

Up to date steam locomotive maintenance: Valve setting with electronic steam engine indicator



Important: Optimal valve setting

The correct operation of the valve gear is prerequisite for economical and low-wear operation as well as the full performance of a steam engine. This applies equally to steam locomotives, marine steam engines, but also to stationary steam engines.

Incorrect valve setting mean:

- Poor running characteristic
- Up to 20% lower performance
- Significantly increased steam, fuel and water consumption
- Bad steaming
- Increased wheel slip tendency
- Worse start up behavior (countering)
- Overloading of engine components and thus lower bearing life and increased risk of hot box and failure
- Unnecessary stress on the structure (In extreme cases frame damage can be fostered)

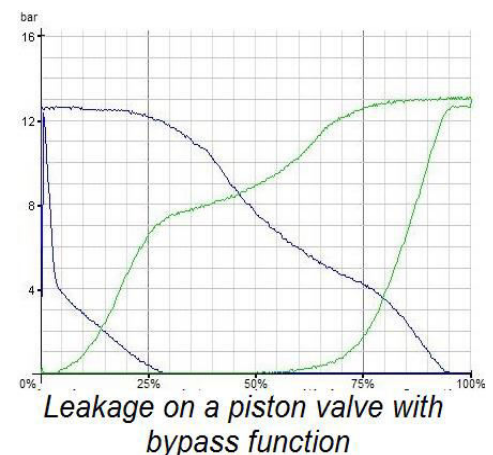
These points, in addition to inconvenience to the staff, are a source of avoidable and sometimes significant additional costs for operation and maintenance. Even in today's heritage or tourist operation, therefore, the proper working of the steam engine should be taken into account in the interests of the most careful and economical operation as well as the avoidance of engine damage.

Is the assumed complicated usage of an indicator necessary?

Yes. Because valve setting of the steam engine by using an indicator offers the most exact adjustment possibility.

Adjusting by the sound of the exhaust beats or measuring with a cold machine does not allow a checkup of the result, does not detect the temperature-induced length extensions and is therefore only conditionally suitable.

The indicator diagrams, on the other hand, provide a deep insight into the mechanical and thermodynamic processes in the cylinder.



Possible valve gear faults, leaks, valve damage as well as the correct dimensions of the clearance volumes can be reliably read from the diagrams.

That's why many railway departments required test runs with indicator after every extensive work on the motion, valve gear or the valves itself. In eastern Germany for example, this had been done consequently until the end of main line operation in the late 80s.

What was state of the art until now?

Some of the disadvantages of classical mechanical indicators are:

- Complicated and time-consuming adaptation work for different loco types - thereby very expensive
- Accurate adaption to the existing environmental conditions is necessary
- Susceptible to measurement errors
- Uncomfortable display and evaluation possibilities
- Strongly limited system performance

In other words, valve setting of steam engines by means of mechanical indicators has long been outdated. Thanks to the digital measurement technology available today, it is possible to create a system which overcomes the weak points of the known, old system and also provides further diverse possibilities.

Simple installation, quick and precise results

The application of up-to-date measuring and evaluation technology has created a system that is quick and easy to install, which does not require time-consuming loco-specific adaptation work and is immediately ready for use.

With this "plug and play" solution, the time required for installation on any two-cylinder machine is less than an hour.

Convenient evaluation, high accuracy, meaningful documentation

It was also possible to drastically reduce the effort required to record the indicator diagrams. By capturing and storing the measured data in real time, reasonable conclusions can be drawn about the quality of the steam distribution after only a few meters of test run.

If the small paper strips (which were still located on the writing drum immediately after a measurement) had to be measured, when a mechanical indicator is used, the evaluation software provides the possibility to immediately describe the pressure/stroke diagrams of the individual cylinder rooms immediately after a measurement on a laptop on the footplate.

The right decisions are made for a readjustment of the valve by special features and options in the graphics interface as well as by special computational operations. For example, the indicated work and the horsepower of each cylinder.

System Performance

- Piston stroke max. 1250 mm
- Pressure range -1 to 25 bar g (up to 40 bar possible on request)
- Low pressure cylinders with vacuum operation
- Suitable for saturated and super heated steam
- Practically unlimited number of measurements in a short time
- Suitable for locomotives, stationary as well as marine engines

Evaluation Parameter

- Creation of indicator diagrams / deviations between the cylinder rooms
- Accurately determining the real cut off and the remaining valve times
- Detection of maximum pressure
- Calculation of average pressure
- Calculation of indicated horsepower

