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THE FUTURE IN MOLD CLEANING IS HERE:

« K.L.R.S. »

KEYMICAL LASER RESONANCE SYSTEM

Keymical®

WORLD TRADE CENTER

K.L.R.S.

KEYMICAL LASER RESONANCE SYSTEM PRESENTATION

12 January 2019

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KLRS is an international Keymical patent

At the end of 2017 Keymical has registered the international request of patent for the KLRS technology.

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What is KLRS?

KLRS is a new integrated technology for cleaning tire molds on the inside and outside, segments and side-walls, spring vents included.
No Chemicals, Ice Blaster or Sand Blaster are used with KLRS technology.
KLRS is the cheapest technology to clean tire molds offline with the best cleaning performaces.
At the end of the cleaning process a specific patented vision system is able, automatically, to recognize which spring vents are opened and which one are still blocked.

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How does KLRS work?

KLRS is an integrated technology that uses together:

1) Robot (6 anthropomorphic axis robot).
2) Laser with head scanner to clean tire mold surface.
3) Patented Resonance Technology to unblock spring vents (>70%) and to clean ventilation channels (included puzzle mold).
4) A patented Vision Technology is able to recognize automatically, after the cleaning process, which spring vents (ventilation valves) are open and which one are still blocked.
5) Smoke Aspiration system and filters.
6) Final table check station with a screen that shows to the operator which spring vents are still locked (in hilight in red).
7) On the final checking table station there is a smoke aspiration system in order to allow the operator to apply Key Flow (rust preventative for sidewall) in complete safety.

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How does KLRS work?

The integrated technologies work together as follows:

1) A 3D vision system scans the segment in order to recognize dimension and profile. These datas are necessary to provide the right instruction to the robot movements.
2) Robot and Laser start to clean segment, the laser's scanner head is moved by a 6 axys anthropomorphic robot in order to strike any point of the tread surface. It can clean segments and sidewalls.
3) During the Laser cleaning process, segments are tightened into a specific-press, a resonance modulator and its software identify their resonance point in few seconds, than a specific vibration is transmissed to the segment at the same resonance frequency. The vibration has enough power to remove soil deposit from spring vents and spring ventilation channels. This application is also applied on puzzle molds. Steps 2 and 3 are done simultaneously.
4) A dedicated vision system recognize which spring vent is opened and which one is still locked. Spring vents blocked are showed to the operator highlighted in red on the dedicated screen which is positioned on the final checking table.

Note: Resonance technology is applied on tire mold segments exclusively. It is not possible to apply the resonance technology on side walls.

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How does KLRS work?

How do you insert the tire mold segments and side walls inside the KLRS machine?:

1) The KLRS machine has two dedicated trolleys to load and insert the segments into the machine
2) The KLRS machine has two dedicated trolleys to load and insert the sidewalls into the machine.
3) Inside KLRS are placed simultaneously n. two trolleys, one dedicated to the segments and another one dedicated to the side walls.
4) Each second trolley is used for preparing a sector/sidewall outside the cabin, while the cleaning process is going on
5) Every time a segment or a sidewall is cleaned, it is possible to open the KLRS machine door and change the trolley.
6) KLRS machine start to clean firstly all the segments (usually 8 or 9 depending on the segments number) and secondly the two sidewalls.
7) It is also possible, thanks to the KLRS machine flexibility, to clean segments only or side walls only. It is a customer's choice.

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Using KLRS technology, is it possible to damage the segment and the side wall?

The Laser power has been set up to clean the tire mold aluminium surface and the steel surface safely. The same segment/sidewall can be cleaned by the laser more than 100 time without any damage.

Lab test certify 3,7 aluminium surface roughness before Laser cleaning. After 100 Laser cleaning processes the aluminium surface roughness has been 4,2.

KLRS can be also used to remove teflon coating with a specific set up.

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How long does it take to clean 1 mold on the inside and outside, spring vents included?

The process of washing an entire mold (2 side walls and 8/9 segments) takes about 60 minutes for summer mold and 90 minutes for winter mold.

The cleaning process includes:

1) Laser cleaning (external cleaning).
2) Resonance cleaning (unlocking spring vents and cleaning ventilation channels or puzzle molds).
3) Automatic recognition of open spring vents and those still blocked.
4) Protection (Key flow protective oil).

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Do I have a limit for tire mold dimension?

No limit for the mold size (segment and side wall).

KLRS can be used for PCR market and TBR market.

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Do I need Chemicals, Dry Ice or Sand/Plastic for Blaster machine?

No, KLRS does not need chemicals, dry ice, sand or plastic micro balls.

KLRS technology needs only electricity. The consumption is < 17 Kw/h.

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How much space do I need into my plant to have n.1 KLRS machine?

Minimum space: 4400x4600mm,
It doesn’t include the final check table area.
The final check table (1105mm x 4300mm) can be placed near the KLRS machine at your preference. The distance between KLRS and final check table cannot be more than 6 meters.
The ideal space is: 4600mm x 7900mm.

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How many people do I need to manage the KLRS machine?

One worker for shift is necessary to manage the KLRS machine. Just to put in and take out segments and sidewalls's trolleys by the KLRS machine.

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What is the cost of KLRS energy to clean 1 mold?

The energy cost is about 1,5 Euro/mold.
The only cost we have are: electrical energy and compressed air at 6 bar.
The electrical consumption is about 17 Kw/h max.

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What is the KLRS maintenance cost?

The yearly maintenance cost is maximum 4.000,00 / 5.000,00 Euro, which includes:

- Laser lenses
- Laser chiller check up
- Robot greasing and belts replacement
- Resonance device check up
- Aspiration system filters

What is the cost of the remote assistance and the software rent per year?

It costs 20.000,00 Euro/Year.

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What is the KLRS mold cleaning capability per day?

- One operator per shift is necessary for running the machine;
- KLRS cleaning capacity is about 16 moulds/day on three shifts.

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HSE problem?

Laser, Robotic Arm, and Resonance Devices are inside a specific cabin, during the cleaning process the cabin is closed, no laser ray can go outside the cabin, no smoke can go outside the cabin because a specific aspiration system will collect and filter the smoke. Cabin can only be opened when the laser and robot are off.
Key Flow rust preventative is applied on side walls on the final checking table, the table is equipped with a smoke aspiration system.

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Do I need to manage and pay for soil discharge?

Laser cleaning creates smoke that will be removed from an aspiration system.
The smoke will be filtered using specific filter located into the aspiration system.
The only things to discharge are the air filters when full.

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What kind of rubber compound/soil KLRS can remove from the mold?

KLRS can remove organic and inorganic soil, inks, paints, release agent sylicon, not vulcanized rubber, rust and any kind of contamination.

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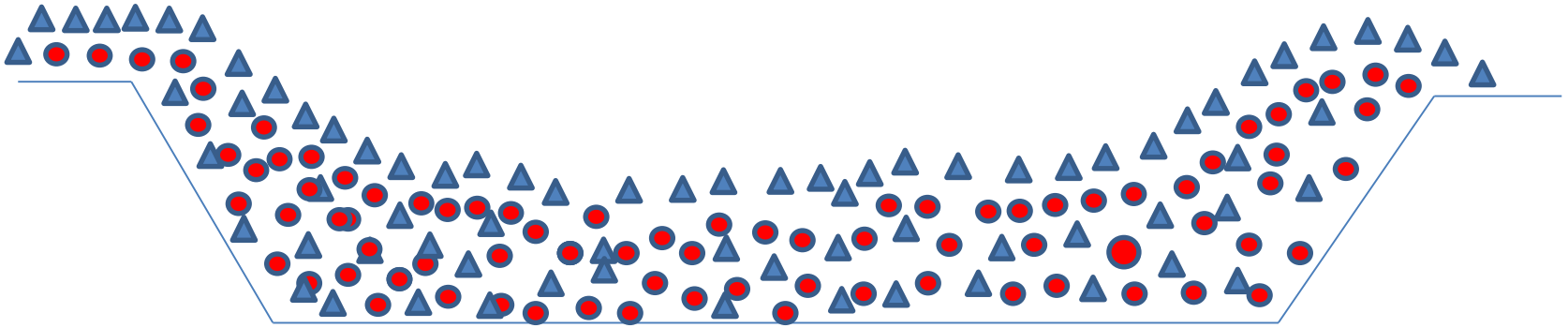
KLRS can remove organic and inorganic rubber compound soil.



RED = INORGANIC SOIL (silica, sulfur, etc..etc..)

BLUE = ORGANIC SOIL (Carbon black, oil, etc…etc...)

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ACTUAL CURRENT MOULD CLEANING TECHNOLOGIES WITHIN TYRE's INDUSTRIES

- AUTOMATIC SAND BLASTER
- MANUAL SAND BLASTER
- MANUAL DRY ICE
- AUTOMATIC DRY ICE
- ALKALINE SPRAY CLEANING MACHINE
- UMCS (ULTRASONIC MOLD CLEANING SYSTEM)
- KLRS (KEYMICAL LASER RESONANCE SYSTEM)

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BEST AND WORST (Off line) TIRE MOLD CLEANING TECHNOLOGIES

TECHNOLOGIEA1:I16S	MOULD EROSION	CLEANING RESULT	SPRING VENTS	TIME TO CLEAN 1 MOLD	ENVIRONMENTAL	PRODUCT/CHEMICAL CONSUMPTION COST	AUTOMATIC CAPABILITY TO RECOGNIZE SPRING VENTS OPEN AND LOCKED AFTER CLEANING	FINAL SCORE
	SCORE 1 = NO MOLD EROSION	SCORE 1 = EXCELLENT CLEANING	SCORE 1 = ABLE TO UNLOCK SPRING VENTS	SCORE 1 = BELOW 90 MIN.	SCORE 1 = ENV.FRIENDLY	SCORE 1 = NO CONSUMPTION COST	SCORE 1 = ABLE TO IDENTIFY	
	SCORE 0,5 = MEDIUM MOLD EROSION	SCORE 0,5 = MEDIUM CLEANING	SCORE 0,5 = MEDIUM ABLE TO UNLOCK SPRING VENTS	SCORE 0,5 = BETWEEN 90 MINUTES AND 120 MINUTES.	SCORE 0,5 = MEDIUM ENV. FRIENDLY	SCORE 0,5 = MEDIUM CONSUMPTION COST		
	SCORE 0 = STRONG MOLD EROSION	SCORE 0 = POOR CLEANING	SCORE 0 = POOR ABLE TO UNLOCK SPRING VENTS	SCORE 0,0 = MORE THAN 120 MINUTES.	SCORE 0 = POOR ENVIRONMENTAL FRIENDLY	SCORE 0 = HIGH CONSUMTION COST	SCORE 0 = NOT ABLE TO IDENTIFY	
AUTOMATIC SAND BLASTER	SCORE 0	SCORE 1	SCORE 0	SCORE 1	SCORE 0,5	SCORE 0,5	SCORE 0	3,0
MANUAL SAND BLASTER	SCORE 0	SCORE 1	SCORE 0	SCORE 0,5	SCORE 0,5	SCORE 0,5	SCORE 0	2,5
AUTOMATIC DRY ICE	SCORE 1	SCORE 0,5	SCORE 0	SCORE 1	SCORE 1	SCORE 0	SCORE 0	3,5
MANUAL DRY ICE	SCORE 1	SCORE 0,5	SCORE 0	SCORE 0,5	SCORE 1	SCORE 0	SCORE 0	3,0
AUTOMATIC LASER	SCORE 1	SCORE 1	SCORE 0	SCORE 1	SCORE 1	SCORE 1	SCORE 0	5,0
ALKALINE SPRAY MACHINE	SCORE 0,5	SCORE 0,5	SCORE 0	SCORE 1	SCORE 0	SCORE 0	SCORE 0	2,0
U.M.C.S.	SCORE 0,5	SCORE 0,5	SCORE 1	SCORE 0	SCORE 0.5	SCORE 0	SCORE 0	2,5
K.L.R.S	SCORE 1	SCORE 1	SCORE 1	SCORE 1	SCORE 1	SCORE 1	SCORE 1	7,0

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BEST SCORE

KLRS WINS WITH FULL MARKS:
SCORE 7

-KLRS IS THE SOLE TECHNOLOGY ABLE TO CLEAN MOLDS, INCLUDED SPRING-VENTS AND VENTILATION CHANNELS AND ABLE TO CLEAN THE INTERSTICE MICRO-GAP VENTS OF THE PUZZLE MOLDS.

-KLRS DOESN'T CREATE CORROSION ON THE SEGMENT ALUMINUM SURFACE.

KLRS IS THE SOLE TECHNOLOGY ABLE TO UNLOCK SPRING VENTS AND ABLE TO RECOGNIZE AUTOMATICALLY WHICH SPRING VENTS ARE OPENED AND WHICH ARE IS STILL BLOCKED.

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BEST SCORE

KLRS IS THE CHEAPEST TECHNOLOGY ABLE TO CLEAN TIRE MOLDS SAFELY

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R.O.I.

KLRS provides one of the best R.O.I. (return on investment) in mold cleaning.

For each mold cleaned you save at least 150,00 Euro per mold, labour included. Other technologies need to have an additional manual work to unlock spring vents and to recognize (one by one) which spring vents are open and which one are still locked.

If you consider to clean 3.000 mold/year, it means that your saving will be at least of €450.000,00/Year.

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WITHIN THE TECHNOLOGY

K.L.R.S.

Keymical Laser Resonance System

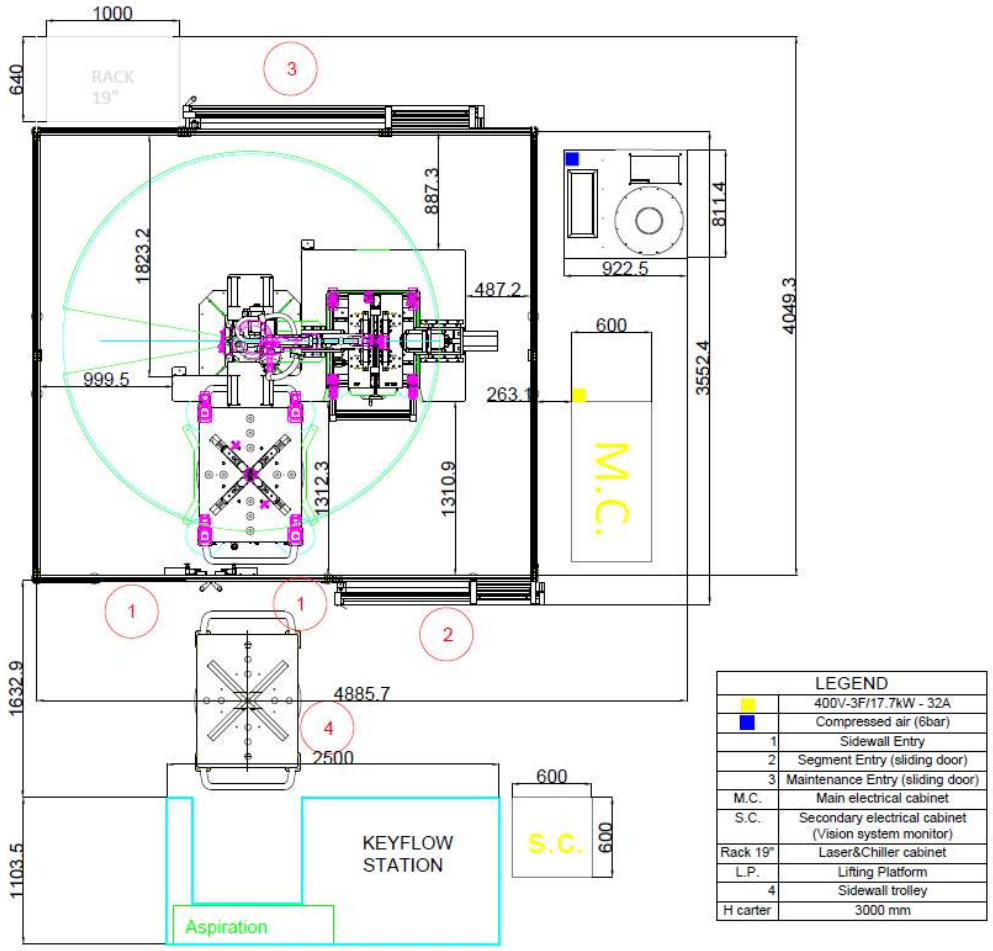
P.C.R. (Passenger Car Radial) – T.B.R. (Truck Bus Radial)

KLRS CLEANING CAPABILITY:

- KLRS PCR
  CLEANING CAPABILITY: 16-18 MOLDS/DAY - 3S

- KLRS TBR
  CLEANING CAPABILITY: 14 MOLDS/DAY – 3S

K.L.R.S. LAYOUT
(KEYMICAL LASER RESONANCE SYSTEM)



LEGEND	
	400V-3F/17.7kW - 32A
	Compressed air (6bar)
1	Sidewall Entry
2	Segment Entry (sliding door)
3	Maintenance Entry (sliding door)
M.C.	Main electrical cabinet
S.C.	Secondary electrical cabinet (Vision system monitor)
Rack 19"	Laser&Chiller cabinet
L.P.	Lifting Platform
4	Sidewall trolley
H carter	3000 mm

HOW TO WORK

1) Operator takes the sidewall and position it on the dedicated trolley for sidewall. Operator push the trolley inside KLRS machine in the sidewall position.

2) Operator takes 1 segment and position it on the dedicated trolley for segment. Operator push the trolley inside the KLRS machine in the segment position.

3) Operator closes the door and choices the right cleaning program.

4) A 3D scanner starts to recognize the segment profile and the segment dimension. Software sends data to the robot.

5) Robot with Laser head scanner starts to clean segment. During the laser cleaning process with Robot, resonance vibration transmitted to the segment is «ON», just for cleaning spring vent and spring ventilation channels. During the cleaning process compressed air and aspiration system are «ON» for removing smoke and powder from segment and sidewall. Before the cleaning process is over, a dedicated vision system recognizes which spring vents are open and which one are still locked. A picture of the segment is sent to a screen located near the checking table in order that the operator, during the final check of the segment, can remove the spring vents still locked because broken. The segment photo will be showed on the screen close to the checking table, putting in evidence in hilight in red the spring vents still locked.

6) After the cleaning process operator can remove from the KLRS machine the trolley with the cleaned segment and can push inside the KLRS the second trolley ready with another segment that need to be cleaned and start again the process. The segment cleaned can now be removed from the trolley and the operator can put it on the checking table.

7) Operator takes another segment and repeates the same operation untill all the segments are cleaned.

8) Meanwhile the operator has moved all the the segment from KLRS to the checking table. The checking table area can be used for many other operation like change a faulty spring vent valve, spray rust preventative on side wall, general checking and so on.

10) After having cleaned all the segments, KLRS is ready to clean the first sidewall just inside the machine.

11) After the cleaning process operator can remove the trolley with the cleaned sidewall and can push inside the KLRS the second trolley ready with another sidewall that need to be cleaned and start again the process. The second sidewall cleaned can now be removed from the trolley and the operator can put on the 2 cleaned sidewalls the Key Flow rust preventative.

12) Sidewall spring vents need to be checked manually. No resonance and vision system are applied on sidewalls.

FLOW:

Step 1…….. 3D Scanner. Laser (sidewall and segment) + Resonance (segments only) work simultaneously.

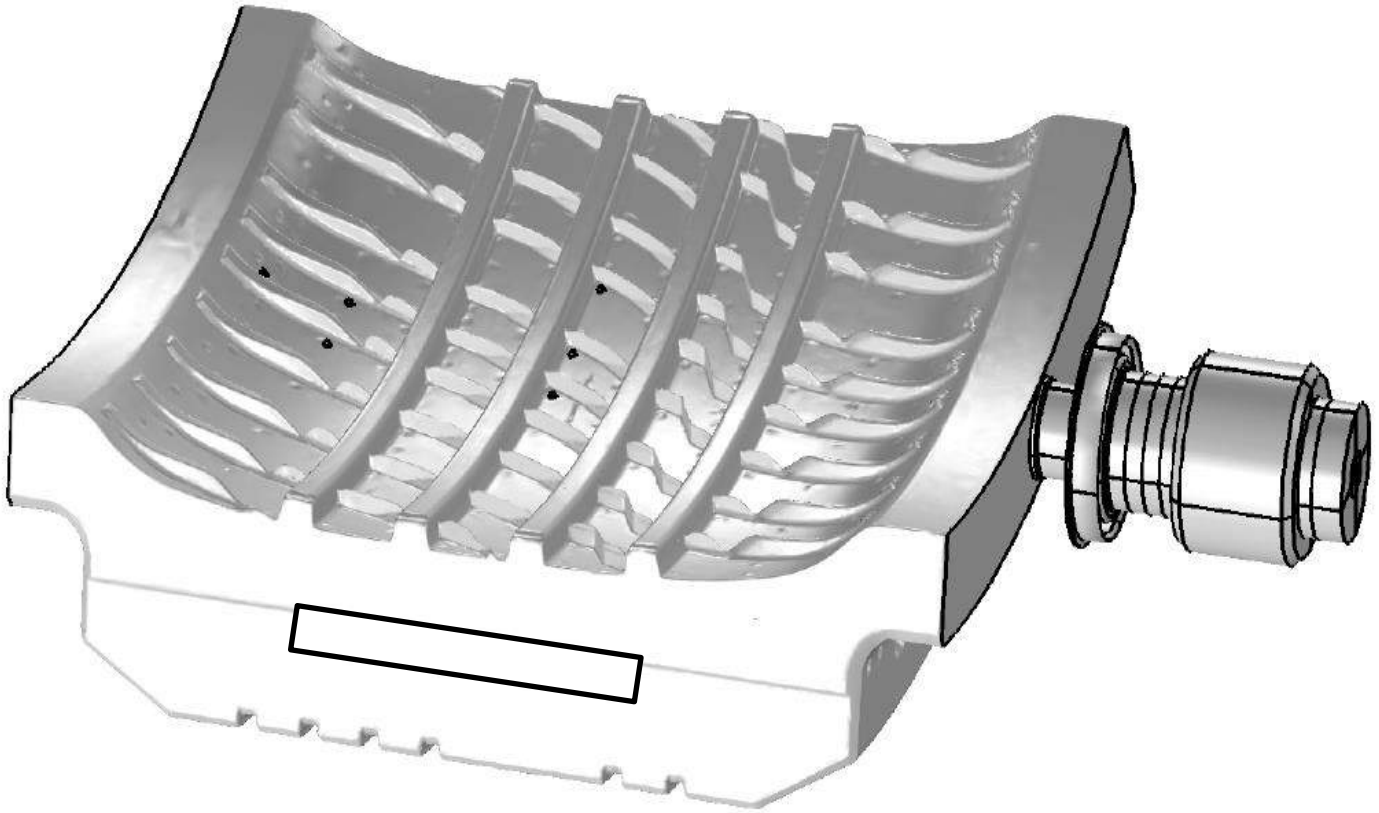
Step 2……Vision system to recognize which spring vents are open and which one are still locked. A segment photo is sent to the checking table screen.

Step 3……Final check and rust preventative Key Flow on the sidewalls.

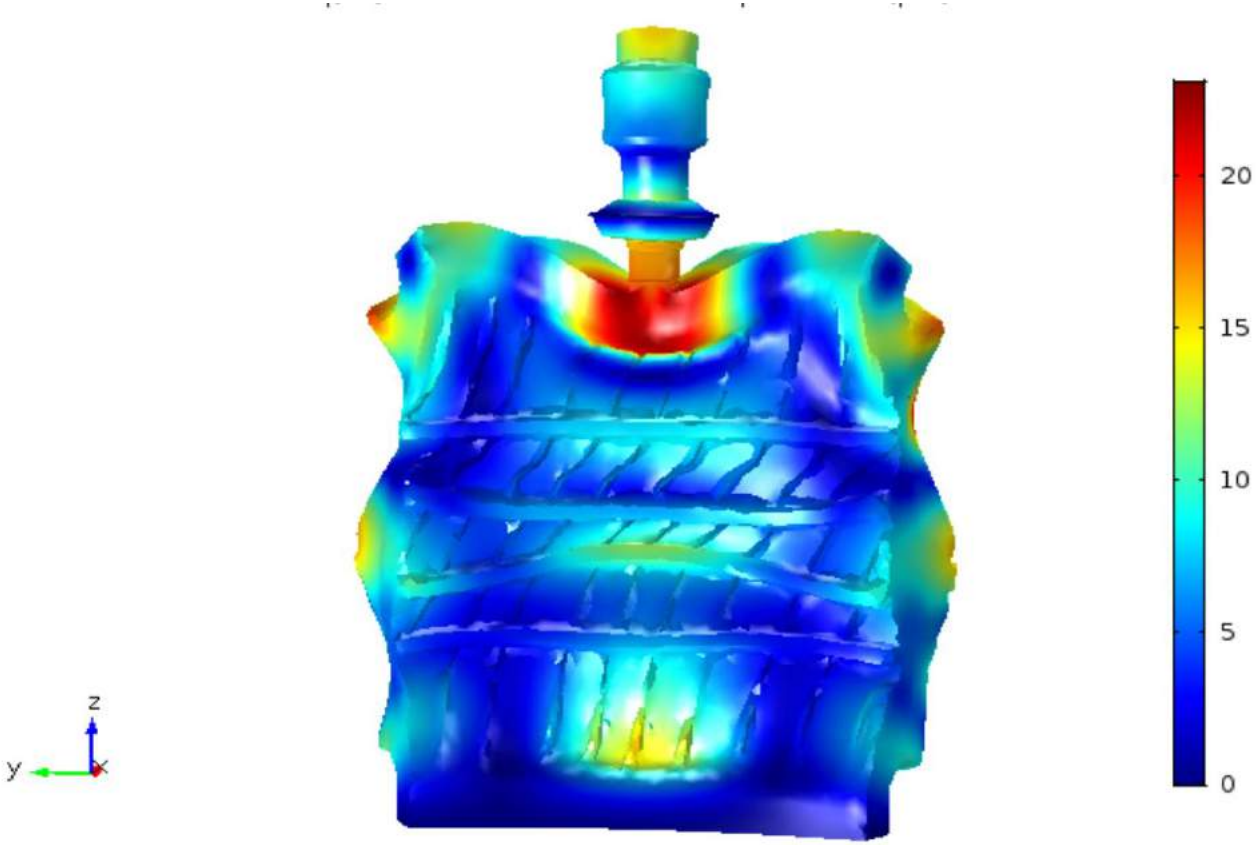
Note: Every cleaning step lasts about 5/12 minutes, it depends on the kind of mold (summer or winter). In other words, If a mold consists of 2 side walls and 8 segments, for example, in total we will have 10 pieces to wash. So the result of the wash time will be 10x5minutes, total 50 minutes + handling time.

6 A. ANTHROPOMORPHIC ROBOT

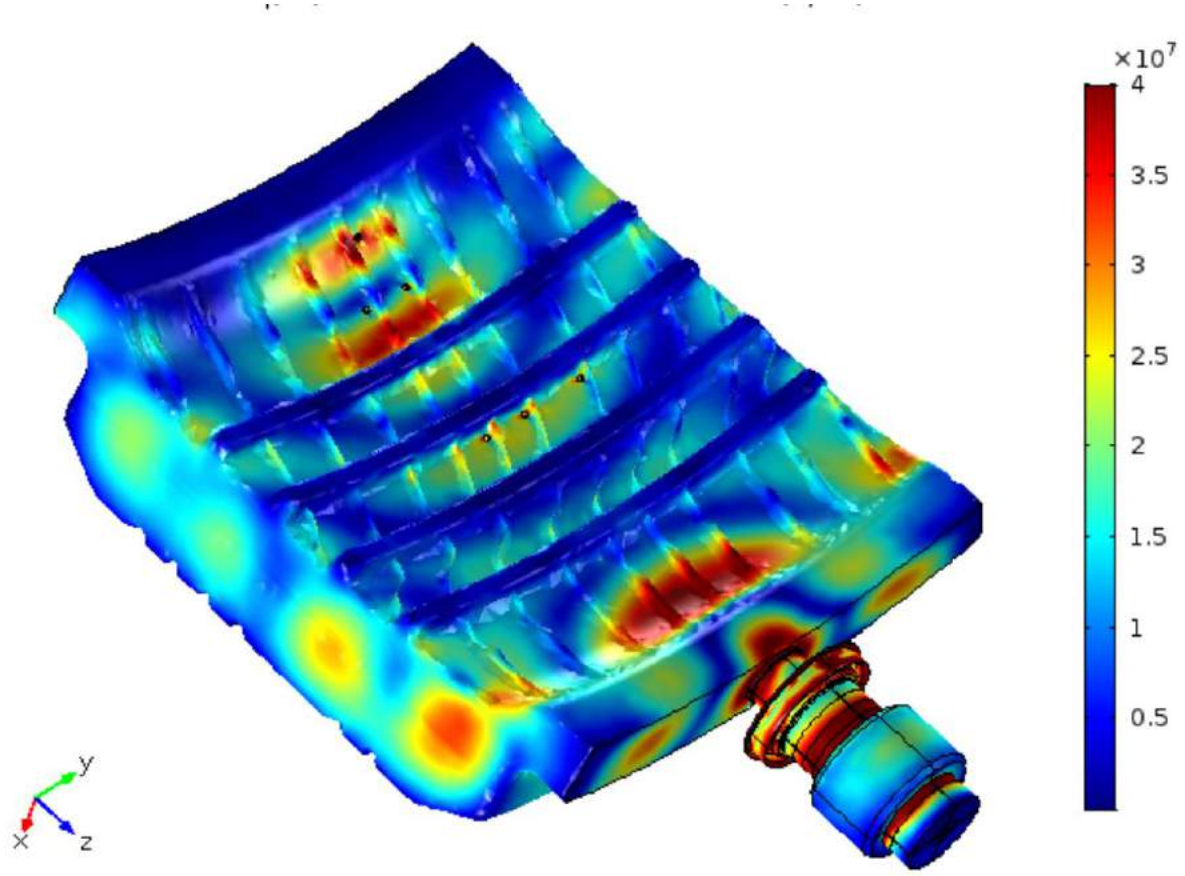
RESONANCE WAVES FREQUENCY CONVERTER TOLL



RESONANCE WAVES EFFECT ON SEGMENT



TRE (3?) D MAP STRESS (PA)



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