



**CINTURATO**

**PIRELLI**

# The Pirelli Collezione

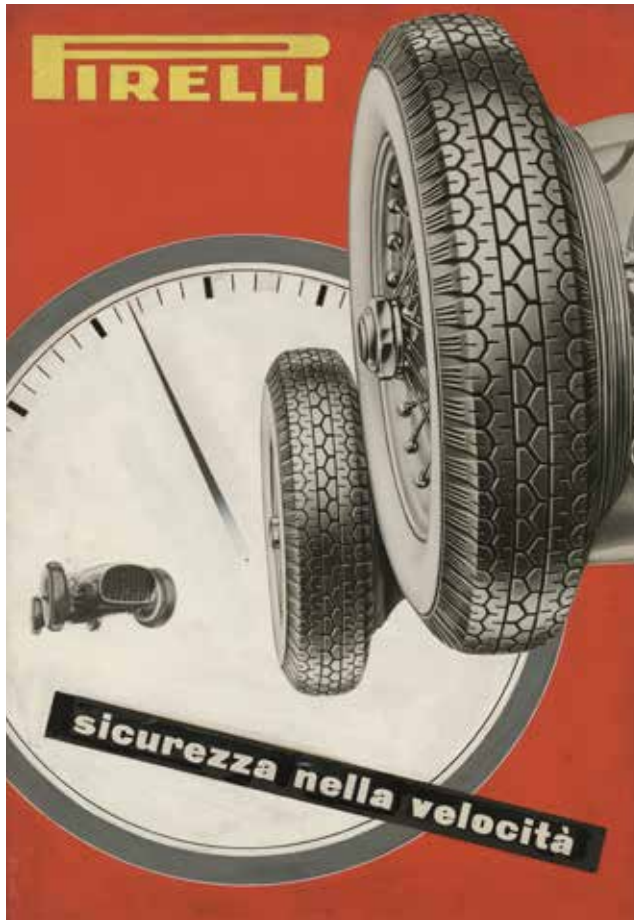
## Tyre manufacture and testing



FONDAZIONE PIRELLI

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Collezione





1 Pavel Michael Engelmann, sketch for STELVIO™ Pirelli tyre advertising campaign, 1954

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## The Pirelli Collezione

Pirelli's desire in creating the *Collezione* is to provide the perfect tyres for vintage vehicles. The exact timeframe is not fixed as it remains flexible to cover not only the iconic supercars and those with which Pirelli has a rich historical working relationship, but also those sizes that permit the vast majority of enthusiasts to maintain or restore their cars and enjoy the thrills of the original driving performance. Pirelli is proud to be associated with FIVA and shares completely its fundamental aim "to support and encourage the preservation and responsible use of historic vehicles", developing the products contained within the *Collezione* to achieve this goal.

The creation of these products starts with the identification of the exact tyre size and pattern that was either fitted or available at the specific historical period for the model of car being considered. To facilitate this, Pirelli engineers have access to an incredible Historic Archive contained within the *Pirelli Foundation*. Here all the original data concerning vehicle size fitments, factory specifications, materials, mould designs and even advertising material plus a lot more are available. Pirelli's heritage of having been a supplier to the major vehicle manufacturers for over a century also permits us access to the historical data of our partners whenever necessary.

Definition of the size and pattern is the first step in developing these specialized products. However understanding how to produce them, using the right processes

and materials within a modern factory environment, remains the most difficult and complex challenge for Pirelli's engineers. The size, shape, construction techniques and most significantly materials have all evolved dramatically over recent decades making it very easy to over engineer the original performance characteristics. This would result in a tyre that completely changes the cars road handling as the tyres would no longer be compatible with the vehicles original suspension geometry. Another very important feature that the Pirelli *Collezione* can offer is the original aesthetic appearance of the tyres, since many were fitted as original equipment at the time. This is a fundamental feature in preserving the original design features of these vehicles.

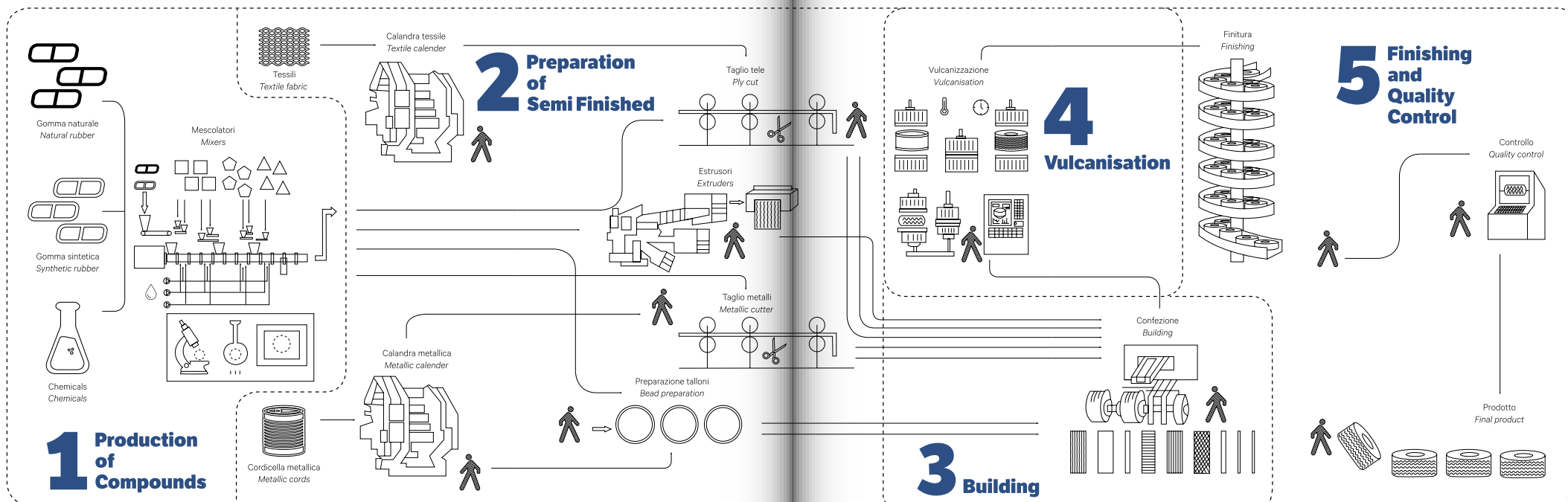
The second step in this long and complicated development process is prototype testing, initially performed on an indoor test rig to ensure compliance with today's rigorous quality performance standards and obtain legal markings as required. This is then followed by outdoor verification using the original target vehicle. Pirelli is fortunate to have supplied most of the "World's Finest" over the years therefore has frequent access to vehicles provided by their heritage departments, or directly by passionate owners keen to get their treasured conservation or restoration projects back on the road.

How this is transformed into the final product is fully described below.

## An overview of the production process

Building tyres for vintage cars in a modern factory follows exactly the same basic processes as those adopted at the time, but the level of automation in a modern plant imposes new challenges when attempting to reproduce structures, geometries and sizes of several decades ago. These problems are compounded when you consider the cross ply era. The approach used by the Pirelli engineers is to

concentrate generally on small volume lots with characteristics and structures that deviate only slightly from the original designs. To achieve this under the constraints of the state of the art processes used for ultra high performance road tyres or indeed motorsport, Pirelli benefits from the manual skills of its highly trained operators. While technology has evolved over the decades the basic production flow remains as outlined below.

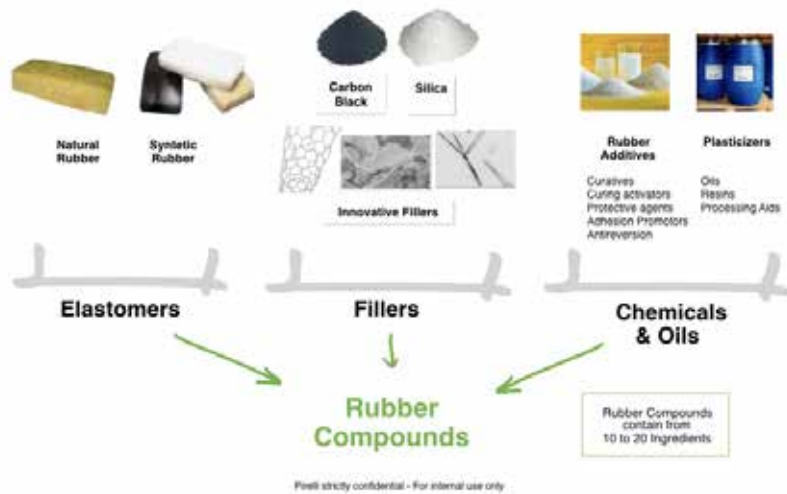




## Mixing, preparation of the compounds

Traditionally, the production process begins with the transformation of a wide range of raw materials to produce the tyre's rubber compound, mainly tread and sidewall but also the smaller although no less important internal compounds. These rubber compounds are obtained from mixing together various natural and/or synthetic rubber polymers, reinforcing fillers and various other "chemicals".

The polymer has always been the base of the tyre construction and can be of either natural origin (such as natural rubber) or a synthetic material such as butadiene, styrene or isoprene - all developed in the late 1930's. For the reinforcing materials there are two basic components: firstly carbon black which was introduced around the 1920s specifically to increase grip and wear resistance. More recently in the early 1980's silica was introduced to lower rolling resistance and so reduce fuel con-



sumption, while also improving behaviour on snow and on wet surfaces in general. Everything is mixed together in a machine called a Banbury internal mixer, equipped with rotors that move tangentially, masticating the compound against the internal walls of the machine under precise temperature and energy conditions to guarantee a perfectly homogenous blend. Over the years this operation has been increasingly automated in order to obtain perfect distribution of the ingredients, reduce energy consumption and improve final product quality.

11 Compound mixing machinery during 1920s



## Semi finishing, production of individual components

The next phase involves the preparation of the individual components called “semi-finished products”, which together constitute the final structure of the tyre. These are different elements each designed to perform a specific function within the construction made of rubber or rubberised textile or metallic material. The former is obtained by an extrusion process whereby the rubber compound is forced to pass through a nozzle that determines its final shape. The semi-finished products of rubberised textile such as Nylon, Rayon or fine steel wire are all impregnated with a rubber coating

**12-13** Semi finished component preparation in the 1950s and today  
(Photo by: Carlo Furgeri ©2016 Pirelli & C. S.p.A)

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during a “calendering” process. Each material is subsequently cut to a specific angle and width depending on its final destination within the tyre, and collected on a roll for use during the tyre building phase.

This is certainly one of the areas where the many decades of studies and experience have permitted Pirelli to make the biggest technological breakthroughs, which from time to time have revolutionised the tyre world with inventions such as “Cord” fabric during the early-mid 20th century or the “radial” CINTURATO™ in the immediate post-war period. As a means of stimulating continuous research and development Pirelli has always been committed to both car and motorcycle racing.



## Building, assembly of the tyre

Here the semi-finished products are assembled to obtain the final shape of the tyre; a process referred to as tyre building. Of course, automation has played an increasingly important role over the years, making it possible to move from a completely manual process to the modern, highly robotised processes found today. The building operation is divided into two distinct phases. The first is the assembly of the carcass, during which one or more layers of rubberised calendered textile material are applied onto the building drum, followed in a precise sequence by the metallic wire bead (the part that anchors the tyre to the rim) and any other internal reinforcing materials.

14-15 Tyre building in the 1960s and today (n. 15 Photo by: Carlo Furgeri ©2016 Pirelli & C. S.p.A)

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The second stage (for a radial tyre) consists of the pre-shaping of the carcass so that the steel or textile belts can be applied, followed by the Nylon overlay (where present), completing the operation with the application of the tread and sidewall rubber. For a traditional cross ply construction the building happens in a single phase only.

16 Modern curing machine (Photo by Carlo Furgeri ©2008 Pirelli & C. S.p.A.)

## Curing, vulcanisation

Vulcanisation is the process that allows the rubber parts of the so-called "green" tyre obtained at the end of the building process to be bonded together, taking them from a plastic to a solid state. This happens in a curing machine or vulcaniser for about

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15-20 minutes, depending on the size and construction of the tyre. This “curing” is carried out under precise temperature and pressure parameters to induce the controlled chemical reaction between sulphur, vulcanisation agents and polymers. This causes the rubber compounds to transform into a stable state, while maintaining their elastic deformability characteristics when subjected to stress. The “green” tyre is inserted into a mould in the curing machine, which when closed exerts an internal inflation pressure causing the tyre to assume the shape of the mould. As a result the tread pattern imprinted in the rubber and all the sidewall inscriptions are impressed on the tyre sidewalls.

**17** Modern tyre uniformity and internal structural control. (Photo by Carlo Furgeri © 2008 Pirelli & C. S.p.A)

### Finishing, final production quality control

The tyre ejected from the vulcaniser is now a finished product, ready to use. Before being sent to the warehouse it is first subjected to a series of finishing and control procedures. The initial operation may simply be the removal of moulding spew (the

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small rubber pins present following the curing operation) but after this the stringent quality controls are carried out.

First an internal and external visual inspection is made by highly trained personnel; as you can see below, this has changed little over the years; however, in today's modern factories these visual checks are now followed by a series of automatic measurements for balance, as well as X Ray inspections. Sample tyres are collected for indoor rig testing to verify high speed and fatigue integrity.

**18-19** The final visual inspection area during the 1920's and today (n. 19 Photo by Carlo Furgeri ©2016 Pirelli & C. S.p.A.)

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## The final product





## Outdoor testing, specification tuning and manufacturers homologation

Following successful building and indoor integrity tests outdoor testing takes place before the final specification is released to production. Depending on the application this may simply involve a handling appraisal with a vehicle borrowed from an owner or local car club as we did with the introduction of the CA67™ for the Lancia Flaminia, for example. Alternatively, a more extensive series of indoor and outdoor tests are necessary to achieve full manufacturers homologation. The *Collezione* range specifically developed for Porsche is a good example, with each homologated tyre individually marked with the prestigious Porsche “N” approval, following a comprehensive testing process.

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With the increasing popularity of the *Pirelli Collezione* the number of tyres individually recreated to satisfy the ever growing demand for “original performance” rather than just a cosmetically correct fitment is growing. Pirelli will issue a series of marketing bulletins as each new product is released.

20-21 Porsche wet and dry handling.  
(Photo by: Michl Koch / KoMeCon)  
22-23 Lancia Flaminia wet and dry handling at Pirelli's Vizzola circuit

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## The Pirelli Foundation

All the materials in this publication come from the company's Historical Archive, which is preserved by the *Pirelli Foundation*. Set up in 2008, the Foundation's many activities include the conservation and promotion of the Group's Historical Archive. Over 3.5 km of documents record the history of Pirelli from its foundation in 1872 through to the present day. A key feature of this extraordinary cultural and artistic heritage is the section on communication, which illustrates Pirelli's highly successful collaboration with intellectuals, artists and photographers and the company's ability to anticipate future forms and instruments of communication. These range from design to photography, and from the first experiments with computer graphics to the latest digital marvels.

An important section is devoted to documents from the Pirelli Research and Development Department, with technical drawings of the various treads, technical specifications for the manufacture of tyre moulds, and documents on the original machinery.

The Historical Archive also contains the private archive of the Pirelli family, a technical and scientific library with more than 16,000 volumes and many house organs and magazines, including the complete collection of *Pirelli. Rivista d'informazione e di tecnica*. Clearly pointing to the huge value that the Pirelli Archive has for the community, the Soprintendenza Archivistica proclaimed its historic interest back in 1972, placing it under its own protection.

The Foundation also works in education, with courses for schools of all types and levels, as well as universities, with the main aim of introducing also the youngest members of society to the world of production and work, teaching them the fundamental values of the Group's corporate culture.

[fondazionepirelli.org](http://fondazionepirelli.org)

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Cover: Bob Noorda, advertisement for Pirelli CINTURATO™ tyre, 1959



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