

## The validation process proves 'Faital paradigm': reliability, industrialization, quality control.

**An eight week "six days". "I have seen things you people wouldn't believe..."**

"I have seen things you people wouldn't believe..." many of us will remember these famous words by Rutger Hauer's "NEXUS6" in Ridley Scott's "Blade Runner", regarded as one of the major science fiction movies of the twentieth century.

This could also be the statement of a Fital loudspeaker coming out of an ordinary validation test lasting an incredible eight weeks, a life-span.

### **But let's start from the beginning**

Fital PRO is the brand name of Fital S.p.A., one of Italy's most respected and reputable loudspeaker manufacturers who have been in business since 1958 and have their headquarters at San Donato Milanese, near Milan.

Today Fital is a multinational company manufacturing loudspeakers for the motor industry, with branches and production plants in six countries worldwide (there is a distinct possibility that the sound system in your car is a Fital product carrying a more familiar name). Advanced technological manufacturing processes, faultless contemporary design, innovation and reliability are all factors underlying the indisputable success of the company.

All products before series production and distribution are tested on an internal validation line inside the San Donato Milanese plant on a long and backbreaking test route.

At the end of 2005 Fital introduced the FitalPRO range of professional loudspeakers which include all the elements such as reliability and quality for which Fital has become world renowned.

### **Between mythology and reality: the reliability technology**

Faital applies precise "reliability features" to whole products, so the FitalPRO ranges which are professional oriented, derive from the great experience of the very severe "automotive" market.

Actually the typical car manufacturer which has its products made by Fital never accepts compromises as regards reliability: one of the primary tasks is to verify the first needs of every OEM application, that is absolute "reliability".

Actually every customer requests the respect of a specific set of rules he has developed himself, developed over time, and which represents an "accelerated life test" for every component.

Said test is based on standards or on precise guidelines which very often are specifically requested by the normalization organizations, like IEC and AES (they generally provide strict guidelines for the brake-in and life tests, the duration, and several other tests to organize a common set of procedures in order to produce results applicable to every manufacturer e.g. "nominal power").

In general Fital will tax to the limit every component for his customers according to three general set of tests, 1) electric tests, 2) mechanical tests, 3) climate-thermic-chemical, and a lot more as we'll see in detail soon.

At the end of this try out test every loudspeaker is to guarantee the original performance, an untouched resonance frequency  $F_s$ , efficiency and distortion values as before the test.

### **The "Fital paradigm"**

Two are, therefore, the prerequisite: on the one side the "typical" automotive manufacturer does not allow any compromise as per reliability; on the other hand the product is to be price competitive, essential, employing materials stressed to the limit.

Starting from these strict boundaries, the "Fital paradigm" of "reliability industrialization - quality control" works very well and allows Fital to be in a position to supply the main car manufacturers with "Premium" products distributed on the market under very respected brands.

The same thing is happening in the professional market which is showing interest towards the new

lines of FitalPRO products since their launch.

### **A system of equations may help**

If we ever asked Fital engineers to describe the excellent ingredients just mentioned, they would almost certainly use a system of equations:

industrial design+robust production process = reliability

research on materials & component design = reliability

reliability+acoustic package = sound quality (over time)

reliability = customer satisfaction

### **Chronicle: to cut a long life short**

Let's start by taking a look at the validation process which every Fital and FitalPRO loudspeaker is subjected to.

As we said, the different specifications requested from customers may vary somehow but the main ideas are common and are directly related to a general "reliability" concept. It is a set of different strains to withstand: mechanical, climatic, damp, vibrations, a wet and warm environment, thermic shocks, chemical and dust aggressions. In other words, the natural aging process is accelerated and every component is tested in extreme conditions - even combining the tests to an unbelievable extent.

A complete set of tests namely requires a lot of time, even eight weeks along a coherent line which is carried on according the customer development plan and on a first series of loudspeakers, the typical set of 10 similar models originating from the same set of samples has to carry on all the tests before entering the regular production chain.

## **Two targets: acoustic package and "industrialiability"**

Our story begins with a commercial need leading the interest of Fital R&D; then a prototypical design phase outputs a series of semi-definitive products, which will undergo a first series of tests in order to verify their power handling and several other tests spread in an appropriate way.

The starting phase is made easier from some stand points: the engineers may count on several equipments, measuring hardware, software and areas at the state of the art (and even more) as per material research, industrialisation processes industrial design are concerned.

The FitalPRO "recipe" is to produce a large quantity of loudspeakers while maintaining the highest possible levels of manufacturing efficiency and acoustic quality: they must be easy to produce but at the same time they must guarantee a highly technological content which is transferred to the industrial production chain.

Again in the design phase, the main focus is on sturdiness and the integration of technologies which are derived "for free" from everyday engagement in the automotive market, a commitment which is generally not involved in the pro-audio area, a part from here. But it is at the same time true that some important innovations are derived from professional design and than are projected on the automotive production, closing an excellence circle.

## **Communicant "cones"**

In a synthesis, from the automotive area are derived all the sturdiness and testing procedures, while from the "pro" area some solutions are "stolen" and related back - where possible and compatibly with costs - in the automotive area.

A typical Fital project is therefore born from a technical/commercial requisite and soon it receives a first round of feedback from the engineers to get to a pragmatic technical proposal which is to be commercially sustainable.

So the components are projected in detail to create an acoustical prototype which will be the means to define the sonic performances (the "acoustic package" is the first target to reach), a

component which is all but perfect and hardly stands the test fatigue; then we step to phase two for the reliability testing; and still we are far from final production, since provisional moulds are used here, enough for reliability tests, to polish up the industrial design and in quest for a "good industriability" (even the second target is accomplished).

The idea of "good industriability" refers to the fact that some times the "pro engineers" come out with a performance wise proposal that may be totally unsuitable for mass production on and for Fital production line. The main goal is to maintain convenience and high quality sound. Production has to guarantee a certain amount of transducers per hour with repetitive high quality acoustic results, while those who work on hand-crafted production lines can't guarantee such results at all.

### **"I have seen things you people wouldn't believe..."**

Before all tests the new transducers are one-by-one plugged into testing instruments, loaded onto an appropriate test box and measured as per performances: a dedicated software and appropriate templates, reveal if the transducer is up to the initial prerequisites of the project.

So the next step is a "silent room", a testing box which is used to isolate the component during the first endurance test which is meant to verify the AES and IEC specifics. This is the same test that in the prototypical phase had produced the main data sheet values.

Then it is the turn of an expensive mechanical devise called "shaker" which has a vibrating plate to mount the component "to torture", through dedicated adaptors. At this point the subject of the test - which receives an audio signal so it operates in a "normal way" - starts receiving an endless series physical strains, "bumps, hits and smacks" cyclic and off-hand, which can easily get to 100 G accelerations and easily amount to 50/100.000 strokes per test.

It's clear such an abuse is meant to verify if all the part subjected to mechanical move, just like suspensions, cones, spiders, lead wires, etc. and all the set, may survive in extreme conditions, just as the transducer itself were assembled in a professional enclosure designed for endless sound reinforcement touring or fixed in a car door travelling at high speed off-road for all its life!

Every test phase is followed by a painstaking inspection, instrumental and by sight, to verify the

results of the abusive treatment and to be sure quality performance is untouched.

### **..."attack ships on fire off the shoulder of Orion"...**

Stepping to the next phase our transducers undergo a first climatic test (called "Arizona-Arctic") in which the unlucky loudspeaker is closed into a dedicated oven/freezer to suffer from sudden and extreme thermic shocks, with temperature swings ranging from -40 to +110 degrees Centigrades in very few seconds. This is carried on in order to verify the extreme strains resistance which may cause damages to glued and plastic parts.

And it is not over yet, because before surviving this test the transducer again is put through sudden thermic variations in a dry environment first and immediately after with 60/90% moisture.

Once again the functionality is checked, and the test tour is on again; this time we reach a kind of dark room used to check the ability to tolerate ultraviolet radiations, discolouration and obsolescence of the component in continuous sunlight exposure.

And then again "to the massacre" with the "dry corrosion" test to verify the amplified effects of salt corrosion and other unlikely chemical compounds like detergents and alike.

In this section of matches the "dust test" sees the loudspeaker driven again with signal exposed for long cycles of working operations in an extremely hot environment, totally dump and dusty.

Last official phase, water resistance. In this last segment of the murderous test path the transducer is closed into a plexiglass cage, tighten with adaptors, driven by an audio signal, and, soon afterwards a totally unprofessional "garden pipeline" and sprinkler start squirting the cone!

The thorough test cycle span is variable, up to a common term of eight weeks, again according to the set of specifications the customer wanted, and according to the destination of the loudspeaker tested, so sometimes some more additional tests are requested just like "drop test" and "torsion resistance". Don't do it at home!

**..."I watched E-beams glitter in the dark near Tannhauser gate"...**

And if you think by now the process is over, you are wrong since often the tests go on and are "composed", that is, for example, transducers are placed on the shaker, fed with a signal from a powerful amp and everything is shoved into the oven/freezer (e.g. the Japanese and German markets require also a combined test that may even account up to 1,000 hours at high temperature, with huge vibrations at a quarter of nominal power), so mechanic resistance is summed to temperature, dump and other tests, with a certain amount of sadism.

At the end of this "holiday" the loudspeaker coming out of the tests line (it seems to see it coming out coughing and with some smoke coming out of the cone!) is plugged to the tests instruments again, fixed onto the initial testing box and measured again in the overall performance thanks to a proper software.

Again through definite templates it is easy to see if it still respects the same original performance and acoustic requisites.

If everything is well within the reference parameters our tested product is finally checked from an aesthetic point of view.

And if in the end we get back to the initial Blade Runner, the quote closes in: "And all those moments will be lost in time like tears in the rain. Time to die..."

But it is exactly the opposite for Fital and FitalPRO, since, after seeing so much, the useful life of the component begins and only at that time it has truly earned Fital brand name.

You are officially invited to visit our premises and observe the testing/validation process and see for yourself an example of the high level of engineering excellence and quality maintained at Fital. We are proud of our specialization which is an example of Italian manufacturing at its best which in turn has over the years led to Fital winning many prestigious prizes awarded by major world motor manufacturers. And for the professional lines the adventure is just beginning.