AVONDALEE SHIPYARDS, INC.

PIPE STORAGE AND MOVEMENT STUDY

BY

DENSON ENGINEERS, INC.
NEW ORLEANS, LA

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I. Foreword

Denson Engineers, Inc. was commissioned by Avondale Shipyards to perform a study of industry standards relating to purchasing, handling and storing of tubular goods. This study was performed under the direction of Mr. R.A. Price, Manager, R&D Operations Avondale. Also directly involved in the coordination were Glen Briggs, Assistant Manager Warehousing, Materials Control Department; and Wayne Kraemmer, Material Coordinator, Pipe Rack Unit and other Avondale Shipyards departmental managers.

Additionally, guidance and support for this study were provided by Mr. E.A. Blanchard, Group Vice President and Mr. E.E. Blanchard, Vice President Production.

The purpose of this study was to evaluate various pipe purchasing, handling and storage practices in the shipbuilding industry. From these evaluations, recommendations were made for reducing material costs and improving productivity in accordance with the objectives of the National Shipbuilding Research Program, under the aspects of the Merchant Marine Act of 1970.

This project is one of many now jointly funded by the Department of Transportation, Maritime Administration and the United States Navy, cost shared by Avondale Shipyards, through SNAME Panel SP-1/3 Shipyard Facilities and Environmental Effects.

II. Executive Summary

Denson Engineers, Inc., at the request of Avondale Shipyards, has

conducted a study of standard shipyard pipe purchasing and handling practices. This study included consulting with members of Avondale's management, Material Control and Plant Engineering and Maintenance Department, as well as, with several piping suppliers. This project resulted in recommendations for shipyard purchasing and handling procedures of tubular products, as well as, changes in Avondale's current practices. These recommendations include:

a) Order double-random lengths, DRL, for all steel pipe in sizes 2" through 24".
b) Order single-random lengths, SRL, for steel pipe in sizes less than 2".
c) Restrict specifications to A-106 steel for low carbon steel pipe.
d) Order pipe with square-cut or "plain" ends versus beveled ends.
e) Specify delivery by flat-bed trailer with materials strip loaded or in standard bundles.
f) Provide a centralized pipe handling and storage facility.
g) Provide dedicated equipment at all major pipe handling sites.

Applying these recommendations to shipyard operations could result in an estimated materials savings of $152,350 or 24.5% on Pipe Shop material for a typical T.A.O. construction project. Labor costs for pipe handling are expected to be reduced by about $64,000 per year through personnel reductions and reduced equipment use. Pipe Shop materials are estimated to represent 80% of the total pipe used for each shipbuilding project.

Costs of implementing these recommendations are estimated to be $510,000. This figure does not include the cost of the property to be converted into the new pipe handling and storage facility. Assuming

completion of four T.A.O. contracts per year, payback for this program is estimated to be 9.09 months and the discounted 10 year ROI is 132%.

It is expected that savings will also result from improved productivity in the form of better inventory control, reduced inventory requirements and improved pipe handling capabilities.

This study was applied to Avondale Shipyards, as a test case study. However, any U.S. shipyard could review their existing procedures for pipe requirement, storage and handling and expect a major cost and productivity improvement.

III. PIPE PURCHASING SPECIFICATIONS

1. General

In this section, the specifications used for purchasing of metallic pipe and tubing shall be examined, looking for the most cost effective combination of material costs, handling and storage costs. While some savings may be possible on any item, the overall impact on project costs depends on the quantities involved. Therefore, this study has focused primarily on the purchase or seamless carbon steel pipe, types A-53 Gr.B and A-106 Gr.B. These materials represent the majority of a typical T.A.O. construction project's Bill-of-Materials examined during the course of this study and listed in Section VII, Appendix. Stainless steel and non-ferrous pipe will also be discussed, however, welded steel pipe and/or galvanized pipe will be omitted from this report due to the small quantities used. Note that the Bill-of-Materials used in conducting this study is for Pipe Shop materials only and is estimated

to represent approximately 80% of the total pipe required for project completion.

The specifications reviewed include materials quantities, end treatments, lengths and packaging. Each item will be presented with possible alternatives and savings. MIL specifications, pricing guidelines, and comparative cost calculations are included in the Appendix of this report.

2. Materials

The selection of stainless steels and non-ferrous materials reflect specific design criteria and no attempt has been made to alter these selections. In the case of carbon steel pipe, however, the selection process should be examined. Current practices include purchases of both A-53 and A-106 steel pipe according to the job engineering specifications. These steels are very similar in their properties though the A-106 is approximately 5% more expensive due to tighter restrictions on quality control. Because of the price difference, A-53 is often specified instead of A-106 as a cost saving measure. A look at mill pricing guidelines, however, shows that for small quantities this practice is counter-productive. When placing small orders for A-53 pipe, extra handling charges from the mill are incurred which out weigh the expense of A-106 pipe.

In addition to materials savings, labor savings may be achieved by eliminating the duplicity of handling and storage tasks associated with two materials versus a single material. Eliminating the use of A-53 steel would also eliminate the risk of inadvertently substituting A-53

for A-106 during fabrication resulting in improved quality control. It is, therefore, considered acceptable practice and hereby recommended to restrict purchases to A-106 for all low carbon steel pipe.

3. Quantities

Steel mills prefer to sell and ship their products in large quantities, therefore, their pricing is based on large orders. Small orders, less than 5 tons per item, are penalized with additional charges for handling etc. United States Steel defines this item as "one o.d., wall, surface finish, end finish and length in one specification or grade and marking for shipment at one time, to one consignee, at one destination." This means that each line item on a B.O.M. is a separate item when the mill determines pricing. These additional charges are on a sliding scale where costs increase as the size of the order decreases. Depending on the order quantity, the additional small order charges add between 5% and 10% to the price of the order.

There are two alternatives to the mixture of A-53 and A-106 steel pipe specified on the typical B.O.M. The first is to substitute A-106 for A-53 steel pipe whenever the quantity of A-106 of the same dimensions is large. This eliminates or decreases the small order penalties on these items, but requires that each B.O.M. be reviewed to determine when material substitutions are economically advisable.

The other alternative would be to substitute A-106 steel for all A-53 steel pipe. In comparison to the typical material mixture, utilizing a single material for all steel pipe would produce a sizable savings through reduced small order penalties and simplified storage and

handling. While this option would not cut material costs as much as the more refined alternative listed above, it would avoid economic review of each B.O.M. and prevent accidental mixing of materials during fabrication.

It is recommended that consolidation of materials and/or sizes be used to avoid small order penalty charges whenever possible. The exclusive specification of A-106 steel for all mild carbon steel pipe purchases is an example of such a consolidation.

4. End Treatments

Standard mill practice is to furnish either bevelled or square cut end on extra-strong and lighter pipe at no extra charge. If no preference is noted by the customer, these pipes are usually bevelled. Pipes with heavier than extra-strong walls are furnished with square cut ends. Bevelling of heavy wall pipe is available for an extra charge of 3% to 7%, with large diameter pipes having the greatest increase.

The extra charge for bevelling heavy wall pipe at the mill is not justified since the bevels may not be required, at least one of the ends may become scrap, and most fabrication shops are equipped to bevel pipe. Also, fabrication may require something other than the single bevel available from the mill. Ordering all pipe with square cut ends is recommended when ordering from mills. Specify "plain ends" when ordering from suppliers inventory.

By specifying "plain ends" on an order a customer simply states that the standard end treatments described above are acceptable.

5. Lengths

A. Industry has several standard practices regarding pipe lengths, depending on the material and the pipe diameter. Steel pipe in nominal diameters of 2" through 24" is available in single-random lengths (SRL), double-random lengths (DRL) or uniform lengths as specified. SRL indicates a range of lengths between 18' and 25' with an allowance of 5% for lengths of 16' to 18'. However, suppliers indicate that SRL lengths seldom exceed 22'. DRL pipe is generally supplied in 38' to 40' lengths, though some variation is allowable. The above descriptions of SRL and DRL apply only to Line Pipe, and much broader variations are allowed if Standard Pipe is specified. Since there is no difference in cost, the specifications should always indicate Line Pipe.

Standard lengths of other diameters and materials differ somewhat. Smaller sizes of steel pipe and most stainless steel pipe are available in SRL or in uniform 20' lengths. Brass, Copper, Copper Nickle and other non-ferrous pipe is generally supplied in uniform lengths of 20' according to industry-accepted MIL specifications.

In addition to the standards listed above, pipe of any diameter or material can be special ordered in other, non-standard, lengths. These special orders may attempt to target a particular length as in "Aim At XX'" specifications or to restrict lengths to some maximum or minimum value. Most such orders are subject to cost extras.

B. Several options have been investigated regarding the lengths specified on purchases of steel pipe from 2" to 24" in diameter.

The investigation concentrates on A-53 and A-106 steel pipe as listed on the B.O.M. of a typical project.

Cost comparisons are based on pricing per foot as determined from United States Steel guidelines included as part of the Appendix. Costs calculations are based on these typical B.O.M. quantities and do not take into account that excess pipe will be placed in surplus inventory and not charged to the job. For example, if 10' of 4" Schedule 160 pipe is required from a 40' DRL joint, the remaining 30' would be placed in surplus inventory and not charged against the project. The calculated costs for purchasing steel pipe, as listed on the typical B.O.M., using various length specifications are as follows:

Purchase Specifications	Project Pipe cost
a. 21' Uniform Lengths	$618,704
b. Single-Random Lengths	478,023
c. Double-Random Lengths	453,921

These figures indicate that a substantial premium is paid for purchasing 21' uniform lengths. Material costs could be reduced approximately 27% by ordering all pipe in DRL. SRL orders would save 23% on materials.

Material costs are not, however, the only criteria to be considered. Total costs and realized savings in project costs must also take into account the costs of implementing these alternate purchasing plans and extra handling and storage costs in the form of equipment and labor. These implementation costs are discussed

in detail in later sections of this report.

Some shipyards who have implemented automated pipe fabricating shops, have standardized on 21' uniform length for all steel pipe and tubing based on the maximum capacity of various pieces of the shop equipment. Also, the uniform length simplifies the process of nesting spool pieces within pipe joints handled by the shop.

Switching to the DRL specification would require that each joint be cut to a predetermined standard length (in half) when delivered to the yard. Cutting a 38' to 40' section in half would yield pipe lengths of 19' to 20' which would be satisfactory for use in the automated pipe shops. If a 19' length were then adopted for nesting purposes, the maximum drop-off would be 1' per length of pipe entering the shop with an average of 6". This would amount to approximately 2.6% of each order and must be deducted from previously calculated savings.

Use of SRL specifications would require an 18' nesting length, or less, based on minimum lengths supplied by the mills. The excess pipe would be 'substantial since SRL may run to 25' in length. In addition, all lengths over 21' would have to be cut to suit the standardized automatic pipe shop equipment. Assuming normal distribution of supplied lengths, it is estimated that 50% of an SRL order would exceed 21'. Therefore, the apparent material cost savings of the SRL purchasing plan will be severely dimished by the additional costs of required cutting, handling, and excessive waste.

The amount of material left over after nesting cannot be determined from available data, but is expected to be similar regardless of the nesting length standard used.

There are several other length specifications which will be briefly discussed here. "Aim At XX'" is a specification which instructs a supplier to try to select sections of pipe near the indicated length. This specification has no set range of lengths other than those applicable to SRL or DRL standard pipe. Also the percentage of lengths near the target value is unknown. Depending on the supplier and stocks available, the result may be near uniform lengths or not better than SRL or DRL; there is no guarantee of the lengths delivered.

Suppliers may also be instructed to ship pipe with maximum or minimum lengths. However, when specifying a maximum length expect the supplier to dump excess short lengths pulled from other orders. Likewise, a minimum length specification may include an abundance of long lengths.

While most suppliers do not charge extra for "Aim At xx'" specifications, unless the length is within the SRL or shorter range, all charge extra for specifications of maximum or minimum lengths. These specifications are not recommended due to the uncertainty of the lengths which will be delivered.

c. Length specifications for steel pipe in sizes less than 2" are somewhat different than those of the larger sizes. Because small diameter pipe is produced on a tubing mill rather than a pipe mill

long lengths, in excess of 25', are not available. Industry standards are SRL, as described earlier; and 20' uniform lengths, although the 20' lengths are an extra cost item. The 217 uniform length for small pipe is also a special order with extra costs attached. Due to the volume of pipe used by shipyards, some suppliers now stock the 21' uniform lengths and charge only a 5% premium for such orders. This is based on the suppliers ability to also sell 21' lengths to their other clients who would normally purchase 20' lengths. While savings of 5% may not represent a large dollar total, there appear to be no extra expenses in switching to 20' uniform lengths or SRL. Pipe in the smaller than 2" range is not usually handled in the automated pipe shop, therefore, the occasional long lengths of SRL should not be a problem.

D. SRL is the only standard length available in stainless steels but, it differs slightly from the previous description. Pipe sizes 2" and larger generally fall within a range of 20' to 21' while smaller sizes range between 17' and 24'. Suppliers contacted estimate the extra charge for uniform 21' lengths at 15%. AS stainless pipe is not processed through the automated pipe shop there is no reason to require the 21' uniform lengths at such a premium price.

E. Non-ferrous pipe such as copper, copper-nickle, and brass are usually ordered according to MIL specs and as such there is little to be said regarding purchases of these items. The standard sections are a uniform 20' in length though brass is also available in 12' uniform lengths. Variations from these standards

would result in extra charges and are not recommended.

6. Shipping and Handling

A. Packaging of pipe of tubing is used to aid material handling or to protect the produce from damage. Quantities of small diameter pipe or tubing may be bundled or crated for easier handling of a flexible or fragile item. Special metallurgy or surface finishes may also require packaging to prevent damage. Steel pipe in diameters of 2" or more is not generally bundled, though some mills will provide secured lifts for pipe sizes up to 5" in diameter. Customer specified packaging other manufacturers' standard practice is a cost extra to be avoided, especially on DRL lengths which must be separated for cutting at delivery. An excerpt from the U.S. Steel price guide, attached in the Appendix, shows the standardized bundling and packaging available.

B. Purchase orders should specify strip loading of all shipped loose pipe. Strip loading consists of loading pipe in layers, large diameters generally on bottom, with timbers inserted to separate layers of individual items. Large quantities may be separated into several layers. This facilitates unloading by either forklift or crane and slings. Packaged items may then be loaded on top of the strip loads. This form of loading is usually available at no extra cost.

c. Delivery by flat-bed trailer truck should be specified on all orders. Flat-bed trailers are readily available at no extra charge while the supply of flat rail cars may be limited causing delays

in shipment. Locating flat rail cars with bulkhead ends, as required by mills for some shipments, is more difficult and may cause considerable delays. Gondola rail cars are to be avoided as they are difficult to unload. Likewise, closed trailers should be specifically excluded due to the difficulty in unloading.

D. The specification of 21' uniform lengths has no effect on handling of pipe deliveries. However, purchasing SRL and DRL lengths increases handling costs in several ways. All SRL and DRL pipe must be off-loaded, sorted, fed to a cutting station, cut, and moved to storage. Transporting pipe to the cutting station and cutting the pipe represents additional handling not applicable to any uniform length pipe.

The cost of installing the cutting station is an extra expense which will be reviewed in a later section. Also, as it is desirable to unload a truck as quickly as possible, SRL and DRL pipe may have to be placed in temporary storage until it can be cut, thus increasing handling and storage requirement.

7. Vendors Contacted

A. The following suppliers of steel pipe were contacted in regard to this study. Copies of correspondence are included in the Appendix.

ARMCO, Inc.
White Station Towers
5050 Popular, Suite 1028
Memphis, TX 38117

Babcock & Wilcox
Tubular Products Division
Post Office Box 401
Beaver Falls, PA 15010

Gulf Supply Company, Inc.
Post Office Box 569
Harvey, LA 70059

Standard Supply & Hardware Company, Inc.
832 Tchoupitoulas Street
New Orleans, LA 70130

U.S. Steel Corporation
Post Office Box 1590
Houston, TX 77251

Van Leeuwen Pipe & Tube Corporation
Post Office Box 99
Belle Chasse, LA 70037

Vinson Supply Company
Post Office Box 164
Harvey, LA 70059

B. The following suppliers of stainless steel and non-ferrous pipe were contacted in regard to this study.

Alaskan Copper Company
Post Office Box 3546
Seattle, WA 98124

Arco Metals Company
Post Office Box 800889
Dallas, TX 75380

Industrial Metals Company
Post Office Box 10507
New Orleans, LA 70181

w & o supply
1406 Dealers Avenue
New Orleans, LA 70123

Youngstown Welding & Engineering Company
Post Office Box 2461
Youngstown, OH 44509

IV. PIPE HANDLING

1. Concepts

A. The specifications for purchasing pipe have an influence on the most efficient manner of handling and storing the pipe. The pipe length, the way it is loaded and delivered, the variety of materials, etc. all determine how the pipe is best handled. Several plans and options are discussed in this section.

B. The simplest plan would have all pipe delivered directly to the fabrication shops and stored at the point of use. This assumes that adequate storage area and pipe handling equipment are available at each location. Space limitations at various locations may require the use of storage racks versus flat storage or that pipe lengths be restricted. Equipment used to handle the pips may be non-dedicated, borrowed from other uses, with possible availability problems or dedicated solely for this purpose, which is generally more costly. In addition, the pipe handling equipment may be movable or fixed.

Movable equipment such as forklifts and various types of mobile cranes would be able to service multiple storage areas while pedestal and gantry cranes would be site specific. In confined areas, front-load forklifts may have difficulty maneuvering carrying long pipe lengths, side-load units though not as restricted may also have problems with DRL joints. Cranes may be able to avoid some of the limitations of forklifts in tight quarters, however, the use of storage racks is more complicated

for cranes than for forklifts. Also, while both forklifts and crane perform well unloading flat-bed trailers and rail cars, a crane is preferable for receiving gondola-type rail cars and a forklift is better at unloading van-type trailers should such modes of delivery be required.

While this plan conveniently maintains supplies near the end users, it also can result in the scattering of pipe inventory. Scattered inventory is more difficult to control and some ability to transfer material between shops or projects may be lost, requiring an increase in materials maintained on hand.

c. The alternative to receiving and storing materials at the fabrication shops is to provide a centralized pipe handling facility. Ideally, this facility would be adjacent to the shops to minimize transportation costs, but the prime requirement is to find a location which provides adequate space for handling and storage of the total inventory. Flat storage is preferable to racks in that it is equally accessible to crane or forklift and does not require the construction, maintenance, and hazards involved with pipe rack. It should be noted that specifying rail car delivery will restrict site selection to those with access to rail service while truck delivery would be quite flexible. The facility should be furnished with equipment capable of unloading, storing, preparing if necessary, and distributing all pipe required by the fabrication shops in a timely manner. As discussed earlier, this equipment may be dedicated or borrowed, mobile or fixed, however, a centralized facility will generally handle a sufficient volume to justify dedicated equipment. Pedestal or

gantry type cranes which require little ground area may be used to maximize storage area.

Improved inventory control and the ability to shift materials as projects demand, should result in reduced inventory and accounting costs. In addition, the increased space available to a centralized facility allows handling of pipe in DRL lengths which is the least expensive way to purchase pipe. Provisions can also be made to cut or otherwise prepare the pipe prior to distributing to the shops. These requirements may arise from such things as a shipyard's use of an automated pipe fabrication shop with restrictions on maximum pipe lengths.

D. Assuming that steel pipe will be ordered in double-random lengths, this section addresses the necessity to cut the pipe as it arrives, prior to being placed in the storage area. Typically this will require one cut per DRL pipe joint with not more than 5% requiring two cuts, those over 42' in length. Several means of cutting the pipe, 2" to 24" diameter, are listed below. Literature on this equipment is included in the Appendix.

a) Rotary stone saw, requires manually rotating pipes over approximately 4" in diameter.
b) Power hacksaw, electric or pneumatic.
c) Guillotine saw, reciprocating blade saw.
d) Traveling rotary saw, automatically feeds around pipe cutting as it goes.
e) Band saw, (vertical or horizontal).
f) Cutting torch, manual or automatic.

Of the above cutting methods, items b, c and d should be avoided for production quantities of work. 24" diameter is the maximum allowable on the power hacksaw and the cut is subject to deformation of the blade. Speed is fairly slow and blade usage high. The guillotine saw makes a better cut than the hacksaw, but is slow and awkward to handle. The traveling rotary saw makes a reasonable square cut but is quite slow, requiring over thirty minutes to cut a 24" XS pipe. These methods are best suited to limited service where portability is important.

The use of a rotary stone saw is acceptable for pipe diameters to 4", but the need to manually rotate larger pipe is slow and labor intensive.

Cutting pipe with a torch is relatively fast, a 24" XS pipe can be cut in five minutes manually, less using an automatic torch. Torch cutting may leave a rough edge and squareness could be a problem when cut manually. However, a torch may also be used to bevel pipe ends while cutting, an option only the traveling rotary saw can match.

By far, the superior cut is made using either vertical or horizontal band saw. Band saws checked can remove fifteen square inches of material per minute, cutting a 24" XS pipe in two-and-a-half minutes. The resulting cuts are both square and smooth. Production can be increased by cutting groups of small pipe at one time, reducing labor costs.

E. Pipe purchasing specifications will affect pipe storage and -20-

handling. Purchasing two grades of pipe instead of a single grade means that space must be provided for separate storage of each grade. Handling costs will increase since handling two small quantities of pipe will not be as efficient as handling one larger bundle. Also, for similar materials, controls must be worked out to prevent mixing of the materials. An example of this situation would be the purchase of both A-53 and A-106 steel pipe as discussed earlier.

2. Cost Estimates

A. This section contains estimated costs for utilizing the centralized pipe storage and handling concepts presented above. Estimates are included for materials, equipment, installation and operation expenses, however, site preparation has been omitted due to wide variations in real estate prices and conditions. These estimates are based on average costs in the New Orleans, Louisiana area. See Appendix for calculations.

B. Assuming a suitable parcel of land has been acquired and that clearing and filling are complete, the following are estimated costs for converting the land to use as a pipe storage area. TWO options exist for pipe storage, either flat storage on concrete slabs or stacked storage in vertical pipe racks. Using a list of normal pipe inventory provided by Avondale Shipyards, a price for each option was determined. A copy of this list appears in the appendix for comparison to inventory held by other shipyards. The estimated cost of pouring and finishing the concrete slabs is $85,000. The price of typical pipe racks to provide vertical

storage of Avondale's normal inventory is estimated at $370,700. While actual costs will vary with the volume of pipe maintained at each shipyard, the comparative cost advantage of the concrete slabs should change little.

c. Handling costs include all equipment and labor needed to receive, store, and distribute the pipe. AS has already been discussed, a considerable savings is possible by buying DRL length pipe. Therefore, handling equipment should be selected based on the DRL requirement.

Front-loading forklifts are not designed for carrying extremely wide items and may have considerable maneuvering problems when transporting 40' lengths of pipe. Side-loading forklifts are better able to deal with long lengths as they hold the pipe parallel to the direction of travel, however, the excessive overhand at the ends of the forklift would limit their manuverability. Either of these pieces of equipment require open aisles between the slabs or pipe racks for access and possibly wider areas for turning, etc., therefore, they are not recommended for use in the storage. A forklift may be useful for unloading shorter pipe lengths at various distribution points, the fabrication shops, etc. if space allows. A side loading forklift of 5 ton capacity costs approximately $71,000. A front loading machine of equal capacity can be purchased for $30,000 -$35,000.

As mentioned, above a forklift is not recommended for use within the pipe storage area. Instead a crane is preferred for this service. However, a tracked or rubber tired crane will also

require access aisles, though fewer, since the crane can reach across several slabs. Recommended is a gantry type bridge crane. It requires only two narrow aisles to accommodate its supporting rails allowing full utilization of available space for storage, yet its mobility allows access to a much greater area than a fixed crane. Estimated cost of a 10 ton capacity crane with 20' lift and 65' span is $175,000. A pair of rails for the crane cost approximately $65 per foot, installed.

D. The cost of cutting pipe at the storage area includes the price of a saw, the construction of a saw shelter with utilities and loading tables, and the labor to operate the facility. The cost of a quality band saw with 12" capacity, HE & M model 1000, is approximately $12,000. A saw with 24" capacity, HE & M model 1500L, increases to $35,000. The larger saw is recommended to avoid difficulty in cutting large diameter pipe and the delays associated with other cutting methods. The construction of a shelter to protect the saw from weather is estimated to cost $35,000 with utilities and roller conveyor tables to move pipe in and out of the saw. Using the typical B.O.M. and a saw capacity or 15 square inches of material removed per minute, total cutting time for the average project is 8.5 hours. Use a factor of four (4) and a $20/mh rate to determine labor costs, including loading and unloading of pipe, for two men operating the saw.

V. SAMPLE IMPLEMENTATION

1. General

Avondale Shipyards of New Orleans, Louisiana has recently

considered and have initiated changes to their system of purchasing, storing and handling all tubular goods. Avondale's current system and the proposed changes are described herein along with an estimate of the resultant costs and savings. While Avondale's situation is unique in that their actions have been prompted by conditions at the work site as well as economics, none the less, an examination of their system and proposed changes should be enlightening.

2. Background

A review of Avondale's current pipe purchasing specifications indicated that non-ferrous and stainless steel pipe is ordered in accordance with industry standard MIL specifications. All steel pipe is currently purchased in 21' uniform lengths due to the maximum length restrictions of the automated pipe fabrication shop. In addition, while job specifications usually call for both A-53 and A-106 steels, only A-106 is purchased to avoid sorting and quality control problems. Steel pipe shipments are received at the pipe shop by truck or rail and unloaded using a locomotive crane borrowed from another department. This results in delays due to crane availability and a clustering of pipe storage in a crowded area adjacent to the pipe shop. The storage at the pipe shop is restricted by the proximity of the river levee, the adjacent property line and the railway spur to the yard. Refer to the "Partial Site Plan" drawing in Appendix. Movement of pipe into the shop requires hand carrying of small sizes or additional use of the locomotive crane for larger pipe.

The present storage area can not be expanded and may be subject to reduction if proposed set back levees are constructed. Therefore, an alternate location for pipe storage was required.

3. Recommendations

Based on the study of alternatives presented earlier in this report, recommendations have been made to Avondale's management indicating that significant changes in their pipe purchasing and handling practices could be justified. Those recommendations include:

1. Modification of pipe purchasing specifications relating to pipe lengths and material selections.
2. Installation of dedicated handling equipment at the pipe shop.
3. Relocation of pipe storage and handling area to create a central shipping, receiving and storage facility.
4. Acquisition of dedicated pipe handling equipment for the movement of materials throughout the yard.

It was recommended that steel pipe specifications be rewritten to eliminate the 21' uniform length requirements. Instead, SRL or 20' uniform lengths should be ordered for pipe sizes of less than 2". Sizes 2" through 24" should be purchased in DRL lengths and cut in half after delivery. In addition, A-53 steel should be replaced by A-106 resulting in a single material for all seamless steel pipe. It was also recommended that purchasing specifications for non-ferrous and stainless steel pipe not be changed since deviating from current standard industry practices will result in

greater material and handling costs.

It was recommended that the pipe storage area be relocated to a parcel of land located adjacent to the main yard, approximately one half mile from the pipe shop. This land is presently owned by Avondale, is centrally located to the yard operations, and is convenient for shipping and receiving transports. The plan calls for pipe to be delivered by flat bed trailers, unloaded by a gantry type bridge crane and stored flat on concrete slabs. Upon delivery, DRL steel pipe is to be cut into 19' to 20' lengths using band saws installed at the receiving area, then moved to storage.

Pipe would then be transported from storage to the pipe shop via a specially modified trailer with racks to contain and separate various items. The trailer would be loaded by crane at the storage area, towed to the pipe shop, and unloaded by a new permanently installed tower crane. All equipment is to be dedicated 100% to pipe handling and delays due to equipment availability conflicts should be minimized.

4. Implementating

In examining the costs of implementing Avondale's proposed system, it is useful to separate changes made in purchasing practices and those made in storage and handling procedures.

A. Two major changes in pipe purchasing are proposed, the specification of A-106 for all seamless steel pipe and the

ordering of DRL lengths for steel pipe from 2" through 24" in diameter. The first item, purchasing all A-106 steel pipe, has already been discussed in this report and is expected to produce a net savings.

The second item, buying DRL pipe will result in savings in material costs, but will reqire installation of a pipe cutting saw and a facility to house the saw, as well as, additional pipe handling. Avondale has opted for a saw capable of cutting pipe sizes through 24" which will cost an estimated $35,000. An additional $35,000 is estimated for installation, pipe handling accessories and a protective shelter.

Using the typical B.O.M., the band saw will be able to cut all DRL lengths for a complete project in approximately 8 1/2 hours. Using a factor of four (4) to account for feeding and removing pipe from the saw, the cutting of all steel pipe on the typical project should require only 34 hours. Assuming two workers, operator and helper, at a composite labor rate of $20 per manhour, the labor costs for cutting the pipe are projected to be $1,360.

Pipe Specifications	Material Costs
A-53 and A-106 21' Uniform Lengths	$618,704
A-106 Double-Random Lengths	$454,011

The savings in materials costs for using all A-106 DRL pipe in sizes 2" through 24" on a single typical project shows a savings of $164,693 or 26.6%. Actual savings must be reduced by approximately $11,800 to cover additional expected material

drop-offs, additional labor and handling of $1,360 and the equipment costs. The savings due to simplified handling of a single material, A-106 versus A-106 and A-53, can not be quantified, but certainly do exist. The primary savings will be realized in improved quality control by eliminating the chance of intermixing pipe materials. There are also savings from avoiding storing and handling of the two grades.

A less significant change in the purchasing of steel pipe is the specification of SRL joints versus the uniform 21' lengths for sizes less than 2". The resultant savings are approximately $850 on each typical project.

B. The proposed changes in pipe storage and handling represent a considerable capital investment. These investments must be looked at over the life of the system, not in relation to any one project.

Pipe storage must be provided for surplus inventory, regular inventory and pipe ordered for a particular project. Review of these quantities and consultation with Avondale's Material Control personnel resulted in the proposed storage plan to be found on the drawing entitled "New Pipe Storage Area" found in the Appendix.

The storage site will consist of concrete slabs for the flat storage of pipe. The plans call for installation of 90 slabs 12" wide, 21' 6"{ long and 12" thick and 1 slab 24' wide, 246' long and 12" thick. Cost of these slabs is approximately $95,000 installed. A gantry type bridge crane to be purchased for handling pipe in

the storage area will have a 10 ton capacity, a 20' lift, and a 65' span. Cost to purchase and install this crane is estimated to be $175,000. In addition, the crane requires a pair of rails 650' long: At $65 per foot installed this adds $42,250 to the cost. The pipe saw to be installed has already been discussed.

The tower crane proposed for the pipe fabrication shop is to be 50' tall to avoid interference with the surrounding building roofs. It is projected to have a boom radius of 65' allowing it to unload either rail or trailer deliveries and reach all conveyors serving the pipe shop, except the "large pipe" conveyor, without extending beyond the property line. The large pipe conveyor is seldom used and a larger capacity crane would be required for handling the pipe than is planned. Anticipated cost of the tower crane, including installation is $125,000.

The final equipment requirement of the proposed system is a trailer for moving pipe from the storage area to the pipe shop. This is projected to be a modified 40' flat bed trailer fitted with racks to separate and contain the pipe enroute to the shop. Modifications to an existing trailer are estimated to cost $3,000 with a new trailer purchase cost of $25,000. Current plans are to utilize one trailer with additional units added to the fleet as requirements dictate. A detailed drawing of the proposed trailer modification is included in the Appendix.

Total capital costs listed here are approximately $510,000 including the saw, saw shelter and not including land costs. These costs are expected to be partially offset by gains in productivity

due to better inventory control, reduced inventory requirements, and improved pipe handling capabilities. The gains due to inventory control or reductions can not be estimated using available data, however, savings in pipe handling resulting from the proposed system can be demonstrated.

Under the current system, Avondale's pipe rack staff consists of a supervisor and three workmen. This crew can be reduced using the proposed system to a supervisor and two workmen as shown by the following task descriptions. Eliminating one man at $20 per hour for one year equates to $41,712 in savings per year.

Unloading of pipe from delivery trucks at the storage area by the present method requires a crew of five men. The crew includes the railroad crane operator, two workmen accompanying the crane, and two men from the pipe rack staff. The proposed plan would require only three men, an operator for the storage area crane and two workmen. Only two workmen would be needed because of the ease with which flat bed trailers with bundled or strip loaded materials, as recommended above, can be unloaded. This would free up two workmen and the railroad crane for other activities.

The plan being considered will require transfer of material from the storage area to the pipe shop. The proposed method is to load a transport trailer with materials, tow the trailer to the pipe shop, and transfer the pipe into the pipe shop storage racks using the tower crane located there. Meanwhile, the crane at the storage area may be loading another trailer or be engaged in other work. This activity will require a three man crew at the storage area to

load the trailer, a truck and driver to tow the trailer from the storage area to the pipe shop, and a three man crew at the pipe shop to transfer the pipe into the racks. The pipe shop will provide the crew to load the pipe into the racks, although the storage area crew could be used. The truck and driver will be provided, as needed, by the transportation department.

For comparison, the current method of transferring materials to the pipe shop is a pick-and-carry operation; pick-up a quantity of material, carry it to its destination using manpower or the railroad crane, then return for another load. This method normally requires use of the railroad crane, borrowed from another department, and a five man crew as described earlier. This method also makes transfer operations dependent on availability of the railroad crane.

Comparing the two methods of transferring pipe from storage to the pipe shop racks, the proposed method saves the cost of two workmen and eliminates the use of the railroad crane.

In all cases, the maximum crew required to store and handle the pipe does not exceed three men. So there is a savings of one permanent, full time employee plus additional savings through reduced manpower requirements for specific tasks.

VI. Summary

From the above review, it is evident that variables in shipyard procedures for purchasing and handling pipe can have a dramatic impact

on material costs and operating expenses. Conclusions and specific cost cutting recommendations are summarized below.

A. Recommendation:

Order double-random lengths (DRL) for all steel pipe in sizes 2" through 24". The length of pipe joints specified on purchase orders is the single most important variable in determining material costs. Using Avondale as an example, on a typical T.A.O. construction project the use of double-random lengths (DRL) versus 21' uniform lengths for steel pipe in sizes 2" through 24" will save $164,693 or 26.6% in pipe shop material costs. After adding expenses for cutting and extra handling of the pipe, net savings of $151,500 per project are estimated.

B. Recommendation:

Order single-random lengths (SRL) for all steel pipe in sizes smaller than 2". In steel pipe sizes less than 2" the use of single-random lengths (SRL) is 5% less expensive than 21' uniform lengths. On a typical project these savings will amount to an estimated $850.

c. Recommendation:

Restrict specifications to A-106 steel for all low carbon steel pipe. The practice of ordering lesser grade steel pipe whenever possible, usually in small quantities, as a cost reduction method are counter productive. Extra charges assigned to small orders

often result in costs greater than those of the higher grade material purchased in bulk. For example, A-106 steel pipe is approximately 5% more expensive than A-53 steel pipe, however, the extra charges from small orders range 5% to 10%. It is, therefore, more economical to specify the higher grade exclusively than to mix the material grades. Additional savings are probable when handling and storing a single material rather than two. Also, accidental substitution of materials during fabrication is avoided.

D. Recommendation:

Order all steel pipe with square cut ends when purchasing from a mill, plain ends when purchasing from suppliers stock. Avoid specifying bevelled ends.

Pipe mills provide square cut ends at no charge in all steel pipe sizes. Light wall steel pipe, extra strong or lighter, is available with bevelled ends at no charge through size 12". Bevelling of heavier wall or larger size pipes is an extra cost option adding 3% to 7% to the pipe price. Suppliers generally stock bevelled end pipe. Plain end specifications allow either bevelled or square cut ends.

E. Recommendation:

Specify delivery by flat bed trailer with materials strip loaded or in standard bundles. Handling expenses are affected by the manner in which pipe deliveries are made. Railroad gondola cars and enclosed trucks or trailers are difficult to unload by

forklift or crane and result in increased labor costs. Flat rail cars are easily unloaded, but their availability may delay shipments; especially, in cases where mills require bulkheaded rail cars. Rail deliveries also limit pipe handling facilities to areas with railroad access. Flat bed trailers offer ease of unloading, excellent availability and do not restrict delivery sites.

Whatever the mode of transportation, proper loading of material can aid in reducing pipe handling costs. Some tubular products, for their protection or to facilitate handling, may be packaged in bundles or secured lifts from the factory. Also, pipe can be strip loaded by placing loose items in layers separated by timbers to make unloading and sorting easier. Strip loading and some forms of bundling are available at no charge and will cut the time required to unload and sort pipe deliveries.

F. Recommendation:

Provide a centralized pipe handling and storage facility. It was found in this study that a centralized shipping, receiving and storage facility reduces material costs through improved inventory control, reduced inventory due to the ability to transfer materials between projects, and reduced pipe handling staff requirements. Duplicity of inventory and pipe handling efforts are avoided by consolidating all handling and storage at a single site. Labor savings alone are estimated at $64,000 per year for Avondale Shipyards.

G. Recommendation:

Provide dedicated equipment for use at all major pipe handling sites. In addition to providing the centralized facility mentioned above, each major pipe handling site throughout the shipyard should have dedicated pipe handling equipment. This equipment need not be as elaborate as at the main pipe yard, but adequate to handle the majority of deliveries to that site. Shuffling of equipment from other uses or departments for pipe handling generally results in delays and additional labor costs. These recommendations are currently being implemented at Avondale Shipyards near New Orleans, Louisiana with the following results. Avondale is preparing a site for a new centralized pipe handling facility which will receive, store and distribute all pipe for the shipyard. The facility will feature concrete slabs for pipe storage, a moving gantry type bridge crane and a pipe cutting area where DRL pipe can be received, cut in halves and moved to storage. Large supplies of pipe will be distributed using a specially modified trailer while small orders will be moved by flat bed trucks. At the pipe shop, the only major delivery point, a tower crane will be erected for unloading pipe supplies and feeding pipe to the pipe shop conveyors. The estimated cost of these improvements is $510,000, not including the value of the land to be used.

Avondale is considering altering pipe purchasing specifications to eliminate all grade A-53 steel and to eliminate the 21' uniform length requirement. It has been proposed that all low carbon steel pipe be grade A-106, sizes 2" through 24", be DRL, with SRL for

sizes less than 2". Stainless steel and non-ferrous piping specifications will be unaffected. Delivery by flat bed truck will also be specified. Material costs savings are projected to be 24.5% or $152,350 per typical project. Estimated labor savings are about $64,000 per year.

Assuming an average of four projects per year, the yearly combined savings of materials and labor for the proposed system are $673,400. With an initial investment of $510,000 the implementation of these recommendations would payout in 0.78 years or 9.09 months. Over a ten year system life with a 10% interest rate the discounted return on investment, R.O.I., would be 132%.

Not included in these calculations are the additional savings expected to result from improved productivity in the form of better inventory control, reduced inventory requirements, and improved pipe handling capabilities.

VII. Appendix

A. Typical Project Bill of Materials

B. Normal Pipe Inventory

c. Excerpts from - Prices, Standard Pipe and Line Pipe, United States Steel

D. Steel Pipe Cost Comparisons, Sizes 2" through 24"

E. Steel Pipe Cost Comparisons, Sizes less than 2"

F. Excess Drop Off Calculations

G. Correspondence

H. Equipment Literature

I. Pipe Cutting Cost

J. Net Material Cost Savings

K. Pipe Handling Costs Comparisons

L. Concrete Slab Estimate

M. Trailer Modification Estimate

N. Project Payout/Project R.O.I.

O. Drawings

a) Partial Site Plan

b) New Pipe Storage Area

c) Transport Trailer Modifications

d) Pipe Shop Site Plan

APPENDIX A

TYPICAL PROJECT BILL-OF-MATERIALS

TYPICAL PROJECT BILL-OF-MATERIALS

Size and Description	Feet Required
PIPE	
l", STL, A53, BW, S 80, GALV	208
1-1/2", STL, A53, BW, S 80, GALV	2908
1-1/4", STL, A53, BW, S 80, GALV	6
2", STL, A53, BW, S 80, GALV	487
8", STL, API-5L GR X-42, ERW, STD	46
3-1/2"OD, STL, API-5L GR X-46, SMLS, .300 W	6285
14", STL, A53-B, SMLS, S 40	4
16", STL, A53-B, SMLS, S 40	13
12",STL, A106-B, SMLS, S 40	1301
14", STL, A106-B, SMLS, S 40	230
18", STL, A106-B, SMLS, S 40	183
20",STL, A106-B, SMLS, S 40	400
16", STL, A106-B, SMLS, S 60	3
8", STL, A106-B, SMLS, S 80	130
10", STL, A106-B, SMLS, S 80	64
12", STL, A106-B, SMLS, S 80	453
12", STL, A106-B, SMLS, S 80	453
14", STL, A106-B, SMLS, S 8U	45
16", STL, A106-B, SMLS, S 80	129

Size and Description	Feet Required
18", STL, A106-B, SMLS, S 80	76
24", STL, A106-B, SMLS, S 80	55
l0", STL, A106-B, SMLS, S 100	25
8", STL, A106-B, SMLS, S 120	3
2", STL, A53-B, SMLS, S 160	8
2-1/2", STL, A53-B, SMLS, S 160	3
3", STL, A53-B, SMLS, S 160	8
5", STL, A53-B, SMLS, S 160, GALV	3
1-1/4", STL, A106-A/B, SMLS, S 160	63
4", STL, A106-B, SMLS, S 160	1
5", STL, A106-B, SMLS, S 160	25
6", STL, A106-B, SMLS, S 160	9
10", STL, A106-B, SMLS, S 160	9
2-1/2", STL, A53-B, SMLS, S 40	11
3", STL, A53-B, SMLS, S 40	239
4", STL, A53-B, SMLS, S 40	375
5", STL, A53-B, SMLS, S 40	19
6", STL, A53-B, SMLS, S 40	28
8", STL, A53-B, SMLS, S 40	1
5", STL, A53-B, SMLS, S 40, GALV	4
1/2", STL, A106-A/B, SMLS, S 40	2530
1/4", STL, A106-A/B, SMLS, S 40	234
3/4", STL, A106-A/B, SMLS, S 40	1590

Size and Description	Feet Required
3/8", STL, A106-A/B, SMLS, S 40	304
1", STL, A106-A/B, SMLS, S 40	2145
1-1/2", STL, A106-A/B, SMLS, S 40	2128
1-1/4", STL, A106-A/B, SMLS, S 40	972
2", STL, A106-A/B, SMLS, S 40	100
5", STL, A106-A/B, SMLS, S 40	5
2", STL, A106-B, SMLS, S 40	3824
2-1/2", STL, A106-B, SMLS, S 40	6542
3", STL, A106-B, SMLS, S 40	4452
4", STL, A106-B, SMLS, S 40	4226
5", STL, A106-B, SMLS, S 40	1451
6", STL, A106-B, SMLS, S 40	5499
8", STL, A106-B, SMLS, S 40	3740
10", STL, A106-B, SMLS, S 40	1137
3", STL, A106-B, SMLS, S 40, GALV	2
3", STL, A106-A, SMLS, S 80	6
1/2", STL, A106-A/B, SMLS, S 80	1270
1/4", STL, A106-A/B, SMLS, S 80	44
3/4", STL, A106-A/B, SMLS, S 80	3042
3/8", STL, A106-A/B, SMLS, S 80	2
1", STL, A106-A/B, SMLS, S 80	1828
1-1/21", STL, A106-A/B, SMLS, S 80	873

Size and Description	Feet Required
1-1/4", STL, A106-A/B, SMLS, S 80	233
1/2", STL, A106-A/B, SMLS, S 80, GALV	245
1/2", STL, Al(16-A/B, SMLS, S 80, GALV	245
3/4", STL, A106-A/B, SMLS, S 80, GALV	255
1", STL, A106-A/B, SMLS, S 80, GALV	443
1-1/2", STL, A106-A/B, SMLS, S 80, GALV	930
2", STL, A106-B, SMLS, S 80	5625
2-1/2", STL, A106-B, SMLS, S 80	4
3", STL, A106-B, SMLS, S 80	149
4", STL, A106-B, SMLS, S 80	157
5", STL, A106-B, SMLS, S 80	268
6", STL, A106-B, SMLS, S 80	1680
8", STL, A106-B, SMLS, S 80	1383
2-1/2", STL, A106-B, SMLS, S 80	3
6", STL, A106-B, SMLS, S 80	1
2", STL, A53-B, SMLS, S 80	49
2-1/2", STL, A53-B, SMLS, S 80	39
3", STL, A53-B, SMLS, S 80	62
4", STL, A53-B, SMLS, S 80	72
6", STL, A53-B, SMLS, S 80	87

Size and Description	Feet Required
2-1/2", STL, A53-B, SMLS, S 80, GALV	2
3", STL, A53-B, SMLS, S 80, GALV	13
12", STL, A106-B, SMLS, STD	56
14", STL, A106-B, SMLS, STD	37
16", STL, A106-B, SMLS, STD	78
18", STL, A106-B, SMLS, STD	41
14", STL, A53-B, SMLS, XS	2
10", STL, A106-B, SMLS, XS	305
10", STL, A106-B, SMLS, XS	305
12", STL, A106-B, SMLS, XS	342
14", STL, A106-B, SMLS, XS	87
16", STL, A106-B, SMLS, XS	344
18", STL, A106-B, SMLS, XS	11
24", STL, A106-B, SMLS, XS	8
2", STL, A53-B, SMLS, XXS	7
5", STL, A53-B, SMLS, XXS	7
1", STL, A106-A/B, SMLS, XXS	3
1-1/2", STL, A106-A/B, SMLS, XXS	14
2", STL, A106-B, SMLS, XXS	15
2-1/2", STL, A106-B, SMLS, XXS	4
3", STL, A106-B, SMLS, XXS	173
4", STL, A106-B, SMLS, XXS	13
1-1/4", SS, A312 TP 304L, SMLS, S 40S	291

Size and Description	Feet Required
1/2", SS, A312 TP304L, SMLS, S 40S	113
1/4", SS A312 TP304L, SMLS, S 40S	23
3/4", SS A312 TP 304L, SMLS, S 40S	1137
3/8", SS, A312 TP 304L, SMLS, S 40S	2
1", SS, A312 TP 304L, SMLS, S 40S	792
1-1/2", SS, A312 TP 304L, SMLS, S 40S	1637
2", SS, A312 TP 304L, SMLS, S 40S	1449
1-1/2", SS, A312 TP316L, SMLS, S 4US	40
3", SS, A312 TP316L, SMLS, S 40S	7
2", SS, A312 TP316L, SMLS, S 80S	2
4", SS, A312 TP304, SMLS, S 40	24
2-1/2", SS, A312 TP304L, SMLS, S 40	15
3/8", SS, A312 TP304, SMLS, S 40	2
3/4", SS, A312 TP316, SMLS, S 40	10
3/8", SS, A312 TP316, SMLS, S 40	112
3", SS, A312 304L, SMLS, S 40S	41
4", SS, A312 TP304L, SMLS, S 40S	29
4", SS, A312 TP304, WLD, S 40S	1
1-1/2", SS, A312 TP304L, WLD, S 40S	9
2", SS, A312 TP304L, WLD, S 40S	13
3", SS, A312 TP304L, WLD, S 40S	23

Size and Description	Feet Required
TUBING	
l/4"OD, CU, B75 AND MIL-T-24707 TP C12200, SMLS, .030 W, COIL	6
l/4"OD, CU, B75 AND MIL-T-24107 TP C12200, SMLS, .032 W, COIL	52
3/8"OD, CU, B75 AND MIL-T-24107 TP C12200, SMLS, .032 W, COIL	1464
l/4"OD, CU, B75 AND MIL-T-24107 TP C12200, SMLS, .032 W, SL	793
l/4"OD, CU, B75 AND MIL-T-24107 TP C12200, SMLS, .035 W, COIL	81
1-1/4", CU, B75 AND MIL-T-24O17 TP C12200, SMLS, .065 W.	146
1/2", CU, B75 AND MIL-T-24107 TP C12200, SMLS, .065 W	57
3/4", CU, B75 AND MIL-T-24107 TP C12200, SMLS, .065 W	170
1", CU, B75 AND MIL-T-24107 TP C12200, SMLS	13
1-1/2", CU, B75 AND MIL-T-24107 TP C12200, SMLS, .065 W	124
2", CU, B75 AND MIL-T-24107, TP C12200, SMLS, .065 W	523
2-1/2", CU, B75 AND MIL-T-24107 TP C12200, SMLS, .065 W	84
3", CU, B75 AND MIL-T-24107 TP C12200, SMLS, .065 W	444
4", CU, B75 AND MIL-T-24107 TP C12200, SMLS, .065 W	194
l/2"OD, CU, B75 AND M1L-T-24107 TP C12200, SMLS, .065 W, SL	4

Size and Description	Feet Required
3/8", CU, B75 AND MIL-T-25107 TP C12200, SMLS, .065 W	129
5", CU, B75 AND MIL-T-24107 TP C12200, SMLS, .068 W	254
6", CU, B75 AND MIL-T-24107 TP C12200, SMLS, .081 W	9
2", CU, B75 AND MIL-T-24107, SMLS, .083 w	13
l/2"OD, CU, TP K, B88 AND WW-T-799-D, SMLS, COIL	368
3/4"OD, CU, TP K, B88 AND WW-T-799-D, SMLS, COIL	80
3/8"OD, CU, TP K, B88 AND WW-T-799-D, SMLS, COIL	1314
5/8"OD, CU, TP K, B88 AND WW-T-799-D, SMLS, COIL	533
l/2"OD, CU, TP K, B88 AND WW-T-799-D, SMLS, SL	1905
3/4"OD, CU, TP K, B88 AND WW-T-799-D, SMLS, SL	8
3/8"OD, CU, TP K, B88 AND WW-T-799-D, SMLS, SL	105
5/8"OD, CU, TP K, B88 AND WW-T-799-D, SMLS, SL	5136
7/8"OD, CU, TP K, B88 AND WW-T-799-D, SMLS, SL	3429
1-1/8"OD, CU, TP K, B88 AND WW-T-799-D, SMLS, SL	2988
l-3/8"OD, CU, TP K, B88 AND WW-T-799-D, SMLS, SL	3073
l-5/8"OD, CU, TP K, B88 AND WW-T-799-D, SMLS, SL	1098

Size and Description	Feet Required
2-1/8"0D, CU, TP K, B88 AND WW-T-799-D, SMLS, SL	413
2-5/8"0D, CU, TP K, B88 AND WW-T-799-D, SMLS, SL	686
3-1/8"0D, CU, TP K, B88 AND WW-T-799-D, SMLS, SL	833
3-5/8"0D, CU, TP K, B88 AND WW-T-799-D, SMLS, SL	72
1/4"0D, CU, B280 AND WW-T-776A-1 SMLS, BRIGHT ANNEAL REFRIGERATION COIL	5
l/4"IPS, CU-NI 70-30, MIL-T-16420, CL 6000 TP 1, SMLS, .120 W	153
3/8"IPS, CU-NI 70-30, MIL-T-16420, CL 6000 TP 1, SMLS, .148 W	167
l/2"IPS, CU-NI 70-30, MIL-T-16420, CL 6000 TP 1, SMLS, .203 W	985
3/4"IPS, CU-NI 70-30, MIL-T-16420, CL 6000 TP 1, SMLS, .238 W	224
1"IPS, CU-NI 70-30, MIL-T-16420, CL 6000 TP 1, SMLS, .300 W	61
1-1/2"IPS, CU-NI 70-30, MIL-T-16420, CL 6000 TP 1, SMLS, .425 W	370
3/4", CU-NI 70-30, MIL-T-16420K, CL 200 GR I, SMLS, .065 W	30
1-1/2", CU-NI 70-30, MIL-T-16420K, CL 200 GR I, SMLS, .072 W	4
2", CU-NI 70-30, MIL-T-16420K, CL 200 GR I, SMLS, .083 W	361
3", CU-NI 7U-30, MIL-T-16420K, CL 200 GR I, SMLS, .095 W	113

Size and Description	Feet Required
5", CU-NI 70-30, MIL-T-16420K, CL 200 GR I, WLD, .125 W	21
6", CU-NI 70-30, MIL-T-16420K, CL 200 GR I, WLD, .134 W	758
12", CU-NI 70-30, MIL-T-16420K, CL 200 GR I, WLD, .250 W	642
14", CU-NI 70-30, MIL-T-16420K, GR I, WLD, .250 W	1
16", CU-NI 70-30, MIL-T-16420K, GR I, WLD, .250 W	89
1/4"OD, CU-NI 90-10, MIL-T-16420K, CL 200 GR I, SMLS, .035 W	36
3/8"OD, CU-NI 90-10, MIL-T-16420K, CL 200 GR I, SMLS, .035 W	766
1/2", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, SMLS, .065 W	223
1/4", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, SMLS, .065 W	2
3/4", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, SMLS, .065 W	380
3/8", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, SMLS, .065 W	20
1", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, SMLS, .065 W	102
1-1/2", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, SMLS, .065 W	115
1-1/2", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, SMLS, .072 W	597
2", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, SMLS, .083 W	67
2-1/2", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, SMLS, .083 W	150

Size and Description	Feet Required
3/4", CU-NI 90-10, MIL-T-16420K, GR I, SMLS, .083 W	10
3", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, SMLS, .095 W	1102
4", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, SMLS, .109 W	15
15-1/2"ID, CU-NI 90-10, 6402 ALLOY 706, WLD, .625 W	5
19-1/4"ID, CU-NI 90-10, 6402 ALLOY 706, WLD, .625 W	19
3", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, WLD, .095 W	98
4", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, WLD, .109 W	171
5", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, WLD, .125 W	964
6", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, WLD, .134 W	201
8", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, WLD, .148 W	411
14", CU-NI 90-10, MIL-T-16420K, CL 50 GR I, WLD, .165 W	11
20", CU-NI 90-10, MIL-T-16420K, CL 50 GR I, WLD, .180 W	9
10", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, WLD, .187 W	245
12", CU-NI 90-10, MIL-T-16420K, CL 200 GR I, WLD, .250 W	456
14", CU-NI 90-10, MIL-T-l6420K, GR I, WLD, .250 W	271
16", CU-NI 90-10, MIL-T-16420K, GR I, WLD, .250 W	242

Size and Description	Feet Required
20"OD, CU-NI 90-10, MIL-T-16420K, GR I, WLD, .250 W	11
24"OD, CU-NI 90-10, MIL-T-16420K, GR I, WLD, .250 W	57
20"OD, CU-NI 90-10, MIL-T-16420K, GR I TP II, WLD, .375 W	191
4-1/2"OD, STL, A519 AND AISI 1018, SMLS, .375 W	2
7-1/2"OD, STL, A519 AND AISI 1018, SMLS, .250 W	4
1-5/8"OD, STL, A519 AND AISI 1018, SMLS, .313 W	1
7-3/4"OD, STL, A519 AND AISI 1018, SMLS, .375 W	15
7-3/4"OD, STL, A519 AND AISI 1018, SMLS, .500 W	1
1/4"OD, SS, A213 TP 304, SMLS, .035 W, ANNEALED	99
1/2"OD, SS, A213 TP 304, SMLS, .049 W, ANNEALED	123
3/4"OD, SS, A213 TP 304, SMLS, .065 W, ANNEALED	472
1/4"OD, SS, A213 TP 304L, SMLS, .035 W	30
3/4"OD, SS, A213 TP 304L, SMLS, .049 W	20
1/2"OD, SS, A213 TP 304L, SMLS, .095 W	145
3/4"OD, SS, A213 TP 304L, SMLS, .095 W	138
3/8"OD, SS, 213 TP 316, SMLS, .035 W	70

Size and Description	Feet Required
1/2"OD, SS, A213 TP 316, SMLS, .049 W	90
3/8"OD, SS, A213 TP 316, SMLS, .065 W	1085
3/4"OD, SS, A269 TP 304L, SMLS, .049 W	9

APPENDIX B

NORMAL PIPE INVENTORY

NORMAL INVENTORY

Size and Description	Max Ft.	Min Ft.	Current Inventory Ft.
14″, STL, A53-B, SMLS, STD, SE, GALV, SRL	42	10	387
l", STL, A53, S 40, PE, GALV, 21′	1000	500	1544
2", STL, A53, S 40, PE, GALV, 21′	800	400	1267
3", STL, A53, S 40, PE, GALV, 21′	600	200	210
4", STL, A53, S 40, PE, GALV, 21′	600	200	609
1/2", STL, A53, S 40, PE, GALV, 21′	800	400	1036
1/4″, STL, A53, S 40, PE, GALV, 21′	500	100	685
3/8″, STL, A53, S 40, PE, GALV, 21′	300	100	408
1-1/2″, STL, A53, S 40, PE, GALV, 21′	1200	500	1323
1-1/4″, STL, A53, S 40, PE, GALV, 21′	1200	500	861
2-1/2″, STL, A53, S 40, PE, GALV, 21′	400	200	189
3-1/2″, STL, A53, S 40, PE, GALV, 21′	100	20	71
3/4″, STL, A53, S 40, PE, GALV, 21′	1200	600	1533
l“, STL, A53, S 80, PE, GALV, 21′	500	100	2189
2“, STL, A53, S 80, PE, GALV, 21′	600	200	1341

(353)

Size and Description	Max Ft.	Min Ft.	Current Inventory Ft.
1/2″, STL, A53, S 80, PE, GALV, 21′	500	100	319
3/4″, STL, A53, S 80, PE, GALV, 21′	2100	1000	2351
3/8″, STL, A53, S 80, PE, GALV, 21′	100	20	7 1
1-1/2″, STL, A53, S 80, PE, GALV, 21′	2100	1000	3
1-1/4″, STL, A53, S 80, PE, GALV, 21′	300	100	474
1“, STL, A106-A/B, SMLS, S 40, SE, GALV, 21′	800	400	878
2“, STL, A106-B, SMLS, S 40, SE, GALV, 21′	800	40O	776
3“, STL, A106-B, SMLS, S 40, SE, GALV, 21′	500	200	300
4“, STL, A106-B, SMLS, S 40, SE, GALV, 21′	600	300	315
5“, STL, A106-B, SMLS, S 40, SE, GALV, 21′	300	100	1175
6“, STL, A106-B, SMLS, S 40, SE, GALV, 21′	210	63	100
8“, STL, A106-B, SMLS, S 40, SE, GALV, 21′	40	20	66
1/2″, STL, A106-B, SMLS, S 40, SE, GALV, 21′	800	400	945
1/4″, STL, A106-A/B, SMLS, S 40, SE, GALV, 21′	500	100	449
3/4″, STL, A106-A/B, SMLS, S 40, SE, GALV, 21′	800	400	1286
3/8″, STL, A106-A/B, SMLS, S 40, SE, GALV, 21′	500	100	1420

1978

Size and Description	Max Ft.	Min Ft.	Current Inventory Ft.
1-1/2″, STL, A106-A/B, SMLS, S 40, SE, GALV, 21′	400	100	724
1-1/4″, STL, A106-A/B, SMLS, S 40, SE, GALV, 21′	1200	200	421
2-1/2″, STL, A106-B, SMLS, S 40, SE, GALV, 21′	600	200	6 7 1
l“, STL, A106-A/B, SMLS, S 80, SE, GALV, 21′	800	2400	2213
2“, STL, A106-B, SMLS, S 80, SE, GALV, 21′	800	400	985
3“, STL, A106-B, SMLS, S 80, SE, GALV, 21′	400	200	239
4“, STL, A106-B, SMLS, S 80, SE, GALV, 21′	400	200	227
6“, STL, A106-B, SMLS, S 80, SE, GALV, 21′	40	20	43
8“, STL, A106-B, SMLS, S 80, SE, GALV, 21′	42	10	53
1/2″, STL, A106-A/B, SMLS, S 80, SE, GALV, 21′	800	400	1574
1/4″, STL, A106-A/B, SMLS, S 80, SE, GALV, 21′	500	100	582
3/4″, STL, A106-A/B, SMLS, S 80, SE, GALV, 21′	1000	500	1159
3/8″, STL, A106-A/B, SMLS, S 80, SE, GALV, 21′	500	100	663
1-1/2″, STL, A106-A/B, SMLS, S 80, SE, GALV, 21′	1000	500	1737
1-1/4″, STL, A106-A/B, SMLS, S 80, SE, GALV, 21′	800	400	736
2-1/2″, STL, A106-A/B, SMLS, S 80, SE, GALV, 21′	300	100	210

1237

Size and Description	Max Ft.	Min Ft.	Current Inverltory Ft.
12″, STL, A106-B, SMLS, STD, SE, GALV, 21′	100	20	86
24″, STL. A53-B. SMLS, S 10, SE; SRL	100	20	554 “
3-1/2″, STL, A53-B, SMLS, S 8(.), SE, 21′	300	100	394
l“, STL, A53, BW, S 40, PE, 21′	4200	2100	31′48
2“, STL, A53, BW, S 40, PE, 21′	2100	1000	1659
3“, STL, A53, BW, S 40, PE, 21′	500	200	1136
4“, STL, A53, BW, S 40, PE, 21′	420	100	323
1/2″, STL, A53, BW, S 40, PE, 21′	4200	1200	619
1/4″, STL, A53, BW, S 40, PE, 21′	500	200	372
3/4″, STL, A53, BW, S 40, PE, 21′	4200	2100	4179
3/8″, STL, A53, BW, S 40	500	200	1008
1-1/2″, STL, A53, BW, S 40, PE, 21′	2100	1000	1858
1-1/4″, STL, A53, BW, S 40, PE, 2i′	3000	2000	332
2-1/2″, STL, A53, BW,. S 40, PE, 21′	500	200	630
l“, STL, A53, BW, S80, PE, 21′	500	200	2175
2“, STL, A53, BW, S 80, PE, 21′	1000	500	651

1974

Size and Description	Max Ft.	Min Ft.	Current Inventory Ft.
3", STL, A53, BW, S 80, PE, 21′	100	200	21
1/2", STL, A53, BW, S 80, PE, 21′	1100	200	785
1/4", STL, A53, BW, S 80, PE, 21′	500	200	816
3/4", STL, A53, BW, S 80, PE, 21′	500	200	861
1-1/2", STL, A53, BW, S 80, PE, 2i′	500	200	294
1-1/4", STL, A53, BW, S 80, PE, 21′	500	200	285
2-1/2", STL, A53, BW, S 80, PE, 21′	300	100	210
12", STL, A106-B, SMLS, S 100, SE, 21′	20	5	69
14", STL, A106-B, SMLS, S 100, SE, SRL	20	5	35
20", STL, A106-B, SMLS, S 100, SE, SRL	20	5	38
16", STL, A106-B, SMLS, S 100, SE, SRL	42	5	13
5", STL, A1U6-B, SMLS, S 120, SE, 21′	42	10	42
4", STL, A106-B, SMLS, S 120, SE, 21′	100	20	0
6", STL, A106-B, SMLS, S 120, SE, 21′	40	20	42
8", STL, A106-B, SMLS, S 120, SE, 21′	20	'lo	13
i(l", STL, A106-B, SMLS, S 120, SE, 21′	20	5	22

35 4/6

Size and Description	Max Ft.	Min Ft.	Current Inventory Ft.
12″, STL, A106-B, SMLS, S 120, SE, 21′	20	5	8
8″, STL, A106-B, SMLS, S 140, SE, 21′	20	5	7
l0″, STL, A106-B, SMLS, S 140, SE, 21′	42	50	42
l″, STL, A106-A/B, SMLS, S 160, SE, 21′	100	20	78
2″, STL, A106-B, SMLS, S 160, SE, 21′	100	20	2441
3″, STL, A106-B, SMLS, S 160, SE, 21′	100	20	23
4″, STL, A106-B, SMLS, S 160, SE, 21′	100	20	186
5″, STL, A106-B, SMLS, S 160, SE, 21′	60	20	428
6″, STL, A106-B, SMLS S 160, SE, 21′	40	20	145
8″, STL, A106-B, SMLS, S 160, SE, 21′	20	5	178
1/2″, STL, A106-A/B, SMLS S 160, SE, 21′	100	50	1461
10″, STL, A106-B, SMLS S 160, SE, 21′	42	5	43
12″, STL, A106-B, SMLS S 160, SE, 21′	40	10	40
3/4″, STL, A106-A/B, SMLS, S 160, SE, 21′	100	50	293
1-1/2″, STL, A106-A/B, SMLS, S 160, SE, 21′	100	20	833
1-1/4″, STL, A106-A/B, SMLS, S 160, SE, 21′	210	42	71

Size and Description	Max Ft.	Min Ft.	Current Inventory Ft.
2-1/2", STL, A106-B, SMLS, S 160, SE, 21'	100	20	161
10", STL, A106-B, SMLS, S 20, SE, 21'	20	5	7
6", STL, A106-B, SMLS, S 40, SE, 21'	4200	2100	1
3", STL, A106-B, SMLS, S 40, SE, 21'	4200	2100	2073
4", STL, A106-B, SMLS, S 40, SE, 21'	4200	2100	3095
5", STL, A106-B, SMLS, S 40, SE, 21'	4200	2100	934
8", STL, A106-B, SMLS, S 40, SE, 21'	4200	2100	1562
1/2", STL, A106-A/B, SMLS, S 40, SE, 21'	3000	2000	3261
1/4", STL, A106-A/B, SMLS, S 40, SE, 21'	2000	1000	1047
1", STL, A106-A/B, SMLS, S 40, SE, 21'	2000	1000	1005
10", STL, A106-B, SMLS, S 40, SE, 21'	3000	1500	1202
12", STL, A106-B, SMLS, S 40, SE, 21'	1000	500	1018
14", STL, A106-B, SMLS, S 40, SE, SRL	100	200	489
20", STL, A106-B, SMLS, S 40, SE, SRL	20	0	124
24", STL, A106-B, SMLS S 40, SE, SRL	20	5	7
3/8", STL, A106-A/B, SMLS, S 40, SE, 21'	1000	500	1447

17433

Size and Description	Max Ft.	Min Ft.	Current Inventory Ft.
1-1/2″, STL, A106-A/B, S 40, SE, 21′	2400	1500	1254
1-1/4″, STL, A106-A/B, S 40, SE, 21′	2000	1500	1866
2-1/2″, STL, A106-B, SMLS, S 40, SE, 21′	4200	2100	7313
3-1/2″, STL, A106-B, SMLS, S 40, SE, 21′	300	100	392
3/4″, STL, A106-A/B, SMLS, S 40, SE, 21′	2000	1000	2762
18″, STL, A106-B, SMLS, S 40, SE, SRL	42	5	25
2“, STL, A106-B, SMLS, S 40, SE, 21′	4200	2100	3155
81", STL, A106-B, SMLS, S 60, SE, 21′	40	20	21
12″, STL, A106-B, SMLS, S 60, SE, 21′	20	5	15
16″, STL, A106-B, SMLS, S 60, SE, SRL	42	5	6
18′′,″STL, A106-B, SMLS, S 60, SE, SRL	100	20	122
24″, STL, A106-B, SMLS, S 60, SE, SRL	20	5	34
l“, STL, A106-A/B, SMLS, S 80, SE, 21′	1000	500	2171
2“, STL, A106-B, SMLS, S 80, SE, 21′	4200	2100	7162
3“, STL, A106-B, SMLS, S 80, SE, 21′	4200	2100	1694
4“, STL, A106-B, SMLS, S 80, SE, 21′	3000	1000	1204

2994

Size and Description	Max Ft.	Min Ft.	Current Inventory Ft.
5", STL, A106-B, SMLS, S 80, SE, 21′	2100	1000	8217
6", STL, A1(.)6-B, SMLS, S 80, SE, 21′	3000	1500	2146
8", STL, A106-B, SMLS, S 80, SE, 21′	500	100	1269
1/2", STL, A106-A/B, SMLS, S 8U, SE, 21′	2000	1000	1400
1/4", STL, A106-A/B, SMLS, S 80, SE, 21′	2000	1000	1762
10", STL, A106-B, SMLS, S 80, SE, 21′	20	5	2094
12", STL, A106-B, SMLS, S 80, SE, SRL	600	200	976
14", STL, A106-B, SMLS, S W_), SE, SRL	63	21	51
16", STL, A106-B, SMLS, S 80, SE, SRL	20	5	206
18", STL, A106-B, SMLS, S 80, SE, SRL	63	20	177
24", STL, A106-B, SMLS, S 80, SE, SRL	100	20	80
3/4", STL, A106-A/B, SMLS, S 8(I, SE, 21′	2100	1000	672
3/8", STL, A106-A/B, SMLS, S 80, SE, 21′	1000	500	1033
1-1/2", STL, Al(J6-A/B, SMLS, S 8(J, SE, 21′	2100	1000	1512
2-1/2", STL, A106-B, SMLS, S 80, SE, 21′	3000	1500	1970
10", STL, A53-B, SMLS, s 100	42	10	33

23598

Size and Description	Max Ft.	Min Ft.	Current Inventory Ft.
18″, STL, A106-B, SMLS, XS	42	10	108
12″, STL, A106-B, SMLS, STD, SE, 21′	2100	1000	1379
14″, STL, A106-B, SMLS, STD, SE, SRL	1000	500	635
16″, STL, A106-B, SMLS, STD, SE, SRL	100	20	87
18″, STL, A106-B, SMLS, STD, SE, SRL	20	5	32
20″, STL, A106-B, SMLS, STD, SE, SRL	20	5	29
24″, STL, A106-B, SMLS, STD, SE, SRL	105	20	33
10″, STL, A106-B, SMLS, XS, SE, 21′	1000	500	585
12″, STL, A106-B, SMLS, XS, SE, 21′	100	20	127
14″, STL, A106-B, SMLS, XS, SE, SRL	800	200	349
16′′,″ STL, A106-B, SMLS, XS, SE, SRL	100	20	357
20″, STL, A106-B, SMLS, XS, SE, SRL	20	5	96
24″, STL, A106-B, SMLS, XS, SE, SRL	20	5	47
l-1/4″, STL, A106-A/B, SMLS, XS, SE, 21′	1000	500	1249
2“, STL, A106-B, SMLS, XXS, SE, 21′	100	20	85
3“, STL, A106-B, SMLS, XXS, SE, 21′	100	20	842

Size and Description	Max Ft.	Min Ft.	Current Inventory Ft.
4“, STL, A106-B, SMLS, XXS, SE, 21′	100	20	62
5“, STL, A106-B, SMLS, XXS, SE, 21′	60	20	125
6“, STL, A106-B, SMLS, XXS, SE, DRL	40	20	129
8“, STL, A106-B, SMLS, XXS, SE, 21′	20	5	19
1/2”, STL, A106-A/B, SMLS, XXS, SE, 21′	105	21	425
3/4”, STL, A106-A/B, SMLS, XXS, SE, 21′	100	50	112
1-1/2”, STL, A106-A/B, SMLS, XXS, SE, 21′	100	20	82
1-1/4”, STL, A106-B, SMLS, XXS, SE, 21′	100	20	3936
2-1/2”, STL, A106-B, SMLS, XXS, SE, 21′	100	20	112

4946

APPENDIX C

EXCERPTS FROM - PRICES,

STANDARD PIPE AND LINE PIPE, UNITED STATES STEEL

Prices

Standard Pipe

and

Line Pipe

United States Steel Corporation

Pittsburgh, Pennsylvania

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PREFACE

The prices and extras listed do not necessarily represent the range of products, sizes, grades and chemistries, or the finishes and treatments we are able to furnish.

The prices and extras listed are based upon the use of our customary methods of production. If any additional or different methods are required, other extras may apply.

The prices, extras and other details listed are subject to change without notice, and billings will reflect prices in effect at time of shipment.

Availability of all items is subject to inquiry.

Symbols within parentheses shown for certain extras ore for invoicing purposes only.

A listing of the current price pages for this price list is shown on Page 62

1 Explanation of Pricing Method

General

Standard Pipe and line Pipe are priced on a per 100' basis. For each size and type of pipe a "Per Foot Base" is shown. In addition, a Pricing Factor is stated in terms of points for each size and type of pipe. By multiplying the Pricing Factor by the "Per Foot Base" of a given size and type of pipe, the price per 100' is obtained.

All commonly ordered sizes and types of Standard Pipe and line Pipe are listed in the Price Tables. When unusual items or certain extras are involved, it may be necessary that the required price be computed. For these reasons, more detailed explanations of pricing method together with examples are shown on the following pages.

Per Foot Weight

Per foot weight for plain end pipe is determined as follows:

OD minus wall thickness times wall thickness times 10.68 lbs. Round result to two decimals increased when third decimal is .xx5 or more = Per Foot Weight.

Example: Size 5 9/16" OD .875" wall
5.563 − .875 = 4.688
4.688 x .875 = 4.102
4.102 x 10.68 = 43.80936 or **43.81** lbs/foot

Per Foot Base

Per Foot Base is derived from the plain end weight per foot of the pipe size involved on a **10¢** per pound basis. Computation will extend thru the second decimal which shall be increased when third decimal is .xx5 or more.

Example: (a) Plain End Weight Per Foot = 43.81 Lbs.
43.81 x **$.10** = **$4.381** Per Foot Base = **$4.38**

(b) Plain End Weight Per Foot = 14.98 Lbs.
14.98 x **$.10** = **$1.498** Per Foot Base = **$1.50**

Price Per 100'

Prices are adjusted by increasing or decreasing the number of **Points** of the pricing factor. In applying this pricing factor to the per foot base to obtain the price per 100', the computation will extend thru the second decimal which shall be increased when third decimal is .xx5 or more.

Example: Per Foot Base = **$4.38**
Pricing Factor = **335 Points**
335 x $4.38 = **$1467.30** Price Per 100'

Price Per Ton

Price per ton is determined from price per 100' divided by per foot weight of item involved with result multiplied by 20 = Price Per Ton.

Example: Price Per 100' = **$1467.30**
Per Foot Weight = 43.81 Lbs.
$1467.30 ÷ 43.81 = 33.49235334
Multiply by 20 = $669.847 or **669.85** Per Ton

The Price Tables in this price list show the Per Foot Base, the Pricing Factor applicable to that grade and the price per 100' for that grade. In most cases, the price per net ton is also shown for the same grade as well as the price per 100' and per net ton for higher grades.

1 Explanation of Pricing Method

Unlisted Sizes-Black Plain End

Walls Lighter Than Published-(See Example Below)

For wall thicknesses lighter than those published in the Price Tables, the applicable price base is:

a. Seamless and Electric Weld

1. Select the price per 100′ of Grades A & B for lightest wall listed–Same OD.
2. **Divide this Price Per 100′ by the per foot base of the required lighter wall. Round** result to the next higher Full Point. This result is the pricing factor for the required size.
3. Add applicable Points Higher Price for specification, cut lengths, quantity, etc.
4. Multiply the total pricing factor by the per foot base of the required item to obtain the price per 100′.

b. Double Submerged Arc Weld–Inquire.

Intermediate Wall Thicknesses

For wall thicknesses intermediate to those published in the Price Tables, the applicable price base is:

a. Continuous Weld
10 Points Higher Price than the Pricing Factor applicable to the closest published wail thickness in the same OD.

b. Seamless and Electric Weld
30 Points Higher Price than the Pricing Factor applicable to the closest published wall thickness in the same OD, Seamless or Electric Weld as required.

c. Double Submerged Arc Weld
The same Pricing Factor as that which applies to the closest published wall thickness in the same OD.

NOTE: In all cases above, exact mean Walls take the Higher Pricing Factor.

Walls Heavier Than Published

For wall thicknesses heavier than those published in the Price Tables, the applicable price base is:

a. Seamless
40 Points Higher Price than the Pricing Factor applicable to the heaviest wall published in the same OD in Seamless Pipe Price Tables.

b. Electric Weld
The same Pricing Factor as that which applies to Seamless Pipe in the same OD and Wall Thickness.

c. Double Submerged Arc Weld–Inquire.

Intermediate OD′s–Double Submerged Arc Weld Pipe Only.

Far OD′s of Double Submerged Arc Weld Pipe in sizes 24″ OD through 48″ OD intermediate to those published in our Price Tables, Price is 29 Points Higher Price than the price for the nearest published OD in the same wall thickness.

NOTE: Exact mean OD′S take the Higher Pricing Factor.

Example for Walls Lighter than Published–Seamless Pipe

ä EXAMPLE: Seamless A53 Grade B Black Plain End DRL

Seamless 6⅝″ OD x .250″ Wall 17.02 lbs. **$1.70** Per Foot Base

$693.50 Price for 6⅝″ OD x .280″ Wall (lightest listed)

÷ **1.70** Per foot base for 6⅝″ OD x .250″ Wall

407.95 Points

or 408 Points pricing factor

× **1.70** Per foot base for 6⅝″ x .250″ Wall

$693.60 Per 100′ at producing mill

1 Explanation of Pricing Method

Calculation of Prices

Prices per 100′ for most sizes and classes of pipe are shown in the Price Tables. The following examples illustrate the pricing method when prices must be calculated.

Example No. 1

Assume a certain size and type of pipe has a per foot base of $.09 and the current Pricing Factor is 463 Points.

Published per foot base ..... **$.09**
Published Pricing Factor. .....
Net price per 100′ (463 x $.09) **$41.67**

Example No. 2

Assume a certain size and type of pipe has a per foot base of $.37 and the current Pricing Factor is 390 Points.

Published per foot base ..... **$.37**
Published Pricing Factor .....
Net price per 100′ (390 x $.37) **$144.30**

Example No. 3

Assume a certain size and type of pipe has a per foot base of **$1.08,** has a current Pricing Factor of 345 Points, and is subject to a deduction of 7 Points and an extra of 26 Points.

Published per foot base **$1.08**
Published Pricing Factor ..... **345 Points**
Deduction ..... 7 Points
New Pricing Factor (345 Points less 7 Points) ..... 338 Points
Extra ..... 26 Points
Net Pricing Factor (338 Points plus 26 Points) ..... **364 Points**
Net price per 100′ (364 x $1.08) = ... $393.12

▶Example No. 4

Assume an item of 16″ OD x .380″ Wall Seamless Pipe is required. This wall thickness is intermediate to those published in the Price Tables. The Plain End weight per foot for this size is calculated at 63.39 lbs/foot which establishes per foot base of $6.34 for this size.

Pricing Factor for closest published wall thickness in the same OD (.375″) . . . . . 410 Points
Points Higher Price for intermediate wall (Page 4) . . . . . 30 Points
Total Pricing Factor . . . . . 410 Points + 30 Points = 440 Points
Net price per 100′ (440 x $6.34) = ... $2789.60

1 Explanation of Pricing Method

Standard Pipe—Specifications

Standard Weight, Extra Strong and Double Extra Strong Standard Pipe are generally produced to ASTM A120/A53 and related specifications. For other specifications, the following Points Higher Price apply:

Specification	Production Method	Points Higher Price Than ASTM AJ20/A53
ASTM A53/ASME SA53 (AWWA C200)	Seamless or EW Continuous Weld	None None
ASTM A106/ASME SA106– Grades A or B . . . . . Grade C	Seamless Seamless	30 40
ASTM A501 Round–Structural Tubing	Seamless Continuous Weld	None 15
ASTM A618 Round–Structural Tubing Grade la–USS COR-TEN j Grade lb–USS COR-TEN E Grade II –USS TRI-TEN . . Grade 111–USS EX-TEN 50	 Seamless Seamless Seamless Seamless or Continuous Weld	 75 75 45 35 35
ASTM A7 14–Class 2 Grade I (USSCOR-TEN Aor B] . . . . . . Class 2 Grade II (USSTRI-TEN) . . . . . . Class 2 Grade Ill (USS EX-TEN 50 Cu .20 Min) . . . . Class 4 Grade Vll (USS COR-TEN A) Class 4 Grade Vlll (USS COR-TEN B\	 Seamless Seamless Seamless Seamless Seamless	 75 45 **45** **75** **75**
}ASTM A79S Type E–Grade Aor B . . . . . . Type F . . . . . . Type S-Grade A or B	 EW Continuous Weld Seamless	 None None None
USS430 Slurry Pipe	Seamless or EW.	40
USS 431 Slurry Pipe for Heat Treating	Seamless	40
USS 451 Hot Finished PE Pipe for Paper Mill Rolls .	Seamless	30
USS 470 Pipe for Welding Fittings (S .010 Max) . . .	Seamless	30*
USS 471 High Strength low Alloy Pipe for Fittings .	Seamless	50*
USS 475 Pipe for Cold Formed Welding Fittings . . .	Seamless	3f)*

*A$_{pp}$lies to all pub~shed Seamless pipe Sizes and items Of 20 tons Or more of Seamless pifJe Sizes in walls lighter than listed, intermediate walls and walls heavier than listed. for unpublished seamless walls of quantities less than 20 tons of an item . . . . . Inquire

NOTES: ASTM A333 Grades 1 and 6 Seamless is sold as Pressure Pipe and sold fram USS Tubing Specialties Schedule C–Mechanical and Pressure Tubing.
Tubular Products far nuclear and other special applications including thase to ASTM A655, referencing 10 CFR21 and/or NCA 3800 . . . refer ta USS Tubing Specialties, Gary, IN.

April 25, 1984
(Fhsdicates change from issue January 5, 1983)
(Effective April 15, 1984)

1 Explanation of Pricing Method

Standard Pip+Specifications (continued] f

ASTM A589 Type II Water-Well Reomed and Drifted Pipe—
Threaded and Coupled—81ack and Galvanized.

Prices for this class of pipe are the same as for Standard Pipe threaded and coupled, for Random Mill Lengths, plus the following Points Higher Price.

Continuous Weld Pipe	Black	Galvanized
Nom thru 3½" OD	55	45
4"0Dand 4½" OD	40	35

Seamless and Electric Weld Pipe	Black	Galvanized
23/8" 0Dthth 65/8" OD	55	45

Standard Pipe-End Finish

Standard Pipe-½" Nom thru 12¾" OD

Prices are based on plain end pipe. For pipe Threaded Both Ends (TBE) or for pipe Threaded ond Coupled (T&C) the following Points Higher Price apply:

Size, Inches All wok Unless Otherwise Listed	Points Higher Price Than Plain End Pipe							
	Standard Weight and Lighter				Heavier than Standard Weight			
	Black		Galvanized		Black		Galvanized	
	TBE	T&C	TBE	T&C	T8E	T&C	T8E	T&C
Continuous Weld A120/A53								
▶½ Nom	ä 37	ä 47	4 2	▶52	▶63	▶90	▶69	▶116
▶¾ Nom	▶37	▶47	ä 42	▶53	▶63	▶89	▶69	▶116
▶1 Nom	▶27	▶36	3 7	▶47	▶47	▶74	▶53	▶90
ä 1¼ Nom thru 2 3/8 OD	▶27	▶37	ä 37	▶48	▶47	▶74	▶53	▶89
2⅞ and 3½ OD	▶37	▶47	4 7	▶58	▶47	▶69	▶47	▶79
4 and 4½ OD	▶47	▶63	4 7	7 4	ä 47	6 8	ä 47	ä 78
Seamless an Electric Weld A53								
2⅜ OD thru 6⅝ OD	50	85	50	85	50	85	50	85
8⅝ OD thru 12¾ OD	50	95	50	95	50	85	50	85

NOTE: Pipe threaded one end only [oiher end PE] is the same price as pipe threaded both l rids.

1 Explanation of Pricing Method

Line Pip*Specification AP1 5L (AWWA C200)

Continuous Weld Line Pipe is produced to specification API 51 Grade A25 Class 1 (in some cases Grade A25 Class 2). The following Points Higher Price over Black or Galvanized ASTM A 120/A53 Plain End (PE], Threoded Both Ends (TBE) or Threaded and Coupled [T&C) as ordered, apply:

Plain End—All Walls ..... [over A 120/A53 PE) . ..20
Threaded Both Ends (No Couplings)-All Walls ..... (over A120/A53 TBE) . 20
Threaded and Coupled—Standard Weight and Lighter ... (over A120/A53 T&C)
1/2″ Nom thru 3½″ OD 50
4″ and 4½″ OD 35
–Heavier than Standard Weight . . (over A120/A53 T&C)
All Sizes 20

Seamless, Electric Weld and Double Submerged Arc Weld Pipe black or galvanized produced to specification API 5L Grades A and B are the following Points Higher Price than ASTM A 120 black or galvanized Plain End, Threaded Both Ends or Threaded and Coupled, as ordered:

Plain Ends and Threaded Both Ends (no couplings) .....None
Threaded and Coupled–8⅝″ OD thru 12 ¾″ OD–Standard weight and lighter, also all OD's heavier than standard weight .....None
Threaded and Coupled–6⅝″ OD and smaller–Standard weight and lighter 10

NOTE: Pipe 6⅝″ OD and larger produced to the requirements of API 5L may olso be certified as meeting specification AWWA C200 at no additional extra.

ä Line Pipe-Specification API 5L (AWWA C200)

Seamless, Electric Weld and Double Submerged Arc Weld Line Pipe produced to X Grades of Specification APf 51 are priced on basis of the following:

Seamless–Plain End X Grades of API 5L

Wall Range	Points Higher Price Than API 5L Grades A or B					
	X Grades			HW Grades		
	X42*	X46 *	X52*	HW42	HW46	HW52
Extra Strong and Lighter	21/	33	52	29	41	60
Over Extra Strong Thru.375"	29					
Over .375″ thru .750″	33	29::	60	37	49	72
Over .750″	'39	51	70	47	59	78

Electric Weld and Double Submerged Arc WeId–Plain End X Grades of API 5L

Wall Range–X Grades	Points Higher Price Than API 5L Grades A or B					
	X42 *	X46*	X52 *	X60	X65	X70* *
All Walls–Regular Grade	11	23	42	61	77	94
If Alloy Bearing Other than MillPractice is Specified , . . .	19	31	50			

*Columbium, Vanadium or a combination thereof may be used at Mill Option for API 5L Grades X42, X46 and X52 unless specifically prohibited.

* * DSAW only.

NOTES: For Intermediate Grodes, apply points higher price for next higher grade listed.
Pipe 6⅝" OD and larger produced to the requirements of X Grades of API 5L may also be certified as meeting specificotion AWWA C200 at no additianal extra.

2 Extras

Special End Finishes

Threaded and Coupled Pipe-Couplings Not Attached to Pipe at Mill

On all pipe ordered threaded and coupled, it is our standard mill practice to attach couplings to pipe at mill. If order specifies that couplings be shipped with (in burlap bags), but not attached to the pipe, Paints Extra is 10

NOTE: This extra charge does not apply in those instances where it is required that couplings be charged far separately at the loose coupling price, such as cut lengths. If couplings are shipped alone in wooden hexes–Refer to PML far Points Extra.

Grooving * Continuous Weld, Seamless or Electric Weld Plain End Pipe for Mechanical Coupfings

Points Extra for Single or Double Grooving one or both ends of each piece, Cut or Rolled Grooves. (Does not include applicable Length Extras, if any).

		Length Range, Feet					
	Under 10	10 to under 15	15 to under 20	20 to under 25 and Single Random	*25 to under 30	*30 to under 35	*35 and Over and Double Random
Single Grooving	Subject to Inquiry	55	40	35	30	25	20
Double Grooving	Subject to Inquiry	100	75	60	50	45	40

*continuous Weld pipe can be grooved only in lengths under 25′ and 38′ and over.

NOTE: Extras for types at grooving other than the above ore Suject to Inquiry.

Single Bevel–Heavy Wall Seamless Pipe-All Sizes

Seamless Standard Pipe and line Pipe, Plain End in Extra Strong and Lighter Walls are furnished with ends beveled for welding or cut square as ordered without extra charge. Walls above Extra Strong are furnished with ends cut square without extra charge. If beveled ends are required on walls heavier than Extra Strong, the following extras apply:

Wail Thickness, Inches	ä Points Extra
Over Extra Strong to under .800	20
.800 to under 1.200	30
1.200 and over	45

Two-Step Bevel–Heavy Wall Seamless Pipe (Lorain, OH Only)

When specified we will furnish a "Two-Step" Bevel on certain sizes of Seamless Pipe in wall thicknesses over .750". The first .750" of wall thickness from ID) may be beveled 30" plus 5° minus 0° or 37 ½° plus or minus 2 ½°. The remaining wall thickness will be beveled 10° plus or minus 1° Extra charge for this operation is as follows:

Seamless Sizes 6 5/8" OD thru 26" OD

Wall Thickness, Inches	l Points Extra
Under I.000	50
1.000 and over	70

2 Extras

Processing

Internal Epoxy Coating

Plain End Double Submerged Arc Weld Line Pipe 24″ OD and larger can be internally coated with Epoxy Resin Amine or Polyamid Type Coatings which have been opproved for application by USS. The following extra charges apply

Size OD, fnches	Extras per 100′	
	Coating of 1.5 Mils	Each Additional .1 Mils
24	$168.45	$3.28
26	194.18	
30	204.36	4.09
36	278.15	4.84
40	291.50	5.36
42	299.24	5.61
44	331.88	6.00
46	346.50	6.25
4a	361.13	6.50

NOTES: If Buyer requires that Coating Manufacturer's Representative be present during application of the coating, this can be arranged and Buyer will be billed at actual cast plus representive's transportation costs.

Prices for internal coatings other than those listed abave are Subject to Inquiry.

Galvanized *

Prices for Galvanized Pipe are based on 1.80 ounce minimum average coating weight. The higher extra charges for specified Zinc coating weights heavier than 1.80 ounce minimum average are:

Range–Min Average Coating Weight, Oz	Points Extra Over 1.80 Oz Min Average
Over 1.80 thru 2.00	10
Over 2.00 thru 2.25	20

Caustic Washing *–The Points Extra charge for dipping pipe into a caustic wash is 15

Pickling *– The Points Extra charge for pickling (descaling) pipe is 15

Drifting *–The Points Extra charge for drifting plain end pipe or pipe with threads only, no couplings is. 15

*Available only through 22′ maximum lengths or single random lengths.

Item Quantity

An item is defined as one OD, Wall, Surface Finish, End Finish and length in one Specification or Grade and Marking for shipment at one time to one consignee at one destination.

Prices for Seamless, Electric Weld and Double Submerged Arc Weld Pipe are subiect to Quantity Extras. Paints Extra, which apply to quantities ordered, not on quantities shipped are:

23/8″ OD and Larger–Seamless, Electric Weld and Double Submerged Arc Weld

Quantity, Tons	ä Points Extra
5 and over	None
21/2 to under 5	30 (QM1)
1 to under 21/2	35 (QM2)
l/2 to under 1	45 (QM3]
Under 1/2	60 (QM4)

2 Extras
▶Deletion

Surface Finish—Black Pipe

Our regular mill practices include the following:

[1] Regular Mill Coating—Continuous Weld, Electric Weld and Seamless Pipe are coated with mill spray oil (on the OD only) . . . . . None

Double Submerged Arc Weld is normally- furnished bare, i.e., the pipe is not coated with milf spray oil and grease spots and cutting oil are not removed. When arrangements are made to furnish Double Submerged Arc Weld pipe with Regular Mill Coating, the extras are:

	Per 100′
24′′ OD	$11.50
26″ OD	12.50
30″ OD	14.50
36″ OD	17.50
40″ OD	19.50
42″ OD	21.50
44″ OD	24.00
46″ OD	26.00
48″ OD	28.00

(2) Bare-pipe is not coated with mill spray oil; grease spots and cutting oil are not removed . . . . . None

(3) Dry-pipe is not coated with mill spray oil and all grease spots and cutting oil have been removed. [Available orrly through 22′ maximum lengths or single random lengths). The Points Extra is 15

Other specified coatings such as Ferro Coat . . . . . lnquire

Tolerances

Wall Thickness

The following are out standard wall thickness minus tolerances applicable to Electric Weld line Pipe:

	ASTM A53	API 51	API 51X
18″ OD and smaller	Minus 12 1/2%	Minus 12Y2%	Minus 121/2%
20″ OD and larger	Minus 121/2%	Minus 10%	Minus 8%

Electric Weld line Pipe may be ordered to more restrictive minus wall tolerances at the following Points Extra:

1. When a minus tolerance specified closer than standard but not closer than 50% of standard 10
2. When minus tolerance is specified closer than 50% of sfandard 15

Straightness

USS standard straightness tolerance for other than APl Pipe is 3/4′′ in 20′ or in proportion for longer or shorter lengths. For API Pipe, straightness is per specification. For tolerances closer than mill standard or APl specifications, the Points Extra is 15

2 Extras

Testing

Supplemental Fracture Toughness Tests (For Information Only)

Charpy V-Notch Impact Tests

These tests where possible will be made on 2/3 size Charpy V-notch specimens on Seamless or Electric Weld and Double Submerged Arc Weld line Pipe. Where full curve data are developed for fracture appearance, transition temperatures and energy absorption, one sample will be broken at each of the various temperatures to establish a curve. - Where single temperature tests are performed for fracture appearance and energy absorption, the average of three specimens from one pipe will be reported.

Drop Weight Tear Tests

These tests will be performed on Seamless or Electric Weld and Double Submerged Arc - Weld line Pipe. Where full curve data is developed for fracture appearance transition . temperature, one sample will be broken at each of various temperatures to establish a curve. Where tests are performed for fracture appearance at one temperature, the average of two specimens from one pipe will be reported.

When above tests are requested, the following Extras Per Test apply:

	Charpy Inpact Test	Drop Weight Tear Test
Full curve data per set	$220.00	$220.00
One test at one temperature	93.50	93.50

Hydrostatic Tests

Seamless, Electric Weld and Double Submerged Arc Weld Plain End line Pipe are hydro- . statically tested to standard or alternate test pressures designated in API Specifications for this product. However, Seamless, Electric Weld and Double Submerged Arc Weld Plain End line Pipe in grades through X60 may be tested to higher pressures, up to a maximum of 95% of the specified minimum yield strength designated in API Specifications.

Paints Extra for higher hydrostatic testing are 10

Burst Tests

Burst Tests will be performed using customer's material at the following Extras Per Test.

85/8″ OD thru 18″ OD	$517.00
Over 18″ OD thru 26″ OD	687.50
Over 26″ OD . .	858.00

Supplementary Testing–Seamless Pipe Specification ASTM A106

The following extra charges apply for supplementary requirements under ASTM AI06 or similar specifications.

Requirement	Extra Charge
[S1) Chemical Analysis–	
Thru 4 Elements	$ 45.00 per test
5 Elements	55.00 per test
For each element over 5	15.00 per test
[S2) Transverse Tension Tests– [Tests made on specimen from each end of each length) .	$100.00 per length tested
(S3] Flattening Tests– (Tests made on specimen from each end of each length) .	$ 30.00 per length tested
(S4) Etch Tests	$40.00 per test
Photo-Micrographs	$ 40.00 each .
Marking and Handling	$ .25 per piece (PM3)

2 Extras

Length

Standard Pipe and line Pipe is available in random mill lengths an the following basis:

Standard Pipe

*Length	Production Method	Wall Thickness	Length Range, Feet	Permissible Shorts	
				% Order	Length Range, Feet
†Single Random (SRL]	All except Double Submerged Arc Weld	Standard Weight Extra Strong Dbl. Extra Strong	16 thru 22 12 thru 22 12 thru 22	5 5 5	12 thru 16 6 thru 12 6 thru 12
Double Random (DRL)	All	Standard Weight Extra Strong Dbl. Extra Strong	35′ Min. Average 35′ Min. Average Subject to Inquiry	. .. ..	....

Line Pipe

*Length	Production Method	Wall Thickness	Length Range, Feet	Permissible Shorts	
				% Order	Length Range, Feet
†Single Random [SRL)	All except Double Submerged Arc Weld	All Walls	18 thru 22 (T&C) 18 thru. 25 (PE)	5	16 thru 18
Double Random [DR~	All	All Walls	PLAIN ENDS Length depends upon OD and wall thickness. However, double random pipe is generally furnished in lengths averaging 38′ to 40′. THREADED AND COUPLED Double random lengths, Subiect to Inquiry.		

* continuous Weld Pipe in sizes 1/2" and 3/4" Nom is not available in lengths over 25′.

†Single Random Lengths—Seamless and Electric Weld Pipe

Seamless and Electric Weld Pipe ordered in single random lengths (SRL) will be subject to
▶Points Extra of: Seamless Pipe **25**
Electric Weld Pipe **12**

2 Extras

Length (continued)

Uniform Lengths–Continuous Weld Pipe Only–1/2″ Nom thru 41/2″ OD

Continuous Weld Pipe may be ordered in uniform length 17′ and over. The extra charges for such uniform lengths higher than random lengths for plain end, threaded both ends/threaded one end (no couplings) or threaded and coupled os ordered are:

Uniform Length or Length Range, Feet	† Length Tolerance Plus or Minus, Inches	Quantity of One Size, One Length and One Grade Ordered Tons	Points Extra		
			Size, Inches		
			1/2 thru 11/4 Nom	1 1/2 Nom thru 27/8 OD.	31/2 OD thru 4 1/2 OD
17 to under 21	1	20 and over†;	**30**	**25**	20
21	1	Any Quantity	**None**	**None**	None
* * 17 to under 25	6	20 and over	**None**	**None**	None
	6	10 to under 20†	**35**	**30**	**25**
25	6 or 12	Any Quantity	**None**	**None**	**None**
*Over 25 to under 35	6	20 and over	**40**	**35**	**30**
	6	10 to under 20†	**55**	**50**	**40**
*35 and over	6	20 and over†	**None**	**None**	None

*sizes 1/2″ and 3/4″ Nom in uniform lengths over 25′ are not available.

* * For Continuous Weld, Black or Galvanized Reamed and Drifted–Threaded and Coupled Pipe to ASTM A589 Type 11 in 18′0″ uniform lengths plus or minus 6″, 18′0″ Max. length or 20′0″ Max. Length–any quantity . . . . . No Length Extra Applicable

†For lesser quantities or for closer length tolerances, full Continuous Weld Cutting or Cutting and Threading Extras apply. (See Table for Cut length Continuous Weld Pipe) . . . . . .(Dll)

Selected Random Lengths–Seamless, Electric Weld, or Double Submerged Arc Weld –Plain End Pipe Only–16′ and longer

length Ranges involving lengths longer than 42′ are subject to inquiry for availability.

length Range, Feet	Percent (%) Extra of Seamless, Electric Weld or Double Submerged Arc Weld Full Cutting-Charge *
Under 2	100
2 to under 4	60
4 to under 6	50
6 to under 8	40
8 to under 10	30
10 and over	**20** √

* Based on Minimum length specified-round to Next Higher Full Point.

2 Extras

Length (continued)

Specified Minimum or -Maximum Lengths—Plain End Pipe Only

Minimum lengths and Maximum Lengths may be ordered in lengths 16′ and over. On such orders the mill may ship pipe of any length provided the minimum or maximum length requirements are met. Extras are calculated as follows:

Minimum Lengths—Seamless or Electric Weld

Orders specified to minimum lengths in the 16′ through 22′ length Range—Subtract length specified from 22′ to obtain length range and apply appropriate Selected Random length Range Extra [18′ Minimum"Length specified-22′ Minus 18′ = 4′ length Range at 50% of Cut length Extra), rounded to the next higher full point.

Orders specified to minimum lengths in the over 22′ through 42′ length Range—Subtract length specified from 42′ to obtain length Range, and apply appropriate Selected Random Length Range Extra (26′ Minimum Length specified-42′ Minus 26′ = 16′ Length Range at 20% of Cut Length Extra), rounded to the next higher full point.

Orders specified to minimum length over 42′—Full Cut length Extra is applicable.

Minimum Lengths—Double Submerged Arc Weld

Specified Minimum Lengths may be ordered at **Points Extra** charge of:

Size	Specified Minimum Length, Feet					
	26	27 or 28	29 or 30	31 or 32	33 or 34	35 or 36
All OD's and Walls	2	3	4	5	6	7

NOTES: Intermediate Minimum Lengths take the higher extra.
Inquire for Minimum Lengths over 36′.

Maximum Lengths—Seamless, Electric Weld or Double Submerged Arc Weld

Orders specifying Maximum Lengths 16′ to under 42′—Subtract 16′ from specified maximum length and apply appropriate Selected Random Length range above. (23′ Maximum Length specified-23′ Minus 16′=7′ Length Range at 40% of Cut Length Extra], rounded to the next higher full point.

Orders specified to a maximum length 42′ and over . . . . . None

NOTE: Specified minimum or moximum length determines the applicable Cut Lenglh Extra.

Cut Lengths

Standard Cut Length Tolerances

Length, Feet	Tolerance, Inches
Thru 24	Plus 1/8, Minus 1/8
Over 24 thru 34	Plus 5J$_6$, Minus 0
0ver 34 thru 42	Plus 3/8, Minus 0
Over 42....	Subject to Inquiry

2 Extras

Length (continued)

Cut lengths (continued)

1. If Plain End cut length Continuous Weld, Seamless, Electric Weld or Double Submerged Arc Weld pipe is ordered, the Points Extra for cutting only (bold face type) shown in the following tables, are added to the plain end pricing factor for base random lengths.
2. If Threaded Both Ends or threaded one end (no couplings) cut length Continuous Weld, Seamless or Electric Weld pipe is ordered, the Points Extra for cutting and threading (light face type) are added to the Threaded Both Ends (TBE) pricing factor for base random lengths.
3. If Threaded and Coupled cut length Continuous Weld, Seamless or Electric Weld pipe - is ordered, the Points Extra for cutting and threading (light face type), are added to the Threaded Both Ends (TBE) pricing factor for base random lengths. In this case, the couplings are charged separately at the loose coupling price. No charge for attaching couplings to pipe at mill.

Continuous Weld Pipe--Sizes 1/2″ Nom thru 41/2 OD

Size, Inches	length, Feet					
	6 to under 12	12 to under 15	15 to. under 18	18 to under 25	25 to under 35	35 and Over
	Points Extra					
	Cutting Only—Bold Face Type Cutting and Threading (Threaded One End or Both Ends) Light Face Type					
1/2 and 3/4 Nom	80	100	70	50	*	*
	100	110	75	55	*	*
1 Nom thru 23/8 OD	70	85	65	45	65	40
	85	95	70	50	70	45
27/8 OD thru 41/2 OD	55	75	55	40	55	35
	70	85	60	45	60	40

*Sizes 1/2″ and 3/4″ Nom are available in Cut Lengths under 25′ only.

2 Extras

Length (continued)

Cut Lengths (continued)

Seamless, Electric Weld and Double Submerged Arc Weld Pipe

Cutting and Cuttting and Threading Point Extras–Standard Cut length Tolerances.

Size OD, Inches	Wall Thickness	Length Range, Feet: 9 to under 14	14 to under 21	21 to under 28	28 to under 35	35 thru 42	Over 42 thru 60-
		ä Points Extra					
		Cutting Only–Bold Face Type Cutting and Threading (Threaded One End or Both Ends) Light Face Type					
* 23/8 thru 4 1/2	Lighter Than Standard Weight	125	100	175	100	85	45
		165	120	230	120	100	Not Available
	Standard Weight And Heavier	**105**	**90**	**150**	**90**	**75**	40
		150	110	200	105	90	Not Available
ä Over *** 4 r/2	Lighter Than Standard Weight	**135**	**120**	**210**	**135**	**90**	90
		175	145	290	165	105	Not Available
	* *Stondard Weight And Heavier	**120**	**105**	**175**	**120**	**75**	75
		155	135	245	145	90	Not Available

*Not available in cut lengths—extras are listed to allow for calculation of Extras for Selected Random Lengths and Minimum-Maximun Lengths.

▶**For Sizes 8⅝", 10¾" and 12¾" OD use Standard Walls (.322", .365" and .375" respectively; sizes over 12¾" OD .375" wall are considered standard).

***Cutting and Threading Extras (light face type) are for Maximum 12¾" OD only. Threading not available on sizes over 12¾" OD.

NOTE: In the heavier wall thicknesses, maximum lengths available are governed by the required wall thickness. (The heavier the wall the shorter the maximum length.)

Cut Lengths Under 9'—Extra is the same per piece as for a 9' length. To obtain the **Points Extra**—multiply Cutting or Cutting and Threading Extra shown above for the required size and wall by 108 (9' in inches). Divide the result by the desired Length in inches and round this result to **Next Higher Full Point.**

▶Example: 10¾" OD x .500" Wall Plain End Cut 4' 11" Long
Cutting Extra—9' Length — **120 Points**
120 Points x 108" (9') = 12960
12960 ÷ 59" (4'11") = **219.66 Points**
Round to **Next Higher Full Point** for **220 Points Extra.**

2 Extras

Pack-Mark-Load

Packing

Thread Protection

Regular mill practice provides for protection of the threads on the end of the pipe not protected by the coupling on threaded and coupled pipe, and for threads on both ends of - threaded only pipe, in accordance with the following table:

Type of Pipe	Type of Shipment	Size, Inches		
		1½ Nom and Smaller	2⅜ thru 4 OD	4½ OD and Over
Standard Pipe	Ocean	Plastic Protectors or Burlap	Plastic or Metal Protectors	Plastic or Metal Protectors
	Non-Ocean	*No Protection	*No Protection	
Reamed and Drifted Pipe	Ocean	Fiber Protectors or Burlap	Metal Protectors	Metal Protectors
	Non-Ocean	*No Protection		
Line Pipe	Ocean	Plastic Protectors or Burlap	Plastic or Metal Protectors	Plastic or Metal Protectors
	Non-Ocean			

*NOTE: When thread protection on these items is specified by the Buyer, the following extras will apply:

Threaded and Coupled Pipe . . . . . Points Extra 15 (P1)

Threaded only Pipe and T&C Pipe involving Couplings Shipped with but not attached to Pipe . . . . . Points Extra 20 (P2)

Capping Ends of Plain End Pipe

Metal or Plastic Caps can be fitted to the ends of Plain End Standard Pipe and/or Line Pipe in sizes ½" Nom. through 24" OD. The extras are:

Size Range, Inches	Length	▶Points Extra
½ Nom thru 12¾ OD	Single Random, 21' Uniform or Cut Lengths Under 25'	**30** (P6)
½ Nom thru 12¾ OD	Double Random or Cut Lengths 25' and Over	**25** (P7)
14 OD thru 24 OD.....	Single Random, 21' Uniform or Cut Lengths Under 25'	**35** (P8)
14 OD thru 24 OD.....	Double Random or Cut Lengths 25' and Over	**30** (P9)

Loose Couplings

Regular Mill Practice provides for packing Loose Couplings in Burlap Bags . . . . . Norse

For Couplings shipped separate from the Pipe or when couplings only are shipped and wooden boxes are ordered as shipping container, the Extras Per Box are:

1/2" NOM thru 41/2" OD . . . . . $30.00* *

Over 41/2" OD thru 123/4" OD $60.00**

* *Applicably to the number of Wooden Boxes used.

2 Extras

Pack-Mark-Load (continued)

Packing (continued)

Bundling

Continuous Weld Pipe in sizes ⅛" through ⅜" Nom is shipped in bundles. Bundles will not be broken, shipments being made to the closest bundle. The number of pieces per bundle and the approximate footage and weight are in table below.

Continuous Weld Pipe in Sizes ½" Nom and larger, as regular mill practice, will be shipped not bundled. When bundles are specified for sizes ½" Nom through 1½" Nom, the number of pieces per bundle and the approximate footage and weight will be as shown below.

Standard Weight and Extra Strong Pipe

Nom Size, Inches	Per Bundle		Weight Per Bundle—21' Uniform Lengths				
			Standard Weight Pipe			Extra Strong Pipe	
	Pieces	Feet	Plain End	T&C		Std or Line	
			Std or Line	Std	Line	Plain End	T&C
⅛	30	630	151	151	158	195	195
¼	24	504	212	212	217	272	272
⅜	18	378	215	215	215	280	280

●Secured Lifts

Continuous Weld Pipe

Regular mill practice at Lorain, OH and Fairless, PA mills is to pre-package Black and Galvanized Continuous Weld Pipe sizes ½" Nom thru 1½" Nom into approximately one ton maximum secured lifts as follows:

Nom Size, Inches	Wall Thickness, Inches	Pieces in Lift	Footage in Lift	Weight Per Lift—21' Uniform Lengths	
				Plain End	T&C
Standard Weight Pipe					
½	.109	50	1050	893	893
¾	.113	40	840	949	949
1	.133	30	630	1058	1058
1¼	.140	40	840	1907	1915
1½	.145	35	735	1999	2007
Extra Strong Pipe					
½	.147	25	525	572	572
¾	.154	25	525	772	777
1	.179	20	420	911	916
1¼	.191	15	315	945	951
1½	.200	15	315	1144	1153

2 Extras

Pack-Mark-Load (continued)

Marking

Special or Unusual Marking-Prices are subject to inquiry.

Loading

Regular mill practice is to ship pipe in open trucks or gondola cars without covering. Sizes 3/8", Nom and smaller are bundled as indicated in Bundling table. Sizes 1/2" Nom thru 11/2" Nom is Standard Weight and Extra Strong walls are pre-packaged at our Lorain, OH and Fairless, PA mills in secured lifts–see General Information for secured lift table. Any item ordered to a quantity less than that contained in a pre-packaged secured lift will be subject to an extra for breaking the standard secured lift. On all other sizes–Lorain mill regular practice is to load solid without separators. If lifts (regular or secured) are required, the lift weight must be so specified. All other pipe mills regular practice is to load solid or in 5 ton secured or assembled lifts at mill's option.

Extra Per Item for breaking the Standard Secured lifts is $30.00 (PI.3)

[This extra is not charged when Bundling is ordered and extra (P9) is charged).

When special loading practices are specified, the following extras apply.

loading in Secured lifts of Under 5 Tons down thru 1 Ton . . . . . None

A Secured lift is defined as a specified maximum weight of individual pieces of pipe or standard bundles of pipe, or both, that are secured with metal strapping for handling as a unit package. Secured lifts are supported and separated with lumber in the car or on the truck to permit access of loading and unloading equipment.

loading in lifts . . . . . None

A lift is defined as a specified maximum weight desired for convenient handling which may be comprised of any number of loose pieces of pipe, or any number of standard bundles or secured lifts of pipe, or all three. All lifts are separated by lumber.

For covering rail carloads or truckloads with waterproof paper or similar covering . . Inquire (P10)

loading on flat cars-Extra Per Car is $220.00 (PL1)

For wrapping ends of Secured lifts with waterproof material–Points Extra is . . . .15 (PL2]

Special Requirements

Test Reparts–Continuous Weld Pipe-(Heat Numbers Not Furnished).

Test Reports for Continuous Weld Pipe will be furnished at Extra Per Order of:

Certified . . . . . $50.00 (MTC]

Notarized (Sworn) . . . .100.00 (MTS)

Test Reports–Seamless, Electric Weld and Double Submerged Arc Weld Pipe.

When specified or required, Test Reports including heat numbers will be furnished at the following Extras per 100'.

(Ordered length will determine the extra, not lengths shipped. When selected random or minimum lengths are specified, the minimum Iength ordered will determine the extra).

Document Ordered	Single Random (Lengths 25' and under)		Long and Double Random (Lengths over 25')	
	Certified	Notarized (Sworn)	Certified	Notarized (Sworn)
Mill T/R–specified on order	**$3.00** (MT1)	**$6.00** (MT2)	**$1.50** (MT1)	**$3.00** (MT2)
MIII T/R–after shipment (including recertification] . . ...'...	15.00	30.00	7.50	15.00
Heat numbers on tallies and/or invoices when T/R has not been ordered(1)				
Before shipment	**$3.00** (MT5)		**$1.50** (MT5)	
After shipment	**15.00**		**7.50**	

(1) Heat numbers will be shown on tallies and/or invoices when Test Reports have been ordered at extra of . . . . . None

SEAMLESS PIPE—ITEM QUANTITY EXTRAS PER 100'

For quantities under 5 tons, the values below will be added to Seamless Pipe Prices shown on the following pages.

MILL- LORAIN, OH & FAIRFIELD, AL

Size Inch OD	Size Inch Wall	Per Foot Base	2½ Tons to Under 5 Tons (QM1) 30 Points	1 Ton to Under 2½ Tons (QM2) 35 Points	½ Ton to Under 1 Ton (QM3) 45 Points	Under ½ Ton (QM4) 60 Points
2⅜	.154	$ .37	$ 11.10	$ 12.95	$ 16.65	$ 22.20
2⅜	.218	.50	15.00	17.50	22.50	30.00
2⅜	.436	.90	27.00	31.50	40.50	54.00
2⅞	.203	.58	17.40	20.30	26.10	34.80
2⅞	.276	.77	23.10	26.95	34.65	46.20
2⅞	.552	1.37	41.10	47.95	61.65	82.20
3½	.216	.76	22.80	26.60	34.20	45.60
3½	.300	1.03	30.90	36.05	46.35	61.80
3½	.600	1.86	55.80	65.10	83.70	111.60
* 4½	.237	1.08	32.40	37.80	48.60	64.80
* 4½	.337	1.50	45.00	52.50	67.50	90.00
4½	.674	2.75	82.50	96.25	123.75	165.00
5⁹/₁₆	.258	1.46	43.80	51.10	65.70	87.60
5⁹/₁₆	.375	2.08	62.40	72.80	93.60	124.80
5⁹/₁₆	.750	3.86	115.80	135.10	173.70	231.60
* 6⅝	.280	1.90	57.00	66.50	85.50	114.00
* 6⅝	.432	2.86	85.80	100.10	128.70	171.60
6⅝	.864	5.32	159.60	186.20	239.40	319.20
* 8⅝	.322	2.86	85.80	100.10	128.70	171.60
* 8⅝	.500	4.34	130.20	151.90	195.30	260.40
8⅝	.875	7.24	217.20	253.40	325.80	434.40
10¾	.365	4.05	121.50	141.75	182.25	243.00
10¾	.500	5.47	164.10	191.45	246.15	328.20
12¾	.375	4.96	148.80	173.60	223.20	297.60
12¾	.500	6.54	196.20	228.90	294.30	392.40
12¾	1.000	12.55	376.50	439.25	564.75	753.00
14	.375	5.46	163.80	191.10	245.70	327.60
14	.500	7.21	216.30	252.35	324.45	432.60
16	.375	6.26	187.80	219.10	281.70	375.60
16	.500	8.28	248.40	289.80	372.60	496.80
18	.375	7.06	211.80	247.10	317.70	423.60
18	.500	9.35	280.50	327.25	420.75	561.00
20	.375	7.86	235.80	275.10	353.70	471.60
20	.500	10.41	312.30	364.35	468.45	624.60
22	.375	8.66	259.80	303.10	389.70	519.60
22	.500	11.48	344.40	401.80	516.60	688.80
24	.375	9.46	283.80	331.10	425.70	567.60
24	.500	12.55	376.50	439.25	564.75	753.00
26	.375	10.26	307.80	359.10	461.70	615.60
26	.500	13.62	408.60	476.70	612.90	817.20

* These sizes available from both Fairfield, AL and Lorain, OH.
All others Lorain, OH, only.

4. Weights, Dimensions and ▶Prices

—QUANTITY—
5 TONS OR MORE

SEAMLESS PIPE—SINGLE RANDOM LENGTHS (SRL)
BLACK ASTM A53 Grades A and B

▶MILL- LORAIN, OH

OD, Inches	Wall, Inches	Weight Per Foot, Pounds		Per Foot Base	T&C		PE	
		T&C	PE		Pricing Factor	Price, Per 100'	Pricing Factor	Price Per 100'
STANDARD WEIGHT PIPE (STD)								
2⅜	.154	3.68	3.65	$ .37	586	$ 216.82	501	$ 185.37
2⅞	.203	5.82	5.79	.58	523	303.34	438	254.04
3½	.216	7.62	7.58	.76	530	402.80	445	338.20
4½	.237	10.89	10.79	1.08	512	552.96	427	461.16
5⅝	.258	14.81	14.62	1.46	609	889.14	524	765.04
6⅝	.280	19.18	18.97	1.90	497	944.30	412	782.80
8⅝	.322	29.35	28.55	2.86	504	1441.44	409	1169.74
10¾	.365	41.85	40.48	4.05	512	2073.60	417	1688.85
12¾	.375	51.15	49.56	4.96	504	2499.84	409	2028.64
EXTRA STRONG PIPE (XS)								
2⅜	.218	5.07	5.02	.50	560	280.00	475	237.50
2⅞	.276	7.73	7.66	.77	547	421.19	462	355.74
3½	.300	10.33	10.25	1.03	541	557.23	456	469.68
4½	.337	15.17	14.98	1.50	539	808.50	454	681.00
5⅝	.375	21.09	20.78	2.08	602	1252.16	517	1075.36
6⅝	.432	28.89	28.57	2.86	504	1441.44	419	1198.34
8⅝	.500	43.90	43.39	4.34	501	2174.34	416	1805.44
10¾	.500	55.82	54.74	5.47	505	2762.35	420	2297.40
12¾	.500	66.71	65.42	6.54	499	3263.46	414	2707.56
DOUBLE EXTRA STRONG PIPE (XXS)								
5⅝	.750	38.61	38.55	3.86	737	2844.82	652	2516.72
6⅝	.864	53.14	53.16	5.32	619	3293.08	534	2840.88
8⅝	.875	72.44	72.42	7.24	619	4481.56	534	3866.16

▶(Deletion)

NOTE: Extra for Single Random Lengths (SRL) is included in above prices.

4 Weights, Dimensions and ▶Prices

—QUANTITY—
5 TONS OR MORE

SEAMLESS PIPE—SINGLE RANDOM LENGTHS (SRL)
GALVANIZED ASTM A53 Grades A and B

MILL- LORAIN, OH

OD, Inches	Wall, Inches	Weight Per Foot, Pounds		Per Foot Base	T&C		PE	
		T&C	PE		Pricing Factor	Price Per 100'	Pricing Factor	Price Per 100'
STANDARD WEIGHT PIPE (STD)								
2⅜	.154	3.68	3.65	$ .37	698	$ 258.26	613	$ 226.81
2⅞	.203	5.82	5.79	.58	638	370.04	553	320.74
3½	.216	7.62	7.58	.76	645	490.20	560	425.60
4½	.237	10.89	10.79	1.08	627	677.16	542	585.36
5⅝	.258	14.81	14.62	1.46	724	1057.04	639	932.94
6⅝	.280	19.18	18.97	1.90	612	1162.80	527	1001.30
8⅝	.322	29.35	28.55	2.86	619	1770.34	524	1498.64
10¾	.365	41.85	40.48	4.05	628	2543.40	533	2158.65
12¾	.375	51.15	49.56	4.96	620	3075.20	525	2604.00
EXTRA STRONG PIPE (XS)								
2⅜	.218	5.07	5.02	.50	675	337.50	590	295.00
2⅞	.276	7.73	7.66	.77	662	509.74	577	444.29
3½	.300	10.33	10.25	1.03	655	674.65	570	587.10
4½	.337	15.17	14.98	1.50	654	981.00	569	853.50
5⅝	.375	21.09	20.78	2.08	716	1489.28	631	1312.48
6⅝	.432	28.89	28.57	2.86	619	1770.34	534	1527.24
8⅝	.500	43.90	43.39	4.34	616	2673.44	531	2304.54
10¾	.500	55.82	54.74	5.47	620	3391.40	535	2926.45
12¾	.500	66.71	65.42	6.54	614	4015.56	529	3459.66
DOUBLE EXTRA STRONG PIPE (XXS)								
5⅝	.750	38.61	38.55	3.86	852	3288.72	767	2960.62
6⅝	.864	53.14	53.16	5.32	733	3899.56	648	3447.36
8⅝	.875	72.44	72.42	7.24	734	5314.16	649	4698.76

NOTE: Extra for Single Random Lengths (SRL) is included in above prices.

4 Weights, Dimensions and ▶Prices

—QUANTITY—
5 TONS OR MORE

SEAMLESS—SINGLE RANDOM LENGTHS (SRL)

REAMED AND DRIFTED PIPE, T&C AND LINE PIPE, T&C

MILL- LORAIN, OH

Diameters		Wall, Inches	Weight Per Foot, Pounds		Per Foot Base	Black		Galvanized	
OD	ID		T&C	PE		Pricing Factor	Price Per 100'	Pricing Factor	Price Per 100'
REAMED AND DRIFTED PIPE-THREADED AND COUPLED ASTM A589 TYPE II									
2⅜	2.067	.154	3.75	3.65	$ .37	641	$ 237.17	743	$ 274.91
2⅞	2.469	.203	5.90	5.79	.58	578	335.24	683	396.14
3½	3.068	.216	7.70	7.58	.76	585	444.60	690	524.40
4½	4.026	.237	11.00	10.79	1.08	567	612.36	672	725.76
5 9/16	5.047	.258	15.00	14.62	1.46	664	969.44	769	1122.74
6⅝	6.065	.280	19.45	18.97	1.90	552	1048.80	657	1248.30
LINE PIPE-THREADED AND COUPLED API 5L GRADES A AND B									
2⅜	2.067	.154	3.75	3.65	.37	596	220.52	708	261.96
2⅞	2.469	.203	5.90	5.79	.58	533	309.14	648	375.84
3½	3.068	.216	7.70	7.58	.76	540	410.40	655	497.80
4½	4.026	.237	11.00	10.79	1.08	522	563.76	637	687.96
5 9/16	5.047	.258	15.00	14.62	1.46	619	903.74	734	1071.64
6⅝	6.065	.280	19.45	18.97	1.90	507	963.30	622	1181.80
8⅝	7.981	.322	29.35	28.55	2.86	504	1441.44	619	1770.34
10¾	10.020	.365	41.85	40.48	4.05	512	2073.60	628	2543.40
12¾	12.000	.375	51.15	49.56	4.96	504	2499.84	620	3075.20

NOTE: Extra for Single Random Lengths (SRL) is included in above prices.

4 **Weights, Dimensions and ▶Prices**

—QUANTITY—
5 TONS OR MORE

▶▶MILL—LORAIN, OH

SEAMLESS—DOUBLE RANDOM LENGTHS

BLACK PLAIN END PIPE—NON-STANDARD DIAMETERS

▶5", 7⅝", 9⅝" and 11¾" OD pipe sizes are not regularly manufactured items. However, orders for these sizes are acceptable subject to the following:

▶1. Minimum carload quantity (21 tons) of a size and wall thickness is required.

▶2. Pipe sizes 5" OD, 7⅝" OD, 9⅝" OD and 11¾" OD are produced only at **Lorain, OH.**

3. Pipe will be furnished in Double Random Lengths.

4. Regular Standard Pipe Extras apply including extra for Single Random Lengths (SRL). For the application of extras—Extra Strong Walls are defined as:
▶ (Deletion)
5"OD—.375" Wall
7⅝"OD—.500" Wall
9⅝"OD—.500" Wall
11¾"OD—.500" Wall

5. Prices for wall thicknesses Lighter, Intermediate or Heavier than those listed below are priced on basis of unlisted sizes—See "Explanation of Pricing Method".

OD, Inches	Wall Thickness, Inches	Weight Per Foot Plain Ends, Pounds	Per Foot Base	Pricing Factor, Grades A&B	**Price Per 100'**	Price Per Ton
			Standard Pipe			
▶(Deletion)						
5	.300	15.06	1.51	557	**841.07**	1116.96
5	.454	22.04	2.20	619	**1361.80**	1235.75
7⅝	.400	30.87	3.09	421	**1300.89**	842.82
9⅝	.405	39.88	3.99	430	**1715.70**	860.43
9⅝	.540	52.40	5.24	503	**2635.72**	916.74
11¾	.410	49.66	4.97	458	**2276.26**	916.74
11¾	.545	65.22	6.52	501	**3266.52**	1001.69

4 Weights, Dimensions and ▶Prices

—QUANTITY—
5 TONS OR MORE

SEAMLESS PLAIN END—DOUBLE RANDOM LENGTHS

***STANDARD PIPE AND LINE PIPE**

MILL- LORAIN, OH

Wall Thickness, Inches	Weight Per Foot, Pounds	Tons Per Mile	Per Foot Base	Pricing Factor ASTM A53 & API 5L Grades A & B	ASTM A53 & API 5L Grades A & B	ASTM A106 Grades A & B	▶API 5L Grade X42	▶API 5L Grade X52
					Bold Figures—Price $ Per 100' Light Figures—Price $ Per Ton			
2-3/8" OD								
.154 STD	3.65	9.64	$ .37	476	**176.12** 965.04	**187.22** 1025.86	**183.89** 1007.62	. . . . .
.218 XS	5.02	13.25	.50	450	**225.00** 896.41	**240.00** 956.18	**235.50** 938.25	. . . . .
.260	5.87	15.50	.59	589	**347.51** 1184.02	**365.21** 1244.33	. . . . .	. . . . .
.436 XXS	9.03	23.84	.90	589	. . . . .	**557.10** 1233.89	. . . . .	. . . . .
2-7/8" OD								
.203 STD	5.79	15.29	.58	413	**239.54** 827.43	**256.94** 887.53	**251.72** 869.50	. . . . .
.240	6.75	17.82	.68	437	**297.16** 880.47	**317.56** 940.92	. . . . .	. . . . .
.276 XS	7.66	20.22	.77	437	**336.49** 878.56	**359.59** 938.88	**352.66** 920.78	. . . . .
.320	8.73	23.05	.87	570	**495.90** 1136.08	**522.00** 1195.88	. . . . .	. . . . .
.552 XXS	13.69	36.14	1.37	570	. . . . .	**822.00** 1200.88	. . . . .	. . . . .
3-1/2" OD								
.216 STD	7.58	20.01	.76	420	**319.20** 842.22	**342.00** 902.37	**335.16** 884.33	. . . . .
.260	9.00	23.76	.90	431	**387.90** 862.00	**414.90** 922.00	. . . . .	. . . . .
.300 XS	10.25	27.06	1.03	431	**443.93** 866.20	**474.83** 926.50	**465.56** 908.41	. . . . .
.360	12.07	31.86	1.21	563	**681.23** 1128.80	**717.53** 1188.95	. . . . .	. . . . .
.600 XXS	18.58	49.05	1.86	563	. . . . .	**1102.98** 1187.28	. . . . .	. . . . .
●**4 " OD**								
.226	9.11	24.05	.91	453	**412.23** 905.01	. . . . .	. . . . .	. . . . .
.318	12.50	33.00	1.25	480	**600.00** 960.00	. . . . .	. . . . .	. . . . .

*Standard Pipe—Furnished in Grades A and B Only.

4 Weights, Dimensions and ▶Prices

—QUANTITY—
5 TONS OR MORE

SEAMLESS PLAIN END—SINGLE RANDOM LENGTHS (SRL)

BLACK ASTM A53 Grades A and B

▶▶MILL—FAIRFIELD, AL

OD, Inches	Wall, Inches	Plain End, Weight Per Foot, Pounds	Per Foot Base	Pricing Factor ASTM A53 & API 5L Grades A & B	ASTM A53 & API 5L Grades A & B Price Per 100'
STANDARD WEIGHT PIPE (Std)					
4½	.237	10.79	$1.08	437	**$471.96**
6⅝	.280	18.97	1.90	422	**801.80**
8⅝	.322	28.55	2.86	419	**1198.34**
EXTRA STRONG PIPE (XS)					
4½	.337	14.98	1.50	464	**696.00**
6⅝	.432	28.57	2.86	429	**1226.94**
8⅝	.500	43.39	4.34	426	**1848.84**

Note: Extra for Single Random Lengths (SRL) is included in above prices.

SEAMLESS PLAIN END—DOUBLE RANDOM LENGTHS

***STANDARD PIPE AND LINE PIPE**

▶▶MILL—FAIRFIELD, AL

Wall Thickness, Inches	Weight Per Foot, Pounds	Tons Per Mile	Per Foot Base	Pricing Factor, ASTM A53 & API 5L Grades A & B	ASTM A53 & API 5L Grades A & B	ASTM A106 Grades A & B	▶API 5L Grade X42	▶API 5L Grade X52
					Bold Figures—Price $ Per 100' Light Figures—Price $ Per Ton			
4½" OD								
.237 STD	10.79	28.49	$1.08	412	**$444.96** 824.76	**$477.36** 884.82	**$467.64** 866.80	**$501.12** 928.86
.337 XS	14.98	39.55	1.50	439	**658.50** 879.17	**703.50** 939.25	**690.00** 921.23	**736.50** 983.31
6⅝" OD								
.280 STD	18.97	50.08	1.90	397	**754.30** 795.26	**811.30** 855.35	**794.20** 837.32	**853.10** 899.42
.432 XS	28.57	75.42	2.86	404	**1155.44** 808.85	**1241.24** 868.91	**1215.50** 850.89	**1304.16** 912.96
8⅝" OD								
.322 STD	28.55	75.37	2.86	394	**1126.84** 789.38	**1212.64** 849.49	**1186.90** 831.45	**1275.56** 893.56
.500 XS	43.39	114.55	4.34	401	**1740.34** 802.18	**1870.54** 862.20	**1831.48** 844.19	**1966.02** 906.21

*Standard Pipe—Furnished in Grades A and B Only

4 Weights, Dimensions and ▶Prices

—QUANTITY—
5 TONS OR MORE

SEAMLESS PLAIN END—DOUBLE RANDOM LENGTHS

***STANDARD PIPE AND LINE PIPE**

MILL- LORAIN, OH

Wall Thickness, inches	Weight Per Foot, Pounds	Tons Per Mile	Per Foot Base	Pricing Factor ASTM A53 & API 5L Grades A & B	ASTM A53 & API 5L Grades A & B	ASTM A106 Grades A & B	▶API 5L Grade X42	▶API 5L Grade X52
					Bold Figures—Price $ Per 100' Light Figures—Price $ Per Ton			
4-1/2" OD								
.237 STD	10.79	28.49	$ 1.08	402	**434.16** 804.75	**466.56** 864.80	**456.84** 846.78	**490.32** 908.84
.337 XS	14.98	39.55	1.50	429	**643.50** 859.15	**688.50** 919.23	**675.00** 901.20	**721.50** 963.28
.438	19.00	50.16	1.90	531	. . . . .	**1065.90** 1122.00	. . . . .	. . . . .
.674 XXS	27.54	72.71	2.75	590	. . . . .	**1705.00** 1238.20	. . . . .	. . . . .
5-9/16" OD								
.258 STD	14.62	38.60	1.46	499	**728.54** 996.63	**772.34** 1056.55	**759.20** 1038.58	**804.46** 1100.49
.375 XS	20.78	54.86	2.08	492	**1023.36** 984.95	**1085.76** 1045.00	**1067.04** 1026.99	**1131.52** 1089.05
.500	27.04	71.39	2.70	609	**1644.30** 1216.20	**1725.30** 1276.11	. . . . .	. . . . .
.625	32.96	87.01	3.30	627	**2069.10** 1255.52	**2168.10** 1315.59	. . . . .	. . . . .
.750 XXS	38.55	101.77	3.86	627	**2420.22** 1255.63	**2536.02** 1315.70	. . . . .	. . . . .
6-5/8" OD								
.280 STD	18.97	50.08	1.90	387	**735.30** 775.22	**792.30** 835.32	**775.20** 817.29	**834.10** 879.39
.432 XS	28.57	75.42	2.86	394	**1126.84** 788.83	**1212.64** 848.89	**1186.90** 830.87	**1275.56** 892.94
.562	36.39	96.07	3.64	487	**1772.68** 974.27	**1881.88** 1034.28	. . . . .	. . . . .
.719	45.35	119.72	4.54	509	**2310.86** 1019.12	**2447.06** 1079.19	. . . . .	. . . . .
.864 XXS	53.16	140.34	5.32	509	**2707.88** 1018.77	**2867.48** 1078.81	. . . . .	. . . . .
1.000	60.08	158.61	6.01	546	**3281.46** 1092.36	**3461.76** 1152.38	. . . . .	. . . . .
1.188	68.98	182.11	6.90	546	**3767.40** 1092.32	**3974.40** 1152.33	. . . . .	. . . . .

*Standard Pipe—Furnished in Grades A and B Only.

4 Weights, Dimensions and ▶Prices

—QUANTITY—
5 TONS OR MORE

SEAMLESS PLAIN END—DOUBLE RANDOM LENGTHS

*STANDARD PIPE AND LINE PIPE

▶▶ MILL- LORAIN, OH

Wall Thickness, Inches	Weight Per Foot, Pounds	Tons Per Mile	Per Foot Base	Pricing Factor ASTM A53 & API 5L Grades A & B	ASTM A53 & API 5L Grades A & B	ASTM A106 Grades A & B	▶API 5L Grade X42	▶API 5L Grade X52
					Bold Figures—Price $ Per 100' Light Figures—Price $ Per Ton			
8-5/8" OD								
.322 STD	28.55	75.37	$ 2.86	384	**1098.24** 769.35	**1184.04** 829.45	**1158.30** 811.42	**1246.96** 873.53
.500 XS	43.39	114.55	4.34	391	**1696.94** 782.18	**1827.14** 842.19	**1788.08** 824.19	**1922.62** 886.20
.594	50.95	134.51	5.10	509	**2595.90** 1019.00	**2748.90** 1079.06	. . . . .	. . . . .
.719	60.71	160.27	6.07	509	**3089.63** 1017.83	**3271.73** 1077.82	. . . . .	. . . . .
.875 XXS	72.42	191.19	7.24	509	**3685.16** 1017.72	**3902.36** 1077.70	. . . . .	. . . . .
.906	74.69	197.18	7.47	509	**3802.23** 1018.14	**4026.33** 1078.14	. . . . .	. . . . .
10-3/4" OD								
.365 STD	40.48	106.87	4.05	392	**1587.60** 784.39	**1709.10** 844.42	**1672.65** 826.41	**1798.20** 888.44
.500 XS	54.74	144.51	5.47	395	**2160.65** 789.42	**2324.75** 849.38	**2275.52** 831.39	**2445.09** 893.35
.594	64.43	170.10	6.44	513	**3303.72** 1025.52	**3496.92** 1085.49	. . . . .	. . . . .
.844	89.29	235.73	8.93	513	**4581.09** 1026.11	**4848.99** 1086.12	. . . . .	. . . . .
1.125	115.64	305.29	11.56	537	**6207.72** 1073.63	**6554.52** 1133.61	. . . . .	. . . . .

*Standard Pipe—Furnished in Grades A and B Only.

SEAMLESS PLAIN END—DOUBLE RANDOM LENGTHS

*STANDARD PIPE AND LINE PIPE

▶▶ MILL- LORAIN, OH

Wall Thickness, Inches	Weight Per Foot, Pounds	Tons Per Mile	Per Foot Base	Pricing Factor ASTM A53 & API 5L Grades A & B	ASTM A53 & API 5L Grades A & B	ASTM A106 Grades A & B	▶API 5L Grade X42	▶API 5L Grade X52
					Bold Figures—Price $ Per 100' Light Figures—Price $ Per Ton			
12-3/4" OD								
.375 STD	49.56	130.84	$ 4.96	384	**1904.64** 768.62	**2053.44** 828.67	**2008.80** 810.65	**2162.56** 872.70
.406	53.52	141.29	5.35	389	**2081.15** 777.71	**2241.65** 837.69	**2193.50** 819.69	**2359.35** 881.67
.500 XS	65.42	172.71	6.54	389	**2544.06** 777.76	**2740.26** 837.74	**2681.40** 819.75	**2884.14** 881.73
.562	73.15	193.12	7.32	503	**3681.96** 1006.69	**3901.56** 1066.73	. . . . .	. . . . .
.688	88.63	233.98	8.86	503	**4456.58** 1005.66	**4722.38** 1065.64	. . . . .	. . . . .
.844	107.32	283.32	10.73	503	**5397.19** 1005.81	**5719.09** 1065.80	. . . . .	. . . . .
1.000 XXS	125.49	331.29	12.55	503	**6312.65** 1006.08	**6689.15** 1066.08	. . . . .	. . . . .
1.312	160.27	423.11	16.03	503	**8063.09** 1006.19	**8543.99** 1066.20	. . . . .	. . . . .
1.500	180.23	475.81	18.02	541	**9748.82** 1081.82	**10289.42** 1141.81	. . . . .	. . . . .
1.750	205.59	542.76	20.56	541	**11122.96** 1082.05	**11739.76** 1142.06	. . . . .	. . . . .
2.000	229.62	606.20	22.96	541	**12421.36** 1081.91	**13110.16** 1141.90	. . . . .	. . . . .
2.375	263.16	694.74	26.32	541	**14239.12** 1082.16	**15028.72** 1142.17	. . . . .	. . . . .
14" OD								
.375 STD	54.57	144.06	5.46	423	**2309.58** 846.47	**2473.38** 906.50	**2424.24** 888.49	**2593.50** 950.52
.500 XS	72.09	190.32	7.21	434	**3129.14** 868.12	**3345.44** 928.13	**3280.55** 910.13	**3504.06** 972.13
.594	85.05	224.53	8.51	530	**4510.30** 1060.62	**4765.60** 1120.66	. . . . .	. . . . .
.750	106.13	280.18	10.61	530	**5623.30** 1059.70	**5941.60** 1119.68	. . . . .	. . . . .
1.094	150.79	398.09	15.08	530	**7992.40** 1060.07	**8444.80** 1120.07	. . . . .	. . . . .
1.406	189.11	499.25	18.91	530	**10022.30** 1059.94	**10589.60** 1119.94	. . . . .	. . . . .
1.500	200.25	528.66	20.03	548	**10976.44** 1096.27	**11577.34** 1156.29	. . . . .	. . . . .
2.000	256.32	676.68	25.63	548	**14045.24** 1095.91	**14814.14** 1155.91	. . . . .	. . . . .

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April 25, 1984
(▶Indicates change from Issue January 5, 1983)
(▶Effective April 15, 1984)
(▶▶Effective January 15, 1984)

Printed in U.S.A.

4 Weights, Dimensions and ▶Prices

—QUANTITY—
5 TONS OR MORE

SEAMLESS PLAIN END—DOUBLE RANDOM LENGTHS

***STANDARD PIPE AND LINE PIPE**

MILL- LORAIN, OH

Wall Thickness, Inches	Weight Per Foot, Pounds	Tons Per Mile	Per Foot Base	Pricing Factor ASTM A53 & API 5L Grades A & B	ASTM A53 & API 5L Grades A & B	ASTM A106 Grades A & B	▶API 5L Grade X42	▶API 5L Grade X52
					Bold Figures—Price $ Per 100' Light Figures—Price $ Per Ton			
16" OD								
.375 STD	62.58	165.21	$ 6.26	432	**2704.32** 864.28	**2892.12** 924.30	**2835.78** 906.29	**3029.84** 968.31
.500 XS	82.77	218.51	8.28	423	**3502.44** 846.31	**3750.84** 906.33	**3676.32** 888.32	**3933.00** 950.34
.656	107.50	283.80	10.75	517	. . . . .	**5880.25** 1094.00	. . . . .	. . . . .
.844	136.61	360.65	13.66	517	. . . . .	**7472.02** 1093.92	. . . . .	. . . . .
1.031	164.82	435.12	16.48	517	. . . . .	**9014.56** 1093.87	. . . . .	. . . . .
1.219	192.43	508.02	19.24	517	. . . . .	**10524.28** 1093.83	. . . . .	. . . . .
1.594	245.25	647.46	24.53	517	. . . . .	**13417.91** 1094.22	. . . . .	. . . . .
1.618	248.52	656.09	24.85	555	. . . . .	**14537.25** 1169.91	. . . . .	. . . . .
2.000	299.04	789.47	29.90	555	. . . . .	**17491.50** 1169.84	. . . . .	. . . . .
18" OD								
.375 STD	70.59	186.36	7.06	448	**3162.88** 896.13	**3374.68** 956.14	**3311.14** 938.13	**3530.00** 1000.14
.438	82.15	216.88	8.22	448	**3682.56** 896.55	**3929.16** 956.58	**3855.18** 938.57	**4110.00** 1000.61
.500 XS	93.45	246.71	9.35	439	**4104.65** 878.47	**4385.15** 938.50	**4301.00** 920.49	**4590.85** 982.53
.562	104.67	276.33	10.47	535	. . . . .	**5915.55** 1130.32	. . . . .	. . . . .
.750	138.17	364.77	13.82	535	. . . . .	**7808.30** 1130.25	. . . . .	. . . . .
.938	170.92	451.23	17.09	535	. . . . .	**9655.85** 1129.87	. . . . .	. . . . .
1.156	207.96	549.01	20.80	535	. . . . .	**11752.00** 1130.22	. . . . .	. . . . .
1.375	244.14	644.53	24.41	535	. . . . .	**13791.65** 1129.81	. . . . .	. . . . .
1.500	264.33	697.83	26.43	572	. . . . .	**15910.86** 1203.86	. . . . .	. . . . .
1.562	274.22	723.94	27.42	572	. . . . .	**16506.84** 1203.91	. . . . .	. . . . .

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—QUANTITY—
5 TONS OR MORE

SEAMLESS PLAIN END—DOUBLE RANDOM LENGTHS

***STANDARD PIPE AND LINE PIPE**

MILL- LORAIN, OH

Wall Thickness, Inches	Weight Per Foot, Pounds	Tons Per Mile	Per Foot Base	Pricing Factor ASTM A53 & API 5L Grades A & B	ASTM A53 & API 5L Grades A & B	ASTM A106 Grades A & B	▶API 5L Grade X42	▶API 5L Grade X52
					Bold Figures—Price $ Per 100' Light Figures—Price $ Per Ton			
20" OD								
.375 STD	78.60	207.50	$ 7.86	447	**3513.42** 894.00	**3749.22** 954.00	**3678.48** 936.00	**3922.14** 998.00
.500 XS	104.13	274.90	10.41	438	**4559.58** 875.75	**4871.88** 935.73	**4778.19** 917.74	**5100.90** 979.72
.594	123.11	325.01	12.31	535	. . . . .	**6955.15** 1129.91	. . . . .	. . . . .
.812	166.40	439.30	16.64	535	. . . . .	**9401.60** 1130.00	. . . . .	. . . . .
1.031	208.87	551.42	20.89	535	. . . . .	**11802.85** 1130.16	. . . . .	. . . . .
1.281	256.10	676.10	25.61	572	. . . . .	**15417.22** 1204.00	. . . . .	. . . . .
1.375	273.51	722.07	27.35	572	. . . . .	**16464.70** 1203.96	. . . . .	. . . . .
22" OD								
.375 STD	86.61	228.65	8.66	512	**4433.92** 1023.88	**4693.72** 1083.87	**4615.78** 1065.88	**4884.24** 1127.87
.500 XS	114.81	303.10	11.48	502	**5762.96** 1003.91	**6107.36** 1063.91	**6004.04** 1045.91	**6359.92** 1107.90
.875	197.41	521.16	19.74	611	. . . . .	**12653.34** 1281.94	. . . . .	. . . . .
1.219	270.55	714.25	27.06	663	. . . . .	**18752.58** 1386.26	. . . . .	. . . . .

*Standard Pipe—Furnished in Grades A and B Only.

4 **Weights, Dimensions and ▶Prices**

—QUANTITY—
5 TONS OR MORE

SEAMLESS PLAIN END—DOUBLE RANDOM LENGTHS

***STANDARD PIPE AND LINE PIPE**

MILL- LORAIN, OH

Wall Thickness, Inches	Weight Per Foot, Pounds	Tons Per Mile	Per Foot Base	Pricing Factor ASTM A53 & API 5L Grades A & B	ASTM A53 & API 5L Grades A & B	ASTM A106 Grades A & B	▶API 5L Grade X42	▶API 5L Grade X52
					Bold Figures—Price $ Per 100' Light Figures—Price $ Per Ton			
24" OD								
.375 STD	94.62	249.80	$ 9.46	456	**4313.76** 911.81	**4597.56** 971.79	**4512.42** 953.80	**4805.68** 1015.79
.500 XS	125.49	331.29	12.55	446	**5597.30** 892.07	**5973.80** 952.08	**5860.85** 934.07	**6249.90** 996.08
.562	140.68	371.40	14.07	546	. . . . .	**8104.32** 1152.16	. . . . .	. . . . .
.688	171.29	452.21	17.13	546	. . . . .	**9866.88** 1152.07	. . . . .	. . . . .
.969	238.35	629.24	23.84	561	. . . . .	**14089.44** 1182.25	. . . . .	. . . . .
1.000	245.64	648.49	24.56	598	. . . . .	**15423.68** 1295.80	. . . . .	. . . . .
1.219	296.58	782.97	29.66	598	. . . . .	**18626.48** 1256.08	. . . . .	. . . . .
1.312	317.91	839.28	31.79	598	. . . . .	**19964.12** 1255.96	. . . . .	. . . . .
26" OD								
.375 STD	102.63	270.94	10.26	487	**4996.62** 973.72	**5304.42** 1033.70	**5212.08** 1015.70	**5530.14** 1077.68
.500 XS	136.17	359.49	13.62	478	**6510.36** 956.21	**6918.96** 1016.22	**6796.38** 998.22	**7218.60** 1060.23
.562	152.68	403.08	15.27	618	. . . . .	**9894.96** 1296.17	. . . . .	. . . . .
.875	234.79	619.85	23.48	647	. . . . .	**15895.96** 1354.06	. . . . .	. . . . .
1.188	314.81	831.10	31.48	662	. . . . .	**21784.16** 1383.96	. . . . .	. . . . .

*Standard Pipe—Furnished in Grades A and B Only.

APPENDIX D

STEEL PIPE COST COMPARISONS, SIZES 2" THRU 24"

STEEL PIPE PRICING CRITERIA (SIZES 2" THRU 24")

APPENDIX D1

PIPE SIZE	SCHEDULE	MATERIAL	QUANTITY (FT)	TOTAL WT. (LB)	BASE $/FT @ $0.10/LB	BASE PTS (A-53B)	XTRA PTS (A-106B)	XTRA PTS (SRL)	XTRA PTS (21')	XTRA PTS (QTY)
2"	80	A-53B	49	246	0.50	450		25	150	60
	160		8	60	0.75	619		25	150	60
	XXS		7	63	0.90	589		25	150	60
2"	40	A-106B	3924	14323	0.37	476	30	25	150	
	80		5625	28238	0.50	450	30	25	150	
	XXS		15	135	0.90	589	30	25	150	60
2 1/2"	40	A-53B	11	64	0.58	413		25	150	60
	80		39	299	0.77	437		25	150	60
	160		3	30	1.00	600		25	150	60
2 1/2"	40	A-106B	6542	37878	0.58	413	30	25	150	
	80		7	54	0.77	437	30	25	150	60
	XXS		4	55	1.37	570	30	25	150	60
3"	40	A-53B	239	1812	0.76	420		25	150	45
	80		62	634	1.03	431		25	150	60
	160		8	115	1.43	461		25	150	60
3"	40	A-106B	4452	33746	0.76	420	30	25	150	
	80		155	1589	1.03	431	30	25	150	45
	XXS		173	3214	1.86	563	30	25	150	35
4"	40	A-53B	375	4046	1.08	412		25	150	35
	80		72	1079	1.50	439		25	150	45
4"	40	A-106B	4226	45599	1.08	412	30	25	150	
	80		157	2352	1.50	439	30	25	150	35
	160		1	23	2.25	630	30	25	150	60
	XXS		13	358	2.75	590	30	25	150	60
5"	40	A-53B	19	278	1.46	499		25	175	60
	XXS		7	270	3.86	627		25	175	60
5"	40	A-106B	1456	21287	1.46	499	30	25	175	
	80		268	5569	2.08	492	30	25	175	30
	160		25	824	3.30	627	30	25	175	60
6"	40	A-53B	28	531	1.90	397		25	175	60
	80		87	2486	2.86	404		25	175	35
6"	40	A-106B	5499	104316	1.90	397	30	25	175	
	80		1681	48026	2.86	404	30	25	175	
	160		9	408	4.54	509	30	25	175	60

STEEL PIPE PRICING CRITERIA (SIZES 2″ THRU 24″) APPENDIX D1 (CONT.)

PIPE SIZE	SCHEDULE	MATERIAL	QUANTITY (FT)	TOTAL WT. (L8)	BASE $/FT @ $0.10/LB	BASE PTS (A-53B)	XTRA PTS (A-106B)	XTRA PTS (SRL)	XTRA PTS (21′)	XTRA PTS (QTY)
8″	40	A-53B	1	29	2.86	394		25	175	60
8″	40	A-106B	3740	106777	2.86	394	30	25	175	
	60		1513	53923	3.56	414	30	25	175	
	120		3	182	6.07	509	30	25	175	60
10″	40	A-106B	1137	46026	4.05	392	30	25	175	
	Xs		610	33391	5.47	395	30	25	175	
	80		64	4124	6.44	513	30	25	175	
	100		25	1926	7.70	543	30	25	175	35
	160		9	1041	11.56	537	30	25	175	45
12″	STD	A-106B	56	2775	4.96	384	30	25	175	35
	40		1301	69630	5.35	389	30	25	175	
	XS		342	22374	6.54	389	30	25	175	
	80		906	80299	8.86	503	30	25	175	
14″	40	A-53B	4	254	6.34	464		25	175	60
	XS		2	144	7.21	434		25	175	60
14″	STD	A-106B	37	2019	5.46,	423	30	25	175	35
	40		230	14591	6.34	464	30	25	175	
	XS		87	6272	7.21	434	30	25	175	30
	80		45	4776	10.61	530	30	25	175	35
16″	40	A-53B	13	1076	8.28	423		25	175	45
16″	STD	A-106B	78	4881	6.26	432	30	25	175	35
	XS		344	28473	8.28	423	30	25	175	
	60		3	323	10.75	517	30	25	175	60
	80		129	17623	13.66	517	30	25	175	
18″	STD	A-106B	41	2894	7.06	448	30	25	175	35
	XS		11	1028	9.35	439	30	25	175	45
	40		183	19155	10.48	535	30	25	175	
	80		76	12990	17.09	535	30	25	175	
20″	40	A-106B	400	2462	12.31	535	30	25	175	35
24"	XS	A-106B	8	1004	12.55	446	30	25	175	45
	80		55	16312	29.66	598	30	25	175	
		TOTAL WEIGHT (LBS)		918781						

STEEL PIPE COST COMPARISONS (SIZES 2" THRU 24") APPENDIX D2

PIPE SIZE	SCHEDULE	MATERIAL	PRICE DRL	PRICE SRL	PRICE 21'	PRICE DRL	PRICE DRL**
2"	80	A-53B	124.95	131.08	161.70	*	*
	160		40.74	42.24	49.74	40.74	42.54
	XXS		40.89	42.46	50.34	40.89	42.78
2"	40	A-106B	7346.51	7709.48	9524.33	7346.51	7346.51
	80		13500.00	14203.13	17718.75	13617.60	13617.60
	XXS		91.67	95.04	111.92	91.67	91.67
2 1/2"	40	A-53B	30.18	31.77	39.75	*	*
	80		149.25	156.76	194.29	149,25	158.26
	160		19.80	20.55	24.30	19.80	20.70
2 1/2"	40	A-106B	16809.01	17757.60	22500.55	16837.28	16837.28
	80		28.41	29.75	36.49	28.41	28.41
	XXS		36.17	37.54	44.39	36.17	36.17
3"	40	A-53B	844.63	890.04	1117.09	*	*
	80		313.55	329.52	409.34	*	*
	160		59.60	62.46	76.76	59.60	63.03
3"	40	A-106B	15225.84	16071.72	20301.12	16043.22	16043.22
			807.83	847.74	1047.30	1108.61	1108.6
	XXS		2020.78	2101.22	2503.45	2020.78	2020.78
4"	40	A-53B	1810.35	1911.60	2417.85		*
	80		522.72	549.72	684.72	522,72	555,12
4"	40	A-106B	20173.23	21314.25	27019.35	21963.33	21963.33
	80		1186.92	1245.80	1540.17	1186.92	1186.92
	160		16.20	16.76	19.58	16.20	16.20
	XXS		243.10	252.04	296.73	243.10	243.10
5"	40	A-53B	155.07	162.00	203.61		*
	XXS		185.63	192.38	232.91	185.63	193,73
5"	40	A-106B	11245.27	11776.71	14965.35	11392.02	11392.02
	80		3077.07	3216.43	4052.59	3077.07	3077.07
	160		591.53	612.15	735.90	591.53	591.53
6"	40	A-53B	243.12	256.42	336.22	*	*
	80		1092.32	1154.52	1527.75	*	*
6"	40	A-106B	44613.39	47225.41	62897.56	44840.55	44840.55
	80		20865.24	22067.16	29278.65	21945.12	21945.12
	160		244.75	254.97	316.26	244.75	244.75

* SMALL QUANTITIES OF A-53 PIPE REPLACED BY A-106 PIPE

** PRICE FOR ALL PIPE IN A-106 MATERIAL SPECIFICATION

STEEL PIPE COST COMPARISONS (SIZES 2″ THRU 24″) APPENDIX D2 (CONT.)

PIPE SIZE	SCHEDULE	MATERIAL	PRICE DRL	PRICE SRL	PRICE 21′	PRICE DRL	PRICE DRL**
8″	40	A-53B	12.98	13.70	17.99	*	*
8″	40	A-106B	45352.74	48026.84	64071.44	45364.86	45364.86
	60		23915.08	25261.65	.33341.07	23915.08	23915.08
	120		109.08	113.63	140.95	109.08	109.08
10″	40	A-106B	19432.47	20583.68	27490.95	19432.47	19432.47
	XS		14180.98	14848.32	20020.20	14180.98	14180.98
	80		2382.28	2485.32	3103.56	2382.28	2382.28
	100		1189.65	1237.78	1526.53	1189.65	1189.65
	160		636.72	662.73	818.79	636.72	636.72
12″	STD	A-106B	1247.14	1316.58	1733.22	1247.14	1247.14
	40		29163.87	30903.95	41344.48	29163.87	29163.87
	XS		9371.69	9930.86	13285.88	9371.69	9371.69
	80		42784.76	44791.55	56832.29	42784.76	42784.76
14″	40	A-53B	132.89	139.22	177.27	*	*
	XS		71.23	74.84	96.47	*	*
14″	STD	A-106B	985.86	1036.36	1339.39	985.86	985.86
	40		7203.51	7568.06	9755.36	7328.79	7328.79
	XS		3098.71	3255.53	4196.44	3169.95	3169.95
	80		2840.83	2960.19	3676.37	2840.83	2840.83
16″	40	A-53B	503.76	530.67	692.13	503.76	536.05
16″	STD	A-106B	2426.75	2548.82	3281.24	2426.75	2426.75
	XS		12902.89	13614.97	17887.45	12902.89	12902.89
	60		195.76	203.82	252.20	195.76	195.76
	80		9638.91	10079.44	12722.65	9638.91	9638.91
18″	STD	A-106B	1484.93	1557.29	1991.48	1484.93	1484.93
	XS		528.65	554.36	708.64	528.65	528.65
	40		10835.80	11315.26	14192.02	10835.80	10835.80
	80		7338.45	7663.16	9611.42	7338.45	7338.45
20"	40	A-106B	29544.00	30775.00	38161.00	29544.00	29544.00
24″	XS	A-106B	523.08	548.18	698.78	523.08	523.08
	80		10244.56	10652.39	13099.34	10244.56	10244.56
		TOTALS	$454035.73	$478022.57	$618703.81	$453921.02	$454010.84

* SMALL QUANTITIES OF A-53 PIPE REPLACED BY A-106 PIPE

** PRICE FOR ALL PIPE IN A-106 MATERIAL SPECIFICATION

APPENDIX E

STEEL PIPE COST COMPARISONS, SIZES LESS THAN 2“

STEEL PIPE COST COMPARISONS (SIZES LESS THAN 2“) APPENDIX E

PIPE SIZE	SCHEDULE	MATERIAL	QUANTITY (FT)	TOTAL WT (LB)	UNIT PRICE ($/FT)	SRL	UNIFORM LENGTH 21′
1/4″	40	A-106A/B	234	98.28	0.79	184.86	194.10
	80	SMLS	44	23.76	0.86	37.84	39.73
1/2″	40	A-106A/B	2350	1997.50	0.70	1645.00	1727.25
	80	SMLS	1270	1384.30	0.80	1016.00	1066.80
3/4″	40	A-106A/B	1590	1796.70	0.90	1431.00	1502.55
	80	SMLS	3042	4471.74	0.95	2889.90	3034.40
1“	40	A-106A/B	2145	3603.60	0.90	1930.50	2027.03
	80	SMLS	1828	3966.76	1.06	1937.68	2034.56
	XXS		3	10.98	4.45	13.35	14.02
1 1/4″	40	A-106A/B	972	2206.44	1.06	1030.32	1081.84
	80	SMLS	233	699.00	1.38	321.54	337.62
	160		63	236.88	1.80	113.40	119.07
1 1/2″	40	A-106A/B	2128	5788.16	1.33	2830.24	2971.75
	80	SMLS	873	3168.99	1.64	1431.72	1503.31
	XXS		14	89.74	5.25	73.50	77.18
		TOTALS		29542.83		$16886.85	$17731.21

NOTE: UNIT PRICES PROVIDED BY STANDARD
SUPPLY AND HARDWARE COMPANY, INC.

APPENDIX F

EXCESS DROP-OFF CALCULATIONS

EXCESS DROP-OFF CALCULATIONS

Double-Random Lengths

Assuming DRL Line Pipe is delivered in lengths between 38′ and 40′, saw cut half lengths would vary from 19′ to 20′. The average length would be 19′-6″. Using the minimum half length of 19′ as a standard for pipe spool nesting the excess pipe lost per half length would average 6″ or 12″ per DRL joint. This represents pipe lost or wasted over and above losses associated with the spool nesting process.

With the average DRL length being 39′, the loss of 12″ per joint equals 2.56% of the total order. Therefore, material cost savings resulting from the purchase of DRL pipe must be reduced by the amount of these losses.

$$2.6\% \times \$454,011 = \$11,804$$

Single-Random Lengths

SRL Line Pipe is delivered in lengths ranging from 18′ to 25′ with a 5% allowance for short lengths between 16′ and 18′. If an 18′ spool nesting standard is adopted to accept most of the shipment the drop-off from each joint would vary from zero up to a maximum of 7′. An average 3′-6″ would be lost on each joint.

Losing 3′-6″ from each SRL joint averaging 21′-6" in length equals 16.3% of the total shipment. An additional 5%, the allowed short lengths, are unsuitable for use with the 18′ nesting standard.

APPENDIX G

CORRESPONDENCE

The attached letter has been sent to the following:

ARMCO, Inc.
White Station Towers
5050 Popular
Suite 1028
Memphis, Tennessee 38117

Attention: Mr. Pascal Barren

Babcock & Wilcox
Tubular Products Division
Post Office Box 401
Beaver Falls, Pennsylvania 15010

Gulf Supply
Post Office Box 569
Harvey, Louisiana 70059

Attention: Mr. Malcolm Schexnayder

Standard Supply
832 Tchoupitoulas Street
New Orleans, Louisiana 70130

Attention: Mr. Richard Lacoste

U.S. Steel Corporation
Post Office Box 1590
Houston, Texas 77251

Attention: Mr. Ken Foster

Van Leeuwen Pipe & Tube Corporation
Post Office Box 99
Belle Chasse, Louisiana 70037

Vinson Supply
Post Office Box 164
Harvey, Louisiana 70059

Attention: Mr. Darryl Soignet

DENSON ENGINEERS
Incorporated

CONSULTANTS
SEVENTH FLOOR 210 O'KEEFE AVENUE NEW ORLEANS. LOUISIANA 70112 504-561-1131

LEONIDAS L. DENSON, P. E.

CHARLES E. PREWITT P. E.
THOMAS J. HUDSON. P. E.

19 August 1985.

ARMCO, Inc.
White Station Towers
5050 Popular
Suite 1028
Memphis, Tennessee 38117

Attention: Pascal Barron

File 8240: Pipe Handling Study
Avondale Shipyards, Inc.

Dear Mr. Barron:

Denson Engineers, Inc. has been retained by Avondale Shipyards to review purchasing, handling and storage practices for pipe and tubing in the ship building industry. As part of this study, Avondale has asked us to contact their pipe and tubing suppliers to obtain information regarding alternatives to their current practices. Your response and input to this undertaking will be greatly appreciated.

We understand that Avondale's current ferrous pipe purchasing specifications require 21 foot uniform lengths with plain ends. Packaging and shipping is left to the vendor to determine "best way". The following alternatives are being considered:

1. Length - D.R.L. and S.R.L. in lieu of 21-foot uniform length.

2. End finish - Beveled end in lieu of straight cut or plain ends.

3. Packaging - Packaging in bundles weighing about 5 tons in lieu of standard bundles and providing spacers between bundles to allow off loading by forklift units or overhead cranes.

4. Shipping methods - Shipment only by flatbed truck instead of "bestway" using non-specified trailers or rail.

5. Materials - Piping materials being considered by this study include the following:

   a. ASTM A-106
   b. ASTM A-53
   c. ASTM A-210
   d. ASTM A-513

e. ASTM A-519
f. API-5L
g. ASTM A120
h. ASTM A312
i. ASTM A335
j. ASTM A213, A269, and A312
k. MIL-T-18165B
l. MIL-T-20157C
m. AISI 1018, ASTM A-519

It is requested that you advise us of the feasibility and cost add-ens or deducts to implement these alternates. It is also requested that you forward any literature concerning standard mill practices and extras that addresses the items above.

If pipe size, order quantity, materials; surface coating, or production method enter into the response, please indicate and include the appropriate data.

We appreciate your cooperation and your prompt attention to this request. Should you have any questions, feel free to contact the undersigned.

Very truly yours,

Charles E. Prewitt, P.E.
President

CEP/mlb

cc: R. Price, ASI
J. H. Carreras, ASI

The attached letter was sent to the following:

Alaskan Copper Company
Post Office Box 3546
Seattle, Washington 98124

Attention: Mr. Kermit Rosen, Jr.

Arco Metals Company
Post Office Box 800889
Dallas, Texas 75380

Industrial Metals Company
Post Office Box 10507
New Orleans, Louisiana 70181

Attention: Mr. Roy Hauck

W & O supply
1406 Dealers Avenue .
New Orleans, Louisiana 70123

Attention: Mr. Mitch Thompson

Youngstown Welding & Engineering Company
Post Office Box 2461
Youngstown, Ohio 44509

Attention: Mr. Rob Yepsen

DENSON ENGINEERS
Incorporated

CONSULTANTS
SEVENTH FLOOR 210 O'KEEFE AVENUE NEW ORLEANS. LOUISIANA 70112 504-581-1131

LEONIDAS L. DENSON, P.E.

CHARLES E. PREWITT. P.E.
THOMAS J. HUDSON. P.E.

19 August 1985

Alaskan Copper Company
Post Office Box 3546
Seattle, Washington 98124

Attention: Mr. Kermit Rosen, Jr.

File 8240: Pipe. Handling Study
Avondale Shipyards, Inc.

Dear Mr. Rosen:

Denson Engineers, Inc. has been retained by Avondale Shipyards to review purchasing, handling and storage practices for pipe and tubing in the ship building industry. As part of this study, Avondale has asked us to contact their pipe and tubing suppliers to obtain information regarding alternatives to their current practices. Your response and input to this undertaking will be greatly appreciated.

Avondale currently purchases tubing products according to various MIL pecifications which include requirements for metallurgy end preparation, fabrication, and tolerances for lengths of product. Packaging and shipping is left to the vendor to determine "best way". The following alternatives are being considered:

1. Length - 21-foot uniform length in lieu of SRL specified in MIL specs.

2. Packaging - Packaging in 5 ton bundles in lieu of standard bundles or crates.

3. Shipping methods - Shipment only by flatbed truck instead of "best way" using non specified trailers or rail.

4. Materials - Materials being considered in this study include seamless and welded products as follows:

   a. Copper, MIL-T-24107
   b. Copper, ASTM B75
   c. Copper, ASTM B280.
   d. Copper, ASTM B88, Fed Spec WW-T-799F
   e. Copper-nickel 70-30 and 90-10, MIL-T-16420 and 16420K

f. Copper-nickel 90-10, ASTM B402 Alloy 706
g. ~~Copper-nickel~~ Nickel-Copper MIL-T-1368C-2
h. Red Brass, ASTM B43, Fed Spec WW-P-351-1
i. Steel, AISI 1018, ASTM A-519
j. Stainless steel, ASTM A213, A269 and A312

It is requested that you advise us of the feasibility and cost add-ens or deducts to implement these alternatives. It is also requested that you forward any literature concerning standard mill practices and extras that address the items above. If pipe or tubing diameter, order quantity, MIL spec, or production method enters into the response, please indicate and include the appropriate data.

We appreciate your cooperation and your prompt attention to this request. Should you have any question, feel free to contact the undersigned.

Very truly yours,

Charles E. Prewitt, P.E.
President

CEP/mlb

cc: R. Price, ASI
R. J. Dupuy, ASI

November 15, 1985

Denson Engineers, Inc.
210 O'Keefe Avenue
7th Floor
New Orleans, Louisiana 70112

ATTENTION: Mr. Charles E. Prewitt

REFERENCE: AVONDALE SHIPYARD'S FILE NO. 8240
PIPE HANDLING STUDY
ASTM A53, A120, A106 PIPE

Dear Mr. Prewitt:

Presently Avondale Shipyards requires pipe 12" and below to be 21' square cut lengths. All U.S. mills do charge extra if purchased as 21' uniform lengths, with the exception of the A120/A53 BW pipe which is sold as standard 21' uniform lengths.

Example pricing differences detailed below are based on mill shipments to our stock showing single random length price, double random length and 21' square cut length. Normally single random length pipe is approximately 5% higher than double random length. Pipe required to be 21' uniform lengths are approximately 15-25% higher than double random lengths.

In reference to end finish, the standard practice on pipe 2" and larger, having a wall thickness of Xhvy and under is to furnish both ends bevelled. Please note that there is no additional charge for the bevelling of this pipe under the conditions described above.

All pipe shipped by Gulf Supply Company is shipped by an open bed flat bruck. All A120/A53 continous weld pipe 2" and under is shipped in standard bundles of approximately 2 tons per bundle. Seamless pipe 2" and larger is usually shipped in standard loose joints. Since Avondale stores most of their pipe with spacers in between each joint, there would seem to be no advantage to bundle requirements since the bundle would have to be broken upon receiving.

Gulf Supply Company, Inc.
751 Peters Road, P.O. Box 569, Harvey, Louisiana 70059, Telephone: 504-367-9150

Please note that the prices below are for estimating and evaluating purposes only. Variables such as “size, schedule, quanity, stock available, stock available with lengths equal or longer than 42', delivery required and mill location all can impact the below pricing.

If further discussion is necessary, please feel free to contact me at any time (504) 367-9150.

Sincerely,

Malcolm Schexnayder II
Sales Representative

MS/he

attachment

cc: Mr. Juan Carrerras

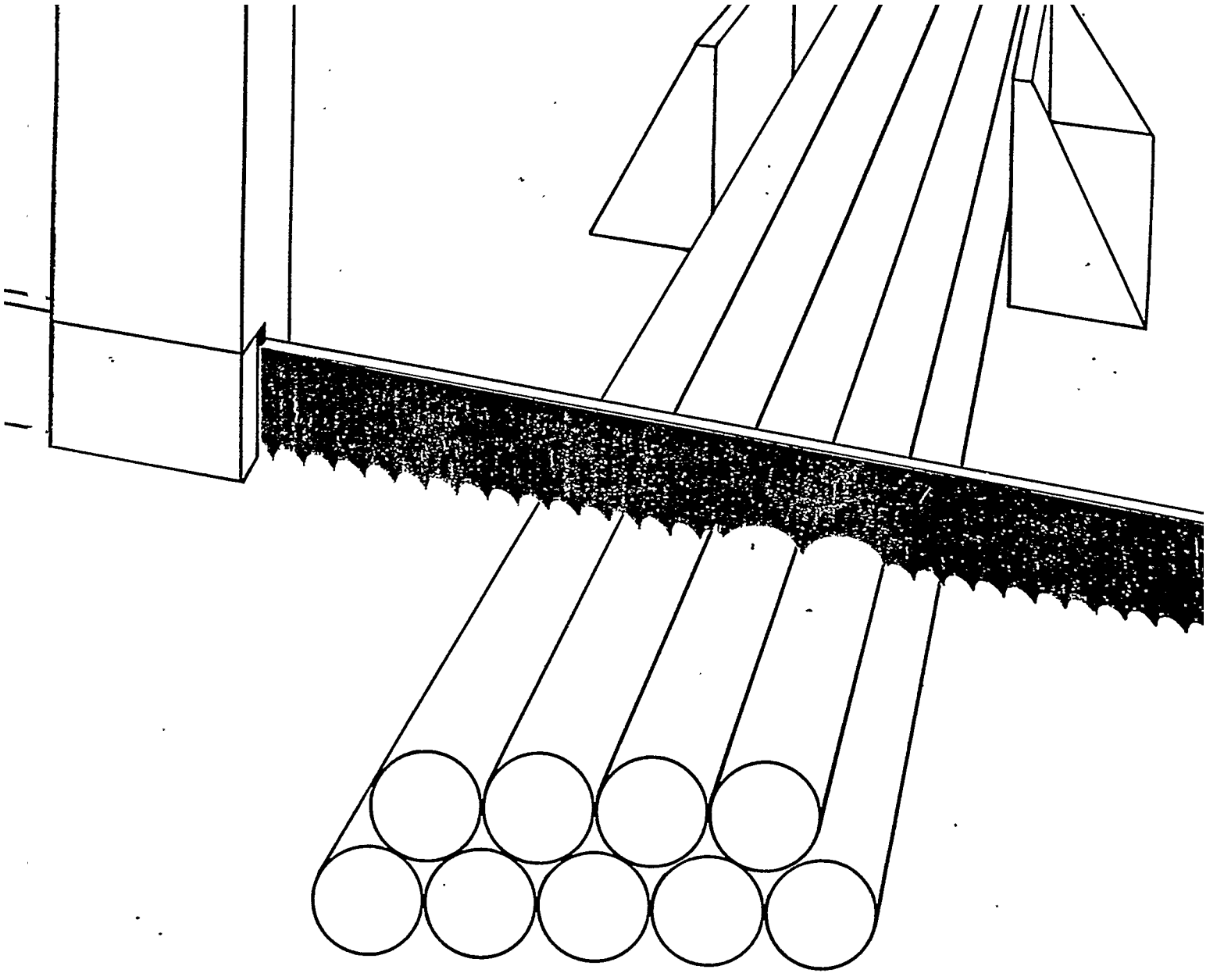
PRICING FROM GULF SUPPLY COMPANY

"EXAMPLE ONLY"

	2 1 '	SRL	DRL
1/2" Std Blk A106B $mls. Pipe	.77	.72	N/A
3" D I T T O	3.68	3.29	3.16
6" D I T T O	7.80	6.96	6.66

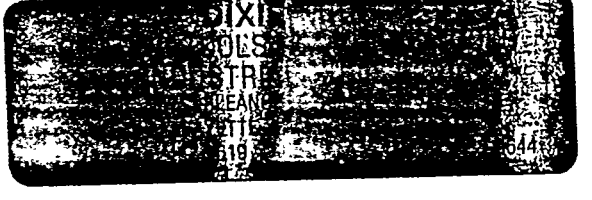
APPENDIX H

EQUIPMENT LITERATURE



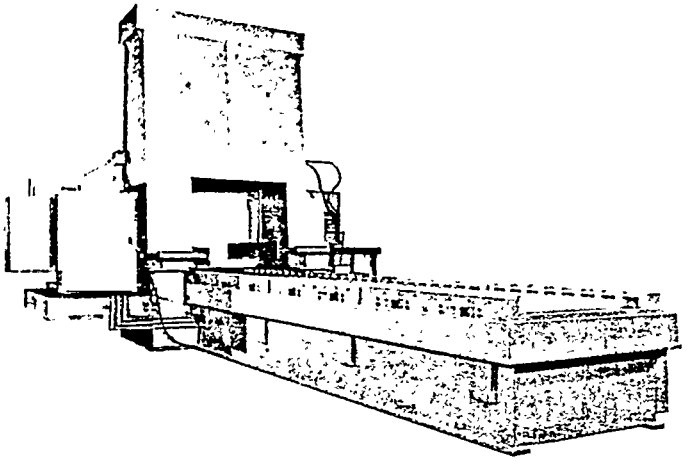
H&E® SAW

The saw that cuts straight.



HEM SAW

The saw that cuts straight.



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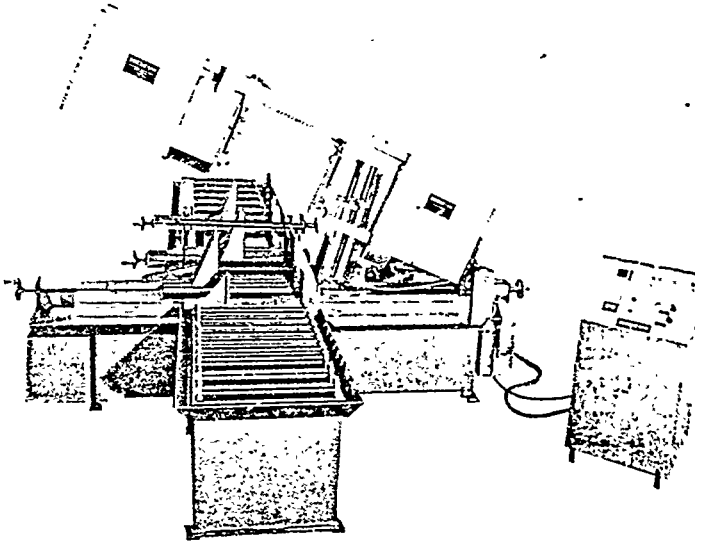

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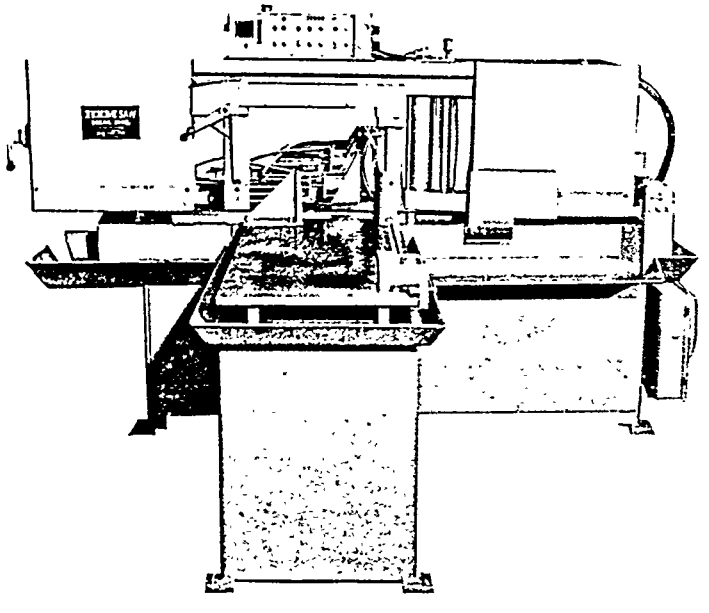

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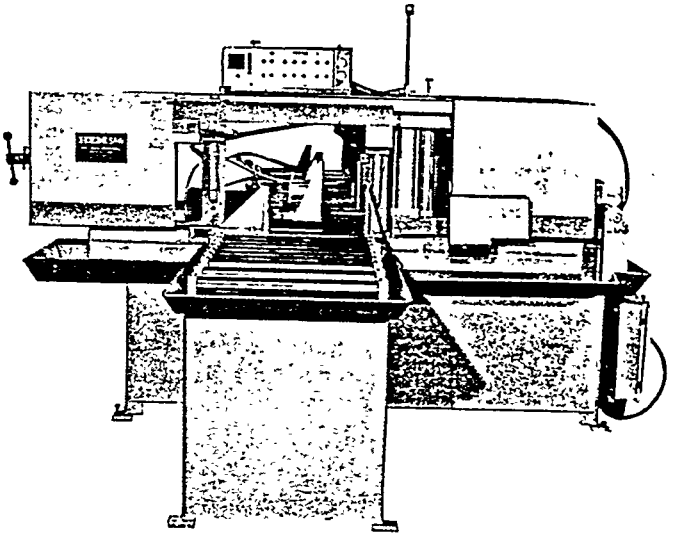

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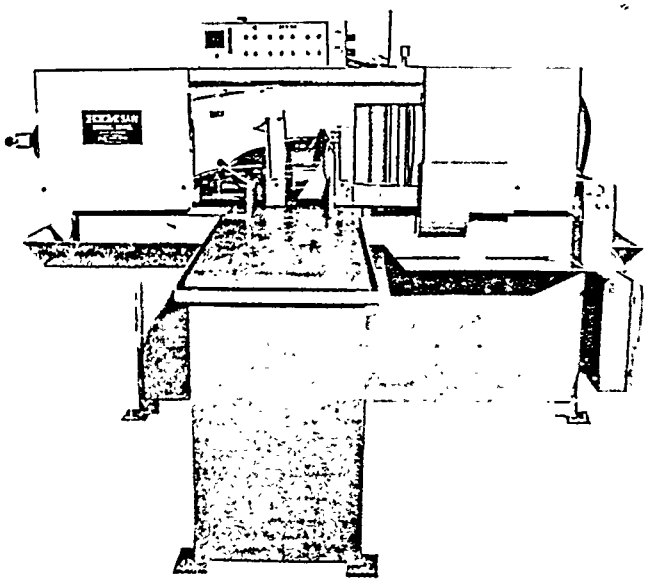
HE&M SAW

The saw that cuts straight.



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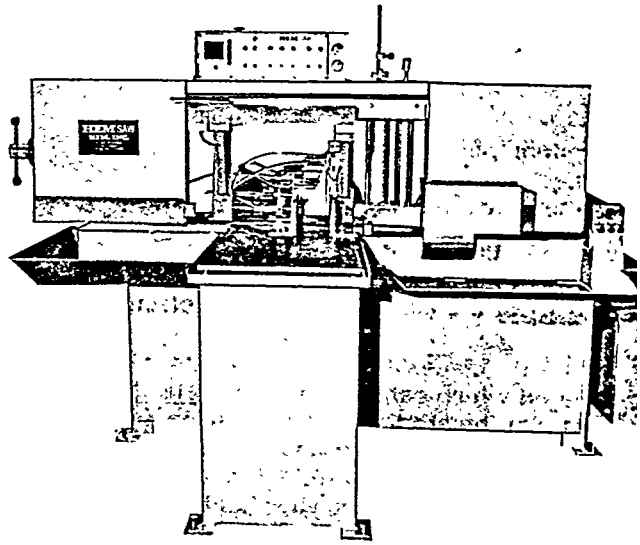

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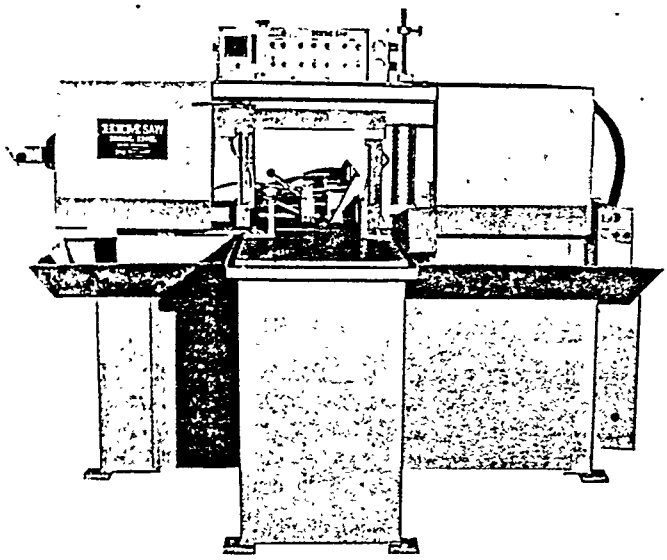
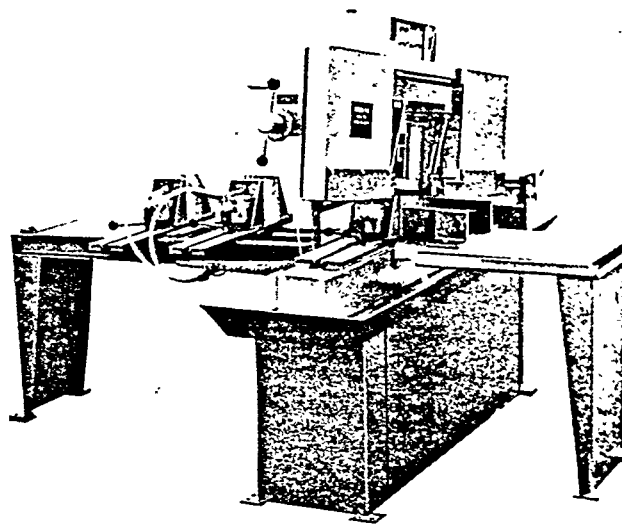


MODEL 750A



MODEL 500A

THE UNIQUE HE&M SAW RATING SYSTEM

For each blade there is an optimum size of material to be cut–a size which allows the saw to both cut quickly and to provide maximum blade life. This size is determined by the laws of physics governing the relationship between guide spacing and beam stiffness of the blade. (Anyone interested in the theoretical aspects will find them discussed in the section concerning "Beam Deflection" in any good engineering handbook. You will also want to read about the practical applications of the theoretical analysis in the HE&M booklet, Band Saw Cutting, A Practical Guide, which is available free from your dealer.)

This system may be unique in the rating of band saw machines; however, for simplicity of sales, many of these facts are often omitted by other manufacturers.

This information will definitely help guide you in the selection of the saw that best fits your needs. (See page 2 about the economics of saw selection.)

Thus, it is the blade which sets the Iimits as to the size of material which can be cut. These are the laws of physics, not the arbitrary rules of any manufacturer. The size and quality of the saw, of course, determine how well the blade is controlled, how much tension can be applied and how well it is held in alignments it cuts, so within the outside limits set by the blade dimensions of the design of the saw is extremely important. A high quality half-inch machine will easily-out perform a poor quality one inch machine. But even the best quality machine cannot cut *efficiently* if the blade is attempting to cut through a larger piece of material than the laws of physics permit. That is why different sizes of saws are made.

The HE&M Saw Rating System classifies each sa using three size ranges.

The OPTIMUM size range will give you the maximu blade life which you can expect from that size blade Also, in the optimum size range, literally no skill, p blades, etc., will still achieve straight cutting.

Using an electron welded blade, 20 to 40 hours c blade life would be a reasonable expectation whe operating in the OPTIMUM size range. And yc should get very rapid cutting. For example, in cuttir 5" diameter Cl215, 30 seconds per part and 4 hours per blade should be easily achieved. Our Mode 1200 will do this easily and consistently. As a matt(of fact, we will be happy to show you 20-secor parts.

When your saw is being run in the ECONOMI(MAXIMUM size range, you would expect to reduce the blade life and cutting speed by up to 50%. This may be a very sound operating range if not used too frequently.

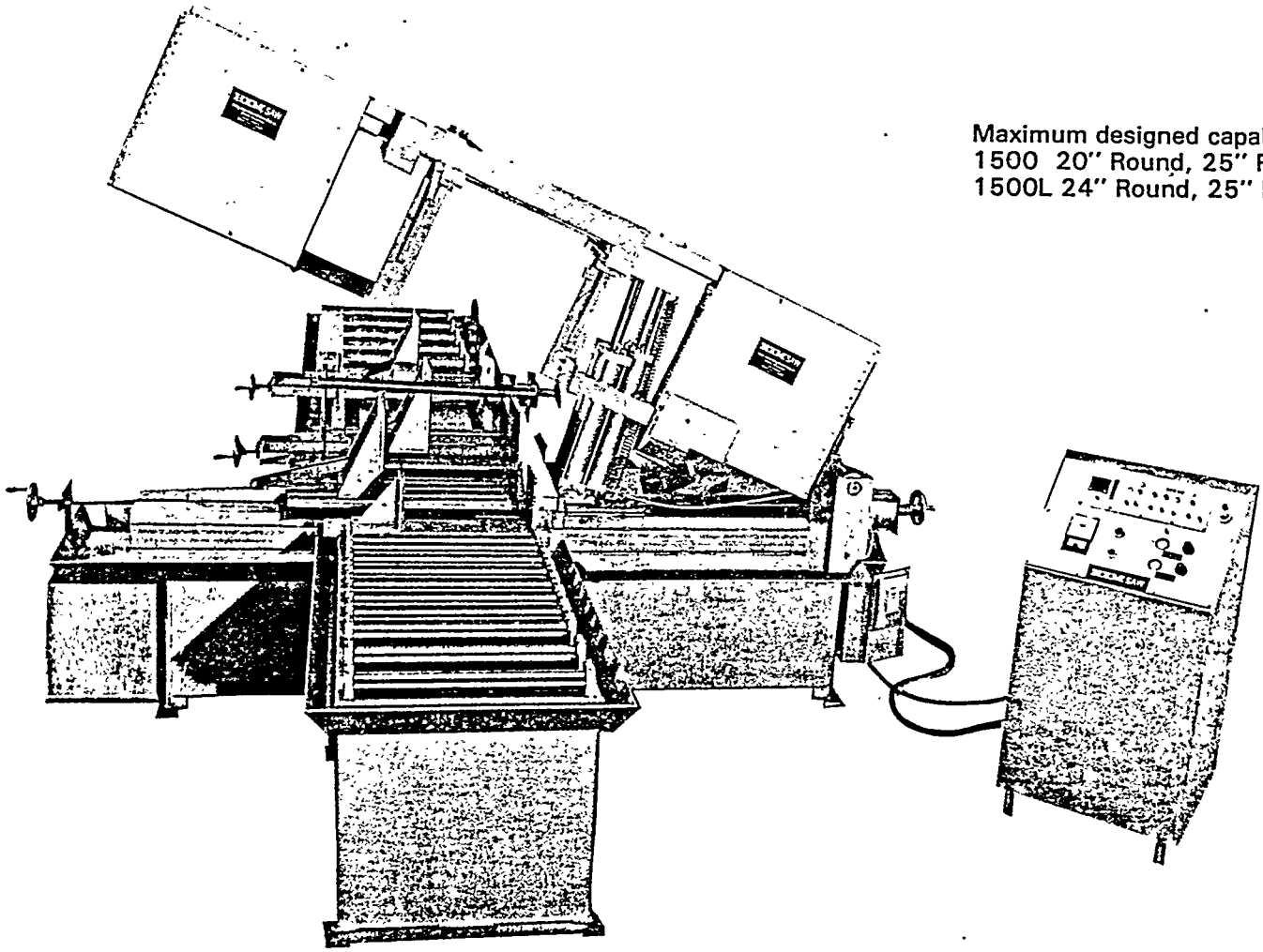
The DESIGN MAXIMUM is the absolute maximum size the saw will handle. Approaching optimum size levels of performance, in this range, are possible provided a skilled operator and good saw blades are used

In general, you will want to select a saw which will be doing most of its production work in the OPTIMUM range. However, since a saw which is not kept busy cannot produce profits while it rests, you would also select a size which will allow you to keep it busy.

MODEL	MAXIMUM DESIGNED CAPABILITY	ECONOMIC MAXIMUM	OPTIMUM CAPABILITY
500	9" ROUND 9½"FLAT	7" ALUM. & BRASS "5" MILD STEEL 3" STAINLESS	4" ALUM. & BRASS 3" MILD STEEL 1½" STAINLESS
750	10" ROUND 12" FLAT	10" ALUM. & BRASS 7" MILD STEEL 4½" STAINLESS	6" ALUM. & BRASS 4" MILD STEEL 3" STAINLESS
1000	12¾" ROUND 12¾" FLAT	12" ALUM. & BRASS 8" MILD STEEL 6" STAINLESS	8" ALUM. & BRASS 5" MILD STEEL 4" STAINLESS
1200	14" ROUND 16" FLAT	13" ALUM. & BRASS 10" MILD STEEL 8" STAINLESS	10" ALUM. & BRASS 6" MILD STEEL 5" STAINLESS
1200L	16" ROUND 20" FLAT	13" ALUM. & BRASS 10" MILD STEEL 8" STAINLESS	10" ALUM. & BRAS 6" MILD STEEL 5" STAINLESS
1500	20" ROUND 25" FLAT	16" ALUM. & BRASS 15" MILD STEEL 11" STAINLESS	12" ALUM. & BRAS 10" MILD STEEL 7" STAINLESS
1500L	24" ROUND 25" FLAT	16" ALUM. & BRASS 20" MILD STEEL 11" STAINLESS	12" ALUM. & BRAS 10" MILD STEEL 7" STAINLESS
2000-40	40" ROUND 40" FLAT	25" ALUM. & BRASS 23" MILD STEEL 20" STAINLESS	20" ALUM. & BRAS 15" MILD STEEL 11" STAINLESS

MODEL 1500A

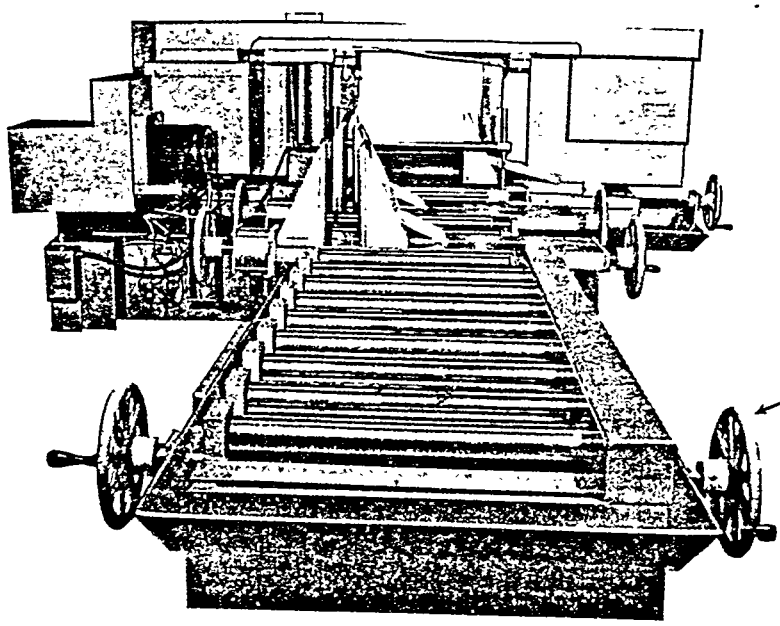
Our largest standard saw, larger model available on special order. The 1500 is a precision machine tool and its performance is simply amazing.



Maximum designed capabil
1500 20" Round, 25" Fla
1500L 24" Round, 25" Fl

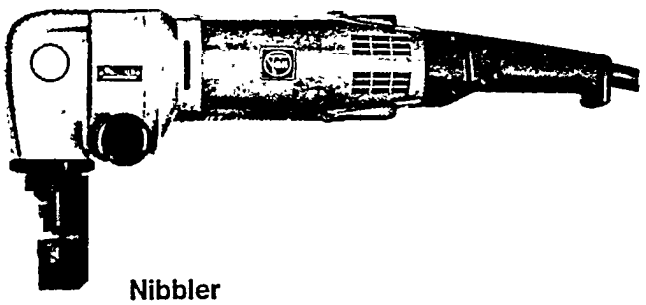
Motor: 10 H.P., 220/440 VAC, 3 Phase. **Shipping Weight:** Automatic 12,500 lbs. **Blade Size:**
Ball Bearing TEFC

MODEL 1500
1½" x 20' 6" x .05(
MODEL 1500L
1½" x 21' 6" x .05(



Hand Powered Rollers
For Material Positionin

Rear View of 1500A with vises and hand-powered roller feed table

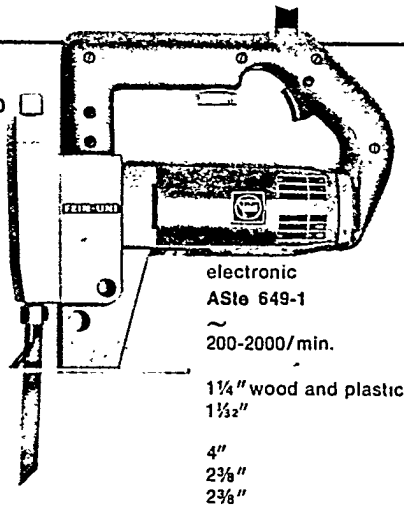


Nibbler

Type □	RSs 664
Current	~
Steel Sheet—up to Gauge/in.	6/3/16"
Stainless Steel—up to Gauge/in.	9/3/64"
Aluminum Sheet—up to Gauge/in.	6/3/16"
Plastics up to	3/16"
Strokes/min.	600
Cutting Speed—ft./min.	5.9
Radius of smallest curve	5 1/8"
Input Watts	1400
Output Watts	920
Net weight	23.1 lbs.

Dust Extraction:

Dust extractor Type 920 10 □ with accessories page 15

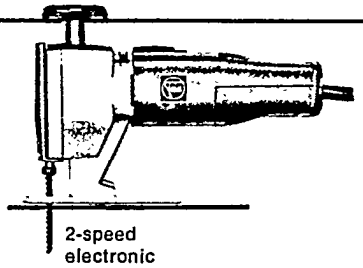


Hack Saw

Type □	electronic ASte 649-1
Current	~
Strokes	200-2000/min.
Radius of the smallest curve	1 1/4" wood and plastics 5/8"
Length of Stroke	1 1/32"
Cutting Capacity:	
Softwood more than	4"
Hardwood, plywood	2 3/8"
Fibre, kraft paper	2 3/8"
Asbestos cement	1 5/8"
Steel, brass	1/2"
Stainless steel	3/32"
Aluminum	3/4"
Input Watts	750
Output Watts	500
Net weight	12.2 lbs.

Dust Extraction:

Dust extractor Type 920 10 with accessories page 15

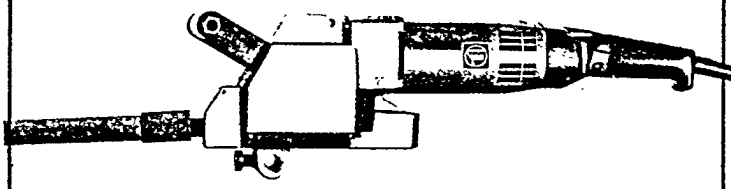


FEIN

Hack Saws

2-speed electronic

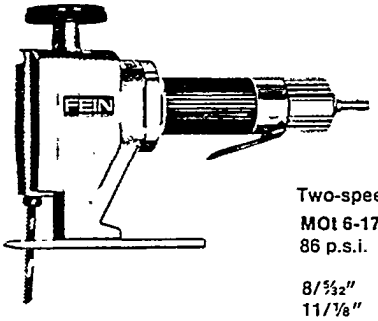
Type □	ASt 636	ASte 636	ASt 636b
Current	~	~	~
Cutting Capacity	Steel 5/32"; alum, copper, brass 3/8"; softwood 2"; hardwood, plywood 1 5/8"; fibreboard 3/4"	stainless steel 1/8"; steel 5/32"; alum, copper, brass 3/8"; softwood 2"; hardwood, plywood 1 5/8"; fibre, glass fibres 3/4"	softwood 2" hardwood 1 5/8": plywood 1 5/8"
Strokes	1600/min.	1st speed: 700/min. 2nd speed: 1600/min.	4500/min.
Length of Stroke	3/4"	3/4"	3/4"
Smallest radius	1 1/4" wood; plastics 5/8"	1 1/4" wood; plastics 5/8"	5/8"
Input Watts	280	280	280
Output Watts	150	150	150
Net weight	4.6 lbs.	4.6 lbs.	4.6 lbs.



Hack Saws

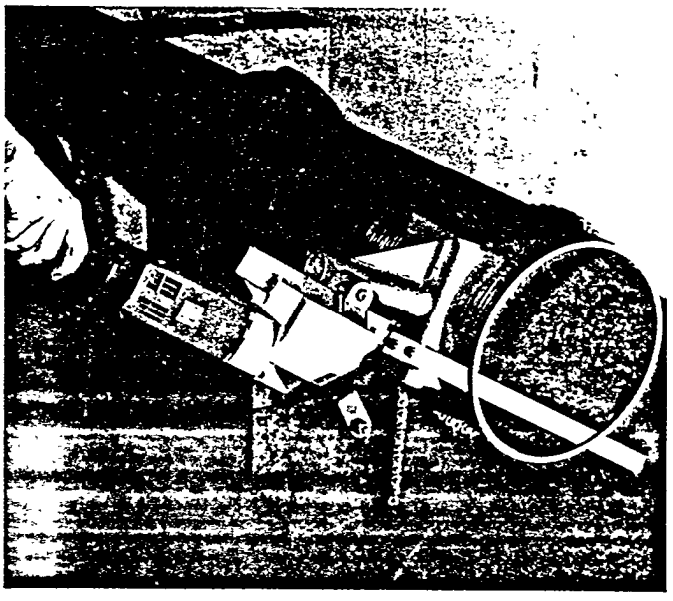
Pneumatic Hack Saw

Type	ASlx 649 □	electronic ASlxe 649 □	MOt 6-18
Current	~	~	~
Air requirements	—	—	86 p.s.i.
for pipes ϕ	24"	24"	24"
for profiles max. width	11 27/64"	11 27/64"	11 27/64"
at max. height	21 11/16"	21 11/16"	21 11/16"
Strokes/min.	350	100-350	330
Length of stroke	2 3/8"	2 3/8"	2 3/8"
Air Consumption	—	—	50 c.f m.
Input Watts	750	750	—
Net weight	13 lbs.	13.7 lbs.	15.4 lbs.
Hosepipe, inside diameter	—	—	1/2"
Fixing thread (internal)	—	—	3/4"



Pneumatic Hack Saw

Type	Two-speed MOt 6-17-1
Air requirements	86 p.s.i.
Cutting Capacity:	
Steel—Gauge/in.	8/5/32"
Stainless steel—Gauge/in	11/1/8"
Alum, copper, brass	3/8"
Softwood	2"
Hardwood, plywood	1 5/8"
Fibreboard	3/4"
Strokes (no load) 1st speed	1300/min.
Strokes (no load) 2nd speed	1850/min.
Length of stroke	3/4"
Air Consumption	10.6 c.f m
Output Watts	220
Net weight	4 lbs.
Hosepipe, inside diameter	3/32"
Fixing thread (ext.)	1/4"



EFFECTIVE JULY 1, 1985

MODEL			PRICE EACH
HAND PLANER			
HS 2151 - 220 VOLT ONLY			$ 295.00
CUT-OFF GRINDER			
MSF 679 b			NOT AVAILABLE
ANGLE POLISHER			
MSZX 648			298.00
BODY PANEL SAW			
ASTLX 636-2			375.00
SHEET METAL SHEARS	CUTTING CAPACITY		
QSZ 636-3	16 ga. (1/16”)		340.00
QSZ 636-4	12 ga. (3/32”)		380.00
QSZ 649.	9 ga. (9/64”)		595.00
QSZ 664	7 ga. (3/161")		960.00
QB 141 a	7 ga. (3/16”)	3 PHASE	1999.00
NIBBLERS			
RSS 636-2	18 ga. (3/64")	CORRUGATED	298.00
RSS 636-1	18 ga. (3/64”)		380.00
RSS 636-4	18 ga. (3/64")	CORRUGATED	385.00
RSS 636-5	14 ga. (5/64”)		380.00
RSS 649-1	14 ga. (5/64”)		595.00
RSS 649-2	14 ga. (5/64”)	CORRUGATED	595.00
RSS 649-3	11 ga. (1/8”)		805.00
RSS 649-4	10 ga. (9/64")		930.00
RSS 664	6 ga. (3/16”)		995.00

Refer to Page 8 of price list for Punches and Dies.

HACKSAWS		RPM NO LOAD	
AST 636-1		3700	295.00
AST 636b		4500	325.00
ASTE 636-1		800-3700	375.00
MOT 6-17-1	PNEUMATIC 2 SPEED	1300/1850	620.00
ASTE 649-1		200-2000	760.00
ASTX 649		350	850.00
ASTXE 649		100-350	950.00
MOT 6-18	PNEUMATIC	0-330	1230.00

Refer to Page 6 of price list for Saw Blades and Pipe Clamps.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

EFFECTIVE JULY 1, 1985

CIRCULAR SAWS

MODEL	PRICE EACH
SSK 646	NOT AVAILABLE
SSK 660	$ 335.00
SSK 661	375.00
SSKM 648-1	1200.00

ELECTRIC WINDOW CUTTER & BLADES

ASTLXE 636-5 — $ 445.00

6-39 -03-072-01-7 Blade	$42.00	6-39-03-081-01-3 Blade	42.00
6-39-03-073 -01-1 Blade	26.00	6-39-03-082-01-6 Blade	44.00
6-39-03-076-01-6 Blade	47.00	6-39-03-084-01-8 Blade	44.00
6-39-03-079-01-2 Blade	47.00	6-39-03-085-01-2 Blade	44.00
6-39-03-080-01-4 Blade	44.00	6-39-03-087-01-9 Blade	47.00
		6-39-03-092-01-5 Blade	47.00

HACKSAW ACCESSORIES

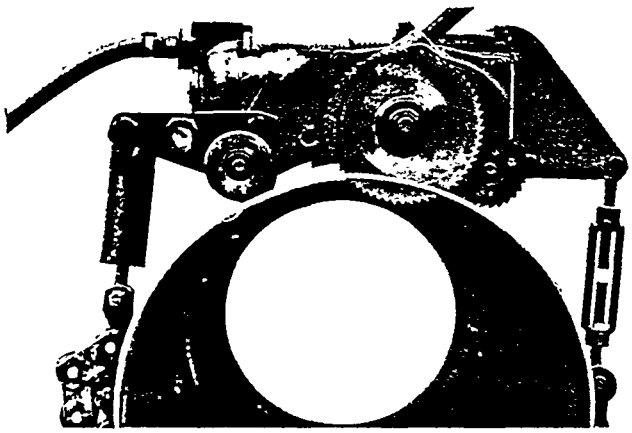
PART NUMBER	OLD NUMBER		PRICE EACH
3-02-16 -130-00-4		PIN FOR EXTENSION CHAINS	$ .20
3-02-31 -003-00-3	BF31-3	17-3/8" EXTENSION CHAIN FOR PIPE CLAMP	30.00
3-02-31 -008-00-0	BF31-8	39-3/8" EXTENSION CHAIN FOR PIPE CLAMP	60.00
3-27-14-062-02-3	S14-62-2	FREE HAND SUPPORT	145.00
3-39-01 -042-00-3		CARRYING CASE FOR MOT6-18 AND ASTX649	85.00
4-11-40-004-00-7		COUPLING FOR MOT6-18	18.00
9-06-06 -002-00-9	S14-35-3	SAW BLADE GUIDE	185.00
9-07-02-001 -00-1	S14-10-1	PIPE CLAMP - 6"	165.00
9-07-02-003-00-8	S14-20-2	PROFILE PIPE CLAMP	185.00
9-07-02-004 -00-6	S 14-37-2	PIPE CLAMP - 12-3/4"	198.00

HACKSAW BLADES

PART NUMBER	OLD NUMBER	LENGTH	TEETH/INCH	PACKAGING	PRICE EACH
6-35-03-063-00-7	Z22-6 HSS	12"	16	50/BOX	$ 6.50
6-35-03-064-00-5	Z22-7 HSS	16"	16	50/BOX	6.90
6-35-03 -065-00-9	Z22-9 HSS	8"	8	50/BOX	6.00
6-35-03 -066-00-2	Z22-10 HSS	8"	16	50/BOX	6.00
6-35-03 -067-00-6	Z22-11 HSS	8"	24	50/BOX	6.00
6-35 -03-068-00-4	Z22-29 HSS	16"	8	50/BOX	6.90
6-35-03 -069-00-8	Z22-30 HSS	21"	12	25/BOX	9.10
6-35-03-069-11-8	Z22-30 HSS-SL	21-13/16"	12	25/BOX	9.20
6-35-03-070 -00-0	Z22-31 HSS	12"	12	50/BOX	6.40
6-35-03-032 -00-6	Z22-32 WS	16"	4	25/BOX	26.50
6-35-03-037-11-1	Z22-37 HSS-SL	37"	12	20/BOX	32.50
6-35-03-040-11-3	Z22-40 HSS-SL	21"	4	25/BOX	9.20
6-35-03 -071-11-9	Z22-71 HSS-SL	12"	4	50/BOX	7.00
6-35-03 -072-00-2	Z22-72 HSS	20"	14	25/BOX	10.40
6-35-03 -073-00-6	Z22-73 HSS	24"	14	20/BOX	10.90
6-35-03-074 -02-0	Z22-74 HSS	24"	8	20/BOX	13.80
6-35-03 -075-06-0	Z22-75 HSS	30"	12	25/BOX	16.90

HSS Blades are made from High Speed Steel.
HSS-SL Blades are made from High Speed Steel with added Molybdenum for extra tough jobs.

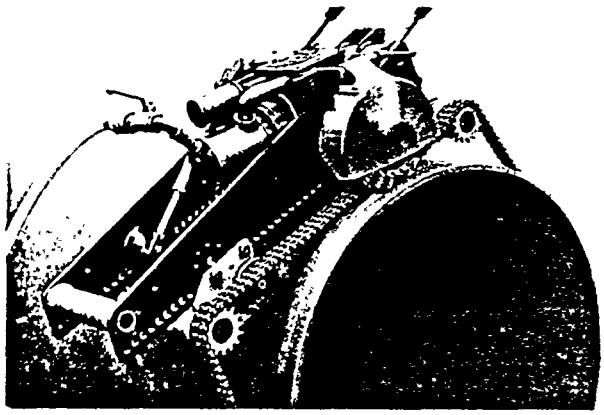
PRICES SUBJECT TO CHANGE WITHOUT NOTICE



FEIN Electric and pneumatic pipe saws

Type RBu 144 b, RMO 5 b for ordinary cuts with 2⅜" feed, for pipes 8" - 55" external diameter with a wall thickness up to 2⅜".

Type RBo 145-1a, RMO 5 a for V or U cuts with 1⅛" feed, for pipes 8" - 55" external diameter with a wall thickness up to 1½".



FEIN Pneumatic pipe milling machines

for pipe diameters from 12¾" - 59⅝" and max. 1⅛" or 1¾" wall thickness.

RDG 18-2 a Feed 1½" for highly alloyed steel pipes
RDG 18-2 b Feed 3⅛" for low alloyed steel pipes
RDG 18-2 c Feed 6¼" for unalloyed steel pipes, cast iron pipes
RDG 18-2 e Feed 12⅝" for plastic pipes

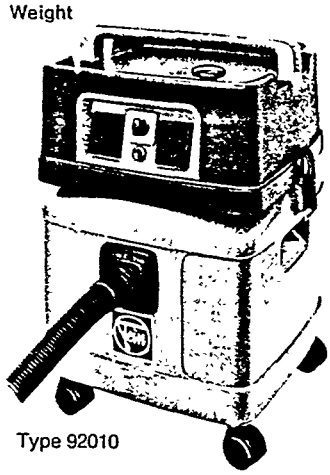
FEIN Dust Extraction

Dust extractor type 92010
movable with automatic switch on device

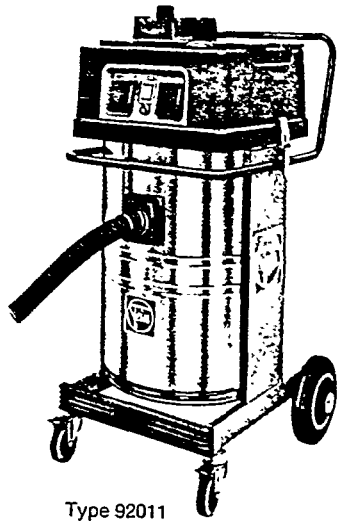
Capacity	10 gallon
Input Watts	1000 -1100
Vacuum	3.4 p.s.i
Flexible cord	26.2 ft.
Weight	30.8 lbs.

Dust extractor type 920 06

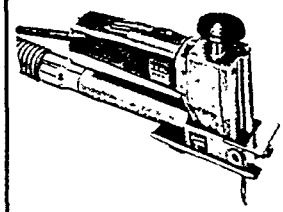
Order reference	9 20 06 222 01 2
Capacity	47.5 quarts
Input Watts	700-800
Vacuum	2.3 p.s.i.
Flexible cord	24.6 ft.
Weight	39.7 lbs.



Type 92010



Type 92011



Type ASt 636

For Hammer FSc 637-1

Adapter with dust extraction	Order reference 6 39 03 054 01 1
Suction tube 5 m (16.5 ft)	Order reference 3 14 14 020 00 7
Adapter for dust extractor	Order reference 3 32 18 012 00 8

For Hammer FSce 642 -1

Adapter with dust extraction for Air drills	Order reference 6 39 03 069 00 4
Suction tube 5 m (16.5 ft)	Order reference 3 14 14 020 00 7
Adapter for dust extractor	Order reference 3 32 18 012 00 8

For Angle Grinders MSf 666-1 c, MSf 680 c

Suction tube 3,5 m (11.5 ft.)	Order reference 3 14 14 014 00 2
Adapter for dust extractor	Order reference 3 32 18 017 00 1
Protective suction hood	Order reference 3 18 10 171 00 5

For Hack Saws ASt 636, ASt 636 b, ASte 636, MOt 6-17-1

Device for dust extraction	Order reference 9 26 02 002 02 5
Suction tube 3,5 m (11.5 ft.)	Order reference 3 14 14 014 00 2
Adapter for dust extractor	Order reference 3 32 18 017 00 1

For Hack Saw ASte 649-1

Device for dust extraction	Order reference 9 26 02 012 01 8
Suction tube 3,5 m (11.5 ft.)	Order reference 3 14 14 014 00 2
Adapter for dust extractor	Order reference 3 32 18 017 00 1

For Circular Saws SSk 660, SSk 661

Extractor stub pipe	Order reference 3 13 21 073 00 0
Suction tube 5 m (16.5 ft.)	Order reference 3 14 14 016 03 0

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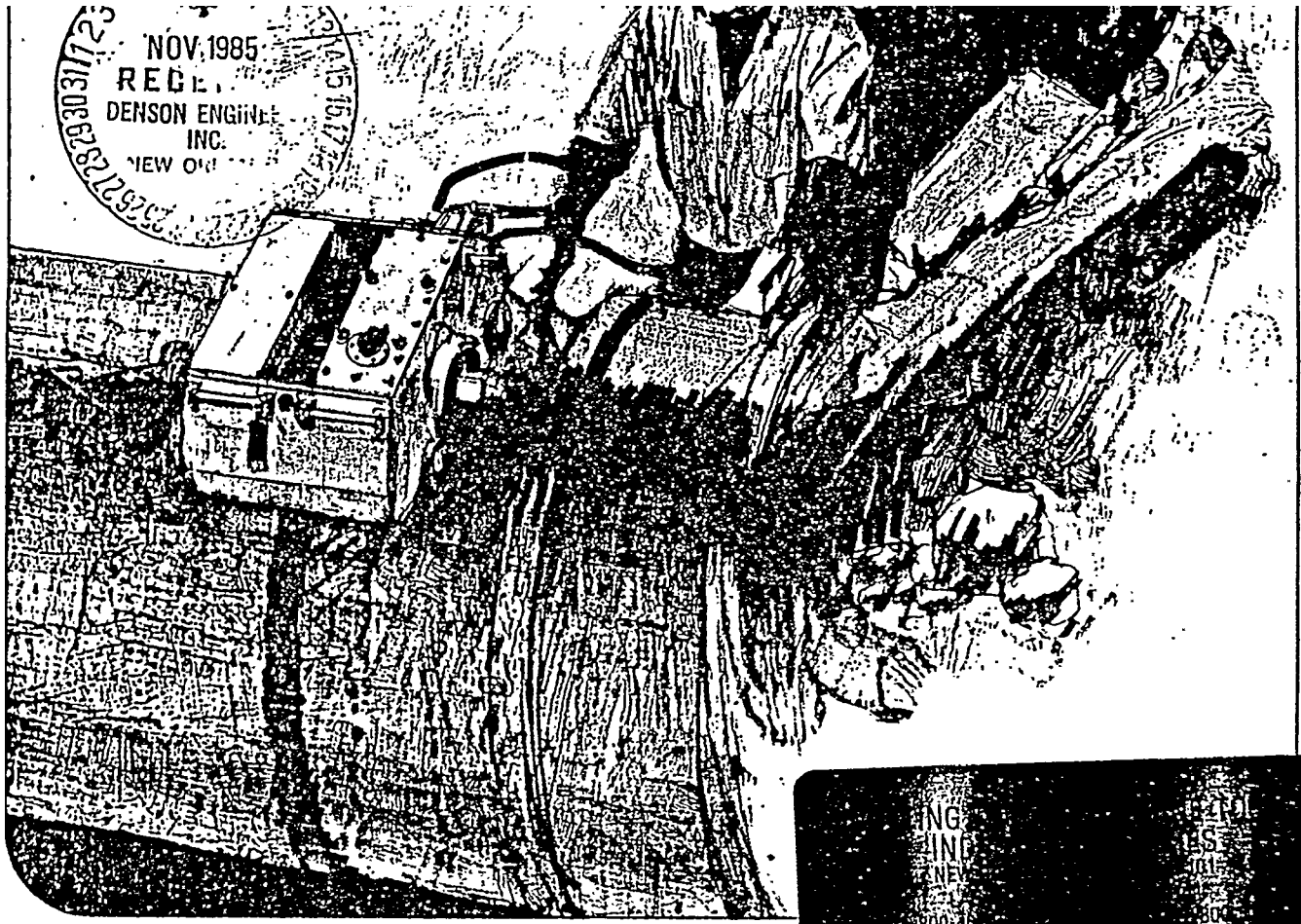
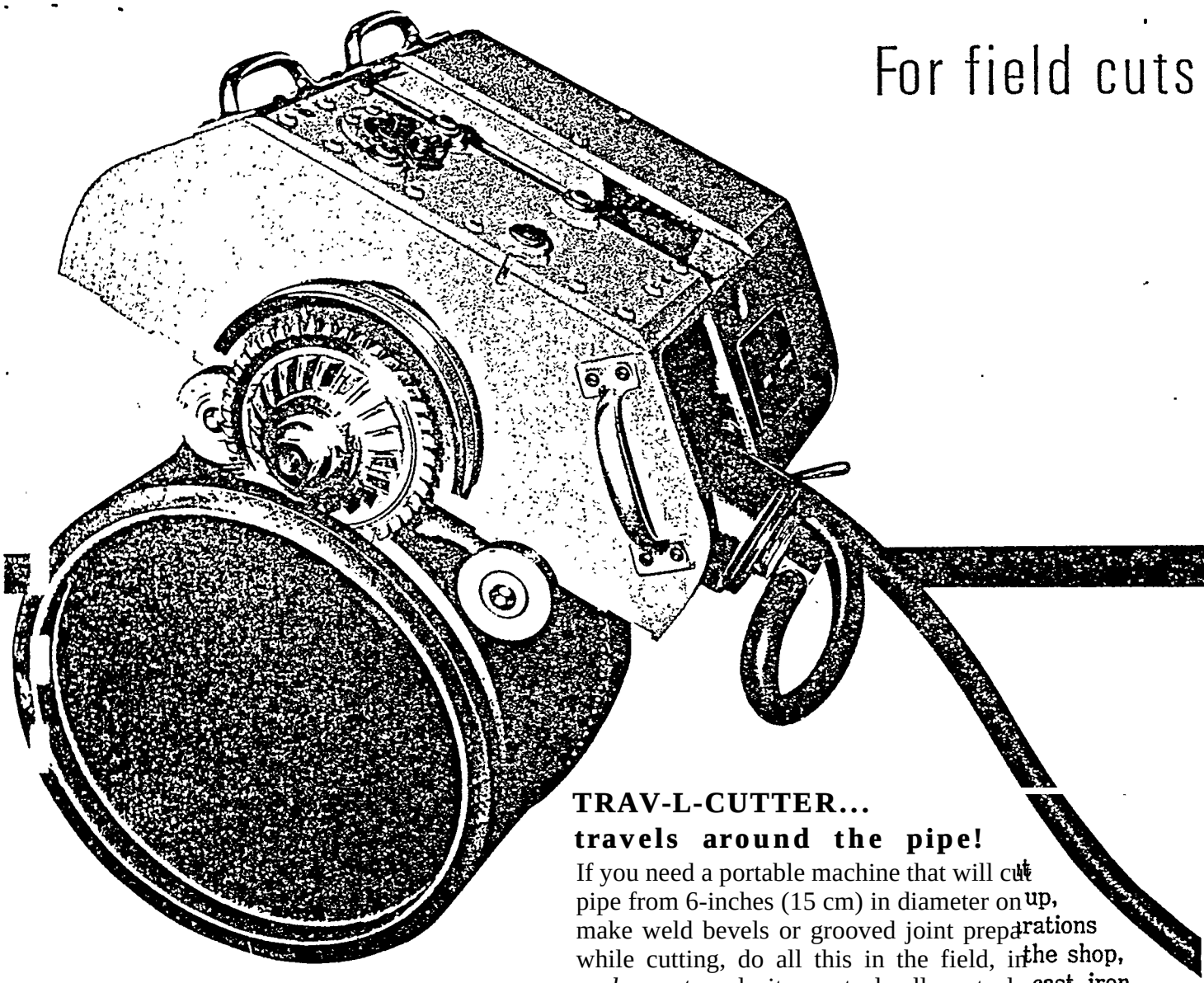


WACHS TOOLS FOR PIPE AND VALVES

- cutting
- beveling
- end preparation
- valve operating
- pumping

E. H. WACHS COMPANY

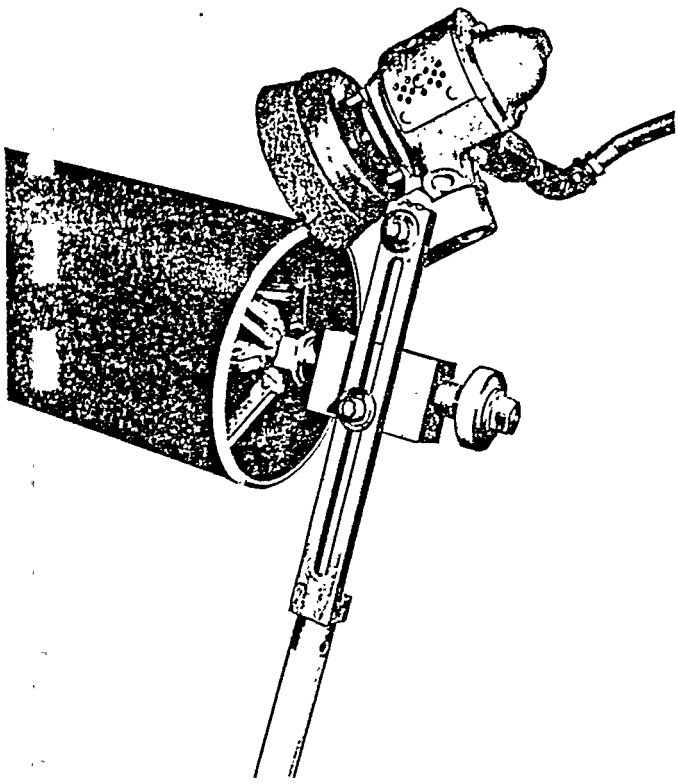
For field cuts..



TRAV-L-CUTTER... travels around the pipe!

If you need a portable machine that will cut pipe from 6-inches (15 cm) in diameter on up, make weld bevels or grooved joint preparations while cutting, do all this in the field, in the shop, *under water;* do it on steel, alloy steel, cast iron, asbestos-cement, pre-stressed concrete or Ductile Iron there's only one machine you can buy–the Wachs TRAV-L-CUTTER.

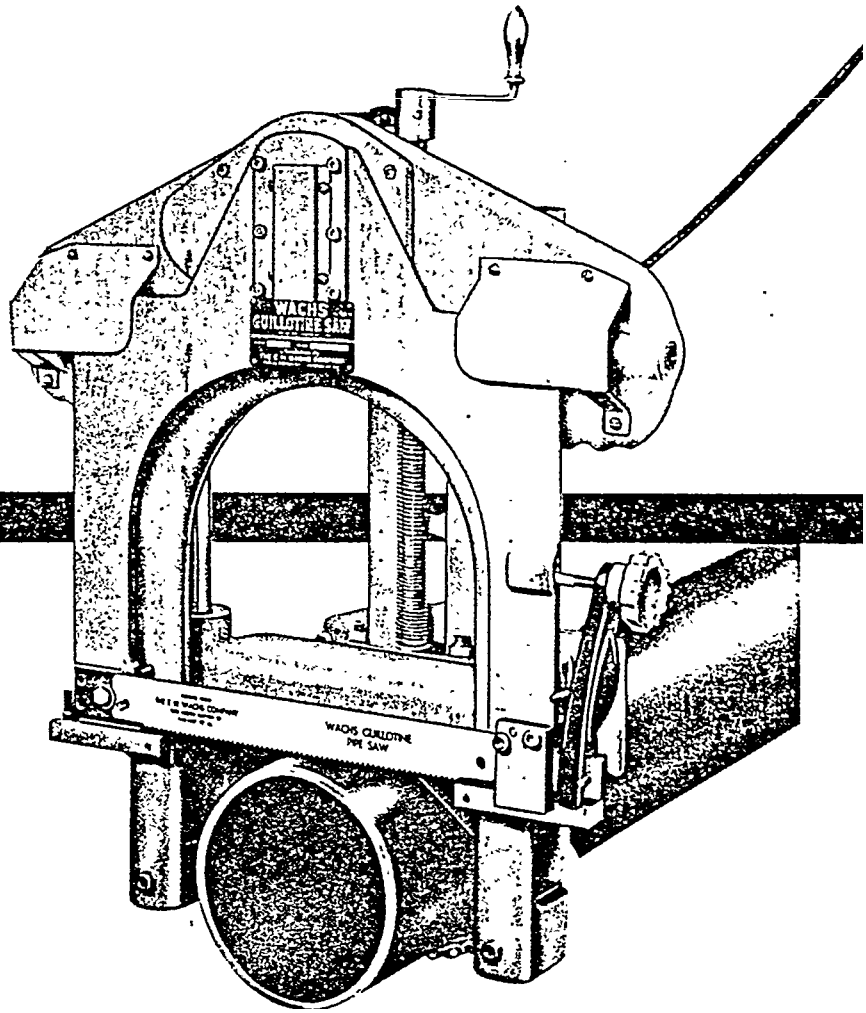
Where do you cut pipe? In a ditch–TRAV-L-CUTTER nee only 10" (26 cm) clearance. On a gas or oil line — flameless cutting eliminates the hazards. In a nuclear or conventional power plan—TRAV-L-CUTTER makes machine shop accurate cuts anywhere on pipe or other vessels up to 18-feet (5.5 m) in diameter. You name it. If you cut pipe–or have a problem cutting other cylindrical objects–the Wachs TRAV-L-CUTTER will do your job. Model E, air drive; Model H-E, hydraulic drive.

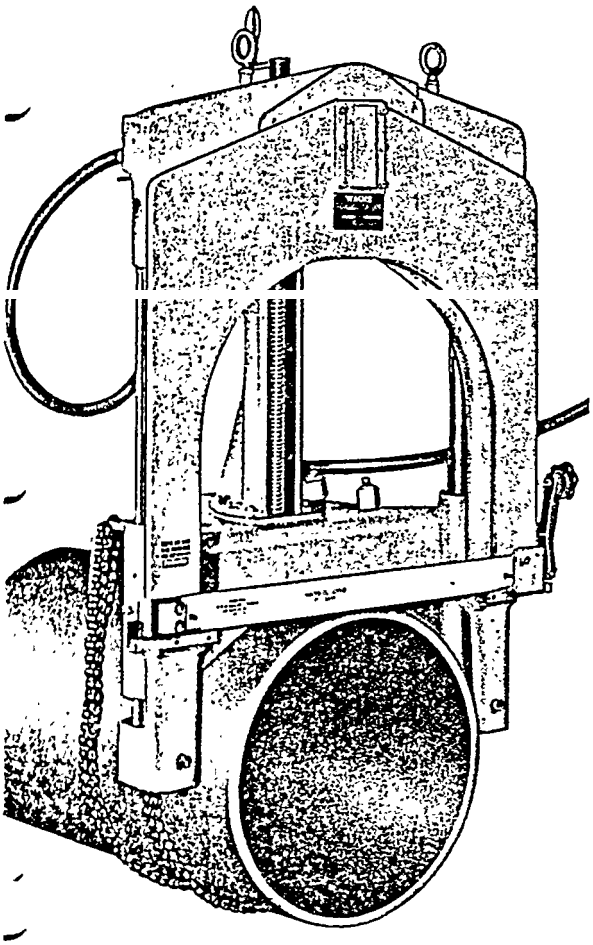


Portable BEV-L-GRINDERS make on-the-job weld bevels

Portable Wachs BEV-L-GRINDERS enable you to do quick, accurate beveling and facing of 3" to 18" (7 to 46 cm) pipe on the job. BEV-L-GRINDER is light, easy to handle, sets up in minutes, and makes weld preparations with machine-shop accuracy, on all types of pipe. Air, electric or hydraulic powered.

.or shop cuts . . . Wachs power pipe cutters and bevelers for all types and sizes of pipe.





THE GUILLOTINES

Two portable saws for steel, cast iron, stainless or alloy steel pipe; and solid or hollow bar, structural, and rail. These saws are preferred where straight right angle cuts are required.

Model C, the smaller GUILLOTINE, cuts 2“ through 9“ (5 to 23 cm) O.D. pipe; Model D cuts 10” through 18” (24 to 46 cm) O.D. pipe. Both of these machines have proved their worth in tight quarters situations where clearances pose special problems. Model C needs only 24” (61 cm) and Model D only 32” (82 cm) of width to operate in.

The GUILLOTINES make “hot cuts” on pipe where fire and explosion dangers exist. Oil and gas pipe lines and chemical lines can be cut into without the hazards of torch cutting.

These saws aren’t merely the best way, they are the only good way to cut stainless steel pipe over Schedule 80. And for field fabrication of stainless steel pipe. Remember, with the portable Wachs GUILLOTINES, the saws go to the job.

Both models available with air, electric or hydraulic drive.

APPENDIX I

PIPE CUTTING COST

PIPE CUTTING COSTS

Pipe cutting cost were calculated for all steel pipe 2" thru 24" for a typical project, assuming one cut per DRL joint. The number of joints were determined by dividing the required footage of each item by 39', the average length of DRL joints delivered.

Traveling Rotary Saw

The time required for cutting the pipe with a traveling rotary saw was calculated by combining the circumference of each cut and dividing by the published cutting rate of 2-3/8" per minute.

Total circumference = 22,019 in.

Total cutting time = 22,019 in./2.375 in./min.
= 9,268 min.
= 154.5 *hr.* (unacceptable)

Band Saw

The time required for cutting the same pipe using a band saw was determined by summing the metal cross-sectional area of each cut and dividing by a cutting or metal removable rate of 15 sq. in. per minute.

Total cross-sectional area (metal only) = 7,604-sq. in.

Total cutting time = 7,604 sq. in./l5 sq. in./min.
= 507 min.
= 8.5 hr.

The above figures are for actual cutting time only and do not include handling pipe, saw set-up, etc. Assume two workmen, a saw operator and a helper, at $20.00 per manhour and a factor of four to cover activities other than cutting time.

8.5 hr. x 2 men x $20.00/manhour x 4 = $1,360.00

This is the estimated pipe cutting cost for atypical project.

APPENDIX J

NET MATERIAL COST SAVINGS

NET MATERIAL COST SAVINGS

The net savings on materials represent the difference in price between purchasing steel pipe by Avondale's current methods and purchasing the pipe according to the recommendations of this report after all extra costs have been accounted for.

Baseline Cost is the price paid for steel pipe on a typical project using Avondale's methods. See Appendix, Item A, for listing of materials; Items C and D, for price calculations.

Baseline Cost = $ 17,731 (sizes less than 2")
+618,704 (sizes 2" thru 24")
~~$470,898~~ $636,435 .

Estimated cost is the price paid for steel pipe on the same project by purchasing only A-106 steel in SRL for sizes less than 2" and DRL for sizes 2" thru 24".

Estimated Cost = $ 16,887 (sizes less than 2")
+454,011 (sizes 2" thru 24")
$470,898

Gross Savings is the difference between the Baseline and Estimated Costs.

Baseline Cost	$636,435
Estimated Cost	-470,898
Gross Savings	$165,537

Net Savings are the Gross Savings less losses for exces drop-off, see Appendix Item F, and pipe cutting costs.

Gross Savings	$165,537
Excess Drop-Off	-11,804
Pipe Cutting Costs	- 1,360
Net Savings	$152,373

Therefore, the Net Material Cost Savings per project resulting from modification of the purchasing specifications are expected to be approximately $152,350.

APPENDIX K

PIPE HANDLING COSTS COMPARISONS

PIPE HANDLING COST COMPARISONS

A comparison of pipe handling costs associated with Avondale's current system versus the system proposed in this study.

Task	Avondale System Requirements	Proposed System Requirements	
1. Receiving Pipe Deliveries (6 times weekly at 1-1/2 to 2 hours each)	Railroad Crane Crane Operator 4 Workmen 5 men x 10.5 hr./wk. x 52.14 wk./yr. x $20.00/hr. = $54,747.00/yr.	Gantry Crane Crane Operator 2 Workmen 3 men x 10.5 hr./wk. x 52.14 wk./yr. x $20.00/hr. = $32,848.20/yr.	($21,898.80/yr.)
2. Pipe Cutting (34 hr. per project with 4 projects per year)	N/A	Saw Operator Helper 2 men x 34 hr./proj. x 4 proj./yr. x $20.00/hr. = 5,400.00/yr. 1,360.00/proj.	-o- Note 1
3. Material Transfer to Pipe Shop	Railroad Crane Crane Operator 4 Workmen	Gantry/Tower Crane Crane Operator 2 Workmen Truck Driver	-o- Note 2
4. Pipe Rack Operators	Supervisor 3 Workmen 4 men x 40 hr./wk. x 52.14 wk./yr. x $20.00/hr. = $166,848.00/yr.	Supervisor 2 Workmen 3 men x 40 hr./wk. x 52.14 wk./yr. x $20.00/hr. = $125,136.00/yr.	($41,712.00/yr.)
	Anticipated Labor Savings from Proposed Plant		$63,610.00/yr.

NOTE 1: Cost of pipe cutting has already been deducted from material cost savings.

NOTE 2: Material transfer involves more complex task under proposed plan, but uses fewer men. A net savings is expected. However, since the pipe shop may provide labor to unload materials at the shop, accounting practices may effect this estimate.

APPENDIX L

CONCRETE SLAB ESTIMATE

CONCRETE SLAB ESTIMATE

These are the estimated costs for materials and construction of concrete slabs as shown in Appendix, Item O, drawing b - "New Pipe Storage Area".

Concrete

90 Slabs @ 21′ x 12′ x 1′ ea.:	21′ x 12′ x l′	= 252 cu. ft./es.
	90 X 252 cu. ft.	= 22,680 cu. ft.
	$\frac{22,680 \text{ cu. ft.}}{\text{cu. ft./cu. yd.}}$	= 840 cu. yds.
1 Slab @ 24′ x 246′ x 1′ ea.:	24′ X 246′ X 1'	= 5,904 cu. ft.
	$\frac{5,904 \text{ cu. ft.}}{27 \text{ cu. ft./cu. yd.}}$	= 219 cu. yds.
	Total Concrete	= 1,059 cu. yds.

Local price of 3000 PSI concrete is $36.00/cu. yd. delivered.

Concrete Cost @ $36.00/cu. yd. x 1059 cu. yd. = $38,124

Concrete Finishing

90 Slabs @ 21′ x 12′ ea.:	21′ x 12′	= 252 sq. ft.
	90 x 252 sq. ft.	= 22,680 sq. ft.
1 Slab @ 24′ x 246′ ea.:	24′ X 246′	= 5,904 sq. ft.
	Total Surface	= 28,584 sq. ft.

Local rate for pouring and surface finish of concrete is $.50/sq. ft.

Finishing Cost @ 28,584 sq. ft. x $.50/sq. ft. = $14,292

Forming

90 Slabs @ 21′ x 12′ ea.:	2(21′) + 2(12′)	= 66′
	911 x 66′	= 5940′
1 Slab @ 24′ x 246′	2(24′) + 2(246′)	= 540
	Total Perimeter	= 6480′

Forming price, including materials and labor, per Means manual is $6.00 SFCA (Square Foot Calculated Area)

SFCA = height x perimeter, at height = 12"

SFCA - 6480 sq. ft.

Forming Cost 6480 sq. ft. x $6.00/sq. ft. = $38,880

Concrete Slab Estimate:	38,124	Concrete
	14,292	Finishing
	+38,880	Forming
	$91,296	

APPENDIX M

TRAILER MODIFICATION ESTIMATE

TRAILER MODIFICATIONS ESTIMATE

Cost estimates presented here are for the modification of one trailer per Appendix, Item O, drawing C - "Transport Trailer Modifications." The purchase price of a new trailer is not included.

Materials

60′ of W12 x 65 I-beam:	60′ X 65#/ft. = 3,900#	
	3,900# x $0.20/#	= $780.00
120′ of 4" std. steel pipe:	120′ x $5.00/ft.	= $240.00
48′ of 1/2" dia. steel rod:	48′ X 0.668#/ft. X $0.23/#	= $7.37
9 sq. ft. of 1/4" steel plate:	9 sq. ft. x 10.2#/sq. ft. x $0.22/#	= $20.20
48′ of 4" x 12" wooden plank:	48′ x$3.00/ft.	= $146.00
	Total Materials	= $1,194.00

Fabrication

Combined linear total welds 132 in., assume fillet welds at rate of 4" per hour.

132 in./4 in./hr. = 33 hr. welding

Use welder and helper at $20.00/hr. composite rate

2 men x 33 hr. x $20.00/manhour = $1,320.00 welding

Combined rate for sandblasting/painting, including labor and equipment equals $50.00/hr. Estimated time to blast and paint modifications to trailer is eight hours.

8 hr. x $50.00/hr = $400.00 Coating

Total Fabrication = $1,720.00

Total Modification Cost $2,914.00

APPENDIX N

PROJECT PAYOUT/PROJECT R.O.I.

Project Payout

Annual Savings

4 contracts @ $152,350	=	$609,400
Labor and Equipment Savings $64,000	=	64,000
		$673,400
Capital Investment		$510,000
Estimated Payout for Project $\frac{510,000}{673,400}$	=	0.76 years or 9.09 months

Project R.O.I.

Assume 10-year life

Annual Savings over Life.	$673,400
Investment	$510,000
R.O.I. Factor	0.76
% R.O.I. over 10 years	132%
% R.O.I. over 1 year	32.0%

APPENDIX O

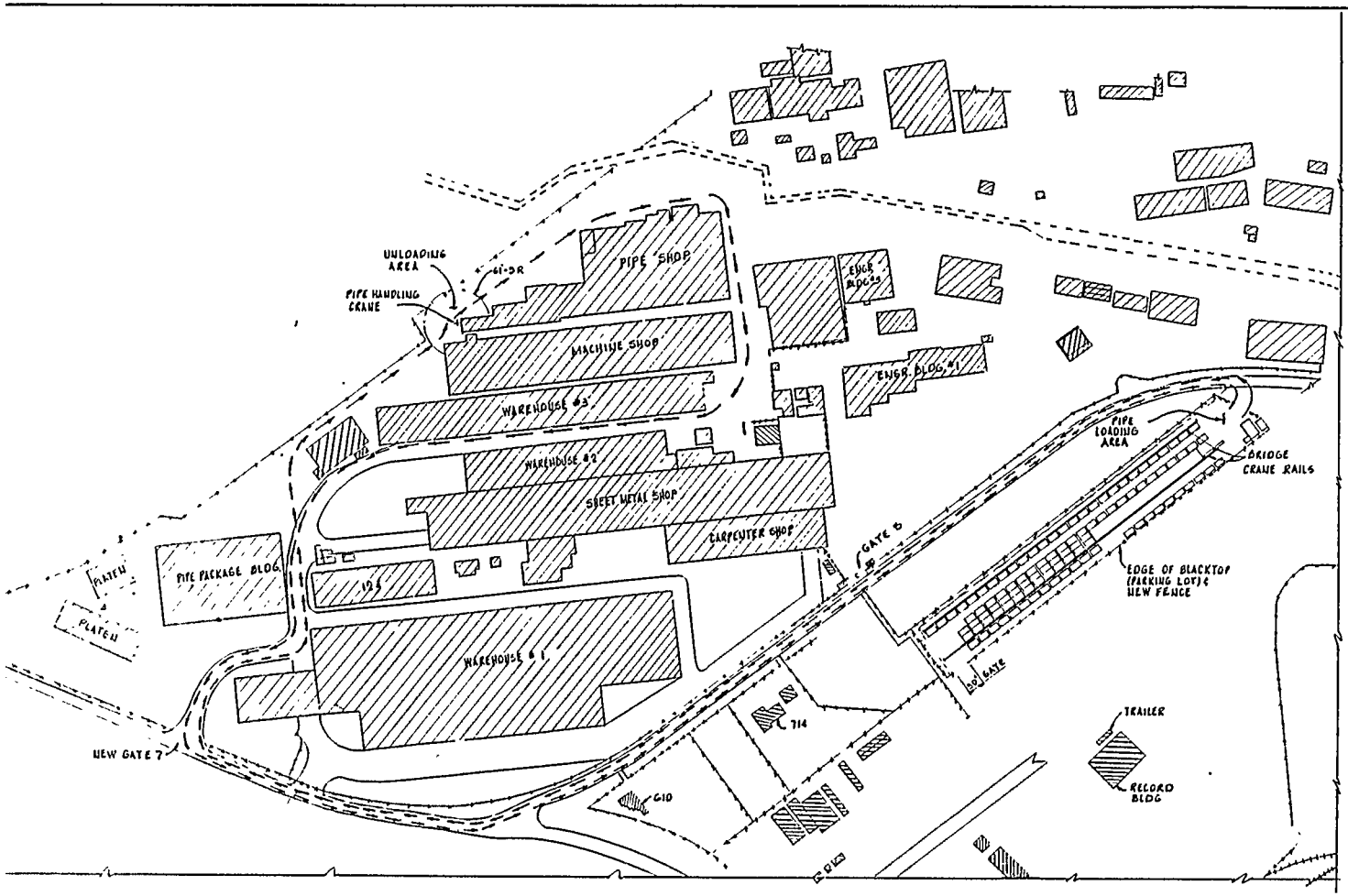
DRAWINGS

a) Partial Site Plan

b) New Pipe Storage Area

c) Transport Trailer Modifications

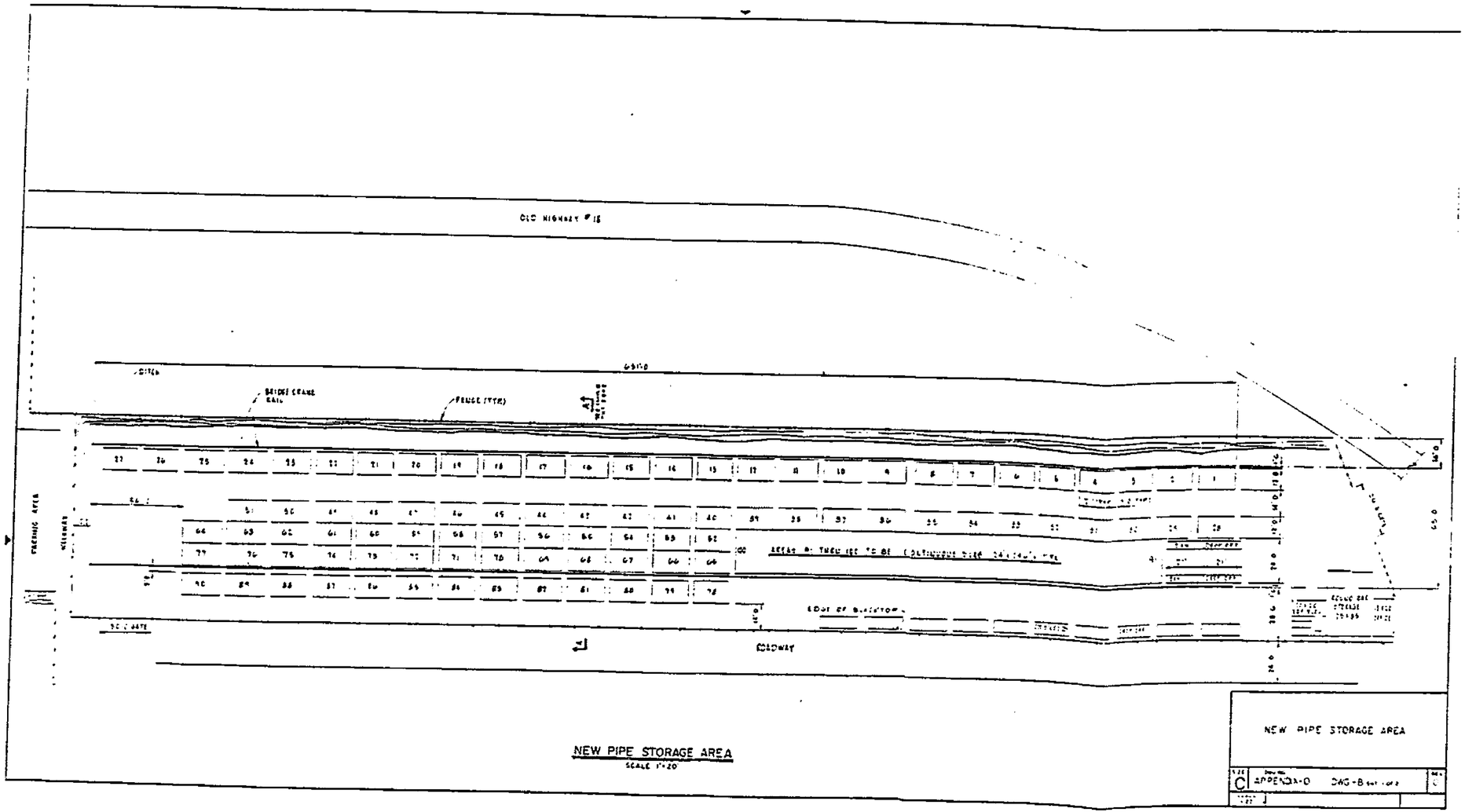
d) Pipe Shop Site Plan

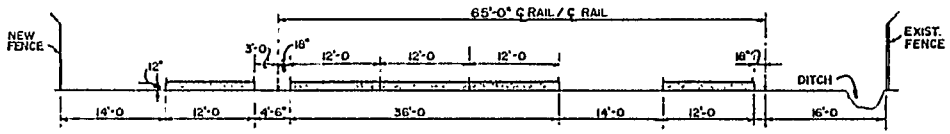


PARTIAL SITE PLAN
SCALE 1"=100'

PARTIAL SITE PLAN

SIZE	DWG NO	REV
C	APPENDIX-O DWG.-A	0
SCALE 1"=100'		

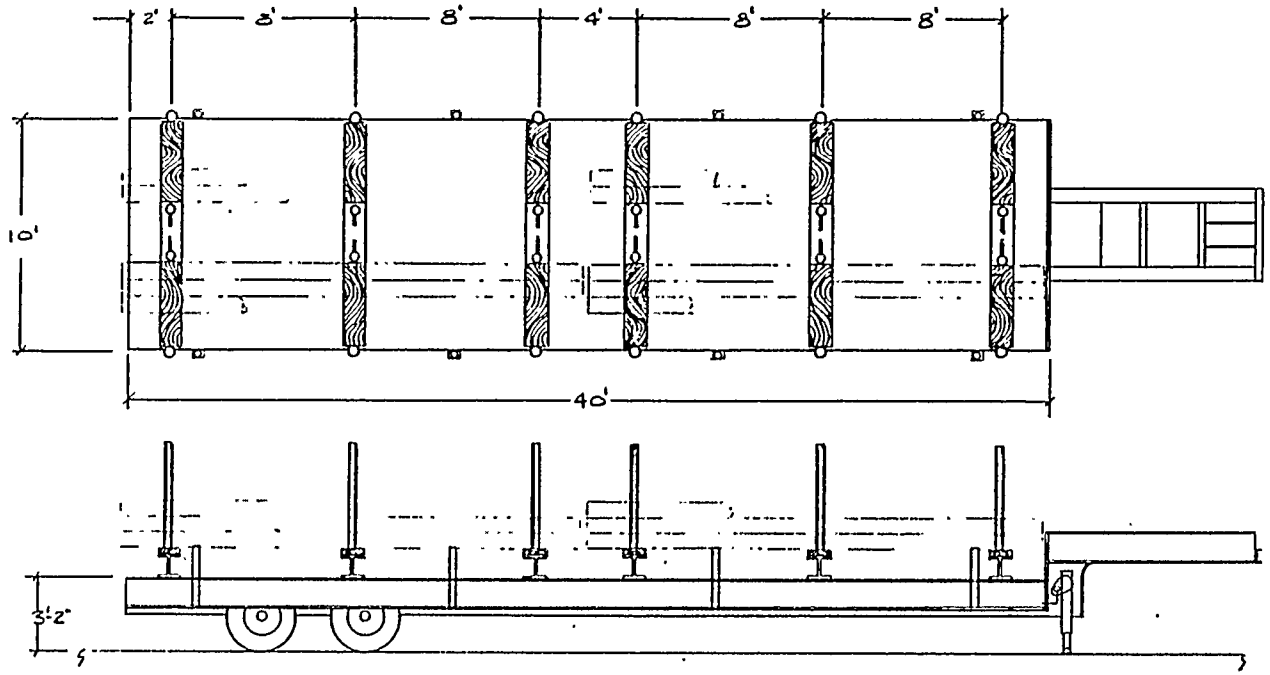

OLD HIGHWAY #15
BRIDGE CRANE RAIL
FENCE (TYP.)
EDGE OF PAVEMENT
ROADWAY
NEW PIPE STORAGE AREA
NEW PIPE STORAGE AREA
SCALE 1"=20'
APPENDIX-D

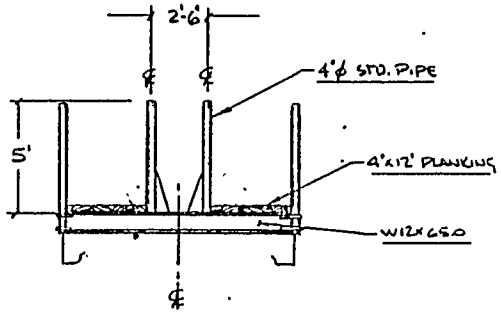


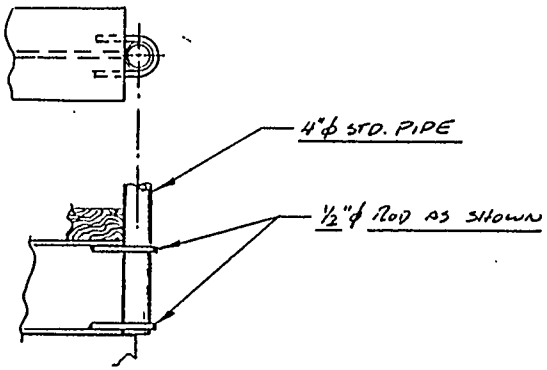
SECTION "A-A"
SCALE: 1/8"=1'-0

NEW PIPE STORAGE AREA

SIZE	DWG. NO	REV
C	APPENDIX-O DWG.- B SHT 2 OF 2	0
SCALE 1/8"=1'-0		



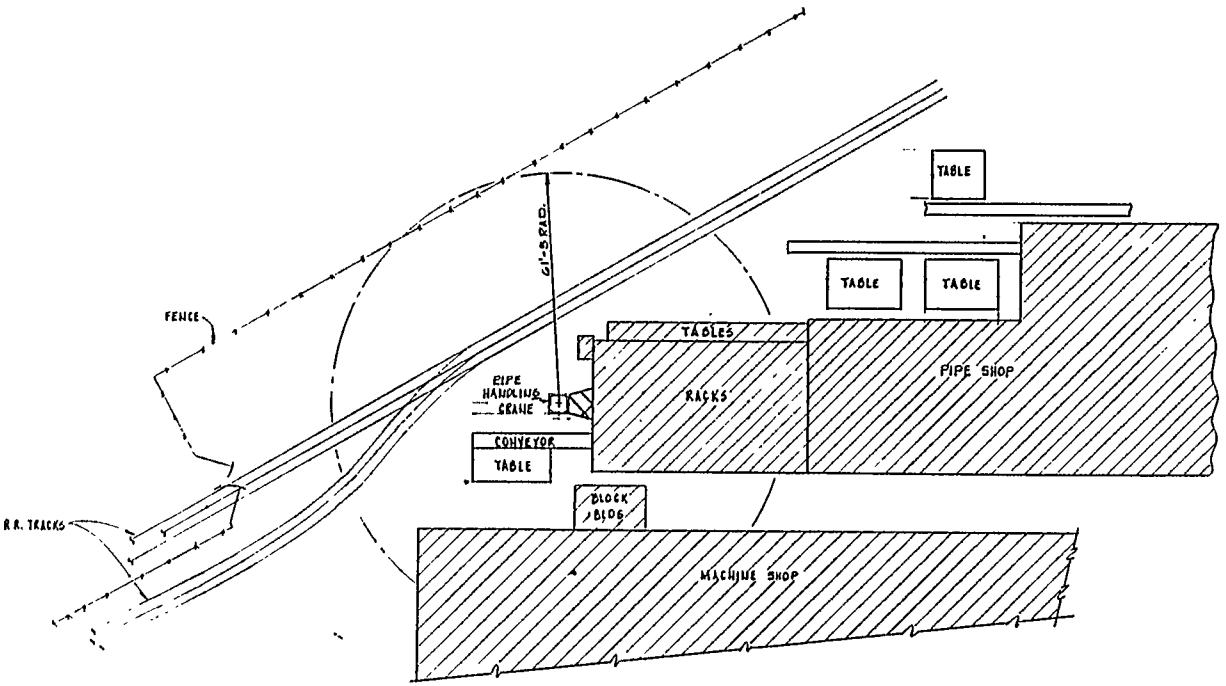




TYPICAL OUTSIDE PIPE DETAIL
SCALE: 1"=1'-0"

TRANSPORT TRAILER MODIFICATIONS

SIZE	DWG NO	REV
C	APPENDIX-O DWG.-C	O
SCALE 1/4"=1'-0		



PIPE SHOP SITE PLAN
SCALE 1/16" = 1'-0

PIPE SHOP SITE PLAN

SIZE	DWG NO.	REV.
C	APPENDIX-O DWG-D	0
SCALE 1/16" = 1'-0		