

5.9 Measuring and testing hydraulic elevators

The pressure sensor HS1 is used for measurements on hydraulically operated elevator systems. Its measured values are recorded via a direct USB connection to the computer.

5.9.1 Creating a project

In order to carry out measurements on a hydraulically operated elevators, the elevator must be installed as a project in the Henning Sensor Suite (see chapter 5.7.4) and a hydraulic ELVI measurement must be added. The latter is done by opening the project tree of the relevant project and selecting the "Create new hydraulic test" function from the context menu of the "ELVI System" entry. The context menu opens by clicking with the right mouse button on the project branch "ELVI-System".

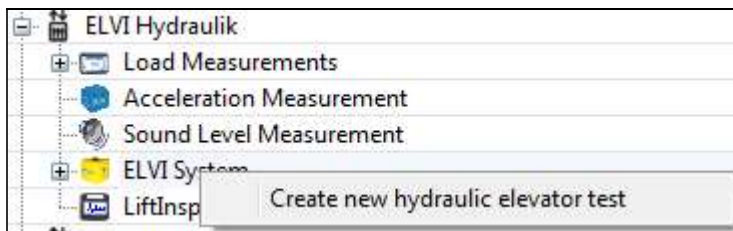


Illustration 130: Create new hydraulic elevator test

For the hydraulic test, the following dialog box opens, which is also opened after opening existing measurements on hydraulic elevators:



For this, a fill-in aid exists in the form of a calculator, which opens when the button is used. Among other things, a list of current jack-types with their effective piston surface areas are shown, which may be selected from the list.

Illustration 132: Calculator for effective piston surface area

Once the necessary parameters have been filled, the measurement can be carried out with the pressure sensor HS 1. (See chapter 0). The pressure currently measured by the pressure sensor HS1 is shown in the dialog field. The prerequisite for this is, that the pressure sensor is connected to the computer and the corresponding drivers have been installed. The pressure is shown just below the ID in the preselected unit.

Illustration 133: Reading out the pressure sensor HS1

Below the displayed value, two factors are output:

The "entered factor" is the ratio between the pressure entered as "static pressure at nominal load" and the current measured value; the "measured factor" is the correspondent value with the self-measured static pressure at nominal load. (see chapter 5.9.3.10).

5.9.2 Carrying out the individual measurements

As soon as a pressure sensor HS1 is available in the software, the button

will be released. A click on this opens a submenu in which the current measurement task may be selected. Depending on which measurement task is selected, various evaluation functions are executed after the measurement has ended.

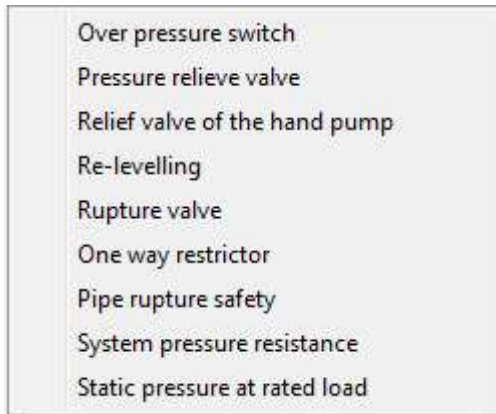


Illustration 134: Selecting measurement task upon starting a measurement

As soon as a measurement has been started, the current pressure profile (including the factors for the static pressure at nominal load) is displayed in a diagram. It should be noted that only a part of the measured data is displayed, since the high sampling rate would prevent a fluent online display.

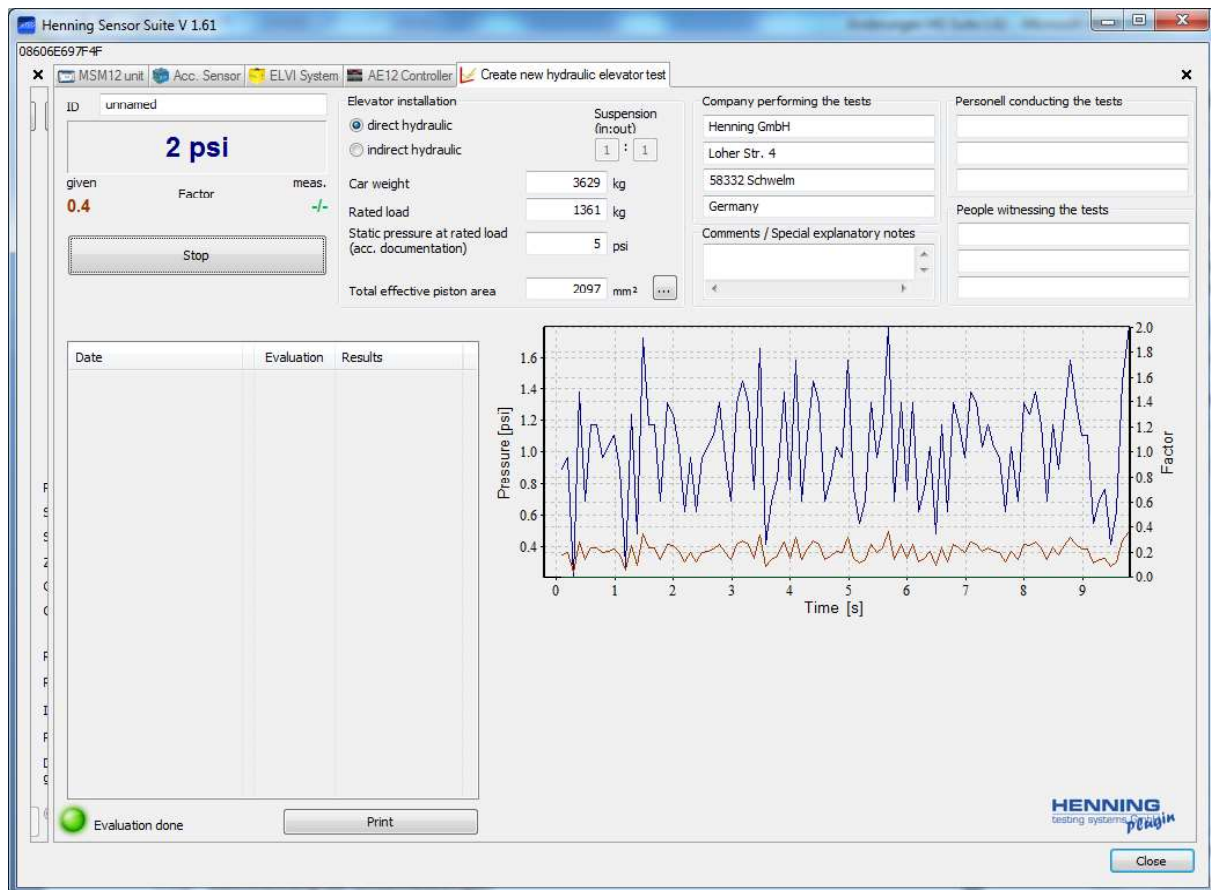


Illustration 135: Curve display when measurement has been started

The measurement can be terminated with a click on the button . As soon as this is done, the measurement is dis-

played in the list view, with the corresponding measurement task, the date and time, and the evaluation is started.

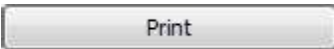
5.9.3 Reading out measurement data

5.9.3.1 Individual test

5.9.3.1.1 Opening an individual test

To display the pressure distribution of a measurement, the corresponding entry in the list is double-clicked. This displays both the pressure profile (and also the course of the factors) over time in the diagram view, as well as the evaluation results below the diagram.

5.9.3.1.2 Einzelprüfung im Report ausgeben

In front of each individual test you will find a check-mark. So marked individual tests are displayed in the report as soon as the button  is pressed.

5.9.3.1.3 Deleting individual tests

To delete a individual test click it with the right mouse button and select in the subsequently opening context menu the entry "Delete".

The individual test is then permanently deleted after a security question.

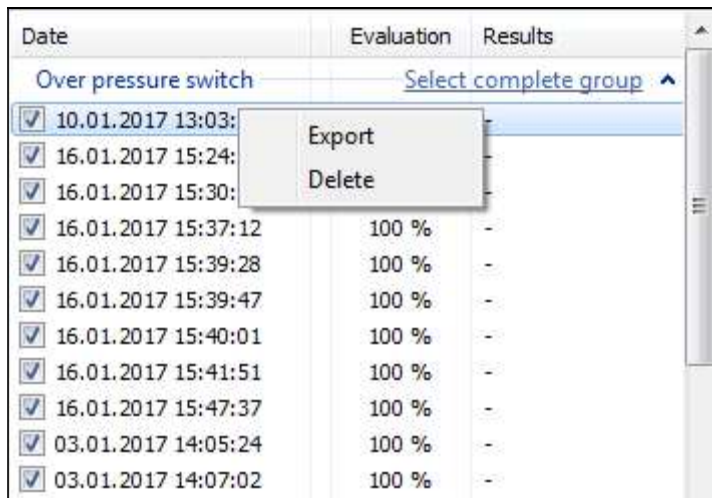


Illustration 136: Context menu for an individual test

5.9.3.1.4 Exporting the Measurement Data for an Individual Test

To export the raw data of a individual test into the CSV format (compatible MS Excel), mark the item with the right mouse button and select in the subsequently opening context menu the entry "Export".

Then a dialog box will be opened to specify the location of the export.

5.9.3.2 Measuring the over pressure switch

For this measurement, technical experts are required to check, at which pressure the over pressure switch is activated.

For this purpose, technical experts should perform the following steps during the current pressure measurement carried out by the HS1 sensor:

- Close stop valve
- Build up pressure
- Wait till the over pressure switch is activated.

The software of the inspection system automatically determines the maximum pressure reached and makes it available to the expert. Subsequently, the expert must evaluate this display reading and decide, whether the check was successful.

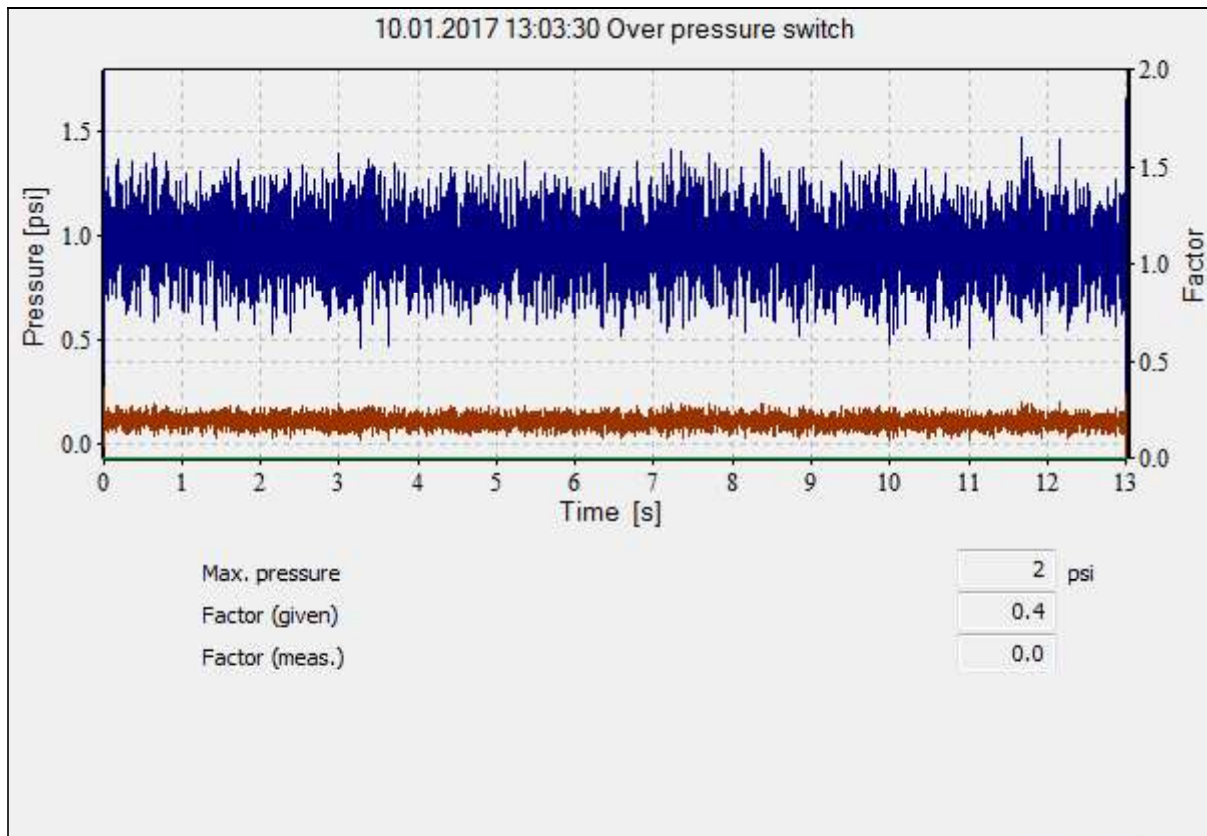


Abbildung 137: Ausgabe einer Beispielmessung zum Druckbegrenzungsschalter

5.9.3.3 Measuring the pressure relief valve

For this measurement, technical experts are required to check that the pressure relief valve responds at the latest to 1.4 times static pressure (static pressure at payload)

The experts can measure the pressure progression during a time period using the hydraulic sensor HS1 and store for documentation. The software analyses the pressure progression and automatically defines max. pressure.

Technical experts should perform the following steps during the current pressure measurement:

- Bridge the bridge switch in the switch caret
- Drive the elevator up
- In doing so, close the stop sluice valve slowly.

The pressure relief valve will be activated at some point of time. The software defines the max. pressure achieved, and the experts can observe if this pressure value is less than 1.4 fold static pressure at payload, and decide, whether the check was successful.

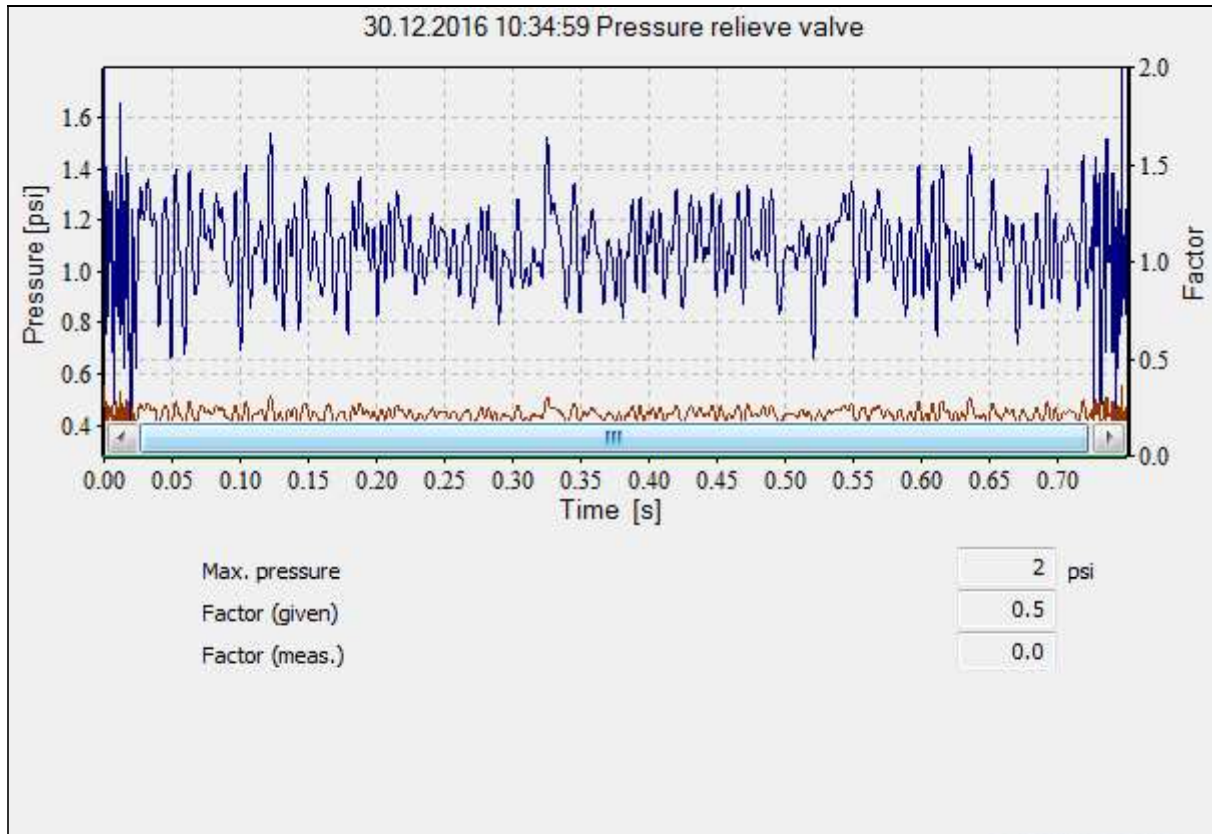


Abbildung 138: Ausgabe einer Beispielmessung zum Sicherheitsventil

5.9.3.4 Measuring the pressure relief valve of the hand pump

For this measurement, technical experts are required to check that pressure relief valve responds to the given pressure limit (max. 2,3 times static pressure at payload).

The experts can measure the pressure progression during a time period using the hydraulic sensor HS1 and store for documentation. The software analyses the pressure progression and automatically defines max. pressure limit.

Technical experts should perform the following steps during the current pressure measurement:

- Close the stop valve
- Press the hand pump till max. pressure is achieved.

The pressure relief valve will be activated at some point of time. The software defines the max. pressure achieved, and the experts can decide, whether the check was successful at this pressure value.

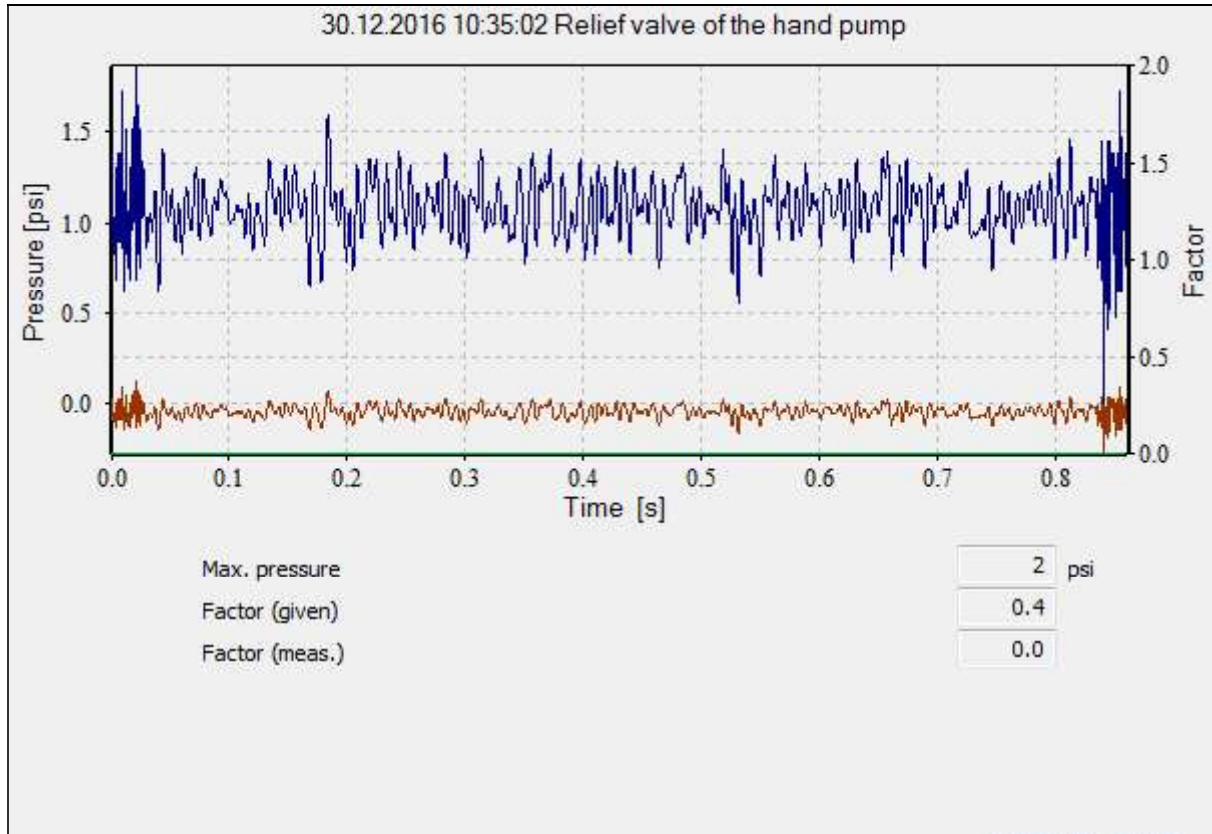


Abbildung 139: Ausgabe einer Beispielmessung zum Ventil Handpumpe

5.9.3.5 Measuring the re-levelling

5.9.3.5.1 Checking the functionality of the re-levelling

The function and the effectiveness of the re-levelling switch are manually checked by technical experts without the software support.

Technical experts should perform the following steps:

- The unloaded car is travelled from the lowest to the top landing, stopping at every single floor.
- Emergency lowering will be performed at every floor to check the electrical functionality of the re-levelling.

5.9.3.5.2 Effectiveness of the re-levelling

The functionality of the re-levelling will be checked by technical experts. Technical experts should perform the following steps:

- The unloaded elevator is run till the piston end stop.

The sensor HS1 will measure the pressure. The software defines the max. pressure achieved, and the experts can observe if this pressure value corresponds with min. 1.4 times static pressure at payload, and decide, whether the check was successful.

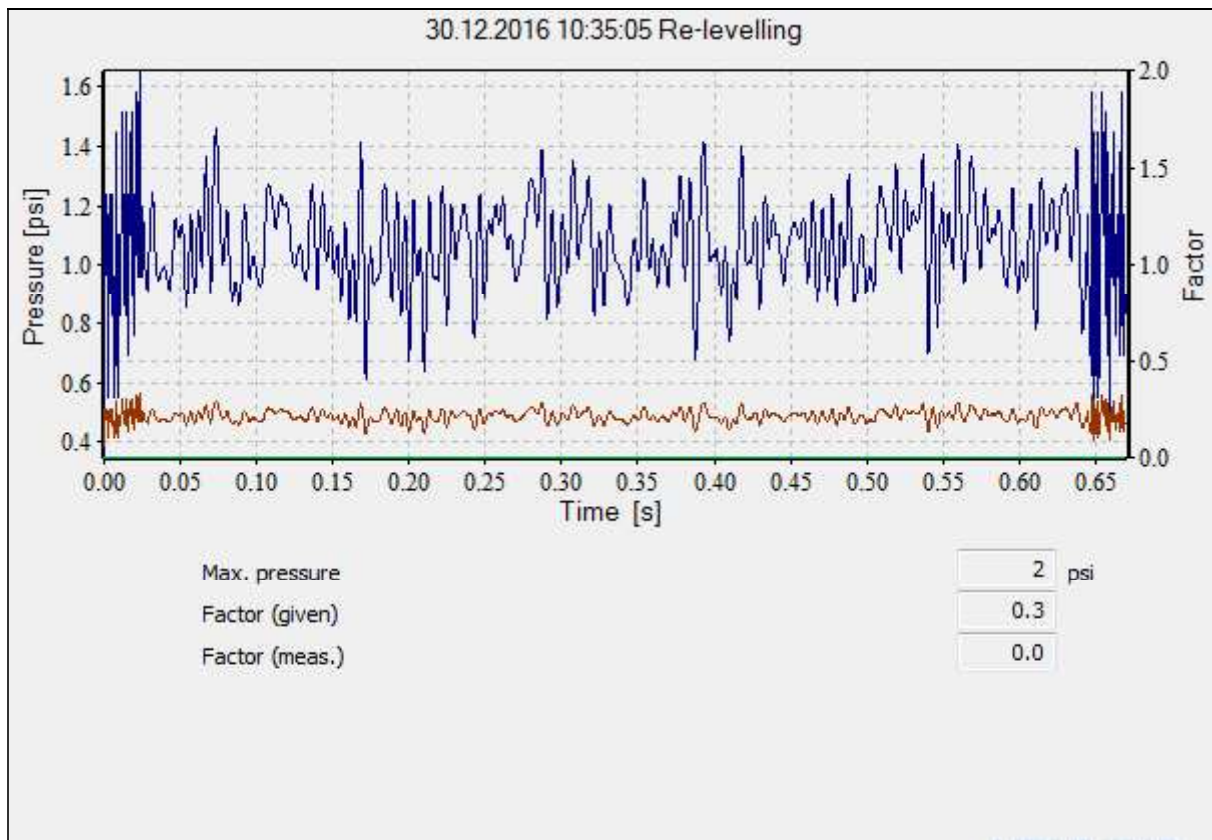


Abbildung 140: Ausgabe einer Beispielmessung zur Absinkverhinderung

5.9.3.6 Measuring the rupture valve

For a proper functioning of the rupture valve it is necessary to prove if the valve is activated during the down run of the elevator, when the necessary flow volume is provided.

During the down run of the elevator, please activate the manual device that provides the above mentioned flow amount. The sensor HS1 will measure the pressure for this elevator run.

By observing the displayed pressure progression and discovering the pressure drop on the graph, the expert defines whether the rupture valve was activated.

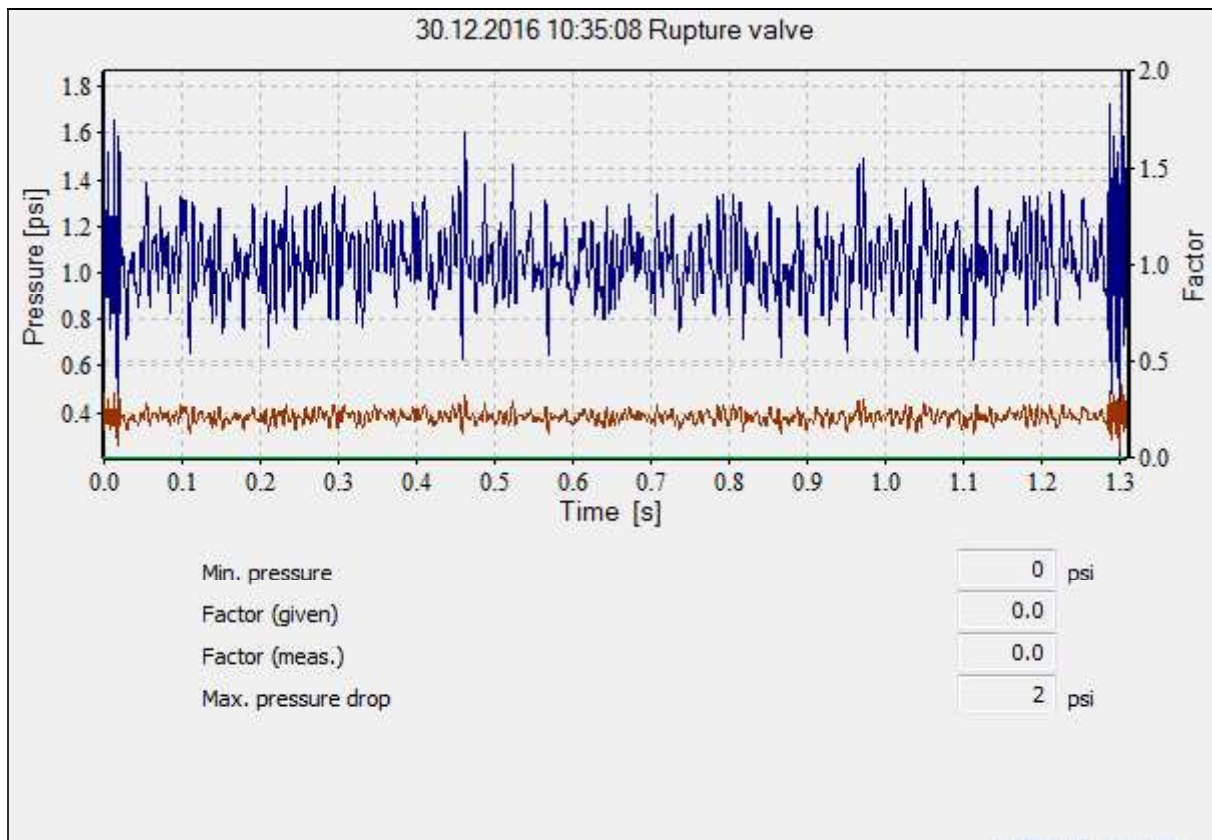


Abbildung 141: Ausgabe einer Beispielmessung zum Leitungsbruchventil

5.9.3.7 Measuring the one way restrictor

For a proper functioning of the one way restrictor it is necessary to prove if the valve is activated during the down run of the elevator, when the necessary flow volume is provided.

During the down run of the elevator please activate the manual device that provides the above mentioned flow amount. The sensor HS1 will measure the pressure for this elevator run.

By observing the displayed pressure progression and discovering the pressure drop on the graph, the expert defines whether the one way restrictor was activated.

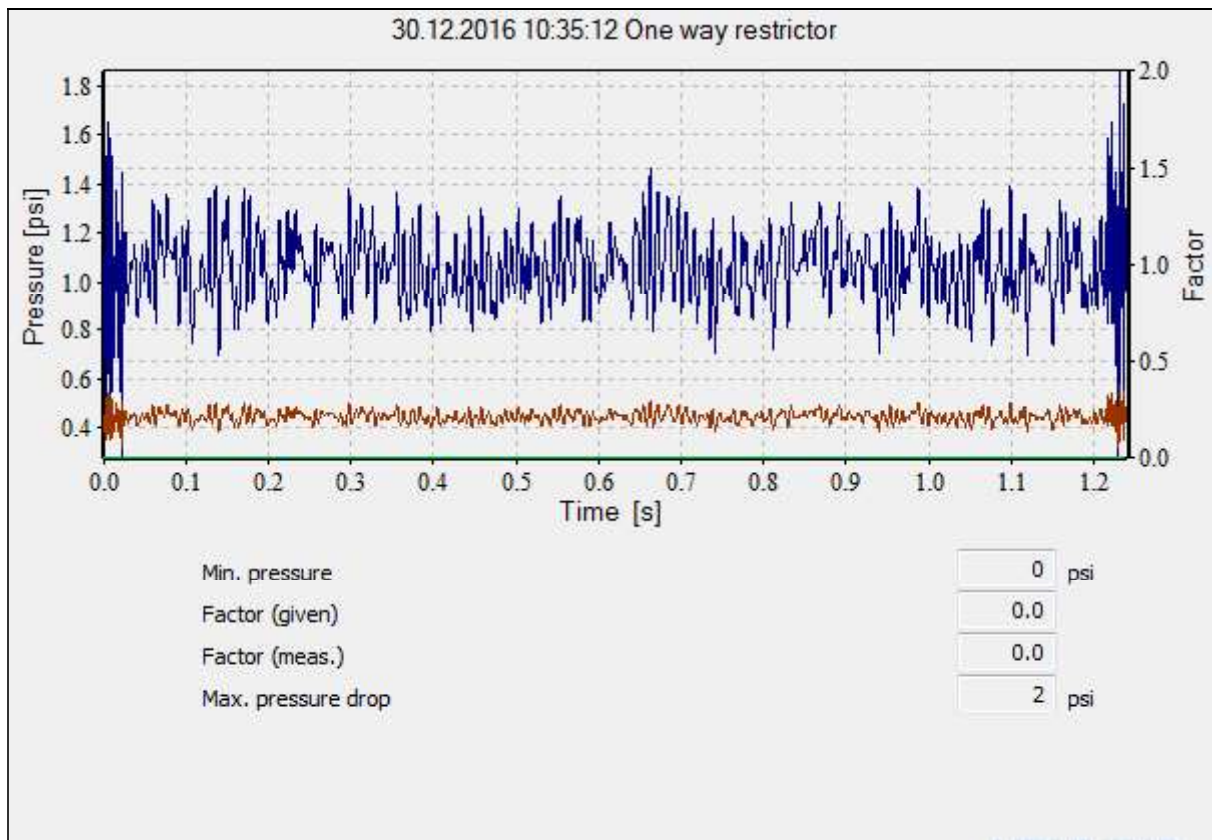


Abbildung 142: Ausgabe einer Beispielmessung zum Drosselrückschlagventil

5.9.3.8 Measurement of the pipe rupture safety

The effectiveness of the pipe fracture protection or of the line break valve is given when the car is immediately stopped and held down as soon as the downward nominal speed is exceeded by 0.3 m/s.

The expert performs a downward travel and, during this, releases the manually actuated device, Flow rate in the line break valve / pipe breakage protection. From the recorded pressure profile, the expert determines whether the tube breakage arrestor has tripped by searching for a corresponding pressure drop in the curve. In addition, it is also recommended to carry out a measurement with the acceleration sensor PS2 in order to check compliance with any delay limits. The software of the test system can record the max. reached speed, the average delay and the duration of delays greater than 2.5g. On the basis of these values, the expert can check whether the test has been passed.

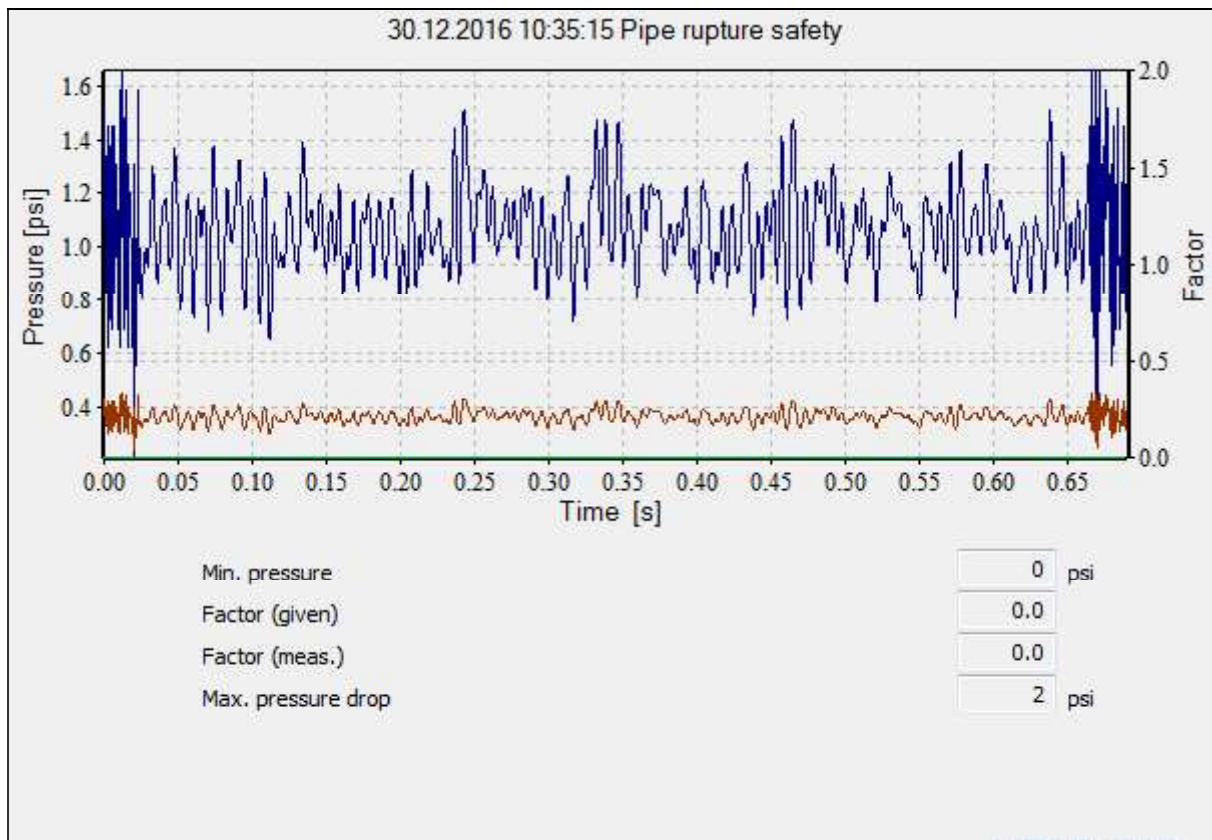


Abbildung 143: Ausgabe einer Beispielmessung zur Rohrbruchsicherung

5.9.3.9 Measuring the system pressure resistance

This check is defined for tests prior to the commissioning in the standard. For commissioning, the car loaded with the rated load is travelled to the top landing. Afterwards, it is to be tested that, within 10min, the car does not descend by more than 10mm. After commissioning, the test result is manually transferred by the expert into the protocol.

In order to check the system pressure resistance by repeated inspections without rated load, immediately after the test for effectiveness of the re-levelling the car is left standing with at least that pressure which is reached at rated load in the piston stop area for minimum 10min, while the pressure measurement with the hydraulic sensor HS1 is continued.

At the end of the 10min the pressure measurement is finished, and the pressure drop within the 10min is determined by the expert from the pressure pattern. In addition, the expert determines by how many millimetres the car has lowered within the 10min. From these two results the expert decides on the test result of the system pressure resistance. This check at the time of commissioning must be carried out as described in the standard, by verifying that "the car loaded with rated load standing in the top landing does not sink by more than 10 mm in 10 minutes"

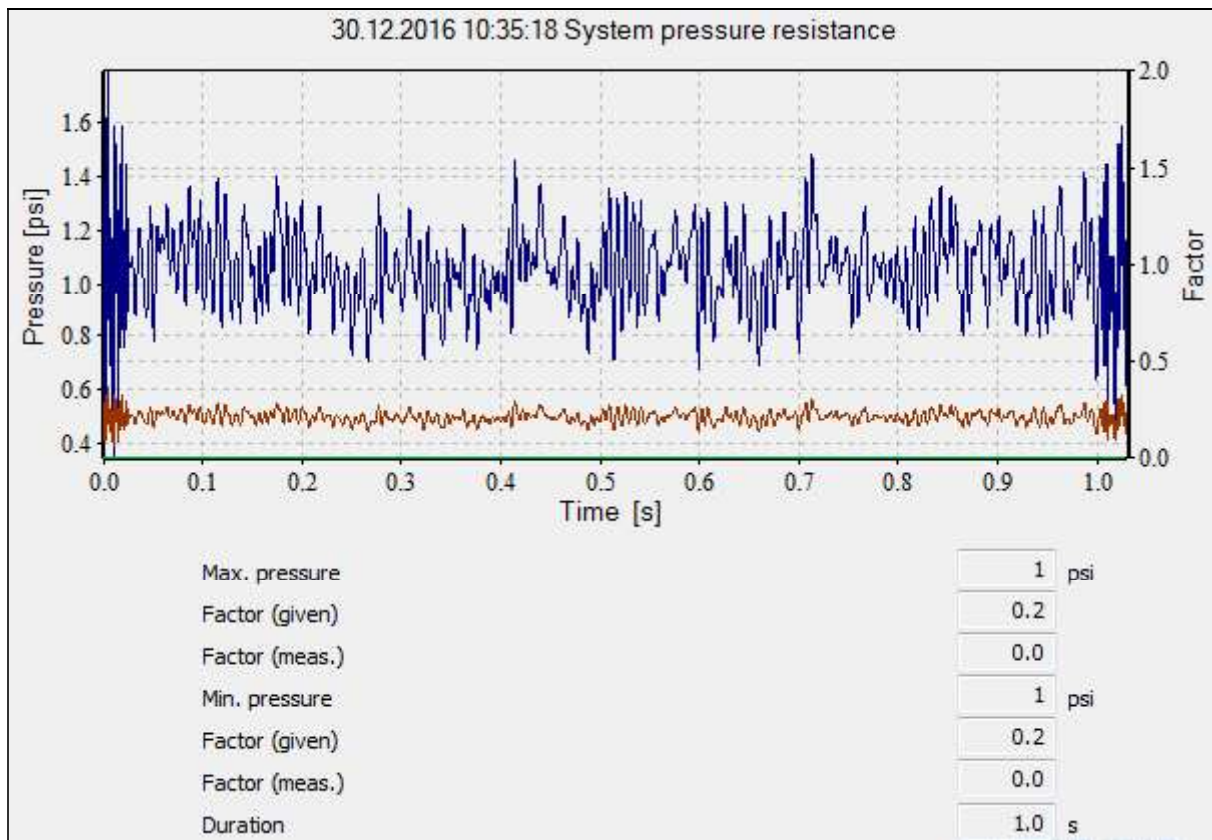


Abbildung 144: Ausgabe einer Beispielmessung zur Druckfestigkeit

5.9.3.10 Measurement of the static pressure at payload

In order to calculate the static pressure at rated load, when rated load is not available, the analytic algorithms should have data about the static pressure of the elevator at no load.

For this purpose, the expert conducts the full run of the elevator, arriving at each stopping point once during the up run and once during the down run.

Later a time benchmark (time index) is required to be set for this graph. The pressure present at this point of time will be acquired by the evaluation algorithms as static pressure at no load without **any further validation checks**.

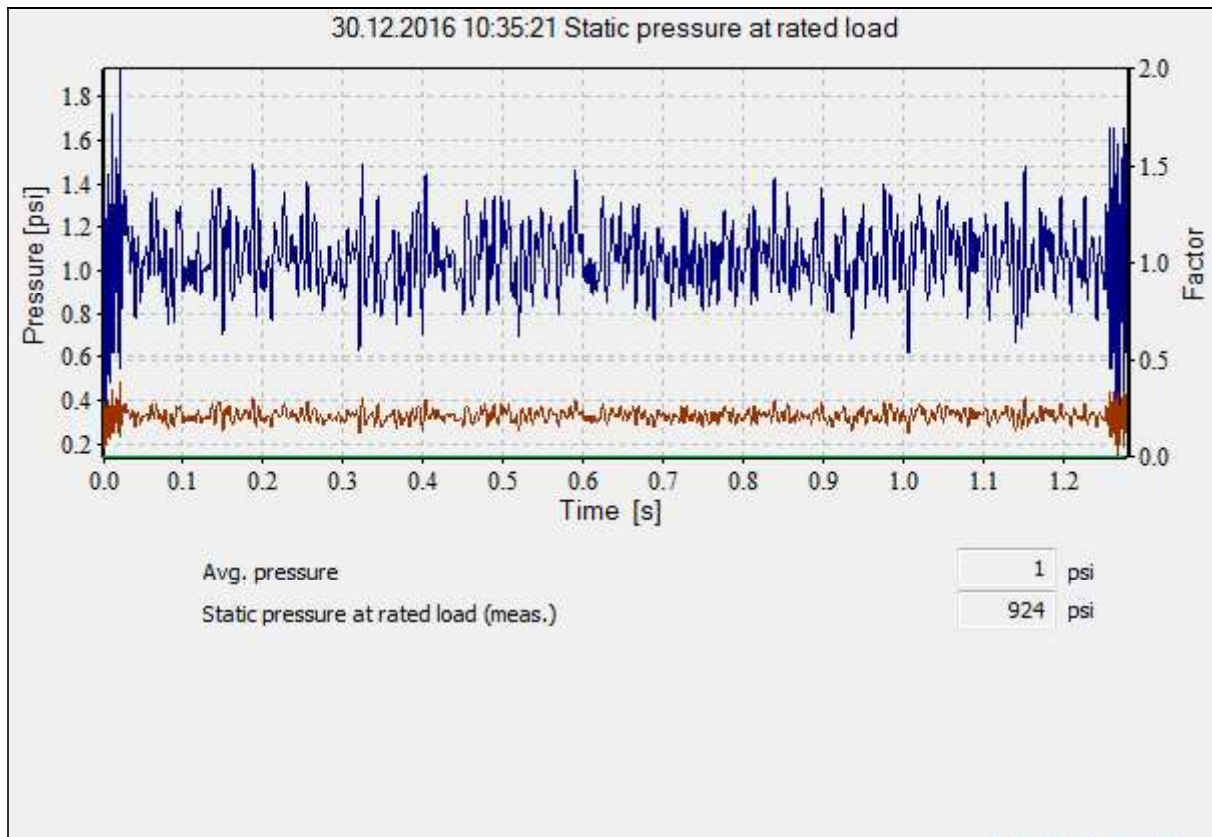


Abbildung 145: Ausgabe einer Beispielmessung zum statischen Druck bei Nennlast

5.9.4 Creating the Report

Each individual test may be marked with a check mar in the list. Marked test will be printed out in the report when the button „Print” is pressed.

The report consists of a cover page, showing the technical data of the installation as well as information regarding the examination. The following pages show the individual test with the evaluation results. The results are displayed exactly like in the software interface and include the curve display.