



DGMK DEUTSCHE WISSENSCHAFTLICHE GESELLSCHAFT FÜR ERDÖL, ERDGAS UND KOHLE E.V.
DGМК German Society for Petroleum and Coal Science and Technology

DGMK-Projekt 496

Repair of inadmissible defects in tubes of mineral oil pipelines especially by use of shells

Abstract:

The tests and the results regarding the different methods to repair inadmissible defects in the tubes of oil pipelines described in literature are compared, the advantages and disadvantages evaluated and presented in a survey.

Concerning the shell systems:

- annular gap grouted in with concrete
- close fitting shell with thermal prestress

it could be verified that certain kinds of defects could be durably repaired

Length of report:	84 pages, 2 fig., 2 tab., 5 graph., 26 ref.
Duration of project:	1993-1994
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DGMK-Division:	Refining and Product Application
Published:	Hamburg, October 1994

Summary

This paper wants to compare various methods to repair inadmissible defects in the tubes of oil pipelines. These methods differ in their field-proving. The different repair systems with shells were examined particularly. It intends to present the tests and studies described by literature dealing with this subject and it wants to show the advantages and disadvantages of the individual method. Finally, this work wants to evaluate whether the methods are suitable for repair works carried out on pipelines transporting mineral oil.

The evaluation of the procedures described in literature showed that there is neither a standardized form of procedure nor equal testing criteria for comparing the various repair methods. The same applies to the kind and scope of inspections, tests and examinations carried out to assess defective spots that were repaired. Therefore, the results' validity differs strongly.

Based on possible defects, the different methods to repair a pipeline's outside were inspected and tested for their applicability and effectiveness. The possibilities for repairing a pipeline's inside were not examined in detail considering the high amount of effort involved and with regard to operational problems. A tabular survey presents the already well-known and well-tried procedures with regard to their advantages and disadvantages, their effectiveness, their testability and applicability to repair different types of defects.

The close inspection of the mode of operation and of changes within the pipe as well as the evaluation of the overall applicability showed that the repair methods using shells without welding at the pressure bearing pipelines' surface have the highest advantage as far as safety and operational availability are concerned.

The following shell systems were examined in detail:

- annular gap grouted in with concrete
- annular gap grouted in with artificial resin and
- close fitting shells with thermal prestress

The shell system "annular gap grouted in with artificial resin" showed major weak points caused by the artificial resin's low compressive strength and its tendency to creep which became evident in cycle tests and changing load and also due to the wide range of variations in its chemical composition. Moreover, in the evaluated literature the criteria which are necessary for long-term use have not been sufficiently examined so that a final assessment cannot yet be made.

The repair methods "shell, annular gap grouted in with concrete" applied to repair geometric form errors and the system "close fitting shell with thermal prestress" for repair defects which reduce the walls' thickness are thoroughly presented in this work. The evaluation of tests and inspections which have been carried out up to now and further theoretical consideration allowed to prove the following fact: In case of the material combinations used in this study, the described defects could be durably repaired without imposing any restrictions on operation. The measures to be observed when carrying out these two procedures were developed in check lists including the most important individual steps for the repair.