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PROBLEM PAGE

Published by the

AMERICAN DISTRICT STEAM COMPANY

GENERAL OFFICES AND WORKS

NORTH TONAWANDA, N.Y.
Withstands Strain of Heaviest Traffic

THOSE big, heavy trucks loaded to the limit, thumping through the traffic, dealt smashing blows to the sub-construction as well as to the pavements over which they travel. But even the constant hammering of the heaviest traffic does not crush ADSCO extra-strong, salt-glazed tile built into ADSCO Multicell Conduit. Long standing installations under cobblestone streets over which millions of tons of freight annually move, are in as good condition today as when traffic first started rolling over them years ago. Proof without doubt, that the extra strength of ADSCO Multicell Tile conduit withstands strains that would quickly crush ordinary conduit.

Strength is but one of the many features of ADSCO Multicell Conduit. Insulating efficiency, long life, freedom from maintenance, conduit elasticity, accessibility and flexible construction are just a few of the reasons why a high percentage of the leading district heating companies have standardized on ADSCO Multicell Conduit for their high pressure mains.

The Monthly Advocate
Edited and Published by
American District Steam Company
North Tonawanda, N.Y.
Originators of District Heating and Underground Distribution of Steam for Heating and Power Purposes

Another Step Forward for Kalamazoo

AUGUST 23, 1927 is a memorable day to the citizens of Kalamazoo, Michigan, for it was on that date they passed, by a three to one vote, the granting of a franchise to the Consumers Power Company for the installation of a District Heating plant. Previous to that time, the people of Kalamazoo had discussed, favorably and unfavorably, the granting of a franchise for such a plant. They knew very little of its advantages until Mr. D. E. Karn of the above company made a study of the conditions in collaboration with ADSCO Engineers and explained why such an installation would be advantageous to everyone concerned.

Within three days from the passing of the franchise and the subsequent approval by the mayor, council and city engineer of all plans for the construction work in streets and crossing the Memorial Bridge, the contractor's engineer, Mr. Henry J. Snyder, was in Kalamazoo and the work was promptly begun.

Before the award of the franchise, ADSCO Engineers had assisted the company in developing the route and sizes of mains, location of fittings, etc., so that it was possible to immediately begin the construction work—and, within ninety days from the date of election, steam was turned into the twelve inch mains.

The construction is ADSCO Multicell Conduit. Pressure on mains is maintained at about 75 pounds. This enables the company to supply steam for every purpose and to every class of user, including the larger hotels and restaurants which are using the steam for heating water and for cooking.

The use of pressure reducing valves permits the company to supply steam at the pressure required in various premises without changing the in-
terior piping.
Approximately one mile of mains was installed but the demand for the service is so great that extensive additions will probably be made during 1928.

Mr. Karn is to be commended for his good judgment in securing an experienced operating engineer in the person of Mr. Thomas Neal, formerly with the Consumers Power Company of Grand Rapids. Throughout the installation of the mains and services, Mr. Neal was constantly on the ground. As a result, he knows every foot of the lines and will be familiar with each interior job as it is connected.

The problems of operation have been reduced to a minimum because ADSCO Duplex-Sleeve Guided Expansion Joints, electrically welded into the pipe line, were used throughout the entire system.

Construction Engineer Snyder is also particularly proud of the fact that all underground work was completed, trenches filled and the paving relaid before connections were made in the power house, with not a leak in the mile of main and services when the steam was turned on before a representative gathering of citizens, city officials, engineers and newspaper men.

COMMENTING on the new heating system in Kalamazoo, the Kalamazoo Gazette published the following editorial under the heading "Another Step Forward".

"With the inauguration of its new district heating system, serving a large portion of the downtown business area, Kalamazoo makes one more important stride as a progressive American community. From the time the proposed franchise received the approval of the city's voters last August, the Consumers Power Company has been steadily at work installing the mains and making other preparations for the furnishing of live steam to its prospective patrons of the commercial district. A promising engineering project, discussed and studied for many years by various public-spirited citizens of Kalamazoo, is thus carried into effect.

" WHETHER the principle of district heat, in practice, will meet the expectations of its many local exponents, is a question which experience alone can answer. It may be noted, however, that there is no apparent reason why the system should not prove as successful in Kalamazoo as it has in the numerous other American communities where it has been tried. When properly operated and maintained, such systems have generally been quite satisfactory, and it is certainly difficult to believe that an organization like the Consumers concern would be satisfied with anything less than the most efficient operation and maintenance possible. By eliminating a large number of individual firepots, boilers and chimneys from the downtown district, the new system should tend to reduce the local fire hazard and to furnish at least a partial solution of Kalamazoo's annual smoke problem.

"Up to the present, the power concern's officials have made no definite announcements regarding the future expansion of the district heating system. It may be assumed, however, that as the demand for this kind of service increases, the company will be prepared to meet it, whenever this can be done on an economic basis. The scientific soundness and practical efficiency of district heat have been well established by experience elsewhere, and it is to be expected that Kalamazoo will be equally benefited by this up-to-date method of heating."
Fighting the Menace to Steam Lines With Proper Anchorage

Perhaps no feature in the construction of both high and low pressure steam lines is more important than proper anchorage. Although this is an important factor where pipe lines are laid underground, it is even more so where the construction is overhead—on piers, poles, towers or other supports.

During the early days of underground steam distribution, the old "junction boxes" (expansion joints) were anchored into the side walls of the manhole by being bolted to a cast iron chair, a portion of which was built into the bottom and side walls of the manhole. At each end of the chair, adjustable guides were fitted to permit the pipe line, at the point where it was bolted to the flanges of the slips, to be properly aligned and guided into the body of the expansion joint. Later, a cast iron crossbar anchorage was employed for anchoring slip joints. This was bolted to the bottom of the joint and extended into the side walls of the manhole. Still later, in addition to this form of anchorage, wrought iron bars \( \frac{5}{4}" \times 2" \times 16' \) long were employed. One end of the bar was bolted to the fitting and the other end clamped to the side of the wood casing or conduit with heavy lag screws spaced 2' apart. Due to the corrosive effect of seepage water, these bars rusted away after a few years and became useless. Their life, however, was prolonged several years with a rust-proof paint.

Today it is quite important that the fittings be laid out to approach, as near as possible, a so-called "balanced effect". Where double expansion joints are used, the anchorage is of less importance, since it merely supports the joint and overcomes the friction of the slips being forced through the packing and into the body of the expansion joint. Where single expansion joints are used, the steam, so far as is practicable, should flow through the body of the expansion joint and out the slip end. This will tend to thoroughly heat the packing and the slip before expansion takes place, thereby greatly relieving the strain on the anchorage of the body of a single expansion joint anchored to a sub-base in the concrete bottom of the manhole or tunnel. By use of single expansion joints, it is possible to shorten the straight runs of pipe between anchorage points—a necessary feature in the construction of steam mains in cities where a great many obstructions are encountered.

By the use of two single expansion joints, acting in place of a double, it is possible to make an angle by the use of adjustable wedges between the flanges of the rigid ends of the expansion joints. Where two singles are used in this way, the number of manholes may be reduced one-half.

In the design of anchorage for ADSCO underground fittings, ADSCO engineers observe a safety factor of at least 5 to 1. The unit of stress is arrived at by the power required to move a relatively horizontal section of pipe 250 ft. long, properly mounted on roller guides, plus the power to overcome the friction required to push the cold slip into a cold expansion joint when the packing is drawn up to the highest degree of tightness. The possible settling of the pipe section which would increase the friction in the conduit, is also taken into consideration. Anchorage designed in this way and properly bolted to a lip sub-anchorage, firmly embedded in a properly designed concrete base, will never give trouble.

Where a right angle or any great angle is made in the pipe line, the pressure and temperature of the steam is taken into consideration and the anchorage designed in accordance with the above method. In addition to the base anchor, ADSCO backs up the fitting at the turn with a properly designed abutment in line with the center line of the pipe.

Slide from the cast iron wings now used for anchoring ADSCO Variators, and to some extend Anchor Specials, ADSCO also use Line Anchor Clamps and a type of fitting that might be called a Cast Steel Base Anchor. In many instances, and particularly for a high pressure steam line, as many as four anchors are recommended. The use of Cast Steel Base Anchors permits of anchoring fittings or the pipe itself to the top, sides and bottom of the conduit by welding in any position desired. In addition to the forms of anchorage described which, in reality, are special underground fittings, ADSCO use various applications of welded anchorage fabricated in the field to meet special conditions.

The kind and type of anchorage is often influenced by the use of Alignment Guides. These devices hold the pipe line firmly in proper alignment, and, being installed in front of expansion joints, assure a true thrust of the slip into the body of the joint without permitting any lateral movement. The strain of pipe distortion is in this way taken off the expansion joint anchorage.

For high pressure underground steam pipe lines, all anchorages are designed at the time the work is being constructed to cover the particular conditions encountered. Anchorages of this character are made by the use of steel I-beams cut to proper form with an acetylene torch and then welded in place directly to the top, sides and bottom of the conduit. The ends of such anchor bars are thoroughly embedded in concrete or brick work. This type of anchorage is most satisfactory when a safety factor of at least 10 to 1 is maintained.
There is an ADSCO Expansion Joint for every pipe expansion requirement from the simplest form to any combination.

A low pressure steam riser should have one type of internally guided joint; a line conveying high pressure superheated steam requires quite a different type of externally guided joint with air-cooled slip to prolong the life of the packing.

ADSCO expansion joints are designed not only to meet every operating condition of pressure and temperature for steam, water, oil and other liquids and gases, but to combine such cost-reducing features as double and single joints in all designs, combinations of anchorage, service and drip outlets.

The ADSCO standard line of joints includes every combination of slip type as well as packingless joints (variators). In addition there are hundreds of special joints for special conditions.

All are described and illustrated in our valuable book "Reference Data on Expansion in Pipe Lines". Contains valuable charts, tables, etc. Supplies a quick and convenient method for engineers and users of expansion devices to compute the amount of expansion due to varying temperatures. Send for it today as the first step in solving all your pipe expansion problems. Mail the post card.

Get This Worth While Book Free
The Economics of small District Heating Systems

With the growing demand for service in all phases of human, civic and federal existence—District Heating service for homes is fast taking its place with the more generally accepted utilities. True, service costs Dollars—but, to paraphrase a famous business slogan, "The recollection of Heating Service (quality) remains—long after the cost (price) is forgotten."

District, Central or Community Heating, call it what you will, fills a definite need. Given a community of individuals whose circumstances warrant the full measure of physical comfort in their homes, District Heating Service is a matter of business procedure to organize, construct and operate. Such an expression of a community interest, brings advantages to all.

While each District or Community operating unit must be examined independently as to its engineering aspects, this article will consider the elements involved in a single residential community of 200 houses of the better grade, equipped with 600 sq. ft. each of atmospheric or vapor radiation, and in the general latitude of New York City.

With 250 B.T.U. per sq. ft. allowed for maximum demand, including distribution loss, the boiler plant for 200 houses must supply 250 B.T.U. x 600 x 200 = 30,000 lbs. of steam per hour (1000 B.T.U. per 1 lb. steam) on a nominal basis of calculation (30 lbs. per H.P.)—1000 H.P. of boiler capacity will be required. Thus, two 500 H.P. units equipped for modern powdered coal combustion (or oil burners where justified) will furnish adequate supply capacity. This for the reason that one 500 H.P. unit may be easily operated at 200% of rating indefinitely, thereby leaving one unit in reserve.

For the extent of distribution system, the fair assumption is made that 50 feet of main piping will be required and 50 feet of service pipe to each house. The system then will consist of:

50' x 200 = 10,000 feet mains
50' x 200 = 10,000 feet services

Pressures

Boiler operating pressure is assumed at 100 lbs. gauge, and system pressures 20 lbs. initial and 2 lbs. terminal minimum. The 2 lb. terminal pressure would be maintained with the aid of an electrical long distance indicating and recording gauge.

Operating the boilers at 100 lbs. gauge and discharging through a reducing valve to the
system at 20 lbs. or less would insure dry steam. Limiting the system pressure within the limits specified would make a uniformity of house traps, reducing valves, etc., and simplify operations. System pipe sizes would also be kept at a reasonable minimum by calculating same on the basis of 20 lbs. initial pressure.

Boiler Investment

It is highly important that the steam generating equipment should be both efficient and appropriate for the specific need of each situation. For the case in point, the cost of boiler plant should not exceed $65,000.00, exclusive of real estate.

Steam Main Investment

The cost of steam mains would depend on the specification, location and other conditions. Assuming Low Pressure, good under-drainage, ADSCO “variator-casing” construction which would be most suitable, efficient and durable—the cost of the 10,000 feet of mains would be approximately $80,000.00 plus trench cost which would depend on depth, soil, presence of rock, etc., and street paving. Under favorable conditions this item would be about $15,000.00.

Return Mains

The cost of Return Mains is not included herein, for the reason that the value of the water and the small residue of heat remaining in the condensate from atmospheric systems, would not, in this instance, justify the investment in a permanent system of Return Mains.

Service Main Cost

This is usually a direct charge to the individual houses and so not included in investment. If a majority of service pipes to houses are installed during construction of the general system, the cost would be approximately $3.50 per lineal foot, exclusive of house piping connections.

House Piping

While any type of house “Piping System” may be successfully operated from a District Plant, the ADSCO atmospheric or vapor orifice system is the most readily controlled, therefore, the most satisfactory. The installation cost would be no greater than many so-called systems having less real merit.

Meters

The essence of successful operation of all utility supply of whatever nature is the Meter. In steam heating, the condensation meter must be used if good results are desired. The cost of meters for the 200 houses in question would be about $35.00 each, in place. These would be owned and controlled by the operating organization.

Return Mains

For physical maintenance of underground steam mains, etc., and not including labor for trap inspection and meter reading, etc., 3% of 1% of investment in underground steam mains is ample or $95,000.00 x 1% = $950.00. Physical maintenance of boilers and equipment should not exceed $2.50 per B.H.P. per year on which basis this item will be:

$2.50 x 1000 = $2,500.00 per year.

Depreciation

An average of 4% on mains and meters and 6% on boilers would be ample for first class original construction, therefore,

(Boiler Plant) $65,000.00 x 6% = $3,900.00
(Mains and Meters) $102,000.00 x 4% = $4,080.00
Allowance for Depreciation = $7,980.00

Office Expenses

The office could be in the boiler plant building, and with an office girl as assistant for billing, telephone calls, etc., could be managed by the superintendent at minimum expense, say $1,000.00 per year.

Summary of Investment Estimates

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000 H.P. Boiler equipped except land</td>
<td>$65,000.00</td>
</tr>
<tr>
<td>10,000 feet underground steam main</td>
<td>$80,000.00</td>
</tr>
<tr>
<td>10,000 feet trench, backfill, etc.</td>
<td>$15,000.00</td>
</tr>
<tr>
<td>200 Meters</td>
<td>$7,000.00</td>
</tr>
<tr>
<td>Miscellaneous costs and working capital</td>
<td>$10,000.00</td>
</tr>
<tr>
<td>200 Service pipes to houses paid by individuals</td>
<td>$15,000.00</td>
</tr>
<tr>
<td>Total</td>
<td>$177,000.00</td>
</tr>
</tbody>
</table>

Fuel Quantity and Cost

The price of bituminous coal will be taken at $5.00 per net ton delivered; the evaporative efficiency at 7 lbs. of steam per 1 lb. of coal. Quantity of fuel depends on (a) number of homes, (b) size or square feet of radiation of each, (c) use of steam per square foot of radiation, (d) distribution efficiency. In carefully operated District Steam Heating Systems, 85% of the steam generated will reach the condensation meters. Therefore, the fuel for this operation would be:

500 lbs. x 600 (sq. ft.) x 200 (houses) = 5040 tons
2000 lbs. x 7 lbs. (evap.) x .85 (eff.) = 1756.4 tons

Thus the cost will be $5.00 (per ton) x 5040 tons = $25,200.00.

Summary of Operation

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>$69,000.00</td>
</tr>
<tr>
<td>Operating Expenses and Maintenance</td>
<td>$40,295.00</td>
</tr>
<tr>
<td>Supt. and Labor (Plant and District System)</td>
<td>$9,200.00</td>
</tr>
<tr>
<td>Coal for Steam (@ $5.00 N.T.)</td>
<td>$25,200.00</td>
</tr>
<tr>
<td>Maintenance-Mains</td>
<td>$1,200.00</td>
</tr>
<tr>
<td>3 Firemen, 12 months</td>
<td>$4,320.00</td>
</tr>
<tr>
<td>1 Utility labor</td>
<td>$680.00</td>
</tr>
<tr>
<td>Office Expense, Telephones, etc.</td>
<td>$2,500.00</td>
</tr>
<tr>
<td>1 Supt.</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>5% Contg. and Misc. Operating</td>
<td>$1,920.00</td>
</tr>
<tr>
<td>Total Operating cost</td>
<td>$40,295.00</td>
</tr>
</tbody>
</table>

Summary of Expenses

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Surplus</td>
<td>$38,705.00</td>
</tr>
<tr>
<td>Deduct for Depreciation</td>
<td>$7,980.00</td>
</tr>
<tr>
<td>Balance for interest on capital and taxes</td>
<td>$27,725.00</td>
</tr>
</tbody>
</table>

Conclusion

The foregoing represents what can fairly be expected in similar situations. As the number of houses varies, other factors will vary according to the specific case. Good engineering analysis of each case and advice by qualified experts will save many situation: from the pitfalls of poor construction, inadequate rates and mistaken operating policies.
Question: Why do you emphasize adequate under-drainage for buried steam lines; and what features are of particular importance?

Answer: The hundreds of miles of steam lines installed underground without proper provision for under-drainage and the shockingly short life and inefficiency of such lines are the immediate answer to this question.

Industrial plants, government and other institutions, railroads and even some district heating companies frequently disregard under-drainage and, in almost every such case, costly repairs and replacements and continuing high heat losses are constant reminders of the penny wise, pound foolish omission.

Regardless of the type of conduit used, ground water (wherever precipitation is normal) will lie around the conduit and, wherever possible, get inside to the steam line. Any considerable amount of water entering the conduit will obviously cause heavy heat loss and, working in conjunction with the high temperature in the conduit, this moisture sets up a rapid corrosive action.

If all ground water is not promptly carried away by proper under-drainage, the insulation on the pipe deteriorates rapidly and, in extreme cases, is rendered valueless. The pipe itself becomes pitted and, in a short time, leaks occur.

The use of a double line of common farm drain tile laid to grade, on each side of the floor of the trench, and covered to a depth of six inches with crushed rock, assures free passage of ground water when trapped at low points into sewers or other suitable outlets.

In laying the tiles, it is a good plan to set them about \( \frac{3}{8} \) apart and place a 4" strip of roofing paper over the joint, running it down each side. The water then tends to enter from the bottom and carries the minimum of silt into the drainage system.

Proper under-drainage is one of the best guarantees of high efficiency and long life for underground steam lines.

If a concrete base is to be poured over the crushed rock, it is well to lay a surface of heavy paper first. This prevents moisture from the concrete getting down into the under-drainage filter bed.
New 18" High Pressure Line for Kansas City

The Kansas City Power and Light Company is one of the many up-to-the-minute public utility companies which, seeing the district heating needs of their cities expand, are keeping pace by extending their steam distribution systems.

And, like other modern public utilities, they are employing the Northeastern Piping & Construction Corporation, specialists in high pressure underground steam line construction, to produce dependable, economical construction.

Within the past year, public utility companies in Rochester, N. Y., Saginaw, Grand Rapids and Kalamazoo, Michigan, Cedar Rapids, Ia., Philadelphia, Pa., London, Ont., and many other cities in the United States and Canada have cut their installation and upkeep costs by contracting with the Northeastern Piping & Construction Corporation and the Canadian District Steam Company, Limited, to install new underground mains or extend their old lines.

NORTHEASTERN PIPING & CONSTRUCTION CORP.
NORTH TONAWANDA, N. Y.

Subsidiary of

AMERICAN DISTRICT STEAM COMPANY

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