Two strokes engines used on these type of vehicles are really simple but this simplicity is the best answer for this market segment .

Compared to four strokes engines, they are lighter, more powerful, simpler to be handled for hours (due to reduced vibrations) and inexpensive since their price is not relevant to the total cost of those engines that require a low market price.

Day by day strict emission regulations make harder for aspirated two strokes engines to survive because of their high toxic emission coming from the high value of unburned hydrocarbons (HC).

#### High exhaust smoke and particulate emissions.

Even this problem is linked to the structure of the traditional s stroke aspirated engine in which the lubrication is done mixing oils with fresh intake charge from the cylinder . With D.I.C.C. this problem is mostly reduced or completely removed.

#### **D.I.C.C. is patented and registered in following countries:**

**Europe Patent n° 1642013**  
**USA Patent n° 10/558.261**  
**India Patent n° 5223/DELNP/2005**  
**China Patent n° 2004 8 0014940.0**

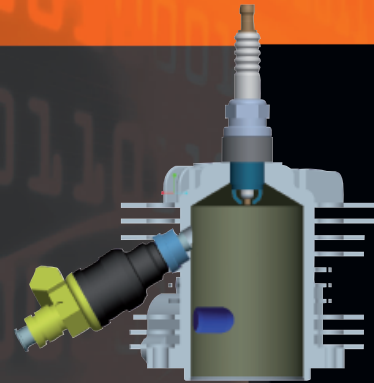


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# ATHENA

RESEARCH



## D.I.C.C.

(Direct Injection Combustion Control)

**3<sup>RD</sup> MILLENNIUM TECHNOLOGY  
FOR 2 STROKES ENGINES**

#### **A modern team for an innovative project**

D.I.C.C. is born from experience of a team made of many companies and professionals:

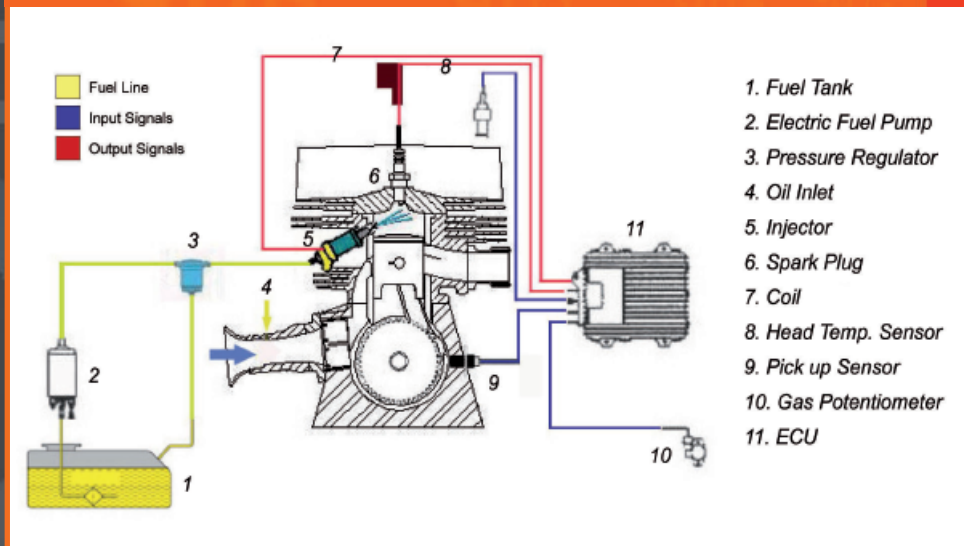
- Infinity Parts s.r.l.:** Owner of the idea and D.I.C.C. patent.
- Athena S.p.A.:** Producer of mechanical components and electronics for internal combustion engines.
- Athena Evolution s.r.l.:** Athena Research & Development department.
- Ing. Enrico Nino:** research coordinator for the Università della Basilicata "Engineering and physics for environment" department.
- Apicom S.p.A.:** Engine test bench and emission test bench production leader.
- Ing. Jan Witteween:** general coordinator for D.I.C.C. and international expert for two strokes engines.

Athena propose the direct injection system **D.I.C.C.** engineered on the following concepts:

- The system has to introduce into the cylinder the fuel needed only at the end of scavenging. With this method the injection is done only with air and not with mixture.
- The idea is to obtain regular condition with lean mixture (excess of oxygen) realizing stratified charge status inside the combustion chamber, in all working conditions.
- Leave out from the combustion most quantity of lubricant.
- This system has to achieve all those aims with a simple and economically advantageous layout from the industrialization point of view, with standard “off the shelf” components.

Athena realized a KIT, composed by mechanical and electronic components, that can transform standard two strokes engines in low environment impact direct injection engines with reduced toxic emission that can withstand with current and future regulations.

### “SYSTEM LAYOUT”



### “ADVANTAGES”

Performances being equal, D.I.C.C allows a fuel consumption reduction up to **50%**, lubricant consumption reduction up to **60%**, reduced **CO** emissions up to **65%**, **HC+Nox** emissions reduction up to **60%**.

The following table is a comparison on a Franco Morini 50cc engine.

	ORIGINAL ENGINE	DICC ENGINE	DIFFERENCE
Developer power	2 CV	3,8 CV	+90%
Emitted CO	0,87	0,323	-60%
Emitted HC+NOx	1,13	0,628	-44%
Number of catalyst	2 400 cels	1 200 cels	-50%

### EASY TO MANUFACTURE:

The main point of the project is the really simple construction and therefore the possibility to use the system in all two strokes engines. For this reason Athena can offer a complete KIT composed by thermal unit, injector, fuel pump, ECU and all other components needed to transform a common carburetor engine into a electronic direct injection with or without on board battery.

Athena can offer a complete service including designing, prototype realization, calibration and emission tests.

The easy manufacturing, due to the absence of timing parts, turns into high efficiency consequently high specific output and a reduced weight/power ratio engine. These features along with **low production and maintenance costs**, allowed two strokes engines to be widely used in mopeds, scooters, small motorcycles and “outdoor” machineries (chainsaws, brush cutter, etc).