J.K. Mullen Home for Boys
May 3, 1938

The J. K. Mullen Home for Boys
Fort Logan, Colorado.

Attention Brother Basil

Dear Sir:

In order that bids on your two pipe lines be of comparable nature, I recommend that you use the specifications herein mentioned. There is no departure from the blue prints submitted on the 10-inch pipe line except that there will be no 4-inch extension. You may, however, wish to place an 8-inch gate valve at the bridge where an 8-inch blind flange is indicated and connect with a short piece of pipe for discharging into the creek. If this is not put in, then a 1-inch gate valve on a short nipple should be placed in the flange as a hand-operated air relief. The pipe must be well secured to the bridge. At the Simonton Ditch entrance, the top of the pipe should be 20 inches below the top of the wall.

The new seepage line from the seep stream to the barns with intake box, is shown on a separate blue print. The intake box is designed to take all the low flow and to pass flood flows, or to take none at all. The gate allows certain adjustments and can be used to flush out entrance. This gate can be held in position by means of a pin thru the handle and a 4 x 4. A 6-inch depth of water will pass over the sill into the box before water will pass over the gate. A screen of 1/2-inch mesh, galvanized hardware cloth, bolted to a frame of 3/4-inch angle iron prevents trash from entering the pipe line. A plank cover is to be provided, as indicated, which may be locked in place by means of a strap iron, hinged at one end and padlocked at the other. This plank cover should extend far enough over to prevent removal of the screen. We are not unmindful of ice conditions in the winter time and can not anticipate just how this arrangement will function in extreme weather. The pipe line is to be six inch to the outlet box at station 27 + 00 on the 10-inch line, and 4 inch from that point to the barns. The line is to pass under this box and a riser equipped with a 6-inch Martin type Q valve is to be installed on the north side of the box at ditch bottom elevation. There is also a riser and 6-inch Martin type Q valve to be installed in a box on the upper edge of the small tract just below the highway. This box is to be the same as at Station 17 + 57 on the 10-inch line. Distances on this pipe line have not been obtained by us and are approximate.
Mullen Home.

It is suggested that you obtain bids for the below listed items, installed and ready to operate. The class of pipe desired is 14-gauge galvanized and dipped slip joint riveted pipe in all cases; brand of metal to be specified. The bid may be in a lump sum, but all straight run of pipe must be priced per foot as measured over the finished line, and this price will be used to compute the total of such pipe. Lengths here given are to be considered only approximately correct.

Main Irrigation Line:

2700 feet of 10-inch pipe
1- 12" x 10" x 36" reducing section
1- 3" riser 4" long with gasket and blind flange (x)
1- 1" gate valve and nipple to be tapped into above flange, (x)

Proper bridge fastenings:

1- 10" riser 18" long riveted to 10" Martin type Q valve
1- 10" " 4" " " to 10" " " Q "
2- 10" " 10" " " to 10" " " " "
1- 10" cast iron slide gate, complete
1- permanent trash rack about 3 ft. square of about 1/2 inch round iron rods.
2- drain connections with 2-inch gate valves and approximately 4 feet of 2-inch pipe
1- piece of perforated well casing approximately 22 inches in diameter and 30 inches long, with cover
2- valve keys with 3 foot handles
4- concrete structures as shown on plans.

(x) Quote on alternative proposal of 3" gate valve and attached 90 degree 4-piece 3-inch elbow.

Seepage Water Line:

500 feet 6-inch pipe
1650 feet 4-inch pipe
1- 6" riser about 4 ft. long riveted to 6" Martin Type Q valve
1- 6" " 4½" " " to 6" " " Q "
1- 12" x 18" steel slide gate with drilled handle
1- 15" x 2½" removable screen trash rack
2- concrete structures as shown on drawing
5- inch service connections
1- inch " " " 
Mullen Home

It is understood and agreed upon that the J. K. Mullen Home for Boys will remove all old pipe line necessary, make all excavations, keep dry all pits and trenches and furnish at all times no more than three men to assist the contractor in the field. The contractor agrees to completely finish the job ready for operation in a good and satisfactory manner, to begin work immediately upon signing the contract, and to pursue the work with due diligence and speed. The contractor assumes all responsibility for proper procedure and protection to the public for highway and railroad crossings, and to further save harmless the above Home for Boys for any damages or injuries at such crossings or injuries to workmen employed by the contractor.

Unfortunately I lost my notes on the service connections at the end of the 4-inch line, so please insert where shown. We recommend that you engage an unemployed civil engineer to act as inspector for you on this work. The cost of this work fully warrants it and he will supplement the gaps in the plans. To get in touch with such an engineer, call the Colorado Society of Engineers, 525 Cooper Building.

Yours very truly,

W. E. [signature]

Associate Irrigation Engineer
Duplicate pages not scanned

See originals in folder
A. Proposed reservoir less than 1 A area

B. Proposed large reservoir

J.K. Mullen Home for Boys
Brother Basil in charge
R.F.D. Ft. Logan
Ph. Englewood 1070
Maurice Ohrel - farmer
Memorandum in re J. K. Mullen Home for Boys
Inspection Trip with Alvin Kezer, Nov. 12, 1932.

W. Erse

Went to Denver with Parshall. Met Kezer at Shirley-Savoy Hotel. He and I were driven out to farm at 1.00 p. m. by 'Donner's chauffeur. Taken over ground by Bro. Basil.

A 10-inch steel pipe line, probably 20 years old and rusted out is used to furnish water from the Simorton Ditch to most of the land on the south side of the creek. A ditch on the south side had been used but difficulty in maintaining it led to pipe line installation. Portions of the ditch still remain and it is in use from a point just west of the west boundary, where it picks up seepage water originating from the south. It is estimated that between 1/2 and 3/4 second-feet were flowing here to-day. At this point the effluent of the sewage disposal system from Ft. Logan is discharged, perhaps 20 g. p. m. Beyond here about 1/4 mile is another seepage flow of about one-half capacity of the first one and can be added to it thru remnants of the old ditch. All of the water exists at an elevation such that it can be stored in a reservoir at A, shown on map. It is not known how much seasonal variation there is in these seep streams, but Bro. Basil said that there was more water flowing now than in summer. There are about 53 acres on the south side of the creek and in the past few years, after failure of the pipe line, there has been an inadequate water supply from the above sources, partly due no doubt to the meager uniform flow. Thru the use of a reservoir the flow could be used more efficiently, and it may be that the combined flow from the three sources would be sufficient for
this area. If a flow of 3/4 second-feet were obtained, 45 acre-feet would be accumulated in one month, or sufficient for one irrigation of 0.35 foot. If this proves true, then there would be no need of a pipe line from the Simonton Ditch. I believe that a 2-day storage, or about 3 acre-feet is possible at A and would allow a good irrigating stream to be run out on the third day.

There may be some question as to the right to intercept the seepage water from the second source mentioned, as it has not been used on this land except at some time in the past when the supply ditch was functioning. I advised Bro. Basil to seek legal advice on this. Since the surface soil at A is composed of gravel outwash from the mesa to the south mixed with river deposits, there may be some question as to the water-tightness of a reservoir. I advised digging shallow pits to investigate this. It is possible to run water from the Simonton Ditch thru pipe line into the reservoir, according to Bro. Basil.

On the north side of Bear Creek, just under the Agricultural Ditch, they propose another reservoir, B. A draw starts near the west boundary and to find the most advantageous location would require a little surveying. The soil appears to be satisfactory.

Tile lines laid to convey water down steep slopes are broken or plugged in many places and water now flows on the surface causing deep erosion. Tile lines should be repaired and put in service again.

In the bottom, at least a half of a 30-acre field is so alkaline that crops will not grow and the balance is very poor. This tract is bounded on the north and south by open drains and thru the center is an
3-inch tile line. I saw only the north drain for about 400 feet from lower end. This drain ditch is about 2 or 3 feet deep and the bottom is obstructed with vegetable growth. It was flowing about 25 g.p.m.

Water from two small springs was flowing in from above and evidence of others at wetter times or when water is flowing in Simonton Ditch. The south drain flows nearly as much as, and the tile line twice as much as the north drain ditch, according to Bro. Basil. Prof. Kezer believes the soil can be reclaimed if water table was lowered. I believe if the north ditch was replaced with deeper tile drain and laterals, it would be very much more effective. Advised some prospect holes with auger to 6 feet along ditch. Some drainage on south side around barns is effective. Barns have to be protected by storm ditch above.

Things to be done:

1- Ascertain extent of water supply on south side and decide if the sewage effluent is safe to use.

2- Lay out reservoir, should it prove feasible, and plan inlet collecting ditch.

3- Survey for reservoir at B.

4- Determine means of draining bottom land and make survey.

5- If water supply proves inadequate, plan new pipe line from Simonton Ditch to cover part of area.
Date: Nov. 8, 1932

To: Mr. Ralph Parshall

From: President Lory

Subject: Cooperation with Mr. Dower in Mullen estate.

Mr. Dower of Denver, one of the administrators of the estate of Mr. J. K. Mullen, asked our cooperation in the development of the Shirley farms which were purchased by the estate and are being remodeled as a home for orphan boys.

I appointed a committee consisting of Professor Kezer, Chairman, Professor Morton and Professor Moorhouse to represent us in this service. There are some questions about irrigation and drainage which they would like us to answer for them. Could either you or Mr. Code do this? If so, confer with Professor Kezer who will arrange for you to see Mr. Dower. A trip to the farm and some preliminary surveys will be necessary.
J. K. MULLEN HOME FOR BOYS

Denver, Colorado.

Gentlemen:

We are submitting herewith plans for your irrigation pipe line from the Simonton Ditch to points on the south side of Bear Creek. It appears that a 10" pipe will have ample capacity for the area under consideration. At the first outlet, station 10 + 22, it will be possible to obtain about 196 miner's inches. At the second outlet station, 17 + 57, where a field ditch is to be supplied, 136 miner's inches can be obtained. At station 25 + 29, just north of the railroad tracks, 77 miner's inches can be obtained, and at the upper carrying ditch, station 27 + 0, 68 miner's inches. Above this point there is a patch of ground about an acre in extent which can be reached by extending the line with 4-inch pipe. The length of the extension is not known but is approximately 100 feet.

At station 10 + 22, it is proposed to use the old concrete splash box, but the center concrete cylinder is to be removed. The new riser will occupy this space. When the valve is opened, there will be a tremendous rush of water which we propose to control with a piece of perforated well casing as shown. The top of this well casing will have a cover containing a hole through which the valve is to be opened by means of a long-handled key. To give the operator further protection, a space of 6 inches is to be left unperforated. As we do not know the exact
size of the old concrete cylinder, it was our plan to have the well
casing just fit into this central hole.

At about Station 12+54 the line crosses the large tile line where
it is proposed to build another concrete box similar to the old one. The
length is to be as desired and the depth as necessary. It is thought
advisable to have a cover on the box, as shown. At station 17 + 57 is
another outlet structure for water to be turned into a field ditch. By
building up the banks slightly, water can be run either east or west.
A similar structure is to be built at station 25 + 25, but open at one end
only. At the intersection with the upper ditch, a more elaborate struct-
ure is provided which can be used as an outlet to either the ditch itself
or the field ditch just below it. It can be used also to receive water
from this ditch into the pipe line to be withdrawn at any outlet. A
plain slide gate and trash rack must be provided. All concrete struct-
ures to have 6-inch walls.

It is proposed to use the old heading in the Simonton ditch and
part of the old 18-inch line must be removed. The new pipe is to have
a bell end to fit into the old hole in the concrete. There are sev-
eral grade changes between the heading and the bridge which may require
some vertical angles in the pipe line, depending on the type of pipe used.
The line will be carried on the beams supporting the bridge stringers on
the downstream side. A wooden cover should be provided here to prevent
the sun shining directly on the pipe. An expansion joint may be advis-
able here also. The handhole indicated at the double turn is to facil-
itate cleaning out any obstruction occurring here.
Drain-outs are provided at the bridge and large tile line. The valves which are planned are those manufactured by the Martin Iron Works, Los Angeles, Calif. They are known as Type C alfalfa valves, are very satisfactory for such a condition as they are watertight, being seated on a composition gasket. They are much cheaper than gate valves. The riser pipes must be shop riveted to these valves.

A uniform depth of covering of 18 inches is indicated across the cultivated area. This may be changed to suit farming operations. Less covering is required north of the bridge, but the line must remain covered to prevent large temperature changes. Permission must be obtained from the railroad company to cross under their tracks. This permission must be obtained before letting of contract in order to find out their requirements.

Complete details of the concrete structures are not given, but any good carpenter can construct these from the generalized plans. It may be necessary to change the dimensions on the end structure where it was assumed that the center-to-center distance between the ditches was 6 feet.

In asking for bids on the pipe line the following plan is recommended:

Classes of pipe to be considered; approximate length 2700 feet as per attached drawing. **Price per foot**

- Plain galvanized, riveted or welded in 14 and 12 gauges. Joints to be specified.
- Dipped black, galvanized pipe in 14 and 12 gauges. Joints to be specified.
- Dipped and wrapped, black and galvanized pipe in 14 and 12 gauges.

The contractor is also to furnish:
1- 10" x 12" bell end at station 0 + 00,
1- 8" riser 4 inches long with light flange and companion blank flange and gasket (for handhole),
1- 10" riser 18" long riveted to 10" Martin type Q valve,
1- 10" riser 6" long riveted to 10" Martin type Q valve,
2- 10" risers, 10 inches long riveted to 10" Martin type Q valves,
1- 10" plain slide gate and fittings,
1- Trash rack of vertical rods approximately 3 feet square,
2- Drain-out connections as shown, equipped with 2-inch gate valves,
1- piece of 16-gauge perforated well casing, about 24 inches in diameter and 2 feet long perforated 1/4 inch, provided with cover containing keyhole,
1- key with 3-foot handle to open valves,

Additional pipe: Approximately _____ feet of 4-inch pipe with above specifications except in 16 and 14 gauges.

The above prices should include the installation, if so desired, and it is recommended. The contractor must provide his own final measurements to outlets and structures.

The trenching and concrete work can be handled as separate items.

IRRIGATION INVESTIGATIONS
Colorado Agr. Expt. Station

Oliver W. W. M.

Reobey recommends top of inlet to be submerged 2 feet. Taper first section of 20' from 20" to 10'. To avoid end thrust breaking pipe strap down at bridge. Air relief valve on blind flange at bridge.
Mr. W. E. Code,
Associate Irrigation Engineer,
Irrigation Investigations,
Fort Collins, Colorado.

Dear Sir:

We are in receipt of your letter of February 18, asking about valves to be used on steel pipe and to be used under an approximate head of 45 ft.

In answer to your letter, we take pleasure in recommending our Type Q Valve, which you will find illustrated on page 28 of our No. 31-E Catalogue, copy of which we are enclosing. This valve, you will see, attaches to a steel pipe with rivets and the flange is so arranged that a 10" valve fits over a 10" pipe.

We do not believe that you will have any trouble, whatsoever with these valves standing pressure, as we have installed this valve in this country under considerably higher pressures than 45 ft. Sometimes, in case of excessive pressure, we make this valve with the screw having a fine thread which, of course, allows the user to cinch the lid down much tighter than if the valve is equipped with screw having coarse thread, as are the B Valves which we shipped you last year.

We note what you say in reference to welding an ordinary orchard valve to your pipe, but we are compelled to state that we do not recommend this procedure, as the orchard valves are not really made to stand that much pressure. and doubt if you could make a satisfactory job with the orchard valves.

We might add here that the Q Valve can be used with a portable hydrant the same as the B Valve.

We will be glad to allow you the same discount on these valves as allowed on those shipped you last year; namely, 40% Net, f.o.b. Los Angeles, Calif.
Mr. W. E. Code, 2  2/21/32

Thanking you for your inquiry and hoping we will have
the pleasure of furnishing you with some of these valves, we are

Yours very truly,

MARTIN IRON WORKS

GJM/MH

Sales Department.

 signature
Fort Collins, Colorado
March 9, 1923

Mr. W. W. McLaughlin, Chief
Division of Irrigation
Bureau of Agr. Engineering
Berkeley, Calif.

Dear Mr. McLaughlin:

I was pleased to receive your letter of the 6th relative to the proposed pipe line for the J. K. Mullen Home for Boys. The several suggestions enumerated are very timely and I assure you we shall take advantage of them in the final plans of work.

With reference to your comment on this work, I concur fully with your idea that if this installation is made we should retain supervision of it. It is not likely that I would be able to supervise personally the whole job, but I have complete confidence in Mr. Code's ability to look after it. However, I shall keep in touch with the job as it develops.

Thanking you for your suggestions and comment, I am,

Yours very truly,

Senior Irrig. Engineer
March 6, 1933

Mr. R. L. Parshall
Colorado Agr'l Experiment Station
Fort Collins, Colorado

Dear Mr. Parshall:

I have asked Mr. Scobey to go over the blueprint and your suggestions regarding the pipe line for the J. K. Millen Home for Boys. The following suggestions are formulated after consultation between us:

The size of the pipe appears to be correct for the flows as indicated. Apparently the hydraulic gradient is drawn from the water surface in Simonton Ditch to the assumed points of outlet. This gradient should commence about 2 feet below the surface in this ditch, in order to allow for plenty of inlet loss plus the necessary velocity head. In other words, we suggest that the extreme top of the pipe at the inlet be at least 2 feet below the water surface in the ditch.

The entrainment of air and other troubles will be minimized if you taper the first 20 feet of pipe from a diameter of, say, 20 inches to the 10 inch pipe.

We note a sharp break in the gradient as the pipe drops downward at a pier on the bridge. To avoid any possibility of end-thrust breaking the pipe, we suggest that it be strapped down to the pier to prevent movement either upward or sidewise.

We suggest that an air-relief valve be placed on the blind flange at the bridge; the hood for the flange will make a good collection chamber for the air.

An additional possibility that I would like to have you consider, and then advise me, is as follows:

Should we not retain supervision of the installation of this system? If we are responsible for the design thus far, we do not wish to be placed in the position of responsibility for minor failures after construction but very little credit so long as operation is successful. In other words, so long as everything works satisfactorily it is THEIR installation, but if any trouble occurs then this trouble is broadcast as our responsibility.

Very truly yours,

Division of Irrigation,

[Signature]

W. W. [Invisible Signature]
GENERAL SPECIFICATIONS
for
ELECTRIC ARC-WELDED STRAIGHT SEAM PIPE

1. **General** -- All pipe furnished under these specifications shall have an outside diameter not less than that specified in the schedule but must conform to the requirements of standard bolted couplers, standard pipe flanges or special fittings or connections in case these are used.

2. **Plates or Sheets** -- All sheets used in the fabrication of electric arc-welded steel pipe shall be blue annealed sheets of welding quality and all plate of 3/16" or seven gauge and heavier shall conform to the American Society for Testing Materials Specifications for structural quality forge welding steel, Grade A (Serial Designation A78-30). The sheets or plates furnished shall be rolled to U. S. Standard gauge.

3. **Protection of Metal** -- All plates and all fabricated pipe shall be carefully protected from rust from the time of their manufacture until the pipe is dipped or coated.

4. **Arc Welded Pipe** -- All pipe shall be fabricated in lengths not exceeding thirty feet by welding together not more than six courses and each course shall be made from a single plate or sheet.

5. **Shearing and Rolling** -- All plates or sheets shall be sheared in a straight line along the edges that will form the longitudinal seam so that these edges when brought together will show practically no gaps or variations. Each course shall be rolled to a true cylinder before welding.

6. **Automatically Welded Seams, Description of** -- All seams, both longitudinal and circumferential shall be automatically electric arc welded. This shall be interpreted to mean that the act of welding is performed by automatically propelling an electric welding head above stationary metal, or automatically moving metal below a stationary electric welding head, and that in either case the amount of weld metal deposited...
shall be consistently the same for each foot of welded seam. This process shall be varied only in the case of elbows, tees, wyes, crosses or other specials where the shape of the finished product prohibits the use of automatic equipment.

7. **Types of Joint** -- All longitudinal seams on all diameter pipe shall be automatically butt welded and all circumferential seams on pipe up to and including eighteen (18) inches shall be automatically butt welded in gauges No. 10 or lighter. All circumferential seams on pipe over eighteen (18) inches in diameter, or on any diameter pipe fabricated from material heavier than No. 10 gauge, shall be automatically lap welded of the bell and spigot type, with a lap of not less than one and one-eighth (1-1/8) inches. The bells shall be formed by rolling or swaging the sections after the longitudinal seam has been welded. The bells shall be of such diameter as will give a close fit, but no part of the pipe shall have a diameter less than that specified. All welded joints shall have an efficiency of at least 90% in tension.

8. **Shop Welding** -- All welders employed in fabrication of the pipe shall be experienced on pipe welding. The butted edges of the plate on the longitudinal seam shall be held firmly in place during the welding operation by a clamp extending continuously the full length of the seam and backed up by a copper chill bar the full length, applied with pressure sufficient to insure the edges being welded in proper alignment and to prevent any undue roughness on the inside of the pipe. All seams must be thoroughly welded to the full depth of the plate in a continuous operation for the full length of each course of pipe, with an unvarying electrical pressure and a constant length of arc. The welds on the automatically electrically welded circumferential seams shall be built up to the full thickness of the plate. All welds must be thoroughly fused with the pipe metal at all sections of the weld,
and shall be free from laps, cold shuts, gas pockets, oxide inclusions, or other defects.

10. **Shop Tests** -- The manufacturer shall, on request of the Engineer, prepare test specimens for tension tests of welds. These shall be made in such a manner as will duplicate the conditions under which the pipe joints are made, and shall be of a size which will permit cutting and machining a standard tension test specimen from each piece. Except in case of failure to pass the tension test not more than one such specimen shall be required for each twenty five lengths of pipe, or a minimum of seven hundred and fifty feet in length.

Each length of pipe after fabrication and before coating, shall be subjected to a hydrostatic pressure test equal to one and one-half (1-1/2) times the safe working pressure. During the test the pipe shall be struck with a one and one-half (1-1/2) pound hammer along all joints, in such a manner as to thoroughly vibrate the metal, and any leaks discovered shall be immediately corrected to the satisfaction of the Engineer or his duly authorized inspector.

11. **Pipe Coating and Application** -- After the pipe has been shop tested, all loose scale and foreign matter shall be removed. It shall then be immersed in a bath of Pioneer Mineral Rubber #225 pipe dip, which dip is maintained at a temperature of about four hundred (400) degrees F. The pipe shall be allowed to remain in the bath until it attains the same temperature as the dip. It shall then be removed from the vat and allowed to drain in a vertical position until cool, producing an even coating inside and outside. Special fittings or irregular shapes may be coated by hand.

12. **Soil Proof Wrapping** -- Where pipe is to be wrapped it shall, after having been dipped and allowed to cool and dry, be placed in a wrapping machine and spirally wrapped with a special felt covering;
covering shall be as per Paraffine Company's, Inc. specification, or equal, and shall weigh not less than thirty seven (37) pounds per one hundred (100) square feet. Wrapping shall be put on under a tension of not less than thirty three (33) pounds per twelve (12) inch width of wrapping. During the wrapping a constant flow of hot pipe dip is to be applied in such a manner as to thoroughly bond and cement the wrapping to the pipe, excluding all air pockets and spaces. The wrapping shall extend to within five inches of each end of each section of pipe and shall be finished off by sealing with hot dip.

13. Preparation of Pipe Ends for Electric Field Welding -- Where installation of the pipe by electric field welding is specified, one end of each pipe length shall be rolled out to an enlarged diameter to provide a tight fitting socket for the male end of another pipe, but no part of the pipe shall have a diameter less than that specified. The enlarged end shall be formed by rolling or swaging the sections after the longitudinal seam has been welded. Where pipe is to be welded in the field, the coating shall be removed from the end for a distance of about two and one-half (2-1/2) inches.
SPECIFICATIONS FOR SPI-WELD PIPE

METAL:—All sheets, or strips, used in the fabrication of Spi-Weld Steel Pipe shall be of prime quality mild open hearth steel of welding quality. The surface shall be clean and free from blisters or blemishes. The sheets furnished shall be rolled to U. S. Standard Gauge.

PROTECTION OF METAL:—All sheets, or strips, and all fabricated pipe shall be carefully protected from rust from the time of manufacture until the pipe is dipped or coated.

METHOD OF MANUFACTURE—All pipe shall be manufactured by the spiral butt seam method and shall be rolled to a true cylinder before welding. The pipe shall be spirally welded either by the automatic electric arc welding method or by the automatic oxy-acetylene process. The interior of the pipe shall be smooth and a cross-section taken through the weld shall in all cases be greater than the thickness of the sheet. All welds must be thoroughly fused with the pipe metal at all sections of the weld and must be free from defects.

SHOP TESTS:—Each length of pipe after fabrication and before coating shall be carefully inspected and subjected to a hydrostatic test of one and one-half times the safe working pressure. During the test, the pipe shall be struck sharply at six inch intervals along the weld with a hammer weighing one and one-half pounds in such a manner as to thoroughly vibrate the metal. Any leaks that might develop shall be immediately repaired before coating.

PIPE COATING AND APPLICATION:—After shop testing, all loose scale or foreign matter shall be removed and the pipe shall be dipped in a bath of asphaltic pipe dip maintained at a suitable temperature for proper application. The pipe shall remain in the vat until it attains the same temperature as the dip. It shall then be removed from the vat and allowed to drain until cool. The resulting coating shall be tough, elastic, strongly adhesive and durable at normal atmospheric temperatures. It shall be free from blisters or other imperfections.

WRAPPING:—When pipe is to be wrapped it shall, after having been dipped and allowed to cool and dry, be placed in a wrapping machine and spirally wrapped with asbestos, rag-felt or Osnaburg fabric, according to the specifications, applied under tension. A protective wrapping of Kraft paper shall be placed on the outside if Osnaburg wrap is used. During the wrapping, hot pipe dip is to be applied in such a manner as to thoroughly bond and cement the wrapping to the pipe, excluding all air pockets and air spaces. The wrapping shall extend to within five inches of each end of each pipe section.

PREPARATION OF PIPE ENDS FOR ELECTRIC FIELD WELDING:—Where installation of the pipe by electric field welding is specified, one end of each pipe length shall be rolled out to provide a tight fitting socket for the male end of another pipe. The enlarged end shall be formed by rolling or swaging the section after the longitudinal seam has been welded and in a special roll or swaging machine.
For Long-Dependable Trouble-Free Service

Calco Spi-weld Pipe of Galvanized Armco Ingot Iron

For the Efficient Conveyance of Water, Gas and Oil

With Galvanized Field Couplings or Flanges
A Heavy Zinc Coating on a Base of the Purest and Most Durable of Available Metals

"THE IRON THAT'S MADE TO LAST"
Calco Spi-weld Pipe

Has Demonstrated Its Structural Superiority

Through a long period of development methods have been perfected by which the plates are formed into a true circular tube with one smooth, butt-welded, spiral seam. The true round form is essential to convenient assembling in the field and also to high carrying capacity. It is an outstanding merit of this construction.

The welds produced in the manufacture of Calco Spi-weld Pipe develop the full strength of the material. Before leaving the factory every length is hydrostatically tested to a pressure at least 50 per cent greater than that recommended as a working standard.

Transverse seams are almost wholly avoided and the interior of Spi-weld Pipe is almost ideally smooth. On this account Spi-weld Pipe has been placed in the class of highest carrying capacity by Fred C. Scobey, Senior Irrigation Engineer, Division of Agricultural Engineering of the U. S. Bureau of Public Roads, in his bulletin No. 150, "The Flow of Water in Riveted Steel and Analogous Pipes."

*Trade Mark Registered
U. S. Patent Office
Now Heavily Galvanized Pure Iron is Available for Spi-weld Pipe

Galvanized Armco Ingot Iron has an unequalled service record in the form of corrugated culverts. All over the United States and Canada are thousands of Armco Culverts which have been serving under the highways and railroads for from fifteen to twenty-five years and which seem only to have begun their period of usefulness. Their basic material is the purest and most even of commercial irons and the service life of their galvanized coating is much extended by its favorable relation to a pure iron base. In other words, the comparative absence of negative impurities in the base metal is a favorable circumstance with respect to the life of the galvanizing.

Galvanized Ingot Iron is not corrosion proof; in some exceptional locations it is severely attacked. But the record of the past quarter-century shows that on the basis of service rendered, its moderately higher cost is amply justified.

Galvanized Armco Spi-weld Pipe is available in the sizes and gauges shown on the following page. Tables of capacity and detailed dimensions are included in other Spi-weld literature.

It is furnished in 20-foot or 30-foot lengths, unless otherwise specified, and with plain ends.

Field joints are made with Dayton type, galvanized couplings or flanges.

For extremely corrosive situations Galvanized Spi-weld can be given the extra protection of Osnaburg Wrapping.

For further detailed information write our offices or ask for a call by our representative.
# Dimensions and Weights of Calco Spi-Weld Pipe

<table>
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<tr>
<th>Outside Diameter in Inches</th>
<th>U. S. Standard Gauge</th>
<th>Weight Per Foot Pounds</th>
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*Based on a fiber stress of 12,000 pounds per square inch. Working head = 2.31 \times Working Pressure.

All sheets and plates from which Calco Spi-weld Pipe is fabricated are rolled to U. S. Standard Gauge.

All quotations, sales or contracts for sale by us are subject to terms and guaranties listed in our principal catalogues.

The word “Armco” as used herein by permission is the trade-mark of the American Rolling Mill Co. and refers to its rust resisting Ingot Iron.

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R. Hardestry Manufacturing Co.
Denver, Colorado

Pueblo, Colorado -- Salt Lake City, Utah
Missoula, Montana -- Sidney, Montana -- Boise, Idaho
HARDESTY
dependable
AUTOMATIC
ELECTRIC ARC
WELDED PIPE

The
R. HARDESTY
MANUFACTURING CO.
315 AT BLAKE ST.
DENVER  COLORADO
A NEW era has dawned in the pipe industry, born of the development of automatic welding machinery such as has never before been known. Everywhere, engineers and users of pipe are being convinced by the rapidly growing number of successful installations that the problem of dependable welding has been solved. The shortcomings and disappointments of hand welding have long been recognized and hand welding in general classified accordingly, with ample experience to justify the judgment.

However, now, as a result of the knowledge and skill of the electrical engineers of this country, machines have been invented and perfected whose process of operation is as scientific as the smelting and refining of the metal itself. The result has been revolutionary.

This is the "Age of Progress." Old methods give way to new and better methods. All professional and business men know and recognize this fact. They work and buy accordingly.

Hardesty Soil Proof Wrapped Pipe was selected for this Power Plant Installation in Wyoming
THE PIPE OF THE FUTURE

In the "March of Progress" there are certain pioneers who, while mindful of modern day developments, refuse to place a product on the market that is still in the experimental stage, or countenance any product about which there is doubt. The House of Hardesty is such a pioneer and has always been careful to place on the market only proven products.

This latest offering—Hardesty DEPENDABLE Automatic Electric Arc Butt Welded Pipe—is presented to our customers and friends with the assurance that it has successfully passed the most exacting tests of our Engineering and Research Departments and that they have proclaimed it as being ready for the user.

The pipe presented is completely automatic electric butt welded, this company being one step ahead of other manufacturers in that it not only automatically welds the longitudinal seams but also automatically welds the circumferential seams. Hand welding and the personal element have been entirely eliminated and with them has vanished every objection raised against welded construction.

A Field Welded Curve in Hardesty Wrapped Pipe
THE usual impression that a weld is not dependable has been based on the behavior of hand welding in general and has been fully justified in fact. Hand welding is not a sure process and is good or bad to just the same degree that the operator is good or bad, and it will continue to be so. For many years it has been the aim of electrical engineers to produce a machine for automatic welding—a device whose successful operation would not be dependent upon the experience, skill and sincerity of a man. They have accomplished this, with the result that electric arc welding is now a most dependable, economical and highly practical means of joining metal plates together.

The automatic process produces uniform welds of a superior quality and eliminates the uncertain, and therefore undesirable, personal element unavoidable in hand welding. In automatic welding it is possible to maintain a shorter arc than in hand welding. The plate or work is heated by the release of energy at the terminal of the arc, by radiation and conduction from the arc and by radiation from the hot surface of the electrode and the hot metal deposited on it. With a short arc this heat is concentrated on the plate, whereas with a long arc a great deal of it is lost into the surrounding space. Consequently, with a short arc a greater portion of the energy is transformed into useful heat.

A long arc is not so stable as a short arc and tends to wander about over a considerable area on the plate and the arc flame blows about very rapidly. This action, together with the greater length of the arc, affords considerable opportunity for the air to come in contact with the metal passing from the electrode to the plate and also in contact with the very hot metal in the arc pool or crater. This results in the absorption of oxygen and nitrogen, both of which are detrimental to the quality of the weld. With a short arc, the flame consisting of vapors coming out of the arc acts as a protection and prevents very largely the absorption of these outside gases.
short arc is constantly maintained in automatic welding, but in hand welding its maintenance is physically impossible. Hence the superiority in solidity, ductility, and uniformity attributable to automatic welding is not obtainable in hand welding.

By our method of automatic welding, the electric arc is stabilized and the heat so localized that no strains or stresses are set up in the metal adjacent to the weld. Each foot of weld contains exactly the same amount of welding material as every other foot. The sheets are fused for the entire thickness and a surplus of metal is deposited uniformly above the level of the sheet so that the weld is of a strength equal to, or greater than, that of the plate itself.

The method of riveting plates together is a process whereby a certain amount of the original plate material is punched from the sheet. In the case of double riveted construction, if the designing
AUTOMATIC ELECTRIC BUTT WELDING

is very carefully done and the workmanship is good, a joint will result whose strength is a little more than 70 per cent of the strength of the unpunched plate.

The accompanying photograph shows the result of a test to destruction of a 15 inch automatic electric arc butt welded pipe. The original specimen was 48 inches in circumference from end to end and when ruptured was 60 inches in circumference in the center. It can be seen that the rupture occurred well away from the seam. In other words, a joint efficiency greater than 100 per cent was obtained.

Many other similar tests conducted by this company have proven conclusively that the strength of the weld is greater than that of the metal itself, for in no instance has the rupture occurred in, or at the edge of the weld.

There are three common methods used in joining plates. These are the butt weld, the butt strap weld, and the lap weld. The lap type of joint may be welded at one or both edges. The butt strap

A Test to Destruction of a Section of Hardesty Automatic Electric Welded Pipe
AUTOMATIC ELECTRIC BUTT WELDING

Joint may be welded as a true butt weld and two edge welds. Welding engineers generally are agreed, however, that the simple butt weld is the most efficient when applied to sheets and plates. For this and other reasons it has been adopted in our process of manufacture. All statements relative to automatic welds in this bulletin, therefore, have reference to butt welds.

We are at present confining automatic welding operations to material ranging in thickness from 1/16 to 1/4 inch. For these thicknesses the efficiency of automatic welded construction has been conclusively proven. Greater thicknesses of metal, however, present different problems. Great strides are now being made in welding processes for heavy plates, and indications are that in the very near future thick plates will be welded with an efficiency equal to that now obtained in the thinner ones.

SMOOTH INTERIOR SUPERIORITIES

The use of butt welded construction and special devices in the manufacture of Hardesty Automatic Electric Butt Welded Pipe eliminates all laps and globules or “tear drops” of metal in the inside of the pipe barrel.

As will be shown later, this smooth interior lengthens the life of the pipe by eliminating certain primary causes of erosion.

But of equal importance is the fact that it offers also a much greater carrying capacity than rough interior pipe of the same diameter.

Hydraulic engineers recognize this great difference in carrying capacity by assigning to smooth interior pipe a co-efficient of 140
in the Hazen-Williams Formula, as against 115 for riveted pipe. Experience has shown these relative carrying capacities to be correct.

By comparison on this basis, it may be readily seen that a given diameter of welded pipe will convey from fifteen to twenty per cent more water than a rough interior pipe of the same diameter, or, a much smaller size welded pipe may be selected to deliver the same quantity as the larger rough interior pipe.

The smooth interior is an especially vital point to be considered where added friction means loss in dollars. In the case of pumping plants, every unnecessary bit of friction offered by the pipe results in extra work for the pumps to perform, just as though they were raising the water to a higher level.

With power plants unnecessary friction in the pipe, which must be overcome by the water descending to the power plant, subtracts just so many horse power from the useful output of the plant. These inefficiencies are eliminated when Hardesty Smooth Interior Pipe is used.

Many uses are found for Hardesty Pipe by Sugar Factories
TYPES OF JOINTS

In many pipe installations operating under comparatively low pressures, a type of slip or drive joint has proved very satisfactory. The old type of joint was similar to a stove pipe or telescope joint and presented a lap inside the pipe barrel. In order to maintain the smooth interior of Hardesty Automatic Electric Butt Welded Pipe it was necessary to devise a new type. The improved Hardesty slip joint with the smooth interior is shown in the accompanying photograph. It is easily installed, is water tight under medium pressures, and acts as a perfect expansion joint. The old type of slip joint was cone shaped, and any contraction in the length of the line led to leakage in the joint. The Hardesty improved slip joint collar, being of constant diameter, eliminates this disadvantage and allows a movement of several inches in the joint without leakage.

The slip joint may be furnished without fastening or with bolts as shown.

The Dayton or Dresser Type Sleeve Coupler shown in the accompanying illustration is the most perfect, water-tight, easily installed field joint ever designed for high or low pressure work.

It is admirably adapted to Hardesty Automatic Electric Butt Welded Pipe and is highly recommended for hydraulic work where pressures range from zero to four hundred pounds per square inch.
TYPES OF JOINTS

The steel couplings combine flexibility and strength, which care for curvature of line, contraction, and expansion, as well as settling ground. Gaskets in these couplers have been found in excellent condition after forty years’ service. The joint may be used to advantage also on steam, air, and vacuum lines.

We are prepared to place upon our pipe flanges of either pressed or rolled steel, forged steel, cast steel, or cast iron. Steel flanges will be welded in place and cast iron flanges riveted. Flanges can be furnished of light or heavy type as required by operating conditions.

Two types of gaskets are available for general use, namely the flat gasket (full or part face) and the round tube. Experience has shown that the flat gasket is not always satisfactory for light rolled or pressed steel flanges although perfectly satisfactory with heavier steel or cast iron flanges. The tubular gasket should therefore be used on light flanges and flat gasket for heavier flanges.

Hardesty Automatic Electric Butt Welded Pipe is well adapted to field welding. This process of late years has come into very general use and offers an economical method of joining pipes in the field.
EROSION and corrosion are the two main causes of metal pipe failure, aside from outside destructive physical forces.

Erosion is the wearing or grinding away of the metal by foreign substances. Erosive action is not usually serious in smooth interior conduits conveying water containing little or no abrasive substances. It does, however, become a very decided factor in the life of the pipe when the interior is rough and contains steps or projections such as the laps and rivet heads which are present in riveted pipe. Around such obstructions swirls and eddies form and small abrasive particles whirling in the eddies constantly wear away successively the protective coating, the iron oxide which forms when the coating has gone, and finally the body of the pipe itself. The natural protective rust coat is not allowed to remain, and the life of the pipe, therefore, is dependent on its thickness rather than upon any natural resistance which it may offer to ordinary corrosive action.

The accompanying photograph shows clearly the nature of a failure of this type at the downstream side of a lap in a riveted pipe.
COMMON CAUSES OF PIPE FAILURE

carrying ordinary irrigation water. The smooth interior of the Hardesty Automatic Electric Butt Welded Pipe admits of no such failure as this of the riveted pipe.

So much for erosion.

CORROSION may be broadly defined as the action on metals of certain external agencies which cause their deterioration or destruction. Commercial metals tend to revert to more stable compounds, of which the metal ores as found in nature are familiar examples. The theory of corrosion as now generally accepted states that this action is electro-chemical as well as chemical in nature. The following statements apply to corrosion of pipe lines under the usual conditions in which they are installed and do not apply particularly to strictly chemical reactions which may take place in a laboratory.

It is a well known fact that iron will not corrode at normal temperatures in the entire absence of moisture. If metals are im-

Rigidity of concrete necessitates originality in caulking
COMMON CAUSES OF PIPE FAILURE

...mersed in water or other electrolyte, each has a certain definite electrical potential and tendency to dissolve. The tendency to dissolve or corrode is dependent upon the presence of acids, alkalies, salts, hydrogen, oxygen, and other metals. The rate of corrosion is also affected by the composition of the metal itself.

Unlike metals in contact with, or connected by, an electrolyte form small galvanic batteries because of their difference in electric potential. A small electric current is developed which to a greater or less degree dissolves or changes one metal at the expense of another. This type of corrosion exists wherever an iron or steel pipe line comes in contact with acids, so-called alkalies, or earth salts which exist either outside the pipe, in the water carried, or in the metal itself. This electrolytic or galvanic action may be termed natural corrosion.

If, now, an externally created electric current is imposed upon a pipe line so that the pipe acts as an electric conductor for this current, a very much aggravated galvanic action occurs, usually in moist soils where the imposed current leaves the pipe. The very rapid destruction of the metal in this manner is generally known in the hydraulic field as stray current electrolysis.

Experience already obtained indicates that certain compositions of metals are better than others under certain conditions. There are so many factors, however, governing the rate of corrosion, and so little is known about the subject, that at the present time, comparatively speaking, greater strides have been made in the development of protective coatings than in the development of commercial metals to resist destruction.

Hardesty Automatic Electric Butt Welded Pipe can be supplied in open hearth steel, copper bearing steel, or pure iron, which are the three types of commercial sheets and plates now available for selection in accordance with the individual conditions encountered.
EVERY man, whether engineer or layman, who has had any experience with pipe lines, knows that these installations must be protected against all forms and causes of corrosion. In order for corrosion to take place, the destructive agencies must come in contact with the metal. In the case of ordinary pipe lines, water forms the vehicle which brings the destructive agencies to the pipe. It follows, therefore, that the most practical and positive protection against corrosion is to prevent this moisture from reaching the metal. It can only be accomplished by coating the pipe with a substance which will firmly adhere to the metal surface, which will prove impervious to water, which has no loopholes, and which is chemically inert in the presence of acids, alkalies, or other salts contained in the soil or in the water in the pipe. The coating must be so constituted that it will retain its elasticity and insulating qualities for a long period of time.

Asphalt as found in the ground has existed for thousands of years in the condition in which it is found. It is a product on which the forces of nature have ceased to act. It is a product in which no more changes can occur; and it is reasonable to expect, and experience has shown, that if properly treated and applied to a pipe and again placed in the ground it will continue to exist as it did before.

A mile of Hardesty Soil Proof Wrapped Pipe for city water works extension
HARDESTY PIPE COATING

As a primary protection against corrosion, Hardesty Automatic Electric Butt Welded Pipe is given a coating of hot asphalt, which has proven its worth through years of satisfactory service. Following inspection of the finished pipe, all loose scale and foreign substances are removed from the surface of the metal and the pipe is taken to the dipping plant. Here it is immersed in a bath of protective asphalt coating heated to a temperature of approximately 425 degrees and allowed to remain until it attains the same temperature. The liquid flows through the inside of the pipe and over the outside, excluding all air and tenaciously adhering to the metal. After dipping, the pipe is lifted from the vat and drained in a vertical position, thus producing an even thickness of coating inside and out.

This company spares no expense to avail itself of the experience of the manufacturers of pipe coating materials, and we obtain the best that is to be had and apply it as carefully as possible. During the dipping process the degree of heat is properly regulated and a careful check is kept on the consistency of the asphalt by laboratory tests. All Hardesty Automatic Electric Butt Welded Pipe, unless specifically ordered otherwise, is immersed in the bath of hot preservative coating.

Difficult Arc Welded Fittings can be Soil-Proof Wrapped

— 16 —
THE preservative coating is placed inside and outside of all pipe, but in addition there can be applied a Hardesty Soil Proof Wrapping consisting of a two-ply asphalt impregnated, machine saturated and coated waterproof felt wound spirally around the pipe with an additional coating of hot asphalt flowed between the wrapping material and the first asphalt coating applied by the dipping process. The addition of this felt coating is a most economical investment to prolong the useful life of any pipe line.

In the average pipe line, corrosion occurs from the inside out and from the outside in at about the same rate. It can readily be seen, therefore, that, in the case of the average pipe line, by protecting one side of the metal with a waterproof material the corrosion on the pipe will be approximately one-half what it would be without such protection. If one-half the corrosion is eliminated, it follows that the life of the pipe is doubled. In exceptionally destructive soils, the rate of corrosion on the outside of the pipe may be far greater than on the inside. This condition is most prevalent in the Western states, where pipe lines traverse soils highly impregnated with alkali. By waterproofing the outside of a pipe, under these conditions, the elimination of corrosion caused by soil salts will much more than double the life of the pipe.

If the life of an installation can be doubled by the wrapping, isn’t this proof enough of the economy of purchasing wrapped pipe in preference to unwrapped pipe at the outset? Where corrosive soils are encountered, the need of a soil proof wrapping becomes even more imperative.

The problem of maintenance has not been mentioned for the reason that it requires no great stretch of the imagination, we believe, to see that the difference in cost between wrapped and unwrapped pipe is expended many times over in an expensive endeavor.
HARDESTY WELDED PIPE

HARDESTY SOIL PROOF WRAPPING

to prolong the use of the unwrapped pipe after its proven economic existence has been exceeded. Actual experience in installations where the same conditions prevail has shown that pipe coated with asphalt only has failed completely while the wrapped pipe was still in excellent condition.

The application of the asphalt impregnated felt to the outside of the pipe is not new. Instances are on record where sheet metal pipe protected on the outside in this way has been examined after ten years’ service and the wrapping and pipe found to be in perfect condition.

It is quite evident from this experience that the wrapping material has excluded all air, water and destructive elements from the metal of the pipe and that the action of corrosion has been successfully defeated.

Other advantages aside from those mentioned are that soil proof wrapping tends to protect the pipe from heat and cold and is a very good insulator against stray electric currents which might cause electrolysis of the metal, as explained elsewhere.
HARDESTY SOIL PROOF WRAPPING

In the case of pumping plants or installations in the vicinity of running machinery, the soil proof wrapping tends also to eliminate or deaden vibration.

In any case the application of the felt to the outside of the pipe is insurance that a double unbroken coating of perfect compound will be obtained intact in the final installation.

In order to obtain the full service value of either asphalt or any other coating it must contain no scars or flaws at the time of back-filling. It is, therefore, absolutely necessary to carefully retouch or recoat all scars or abrasions incurred during transit or handling of the pipe.

Careful attention to this precautionary measure will be more than repaid by service rendered.

The foregoing discussion applies to pipe buried in the soil.

If pipe is to be subject to atmospheric conditions it may, and probably will be desirable, to vary the coating compounds to suit the requirements.

Fittings can be made to fit any condition
These are for air distribution
ADAPTABILITY OF HARDESTY BUTT WELDED PIPE

HARDESTY Automatic Electric Butt Welded Pipe of proper thickness is the ideal pipe for flow lines, inverted siphons, and pressure lines in irrigation or power development work and for supply lines from reservoirs or other sources to cities and towns.

Because of the many degrees of thickness possible when fabricating this type of pipe, it can be made to conform more exactly to strength requirements than can any constant thickness type. However, strength requirements based on pressure within the pipe should not be the only consideration.

The erosive or corrosive properties of the water carried, the surrounding soil conditions, the external forces acting on the pipe, together with the ultimate life required, should all bear on the decision as to the proper gauge and kind of metal.

One very decided advantage of Hardesty Automatic Electric Butt Welded construction is that fittings of any type, such as elbows, wyes, tees, crosses, etc., can be provided in the pipe line to fit the exacting conditions of construction without the penalty of the usual enormous cost for special fittings.

Hardesty Arc Welded Fittings are frequently made with either bell or spigot end for lead caulking in Cast Iron or Matheson Joint Pipe
ADAPTABILITY OF HARDESTY BUTT WELDED PIPE

These fittings are exceptionally useful in City Pipe Line Work, in Mining Work and in such places as Factories, Sugar Refineries, Ore Extraction Mills, Sand and Gravel Plants, Chemical Plants, etc. The pipe has been found highly economical for spray and cooling systems where frequent outlets and constantly decreasing sizes of pipe are required.

This pipe is equally adaptable to water, air, blower, exhaust steam or vacuum lines.

Because it offers longer service life, possesses greater carrying capacity and offers less friction resistance, Hardesty Pipe is more valuable to the purchaser and is worth a higher price than any rough interior conduit of the same material.

Hot Asphalt hermitically seals the wrapping at the field joint and assures an unbroken armor for the metal
HARDESTY SERVICE

In order to best serve the purchaser, our Engineering Department will, if furnished the necessary information, gladly make recommendations as to products considered best for the given conditions.

The data furnished should consist of a general description of the proposed work; a profile and alignment survey of the line, or statements as to the quantity of water to be carried, the total length of pipe with number and degree of elbows if any, the available fall and the maximum pressure; whether an open end flow line or line with valves is intended; whether pipe line is laid on the surface or underground; the depth of fill if buried, and any unusual features of erosion or other action bearing on the life, operation, or capacity of the pipe line. In order to better determine the type or composition of metal best adapted to the conditions, it is further advisable to know if the water carried and the soil surrounding the pipe is neutral, acid, or alkali.

Many details of the successful operation of a line depend upon the contour of the ground traversed, and the value and importance of an accurate profile on expensive installations can not be overstressed. The service of a competent engineer should be obtained for this part of the work if for no other.

The installation of a pipe line should be made under the supervision of an experienced man and often requires the use of tools and equipment not ordinarily obtainable.

This company is prepared to furnish both men and equipment for the installation of Hardesty Electric Automatic Arc Welded Pipe.
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<td>19.4</td>
<td>24.9</td>
<td>29.2</td>
<td>32.0</td>
<td>38.5</td>
</tr>
<tr>
<td>24</td>
<td>18.1</td>
<td>24.4</td>
<td>22.1</td>
<td>28.4</td>
<td>36.2</td>
<td>39.5</td>
<td>47.8</td>
</tr>
<tr>
<td>30</td>
<td>22.5</td>
<td>30.4</td>
<td>27.6</td>
<td>35.5</td>
<td>45.6</td>
<td>50.7</td>
<td>47.8</td>
</tr>
<tr>
<td>36</td>
<td>27.0</td>
<td>36.4</td>
<td>33.1</td>
<td>45.2</td>
<td>54.6</td>
<td>64.7</td>
<td>57.3</td>
</tr>
<tr>
<td>42</td>
<td>35.5</td>
<td>49.5</td>
<td>36.2</td>
<td>52.7</td>
<td>65.7</td>
<td>86.8</td>
<td>66.8</td>
</tr>
<tr>
<td>48</td>
<td>44.0</td>
<td>56.5</td>
<td>40.1</td>
<td>56.0</td>
<td>72.6</td>
<td>97.3</td>
<td>76.3</td>
</tr>
<tr>
<td>54</td>
<td>49.6</td>
<td>63.7</td>
<td>46.7</td>
<td>67.7</td>
<td>81.8</td>
<td>114.2</td>
<td>95.3</td>
</tr>
<tr>
<td>60</td>
<td>54.6</td>
<td>66.7</td>
<td>51.5</td>
<td>72.7</td>
<td>90.8</td>
<td>133.5</td>
<td>114.2</td>
</tr>
</tbody>
</table>

The figures given for dipped pipe are weights in pounds per foot of plain end pipe treated with standard hot asphalt coating only. The figures for wrapped pipe are weights of finished plain end pipe with both standard hot asphalt coating and Hardestey Soil Proof Wrapping applied.

Shipping weights of pipe must include, of course, the weights of field joints. Weights of various types of joints will be furnished on request.

We can furnish gate valves, air and vacuum relief valves, pressure air relief valves, check valves, foot valves, drain plugs and all accessories normally present on pipe lines.

On request, prices will be furnished on all pipe, pipe fittings, and accessories for complete installation.
HYDRAULICS OF PIPE

The quantity of water which will pass through any given pipe is determined by the total fall, total head or pressure producing flow, the length of the pipe, the condition of the pipe interior, whether smooth or rough, the number and abruptness of bends and the presence of valves or other fittings incorporated in the line.

The total head is divided into three parts: first the entrance head, second the velocity head and third the friction head. In pipe lines of considerable length, the sum of entry head and velocity head does not ordinarily exceed one foot and in cases of long pipes under low heads may be entirely neglected.

The discharge for long pipes may therefore be read directly from the chart on the following page which is based on friction head only. Both entry head and velocity head, however, must be considered in determining discharges of short pipes especially when high heads are involved.

Calculations for flow become highly technical in lines where various diameters are used and where curves, valves and fittings occur and such cases should be referred to an engineer familiar with this work.

Furthermore, the successful operation of a pipe line is frequently dependent upon the proper location of air valves, vacuum relief valves, expansion joints, anchorages, etc., thus greatly increasing the need for technical advice on such installations and making an imperative demand for the services of an experienced engineer.

The accompanying chart gives the flow in Hardesty Automatic Electric Arc Welded Pipe based on a consideration of friction only in a line of straight pipe. For very long lines under low heads, the discharge may be read directly from the chart, providing the line contains no elbows and is of constant diameter. For short pipes and high heads, it is necessary to consider entrance head and velocity head in addition to friction head and consequently the discharge is not given directly by the chart. The entrance head is that portion of the total head lost at the intake when water enters the pipe. It may ordinarily be assumed at one-half of the velocity head. The velocity head is that portion of the total head expended in creating the velocity of the moving water column. Values of velocity heads corresponding to given velocities are computed from the formula $h = \frac{V^2}{2g}$ where $h$ is the head in feet, $V$ is the velocity in feet per second and $g$ equals 32.2, the gravity constant. For convenience a small table of velocity heads is given herewith.

THEORETICAL HEADS IN FEET CORRESPONDING TO GIVEN VELOCITIES IN FEET PER SECOND

<table>
<thead>
<tr>
<th>$V$</th>
<th>$h$</th>
<th>$V$</th>
<th>$h$</th>
<th>$V$</th>
<th>$h$</th>
<th>$V$</th>
<th>$h$</th>
<th>$V$</th>
<th>$h$</th>
<th>$V$</th>
<th>$h$</th>
<th>$V$</th>
<th>$h$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>.02</td>
<td>4</td>
<td>.25</td>
<td>7</td>
<td>.76</td>
<td>10</td>
<td>1.6</td>
<td>16</td>
<td>4.0</td>
<td>22</td>
<td>7.5</td>
<td>28</td>
<td>12.2</td>
</tr>
<tr>
<td>2</td>
<td>.06</td>
<td>5</td>
<td>.39</td>
<td>8</td>
<td>1.0</td>
<td>12</td>
<td>2.2</td>
<td>18</td>
<td>5.0</td>
<td>24</td>
<td>9.0</td>
<td>30</td>
<td>14.0</td>
</tr>
<tr>
<td>3</td>
<td>.14</td>
<td>6</td>
<td>.56</td>
<td>9</td>
<td>1.3</td>
<td>14</td>
<td>3.0</td>
<td>20</td>
<td>6.2</td>
<td>26</td>
<td>10.5</td>
<td>32</td>
<td>15.9</td>
</tr>
</tbody>
</table>

The determination of the discharge of short pipes is made by a series of trial calculations in which the velocity is assumed and the corresponding entrance head, velocity head and friction head are figured. In the correct solution, the assumed velocity will equal the actual velocity as found from the chart and the sum of corresponding entry head, velocity head, friction head, and other losses will equal the total available head on the pipe.

Elbows or curves in pipe lines decrease the flow. Experiments indicate a minimum loss when the radius of the curve varies from $2\frac{1}{2}$ to $3\frac{1}{2}$ times the diameter of the pipe. The resistance of an easy right-angled bend is equivalent to that in a straight pipe 10 to 15 diameters in length, while for a sharp right-angled bend or elbow the equivalent length is from 30 to 36 diameters. For easy bends and other degrees of elbow the equivalent length may be taken from the following table. The actual length of the pipe line should be increased by the equivalent length due to bends before determining the ratio of fall to length.

EQUIVALENT LENGTH IN TERMS OF PIPE DIAMETERS

<table>
<thead>
<tr>
<th>Degree</th>
<th>90°</th>
<th>60°</th>
<th>45°</th>
<th>30°</th>
<th>15°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameters</td>
<td>15</td>
<td>6.1</td>
<td>3.3</td>
<td>1.4</td>
<td>0.3</td>
</tr>
</tbody>
</table>
CARRYING CAPACITY OF HARDESTY
SMOOTH INTERIOR ELECTRIC ARC WELDED PIPE

To determine the diameter of pipe necessary to carry a given quantity of water on a given slope, enter the diagram at the left on the line corresponding to the quantity and trace horizontally until the line representing the slope is intersected. The first diagonal line (sloping upward to the right) above this point corresponds to the diameter required, and is indicated at the top or at the right of the diagram at the extremity of the line. The velocity in the pipe is indicated by the diagonal lines (sloping upward to the left) nearest the intersection point.

To determine the quantity carried by any pipe on a given slope, enter the diagram at the bottom with the given slope and trace vertically until the diagonal line representing the pipe is intersected. The horizontal line passing through this point represents the discharge in second feet, and the other diagonal lines nearest the intersection indicate the velocity.

The above diagram is based on King's Formula using average values of the coefficient for smooth asphalted pipes. Discharges approximate very closely the values obtained from the Hazen-Williams formula when C=146.
HARDESTY WELDED PIPE

SPECIFICATIONS FOR AUTOMATIC ELECTRIC ARC BUTT WELDED, ASPHALT COATED, SOIL PROOF WRAPPED, SMOOTH INTERIOR METAL PIPE

Each section of pipe shall be subjected to internal hydrostatic pressure test 100% in excess of specified working pressure.

1. DIAMETER. All pipe furnished under these specifications shall have an inside diameter not less than that specified in the schedule except that the outside diameter of the pipe shall conform to the requirements of standard pipe flanges, special fittings or connections in case these are used. When pipe is equipped with flanges or special field connections, the manufacturer shall state the clear inside diameter of the pipe which will be furnished.

2. ANALYSIS OF MATERIAL. The metal from which pipe eight gauge and lighter is manufactured shall conform with one of the following analyses as selected by the engineer:

<table>
<thead>
<tr>
<th>PURE IRON</th>
<th>OPEN HEARTH STEEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon</td>
<td>.045</td>
</tr>
<tr>
<td>Sulphur</td>
<td>.065</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>.011</td>
</tr>
<tr>
<td>Carbon</td>
<td>.011</td>
</tr>
<tr>
<td>Manganese</td>
<td>.035</td>
</tr>
<tr>
<td>Copper</td>
<td>.040</td>
</tr>
<tr>
<td>Oxygen</td>
<td>.021</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>.001</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>.004</td>
</tr>
<tr>
<td>TOTAL</td>
<td>.147</td>
</tr>
<tr>
<td>Iron</td>
<td>99.853</td>
</tr>
</tbody>
</table>

If copper bearing iron or steel is to be furnished, copper may be added to either of the above analyses to produce a copper content of .17 minimum to .40 maximum.

The material from which pipe eight gauge and heavier is manufactured shall conform to the standard specifications for plain steel or copper bearing steel, etc., as outlined in the latest year book of the American Society for Testing Materials. At the option of the engineer, the manufacturer may be required to furnish a certified copy of the rolling mills analysis of the heat from which the sheets or plates are rolled, or may furnish test pieces for testing by a recognized testing laboratory, the manufacturer to be held free from any expense if the latter procedure is adopted.

3. VARIATIONS OF WEIGHTS AND THICKNESS. Sheets and plates may vary in weight and thickness within the limits of permissible variations as given in the last year book of the American Society for Testing Materials.

4. TYPE OF CONSTRUCTION. All pipe furnished under these specifications shall be manufactured by Automatic Electric Arc Butt Welding both the longitudinal and circumferential seams. The process of manufacture shall be such that the sheets are fused for the entire thickness but no globules of metal shall be present within the pipe barrel. The welding process must be such that the same amount of the welding material is added in each foot of longitudinal and circumferential seam.

5. SHEARING. All sheets and plates shall be sheared to exact size with opposite edges parallel and corners rectangular.

6. ROLLING OR FORMING. All sheets and plates shall be rolled or formed cold to true cylinders of the required diameter, and the flat spots ordinarily left at the ends of the sheets or plates shall be eliminated. No damaged sheets or plates shall be used.

7. ELECTRIC ARC WELDING. All welding of both longitudinal and circumferential seams must be done by fully automatic electric devices. This shall be interpreted to mean that the act of welding is performed by automatically propelling an electric welding head above stationary metal or automatically moving metal below a stationary electric welding head and that in either case the amount of weld metal deposited shall be consistently the same for each foot of welded
HARDESTY WELDED PIPE

seam. This process shall be varied only in the case of elbows, tees, wyes, crosses or other specials where the shape of the finished piece prohibits the use of automatic equipment.

The treatment of the edges of seams to be welded shall be according to the best shop practice and shall be such as will insure a strong, thorough and workmanlike joint.

Care shall be taken that the edges to be welded both on the longitudinal and circumferential seams shall meet truly and fairly and that the sides of the sections to be welded shall be flush with each other. The welding rod used must be of first class material and the resulting weld must show thorough fusion for the entire thickness of plate and must be free from laps, cold shuts, gas pockets, oxide inclusions, and other defects.

If for any reason welding is stopped on a continuous seam, the operator in restarting shall lap back into the finished weld a sufficient distance to insure a sound weld at the junction of welds and present a continuously sound weld for the entire length of seam. On all circumferential or other welds where a tie is made to a finished weld, the weld must likewise overlap a sufficient distance to expose soundly welded seam and finish to present a continuously sound weld.

8. INSPECTION AND TEST OF WELD. Each section of pipe as soon as manufactured shall be carefully inspected. The weld shall be tested by striking the metal on each side of the welded seam a sharp blow with a hammer in such a manner as to thoroughly vibrate the metal. If desired by the engineer, test specimens of the weld shall be submitted by the manufacturer for testing by a recognized testing laboratory, the manufacturer to be held free of any testing expense incurred in this procedure. Each section of pipe shall be subjected to internal hydrostatic pressure test 100% in excess of specified working pressure.

9. TEST SPECIMENS OF WELDS. One longitudinal weld at least eighteen inches long shall be made identical to the welds employed in the fabrication of the pipe and also one complete circumferential weld. The time allowed to make these welds shall fall within the limit set for production work. For a bending test at least four specimens 1½ inches wide and not less than 4 inches long shall be cut from both the longitudinal and circumferential weld. The bending test shall consist of gripping each specimen in a vise with the weld flush with its jaws and sLEDging against the side from which the weld was made until the piece has bent through an angle of 90 degrees. A satisfactory test specimen shall not fracture at an angle less than 45 degrees. The specimens shall then be reversed and hammered from the opposite side until fracture occurs. The fracture of a satisfactory specimen shall occur either outside the weld, or if in it, shall show full penetration and thorough fusion, without gas pockets, cold shuts or other defects. Tensile test pieces of the weld conforming to the A. S. T. M. Standard design for tensile test specimens for steel plate shall be cut and tested. These specimens shall contain near their center a weld running at a right angle to the main axis and line of stress. The tensile test shall show not less than 80% of the ultimate tensile strength of the unwelded plate.

10. FIELD SLIP JOINTS. If the pipe is to be furnished with slip joint connections, these connections shall be so manufactured that the pipe may be readily driven watertight with no laps or edges of metal projecting into the barrel of the pipe.

11. FLANGED JOINTS. If pipe is to be furnished equipped with flanges, bolts and gaskets, the flanges shall conform in thickness, outside dimension, bolt circle and inside dimension with the Riveted Pipe Manufacturers Standard or the A. S. M. E. Standard.

Flanges may be attached to the pipe by peening the metal of the pipe over the face of the flange or by riveting or welding the flange to the pipe, the method used to be determined by the engineer.

12. SLEEVE JOINTS. Sleeve connections, if furnished with the pipe, shall be of standard diameter and specifications of the manufacturer furnishing the couplings, and subject to approval by the engineer.

13. BOLTS AND GASKETS. Gaskets shall be of tubular rubber, flat rubber or other type as specified by the engineer. All bolts shall be galvanized or black, as specified by the engineer, and of a sufficient length to permit easy assembly of flanged joints.

14. SPECIAL PIPE FITTINGS. All special fittings, such as elbows, tees, wyes, crosses, reducers, etc., shall be welded complete to dimension and plan furnished by the engineer.

15. PIPE COATING. At all times and until the finished pipe is dipped, the sheets or plates and undipped pipe shall be kept under cover and in no way exposed to rain, snow or other
moisture. Any rust forming on plates or pipe is to be removed together with all dirt, loose scale and other extraneous matter before dipping.

After manufacture of the pipe is complete, it shall be submerged in a bath of preservative coating maintained at a temperature of 400 to 450 degrees F. and allowed to remain until the pipe attains the same temperature as the bath. It shall then be removed from the vat and allowed to drain in a vertical position until cool, producing an even coating inside and outside the pipe barrel. If necessary, in the opinion of the engineer, the pipe may be double dipped by immersing in the bath a second time, quickly removing and again allowing to drain in a vertical position until cool. At the option of the engineer, the pipe may be coated inside and outside with asphalt paint or tar in lieu of the hot dipping material above specified.

16. SOIL PROOFING. After the pipe has been dipped, the section of pipe shall be placed in the wrapping machine and spirally wrapped with a special felt pipe covering. This covering shall be as per Paraffine Companies, Inc., Specifications or equal and shall weigh not less than 37 lbs. per 100 square feet. Wrapping shall be put on under a tension of not less than 33 lbs. per 12" width of wrapping. During the wrapping a constant flow of hot refined asphalt is to be applied in such a manner as to thoroughly bond and cement the wrapping to the pipe, excluding all air pockets and spaces. The wrapping shall extend to within 5" of each end of each section of pipe and shall be finished off by sealing with hot asphalt. The contractor shall furnish with each section a strip of covering of sufficient width and length to thoroughly soil proof field joints. The outside of the field joint shall be wrapped with a strip of Paper Pipe Covering or equal of sufficient length to overlap not less than 1" on both sides and on every turn. Care shall be taken to see that the soil proofing adheres closely to the field joint. The covering shall be well sealed with hot asphalt. After the pipe is laid and joined and before it is backfilled, the line shall be gone over and all defective places in the covering shall be thoroughly covered with patches well sealed with hot asphalt and the entire coating placed in a perfect condition.

17. REJECTION. Failure on the part of any pipe section to pass these specifications in any particular shall constitute cause for rejection.

18. GENERAL DESIGNING FEATURES. Safe working head for pipe shall be determined on the basis of the elastic limit and not the ultimate strength of the material from which the pipe is manufactured. Suitable safety factors, as determined by the Engineer, shall be used in the calculations. Regardless of safe head determinations, pipe must not be of lighter gauge than indicated in the following table:

<table>
<thead>
<tr>
<th>GAUGE OR THICKNESS OF METAL USED</th>
<th>MAXIMUM DIAMETER OF PIPE FOR GIVEN GAUGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>16 inches</td>
</tr>
<tr>
<td>14</td>
<td>20 inches</td>
</tr>
<tr>
<td>12</td>
<td>24 inches</td>
</tr>
<tr>
<td>10</td>
<td>30 inches</td>
</tr>
<tr>
<td>8</td>
<td>36 inches</td>
</tr>
<tr>
<td>3/16</td>
<td>42 inches</td>
</tr>
<tr>
<td>1/4</td>
<td>48 inches</td>
</tr>
</tbody>
</table>

Deflections shall not exceed two degrees at slip joints and five degrees at sleeve couplings. Resulting radii and degree of curvature for various length of pipe sections are given in the following table:

<table>
<thead>
<tr>
<th>APPLYING TO PIPES 6 TO 20 INCHES IN DIAMETER INCLUSIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH OF PIPE SECTIONS</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>30 ft.</td>
</tr>
<tr>
<td>20 ft.</td>
</tr>
<tr>
<td>10 ft.</td>
</tr>
<tr>
<td>5 ft.</td>
</tr>
</tbody>
</table>

— 28 —
January 23, 1933

United States Dept. of Agriculture  
Bureau of Agricultural Engineering  
Ft. Collins, Colorado

Gentlemen:

Attention: Mr. R. L. Farshall,  
Senior Irrigation Engineer

We are in receipt of your letter of January 20th regarding the pipe which you contemplate using. We note from your letter that you think that both installations warrant our best material. In that case, we would recommend our galvanized steel because it would last much longer than the black steel.

We are quoting on our riveted galvanized and dipped slip joint pipe. Our prices are as follows:

Item 1:

2000' of 15" diameter 16 gauge galvanized and dipped riveted, slip joint pipe, made of copper bearing steel. Total weight, 25,840#. Price per foot, 80¢. Total price, ........................................... $1600.00

Item 2:

2500' of 10" diameter 16 gauge galvanized and dipped riveted, slip joint pipe, made of copper bearing steel. Total weight, 21,050#. Price per foot, 56¢. Total price, ........................................... $1460.00

The above prices are f.o.b. Denver, Colorado. We hope they will be attractive to you and we appreciate your sending us the inquiry.

We are pleased to note from your letter that you are enjoying "Highways of Happiness". This little periodical seems to be making us quite a number of friends throughout the country. As you will note, we do not use much advertising in it and I imagine that is one reason so many people enjoy it.
January 23, 1933

United States Dept. of Agriculture

Page 2.

Dr. Loring attended our Banquet Saturday night. We missed you at the Convention and Banquet. We had quite a successful Convention. The Reclamation Service held open house for us in their laboratories which was very interesting.

Very truly yours,

THE THOMPSON MANUFACTURING COMPANY

G.H. Garrett-H
Chief Engineer
January 24, 1933

Mr. R. L. Parshall
Senior Irrigation Engineer
c/o Colorado Agricultural College
Fort Collins, Colorado

Dear Mr. Parshall:

We appreciate the request contained in your letter of January 20 for prices on the two items of pipe which are listed below. We regret, however, that you did not describe a little more fully what the type of the installation would be and what operating pressures would prevail so that we could assist by way of recommendations on gauge of metal, type of joint, etc. However, we will attempt to give you information so that the required prices will be included. Furthermore, as we understand you would only require estimating prices at the present time, and we particularly wish to call to your attention that these prices are supplied on this basis with the understanding that we will receive an opportunity of furnishing final quotations before a decision is reached in regard to purchase.

 Principally due to market fluctuations and also because of one price change which we know is in effect in the steel market which is not taken into consideration in the prices quoted below, we ask that the procedure outlined above be followed.

2,000 ft. of 15" diameter 14 gauge HARROWELD black steel hot asphalt dipped slip joint pipe, in 20- or 30-foot shipping lengths.

Price per foot, net f.o.b. Denver, Colorado — $1.03
Shipping weight per foot, hot asphalt dipped only, 12.8 lbs.
Shipping weight per foot, hot asphalt dipped and soil proof wrapped, 17.7 lbs.

15" diameter 12 gauge pipe, same as above, hot asphalt dipped only.

Price per foot, net f.o.b. Denver, Colorado — $1.34
Shipping weight per foot, hot asphalt dipped only, 13.8 lbs.
Shipping weight per foot, hot asphalt dipped and soil proof wrapped, 22.7 lbs.

15" diameter 10 gauge pipe, same as above, hot asphalt dipped only.
Mr. R. L. Parshall  
Ft. Collins, Colo.  

Price per foot, net f.o.b. Denver, Colorado --- $1.64
Shipping weight per foot, hot asphalt
dipped only, 23.9 lbs.
Shipping weight per foot, hot asphalt
dipped and soil proof wrapped, 27.8 lbs.

Additional cost for Hardesty Soil Proof Wrapping,
(40-lb. asphalt-saturated felt wrapping) additional
per foot irrespective of the gauge of metal to which
it be applied, over and above the above listed prices.
        Additional per foot -------- $ .25

2,500 ft. of 10" diameter 14 gauge HARCOWELD black steel
hot asphalt dipped slip joint pipe in 20- or 30-foot
shipping lengths.
        Price per foot, net f.o.b. Denver, Colorado ---- $ .78
        Shipping weight, dipped only, 9.3 lbs. per foot.
        Weight per foot, dipped and soil proof wrapped, 11.9 lbs.

10" diameter 12 gauge pipe, same as above, dipped only.
        Price per foot, net f.o.b. Denver, Colorado ---- $1.02
        Shipping weight per foot, dipped only, 12.6 lbs.
        Weight per foot, dipped and soil proof wrapped, 15.2 lbs.

Additional cost per foot for soil proof wrapped applied to
any of the above quoted 10" diameter pipe -------- $ .18

All of the above quoted pipe with slip joints will be suitable
for operation under pressure heads of 100 feet or less. For
pressure heads in excess of 100 feet we would recommend the use
of coupler end pipe suitable for use with Dayton couplers. For
plain end or coupler end pipe the following prices will apply:

2500 ft. of 10" diameter 14 gauge HARCOWELD black steel
hot asphalt dipped plain end pipe, in 20- or 30-foot
shipping lengths, but exclusive of Dayton couplers.
        Price per foot in 14 gauge ------------------------ $ .74
        Ditto 12                                       .97
        Ditto 10                                       1.19

Additional cost for soil proof wrapping will be equal to those
named for the above quoted slip joint pipe.

2000 ft. of 15" diameter 14 gauge HARCOWELD black steel
hot asphalt dipped plain end pipe, in 20- or 30-foot
shipping lengths, but exclusive of Dayton couplers.
        Price per foot in 14 gauge ------------------------ $ .97
        ditto 12                                         1.27
        ditto 10                                         1.57
Mr. R. L. Parshall  
Ft. Collins, Colo.  

10" diameter No. 1 Dayton Couplers. Price each $2.43  43 lbs.  
15" diameter No. 1 Dayton Couplers. Price each 5.33  76 lbs.  

The above quoted weights and additional cost for soil proof wrapping for 15" diameter slip joint pipe will apply for the plain end pipe.

Shipment of this quantity of pipe can be made for either item in approximately two weeks from receipt of order, and for both items in not to exceed **21 days**.

You mentioned that both of these installations would warrant our best grade of material. The best grade of pipe which it is possible for us to supply is ARMCO Ingot Iron spiral welded pipe hot galvanized after fabrication and assembled in the field with galvanized couplers. We list the following prices on this equipment which we would recommend for the installation; 12 gauge is the minimum gauge in which this pipe could be supplied.

2500 ft. of 10" diameter 12 gauge Spi-Weld galvanized  
ARMCO Ingot Iron plain end pipe for coupler joints,  
in 20- or 30-foot shipping lengths.  
Price per foot, exclusive of couplers ---------- $1.21  
Shipping weight per foot, 12.1 lbs.  
Maximum recommended operating pressure, 265 lbs.  
per square inch.

We do not list 15" diameter Spi-Weld pipe, but in case this is exactly the size you must have, we believe it would be possible to make arrangements to supply the pipe in 15" diameter inasmuch as 15" couplers are available. Not having exact prices on this size, however, we will give you prices as follows:

2000 ft. of 14" diameter 12 gauge Spi-Weld plain end pipe  
for coupler joints, in 20- or 30-foot shipping lengths,  
but exclusive of necessary Dayton Couplers.  
Price per foot, net f.o.b. Denver, Colorado ---- $1.66  
Shipping weight per foot, 17 lbs.  
Recommended operating pressure, **maximum 183 lbs.**  
per square inch.

16" diameter pipe, otherwise same as above, exclusive of couplers.  
Price per foot, net f.o.b. Denver, Colorado ---- $1.88  
Shipping weight per foot, 19.5 lbs.  
Maximum recommended operating pressure 165 lbs.  
per square inch.
Mr. R. L. Parshall  
Ft. Collins, Colo.  

We are also enclosing a circular describing the galvanized Spi-Weld pipe. And as soon as these installations materialize to a point where it is possible for me to be of assistance by way of any additional information, quotations, or other data required, we will welcome an opportunity of getting in touch with you either by appointment here in Denver or by coming to Fort Collins upon your request.

With best personal regards.

Very truly yours,

THE R. HARDESTY MFG. CO.

M. A. Newell  
Enc.

Pipe Department