GE
Inspection Technologies

Wall Thickness Measurement Tool

Enhancing Rhythm® Review Capabilities

Applications

- Refineries, oil and gas, water, chemical plants

Efficient and accurate way to monitor corrosion conditions in on-stream applications and for flow accelerated corrosion

In refineries, chemical plants, and any operation where some kind of medium is progressing through pipes or tubes, it is extremely important that the reliability of the infrastructure is monitored accurately, without having to shut down the operation or removing the insulation around the pipes. In addition, the measurement needs to be fast and accurate.

In the past, this was done on film, resulting in difficult, unreliable, and subjective results, or was not done at all, leaving the decision to exchange pipes on rough estimations.

The wall thickness, manually measured on a film, took into account the visually detectable wall edges. These visually detectable wall edges however, are not the real wall edges, but the area on the image where the density of the image is varying the most. The assumed wall edge is thus an optical illusion, and the measurement is wrong. To overcome this problem, the practice of scratching away part of the emulsion on film was used, to come as close as possible to the visual real edge.

Oil and gas users with non-Rhythm software will have to manually estimate the OD and ID points by pointing and clicking. This leads to inaccurate and inconsistent measurements between different operators. Especially problematic in the digital world, image adjustments can dramatically affect the appearance of the OD.

The availability of digital images opens a world of opportunities to determine the condition of pipes and tubes by using extremely accurate software-controlled mathematical calculations. With GE's new algorithms in place, petrochemical plants can fine-tune and anticipate their pipe replacement process for optimum operation and cost efficiency. These algorithms help plants replace parts when and where necessary, and with reduced risk as more measurements can be done with the same effort. (Before, if tested at all, only the most critical parts were tested. Now secondary critical parts can be tested also, which were not considered in the past.)

The software uses any reference available in order to determine the wall thickness, either tangential by mathematical interpretation of a density line profile, or the penetrating thickness by calculating the material loss by comparison with a reference body. This reference may include the physical dimensions of the pipe, the distance of the radiation source to the detector, or any reference body for measurement calibration. For penetrating radiation measurement, the reference can be a wedge or the nominal thickness of the double wall of the pipe.

Rhythm

The heart of the system, the Rhythm® Enterprise Inspection Management software, includes the most advanced features for image acquisition, review and archival—fulfilling the needs of the industry. Rhythm also organizes communication between the wall thickness measurement module and external maintenance databases. There is no need to manually input physical pipe dimensions, as the data is communicated automatically from the plant database.

Results of the measurement are given back to the source database, together with the exact location of the measurement, in order to ensure that periodic testing of parts is always done at exactly the same position. A mobile ID station allows the testing crew to take all necessary data from the database along in a hand-held computer. It programs the cassette at the time of exposure, and gives the operators the chance to change critical data in the field (e.g. the source to detector distance that is measured only at the time of exposure).

Tangential Wall Thickness Measurement

Where traditional attempts to develop software for remaining wall thickness by line profile are reasonably accurate on very good quality images, the GE Inspection Technologies patented algorithm also uses a semi-tomography algorithm, which calculates the position of the inner and outer edge of a pipe by means of a computed tomographic simulation. This makes the determination of the position of inner and outer wall independent of the sharpness of the image, allowing crisp and accurate measurement also on thicker pipes, thicker walls, different type of medium and different radiation sources used.

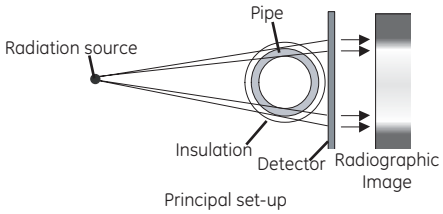
The Rhythm Wall Thickness Measurement Tool automatically detects exact ID and OD transitions using a highly accurate, proprietary algorithm that eliminates guesswork and inconsistencies between operators.

The Wall Thickness Measurement Tool also offers automated edge detection (when using a steel ball, steel ball wrapped in Pb or a "Ricky Tee") during calibration, allowing fast, easy and accurate adjustments for different blow factors.

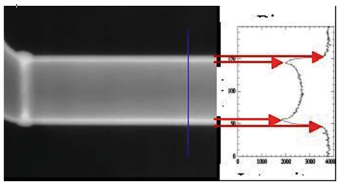
The Wall Thickness Measurement Tool provides dynamic updates of wall thickness measurement data as the sample line is repositioned at different points along the tangential wall.

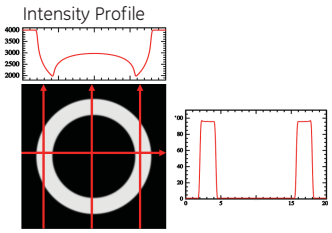
Wall Loss Measurement Using Penetrating Radiation

The penetrating wall thickness measurement takes an intensity reference in the image. This can either be a reference body near the location of the measurement, or can be the nominal thickness of the double pipe wall. If the absorption coefficient is known, only one reference point in the image is needed. If this parameter is not known, it is calculated by the software using a supplementary reference point in the image.

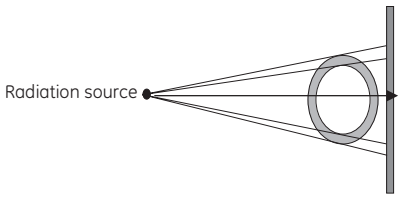


Principal set-up

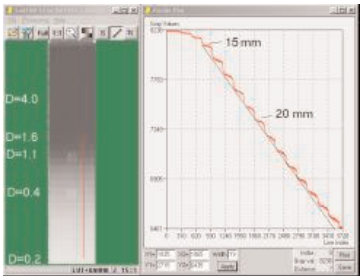

Traditional calculation of the wall thickness by using line profile



Computed Tomography simulation



Penetrating wall thickness measurement is dependent on the radiation intensity here



From the density reference, the corresponding wall thickness is calculated

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