

THE TEMPLE OF **VTEC** ASI

SHORT TECHNICAL OVERVIEW SERIES



TOVA SUPER EXCLUSIVE New FD2 CIVIC TYPE-R K20A Spec R Engine !

In March 29 2007, Honda launched the FD2 **Civic TYPE R** for the Japanese domestic market (only). Honda's Type R is already a legendary household name amongst car enthusiasts, whether Honda or otherwise. They are specially tuned to advantage of the potential of the base model, to push the performance boundaries to their limits using generous technology gleaned from Honda's passionate involvement in motorsports. Consequently, the greatest seduction a Honda offers is its racing car-like character and driving feel. First offered on the NSX-R in 1992, the Type R range was extended to the DC2 Integra in 1995, and the EK9 Civic in 1997. The EK9 Civic TYPE R was renewed in 2001 by the EP3 Civic TYPE-R. This Civic TYPE-R is the third generation of an already mighty name. It is a result of the distillation of 15 years of technical

progress and represents the latest expression of Honda's "Challenging Spirit".

All is not a bed of roses for Honda's most fervent fans, unfortunately. While Honda fans, especially the TYPE-R fanatics, are extremely vocal and strong in our admiration and support of Honda TYPE-R effort, in direct contrast, Honda has reciprocated this favour. This of course has been the major cause of frustration amongst the most fervent of us who live outside of Japan - that despite our support and fanaticism, Honda was *never* willing to give us the JDM-spec TYPE-R machi official model. We always had to resort to the parallel importers, for those fortunate ones who have such a resource. For those who don't, well we can only drool in frustration. In the absolute term this stubborn stance of Honda is of course totally ill advised, but to borrow a phrase from my favourite science fiction character. Indeed if I am to be more bluntly honest, I would personally rather see a rather silly and stupid stance to take, especially against one's most fervent supporters. It is something that I admit I have not understood the rationale for. Fortunately however, from a chance meeting with Honda's CEO Mr Takeo Fukui, coupled with the fortune of interacting with a group of very pro-active Honda Malaysia staff, all these things are about to change very, very soon.

In August 2007, Honda Malaysia will go down in history as the *first* overseas Honda country office to succeed in getting approved to launch an original-spec JDM Type R model into its local domestic line-up - the new **2007 FD2 Civic TYPE R** !! Finally, after the first Type-R model was launched by Honda, and after 15 years of begging, Honda fans in Malaysia at least, will truly enjoy an original-spec JDM Type-R, the FD2 Civic TYPE-R.

In conjunction with this monumental occasion, TOVA will be publishing a series of short technical overviews on this machine, from now and leading to the official launch later this week and continuing after that. We will look at all aspects of the incredible new machine. We start off the series with this TOVA exclusive look at the technologies that Honda put into the new Spec R engine. The materials for this article are derived from two main sources. The introduction is based on the 'Type R' article (engine section) published on the special Civic TYPE R page of Honda's corporate website, automobile section. This was supposedly written by the Civic TYPE R's engine development engineer. The main technical section is a best-effort translation from the engine section of the 'Civic TYPE-R Factbook' that is made available only to Honda's media members. Both resources are available only in Japanese and of course I am not able to read Japanese. However, good fortune has smiled on us full of Type-R fanatics. Because Japanese is an 'oriental language', like Chinese, by using the web-page translation from Google we are able to more or less understand the unusual 'colourful' article from the translation and derive a more intelligible article. Some of the photos came from another source. Honda's English-language media site for the FD2 Civic TYPE R includes a package of photos which are the same photos in the factbook engine article but properly translated into English. By using these photos and an effort attempt to translate the text of the factbook engine article, I have completed the short technical overview of the new 2007 Spec R engine below. That photo package actually contains a few additional photos which are not even in the factbook. They contain useful extra information, I have included them into the factbook translation, using them to augment the factbook information.

The translation of the Factbook engine article is put into a JPEG file for publishing here on this page. While this will mean longer loading times -and I apologize to long-time readers for this- nevertheless, it is the best means I can think of to water this copyright this article. It is a TOVA exclusive after all. I hope owners, potential owners and just plain fans of the new watering new FD2 Civic TYPE-R will enjoy and appreciate this article.

The K20A 2007 Spec R Engine

THE DEVELOPMENT APPROACH

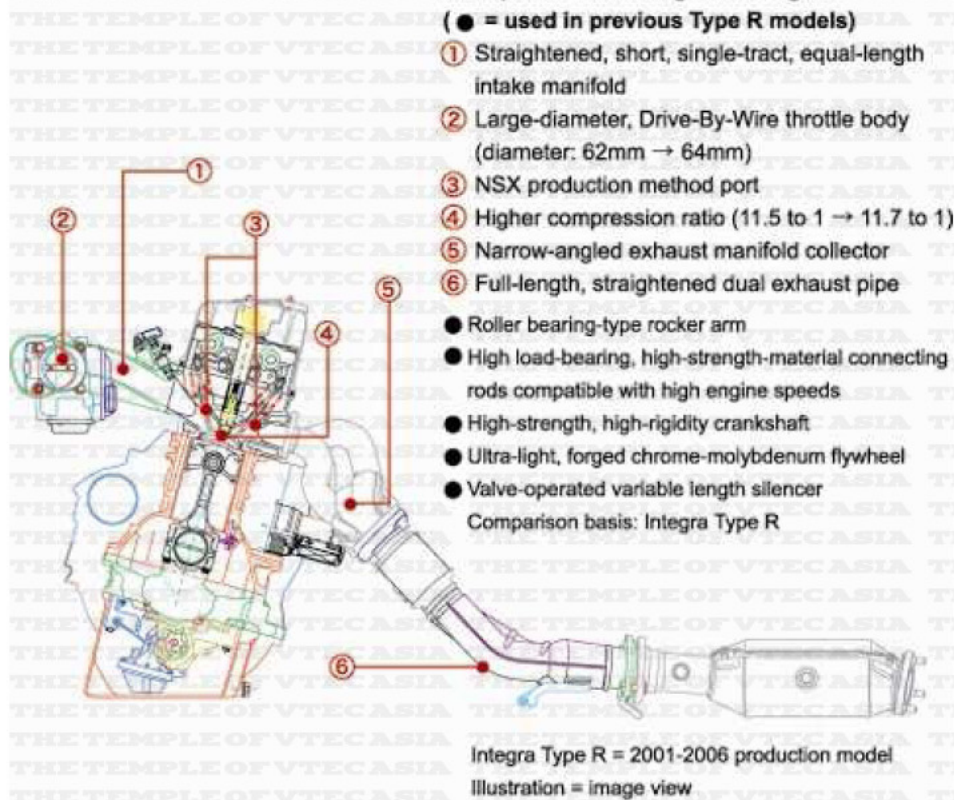
The base for the new Civic Type-R engine is that of the JDM CL7 Accord Euro-R. This engine is widely accepted as a Honda's definitive 2.0l 4-cylinder 'sports' engine. Initially, there was debate within Honda on whether to use this engine 'as-is', with its 220ps max power. Eventually it was pointed out that the very soul of Honda's Type-R DNA is the relentless pursuit of efficiency and perfection. So the decision was reached where the K20A engine should be further developed, in an effort to attain the highest possible development of the engine for Type-R fans, no matter how small the final improvements might be in absolute terms.

The approach to extracting more power out of the K20A engine is a back-to-basics approach, via maximizing the efficiency of the basic 'intake-combustion-exhaust' engine cycle. So the development approach was to develop an engine that is as efficient as possible over the whole cycle. A back-to-basics approach meant that development was through tried and tested methods. Here, experience is more important -and effective- than just theory alone. Very often, techniques that are known to work based on experience may not always be supported by theory or plain numbers ! Using this approach resulted in a true TYPE-R engine with a characteristic that is very different from those of other manufacturers. A fact that any TYPE-R owner will readily attest to - the magic of Honda's TYPE-R is truly unique !

ENGINE TECHNOLOGY HIGHLIGHTS

Main power-enhancing technologies

The development objective

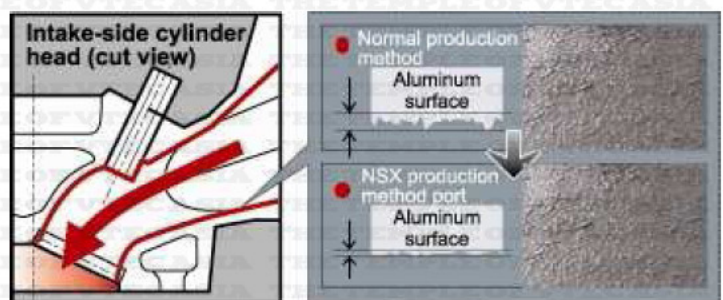


New Civic TYPE-R K20A Spec R - Key Technologies

All of the high-power delivering technology used on the K20A Spec R on the DC5 Integra TYPE-R and CL7 Accord EURO-R are implemented on the new Civic TYPE-R's K20A Spec R. The list includes roller bearing rocker arms, high strength conrods and crankshaft, forged chrome-molybdenum flywheel and a rear muffler with a valve actuated variable length silencer.

To this list was added new technologies for enhancing air-flow in and out of the engine and thus generate even more power. According to the Honda Malaysia head product planner, the chief engineer for the new Civic TYPE-R's engine development was with Honda's Formula-1 engine development program prior his assignment for the Civic TYPE-R project.

New technologies applied to the Civic TYPE-R's K20A Spec R are as follows. An enlarged throttle body, a new intake manifold with short individual equal length intake runners, and the adoption of the manufacturing methods which was used to produce the engine of the NSX-R, specifically the polishing of the intake and exhaust ports surfaces for smoother air-flow into the combustion cylinders. These combines to contribute to a higher intake air-flow efficiency. For more efficient combustion and extraction of power, the compression ratio is raised from 11.5 to 11.7. The exhaust manifold, which is a 4-2-1 'Tri-Y' design have revised collectors designed to accommodate smoother and shorter exhaust runners for reduced exhaust gas out-flow restriction. The down-pipe from the exhaust manifold leading to the catalytic converter has also been straightened.



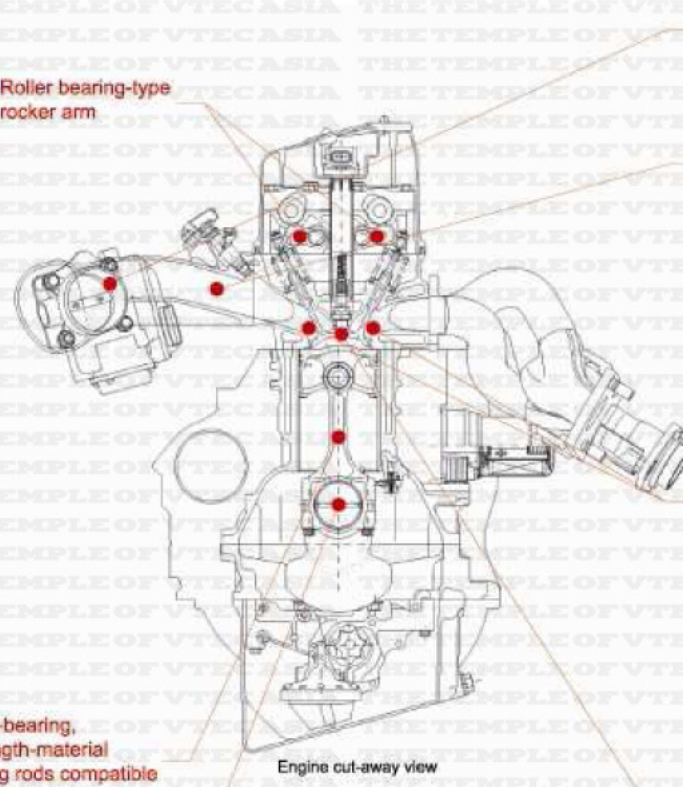
Same treatment on exhaust side

The development objective for the new Civic Type-R is for it to be the **fastest FF TYPE-R** model in Honda's history. To complement this, the K20A was developed to be the most powerful 2.0l mass production naturally aspirated (NA) engine in the world. This means a challenge of extracting even more power from the already very powerful CL7 K20A SPEC-R engine. As the K20A engine already achieves a very high specific output, so for the task of extracting a power increase, a more detailed and thorough development approach was necessary.

into engine. Accurate metering of air-flow is critical for fine tuning of the air-fuel ratio of the engine and the impact from the removal of the MAF sensor is compensated for by revised and more advanced mapping in the ECU. Finally, although beneficial for more efficient power delivery to the wheels, the EPS (remember the base engine is that of the CL7 Accord EURO-R) is replaced with a hydraulic power steering system for better steering feel. These improvements contributes to superior torque from the K20A Spec R.

Finally, the throttle control is converted from a cable-based (from the CL7/DC5) to a Drive-By-Wire (DBW) system, allowing a finer control of the throttle opening to input from the accelerator pedal. From low speed, when the driver goes WOT, the engine responds with a smooth power delivery. This contributes towards the goal of delivering superior 'control-quality' to the Civic TYPE-R driver.

FD2 CIVIC TYPE R K20A Spec-R DOHC i-VTEC engine



Roller bearing-type rocker arm

Large-diameter, Drive-By-Wire throttle body (diameter: 62mm → 64mm)
 Drive-by-wire allows finer tuning of throttle response to driver input for smooth driving at low speeds and sharp response when accelerating.

Straightened, short, single-tract, equal-length intake manifold
 Air intake efficiency is improved thanks to the optimized inertia effect created by the straightened, short, single-tract, equal-length intake manifold

High load-bearing, high-strength-material connecting rods compatible with high engine speeds

High-strength, high-rigidity crankshaft

NSX production method intake port
 Plastic coating of die surface for smoother port surface, improving air flow especially at high engine speeds. A technology shared with the NSX engine.

High compression ratio (11.5 to 1 → 11.7 to 1)*
 Improved cooling performance (vertical-flow water jacket) and redesigned piston head for further increased compression ratio

* vs. Integra Type R (DC5)

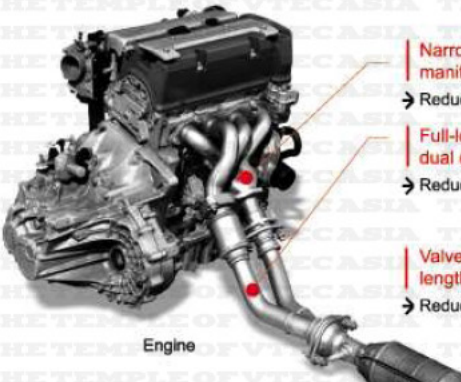
Engine cut-away view

Intake manifold design

Integra Type R (DC5) Civic Type R

Integra Type R (DC5) Civic Type R

CIVIC TYPE R 2007.03.29



Narrow-angled exhaust manifold collector
 → Reduced exhaust back-pressure

Full-length, straightened dual exhaust pipe
 → Reduced exhaust back-pressure

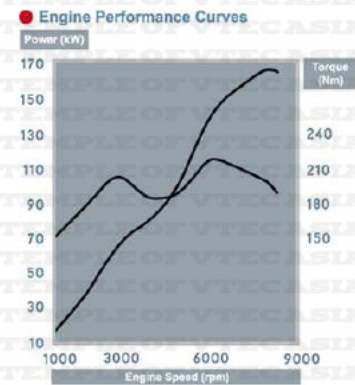
Valve-operated variable length silencer
 → Reduced exhaust back-pressure

Engine

Intake manifold design

Integra Type R (DC5) Civic Type R

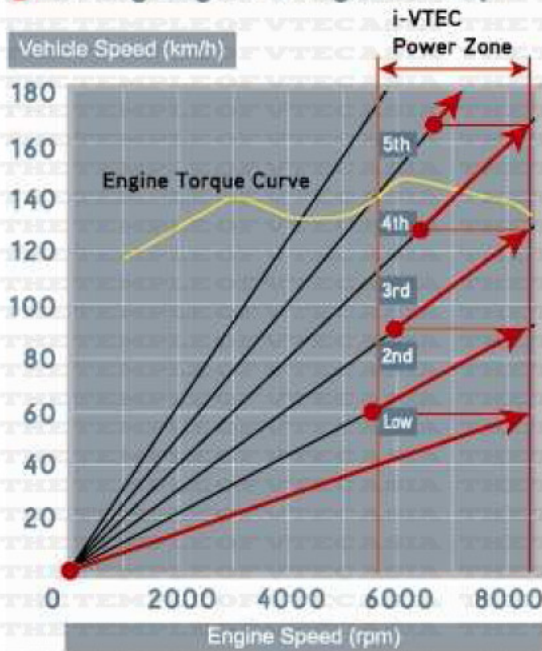
	New CIVIC TYPE R	INTEGRA TYPE R (DC5)
Maximum Rpm (Redline)	8,400rpm	8,400rpm
Maximum Power (nett)	165kW [225PS] /8,000rpm	162kW [220PS] /8,000rpm
Maximum torque (nett)	215N m [21.9kgm] /6,100rpm	206N m [21.0kgm] /7,000rpm
Specific Output (power/liter)	82.5kW [112.5PS]	81kW [110PS]
VTEC changeover	5,800rpm	6,000rpm
Bore X stroke	86.0×86.0mm	86.0×86.0mm
Displacement	1,998cm ³	1,998cm ³
Compression Ratio	11.7	11.5
Spark-Plug	Iridium Heat Range 7	Iridium Heat Range 7
Throttle bore diameter	64mm	62mm
Intake Manifold Design	Individual Short Runners	Individual Short Runners
Air Intake (piping) diameter	75mm	70mm
Exhaust pipe diameter	54mm	54mm



TRANSMISSION

The transmission gearbox takes the output from the engine flywheel, multiplying it with the selected gear ratio before delivering to the front driving wheels for maximum lap times on the circuit. For sharper acceleration, gears 1 to 3 are revised with an approximately 3% overall shorter (higher) ratio. To exploit the higher power and torque of the new K20A engine, gears 4, 5, and 6 are revised for an approximately 1% taller (smaller) ratio.

Running diagram with gear overlap



Due to the aggressive cam profiles, the power delivery of the new Civic TYPE-R's K20A Spec R engine has a dip, a 'hole', in the middle of its power chart around the 3,000 to 4,000rpm range. The individual gear ratios for gears 1 to 5 are chosen so that shift-ups from red-lines to the next higher gear will drop the engine rpm right into the power band – after the 'hole' and where power and torque are increasing.

The gearbox also receives new synchros. For gears 1 and 2, triple cone synchros are used. Third gear uses dual carbon cones. Fourth gear uses dual cones. And finally fifth and sixth gears uses single carbon cones. An advanced high rigidity aluminium casing is used for the transmission. For improved lubrication at high rpms, the new casing features resin baffle plates, to avoid oil starvation at high cornering speeds. Finally, a short stroke shift linkage contributes to a sporty shifting feel.

Gear Ratio (overall/Individual gear ratio)

Gearbox Cut-Away Diagram

	New CIVIC TYPE R	INTEGRA TYPE R (DC5)
1st gear	53.417/3.266	51.182/3.266
2nd gear	34.837/2.130	33.379/2.130
3rd gear	24.811/1.517	23.773/1.517
4th gear	18.760/1.147	18.993/1.212
5th gear	15.063/0.921	15.223/0.972
6th gear	12.051/0.738	12.232/0.780
Final Drive	-/5.062	-/4.764

Transmission with baffle plate to mitigate oil starvation at high cornering speeds

- ① Oil gutter plate
- ② Baffle plate



6-speed manual transmission

CONCLUSION

The new Civic TYPE R presents a very enticing vehicle to the hard-core Honda enthusiast, especially the TYPE-R fanatics. Hopefully this technical overview is worthy of the new Civic TYPE-R's already legendary reputation amongst these fans.

WongKN,
July 2007,
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