NEW TECHNOLOGICAL AND TECHNICAL DECISIONS IN DIAGNOSTICS OF STEEL GAS MAINS INSIDE INHABITED AND INDUSTRIAL BUILDINGS

G.Giller, I.Litvinov, L.Mogilner, B.Sokolinsky
Joint-Stock Company "Polytest", Moscow, Russia

Abstract: Under the standards accepted in Russia service life of internal gas supply systems is 30-40 years. In process of the expiration of this term gas mains should be surveyed for an estimation of their current technical condition and an opportunity of the further operation. With this purpose specialized methods NDT for internal gas mains are developed. The technique of the ultrasonic control of gas main inside the building construction is developed. This technique uses of Lamb-tipe waves. The technique of an estimation of an aggressive environmental influence on a gas main has received practical application. Due to use of ultrasonic probes "chorded" type, the problem of the welded joints ultrasonic testing of small diameters gas pipes is successfully solved.

As a result of studying the development damage's mechanism on internal gas mains, experts of "Polytest" create methodology of realization of technical diagnosing of this objects. It based on two stages - definition of the current technical condition of a gas main and an estimation of real conditions of one's operation.

The problem the gas main's technical diagnostics was solved due to the complex approach with use of means of the ultrasonic control and methods VIC.

Now there is a necessity for creation of the state standard for realization of technical diagnostics internal gas mains.

Introduction: Under the standards accepted in Russia service life of internal gas supply systems is 30-40 years. In process of the expiration of this term gas mains should be surveyed for an estimation of their current technical condition and an opportunity of the further operation. With this purpose specialized methods NDT for internal gas mains are developed.

On available statistics one damage fall at the average on 1000 meters internal gas mains. In these conditions the estimation shows, that cost of a complex of works on diagnostics of pipelines together with the subsequent repair approximately in 10 times will be lower than cost of its full replacement.

In present report experience of development and introduction a technique of the technical diagnostic internal gas mains, saved up in the period with 1996 on 2003г is generalized.

Results: Experience shows, that basic damaging factor internal gas mains is electrochemical corrosion of an external surface of the pipeline, arising owing to its humidifying or humidifying of a case in places of transition through building designs (a wall, inserted floor)**.** Thus corrosion speed of first of all depends on intensity of humidifying of its surface.

Regular humidifying of surface internal gas mains can occur because of the lining features. For example, cases, when a gas main in part insert in a wall of a refuse chute which periodically washed out hot water, or gas mains pass near a bath. However it - faster exception, and more often humidifying of a surface of a gas main occurs for the casual reasons connected to a negligence of people or malfunction of engineering networks.

As a limiting estimation it is necessary to count, that if as a result of corrosion damage thickness of a pipe's wall began less than 2 mm, such gas main site to maintain dangerously as it can not sustain possible mechanical influences. Considering, that nominal thickness of a wall of a gas main makes 2,5-4 mm, we shall receive, that under usual conditions of operation term for which thickness of a wall of a gas main can decrease up to inadmissible limits, lays in an interval of 10-30 years.

The mechanism of development of damages to places of transitions through building designs depends on a units transition design. As this mechanism is not described in details in the literature, we believe, that it would be useful to stop on it more in detail.

It is possible to allocate three basic such as units of transition through building designs (Fig. 1, Fig. 2, Fig. 3).

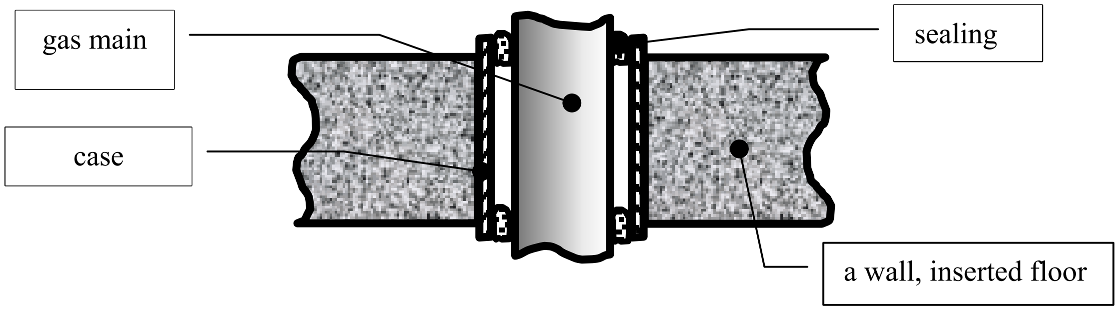


Fig. 1.
Unit of transition of a gas main through building designs Type 1.

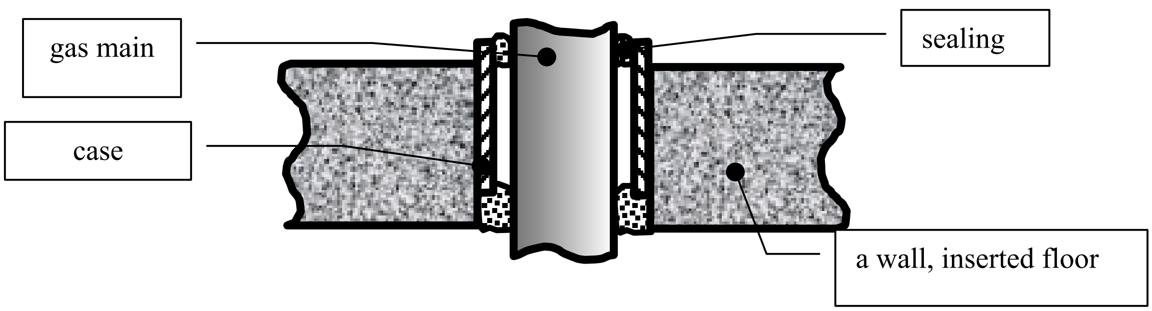


Fig. 2
Unit of transition of a gas main through building designs Type 2.

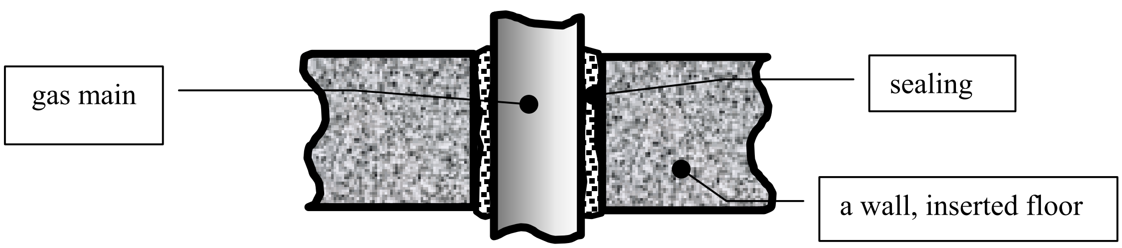


Fig. 3
Unit of transition of a gas main through building designs Type 3.

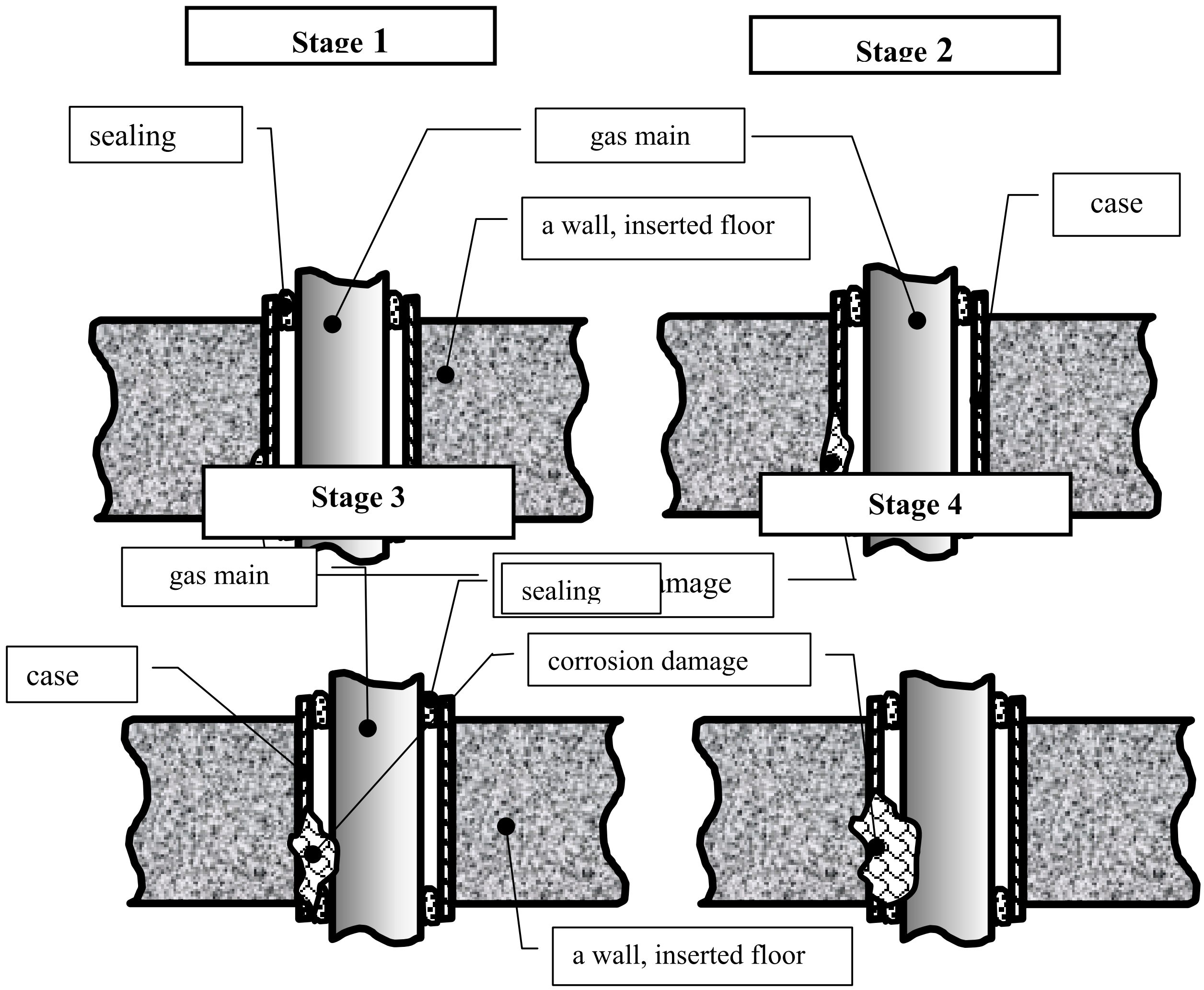
- Type 1: the case completely protects a gas pipe from contact to concrete.
- Type 2: the case in part protects the pipeline from contact to concrete.
- Type 3: the case is absent, the gas main directly contacts to concrete.

In all three cases process of corrosion begins with humidifying a building design (inserted floor overlapping) owing to outflow of a moisture or formation of a condensate.

For Type 1 corrosion develops as follows (Fig. 4):

At the first stage is exposed to corrosion a case before through damage (the Stage 1-2), further occurs filling of space by corrosion products between a case and a pipe (the Stage 3). The moisture gets directly on a surface of a gas main then the gas main starts is exposed to corrosion down to through damage. Thus there is a sintering products of corrosion from a gas main and its case (the Stage 4).

Further, and 3 process of corrosion is practically identical to transitions of types 2: is exposed to corrosion a surface of a gas pipe in a place of contact to concrete.



Stages of development of corrosion damage of a gas main taking place through building designs.

The greatest quantity of defects of gas mains in places of transitions through building designs which managed to be revealed during technical diagnostic, falls to the Stage 1 development of corrosion damages. At this stage corrosion damage looks, as a rule, as so-called "neck" (Fig. 5) which represents a ring deepening in a body of a pipe or its case, located in a place of contact to concrete on perimeter of the pipeline. Corrosion damage "neck" has rough edges, and on depth can change within the limits of 0.1-2 mm. "Neck" is located, on distance no more than 3 centimeter from a surface of a building design through which passes a gas main.

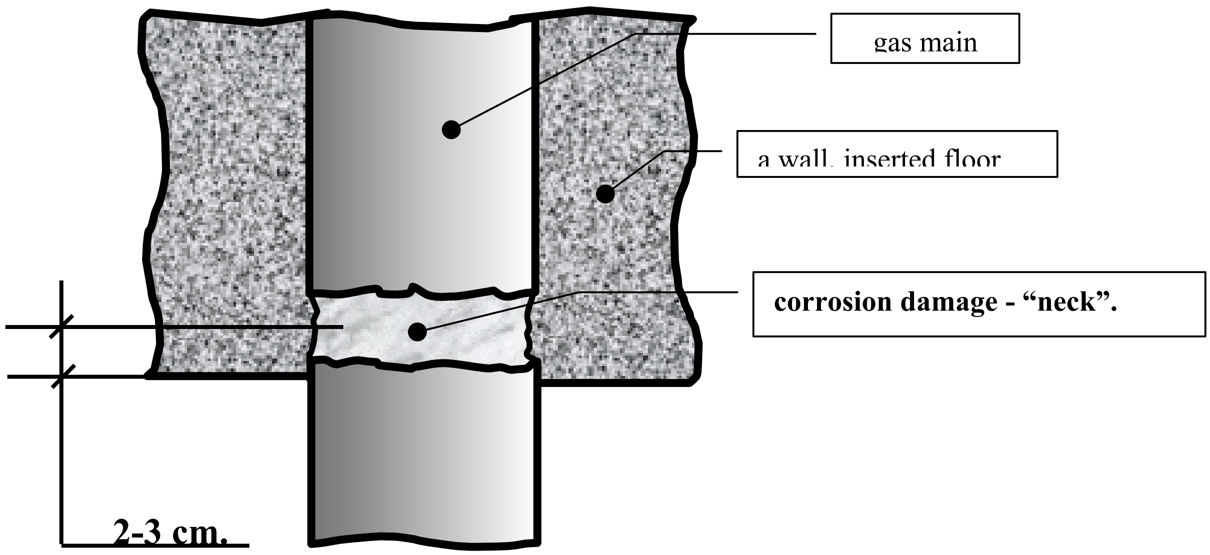


Fig. 5
Most frequently meeting corrosion damage of an internal gas main to a place of transition through a building design - “neck”.

Discussion: Actions for technical diagnostic internal gas mains should have complex character and take into account above mentioned parameters of defects and mechanisms of their occurrence.

As to pipeline transitions through building designs these sites are most difficult for diagnostic. It is necessary to apply a complex of methods to their inspection: ultrasonic detection, the visual - measuring control of opened sites of a gas main, an estimation of aggression of concrete.

During technical diagnostic internal gas mains the following kinds of works can be carried out.

1. Ultrasonic quality inspection of ring welded connections with help ultrasonic “chorded” type probes.
2. Ultrasonic quality inspection and an estimation of a technical condition of sites of the gas main which is taking place through building designs. For realization of the given kind of works specialized ultrasonic probes and a technique of the control with use of "normal" waves are developed.
3. Flow detection allows to reveal:
   - Leak from carving connections;
   - Leak from cocks;
   - Leak from welded connections and other sites of pipelines..
4. Definition is intense the deformed condition of a gas main can be carried out as visually, and by means of various instrument methods.
5. Visually measuring control will be carried out by a special technique of diagnostics of sites of the gas main which is taking place through building designs. For visually measuring control the specialized data cards and system of the coding are developed.
6. Ultrasonic thickness measurements will be carried out, as a rule, with use of small-sized probes on frequency 10 MHz.
7. Definition of corrosion activity of concrete.
   - The quantity of chlorides is determined by means of chemical indicators.
   - A liquid phase alkalinity of concrete it is determined by means of chemical indicators.
   - The superficial potential of a gas main or its case is determined with the help of a special technique. For realization of measurements it is used copper-sulfate an electrode of comparison and specialized voltmeter. The size of superficial potential is influenced with such factors, as humidity of concrete and a chemical compound of a liquid phase of concrete. The size of superficial potential actually characterizes intensity of course of process of corrosion at the moment of realization of measurements.
   - Humidity of concrete is determined by means of hydrometers. Depth of definition of humidity can reach 10 sm. To exclude influence of metal armature, apply in addition measuring instruments of superficial hydrometers .

8. A visual estimation of a degree of potential danger depending on a place of position of a gas main and design features of its lining. Thus it is estimated:

- A degree of potential danger depending on a site of a gas main (presence of leakings marks, an opportunity of mechanical damages, remoteness of potential moisture sources).
- A degree of danger of sources of the moisture located near to a gas main. Sources of a moisture can be "open" and "closed". From "open" sources of a moisture (a bowl, a bath, souls, a refuse chute) water directly can get on a gas main or humidify inserted floor. That water has got on a gas main from the "closed" sources of a moisture, their tightness should be broken. Open sources of a moisture are most dangerous.
- presence and a site of cases. (Fig. 1,2,3)

Conclusions: The listed above methods now are well enough fulfilled and take root into practice of technical diagnostic internal gas mains.

Now our organization conducts improvement of a complex technique of technical diagnostic internal gas mains, as there is a necessity for creation of the state standard for realization of technical diagnostics internal gas mains.