Industrial Manufacture

Contradiction or reality

Florex Engineering
L'expérience horlogère au service de vos objectifs
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Content

0 Introduction

The Swiss watch industry landscape has dramatically changed during last decade.

These changes have been generated by the will of SwatchGroup stop the delivery to third parties.

Many from scratch movement developments from small quantity production factories, need differentiation. The consequences:

- Growth needs of skilled people in specific businesses and craftsmanship, difficult to find them and need time to train them
- Reliability is a quality level stability during a long period: how to launch a product with an intrinsic good reliability
- Huge movements price increase forcing the brand to enhance “manufacture” characteristics of their product and to step into the so called “Haute Horlogerie”

But what is really behind “Manufacture”?

1 Industrial World or Manufacture

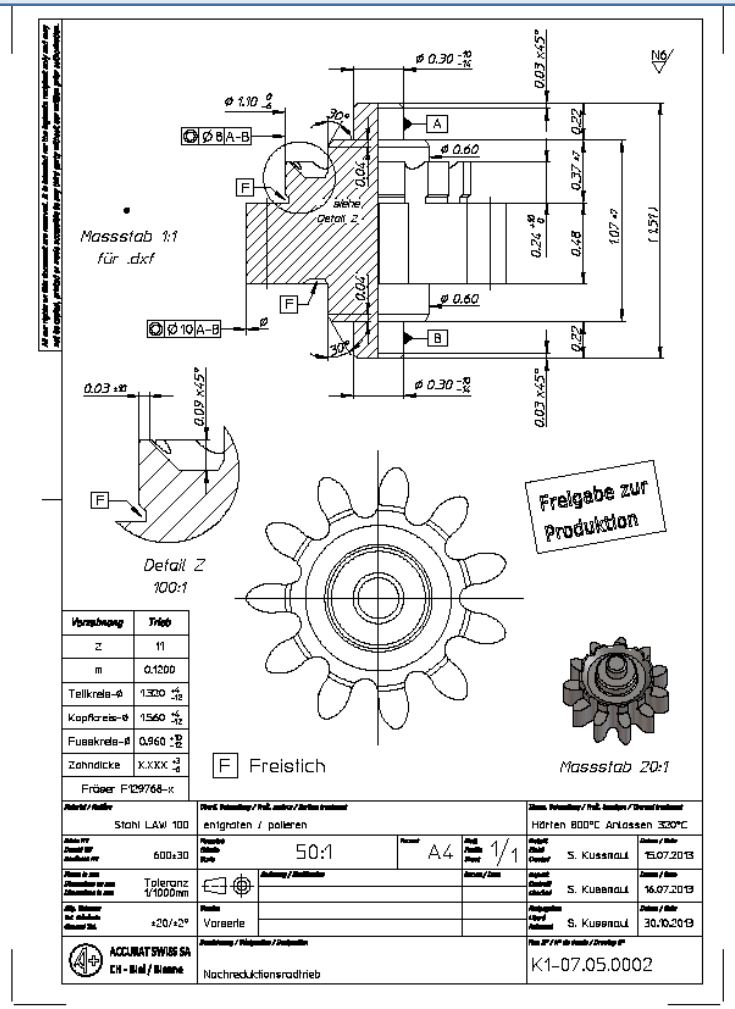
Quantity need repeatability to enable high automatisation ratio

- Component quality is given by process manufacturing mastering.
- Product quality is guaranteed by construction adapted to the production means. High automatisation ration implies mastered geometrical variation, no tuning needed to get reliable product.

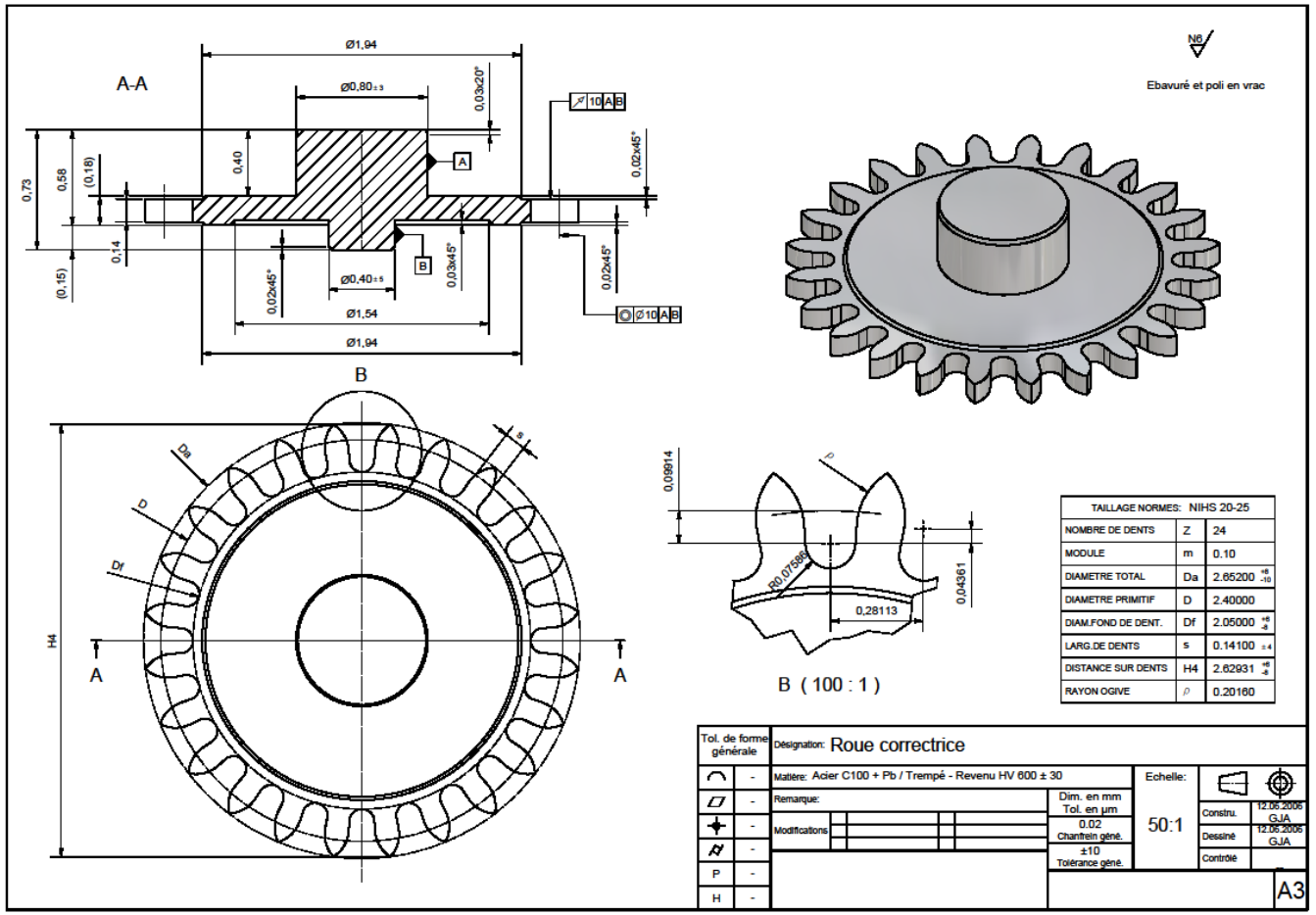
Expensive small series needs esthetic based on craftsmanship to justify price

- Component quality is defined by the quality of its decoration.
- Product quality is guaranteed by measurements throughout production, it will vary over time and need fine tuning during assembly processes that induce reliability problems.

1 Industrial World or Manufacture / Construction

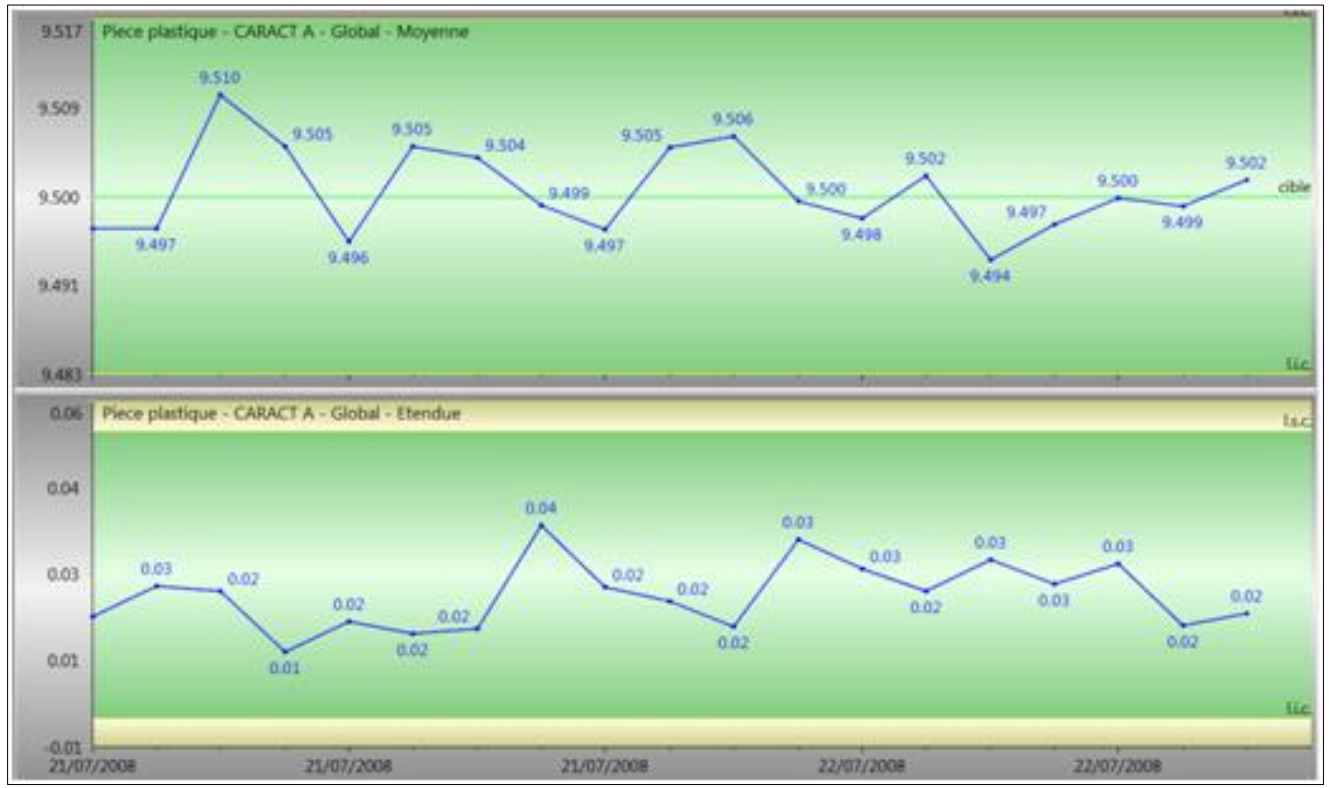


Industrial draft with a lot of information

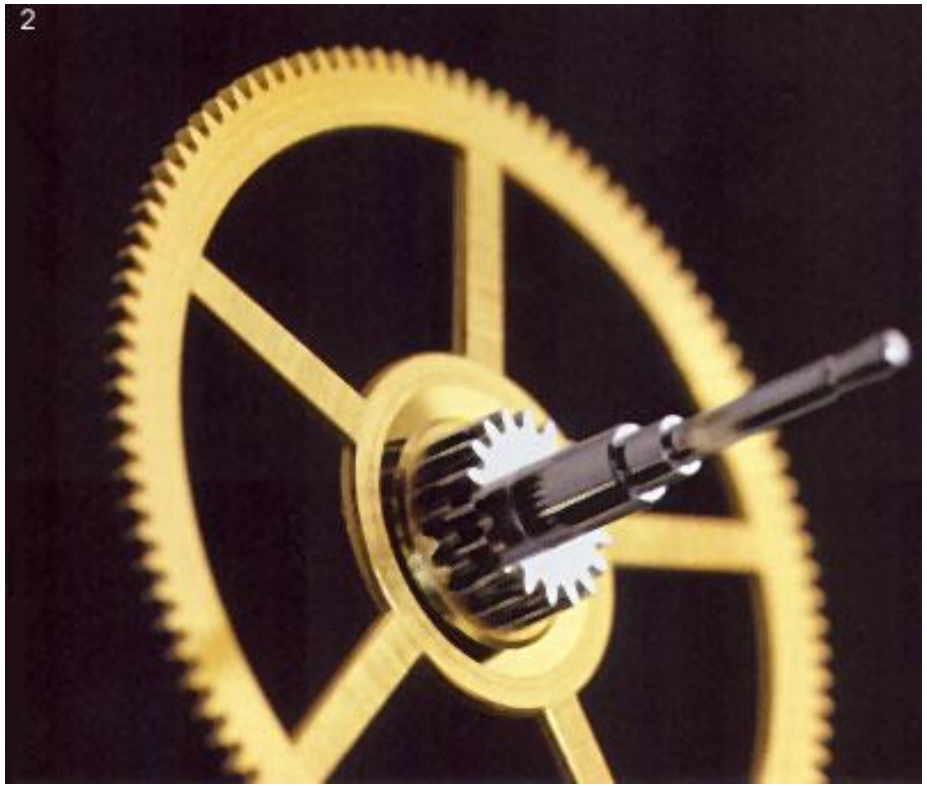


Manufacture draft with a lack of information and small tolerances

1 Industrial World or Manufacture



Production under statistical process control or similar production mastering tools



Very precise esthetical codes that degrade the part technical behavior

1 Industrial World or Manufacture / Manufacture constrains

Esthetical constrains

- Wheel decorations:
  - Moulurage, cerclage
  - Roulage
  - Anglage, arm thickness, max thickness
- Spring decorations
  - Anglage, satinage, unfunctional size
- Flange decoration
  - Satinage
  - Reference plane decoration

Factory localization

Small Series

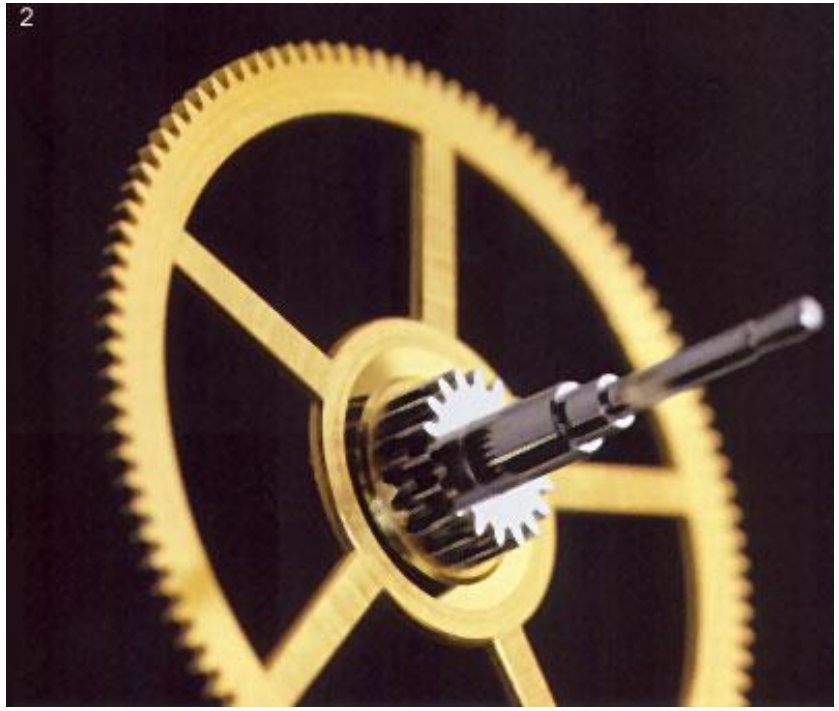
Consequences

- Wheel flatness
- Spring efficiency
- Exceeding physical limits leads to customize all assemblies and movements
- Stability
- Repeatability

- Lack of skilled, professional people
- Unknown production control tools

2 Wheels comparison

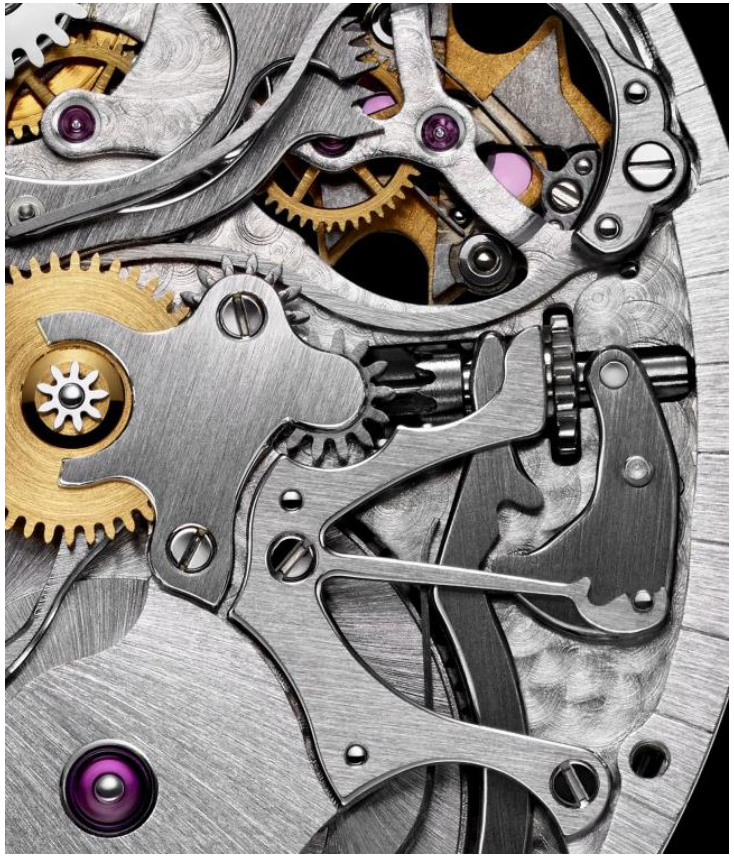
Flatness and concentricity are control hit points.
Geometry defined to increase these characteristics



Esthetical codes destroy robustness and flatness

2 Spring comparison

Final shape defined by simulation to ensure the function



Final shape defined during prototyping phase. Function modification induce by esthetic

2 Flanges

Manufacturing marks erased by all faces decoration induce reference modification. But result is beautiful

2 Flanges

Impossible to stay flat after engraving

1 Industrial World or Manufacture / Industrial constrains

Technical constrains

- Lower price segment
- Big series
- Automation
- Unskilled people
- Standardisation

Consequences

- Higher security coefficients
- Well known production control tools
- Component stability
- Simplicity
- Higher productivity rate per employee
- Versioning difficulties
- No personalization
- Forms dictated by technical and production consideration

3 Workshop organization

Half automated assembly line, higher productivity with unskilled employees.

Each employee assemble its own movement, from A to Z. Need skilled people or watchmaker

3 Industrial movements

Poorer decoration, bridge shape defined by automatisation, springs and wheels

2 Manufacture, a world of Complications

Swatch mechanical 51 pieces

Global Volume and performance:

- Diameter 25 [mm]
- Height 4.50 [mm]
- Frequency 4 [Hz]
- Power Reserve 42 [h]
- Rate -10 / + 20 [s/d]
- Chrono module possible with less power reserve (37h)

Quantity implies easy to assemble, simpler solution, less components, no tuning.

Only 10% of the production needs a watchmaker's knowhow to be accurate (COSC compatible).

Minute Repeater 510 pieces

Global Volume and performance:

- Diameter 20 [mm]
- Height 3.60 [mm]
- Frequency 4 [Hz]
- Power Reserve 52 [h]
- Rate 0 / + 8 [s/d]
- Chrono module possible with less power reserve (45h)

More complicated solutions for equal functions.

Due to place reduction, need of tuning and adaptation of each assemblage.

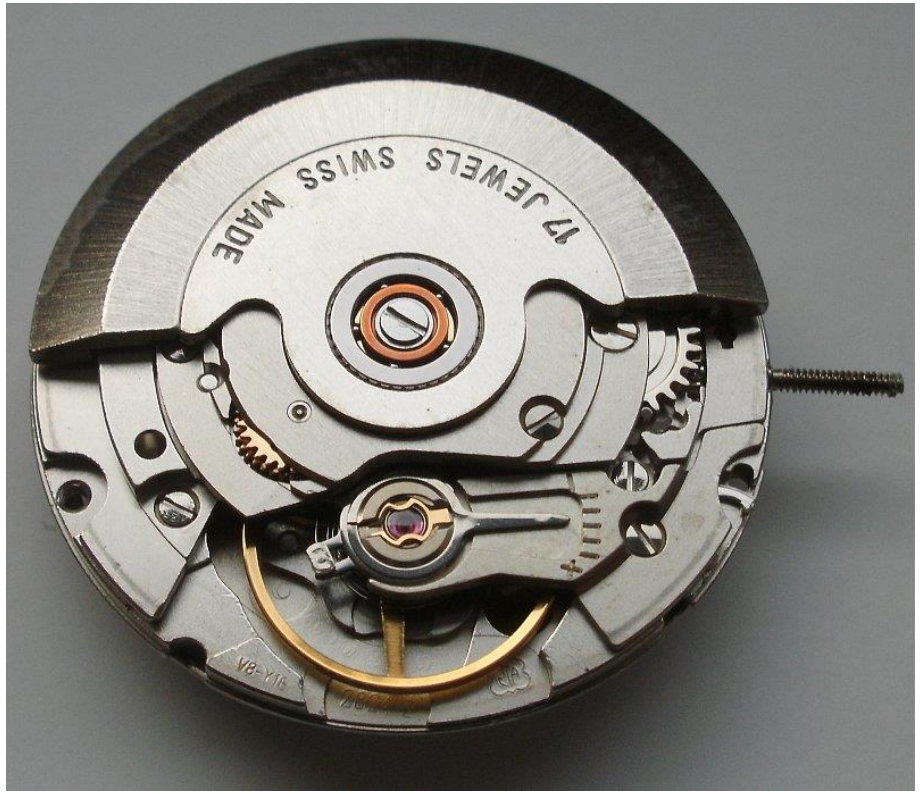
Function optimization by modifying spring shapes, security reduction, escapement enhancement.

2 World of Complication / Componant Number

Swatch P51 with 51 components

Minute repeater with more than 500 components

2 World of Complication / Volume



3 hands industrial movement:
Volume 118 mm^3
Power Reserve 38h

3 hands manufacture movement:
Volume 72 mm^3
Power reserve 50h

3 Workshop organization

Product development

Seven to ten years development timeframe: prototyping, industrialization, reliability tests and improvements.
Pre-series production size 10k pieces.
Team work organization that integrate production specialists, marketing and engineers.

Two to three years for construction and prototyping.
Pre-series production size 100 pieces.
A one man show development.

Production and control

Statistical Process Control, sampling end control.
All year running production.
Specialists individual technologies.
Production cycle optimisation.

All individual compontants: 100% control quality.
Derogation if compontants are inaccurate.
No time to reproduce inaccurate series.
Setting and production ratio time is very high.

Pricing flexibility

Higher industrialization ratio (needs small and mastered standard deviation) to increase productivity.

Hire staff to increase production or resolve any difficulties.

3 Workshop organization

Four components automat assembly system

Detail:
automated handling need component geometry stability

Each component needs its specific gripper who's very sensitive to the component geometry variation

3 Workshop organization

Parallel machining to enhance tack time

Adapted packaging to reduce manipulation time

4 Reconciliation ?

What is the product

A watch, even better MY watch, that brings a function and give a status

AND works well for a long time

Watchmaking, a story of compromise

Small (wrist watch) and complicated

A robust jewelry

Unique and reliable

4 Reconciliation, no but one more compromise

Industrial

- Quantity
- Process oriented development
- Cost effective
- Functionality

Manufacture

- Small series
- Haute Horlogerie labels oriented development
- Prowess
- Esthetic

And further more:

Craftmanship which is Industrial

5 HORAGE K1 positioning

- Construction based on mass production in movement solution
- Production means defining from the beginning
- Design to produce, security, tolerances
- Industrial partners included in the project from the beginning
- Standardization but modularity bring small series (see next slide)

- Ease of production
- Ease of assemble
- Ease of time setting
- Sturdiness
- Modularity: variability for the customer, small series feeling
- Embellishment on visible parts without disturbing reliability

5 HORAGE K1 positioning

Same movement with

18 differentiated displays

Configurable at the encasing level of the process, giving extreme flexibility to respond market changing

Added to design of dial and case enable to create an huge family collection

With the same movement produce in 40’000 series per year enable you to have an impress of 2’000 series

6 Conclusion

Industrial codes

- Functional and cost effective
- Torques and forces simulated, tolerances analysis
- Production process under control
- Special tooling and automation enabled by production quantity
- Assembly efficiency, no customization

Manufacture codes

- Esthetic code that introduce production variability
- Complications (size , functionalities)
- More functions in less volume, reducing security
- Small quantity, unable to apply Process Control organization
- Development time reduce

To different worlds combined in the Horage K1 movement

Thank you for your attention

- it’s time for a change -