DWT Hamburg, EN and Universal Wheel Tracker Calibration Tool 78-PV3/KIT

MANUALE DI ISTRUZIONI
INSTRUCTION MANUAL

Index

This instruction manual is an integral part of the machine and should be read before using the machine and be safely kept for future reference.

The proper use of this machine must be strictly adhered to, any other use must be considered as incorrect.
The manufacturer cannot be held responsible for damage caused by incorrect use of the machine.
The machine must not be tampered with for any reason. In case of tampering, the manufacturer declines any responsibility of functioning and safety of the machine.

This Manual is published by **CONTROLS**.
CONTROLS reserves the right to update its manuals without notification
in order to correct possible typing errors, mistakes, updating of
information and/or updating of programs and/or accessories.
Such changes will be inserted in the latest edition of the current manual.

This present in English is the original version of the manual. Printed in Italy

1. INTRODUCTION

NOTE:
The present manual is updated for the product it is sold with in order to grant an adequate reference in operating and maintaining the equipment.
The manual may not reflect changes to the product not impacting service operations.

The **78-PV3/KIT DWT Wheel Tracker calibration tool** is a verification and calibration device for your **IPC Global DWT Double Wheel Tracker**.

The kit includes a full range of calibration and verification devices, including:

- **A high-resolution encoder** (with traceable calibration certificate) with data acquisition module, connection to PC, PC software and laptop, to measure and record all the wheel movement parameters, such as the RMSE (Root-Mean Square Error) to measure the real sinusoidal movement (based on the specifications from NCHRP Project 20-07 Task 361, now included in AASHTO T324-2019), wheel position and speed, and wheel speed at center. All the wheel movement data are then recorded and visualized with the included software, and a comprehensive verification report including all the data for further analysis can be issued.
- **A shaped metal specimen** conforming to the specification of AASHTO T324-2019 Section X2 and Figure X1.1 to verify and calculate the RMSE of the rut measurement in the 11-points.
- **A 3500 N capacity load cell**, with spherical seat and readout unit (with traceable calibration certificate), to verify and calibrate the load on the wheel.
- **A digital thermometer with probe** (with traceable calibration certificate) to measure the temperature of water or air.
- **Adapters and spacers** for use with IPC Global Double Wheel Tracker.
- **A laptop PC** with dedicated software.
- **A carrying case** in hard plastic.

The kit allows to provide a comprehensive verification and calibration of the wheel tracker to all the specifications included in AASHTO T324-2019 and EN 12697-22 Small Device (apart from wheel rubber hardness), or to periodically check the performances of the Wheel Tracker machine. The kit has been designed for use with IPC Global DWT Double Wheel Tracker but it can be adapted for use with equipment from other manufacturers.

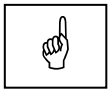
Main features:

- One single kit that comes with its own carrying case.
- Complete calibration system to verify and calibrate:
  - All parameters defined in AASHTO T324-2019, included the RMSE sinusoidal verification and the RMSE 11-points rut depth verification using the shaped metal specimen prescribed in the Appendix X2 of the Standard;
  - Wheel movement, load, temperature and rut depth.
- Traceable: All calibration tools included in the kit come with a traceable calibration certificate.
- A complete kit including a laptop PC with pre-installed PC software to display and record all the measurements and to issue a verification and calibration certificate.
- Universal: our kit can be adapted to verify and calibrate any brand of Double Wheel Tracker.
- Reference Standards: EN 12697-22, AASHTO T324-2019.

The following models are available:

78-PV3/KIT
DWT Wheel Tracker calibration tool is a verification and calibration device for your IPC Global DWT Double Wheel Tracker.

1.1 Icons appearing in the manual



This icon indicates a NOTE; please read thoroughly the items marked by this picture.

This icon indicates a WARNING message; the items marked by this icon refer to the safety aspects of the operator and/or of the service engineer.

1.2 Manual revision history

Revision/Date	Change description
Rev. 1 24/09/2021	Manual release

1.3 Intended use and improper use

The **78-PV3/KIT DWT Wheel Tracker calibration tool** is a verification and calibration kit for your **IPC Global DWT Double Wheel Tracker** machines, or wheel tracker machines from other manufacturers.

It can only be used to perform the functions described in the present manual. The operation and use of the Double Wheel Tracker machines are described in the relevant manuals to which reference must be done.

Never use the **78-PV3/KIT DWT Wheel Tracker calibration tool** kit and the **IPC Global DWT Double Wheel Tracker** machines for purposes other than those for which it was designed and manufactured. Any other use of the machine is to be considered improper, not foreseen and hence dangerous.

CONTROLS will not be responsible for improper use of the machine.

1.4 Safety information

WARNING:
Please read this chapter thoroughly.

CONTROLS designs and builds its devices complying with the related safety requirements; furthermore it supplies all information necessary for correct use and the warnings related to use of the equipment.

CONTROLS will not to be held responsible for:

- use of the equipment different than the intended use,
- damages to the unit, to the operator, caused both by installation and maintenance procedures different than those described in this manual supplied with the unit, and by wrong operations,
- mechanical and/or electrical modifications performed during and after the installation, different than those described in this manual

The unit is not designed to be used in an explosive atmosphere.

Installation and any technical intervention must only be performed by qualified technicians authorized by CONTROLS.

Only authorised personnel can remove the covers and/or have access to the components under voltage.

During normal use, if the operator detects irregularities or damages, he/she should immediately inform the authorized technical personnel.

Maintenance and service activities can only be performed by skilled authorized technical personnel that have been properly trained on the residual risks of the equipment.

It is responsibility of the purchaser to make sure that the operators have been properly instructed concerning the safety issues and the residual risks related to the equipment.

WARNING:
Refer to the manual of the IPC Global DWT Double Wheel Tracker machines, or to the manual of other manufacture's machine, for full information on the safety of use and residual risks associated with them.

1.5 Environmental risks and disposal

INFORMATION TO THE OWNER OF THE EQUIPMENT

The above symbol, when attached to the equipment or to the relevant packaging, indicates that the product must be disposed of separately from other rubbish at the end of the useful life.

Therefore, at the end of its useful life, the owner should dispose of the product in a suitable collection point for electrical and electronic products provided by the local authorities.

The correct disposal of this product and the subsequent treatment encourages the manufacture of products using re-cycled materials and limits the environmental impact of the product caused by improper disposal.

Improper disposal of the product is subject to penalties as foreseen by the local regulations.

Please refer to the local laws and regulations for proper disposal of the product.

1.6 CE declaration

This page shows a copy of the CE declaration. The original is supplied with the equipment as a separate document.

DECLARATION OF CONFORMITY
DICHIARAZIONE DI CONFORMITÀ
Directive 2006/42/CE, Annex II, sub A) - Direttiva 2006/42/CE, Allegato II, parte A)

CE

REV16

Manufacturer *Fabbricante*	**CONTROLS S.P.A.**
Address *Indirizzo*	Via Salvo D'Acquisto 2/4 20060 Liscate, (MI) Italy
	Herewith declares that the machine *Dichiara che la macchina*
Model *Modello*	**78-PV3/KIT**
Serial number *Matricola*	21007096
Description *Descrizione*	

is in conformity with the provisions of the following EC directives:
è conforme a quanto previsto dalle seguenti direttive CE:

2006/42/CE (Machinery Directive)
(Direttiva Macchine)

2014/35/UE (Low Voltage Directive)
(Direttiva Bassa Tensione)

2014/30/UE (Electromagnetic Compatibility Directive)
(Direttiva Compatibilità Elettromagnetica)

CONTROLS

Date of issue
Data di emissione

24 September 2021

Nicola Lezzerini
Technical Director - Person authorized to compile the technical file
Direttore tecnico - Persona autorizzata alla costituzione del fascicolo tecn

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2. DESCRIPTION

The main components of the **78-PV3/KIT DWT Wheel Tracker calibration tool** are here after depicted and identified.

A high-resolution encoder (with traceable calibration certificate) with data acquisition module and connection to PC.

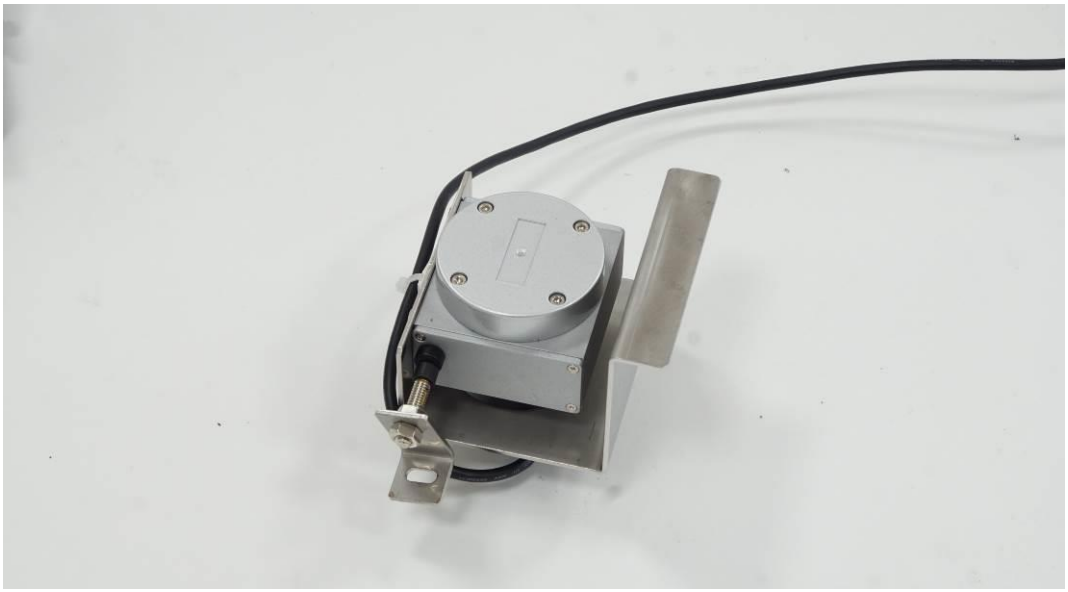

Fig. 2-1

Fig. 2-2

Shaped metal specimen conforming to the specification of AASHTO T324-2019 Section X2 and Figure X1.1 to verify and calculate the RMSE of the rut measurement in the 11-points.

Fig. 2-3

3500 N capacity load cell, with spherical seat and readout unit (with traceable calibration certificate), to verify and calibrate the load on the wheel.

Fig. 2-4

Digital thermometer with probe (with traceable calibration certificate) to measure the temperature of water or air.

Fig. 2-5

Adapters and spacers for use with IPC Global Double Wheel Tracker.

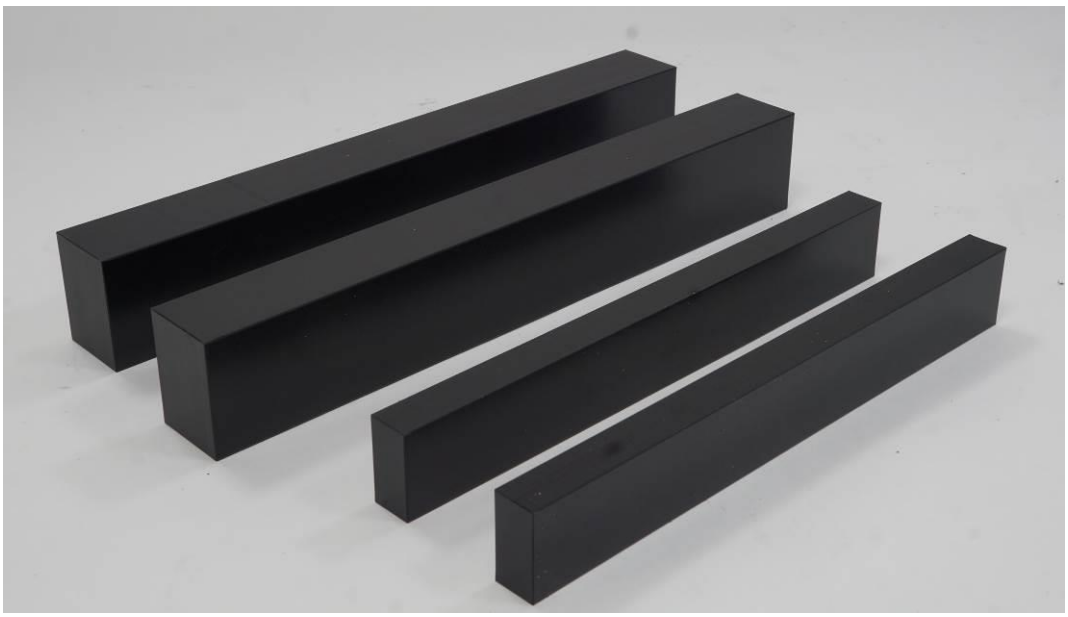

Fig. 2-6

Laptop PC with dedicated software.

Fig. 2-7

Carrying case in hard plastic.

Fig. 2-8

2.1 Identification plate

The identification plate is located on the kit

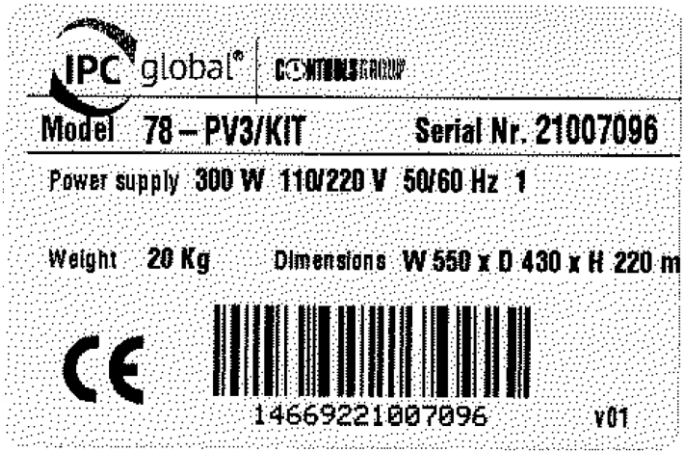

Fig. 2-9

2.2 Technical specifications

General features	
Product	**DWT Wheel Tracker calibration tool**
Manufacturer	CONTROLS Liscate (MI) Italy
Product code	**78-PV3/KIT**
Load verification device: -Capacity -Resolution -Accuracy	 3500 N 0.1 N ± 0.1 N
Wheel sinusoidal movement, span, speed at center and position device: -Span -Resolution -Accuracy -RMSE resolution	 1000 mm 0.01 mm ± 0.01 mm 0.01 mm
Temperature verification device: -Ranges -Resolution -Accuracy -Battery life/type -Probe length	 From -50°C to 199.9°C (-58°F to 399.9°F) 0.1°C (0.1°F) ± 0.2% full scale 3 x 1.5V/approx. 1600 hours of continuous use 120 mm
Total weight	20 kg
Dimensions	550 x 420 x 220 mm

3. USE OF THE VERIFICATION KIT

The present chapter describes the execution of the different tests allowed using the verification and calibration devices provided with the **DWT Wheel Tracker calibration tool** kit.

Reference to the manual of the **IPC Global DWT Double Wheel Tracker** machine, or to the manual of other manufacturer's machine, must be made for the information and instructions on the use of the machine to perform the different checks.

WARNING:
Refer to the manual of the IPC Global DWT Double Wheel Tracker machines, or to the manual of other manufacture's machine, for full information on the safety of use and residual risks associated with them.

3.1 Unpacking and inspection

The kit was carefully checked both mechanically and electrically before shipment; it should be inspected for any damage that may have occurred in transit.

NOTE:
If the shipping container or packaging material is damaged, it should be kept until the unit has been mechanically and electrically checked.
If there is mechanical damage and/or the contents are incomplete (see the shipping list), please notify the local CONTROLS representative.
If the shipping container is damaged or shows sign of stress, notify the carrier as well as the CONTROLS representative. Save the shipping material for carrier's inspection. Also take some pictures.

3.2 Use of the verification kit

The kit includes a PC with the software program already installed and ready to run.

Launch the program by double-clicking of the shortcut on the PC screen, first a panel with the software version and logo will be shown briefly

Fig. 3-1

The same panel can be recalled by pressing the button  on the top bar of the program.

It is then followed by the main screen of the test program.

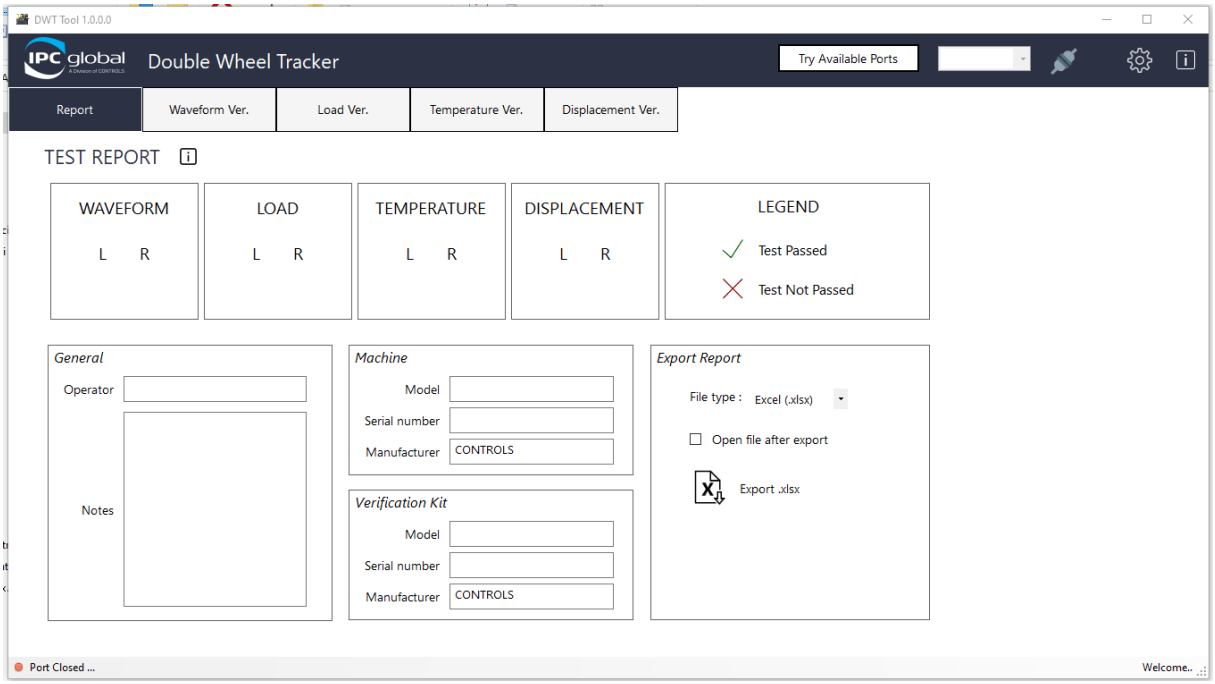

Fig. 3-2

The button  upper bar of the software panel, allows selecting the reference test standard and general settings.

Make reference to the next chapters to see the different options and test procedures.

3.2.1 REPORT tag

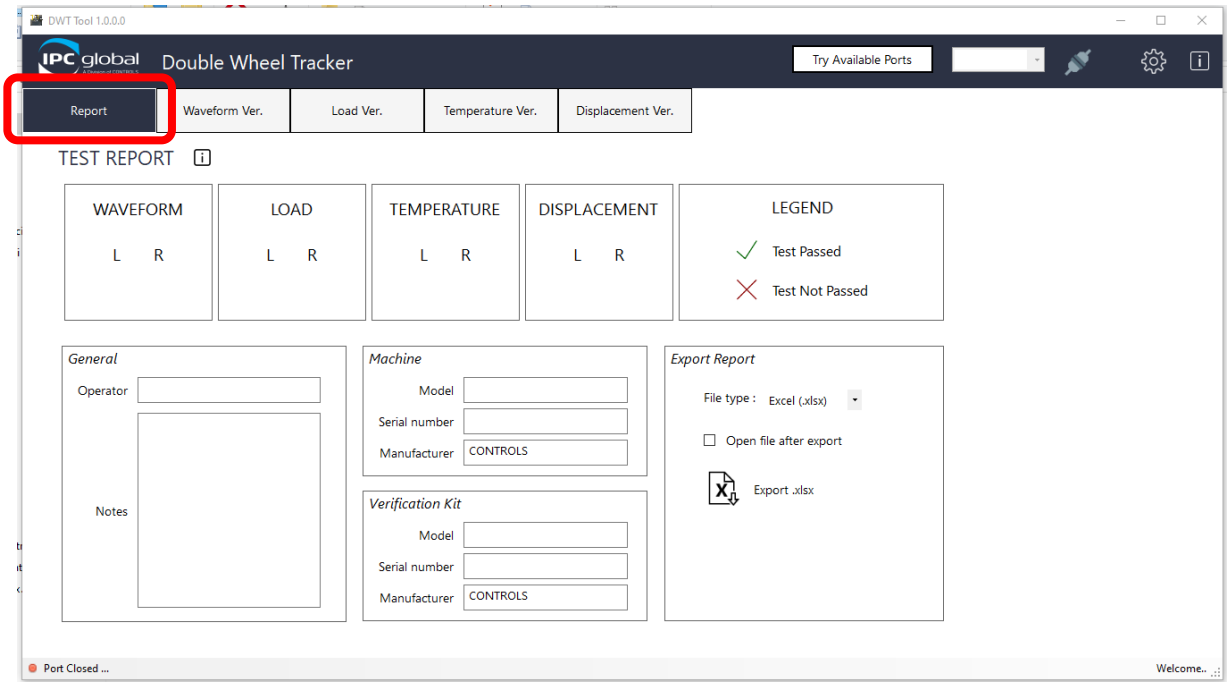

Fig. 3-3

The ***REPORT*** tag will show the results of the different tests performed on the machine, whether ***PASSED*** or ***NOT PASSED***.

It will also allow inputting additional data (***GENERAL*** and of the ***MACHINE***) that will be included in the report.

The latter can then be downloaded as Excel file, PDF file or both (***EXPORT REPORT*** window). Refer to chapter 3.2.6 to see an example of the test report.

3.2.2 WAVEFORM VERIFICATION tag

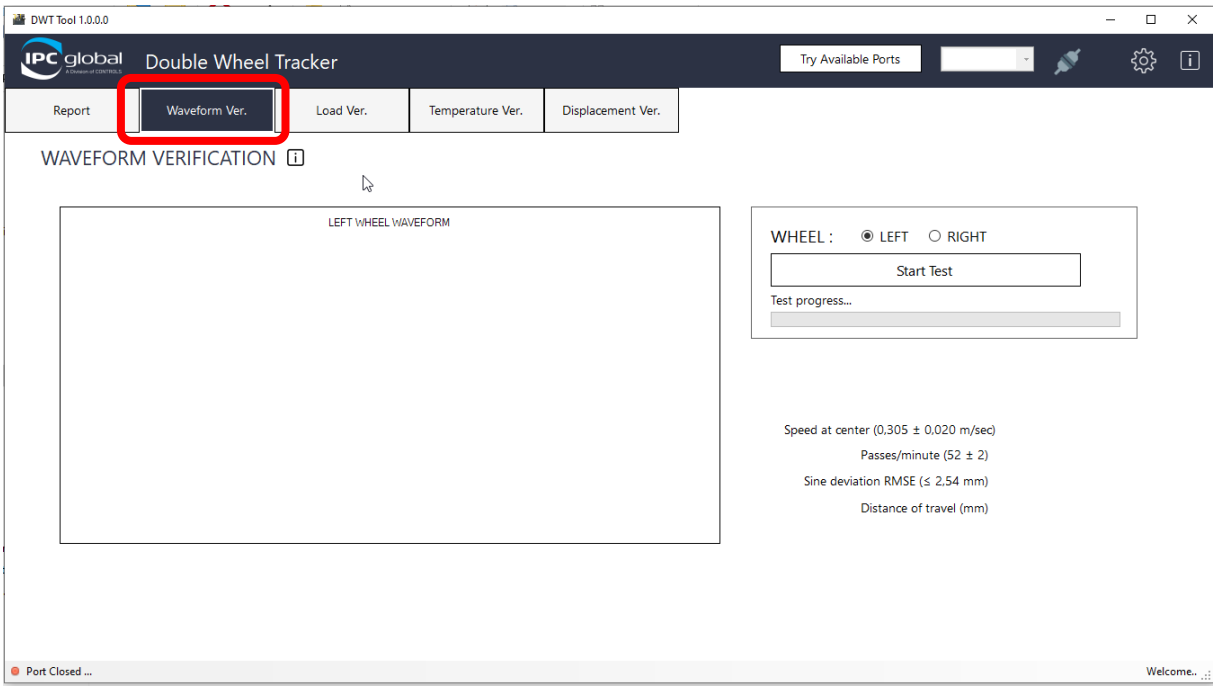

Fig. 3-4

The execution of the ***WAVEFORM VERIFICATION*** test requires the use of the following parts included in the kit:

High-resolution encoder (with traceable calibration certificate).

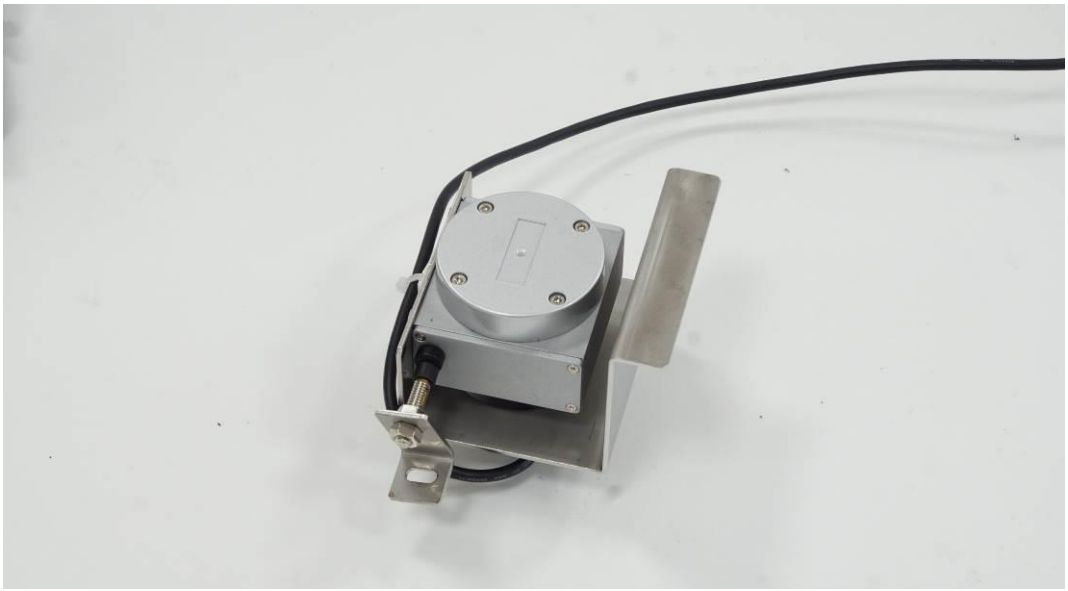

Fig. 3-5

Data acquisition module for connection to the PC

Fig. 3-6

First the encoder must be mounted on the machine by means of the relevant fixing plates included, as shown in the following images.

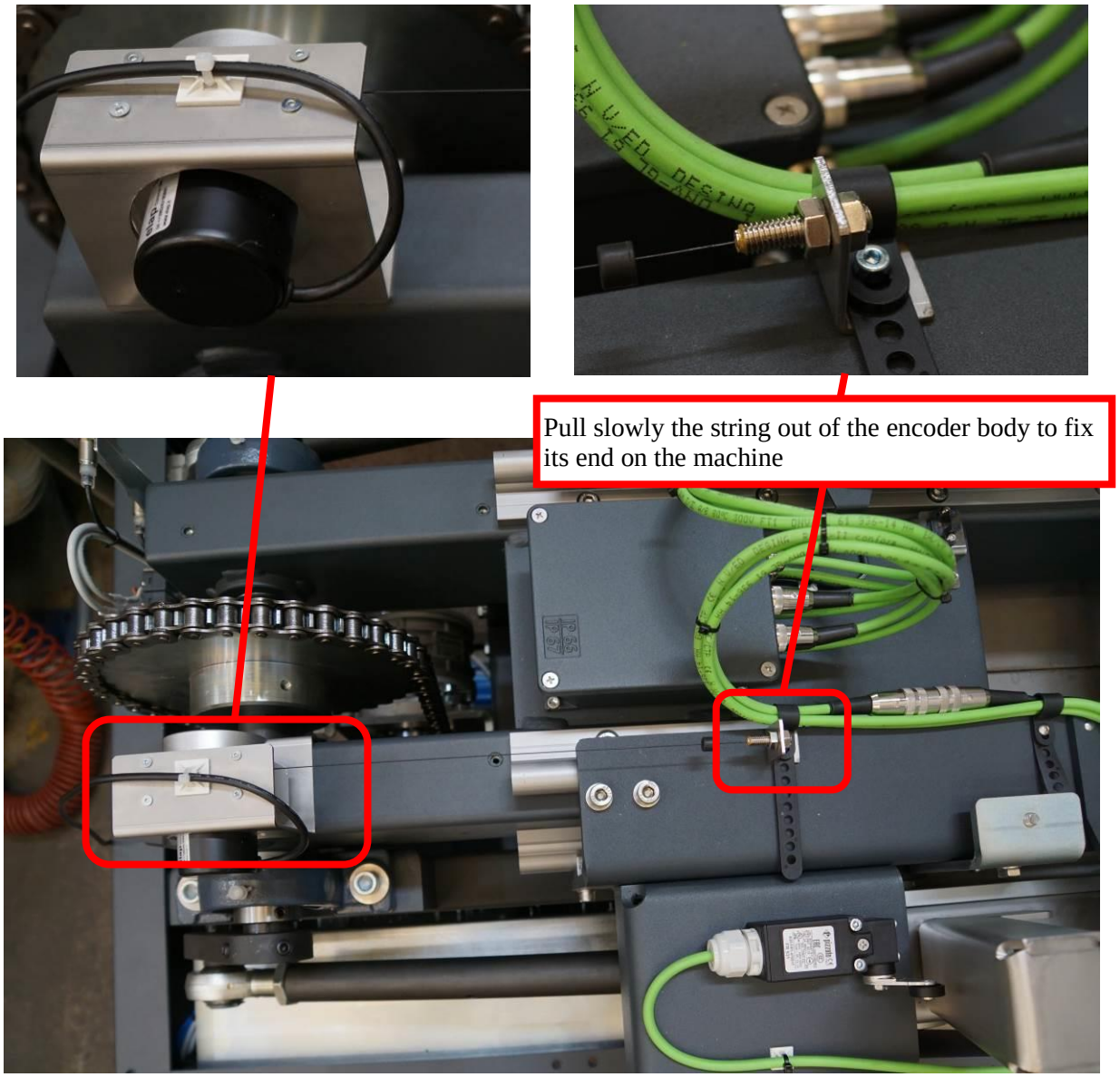

Fig. 3-7

Then connect the data acquisition module to:

- the PC via the USB cable-port;
- the encoder via the analog cable.

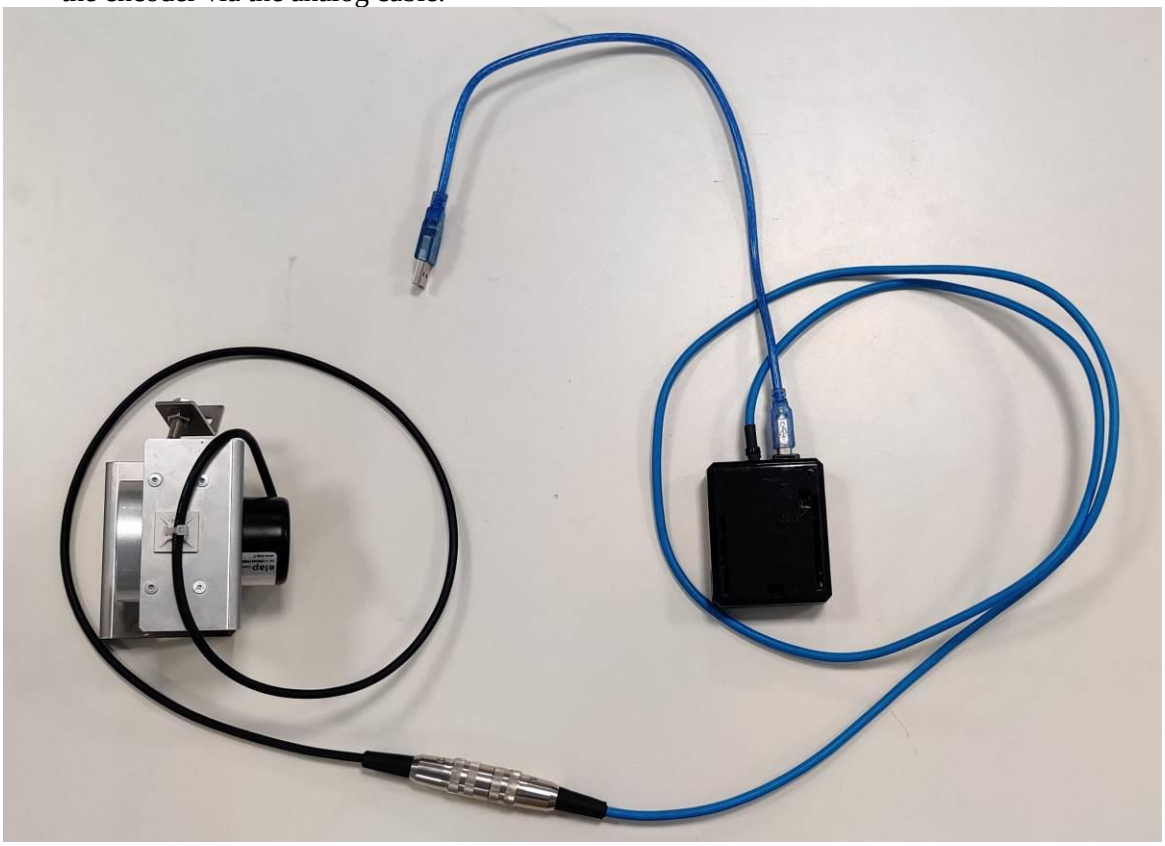

Fig. 3-8

Position the encoder cable on the machine in order it will not interfere with the movements.

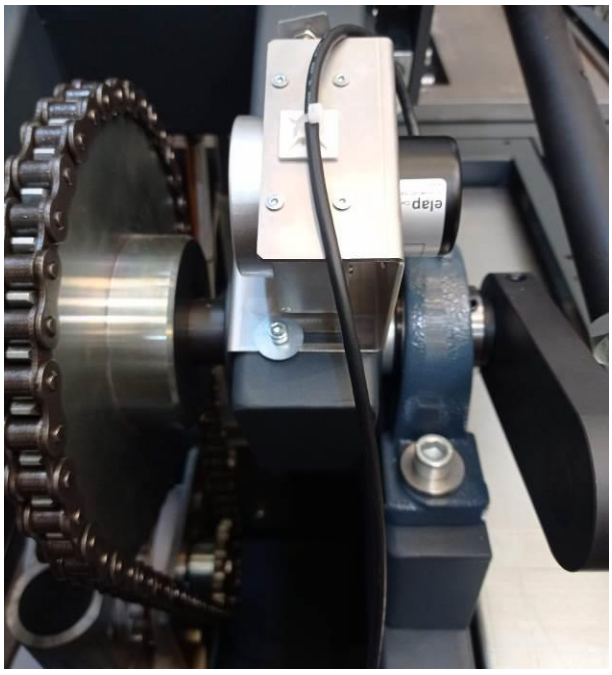

Fig. 3-9

Prepare the moulds with wooden pieces in order they are flush to the upper edge of the mould and centered with respect to the wheels

Fig. 3-10

Now, on the DWT machine use the ***MANUAL COMMANDS***, that can be accessed by pressing the button  on the side command bar of the ***SETTING*** menu (refer to the DWT Double Wheel Tracker manual for further information or to the other manufacturer's machine manuals to operate on the machine).

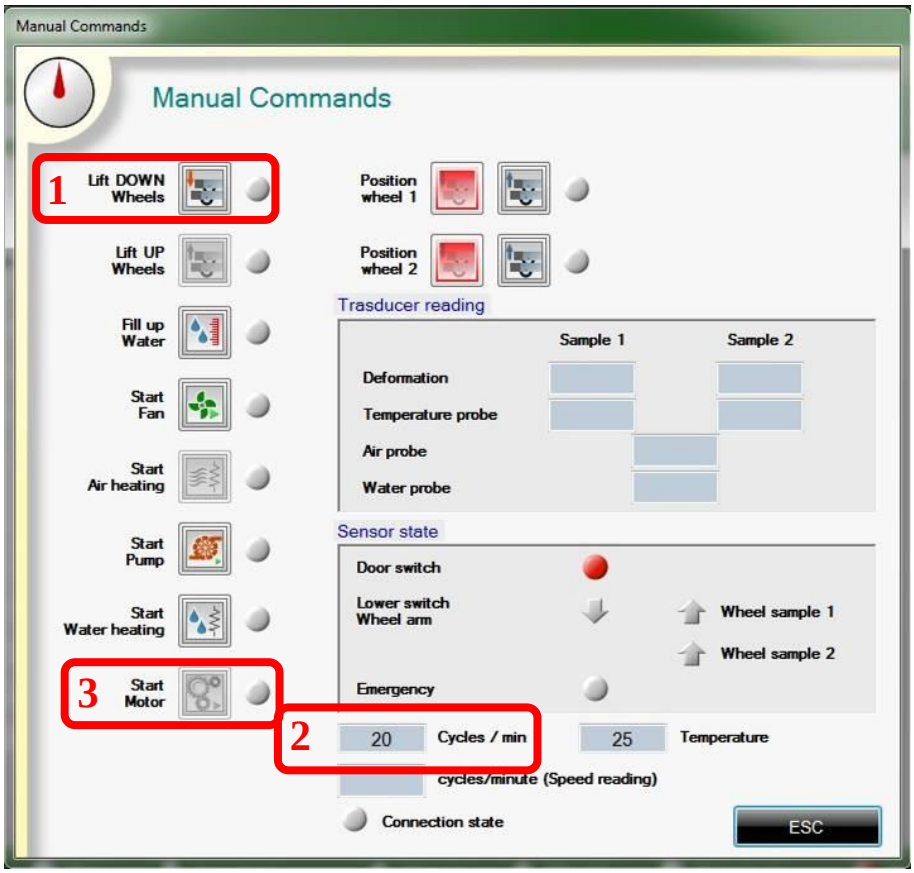

Fig. 3-11

1. Press button ***LIFT DOWN WHEELS***  to lower the arms until they touches the wooden pieces in the moulds
2. Set the speed 26 Cycles/min (Standard test speed)
3. Start the wheel arm motor by pressing the button ***START MOTOR***  .

Allow the speed to stabilize and, on the computer of the verification kit:

1. Check that the program is connected to the interface box of the encoder (the connection will be achieved automatically)
2. Select the wheel to be checked
3. Press the button START TEST.

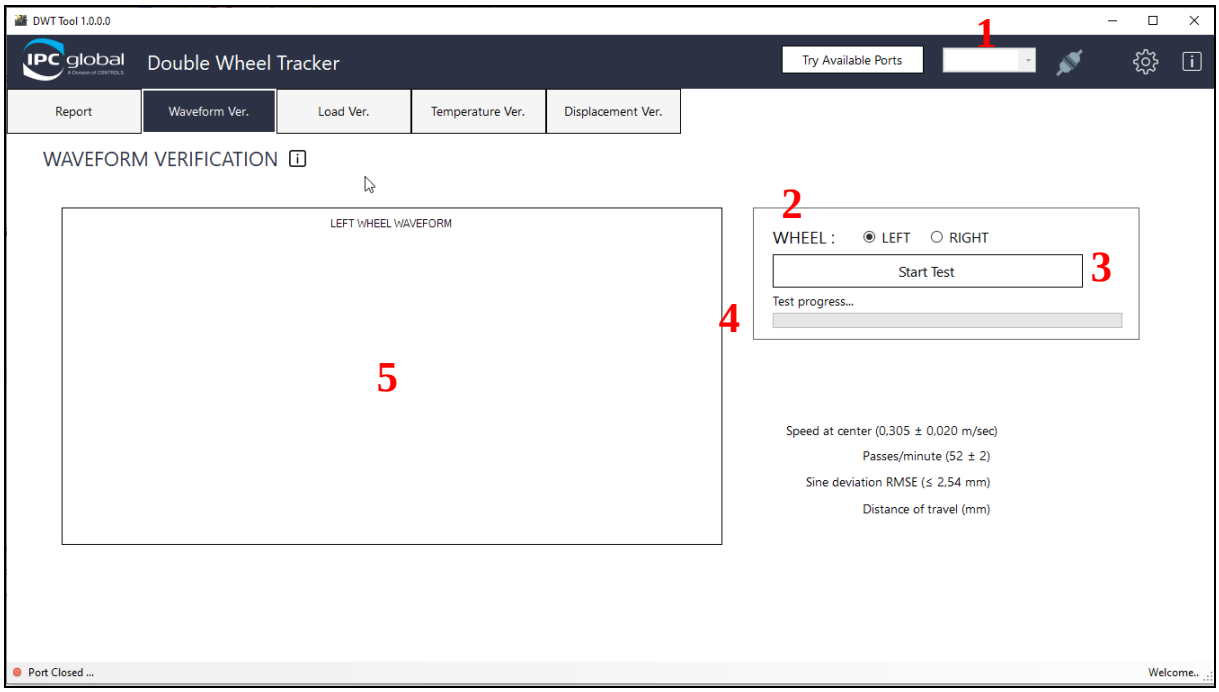

Fig. 3-12

The acquisition will start and the progress will be indicated in the bar [4]. Note that the first 10 passes will be skipped and the real test will consist of the following 20 passes. A sinusoidal waveshape will build up in the ***WAVEFORM*** window [5].

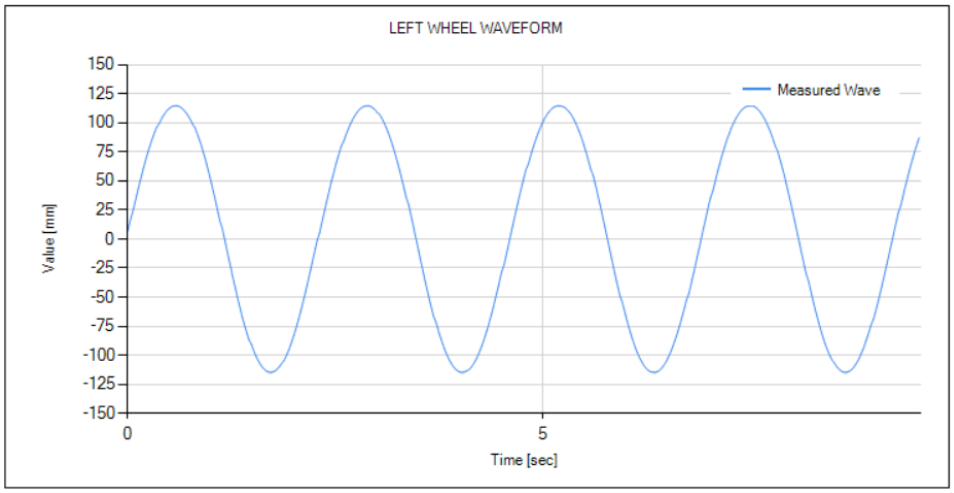

Fig. 3-13

At the end of the acquisition of the 20 passes, the program will automatically calculate the results (the bar **[4]** will indicate the progress also in this case), with the annotation whether or not the test was passed, with reference to the limits included with AASHTO T324-19 [See Fig. 3-14]

Speed at center (0,305 ± 0,020 m/sec)	0,310	PASS
Passes/minute (52 ± 2)	52,1	PASS
Sine deviation RMSE (≤ 2,54 mm)	1,74	PASS
Distance of travel (mm)	230,8	

Fig. 3-14

Repeat the above listed actions for both wheels (left and right), moving the encoder from one arm to the other.

At the end of the verification, lift up the arms by using the ***MANUAL COMMANDS*** of the ***DWT Double Wheel Tracker*** machine, remove the wooden pieces from the mould and remove the encoder from the machine.

3.2.3 LOAD VERIFICATION tag

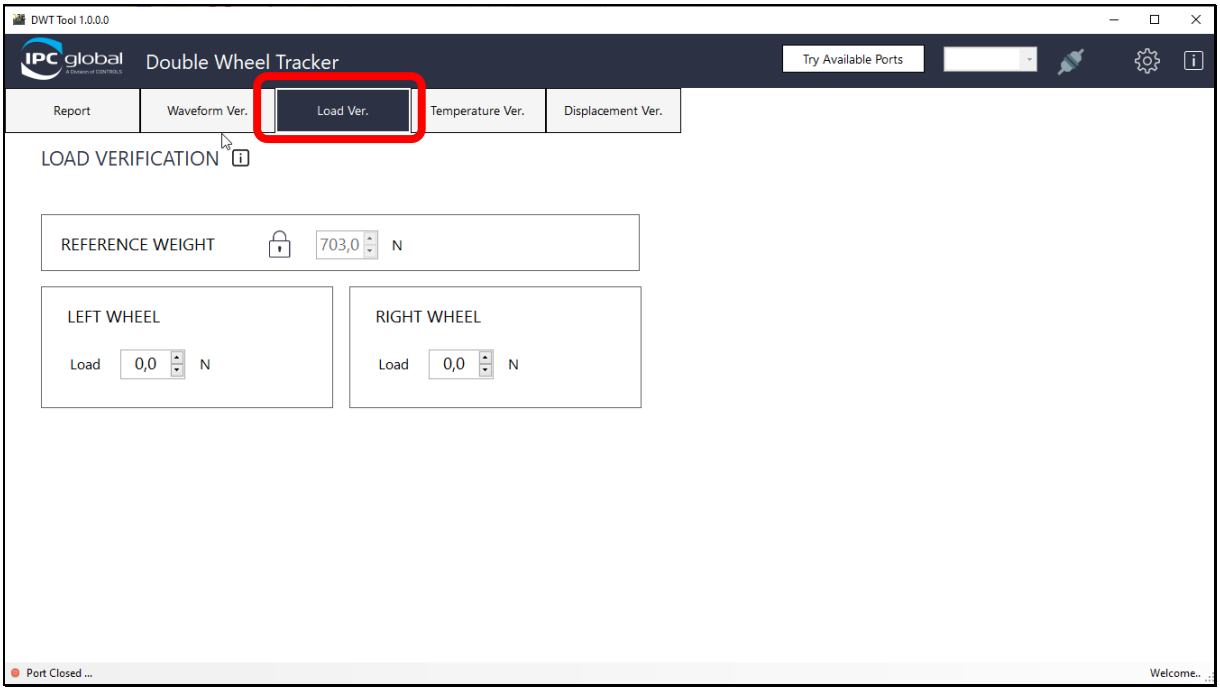

Fig. 3-15

The execution of the ***LOAD VERIFICATION*** test requires the use of the following parts included in the kit:

3500 N capacity load cell, with spherical seat and readout unit (with traceable calibration certificate), to verify and calibrate the load on the wheel.

Fig. 3-16

Plate to install on the machine to stably position the loadcell, used with all versions of the IPC Global DWT Machine except PV33D0x.

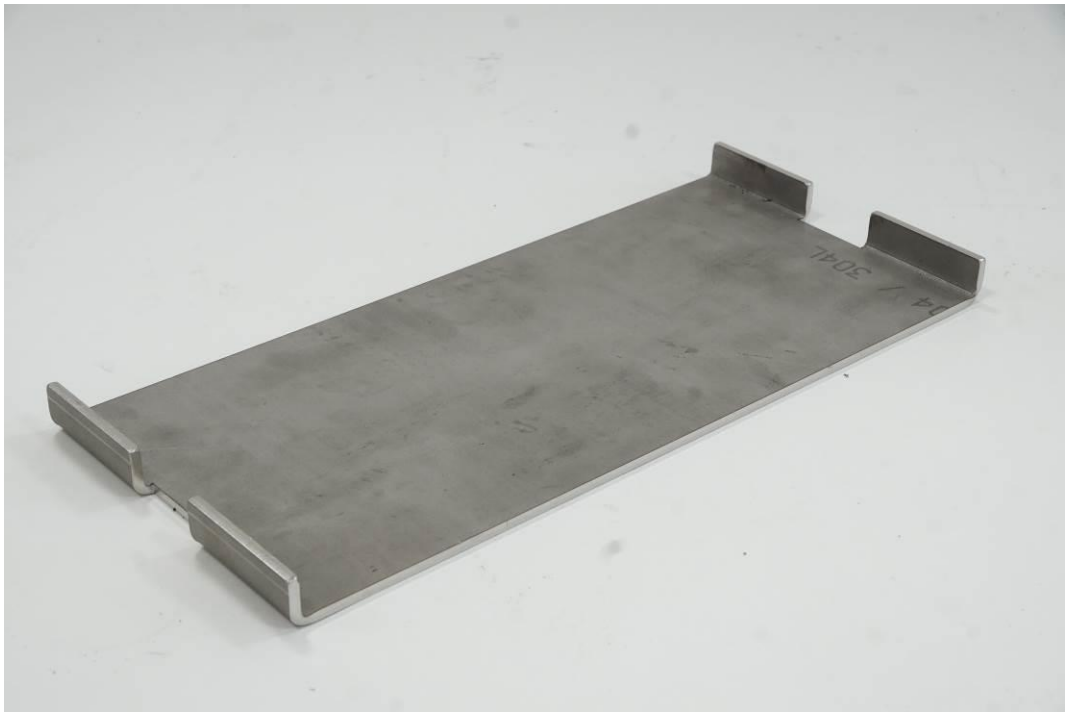

Fig. 3-17

Referring to the following pictures, place the plate on the machine and the loadcell with the spherical seat facing up, making sure it will align with the wheel once it will be lowered.

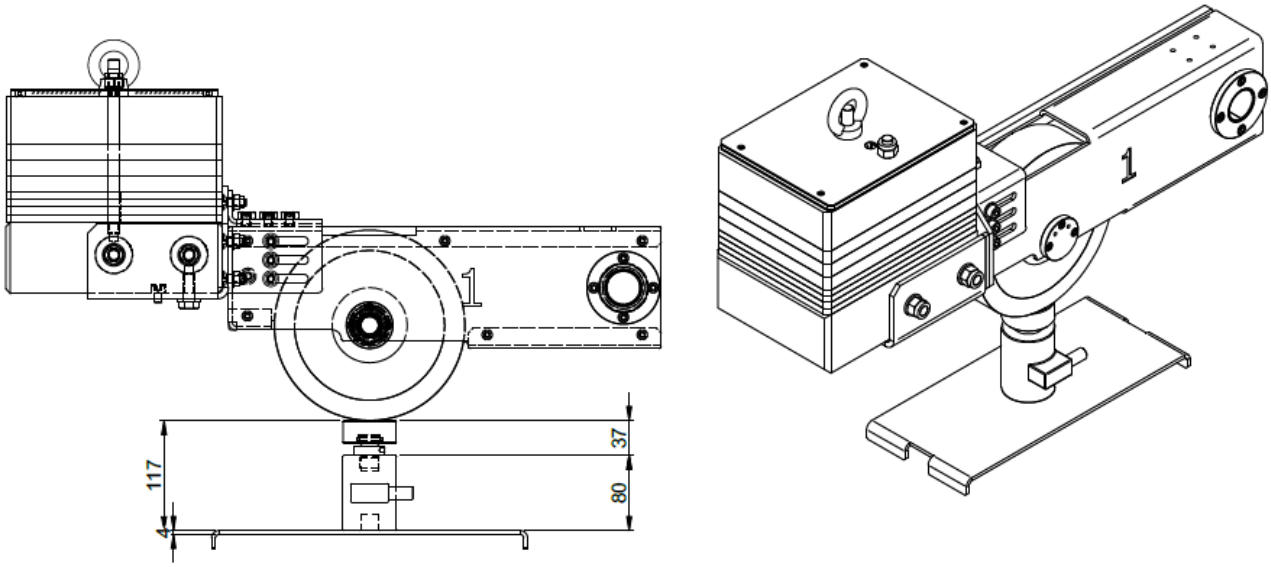

Fig. 3-18

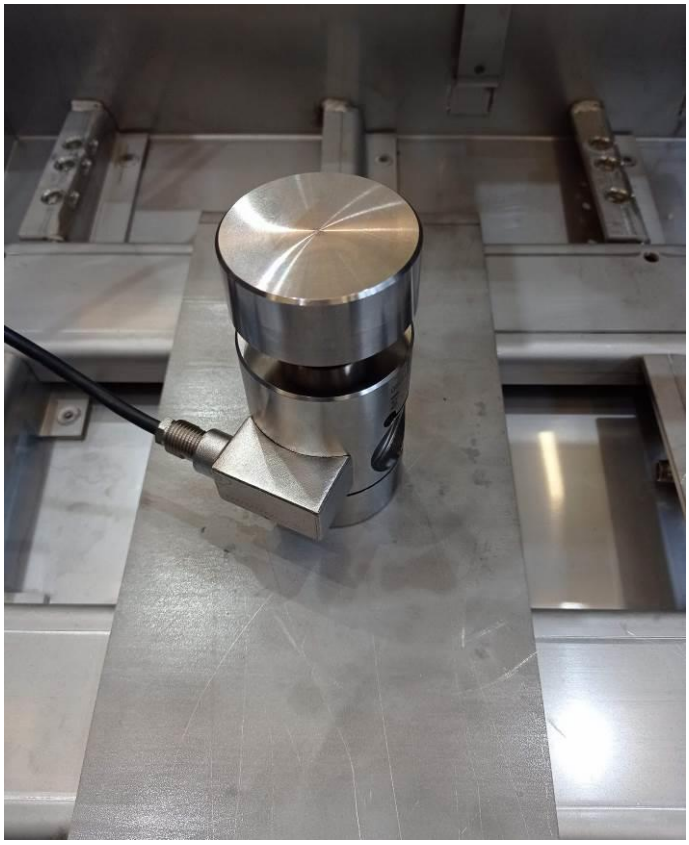

Fig. 3-19

If test must be performed on a PV33D0x machine, refer to the following picture: machine's mould must be used in this case.

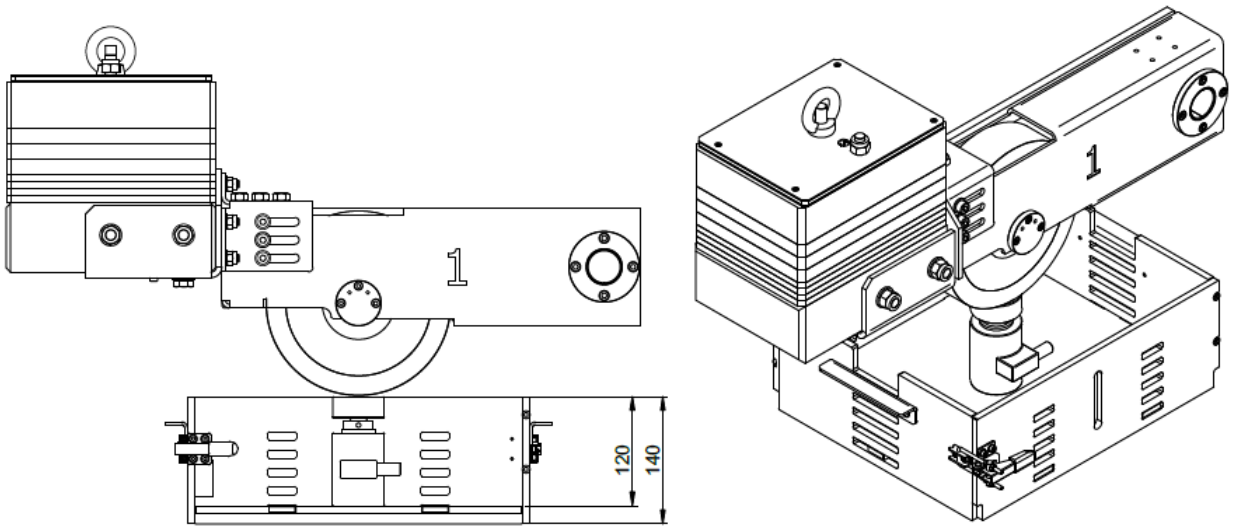

Fig. 3-20

Now, on the **DWT Double Wheel Tracker** machine use the ***MANUAL COMMANDS***, that can be accessed by pressing the button  on the side command bar of the ***SETTING*** menu (refer to the DWT Double Wheel Tracker manual for further information).

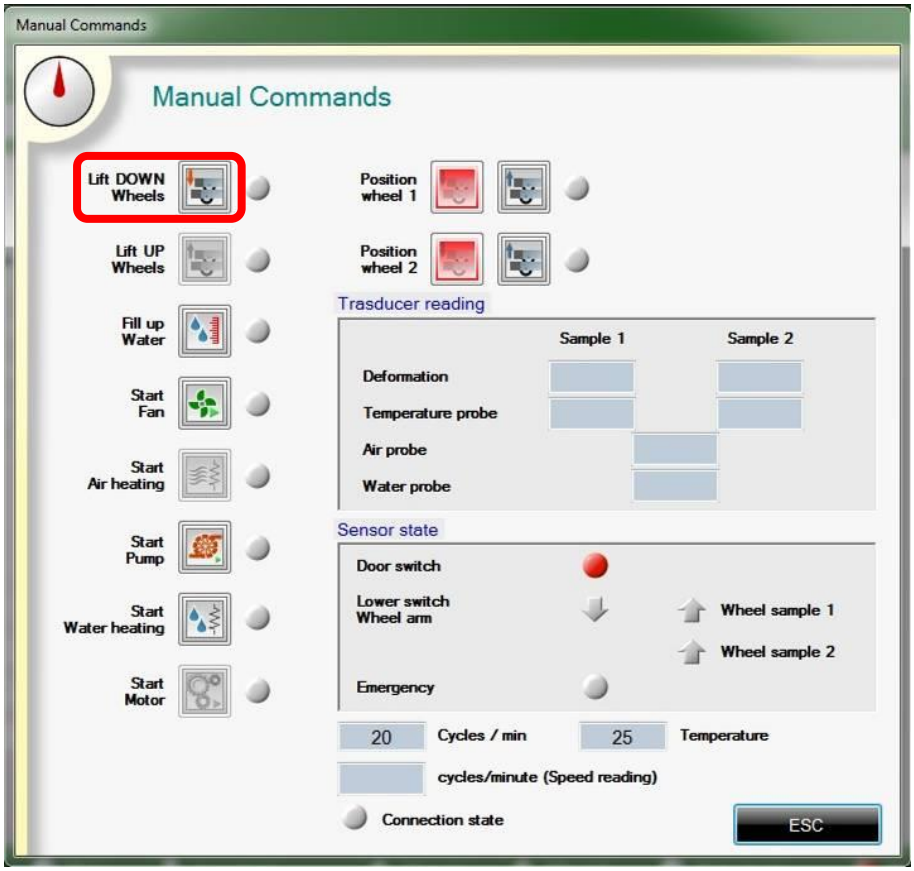

Fig. 3-21

Press button ***LIFT DOWN WHEELS***  to lower the wheel until it touches the spherical seat of the loadcell.

Allow the load read by the reference loadcell to stabilize and take note of it.

Fig. 3-22

Repeat the same procedure for the other wheel.

Once the load values of the 2 wheels have been achieved, enter them in the relevant field of the program window either by typing them in or using the arrows.

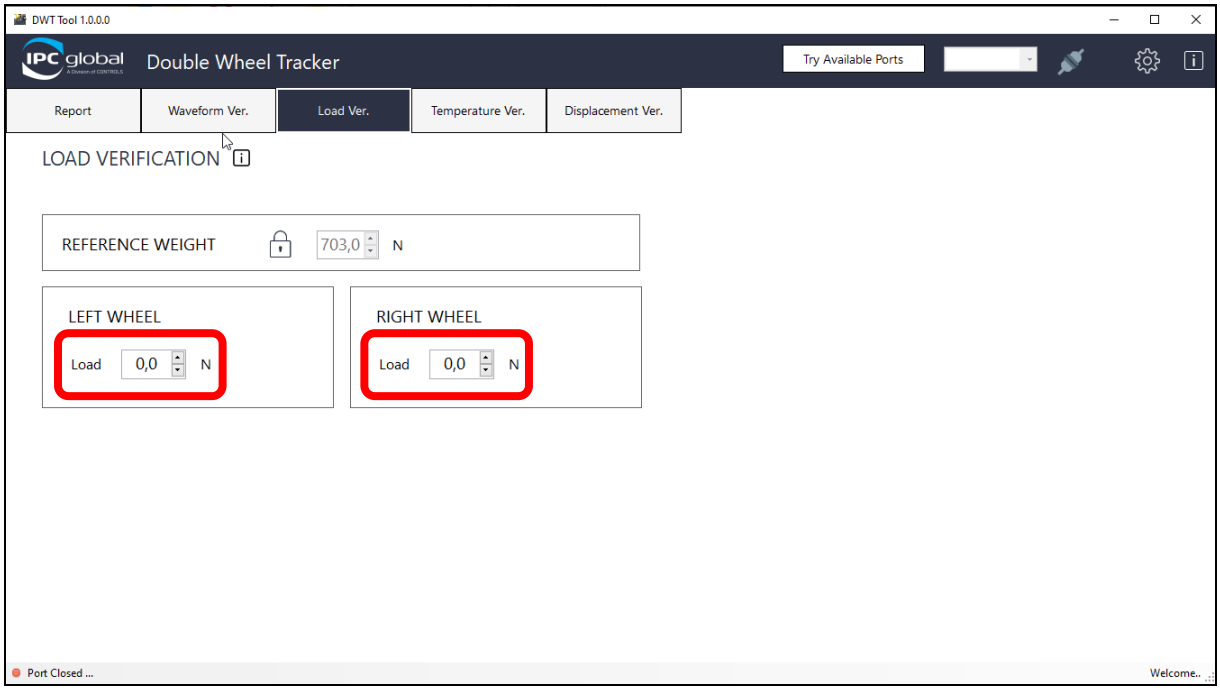

Fig. 3-23

The ***PASS*** or ***FAIL*** message will automatically appear.

Reference value for AASHTO-T324 (2019) is 703N and the acceptance tolerance is ±4.5N.

3.2.4 TEMPERATURE VERIFICATION tag

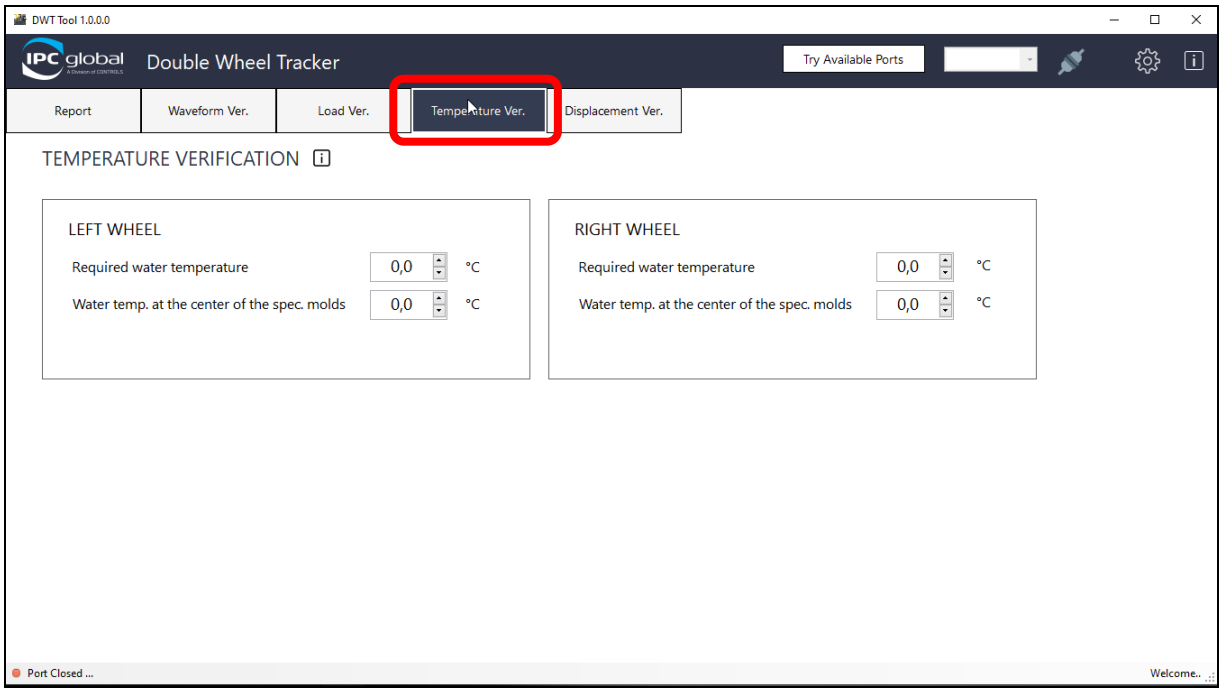

Fig. 3-24

The execution of the ***TEMPERATURE VERIFICATION*** test requires the use of the following parts included in the kit:

Digital thermometer with probe (with traceable calibration certificate) to measure the temperature of water or air.

Fig. 3-25

Fit the reference temperature probe near the tank temperature probe of the machine and route the relevant cable out to the reference thermometer.

Fig. 3-26

Fig. 3-27

Turn ON the **DWT Double Wheel Tracker** machine and use its commands to fill the tank with water and heat it up, allowing it to properly stabilize (e.g. around a couple of hours if the test is at 60°C in water)

Wait for additional 15 minutes to allow the temperature to stabilize around the reference probe. In the meantime, enter the ***REQUIRED WATER TEPERATURE*** **[1]** that is the temperature set for the water on the DWT machine.

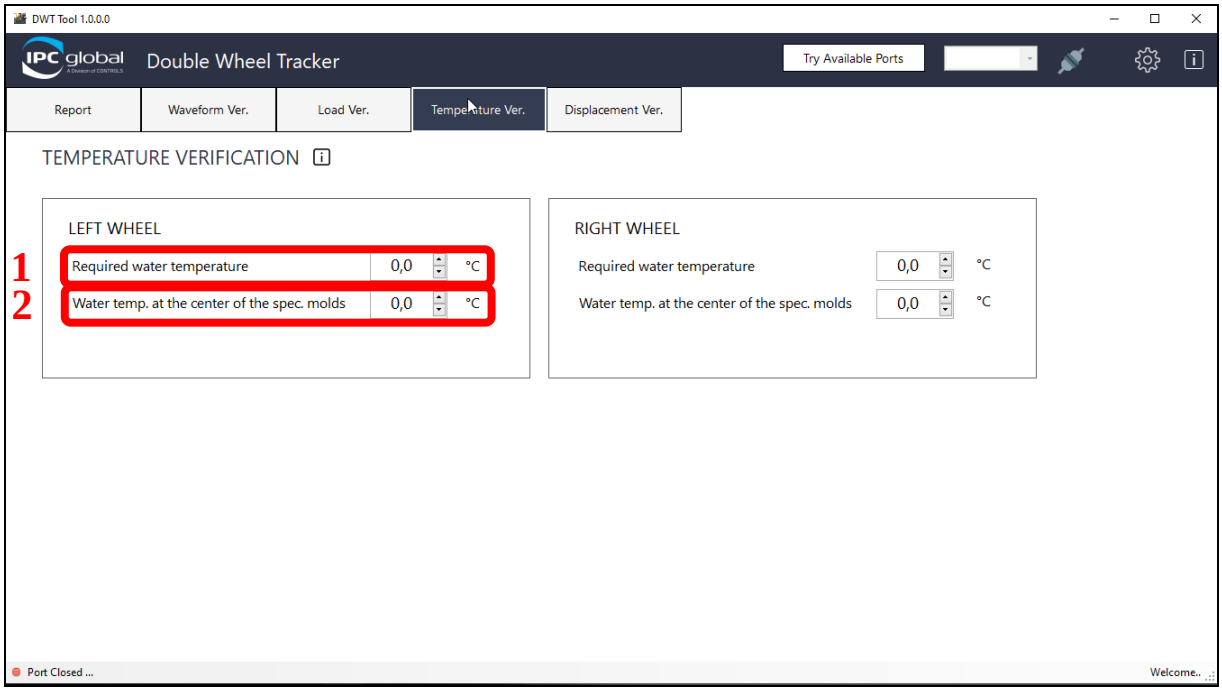

Fig. 3-28

Read the temperature on the reference thermometer and input it in the relevant field **[2]** of the test program: it will directly tell if the test is ***PASSED*** or ***FAILED***.

Tolerance for AASHTO-T324 (2019) is ±1°C.

3.2.5 DISPLACEMENT VERIFICATION tag

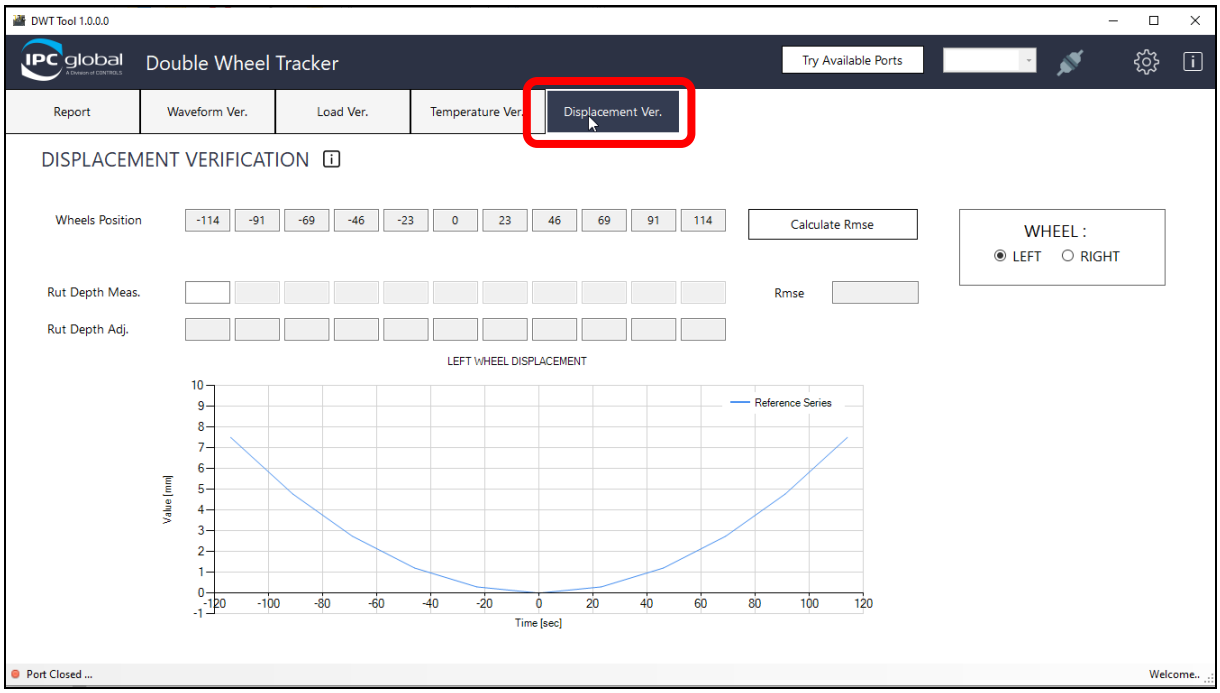

Fig. 3-29

The execution of the ***DISPLACEMENT VERIFICATION*** test requires the use of the following parts included in the kit:

Shaped metal specimen conforming to the specification of AASHTO T324-2019 Section X2 and Figure X1.1 to verify and calculate the RMSE of the rut measurement in the 11-points.

Fig. 3-30

Spacers to help positiong and centering the shaped metal specimen in the mould.

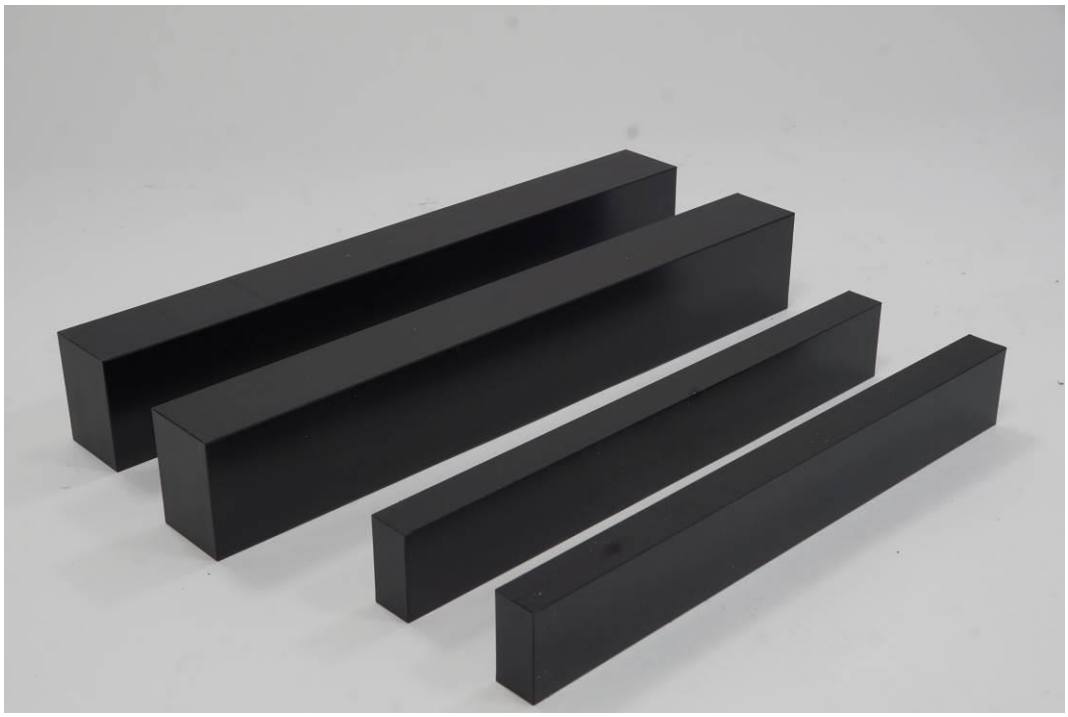

Fig. 3-31

Load the shaped metal specimen in the mould of the wheel to check and use the metal knobs on it to secure firmly into position in order it will not move during the test under the load of the wheel. Make sure its upper part is flush to the upper edge of the mould.

Fig. 3-32

Set up and start a standard test and stop it after at least 20 cycles. (refer to the **DWT Double Wheel Tracker** manual for further details on its). Once done:

- Export the test as .CSV format
- Extract the rut depth measurements at the eleven points requested by the standard from the exported test
- Select the relevant wheel, input the extracted data in the ***RUT DEPTH MEASURED*** boxes (they have the same format as the exported data) and press ENTER
- Repeat the same for the other wheel.

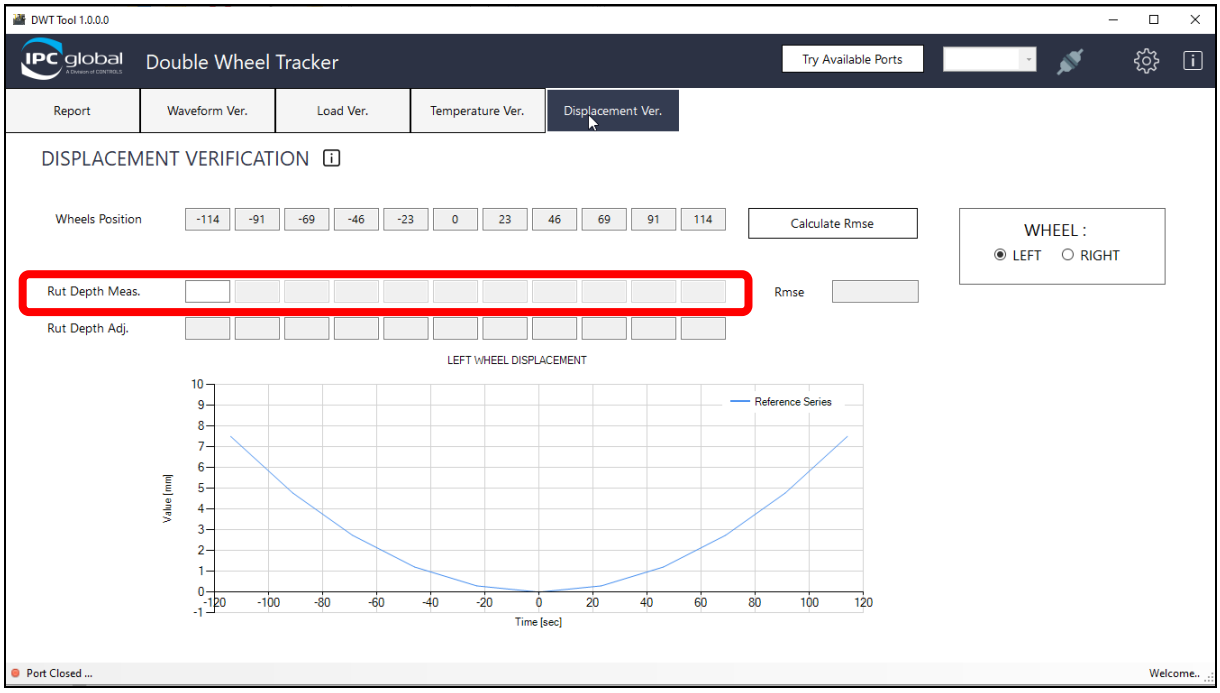

Fig. 3-33

Once the data gathered from the test report are entered, press the ***CALCULATE RMSE*** button, the program will calculate ***RUT DEPTH ADJUSTED VALUE*** (it will just remove offset from the data, if present) and display the ***RMSE*** value, with the annotation whether or not it is within tolerances.

The blue curve on the graph is the theoretical profile while the orange graph is the profile calculated based on the rut values measured by the LVDT of the DWT machine (see next figure).

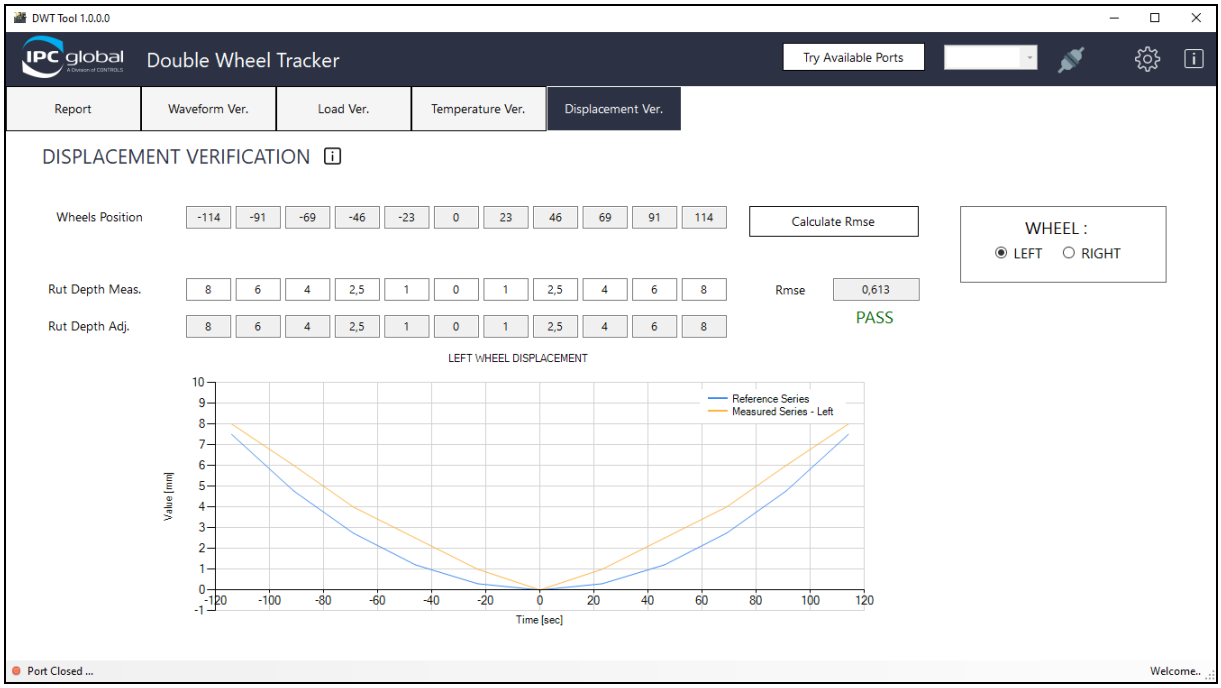

Fig. 3-34

The maximum allowed value for 11-point measurement RMSE for AASHTO-T324 (2019) is 1.27mm

3.2.6 Test report

In the ***REPORT*** tag panel of the program, a button allows exporting the test report either in Excel or PDF format or both.

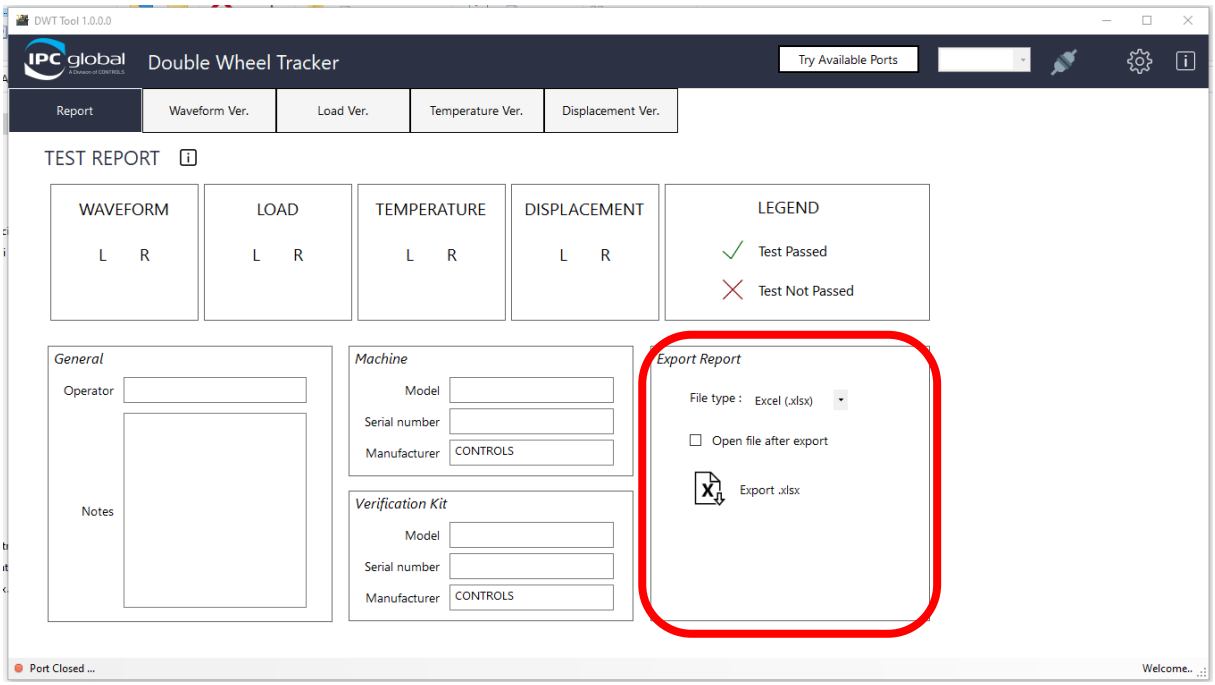

Fig. 3-35

An example of the report is here after provided.

CONTROLS

Double Wheel Tracker - Verification tool calibration certificate

Machine	
Model	**PV33D05**
Serial number	**21005263**
Manufacturer	**CONTROLS**

Verification Tool	
Model	**PV3/KIT**
Serial number	**21004587**
Manufacturer	**CONTROLS**

LEFT WHEEL - L

WAVEFORM - L		
Speed at center [m/sec]	0,31	PASS
Passes/Minute	52,1	PASS
RMSE [mm]	1,81	PASS

LOAD - L		
Reference Load [N]	703	PASS
Measured Load [N]	702,5	

TEMPERATURE - L		
Reference Temp. [°C]	60	PASS
Measured Temp. [°C]	59,5	

DISPLACEMENT - L			
Pos. [mm]	Ref. [mm]	Meas. [mm]	Adj. [mm]
-114	7,5	8	8
-91	4,77	5	5
-69	2,74	2,5	2,5
-46	1,21	1	1
-23	0,3	0,5	0,5
0	0	0	0
23	0,3	0,5	0,5
46	1,21	1	1
69	2,74	2,5	2,5
91	4,77	5	5
114	7,5	8	8
RMSE [mm]		0,104	PASS

RIGHT WHEEL - R

WAVEFORM - R		
Speed at center [m/sec]	0,31	PASS
Passes/Minute	52,1	PASS
RMSE [mm]	1,81	PASS

LOAD - R		
Reference Load [N]	703	PASS
Measured Load [N]	701	

TEMPERATURE - R		
Reference Temp. [°C]	60	PASS
Measured Temp. [°C]	59,7	

DISPLACEMENT - R			
Pos. [mm]	Ref. [mm]	Meas. [mm]	Adj. [mm]
-114	7,5	9	9
-91	4,77	5	5
-69	2,74	2,5	2,5
-46	1,21	1	1
-23	0,3	0,5	0,5
0	0	0	0
23	0,3	0,5	0,5
46	1,21	1	1
69	2,74	2,5	2,5
91	4,77	5	5
114	7,5	9	9
RMSE [mm]		0,18	PASS

Notes

Date	Operator
23/09/2021	Test operator

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Notes:

CONTROLS S.p.A.
is certified **ISO 9001:2008**

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