DISTRICT HEATING

PUBLISHED QUARTERLY SINCE 1915

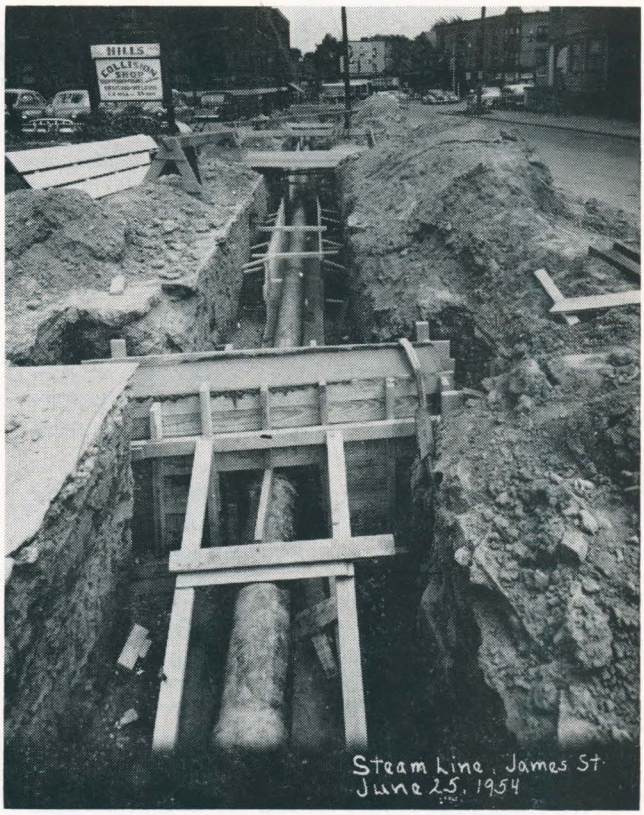
APRIL, 1955 — VOL. XL, NO. 4

CHICAGO

AN OFFICIAL PUBLICATION OF THE NATIONAL DISTRICT HEATING ASSOCIATION

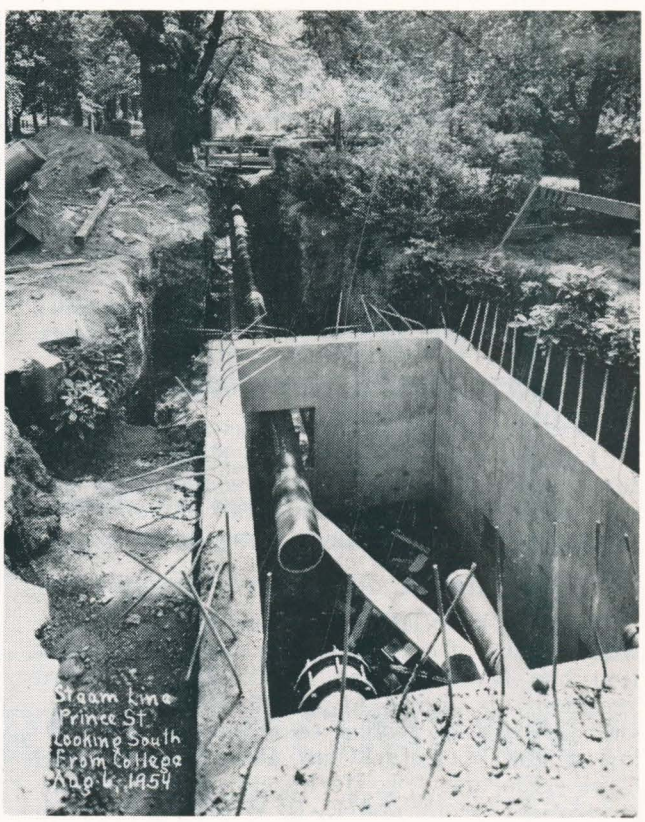
Details of Steam Main Extension at Rochester, N. Y.

Steam Line—College Ave., June 25, 1954



Steam Line—James St., June 25, 1954

Steam Line—College Ave., July 23, 1954



Steam Line—Prince St. Looking South From College Ave., August 6, 1954

New Two-Mile-Long High Pressure Steam Main Installation at Rochester, N. Y.

M. H. OOGJEN, JR.[1]

The Rochester Gas and Electric Corporation recently completed an extension to its high pressure steam-distribution system of approximately two miles, starting from its Station 8 in Lawn Street. This extension consists of 1.25 miles of 12 in. pipe, 0.55 miles of 8 in. pipe, and 0.12 miles of 6 in. pipe. It probably is the longest extension to be made at one time. Construction on this project began May 15, 1954, and was completed in time for the fall heating season.

There were two reasons for making this extension. The first, and most important, was to pick up additional customers with very desirable loads; and the second, to eliminate the operation of an isolated and independent station thereby providing greater capacity to that particular area as well as obtaining a more economical operation of the system.

A preliminary survey of the existing underground utilities showed the most advantageous location for the main to be between the property line and the curb. This position also minimized interference with traffic. Where in-street construction was necessary, due to crossing of intersections, open Z-bends were used in a skew plane. This enabled crossings to be made beneath existing utilities. This method of construction was further utilized by taking advantage of the Z-bends for expansion purposes, and also using the low point of the bend as a location for condensate removal.

In connection with projects of this kind, it is necessary to take into account proposed public improvements in the area in which the work is to be done. On this job there was only one obstruction of this kind to be considered. This was a proposed underpass across the route of the steam main, which is to be developed as a part of the inner loop of the City of Rochester in conjunction with the New York State Thru-way. To insure continuity of operations and customer service when this public improvement materializes, two additional vaults were constructed, one on either side of the proposed underpass. Each vault was equipped with necessary additional valves and take-offs so that a new segment of the steam line could be incorporated in the inner loop project at the time of construction. This change in the system would, of necessity, be done in close cooperation with the Public Works Department of the State of New York.

The design of this new addition to our distribution system was based on operating conditions of 400 psi and 550 F. The maximum allowable bending stress for these conditions of service is 15,000 psi. To provide for temperature conditions in excess of 550 F due to desuper-heater malfunction, the bends were designed so that stress induced under normal operating conditions would be under 13,000 psi. This provides a margin of safety in addition to the normal safety factors incorporated in the design formula. When the main would be at full operating temperature, consideration had to be given to the 40 feet of total growth due to expansion. This expansion was handled by the conventional methods of right-angle bends, open Z-bends, U-bends, and piston-type expansion joints. Expansion loops were used wherever possible to minimize the number of expansion joints needed, thereby reducing the required vaults to house the joints and the burden of future maintenance.

The steam line necessarily had to be installed in accordance with the A.S.M.E. code for pressure piping. In order to minimize the number of welds, which were costly and time consuming, 40-foot random lengths of pipe were used. Also, in order to reduce the stress concentration at the bends in the expansion loops, five-diameter-radius prefabricated bends were used in place of the conventional welding ells. These factors do not lend themselves to the use of prefabricated insulation. Therefore, insulation poured on the job was used. The insulating material was a patented mix of Vermiculite and cement with a wetting agent. A thickness of 6 in. of this material compares with 2½ in. of commercial preformed insulation commonly used for this work. The particular project under discussion here has an over-all minimum thickness of 8 in. insulation. Along straight sections of the line where longitudinal displacement occurs, the pipe was wrapped with corrugated cardboard to serve as a parting medium. At the bends where lateral displacement takes place, the pipe is wrapped with fibre glass in proportion to the displacement, which forms a void in the insulation and allows the pipe freedom of motion. At these points a special mix of insulation having a compressive strength of 25 psi was used as compared to 50 psi compressive

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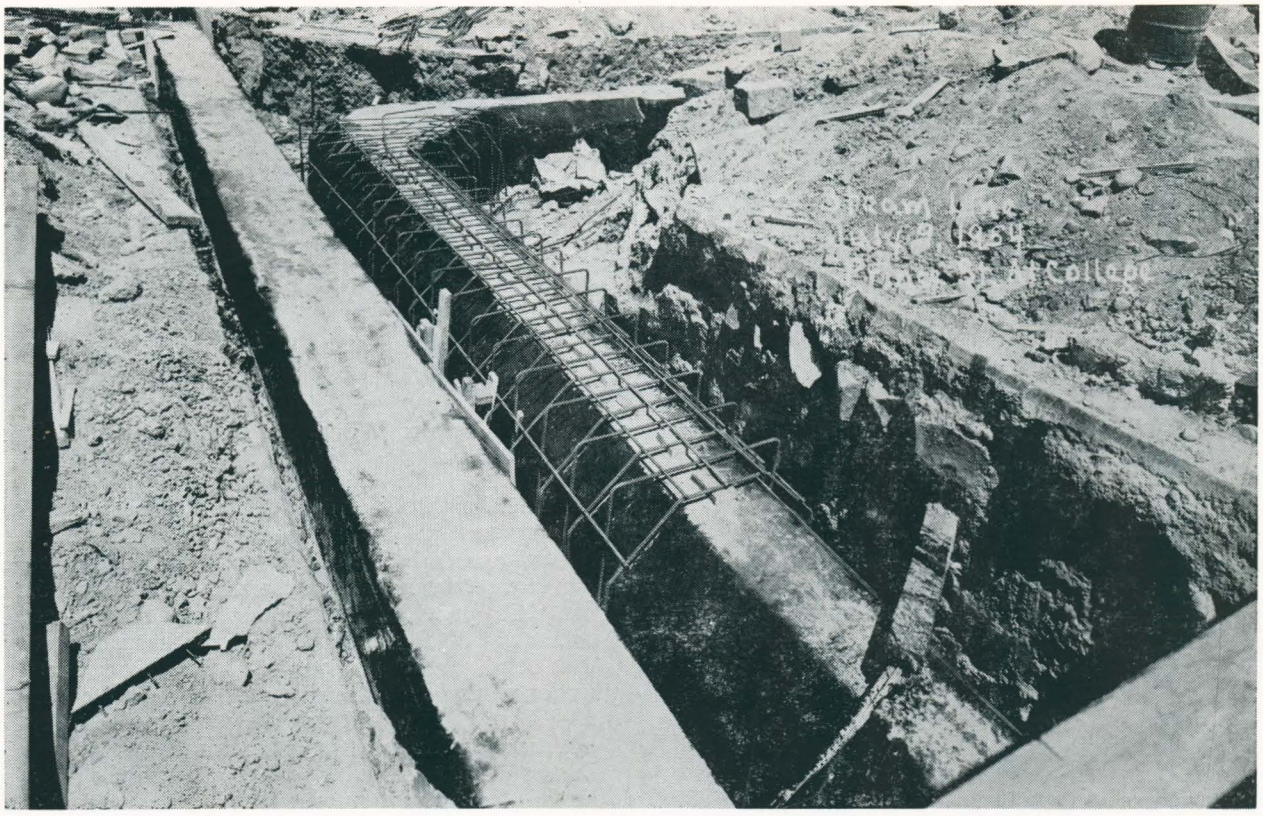

Steam Line—Prince St. at College Ave., July 9, 1954

strength for the insulation used where the expansion is longitudinal. A reinforced concrete envelope encases all sections where the lateral movement is in excess of two inches, and a maximum deflection of 8 in. is provided for. Where extremely high external loading is possible, such as at street crossings, a special reinforced concrete envelope was designed to accommodate up to 20,000 lb concentrated load in the center of the span.

The construction of 28 vaults was required for this project to house valves, expansion joints and steam traps. Their construction was entirely of reinforced concrete with top slabs capable of supporting a concentrated load of 20,000 lb in the center of the span. Each vault has two openings, one for operational usage and the other as an aid to ventilation. Standard equipment includes a removable aluminum ladder and a direct sewer drain in the floor, which complies with the existing plumbing code, or where conditions will not permit, a sump with a steam ejector to a tee in the wall at a higher elevation which drains to the sewer. Also, the vaults are waterproofed completely inside and out.

In order to comply with the welding code requirements for the designed pressure and temperature, a competent testing laboratory was engaged to provide the necessary inspection. This work involved visual inspection of every weld, technicians to photograph with gamma rays every weld for further inspection. With the completion of each section of line came the final hydrostatic test. The welds were subjected to a 650-psi hammer test followed by visual inspection and then a 1000-psi 50-min duration test again followed by inspection. No leaks developed in any of the joints on the entire job during these tests. This success may be attributed to the gamma-ray testing of the welds.

This new steam main extension has been the means of eliminating boilers that burned in excess of 16,000 tons of coal a year. From an air pollution viewpoint, this new steam main extension has permitted the generation of steam in a large central station designed with highly efficient dust-recovery equipment to replace the generation of the equivalent steam in eleven small isolated industrial plants with inadequate dust-recovery equipment.

There are now 12 customers being supplied from this steam main extension—Raithel Tire Company, Clifford's Restaurant, Treadway Inn, Moose Club, Christian Science Church, Sacred Heart Academy, Masonic Temple and Auditorium, Princeton Apartments, Eastman Dental Dispensary, Saint Agnes School, Bausch and Lomb Optical Company—Navy Building and Fasco Industries. These customers have a total load of 120,000,000 pounds of steam annually. Next fall several of the buildings of the Women's College of the University of Rochester will be served from this steam main giving the company an additional load of approximately 60,000,000 pounds of steam annually.