

## THERMOPLASTIC BOX - AN ALTERNATIVE FOR INSTALLING SUCTION SYSTEMS IN THE WATER DISTRIBUTION NETWORK

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**Abstract:** In managing water operations, controlling pressure in water distribution pipes is essential to prevent leaks and minimize water losses. The use of suction valves in primary networks is essential to unload the air flow, avoid negative pressures and collapse in the pipes. Normally, the net suction cups are installed in large boxes, built with concrete or masonry staves, which entails high costs, specialized labor and longer execution time. In this work, an alternative way of installing suction cups in distribution networks will be presented using thermoplastic boxes on public sidewalks, idealized by the engineering and operation team of the UGR (Regional Management Unit). The use of these boxes in sanitation is common and has been intensified due to the resistance of the material, practicality in execution and low cost. It will be demonstrated how the points of installation, assembly and installation of the boxes were chosen and how the suction cups installed improved the water supply of the customers located in their surroundings.

**Keywords:** Suction cup, loss management, thermoplastic case.

## INTRODUCTION

The UGR (Regional Management Unit) is always looking for innovative technologies and working methods to improve the management of water operations and promote a quality service for the population in the area where it operates. The UGR engineering and operation team idealized the assembly of the suction cup installation using thermoplastic boxes. The use of these boxes in sanitation is usual, mainly for installations of residential water meters, making the measurement of consumption safer, avoiding irregular handling and facilitating the monthly reading of technicians in the field. The type of material used in the manufacture of these boxes is polypropylene, a very resistant plastic and,

thinking about these characteristics, a way of using it in the installation of suction valves on public sidewalks was devised,

The suction cups that will be presented in this work have lower air flows, but it will be demonstrated that their installation in HDPE branches, connected to a primary distribution network, is an immediate, efficient, and low cost solution to the problems presented of low pressures of water in places with high elevations, in a supply sector.

In this work, it will be presented how the idea was conceived, as well as the stages of assembly of the sets of boxes with suction cups, and also the results of the pressures obtained in the field and the improvements in the supply after this action.

## OBJECTIVE

The objective of this work is to demonstrate the use of a prefabricated thermoplastic box on a public sidewalk, for the installation of suction cups in water distribution networks, showing constructive agility, reduction of installation costs, improvement in service time and regularization of water supply. water in areas with high elevations and low pressures, coming from air pockets in the water networks.

## METHODOLOGY

The idea for using thermoplastic boxes to install suction cups in distribution networks came up with the engineering and operation team of the UGR, after the need for prompt supply assistance, arising from some complaints of low water pressure and high consumption bills. in properties located in areas of high elevations. After engineering studies, it was confirmed that in the primary networks (larger diameters) that supplied these properties, there were few or no air purge devices (suction cups), which would help to expel the air pockets that form at high points

in the networks. of distribution, according to the mode of operation of the employed water system.

The conventional installation of suction cups is usually carried out in the primary networks and in boxes built in masonry with structural blocks or prefabricated concrete staves, as shown in figure 01. The installation of these boxes demands engineering projects and high construction and labor costs. work, in addition to the need to close public roads during construction.

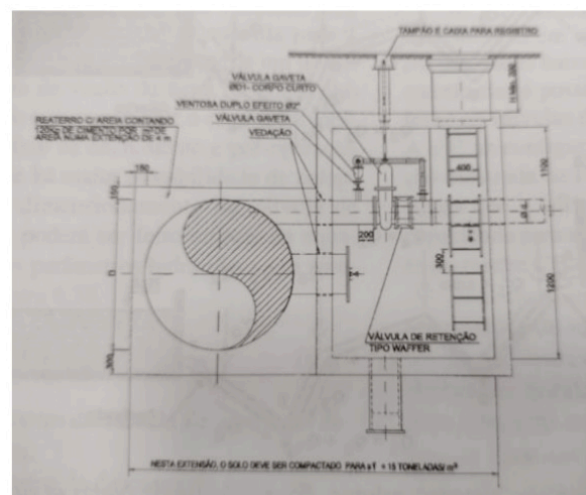


Figure 01 – Traditional suction cup installation.

Source: Tsutiya (2005).

The differential presented in this work is the installation of suction cups with lower capacities for expelling the air flow, in secondary networks (smaller diameters) and HDPE branches, to meet the low pressure complaint, enabling the rapid normalization of the water supply, using constructive method the thermoplastic boxes installed in public sidewalk.

The methodology consisted of monitoring several steps, such as: choosing the locations, sizing the suction cups, preparing the boxes, installing the boxes and monitoring the pressures at some points, as follows.

## CHOICE OF LOCATIONS

After surveying the areas with high elevations in the lower zone of a supply sector, five properties were chosen for this study that had recurrent complaints of low pressure and high consumption that were out of line with the historical average of the residence, according to the number of inhabitants. on site. In this work, data from one of the chosen points will be presented, as illustrated in figure 02.

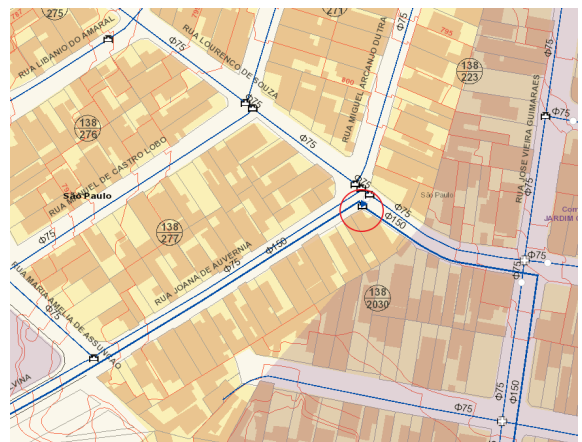


Figure 02 – Suction cup installation – Rua Joana de Auvernia x Rua São Lourenço de Souza.

Source: Sabesp (2022)

## DIMENSIONING OF SUCTION CUPS

The suction cups installed were sized for the air flows indicated by the manufacturer, according to the volumes verified in the field.

The model of the suction cups used is of triple function and high performance with a diameter of  $\frac{3}{4}$ ".

## BOX PREPARATION

The thermoplastic boxes used are those already used as a Water Measurement Unit Box (UMA), for the installation of residential water meters. They are produced in polypropylene material (thermoplastic polymer - recyclable

plastic) in the dimensions: 410mm x 390mm x 200mm, as shown in figure 03.



Figure 03 – Thermoplastic box.  
Source: Doalplastic (2022)

For the installation of the suction cups, the boxes were previously prepared with the hydraulic set and suction cup, as shown in figure 04-The box is closed with a hermetic lid, using screws that require special keys to open it.



Figure 04 – Thermoplastic box with hydraulic set.

Source: Sabesp (2022)

## INSTALLATION OF BOXES IN THE FIELD

The installation of the box was carried out in accordance with the construction procedures, on May 2, 2022 with supervision of works.

The suction cup was installed to purge the air from a DN150mm network through a DN32mm HDPE branch, at the address of one of the claimants at Rua Joana de Auvérnia – elevation 800. A drain was also installed for the suction cup air outlet (Figure 5d), which was protected from external contamination.

Installation steps are illustrated in figure 05 below.

- a) Ditch opening
- b) Installation of the water branch
- c) Assembled hydraulic set (suction cup, valve for closing and connections)
- d) Box installed with drain
- e) Box installed with suction cup and pressure datalogger assembly



Figure 05 – Box installation on the sidewalk.

Source: Sabesp (2022)

## PRESSURE MONITORING

To verify the effectiveness of the suction cup installation, a datalogger was installed on Rua Joana de Auvèrnia, from May 5 to 12, 2022, to monitor the pressures in the area.

The suction cup started operating on May 8, 2022.

Below, in figure 06, the data obtained before the installation of the suction cup, period from May 5 to 12, 2022

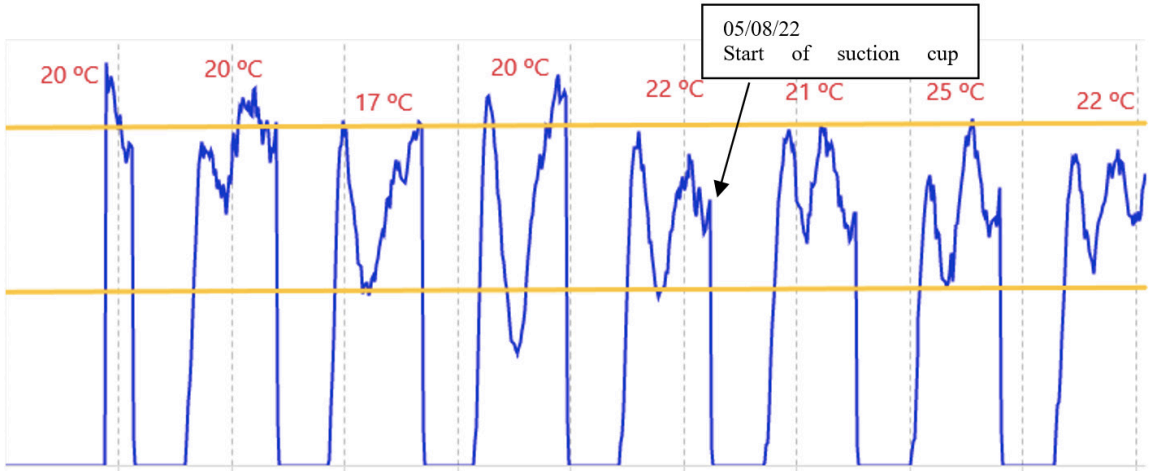


Figure 06 – Pressure graph Rua Joana de Auvèrnia (elevation 800) – May 5th to 12th, 2022.

Source: Sabesp (2022)

For better monitoring of the results, a datalogger was also installed to measure pressure on Rua Libânio do Amaral, located at elevation 795, a little below the main point.

Below, in figure 07, the data for the period from May 5 to 12, 2022.

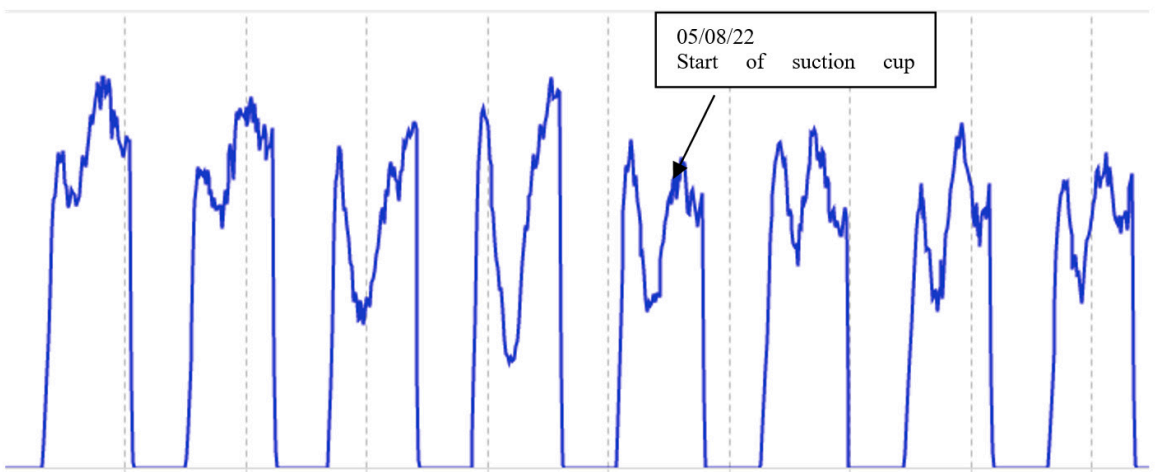


Figure 07 – Pressure graph Rua Libânio do Amaral (elevation 795) – May 5th to 12th, 2022.

Source: Sabesp (2022)

## BENEFIT COST RATIO

The installation of the thermoplastic box on the sidewalk adds benefits in terms of the low construction cost compared to conventional boxes, built in structural blocks or prefabricated concrete staves.

The construction of the box on the public sidewalk reduces costs with backfilling and replacement of pavements, compared to construction on the asphalt bed, in addition to promoting a reduction in labor ergonomics risks.

The cost of installing a thermoplastic box on the sidewalk has an average cost of R\$ 920.00, considering the values of the box, suction cup and water connection. The conventional box on an asphalt bed has an average cost of BRL 2,600.00, considering the values of the box, suction cup and replacement of the pavement, according to prices from Sabesp's TEV price bank (May/21). Therefore, we show that the cost of the box on the sidewalk is more attractive, considering the simpler and faster construction method.

## RESULTS OBTAINED

In the data presented in graphs 01 and 02, the pressures can be verified before and after the installation of the suction cup, and after the installation there was an increase in the pressure measured at times of higher consumption, as well as greater stability of pressures throughout the day, considering that the average temperatures of the days measured were similar, it is proven that there was an improvement in the recovery of the supply, that is, even with the installation of a greater number of boxes with suction cups of smaller capacity, the faster the expulsion of air in the distribution network, enabling agility in dealing with the most critical problems of short-term shortages, providing adequate pressure on the properties they serve.

In addition to the measured data of

local pressures, some positive topics with the installation of the boxes could also be observed:

- Product recognized in the market – the boxes are widely used in the sanitation market, with proven resistance and durability properties.
- Agility in execution – installation of the box is quick and the workforce used is the same as other sanitation works. The boxes are light, easy to handle.
- Cost reduction – the installation of the box on the sidewalk reduces the costs of installing a suction cup, compared to traditional boxes, built on an asphalt bed.
- Safety – the boxes installed on the sidewalk are shallow and smaller and do not constitute confined spaces, reducing the risk of accidents at work.

## CONCLUSIONS

The use of thermoplastic boxes for installing suction cups in distribution networks is an alternative to larger boxes, they are low cost as they have been sold for some time in the sanitation market, and they allow for quick installation on public sidewalks as the open ditches are shallow and the labor used is the same as that used in other sanitation works, such as water connections, changing branch lines or maintaining small-diameter network works. The dimensions of the box allow the assembly of a hydraulic set for the suction cup, some closing valves and even a datalogger, not mandatory, but which can be added, to complement engineering studies and operation of the installed suction cup.

The suction cup is a device for expelling air from distribution networks, which are normally dimensioned and installed in primary networks with larger diameters, but we demonstrate in this work that, in the event

of critical situations of low pressure with damage to the supply of customers, caused by pockets of air in the network, the option of installing suction cups with smaller capacities in thermoplastic boxes is an immediate, easy-to-install and low-cost solution that helps to improve the operation of the water system, normalizing the supply, minimizing low pressures and reducing customer complaints, until suction cups with greater capacities are installed, according to the projects studied.

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