Projecte de Fi de Màster

Màster Universitari en Enginyeria d'Automoció

IMPLEMENTACIÓ DE LA NORMA 408/2003 (MODIFICADA PER LA 466/2009) D'HOMOLOGACIÓ DE CLAUS PER A PNEUMÀTICS

ANNEX: Instruccions de treball, full d'assaig i informe d'assaig

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Convocatòria: Gener 2016

Escola Tècnica Superior
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Sumari

1. Introducció

Com annexes a la memòria es presenten els següents documents:

- Instruccions de treball: en elles es presenta tota la informació i indicacions necessàries per comprendre el procediment d'assaig de claus, les operacions a realitzar i la metodologia per dur-les a terme. L'objectiu de les instruccions de treball és que qualsevol persona pugui realitzar el procés d'assaig.
- Full d'assaig: document on s'anoten totes les dades referents a l'assaig per tal de garantir la seva traçabilitat i reproductibilitat. També en mostra els resultats i altres dades d'interès.
- Informe d'assaig: document que es facilita al client que recull les dades importants dels assajos realitzats i els resultats d'aquets.

2. Instruccions de treball

1. OBJECTIVE

The objective is to define the test procedure to get the approval of studs for tyres in accordance with the Decree of the Ministry of Transport and Communications on Tyre Studs, 408/2003 (last amended by Degree 466/2009).

2. SCOPE

This decree applies to studs and studded tyres used in category M, N and L vehicles and their trailers. In the case of studs and studded tyres of a category L vehicle and its trailer, the decree on vehicle tyres applies.

3. REFERENCE DOCUMENTS

Decree of the Ministry of Transport and Communications on Tyre Studs, 408/2003 (last amended by Degree 466/2009)

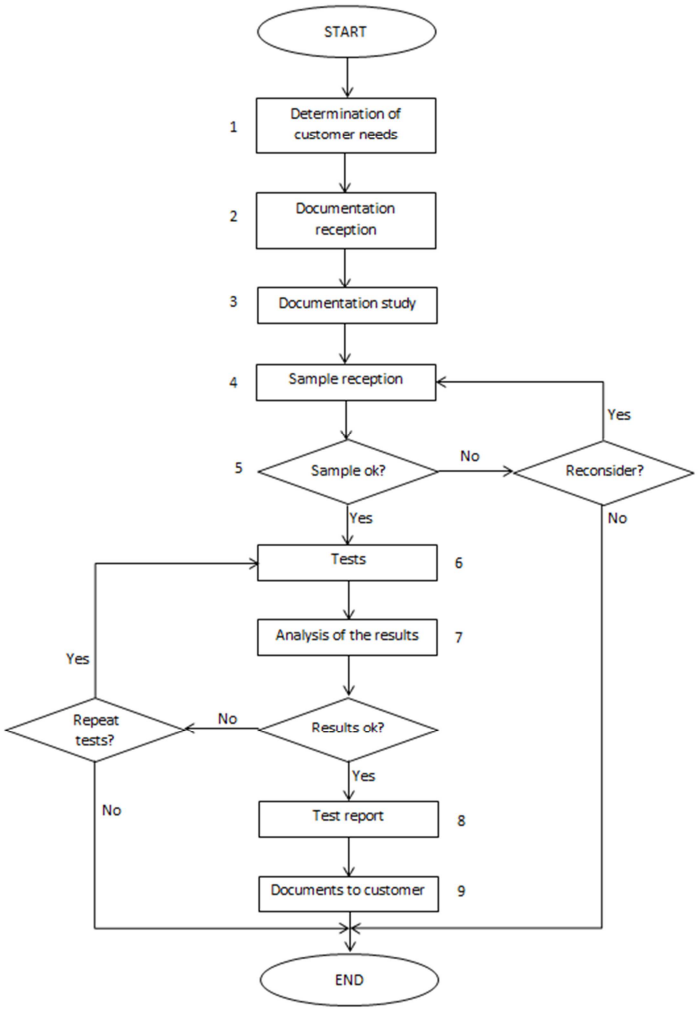
ETRTO

STRO

4. RESPONSABILITIES

See point 5.

5. PROCEDURE

Responsible:		Description:
1. Project Manager 2 to 5. Homologation engineer 6. Homologation engineer and test technicians 7 to 9. Homologation engineer		See following pages

Department: **Homologación VI**		
Performed: **Puigmiquel, Jaume**	Checked: **Gallegos, David**	Approved: **Lafuente, Ignacio**

5.1. DETERMINATION OF CUSTOMER NEEDS

Identify customer needs, the type of work to be done.

5.2. TO 5.3. TECHNICAL DOCUMENTATION

According to the type of work to be done, customer shall give the Laboratory the documentation needed in order to study it and determine how many tests are needed and the number of sample to be sent.

5.4. TO 5.5. TEST SAMPLES

Once received the test samples for tests, these have to be checked according customer technical documentation. If everything is correct, the process goes on.

5.6. TO 5.7. TESTS

Tests according to the regulation are performed as agreed with the customer. Test results are revised to ensure everything is ok and tests are well done.

5.8. TO 5.9. TEST REPORT

Test conditions and results are reflected in a document to be given to the customer.

6. ANNEXED DOCUMENTS

IT-HO-Finish Decree 408/2003 Test procedure

IT-HO-Finish Decree 408/2003 Stud protrusion and force measurement

IT-HO-Finish Decree 408/2003 Over-run test

7. EDITION CONTROL

Nº Edición	Fecha	Motivo

1. OBJECTIVE

The object of the present document is to define the test procedure according to the stud weight, protrusion and force measurement.

2. SCOPE

This decree applies to studs and studded tyres used in category M, N and L vehicles and their trailers. In the case of studs and studded tyres of a category L vehicle and its trailer, the decree on vehicle tyres applies.

3. DEFINITIONS

PC means passenger cars

LT means light trucks

T means heavy trucks

C means commercial vehicle, including light and heavy trucks

4. REFERENCE DOCUMENTS

Decree of the Ministry of Transport and Communications on Tyre Studs, 408/2003 (last amended by Degree 466/2009)

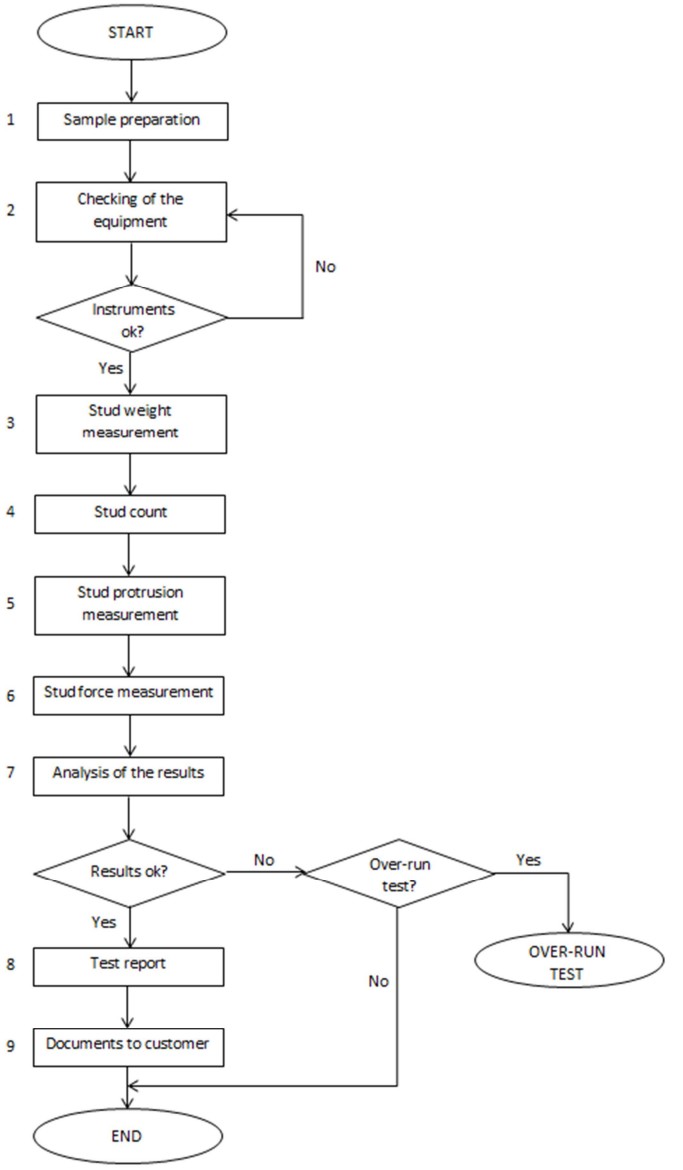
ETRTO

STRO

5. RESPONSABILITIES

See point 6.

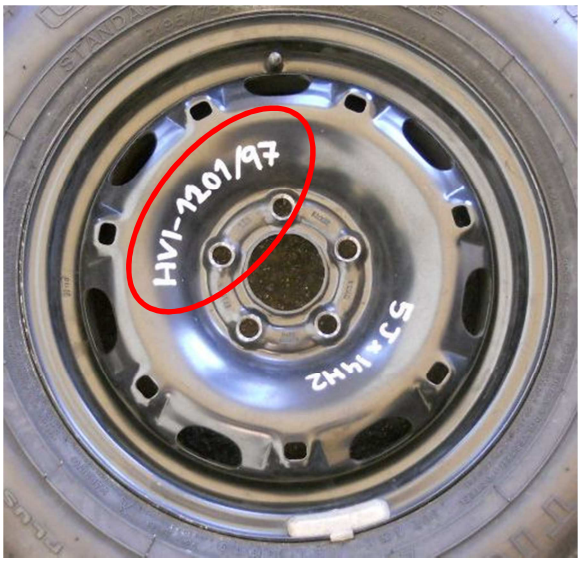
6. PROCEDURE

Responsible:		Description:
1 to 5. Test technician 7 to 8. Homologation engineer		See following pages

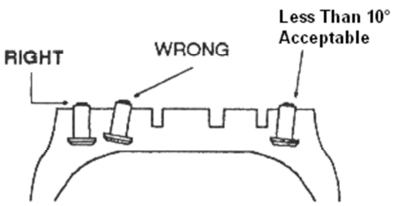
6.1. SAMPLE PREPARATION

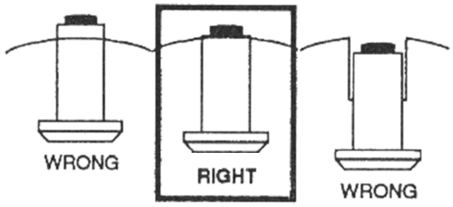
Test tyres must to be mounted on test rims declared by the tyre manufacturer in the approval application, in the ETRTO or in the STRO.

All rims must be marked with an internal reference number (HVI) to relate them with the test tyre.



Studs must be installed using a stud gun, avoiding to be fixed at an angle and looking for the optimal protrusion.





6.2. CHECKING OF THE EQUIPMENT

Test instruments are considered correct if they have certificates of calibration and maintenance in order.

Example of calibration report:

APPLUS+ IDIADA	*Certificado de Calibración Interna*

HD-DespLin.

Equipo calibrado

N° de inventario: 05220 — Pág. 1/1
Equipo:
Marca / Modelo: /
N° de serie: 200512153094
Campo de medida:
Resolución:
Procedimiento: IT-CAL-28
Fecha Calibración:
Próx. Calibración:

Equipo patrón utilizado

N° de Inventario:			
Ultima Calibración:			
Próx. Calibración:			

Condiciones ambientales

Temperatura:
Humedad relativa:

RESULTADOS

	Patrón	Serie 1	Serie 2	Serie 3
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Fondo de escala: mm

Constante de conversión:

c = 0

Incertidumbre = #¡DIV/0! #¡DIV/0!

Factor de incertidumbre k = 2
Unidades series:
Unidades patrón: mm
Unid. constante:
Tolerancia: F.E.

Observaciones

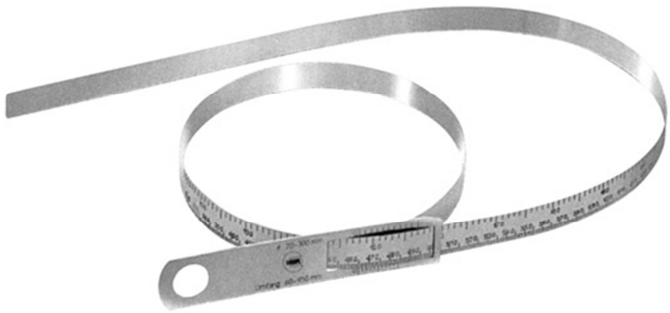
Calibrado por:	Revisado por:	Conforme responsable:

6.3. STUD WEIGHT MEASUREMENT

The stud weight result is the weight average of the measurement of ten samples of studs.

6.4. STUD COUNT

Measure the tyre rolling circumference using the circumeter.



Count the number of studs installed on tyres.

The number of studs per one meter of tyre rolling circumference is calculated as follows:

$$S = \frac{n_S}{l} \cdot 1{,}000$$

Where:

- S is the number of studs per one meter of tyre rolling circumference.
- n_s is the number of studs in the tyre.
- l is the length of the tyre rolling circumference in millimetres.

6.5. STUD PROTRUSION MEASUREMENT

Stud protrusion have to be carried out at the earliest one day and at the latest two days after the studs have been installed on tyres.

The measurements have to be taken at 20 ± 2 ºC, that means that the tyres have to be placed in the measurement room some time before the measurement to let them to equalise the temperature.

Prior the measurement, tyre pressure has to be checked:

Vehicle	PC	LT	T
Pressure (kPa)	180	300	Complying with the tyre load

Stud protrusion is to be measured with the calliper specific for this operation.

20 studs per tyre will be measured: 10 consecutive from both edges starting from a random point. More number of studs can be measured if there is a specific reason or is required by the applicant.

The force of the calliper against the tyre has to be between 15 and 20 N.

The protrusion is the mean value of the measured stud protrusion:

$$U_m = \frac{\sum U_n}{n}$$

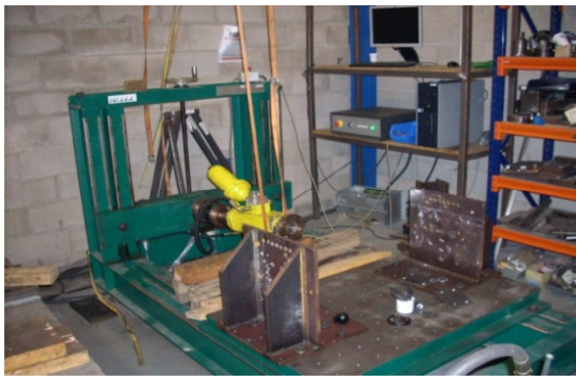
Where:

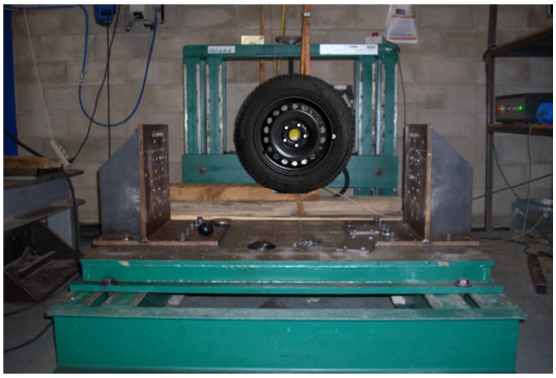
- U_m is the average stud protrusion measured.
- U_n is a stud protrusion measurement.
- n is the number of measurements.

6.6. STUD FORCE MEASUREMENT

The measurements have to be taken at 20 ± 2 ºC, that means that the tyres have to be placed in the measurement room some time before the measurement to let them to equalise the temperature.

Place the wheel on the hub of the fatigue bench and tight the bolts with the torque wrench.





Apply the tyre a load not greater than 70% of the load index.

The load shall be applied parallel to the tyre radius travelling through the stud and perpendicular to a level surface describing the road surface. The measurement shall be taken statically with the stud sunk at the tyre tread level, parallel to the load.

Applied load, and basis force and displacement will be shown in the bench computer from the information given by the load cells.

20 studs per tyre will be measured: 10 consecutive from both edges starting from a random point. More number of studs can be measured if there is a specific reason or is required by the applicant.

The stud force is the mean value of forces measured in the said manner:

$$F_m = \frac{\sum F_n}{n}$$

Where:

- F_m is the average stud force measured.
- F_n is a stud force measurement.
- n is the number of measurements.

If the protrusion does not comply with the regulation, the stud force has to be adjusted as follows:

$$F = F_m \cdot \frac{U_s}{U_m}$$

Where:

- F is the adjusted stud force.
- F_m is the average stud force measured.
- U_s is the allowed protrusion mean value.
- U_m is the average stud protrusion measured.

6.7. ANALYSIS OF THE RESULTS

Test results are revised to ensure everything is ok and tests are well done.

6.8. TO 6.9. TEST REPORT

Test conditions and results are reflected in a document to be given the customer.

7. ACCEPTANCE CRITERIA

A stud type will approve the test if:

- They have only one tip, not pointed or tube shaped.
- The number of studs per one meter of tyre rolling circumference is less than 50.
- The stud weight is under the limit, depending on the vehicle category where the studded tyres will be fitted:

Vehicle	PC	LT	T
Stud weight limit (gr)	1.1	2.3	3.0

- The stud protrusion is under the limit, depending on the vehicle category where the studded tyres will be fitted:

Vehicle	PC	LT	T
Stud protrusion limit (mm)	1.2	1.2	1.5

- The stud force is under the limit, depending on the vehicle category where the studded tyres will be fitted:

Vehicle	PC	LT	T
Stud force limit (N)	120	180	340

A type of stud not complying with the acceptance criteria is able to grant the approval provided that such a stud mounted on a suitable tyre does not wear the road surface more than a studded tyre complying with the regulation (over-run test).

8. ANNEXED DOCUMENTS

IT-HO-Finish Decree 408/2003 Homologation procedure

IT-HO-Finish Decree 408/2003 Stud protrusion and force measurement

IT-HO-Finish Decree 408/2003 Over-run test

9. EDITION CONTROL

Nº Edición	Fecha	Motivo

1. OBJECTIVE

The object of the present document is to define the test procedure to follow during an over-run test.

2. SCOPE

This decree applies to studs and studded tyres used in category M, N and L vehicles and their trailers. In the case of studs and studded tyres of a category L vehicle and its trailer, the decree on vehicle tyres applies.

3. DEFINITIONS

PC means passenger cars

LT means light trucks

T means heavy trucks

C means commercial vehicle, including light and heavy trucks

4. REFERENCE DOCUMENTS

Decree of the Ministry of Transport and Communications on Tyre Studs, 408/2003 (last amended by Degree 466/2009)

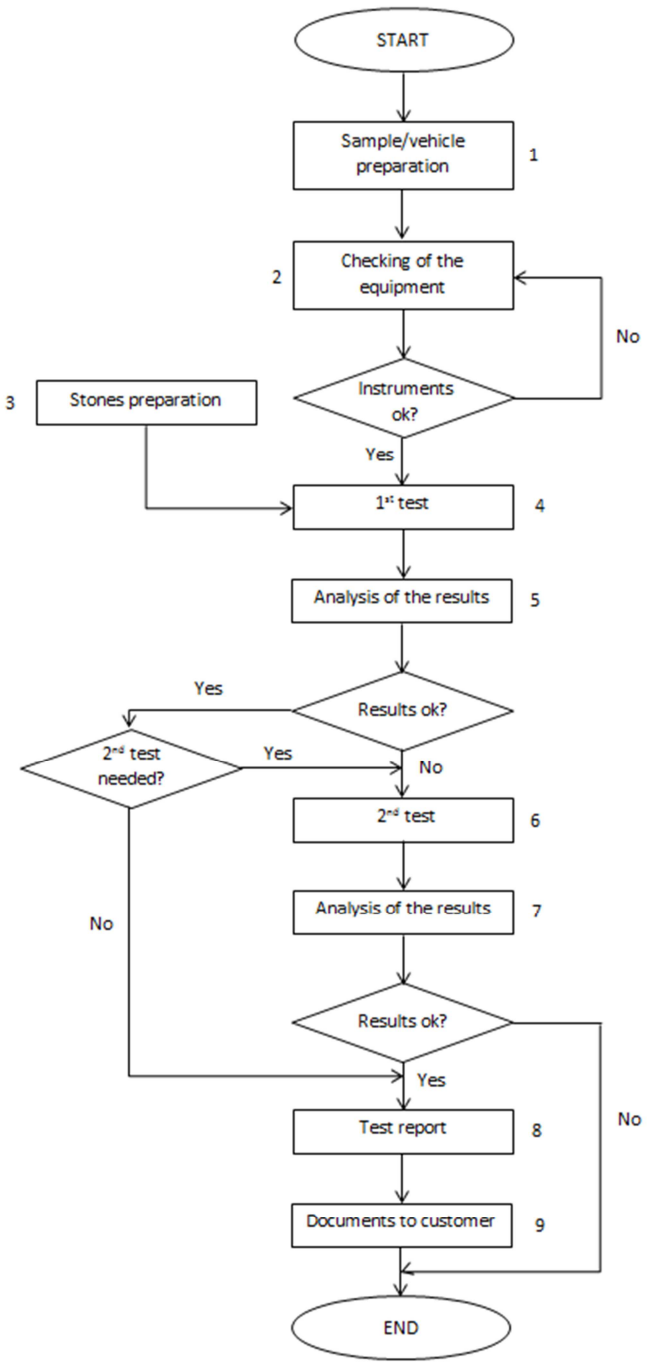
ETRTO

SRTO

5. RESPONSABILITIES

See point 6.

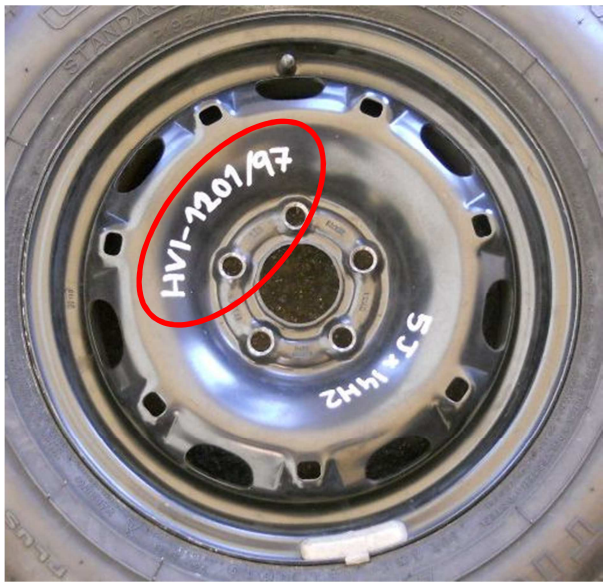
6. PROCEDURE

Responsible:		Description:
1 to 5. Test technician 6. Homologation engineer 7. Test technician 8 to 10. Homologation engineer		See following pages

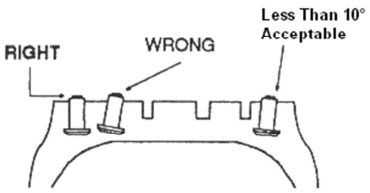
6.1. SAMPLE/VEHICLE PREPARATION

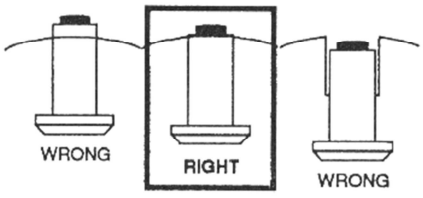
Test tyres must to be mounted on test rims declared by the tyre manufacturer in the approval application, in the ETRTO or in the STRO.

All rims must be marked with an internal reference number (HVI) to relate them with the test tyre.



Studs must be installed using a stud gun, avoiding to be fixed at an angle and looking for the optimal protrusion.



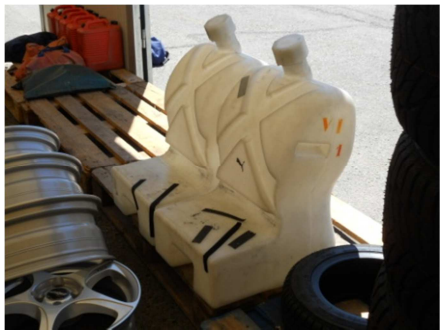


Two samples of studded tyres will be fitted in the vehicle, on the same car side.

The vehicle must be loaded to aim a tyre load between 60% and 80% of the load value corresponding to the load index of the tyre, being the all vehicle load between 65% and 75% of the same value.

The load difference between axles and sides of the car can't be more than 5%.

Sand bags and plastic dummies filled with water are used to adjust the load of each wheel.



The test vehicle is fitted with a speed and acceleration measurement device (Racelogic Vbox) in order to know that parameters required in the regulation. The device is connected to an auxiliary power unit or directly to the vehicle battery.

6.2. CHECKING OF THE EQUIPMENT

Test instruments are considered correct if they have certificates of calibration and maintenance in order.

Example of calibration report:

APPLUS+ IDIADA	*Certificado de Calibración Interna*

HD-DespLin.v

Equipo calibrado

Nº de inventario:	05220		Pág. 1/1
Equipo:			
Marca / Modelo:	/	Procedimiento:	IT-CAL-28
Nº de serie:	200512153094		
Campo de medida:		Fecha Calibración:	
Resolución:		Próx. Calibración:	

Equipo patrón utilizado

Nº de Inventario:			
Ultima Calibración:			
Próx. Calibración:			

Condiciones ambientales

Temperatura:
Humedad relativa:

RESULTADOS

	Patrón	Serie 1	Serie 2	Serie 3
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Fondo de escala: mm

Constante de conversión:

c = 0

Incertidumbre = #¡DIV/0! #¡DIV/0!

Factor de incertidumbre k = 2

Unidades series:

Unidades patrón: mm

Unid. constante:

Tolerancia: F.E.

Observaciones

Calibrado por:	Revisado por:	Conforme responsable:

6.3. STONES PREPARATION

This process has to be done before and after the test, prior stones weighting.

Stones have to be cleaned under tap water with a light application of a dishwashing brush, with the possible use of pressurized air to remove excess of water.

After cleaning, stones have to be dried during 3 days ± 2 h in a convection oven, always in the same place and with the same orientation.

The last operation is to cool the stones. They have to be placed in the cooler during 120 ± 5 min with no more than 10% of air humidity. Stones have to be placed into the cooler in such a way that they do no touch each other and always in the same places and with the same orientation.

After the conditioning process, the stones are weighted using the precision scale.

And prior moving them to the test track, stones are placed in its mobile frame with rubber spacers between them.

6.4. AND 6.6. OVER-RUN TEST

Tests have to been performed at least 48 hours after studding the tyres.

The inflation pressure of the tyres has to be checked prior the test and be according the Decree:

Vehicle	PC			LT	T
	LI corresponding mass <600 kg	600 kg < LI corresponding mass <800 kg	LI corresponding mass >600 kg		
Pressure (kPa)	2.3 ± 0.1	2.5 ± 0.1	2.7 ± 0.1	3.5 ± 0.1	Complying with the tyre load

Tyres have to be placed in somewhere at ambient temperature some time before the test to let them to equalise the temperature.

The surface temperature (measured before the test, where there's no spray from test stones wetting water) must be between 2 and 20 ºC.

The ambient temperature (measured before, in the middle of and after the test) must be between 2 and 25 ºC.

Tyre temperature has to be measured before, in the middle of and after the test.

Stones in its frame are placed in the hole in the middle of the test track using sand to level it with the track surface.

During the test, stones have to be wetted with a volume of tap water between 100 and 150 liters per hour.

The test begins accelerating the vehicle from 0 to 100 ± 0.2 km/h (80 ± 0.2 km/h for LT and T) accelerating no more than 2 m/s^2.

At least 50 meters before the test stones the final speed has to be reached.

After one run, car is braked with an acceleration no more than 2 m/s^2, the driver turns around and starts a new run in the opposite direction.

The test finish after 200 runs across the stones (400 tyre roll-over).

6.5. AND 6.7. ANALYSIS OF THE RESULTS

Stud protrusion of the test tyres is measured as shown in the IT-HO-Finish Decree 408/2003 Stud protrusion and force measurement.

Also, test tyres are checked in order to verify that no more than 5 studs are lost during the test.

And again, test stones are conditioned and weighted (according the point 6.3) to obtain the weight loss.

Test results are revised to ensure everything is ok and tests are well done.

The result will be the average wearing value (in gr) of the rows at a precision of two decimal places.

6.8. AND 6.9. TEST REPORT

Test conditions and results are reflected in a document to be given the customer.

7. ACCEPTANCE CRITERIA

Studding process

Tyres can't be accepted for testing if one or more of the following conditions are fullfiled:

- The protrusion of an individual stud on the test tyres is over ±30% of the average stud protrusion of the test tyres
- The average stud protrusion of the test tyre is over ±10% of the target stud protrusion intended by the styre manufacturer/studder.
- With a target stud protrusion under 0.5mm, if an individual stud protrusion differ from the target value by a maximum of ±0.1 mm.

If the tyre manufacturer/studder does not report the target stud protrusion, the test tyre will not be accepted for testing.

Test results

If the stud protrusion after the test is over ±25% of the initial measurement, studded tyres will fail the test, as well if there're more than 5 studs left.

The limit values of rows weight loss are:

Vehicle	PC			C
	LI corresponding mass <600 kg	600 kg < LI corresponding mass <800 kg	LI corresponding mass >600 kg	
Limit value (gr)	0.9	1.1	1.4	1.8

A type of studs will approve the test if:

- The average row wear result is less than 90% of the limit value in the first over-run test.
- After 2 over-run tests, both wear results are under the limit value.
- The wear result of the tested tyres is less than the one of an approved type.

8. ANNEXED DOCUMENTS

IT-HO-Finish Decree 408/2003 Test procedure

IT-HO-Finish Decree 408/2003 Stud protrusion and force measurement

IT-HO-Finish Decree 408/2003 Over-run test

9. EDITION CONTROL

Nº Edición	Fecha	Motivo

3. Full d'assaig

Mesures en laboratori i de força admissible:

STUD FOR TYRES TYPE APPROVAL o TEST SHEET FOR OVER-RUN TEST METHOD?

According to the Finnish Decree 408/2003 (last amended by 466/2009)

Report No.: Driver/Responsible:

Applicant: Quotation:

Studs

Manufacturer: Internal reference:

Trade name: Commercial description:

Tyre

Manufacturer: Internal reference:

Trade name: Commercial description:

Size: Load index: Speed code:

Corresponding mass (kg): #N/A

Tyre class: Reference inflation pressure (kPa): 500

Studding process

Studder: Place:

Date:

Stud protrusion measurement

Date:

Rim size: Int. ref.: Infl. pres. (kPa):

= #N/A

Tyre circumference lenght (mm): **Stud/meter:** #¡DIV/0!

< 50

Number of studs:

Average stud weight (gr):

< #N/A

Tyre 1

Protrusion (mm):	Edge 1			Edge 2

Target stud prot. (mm):

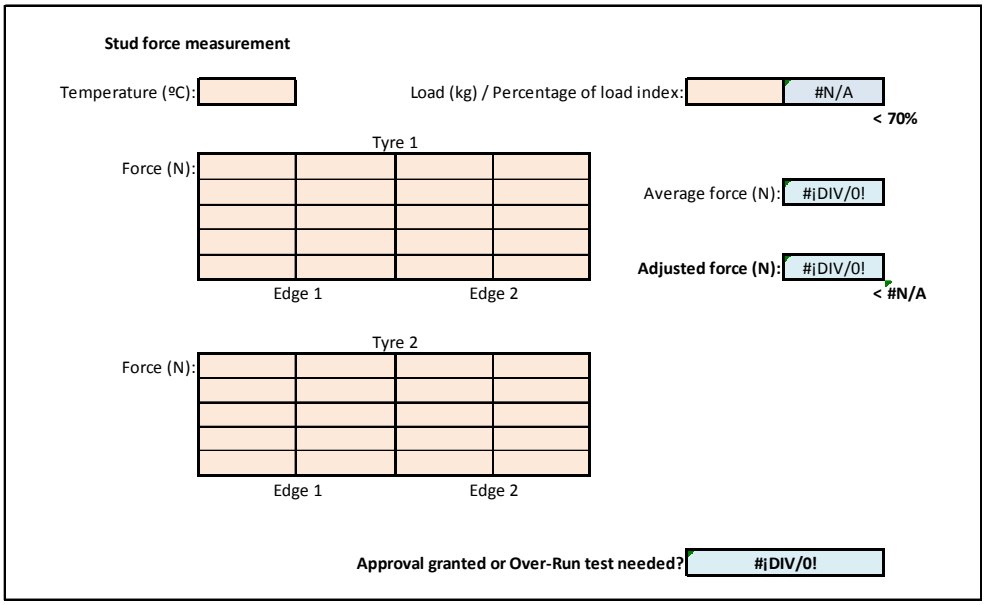
Tyre 2

Protrusion (mm):	Edge 1			Edge 2

Average prot. (mm): #¡DIV/0!

#N/A **<** **#N/A**

Target: 0,00 **<** 0,00


Stud force measurement
Temperature (ºC):
Load (kg) / Percentage of load index:
#N/A
< 70%
Tyre 1
Force (N):
Average force (N):
#¡DIV/0!
Adjusted force (N):
#¡DIV/0!
< #N/A
Edge 1
Edge 2
Tyre 2
Force (N):
Edge 1
Edge 2
Approval granted or Over-Run test needed?
#¡DIV/0!

Primer assaig de mesura de desgast de l'asfalt:

STUD FOR TYRES TYPE APPROVAL o TEST SHEET FOR OVER-RUN TEST METHOD?

According to the Finnish Decree 408/2003 (last amended by 466/2009)

Vehicle

Trade name: Model:

Internal reference: Tyres internal ref.:

	Front left	Front right	
Load (kg):			
Percentage of load index:	#N/A	#N/A	60 < % < 80

	Rear left	Rear right	
Load (kg):			
Percentage of load index:	#N/A	#N/A	60 < % < 80

Axles diference (%): #N/A < 5%

Average percentage of load idex: #N/A

Side diference (%): #N/A < 5% 65 < % < 75

Pressure (kPa):

Front left	Front right

Rear left	Rear right

#N/A < kPa < #N/A

Test and stones Start hour: Finish hour:

Track: Date:

Initial weight

					Row 1
					Row 2
					Row 3

	Before	During	After	
Ambient temperature (ºC):				2 < ºC < 20
Surface temperature (ºC)				2 < ºC < 25
Tyre temperature (ºC)				

Final weight

					Row 1
					Row 2
					Row 3

Lost of weight (gr):	0,00	Row 1	Acceleration during the test (m/s2):	< 2,0
	0,00	Row 2		
	0,00	Row 3	Studs removed during the test:	< 5
Average lost of weight (gr):	0,00		Error percentage with 95% confidence:	#¡DIV/0! < 15
Wear limit value (gr):	#N/A		Lost of weight as percentage of the limit value:	#N/A

Approval status #N/A

Segon assaig de mesura de desgast de l'asfalt:

STUD FOR TYRES TYPE APPROVAL o TEST SHEET FOR OVER-RUN TEST METHOD?

According to the Finnish Decree 408/2003 (last amended by 466/2009)

Vehicle

Tyres internal ref.:

	Front left	Front right	
Load (kg):			
Percentage of load index:	#N/A	#N/A	60 < % < 80

	Rear left	Rear right	
Load (kg):			
Percentage of load index:	#N/A	#N/A	60 < % < 80

Axles diference (%): #N/A < 5%

Average percentage of load idex: #N/A

Side diference (%): #N/A < 5% 65 < % < 75

Pressure (kPa):

Front left	Front right

Rear left	Rear right

#N/A < kPa < #N/A

Retest and stones

Start hour: Finish hour:

Date:

Initial weight

					Row 1
					Row 2
					Row 3

	Before	During	After	
Ambient temperature (ºC):				2 < ºC < 20
Surface temperature (ºC)				2 < ºC < 25
Tyre temperature (ºC)				

Final weight

					Row 1
					Row 2
					Row 3

Lost of weight (gr):	0,00	Row 1	Acceleration during the test (m/s2): < 2,0
	0,00	Row 2	
	0,00	Row 3	Studs removed during the test: < 5

Average lost of weight (gr): 0,00

Error with 95% confidence: #¡DIV/0! < 15

Wear limit value (gr): #N/A

Approval granted: #N/A

Check protrusion variation

ETSEIB

Mesures finals:

STUD FOR TYRES TYPE APPROVAL o TEST SHEET FOR OVER-RUN TEST METHOD?

According to the Finnish Decree 408/2003 (last amended by 466/2009)

Final stud protrusion measurement

Tyre 1

Protrusion (mm):				
	Edge 1		Edge 2	

Average prot. (mm): #¡DIV/0!

Tyre 2

Protrusion (mm):				
	Edge 1		Edge 2	

Average prot. (mm): #¡DIV/0!

Total average prot. (mm): #¡DIV/0!

Protrusion before test: (mm): #¡DIV/0!

Percentage of variation: #¡DIV/0! **< 25**

Equips utilitzats:

STUD FOR TYRES TYPE APPROVAL o TEST SHEET FOR OVER-RUN TEST METHOD?

According to the Finnish Decree 408/2003 (last amended by 466/2009)

Equipment

Stud force measurement devices		Over-run test measurement devices	
Pressure:		Vehicle scale:	
Tyre circumference:		Pressure:	
Studs scale:		Ambient temperature:	
Protrusion gauge:		Surface device:	
Indoor temperature:		Tyre temperature:	
Load scale:		Vehicle speed	
Force scale:		Vehicle acceleration:	
		Stone's scale:	
Stone's oven:			
Stone's cooling device:			

4. Informe d'assaig

TEST ACCORDING TO THE DECREE OF THE MINISTRY OF TRANSPORT AND COMUNICATIONS ON TYRE STUDS, 408/2003 (LAST AMENDED BY DEGREE 466/2009)

Applicant	: - - -
Tyre manufacturer	: - - -
Tyre trade name	:
Tyre commercial description	:
Tyre class	: Elija un elemento.
Tyre size	:
Category of use	: Elija un elemento.
Stud manufacturer	: - - -
Stud trade name	:
Stud commercial description	:
Place and date of issue	: L'Albornar, Santa Oliva (Tarragona), XX/XX/XXXX

CONCLUSIONS: The tested samples of the family FULFIL the technical prescriptions with regard to road surface wear pursuant to Finnish Decree 408/2003 (last amended by Degree 466/2009).
The characteristics of the tested samples are detailed in the annex to the test report.

ANNEX TO THE TEST REPORT

1. TEST DATA

	Applicant	: - - -

1.1. Test tyre details

1.1.1.	Manufacturer	: - - -
1.1.2.	Trade name	:
1.1.3.	Commercial description	:
1.1.4.	Category of use	: Elija un elemento.
1.1.5.	Tyre class	: Elija un elemento.
1.1.6.	Tyre size	:
1.1.7.	Tyre structure	: Elija un elemento.
1.1.8.	Load index / Corresponding mass (kg)	:

1.2. Test stud details

1.2.1.	Manufacturer	: - - -
1.2.2.	Trade name	:
1.2.3.	Commercial description	:
1.2.4.	Internal reference	:

1.3. Studding process

1.3.1.	Studder	:
1.3.2.	Place and date	:

2. STUD PROTRUSION AND FORCE MEASUREMENT

2.1. Test samples

2.1.1. Tyres internal references : HVI-

2.1.2. Test rims : X.X x XX

2.1.3. Test rims internal references : HVI-

2.1.4. Inflation pressure (kPa) : Elija un elemento.

FULFILS / ~~NOT FULFILS~~

2.2. Equipment

Equipment	Internal reference
Manometer	
Circometer	
Stud scale	
Protrusion gauge	
Thermometer	
Load cell	
Force cell	

2.3. Average stud weight (gr) : X.XX < Elija un elemento.

FULFILS / ~~NOT FULFILS~~

2.4. Studs count :

		Studs / meter
Tyre circumference length (mm)		XX.XX < 50
Number of studs		

FULFILS / ~~NOT FULFILS~~

2.5. Stud protrusion measurement

2.5.1. Temperature (ºC) : XX.X (dins l'interval 20 ± 2ºC)

FULFILS / ~~NOT FULFILS~~

2.5.2. Protrusion measurement (mm) :

Tyre 1				Tyre 2			
Edge 1		Edge 2		Edge 1		Edge 2	

Target stud protrusion	x.xx < Elija un elemento.
Average stud protrusion	Target – 10% < X.XX < Target + 10%

FULFILS / ~~NOT FULFILS~~

2.6. Stud force measurement

2.6.1. Temperature (ºC) : (dins l'interval 20 ± 2ºC)

FULFILS / ~~NOT FULFILS~~

2.6.2. Load (kg) / Percentage of load index : XXX / XX.XX < 70%

FULFILS / ~~NOT FULFILS~~

2.6.3. Force measurement (N) :

Tyre 1				Tyre 2			
Edge 1		Edge 2		Edge 1		Edge 2	

Average force	
Adjusted force	XXX.XX < Elija un elemento.

FULFILS / ~~NOT FULFILS~~

3. OVER-RUN TEST 1

3.1. Test vehicle

3.1.1. Trade name :

3.1.2. Model :

3.1.3. Year :

3.1.4. Transmission :

3.1.5. Wheelbase (mm) :

3.1.6. Vehicle internal reference : HVI-

3.2. Test conditions

3.2.1. Test tyres internal reference :

Front left	**Front right**
HVI-	HVI-
Rear left	**Rear right**
HVI-	HVI-

3.2.2. Vehicle load :

	Load (kg)	**Percentage of load index**
Front axle left wheel		60 < xx.xx < 80
Front axle right wheel		60 < xx.xx < 80
Rear axle left wheel		60 < xx.xx < 80
Rear axle right Wheel		60 < xx.xx < 80
Average		65 < XX.XX < 75

FULFILS / ~~NOT FULFILS~~

Axle load difference (%)	X.XX < 5

FULFILS / ~~NOT FULFILS~~

Side load difference (%)	X.XX < 5

FULFILS / ~~NOT FULFILS~~

3.2.3. Tyres inflation pressure (kPa) :

	Inflation pressure
Front axle left wheel	XXX.XXX (dins l'interval corresp.)
Front axle right wheel	XXX.XXX (dins l'interval corresp.)
Rear axle left wheel	XXX.XXX (dins l'interval corresp.)
Rear axle right wheel	XXX.XXX (dins l'interval corresp.)

FULFILS / ~~NOT FULFILS~~

3.3. Equipment

Equipment	Internal reference
Manometer	
Circometer	
Stud scale	
Protrusion gauge	
Thermometer	
Load cell	
Force cell	

3.4. Test track

3.4.1. Place : Over-run test track, IDIADA

3.4.2. Ambient temperature (ºC) : 2.0 < XX.XX < 20.0

FULFILS / ~~NOT FULFILS~~

3.4.3. Surface temperature (ºC) :

Before	Half	After
XX.XX	XX.XX	XX.XX

2.0 ºC < T_S < 25.0 ºC

FULFILS / ~~NOT FULFILS~~

3.4.4. Tyre temperature (ºC) :

Before	Half	After

3.5. Test and stones

3.5.1. Acceleration (m/s^2) : X.X < 2.0

FULFILS / ~~NOT FULFILS~~

3.5.2. Studs removed : X < 5

FULFILS / ~~NOT FULFILS~~

3.5.3. Stones weight (gr) :

Row	1	2	3
Initial weight			
Final weight			
Difference			

Vehicle	Load index corresponding mass (kg)	Limit values	Average stones weight difference	Test result as percentage of limit value
C1	**Mass < 600**	0.9	x.xx	xx.xx
	600 < Mass < 800	1.1		
	Mass > 600	1.4		
C2 / C3	**-**	1.8		

FULFILS / ~~NOT FULFILS~~

4. OVER-RUN TEST 2

4.1. Test conditions

4.1.1. Test tyres internal reference :

Front left	Front right
HVI-	HVI-
Rear left	**Rear right**
HVI-	HVI-

4.1.2. Vehicle load :

	Load (kg)	Percentage of load index
Front axle left wheel		60 < xx.xx < 80

Front axle right wheel		60 < xx.xx < 80
Rear axle left wheel		60 < xx.xx < 80
Rear axle right Wheel		60 < xx.xx < 80
Average		65 < XX.XX < 75

FULFILS / ~~NOT FULFILS~~

Axle load difference (%)	X.XX < 5

FULFILS / ~~NOT FULFILS~~

Side load difference (%)	X.XX < 5

FULFILS / ~~NOT FULFILS~~

4.1.3. Tyres inflation pressure (kPa) :

	Inflation pressure
Front axle left wheel	XXX.XXX (dins l'interval corresp.)
Front axle right wheel	XXX.XXX (dins l'interval corresp.)
Rear axle left wheel	XXX.XXX (dins l'interval corresp.)
Rear axle right wheel	XXX.XXX (dins l'interval corresp.)

FULFILS / ~~NOT FULFILS~~

4.2. Equipment

Equipment	**Internal reference**
Manometer	
Circometer	
Stud scale	
Protrusion gauge	
Thermometer	
Load cell	
Force cell	

4.3. Test track

4.3.1. Place : Over-run test track, IDIADA

4.3.2. Ambient temperature (ºC) : XX.XX (dins l'interval 2.0-20.00)

FULFILS / ~~NOT FULFILS~~

4.3.3. Surface temperature (ºC) :

Before	Half	After
XX.XX (dins 2.0-25.00)	XX.XX (dins 2.0-25.00)	XX.XX (dins 2.0-25.00)

FULFILS / ~~NOT FULFILS~~

4.3.4. Tyre temperature (ºC) :

Before	Half	After

4.4. Test and stones

4.4.1. Acceleration (m/s^2) : X.X < 2.0

FULFILS / ~~NOT FULFILS~~

4.4.2. Studs removed : X < 5

FULFILS / ~~NOT FULFILS~~

4.4.3. Stones weight (gr) :

Row	1	2	3
Initial weight			
Final weight			
Difference			

Vehicle	Load index corresponding mass (kg)	Limit values	Average stones weight difference	Test result as percentage of limit value
C1	**Mass < 600**	0.9	x.xx	xx.xx
	600 < Mass < 800	1.1		
	Mass > 600	1.4		
C2 / C3	**-**	1.8		

FULFILS / ~~NOT FULFILS~~

5. FINAL STUD PROTRUSION MEASUREMENT

5.1. Stud protrusion (mm) :

Tyre 1				Tyre 2			
Edge 1		Edge2		Edge 1		Edge2	

Average stud protrusion	
Stud protrusion variation	
Percentage of variation	XX.XX < 25

FULFILS / ~~NOT FULFILS~~

Place of test: L'Albornar (Santa Oliva)
Date of test: xx/xx/xxxx