The current features of ADIASYSTEM for inspecting elevators

Dipl.-Ing. Alfons Petry

In the year 1990, statutory inspections of elevators in Germany underwent fundamental changes. The independent third-party inspection company TÜV in Munich, at that time, developed a method specifically for inspecting elevators, the so-called ADIASYSTEM (advanced diagnosis system for elevators). ADIASYSTEM is an expert system software program, installed on a customary notebook PC and is used together with particular electronic transducers at the standard-interfaces of the PC to work as an intelligent measuring tool. The complete hardware is put together in an equipment kit of about 8 kg weight. The method is protected through a couple of patents and registered designs.

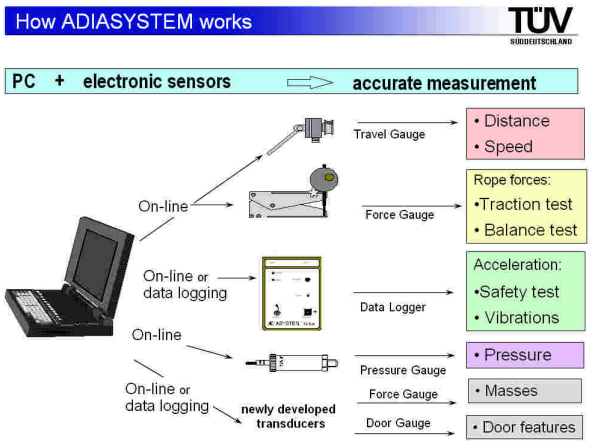

Figure: How ADIASYSTEM works

At the beginning, the objective of ADIASYSTEM was to provide a modern PC-driven alternative solution instead of the periodic load testing of elevators. The regular inspection of the behaviour of an elevator under (over-) load condition is most important to evaluate the safety of the elevator under extreme conditions. Loading the elevator car with up to 150% of its rated load on the one hand is troublesome and costly, and on the other hand delivers only simple yes-or-no statements. Instead of the prescribed load tests, ADIASYSTEM goes ahead with precise and quantitative measurement. The findings gained can be easily compared with the required values specified in codes and standards. System-inherent safety reserves that could not be determined so far, now can be measured with ADIASYSTEM, and thus give additional important information to the expert. The software converts the findings into figures as well as in diagrams, and stores all information on the hard disk. The results of repeated measurements can be easily compared with former ones.

The "classical" ADIASYSTEM test procedures conducted with an empty elevator car instead of a load test mainly consist of the verification of the correct setting of the progressive safety gear (safety test), the measurement of the traction and the re-levelling test at hydraulic elevators. These procedures were already described in former publications in detail, so here only the respective basic ideas will be repeated.

The safety test has to give evidence that the safeties stop an elevator car with rated load within the permissible range of deceleration. With the ADIASYSTEM method, a data logger measures the actual deceleration of the empty car, and the expert system calculates the deceleration for the rated load condition. Only for that very condition the codes and standards stipulate specific requirements. The technical behaviour of a progressive safety gears makes sure that the deceleration forces are largely independently from load and speed. In a test with ADIASYSTEM the elevator is exposed to less stress, due to much less kinetic energy compared with a full load safety test.

As already mentioned, the ADIASYSTEM measurement determines the deceleration of the empty car. However, the experience shows that in many cases retardation values are quite high if a safety gear is activated with an empty car. If the elevator is carrying just one or only few passengers, this stop can become very dangerous. For the time being no requirement for an emergency stop has been specified in the codes. To improve the safety it would make sense to limit the maximum retardation for the empty car too; the ADIASYSTEM is recording that aspect for many years.

Article was published in the Lift Report, issue June 2003

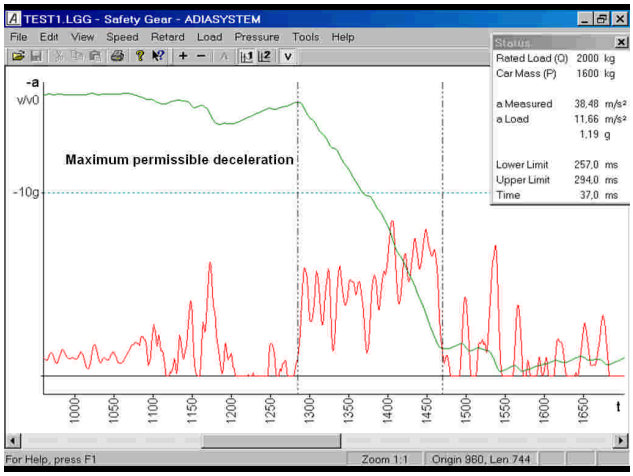

Figure: Safety diagram

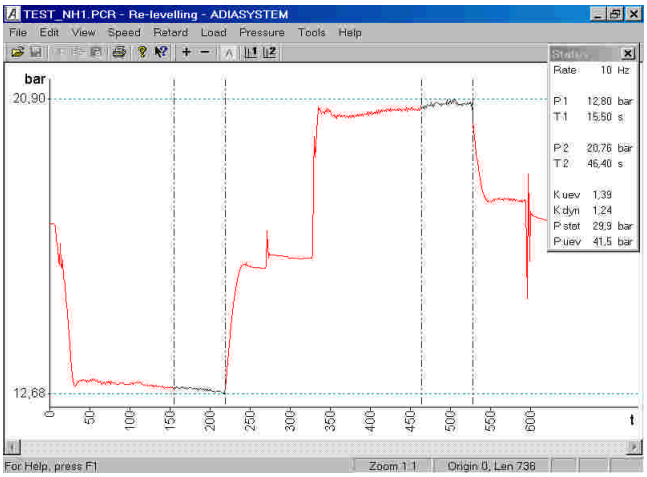

Figure: Diagram re-levelling test

The determination of the traction using the ADIASYSTEM method consists of the measurement if whether the adhesive friction between rope and traction sheave is sufficient to prevent slippage. The relevant codes specify that no slippage must occur with 125% rated load in the car (European Standard EN 81; ASME A17), respectively 150% (in accordance with TRA, German Elevator Code). The conclusions from a conventional load test are only the two alternative statements "car comes to a halt" or “car slips down”. ADIASYSTEM however can measure the amount of load in the car that would exceed the coefficient of friction between ropes and traction sheave and thus causes a dangerous condition. Usually, insufficient traction is to be determined only with a small percentage of elevators; however, it is a quite serious violation. As a matter of fact, current elevator drives are no longer oversized as in the past, therefore a traction measurement will become more important in future.

At hydraulic elevators, traditionally the car is tested in the landings whether the drive is capable to re-level the car with rated load. Again, ADIASYSTEM produces that proof with an empty car, an advantage particular for heavy-duty freight elevators. An electronic gauge is used to record the pressure-time-behaviour of a cycle moving down an up, and the expert system of the ADIASYSTEM software calculates both the hydraulic losses and the efficiency, and makes the statement whether the elevator is capable to re-level with rated load.

For more than 10 years, ADIASYSTEM is the state-of-the-art of testing elevators in Germany. The method fits for elevators of any design and manufacturer, as well as for any speed and rated load. Particular accessory parts are available for the latest machine room less elevators of different manufacturers.

In the last years, a fundamental re-design of the ADIASYSTEM software took place in order to catch-up with the new possibilities of today’s PCs. Real-time measurements originally designed for a DOS environment, had to be converted to a WINDOWS solution, and a new microprocessor-controlled adapter had to be developed for that purpose. Thereby, all previous transducers can still be used under WINDOWS, using RS232 or USB ports. In the near future, transducers will be re-designed to meet the latest technology , having a direct USB connection.

Since the very beginning, new evaluation functions have been supplemented to the ADIASYSTEM again and again. While the original first features concentrated on safety aspects of the elevator, additional diagnostic tools were integrated into the software in the course of time, which did not only cover the safety but also aspects such as quality, availability, travel comfort, etc. These new software features triggered new fields of application. So, ADIASYSTEM is longer just an inspection method applicable to statutory periodic inspections of elevators. Today, it is also a very powerful tool for any kind of measurement and documentation, for acceptance testing of new elevators or for

type approval of elevators and safety parts, for the examinations of escalators and moving walks as well as for expert opinions on any installation of vertical transportation.

The latest ADIASYSTEM software update has been supplemented by extensive digital filter functions. Moreover, a compound view of more than just one diagram can be displayed on the screen simultaneously. The professional user has a choice of several pre-defined filters, or he can define a wide range of own complex filter functions. The following figure gives an example of such a compound view.

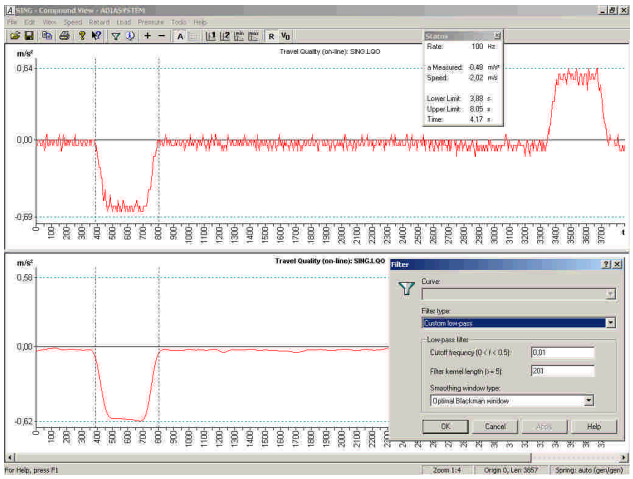

Figure: Compound view / digital filter

The following examples are typical ADIASYS-TEM diagnostic tools.

The data lo gger that is used for the safety test can be also used for the measurement of any accelerations or deceleration in a range of +/- 10 g, using a 12 bit-full-scale-resolution and with an option of different sampling rates. The configuration of various parameters, necessary for the respective measurement, including defined trigger conditions , can be easily adapted per software via the connected PC. As the data logger allows very high sampling rates (up to 5,000 Hz) this device can provide the recording and evaluation of fast processes with high precision. Typical applications include the recording of emergency stops and ride comfort measurements.

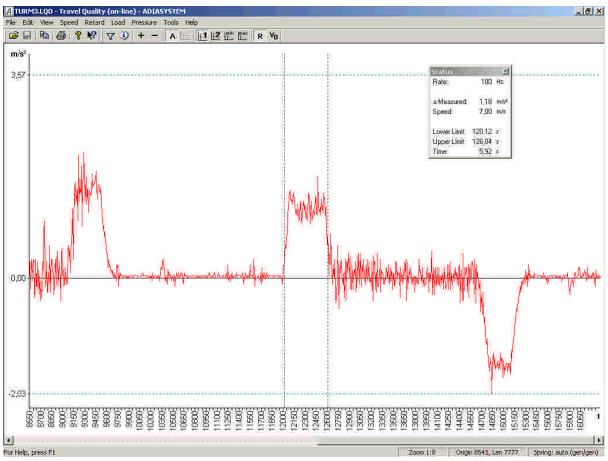

Figure: Ride comfort measurement

ADIASYSTEM's graphic representation of measuring results in a diagram always takes place with the same method. As soon as two movable cursors are set by the user, all relevant results of this measurement are displayed in a status window. The representation of any diagram can be adjusted in many ways to the respective needs by scrolling, compressing and expanding. Hence, ADIASYSTEM provides an excellent procedure to generate the documentation of any measurement made.

The pressure-time diagram of a hydraulic elevator is another example that clarifies, that often only the visualization of a diagram permits a conclusion or identifies a faulty function of the elevator. The results of repeated measurements prove the high reproducibility of the method. So, any diagram corresponds to a fingerprint of the respective situation.

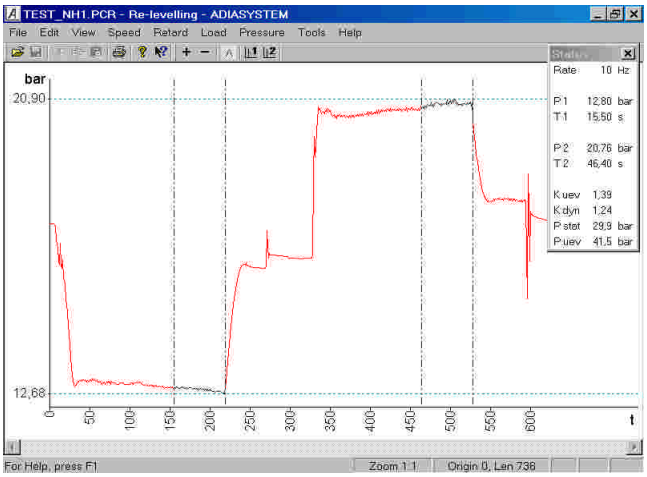

Figure: Pressure-time diagram

Any experienced user can straight away recognize the unusual pressure peaks on the picture above, which are caused by a too narrow distance between both guide rails. He therefore can decide on suitable counter-measures. Without conducting a measure - ment, such defects often remain undetected, leading to a higher wear and to a failure sooner or later. It is obvious that in this case the determined cause does not generate an immediate safety risk. However, on longer terms this effect will cause damage. An up-to-date, modern inspection method like the ADIASYSTEM can help to identify a wi de range of non-conformities.

ADIASYSTEM offers various graphic representations and effective possibilities to evaluate a measurement especially when made with the distance / speed gauge. After recording the measurement all distance, speed and acceleration values are simultane-ously available on the screen and displayed as a function of time. In addition to the measuring values further information can be recorded simultaneously, such as electric trigger signals as well as manual markings through keystrokes of the user. Herewith, costly recordings of reactions on electric control impulses, such as delay or respond times, can be completed and analyzed in a simple manner. The following two diagrams show as examples 1) how simple it is to check the tripping speed of an over-speed governor; and 2) how to evaluate a recording for the time period between the last manual marking and the first electric trigger signal.

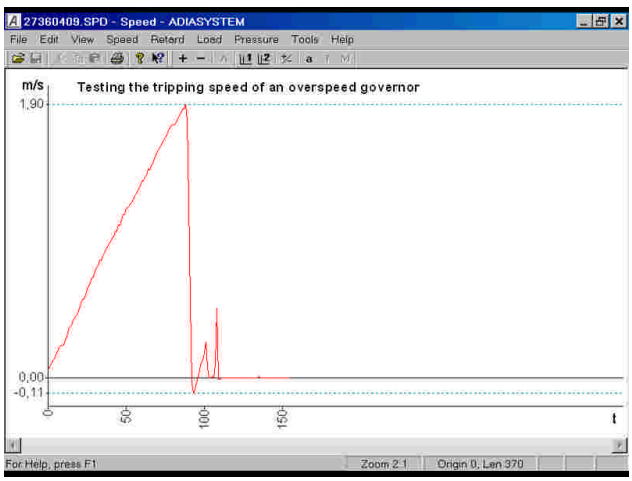

Figure: Speed diagram 1

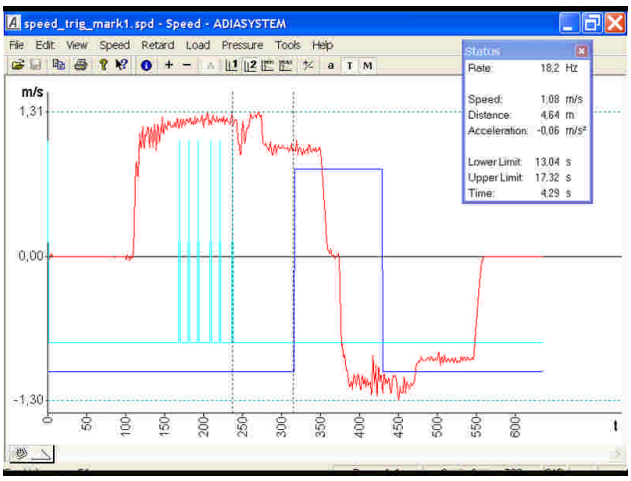

Figure: Speed diagram 2

At present, ADIASYSTEM's scope of applica-tion is supplemented and the hardware is complemented with two newly developed transducers.

The first new device is an electronic load cell for safety relevant measurements on power operated doors in compliance with DIN EN 12445. The measuring range is of up to 2,000 N, and the features of that device meet all specifications of this standard.

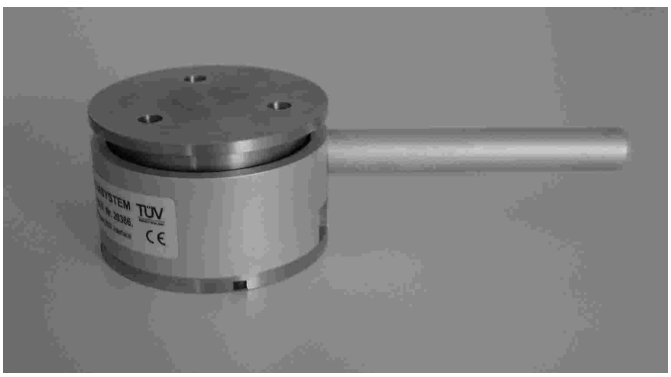

Figure: New door gauge

As this transducer has a dual purpose, the second function can be used for measuring masses up to 4,000 kg. It is suitable tool (for example with the use of a traction sheave clamp) to determine the masses of the elevator car and the counterweight with high precision. This feature will significantly improve the accuracy of the already existing ADIASYSTEM feature "balance test".

The second newly developed transducer can electronically measure and record all essential physical characteristics of elevator doors: the kinetic energy, the hitting speed

and the maximum and the permanent closing force.

Both new transducers are to be connected to the same "intelligent" handle, designed alternatively for both on-line- and off-line-measurements. The handle contains an own microprocessor and presents the results directly after the measurement on a built-in display. All off-line-values remain in a non-volatile memory ; they can be transmitted to the PC later, in order to draw up the documentation, evaluate the diagrams or to file the records.

All intelligent transducers have their own electronic data sheet, to enable an automatic recognition of the plugged sensor. The data sheet saves the individual serial number, date and results of the last calibration, and further information if necessary. As soon as the sensor is connected up, the ADIASYSTEM software is automatically reading the information of the data sheet; the transducer is being identified and has to pass plausibility and validity tests. In case the valid calibration date of the transducer has expired, the software will prevent a further usage of this sensor. This method guarantees that only calibrated transducers are used for measuring. Thus, ADIASYSTEM has a system-integrated control that verifies the status of all measuring devices, a strict demand of any quality assurance system. All transducers have been designed for a robust field operation. The entire technique has proven itself through long-time use very well. The precision of all transducers significantly exceeds the specified requirements of the applicable codes and standards.

Figure: ADIASYSTEM equipment kit

For years, professional experts rely on the essential information that they gain from using the ADIASYSTEM, becoming an indispensable aspect of contemporary evaluation of an elevator. In the future, the utilization of the results of the modern measurements as a part of the inspection service will become more important for owners and maintenance companies, too. The TÜV Süddeutschland is planning to add the essential ADIASYSTEM measuring results and diagrams to the test reports issued, and to give authorized users access to that kind of information in the elevator certificate data base, which is already available and accessible via the Internet.