



HOW IT IS MADE
EXCLUSIVE STORY



FX Engines are pure high competition racing engines for model racing cars.

Designed with the purpose of bringing you to the winners circle and engineered with a focus on absolute perfection by the legendary RC car designer Dipl. Eng. Juraj Hudy.

FX engines are manufactured completely in-house in Slovakia, Europe, using only the most premium European materials and most advanced Swiss, German & Italian technologies.

The commitment to quality and the stamp of premium and absolute perfection are blended into a single badge...**FX...the royal racing engines.**



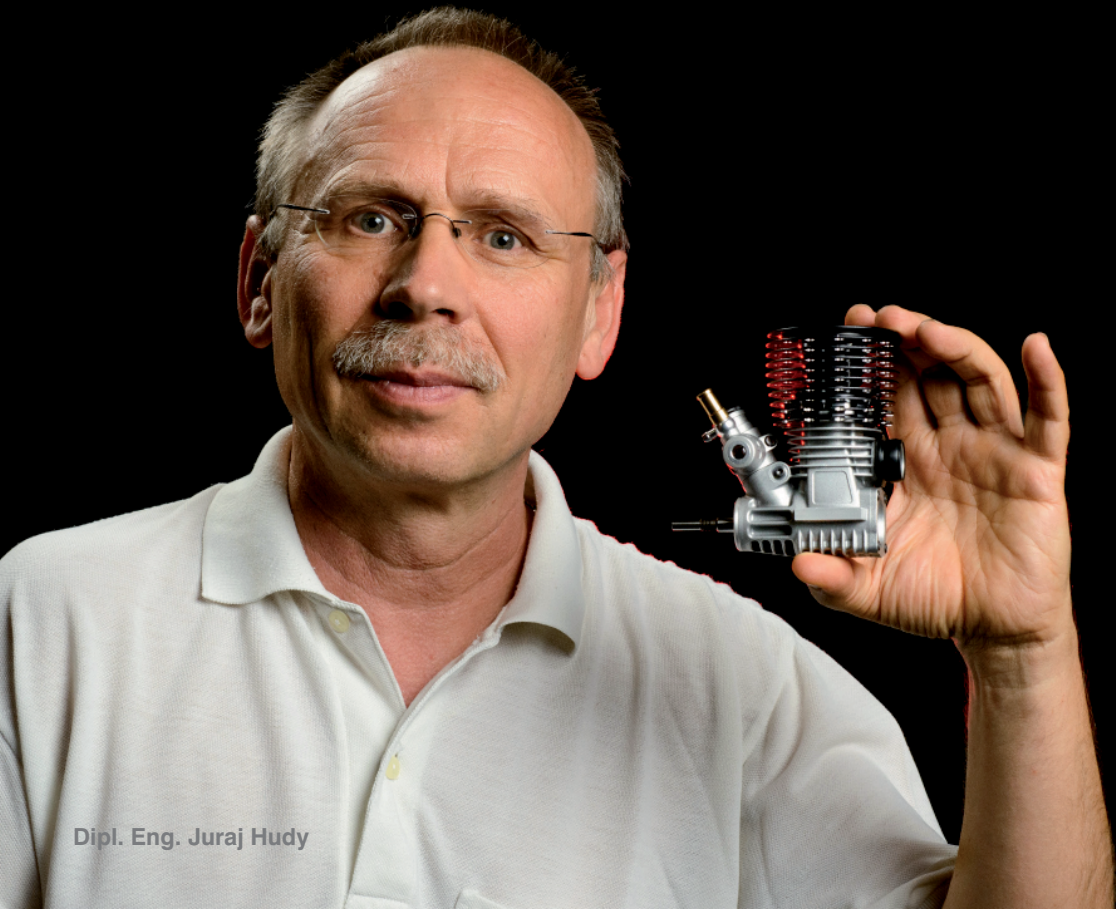
the royal racing engines.

FX Engines is a private company located in Europe in Trenčín, Slovakia. Owned and operated by the Hudy family, the FX Engine company was established in 2006 to develop, design and manufacture RC car engines.

All-new special-purpose machinery was installed just for production of engine parts. FX Engines is one of the world's only companies that fully manufactures every single part in-house including the pressure die-casting of the crankcase.

Every single part is designed and manufactured in-house and every engine is fully assembled by craftsmen. Each individual part has a recorded history of manufacturing and assembly processes including records of measurements for every material batch used, tools and equipment used in production as well as tolerances and sizes measured during production. Additionally, all important parts have their serial numbers recorded...there is a complete and detailed certificate of birth for every FX Engine.





Dipl. Eng. Juraj Hudy

"To design and especially to produce an RC car engine has been the most difficult and challenging project I have ever worked at. I have been an RC car designer for more than 40 years and I have brought both our companies, HUDY & XRAY, to the absolute top in their respective fields. We have achieved this only due to a total dedication to the smallest details and a commitment to never-ending development of continuous improvements.

I started this engine project, an all new adventure and milestone in my professional carrier, more than 6 years ago and I never expected it would take such a long time before the final engine would be ready for mass production and to get it into the hands of RC car drivers. I was unwilling to release the product until I was completely happy with all the details, the performance, reliability and longevity of the parts, so there was no option but to continue the development until we achieved our goals. During this 6 year process, we changed almost everything, including re-starting from scratch twice. ►►►



Three phases of the project

1

In the first years, the main concentration was (besides the engine development) on choosing the proper technology. Only by using the best and appropriately designed machines for the particular parts of the engines could we ensure the steady quality and achievement of the very strict tolerances required during production; which was in many cases only 0.001mm.

The main aim was to be fully independent from any subcontractors and as such all the machinery for every single part was carefully chosen and installed and like the rest of the project, we did not make any compromises and installed only the world's highest quality German, Swiss and Italian machines. Many of the machines were custom designed and modified for the particular engine part production to achieve the desired flexibility, efficiency and quality.

2

In the second phase, all the technologies were implemented and first prototypes produced for testing. In this phase dozens of different materials were tested and analyzed to achieve the desired performance, reliability and life time.

3

In the last phase in the last two years, when all the materials were already chosen, the main focus was on the fine tuning of all details of the engine parts to achieve the highest performance.

The performance of the engine is measured not only by the quality, lifetime, reliability and fuel consumption, but also by how easy the engine is to set up and tune. In the final phase of fine tuning it was a real challenge to find a balanced mix of all these features. The priority for me was to design an engine which will be easy to set-up and friendly to use while still maintaining the highest possible performance and reliability.



During the years we updated from standard production processes to all-new processes specifically designed for engine part production. We established special procedures for hand finishing nearly every part, as well as completely new processes for quality inspection and tracking throughout the entire manufacturing and assembly process.

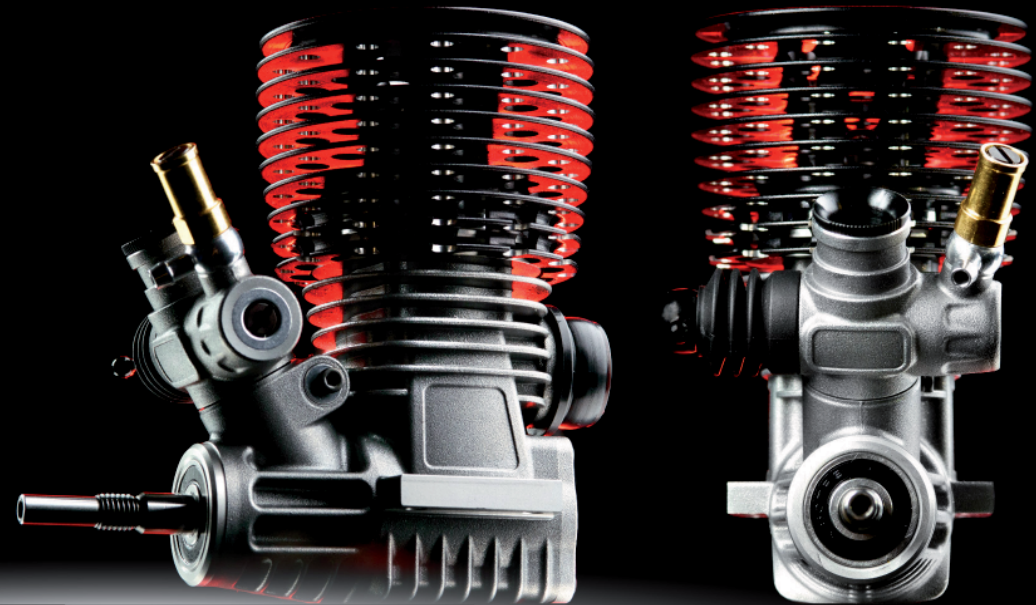
Utilizing the knowledge of special materials and special hardening processes I have developed over the decades combined with the state of the art machinery we incorporated specifically for the engine production, I was finally confident in the equipment and materials. The dedicated internal team that has been working on this project for 6 years, specifically trained and skilled in their work procedures using the TQM (Total Quality Management) approach gave me confidence in our people and processes.

I am finally more than satisfied and we are ready to make this vision a reality and bring the engine to market. The final design and specifications were tested for more than 2 years in all the different track conditions around the world by some of the world's best RC car racers and as such the reliability and performance were proven to meet our strict requirements for quality and craftsmanship.

I am supremely confident in the final engine and now I am very proud and very happy to present you the result of our hard work...the all-new FX Engines product line. Enjoy."

Dipl. Eng. Juraj Hudý

FX Engines owner, engineer and designer



FX Engines development

This exclusive story will bring you through a production process of your new FX Engine to disclose our attention to the finest details in order to bring you a premium engine.

3D design

State of the art 3D modeling software has been used to ensure that all of the engine components and their respective tolerances mate perfectly in order to ensure flawless assembly.

Data management

All versions of all drawings and 3D models are stored in an SQL database with detailed records of each version of the file, including the name of each designer responsible for making a change. This allows us to maintain a detailed history of the ongoing development in order to know the 'who, what, when, where and how' for each change in order to maintain the most favorable features during the development process.

Work flow process

All drawings, models and production programs are subject to a review and approval process from the main project designer, designer of the part and production manager. Without the approval of all the three persons a drawing, model or manufacturing program will not be released to the next step of the work process.



Mould design

All of the moulded and cast components are produced with moulds that have been fully engineered, designed and produced in house using specialized Mould Designer 3D software. The thorough FX Work Flow Process is followed to ensure superior quality.

Mould flow check

Prior to final approval of the moulds, special Mould Flow software is used to simulate the moulding or casting process. The software virtually injects the composite, rubber or alloy to simulate the production process and determine areas where the material does not optimally flow, which could result in a weakness. This allows FX to maintain superior quality by handling and understanding all steps of the production process and to change in advance any details as necessary in order to ensure flawless final product.

Programs for machines

Once final design of all parts are approved and FX Workflow Process approval has been completed, the engineers upload their manufacturing programs into the same SQL database for reference, so again all the versions of all programs are stored and recorded. All of the machines in the manufacturing process are connected to an internal network and only approved manufacturing programs may be downloaded and used for production.

FX Engines production

Mould manufacturing

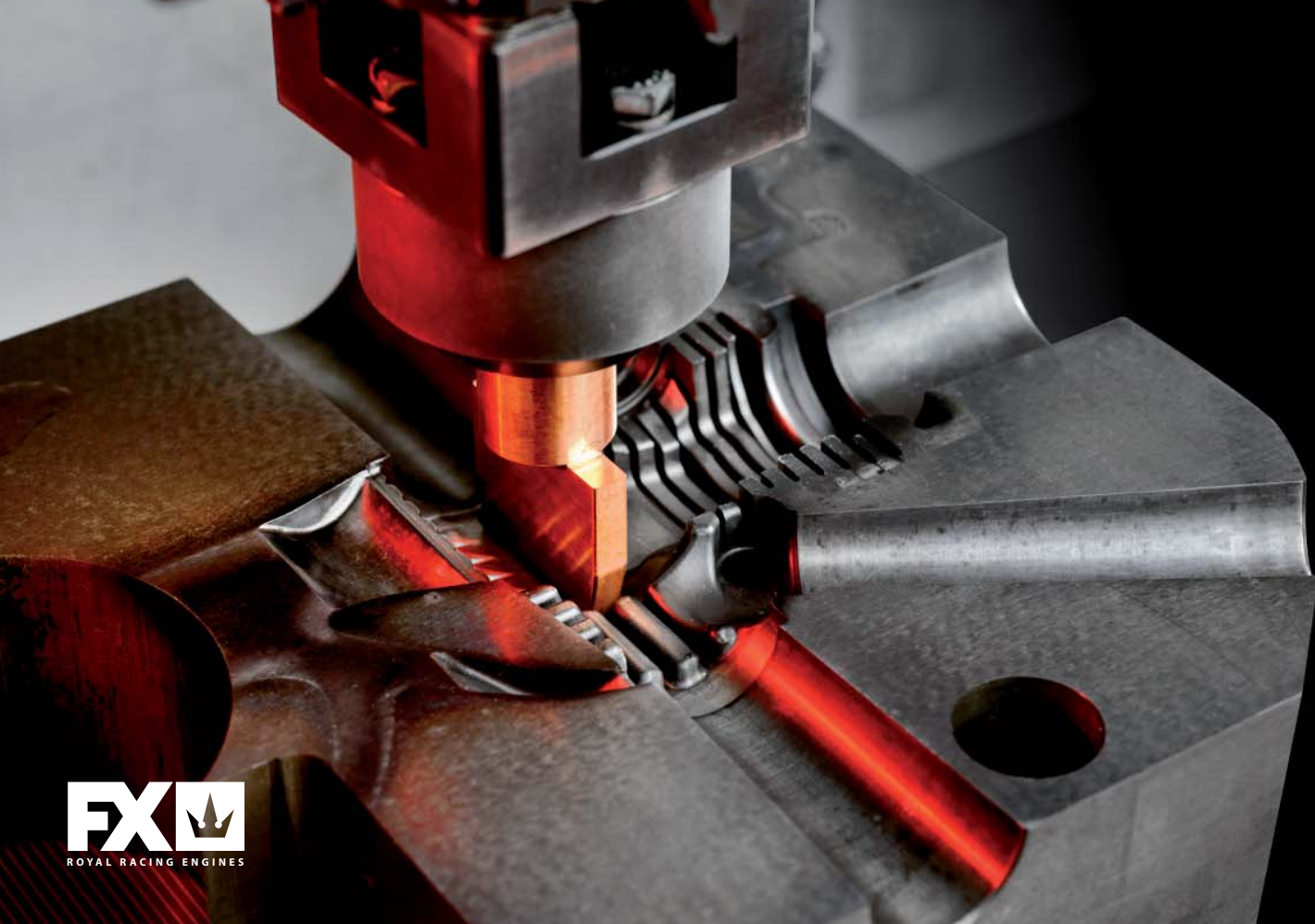
Once the mould is released into production all parts are manufactured in-house. The highly trained staff at FX has vast experience in mould manufacturing and finishing and take great pride in their craft.

To produce a mould for casting is extremely demanding because the mould needs to be extra large but still maintain incredibly tight tolerances. The selection of the proper material for caste mould production is critical and the heat treatment procedures are very specialized. The mould must be resistant to the extreme temperatures of the melted aluminum which exceeds 690-700°C. The heat treatment of all the mould parts is done at above 1000°C (over 1800 Fahrenheit) which only few specialized companies are capable of applying.

Mould electrode production

The 3D CAD model of the finished part is used to generate the program for the electrical discharge machining (EDM) electrode. A specialized high-precision 5-axis milling machine is then used to produce the electrode component. A craftsman then hand polishes the electrode to achieve the desired finish.





Moulding shape production

The EDM electrodes are used on specialized Swiss machines to create the mould cavities.

Moulding holes production

All holes and openings of the mould are held within a tolerance of 0.001mm.

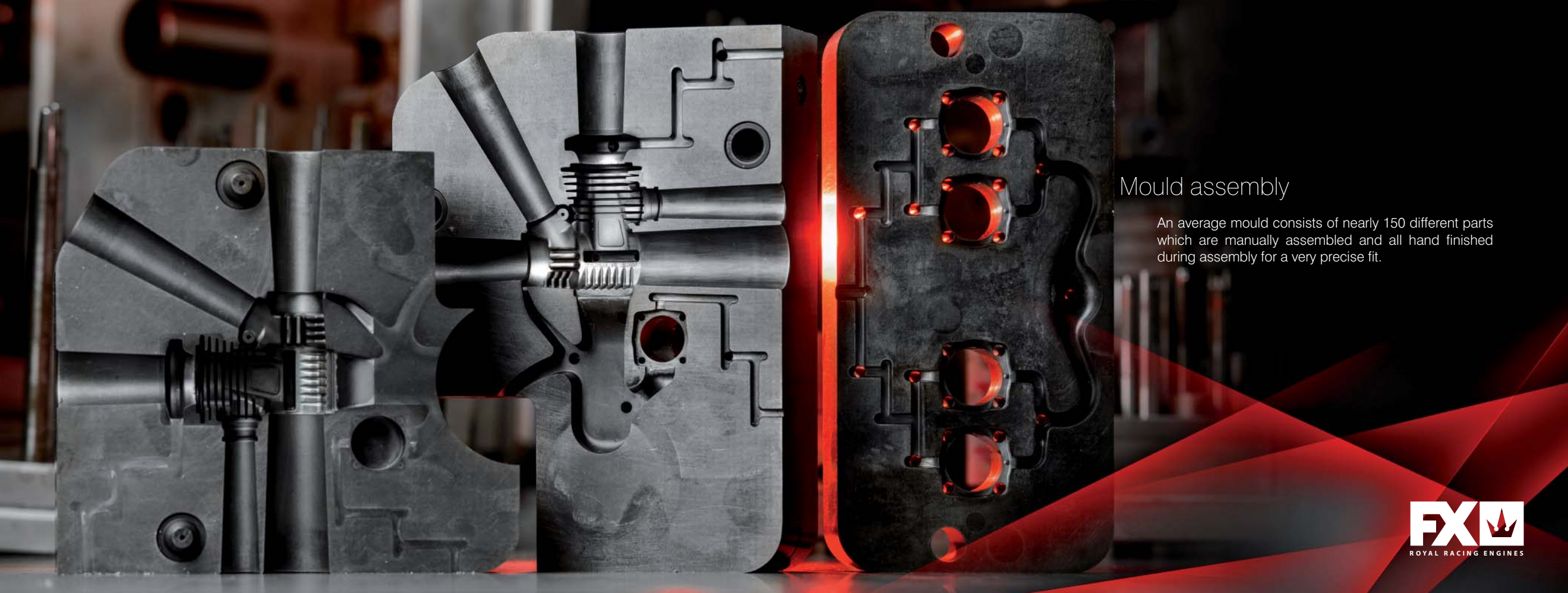


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Moulds grinding and machining

The housing of the mould and all of the required pins and inserts are machined using high-quality CNC milling machines and are manually ground and hand finished for a perfect fit.



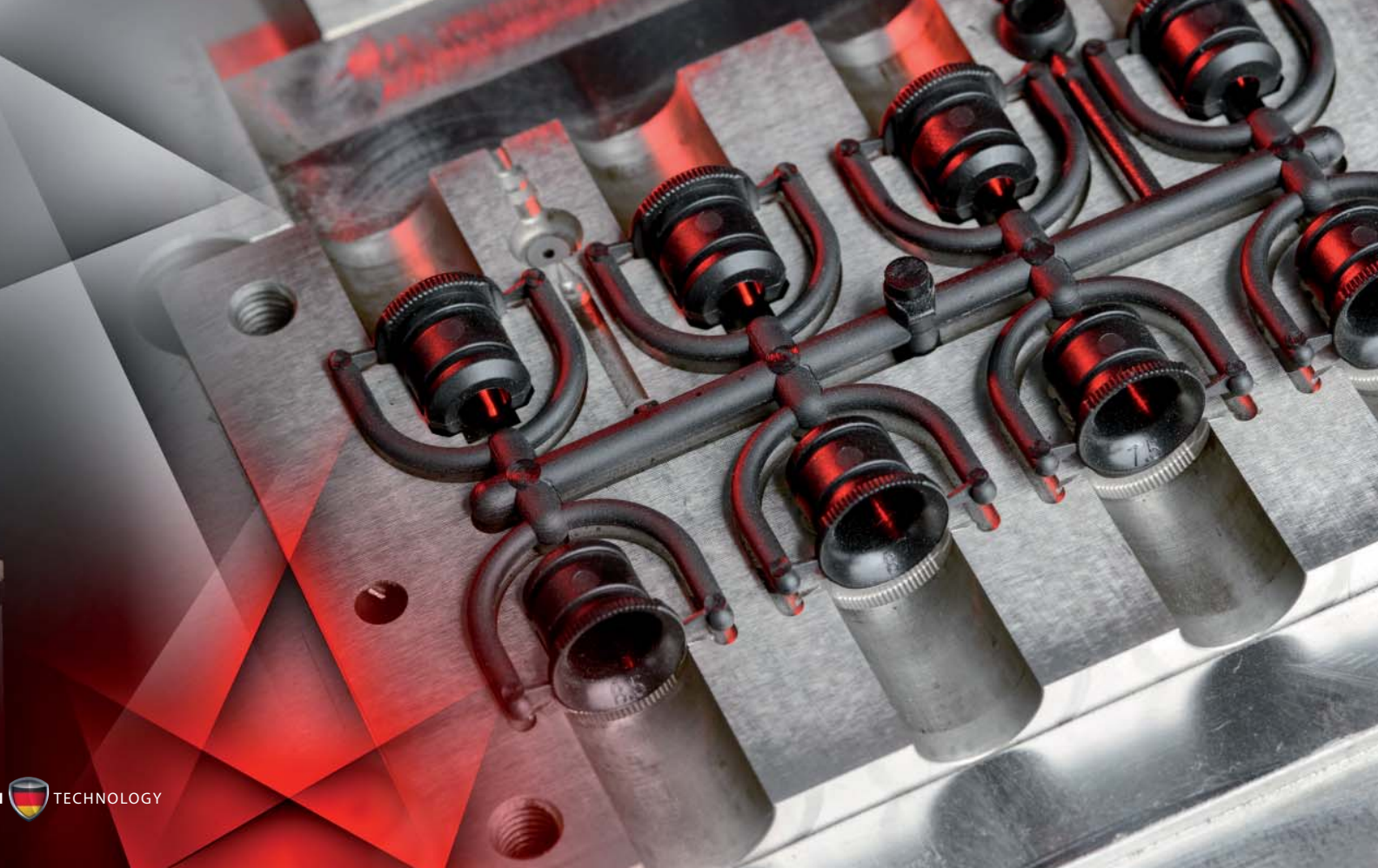


Mould assembly

An average mould consists of nearly 150 different parts which are manually assembled and all hand finished during assembly for a very precise fit.

Moulding of composite parts

All composite parts are moulded using German moulding machines. The composite mixtures are a proprietary FX blend that ensures the required strength and rigidity while maintaining just enough flex to assure durability.





Die casting

FX Engines is one of the very few companies in the world with their own in-house die casting technology. All of the cast aluminum components are die cast under pressure using high precision Italian die casting machines.

Vacuum casting

Vacuum is applied to the mould cavity during the casting process to help the air to be removed, eliminating internal bubbles or voids from the final product. The vacuum casting procedure also helps the melted aluminum to flow into the mould faster which again helps to increase the quality of the casted product.

Robotic melting furnace

The aluminum ingots are melted in robotic furnace which loads automatically the melted aluminum into the die casting machine.

Milling production

All of the aluminum parts are machined on precise German CNC machines. Each part has a specialized fixture in which the pieces are manually mounted prior to milling. After the machining process, every part is removed, measured and inspected to assure that it meets the exacting FX Engines standards. Only diamond cutting tools are used in order to ensure the quality and precision of cut required by FX Engines. Specialized laser sensors are used to monitor the cutting tools to compensate for wear and maintain the quality of cut.



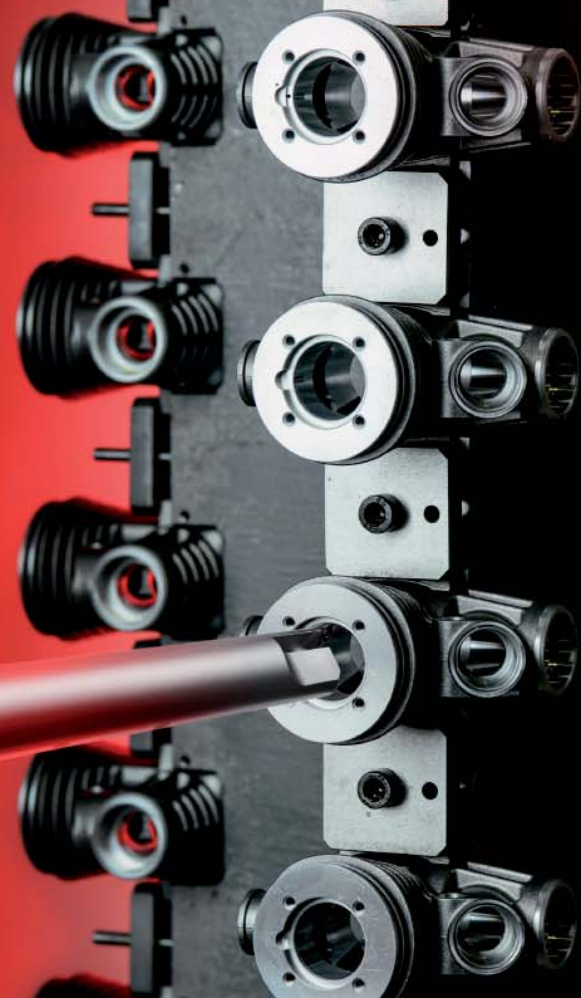
Milling production of small diameter aluminum parts

The smaller diameter aluminum parts are machined on a precision German CNC machine, however the smaller machine allows for 5 axis control allowing for complete machining without the need to re-fixture the parts.



Milling production of brass parts

To produce parts like sleeves requires a very special 5-axis milling machine which allows milling from all the sides. For this particular production a customized German machine was installed with special software and custom produced tools and holders. To achieve highest quality the machine is specially equipped with a 24 000RPM spindle. This machine is used exclusively for the production of sleeves.



Machining of die casted products

All die cast products such as the crankcase, cover and carburetor are additionally machined using high precision German 5-axis CNC machines. The machines use two large pallet tables that can hold up to a total of 40 crankcases, while the fully automated machine uses its battery of 60 different tools to finish the components, while also performing quality checks with a special laser equipped robot and self-adjusting to ensure that the tight tolerances are maintained. Special parts which require milling from all sides such as carburetors and engine cases are all machined at this robust ultra precise machine.

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Cutting production of steel parts

All of the steel parts are CNC machined using the high precision German machines, the most precise and expensive machines of their kind. The ultra robust construction allows these machines to reach and hold manufacturing tolerance of 0.002mm throughout the production run. The machines feature 11 axis control, which allows production in two spindles with two revolving tool holders and two linear supports with rotating units, without requiring human interaction, ensuring ultra-precise control. This machine is used for special steel parts which require repeatable ultra high precision of tolerances and surface finish such as crankshafts or carburetor needles. Thanks to the repeatably tight tolerance of all carburetor parts, all FX carburetors are exactly the same so the carburetor setting at different engines are all the same.

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Cutting production of large diameter aluminum parts

All billet-produced aluminum parts are CNC machined on German machines. The large parts such as the engine head are produced on a large 11 axis machine with 2 spindles and 3 revolving tool holders which allow two parts to be manufactured at the same time due to the extreme flexibility of this equipment. The automatic material loader holds bar material up to 65mm in diameter and up to 4m in length.

Cutting production of small aluminum parts

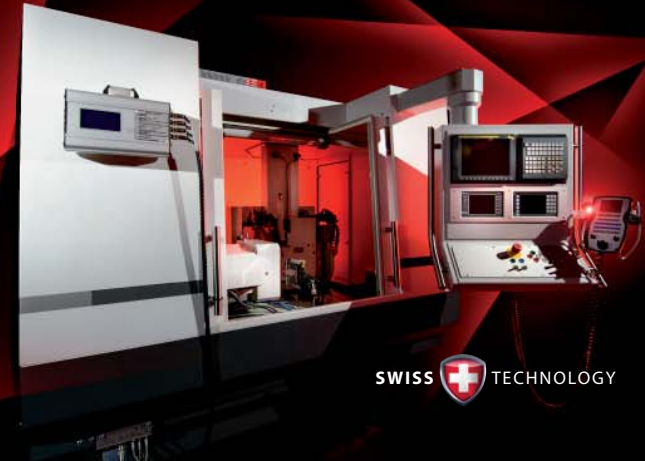
All of the smaller diameter aluminum parts, such as parts for carburetor, are produced using Italian and German 8-11 axis CNC machines. All the machines have 2 spindles and linear supports with fixed and rotating units which allow cutting and milling at the same time.

A close-up photograph of a grinding process. A cylindrical metal part is being ground against a rotating wheel. A bright orange-red light is visible at the point of contact between the part and the wheel. The background is dark with some yellow and red elements.

Grinding

Grinding may sound like an easy operation but the opposite is true. Precision grinding is a crucial part of the manufacturing process as it brings the parts to their final dimensions and tight tolerances and repeatability are critical. To achieve repeatable tolerances of 0.001mm, an industry-leading Swiss CNC grinding machine was installed. The machine features two grinding drums, one which prepares the required dimension, and the second one which brings the part to the final dimensions, all fully automatically.

The robotic machine measures every single product and adjusts the program and settings appropriately to maintain the target diameters and super smooth finish demanded by FX Engines. Special parts which require the tightest tolerances are ground using this machine such as crankshaft, outside diameter of pistons and inner diameter of sleeves.



Sand blasting

The crankcase, carburetor, rear cover and engine cooling head are all sand blasted. To ensure the best quality all engine heads are individually manually blasted.



Color coating and hard coating

The hard coating of the aluminum parts, as well as the color coatings are all processed using a highly advanced coating line, featuring 20 baths and a fully automated process that allows 3 batches of product to be processed at the same time. The coating process is very precise and requires strict controls to manage the many factors that can affect the chemical reactions involved.

During the coating process all details must be considered and process adjusted which includes: air temperature, temperature of every bath, PH of every bath, size and surface of every part and batch, type of material used, color and chemicals mixtures used, thickness of final structure to be achieved, amount of batches already run, etc. Again, this is an internal process at FX Engines to maintain our strict standards of quality control.

Laser engraving

The fully automated laser engraving process is performed on German CNC engraving machines with rotating tables for precision and clarity.





Hone machine

A very precise, old school American honing machine is used for manually hand-finishing of holes in the products. Every hole and opening are manually calibrated and the surfaces polished until they meet the required specifications. All parts where the fitment is critical such as sleeves as well as holes on conrod shafts, pistons and carburetors are all manually and individually honed.

Cleaning machine

Due to the tight tolerances of a nitro engine it is extremely important that all parts are free from debris. After each step of the manufacturing process, all parts are cleaned in a fully automatic cleaning machine and oiled to protect against corrosion.

Before assembly all parts are once again cleaned, but this time in small batches using a special ultrasonic machine to remove any remaining debris prior to finished assembly.



FX Engines unmatched perfection

During production, the sizes and tolerances of all important and key parts of each engine are measured and recorded. All of the main parts have serial numbers engraved and all of the important sizes, tolerances and information about the production of the part are recorded and stored.

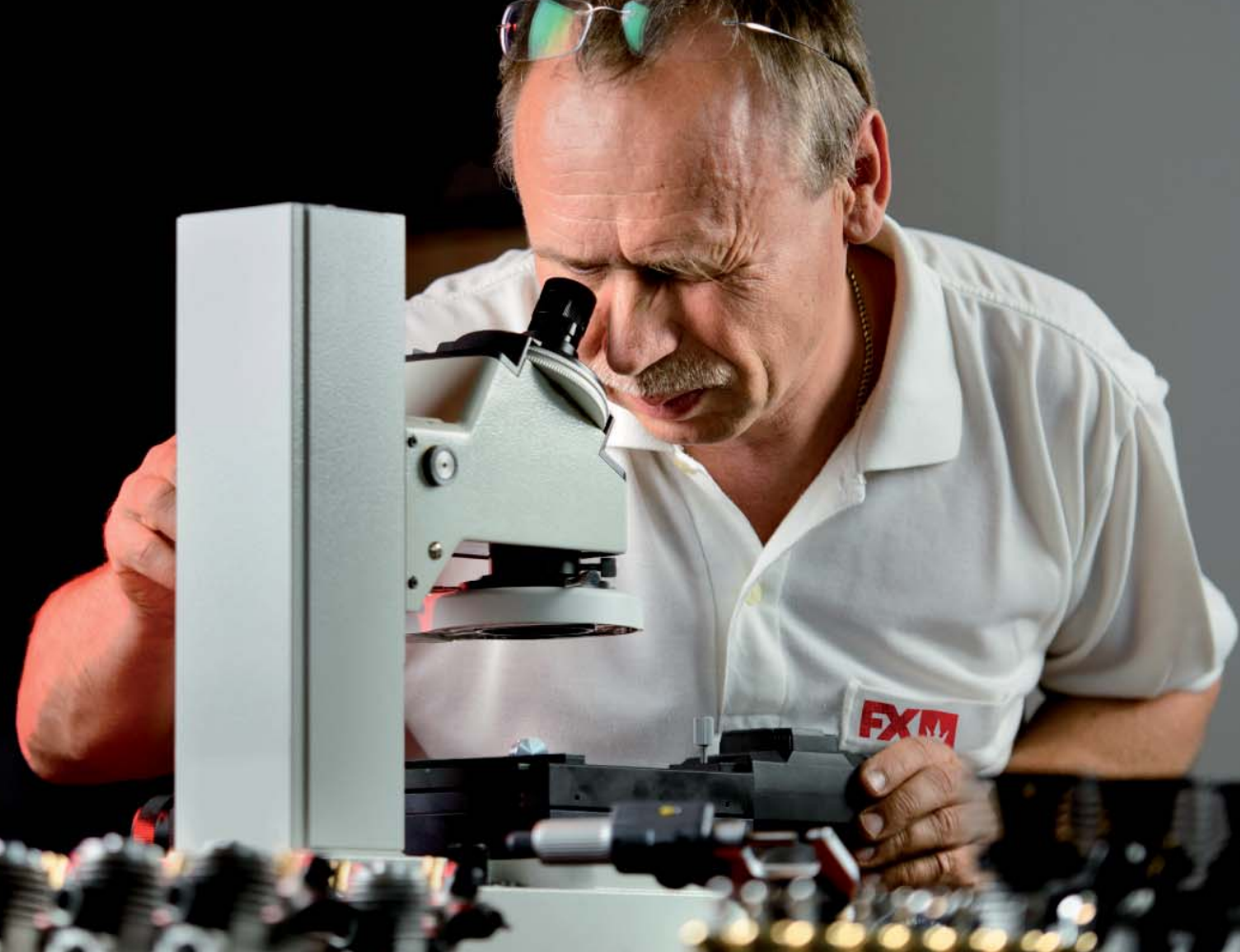
The surface roughness, finish and treatment on crucial parts such as crankcase, crankshaft, sleeve, piston, pistons inserts, carburetor, sliders, are also extremely important and all are individually measured and recorded.

A birth certificate is issued for every engine where all of the serial numbers of the main parts are recorded and it is possible at any time to trace the roots of every part back through production processes to its absolute beginning including information on which batch of material was used, what manufacturing program was used and by whom and when the part was produced. FX fully stands behind every single part and every single engine produced.

FX Engines advanced treatments

The heat treatment and hardening process of all the parts is one of the most important processes which has significant influence on the reliability and life time of all the parts. The type of material and all the metallurgic processes involved in the treatment all effect the strength, durability and wear resistance of the parts.

All of the treatment processes were developed by Dipl. Eng. Juraj Hudy for his proprietary steel. Knowledge acquired in over 30 years of experience was utilized for developing and implementing the appropriate procedures for all the engine parts. Every single batch is tested, measured under a microscope, sampled and the data is recorded and archived.

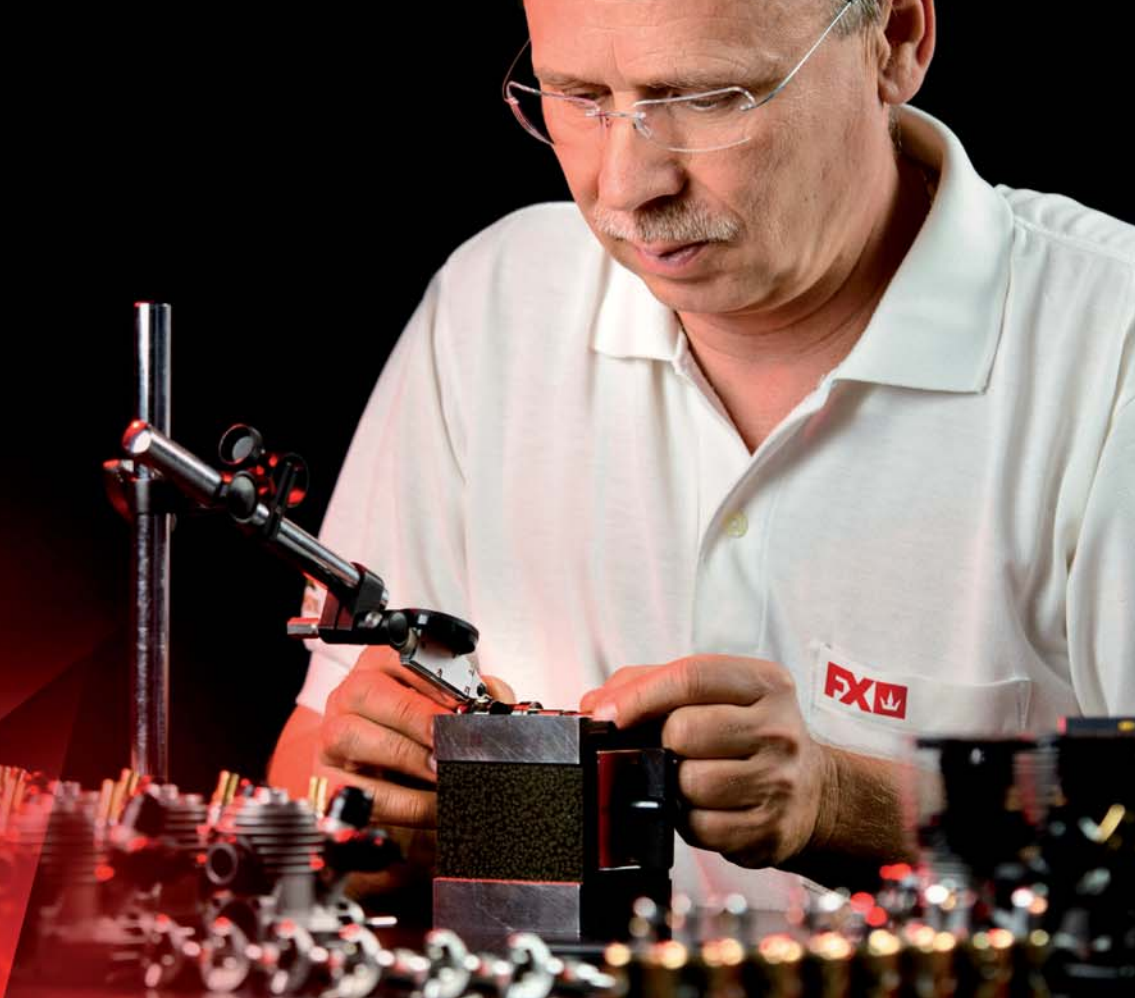




FX Engines artistic assembly

All the artwork and magic made in production is backed up with craftsmanship at assembly. The artisans who assemble FX Engines have been with the team since the very beginning. The skills of these key craftsmen have been perfected over the years during hundreds of prototypes that were assembled, disassembled, inspected and refined.

These years of experience have trained them to know exactly which areas are crucial to ensure achieving the superior quality that their pride of workmanship demands.







FX Materials used

FX uses only the most premium European materials for every single part. There is no compromise with any of the material, tools and equipment used during the production, manufacturing and assembly process.



Aluminum

All aluminum parts such as head, conrod, internal carburetor parts, etc are machined only from the most durable Swiss 7075 T6 aluminum materials. Every new batch of the raw material is measured and inspected upon arrival to ensure it meets the highest requirements.

Silicium

To choose and use the proper material for the pistons is extremely important for the performance of the engine because the pistons experience extreme forces inside the sleeve are subject to heat expansion. There are plenty of material choices from which dozen of different materials were long term tested before the final one was chosen. All the FX pistons are manufactured from bars of Silicium alloy by machining, milling and grinding which ensures consistent material properties over the entire cross-section of the piston.



Steel

The only logical choice for all of the steel parts such as crankshaft was to use nothing other than the world renowned Hudy Steel™. This special steel is custom produced based on the secret formulation developed by Dipl. Eng. Juraj Hudy more than 30 years ago and used successfully for decades in RC cars in the most demanding applications. This unique formula of steel production and hardening processes has remained unchanged. Every new batch of steel is randomly measured and a sample is hardened to confirm the parameters meet the very strict requirements on the specifications of the steel and the labeled samples are stored & archived.

Brass

The sleeves are machined from high tensile brass.





Composite mixtures

There are countless manufacturers and formulations of different composite materials in the market. To choose the right one for a particular part requires years and years of experience in this particular field. Each of these composites can then be additionally mixed and the knowledge of the proper composite mixtures is a highly specialized field.

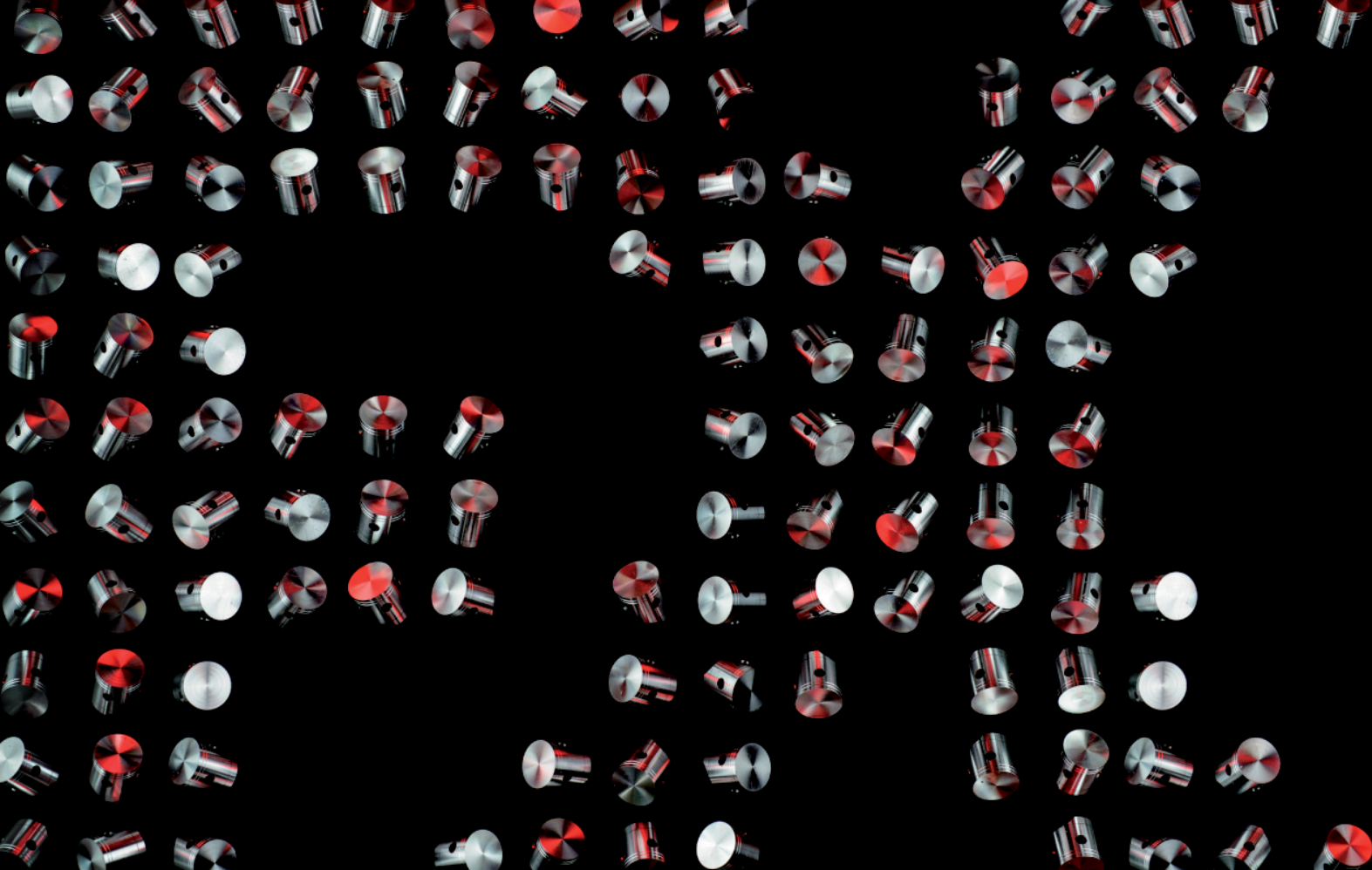
FX uses specialized and experienced masters with more than 20 years of experience in mixing of composite mixtures specifically blended for RC car applications. All of the raw composites are manufactured in Germany or Switzerland and all the mixtures are blended in-house using proprietary recipes to ensure low wear, yet sufficient strength and durability of all the moulded parts.



Aluminum

Like the composite materials there are many different aluminium ingots with various material compositions. Using the best aluminium for the crankcase and carburetor is one of the most important features for a high performance reliable engine. The die-casting aluminium can be mixed like the composite materials; there is almost an infinite number of variations that can be achieved. The main aim is to look for such a material which will provide the ideal combination of heat expansion, heat sink, stability and hardness.

It took the R&D team more than 6 years to test several dozen different aluminium die-casting mixtures to find the best one. The final mixture is a secret recipe containing various amounts of German & Italian ingots which are melted in a given ratio at specified temperature and injected under specific pressure and vacuum.....an art form of its own.



All the development, testing, implementation of new technologies, setting and fine tuning of new technological manufacturing processes, development of all of the materials and their associated treatments have all been tuned to absolute perfection. This has been an incredibly time consuming process, taking 6 years to reach the point where the extreme targets for quality, reliability and performance are met. We have dedicated our passion for perfection to the development of this new product line, and now it is ready for you to enjoy. The wait is over. **FX Engines are here.**

www.FX-engines.com



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MADE IN EUROPE



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