



## RESULTS OBTAINED IN THE DALKIA OTOPENI PROJECT

Objective: Interconnection of heating stations and rehabilitation (repairs) of heating networks.

SACET ORAS OTOPENI 19 August- 25 October 2013

- I. Interconnection of heating stations, achieved with flexible pre-insulated Polybutylene (PB) pipes of 225; 160 mm OD – sticks of 11,8 m and 110 mm OD coils of 50 m.
- II. Repairs of heating networks, achieved with flexible pre-insulated Polybutylene (PB) pipes of 110; 90; 75; 50 and 40 mm OD coils from 50 to 200 m.

### Notes:

a. For the welding of 225; 160 and 110 mm pipes in the interconnection, the HEAD to HEAD Polyfusion welding procedure has been used. For this purpose, the welding equipment of AVIPROD Pitesti (general entrepreneur ACVATOT Bucharest), conducting the installation works, has been used. The devices had been calibrated for PB welding characteristics: 255 Celsius degrees respecting the welding protocol and instructions of Thermaflex.

b. For the repairs, for the welding of pipes from 110 to 40 mm the electro-fusion procedure has been used with the help of tools and devices provided by Thermaflex.

c. Thermaflex had ensured the training of ACVATOT/AVIPROD welders as well as constant technical assistance of installations along the entire duration of the works and provided necessary tool kits along with the electro-fusion welding equipment. The cost of the assistance having been included in the cost of provided materials.

### A. TECHNICAL RESULTS

Due to ACVATOT and AVIPROD specialists and workers experience in welding/ maneuvering/installing of POLIETHYLENE (PE) flexible pipes for water, sewage and methane gas applications, the following have been achieved:



1. Welding of flexible sticks of 11,8 m outside of trenches, in sections of 3 up to 5 sticks /per line including elbows on each branch up-flow/down-flow. These flexible 30 up to 70 m sections have then been rapidly placed into the curvy trenches without the need of installing direction changing fittings, leading to a reduction of 75% in installation time compared to pre-insulated steel pipe solutions.



2. The elasticity of the pre-insulated PB pipes also permitted the evasion of trees, manholes and other obstacles (which greatly reduced the impact on green spaces). They have also permitted the passing of 30 up to 70m sections under other networks: methane gas, drinkable water; sewage; electricity cables; telecommunication cables etc, through their curving and sliding on a 10 cm sand layer.

3. Sections of trenches have been greatly shortened by choosing the shortest path between interconnection points and also due to the lack of elongation loops which are unnecessary for PB pipes. Maneuvering of 11,8 m sticks and coils of pre-insulated pipes is considerably easier due to their reduced weight and flexibility, greatly reducing the requirement for mechanical means and manpower in maneuvering.

4. Priory built concrete ducts have been used without opening them by sliding pre-insulated PB pipes through easily. This permitted welding in optimal conditions outside of trenches and concrete ducts and the installation of the network overpassing important roads without breaking the road or even disturbing traffic. For this procedure, only the concrete plates covering the start and ending of concrete ducts have been temporarily removed.

5. Due to the elasticity of PB pipes, the passing of the main access road of Otopeni has been made possible through the prior concrete duct in spite of extremely restrictive spaces due to the presence of buildings only 6-10 m away from the duct entrance. This optimally reduced both installation time and impact on the well-being of Otopeni citizens.



6. It was also possible to avoid affecting some alleys, streets, parking spaces and green spaces through the use of the old concrete ducts created in the 80's for the transportation of geothermal water, through which 70m sections have been slid through a very narrow space. The sections slid on a concrete tile base of the ducts that had a width of merely 60 cm, the two sections of pre-insulated pipes both having an external diameter of 250 mm, totaling 50cm.

7. The total volume of trench digging has been greatly reduced due to the lower necessary width of trenches. A 80cm cup backhoe has been used for the pre-insulated pipes with a 315 and 250 mm diameter and a 50cm cup for smaller diameters. Unlike pre-insulated steel solutions there was no need to dig extra holes for welding and positioning procedures.





8. During rainy days pipe sections and fittings have been welded in enclosed spaces, avoiding downtime and respecting the time limit agreed upon by Dalkia and the town-hall of Otopeni City.

9. Initially, during the first 2 weeks, pressure tests of uncovered pipe sections have been effectuated at 4,5 bar with air. Upon repeatedly confirming the reliability of the welder's work in order to speed up the installation and finalization of works it was convened to resort only to final tests of the covered network. This allowed fast covering and reconstruction of green spaces; streets; alleys etc. affected by the trenches.

Only the final tests have been effectuated afterwards, with water at 8 bar for 2hrs after having been maintained for 24 hrs at a 4,5 bar pressure. The pressure gauges have not registered any deviation in all this time. Incidentally, on one interconnection on an up-flow PB pipe, a pressure gauge was defective and the pump filled the pipe with a pressure of over 20 bar (way over the admissible 16 bar at a 20 degree temperature). This pressure had afterwards been reduced over the next 5 minutes to 10 bar and afterwards to 8 bar where it remained for the following 2 hrs. Likewise, no pressure loss had been observed.



## **B. ENVIRONMENTAL AND CITIZEN WELL-BEING RESULTS**

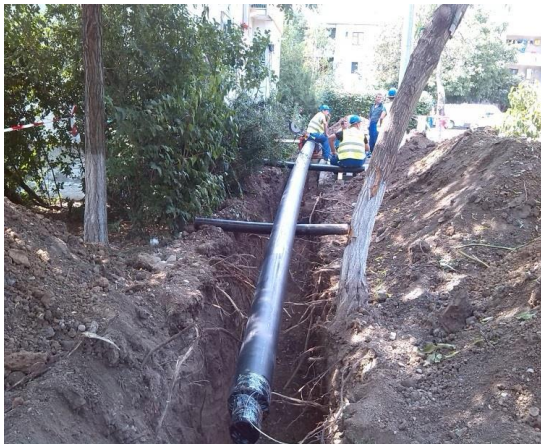
1. Mandatory breaking of some streets and alleys have been made on the days of installations and they have been covered and re-enabled in the same day! Otherwise they have been temporarily covered with steel plates that permitted circulation over the weekend or over the night. In general, after executing trenches on a street, the installation of pre-insulated pipes had been achieved 1 to 2 hrs afterwards.

2. Long and curvy trenches through green spaces and other zones uncirculated by citizens or automobiles have been effectuated gradually and have also been covered later in the same day after the placing sections of the pre-insulated PB pipes without minimal affecting of



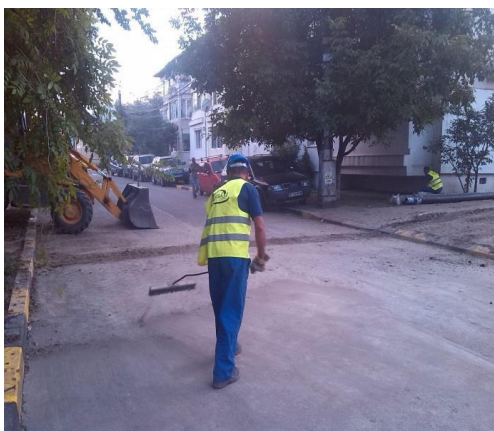
flowers, bushes or trees. Greatly reducing costs for the reconstruction of green spaces.

3. The Town Hall of Otopeni had been constantly consulted in establishing the optimal path of the trenches to avoid affecting trees, bushes or floral zones through the creation of detours and curves of the trenches without needing supplementary materials (fittings, insulation kits). In the same way manholes and vital points of other networks have been avoided.



4. The speed of installation of the pre- insulated PB pipes, 3 to 4 times faster than classical systems, greatly reduced the discomfort and the impact on the well-being of Otopeni citizens by greatly reducing time spent on works in traffic zones and zones of access to living spaces (areas of exposure to risks and discomfort), from a few hours to 1 or 2 days with the exception of weekends.

5. The digging works have resulted in a reduced volume of rubble and debris which permitted it's quick disposal and avoidance of it spreading on streets and walking alleys. This lead to avoiding citizen discomfort in the case of rainy days when mud or filth may have formed in these areas.





6. To avoid disturbing citizens with the noise pollution of heavy machinery such as hoebucks and trucks, works have been limited to the 8-13 and 16-20 time frames. Despite these limitations the speed of executions had not been noticeably affected.

7. Furthermore, on the request of the Otopeni town hall, works have been temporarily stopped to avoid disturbance to two major events: opening of the school year 2013-2014 in Ioan Petrus High School and the Folk Music and Dance Festival. The trenches had been covered hastily, roads and access zones have been cleared, only some small holes have been covered with steel plates. Works have then proceeded after the ending of these events.

8. Automobile traffic had not been detoured or interrupted at any point during the execution of works near streets, with the exceptions of short stops to maneuver hoebucks assisting the removal of dirt, the placing of steel plates and the introduction of the flexible pipes, still permitting circulation on at least one lane.



### C. ECONOMIC AND FINANCIAL RESULTS

1. Due to the increase speed of installation (around 3-4 times faster than the classic system); the reduction of fuel usage for heavy machinery; polifusion head to head welding or electro-fusion methods; reduction of necessary manpower and elimination of consumables unnecessary in the welding of PB pipes the total cost of INSTALLATION has been reduced to 25% compared to the classical installation costs of steel pre-insulated pipes.

2. Additional supplementary unforeseen costs have been avoided ( fittings/ insulation kits/ supplementary pipe length) as obstacles have been avoided by taking advantage of the flexibility of PB pipes and simply placing them in curvy trenches.

3. Elongation loops are unnecessary for PB pipes installations, as such supplementary costs that would have been necessary for classical solutions have been avoided.



4. Costs for civil works execution (digging, filling, reconstruction of alleys and streets) have been reduced by around 40% compared to the classic steel based system. In comparison, the required width and depth of trenches dug is smaller and extra holes for positioning and welding were not necessary for PB pipes.

5. Conveniently, the use of PB pipes permitted the changing of initial paths planned in the documentation with minimal costs, by using existing delivered materials! Supplementary materials were required solely for length extensions or growing the number of branches unforeseen in previous planning.

6. Thermaflex solutions proved to be flexible not only regarding the elasticity of the pre-insulated PB pipes but also more importantly regarding their quick and inexpensive adaptability to real on-field connection situations that greatly differ from the foreseen project plan. These solutions permitted greatly reducing supplementary costs with materials, installation and civil works costs, when facing unforeseen circumstances.

7. The total investment cost (taking into consideration materials, installation and civil works costs) has been reduced by approx. 35-40% compared to the estimated total cost if the project would have been realized with a classical pre-insulated steel solution.

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