CLOW CORPORATION

PIPE ECONOMY

CLOW PRESSURE PIPE PRODUCTS GROUP

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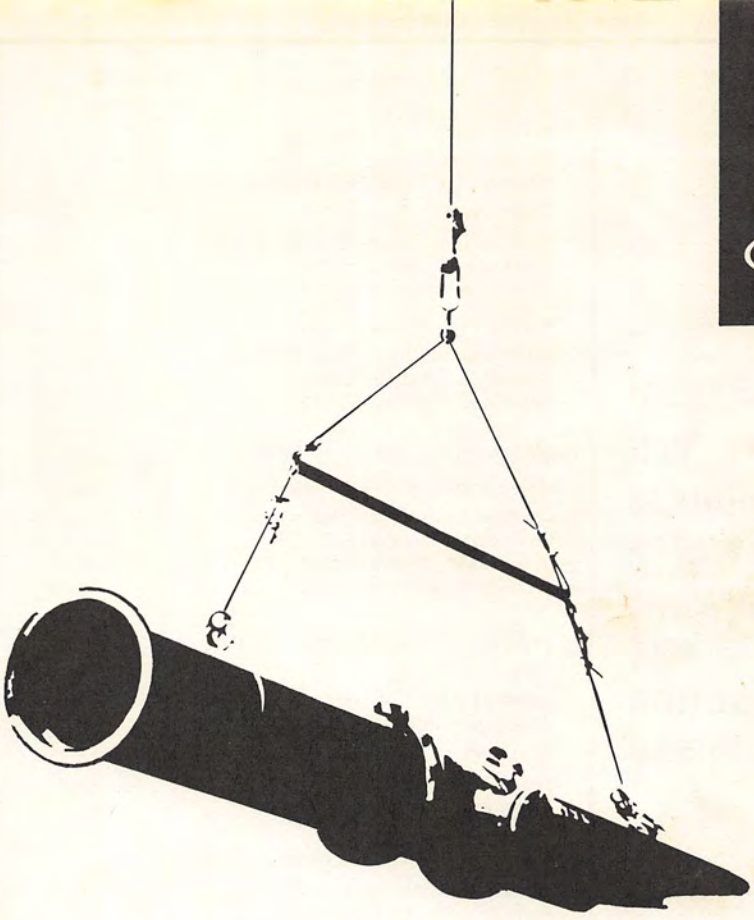

PIPE ECONOMY

A COMPLETE CATALOG AND REFERENCE BOOK FOR ENGINEERS, BUYERS, AND USERS OF CAST IRON PIPE, VALVES, FIRE HYDRANTS, AND RELATED WATER AND WASTE PRODUCTS.

PUBLISHED BY
CLOW CORPORATION
Pressure Pipe Products Group
1050 East Irving Park Road
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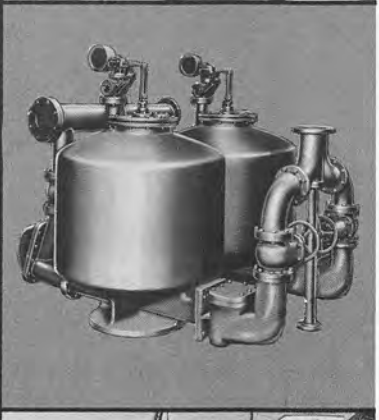

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The benefits of CAST IRON PIPE are proved . . .
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LONG LIFE . . .

Indefinitely long, underground or above ground. Life expectancy proved to be 100 years or more.
All a matter of record.

HIGH FLOW CAPACITY . . .

Large internal diameter; smooth bore, with the ability to stay smooth.
Delivers more water.

TROUBLE-FREE SERVICE . . .

User-designed to engineering standards; permanently tight joints; high structural strength; easy to cut, drill and tap.

No other pipe can provide these essential requirements at so low a cost.

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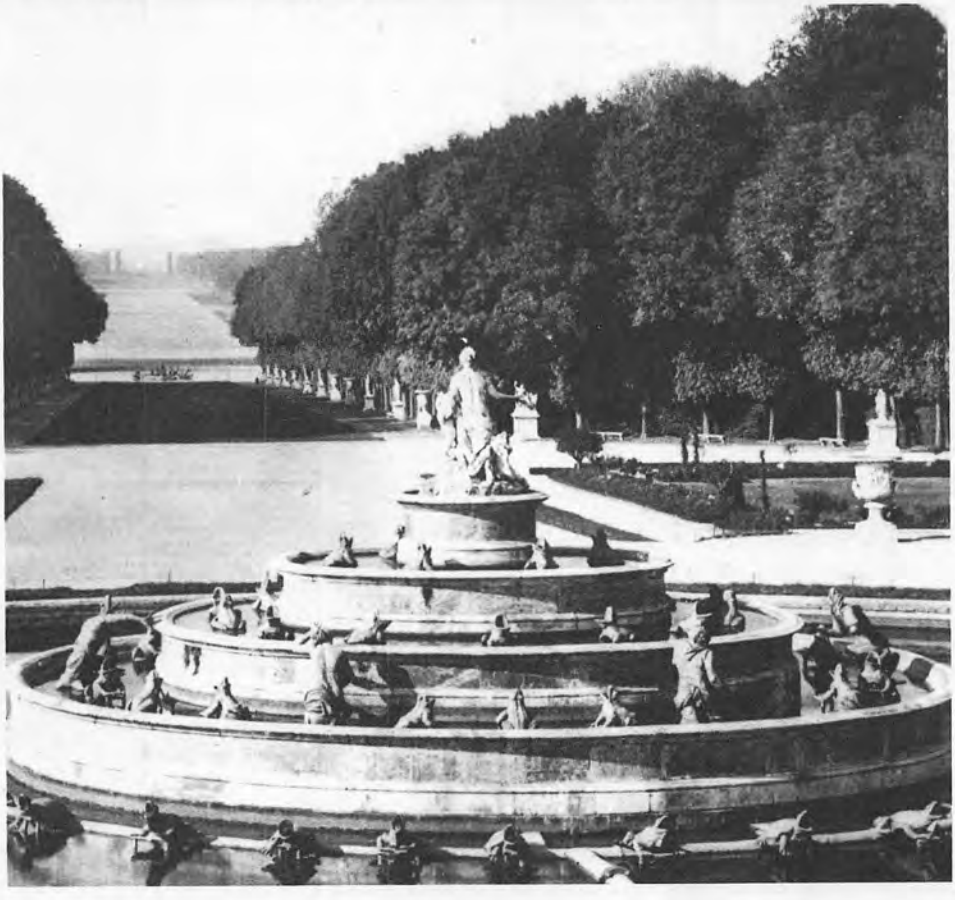
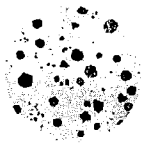
TABLE OF CONTENTS

CAST IRON PIPE IN CONTINUOUS SERVICE SINCE 1664

Pictured below is the famous fountain of Versailles, in which several diameters of cast iron pipe were installed in 1664 A.D. by Louis XIV, King of France, to supply water to Versailles gardens and parks. This pipe, some of which is pictured in top photo, still supplying water under pressure, has been in continuous service for more than 300 years.



Photomicrograph of gray cast iron (100X) showing carbon in the form of graphite flakes.



Photomicrograph of Ductile Cast Iron (100X) showing carbon in the form of graphite nodules.

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GENERAL INFORMATION ABOUT CAST IRON PIPE

Cast Iron Pipe has long been the standard conduit, underground and above ground, for conveying water, gas and sewage in municipal, utility and industrial piping systems. This is because of its indefinitely long life, high flow capacity, trouble-free service, and resultant low cost to the user.

The real life expectancy of cast iron pipe is unknown, but is usually estimated at 100 years or more. The oldest installation of record, which is still in service, is that at Versailles, France, made in 1664, more than 300 years ago. In this country and in Canada there are more than 159 members of the Cast Iron Pipe Century Club, a unique organization composed of cities or utilities who have cast iron pipe still in service after 100 years. The number of members is growing every year.

Cast iron is essentially an alloy of iron, carbon and silicon, containing appropriate amounts of manganese, sulfur and phosphorous, in which a major part of the carbon content occurs as free carbon or graphite interspersed throughout the mass of metal. In gray cast iron, the graphite takes the form of flakes; in ductile cast iron, the graphite is in the form of nodules or spherulites, also in a random distribution throughout the structure.

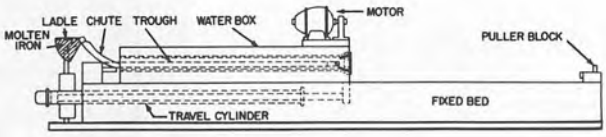
The excellent corrosion resistance of cast iron pipe in underground service is an accepted fact, demonstrated repeatedly in a wide variety of soils. Graphite is noncorrodible and the appreciable volume of this component, together with relatively inert iron phosphides, enables both gray and ductile cast iron to be more resistant to corrosion than other unalloyed ferrous products.

In aggressive environments cast iron pipe is able to serve as an effective, economical conduit for conveying water under pressure due to the formation of an interlocking mat of graphite, phosphides and iron oxides. This mat is both strong and dense enough to inhibit further corrosion. Based on data thus far compiled, the corrosion resistance of ductile cast iron equals or exceeds that of gray cast iron.

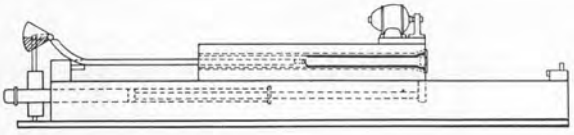
In addition to the benefits of long life, corrosion resistance, high structural strength, and tight joints, cast iron is also readily machinable, an important requirement in any pipe that must be drilled, tapped or cut. At a controlled hardness level, both gray and ductile cast iron is more easily machined than most other metals because the graphite in the iron acts as a lubricant for the cutting tool.

Clow cast iron pipe—gray and ductile—is manufactured in strict accordance with design criteria that have been developed by the American National Standards Institute, and equals or exceeds the requirements of all published standards of the American Water Works Association and the Federal Government.

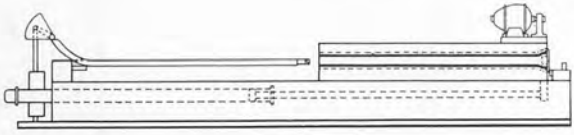
HOW CLOW PIPE CASTING MACHINES OPERATE



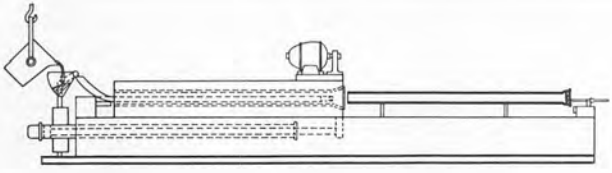
1. Head Core in place—ready to start cast.



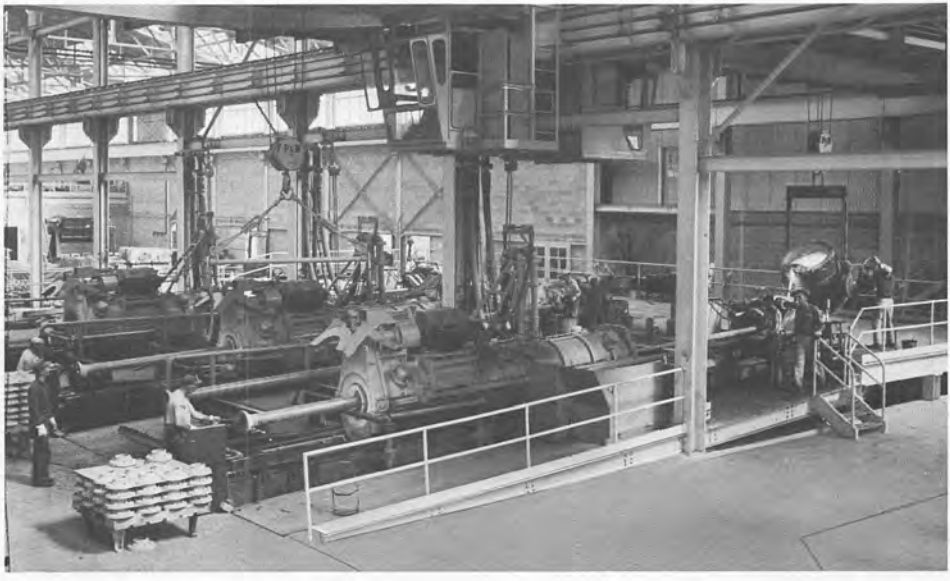
2. Pipe being formed—cast half complete.



3. Cast completed—pipe in the mold.



4. Pipe removed from mold—cycle complete.



THE MANUFACTURE OF CLOW CAST IRON PIPE

Clow cast iron pipe is cast centrifugally in water cooled metal molds, a method which rigidly controls the outside diameter, yet permits the thickness of the pipe wall to be varied to meet individual job requirements. The casting machine consists of a cylindrical metal mold mounted on rollers in a water jacket so that it can be rotated at comparatively high speeds. The water jacket is mounted on wheels so that the entire assembly can be moved by means of a hydraulic cylinder on a fixed bed inclined slightly to the horizontal. The molten iron is fed into the mold through a trough similarly inclined. The trough has a spout on its lower end which is curved toward the sidewall of the mold. Molten iron is supplied to the trough by a casting ladle of sufficient capacity to make one pipe. In casting, the ladle is tilted at a uniform rate by an electrically operated tilting mechanism thus maintaining a constant uniform pouring rate. In forming the inside contour of the pipe bell, a sand core is inserted into the bell end of the mold. This is done when the mold or machine is at the lower end of the fixed bed. Following that operation the machine is moved to the upper portion of the fixed bed.

When the machine is at the extreme upper end of the fixed bed, it is ready for casting, at which time the stationary trough extends into the barrel of the mold for nearly its full length. After the casting ladle has been filled by a transfer ladle from the cupola, the machine operator, stationed at the bell end of the machine, by means of push-button control, brings the mold up to speed and actuates the mechanism controlling the tilting of the ladle. After the iron has filled the bell space the mold is started down the bed of the machine. The stream of iron discharged from the spout flows onto the surface of the mold, where it is held in place by centrifugal force and forms a homogeneous pipe with a perfectly cylindrical bore. The hydraulic cylinder is supplied with a regulated amount of water at a constant pressure which results in uniform longitudinal movement of the mold. Since the pouring rate of the casting ladle and the amount of water supplied to the hydraulic cylinder can be regulated easily and accurately, the wall thickness of the pipe is held within desired tolerances.

After the pipe is completely cast, the mold is kept rotating at its original speed until the pipe has cooled to approximately 1500° F. The pipe is then taken from the machine, transferred to and travels through a closely regulated heat treating furnace where it reaches a maximum temperature of 1720° F. and is slowly cooled below 1200° F. before leaving the furnace.

Following removal of each pipe from the casting machine, the mold is cleaned and is then ready for the casting of another pipe. The entire casting operation requires from 1½ to 8 minutes depending upon the diameter and the thickness of the pipe.

GENERAL INFORMATION ABOUT DUCTILE CAST IRON PIPE

DUCTILE cast iron pipe, a product of advanced metallurgy, offers unique and desirable properties for water, gas and other piping uses. It combines the physical strength of mild steel with the long life of gray cast iron, and has the ability to bend under stress.

The extra strength and toughness of ductile cast iron offers the greatest possible margin of safety against service failures due to ground movement and beam stresses. Virtually unbreakable in ordinary service, it also provides vastly increased resistance to breakage caused by rough handling in shipping and installation.

The corrosion resistance of ductile iron pipe has been proved in a wide variety of accelerated tests to be at least the equal of gray (conventional) cast iron. It is accepted as such by water and other authorities, who have standardized on ductile pipe for their underground systems. The design of ductile pipe adds to calculated thickness the same corrosion thickness allowance used in gray cast iron pipe design, and accordingly offers the user the same long life expectancy.

Clow ductile cast iron pipe is a premium product which greatly increases the operating economies for installations where long service life, low maintenance cost and resistance to breakage from any cause are important factors.

Because of its inherent benefits, the use of ductile iron pipe has been increasing at a rapid rate, and is being specified at an accelerating pace for underground water, gas and other installations.

Clow ductile pipe is manufactured in accordance with ANSI Specifications ANSI A21.51, for Water and Other Fluids, and ANSI A21.52, for Gas. Wall thickness is determined in accordance with ANSI A21.50 (AWWA C150), outlined on page 15.

DUCTILITY

Ductile iron derives its name from its ductility or bending ability, which is indicated in its specified elongation. The ductility in Clow pipe is shown in the illustration at right, showing a ring section of 12″ pipe after a crushing test has been made, and indicates the great resistance to crushing or beam loads that this pipe can withstand in service.

Ring section cut from 12-inch ductile pipe, which has been squeezed under hydraulic pressure to show how metal bends without breaking.

Metallurgy of Ductile Iron Pipe

Ductile iron is produced by adding a closely controlled amount of magnesium alloy to a molten iron of unusually low phosphorous and low sulfur content. The magnesium alloy addition to such a base iron produces a startling change in the microstructure by causing the carbon in the iron to assume a spheroidal or nodular shape, (as contrasted to the flake form of graphite in regular cast iron), and at the same time producing a finer grained iron matrix in the surrounding ferrite structure. As a result of this remarkable change in microstructure, a far stronger, tougher, and ductile material is obtained.

Photomicrograph of ductile iron in pipe at 100X magnification, showing carbon in the form of nodules or spherulites.

Physical Properties of Ductile Cast Iron Pipe and Fittings

Properties of ductile iron are defined and specified in terms of minimum tensile strength, minimum yield strength, and minimum elongation. As shown in the table below, this means that the metal in pipe must have a *minimum* tensile strength of 60,000 psi, a *minimum* yield strength of 42,000 psi, and a *minimum* elongation of 10%. These acceptance values are proved by testing specimens cut directly from the wall of the cast pipe. Notched Charpy Impact Tests are also specified and used to prove impact resistance properties. Ductile iron fittings are produced with 70-50-05 metal in accordance with ANSI A21.10.

Physical Properties of Pipe and Fittings

Physical Properties	Minimum Tensile Strength	Minimum Yield Strength	Minimum Elongation
Pipe	60,000 psi	42,000 psi	10%
Fittings	70,000 psi	50,000 psi	5%

DUCTILE CAST IRON PIPE

INFORMATION ABOUT WALL THICKNESS DESIGN

Ductile iron pipe wall thickness is determined according to the American Standard for the Thickness Design of Ductile Iron Pipe ANSI A21.50 (AWWA C150). As explained in this Standard, the method of design is based on flexible pipe principles as opposed to the rigid pipe principles which apply to gray iron pipe. Whereas in gray iron pipe (ANSI Standard A21.1 [AWWA C101]) external earth load and internal pressure work in *combination* against the pipe, in ductile iron pipe, the external load is *counteracted* by internal pressure. In other words, if empty ductile iron pipe is deflected by earth load, it is re-rounded by the introduction of internal pressure. Furthermore, the design principles applicable to a flexible pipe recognize the support provided by the soil surrounding such a pipe. Such support is not present with rigid piping materials.

The procedure for the thickness design of ductile iron pipe is to calculate the thickness required for the earth load at the depth of cover indicated, including an allowance for trucks passing over the pipe. To this is applied a factor of safety of 2.5. Then a check is made by the standard hoop formula to determine if this thickness is adequate for the internal pressure required. Only in the case of a very shallow depth of cover and an excessive pressure would it be necessary to increase the thickness determined by external load alone.

To this thickness is added a corrosion allowance of .08" and the specified foundry tolerance to determine total calculated thickness.

In order to save time and simplify the procedure, calculations have been made for the most common conditions and published in tables in A21.50.

In specifying and ordering pipe, the total calculated thickness is used to select one of the standard class thicknesses. The standard thickness *nearest* the calculated value is selected. When calculated thickness is halfway between two classes, select the heavier class. When calculated thickness is less than halfway, select the lighter class. When calculated thickness is less than the minimum standard thickness, select the minimum standard thickness. When pipe is to be tapped for service connections, consult Appendix table of ANSI A21.51 (AWWA C151), or see page 220.

The thickness values in the A21.50 tables limit the maximum deflection of the pipe to 2%. Experimentation has proved that it would take more than 3% deflection to impair the cement lining of cement lined ductile iron pipe.

For job conditions different from these most common ones, the thickness must be calculated according to the principles of flexible pipe design. We will be glad to assist in doing this on request.

See page 221 for standard thickness selection table for varying depths of trench, laying conditions, and rated working pressure.

STANDARD THICKNESS CLASSES

ANSI A21.50—AWWA C150

Wall Thickness in Inches

Nominal Diameter Inches	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
3	...	0.28	0.31	0.34	0.37	0.40
4	...	0.29	0.32	0.35	0.38	0.41
6	...	0.31	0.34	0.37	0.40	0.43
8	...	0.33	0.36	0.39	0.42	0.45
10	...	0.35	0.38	0.41	0.44	0.47
12	...	0.37	0.40	0.43	0.46	0.49
14	0.36	0.39	0.42	0.45	0.48	0.51
16	0.37	0.40	0.43	0.46	0.49	0.52
18	0.38	0.41	0.44	0.47	0.50	0.53
20	0.39	0.42	0.45	0.48	0.51	0.54
24	0.41	0.44	0.47	0.50	0.53	0.56

EVOLUTION OF CAST IRON PIPE & FITTINGS SPECIFICATIONS

PRIOR to 1902, there were no standard specifications for cast iron pipe in this country. Before that time, pipe was furnished to individual consumer specifications, or to manufacturer's specifications.

The first widely accepted specifications were those adopted by the American Water Works Association in 1908. These covered pit cast water pipe, and fittings, and were preceded by specifications of the New England Waterworks Association in 1902, and by those of the American Society for Testing Materials in 1904.

Separate specifications for pit cast iron pipe and fittings for gas were adopted by the American Gas Institute in 1911, and were revised and reissued by the American Gas Association in 1929.

In 1927, Federal Specifications FS-537 were issued covering cast iron water pipe, centrifugally cast. These specifications were superseded by Federal Specifications WW-P-421 in 1931.

In 1926, Committee A21 of the American Standards Association was formed to prepare new standard specifications for cast iron pipe under the sponsorship of the AGA, ASTM, AWWA, and NEWWA. Participating in this work were representatives of sponsors, consumers, producers, and consulting engineers. This Committee studied the factors influencing the design of cast iron pipe, evaluating the best available knowledge of ground stresses, the actual up-to-date record of pipe service experience, and advances made in manufacturing and metallurgy.

The result of this comprehensive, scientific study was the issue in 1939 of ASA A21.1, "Manual for the Computation of Strength and Thickness of Cast Iron Pipe." This manual recognizes in pipe design the effect of trench loads, water hammer, corrosion, and safety factors, as well as internal pressure, and represents the best knowledge that could be applied to cast iron pipe design. Specification ASA A21.1 was the basis for the several specifications which in 1952 and 1953 were first issued by the American Standards Association and adopted by its sponsoring bodies.

In 1955, the Federal Specifications Board issued a revised WW-P-421 specification, WW-P-421a, which was later superseded by WW-P-421b and WW-P-421c. Weights, thicknesses and dimensions of pipe in this specification conform to the appropriate provisions of ANSI specifications.

In 1965, ASA A21.50 (AWWA Manual H3) was adopted, covering ductile cast iron pipe design, along with ASA A21.51 (AWWA C151) Ductile Cast Iron Pipe for Water, and ASA A21.52, Ductile Cast Iron Pipe for Gas.

In 1968, A21.14, "Gray Iron and Ductile Iron Fittings for Gas," was adopted by the standards association.

In 1969, the standards association changed its name to American National Standards Institute, Inc. It also changed the designation of its standards to "American National Standard," abbreviated ANSI for the identification of documents: as ANSI A21.11.

Our cast iron pipe and fittings conform to the latest revisions of the following ANSI specifications listed on page 17.

In 1972, the Standards Institute adopted A.21.5 (AWWA C105), "Polyethylene Encasement for Gray and Ductile Cast Iron Piping for Water and Other Liquids."

For information, selected parts of some specifications have been reproduced in the Addenda Section of this catalog and complete copies of such specifications will be furnished on request. It is our policy, however, in the absence of customer specifications to the contrary, to furnish cast iron pipe and fittings conforming with the latest revision of the specification which applies.

Important specification data is detailed on pages 212-221

CAST IRON
PIPE & FITTINGS
SPECIFICATIONS

ANSI specifications are sponsored by
American Gas Association
American Water Works Association
New England Water Works Association

For detailed information on specifications, see pages 210-222

AMERICAN NATIONAL STANDARDS INSTITUTE
AMERICAN WATER WORKS ASSOCIATION
AND FEDERAL SPECIFICATIONS

ANSI Spec. A21.1/AWWA Spec. C101:
Thickness Design of Cast Iron Pipe.

ANSI Spec. A21.4/AWWA Spec. C104:
Cement Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water.

ANSI Spec. A21.5 (AWWA C105):
Polyethylene Encasement for Gray and Ductile Cast Iron Piping for Water and Other Liquids.

ANSI Spec. A21.6/AWWA Spec. C106:
Cast Iron Pipe Centrifugally Cast in Metal Molds, for Water or Other Liquids.

ANSI Spec. A21.10/AWWA Spec. C110:
Cast Iron and Ductile Iron Fittings, 2″ through 48″, for Water and Other Liquids.

ANSI Spec. A21.11/AWWA Spec. C111:
Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings.

ANSI Spec. A21.14:
Gray Iron and Ductile Iron Fittings 3″ thru 24″ for Gas.

ANSI Spec. A21.50/AWWA Spec. C150:
Thickness Design of Ductile Iron Pipe.

ANSI Spec. A21.51/AWWA Spec. C151:
Ductile Iron Pipe, Centrifugally Cast, in Metal Molds or Sand Lined Molds, for Water or Other Liquids.

ANSI Spec. A21.52:
Ductile Iron Pipe, Centrifugally Cast, in Metal Molds or Sand Lined Molds, for Gas.

ANSI Spec. B16.1:
Cast Iron Pipe Flanges and Flanged Fittings, Class 125.

Federal Specification WW-P-421c:
Pipe, Cast Gray and Ductile Iron, Pressure (For Water or Other Liquids), 3″ thru 24″.

TERMS AND CONDITIONS

1. All orders are subject to approval and acceptance by Clow's Sales Department.

2. *Acceptance of orders, whether oral or written, is based on the express condition that Buyer agrees to all of the terms and conditions contained herein. Acceptance of delivery by Buyer will constitute Buyer's assent to these terms and conditions. These terms and conditions represent the complete agreement of the parties, and no terms or conditions in any way adding to, modifying or otherwise changing the provisions stated herein shall bind Clow unless made in writing and signed and approved by an officer or other authorized person at the home office of Clow or at the main office of one of Clow's divisions. No modification of any of these terms will be effected by Clow's shipment of goods following receipt of Buyer's purchase order, shipping request or similar forms containing printed terms and conditions conflicting or inconsistent with the terms herein.*

3. Unless otherwise stated herein, all prices are F.O.B. point of manufacture and are subject to adjustment, without notice, to Clow's prices in effect at the time of shipment. Any increase in transportation rates or any changes in routing resulting in an increase in transportation costs shall be paid and borne by Buyer.

4. Terms are NET 30 days. A service charge of 1½% per month will be added to all past due accounts.

5. Clow shall not be liable for delays in shipment or default in delivery for any cause beyond Clow's reasonable control including, but not limited to, government action, shortage of labor, raw material, production or transportation facilities, labor difficulty involving employees of Clow or others, fire, flood or other casualty. In the event of any delay in Clow's performance due in whole or in part to any cause beyond Clow's reasonable control, Clow shall have such additional time for performance as may be reasonably necessary under the circumstances. Acceptance by Buyer of any goods shall constitute a waiver by Buyer of any claim for damages on account of any delay in delivery of such goods.

6. All taxes and excises of any nature whatsoever now or hereafter levied by governmental authority upon the sale or transportation of any goods covered hereby shall be paid and borne by Buyer.

7. Delivery of goods by Clow to carrier shall be deemed delivery to Buyer and thereupon title to such goods, and risk of loss or damage, shall be Buyer's. Any claim by Buyer against Clow for shortage or damage occurring prior to such delivery must be made in writing within five (5) days after receipt of shipment and accompanied by original transportation bill signed by carrier noting that carrier received goods from Clow in the condition claimed.

8. All goods sold by Clow are warranted to be free from defects in material and workmanship. THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES NOT EXPRESSLY SET FORTH HEREIN, WHETHER EXPRESS OR IMPLIED BY OPERATION OF LAW OR OTHERWISE, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS.

Clow shall not be liable for incidental or consequential losses, damages or expenses, directly or indirectly arising from the sale, handling or use of the goods, or from any other cause relating thereto, and Clows liability hereunder in any case is expressly limited to the replacement (in the form originally shipped) of goods not complying with this agreement, or, at Clow's election, to the repayment of, or crediting Buyer with, an amount equal to the purchase price of such goods, whether such claims are for breach of warranty or negligence.

Any claim by Buyer with reference to the goods sold hereunder for any cause shall be deemed waived by the Buyer unless submitted to Clow in writing within thirty (30) days from the date Buyer discovered, or should have discovered, any claimed breach.

9. Clow reserves the right to require payment for any shipment hereunder in advance, or satisfactory security, if the financial responsibility of Buyer becomes unsatisfactory to Clow. If Buyer fails to make payment in accordance with the terms of this agreement, or fails to comply with any provision hereof, Clow may, at its option, (and in addition to other remedies) cancel any unshipped portion of this order, Buyer to remain liable for all unpaid accounts.

10. Delivery by truck will be made to nearest points reasonably accessible by truck as determined by the driver. Buyer will furnish and pay for necessary labor to unload and store goods. Buyer shall note loss or damage on truck shipments upon delivery ticket returned to Clow.

11. Goods cannot be returned, and orders once accepted cannot be cancelled, without Clow's prior written consent.

12. Waiver by Clow of any breach of these terms and conditions shall not be construed as a waiver of any other breach, and failure to exercise any right arising from any default hereunder shall not be deemed a waiver of such right which may be exercised at any subsequent time.

CHANGES IN STANDARDS

The constant advancement of our industry will, from time to time, permit us to make improvements in the product. The details of illustrations, specifications and measurements shown in this catalog are correct as of the date of publication. We reserve the right, however, to make any changes which in our opinion will improve the product and will make every effort to furnish any material ordered from this catalog in accordance with the standards current at the time the order is filled.

WHEN ORDERING OR REQUESTING QUOTATIONS

Figure Numbers

Wherever possible designate pipe, fittings and other material by Pipe Economy Figure Numbers. Use of Figure Numbers avoids all confusion as to what is wanted, and will help us to submit quotations and fill orders accurately and promptly.

Destination and Method of Shipment: Freight is an important part of the cost of material, and it is important that we know if quantities to be quoted are truckload or less than truckload, and we must know the destination. If shipment is wanted by rail we should be so advised. We should be advised also if partial shipments must be made comprising less than carload, or less than truckload quantities.

Length and Types of Pipe: Give the number of feet of each pipe size required: pipe are made in nominal 18-foot lengths but can measure over 18 feet. The actual length is used in computing footage and for pricing. State type of joint: Super Bell-Tite, Mechanical Joint, Flanged, etc. Unless otherwise specified, we will always ship plain rubber gaskets for Super Bell-Tite and Mechanical Joint pipe.

Class of Pipe: When ordering, refer to ANSI thickness class (gray iron Class 22, Class 23, etc. or ductile iron Class 1, Class 2, etc.). If you specify pipe by pressure class, also state the depth of trench and laying condition.

Interior and Exterior Coatings: Unless otherwise specified, Super Bell-Tite and Mechanical Joint pipe will be furnished with standard cement lining inside and tar-coating out and other types of pipe and all fittings will be furnished tar-coated inside and out; however, cement lined Flanged pipe may be substituted in lieu of tar-coated without prior notification.

Cut Pipe: If shorter than nominal 18-foot length Super Bell-Tite or Mechanical Joint pipe is required, give exact *laying* length. This pipe will be furnished laying length unless specifically ordered overall length. While the standard laying length for Flanged, F. & P E., or F. & B. pipe is 17'-0", we can furnish any shorter lengths as required.

Field Cuts: If 14" and larger diameter *ductile* pipe must be cut in the field, specify the number or percentage of pipe on the order. Such pipe will be gaged full length and marked with a blue stripe running the length of the barrel.

Flanges: Unless otherwise specified, all flanges will be faced and drilled to 125 pound template as specified in ANSI B16.1. Flanges ordered tapped for studs, unless specified otherwise, will be tapped to 125 pound template. Note that in standard drilling, bolt holes straddle the centerline. Where special drilling is required, furnish sketch specifying bolt circle, and number and size of bolt holes.

Tapped Pipe and Fittings: Unless otherwise specified, tapped pipe and fittings will be tapped for iron pipe size pipe, and tapped directly into the body of the pipe or fittings. If the size of tap in a fitting requires a boss, the boss will be cast on or welded on at our option. Taps are located on the centerline straddling bolt holes unless specified otherwise.

For Ordering Information on Fire Hydrants and Valves, see pages 139 and 157.

UNDERWRITERS LABORATORIES, INC. LISTING

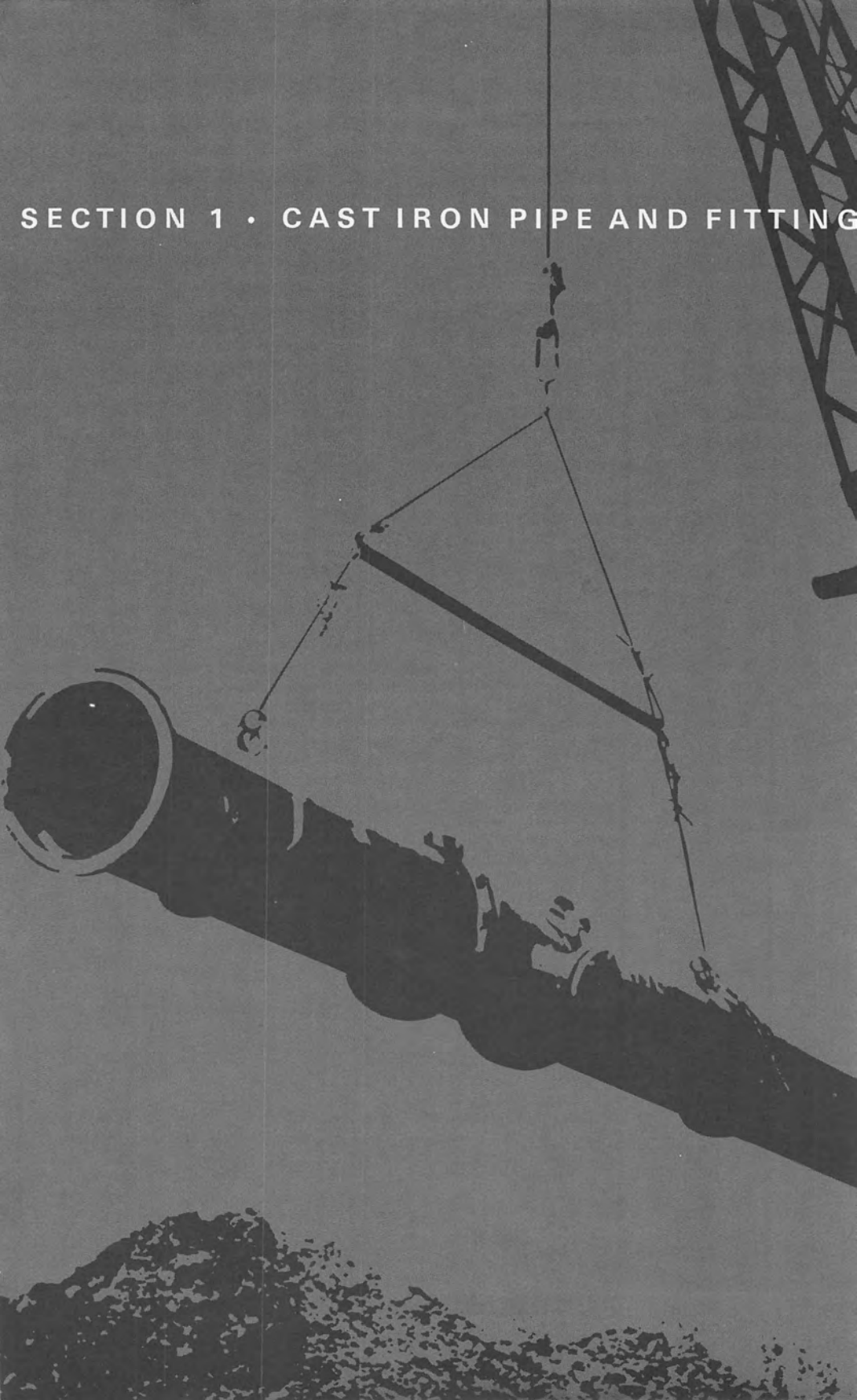
Clow Gray Cast Iron and Ductile Cast Iron Pipe with Push-On, Mechanical, and/or Flanged Joint is Underwriters Laboratories, Inc. listed in all diameters 3" through 24" in *all* standard thickness classes of specifications ANSI A21.6 (AWWA C106), ANSI A21.51 (AWWA C151) and Federal Specifications WW-P-421c, including tar coated, uncoated or cement mortar lined.

3" thru 12" gray cast iron pipe with plain ends in steel pipe sizes is listed for above ground service not exceeding 150 psi.

Clow ANSI A21.10 (AWWA C110) and ANSI B16.1 bends, tees, crosses and reducers with Push-On, Mechanical, and/or Flanged Joints are Underwriters listed in all sizes 3" through 12" for water working pressures not exceeding 250 psi.

For Underwriters listed gate valves, indicator posts, check valves, and hydrants see pages 162, 163 and 164.

SECTION 1 · CAST IRON PIPE AND FITTING



SECTION 1 · CAST IRON PIPE AND FITTINGS

CLOW CAST IRON PIPE

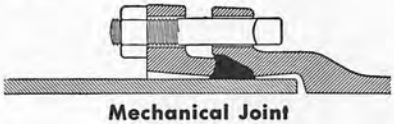
A Joint for Every Service Requirement

SUPER BELL-TITE PUSH-ON JOINT

Super Bell-Tite® Push-On Joint

The Super Bell-Tite Push-On joint is a rubber ring gasket, compression type joint, used for water, sewage and other liquids. This is an economical joint because a rubber gasket is the only accessory required to make a pressure-tight seal; and the ease of assembly saves time and cost of installation. Small diameters can be assembled manually; larger diameters usually require a mechanical assist. See pages 27-35.

MECHANICAL JOINT



Mechanical Joint

A time-saving, easy-to-install mechanical joint used extensively for underground water, sewage, and gas lines, and for conveying liquids and semi-solids, both outside and inside of buildings. Both Mechanical joint pipe and fittings are shipped complete with required joint accessories, including gland, gasket, bolts and nuts. See pages 36 thru 54 for pipe and fittings. For Locked Mechanical Joint Pipe, see page 92.

SUPER-LOCK JOINT

Super-Lock Joint

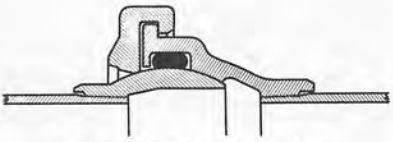
Super-Lock Joint is a Super Bell-Tite Push-On Joint with a lock ring welded onto the plain end, and a retainer which mates with lugs cast onto the Super Bell-Tite bell. The joint provides a positive means of restraining Super Bell-Tite pipe, yet makes up easily and can be deflected after assembly. Available only in ductile cast iron, it is furnished in any weight or thickness class. See pages 86-88 for details.

CLOW CAST IRON PIPE

A Joint for Every Service Requirement

JOINTS FOR SPECIAL SERVICES

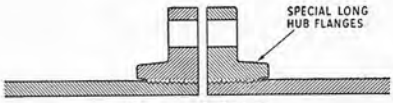
RIVER CROSSING JOINT



River Crossing Joint

Clow River Crossing Joint is designed especially for river crossing and submerged piping and for pipe lines requiring up to 15° joint deflection. Easy, boltless joint assembly make this pipe ideal for such purposes. The joint provides a maximum 15° free turning deflection with no reduction in the internal opening area at any deflection. Pipe and components are all high tensile corrosion-resistant *ductile* cast iron. Details appear on pages 55 thru 59.

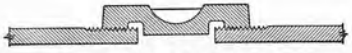
FLANGED JOINT



Flanged Joint

Flanged joint cast iron pipe is widely used for exposed piping inside and outside of buildings for conveying water, sewage, sludge and other liquids corrosive to steel but not to cast iron. It is also used for low pressure air, steam, oil, gas and other services. A complete line of flanged fittings for use with this pipe is shown on pages 65 thru 82. Bolts, studs, and gaskets for assembly can also be furnished. Pipe details on pages 60-63.

THREADED I.P.S. JOINT



Threaded I.P.S. Joint

Cast iron I.P.S. (Iron Pipe Size) Pipe is cast to the same outside diameter as steel pipe, and is used for plumbing and drainage services, such as downspouts, waste and vent lines. The pipe is used with regular screwed, drainage and soil fittings, and can be cut, threaded and fitted on the job with the ordinary tools of the piping trade. Pipe of the same O. D. is also furnished with an integral hub for calked or push-on joint. Details appear on page 84.

CEMENT LINED CAST IRON PIPE AND FITTINGS

In certain sections of our country, water distribution systems carry a soft water which may affect the inside surface of cast iron pipe and fittings, by causing a type of incrustation known as tuberculation. Fortunately, waters which so affect cast iron pipe lines are in the minority, and where they do exist, cement lined piping is recommended. Clow plants produce this product in accordance with specification ANSI A21.4 (AWWA C104) and/or Federal Specification WW-P-421c.

Photograph of a cement lined cast iron pipe (without seal coating) that has been cut and tapped, showing how the cement lining does not spall off in either operation.

Although the lining actually affects a slight reduction in the inside diameter of the pipe, the increase in the flow coefficient is sufficient to more than offset this reduction in diameter; that is, lined piping will carry as much water as new unlined cast iron pipe without extra pumping cost and with no increase in friction loss. The lining operation is briefly described below.

A mixture of Portland cement and sand, graded and mixed with water according to the specification is fed through a tube and discharged at a uniform rate upon the inner wall of the revolving pipe. A trowel on the discharge end of the tube spreads the cement upon the wall as the pipe revolves and as the tube moves endways, thus distributing the cement uniformly over the inside of the pipe. The thickness of the lining is gauged by the volume of cement discharged from the tube, and the travel speed of the tube.

The rotational speed of the pipe is high enough to generate considerable centrifugal force which, combined with the vibration of the pipe, thoroughly compacts the lining, drives out any entrained air, and removes excess water to the inner surface where it drains away, leaving a dense lining with a smooth finish.

Immediately following the lining operation, a bituminous seal coat is, unless otherwise specified, sprayed on the lining surface. The seal coat adheres tightly to the damp cement lining and by preventing a rapid loss of moisture, insures the proper cure of the cement mortar. After curing, the pipe is ready for use. It can be tapped and cut in the same manner as unlined pipe.

The single caution necessary is in loading or unloading pipe where grappling hooks are inserted inside the pipe. Such hooks may injure the lining, and should have a somewhat broad rounded surface that spreads the bearing to more than two square inches of the cement surface. An additional precaution is to cover the hook ends with pieces of rubber tubing.

Fittings are cement-lined to the same thickness as in pipe. We offer a full line of cement-lined fittings for use with cement-lined pipe.

CEMENT = 160#/CF

Thicknesses and Weights of Linings

Nom. Pipe Size Inches	Standard Cement Lining		Double Cement Lining*	
	Thickness	Weight Per Ft.	Thickness	Weight Per Ft.
3	1/16"	0.7 lbs.	1/8"	1.4 lbs.
4	1/16	0.9	1/8	1.7
6	1/16	1.3	1/8	2.6
8	1/16	1.8	1/8	3.5
10	1/16	2.2	1/8	4.4
12	1/16	2.6	1/8	5.2
14	3/32	4.6	3/16	9.2
16	3/32	5.3	3/16	10.5
18	3/32	5.9	3/16	11.8
20	3/32	6.6	3/16	13.1
24	3/32	7.9	3/16	15.8

* Available on special order.

Above weights are based on Class 2 ductile pipe in sizes 3"–12" and Class 1 pipe in sizes 14"–24".

POLYETHYLENE ENCASEMENT FOR CAST IRON PIPE IN CORROSIVE SOILS

Meets all Requirements of Specifications ANSI 21.5 (AWWA C105)

F-191 Polyethylene Tube

Recommended Polyethylene Flat Tube Width by Pipe Size

Flat Tube Width Inches	For Pipe Sizes—Inches	
	Super Bell-Tite and Mechanical Joint	Super-Lock Joint
20	3–6	.....
30	8–12	6–10
41	14–18	12–16
54	20 & 24	18–24

Polyethylene encasement is a proven method of protecting cast iron and ductile iron pipe in areas of severely corrosive soil. The protection is provided by isolating the pipe from the corrosive environment. A completely air and water-tight enclosure is not necessary.

The dielectric capability of polyethylene also provides shielding against stray direct current at most levels encountered in the field.

Eight (8) mil thick polyethylene tube is furnished in the flat tube widths listed above.

More detailed information on polyethylene encasement is available upon request. Both material and installation procedures are specified in ANSI A21.5 and AWWA C105.

Installation on Pipe

1. Pick up the pipe with a sling or pipe tongs. Slip a polyethylene tube which is approximately two feet longer than the pipe over the plain end and leave it bunched up accordian style.

2. Lower the pipe into the trench and make up the joint with the preceding pipe. *Shallow bell holes are required to allow overlap of the tube at the joints.*

3. Remove the sling or tong from the center of the pipe, raise the bell a few inches and slip the polyethylene tube along the pipe barrel, leaving approximately one foot of the tube bunched up at each end of the pipe for wrapping the joints.

4. Overlap each joint by first pulling one bunched-up tube over the bell, folding it around the adjacent plain end, and securing it in place with two or three wraps of the polyethylene adhesive tape. Complete the overlap by repeating the same procedure with the bunched-up tube on the adjacent pipe.

5. Take up the slack tube along the pipe barrel by folding it over the top of the pipe holding the fold in place with polyethylene adhesive tape.

6. Repair any rips, punctures or other damage to the polyethylene with tape or by cutting open a short length of tube, wrapping it around the pipe and securing with tape.

Installation on Fittings, Valves and Piping Specialties

Fit bends, reducers and offsets with polyethylene tube in the same manner described above for pipe.

Wrap valves, tees, crosses and specialty items with a flat sheet obtained by splitting open a length of polyethylene tube. Pass the sheet under the valve or fitting and bring it up around the body. Join the seams by bringing the edges together, folding over twice and securing in place with tape.

Handle slack tube and overlapping at joints in the same manner described above for pipe.

Prepare openings for service taps, air reliefs, etc., by making an X-shaped cut in the polyethylene and temporarily folding back the edges. After installation is completed, replace the polyethylene and repair the cut with polyethylene adhesive tape.

Backfilling

While special backfilling procedures and materials are not necessary, care should be taken not to damage the polyethylene.

Initial backfill material should be free of rocks and debris which could puncture the polyethylene. If suitable backfill material is not available, felt roofing or similar material can be laid over the top of the pipe to protect the polyethylene.

In general, backfilling should be done in accordance with AWWA Standard C-600.

How to Determine Tube Footage

Polyethylene tube is furnished in 20 foot lengths to provide overlap of the tubes at the joints on standard 18 foot length pipe.

To determine the length of polyethylene tube required, divide the required pipe footage by 18 and multiply the resultant number by 20.

How to Order

Polyethylene tube should be ordered by tube footage, pipe size and type of pipe (Super Bell-Tite, Mechanical Joint, or Super-Lock). The footage of pipe requiring polyethylene encasement should also be indicated.

Example: 2000 ft.—F-191 Polyethylene Tube for 1800 ft. of 8″ Super Bell-Tite Pipe.

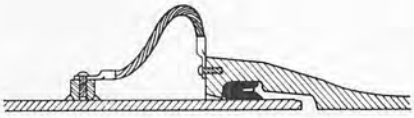
Additional tube should be ordered by footage as required for fittings, valves and hydrants.

Polyethylene Adhesive Tape (1½″ x 8 mil in 100 ft. rolls) is required for closure.

PROVISION FOR ELECTRICAL THAWING

All rubber gasket joints require an additional device in order to provide electrical conductivity from one pipe to another for the purpose of thawing in cold climates. The accessories and methods indicated below provide such conductivity in both Mechanical Joint and Super Bell-Tite Push-On Joint pipe lines, and have been used successfully in a wide variety of installations.

CABLE BOND CONDUCTOR



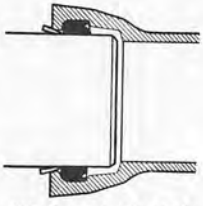
Assembled Installation, Super Bell-Tite Joint

Clow Cable Bond provides positive electrical conductivity across the joints of both Super Bell-Tite and Mechanical Joint pipe and fittings. The copper cable will carry 500-600 amps for an extended period of time. The cable is sufficiently flexible to simplify assembly and to withstand ground and pipe movement after installation. Easy to install, it makes a positive, lasting connection. Detailed information and assembly instructions will be furnished upon request.

SERRATED SILICON BRONZE WEDGES
for Super Bell-Tite Joint

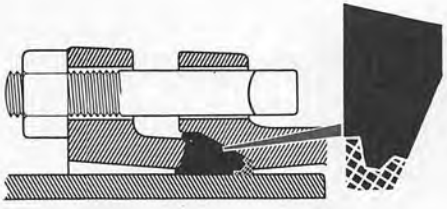
F-175
Serrated Wedge

When so specified, serrated silicon bronze wedges are provided for electrical thawing: two per joint, for 3″ through 12″ pipe; four for larger diameter pipe. Each wedge is driven into the opening between the plain end and the bell until snug. When four wedges are used, they are inserted side by side, in pairs. Wedges can be used with Super Bell-Tite joints only.



Wedges Installed

LEAD-TIPPED GASKETS FOR MECHANICAL JOINT



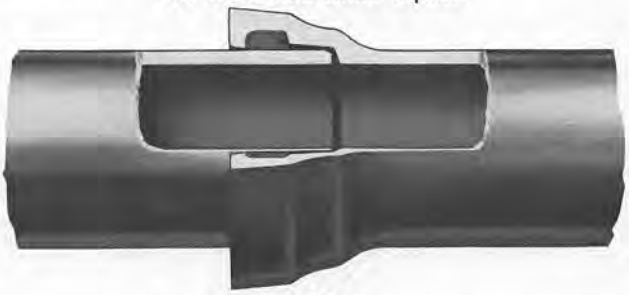
Lead-tipped Mechanical Joint gaskets can be furnished with standardized M. J. pipe and fittings to provide electrical conductivity for thawing.

Such gaskets can be used in lieu of Cable Bond when Mechanical Joint fittings are utilized with cable bonded Super Bell-Tite pipe.

Gasket details are shown on page 41.

SUPER BELL-TITE® PUSH-ON JOINT CAST IRON PIPE

For Water and Other Liquids



F-172

The Super Bell-Tite Push-On Joint is a compression type joint, whose only accessory is a molded rubber gasket. Fitted into the gasket recess of the bell, the gasket forms a pressure-tight seal with ample deflection when compressed in position by the entering plain end of pipe. Super Bell-Tite Joint pipe is recommended for hydraulic pressures only, and can be provided with copper cable bonds for electrical thawing when required.

Assembly of the joint is simple, easy and fast. Pipe can be laid as fast as a shallow trench can be opened; and the speed of installation contributes greatly to the lower cost of a total pipe line installation.

Plain ends of this pipe must be beveled to facilitate assembly.

The joint meets all applicable requirements of ANSI A2.11 (AWWA C111) Specifications, and of Federal Specifications WW-P-421c. The joint also meets the requirements of the Underwriters Laboratories, Inc. and Associated Factory Mutual Companies for 350 psi water working pressure.

Super Bell-Tite pipe and fittings are shipped complete with gaskets and joint lubricant in quantities indicated on page 28. For joint assembly instructions, see pages 28 and 29.

THE GASKET

F-173
Super Bell-Tite Push-On Gasket

A single rubber gasket is the only accessory required to assemble a Super Bell-Tite joint. The gasket is of heavy section and has recesses in one side as pictured here. It forms a pressure-tight seal when fitted into the bell recess and compressed by the entering plain end of a pipe.

Regularly furnished gaskets are synthetic rubber suitable for use with both water and sanitary sewage.

LUBRICANT

Super Bell-Tite lubricant used to facilitate assembly is non-toxic, odorless, tasteless and will not support bacteria. *Do not substitute other material for this use.*

See the table on page 28 for approximate lubricant usage by pipe size.

F-174
Super Bell-Tite Push-On Lubricant

THE STRIPE

Cutaway of the joint completely assembled, showing the stripe no longer visible.

Each length of Super Bell-Tite Push-On pipe has painted on the plain end a circular stripe. This stripe serves as a guide line in making up the joint, to provide a fast, positive visual check as to when the joint is assembled. The joint is made up and pressure tight when the stripe is no longer visible.

WHEN ORDERING

The actual laying lengths of Super Bell-Tite Push-On pipe vary depending upon the pipe size. We compute footage based on actual lengths and *our invoice will cover the actual footage shipped.* See page 19 for Ordering Information.

Note: See page 222 for Super Bell-Tite joint deflection.

SUPER BELL-TITE® PUSH-ON JOINT CAST IRON PIPE

HOW THE JOINT IS ASSEMBLED

A step-by-step procedure for assembling the Super Bell-Tite joint is described and illustrated on the following page. The information given below is of a supplementary and explanatory nature.

BELL CLEANING

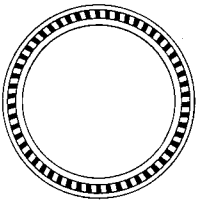
It is essential that the gasket groove be clean and free of foreign matter prior to lubrication and gasket installation. Dirt and sand can normally be wiped out with a cloth. Wet sand, mud and ice may occur at the top or side as well as bottom of the bell—requiring the use of a scraping tool, wire brush or flushing with water

BELL LUBRICATION

The cleaned gasket groove should be lubricated to make gasket installation easier and to assist in the proper positioning of the gasket.

THE GASKET

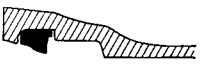
Super Bell-Tite gaskets have recesses in one side as pictured here. Only Super Bell-Tite gaskets can be used. They are not interchangeable with any other gasket. When installing the gasket, the side with recesses must face into the pipe and away from the installer. It is important that the gasket be clean before use.



GASKETING

The gasket must be correctly positioned in the gasket groove. An incorrectly positioned gasket may be torn or jammed by an entering plain end. The gasket will easily slip into its correct position if the bell groove has been lubricated. Check with fingers to be sure of correct placement.

Incorrect



Correct

JOINING

Super Bell-Tite lubricant must be applied to the installed gasket to reduce friction and avoid gasket damage during joint assembly. To assure complete coverage, lubricant may also be applied to the bevel of the plain end. The joint should be assembled with pipe in reasonably straight alignment. Attempting to assemble the joint at a severe angle will cause damage to the gasket.

FIELD CUT PIPE

The outside edge on cut pipe must be beveled and smoothed as any sharp corner may cause gasket damage. A portable grinder is suggested for beveling cut pipe. Straight alignment is especially important when assembling field cut pipe.

COLD WEATHER INSTALLATION

It is more difficult to position the gasket and assemble the joint in cold weather because of the stiffness of cold rubber. For ease of assembly, it is recommended that the gaskets be warmed up prior to placement in the bell. It should be noted that during cold weather it is far more difficult to effectively clean out the bell. Ice or frozen dirt in the gasket groove can prevent proper seating of the gasket.

LUBRICANT

Super Bell-Tite lubricant is non-toxic, odorless, tasteless and will not support bacteria. Do not substitute other or similar material for this use. The following table indicates the approximate lubricant usage by pipe size.

Recommended Number of Joints to be Assembled per Pound of Lubricant

Nominal Pipe Size	3	4	6	8	10	12	14	16	18	20	24
No. Joints per pound of lubricant	22	16	11	8	6	5	5	4	4	3	2

Note: See page 27 for information on the Super Bell-Tite joint.

SUPER BELL-TITE® PUSH-ON JOINT

HOW THE JOINT IS ASSEMBLED

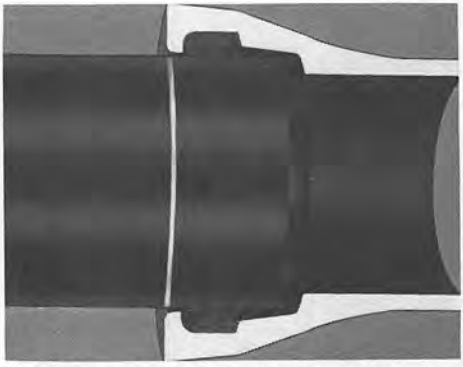
1. Thoroughly clean out the bell. Remove all foreign matter: sand, mud, ice, or excess paint. Brush-coat gasket retaining groove with Super Bell-Tite lubricant.

2. Insert gasket with solid face toward installer. Use one hand to hold a loop in the gasket, the other to tuck the remaining portion into its groove.

3. Release gasket and press remaining loop firmly into lubricated groove. Pull gasket forward against the bell lip—to be sure the gasket is completely seated.

4. Apply a generous coating of lubricant to the exposed gasket surface just prior to joint assembly. Make certain that the entire inner surface of the gasket is coated.

5. Clean the plain end. Remove any dirt, foreign matter or excess paint. Grind or file sharp edges which might damage the gasket. Lubricant may be applied to the beveled nose to facilitate assembly.



6. Guide plain end into bell and provide reasonably straight alignment. "Make" joint by pushing the plain end into the bell. Check the assembly—the joint is completely assembled when the stripe is no longer visible.

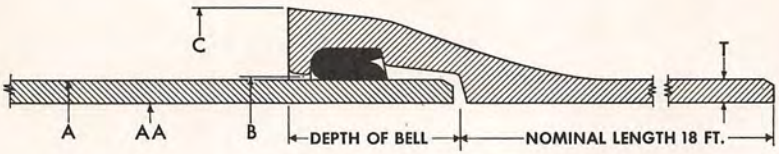
Note: Deflection should be taken after joint is assembled.

CLOW

DUCTILE CAST IRON PIPE

SUPER BELL-TITE® PUSH-ON JOINT

Meets the Requirements of Specification
ANSI A21.51 (AWWA C151), ANSI A21.11 (AWWA C111) and
Federal Specification WW-P-421c for Type II Pipe



F-172-D

SUPER BELL-TITE PUSH-ON JOINT

DIMENSIONS AND WEIGHTS

For Standard Thickness Selection Table 51.2 of ANSI A21.51, see page 221.

Nominal Inside Diameter Inches	Wall Thickness		Dimensions—Inches				Approximate Weight—Pounds			
	ANSI Thick. Class	T In Inches	A Pipe O.D.	AA Av. Pipe I.D.	B Bell I.D.	C Bell O.D.	Bell Metal Only	Pipe Barrel Per Ft.	18-Foot Length* Per Foot	18-Foot Length* Per Length
3	2	.28	3.96	3.40	4.07	5.97	11	9.9	10.5	190†
	3	.31	3.96	3.34	4.07	5.97	11	10.9	11.5	205†
	4	.34	3.96	3.28	4.07	5.97	11	11.8	12.4	225†
	5	.37	3.96	3.22	4.07	5.97	11	12.8	13.4	240†
	6	.40	3.96	3.16	4.07	5.97	11	13.7	14.3	260†
4	2	.29	4.80	4.22	4.91	7.06	14	12.6	13.4	240
	3	.32	4.80	4.16	4.91	7.06	14	13.8	14.6	260
	4	.35	4.80	4.10	4.91	7.06	14	15.0	15.8	285
	5	.38	4.80	4.04	4.91	7.06	14	16.1	16.9	305
	6	.41	4.80	3.98	4.91	7.06	14	17.3	18.1	325
6	2	.31	6.90	6.28	7.01	9.48	25	19.6	21.0	380
	3	.34	6.90	6.22	7.01	9.48	25	21.4	22.8	410
	4	.37	6.90	6.16	7.01	9.48	25	23.2	24.6	445
	5	.40	6.90	6.10	7.01	9.48	25	25.0	26.4	475
	6	.43	6.90	6.04	7.01	9.48	25	26.7	28.1	505
8	2	.33	9.05	8.39	9.16	11.96	36	27.7	29.7	535
	3	.36	9.05	8.33	9.16	11.96	36	30.1	32.1	580
	4	.39	9.05	8.27	9.16	11.96	36	32.5	34.5	620
	5	.42	9.05	8.21	9.16	11.96	36	34.8	36.8	660
	6	.45	9.05	8.15	9.16	11.96	36	37.2	39.2	705
10	2	.35	11.10	10.40	11.22	14.22	49	36.2	38.9	700
	3	.38	11.10	10.34	11.22	14.22	49	39.2	41.9	755
	4	.41	11.10	10.28	11.22	14.22	49	42.1	44.8	805
	5	.44	11.10	10.22	11.22	14.22	49	45.1	47.8	860
	6	.47	11.10	10.16	11.22	14.22	49	48.0	50.7	915
12	2	.37	13.20	12.46	13.32	16.46	62	45.6	49.0	885
	3	.40	13.20	12.40	13.32	16.46	62	49.2	52.6	950
	4	.43	13.20	12.34	13.32	16.46	62	52.8	56.2	1010
	5	.46	13.20	12.28	13.32	16.46	62	56.3	59.7	1075
	6	.49	13.20	12.22	13.32	16.46	62	59.9	63.3	1140

Depth of Bells: 3″-3.00″; 4″-3.25″; 6″-3.50″; 8″-3.75″; 10″-4.00″; and 12″-4.25″.

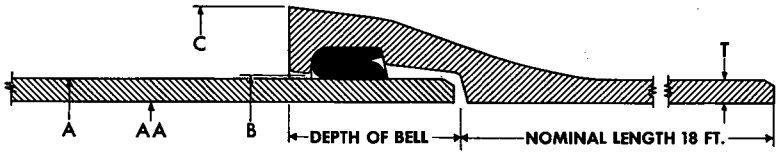
* Including bell. Calculated weight of full length pipe is rounded off to nearest five pounds.
† Although weights shown are 18 foot nominal lengths, 3″ pipe is regularly furnished in 16 to 18 foot random lengths.

Super Bell-Tite pipe is furnished with F-173 Gasket and Joint Lubricant. See page 27.

DUCTILE CAST IRON PIPE

SUPER BELL-TITE® PUSH-ON JOINT

Meets the Requirements of Specification
ANSI A21.51 (AWWA C151), ANSI A21.11 (AWWA C111) and
Federal Specification WW-P-421c for Type II Pipe



F-172-D

SUPER BELL-TITE PUSH-ON JOINT
DIMENSIONS AND WEIGHTS

For Standard Thickness Selection Table 51.2 of ANSI A21.51, see page 221.

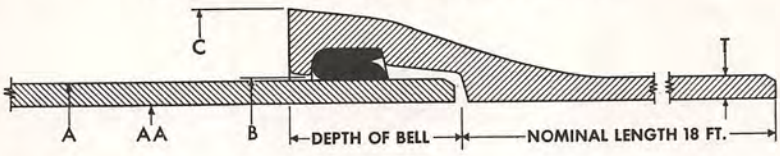
Nominal Inside Diameter Inches	Wall Thickness		Dimensions—Inches				Approximate Weight—Pounds			
	ANSI Thick. Class	T In Inches	A Pipe O.D.	AA Av. Pipe I.D.	B Bell I.D.	C Bell O.D.	Bell Metal Only	Pipe Barrel Per Ft.	18-Foot Length* Per Foot	18-Foot Length* Per Length
14	1	.36	15.30	14.58	15.42	18.66	76	51.7	55.9	1005
	2	.39	15.30	14.52	15.42	18.66	76	55.9	60.1	1080
	3	.42	15.30	14.46	15.42	18.66	76	60.1	64.3	1160
	4	.45	15.30	14.40	15.42	18.66	76	64.2	68.4	1230
	5	.48	15.30	14.34	15.42	18.66	76	68.4	72.6	1305
	6	.51	15.30	14.28	15.42	18.66	76	72.5	76.7	1380
16	1	.37	17.40	16.66	17.53	20.90	94	60.6	65.8	1185
	2	.40	17.40	16.60	17.53	20.90	94	65.4	70.6	1270
	3	.43	17.40	16.54	17.53	20.90	94	70.1	75.3	1355
	4	.46	17.40	16.48	17.53	20.90	94	74.9	80.1	1440
	5	.49	17.40	16.42	17.53	20.90	94	79.7	84.9	1530
	6	.52	17.40	16.36	17.53	20.90	94	84.4	89.6	1615
18	1	.38	19.50	18.74	19.64	23.16	112	69.8	76.0	1370
	2	.41	19.50	18.68	19.64	23.16	112	75.2	81.4	1465
	3	.44	19.50	18.62	19.64	23.16	112	80.6	86.8	1565
	4	.47	19.50	18.56	19.64	23.16	112	86.0	92.2	1660
	5	.50	19.50	18.50	19.64	23.16	112	91.3	97.5	1755
	6	.53	19.50	18.44	19.64	23.16	112	96.7	102.9	1855
20	1	.39	21.60	20.82	21.74	25.39	130	79.5	86.7	1560
	2	.42	21.60	20.76	21.74	25.39	130	85.5	92.7	1670
	3	.45	21.60	20.70	21.74	25.39	130	91.5	98.7	1775
	4	.48	21.60	20.64	21.74	25.39	130	97.5	104.7	1885
	5	.51	21.60	20.58	21.74	25.39	130	103.4	110.6	1990
	6	.54	21.60	20.52	21.74	25.39	130	109.3	116.5	2095
24	1	.41	25.80	24.98	25.95	29.85	168	100.1	109.4	1970
	2	.44	25.80	24.92	25.95	29.85	168	107.3	116.6	2100
	3	.47	25.80	24.86	25.95	29.85	168	114.4	123.7	2225
	4	.50	25.80	24.80	25.95	29.85	168	121.6	130.9	2355
	5	.53	25.80	24.74	25.95	29.85	168	128.8	138.1	2485
	6	.56	25.80	24.68	25.95	29.85	168	135.9	145.2	2615

* Including bell. Calculated weight of full length pipe is rounded off to nearest five pounds.
Depth of bells: 14″-4.50″; 16″-4.75″; 18″-4.88″; 20″-5.00″, and 24″-5.12″.
Super Bell-Tite pipe is furnished with F-173 Gasket and Joint Lubricant. See page 27.

CLOW

SUPER BELL-TITE® PUSH-ON JOINT GRAY CAST IRON PIPE

Meets the Requirements of Specifications
American National Standards Institute A21.6 (AWWA C106) and ANSI A21.11 (AWWA C111
Federal Specification WW-P-421c for Type II Pipe



F-172

FOR WATER OR OTHER LIQUIDS

For selection tables and pressure ratings, refer to pages 216-217.

Nominal Inside Diameter Inches	ANSI A21.6 Thick. Class	Dimensions in Inches					Approximate Weight—Pounds			
		Wall Thick. In Inches	A Pipe O.D.	AA Av. Pipe I.D.	B Bell I.D.	C Bell O.D.	Bell Metal Only	Pipe Barrel Per Ft.	18-Foot Length Per Foot	18-Foot Length Per Length
3	22	.32	3.96	3.32	4.07	5.97	11	11.4	12.0	215†
	23	.35	3.96	3.26	4.07	5.97	11	12.4	13.0	235†
	24	.38	3.96	3.20	4.07	5.97	11	13.3	13.9	250†
	25	.41	3.96	3.14	4.07	5.97	11	14.3	15.0	270†
4	22	.35	4.80	4.10	4.91	7.06	14	15.3	16.1	290
	23	.38	4.80	4.04	4.91	7.06	14	16.5	17.3	310
	24	.41	4.80	3.98	4.91	7.06	14	17.6	18.4	330
	25	.44	4.80	3.92	4.91	7.06	14	18.8	19.5	350
6	22	.38	6.90	6.14	7.01	9.48	25	24.3	25.6	460
	23	.41	6.90	6.08	7.01	9.48	25	26.1	27.5	495
	24	.44	6.90	6.02	7.01	9.48	25	27.9	29.3	525
	25	.48	6.90	5.94	7.01	9.48	25	30.2	31.7	570
	26	.52	6.90	5.86	7.01	9.48	25	32.5	33.9	610
8	22	.41	9.05	8.23	9.16	11.96	41	34.7	36.9	665
	23	.44	9.05	8.17	9.16	11.96	41	37.1	39.4	710
	24	.48	9.05	8.09	9.16	11.96	41	40.3	42.6	765
	25	.52	9.05	8.01	9.16	11.96	41	43.5	45.8	825
	26	.56	9.05	7.93	9.16	11.96	41	46.6	48.9	880
10	22	.44	11.10	10.22	11.22	14.22	54	46.0	49.0	880
	23	.48	11.10	10.14	11.22	14.22	54	50.0	53.0	955
	24	.52	11.10	10.06	11.22	14.22	54	53.9	56.9	1025
	25	.56	11.10	9.98	11.22	14.22	54	57.9	60.9	1095
	26	.60	11.10	9.90	11.22	14.22	54	61.8	64.8	1165
12	22	.48	13.20	12.24	13.32	16.46	66	59.8	63.4	1140
	23	.52	13.20	12.16	13.32	16.46	66	64.6	68.3	1230
	24	.56	13.20	12.08	13.32	16.46	66	69.4	73.1	1315
	25	.60	13.20	12.00	13.32	16.46	66	74.1	77.8	1400
	26	.65	13.20	11.90	13.32	16.46	66	80.0	83.7	1505
14	21	.48	15.30	14.34	15.42	18.66	78	69.7	74.0	1335
	22	.51	15.30	14.28	15.42	18.66	78	73.9	78.2	1410
	23	.55	15.30	14.20	15.42	18.66	78	79.5	83.8	1510
	24	.59	15.30	14.12	15.42	18.66	78	85.1	89.4	1610
	25	.64	15.30	14.02	15.42	18.66	78	92.0	96.3	1735
	26	.69	15.30	13.92	15.42	18.66	78	98.8	103.1	1855
16	21	.50	17.40	16.40	17.53	20.90	96	82.8	88.1	1585
	22	.54	17.40	16.32	17.53	20.90	96	89.2	94.5	1700
	23	.58	17.40	16.24	17.53	20.90	96	95.6	100.9	1815
	24	.63	17.40	16.14	17.53	20.90	96	103.6	109.0	1960
	25	.68	17.40	16.04	17.53	20.90	96	111.4	116.8	2100
	26	.73	17.40	15.94	17.53	20.90	96	119.3	124.6	2245

* Including Bell. Calculated weight of full length pipe is rounded off to nearest five pound

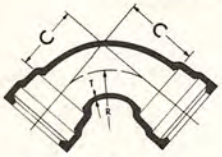
† Although weights shown are for nominal 18-foot lengths, 3" pipe is regularly furnished 16- to 18-foot random lengths. For depth of bell, see page 30 and 3

Super Bell-Tite pipe is furnished with F-173 Gasket and Joint Lubricant. See page 27.

SUPER BELL-TITE® PUSH-ON JOINT CAST IRON FITTINGS

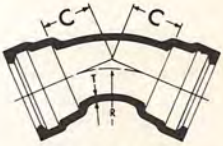
Meet all Physical Requirements of
ANSI A21.10 (AWWA C110) Specifications
and Joint Requirements of ANSI A21.11 (AWWA C111) Specifications

BENDS



F-176
(90°) Quarter Bend
SBT and SBT

For Use with Super Bell-Tite Push-On Pipe or any beveled Plain End Pipe of Same Outside Diameter



F-178
(45°) Eighth Bend
SBT and SBT

DIMENSIONS AND WEIGHTS

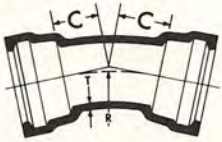
F-176

Nominal Diameter Inches	Pressure Rating psi	Dimensions Inches T	C	R	Approx. Weight Pounds
3	250	.48	5.5	4.00	30
4	250	.52	6.5	4.50	50
6	250	.55	8.0	6.00	85
8	250	.60	9.0	7.00	140
10	250	.68	11.0	9.00	200
12	250	.75	12.0	10.00	270
14	150	.66	14.0	11.50	320
16	150	.70	15.0	12.50	405
18	150	.75	16.5	14.00	515
20	150	.80	18.0	15.50	645
24	150	.89	22.0	18.50	985

F-178

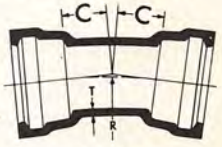
Nominal Diameter Inches	Pressure Rating psi	Dimensions Inches T	C	R	Approx. Weight Pounds
3	250	.48	3.0	3.62	25
4	250	.52	4.0	4.81	45
6	250	.55	5.0	7.25	75
8	250	.60	5.5	8.44	120
10	250	.68	6.5	10.88	165
12	250	.75	7.5	13.25	225
14	150	.66	7.5	12.06	250
16	150	.70	8.0	13.25	315
18	150	.75	8.5	14.50	395
20	150	.80	9.5	16.88	495
24	150	.89	11.0	18.12	715

Super Bell-Tite Fittings Bell O.D.: 3″—5.89″; 4″—7.09″; 6″—9.41″; 8″—11.78″; 10″—14.02″; 12″—16.30″; 14″—18.24″; 16″—20.49″; 18″—22.74″; 20″—24.98″; and 24″—29.43″.



F-180
(22½°) Sixteenth Bend
SBT and SBT

Super Bell-Tite Fittings are Furnished Complete with Gaskets and Joint Lubricant



F-182
(11¼°) Thirty-Second Bend
SBT and SBT

DIMENSIONS AND WEIGHTS

F-180

Nominal Diameter Inches	Pressure Rating psi	Dimensions Inches T	C	R	Approx. Weight Pounds
3	250	.48	3.0	7.56	30
4	250	.52	4.0	10.06	45
6	250	.55	5.0	15.06	75
8	250	.60	5.5	17.62	120
10	250	.68	6.5	22.62	165
12	250	.75	7.5	27.62	230
14	150	.66	7.5	25.12	255
16	150	.70	8.0	27.62	320
18	150	.75	8.5	30.19	400
20	150	.80	9.5	35.19	500
24	150	.89	11.0	37.69	725

F-182

Nominal Diameter Inches	Pressure Rating psi	Dimensions Inches T	C	R	Approx. Weight Pounds
3	250	.48	3.0	15.25	30
4	250	.52	4.0	20.31	45
6	250	.55	5.0	30.50	75
8	250	.60	5.5	35.50	120
10	250	.68	6.5	45.69	165
12	250	.75	7.5	55.81	230
14	150	.66	7.5	50.75	255
16	150	.70	8.0	55.81	320
18	150	.75	8.5	60.94	400
20	150	.80	9.5	71.06	505
24	150	.89	11.0	76.12	730

Depth of bells: 3″—3.00″; 4″—3.25″; 6″—3.50″; 8″—3.75″; 10″—4.00″; 12″—4.25″; 14″—4.50″; 16″—4.75″; 18″—4.88″; 20″—5.00″; and 24″—5.12″.

See page 27 for accessories furnished.

Note

3″ thru 12″ fittings for 350 psi working pressure, and 14″ thru 24″ fittings for 250 and 350 psi working pressure are furnished to the above dimensions in ductile iron.

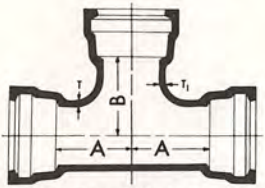
CLOW

SUPER BELL-TITE® PUSH-ON JOINT CAST IRON FITTINGS

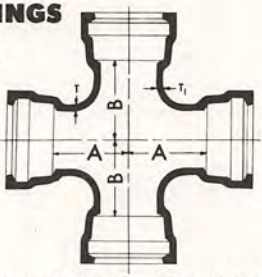
Meet all Physical Requirements of
ANSI A21.10 (AWWA C110) Specifications

TEES AND CROSSES

For Use with Super Bell-Tite Push-On Pipe or any beveled Plain End Pipe of Same Outside Diameter



F-186 Tee SBT, SBT, and SBT



F-190 Cross SBT, SBT, SBT and SBT

DIMENSIONS AND WEIGHTS

F-186 and F-190

Nominal Diameter Inches		Pressure Rating psi	Dimensions—Inches				Approximate Weight—Pounds	
Run	Branch		T	T_1	A	B	**F-186**	**F-190**
3	3	250	.48	.48	5.5	5.5	50	65
4	3	250	.52	.48	6.5	6.5	70	80
4	4	250	.52	.52	6.5	6.5	75	95
6	3	250	.55	.48	8	8	105	120
6	4	250	.55	.52	8	8	115	135
6	6	250	.55	.55	8	8	125	160
8	4	250	.60	.52	9	9	170	195
8	6	250	.60	.55	9	9	185	215
8	8	250	.60	.60	9	9	205	255
10	4	250	.68	.52	11	11	245	265
10	6	250	.68	.55	11	11	255	290
10	8	250	.68	.60	11	11	275	330
10	10	250	.80	.80	11	11	330	395
12	4	250	.75	.52	12	12	325	345
12	6	250	.75	.55	12	12	335	370
12	8	250	.75	.60	12	12	355	405
12	10	250	.87	.80	12	12	405	475
12	12	250	.87	.87	12	12	425	515
14	6	150	.66	.55	14	14	395	435
14	8	150	.66	.60	14	14	415	475
14	10	150	.66	.68	14	14	435	510
14	12*	150	.82	.75	14	14	505	595
14	14*	150	.82	.82	14	14	530	645
16	6	150	.70	.55	15	15	490	530
16	8	150	.70	.60	15	15	510	570
16	10	150	.70	.68	15	15	525	600
16	12	150	.70	.75	15	15	550	645
16	14*	150	.89	.82	15	15	645	755
16	16*	150	.89	.89	15	15	675	810
18	6	150	.75	.55	13	15.5	540	575
18	8	150	.75	.60	13	15.5	560	610
18	10	150	.75	.68	13	15.5	575	640
18	12	150	.75	.75	13	15.5	590	680
18	14	150	.75	.66	16.5	16.5	685	790
18	16*	150	.96	.89	16.5	16.5	830	965
18	18*	150	.96	.96	16.5	16.5	865	1035
20	6	150	.80	.55	14	17	660	695
20	8	150	.80	.60	14	17	680	735
20	10	150	.80	.68	14	17	695	765
20	12	150	.80	.75	14	17	715	805
20	14	150	.80	.66	14	17	720	815
20	16	150	.80	.70	18	18	860	985
20	18*	150	1.03	.96	18	18	1050	1215
20	20*	150	1.03	1.03	18	18	1085	1290
24	6	150	.89	.55	15	19	910	940
24	8	150	.89	.60	15	19	925	980
24	10	150	.89	.68	15	19	940	1005
24	12	150	.89	.75	15	19	955	1040
24	14	150	.89	.66	15	19	960	1050
24	16	150	.89	.70	15	19	980	1085
24	18	150	.89	.75	22	22	1295	1460
24	20*	150	1.16	1.03	22	22	1595	1815
24	24*	150	1.16	1.16	22	22	1685	1995

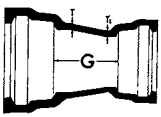
* We reserve the option to furnish these fittings to Class B wall thickness in ductile iron which are rated by ANSI A21.10 for 350 psi working pressure.

Note: 3″ thru 12″ fittings for 350 psi working pressure, and 14″ thru 24″ fittings for 250 and 350 psi working pressure are furnished to the above dimensions in ductile iron.

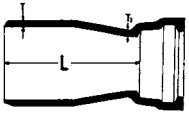
SUPER BELL-TITE® PUSH-ON JOINT CAST IRON FITTINGS

Meet all Physical Requirements of
ANSI A21.10 (AWWA C110) Specifications
and Joint Requirements of ANSI A21.11 (AWWA C111) Specifications

CONCENTRIC REDUCERS



F-194 Reducer
SBT and SBT



F-195 Reducer
Small End SBT

DIMENSIONS AND WEIGHTS
F-194 and F-195

Nominal Diameter Inches		Pressure Rating psi	Thickness Inches		Laying Length Inches		Approximate Weight—Pounds	
Large End	Small End		T	T_1	G	L	F-194	F-195
4	3	250	.52	.48	7	15	35	35
6	3	250	.55	.48	9	17	50	50
6	4	250	.55	.52	9	17	60	55
8	3	250	.60	.48	11	19	75	70
8	4	250	.60	.52	11	19	85	80
8	6	250	.60	.55	11	19	100	90
10	4	250	.68	.52	12	20	105	100
10	6	250	.68	.55	12	20	120	115
10	8	250	.68	.60	12	20	145	140
12	4	250	.75	.52	14	22	135	135
12	6	250	.75	.55	14	22	155	150
12	8	250	.75	.60	14	22	180	175
12	10	250	.75	.68	14	22	200	195
14	6	150	.66	.55	16	24	180	170
14	8	150	.66	.60	16	24	205	200
14	10	150	.66	.68	16	24	225	220
14	12	150	.66	.75	16	24	250	245
16	6	150	.70	.55	18	26	215	210
16	8	150	.70	.60	18	26	245	235
16	10	150	.70	.68	18	26	270	260
16	12	150	.70	.75	18	26	300	290
16	14	150	.70	.66	18	26	310	300
18	8	150	.75	.60	19	27	290	280
18	10	150	.75	.68	19	27	315	305
18	12	150	.75	.75	19	27	345	335
18	14	150	.75	.66	19	27	355	345
18	16	150	.75	.70	19	27	385	375
20	10	150	.80	.68	20	28	365	350
20	12	150	.80	.75	20	28	395	380
20	14	150	.80	.66	20	28	405	390
20	16	150	.80	.70	20	28	440	425
20	18	150	.80	.75	20	28	475	465
24	12	150	.89	.75	24	32	535	515
24	14	150	.89	.66	24	32	545	525
24	16	150	.89	.70	24	32	580	560
24	18	150	.89	.75	24	32	625	605
24	20	150	.89	.80	24	32	670	650

Unless ordered otherwise, we always ship F-195 reducer.
For F-970 PE x PE Reducers, see page 51.

Note

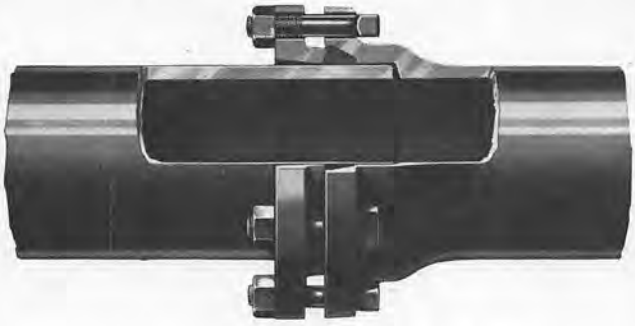
3″ thru 12″ fittings for 350 psi working pressure, and 14″ thru 24″ fittings for 250 and 350 psi working pressure are furnished to the above dimensions in ductile iron.

See page 27 for accessories furnished.

For Bell O.D. and Depth of Bell, see notes on page 33.

MECHANICAL JOINT CAST IRON PIPE

FOR WATER, GAS AND OTHER SERVICES



MECHANICAL JOINT CAST IRON PIPE

The Mechanical Joint is a bolted joint of the stuffing box type, suitable for both hydraulic and gas pressure service. The joint consists of an integral bell with flange, and is made up with a rubber ring gasket, follower gland, nuts and bolts. When assembled the joint provides for normal expansion and contraction and permits adequate deflection in all diameters.

A variety of gasket material can be furnished depending upon the service for which the pipe is intended. A full line of mechanical joint fittings, shown on pages 43 through 54, is available for every pipe line requirement. Mechanical Joint pipe and fittings are also available in ductile iron. See pages 38 and 39.

The pipe is manufactured in accordance with specifications ANSI A21.6, (AWWA C106), ANSI A21.11, (AWWA C111), and Federal Specifications WW-P-421c; and is listed by the Underwriters Laboratories, Inc. in all sizes 3 through 24 inch, as indicated on page 19.

Mechanical Joint ductile cast iron pipe for gas service is manufactured in accordance with ANSI A21.52 and A21.11, shown on page 42.

WHEN ORDERING

The laying length of Mechanical Joint pipe varies between 18′ 1½″ and 18′ 3″, depending upon diameter. Actual lengths are used to determine footage and for pricing, and *invoice will cover actual footage shipped.*

When ordering cut lengths, shorter than 18 feet, be sure to give *laying length* dimension. In the absence of specific ordering instructions, we will ship *laying length* and not overall length.

Note

Accessories are always shipped along with, but are not assembled onto pipe or fittings.

Maximum Deflections of Mechanical Joint Pipe

Size of Pipe Inches	Based on 18-Ft. Length		Approx. Radius in Feet of Curve Produced By Succession of Joints	Approx. Number of 18-Foot Pipe Required for a 90° Bend
	Angle Degrees	Deflection Inches		
3	8°-18′	31.0	125	11
4	8°-18′	31.0	125	11
6	7°- 7′	27.0	145	13
8	5°-21′	20.0	195	17
10	5°-21′	20.0	195	17
12	5°-21′	20.0	195	17
14	3°-35′	13.5	285	25
16	3°-35′	13.5	285	25
18	3°- 0′	11.0	340	30
20	3°- 0′	11.0	340	30
24	2°-23′	9.0	450	39

MECHANICAL JOINT CAST IRON PIPE

HOW THE PIPE IS INSTALLED

The inside of the bell and the plain end of pipe must be cleaned thoroughly of all foreign matter—using a wire brush if necessary. These surfaces (also the gasket) should then be brushed over with soapy water. With gland and gasket on plain end of pipe, "seat" the plain end in the bell. Press gasket firmly and evenly into the bell. Move gland into position for bolting, insert all bolts and make all nuts finger-tight. Keep plain end centrally located within the bell.

When tightening bolts, it is important that the gland be brought up evenly at all points around the bell flange. This can readily be accomplished by partially tightening the bottom bolt first, then the top one, and the remaining bolts—alternately from side to side. Repeat the cycle until all bolts have been made uniformly tight. For correct range of torque, see table below.

If effective sealing is not attained at the maximum torque indicated below, the joint should be disassembled and reassembled after thorough cleaning.

Do not overstress bolts to compensate for improper installation practice.

RATCHET WRENCHES

For Use With Clow Mechanical Joint Pipe and Fittings

F-4967 Ratchet Wrench

For water and gas service, normal range of bolt torques to be applied to bolts in Clow mechanical joints are:

Pipe Size	Bolt Diameter	Range of Torque Foot Pounds
3″	5/8″	45 to 60
4″ thru 24″	3/4″	75 to 90

The following length wrenches will work satisfactorily within ranges of torque specified when used by average (150-lb.) workmen.

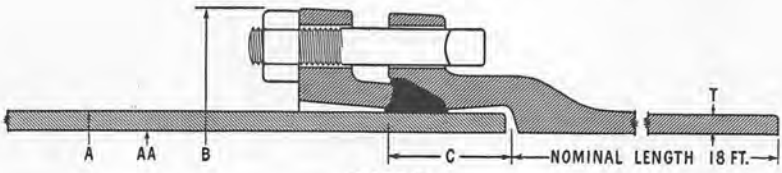
Wrench Size	Wrench Length	For Bolt Diameter
No. 1H	8″	5/8″
No. 2H	10″	3/4″

CLOW

DUCTILE CAST IRON PIPE

MECHANICAL JOINT

Dimensions, Weights, and Tolerances
Meet the Requirements of Specifications
ANSI A21.11 (AWWA C111) Standardized Joint in Combination with
ANSI A21.51 (AWWA C151) Pipe for Water, and/or
Federal Specification WW-P-421c for Type-III Pipe



F-122-D

DIMENSIONS AND WEIGHTS

For Standard Thickness Selection Table 51.2 of ANSI A21.51, see page 221.

Nominal Inside Diameter Inches	Wall Thickness		Dimensions—Inches				Approximate Weight—Pounds			
	ANSI Thick. Class	T In Inches	A Pipe O.D.	AA Av. Pipe I.D.	B Gland O.D.	C Depth of Bell	Bell Metal Only	Pipe Barrel Per Ft.	18-Foot Length* Per Foot	18-Foot Length* Per Length
3	2	.28	3.96	3.40	7.69	2.50	11	9.9	10.5	190†
	3	.31	3.96	3.34	7.69	2.50	11	10.9	11.5	205†
	4	.34	3.96	3.28	7.69	2.50	11	11.8	12.4	225†
	5	.37	3.96	3.22	7.69	2.50	11	12.8	13.4	240†
	6	.40	3.96	3.16	7.69	2.50	11	13.7	14.3	260†
4	2	.29	4.80	4.22	9.12	2.50	16	12.6	13.5	245
	3	.32	4.80	4.16	9.12	2.50	16	13.8	14.7	265
	4	.35	4.80	4.10	9.12	2.50	16	15.0	15.9	285
	5	.38	4.80	4.04	9.12	2.50	16	16.1	17.0	305
	6	.41	4.80	3.98	9.12	2.50	16	17.3	18.2	325
6	2	.31	6.90	6.28	11.12	2.50	22	19.6	20.8	375
	3	.34	6.90	6.22	11.12	2.50	22	21.4	22.6	405
	4	.37	6.90	6.16	11.12	2.50	22	23.2	24.4	440
	5	.40	6.90	6.10	11.12	2.50	22	25.0	26.2	470
	6	.43	6.90	6.04	11.12	2.50	22	26.7	27.9	505
8	2	.33	9.05	8.39	13.37	2.50	29	27.7	29.3	530
	3	.36	9.05	8.33	13.37	2.50	29	30.1	31.7	570
	4	.39	9.05	8.27	13.37	2.50	29	32.5	34.1	615
	5	.42	9.05	8.21	13.37	2.50	29	34.8	36.4	655
	6	.45	9.05	8.15	13.37	2.50	29	37.2	38.8	700
10	2	.35	11.10	10.40	15.62	2.50	39	36.2	38.4	690
	3	.38	11.10	10.34	15.62	2.50	39	39.2	41.4	745
	4	.41	11.10	10.28	15.62	2.50	39	42.1	44.3	795
	5	.44	11.10	10.22	15.62	2.50	39	45.1	47.3	850
	6	.47	11.10	10.16	15.62	2.50	39	48.0	50.2	905
12	2	.37	13.20	12.46	17.88	2.50	49	45.6	48.3	870
	3	.40	13.20	12.40	17.88	2.50	49	49.2	51.9	935
	4	.43	13.20	12.34	17.88	2.50	49	52.8	55.5	1000
	5	.46	13.20	12.28	17.88	2.50	49	56.3	59.0	1060
	6	.49	13.20	12.22	17.88	2.50	49	59.9	62.6	1125

* Including bell. Calculated weight of full length pipe is rounded off to nearest five pounds.

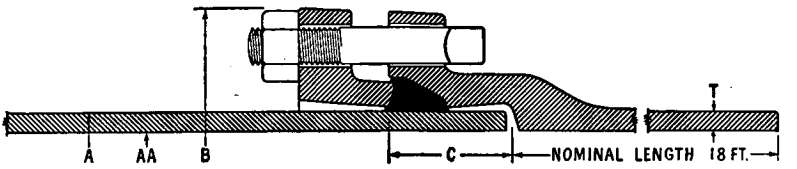
† Although weights shown are 18 foot nominal lengths, 3″ pipe is regularly furnished in 16 to 18 foot random lengths.

See page 41 for standard accessories furnished.

DUCTILE CAST IRON PIPE

MECHANICAL JOINT

Dimensions, Weights, and Tolerances
Meet the Requirements of Specifications
ANSI A21.11 (AWWA C111) Standardized Joint in Combination with
ANSI A21.51 (AWWA C151) Pipe for Water, and/or
Federal Specification WW-P-421c for Type III Pipe



F-122-D

DIMENSIONS AND WEIGHTS

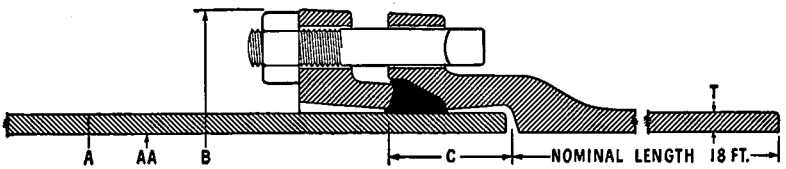
For Standard Thickness Selection Table 51.2 of ANSI A21.51, see page 221.

Nominal Inside Diameter Inches	Wall Thickness		Dimensions—Inches				Approximate Weight—Pounds			
	ANSI Thick. Class	T In Inches	A Pipe O.D.	AA Av. Pipe I.D.	B Gland O.D.	C Depth of Bell	Bell Metal Only	Pipe Barrel Per Ft.	18-Foot Length* Per Foot	18-Foot Length* Per Length
14	1	.36	15.30	14.58	20.25	3.50	76	51.7	55.9	1005
	2	.39	15.30	14.52	20.25	3.50	76	55.9	60.1	1080
	3	.42	15.30	14.46	20.25	3.50	76	60.1	64.3	1160
	4	.45	15.30	14.40	20.25	3.50	76	64.2	68.4	1230
	5	.48	15.30	14.34	20.25	3.50	76	68.4	72.6	1305
	6	.51	15.30	14.28	20.25	3.50	76	72.5	76.7	1380
16	1	.37	17.40	16.66	22.50	3.50	93	60.6	65.8	1185
	2	.40	17.40	16.60	22.50	3.50	93	65.4	70.6	1270
	3	.43	17.40	16.54	22.50	3.50	93	70.1	75.3	1355
	4	.46	17.40	16.48	22.50	3.50	93	74.9	80.1	1440
	5	.49	17.40	16.42	22.50	3.50	93	79.7	84.9	1530
	6	.52	17.40	16.36	22.50	3.50	93	84.4	89.6	1610
18	1	.38	19.50	18.74	24.75	3.50	111	69.8	76.0	1365
	2	.41	19.50	18.68	24.75	3.50	111	75.2	81.4	1465
	3	.44	19.50	18.62	24.75	3.50	111	80.6	86.8	1560
	4	.47	19.50	18.56	24.75	3.50	111	86.0	92.2	1660
	5	.50	19.50	18.50	24.75	3.50	111	91.3	97.5	1755
	6	.53	19.50	18.44	24.75	3.50	111	96.7	102.9	1850
20	1	.39	21.60	20.82	27.00	3.50	131	79.5	86.8	1560
	2	.42	21.60	20.76	27.00	3.50	131	85.5	92.8	1670
	3	.45	21.60	20.70	27.00	3.50	131	91.5	98.8	1780
	4	.48	21.60	20.64	27.00	3.50	131	97.5	104.8	1885
	5	.51	21.60	20.58	27.00	3.50	131	103.4	110.7	1990
	6	.54	21.60	20.52	27.00	3.50	131	109.3	116.6	2100
24	1	.41	25.80	24.98	31.50	3.50	174	100.1	109.8	1975
	2	.44	25.80	24.92	31.50	3.50	174	107.3	117.0	2105
	3	.47	25.80	24.86	31.50	3.50	174	114.4	124.1	2235
	4	.50	25.80	24.80	31.50	3.50	174	121.6	131.3	2365
	5	.53	25.80	24.74	31.50	3.50	174	128.8	138.5	2490
	6	.56	25.80	24.68	31.50	3.50	174	135.9	145.6	2620

* Including bell. Calculated weight of full length pipe is rounded off to nearest five pounds.
See page 41 for standard accessories furnished.

MECHANICAL JOINT GRAY CAST IRON PIPE

Meets the Requirements of Specifications
ANSI A21.11 (AWWA C111) Standardized Joint in Combination with
ANSI A21.6 (AWWA C106) Pipe Barrel for Water
Federal Specification WW-P-421c for Type III Pipe



F-122

FOR WATER OR OTHER LIQUIDS
For selection tables and pressure ratings, refer to pages 216-217.

Nominal Inside Diameter Inches	ANSI A21.6 Thick. Class	Dimensions—Inches				Approximate Weight—Pounds			
		Wall Thick. In Inches	A Pipe O.D.	AA Av. Pipe I.D.	B Gland O.D.	Bell Metal Only	Pipe Barrel Per Ft.	18-Foot Length*	
								Per Foot	Per Length
3	22	.32	3.96	3.32	7.69	11	11.4	12.0	215†
	23	.35	3.96	3.26	7.69	11	12.4	13.0	235†
	24	.38	3.96	3.20	7.69	11	13.3	13.9	250†
	25	.41	3.96	3.14	7.69	11	14.3	15.0	270†
4	22	.35	4.80	4.10	9.12	16	15.3	16.2	290
	23	.38	4.80	4.04	9.12	16	16.5	17.4	315
	24	.41	4.80	3.98	9.12	16	17.6	18.5	335
	25	.44	4.80	3.92	9.12	16	18.8	19.7	355
6	22	.38	6.90	6.14	11.12	22	24.3	25.5	460
	23	.41	6.90	6.08	11.12	22	26.1	27.3	490
	24	.44	6.90	6.02	11.12	22	27.9	29.1	525
	25	.48	6.90	5.94	11.12	22	30.2	31.4	565
	26	.52	6.90	5.86	11.12	22	32.5	33.7	605
8	22	.41	9.05	8.23	13.37	30	34.7	36.4	655
	23	.44	9.05	8.17	13.37	30	37.1	38.8	700
	24	.48	9.05	8.09	13.37	30	40.3	42.0	755
	25	.52	9.05	8.01	13.37	30	43.5	45.2	815
	26	.56	9.05	7.93	13.37	30	46.6	48.3	870
10	22	.44	11.10	10.22	15.62	40	46.0	48.2	870
	23	.48	11.10	10.14	15.62	40	50.0	52.2	940
	24	.52	11.10	10.06	15.62	40	53.9	56.1	1010
	25	.56	11.10	9.98	15.62	40	57.9	60.1	1080
	26	.60	11.10	9.90	15.62	40	61.8	64.0	1150
12	22	.48	13.20	12.24	17.88	50	59.8	62.6	1125
	23	.52	13.20	12.16	17.88	50	64.6	67.4	1215
	24	.56	13.20	12.08	17.88	50	69.4	72.2	1300
	25	.60	13.20	12.00	17.88	50	74.1	76.9	1385
	26	.65	13.20	11.90	17.88	50	80.0	82.8	1490
14	21	.48	15.30	14.34	20.25	78	69.7	74.0	1335
	22	.51	15.30	14.28	20.25	78	73.9	78.2	1410
	23	.55	15.30	14.20	20.25	78	79.5	83.8	1510
	24	.59	15.30	14.12	20.25	78	85.1	89.4	1610
	25	.64	15.30	14.02	20.25	78	92.0	96.3	1735
	26	.69	15.30	13.92	20.25	78	98.8	103.1	1855
16	21	.50	17.40	16.40	22.50	95	82.8	88.1	1585
	22	.54	17.40	16.32	22.50	95	89.2	94.5	1700
	23	.58	17.40	16.24	22.50	95	95.6	100.9	1815
	24	.63	17.40	16.14	22.50	95	103.6	108.9	1960
	25	.68	17.40	16.04	22.50	95	111.4	116.7	2100
	26	.73	17.40	15.94	22.50	95	119.3	124.6	2240

Dimension C: Depth of Bell: 2.50″ on sizes 3″ thru 12″ and 3.50″ on sizes 14″ thru 24″.

* Including bell. Calculated weight of full length pipe is rounded off to nearest five pounds.

† Although weights shown are for 18 foot nominal lengths, 3″ pipe is furnished in 16- to 18-foot random lengths. See page 41 for standard accessories furnished.

MECHANICAL JOINT ACCESSORIES

Meets all Requirements of ANSI A21.11 (AWWA C111) Specifications

F–915 Gasket
(Plain Rubber)

F–1045 Gland

F-918
Mechanical Joint Bolt*

F-919
Mechanical Joint Stud*
(For Tapped Bells)

F-915 Plain Rubber gaskets will always be furnished unless otherwise ordered.
Bolts and Studs are High-Strength, Corrosion-Resistant Alloy with Hexagon Nuts.

***For number and size of bolts, and weight of accessories for joint, see page 43.**
For number and size of studs for tapped bells, see page 118.

CROSS SECTIONAL VIEWS OF STANDARD GASKETS

F-915
Plain Rubber

For water, sewage, dilute alkalis and acid—for temperature not exceeding 150° F.

F-916
Lead-Tipped Rubber

For water service where electrical thawing may be required.

F-917 Asbestos
Impregnated Rubber

For hot water and steam service where temperatures do not exceed 450° F.

F-6340
Transition Gasket

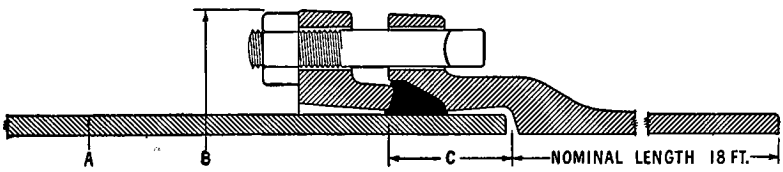
MECHANICAL JOINT TRANSITION GASKET FOR PVC OR IRON PIPE SIZE PIPE

The F-6340 Transition Gasket is a duck-tipped gasket which is available in 3″ thru 12″ sizes and is of somewhat different and larger shape than the F-915 gasket in order to accommodate the smaller outside diameter of PVC or other iron pipe size pipe when socketing with a standardized Mechanical Joint bell. The Transition Gasket has the letters "TRANS" molded onto it for identification. In assembly it is used with regular F-1045 glands and tee-head bolts and nuts. For mechanical joint fittings for PVC pipe, see page 97.

DUCTILE CAST IRON PIPE

MECHANICAL JOINT—FOR GAS

Dimensions, Weights, and Tolerances
Meet the Requirements of Specifications
ANSI A21.11 Standardized Joint in Combination with
ANSI A21.52 Pipe for Gas



F-132-D FOR GAS

For thickness and weights, see pages 38 & 39

Nominal Inside Diameter Inches	Laying Condition†	Rated Working Pressure psi	A Pipe O.D.	B Gland O.D.	Depth of Cover in Feet							
					2½	3½	5	8	12	16	20	24
					Thickness Class							
3	A	250	3.96	7.69	2	2	2	2	2	2	2	2
3	B	250			2	2	2	2	2	2	2	2
4	A	250	4.80	9.12	2	2	2	2	2	2	2	2
4	B	250			2	2	2	2	2	2	2	2
6	A	250	6.90	11.12	2	2	2	2	2	2	2	2
6	B	250			2	2	2	2	2	2	2	2
8	A	250	9.05	13.37	2	2	2	2	2	2	2	2
8	B	250			2	2	2	2	2	2	2	2
10	A	250	11.10	15.62	2	2	2	2	2	2	3	3
10	B	250			2	2	2	2	2	2	3	3
12	A	250	13.20	17.88	2	2	2	2	2	2	3	4
12	B	250			2	2	2	2	2	2	3	3
14	A	250	15.30	20.25	1	1	1	1	2	3	4	4
14	B	250			1	1	1	1	1	3	3	4
16	A	250	17.40	22.50	1	1	1	1	2	3	4	5
16	B	250			1	1	1	1	2	3	4	5
18	A	250	19.50	24.75	1	1	1	1	2	4	5	6
18	B	250			1	1	1	1	2	3	4	6
20	A	250	21.60	27.00	1	1	1	1	3	4	6	..
20	B	250			1	1	1	1	2	4	5	..
24	A	250	25.80	31.50	2	1	1	2	4	6	..	..
24	B	250			1	1	1	1	3	5	..	..

Dimension C: Depth of Bell: 2.50″ on sizes 3″ thru 12″ and 3.50″ on sizes 14″ thru 24″.

† Laying Condition A—Flat bottom trench—without blocks—untamped backfill.
Laying Condition B—Flat bottom trench—without blocks—tamped backfill.

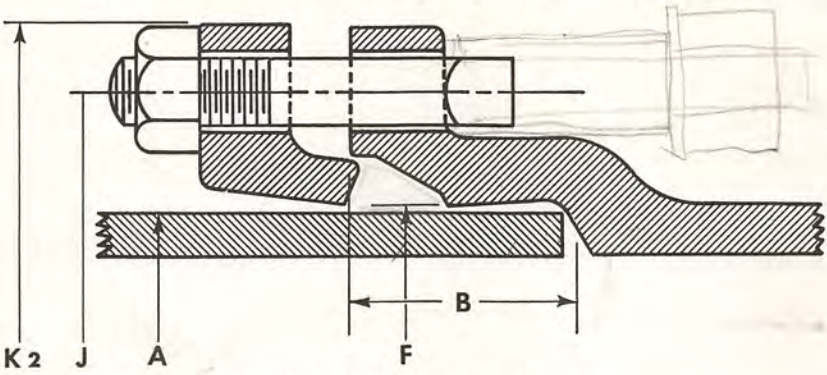
Gaskets

Unless otherwise specified when ordering, all Clow Mechanical Joint Cast Iron Pipe will be furnished with *plain rubber gaskets* which meet all requirements of ANSI Specifications A21.11 for design, physical properties, and prescribed tests.

For maximum deflection of joint, see page 36. For maximum size of service taps, see page 220
See page 41 for standard accessories furnished.

MECHANICAL JOINT FOR PIPE AND FITTINGS

Meet all Requirements of ANSI A21.11 (AWWA C111) Specifications



Mechanical Joint for Pipe and Fittings

ALL DIMENSIONS ARE IN INCHES

Size	Dimensions					Bolts Per Joint	Accessories Wgt. in Lbs.††
	A	B	F	J	K_2†		
3	3.96	2.50	4.06	6.19	7.69	4-⅝x3	7
4	4.80	2.50	4.90	7.50	9.12	4-¾x3½	10
6	6.90	2.50	7.00	9.50	11.12	6-¾x3½	16
8	9.05	2.50	9.15	11.75	13.37	6-¾x4	25
10	11.10	2.50	11.20	14.00	15.62	8-¾x4	30
12	13.20	2.50	13.30	16.25	17.88	8-¾x4	40
14	15.30	3.50	15.44	18.75	20.25	10-¾x4½	45
16	17.40	3.50	17.54	21.00	22.50	12-¾x4½	55
18	19.50	3.50	19.64	23.25	24.75	12-¾x4½	65
20	21.60	3.50	21.74	25.50	27.00	14-¾x4½	85
24	25.80	3.50	25.94	30.00	31.50	16-¾x5	105

† K_2 is outside diameter of glands across bolt holes.
†† Shows total weight of gland, gasket, and a set of bolts required to complete one joint.

MECHANICAL JOINT CAST IRON FITTINGS

Mechanical Joint fittings are used with Mechanical Joint, Super Bell-Tite Push-On, and other plain end centrifugally cast pipe of the same outside diameter. To permit assembly with Super Bell-Tite pipe, plain ends of all mechanical joint fittings are beveled.

Mechanical Joint fittings of size 14 through 24 inch diameter are rated at 150 psi. However, when fittings of this size are wanted for up to 350 psi working pressure, we can furnish such fittings to Class 150 dimensions of ductile iron.

Unless specifically ordered otherwise, Mechanical Joint fittings are always shipped complete with joint accessories. These accessories—gasket, follower gland, and bolts—are detailed on page 41. For assembly and installation instructions see page 37.

The successful operation of the mechanical joint requires that the plain end be centrally located in the bell and that adequate anchorage shall be provided where abrupt changes in direction and dead ends occur.

The rubber gasket seals most effectively (particularly when sealing gas), if the surfaces with which it comes in contact are brushed thoroughly with a wire brush just prior to assembly. This thorough brushing removes all loose rust or foreign material which may be present and provides clean surfaces which should be brushed with soapy water just prior to slipping the gasket over the plain end and into the bell. Soapy water brushed over the gasket prior to installation also removes loose dirt and lubricates the gasket as it is forced into its retaining space.

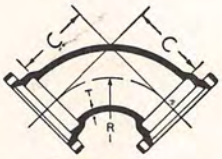
Accessories—gland, gasket, and bolts—are not assembled on pipe and fittings when shipped.

Note

Unless specifically ordered otherwise, mechanical joint bends, tees, and crosses will always be furnished with MJ BE on ALL openings.

MECHANICAL JOINT CAST IRON FITTINGS

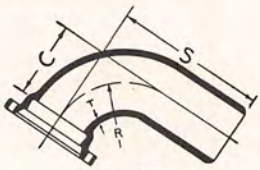
Meet all Applicable Requirements of
ANSI A21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) Specifications



F-925
(90°) Quarter Bend
MJ and MJ

BENDS

For Use with Super Bell-Tite Push-On Mechanical Joint Pipe or any Plain End Pipe of Same Outside Diameter



F-927
(90°) Quarter Bend
MJ and PE

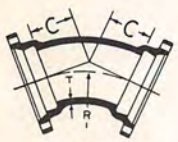
DIMENSIONS AND WEIGHTS

F-925 and F-927

Nominal Diameter Inches	Pressure Rating psi	Dimensions—Inches				Approximate Weight—Pounds Body Casting Only	
		T	C	S	R	F-925	F-927
3	250	.48	5.5	13.5	4.00	35	35
4	250	.52	6 5	14.5	4.50	55	50
6	250	.55	8.0	16.0	6.00	85	80
8	250	.60	9.0	17.0	7.00	125	120
10	250	.68	11.0	19.0	9.00	190	190
12	250	.75	12.0	20.0	10.00	255	255
14	150	.66	14.0	22.0	11.50	340	325
16	150	.70	15.0	23.0	12.50	430	410
18	150	.75	16.5	24.5	14.00	545	520
20	150	.80	18.0	26.0	15.50	680	650
24	150	.89	22.0	30.0	18.50	1025	985

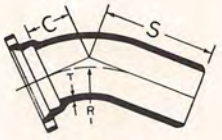
For Base Bends, see page 54.

For MJ Anchoring Fittings, see page 91.



F-930
(45°) Eighth Bend
MJ and MJ

MJ Fittings are Furnished Complete with Joint Accessories
See page 41



F-932
(45°) Eighth Bend
MJ and PE

F-930 and F-932

Nominal Diameter Inches	Pressure Rating psi	Dimensions—Inches				Approximate Weight—Pounds Body Casting Only	
		T	C	S	R	F-930	F-932
3	250	.48	3.0	11.0	3.62	30	30
4	250	.52	4.0	12.0	4.81	50	45
6	250	.55	5.0	13.0	7.25	75	70
8	250	.60	5.5	13.5	8.44	110	105
10	250	.68	6.5	14.5	10.88	155	155
12	250	.75	7.5	15.5	13.25	215	215
14	150	.66	7.5	15.5	12.06	270	255
16	150	.70	8.0	16.0	13.25	340	320
18	150	.75	8.5	16.5	14.50	420	395
20	150	.80	9.5	17.5	16.88	530	500
24	150	.89	11.0	19.0	18.12	755	715

Note

3″ thru 12″ fittings for 350 psi working pressure, and 14″ thru 24″ fittings for 250 and 350 psi working pressure are furnished to the above dimensions in ductile iron.

Note: 90° and 45° bends, sizes 4″ thru 24″, can also be furnished with lugs.

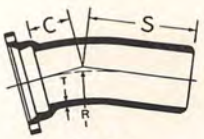
MECHANICAL JOINT CAST IRON FITTINGS

Meet all Applicable Requirements of
ANSI A21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) Specifications

BENDS

For Use with Super Bell-Tite Push-On Mechanical Joint Pipe or any Plain End Pipe of Same Outside Diameter

F-935
(22½°) Sixteenth Bend
MJ and MJ

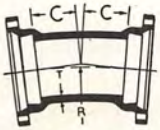


F-936
(22½°) Sixteenth Bend
MJ and PE

DIMENSIONS AND WEIGHTS

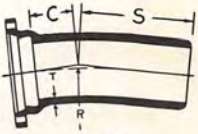
F-935 and F-936

Nominal Diameter Inches	Pressure Rating psi	Dimensions—Inches				Approximate Weight—Pounds Body Casting Only	
		T	C	S	R	**F-935**	**F-936**
3	250	.48	3.0	11.0	7.56	30	30
4	250	.52	4.0	12.0	10.06	50	45
6	250	.55	5.0	13.0	15.06	75	70
8	250	.60	5.5	13.5	17.62	110	105
10	250	.68	6.5	14.5	22.62	160	160
12	250	.75	7.5	15.5	27.62	220	220
14	150	.66	7.5	15.5	25.12	275	260
16	150	.70	8.0	16.0	27.62	345	325
18	150	.75	8.5	16.5	30.19	430	405
20	150	.80	9.5	17.5	35.19	535	505
24	150	.89	11.0	19.0	37.69	765	725



F-937
(11¼°) Thirty-Second Bend
MJ and MJ

MJ Fittings are Furnished Complete with Joint Accessories
See page 41



F-938
(11¼°) Thirty-Second Bend
MJ and PE

F-937 and F-938

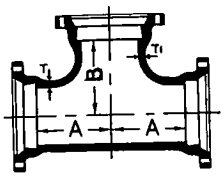
Nominal Diameter Inches	Pressure Rating psi	Dimensions—Inches				Approximate Weight—Pounds Body Casting Only	
		T	C	S	R	**F-937**	**F-938**
3	250	.48	3.0	11.0	15.25	30	30
4	250	.52	4.0	12.0	20.31	50	45
6	250	.55	5.0	13.0	30.50	75	70
8	250	.60	5.5	13.5	35.50	110	105
10	250	.68	6.5	14.5	45.69	160	160
12	250	.75	7.5	15.5	55.81	220	220
14	150	.66	7.5	15.5	50.75	275	260
16	150	.70	8.0	16.0	55.81	345	325
18	150	.75	8.5	16.5	60.94	430	405
20	150	.80	9.5	17.5	71.06	540	510
24	150	.89	11.0	19.0	76.12	770	730

Note:
3″ thru 12″ fittings for 350 psi working pressure, and 14″ thru 24″ fittings for 250 and 350 psi working pressure are furnished to the above dimensions in ductile iron.

Note: Unless otherwise ordered, fittings will be furnished tar-coated inside and out. Fittings uncoated, and fittings tar-coated outside and with cement-lining inside are also available.

MECHANICAL JOINT CAST IRON FITTINGS

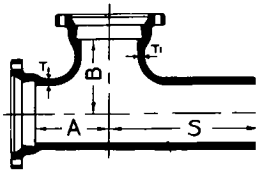
Meet all Applicable Requirements of
ANSI A21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) Specifications



F-940 Tee
MJ, MJ and MJ

TEES

For Use with Super Bell-Tite Push-On Mechanical Joint Pipe or any Plain End Pipe of Same Outside Diameter



F-942 Tee
MJ, PE and MJ

DIMENSIONS AND WEIGHTS

F-940 and F-942

Nominal Diameter Inches		Pressure Rating psi	Dimensions—Inches					Approximate Weight—Pounds Body Castings Only	
Run	Branch		T	T_1	A	B	S	F-940	F-942
3	3	250	.48	.48	5.5	5.5	13.5	55	55
4	3	250	.52	.48	6.5	6.5	14.5	75	70
4	4	250	.52	.52	6.5	6.5	14.5	80	75
6	3	250	.55	.48	8	8	16	110	105
6	4	250	.55	.52	8	8	16	115	110
6	6	250	.55	.55	8	8	16	125	120
8	3	250	.60	.48	9	9	...	155	...
8	4	250	.60	.52	9	9	17	165	160
8	6	250	.60	.55	9	9	17	175	170
8	8	250	.60	.60	9	9	17	185	180
10	3	250	.68	.48	11	11	...	230	...
10	4	250	.68	.52	11	11	19	235	235
10	6	250	.68	.55	11	11	19	250	250
10	8	250	.68	.60	11	11	19	260	260
10	10	250	.80	.80	11	11	19	310	310
12	3	250	.75	.48	12	12	...	305	...
12	4	250	.75	.52	12	12	20	315	315
12	6	250	75	.55	12	12	20	325	325
12	8	250	.75	.60	12	12	20	340	340
12	10	250	.87	.80	12	12	20	390	390
12	12	250	.87	.87	12	12	20	410	410
14	6	150	.66	.55	14	14	22	435	420
14	8	150	.66	.60	14	14	22	450	435
14	10	150	.66	.68	14	14	22	465	450
14	12*	150	.82	.75	14	14	22	540	525
14	14*	150	.82	.82	14	14	22	585	570
16	6	150	.70	.55	15	15	23	540	520
16	8	150	.70	.60	15	15	23	550	530
16	10	150	.70	.68	15	15	23	570	550
16	12	150	.70	.75	15	15	23	590	570
16	14*	150	.89	.82	15	15	23	710	690
16	16*	150	.89	.89	15	15	23	740	720

* We reserve the option to furnish these fittings to Class B wall thickness in ductile iron, whic
are rated by ANSI A21.10 for 350 psi working pressure.

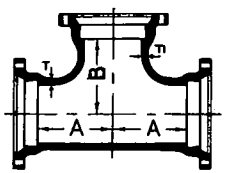
See page 41 for standard accessories furnished.

Note

3" thru 12" fittings for 350 psi working pressure, and 14" thru 24" fittings for 250 and 350 psi working pressure are furnished to the above dimensions in ductile iron.

MECHANICAL JOINT CAST IRON FITTINGS

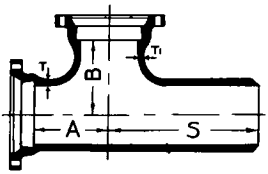
Meet all Applicable Requirements of ANSI A21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) Specifications



F-940 Tee
MJ, MJ and MJ

TEES

For Use with Super Bell-Tite Push-On Mechanical Joint Pipe or any Plain End Pipe of Same Outside Diameter



F-942 Tee
MJ, PE and MJ

DIMENSIONS AND WEIGHTS
F-940 and F-942

Nominal Diameter Inches		Pressure Rating	Dimensions—Inches					Approximate Weight—Pounds Body Castings Only	
Run	Branch	psi	T	T_1	A	B	S	F-940	F-942
18	6	150	.75	.55	13	15.5	21	590	565
18	8	150	.75	.60	13	15.5	21	605	580
18	10	150	.75	.68	13	15.5	21	620	595
18	12	150	.75	.75	13	15.5	21	640	615
18	14	150	.75	.66	16.5	16.5	24.5	755	730
18	16*	150	.96	.89	16.5	16.5	24.5	905	880
18	18*	150	.96	.96	16.5	16.5	24.5	945	920
20	6	150	.80	.55	14	17	22	725	695
20	8	150	.80	.60	14	17	22	735	705
20	10	150	.80	.68	14	17	22	755	725
20	12	150	.80	.75	14	17	22	775	745
20	14	150	.80	.66	14	17	22	795	765
20	16	150	.80	.70	18	18	26	945	915
20	18*	150	1.03	.96	18	18	26	1140	1110
20	20*	150	1.03	1.03	18	18	26	1185	1155
24	6	150	.89	.55	15	19	23	985	945
24	8	150	.89	.60	15	19	23	1000	960
24	10	150	.89	.68	15	19	23	1020	980
24	12	150	.89	.75	15	19	23	1030	990
24	14	150	.89	.66	15	19	23	1055	1015
24	16	150	.89	.70	15	19	23	1075	1035
24	18	150	.89	.75	22	22	30	1400	1360
24	20*	150	1.16	1.03	22	22	30	1720	1680
24	24*	150	1.16	1.16	22	22	30	1815	1775

* We reserve the option to furnish these fittings to Class B wall thickness in ductile iron, which are rated by ANSI A21.10 for 350 psi working pressure.

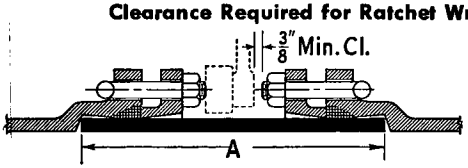
For BASE tees, see page 54.

See page 41 for standard accessories furnished.

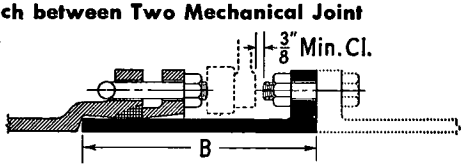
Note

3" thru 12" fittings for 350 psi working pressure, and 14" thru 24" fittings for 250 and 350 psi working pressure are furnished to the above dimensions in ductile iron.

Clearance Required for Ratchet Wrench between Two Mechanical Joint



Mechanical Joint to Mechanical Joint



Mechanical Joint to Flanged Joint

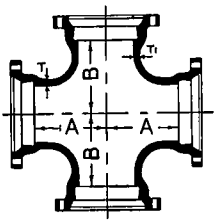
Minimum Length of Connecters Which Can Be Used††

Pipe size.....Inches	3	4	6	8	10	12	14	16	18	20	24
"A"=minimum length....Inches	12.00	12.75	12.75	13.50	13.50	13.25	15.25	16.00	16.00	16.00	16.50
"B"=minimum length....Inches	9.00	9.75	10.00	10.50	10.75	10.50	11.75	12.50	12.50	12.75	13.50

†† If open end wrenches are used, overall lengths "A" and "B" may be reduced by 2¼ inches.

MECHANICAL JOINT CAST IRON FITTINGS

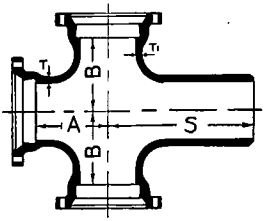
Meet all Applicable Requirements of
ANSI A21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) Specifications



F-945 Cross
MJ, MJ, MJ and MJ

CROSSES

For use with Super Bell-Tite Push-On Mechanical Joint Pipe or any Plain End Pipe of Same Outside Diameter



F-947 Cross
MJ, PE, MJ and MJ

DIMENSIONS AND WEIGHTS

F-945 and F-947

Nominal Diameter Inches		Pressure Rating psi	Dimensions—Inches					Approximate Weight—Pounds Body Castings Only	
Run	Branch		T	T_1	A	B	S	F-945	F-947
3	3	250	.48	.48	5.50	5.50	13.5	70	70
4	3	250	.52	.48	6.5	6.5	14.5	90	85
4	4	250	.52	.52	6.5	6.5	14.5	105	100
6	3	250	.55	.48	8	8	16	125	120
6	4	250	.55	.52	8	8	16	140	135
6	6	250	.55	.55	8	8	16	160	155
8	4	250	.60	.52	9	9	17	185	180
8	6	250	.60	.55	9	9	17	205	200
8	8	250	.60	.60	9	9	17	235	230
10	4	250	.68	.52	11	11	19	260	260
10	6	250	.68	.55	11	11	19	285	285
10	8	250	.68	.60	11	11	19	310	310
10	10	250	.80	.80	11	11	19	380	380
12	4	250	.75	.52	12	12	20	340	340
12	6	250	.75	.55	12	12	20	360	360
12	8	250	.75	.60	12	12	20	385	385
12	10	250	.87	.80	12	12	20	460	460
12	12	250	.87	.87	12	12	20	495	495
14	6	150	.66	.55	14	14	22	475	460
14	8	150	.66	.60	14	14	22	500	485
14	10	150	.66	.68	14	14	22	540	525
14	12*	150	.82	.75	14	14	22	630	615
14	14*	150	.82	.82	14	14	22	710	695
16	6	150	.70	.55	15	15	23	575	555
16	8	150	.70	.60	15	15	23	605	585
16	10	150	.70	.68	15	15	23	645	625
16	12	150	.70	.75	15	15	23	685	665
16	14*	150	.89	.82	15	15	23	830	810
16	16*	150	.89	.89	15	15	23	895	875
18	6	150	.75	.55	13	15.5	21	625	600
18	8	150	.75	.60	13	15.5	21	655	630
18	10	150	.75	.68	13	15.5	21	685	660
18	12	150	.75	.75	13	15.5	21	725	700
18	14	150	.75	.66	16.5	16.5	24.5	870	845
18	16*	150	.96	.89	16.5	16.5	24.5	1060	1035
18	18*	150	.96	.96	16.5	16.5	24.5	1130	1105

Note

3" thru 12" fittings for 350 psi working pressure, and 14" thru 24" fittings for 250 and 350 psi working pressure are furnished to the above dimensions in ductile iron.

See page 41 for standard accessories furnished.

* We reserve the option to furnish these fittings to Class B wall thickness in ductile iron, which are rated by ANSI A21.10 for 350 psi working pressure. For Mechanical Joint Tapped Crosses, see page 112.

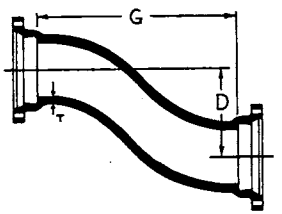
MECHANICAL JOINT CAST IRON FITTINGS

Meet all Applicable Requirements of
ANSI A21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) Specifications

CROSSES DIMENSIONS AND WEIGHTS F-945 and F-947 (Cont'd)

Nominal Diameter Inches		Pressure Rating	Dimensions—Inches					Approximate Weight—Pounds Body Castings Only	
Run	Branch	psi	T	T_1	A	B	S	F-945	F-947
20	6	150	.80	.55	14	17	22	760	730
20	8	150	.80	.60	14	17	22	790	760
20	10	150	.80	.68	14	17	22	820	790
20	12	150	.80	.75	14	17	22	860	830
20	14	150	.80	.66	14	17	22	905	875
20	16	150	.80	.70	18	18	26	1085	1055
20	18*	150	1.03	.96	18	18	26	1330	1300
20	20*	150	1.03	1.03	18	18	26	1415	1385
24	6	150	.89	.55	15	19	23	1025	985
24	8	150	.89	.60	15	19	23	1045	1005
24	10	150	.89	.68	15	19	23	1085	1045
24	12	150	.89	.75	15	19	23	1110	1070
24	14	150	.89	.66	15	19	23	1155	1115
24	16	150	.89	.70	15	19	23	1200	1160
24	18	150	.89	.75	22	22	30	1590	1550
24	20*	150	1.16	1.03	22	22	30	1965	1925
24	24*	150	1.16	1.16	22	22	30	2155	2115

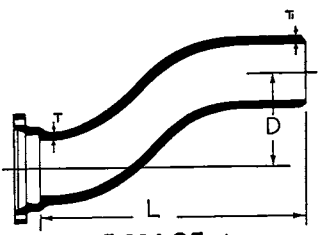
* We reserve the option to furnish these fittings to Class B wall thickness in ductile iron, which are rated by ANSI A21.10 for 250 psi working pressure.



F-982 Offset
MJ and MJ

OFFSETS

For Use with Super Bell-Tite Push-On Mechanical Joint Pipe or any Plain End Pipe of Same Outside Diameter



F-984 Offset
MJ and PE

DIMENSIONS AND WEIGHTS

F-982 and F-984

Nominal Diameter Inches By Offset	Pressure Rating psi	Dimensions—Inches					Approximate Weight—Pounds Body Casting Only	
		T	T_1	D	G	L	F-982	F-984
3 x 12	250	.48	.48	12	22	30	60	60
3 x 18	250	.48	.48	18	30	38	75	75
4 x 6	250	.52	.47	6	19	27	75	70
4 x 12	250	.52	.47	12	22	30	85	80
4 x 18	250	.52	.47	18	30	38	105	100
4 x 24	250	.52	.47	24	23½	31½	105	100
6 x 6	250	.55	.50	6	20	28	110	105
6 x 12	250	.55	.50	12	26	34	135	130
6 x 18	250	.55	.50	18	33	41	165	160
6 x 24	250	.55	.50	24	22¼	30¼	165	165
8 x 6	250	.60	.54	6	21	29	160	155
8 x 12	250	.60	.54	12	28	36	200	195
8 x 18	250	.60	.54	18	35	43	245	240
8 x 24	250	.60	.54	24	38¼	46¼	285	285
10 x 6	250	.68	.60	6	22	30	220	220
10 x 12	250	.68	.60	12	30	38	280	280
10 x 18	250	.68	.60	18	38	46	340	340
12 x 6	250	.75	.68	6	26	34	320	320
12 x 2	250	.75	.68	12	37	45	420	420
12 x 8	250	.75	.68	18	48	56	520	520
12 x 24	250	.75	.68	24	48	56	540	545
14 x 18	150	.66	.66	18	49	57	585	570
16 x 12	150	.70	.70	12	40	48	600	580
16 x 18	150	.70	.70	18	50	58	710	690

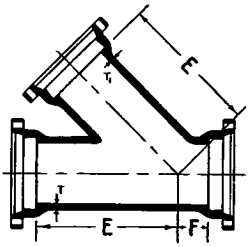
For making offsets on the job, see page 224.

Note: For fittings for 250 and 350 psi working pressure, see note on page 48.

See page 41 for standard accessories furnished.

MECHANICAL JOINT CAST IRON FITTINGS

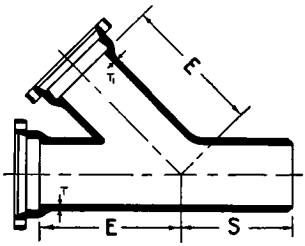
Meet all Applicable Requirements of
ANSI A21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) Specifications



F-950 "Y" Branch
MJ, MJ and MJ

"Y" BRANCHES

For Use with Super Bell-Tite Push-On Mechanical Joint Pipe or any Plain End Pipe of Same Outside Diameter



F-952 "Y" Branch
MJ, PE and MJ

DIMENSIONS AND WEIGHTS

F-950 and F-952

Nominal Diameter Inches		Pressure Rating psi	Dimensions—Inches					Approximate Weight—Pounds Body Castings Only	
Run	Branch		T	T_1	E	F	S	F-950	F-952
3	3	250	.48	.48	10	3	11	60	60
4	3	250	.52	.48	12	3	11	80	75
4	4	250	.52	.52	12	3	11	90	85
6	3	250	.55	.48	14.5	3.5	11.5	120	115
6	4	250	.55	.52	14.5	3.5	11.5	130	125
6	6	250	.55	.55	14.5	3.5	11.5	145	140
8	3	250	.60	.48	17.5	4.5	12.5	180	175
8	4	250	.60	.52	17.5	4.5	12.5	190	185
8	6	250	.60	.55	17.5	4.5	12.5	205	200
8	8	250	.60	.60	17.5	4.5	12.5	230	225
10	4	250	.68	.52	20.5	5	13	270	270
10	6	250	.68	.55	20.5	5	13	285	285
10	8	250	.68	.60	20.5	5	13	310	310
10	10	250	.68	.68	20.5	5	13	340	340
12	4	250	.75	.52	24.5	5.5	13.5	380	380
12	6	250	.75	.55	24.5	5.5	13.5	400	400
12	8	250	.75	.60	24.5	5.5	13.5	425	425
12	10	250	.75	.68	24.5	5.5	13.5	450	450
12	12	250	.75	.75	24.5	5.5	13.5	490	490
14	6	150	.82	.55	27	6	14	570	555
14	8	150	.82	.60	27	6	14	595	580
14	10	150	.82	.68	27	6	14	625	610
14	12	150	.82	.75	27	6	14	670	655
14	14	150	.82	.82	27	6	14	730	715
16	6	150	.89	.55	30	6.5	14.5	735	715
16	8	150	.89	.60	30	6.5	14.5	760	740
16	10	150	.89	.68	30	6.5	14.5	800	780
16	12	150	.89	.75	30	6.5	14.5	835	815
16	14	150	.89	.82	30	6.5	14.5	900	880
16	16	150	.89	.89	30	6.5	14.5	960	940
18	10	150	.96	.68	32	7	15	975	950
18	12	150	.96	.75	32	7	15	1015	990
18	14	150	.96	.82	32	7	15	1075	1050
18	16	150	.96	.89	32	7	15	1135	1110
18	18	150	.96	.96	32	7	15	1200	1175
20	12	150	1.03	.75	35	8	16	1260	1230
20	14	150	1.03	.82	35	8	16	1320	1290
20	16	150	1.03	.89	35	8	16	1375	1345
20	18	150	1.03	.96	35	8	16	1445	1415
20	20	150	1.03	1.03	35	8	16	1525	1495
24	14	150	1.16	.82	40.5	9	17	1865	1825
24	16	150	1.16	.89	40.5	9	17	1925	1885
24	18	150	1.16	.96	40.5	9	17	1990	1950
24	20	150	1.16	1.03	40.5	9	17	2070	2030
24	24	150	1.16	1.16	40.5	9	17	2245	2205

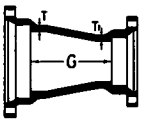
Note

3" thru 12" fittings for 350 psi working pressure, and 14" thru 24" fittings for 250 and 350 psi working pressure are furnished to the above dimensions in ductile iron.
See page 41 for standard accessories furnished.

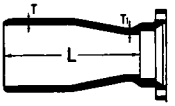
MECHANICAL JOINT CAST IRON FITTINGS

Meet all Applicable Requirements of
ANSI A21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) Specifications

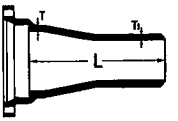
CONCENTRIC REDUCERS



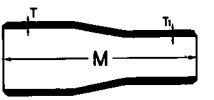
F-960 Reducer
MJ and MJ



F-965 Reducer
Small End MJ



F-967 Reducer
Large End MJ



F-970 Reducer
PE and PE

ECCENTRIC REDUCERS

Eccentric reducers are available in sizes 4 x 3 through 12 x 10 inches. They have the same laying dimensions, metal thicknesses, and weights as shown for concentric reducers.

DIMENSIONS AND WEIGHTS

F-960 thru F-970

Nominal Diameter Inches		Pressure Rating psi	Thickness Inches		Laying Length Inches			Approximate Weight—Pounds Body Castings Only			
Large End	Small End		T	T_1	G	L	M	F-960†	F-965†	F-967†	F-970†
4	3	250	.52	.48	7	15	23	40	35	40	35
6	3	250	.55	.48	9	17	25	55	50	55	50
6	4	250	.55	.52	9	17	25	60	60	60	55
8	3	250	.60	.48	11	19	27	75	70	75	70
8	4	250	.60	.52	11	19	27	80	80	80	75
8	6	250	.60	.55	11	19	27	95	90	90	85
10	4	250	.68	.52	12	20	28	105	100	100	100
10	6	250	.68	.55	12	20	28	115	115	115	115
10	8	250	.68	.60	12	20	28	135	130	130	130
12	4	250	.75	.52	14	22	30	135	130	130	130
12	6	250	.75	.55	14	22	30	150	150	145	145
12	8	250	.75	.60	14	22	30	165	165	165	165
12	10	250	.75	.68	14	22	30	190	190	185	185
14	6	150	.66	.55	16	24	32	190	175	185	170
14	8	150	.66	.60	16	24	32	210	190	205	190
14	10	150	.66	.68	16	24	32	230	215	230	215
14	12	150	.66	.75	16	24	32	255	240	255	240
16	6	150	.70	.55	18	26	34	230	210	230	210
16	8	150	.70	.60	18	26	34	250	230	250	230
16	10	150	.70	.68	18	26	34	280	255	275	255
16	12	150	.70	.75	18	26	34	305	285	305	285
16	14	150	.70	.66	18	26	34	335	310	315	295
18	8	150	.75	.60	19	27	35	295	270	295	270
18	10	150	.75	.68	19	27	35	325	300	320	295
18	12	150	.75	.75	19	27	35	350	325	350	325
18	14	150	.75	.66	19	27	35	380	355	365	340
18	16	150	.75	.70	19	27	35	415	390	395	370
20	10	150	.80	.68	20	28	36	375	345	375	345
20	12	150	.80	.75	20	28	36	405	375	405	375
20	14	150	.80	.66	20	28	36	430	400	415	385
20	16	150	.80	.70	20	28	36	470	435	445	415
20	18	150	.80	.75	20	28	36	510	475	485	455
24	12	150	.89	.75	24	32	40	550	510	550	510
24	14	150	.89	.66	24	32	40	575	535	560	520
24	16	150	.89	.70	24	32	40	615	575	595	555
24	18	150	.89	.75	24	32	40	660	620	635	595
24	20	150	.89	.80	24	32	40	705	665	675	635

† Unless ordered otherwise, we always ship F-965 reducer.

Note

3″ thru 12″ fittings for 350 psi working pressure, and 14″ thru 24″ fittings for 250 and 350 psi working pressure are furnished to the above dimensions in ductile iron.

See page 41 for standard accessories furnished.

MECHANICAL JOINT CAST IRON FITTINGS

Meet all Requirements of
ANSI A21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) Specifications

SOLID SLEEVES

F-1012 and F-1014

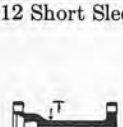
Nominal Diameter Inches	Pressure Rating psi	Thickness T Inches	Overall L Inches		Approximate Weight—Pounds Body Casting Only	
			F-1012	F-1014	F-1012	F-1014
3	250	.48	7.5	12	25	30
4	250	.52	7.5	12	35	45
6	250	.55	7.5	12	45	65
8	250	.60	7.5	12	65	85
10	250	.68	7.5	12	85	115
12	250	.75	7.5	12	110	145
14	250	.82	9.5	15	165	225
16	250	.89	9.5	15	200	275
18	250	.96	9.5	15	240	330
20	250	1.03	9.5	15	275	380
24	250	1.16	9.5	15	360	505

F-1012 Short Sleeve

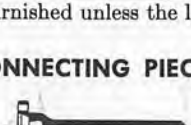
F-1014 Long Sleeve

Note: F-1012 Short Sleeve will be furnished unless the long pattern is specifically requested.

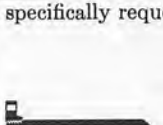
CONNECTING PIECES



F-1025 Connecter MJ and Flange



F-1030 Connecter MJ and PE

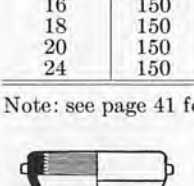


F-1031 Connecter Flange and PE

F-1020 thru F-1031

Nominal Diameter Inches	Pressure Rating psi	Dimensions Inches			Approximate Weight—Pounds Body Casting Only		F-1031	
		T	J	R	F-1025	F-1030	Length V Inches	Approx. Weight Pounds
3	250	.48	8	16	30	40	16	25
4	250	.52	8	16	40	40	16	35
6	250	.55	8	16	60	55	16	50
8	250	.60	8	16	85	80	16	75
10	250	.68	8	16	115	105	16	100
12	250	.75	8	16	155	145	16	140
14	150	.66	8	16	195	185	16	170
16	150	.70	8	16	240	225	16	210
18	150	.75	8	16	280	300	16	235
20	150	.80	8	16	340	360	16	285
24	150	.89	8	16	455	475	16	400

Note: see page 41 for standard MJ accessories furnished. No flange accessories are furnished.

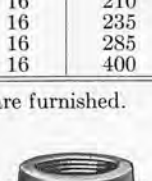


F-1032 Coupling Section

F-1032 Tapped Coupling

For Pipe Size Inches	Tapped I.P.S.‡ Inches	Overall Length Inches	Approx. Weight Pounds
2	2	7.50	5
3	3	7.50	12
4	4	9.25	20
6	6	9.25	30
8	8	9.25	40

‡ For smaller size taps, see F-1054 tapped plug.



F-1032 Tapped Coupling*

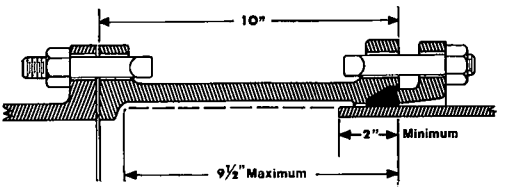
* The plain end of the F-1032 is beveled to socket with Super Bell-Tite and other cast iron pipe.

MECHANICAL JOINT CAST IRON FITTINGS

Meet all Applicable Requirements of
ANSI A21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) Specifications

ADJUSTABLE CONNECTING PIECE

Mechanical Joint to Flange



F-1439 Adjustable Connector

The F-1439 Connector is designed for use in vaults for pump connections and similar installations where it is not possible to know the exact laying lengths. The Adjustable Connector provides 7½ inches of adjustment in laying length, making it possible to speed the final connection of piping to a flanged joint.

The flange is faced and drilled to specifications ANSI A21.10; the mechanical joint meets the requirements of ANSI A21.11. The fitting is rated for 250 psi water working pressure.

The Mechanical Joint end can be furnished with the F-1058 Retainer Gland (page 89). The standard F-1045 Ring Gland will be furnished unless otherwise specified. See page 41 for standard MJ accessories supplied. No flange accessory material is furnished.

Dimensions and Weights

Nom. Pipe Size	Flg. Bolt Circle	Flange Bolts			Pipe O.D.	MJ Bolt Circle	MJ Bolts		Body Thick. Inches	Approx. Weight Pounds
		Type Head	Size	No.			Size	No.		
4	7.50	Tee	⅝ x 3	8	4.80	7.50	¾ x 3½	4	.52	40
6	9.50	Tee	¾ x 3½	8	6.90	9.50	¾ x 3½	6	.55	55
8	11.75	Tee	¾ x 3½	8	9.05	11.75	¾ x 4	6	.60	80
10	14.25	Hex	⅞ x 3¾	12	11.10	14.00	¾ x 4	8	.68	110
12	17.00	Hex	⅞ x 3¾	12	13.20	16.25	¾ x 4	8	.75	150

MECHANICAL JOINT PLUGS, CAPS AND GLANDS

For Use with Mechanical Joint Pipe or any Plain End Pipe of Same Outside Diameter

F-1035 Plug | **F-1054** Tapped Plug | **F-1040** Cap | **F-1042‡** Tapped Cap | **F-1045** Ring Gland | **F-1050†** Split Gland

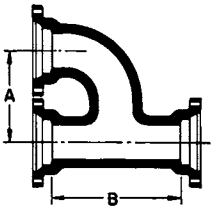
Joint accessories are never furnished with "MJ" Plugs unless specifically ordered.

F-1035 thru F-1054

Size Inches	Pressure Rating psi	Thickness T Inches	Approximate Weight—Pounds						Tap Size Inches F-1054 & F-1042		
			F-1035 Solid Plug	F-1040 Cap	F-1045 Ring Gland	F-1050† Split Gland	F-1054 Tapped Plug	F-1042 Tapped Cap	Std. Tap	Max. F-1054	Max. F-1042
3	250	.50	10	12	4	9			2	2½	2
4	250	.60	15	15	6	14			2	3	2
6	250	.65	25	25	11	18			2	5	2
8	250	.70	45	45	17	20			2	6	2
10	250	.75	65	60	21	30	Will vary depending upon size of tapping. Use weights shown for F-1035 and F-1040		2	8	2
12	250	.75	85	80	26	35			2	10	2
14	250	.82	120	115	37	....			2	2	2
16	250	.89	150	155	46	....			2	2½	2
18	250	.96	190	215	53	....			2	3	2
20	250	1.03	215	250	63	....			2	4	2
24	250	1.16	350	370	90	....			2	4	2½

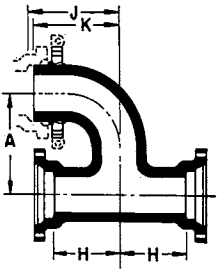
† For replacing regular ring glands found to be broken when pipe line is being tested.

MECHANICAL JOINT HYDRANT TEES



F-943
MJ Hydrant Tee

Hydrant tees are a combination tee and 90 degree elbow for use in hydrant installations where space is limited. Their unique design keeps the hydrant close to the main line, and permits the hydrant to be installed in the same trench, saving digging costs. Because it has one less joint than two fittings, it also saves time and labor in assembly. Since it is an integral unit, it anchors the hydrant to the main, and locates the hydrant a uniform distance from the main.



F-1224
MJ Hydrant Tee
Anchoring on the Branch

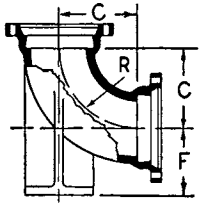
Dimensions and Weights

Nominal Diameter Inches	Dimensions-Inches					Approximate Weight-Pounds	
	A	B	H	J	K	F-943	F-1224*
6x6	12½	16	8	10¾	10	170	175
8x6	13½	18	9	11¾	11	215	220
10x6	14	22	11	13¾	13	275	280
12x6	16	24	12	14¾	14	375	380

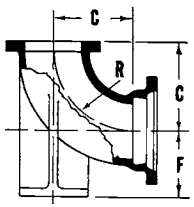
* Includes weight of Anchoring Gland, which is made on at the factory. Anchoring branch sockets with standardized MJ Bell only.

MECHANICAL JOINT BASE BENDS AND BASE TEES

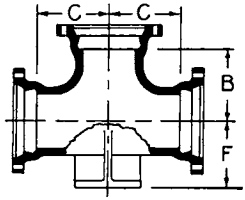
Meet all Applicable Requirements of
ANSI A21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) Specifications



F-1064 90° Base Bend
MJ and MJ



F-1066 90° Base Bend
Flanged and MJ



F-1074 Base Tee
MJ, MJ and MJ

DIMENSIONS AND WEIGHTS

Nominal Diameter Inches	Pressure Rating psi	Dimensions Inches				Approximate Weight-Pounds With Base-Body Casting only		
		B	C	F†	R	F-1064	F-1066	F-1074
3	250	5.5	5.5	4.88	4.0	45	40	60
4	250	6.5	6.5	5.50	4.5	65	60	90
6	250	8.0	8.0	7.00	6.0	105	95	140
8	250	9.0	9.0	8.38	7.0	165	155	215
10	250	11.0	11.0	9.75	9.0	235	220	340
12	250	12.0	12.0	11.25	10.0	320	310	455
14	150	14.0	14.0	12.50	11.5	410	385	635**
16	150	15.0	15.0	13.75	12.5	505	475	790**
18	150	16.5	16.5	15.00	14.0	660	615	1020**
20	150	18.0	18.0	16.00	15.5	800	750	1260**
24	150	22.0	22.0	18.50	18.5	1155	1095	1895**

** May be furnished to Class B wall thickness in ductile iron at our option. See page 47.

Note: Except the F-1066, 3″ thru 12″ fittings for 350 psi working pressure, and 14″ thru 24″ fittings for 250 and 350 psi working pressure are furnished to the above dimensions in ductile iron.

† Dimensions "F" are for *machined* bases. For bases not machined, add approximately ⅛ inch.

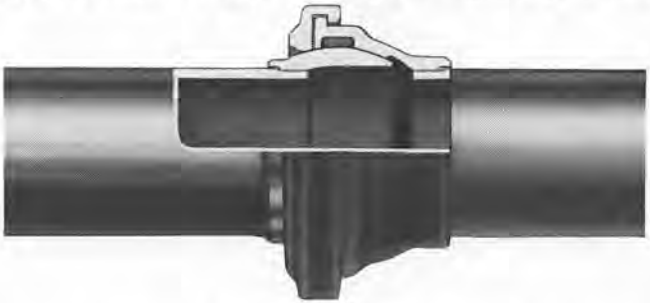
Bases will be machined and/or drilled ONLY when so ordered.

BASE TEES REDUCING ON BRANCH

To compute the total weight of tees reducing on the branch, add weight of the Base Only (see page 78) to the weight of reducing tee wanted (see page 46).

CLOW RIVER CROSSING PIPE

A Premium Product Made Entirely From Super-Strong, Rugged Ductile Iron for River Crossing, Submerged Piping, and Other Uses Requiring a High Quality, Freely Deflecting Locked Joint



F-141

DUCTILE IRON RIVER CROSSING PIPE

Clow River Crossing Pipe has a ball and socket type joint to meet the severe requirements for crossing rivers, streams and lakes, and for other uses where free turning deflection and a restrained joint are needed.

The joint is boltless. Restraint is provided by a bayonet-type locking of the retainer over the bell. Joint design assures uniform load distribution between the restraining components, even when the joint is fully deflected.

Each pipe consists of a bell, ball and retainer assembled on a centrifugally cast barrel. All pipe components are rugged, high-strength ductile iron. The barrel is cast of 60-42-10 ductile iron in accordance with American National Standard A21.51. The bell, ball and retainer are cast of 70-50-05 ductile iron in accordance with the applicable requirements of American National Standard A21.10.

Pipe components are machined to precise tolerances to assure premium performance and ease of assembly. Each pipe is hydrostatically tested at the factory.

The gasket is made of high quality rubber and is symmetrical in shape so that it cannot be installed backwards.

Clow River Crossing Pipe is manufactured in 6″ through 24″ sizes to the dimensions and weights shown on page 56. The connecting pieces shown on page 57 can be furnished to meet the most demanding job requirements and exacting specifications. Two thickness classes are offered in the 18″ through 24″ sizes, one of which is buoyant and will float when filled with air.

Installation data and assembly instructions are shown on pages 58 and 59. Copies are furnished on receipt of each order and forwarded with each shipment.

A RUGGED, EASY-TO-ASSEMBLE JOINT

The Clow River Crossing Joint is a boltless, push-on type joint designed to simplify assembly and speed up installation. The gasket is inserted in the bell and compressed by the entering ball as the joint is made up.

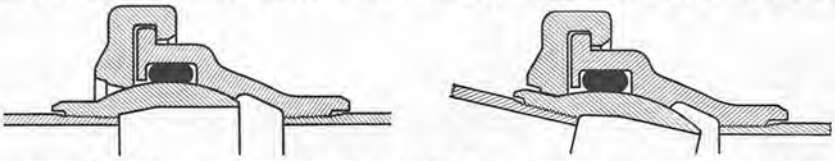
The joint is restrained by locking the bayonet-type retainer over the lugs on the bell. To prevent rotation of the retainer after assembly, a cast iron retainer lock is inserted between the lugs and held in place by a corrosion-resistant roll pin. The roll pin and retainer lock can easily be removed to permit disassembly of the joint.

The absence of any bolts or split parts saves confusion and nuisance during assembly. Joint construction and the symmetrical shape of the gasket assures that the joint can be assembled properly under adverse conditions, even by a diver under water.

Full 18′0″ laying lengths mean fewer joints, and the speed of assembly saves time as well as dredging, diving, or other installation costs sometimes encountered in laying pipe in river bottom trenches.

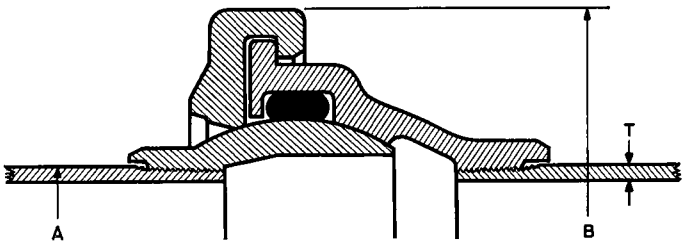
Laid lengths on any given order need not all be 18′0″, but may vary to suit different conditions. In many cases, where a great amount of curvature is required in a line, it may be advisable to use 9-foot lengths to obtain the proper number of joints to provide the required curvature.

FULL 15° FREE TURNING DEFLECTION WITH NO REDUCTION IN THE WATERWAY



No restriction of the pipe waterway takes place in this joint when set to its maximum 15° deflection. It is recommended, however, because of possible field conditions which may be encountered, that in laying out ball joint pipelines, the "design" deflection be limited to 12 degrees per joint.

CLOW RIVER CROSSING PIPE



F-141 River Crossing Pipe

DIMENSIONS AND WEIGHTS

Nominal Pipe Size Inches	A21.51 Thickness Class Number	Pressure Rating psi	Dimensions—Inches			Pipe Barrel lbs./foot	Weight of Full Length Pipe* as Shipped in Pounds
			T Thickness	A Pipe O.D.	B Retainer O.D.		
6	5	350	.40	6.90	13.88	25.0	545
8	5	350	.42	9.05	16.63	34.8	770
10	5	350	.44	11.10	19.13	45.1	1005
12	5	350	.46	13.20	22.00	56.3	1270
14	6	350	.51	15.30	24.50	72.5	1655
16	6	350	.52	17.40	27.00	84.4	1990
18	6	350	.53	19.50	30.00	96.7	2375
18	8†	350	.59	19.50	30.00	107.3	2560
20	6	350	.54	21.60	32.75	109.3	2810
20	9†	350	.63	21.60	32.75	127.0	3110
24	6	350	.56	25.80	38.25	135.9	3700
24	12†	350	.74	25.80	38.25	178.3	4415

* Weight is based on 18′0″ nominal laying length. Minimum laying length is 7′0″.

TABLE OF BUOYANCY

Nominal Pipe Size Inches	A21.51 Thickness Class Number	Wall Thickness in Inches	Weight of Pipe as Shipped	Weight of Full Length Pipe Under Water		Maximum Safe Tension in Pounds††
				Full of Air	Full of Water	
6	5	.40	545	240	465	50,000
8	5	.42	770	240	655	70,000
10	5	.44	1005	220	860	95,000
12	5	.46	1270	155	1080	120,000
14	6	.51	1655	160	1410	145,000
16	6	.52	1990	45	1685	165,000
18	6	.53	2375	− 70	2015	195,000
18	8†	.59	2560	110	2170	195,000
20	6	.54	2810	−200	2375	210,000
20	9†	.63	3110	100	2635	210,000
24	6	.56	3700	−620	3110	260,000
24	12†	.74	4415	95	3715	260,000

† Thickness required to overcome buoyancy. †† Maximum tension that can safely be applied t a single joint when pulling pipe into position or laying it from a barge.

Weights above do not include cement lining.

STANDARD PRACTICE

While Clow River Crossing Pipe is regularly furnished in 18′0″ nominal laying lengths, we reserve the right to furnish a limited percentage of shorter lengths. We will always ship a footage of pipe not less than the total ordered. We also reserve the right to furnish a total footage greater than the footage ordered to allow the use of full length pipe without cutting. Any exceptions to this standard practice must be clearly specified at the time of order.

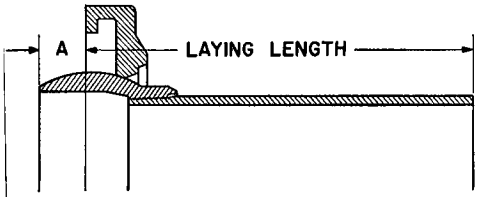
Exact Laying Lengths: If any piece of pipe or length of piping must be furnished with an exact laying length, this must be specifie Random lengths will be used in making u exact laying lengths greater than 18 feet.

End Connections: Clow River Crossing Pipe ca be furnished with the end connections listed o page 57. The type of end connection and lengt of connecting piece must be specified.

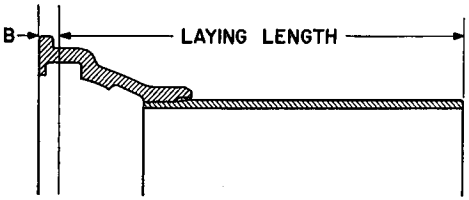
Accessories: Clow River Crossing Pipe ar shipped with the retainer assembled on th pipe and secured to the ball end by hook bolt Gaskets, lubricant, retainer locks and retaine lock pins are shipped in a separate containe

CLOW RIVER CROSSING PIPE

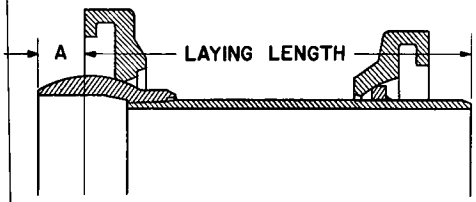
CONNECTING PIECES



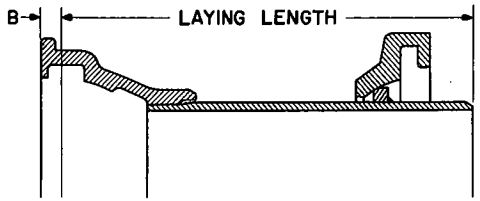
F-141-1 Ball and Plain End



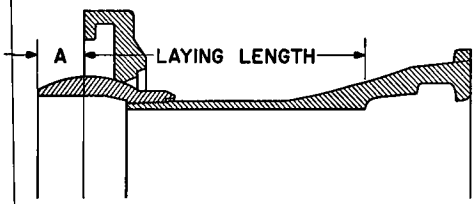
F-141-2 Bell and Plain End



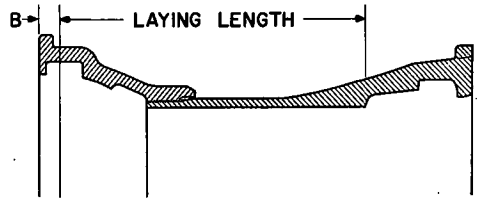
F-141-11 Ball and Super-Lock Plain End



F-141-12 Bell and Super-Lock Plain End



F-141-13 Ball and Super-Lock Bell



F-141-14 Bell and Super-Lock Bell

Dimensions and Weights

Dimensions in Inches						Approximate Weight—Pounds*					
Nom. Pipe Size	Thickness A21.51 Class	Thickness Wall T	Plain End O.D.	A	B	F-141-1	F-141-2	F-141-11	F-141-12	F-141-5 and F-141-13	F-141-6 and F-141-14
6	5	.40	6.90	2¼	1	510	480	530	500	535	505
8	5	.42	9.05	2⅝	1⅛	720	675	755	710	760	715
10	5	.44	11.10	2⅞	1⅛	940	880	985	925	990	930
12	5	.46	13.20	3¼	1⅛	1185	1100	1245	1160	1250	1165
14	6	.51	15.30	3½	1¼	1545	1420	1630	1505	1620	1495
16	6	.52	17.40	3¾	1¼	1835	1680	1935	1780	1930	1770
18	6	.53	19.50	4¼	1¼	2185	1930	2330	2075	2300	2045
18	8	.59	19.50	4¼	1¼	2375	2115	2520	2260	2485	2225
20	6	.54	21.60	4½	1¼	2585	2190	2755	2360	2715	2320
20	9	.63	21.60	4½	1¼	2900	2495	3070	2665	3030	2625
24	6	.56	25.80	5¼	1¼	3365	2780	3655	3070	3510	2955
24	12	.71	25.80	5¼	1¼	4115	3510	4405	3800	4290	3690

* Weights shown are for 18 ft. laying length. Weights of shorter pieces can be determined by subtracting the appropriate barrel weight. (See page 56.)

Maximum laying length is 18′-0″. Minimum laying length is 3′-0″, except 7′-0″ for F-141-5 and F-141-13.

Pipe can be furnished Ball and MJ Bell (F-141-3), Bell and MJ Bell (F-141-4), Ball and Super Bell-Tite Bell (F-141-5), Bell and Super Bell-Tite Bell (F-141-6), Ball and Locked MJ Plain End (F-141-7), Bell and Locked MJ Plain End (F-141-8), Ball and Flange (F-141-9) or Bell and Flange (F-141-10).

Order must specify laying length of connecting pieces.

CLOW RIVER CROSSING PIPE

INSTALLATION DATA

An installation procedure must be determined for each individual installation of River Crossing Pipe. Some successful methods for installing pipe across a river or lake are listed here as a guide. It is usually advisable to prepare the bottom of the river or lake by excavating a trench for the pipe.

Clow F-141 River Crossing Pipe is most frequently used for crossing rivers and lakes. It is also adaptable to many other installations where joint deflection and positive joint restraint are required.

Pulling into Position

Joints are assembled on shore. The river bank is trenched and sloped to prevent overdeflection of the joints during pulling. The lead pipe is usually a connecting piece which is capped or plugged to keep unwanted water out of the pipe and reduce the weight of the submerged pipe. (See page 57 for connecting pieces and page 56 for pipe buoyancy). A cable or harness is attached behind the first joint and the pulling cable secured to the lead end to keep the lead pipe up during pulling. The line is pulled into place from the opposite shore. (See photograph below).

Class 6 River Crossing Pipe in the 18″ thru 24″ sizes will float and require sinking to the bottom after pulling. The heavier classes listed on page 56 are available for installations where flotation is not desired.

Laying from Barge

A crane mounted on a barge is used for handling the pipe from the same or a companion barge.

A chute to guide the pipe into position is constructed and mounted on the barge.

The joints are assembled in this chute and guided into position on the bottom as the barge is moved ahead. The chute must be designed to prevent maximum deflection of the joints as they are guided into position. (See photograph below.)

Cofferdamming

A cofferdam is constructed to divert the flow of water and allow trenching by conventional means.

The pipe is then assembled in the trench in the river bottom.

Joint Deflection

It is recommended that F-141 River Crossing Pipe installations be designed for a maximum joint deflection of 12 degrees. This design angle must also be considered when determining method of installation, slope of approaches or chutes, and the final contour of the installed pipe. Care must also be taken when handling and installing assembled joints to be sure that no joint is deflected to the maximum.

End Connections

The connection of F-141 River Crossing pipe to the balance of the system can be accomplished in several ways. The end pieces can be furnished with any of the type connections shown on page 57.

Installing Clow River Crossing Pipe by pulling it into position.

Installing Clow River Crossing Pipe by laying it from a barge.

CLOW RIVER CROSSING PIPE

HOW THE JOINT IS ASSEMBLED

1. Remove protective coating from the inside of the bell with suitable solvent. Gasket groove must be free of all foreign matter. Lubricate gasket groove and insert gasket. Lubricate the exposed gasket surface.

2. Remove hook bolts securing retainer to ball. Remove protective coating from ball O.D. with suitable solvent. Clean out any dirt behind retainer lugs. Lubricate outside surface of the ball.

3. Guide ball into bell opening so that it rests against installed gasket.

4. Assemble joint by using come-a-long or other mechanical means to pull ball into bell.

5. Position retainer so that the recesses line up with the lugs on the bell. Slide retainer over bell and rotate until the lugs on the bell and retainer line up.

6. At drilled hole on retainer O.D. insert cast iron retainer lock in recess formed by lugs on bell and retainer. Insert roll-pin in drilled hole and drive flush with retainer O.D.

Note: Pipe is usually installed with the ball ahead—that is, the ball is assembled into the bell of the preceding pipe.

FLANGED JOINT CAST IRON PIPE

FOR WATER, SEWAGE, OIL, AND OTHER LIQUIDS

Joint Meets all the Requirements of ANSI A21.15 (AWWA C115) Proposed Specifications

F-162
FLANGED JOINT PIPE

Clow Flanged Joint cast iron pipe is manufactured for water, steam, sewage, oil and other fluid lines, where rigid joints are required. Flanged pipe is available in sizes 3 through 24-inch diameter, in lengths up to 17′ 0″ maximum.

The pipe barrel is centrifugally cast pipe, meeting all the general quality and metallurgical provisions of ANSI specifications A21.6 (AWWA C106) and/or Federal Specifications WW-P-421c. To the plain ends of this pipe, specially designed screw flanges are assembled, in accordance with the foundry practice detailed below. Because of the requirement of *refacing* the face of the flange *and* the pipe simultaneously *after* power tightening, this pipe should not be flanged in the field.

Unless otherwise specified, screwed on flanges are faced and have bolt holes per ANSI B16.1 Class 125 standard template, and are designed for use with either ANSI A21.10 (AWWA C110) or ANSI B16.1 flanged fittings displayed on the following pages. For flanged pipe cast of ductile iron, see page 62.

This pipe should not be threaded or flanged in the field.

Cutaway showing flange assembled on pipe

Foundry Practice

Flanged joint cast iron pipe is made up by threading plain end pipe, screwing on specially designed *long hub* flanges—power tightened, and *refacing* across both face of flange and end of pipe. Due to the *refacing* of flange and pipe ends, the gasket actually seats over the machined ends of the adjoining pipes and, thus, threads are not affected by line pressure nor corrosive action of line contents. The long hub of the flange is designed to cover all pipe threads.

F-1310
Screw Flange
For Cast Iron Pipe

F-1310 Screw Flange

The F-1310 Screw Flange is a special flange tapped for cast iron pipe to outside diameters shown on page 61 with bolt holes in accordance with ANSI B16.1 125 pound template shown on page 65.

When Ordering

The following information is important to properly fill an order for this product: Size and Class (maximum working pressure) of pipe line, the length of the pieces ordered, and the type of end connections required. Unless otherwise ordered, all pipe and flanges will be furnished of gray cast iron.

GASKETS, BOLTS, AND STUDS

Flange accessories must be ordered separately. See page 64 for detailed information.

Weights Are Approximate

Weights shown are subject to a variation of not more than 10% for individual pieces. To obtain weight of short lengths, multiply length by the per foot weight of pipe barrel and add weight of flanges.

Interior cement lined flanged pipe may be substituted in lieu of tar coating without prior notification.

Face to Face Measurements

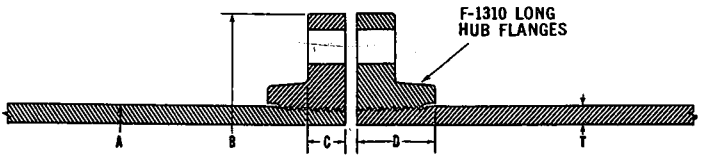
After facing flanges, a tolerance of plus or minus ⅛ inch shall be allowed on all contact surface to contact surface dimensions of full length or short length flanged pipe.

FLANGED JOINT CAST IRON PIPE

FOR WATER, SEWAGE, OIL, AND OTHER LIQUIDS

Pipe Barrel meets all the requirements of ANSI A21.6 (AWWA C106) Specifications
Joint Meets all the Requirements of ANSI A21.15 (AWWA C115) Proposed Specifications

This Pipe Should Not be Threaded or Flanged in the Field



F-162
Flanged Pipe

Dimensions and Weights

Nominal Inside Diameter Inches	ANSI A21.6 Thick. Class	Max. Working Pressure	Dimensions—Inches T Thickness	A Pipe O.D.	B Flange O.D.	C Flg. Thick.	D Hub	Approximate Weight—Pounds* One Flange Only	Pipe Barrel Per Ft.	17 Ft. Length With Flanges
3	24	150	.38	3.96	7.50	3/4	1 3/4	7	13.3	240
3	24	250	.38	3.96	7.50	3/4	1 3/4	7	13.3	240
4	23	150	.38	4.80	9.00	15/16	1 13/16	13	16.5	305
4	23	250	.38	4.80	9.00	15/16	1 13/16	13	16.5	305
6	22	150	.38	6.90	11.00	1	2	17	24.3	445
6	22	250	.38	6.90	11.00	1	2	17	24.3	445
8	22	150	.41	9.05	13.50	1 1/8	2 1/4	27	34.7	645
8	22	250	.41	9.05	13.50	1 1/8	2 1/4	27	34.7	645
10	22	150	.44	11.10	16.00	1 3/16	2 7/16	38	46.0	860
10	22	250	.44	11.10	16.00	1 3/16	2 7/16	38	46.0	860
12	22	150	.48	13.20	19.00	1 1/4	2 5/8	58	59.8	1135
12	23	250	.52	13.20	19.00	1 1/4	2 5/8	58	64.6	1215
14	22	150	.51	15.30	21.00	1 3/8	2 7/8	72	73.9	1400
14	24	250	.59	15.30	21.00	1 3/8	2 7/8	72	85.1	1590
16	22	150	.54	17.40	23.50	1 7/16	3 1/16	90	89.2	1695
16	24	250	.63	17.40	23.50	1 7/16	3 1/16	90	103.6	1940
18	22	150	.58	19.50	25.00	1 9/16	3 1/4	90	107.6	2010
18	24	250	.68	19.50	25.00	1 9/16	3 1/4	90	125.4	2310
20	22	150	.62	21.60	27.50	1 11/16	3 7/16	115	127.5	2400
20	24	250	.72	21.60	27.50	1 11/16	3 7/16	115	147.4	2735
24	23	150	.73	25.80	32.00	1 7/8	3 7/8	160	179.4	3370
24	24	250	.79	25.80	32.00	1 7/8	3 7/8	160	193.7	3615

* Calculated weight of full length pipe is rounded off to nearest five pounds.

›e for both 150 and 250 psi working pressure will always be furnished with flanges the ANSI B16.1 125 pound template on page 65. For connecting to ANSI B16.1 250 und flanges, use the F-1989 Flange Adaptor shown on page 83.

Interior cement lined flanged pipe may be substituted in lieu of tar coating without prior tification.

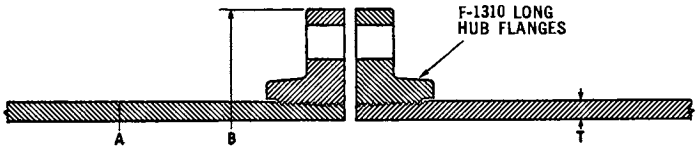
Flange accessories must be ordered separately. See page 64 for detailed information.

on request pipe can be furnished with greater wall thickness than shown in above table concentrated sulphuric acid and other special services.

DUCTILE CAST IRON PIPE

FLANGED JOINT

Pipe Barrel Meets all the Requirements of ANSI A21.51 (AWWA C151) Specifications
Joint Meets all the Requirements of ANSI A21.15 (AWWA C115) Proposed Specifications



F-162-D
DUCTILE CAST IRON FLANGED PIPE

For water, sewage, oil, and other liquids

DUCTILE CAST IRON FLANGED PIPE

The same benefits of high strength and ductility which apply to all pipe of ductile cast iron apply equally to flanged joint pipe. When the job conditions call for pipe with greater strength and increased resistance to breakage than is obtainable with gray cast iron, specify ductile flanged pipe. This is particularly true on the discharge side of high pressure pumps, whenever uneven settling is likely, or wherever high surge or operating pressures may be expected.

Any of the flanged fittings appearing in th catalog can be furnished in ductile iron for u with this pipe.

Ductile flanged pipe is manufactured to wall thickness that provides adequate met under the threads. Such pipe is safely rate for 250 psi working pressure, and unless sp cifically ordered otherwise, is furnished wit ductile iron flanges to ANSI B16.1 125 pour template. For connecting to existing lines wit B16.1 250 pound flanges, use the F-1989 Flang Adapter, shown on page 83.

This pipe should not be threaded or flanged in the field.

DIMENSIONS AND WEIGHTS

Nominal Inside Diameter Inches	ANSI A21.51 Thick. Class	Rated Working Pressure psi	Dimensions—Inches			Approximate Weight-Pounds		
			T Thick-ness	A Pipe O.D.	B Flange O.D.	One Flange Only	Pipe Barrel Per Ft.	17 Foot Length* With Flanges
3	3	250	.31	3.96	7.50	7	10.9	200
4	3	250	.32	4.80	9.00	13	13.8	260
6	3	250	.34	6.90	11.00	17	21.4	400
8	3	250	.36	9.05	13.50	27	30.1	565
10	3	250	.38	11.10	16.00	38	39.2	740
12	3	250	.40	13.20	19.00	58	49.2	950
14	4	250	.45	15.30	21.00	72	64.2	1235
16	4	250	.46	17.40	23.50	90	74.9	1455
18	5	250	.50	19.50	25.00	90	91.3	1730
20	5	250	.51	21.60	27.50	115	103.4	1990
24	6	250	.56	25.80	32.00	160	135.9	2630

* Calculated weight of full length pipe is rounded off to nearest five pounds.

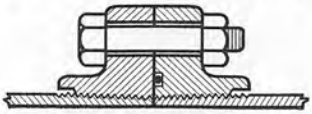
Note

Flange accessories must be ordered separately. See page 64 for detailed information.

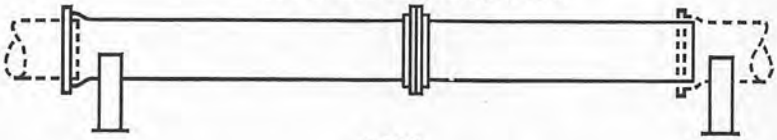
Interior cement lined flanged pipe may be substituted in lieu of tar coating without pri notification.

CLOW LONG-SPAN PIPE

Mechanical Joint with O-Ring Rubber Gasket Flanged Joint
For Elevated Pipe Lines to Reduce Costs of Piers



Section of O-Ring Flanged Joint



F-157
Mechanical Joint & Flanged Long-Span Pipe

Long-Span Pipe is a ductile cast iron multiple length pipe utilizing a special Clow-designed O-Ring Rubber Gasket Joint for the purpose of minimizing the number of piers required in elevated lines. 27-foot units are 18-foot lengths of MJ and Flanged, plus 9-foot lengths of Flanged and Plain End. 36-foot units are 18-foot lengths of MJ & Flanged and 18-foot lengths of Flanged & Plain End. 45-foot units are 18-foot Mechanical Joint & Flanged, 18-foot Flanged & Flanged, and 9-foot Flanged and Plain End pieces.

Installation requires support under each MJ bell, with allowance for expansion and contraction. Length tolerance of each unit is plus or minus ¼-inch.

Pipe are shipped unassembled, with accessories packaged separately. Pipe conforms to ANSI A21.51. Flanges are 70-50-05 ductile iron using cadmium-plated bolts of the same size and number as ANSI B16.1 125 pound flanges.

Installation of Clow Long Span Pipe

Flanged Joint, showing Gasket in groove

Dimensions and Weights

Nominal Pipe Size Inches	Pressure Rating psi	Unit Laying Length Feet*	Wall Thickness		Deflection† at Center of Span in Inches	Weight—Pounds
			A21.51 Class	In Inches		Per Unit Total Length Empty Pipe Including Accessories
6	250	27	4	.37	.53	690
8	250	27	4	.39	.34	965
10	250	27	4	.41	.24	1260
12	250	36	4	.43	.57	2080
14	250	36	4	.45	.45	2545
16	250	36	4	.46	.37	2990
18	250	36	5	.50	.29	3615
18	250	45	6	.53	.70	4890
20	250	36	5	.51	.25	4130
20	250	45	6	.54	.60	5595
24	250	36	6	.56	.18	5450
24	250	45	6	.56	.45	7045

* Plus or minus ¼ inch. † With pipe full of water.

GASKETS BOLTS AND STUDS FOR CLASS 125 CAST IRON FLANGED JOINTS

GASKETS OF SHEET PACKING

F-1940 Ring Gasket*

When Ordering Gaskets always specify material wanted

Red sheet rubber
Cloth inserted rubber
or
Asbestos composition

F-1950 Full Face Gasket†

Gaskets of sheet packing are regularly furnished 1/16-inch thick.

F-1940 Ring Gaskets*

Nominal Size....Inches	2	3	4	5	6	8	10
Gasket I.D....Inches	2	3	4	5	6	8	10
Gasket O.D....Inches	4 1/8	5 3/8	6 7/8	7 3/4	8 3/4	11	13 3/8
Nominal Size....Inches	12	14	16	18	20	24	...
Gasket I.D....Inches	12	14	16	18	20	24	...
Gasket O.D....Inches	16 1/8	17 3/4	20 1/4	21 5/8	23 7/8	28 1/4	...

* Ring gaskets will always be furnished unless order specifically calls for "full face" gaskets.

F-1950 Full Face Gaskets †

Nominal Size....Inches	2	3	4	5	6	8	10
Gasket I.D....Inches	2	3	4	5	6	8	10
Gasket O.D....Inches	6	7 1/2	9	10	11	13 1/2	16
Nominal Size....Inches	12	14	16	18	20	24	...
Gasket I.D....Inches	12	14	16	18	20	24	...
Gasket O.D....Inches	19	21	23 1/2	25	27 1/2	32	...

† Holes are punched in full face gaskets unless specifically ordered otherwise.

MACHINE BOLTS, BOLT-STUDS, AND STUDS

F-1925 Machine Bolt ††
Hex Head—Hexagon Nut

F-1928 Bolt-Stud ††
With Two Hexagon Nuts

F-1932 Stud ‡
With One Hexagon Nut

SIZES, LENGTHS AND WEIGHTS

For Flanged Fittings Size—Inches	Number of Bolts to the Joint	Diameter of Bolts Inches	Bolts, Bolt-Studs and Studs					
			Length—Inches			Weight—Per 100—Pounds		
			F-1925	F-1928	F-1932	F-1925	F-1928	F-1932
2	4	5/8	2 1/4	...	...	40	...	...
3	4	5/8	2 1/2	3 1/4	2 1/4	41	47	29
4	8	5/8	3	3 3/4	2 1/2	45	51	30
5	8	3/4	3	...	...	69	...	...
6	8	3/4	3 1/4	4	3	71	81	51
8	8	3/4	3 1/2	4	3	75	81	51
10	12	7/8	3 3/4	4 3/4†††	3 1/4	113	127	76
12	12	7/8	3 3/4	4 3/4†††	3 1/4	113	127	76
14	12	1	4 1/4†††	5 1/4†††	3 3/4	163	184	113
16	16	1	4 1/2	5 1/4†††	3 3/4	168	184	113
18	16	1 1/8	4 3/4†††	6	4 1/4†††	230	251	161
20	20	1 1/8	5	6	4 1/4†††	236	251	161
24	20	1 1/4	5 1/2	6 1/2	4 1/2	325	351	213

†† Length of Bolts and Bolt-Studs is based on two 125 pound flanges bolted together. If "Filler" is used between flanges, bolt-stud length must be increased by thickness of filler.

‡ The length of the F-1932 Studs is based on the short threaded end being screwed into a tapped hole for a distance approximately equal to the diameter of the stud.

††† These bolts may be furnished 1/4" longer than shown at our option.

Above bolts meet requirements of the ANSI Specification B16.1.

CAST IRON FLANGED FITTINGS

American National Standards Institute Specification ANSI A21.10 (AWWA C110)
American National Standard for Cast Iron Fittings for Water and Other Fluids
American National Standards Institute Specification ANSI B16.1
Cast Iron Pipe Flanges and Flanged Fittings, Class 125

SPECIFICATIONS

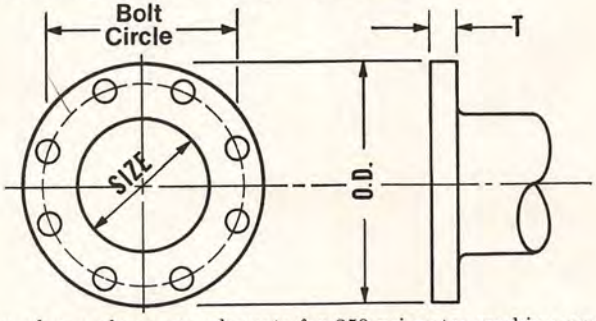
Flanged fittings shown on the pages immediately following are manufactured to either ANSI specifications A21.10 (AWWA C110) or to ANSI B16.1 specifications as indicated on each page heading. Elbows or bends (straight sizes), tees, crosses, concentric reducers, base elbows (except reducing size) and bottom base tees are manufactured to ANSI A21.10 (AWWA C110) specifications. These fittings have identical face to face and center to face dimensions, and the same flange drilling as ANSI B16.1 fittings, but differ slightly in wall thickness, and are rated for 250 psi water working pressure in diameters 12-inch and smaller, and 150 psi water working pressure in diameters 14- thru 24-inch. ANSI A21.10 (AWWA C110) fittings in diameters 14- thru 24-inch for 150 psi water working pressure are furnished to the same thicknesses and to the same center to face dimensions as 150 psi pressure fittings, and with the same flanges, in ductile iron.

Long radius and reducing elbows, reducing-on-the-run tees, side outlet fittings, eccentric reducers and laterals are ANSI B16.1 fittings, and are rated for 175 psi water working pressure in diameters 12″ and smaller and 150 psi water working pressure in 14″ thru 24″ diameters. 3″ thru 24″ ANSI B16.1 fittings for 250 psi water working pressure are furnished in ductile iron to the same thicknesses, dimensions and flanges as Class 125 standard and are manufacturer's standard. All offsets and true wyes are manufacturer's standard.

We do not spot face back of flanges. Where spot facing is required the back of the flange is machined over its entire surface.

When ordering any flanged fittings equipped with bosses and/or tapped holes, refer to and use the letter key on page 82, which designates location by letter.

Standard 125 pound template for drilling shown below is used for all flanged fittings, whether ANSI A21.10 (AWWA C110) or ANSI B16.1.



Note: The flanges shown above are adequate for 250 psi water working pressure. They should not be confused with 250 pound extra heavy flanges covered by ANSI B16.1 which are rated for 250 psi *steam* working pressure.

Dimensions

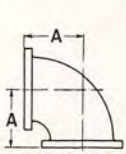
Nominal Pipe Size Inches	Dimensions—Inches					Number of Bolts
	Flange O.D.	Bolt Circle	Flange Thickness T	Bolt Hole Diameter	Bolt Diam. and Length	
2	6	4¾	⅝	¾	⅝ x 2¼	4
3	7½	6	¾	¾	⅝ x 2½	4
4	9	7½	15/16	¾	⅝ x 3	8
5	10	8½	15/16	⅞	¾ x 3	8
6	11	9½	1	⅞	¾ x 3¼	8
8	13½	11¾	1⅛	⅞	¾ x 3½	8
10	16	14¼	1 3/16	1	⅞ x 3¾	12
12	19	17	1¼	1	⅞ x 3¾	12
14	21	18¾	1⅜	1⅛	1 x 4¼	12
16	23½	21¼	1 7/16	1⅛	1 x 4½	16
18	25	22¾	1 9/16	1¼	1⅛ x 4¾	16
20	27½	25	1 11/16	1¼	1⅛ x 5	20
24	32	29½	1⅞	1⅜	1¼ x 5½	20

Note: Drilling templates are in multiples of four, so that fittings may be made to face in any quarter. Bolt holes shall straddle the center line. For bolts, bolt-studs, and studs, see page 64.

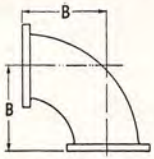
CAST IRON FLANGED FITTINGS

GENERAL DIMENSIONS—STRAIGHT SIZES

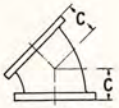
ANSI Specifications A21.10 (AWWA C110) and ANSI Specification B16.1



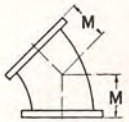
F-801
90° Elbow



F-1804
Long Radius
90° Elbow

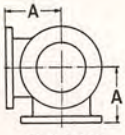


F-807
45° Elbow

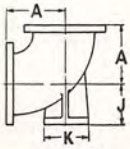


F-1812
Long Radius
45° Elbow

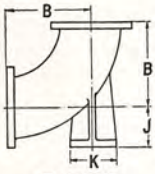
F-811
22½° Elbo



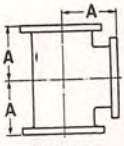
F-1820
Side Outlet
Elbow



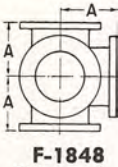
F-827
Base
Elbow



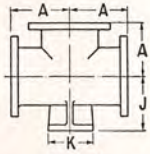
F-1828
Long Radius
Base Elbow



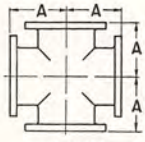
F-818
Tee



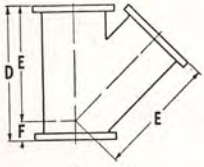
F-1848
Side Outle
Tee



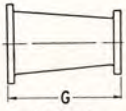
F-829
Bottom
Base Tee



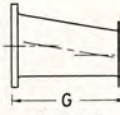
F-823
Cross



F-1880
Lateral



F-834
Concentric
Reducer



F-1894
Eccentric
Reducer

Key to Tables of Dimensions

AA = Face to Face, Tees and Crosses.
A = Center to Face, 46° to 90° Ells, Tees, and Crosses.
B = Center to Face, Long Radius Ells.
C = Center to Face, 1° to 45° Ells.
D = Face to Face, Laterals.
E = Center to Face, Laterals.
F = Center to Face, Laterals.
G = Face to Face, Reducers.
J = Center to Face, Base Flange.*
K = Diameter of Base Flange.*
M = Center to Face, 45° Long Radius Ells.
P = Size of Pipe for Supporting Base El with Round Base Flange.

Size of all fittings listed indicates nominal inside diameter of port.

Size Inches	Diam. of Flange	Dimensions—Inches											
		AA	A	B	C	D	E	F	G	J*	K*	M	P
3	7½	11	5½	7¾	3	13	10	3	6	4⅞	5	4	1½
4	9	13	6½	9	4	15	12	3	7	5½	6	5¼	2
5	10	15	7½	10¼	4½	17	13½	3½	8	6¼	7	6	2½
6	11	16	8	11½	5	18	14½	3½	9	7	7	6¾	2½
8	13½	18	9	14	5½	22	17½	4½	11	8⅜	9	8	4
10	16	22	11	16½	6½	25½	20½	5	12	9¾	9	9	4
12	19	24	12	19	7½	30	24½	5½	14	11¼	11	9½	6
14	21	28	14	21½	7½	33	27	6	16	12½	11	10	6
16	23½	30	15	24	8	36½	30	6½	18	13¾	11	13	6
18	25	33	16½	26½	8½	39	32	7	19	15	13½	14	8
20	27½	36	18	29	9½	43	35	8	20	16	13½	15	8
24	32	44	22	34	11	49½	40½	9	24	18½	13½	17	8

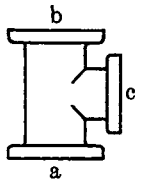
* Size and center to face dimension of base are determined by size of largest opening of fitting. Dimensions shown for "J" are for *machined* bases. For bases not machined, add approximately ⅛-inch. Drillin of round base flange will match the template of the flange corresponding to the size of the supportin pipe "P" using only four holes in all cases so placed as to miss the ribs. *Bases faced and drilled only whe so ordered.*

REDUCING CAST IRON FLANGED FITTINGS

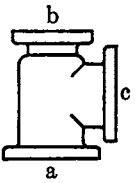
HOW TO ORDER

When ordering reducing fittings, give the size of the openings in the order indicated by the sequence of the letters **a, b, c** and **d.** In designating the size of the openings of side outlet reducing fittings, the size of the side outlet is to be given last.

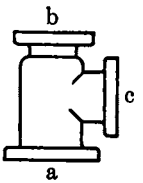
REDUCING TEES



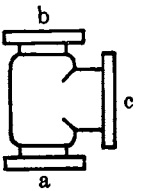
Reducing on Outlet



Reducing on One Run

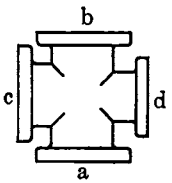


Reducing on One Run & Outlet

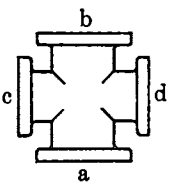


Reducing on Both Runs

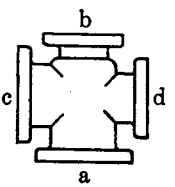
REDUCING CROSSES



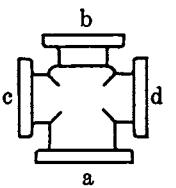
Reducing on One Outlet



Reducing on Both Outlets

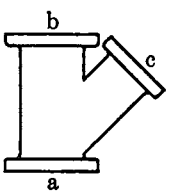


Reducing on One Run and One Outlet

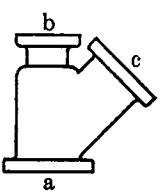


Reducing on One Run and Both Outlets

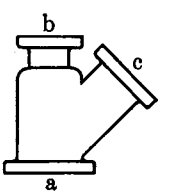
REDUCING LATERALS



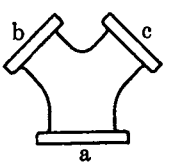
Reducing on Branch



Reducing on One Run

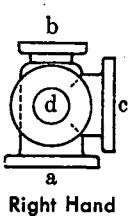


Reducing on One Run and Branch

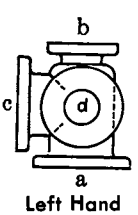


Reducing True Y

SIDE OUTLET TEES

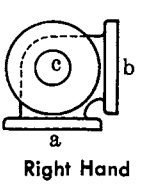


Right Hand

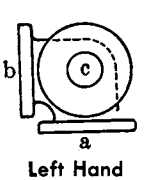


Left Hand

SIDE OUTLET ELBOWS



Right Hand



Left Hand

SPECIAL REDUCING FLANGED FITTINGS

To permit us to ship more promptly, we recommend, wherever possible, the ordering of straight size flanged fittings with flanged reducer, rather than reducing size flanged fittings.

CAST IRON FLANGED FITTINGS

ANSI Specification A21.10 (AWWA C110)

F-801
Flanged 90° Bend

BENDS

Furnished Faced and Drilled
to 125 Pound Template
Unless Otherwise Ordered

F-807
Flanged 45° Bend

DIMENSIONS AND WEIGHTS

F-801

Nominal Pipe Size Inches	Pressure Rating psi	Dimensions Inches T	A	R	Approx. Weight Pounds
3	250	.48	5.5	4.0	25
4	250	.52	6.5	4.5	45
5*	175	.50	7.5	. . .	52
6	250	.55	8.0	6.0	65
8	250	.60	9.0	7.0	105
10	250	.68	11.0	9.0	165
12	250	.75	12.0	10.0	235
14	150	.66	14.0	11.5	290
16	150	.70	15.0	12.5	370
18	150	.75	16.5	14.0	450
20	150	.80	18.0	15.5	580
24	150	.89	22.0	18.5	900

F-807

Nominal Diameter Inches	Pressure Rating psi	Dimensions Inches T	A	R	Approx. Weight Pounds
3	250	.48	3.0	3.62	20
4	250	.52	4.0	4.81	40
5*	175	.50	4.5	. . .	45
6	250	.55	5.0	7.25	55
8	250	.60	5.5	8.44	90
10	250	.68	6.5	10.88	130
12	250	.75	7.5	13.25	195
14	150	.66	7.5	12.06	220
16	150	.70	8.0	13.25	280
18	150	.75	8.5	14.50	325
20	150	.80	9.5	16.88	430
24	150	.89	11.0	18.12	630

* 5″ size is ANSI B16.1 fitting.

F-811
Flanged 22½° Bend

F-814
Flanged 11¼° Bend

DIMENSIONS AND WEIGHTS

F-811

Nominal Pipe Size Inches	Pressure Rating psi	Dimensions Inches T	A	R	Approx. Weight Pounds
3	250	.48	3.0	7.56	20
4	250	.52	4.0	10.06	40
6	250	.55	5.0	15.06	55
8	250	.60	5.5	17.62	90
10	250	.68	6.5	22.62	135
12	250	.75	7.5	27.62	205
14	150	.66	7.5	25.12	225
16	150	.70	8.0	27.62	285
18	150	.75	8.5	30.19	335
20	150	.80	9.5	35.19	435
24	150	.89	11.0	37.69	640

F-814

Nominal Pipe Size Inches	Pressure Rating psi	Dimensions Inches T	A	R	Approx. Weight Pounds
3	250	.48	3.0	15.25	20
4	250	.52	4.0	20.31	40
6	250	.55	5.0	30.50	55
8	250	.60	5.5	35.50	90
10	250	.68	6.5	45.69	135
12	250	.75	7.5	55.81	205
14	150	.66	7.5	50.75	225
16	150	.70	8.0	55.81	285
18	150	.75	8.5	60.94	335
20	150	.80	9.5	71.06	435
24	150	.89	11.0	76.12	645

Note: Sizes 14″ thru 24″ fittings for 250 psi working pressure are furnished to 150 dimensio in ductile iron.

Flange accessories must be ordered separately. See page 64 for information.

CAST IRON FLANGED FITTINGS

ANSI Specification B16.1

REDUCING ELBOWS

Furnished Faced and Drilled to 125 Pound Template Unless Otherwise Ordered

F-1800-R Reducing 90° Elbow

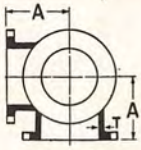
For straight elbow Use F-801

DIMENSIONS AND WEIGHTS

Nominal Pipe Size Inches	Dimensions Inches T	T_1	A	Approx. Weight Pounds	Nominal Pipe Size Inches	Dimensions Inches T	T_1	A	Approx. Weight Pounds
4 x3	1/2	3/8	6.50	33	14 x10	7/8	3/4	14.00	280
5 x3	1/2	3/8	7.50	40	14 x12	7/8	13/16	14.00	320
5 x4	1/2	1/2	7.50	48	16 x 8	1	5/8	15.00	300
6 x3	9/16	3/8	8.00	47	16 x10	1	3/4	15.00	340
6 x4	9/16	1/2	8.00	56	16 x12	1	13/16	15.00	380
6 x5	9/16	1/2	8.00	60	16 x14	1	7/8	15.00	420
8 x3	5/8	3/8	9.00	70	18 x12	1 1/16	13/16	16.50	440
8 x4	5/8	1/2	9.00	77	18 x14	1 1/16	7/8	16.50	480
8 x5	5/8	1/2	9.00	82	18 x16	1 1/16	1	16.50	540
8 x6	5/8	9/16	9.00	90	20 x12	1 1/8	13/16	18.00	520
10 x4	3/4	1/2	11.00	105	20 x14	1 1/8	7/8	18.00	570
10 x5	3/4	1/2	11.00	115	20 x16	1 1/8	1	18.00	640
10 x6	3/4	9/16	11.00	125	20 x18	1 1/8	1 1/16	18.00	680
10 x8	3/4	5/8	11.00	150	24 x14	1 1/4	7/8	22.00	865
12 x6	13/16	9/16	12.00	165	24 x16	1 1/4	1	22.00	880
12 x8	13/16	5/8	12.00	190	24 x18	1 1/4	1 1/16	22.00	930
12 x10	13/16	3/4	12.00	220	24 x20	1 1/4	1 1/8	22.00	1010
14 x8	7/8	5/8	14.00	240	.....	..	..	....	....

SIDE OUTLET ELBOWS

For Pressure Ratings See Page 65



F-1820

For Drilling Template See Page 65

Straight Side Outlet Elbows*

Nominal pipe size.....Inches	3	4	5	6	8	10
Dimension T.....Inches	3/8	1/2	1/2	9/16	5/8	3/4
Dimension A.....Inches	5.50	6.50	7.50	8.00	9.00	11.00
Approximate weight.....Pounds	34	59	75	96	150	240
Nominal pipe size.....Inches	12	14	16	18	20	24
Dimension T.....Inches	13/16	7/8	1	1 1/16	1 1/8	1 1/4
Dimension A.....Inches	12.00	14.00	15.00	16.50	18.00	22.00
Approximate weight.....Pounds	340	470	620	760	970	1510

* In certain sizes, we can furnish side outlet elbows with the side outlet smaller than the main openings. When in need of such fittings, please check with us before placing your order.

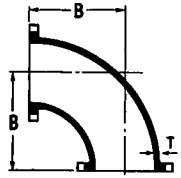
Flange accessories must be ordered separately. See page 64 for information.

CAST IRON FLANGED FITTINGS

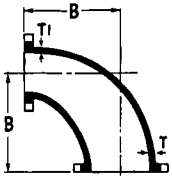
ANSI Specification B16.1

LONG RADIUS ELBOWS

Furnished Faced and Drilled to 125 pound template



F-1804 Straight 90° Long Radius Elbow



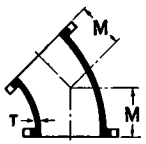
F-1804-R Reducing 90° Long Radius Elbo

DIMENSIONS AND WEIGHTS

F-1804 and F-1804-R

Nominal Pipe Size Inches	Dimensions Inches T	T1	B	Approx. Weight Pounds	Nominal Pipe Size Inches	Dimensions Inches T	T1	B	Approx. Weight Pounds
3 x 3	3/8	..	7.75	28	12 x 10	13/16	3/4	19.00	300
4 x 3	1/2	3/8	9.00	35	12 x 12	13/16	..	19.00	350
4 x 4	1/2	..	9.00	48	14 x 8	7/8	5/8	21.50	330
5 x 3	1/2	3/8	10.25	45	14 x 10	7/8	3/4	21.50	375
5 x 4	1/2	1/2	10.25	60	14 x 12	7/8	13/16	21.50	425
5 x 5	1/2	..	10.25	62	14 x 14	7/8	..	21.50	470
6 x 3	9/16	3/8	11.50	55	16 x 8	1	5/8	24.00	420
6 x 4	9/16	1/2	11.50	70	16 x 10	1	3/4	24.00	480
6 x 5	9/16	1/2	11.50	75	16 x 12	1	13/16	24.00	530
6 x 6	9/16	..	11.50	85	16 x 14	1	7/8	24.00	590
8 x 4	5/8	1/2	14.00	100	16 x 16	1	..	24.00	670
8 x 5	5/8	1/2	14.00	110	18 x 12	1 1/16	13/16	26.50	635
8 x 6	5/8	9/16	14.00	120	18 x 16	1 1/16	1	26.50	775
8 x 8	5/8	..	14.00	145	18 x 18	1 1/16	..	26.50	840
10 x 4	3/4	1/2	16.50	145	20 x 14	1 1/8	7/8	29.00	820
10 x 6	3/4	9/16	16.50	170	20 x 16	1 1/8	1	29.00	915
10 x 8	3/4	5/8	16.50	195	20 x 20	1 1/8	..	29.00	1080
10 x 10	3/4	..	16.50	230	24 x 20	1 1/4	1 1/8	34.00	1430
12 x 6	13/16	9/16	19.00	225	24 x 24	1 1/4	..	34.00	1640
12 x 8	13/16	5/8	19.00	260					

For Pressure Ratings See Page 65



F-1812

For Drilling Template See Page 65

Straight 45° Long Radius Elbows

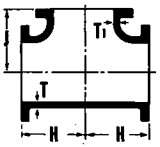
Nominal pipe size ..... Inches	3	4	6	8	10	12
Dimension T ..... Inches	3/8	1/2	9/16	5/8	3/4	13/16
Dimension M ..... Inches	4.50	5.25	6.75	8.00	9.00	9.50
Approximate weight ..... Pounds	30	45	75	120	190	250
Nominal pipe size ..... Inches	14	16	18	20	24	..
Dimension T ..... Inches	7/8	1	1 1/16	1 1/8	1 1/4	..
Dimension M ..... Inches	10.00	13.00	14.00	15.00	17.00	..
Approximate weight ..... Pounds	310	445	550	725	1100	..

From ANSI Specification B16.1

The angle designation of an elbow is its deflection from straight line flow and is the angle between the flange faces.

Flange accessories must be ordered separately. See page 64 for information.

CLOW



F-818 Tee

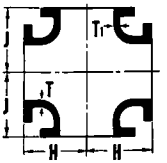
CAST IRON FLANGED FITTINGS

ANSI A21.10 (AWWA C110) Specifications

TEES AND CROSSES

Unless Otherwise Ordered
Furnished Faced and Drilled
to 125 Pound Template

DIMENSIONS AND WEIGHTS



F-823 Cross

Nominal Size		Pressure	Dimensions—Inches				Approx. Weight Pounds	
Run	Branch	Rating psi	T	T_1	H	J	F-818	F-823
3	3	250	.48	.48	5.5	5.5	40	50
4	3	250	.52	.48	6.5	6.5	60	70
4	4	250	.52	.52	6.5	6.5	65	80
5	5	175*	.50	.50	7.5	7.5	81	105
6	3	250	.55	.48	8.0	8.0	85	95
6	4	250	.55	.52	8.0	8.0	90	110
6	6	250	.55	.55	8.0	8.0	95	120
8	4	250	.60	.52	9.0	9.0	140	155
8	6	250	.60	.55	9.0	9.0	145	165
8	8	250	.60	.60	9.0	9.0	155	195
10	4	250	.68	.52	11.0	11.0	205	220
10	6	250	.68	.55	11.0	11.0	215	240
10	8	250	.68	.60	11.0	11.0	225	265
10	10	250	.80	.80	11.0	11.0	270	330
12	4	250	.75	.52	12.0	12.0	290	310
12	6	250	.75	.55	12.0	12.0	295	320
12	8	250	.75	.60	12.0	12.0	310	345
12	10	250	.87	.80	12.0	12.0	360	415
12	12	250	.87	.87	12.0	12.0	385	460
14	6	150	.66	.55	14.0	14.0	375	400
14	8	150	.66	.60	14.0	14.0	390	425
14	10	150	.66	.68	14.0	14.0	400	460
14	12**	150	.82	.75	14.0	14.0	470	555
14	14**	150	.82	.82	14.0	14.0	500	595
16	6	150	.70	.55	15.0	15.0	465	490
16	8	150	.70	.60	15.0	15.0	475	520
16	10	150	.70	.68	15.0	15.0	495	555
16	12	150	.70	.75	15.0	15.0	520	605
16	14**	150	.89	.82	15.0	15.0	610	700
16	16**	150	.89	.89	15.0	15.0	635	755
18	6	150	.75	.55	13.0	15.5	480	505
18	8	150	.75	.60	13.0	15.5	495	535
18	10	150	.75	.68	13.0	15.5	510	560
18	12	150	.75	.75	13.0	15.5	535	610
18	14	150	.75	.66	16.5	16.5	630	720
18	16**	150	.96	.89	16.5	16.5	760	880
18	18**	150	.96	.96	16.5	16.5	785	915
20	6	150	.80	.55	14.0	17.0	610	635
20	8	150	.80	.60	14.0	17.0	620	665
20	10	150	.80	.68	14.0	17.0	635	685
20	12	150	.80	.75	14.0	17.0	660	735
20	14	150	.80	.66	14.0	17.0	665	745
20	16	150	.80	.70	18.0	18.0	810	915
20	18**	150	1.03	.96	18.0	18.0	965	1100
20	20**	150	1.03	1.03	18.0	18.0	1005	1175
24	6	150	.89	.55	15.0	19.0	845	875
24	8	150	.89	.60	15.0	19.0	860	895
24	10	150	.89	.68	15.0	19.0	880	930
24	12	150	.89	.75	15.0	19.0	890	960
24	14	150	.89	.66	15.0	19.0	900	975
24	16	150	.89	.70	15.0	19.0	915	1010
24	18	150	.89	.75	22.0	22.0	1220	1365
24	20**	150	1.16	1.03	22.0	22.0	1510	1695
24	24**	150	1.16	1.16	22.0	22.0	1585	1850

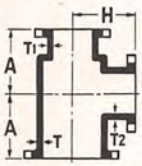
ANSI B16.1 specifications. ** We reserve the option to furnish these fittings to Class B wall thickness in ductile iron which are rated by ANSI A21.10 (AWWA C110) for 250 psi working pressure. Note: For 14" thru 24" fittings for 250 psi working pressure, see note on page 68.

CAST IRON FLANGED FITTINGS

ANSI Specification B16.1

REDUCING TEES

Furnished Faced and Drilled to 125 Pound Template



F-1844-R
Reducing Tee

For Straight Size and Fittings Reducing on Branch Only See Page 7

DIMENSIONS AND WEIGHTS

Nominal Pipe Size Inches	Dimensions—Inches					Approximate Weight Pounds
	T	T_1	T_2	A	H	
4 x 3 x 3	1/2	3/8	3/8	6.50	6.50	50
4 x 3 x 4	1/2	3/8	1/2	6.50	6.50	57
5 x 4 x 4	1/2	1/2	1/2	7.50	7.50	75
5 x 4 x 5	1/2	1/2	1/2	7.50	7.50	78
5 x 5 x 3	1/2	1/2	3/8	7.50	7.50	70
5 x 5 x 4	1/2	1/2	1/2	7.50	7.50	78
6 x 3 x 4	9/16	3/8	1/2	8.00	8.00	83
6 x 3 x 6	9/16	3/8	9/16	8.00	8.00	92
6 x 4 x 3	9/16	1/2	3/8	8.00	8.00	82
6 x 4 x 4	9/16	1/2	1/2	8.00	8.00	89
6 x 4 x 6	9/16	1/2	9/16	8.00	8.00	98
6 x 5 x 4	9/16	1/2	1/2	8.00	8.00	92
6 x 5 x 6	9/16	1/2	9/16	8.00	8.00	100
6 x 6 x 5	9/16	9/16	1/2	8.00	8.00	99
8 x 4 x 6	5/8	1/2	9/16	9.00	9.00	135
8 x 4 x 8	5/8	1/2	5/8	9.00	9.00	150
8 x 6 x 4	5/8	9/16	1/2	9.00	9.00	130
8 x 6 x 6	5/8	9/16	9/16	9.00	9.00	140
8 x 6 x 8	5/8	9/16	5/8	9.00	9.00	155
8 x 8 x 5	5/8	5/8	1/2	9.00	9.00	145
10 x 8 x 6	3/4	5/8	9/16	11.00	11.00	220
10 x 8 x 8	3/4	5/8	5/8	11.00	11.00	240
10 x 8 x 10	3/4	5/8	3/4	11.00	11.00	260
10 x 10 x 5	3/4	3/4	1/2	11.00	11.00	230
12 x 6 x 6	13/16	9/16	9/16	12.00	12.00	280
12 x 6 x 8	13/16	9/16	5/8	12.00	12.00	300
12 x 6 x 10	13/16	9/16	3/4	12.00	12.00	320
12 x 6 x 12	13/16	9/16	13/16	12.00	12.00	340
12 x 8 x 6	13/16	5/8	9/16	12.00	12.00	300
12 x 8 x 8	13/16	5/8	5/8	12.00	12.00	310
12 x 8 x 10	13/16	5/8	3/4	12.00	12.00	330
12 x 8 x 12	13/16	5/8	13/16	12.00	12.00	350
12 x 10 x 6	13/16	3/4	9/16	12.00	12.00	310
12 x 10 x 8	13/16	3/4	5/8	12.00	12.00	320
12 x 10 x 10	13/16	3/4	3/4	12.00	12.00	340
12 x 10 x 12	13/16	3/4	13/16	12.00	12.00	370
14 x 8 x 8	7/8	5/8	5/8	14.00	14.00	410
14 x 8 x 10	7/8	5/8	3/4	14.00	14.00	430
14 x 8 x 12	7/8	5/8	13/16	14.00	14.00	460
14 x 8 x 14	7/8	5/8	7/8	14.00	14.00	480
14 x 10 x 8	7/8	3/4	5/8	14.00	14.00	420
14 x 10 x 10	7/8	3/4	3/4	14.00	14.00	450

Continued on next page

Flange accessories must be ordered separately. See page 64 for information.

CAST IRON FLANGED FITTINGS

ANSI Specification B16.1

F–1844-R REDUCING TEES

(Continued from preceding page)

Nominal Pipe Size Inches	Dimensions—Inches					Approximate Weight Pounds
	T	T_1	T_2	A	H	
14 x 10 x 12	7/8	3/4	13/16	14.00	14.00	470
14 x 10 x 14	7/8	3/4	7/8	14.00	14.00	490
14 x 12 x 8	7/8	13/16	5/8	14.00	14.00	440
14 x 12 x 10	7/8	13/16	3/4	14.00	14.00	460
14 x 12 x 12	7/8	13/16	13/16	14.00	14.00	490
14 x 12 x 14	7/8	13/16	7/8	14.00	14.00	510
16 x 8 x 8	1	5/8	5/8	15.00	15.00	540
16 x 8 x 10	1	5/8	3/4	15.00	15.00	560
16 x 8 x 12	1	5/8	13/16	15.00	15.00	580
16 x 8 x 14	1	5/8	7/8	15.00	15.00	610
16 x 8 x 16	1	5/8	1	15.00	15.00	640
16 x 10 x 8	1	3/4	5/8	15.00	15.00	550
16 x 10 x 10	1	3/4	3/4	15.00	15.00	570
16 x 10 x 12	1	3/4	13/16	15.00	15.00	600
16 x 10 x 14	1	3/4	7/8	15.00	15.00	620
16 x 10 x 16	1	3/4	1	15.00	15.00	650
16 x 12 x 8	1	13/16	5/8	15.00	15.00	570
16 x 12 x 10	1	13/16	3/4	15.00	15.00	590
16 x 12 x 12	1	13/16	13/16	15.00	15.00	620
16 x 12 x 14	1	13/16	7/8	15.00	15.00	640
16 x 12 x 16	1	13/16	1	15.00	15.00	670
16 x 14 x 6	1	7/8	9/16	15.00	15.00	565
16 x 14 x 8	1	7/8	5/8	15.00	15.00	580
16 x 14 x 10	1	7/8	3/4	15.00	15.00	600
16 x 14 x 12	1	7/8	13/16	15.00	15.00	630
16 x 14 x 14	1	7/8	7/8	15.00	15.00	650
16 x 14 x 16	1	7/8	1	15.00	15.00	680

For larger straight sizes and reducing on branch only see page 71.

SIDE OUTLET TEES

For Pressure Ratings See Page 65

F-1848

Straight Side Outlet Tees*

For Drilling Template See Page 65

Nominal pipe size . . . . . Inches	3	4	5	6	8	10
Dimension T . . . . . Inches	3/8	1/2	1/2	9/16	5/8	3/4
Dimension A . . . . . Inches	5.50	6.50	7.50	8.00	9.00	11.00
Approximate weight . . . . . Pounds	48	82	105	135	210	330
Nominal pipe size . . . . . Inches	12	14	16	18	20	24
Dimension T . . . . . Inches	13/16	7/8	1	1 1/16	1 1/8	1 1/4
Dimension A . . . . . Inches	12.00	14.00	15.00	16.50	18.00	22.00
Approximate weight . . . . . Pounds	470	650	850	1040	1330	2080

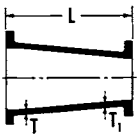
* In certain sizes, we can furnish side outlet tees with the side outlet smaller than the main openings. When in need of such fittings, please check with us before placing your order. Flange accessories must be ordered separately. See page 64 for information.

CAST IRON FLANGED FITTINGS

ANSI Specification A21.10 (AWWA C110)

CONCENTRIC REDUCERS

Furnished Faced and Drilled to 125 Pound Template



For ANSI B16.1 Eccentric Flanged Reducer, see page 75

F-834 Flanged Concentric Reducer

DIMENSIONS AND WEIGHTS

Nominal Pipe Size Inches		Pressure Rating psi	Dimensions Inches			Approx. Weight Pounds
Large	Small		T	T_1	L	
4	3	250	.52	.48	7	30
5	3	175*	.50	.38	8	32
5	4	175*	.50	.50	8	39
6	3	250	.55	.48	9	40
6	4	250	.55	.52	9	45
6	5	175*	.56	.50	9	50
8	4	250	.60	.52	11	65
8	5	175*	.62	.50	11	71
8	6	250	.60	.55	11	75
10	4	250	.68	.52	12	85
10	6	250	.68	.55	12	90
10	8	250	.68	.60	12	110
12	4	250	.75	.52	14	120
12	6	250	.75	.55	14	130
12	8	250	.75	.60	14	145
12	10	250	.75	.68	14	170
14	6	150	.66	.55	16	155
14	8	150	.66	.60	16	175
14	10	150	.66	.68	16	190
14	12	150	.66	.75	16	220
16	6	150	.70	.55	18	190
16	8	150	.70	.60	18	210
16	10	150	.70	.68	18	235
16	12	150	.70	.75	18	265
16	14	150	.70	.66	18	280
18	8	150	.75	.60	19	240
18	10	150	.75	.68	19	265
18	12	150	.75	.75	19	295
18	14	150	.75	.66	19	310
18	16	150	.75	.70	19	340
20	10	150	.80	.68	20	310
20	12	150	.80	.75	20	345
20	14	150	.80	.66	20	355
20	16	150	.80	.70	20	390
20	18	150	.80	.75	20	410
24	12	150	.89	.75	24	480
24	14	150	.89	.66	24	490
24	16	150	.89	.70	24	525
24	18	150	.89	.75	24	550
24	20	150	.89	.80	24	590

* ANSI B16.1 specifications.

Note: Sizes 14″ thru 24″ fittings for 250 psi working pressure are furnished to 150 psi dimensions in ductile iron.

See note on page 75 concerning caution when installing flanged reducers.

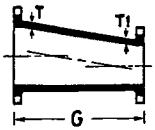
Flange accessories must be ordered separately. See page 64 for information.

CAST IRON FLANGED FITTINGS

ANSI Specification B16.1

ECCENTRIC REDUCERS

rnished Faced and Drilled to 125 Pound Template



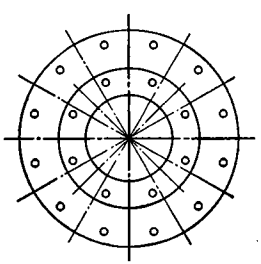
F-1894 Eccentric Reducer

For Concentric Reducers See Page 74

DIMENSIONS AND WEIGHTS

Nominal Pipe Size Inches	Dimensions—Inches			Approximate Weight Pounds
	T	T_1	G	
4 x 3	1/2	3/8	7.00	28
6 x 3	9/16	3/8	9.00	39
6 x 4	9/16	1/2	9.00	47
8 x 4	5/8	1/2	11.00	66
8 x 6	5/8	9/16	11.00	77
10 x 4	3/4	1/2	12.00	95
10 x 6	3/4	9/16	12.00	100
10 x 8	3/4	5/8	12.00	120
12 x 6	13/16	9/16	14.00	140
12 x 8	13/16	5/8	14.00	155
12 x 10	13/16	3/4	14.00	180
14 x 6	7/8	9/16	16.00	180
14 x 8	7/8	5/8	16.00	200
14 x 10	7/8	3/4	16.00	220
14 x 12	7/8	13/16	16.00	250
16 x 6	1	9/16	18.00	230
16 x 8	1	5/8	18.00	250
16 x 10	1	3/4	18.00	280
16 x 12	1	13/16	18.00	310
16 x 14	1	7/8	18.00	340
18 x 8	1 1/16	5/8	19.00	300
18 x 10	1 1/16	3/4	19.00	320
18 x 12	1 1/16	13/16	19.00	350
18 x 14	1 1/16	7/8	19.00	380
18 x 16	1 1/16	1	19.00	430
20 x 10	1 1/8	3/4	20.00	380
20 x 12	1 1/8	13/16	20.00	410
20 x 14	1 1/8	7/8	20.00	450
20 x 16	1 1/8	1	20.00	490
20 x 18	1 1/8	1 1/16	20.00	520
24 x 12	1 1/4	13/16	24.00	580
24 x 14	1 1/4	7/8	24.00	620
24 x 16	1 1/4	1	24.00	670
24 x 18	1 1/4	1 1/16	24.00	700
24 x 20	1 1/4	1 1/8	24.00	760

Flange accessories must be ordered separately. See page 64 for information.



CAUTION

WHEN INSTALLING FLANGED REDUCERS

On a standard flanged reducer, with a different number of holes in the two flanges, there are only two center lines which are common to the drilling in both flanges.

When installing, BE SURE reducer is properly lined up, so that drilling in both flanges will match correctly with other fittings and pipe in line.

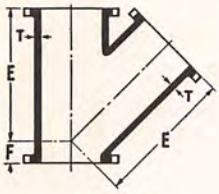
CAST IRON FLANGED FITTINGS

ANSI Specification B16.1

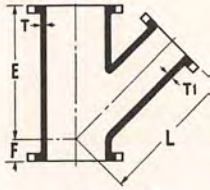
LATERALS

For True Y Fittings, see page 79

For Pressure Ratings see page 65



F-1880
Straight Lateral



F-1880-R
Reducing Lateral

DIMENSIONS AND WEIGHTS

F-1880 and F-1880-R

Nominal Pipe Size Inches	Dimensions—Inches					Approximate Weight Pounds
	T	T1	E	F	L	
3 x 3 x 3	3/8	...	10.00	3.00	...	44
4 x 4 x 3	1/2	3/8	12.00	3.00	12.00	66
4 x 4 x 4	1/2	...	12.00	3.00	...	75
5 x 5 x 4	1/2	1/2	13.50	3.50	13.50	93
5 x 5 x 5	1/2	...	13.50	3.50	...	96
6 x 6 x 3	9/16	3/8	14.50	3.50	14.50	105
6 x 6 x 4	9/16	1/2	14.50	3.50	14.50	115
6 x 6 x 5	9/16	1/2	14.50	3.50	14.50	120
6 x 6 x 6	9/16	...	14.50	3.50	...	125
8 x 8 x 3	5/8	3/8	17.50	4.50	17.50	165
8 x 8 x 4	5/8	1/2	17.50	4.50	17.50	175
8 x 8 x 6	5/8	9/16	17.50	4.50	17.50	195
8 x 8 x 8	5/8	...	17.50	4.50	...	210
10 x 10 x 4	3/4	1/2	20.50	5.00	20.50	270
10 x 10 x 6	3/4	9/16	20.50	5.00	20.50	280
10 x 10 x 8	3/4	5/8	20.50	5.00	20.50	310
10 x 10 x 10	3/4	...	20.50	5.00	...	340
12 x 12 x 4	13/16	1/2	24.50	5.50	24.50	385
12 x 12 x 6	13/16	9/16	24.50	5.50	24.50	400
12 x 12 x 8	13/16	5/8	24.50	5.50	24.50	430
12 x 12 x 10	13/16	3/4	24.50	5.50	24.50	470
12 x 12 x 12	13/16	...	24.50	5.50	...	520
14 x 14 x 6	7/8	9/16	27.00	6.00	27.00	525
14 x 14 x 8	7/8	5/8	27.00	6.00	27.00	550
14 x 14 x 10	7/8	3/4	27.00	6.00	27.00	590
14 x 14 x 12	7/8	13/16	27.00	6.00	27.00	640
14 x 14 x 14	7/8	...	27.00	6.00	...	680
16 x 16 x 6	1	9/16	30.00	6.50	30.00	715
16 x 16 x 8	1	5/8	30.00	6.50	30.00	740
16 x 16 x 10	1	3/4	30.00	6.50	30.00	790
16 x 16 x 12	1	13/16	30.00	6.50	30.00	830
16 x 16 x 14	1	7/8	30.00	6.50	30.00	880
16 x 16 x 16	1	...	30.00	6.50	...	950
18 x 18 x 6*	**1 1/16**	**9/16**	**25.00**	**1.00**	**27.50**	**860**
18 x 18 x 8*	**1 1/16**	**5/8**	**25.00**	**1.00**	**27.50**	**890**
18 x 18 x 10	1 1/16	3/4	32.00	7.00	32.00	930
18 x 18 x 12	1 1/16	13/16	32.00	7.00	32.00	980
18 x 18 x 14	1 1/16	7/8	32.00	7.00	32.00	1030
18 x 18 x 16	1 1/16	1	32.00	7.00	32.00	1100
18 x 18 x 18	1 1/16	...	32.00	7.00	...	1150
20 x 20 x 6*	**1 1/8**	**9/16**	**27.00**	**1.00**	**29.50**	**770**
20 x 20 x 8*	**1 1/8**	**5/8**	**27.00**	**1.00**	**29.50**	**800**
20 x 20 x 10*	**1 1/8**	**3/4**	**27.00**	**1.00**	**29.50**	**840**
20 x 20 x 12	1 1/8	13/16	35.00	8.00	35.00	1220
20 x 20 x 14	1 1/8	7/8	35.00	8.00	35.00	1270
20 x 20 x 16	1 1/8	1	35.00	8.00	35.00	1350
20 x 20 x 18	1 1/8	1 1/16	35.00	8.00	35.00	1400
20 x 20 x 20	1 1/8	...	35.00	8.00	...	1480
24 x 24 x 6*	**1 1/4**	**9/16**	**31.50**	**.50**	**34.50**	**1155**
24 x 24 x 8*	**1 1/4**	**5/8**	**31.50**	**.50**	**34.50**	**1180**
24 x 24 x 10*	**1 1/4**	**3/4**	**31.50**	**.50**	**34.50**	**1200**
24 x 24 x 12*	**1 1/4**	**13/16**	**31.50**	**.50**	**34.50**	**1250**
24 x 24 x 14	1 1/4	7/8	40.50	9.00	40.50	1810
24 x 24 x 16	1 1/4	1	40.50	9.00	40.50	1890
24 x 24 x 18	1 1/4	1 1/16	40.50	9.00	40.50	1950
24 x 24 x 20	1 1/4	1 1/8	40.50	9.00	40.50	2040
24 x 24 x 24	1 1/4	...	40.50	9.00	...	2080

* Regularly furnished *short pattern*. Can be made to special order with long body dimension
Flange accessories must be ordered separately. See page 64 for information.

CAST IRON FLANGED FITTINGS

ANSI Specification A21.10 (AWWA C110)

BASE BENDS

Furnished Faced and Drilled to 125 Pound Template.

F-827
Base Elbows

BASE TEES

For Drilling Template See Page 65.

DIMENSIONS AND WEIGHTS

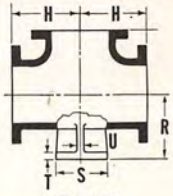
Nominal Size Inches	Pressure Rating psi	Dimensions—Inches					Approx. Weight Pounds
		A	R†	S	T	U	
3	250	5.5	4.88	5.00	.56	.50	35
4	250	6.5	5.50	6.00	.62	.50	55
5*	175	7.5	6.25	7.00	.50	.62	72
6	250	8.0	7.00	7.00	.69	.62	85
8	250	9.0	8.38	9.00	.94	.88	145
10	250	11.0	9.75	9.00	.94	.88	210
12	250	12.0	11.25	11.00	1.00	1.00	300
14	150	14.0	12.50	11.00	1.00	1.00	360
16	150	15.0	13.75	11.00	1.00	1.00	445
18	150	16.5	15.00	13.50	1.12	1.12	565
20	150	18.0	16.00	13.50	1.12	1.12	700
24	150	22.0	18.50	13.50	1.12	1.12	1030

* This fitting is to dimensions and weight of ANSI B16.1 specification.

Bases Are Machined or Drilled Only When So Ordered

For detailed specifications for bases, see page 78.

Side Base Tees, not illustrated, can also be furnished. Furnished Faced and Drilled to 125 Pound Template.



F-829
Bottom Base Tees

Reducing sizes of base tees are also available with base under branch as illustrated. For dimensions see page 72.

DIMENSIONS AND WEIGHTS

Nominal Size Inches	Pressure Rating psi	Dimensions—Inches					Approx. Weight Pounds
		H	R†	S	T	U	
3	250	5.5	4.88	5.00	.56	.50	45
4	250	6.5	5.50	6.00	.62	.50	75
6	250	8.0	7.00	7.00	.69	.62	110
8	250	9.0	8.38	9.00	.94	.88	185
10	250	11.0	9.75	9.00	.94	.88	300
12	250	12.0	11.25	11.00	1.00	1.00	430
14**	150	14.0	12.50	11.00	1.00	1.00	550
16**	150	15.0	13.75	11.00	1.00	1.00	685
18**	150	16.5	15.00	13.50	1.12	1.12	860
20**	150	18.0	16.00	13.50	1.12	1.12	1080
24**	150	22.0	18.50	13.50	1.12	1.12	1665

† Dimension R is for machined bases. For bases not machined, add approximately ⅛ inch.
** 14″ and larger tees may be furnished to Class B wall thickness in ductile iron at our option (see page 71).
Note: Sizes 14″ thru 24″ fittings for 250 psi working pressure are furnished to 150 psi dimensions in ductile iron. (see pages 68 and 71).

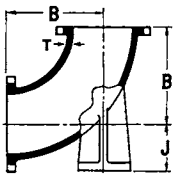
CAST IRON FLANGED FITTINGS

ANSI Specification B16.1

LONG RADIUS BASE ELBOWS

DIMENSIONS AND WEIGHTS

For Pressure Ratings See Page 65



For Drilling Template See Page 65

F-1828
Straight Long Radius Base Elbows

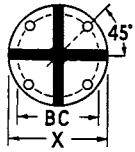
Nominal pipe size..... Inches	3	4	6	8	10	12
Dimension T..... Inches	.38	.50	.56	.63	.75	.81
Dimension B..... Inches	7.75	9.00	11.50	14.00	16.50	19.00
Dimension J*..... Inches	4.88	5.50	7.00	8.38	9.75	11.25
Approximate weight..... Pounds	48	73	120	205	295	435
Nominal pipe size..... Inches	14	16	18	20	24	..
Dimension T..... Inches	.88	1.00	1.06	1.12	1.25	..
Dimension B..... Inches	21.50	24.00	26.50	29.00	34.00	..
Dimension J*..... Inches	12.50	13.75	15.00	16.00	18.50	..
Approximate weight..... Pounds	565	780	995	1240	1815	..

* Dimensions "J" are for *machined* bases. For bases not machined, add approximately ⅛-inc
Bases are *not* faced or drilled, unless specifically ordered.

Base Elbows—Reducing Sizes

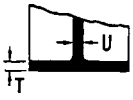
Starting with the 4 x 3 size, reducing sizes of base elbows are available in same range of sizes as shown on page 69 for standard radius elbows and on page 70 for long radius elbows. Such fittings are regularly furnished with the base under the larger size opening. Elbows with the base under the smaller size opening are very special.

Center-to-face dimensions of reducing elbows (as well as base dimensions) are same as for straigl size fittings corresponding to the size of the larger opening—as shown in tables on this pag



ROUND BASE IS REGULAR

Bases will be machined and/or drilled ONLY when so ordered †



Dimensions and Weights of Bases

For fitting size.....Inches	3	4	5	6	8	10	12	14	16	18	20	24
Supporting pipe size.....Inches	1½	2	2½	2½	4	4	6	6	6	8	8	8
Thickness T.....Inches	9/16	5/8	11/16	11/16	15/16	15/16	1	1	1	1⅛	1⅛	1⅛
Thickness U.....Inches	½	½	5/8	5/8	⅞	⅞	1	1	1	1⅛	1⅛	1⅛
Diameter X.....Inches	5	6	7	7	9	9	11	11	11	13½	13½	13½
Number of holes in base.....	4	4	4	4	4	4	4	4	4	4	4	4
Size of holes.....Inches	5/8	¾	¾	¾	¾	¾	⅞	⅞	⅞	⅞	⅞	⅞
Diameter BC.....Inches	3⅞	4¾	5½	5½	7½	7½	9½	9½	9½	11¾	11¾	11¾
Weight of **F-827** base...Pounds	10	10	20	20	40	45	65	70	75	115	120	130
Weight of **F-1828** base..Pounds	20	25	..	35	60	65	85	95	110	155	160	175
Weight of **F-829** base...Pounds	5	10	..	15	30	30	45	50	50	75	75	80

† When bases are ordered drilled other than regular, a sketch must accompany the order.

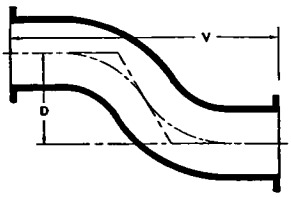
Flange accessories must be ordered separately. See page 64 for information.

CAST IRON FLANGED FITTINGS

Manufacturers Standard
Meets all Applicable Requirements of ANSI A21.10 (AWWA C110)

OFFSETS

Flange and plain end or flange and bell offsets can also be furnished—to special order.



F-838 Offset

For mechanical joint offsets, see page 49.

DIMENSIONS AND WEIGHTS

Nominal Diameter Inches	Pressure Rating psi	Dimensions Inches D	Dimensions Inches V	Approx. Weight Pounds	Nominal Diameter Inches	Pressure Rating psi	Dimensions Inches D	Dimensions Inches V	Approx. Weight Pounds
3 x 6	250	6	19	40	8 x 18	250	18	35	225
3 x 12	250	12	22	50	8 x 24	250	24	38¼	265
3 x 18	250	18	33	65	10 x 6	250	6	22	195
4 x 6	250	6	19	65	10 x 12	250	12	30	255
4 x 12	250	12	22	75	10 x 18	250	18	38	315
4 x 18	250	18	30	95	12 x 6	250	6	26	305
4 x 24	250	24	23½	95	12 x 12	250	12	37	405
6 x 6	250	6	20	90	12 x 18	250	18	48	505
6 x 12	250	12	26	115	12 x 24	250	24	48	525
6 x 18	250	18	33	145	14 x 18	150	18	49	535
6 x 24	250	24	22¼	145	16 x 12	150	12	40	540
8 x 6	250	6	21	140	16 x 18	150	18	50	650
8 x 12	250	12	28	180					

Regularly furnished with flanges faced and drilled per template on page 65.
For making offsets on the job, see page 224.

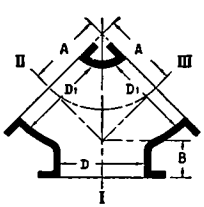
Note: 14″ and 16″ Offsets for 250 psi working pressure are furnished to 150 dimensions in ductile iron.

TRUE "Y" BRANCHES

Manufacturer's Standard

F-844 DIMENSIONS AND WEIGHTS

Nominal Diameter Inches* D	Nominal Diameter Inches* D_1	Working Pressure psi	Dimensions Inches A	Dimensions Inches B	Approx. Weight Pounds
3	3	175	5.50	3.00	30
4	3	175	5.50	3.00	35
4	4	175	6.50	3.00	55
6	3	175	5.50	3.50	55
6	4	175	6.50	3.50	60
6	6	175	8.00	3.50	90
8	4	175	6.50	4.50	85
8	6	175	8.00	4.50	100
8	8	175	9.00	4.50	140
10	6	175	8.00	5.00	140
10	8	175	9.00	5.00	155
10	10	175	11.00	5.00	220
12	6	175	8.00	5.50	160
12	8	175	9.00	5.50	210
12	10	175	11.00	5.50	240
12	12	175	12.00	5.50	315



F-844
Flanged True "Y"

Note

When ordering reducing fittings, give size of openings in the order indicated by numerals I, II and III.

Regularly furnished with flanges faced and drilled per template on page 65.
* Larger sizes can be made to order. Detailed information furnished on request.
Flange accessories must be ordered separately. See page 64 for information.

CLOW

CAST IRON FLANGES

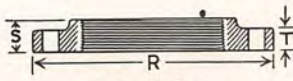
ANSI Specification B16.1

Furnished faced and drilled
to 125 Pound Template

F-1900
Screwed Flange

DIMENSIONS AND WEIGHTS

COMPANION FLANGES



F-1900
Dimensional View

For Steel or Iron Pipe Size Cast Iron Pipe*

F-1900

Nominal Pipe Size Inches	Dimensions Inches			Approx. Weight Pounds	Nominal Pipe Size Inches	Dimensions Inches			Approx. Weight Pounds
	R	S	T			R	S	T	
2	6	1	5/8	5	6	11	1 9/16	1	22
3	7 1/2	1 3/16	3/4	8	8	13 1/2	1 3/4	1 1/8	31
4	9	1 5/16	15/16	14	10	16	1 15/16	1 3/16	45
5	10	1 7/16	15/16	17	12	19	2 3/16	1 1/4	63

* For Screw Flanges for use with cast iron watermain pipe, see page 60.

F-1905 Regular
Reducing Flange

**Cast Iron Flanges are Furnished
With Plain Face and Drilled
ANSI B16.1, 125 Pound
Standard Template
Unless Otherwise Ordered**

REDUCING FLANGES

F-1910 Eccentric†
Reducing Flange

Tappings are for Steel or Iron Pipe Size Cast Iron Pipe

F-1905

Size Inches	Diameter Bolt Circle Inches	Number and Size of Bolts	Approx. Weight Pounds	Size Inches	Diameter Bolt Circle Inches	Number and Size of Bolts	Approx. Weight Pounds
1 x 6	4 3/4	4—5/8 x 2 1/4	5	2 x 11	9 1/2	8—3/4 x 3 1/4	25
1 1/4 x 6	4 3/4	4—5/8 x 2 1/4	5	2 1/2 x 11	9 1/2	8—3/4 x 3 1/4	24
1 1/2 x 6	4 3/4	4—5/8 x 2 1/4	5	3 x 11	9 1/2	8—3/4 x 3 1/4	23
1 1/2 x 7 1/2	6	4—5/8 x 2 1/2	5 1/2	4 x 11	9 1/2	8—3/4 x 3 1/4	22
2 x 7 1/2	6	4—5/8 x 2 1/2	9	5 x 11	9 1/2	8—3/4 x 3 1/4	21
2 1/2 x 7 1/2	6	4—5/8 x 2 1/2	9	3 x 13 1/2	11 3/4	8—3/4 x 3 1/2	40
1 1/2 x 9	7 1/2	8—5/8 x 3	16	4 x 13 1/2	11 3/4	8—3/4 x 3 1/2	38
2 x 9	7 1/2	8—5/8 x 3	16	5 x 13 1/2	11 3/4	8—3/4 x 3 1/2	36
2 1/2 x 9	7 1/2	8—5/8 x 3	16	6 x 13 1/2	11 3/4	8—3/4 x 3 1/2	34
3 x 9	7 1/2	8—5/8 x 3	15	6 x 16	14 1/4	12—7/8 x 3 3/4	56
3 1/2 x 9	7 1/2	8—5/8 x 3	14	8 x 16	14 1/4	12—7/8 x 3 3/4	50
3 x 10	8 1/2	8—3/4 x 3	19	8 x 19	17	12—7/8 x 3 3/4	78
4 x 10	8 1/2	8—3/4 x 3	17	10 x 19	17	12—7/8 x 3 3/4	75

† Eccentric reducing flanges are made to order only.

When Ordering Reducing Flanges

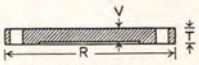
When ordering reducing flanges, give size of pipe tapping first and then the outside diameter of the flange wanted. Example: A flange is required to connect a 6-inch threaded pipe to a 10 inch flanged valve or fitting having 16-inch diameter flanges. Order a 6 x 16 O.D. Reducing Flange. This will avoid confusion caused by orders calling for a 10 x 6 or a 6 x 10 flange. Reducing flanges are regularly furnished to the thickness of and drilled to the template of the regular companion flange of corresponding outside diameter.

BLIND FLANGES, RETURN BENDS, AND FILLERS

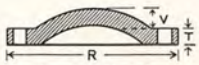
ANSI Specification B16.1

CAST IRON BLIND FLANGES

F-1915 Blind Flange
16-Inch O.D. and Smaller



F-1915 Section
3″ thru 10″



F-1915 Section
12″ thru 24″

F-1915 Blind Flange*
19-Inch O.D. and Larger

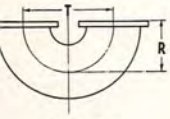
Flanges are faced and drilled to ANSI B16.1 125 pound standard template.

F-1915 Blind Flanges

Nominal Pipe Size Inches	Dimensions Inches R	T	V	Max. Tap Size Inches†	Approx. Weight Pounds	Nominal Pipe Size Inches	Dimensions Inches R	T	V	Max. Tap Size Inches†	Approx. Weight Pounds
3	7½	¾	11/16	1	9	12	19	1¼	1¼	3½	88
4	9	15/16	⅞	1½	16	14	21	1⅜	1 5/16	4	115
5	10	15/16	⅞	1½	20	16	23½	1 7/16	1⅜	4	160
6	11	1	15/16	1½	25	18	25	1 9/16	1 9/16	6	190
8	13½	1⅛	1 1/16	2	42	20	27½	1 11/16	1⅝	6	250
10	16	1 3/16	1⅛	2½	63	24	32	1⅞	1 13/16	8	370

Flanges, 19″ O.D. and larger, are dished with inside radius equal to port diameter of pipe size. Use the F-1905 when larger size taps are required in 12″ and smaller flanges.

CAST IRON FLANGED RETURN BENDS



F-1975
See Note

F-1975

Nominal pipe size..Inches	3	4	4	6	6	8	10	12
Dimension R.....Inches	5.50	6.50	7.50	7.00	8.00	9.00	11.00	12.00
Dimension T.....Inches	11.00	10.00	13.00	12.00	16.00	18.00	22.00	24.00
Approx. weight....Pounds	35	60	65	90	100	175	290	410

Note: Return bends can be furnished with straight or reducing back outlet. Furnished faced and drilled to 125 pound template.

FLANGE FILLERS

F-1984

F-1984 Fillers—Full Size of Flange

Used for closing up between two flanges which do not meet. We can also furnish the "extra length" bolts for making connections. Maximum thickness is six inches; minimum thickness is ⅜ inch.

F-1986 Beveled Fillers—Full Size of Flange

For closing between two flanges which do not face up properly, or for throwing a line of pipe off center to straight flow. Maximum bevel is 6 degrees with a minimum thickness at the small end of ⅜ inch.

F-1986

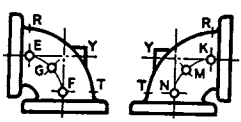
Furnished Faced and Drilled 125 Pound Template Unless Otherwise Ordered.

CLOW

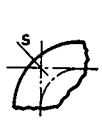
METHOD OF DESIGNATING LOCATION OF

TAPPED HOLES AND/OR BOSSES IN CAST IRON FLANGED FITTINGS

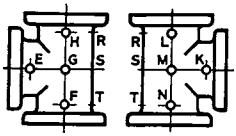
When a cast iron flanged fitting is wanted with a tapped connection, give the size of the tapping required, and designate its location by means of a letter selected from the correct view of the fitting in question.



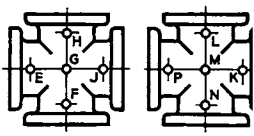
90° Elbow
Straight Size



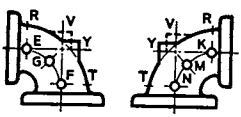
90° Elbow



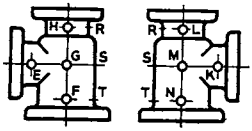
Tee
Straight Size



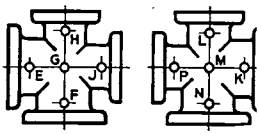
Cross
Straight Size



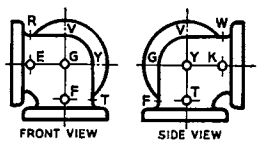
90° Elbow
Reducing Size



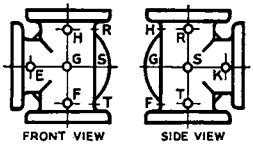
Tee
Reducing Size



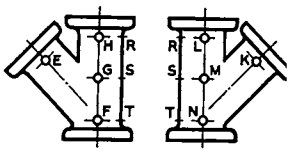
Cross
Reducing Size



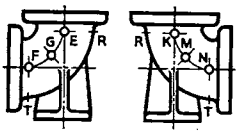
Side Outlet Elbow
Straight Size



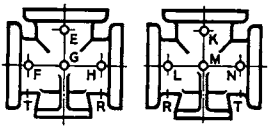
Side Outlet Tee
Straight Size



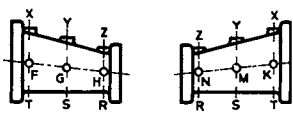
45° Lateral
Straight Size



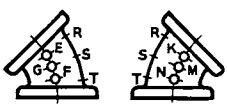
90° Base Elbow



Base Tee

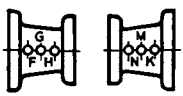


Eccentric Reducer



45° Elbow

Tapping through the wall of fitting is limited to sizes indicated in the table below. Larger size tapped openings will require casting the fitting with an integral boss—the location of which may also be identified by a letter, as explained above. A boss is always required at "V" and "Y" on straight and reducing sizes of 90-degree elbows, and on tapered sides of reducers.



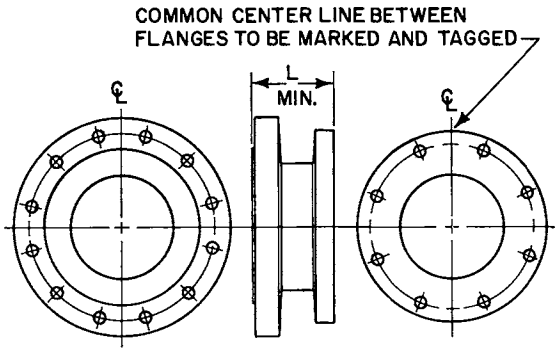
Reducer

Maximum Size of Tapped Hole in Fitting

Size of fitting.....Inches	3	4	5	6	8	10	12	14–24
Size of hole without boss.....Inches	3/8	3/8	3/8	1/2	3/4	1	1 1/2	2
Size of hole with boss.....Inches	2	2 1/2	2 1/2	3	4	4	4	4

SPECIAL FLANGE ADAPTOR

TO CONNECT EXTRA HEAVY 250 POUND FLANGES AND STANDARD 125 POUND FLANGES



F-1989 Flange Adaptor

The F-1989 Flange Adaptor is used to connect flanged pipe or fittings with Class 125 flanges to Class 250 flanges of ANSI B16.1 specifications. Common center lines are marked and tagged to eliminate difficulty in installation.

The template for 250 flanges is reproduced below for information only. We do not furnish pipe or fittings with Class 250 flanges.

The Flange Adaptor is regularly furnished to minimum length "L," as shown in the table, but can be furnished in longer lengths to 3'-6" maximum when required. Adaptors are cast of gray cast iron in Class D thickness, and are rated for 250 psi water working pressure.

Dimensions and Weights

Nominal Pipe Size.....Inches	3	4	6	8	10	12	14	16	18	20	24
Minimum Length, L, Inches.....	5	5	5	6	6	6	7	7	8	8	10
Weight per inch of body.....Lbs.	1.4	1.9	2.9	4.3	6.0	7.8	9.9	12.3	14.9	17.7	23.8
Weight for Length, L, including flanges.....Pounds	25	35	55	90	125	175	230	285	345	425	650

TEMPLATE FOR DRILLING EXTRA HEAVY 250 POUND FLANGES

AMERICAN NATIONAL STANDARD SPECIFICATION B16.1 FOR 250 POUND TEMPLATE†

For 125 pound template, see page 65

Size Inches	Diameter of Flange Inches	Thickness of Flange (Min.) Inches	Diameter of Raised Face Inches	Diameter of Bolt Circle Inches	Number of Bolts	Diameter of Bolts Inches	Length of Bolts Inches
3	8¼	1⅛	5 11/16	6⅝	8	¾	3½
4	10	1¼	6 15/16	7⅞	8	¾	3¾
6	12½	1 7/16	9 11/16	10⅝	12	¾	4
8	15	1⅝	11 15/16	13	12	⅞	4½
10	17½	1⅞	14 1/16	15¼	16	1	5¼
12	20½	2	16 7/16	17¾	16	1⅛	5½
14	23	2⅛	18 15/16	20¼	20	1⅛	6
16	25½	2¼	21 1/16	22½	20	1¼	6¼
18	28	2⅜	23 5/16	24¾	24	1¼	6½
20	30½	2½	25 9/16	27	24	1¼	6¾
24	36	2¾	30 5/16	32	24	1½	7¾

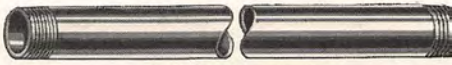
† ANSI B16.1 250 pound cast iron flanges have 1/16-inch raised face.

Note: Drilling templates are in multiples of four, so that fittings may be made to face in any quarter. Bolt holes shall straddle the center line.

I.P.S. CAST IRON PIPE AND DUCTILE IRON PIPE WITH SAME O.D. AS STEEL PIPE

Meets pertinent requirement of Specifications ANSI A40.5 and Federal Specifications WW-P-356a

F-238 Plain End
F-238-D (Ductile Iron)



F-240 Threaded
F-240-D (Ductile Iron)

F-250 Hub and Plain End—for calked or push-on joint

For Drainage, Vent and Waste Piping

This pipe can be cut, threaded, fitted and installed on the job with the ordinary tools of the piping trades. Pipe takes regular stock sizes of cast iron screwed fittings and flanges.

I. P. S. CAST IRON PIPE

Sizes, Dimensions and Weights

Weights of 18-foot random length pipe are rounded off to nearest five pounds.

Nominal Pipe Size Inches	A21.6 Wall Thickness		O.D. In Inches	Random Length Feet	Approximate Weight—Pounds			
					F-238 and **F-240**		**F-250**	
	Class	Inches			Per Foot	Per 18-foot Length	Per Foot Inc. Hub	Per 18-foo Length
3	22	.32	3.50	16–18	10.0	180	10.3	185
4	21	.32	4.50	16–18	13.1	235	13.5	245
5	..	.34	5.56	16–18	17.4	315	17.8	320
6	21	.35	6.62	18	21.5	385	22.0	395
8	21	.38	8.62	18	30.7	555	31.7	570
10	21	.41	10.75	18	41.6	750	43.1	775
12	21	.44	12.75	18	53.1	955	55.2	995

Pipe can be furnished with wall thickness greater than shown in above table.

I. P. S. DUCTILE IRON PIPE

Sizes, Dimensions and Weights

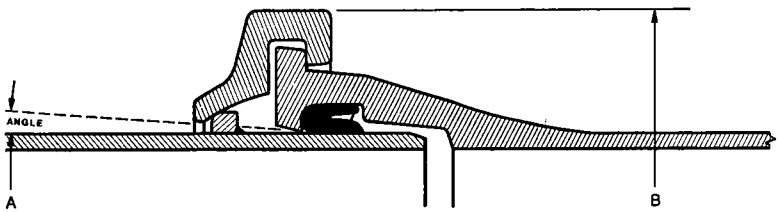
Weights of 18-foot random length pipe are rounded off to nearest five pounds.

Nominal Pipe Size Inches	A21.51 Wall Thickness		O.D. In Inches	Random Length Feet	Approximate Weight—Pounds	
					F-238-D and **F-240-D**	
	Class	Inches			Per Foot	Per 18-foot Length
4	3	.32	4.50	16–18	12.9	230
5	...	.32	5.56	16–18	16.6	300
6	3	.34	6.62	18	20.5	370
8	3	.36	8.62	18	28.6	515
10	3	.38	10.75	18	37.9	680
12	3	.40	12.75	18	47.5	855

SECTION 2 • RESTRAINED JOINTS

CLOW SUPER-LOCK® JOINT PIPE

An All Ductile Iron, Restrained Push-On Joint
Designed for Hard Service Applications



F-128
Super-Lock Joint Pipe

Patented

Clow Super-Lock Joint is a positive means of restraining Super Bell-Tite Push-On Joint pipe and fittings. The Super-Lock Joint is completely boltless and is recommended for both exposed and underground installations with working pressures up to 350 psi.

The Super-Lock Joint can be deflected after assembly to facilitate installation and accommodate earth settlement or movement. The design assures uniform load distribution between the restraining components when the joint is deflected. The unique design of Clow Super-Lock provides for quick and easy disassembly should the need arise.

The Super-Lock Joint complies with all the push-on joint requirements of American National Standard A21.11. Ductile pipe furnished with this joint is made in accordance with American National Standard A21.51. For ANSI A21.51 thickness selection tables, see page 221

Dimensions and Weights*

Nominal Pipe Size Inches	Pressure Rating psi	Joint Deflection		A Pipe O.D. Inches	B Retainer O.D. Inches	Accessories† Weight—Pounds
		In Degrees	Inches in 18 feet			
6	350	4	15	6.90	11¾	20
8	350	4	15	9.05	14⅜	35
10	350	4	15	11.10	16¾	45
12	350	4	15	13.20	19⅛	60
14	350	3	11	15.30	21¾	85
16	350	3	11	17.40	24	100
18	350	3	11	19.50	26⅜	145
20	350	3	11	21.60	28⅝	170
24	350	3	11	25.80	33¾	290

*For Super Bell-Tite Pipe dimensions and weights, see pages 30 and 31.
†Weight includes Lock Ring, Retainer, Retainer Lock, Roll Pin and Gasket.

ORDERING INFORMATION

Random Lengths: While F-128 Super-Lock pipe is regularly furnished in nominal 18 ft. lengths, we reserve the right to furnish random lengths.

Total Footage: Unless otherwise specified on the order, we will furnish a footage not less than the total ordered. We reserve the right to furnish a total footage greater than the footage ordered to allow the use of full length pipe without cutting.

End Connections: Unless otherwise specified on the order, each pipe or length of piping will be furnished Super-Lock Bell and Super-Lock Plain End.

To connect with other type pipe and fittings, Super-Lock Pipe can be furnished with a variety of end connections, including the F-122 Mechanical Joint, the F-141 Rivercrossing Joint and the F-162 Flanged Joint. Check other requirements with us.

Exact Laying Lengths: If any piece of pipe or length of piping must be furnished with an exact laying length, this must be specified when the order is placed. Random lengths will be used in making up exact laying lengths greater than 18 feet.

Laying Length Tolerances: Tolerances on individual pieces of pipe furnished to exact laying lengths shall be plus or minus ¼ inch.

Tolerances on lengths of piping furnished to exact laying lengths shall be plus or minus 0.1 percent of laying length.

Accessories

Super-Lock Pipe are shipped with the lock ring welded in place and the retainer secured to the plain end by hook bolts. Super Bell-Tite gaskets, lubricant, retainer locks and roll pins are shipped in a separate container.

CLOW SUPER-LOCK® JOINT PIPE

Easily Assembled, Easily Disassembled

Assembly

Assembly of the Super-Lock Joint is easily accomplished. Simply assemble the Super Bell-Tite Joint, as shown on page 29, position the retainer on the bell, and insert the retainer lock and roll pin as illustrated below.

No special tools or gages are required.

If the need should ever exist, the joint can be easily disassembled by prying up the roll pin and removing the retainer lock, allowing the retainer to be freely turned for removal.

1. Remove hook bolts securing retainer to plain end. Assemble SBT Joint as outlined on page 29. Clean out any dirt behind retainer lugs. *Shallow bell holes are recommended to facilitate assembly of the retainer.*

2. Position retainer so that the recesses line up with the lugs on the bell. Slide retainer over bell and rotate until the lugs on the bell and the retainer line up.

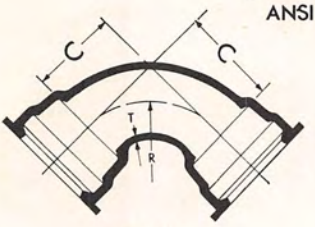
3. At drilled hole on retainer O.D., insert retainer lock in recess formed by lugs on bell and retainer. Insert roll pin in drilled hole and drive flush with retainer O.D.

4. Take any necessary deflection after joint is completely assembled.

SUPER-LOCK® PUSH-ON JOINT DUCTILE IRON FITTINGS

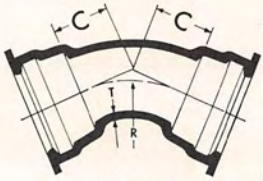
Meet all Applicable Requirements of

ANSI A21.10 (AWWA C110) Specifications and
ANSI A21.11 (AWWA C111) Specifications

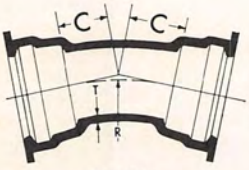


F-202
(90°) Quarter Bend

For Use with Super-Lock Push-On Pipe Shown on Page 86

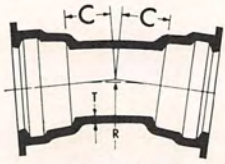


F-204
(45°) Eighth Bend

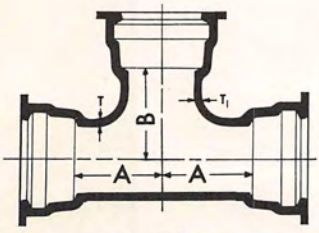


F-206
(22½°) Sixteenth Bend

Super-Lock Fittings are Furnished Complete with Gaskets and Joint Lubricant

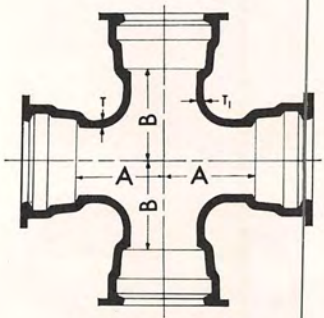


F-208
11¼°) Thirty-Second Bend

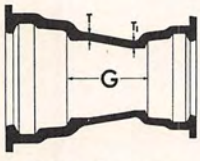


F-210 Tee

Super-Lock Fittings use the **F-173** SBT Gasket shown on page 27



F-212 Cross



F-214 Reducer

SIZES, DIMENSIONS AND WEIGHTS

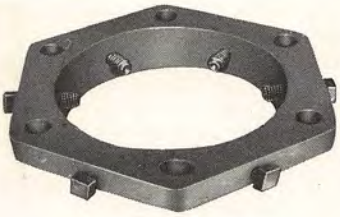
Super-Lock fittings are available in the 6″ thru 24″ sizes and have the same dimensions and weights as the Super Bell-Tite fittings on pages 33, 34, and 35. See page 105 for Super-Lock Plugs.

NOTE

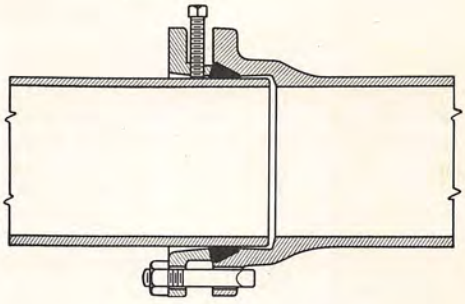
SUPER-LOCK FITTINGS ARE DUCTILE IRON RATED FOR 350 psi WORKING PRESSURE

MECHANICAL JOINT RETAINER GLAND

DUCTILE CAST IRON



F-1058
Retainer Gland



The F-1058 Installed

F-1058 Ductile Iron Retainer Gland

The F-1058 Retainer Gland provides positive holding power for restraining the standardized Mechanical Joint. It eliminates the need for the tie rods or reaction blocking.

The retainer gland is cast of high strength ductile iron and fitted with cup point, square head, double heat treated, parkerized steel set screws. Tightened to 75 foot-pounds torque, the set screws bite into the surface of the pipe—preventing joint separation. The set screws also provide an electrical contact for thawing.

The F-1058 Retainer Gland utilizes standardized tee head bolts and gasket conforming to ANSI A21.11. It is recommended that joint deflection be limited to 3 degrees when this gland is used.

Assembly Procedure

Recommended Joint Deflection is 3° Maximum

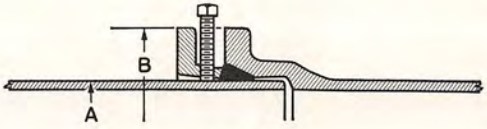
1. Back out all set screws to clear the inside of the gland.

2. Assemble the joint in accordance with the instructions on page 37 of this catalog, being certain to take any necessary joint deflection (3 degrees maximum) *before* tightening the tee head bolts.

3. After the tee head bolts are tightened, make all set screws finger-tight against the pipe.

4. Tighten all set screws to 75 foot-pounds torque by alternately tightening set screws on opposite sides of the pipe.

Maximum Joint Deflection 3°



Recommended Set Screw Torque 75 Foot-lbs.

F-1058

Dimensions and Weights

Nominal Pipe Size Inches	Pressure Rating psi	A Pipe O.D.	B Gland O.D.	Number and Size of Set Screws	Approx. Weight Pounds
3	350	3.96	7.69	4–½x2½	4½
4	350	4.80	9.12	4–½x2½	7
6	350	6.90	11.12	6–⅝x2½	12
8	250	9.05	13.37	8–⅝x2½	17
10	250	11.10	15.62	12–⅝x2¾	25½
12	250	13.20	17.88	16–⅝x2¾	31
14*	250	15.30	20.25	20–⅝x3	37½
16*	250	17.40	22.50	24–⅝x3	48½
18*	200	19.50	24.75	24–⅝x3	56½
20*	200	21.60	27.00	28–⅝x3	71½
24*	150	25.80	31.50	32–⅝x3	92½

* Sizes 14″ thru 24″ are for use with *ductile iron pipe only.*

MECHANICAL JOINT ANCHORING FITTINGS

FOR HYDRANT LEADS, BRANCH LINE STUBS, DEAD-ENDS AND OTHER INSTALLATIONS WHERE POSITIVE ANCHORING IS REQUIRED

Can be disassembled in the field

Clow Anchoring Fittings are "plain end" mechanical joint fittings with an integral follower gland. The protruding plain end, when fitted with gasket, is inserted into a standardized mechanical joint bell, and bolted tight, flange to flange. These fittings eliminate the need of tie rods and other costly, time-consuming methods of positive, fixed placement. When used with shut-off valves, these fittings prevent the valve from blowing-off and eliminate the need of blocking. They save time and labor in installation, and save digging when a hydrant must be moved or replaced. They are desirable in hydrant leads for anchoring the auxiliary valve either at the hydrant or at the tee in the main. They can be used with a shut-off valve in place of a plug in a tee to permit extending the line during construction without interrupting testing; and/or at the stub end of a line, either branch or main line, to eliminate blocking and the possibility of blow-off. Fittings include couplings, pipe, tees and elbows.

MECHANICAL JOINT ANCHORING COUPLING

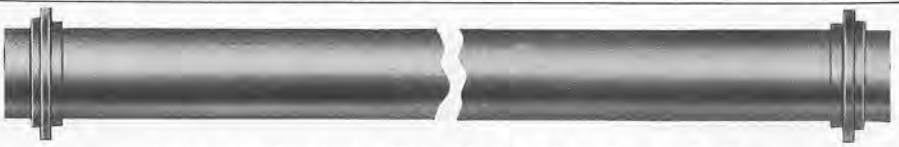
F-1211 MJ
Anchoring Coupling

Anchoring Couplings provide a simple, permanent, less costly way to prevent blow-off and eliminate tie rods and blocking. Used with a standardized MJ tee and/or valve, it provides a positive, permanent way to anchor valves and hydrants

F-1215 MJ
Anchoring Coupling

Dimensions and Weights

Nominal Pipe Size	F-1211				F-1215		
	6	8	6	8	4	6	8
Laying Length	12	12	18	18	14	14	14
Weight in Pounds	70	90	85	115	50	70	100

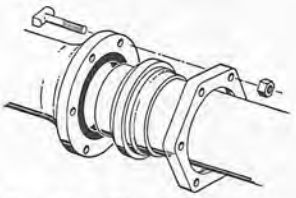


F-1216 ANCHORING PIPE, 4", 6", 8" AND 12" SIZES

WHEN LONG LENGTHS ARE NEEDED TO ANCHOR HYDRANTS

The F-1216 Anchoring Pipe can be furnished in any length from 18" to 18 feet to accommodate almost any anchoring installation requirement. Available in any established length, they provide a positive way of assuring that hydrant installations are accurate to given dimensions, and make possible standardized and uniform installations throughout the system, as well as providing all the benefits of proven holding power.

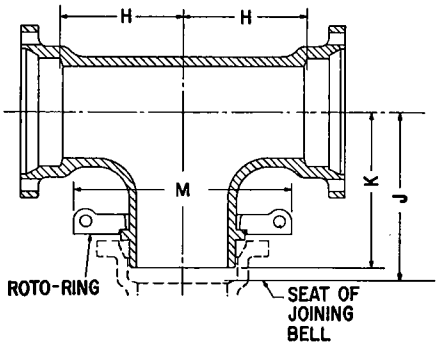
Pipe can be furnished in any combination of joint ends: plain end and anchoring; MJ and anchoring; Push-On and anchoring, etc. It is regularly furnished with a Roto-Ring Gland (see right), on one end, and a solid (non-rotable) gland on the other end. The Roto-Ring Gland permits the anchoring follower gland to rotate freely during assembly to accommodate any orientation of the bolt holes in existing fittings to which pipe will be connected. When assembled, and tightened against the stop shoulder, it makes a fixed joint.



Roto-Ring Gland Construction

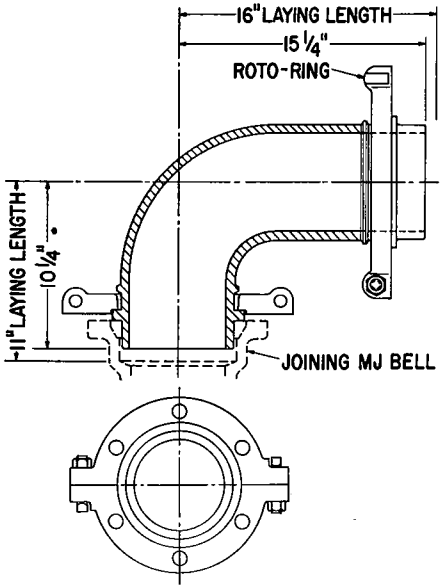
MECHANICAL JOINT ANCHORING FITTINGS

TEES—ELBOWS



F-1217 Anchoring Tee, Mechanical Joint*

(Not illustrated)
F-1221 Super Bell-Tite on-the-run Anchoring Tee
(Available in same sizes as F-1217)



F-1218 Anchoring Elbow* 6" size only

Dimensions and Weights

Pipe Size Inches	Dimensions H	K	J	M	Weight in pounds F-1217†	F-1218
6 x 6	8	10	10¾	14¼	140	120
8 x 6	9	11	11¾	14¼	190	...
10 x 6	11	13	13¾	14¼	260	...
12 x 6	12	14	14¾	14¼	340	...
14 x 6	14	16	16¾	14¼	445	...
16 x 6	15	17	17¾	14¼	550	...
18 x 6	13	17½	18¼	14¼	595	...
20 x 6	14	19	19¾	14¼	730	...
8 x 8	9	11	11¾	16½	200	...
10 x 8	11	13	13¾	16½	285	...
12 x 8	12	14	14¾	16½	360	...
14 x 8	14	16	16¾	16½	455	...
16 x 8	15	17	17¾	16½	560	...
18 x 8	13	17½	18¼	16½	610	...
20 x 8	14	19	19¾	16½	740	...

† Does not include MJ accessories.

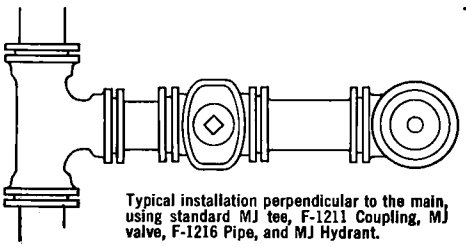
Anchoring Tees and Elbows

The F-1217 Anchoring Tee is a standard MJ tee except that the branch is plain end with an integral gland and split Roto-Ring. The Roto-Ring anchors the plain end to any MJ bell attached to the branch. This tee can be used for hydrant leads and for anchoring a valve to the tee when a future branch line is anticipated.

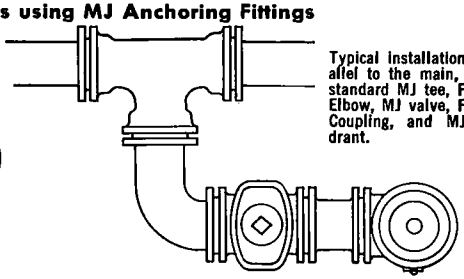
The F-1218 Anchoring Elbow is really three fittings in one—two anchoring couplings plus one 90° elbow. It allows hydrants to be anchored at either of two distances parallel to the main. For example, when bolted to a 6" x 6" standard MJ tee, it anchors the hydrant on either 19" or 24" centers from the main line.

* Branch sockets with standardized MJ bell only.

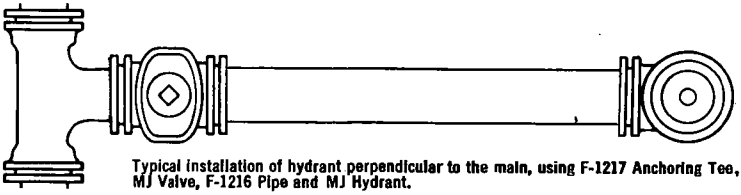
Some Typical Installations using MJ Anchoring Fittings



Typical installation perpendicular to the main, using standard MJ tee, F-1211 Coupling, MJ valve, F-1216 Pipe, and MJ Hydrant.



Typical installation parallel to the main, using standard MJ tee, F-1218 Elbow, MJ valve, F-1211 Coupling, and MJ Hydrant.



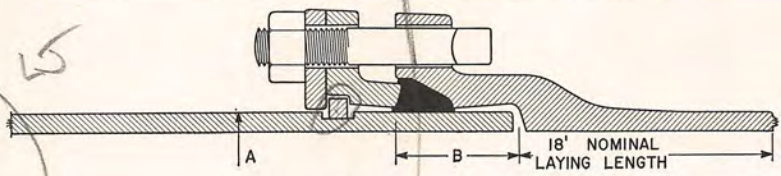
Typical installation of hydrant perpendicular to the main, using F-1217 Anchoring Tee, MJ Valve, F-1216 Pipe and MJ Hydrant.

CLOW

DUCTILE CAST IRON PIPE

LOCKED MECHANICAL JOINT

Meets all Applicable Requirements of Specifications
A21.51 for Ductile Iron Pipe and A21.11 for Mechanical Joint



F-127-D Ductile Iron Pipe
Locked Mechanical Joint

Assembles easily, can be disassembled in the field

Clow Locked Mechanical Joint Pipe provides a positive means to prevent joint separation in pipe lines without the use of tie-rods, friction clamps, or similar devices, even under conditions of severe thrust. The joint is designed for exposed piping in tunnels and buildings, for bridge crossings and other installations where anchoring must be provided.

Pipe is furnished to the minimum thickness listed below to assure adequate thickness under the groove. Upon request, pipe can be furnished with greater wall thickness than shown in the table.

The groove is machined into the plain end of a standardized Mechanical Joint pipe. The "lock" against separation is provided by the assembly of lock ring, lock plate and lock gland which are bolted tight to the flange of the standardized Mechanical Joint bell. Because the lock ring, lock plate and lock gland are factory assembled onto the pipe before shipment, field assembly follows the regular procedure for installing Mechanical Joint pipe. Standard Mechanical Joint fittings are used with this pipe.

The Lock Ring is cast iron, except 3″ and 4″ sizes, which are Dosite (a laminated phenolic). The lock plate and lock gland are high tensile Ductile Iron. Bolts, nuts and gaskets are standardized ANSI A21.11 Mechanical Joint accessories.

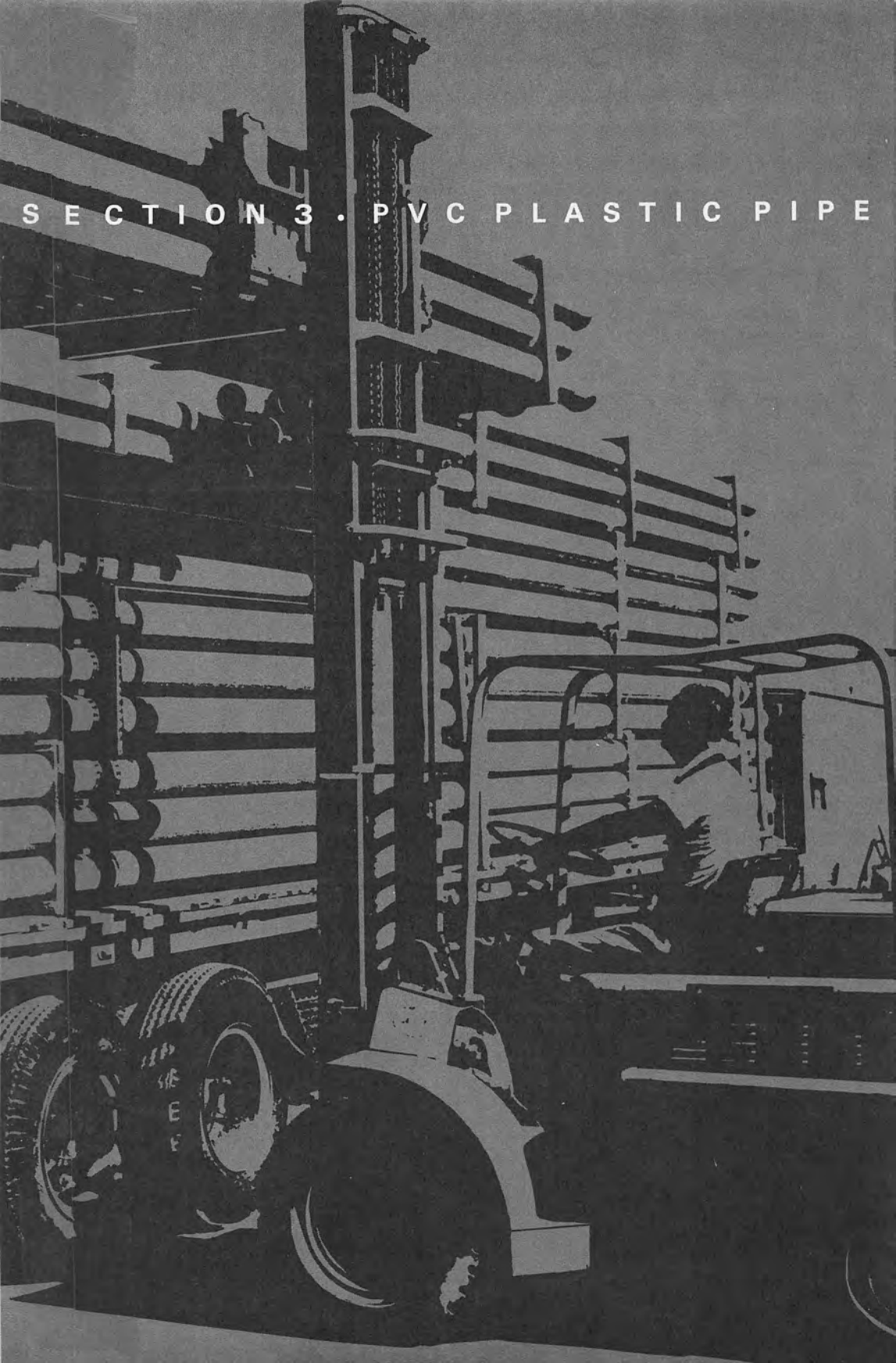
For deflection data see page 222.

DIMENSIONS AND WEIGHTS

Nominal Pipe Size Inches	Pressure Rating (psi)	Wall Thickness		Dimensions-Inches			Weight-Pounds	
		Class	In Inches	A Pipe O.D.	B Bell Depth	Gland O.D.	18-Foot Length Including bell	Accessories Only†
3	350	6	.40	3.96	2.50	7.69	260	8½
4	350	6	.41	4.80	2.50	9.12	325	12
6	350	6	.43	6.90	2.50	11.12	505	20
8	350	6	.45	9.05	2.50	13.37	700	30
10	350	6	.47	11.10	2.50	15.62	905	40
12	350	6	.49	13.20	2.50	17.88	1125	50
14	250	5	.48	15.30	3.50	20.25	1305	70
16	250	5	.49	17.40	3.50	22.50	1530	90
18	200	5	.50	19.50	3.50	24.75	1775	100
20	200	5	.51	21.60	3.50	27.00	1990	125
24	200	5	.53	25.80	3.50	31.50	2490	175

† Accessories include: Lock Plate, Lock Gland, Lock Ring, Tee-head Bolts, and F-915 MJ Gasket.

SECTION 3 • PVC PLASTIC PIPE



CLOW PVC BELL-TITE PRESSURE PIPE

An Integral Bell, Rubber Gasket, Push-On Joint pipe

F-6200
Bell-Tite Joint PVC Pressure Pipe

Clow Bell-Tite PVC (polyvinyl chloride) plastic pressure pipe is used for potable water and sewer force mains, and is available in sizes 2″ thru 12″ diameters. PVC is non-corrosive, and impervious to electrolytic and atmospheric corrosion. It is a low cost pressure pipe, with high flow and long life characteristics.

The Bell-Tite, rubber gasket, push-on joint assembles fast and makes a pressure-tight seal instantly. Once installed it provides for contraction and expansion in service.

The pipe and the bell are one piece, with the Bell-Tite bell walls thickened to be heavier than the pipe barrel. All parts of the bell, including the gasket groove are thickened to meet standard dimension ratio of wall thickness to outside diameter.

Depending upon wall thickness, pipe is rated for 160 or 200 psi. Fittings, adapters, valves, fire hydrants, and polybutylene water service tubing can be furnished to provide a complete installation.

Pipe meets the requirements of ASTM D1784 for PVC Compounds, ASTM D2241 and Product Standard 22 for PVC pipe, and ASTM D3139 for Push-On Joints.

Quick, Easy Assembly—No Special Tools or Equipment Needed

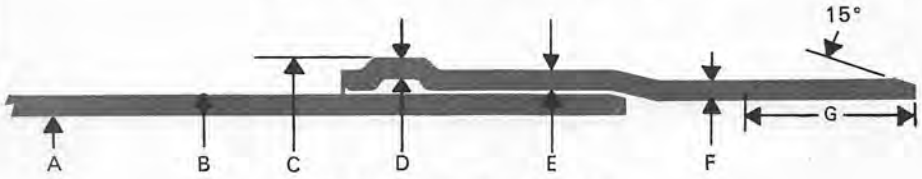
1. Both the gasket groove and the beveled plain end must be clean of all dirt and foreign matter.

2. Insert the gasket in the groove with marked edge toward the face of the bell.

3. Apply lubricant to the beveled plain end. Do not substitute for approved Bell-Tite lubricant.

4. Push plain end into the bell either by hand or with a bar to depth of stop mark.

CLOW PVC BELL-TITE® PIPE



F-6200 Bell-Tite Joint PVC Pipe

SDR 26 — **Dimensions and Weights** — **160 psi rating**

Nominal Size	PSI Rating @73 F.	Pipe Barrel A I.D.	Pipe Barrel B O.D.	C Bell O.D.	Minimum Wall Thickness D Groove	Minimum Wall Thickness E Socket	Minimum Wall Thickness F Barrel	G Stop Mark Inches	Wt. Lbs. Per Foot 20 Ft. Length
2	160	2.193″	2.375″	2.88	.111″	.100″	.091″	3¾	.44
2½	160	2.655″	2.875″	3.44	.132″	.121″	.110″	3⅞	.63
3	160	3.230″	3.500″	4.14	.159″	.148″	.135″	4¾	.93
4	160	4.154″	4.500″	5.33	.205″	.189″	.173″	5⅜	0.53
6	160	6.115″	6.625″	7.77	.298″	.280″	.255″	5⅞	3.33
8	160	7.961″	8.625″	10.11	.386″	.362″	.332″	6	5.66
10	160	9.924″	10.750″	12.60	.480″	.449″	.413″	7⅛	8.79
12	160	01.770″	12.750″	13.81	.572″	.536″	.490″	7¾	12.44

SDR 21 — **Dimensions and Weights** — **200 psi rating**

Nominal Size	PSI Rating @73 F.	Pipe Barrel A I.D.	Pipe Barrel B O.D.	C Bell O.D.	Minimum Wall Thickness D Groove	Minimum Wall Thickness E Socket	Minimum Wall Thickness F Barrel	G Stop Mark Inches	Wt. Lbs. Per Foot 20 Ft.″Length
2	200	2.149″	2.375″	2.94	.140″	.127″	.113″	3¾	.53
2½	200	2.601″	2.875″	3.51	.166″	.152″	.137″	3⅞	.77
3	200	3.166″	3.500″	4.23	.202″	.186″	.167″	4¾	1.13
4	200	4.072″	4.500″	5.43	.258″	.239″	.214″	5⅜	1.87
6	200	5.993″	6.625″	7.92	.377″	.352″	.316″	5⅞	4.09
8	200	7.805″	8.625″	10.29	.496″	.451″	.410″	6	6.91
10	200	9.728″	10.750″	12.81	.618″	.562″	.511″	7⅛	10.75
12	200	11.540″	02.750″	15.12	.723″	.677″	.607″	7¾	15.18

Physical and Chemical Properties

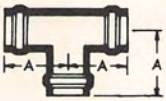
Property	Value	Test Method
Long Term Tensile at 73°F		
Ultimate	4,000	ASTM D-1598
Design	2,000	
Quick Term Properties at 73°F		
Tensile Strength	6,400	ASTM D-1599
Compressive Strength	9,400	ASTM D-695
Flexural Strength	14,500	ASTM D-790

The Bell-Tite® Gasket

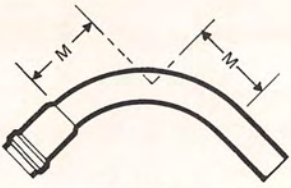
A single rubber gasket is the only accessory required to assemble a Bell-Tite joint. It forms a pressure-tight seal when fitted into the bell recess and compressed by the entering plain end of a pipe.

CLOW BELL-TITE® PUSH-ON JOINT PVC FITTINGS

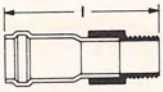
For 2-inch thru 6-inch pipe sizes



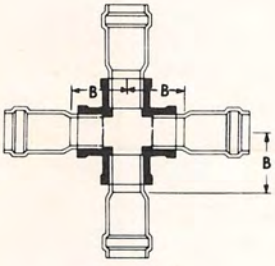
F-6210
Bell-Tite Tee



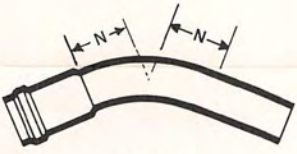
F-6221
Bell-Tite 90° Bend



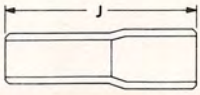
F-6230
Bell-Tite Male Adapter



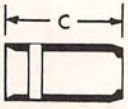
F-6212
Bell-Tite Cross



F-6223
Bell-Tite 45° Bend

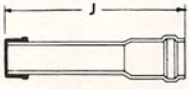


F-6232
Plain End Adapter▲

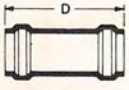


F-6215
Bell-Tite Insert Reducer

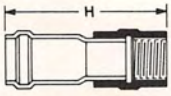
F-6224
Bell-Tite 22½° Bend



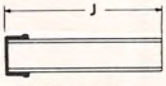
F-6237
Bell-Tite Cap



F-6217
Bell-Tite Repair Coupling



F-6227
Bell-Tite Female Adapter



F-6240
Bell-Tite Plug

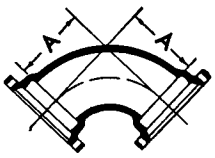
▲To Cast Iron or Asbestos Cement Pipe OD
(3" Cast Iron Only. 10" Asbestos Cement Only.)

Dimensions in Inches

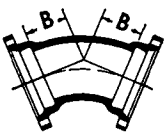
Size	A	B	C	D	H	I	J	M	N	P
2	5	3½	4	7¾	7¾	7¼	14	18	15	16
2½	5½	4⅛	4¼	8¼	9	8⅜	14	19	15	16
3	6¼	5	4½	9	10½	9½	14	19	14	16
4	7¼	6	6	10¼	11¾	11	14	20	13	15
6	9¼	...	6	13½	13	12	14	21	12	15
8	...	...	...	....	....	....	14	..	..	..
10	...	...	...	....	....	....	14	..	..	..

MECHANICAL JOINT CAST IRON FITTINGS FOR PVC PIPE

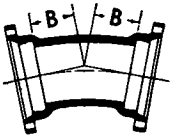
Joint meets all requirements of ANSI specification A21.11 (AWWA-C111)



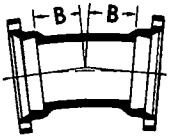
F-6300
90° Bend
MJ and MJ



F-6305
45° Bend
MJ and MJ



F-6310
22½° Bend
MJ and MJ



F-6315
11¼° Bend
MJ and MJ

Dimensions and Weights

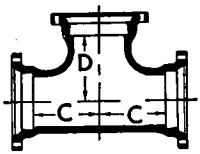
Nom. Pipe Size, Inches	Pressure Rating, psi	Dimensions Inches		Approximate Weight*—Pounds			
		A	B	F-6300	F-6305	F-6310	F-6315
6	250	6.0	3.0	75	65	65	65
8	250	7.0	3.5	110	95	95	95
10	250	9.0	4.5	165	130	135	135
12	250	10.0	5.5	225	185	190	190

* All weights are body weights only and do not include the weight of MJ accessories.

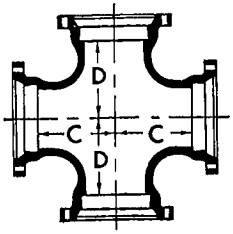
NOTE

Mechanical Joint Fittings for use with PVC Pipe are furnished with F-6340 Duck-tipped Transition Gaskets. See page 41.

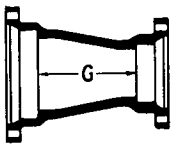
For F-1012 and F-1014 Solid Mechanical Joint Sleeves, see page 52.
For F-1035 MJ Plugs and F-1040 MJ Caps, see page 53.



F-6320
Tee
MJ, MJ and MJ



F-6325
Cross
MJ, MJ, MJ and MJ



F-960
Reducer
MJ and MJ

Dimensions and Weights

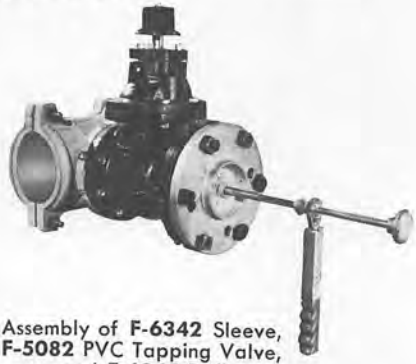
Nom. Pipe Size, Inches	Pressure Rating, psi	Dimensions—Inches			Approx. Weight*—Pounds		
		C	D	G	F-6320	F-6325	F-960
6x 3	250	4.75	6.00	9.00	90	...	55
6x 4	250	4.75	6.00	9.00	95	...	60
6x 6	250	6.00	6.00	.....	105	135	...
8x 4	250	5.00	7.00	11.00	125	...	80
8x 6	250	6.00	7.00	11.00	145	...	95
8x 8	250	7.00	7.00	.....	160	200	...
10x 4	250	5.75	9.00	12.00	170	...	105
10x 6	250	6.75	9.00	12.00	195	...	115
10x 8	250	8.00	9.00	12.00	215	...	135
10x10	250	9.00	9.00	.....	270	325	...
12x 4	250	5.75	10.00	14.00	215	...	135
12x 6	250	6.75	10.00	14.00	235	...	150
12x 8	250	8.00	10.00	14.00	270	...	165
12x10	250	9.00	10.00	14.00	320	...	190
12x12	250	10.00	10.00	.....	355	420	...

* All weights are body weights only and do not include the weight of MJ accessories.

CLOW CAST IRON TAPPING SLEEVES, VALVES AND DRILLS

To Make 4″ & 6″ Wet Taps in PVC Pipe

F-6342 Tapping Sleeve



Assembly of **F-6342** Sleeve, **F-5082** PVC Tapping Valve, and **F-6345** Drill

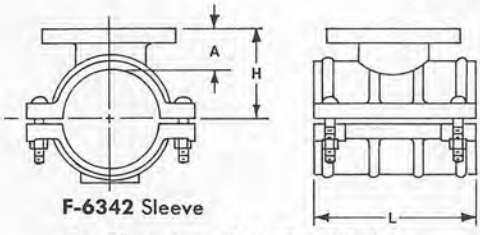
The F-6342 Tapping Sleeve, F-5082 PVC Tapping Valve, and the F-6345 Vegadrill combine to offer the easiest way available to make wet taps in PVC pipe. The Sleeve has a dual-lipped, self-energizing rubber gasket that seals the pipe around the tap, and provides a tight, lasting seal. The F-5082 Valve has a flange on one end which connects to the sleeve flange. The other end is a combination of PVC Bell-Tite & flange which accepts the adaptor plate of the F-6345 Vegadrill. Valves are available in 4″ and 6″ sizes.

In operation, the drill cuts a coupon, which is withdrawn thru the valve by a pilot drill.

The F-6342 Sleeve has ribbed construction, providing strength and ridigity for the plastic pipe, permitting a clean sharp cut thru the pipe wall. Assembly is made easy by use of drop-in bolts on sleeve flanges, as well as by the sleeve gasket being cemented in place at the factory.

The Clow sleeve, valve and Vegadrill offer a fast, low-cost way to make 4″ and 6″ taps in PVC mains under pressure.

DIMENSIONS



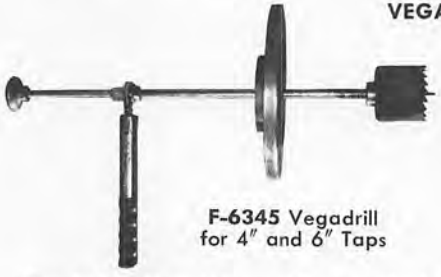
F-6342 Sleeve

For Dimensions of the **F-5082** Valve see page 155

Nominal Pipe Size	Dimensions in Inches			Weight Pounds
	A	H	L	
4 x 4	2¾	5	9¼	49
6 x 4	2⅝	6	10¾	63
6 x 6	2⅞	6⅜	10¾	75
8 x 4	2⅝	6 15/16	12½	93
8 x 6	2 13/16	7⅛	12½	105
10 x 4	2¾	8⅛	14¼	112
10 x 6	2 15/16	8 5/16	14¼	124

Flange machined to B16.1 125 Pound Std.

VEGADRILLS



F-6345 Vegadrill for 4″ and 6″ Taps

Adapter Plate

Coupon as withdrawn

The F-6345 Vegadrill provides a method for making 4″ and 6″ taps and uses an adaptor plate, which bolts to the valve. Moderate pressure and a ratchet operation permit tapping quickly and efficiently.

The aluminum adaptor plate has two bolt circles: the outer 6-bolt circle fits the Clow Flange & PVC Bell-Tite Push-On valve; the inner 4-bolt circle fits a standard MJ bell, permitting the use of a Flange & Flange, or Flange & MJ valve.

The 4″ and 6″ Vegadrills are separate tools, and are not interchangeable. Orders must specify tap size.

CLOW-VEGA TWIN SEAL TAPPING SADDLE FOR PVC PIPE

Easiest and best way to make service taps in PVC pipe

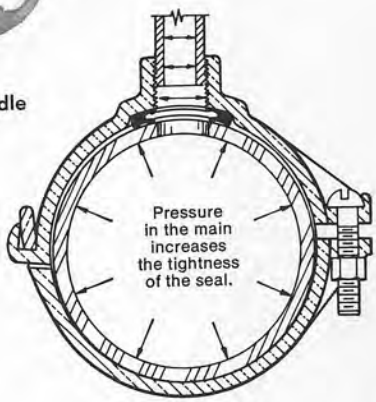
Cast brass construction will not crush pipe out-of-round

Simple 2-piece, 1-bolt assembly requires only a screwdriver to install

* Patent No. 3,471,176

F-6350
Twin Seal Tapping Saddle

The Clow-Vega Twin Seal Brass Tapping Saddle is simple to install, yet provides a positive, watertight connection on PVC pipe. The cast brass construction provides rigidity and strength, yet requires minimum compression—the saddle halves *do not meet*. The patented*, self-energizing, dual-lip resilient rubber gasket assures positive sealing, and actually becomes tighter under pressure of water in the main.



F-6350 Section

F-6350 Saddle Sizes — **Specify CC or IPS Thread**

1½ x ¾	2 x ¾	2½ x ¾	3 x ¾	4 x ¾	6 x ¾	8 x ¾	10 x ¾	12 x ¾
.....	2 x 1	2½ x 1	3 x 1	4 x 1	6 x 1	8 x 1	10 x 1	12 x 1
.....	.....	.....	3 x 2	4 x 2	6 x 2	8 x 2	10 x 2	12 x 2

VEGADRILLS

make saddle taps for all sizes of PVC pipe
Specify CC or IPS Tap
¾", 1" and 2" Sizes

For ¾" and 1" Taps

F-6360 Vegadrill with Speed Handle

Vegadrills are simple, positive, easy-to-use hand drills for tapping PVC pipe. The F-6360 and F-6361 drills couple to corporation stop inserted in the tapping saddle to make the tap.

The F-6365 drill incorporates a bronze pack-off sleeve for use with a corporation cock or 2" valve. The cutter cuts the coupon, and a pilot drill withdraws it thru the cock or valve to complete the tap.

When ordering, specify Figure Number, size, and CC or IPS thread.

F-6361 Vegadrill with Universal Ratchet

F-6365 Vegadrill to make 2" taps

CLOW POLYBUTYLENE WATER SERVICE TUBING

Copper Tube Sizes
Use Standard Flare or Compression Fittings

F-6400 Polybutylene Tubing

Clow Water Service Tubing in copper tube sizes. Use standard flare or compression fittings. Although designed for use in cold water service, accidental hot water back-up can be withstood for short periods of time.

Dimensions and Weights

Nominal Size	O.D. O.D.	Min. Wall Thick.	Working Press. psi @ 73.4°F.	Approx. wt. per 100 ft.	Coil length Ft.	Design Stress psi
¾"	.875	.065	160	7.0 lbs.	500	1,000
1"	1.125	.083	160	11.5 lbs.	300	1,000
1½"	1.625	.120	160	23.5 lbs.	200	1,000
2"	2.125	.157	160	40.3 lbs.	100	1,000

PHYSICAL PROPERTIES

Tensile Strength p.s.i. 3000
Yield Strength, p.s.i. 2000
Ultimate Elongation, % 300
Hardness, Shore D 65
Flexural modulus, p.s.i. ..... 26×10^3
Density, g./cc 0.915
Linear coeff. of thermal expansion, in./in./°C. ..... 15×10^{-5}

SPECIFICATIONS

Description: Tubing is manufactured from polybutylene as defined by ASTM D-2581 type II Grade 1 (PB 2110).

Dimensions: Tubing dimensions and tolerance conform to the values set forth in ASTM D2666.

Testing: Tubing is capable of maintaining a pressure of 300 psi at 73.4° F. for 1,000 hours.

Working Pressure: Tubing has a maximum working pressure of 160 psi at 73.4° F.

Marking: Tubing is marked with size, manufacturer's name, working pressure, National Sanitation Foundation approval, ASTM specification and production code.

Packaging: Tubing is coiled and boxed for protection during shipment, handling and storage. Box is clearly marked with manufacturer's name, NSF seal, size, and coil length.

Type of Connection: Cold flare or compression type.

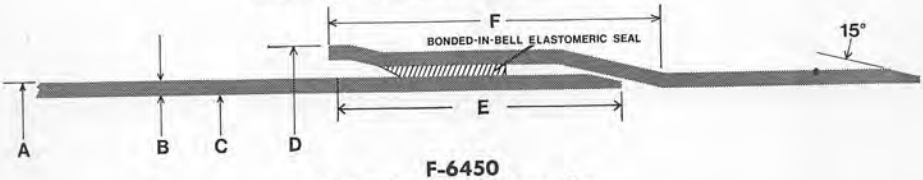
1. Cut service tubing to required length, making certain that end is square and clean. Use hack saw or plastic tube cutter for best results. Put on coupling nut.

2. Make sure the flaring head is backed out all the way and stopped against the stop nut. Push the pilot plug into the tubing as far as it will go, stopping with tubing against the flaring head. Apply the clamping pliers to the tubing about ¾" to 1" from the end of the tubing. Adjust screw on pliers for positive grip on tubing. Grasp the crank handle and screw flaring head in towards the tubing as far as it will go; then, back all the way.

3. Release clamping pliers, pull out pilot plug, and flare is completed. Pull flare knot over flared end of tubing. Make connection to waterworks fitting. Hand tighten as far as possible, then make one-half turn with wrench to complete connection.

CLOW DEFLEC-TITE® PVC SEWER PIPE

Meets all requirements of ASTM D3034



F-6450
Deflec-Tite® PVC Sewer Pipe

Clow Deflec-Tite® PVC (polyvinyl chloride) Sewer Pipe provides an efficient, trouble-free gravity sewer system at reasonable cost. The Deflec-Tite joint has an integral bell with a factory-installed polyurethane gasket that provides a unique compression seal. It is an easy-to-assemble, easy-to-maintain, corrosion-resistant piping system for gravity sewers meeting all ASTM Standards for PVC Sewer Pipe.

Lightweight, long lengths and integral bell reduce the time and labor required for installation. PVC pipe resists chemicals and gases normally encountered in sewer systems, is unaffected by corrosive soils, and has superior abrasion resistance. Its resiliency and flexibility enable the pipe to flex and adjust to stresses of earth movements or trench settlements and loading.

Installation procedures should follow those outlined in ASTM D2321, "Underground Installation of Flexible Thermoplastic Sewer Pipe." Fittings can be furnished for a complete installation.

Deflec-Tite pipe is available in 13- and 20-foot lengths in accordance with the dimensions and weights shown in the table below.

Dimensions and Weights

Nominal Pipe Size Inches	SDR	Dimensions in Inches						Approx. Weight Pounds Per Foot	
		A	B	C	D	E	F	13-Foot Length	20-Foot Length
4	33.5	4.215	.125	3.96	5.12	3¾	4.05	1.03	1.04
6	35	6.275	.180	5.91	7.28	4	4.30	2.24	2.22
8	42	8.400	.200	8.00	9.53	5⅛	5.31	3.37	3.33
8	35	8.400	.240	7.92	9.61	5⅛	5.31	4.02	3.98
10	42	10.500	.250	10.00	11.73	5¼	5.74	5.16	5.22
10	35	10.500	.300	9.90	11.83	5¼	5.74	6.31	6.24
12	42	12.500	.300	11.90	13.83	5⅜	6.02	7.55	7.46
12	35	12.500	.360	11.78	13.95	5⅜	6.02	9.03	8.91

HOW THE PIPE IS ASSEMBLED

1. Before starting assembly, make certain that the factory-installed gasket, bell recess and beveled spigot end are free of all dirt.

2. Apply lubricant to the exposed surface of the gasket; then also to the surface of the spigot up to the stop mark, including the tapered end of the spigot.

3. Align the spigot to the bell and insert. Push spigot into the bell as far as the stop mark, either by hand or with a bar and block.

SECTION 4 · PIPING SPECIALTIES PIPELINE TOOLS AND ACCESSORIES

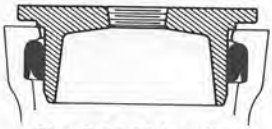
SECTION 4 · PIPING SPECIALTIES, PIPELINE TOOLS AND ACCESSORIES

SUPER BELL-TITE PUSH-ON PLUGS AND TEST PLUGS

For Use With SUPER BELL-TITE PUSH-ON Joint Cast Iron Pipe

SUPER BELL-TITE PUSH-ON UNRESTRAINED PLUG

F-1147 Solid Plug



The F-1149 Installed

F-1151 Test Plug
(Not Illustrated)

F-1149 Tapped Plug

F-1147, F-1149 AND F-1151 PLUG

Size.....Inches	3	4	6	8	10	12	14	16	18	20	24
Maximum tap size.....Inches	2½	3	4	4	4	4	4	4	4	4	4
Size, vent connection.....Inches	⅛	¼	¼	¼	¼	¼	¼	¼	¼	¼	¼
Size, pressure connection...Inches	⅜	½	¾	¾	¾	¾	¾	¾	¾	¾	¾
Approximate weight.....Pounds	8	10	18	33	53	75	110	145	180	220	315

Note: F-1149 tap sizes larger than 3″ require special manufacture.

SUPER BELL-TITE PUSH-ON RESTRAINED PLUG

F-1155 Test Plug

Note

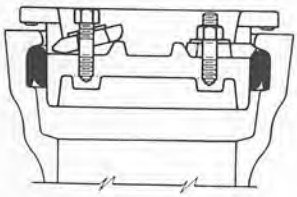
The F-1155 Test Plug is the same as the F-1159 Solid Plug, except for tapping, nipple and petcock.

Regularly furnished with cadmium plated stud bolts.

F-1159 Solid Plug

Instruction Tags are shipped with each plug.

Description and Installation



Section Showing
Plug Installed In Bell*

Retainer dogs have leading edge contour conforming to inside lip of Super Bell-Tite Bell, and with taper on trailing edge to match taper of back-up lug on plug. Dogs are of ductile iron.

In installation, tightening hold down nuts force retaining dogs under lip of the bell, because of the trailing edge against the tapered lug on the plug, and securely holds dogs in this position. The gasket is only slightly displaced, and the seal is not affected.

F-1155 AND F-1159 PLUG

Size.....Inches	3	4	6	8	10	12	16
Maximum test pressure.....PSI	250	250	250	250	150	150	100
Size, vent connection.....Inches	⅛	¼	¼	¼	¼	¼	¼
Size, pressure connection.....Inches	⅜	½	¾	¾	¾	¾	¾
Number of retaining lugs.....	2	2	3	3	3	3	3
Number of stud bolts.....	1	2	3	3	3	3	3
Approximate weight.....Pounds	7	10	18	29	44	59	132

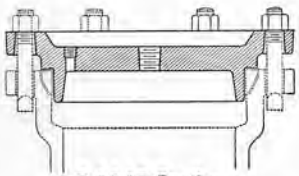
Note

Test plugs are shipped complete with ¼″ x 6″ nipple and brass petcock, except 3″ plugs which have ⅛″ x 6″.

* All Push-On plugs are normally furnished without gaskets.

MECHANICAL JOINT TEST PLUGS AND TEST CAPS

Easily Installed—Easily Removed—Only A Ratchet Wrench Needed
No Leading or Calking Required.



F-1165 Section

Note
Bolts and Gasket
For F-1165
Will be Furnished
Only
When So Ordered

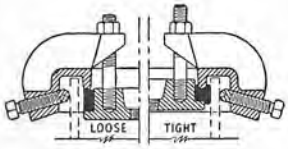
F-1165 Test Plug

F-1165*

For Bell Ends of Mechanical Joint Pipe and Fittings

Size.....Inches	3	4	6	8	10	12
Size, vent connection.....Inches	¼	¼	¼	¼	¼	¼
Size, pressure connection.....Inches	¾	¾	¾	¾	¾	¾
Number of bolt holes.....	4	4	6	6	8	8
Maximum test pressure.....psi	250	250	250	250	250	250
Approximate weight.....Pounds	12	20	30	50	65	85

* Sizes 8-inch and smaller have two vent openings—one on and the other straddling the centerline of bolt holes in the plug—so that a vent can be placed at the top of the line being tested. For sizes larger than 12-inch, our F-1035 Solid Plug can be arranged for use as a test plug.



F-1175 Section

Assembly
Instructions
Are Sent With
F-1175 Test Caps

F-1175 Test Cap

F-1175†

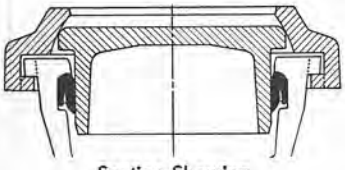
For Plain Ends of Super Bell-Tite or Mechanical Joint Pipe

Size.....Inches	3	4	6	8	10	12
Maximum test pressure.....Pounds	200	200	200	200	175	175
Size, vent connection.....Inches	...	...	¼	¼	¼	¼
Size, pressure connection.....Inches	½	¾	¾	¾	¾	¾
Number of bolts.....	†	†	3	4	4	4
Number of set screws.....	3	3	3	4	8	8
Approximate weight.....Pounds	14	18	32	55	66	80

† The 3 and 4-inch sizes are tapped for and fitted with an extra heavy pipe nipple with a running thread and a special lock nut on the exposed end. The lock nut is used to "set" the gasket against the inside wall of pipe. A cap protects the exposed end of the nipple while the fitting is in transit and, also, it may be used to temporarily close the nipple opening—should it be desired to do so.

Note: Clow Test Plugs and Test Caps are shipped complete. A nipple and brass shut-off stop are furnished for the air release opening and, also, loose screw plugs are furnished for closing all tapped openings—should this be necessary.

SUPER-LOCK PLUGS



Section Showing
Plug Installed in Bell

(Not Illustrated)
F-1139 Tapped Plug
F-1141 Test Plug

Super-Lock Plugs
are Ductile Iron
Rated for 350 PSI
Working Pressure

F-1137 Solid Plug††

Dimensions and Weights

Size.....Inches	6	8	10	12	14	16	18	20	24
Weight of Plug.....Lbs.	17	27	45	60	85	110	145	185	270
Weight of Retainer..Lbs.	20	30	40	55	80	95	135	160	275

For Bell Ends of Super-Lock Pipe or Fittings.

†† Note: Retainer, Retainer Lock, and Roll Pin furnished with plug. Super-Lock push-on plugs normally furnished without gaskets. Test plugs shipped complete with ¼″ x 6″ nipple and brass petcock. Maximum tap size is 4 inches for F-1139 plugs.

MECHANICAL JOINT SPLIT REPAIR SLEEVES

WITH THE SAME GASKETS, 3″ THRU 12″ SLEEVES FIT THE BARREL OF ALL CLASSES OF CAST IRON PIPE

F-1200

Split Sleeve

Split Sleeves can be used on either sand cast (old or new) or on centrifugally cast pipe. Short pattern sleeves, sizes 12-inch and smaller, will repair breaks up to 8½ inches long. Sizes 6, 8, 10, and 12-inch are also made in long pattern for breaks up to 11½, 14½, 17, and 20½ inches long, respectively. Sizes 14 and 16-inch will repair breaks up to 17½ inches long. Unless orders for 6, 8, 10, and 12-inch sleeves specifically call for long pattern, the short pattern will always be furnished.

The boss is regularly tapped for ¾″ I.P.S. pipe and plugged. However, when so ordered, boss will be tapped any size to a maximum of 2½ inches for the 3-inch size sleeve, and to 3 inches for larger sizes. AWWA corporation thread also available.

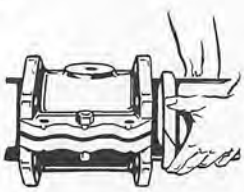
*** When ordering 14 and 16-inch sizes, specify O.D. of the pipe on which sleeves are to be used.**

Dimensions

For Pipe Size* Inches	Dimensions—Inches			Overall Length of Body Inches	Approx. Weight Pounds
	Fits Pipe O.D.		Effective Length C		
	Min.	Max.			
3	3.90	4.02	8.50	11.00	65
4	4.74	5.06	9.50	12.00	105
6 Short	6.84	7.16	8.50	11.00	140
6 Long	6.84	7.16	11.50	14.00	155
8 Short	8.99	9.36	8.50	11.00	185
8 Long	8.99	9.36	14.50	17.00	230
10 Short	11.04	11.46	8.50	11.00	230
10 Long	11.04	11.46	17.00	19.50	315
12 Short	13.14	13.56	8.50	11.00	290
12 Long	13.14	13.56	20.50	23.00	430
14B	15.22	15.38	17.50	20.00	470
14D	15.57	15.73	17.50	20.00	460
16B	17.32	17.48	17.50	20.00	555
16D	17.72	17.88	17.50	20.00	535

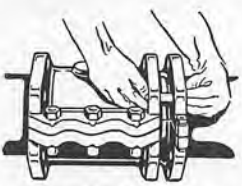
ASSEMBLY AND INSTALLATION

Installation instructions apply to both the F-1200 and F-1205 Split Sleeve

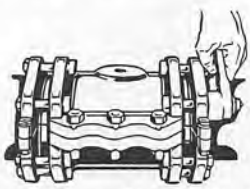


1. With side rubber gaskets in place in the grooves in the face of side flanges of the bottom half of sleeve, place the two halves around the pipe and bolt halves together loosely.

2. The split gaskets are next placed around the pipe at each end of the sleeve, and then pushed to their seat inside the sleeve body. All body bolts are then made tight.



Complete instructions for installing accompany each Split Sleeve



3. The split glands are next bolted together around the pipe—one at each end of sleeve—and then bolted loosely to the end flanges on the body—to be made tight later.

4. By ratchet or box wrench, gland bolts are tightened a little at a time—moving from one to another in order to apply gland pressure evenly on the end gaskets.

CLOW DUCTILE CAST IRON SPLIT REPAIR CLAMPS

For Centrifugally Cast 4, 6 and 8-inch Pipe

F-1202
Ductile Iron Split Repair Clamp

Clow Ductile Iron Split Clamp

For centrifugally cast pipe of 4, 6, and 8-inch diameter, Clow Ductile Iron Split Clamps provide a high strength, light weight, easy-to-assemble split repair clamp. These clamps have an effective sealing length of 4 inches in all sizes, and are particularly advantageous when repairing transverse underground breaks in 4, 6, and 8-inch pipe, in which the pipe wall fracture is circumferential, rather than longitudinal.

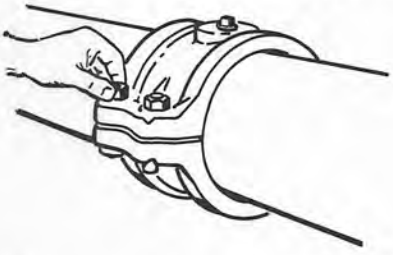
Each clamp half is equipped with boss to permit a 2″ pipe tap. However, unless otherwise ordered, the clamp is regularly furnished with ¾″ I.P.S. tap and plug in one half clamp only. AWWA corporation thread tap and plug also available.

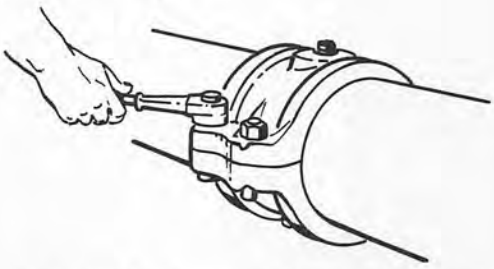
DIMENSIONS AND WEIGHTS

For Pipe Size.....Inches	4	6	8
Fits Pipe O.D.....Minimum	4.74	6.84	8.99
Fits Pipe O.D.....Maximum	4.86	6.96	9.11
Effective length.....Inches	4	4	4
Overall length.....Inches	6¼	6¼	6¼
Approximate weight.....Pounds	26	34	44

Illustration shows two piece construction of the Ductile Iron Clamp. Note how the side gaskets overlap the circumferential gaskets to make a pressure tight seal. All gaskets are cemented in position at the factory and require no field assembly or installation at the job site.

ASSEMBLY AND INSTALLATION





Once the two clamp halves have been assembled around the pipe and the four side flange bolts taken up finger-tight, tightening by wrench is the only requirement for complete and final assembly. Cemented in position, the gaskets form a pressure-tight seal when the clamp halves have been properly tightened around the pipe, covering the rupture.

Complete instructions for installing accompany each clamp.

CLOW SUPER-SEAL STAINLESS STEEL PIPE REPAIR CLAMP

WIDE RANGE SINGLE PANEL CLAMPS

F-1203
Repair Clamp

For repairs to cast iron, PVC, steel and asbestos-cement pipe

All clamps have the patented Chek-O-Seal® Gasket

F-1204
Tapped Repair Clamp

Clow Stainless Steel Repair Clamps and Service Clamps repair all classes of cast iron pipe, and can also be furnished to make fast, economical repairs to PVC, steel, and asbestos-cement pipe as shown in the table below. Panels are 304 stainless steel, and clamps are regularly furnished with bolts and nuts of high corrosion-resistant alloy steel (AWWA C111). Stainless steel bolts can be furnished to special order.

All clamps have the patented Chek-O-Seal® gasket cemented in at the factory, and make a full 360° watertight seal. Lugs are high strength malleable or ductile iron.

The F-1204 Service Clamp is of the same construction as the F-1203 Repair Clamp, except that it is fitted with an 85-5-5-5 brass tapping boss, which is insulated with a neoprene panel to prevent galvanic corrosion. The boss is securely fastened to an insulated inner plate to prevent it from rotating when installing corporation stop.

Service Clamps can be used to repair damaged service connections, make new or oversize taps, for pulled corporation stops and other repairs. It is available in tap sizes ¾" thru 2", IPS or AWWA threads.

When Ordering
Always specify tap size and thread, length, and nominal pipe size designation.

F-1203 and F-1204*
Dimensions and Weights

Clamp Number	Fits Pipe of this Nominal O. D. Range	Nominal Pipe O. D.			Approximate Weight—Pounds							
		PVC	Cast Iron		Length of clamp in inches							
			AWWA CD	ANSI A21.6	6	7½	12	15	18	24	30	36
2	2.35 to 2.55	2.375	.....	2.50	8	10	17	21	25	..	..	..
2½	2.75 to 3.00	2.875	.....	2.75	9	11	19	23	27	..	..	..
3A	3.50 to 3.75	3.50	.....	.....								
3B	3.70 to 3.96	.....	3.96	3.96	10	12	20	24	30	..	..	..
3C	3.90 to 4.15	.....	3.96	3.96								
4A	4.50 to 4.80	4.50	.....	4.80								
4B	4.75 to 5.15	.....	5.00	4.80	10	12	20	25	30	37	48	59
4C	5.10 to 5.50	.....	.....	.....								
5A	5.50 to 5.75	5.56	.....	.....	11	12	21	26	31	39	49	59
5B	5.75 to 6.00	.....	.....	.....								
6A	6.60 to 7.00	6.62	.....	6.90								
6B	6.85 to 7.20	.....	7.10	6.90	11	13	22	27	33	40	52	64
6C	7.20 to 7.45	.....	.....	.....								
8A	8.60 to 8.90	8.62	.....	.....								
8B	9.05 to 9.45	.....	9.30	9.05	12	15	24	30	36	45	58	71
8C	9.40 to 9.60	.....	.....	.....								
10A	10.70 to 11.10	10.75	.....	11.10								
10B	11.00 to 11.40	.....	11.40	11.10	13	17	26	33	39	50	63	67
10C	11.35 to 11.75	.....	11.40	.....								
10D	11.75 to 12.15	.....	.....	.....								
12A	12.70 to 13.00	12.75	.....	.....								
12B	13.10 to 13.50	.....	13.50	13.20								
12C	13.50 to 13.85	.....	.....	.....	14	19	28	36	42	55	70	75
12D	13.70 to 14.00	.....	.....	.....								
12E	14.00 to 14.40	.....	.....	.....								

* For weight of F-1204, add to weight in table, 1 pound with ¾" or 1" boss, 3 pounds with 1½" or 2" boss.

CLOW SUPER-SEAL STAINLESS STEEL REPAIR CLAMP

EXTRA WIDE RANGE MULTI-PANEL CLAMPS

F-1213
Repair Clamp

For repairs to cast iron, PVC, steel and asbestos-cement pipe

All clamps have the patented Chek-O-Seal® Gasket

F-1214
Tapped Repair Clamp

The F-1213 and F-1214 clamps are similar in construction to the F-1203 and F-1204 clamps, except that they are two or three panel clamps, and provide an extra wide range of pipe diameters each will repair. Unless otherwise specified, we will always furnish the two-panel clamp, whose weights are shown in the table below.

These multi-panel clamps provide a fast, easy, low-cost way to repair cast iron, steel, PVC or asbestos-cement pipe. All clamps have the patented Chek-O-Seal® gasket, and the "captive" bolts simplify installation because the sleeve halves will not separate during installation.

When ordering, specify type and size of pipe to be repaired, or order by Figure Number and Clamp Number from the table below.

When Ordering
Always specify tap size and thread, length, and nominal pipe size designation.

F-1213* and F-1214**
Dimensions and Weights

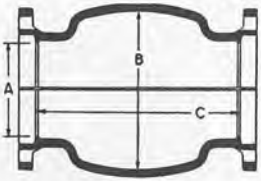
Clamp Number	Fits Pipe of this Nominal O. D. Range	Nominal Pipe O. D.			Approximate Weight—Pounds							
		PVC	Cast Iron		Length of Clamp in Inches							
			AWWA CD	ANSI A21.6	6	7½	12	15	18	24	30	36
4A	4.45 to 5.20	4.50	5.00	4.80	16	20	33	40	50	60	77	94
4B	4.70 to 5.50	.....	5.00	4.80								
6A	6.50 to 7.25	6.625	7.10	6.90	18	21	35	43	53	64	82	100
6B	6.75 to 7.55	.....	7.10	6.90								
8A	8.60 to 9.45	8.625	9.30	9.05	18	23	37	45	56	67	86	105
8B	8.85 to 9.70	.....	9.30	9.05								
10A	10.70 to 11.70	10.75	11.40	11.10	22	27	43	54	64	86	108	129
10B	11.05 to 12.05	.....	11.40	11.10								
12A	12.70 to 13.50	12.75	13.50	13.20	23	29	46	58	69	92	115	137
12B	13.10 to 14.30	.....	13.50	13.20								
14A	15.07 to 15.90	.....	15.65	15.30	24	30	48	60	72	96	120	144
14B	15.90 to 16.70	.....	.....	.....								
14C	16.70 to 17.30	.....	.....	.....								
16A	17.30 to 18.10	.....	17.80	17.40	25	31	50	62	75	100	124	149
16B	18.40 to 19.60	.....	.....	.....								
18A	19.30 to 20.00	.....	19.92	19.50	26	32	52	64	78	104	128	154
18B	20.00 to 20.80	.....	.....	.....								
18C	21.00 to 21.80	.....	.....	.....								
20A	21.50 to 22.30	.....	22.06	21.60	27	34	54	68	72	108	135	162
20B	22.00 to 22.80	.....	22.06	.....								
20C	23.00 to 23.80	.....	.....	.....								
20D	23.40 to 24.20	.....	.....	.....								
20E	24.10 to 24.90	.....	.....	.....								
24A	25.75 to 26.55	.....	26.32	25.80	29	36	58	72	87	116	145	174
24B	26.50 to 27.30	.....	.....	.....								
30A	31.70 to 32.90	.....	32.40	32.00	33	41	66	82	99	132	164	198
30B	32.40 to 33.20	.....	32.40	.....								

* Weights shown are for 2-panel clamps. 3-panel clamps can also be furnished.

** For weights of F-1214 service clamps, add to table weights 1¼ pounds for clamps with ¾" or 1" opening; add 2¼ pounds for 2" opening.

MECHANICAL JOINT BELL SPLIT SLEEVES

Fits All Classes of Cast Iron Pipe



Dimensions

For Pipe Size* Inches	Dimensions—Inches: Inside Diameter B	Dimensions—Inches: Effective Length C	Overall Length of Body Inches	Approx. Weight Pounds
3	8.25	15.25	17.75	125
4	9.62	15.25	17.75	190
6	11.75	15.25	17.75	230
8	14.25	18.50	21.00	335
10	16.75	18.50	21.00	415
12	19.75	18.50	21.00	485
14 B	21.75	21.50	24.00	600
14 D	21.75	21.50	24.00	585
16 B	24.25	21.50	24.00	670
16 D	24.25	21.50	24.00	655

Dimension "A": fits same pipe O.D. as F-1200. See page 106.

F-1205
Bell Split Sleeve

For repairing or reinforcing the joint of cast iron pipe. Can be used on any type joint—Push-On, Bell & Spigot, Mechanical Joint, Flanged (125#), or lug-type. In the latter case, lugs must be removed. For effective length and other dimensions, see table.

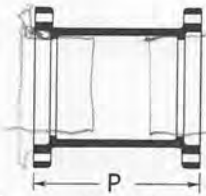
F-1205 split bell sleeves can be used on either sand cast pipe (old or new) or on centrifugally cast pipe. The F-1205 is not regularly furnished with a tapped opening through the body. However, when specifically ordered, we will tap (and plug) this sleeve with ¾-inch iron pipe size thread before making shipment. AWWA corporation thread also available. For assembly instructions, see page 106.

*** When ordering 14 and 16-inch sizes, specify O.D. of the pipe on which sleeves are to be used.**

F-1208
Duo-Sleeve

DUO-SLEEVES

The F-1208 Sleeve is for Use on Plain (cut) Ends of either Centrifugally Cast or Sand Cast Pipe

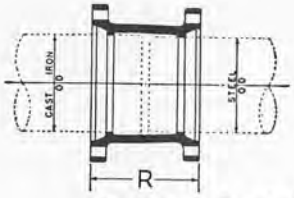


F-1208
Section

F-1208

For pipe size....Inches	4	6	8	10	12
Length "P" overall....Inches	12	12	12	12	12
Weight, with joint accessories....Pounds	84	120	160	190	250

For 3" size use the F-1012 or F-1014 shown on page 52.



F-1212
Section

TRANSITION SLEEVE

For Connecting Plain (cut) Ends Of Cast Iron Pipe to Steel, IPS, or PVC Plastic Pipe of Same Nominal Size

Regularly furnished with plain rubber gaskets, both ends

F-1212

F-1212
Transition Sleeve

For pipe size....Inches	3	4	6	8	10	12
Length "R" overall....Inches	7½	7½	7½	7½	7½	7½
Weight, with joint accessories....Pounds	37	55	80	110	140	180
Fits cast iron pipe of nominal O.D....Inches	3.96	4.80	6.90	9.05	11.10	13.20
Fits steel and PVC pipe of nominal O.D...Inches	3.50	4.50	6.62	8.62	10.75	12.75

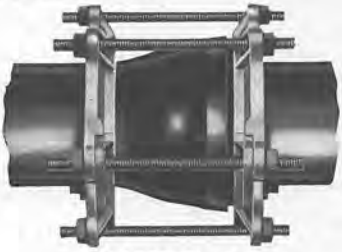
CLOW BELL JOINT LEAK REPAIR CLAMPS

For Cast Iron Calked Joints and Push-On Joints

F-1206 Clamp
for Calked Joint Pipe

The F-1206 Bell Clamp consists of a Bell Ring, Spigot Ring and gasket with appropriate bolts for assembly. The Bell Ring assembles against the shoulder of the calking bell as illustrated. The gasket seals when compressed flush against the face of the bell, and is held tight by taking up the bolts holding the two rings together.

The F-1206 Clamp can be used for both water and gas leaks. Fits AWWA sand cast classes A, B, C, and D, as well as centrifugally cast iron pipe diameters.

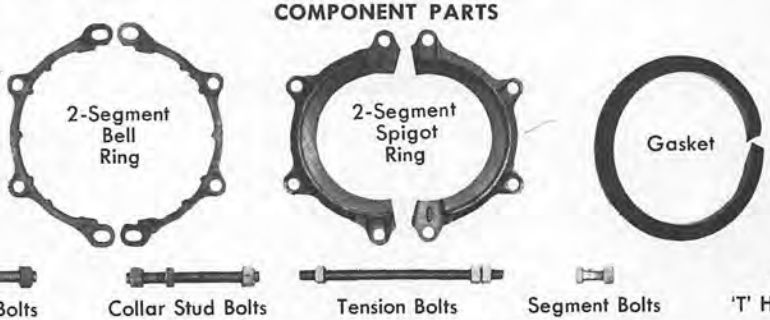


F-1207 Clamp
for Push-On Joint Pipe

The F-1207 Clamp is the same as the F-1206 Clamp except that it consists of two spigot rings and longer bolts. It is anchored on the pipe at the point where the bell contour flares outward, and assembly follows the same, simple procedures used for the F-1206 Clamp.

The F-1207 Clamp can also be used to repair leaks in calked joint cast iron pipe by anchoring one spigot ring behind the bell of the pipe. Using this clamp for both calked and push-on joint pipe reduces inventory and stocking requirements.

COMPONENT PARTS



Weights, Segments and Bolt Use

Nominal Pipe Size—Inches	3	4	6	8	10	12	16	20	24	30
F-1206 for Calked Joint Pipe (one bell ring, one spigot ring)										
Number of segments, Each Ring	2	2	2	2	2	3	3	4	4	4
Number & Size of Bolts, Each Clamp										
5/8 x 1 3/4 Beveled Tee Head Bolts	....	....	....	....	....	3	3	4	4	4
5/8 x 2 Segment bolts	....	....	....	....	....	6	6	8	8	8
5/8 x 6 Tension bolts	2	2	4	4	6	9	9	....	....	....
5/8 x 7 1/16 Collar stud bolts	2	2	2	2	2	....	....	....	....	....
5/8 x 7 1/2 Tension bolts	....	....	....	....	....	....	....	12	12	16
Approximate Weight Pounds Each Clamp	17	18	23	26	33	51	66	103	121	147
F-1207 for Cast Iron Push-On or Calked Joint Pipe (2 spigot rings)										
Number of segments, Each Ring	2	2	2	2	2	3	3	4	4	4
Number & Size of Bolts, Each Clamp										
5/8 x 1 3/4 Beveled Tee Head Bolts	....	....	....	....	....	6	6	8	8	8
5/8 x 2 Segment bolts	....	....	....	....	....	6	6	8	8	8
5/8 x 11 Tension bolts	4	4	6	6	....	....	....	....	....	....
5/8 x 12 Tension bolts	....	....	....	....	8	9	....	....	....	....
3/4 x 14 Tension bolts*	....	4*	6*	6*	....	....	....	....	....	....
3/4 x 16 Tension bolts	....	....	....	....	....	....	9	12	12	12
Approximate Weight Pounds Each Clamp	23	25	32	37	45	69	87	138	157	199

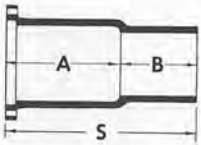
* Used with Asbestos-Cement pipe only.

MECHANICAL JOINT CUTTING-IN SLEEVES

F-1220
Cutting-In Sleeve With Set Screws

For Inserting
Fittings or Valves
into
Existing Pipe Lines

Fits All Classes
of
Cast Iron Pipe



F-1220
Section

F-1220‡

For pipe size.....Inches	3	4	6	8	10	12
Weight, with joint accessories.....Pounds	50	75	105	145	175	235
Weight, body casting only.....Pounds	38	60	85	120	135	180

Dimension S is 20½″; Dimension A, 12″; Dimension B, 8½″.

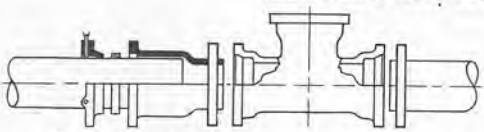
‡ The female end of F-1220 will take the plain ends of either centrifugally cast or sand cast pipe, but will not fit over a beaded spigot end on sand cast pipe. The male end seats into bells of fittings or valves—mechanical joint or calking type.

Important Note

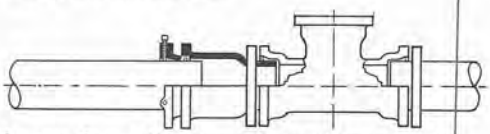
In general, the F-1220 Cutting-in Sleeve is used for cutting in regular bell end fittings and valves. If the fittings or valves have "standardized" mechanical joints, two F-1220 sleeves may have to be used to cut them into *old* cast iron pipe lines—because of the outside diameter of such pipe.

For Cutting-in Valves, see page 156.

INSTALLING THE F-1220 CUTTING-IN SLEEVE



From the existing line cut out only a section of pipe equal in length to overall (end to end) of the fitting or valve to be installed, plus 10 inches. Remove gland and gasket from the sleeve and slip them over the cut end of the pipe, and "telescope" the sleeve onto the pipe—as shown above. Lower the fitting or valve into the trench and line it up. Push fitting or valve "home" against one pipe end and seat the sleeve into the opposite end. Assemble gasket, gland, bolts and nuts on the sleeve joint, and make the set screws tight against the pipe. The joints on fitting or valve can be made up in the usual manner to finish the job.



CAST IRON TAPPED TEES AND CROSSES

F-1225
Mechanical Joint
Tapped Tee

F-1228
Mechanical Joint
Tapped Cross
(Not Illustrated)

F-1225 and F-1228

For pipe size.....Inches	3	4	6	8	10	12
Laying length.....Inches	12	12	12	12	12	12
Weight, with joint accessories.....Pounds	50	75	115	165	215	275
Weight, body casting only.....Pounds	36	55	80	115	155	195

Note: Tapped tees and crosses are regularly furnished tapped for 2-inch pipe. Smaller tappings are usually made with screw bushings to the size ordered. Fittings with larger tappings must be made to order. Maximum size taps are 2 inches for 3-inch; 2½ inches for 4-inch; 3 inches for 6-inch; and 4 inches for 8-, 10-, and 12-inch sizes.

CAST IRON MECHANICAL JOINT SPLIT TEES

Fits all classes of Cast Iron Pipe

Branch Flange is faced and slotted to 125 Pound Template.

For Tapped Outlet: use in conjunction with **F-1900** Flange. Where Tapped Outlet is 3″ or less, use the **F-1200**

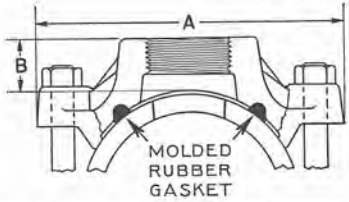
F-5205 Split Tee

Dimensions in Inches

Sleeve Size	Fits Pipe O.D. Min.	Fits Pipe O.D. Max.	Effective Body Length	Approx. Wt. Lbs.	Sleeve Size	Fits Pipe O.D. Min.	Fits Pipe O.D. Max.	Effective Body Length	Approx. Wt. Lbs.
4x 2	4.74	5.06	9.50	115	10x 2	11.04	11.46	8.50	235
4x 3	4.74	5.06	9.50	118	10x 3	11.04	11.46	8.50	241
4x 4	4.74	5.06	9.50	120	10x 4	11.04	11.46	8.50	252
6x 2	6.84	7.16	8.50	148	10x 6	11.04	11.46	17.00	342
6x 3	6.84	7.16	8.50	152	10x 8	11.04	11.46	17.00	349
6x 4	6.84	7.16	8.50	157	10x10	11.04	11.46	17.00	365
6x 6	6.84	7.16	11.50	180	12x 2	13.14	13.56	8.50	295
8x 2	8.99	9.36	8.50	195	12x 3	13.14	13.56	8.50	300
8x 3	8.99	9.36	8.50	199	12x 4	13.14	13.56	8.50	304
8x 4	8.99	9.36	8.50	203	12x 6	13.14	13.56	14.50	382
8x 6	8.99	9.36	14.50	254	12x 8	13.14	13.56	14.50	392
8x 8	8.99	9.36	14.50	268	12x10	13.14	13.56	20.50	481
					12x12	13.14	13.56	20.50	508

Note: The F-5205 Split Tee is the same as the Mechanical Joint Tapping Sleeve shown on pages 154–155.

TAPPED SADDLES FOR CAST IRON PIPE



Sectional view of the F-1280 tapped saddle showing the molded rubber gasket which completely encircles the tapped opening thus insuring at all times a watertight connection.

F-1280 Tapped Saddle

F-1280

For cast iron pipe size..... Inches	3	4	6	8	10
Stock size tapping*..... Inches	1½	2	2	3	3
Maximum size tapping..... Inches	1½	2½	3	4	4
Overall width, "A"..... Inches	6½	7¾	9¾	12⅜	14⅝
Projection, "B"..... Inches	1	1½	1⅝	2	2
Approximate weight..... Pounds	6	12	16	32	42
For cast iron pipe size..... Inches	12	14	16	18	20
Stock size tapping*..... Inches	4	4	4	4	4
Maximum size tapping..... Inches	4	6	6	6	6
Overall width, "A"..... Inches	16⅜	20	22⅛	23½	26½
Projection, "B"..... Inches	2	3	3	3	3
Approximate weight..... Pounds	46	95	120	150	180

* Specify tap size wanted when ordering. When saddles are ordered tapped smaller than stock on hand, stock saddles will be furnished bushed to size of tapping specified.

CAST IRON SLUDGE SHOES AND SUCTION STRAINERS

F-1404 Flanged End* Sludge Shoe

SLUDGE SHOES

Clow sludge shoes are extra strong, have maximum sludge opening, and the flare reduces entrance loss to a minimum.

SUCTION STRAINERS

The aggregate area of perforations is greater than the pipe area.

F-1416 Suction Strainer Flanged End*

F-1404

Pipe Size Inches	Dimensions—Inches				Approx. Weight Pounds
	Laid Height	Diameter at Base	Diameter of Flare	Floor to Bottom of the Flare	F-1404
4	12.00	8.00	8.75	6.00	40
6	13.00	10.00	11.00	7.00	60
8	14.00	12.50	13.50	8.00	85
10	15.00	14.50	15.50	8.00	120
12	15.00	17.00	18.00	8.00	150

F-1416

Pipe Size Inches	O.D. of Strainer Inches	Area in Square Inches		Overall Length "L" in Inches	Approx. Weight Pounds
		of Pipe Port	of Perforations	F-1416	F-1416
4	7.00	12.50	20.00	11.75	40
6	9.00	28.00	37.50	12.25	75
8	13.00	50.00	75.00	15.00	115
10	15.25	78.50	84.00	20.63	175
12	17.25	113.00	126.00	22.13	260

Slots in all F-1416 strainers are ½-inch wide.

*Note: Flanged ends are regularly furnished faced and drilled to 125 pound template—see page 65.

F-1418 Strainer Plug

STRAINER PLUGS

For calking into the bell ends of cast iron water main fittings.

F-1418

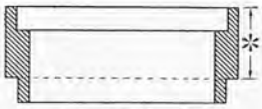
For fitting bells, size.....Inches	3	4	6	8
Overall height.....Inches	3½	4	4	4
Approximate weight.....Pounds	5	8	12	17

F-1495

CAST IRON OVERFLOW RINGS

For establishing any desired overflow water-line in tanks.

*Specify length * when ordering*

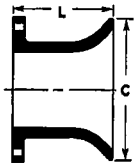


F-1495 Section

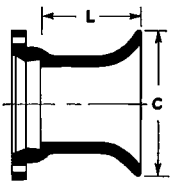
Minimum Laying Length is One Inch

Nominal pipe size.....Inches	4	6	8	10	12	14	16
Outside diameter.....Inches	4.80	6.90	9.05	11.10	13.20	15.30	17.40
Inside diameter.....Inches	3.84	5.86	7.93	9.90	11.90	13.92	15.94
Weight, per inch of laying length...Pounds	1.7	2.6	3.9	5.2	6.7	8.2	9.9

CAST IRON FLARE FITTINGS



F-1440
Flange and Flare

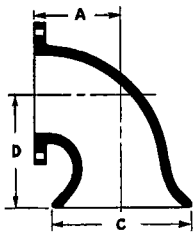


F-1441
MJ and Flare

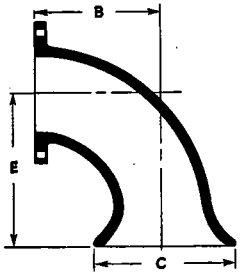
F-1440 and F-1441

For pipe size.....Inches	3	4	6	8	10	12
Dimension L.....Inches	8	8	8	10	10	12
Dimension C.....Inches	7½	9	11	13½	16	19
F-1440, Weight...Pounds	20	30	40	70	95	155
F-1441, Weight...Pounds	25	35	50	80	110	160
For pipe size.....Inches	14	16	18	20	24	...
Dimension L.....Inches	12	16	16	18	18	...
Dimension C.....Inches	21	23½	25	27½	32	...
F-1440, Weight...Pounds	165	240	275	355	480	...
F-1441, Weight...Pounds	190	270	320	410	545	...

Note: F-1441 weights are body weights only and do not include weight of mechanical joint accessories.



F-1460
Flange and Flare
Short Radius 90° Bend



F-1464
Flange and Flare
Long Radius 90° Bend

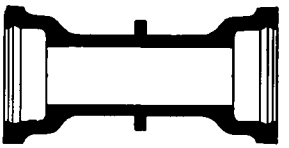
F-1460 and F-1464

For Pipe Size Inches	Dimensions—Inches						Approx. Weight Pounds	
	F-1460 Short Radius			F-1464 Long Radius				
	A	D	C	B	E	C	F-1460	F-1464
3	5½	9	7½	7¾	11¼	7½	25	30
4	6½	10	9	9	12½	9	40	50
6	8	11½	11	11½	15	11	75	90
8	9	13½	13½	14	18½	13½	120	155
10	11	16½	16	16½	22	16	190	230
12	12	18½	19	19	25½	19	280	350
14	14	21½	21	21½	29	21	315	490
16	15	23	23½	24	32	23½	395	700
18	16½	25	25	26½	35	25	495	885
20	18	27	27½	29	38	27½	635	1135
24	22	32½	32	34	44½	32	1000	1340

Note: End flanges are regularly drilled to 125 pound Standard template on page 65.

CAST IRON WALL PIPES

F-1420
Bell and Plain End



F-1422
Bell and Bell

F-1424
Bell and Flange

F-1426
Flange and Plain End

Faces of bells and plain ends will be machined only when so ordered—at an extra charge.

F-1428
Flange and Flange

We do not stock wall pipe. Lengths to meet requirements (within certain limits) can be furnished. Check with us.

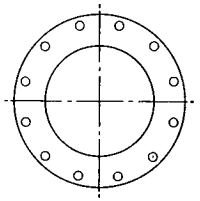
Wall pipes may be placed in position before the concrete is poured—to insure a water-tight connection between the wall and casting—and the pipe lines can be connected to wall casting at any time after the wall has cured.

Wall pipes can be furnished to set flush with the walls or to extend through the wall. When ordered with flanged ends to set flush with walls, we recommend that the flanges be tapped for studs. Where flanged ends extend beyond the wall, flanges will be drilled to 125 pound template unless otherwise ordered. Customer must specify whether flanges shall be tapped or drilled.

Plain ends are furnished to socket in calked bells only. Order must specify if plain end is to socket in MJ or SBT bell.

Intermediate Wall Collars

The intermediate wall collar will always be located at the center of the *overall length* of the pipe ordered, unless otherwise specified. These collars increase resistance to water seepage and provide an anchor in wall. These castings are also furnished without collars. On short lengths due to the shape of the bell, intermediate collars are not needed, and as noted below—are not available.



Important Note

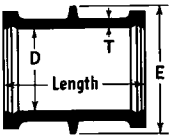
In order that flanged piping (which is to be later joined to a wall casting with flanged end—or ends) be correctly installed, it is necessary that the wall casting be "set in the form" with the bolt holes in flanges *straddling the center lines*—horizontally or vertically. For absolute accuracy, we recommend checking the alignment by means of a spirit level or plumb line before the wall is poured.

Dimensions and Weights

Nominal Pipe Size Inches	Press. Rating psi	Class	Minimum* Overall Length F-1422		Dimensions Inches		Approximate Weight Pounds		
			With Collar	Without Collar	Wall Thick	O.D. of Collar	One Flange	One Bell	Per Inch of Barrel
3	250	D	12	12	.48	7.00	6	20	1.36
4	250	D	12	12	.52	8.00	10	25	1.90
6	250	D	12	12	.55	10.00	13	35	2.94
8	250	D	12	12	.60	12.50	21	49	4.26
10	250	D	12	12	.68	14.50	28	62	5.96
12	250	D	12	12	.75	16.50	43	76	7.81
14	150	B	13	12	.66	19.50	54	88	7.89
14	250	D	13	12	.82	19.50	51	94	9.93
16	150	B	13	12	.70	21.75	67	114	9.55
16	250	D	13	12	.89	21.75	63	125	12.29
18	150	B	13	12	.75	23.75	70	133	11.48
18	250	D	13	12	.96	23.75	65	151	14.87
20	150	B	13	12	.90	25.75	89	156	13.60
20	250	D	13	12	1.03	25.75	82	185	17.69
24	150	B	15	14	.89	30.25	123	199	18.11
24	250	D	15	14	1.16	30.25	112	245	23.84

* Wall pipe can be furnished to meet most requirements. Check for maximum available length.

CALKED TYPE CAST IRON WALL SLEEVES

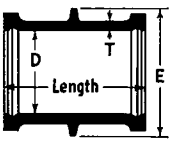


F-1430
Short Pattern Wall Sleeve

Dimensions and Weights F-1430

For Pipe Size Inches	Pressure Rating psi	Diameter D Inches	Thickness T Inches	Collar E Inches	Length Overall* Inches	Approx. Weight Pounds	Weight Per Inch of Barrel
3	250	4.76	.65	9.00	10	40	2.87
4	250	5.80	.65	10.00	10	50	3.42
6	250	7.90	.70	12.00	10	70	4.92
8	250	10.10	.75	14.50	12	110	6.65
10	250	12.20	.80	16.50	12	140	8.49
12	250	14.30	.85	19.00	14	200	10.52
14	250	16.20	.85	22.00	15	245	11.84
16	250	18.50	.90	24.50	15	305	14.26
18	250	20.60	.95	26.75	15	355	16.72
20	250	22.70	1.03	29.00	15	410	19.36
24	250	26.90	1.16	33.50	15	520	23.97

* Lengths listed are standard. Special lengths can be furnished—check your requirements with us.



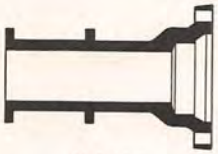
F-1435
Long Pattern Wall Sleeve

Dimensions and Weights F-1435

For Pipe Size Inches	Pressure Rating psi	Diameter D Inches	Thickness T Inches	Collar E Inches	Length Overall* Inches	Approx. Weight Pounds	Weight Per Inch of Barrel
3	250	4.76	.65	9.00	15	55	2.87
4	250	5.80	.65	10.00	15	70	3.42
6	250	7.90	.70	12.00	15	95	4.92
8	250	10.10	.75	14.50	15	130	6.65
10	250	12.20	.80	16.50	18	190	8.49
12	250	14.30	.85	19.00	18	240	10.52
14	50	16.20	.85	22.00	18	285	11.84
16	50	18.50	.90	24.50	24	435	14.26
18	250	20.60	.95	26.75	24	505	16.72
20	250	22.70	1.03	29.00	24	580	19.36
24	250	26.90	1.16	33.50	24	735	23.97

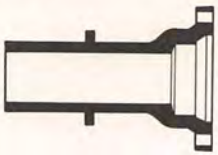
* Lengths listed are standard. Special lengths can be furnished—check your requirements with us.

MECHANICAL JOINT CAST IRON WALL PIPE



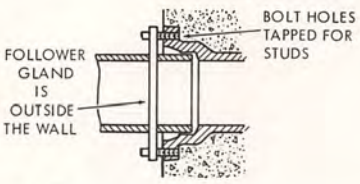
F-1431
Flange and MJ

F-1432
MJ and MJ



F-1433
Plain End and MJ

Mechanical Joint Wall Pipe are designed for ease of installation and minimum joint leakage caused by settling of the structure or pump vibration. When set flush to the wall, as illustrated, the MJ flange must be tapped for studs. When not set flush to the wall, note minimum clearances, as illustrated, in table below.



Dimensions and Weights*

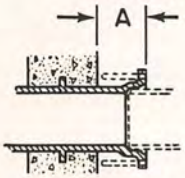
Pipe Size Inches	Pressure Rating psi	Minimum Overall Length* F-1432	Dimensions—Inches				Approximate Weight—Pounds			
			Bell O.D.	Collar O.D.	Wall Thickness	No. and Size of Studs†	Per Inch of Barrel	One MJ Bell	One Flange	Wall Collar
3	250	10	7.69	7.00	.48	4-⅝x3	1.37	11	6	4
4	250	10	9.12	8.00	.52	4-¾x3½	1.90	16	10	5
6	250	10	11.12	10.00	.55	6-¾x3½	2.94	23	13	6
8	250	10	13.37	12.50	.60	6-¾x3½	4.27	31	21	9
10	250	10	15.69	14.50	.68	8-¾x3½	5.96	41	28	10
12	250	10	17.94	16.50	.75	8-¾x3½	7.81	51	43	12
14	150	14	20.31	19.50	.66	10-¾x4	7.89	79	54	26
16	150	14	22.56	21.75	.70	12-¾x4	9.55	97	67	30
18	150	14	24.83	23.75	.75	12-¾x4	11.48	117	70	33
20	150	14	27.08	25.75	.80	14-¾x4	13.60	140	89	35
24	150	16	31.58	30.25	.89	16-¾x4	18.11	185	123	45

* Wall pipe can be furnished to meet most requirements. Check for maximum available length. Note: Order must specify if plain end is to socket in a Mechanical Joint or Super Bell-Tite bell.
† MJ Bells are furnished complete with standard joint accessories (page 41). Order must specify if bells are to be tapped for studs (see page 41 for F-919 studs). Bells not tapped for studs are furnished with F-918 T-Head bolts and nuts to the number and size indicated on page 43.
For 250 psi working pressure, these wall pipes are furnished to above dimensions in ductile iron.

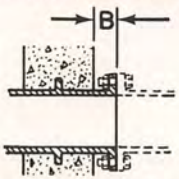
Intermediate Wall Collars

Intermediate wall collars are cast integral on Wall Pipes and Wall Sleeves, and unless otherwise specified, are located at the center of the overall length of the pipe or sleeve.

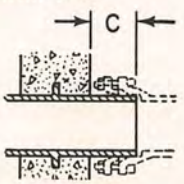
Minimum Installation Dimensions when not set flush with wall



Mechanical Joint



Flanged Joint



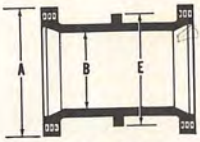
Plain End

Dimensions Inches

For Pipe Size	3	4	6	8	10	12	14	16	18	20	24
Dimension A	4¾	5½	5½	6	6	6¼	6¼	6¾	7	7	7½
Dimension B	1¾	2¼	2¼	2½	2½	2½	3	3	3¼	3½	3¾
Dimension C	4¾	5¼	5¼	5½	5½	5½	6½	7	7	7	7

MECHANICAL JOINT WALL SLEEVES

Used with F-919 Alloy Stud Bolts, see page 41.



F-1436
Short Pattern
F-1438
Long Pattern
Mechanical Joint Wall Sleeve

Get 1 ea. 24" MJ Solid Sleeve D.I.

Dimensions and Weights

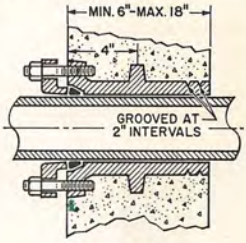
Pipe Size Inches	Rating psi	Dimensions—Inches					Weight—Pounds	
		A	B	E	Overall Length* F-1436	Overall Length* F-1438	F-1436	F-1438
3	250	7.69	4.06	8	7.5	12	30	35
4	250	9.38	4.90	9	7.5	12	40	50
6	250	11.31	7.00	11.5	7.5	12	55	75
8	250	13.63	9.15	13.5	7.5	12	75	95
10	250	15.81	11.20	16	7.5	12	95	125
12	250	18.06	13.30	18	7.5	12	125	160
14	250	20.69	15.44	21.5	9.5	15	195	255
16	250	22.94	17.54	23.5	9.5	15	230	305
18	250	25.28	19.64	26	9.5	15	275	365
20	250	27.31	21.74	28	9.5	15	315	420
24	250	31.75	25.94	32.5	9.5	15	405	550

* Available only in lengths shown. Tapped for studs unless otherwise ordered. See table on page 118 for number and size of F-919 studs. Bell flanges are tapped through unless otherwise specified.

F-1429 Mechanical Joint Wall Sleeve

The F-1429 can be furnished in lengths from 6″ through 18″ in increments of 2″. The sleeve is grooved 2″ intervals to facilitate cutting in the field, but is shipped full length unless otherwise specified. Studs, MJ gaskets and MJ glands are furnished with these sleeves unless otherwise specified. Bell flanges are tapped through unless otherwise specified.

If pipe can be passed through the wall, requiring only one connection, this sleeve can be used in place of the F-1432, F-1433, F-1436 or F-1438.



F-1429
MJ Wall Sleeve

F-1429 Dimensions and Weights

Pipe Size Inches	Dimensions in Inches			Weight—Pounds	
	Bell O. D.	Collar O. D.	Inside Diameter	18 Inch Length	Per 2-inch Increment
3	7.69	7.0	4.06	45	3.7
4	9.12	8.0	4.90	60	4.9
6	11.12	10.0	7.00	85	7.1
8	13.37	12.5	9.15	115	9.9
10	15.69	14.5	11.20	160	13.6
12	17.94	16.5	13.30	190	17.6
14	20.69	21.5	15.44	260	22.1
16	22.94	23.5	17.54	310	27.2
18	24.83	26.0	19.64	370	32.7
20	27.08	28.0	21.74	430	38.7
24	31.58	32.5	25.94	580	51.8

See table on page 118 for number and size of F-919 Studs.

THREE PIECE VALVE BOXES AND PARTS

Unless Otherwise Ordered Covers are Marked WATER

F-2450
Valve Box
5¼″ Shaft Diameter

F-2455
Top Section
in three lengths
see table

F-2460
Center Section
in seven lengths
see table

F-2465
No. 6 Base
for valve sizes
6″ and 8″

F-2450 VALVE BOX

Unless otherwise specified, we furnish valve box complete with F-2465 Base and F-2490 Cover.

Dimensions and Weights

Size Number of Box	Extending Length* in inches with No. 6 Base	Top Section		Center Section		Weight of Box Complete with F-2490 Cover, and		
		No.	Length Overall	No.	Length Overall	No. 6 Base	No. 4 Base	No.160 Base
AAA	17	AAA	6	...	...	56	45	85
AA	25-30	54	10½	60	11	75	64	104
A	30-38	55	13½	61	16	85	74	114
B	37-45	55	13½	62	23	91	80	120
C	42-50	55	13½	63	28	101	90	130
CC	50-58	55	13½	64	36	111	100	140
D	42-62	56	25½	63	28	123	112	152
DD	50-70	56	25½	64	36	133	122	162
E	62-70	55	13½	65	48	119	108	148
F	62-82	56	25½	65	48	141	130	170
G	74-82	55	13½	66	60	129	118	158
H	74-94	56	25½	66	60	151	140	180

*No. 4 Base decreases length of valve box by 2 inches; No. 160 Base by ¾-inch. Lengths longer than 94 inches can be provided by using the F-2475 Extension Section with valve box size H.

F-2475
Extension Section
Laying Length 14″
Overall Length 18″

F-2480
No. 4 Base
for valve size
4″ and smaller

F-2484
No. 160 Oval Base
for valve size
10″ and larger

F-2490
Cover for Water

F-2492
Cover for Gas

F-2494
Stay-Put Cover

F-2496
Flanged Cover

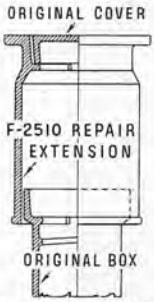
F-2498
Lock Cover

VALVE BOX TOP EXTENSIONS

F-2510
14-Inch Repair Extension

F-2510
Repair Extension

The F-2510 Repair Extension has been designed to simplify the raising of valve boxes to a new grade. It can be used where the valve box is not long enough to be raised to a new grade and is particularly useful where the valve box is imbedded in concrete or other hard material as it eliminates the necessity and expense of digging up the valve box to raise it.



Application of F-2510 Repair Extension

VALVE WRENCH

F-2520 Valve Wrench

For use with valve boxes having 5¼" inside diameter and larger.

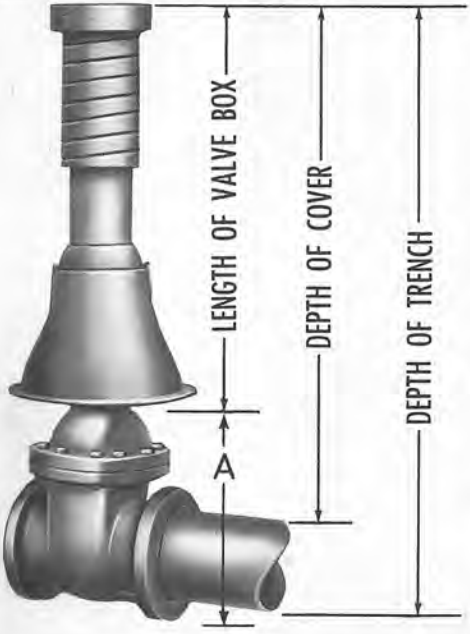
For opening and closing valves installed underground or in other inaccessible places. Can be furnished in any length required, with cross bar handle as shown, or with 2-inch square nut top to serve as a stationary rod.

When ordering state length required. We will furnish wrench for 2-inch square valve operating nut unless otherwise specified.

F-2522 Flexible Socket Valve Wrench

The Flexible Socket Valve Wrench is similar to the F-2520 Wrench except that its socket, or key, is not rigid on the shaft. Because the socket is flexible, it can be used to operate a valve even when the valve box may be other than directly perpendicular to the valve operating nut.

When ordering, state length required. We will furnish wrench for 2-inch square valve operating nut, unless otherwise specified.



Directions for Setting Valve Boxes

The illustration to the left shows a valve box properly placed. When setting a Valve Box in its place, the base should rest two or more inches above the flanged joints of the valve cover. The nut of valve should be about on a line with the hub or upper part of the Valve Box base where connected with upright jacket; this will leave ample space all around valve and prevent box touching it in any way.

Directions for Ordering

Specify valve boxes by size number as shown on preceding page. Otherwise specify the "Depth of Cover" or the "Depth of Trench."

"Depth of Cover" is measured from the top of the pipe line.

"Depth of Trench" is measured from the bottom of the trench.

When ordering valve box parts always give the figure number of the part, and the size number of the valve box.

To Determine length of box required, deduct from Depth of Trench Dimensions "A" in the table below.

Size of valve.....Inches	2	3	4	6	8	10	12	14	16
Valve box base.....Number	4	4	4	6	6	160	160	160	160
Dimension "A", Clow Valve.....Inches	6	6	8	12	17	22	27	39	44

TWO PIECE VALVE BOXES

Valve boxes are designed for use with nut-operated valves installed underground. They are necessary to provide access to the operating nut in order to open or close the valve and are available in two types—the screw type and the slide type. Each type consists of a top section, bottom section, and cover.

Screw Type: The screw type valve box is adjustable to length by means of threads cast into the top and bottom sections. The threads enable the box to be set firmly at the desired length by the mating threads.

Slide Type: The slide type valve box is adjusted by sliding the upper section over the lower section. Flanges on both sections serve to locate the upper section and hold it in place. This design minimizes transmission to the valve of stresses imposed by loads moving over the valve box at ground level.

Extensions: Extension sections can be furnished to increase the length of any valve box beyond its maximum adjustable length. They are frequently used when existing boxes are not of sufficient length to accommodate required changes in valve depth due to grading, and are used to make up a valve box of unusually great length by incorporating one or more intermediate or extension sections.

Covers: Valve box covers are so designed that they can be removed easily to provide access to the valve operating nut. They are strong and rugged, designed to stay in position and resist damage under heavy traffic conditions. Covers are available with WATER or GAS cast on them for ready identification. Unless otherwise specified, covers marked WATER are normally furnished.

Ordering Information: When ordering consult table on page 123 or state: size of valve; depth of cover or depth of trench; and whether the Screw Type or Slide Type valve box is wanted. Refer to Figure and Model numbers.

Covers marked WATER are regularly furnished, unless specifically ordered otherwise

F-2491
Water Cover

F-2493
Stay-Put Cover

See opposite page
How to order

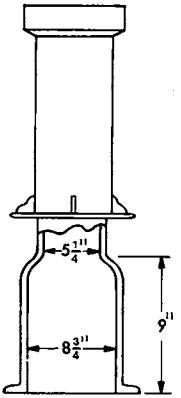
F-2452
Slide Type
Valve Box

F-2477
Slide Type
Extension

F-2476
Screw Type
Extension

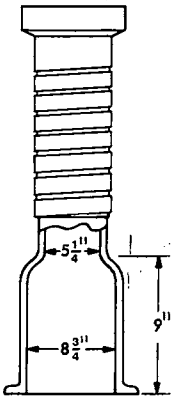
F-2454
Screw Type
Valve Box

TWO PIECE VALVE BOXES



F-2452
Slide Type
Valve Box

Note
These Valve Boxes are used with 2" to 10" valves only. For larger size valves, use the F-2450 see page 120



F-2454
Screw Type
Valve Box

Dimensions and Weights

Valve Box Model Number		Extension in Inches	Weight of Box with **F-2491** Cover	Valve Box Parts			
				Bottom		Top and Cover	
F-2452	**F-2454**			Length	Weight	Length	Weight
461-A	461-S	18–23	57	15	24	10	33
462-A	462-S	27–32	67	24	34	10	33
562-A	562-S	27–38	77	24	34	16	43
564-A	564-S	39–50	86	36	43	16	43
662-A	662-S	33–48	90	30	38	20	52
664-A	664-S	39–60	106	36	43	26	63
666-A	666-S	51–72	113	48	50	26	63
668-A	668-S	63–84	123	60	60	26	63

Extension Sections

	F-2477 Slide Type	**F-2476** Screw Type	
Figure.....Number			
Model.....Number	No. 58A	No. 58	No. 59
Extension.....Inches	14	14	20
Overall length.....Inches	18	18	24
Approximate weight.....Pounds	25	25	30

HOW TO ORDER VALVE BOXES BY VALVE SIZE AND DEPTH OF TRENCH

Valve Box Model Number		Valve Size—Inches					
		2	3	4	6	8	10
Slide Type **F-2452**	Screw Type **F-2454**	Trench Depth Inches	Trench Depth Inches	Trench Depth Inches	Trench Depth Inches	Trench Depth Inches	Trench Depth Inches
461-A	461-S	23–28	28–33	31–36	35–40	39–44	44–49
462-A	462-S	32–37	37–42	40–45	44–49	48–53	53–58
562-A	562-S	32–43	37–48	40–51	44–55	48–59	53–64
564-A	564-S	44–55	49–60	52–63	56–67	60–71	65–76
662-A	662-S	38–53	43–58	46–61	50–65	54–69	59–74
664-A	664-S	44–65	49–70	52–73	56–77	60–81	65–86
666-A	666-S	56–77	61–82	64–85	68–89	72–93	77–98
668-A	668-S	68–89	73–94	76–97	80–101	84–105	89–110
Bottom of Trench to Bottom of Box Inches		5	10	13	17	21	26

CLOW SUPER-SEAL CAST IRON COUPLING SYSTEM

To connect or interconnect any commonly used pipe
Cast Iron, Steel, PVC, or any other pipe
within the specified O.D. Range

The Clow Super-Seal Coupling System is a unique system of couplings, valves and flange adapters with interchangeable glands and gaskets which permit them to connect or interconnect cast iron, steel, PVC and/or asbestos-cement pipe.

Interchangeable glands and gaskets are color coded for easy identification as shown on the opposite page, and will fit any pipe within the specified O.D. range. This versatility permits one basic component to do a variety of jobs simply and efficiently without a large inventory of individual products.

Coupling sleeves, valve bodies and adapters are ASTM A-126, Class B cast iron; glands are ductile or malleable iron; bolts and nuts are corrosion resistant alloy steel.

Valves are available 4″ thru 8″, couplings and adapters, 4″ thru 12″ diameters.

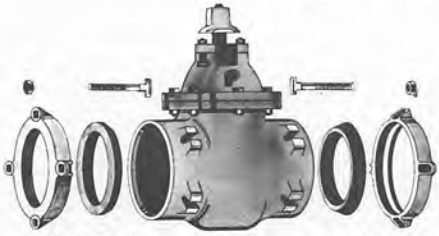
F-2531
Super-Seal Valve

F-2533
Straight Coupling

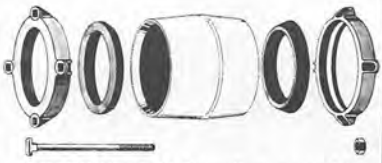
F-2535
Flange Coupling Adapter

F-2537
Multi-Coupling

Exploded View shows interchangability of Glands and Gaskets
Order any combination of parts or complete assemblies



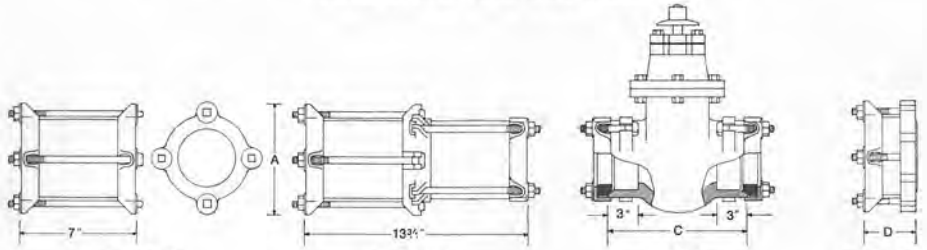
F-2531 Super-Seal Valve assembly includes valve body, 2 glands, 2 gaskets bolts and nuts



F-2533 Straight Coupling assembly includes sleeve, 2 glands, 2 gaskets bolts and nuts

CLOW SUPER-SEAL CAST IRON COUPLING SYSTEM

DIMENSIONS AND PIPE SIZES



F-2533 Straight Coupling

F-2537 Multi-Coupling

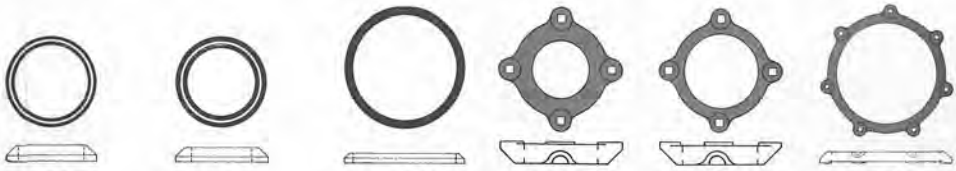
F-2531 Gate Valve

F-2535 Flange Coupling Adapter

DIMENSIONS AND WEIGHTS

Nominal Pipe Size	Dimensions—Inches			Approximate Weight—Pounds			
	A	C	D	Number of Bolts	F-2533	F-2537	F-2535
4	9	11¾	3½	4	28	57	21
6	11⅛	12½	5⅞	5	33	72	43
8	13½	13⅜	6	6	48	102	59
10	16⅜	....	6	7	72	148	82
12	18¾	....	5⅞	8	85	180	110

Note: Couplings use ⅝" x 10", valves and adapters use ⅝" x 5" bolts.
Interchangable Glands and Gaskets are Color Coded for Easy Identification



F-2541 A Gasket (blue)

F-2543 B Gasket (gray)

F-2545 M Gasket (black)

F-2547 A Gland (blue)

F-2548 B Gland (gray)

F-2549 M Gland (black)

PIPE SIZES AND ORDERING INFORMATION

Address orders and inquiries to
Valve Division, Clow Corporation, P. O. Box 350, Oskaloosa, Iowa 52577

SIZE NUMBERS AND DIMENSIONS

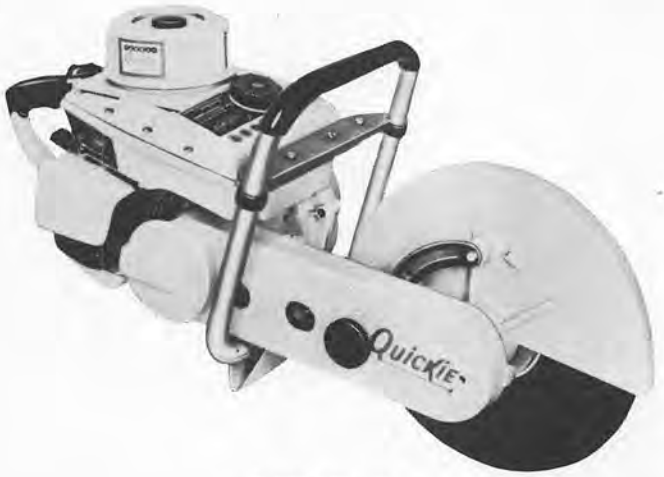
Size No.	Color Code (Gasket & Gland)	Fits Pipe of this Nominal O.D.	Nominal Pipe O.D.		
			Std. Steel and PVC	Cast Iron AWWA Pit Cast	Cast Iron Centrifugally Cast
4A	Blue	4.50–4.85	4.50	4.80	4.80
4B	Gray	4.80–5.10		4.80 5.00	4.80
4AB	Blue & Gray	One end 4A, other end 4B.			
6A	Blue	6.62–6.95	6.62	6.90	6.90
6B	Gray	6.90–7.22		6.90 7.10 7.22	6.90
6AB	Blue & Gray	One end 6A, other end 6B.			
8A	Blue	8.62–9.15	8.62	9.05	9.05
8B	Gray	9.05–9.42		9.05 9.30 9.42	9.05
8AB	Blue & Gray	One end 8A, other end 8B.			

Size No.	Color Code (Gasket & Gland)	Fits Pipe of this Nominal O.D.	Nominal Pipe O.D.		
			Std. Steel and PVC	Cast Iron AWWA Pit Cast	Cast Iron Centrifugally Cast
10A	Blue	10.75–11.10	10.75	11.10	11.10
10M	Black	11.14–11.43		11.40	
10B	Gray	11.60–11.97		11.60 11.84	
10AB	Blue & Gray	One end 10A, other end 10B.			
10AM	Blue & Black	One end 10A, other end 10M.			
10BM	Gray & Black	One end 10B, other end 10M.			
12A	Blue	12.75–13.20	12.75	13.20	13.20
12M	Black	13.32–13.61		13.50	
12B	Gray	13.78–14.26		13.78 14.08	
12AB	Blue & Gray	One end 12A, other end 12B.			
12AM	Blue & Black	One end 12A, other end 12M.			
12BM	Gray & Black	One end 12B, other end 12M.			

QUICKIE TARGET PIPE SAW

Light-Weight Portable, High-Speed, Gasoline Powered Cutting Saw

for cutting ductile iron, gray iron, concrete, steel and other materials



F-4949 Pipe Saw

The F-4949 TARGET Quickie Pipe Saw is a safer, versatile, low-cost, circular saw for cutting all pipe materials. It makes a clean square cut, employing a 12″ abrasive wheel for cutting metal and concrete.

Fast, it will cut any diameter of ductile pipe in minutes. Easy to handle, it weighs only 29¾ lbs and operates in any position. 3.2 pint capacity fuel tank is enough capacity for sustained operation.

The 6½ HP Engine develops 5,200 RPM and has an exclusive clutch and V-Belt drive which allows the belt to slip if the blade jams. An adjustable safety guard assures safer performance.

The saw is furnished as part of a complete kit, detailed below, which has a steel carrying case, including desirable parts and equipment.

Since QUICKIE is also a versatile construction tool, these accessories are available: A low-cost Wet Cutting Kit for use with diamond blades where it is desirable to use diamond blades on masonry and concrete materials. A Wheel Kit is available for horizontal cutting on horizontal surfaces. A 12″ carbide-tipped blade is available for cutting wood.

Saw is part of Complete Kit
Kit Contains

Quickie Gasoline Powered Pipe Saw
12″ Reinforced Abrasive Wheel for metal
12″ Reinforced Abrasive Wheel for Concrete/ Asphalt
Protective Steel Carrying/Storage case
Wrenches
Fuel can with pouring spout and cover
Spare Belt
Tools
Set of Safety Goggles
Can of special Engine Oil

SPECIFICATIONS

The Saw is equipped with a 2-cycle, air cooled heavy duty gasoline engine, provided with dual filters for engine protection. Engine develops 6½ HP at 5,200 RPM. Equipped with compression relief valve to facilitate fast, easy starting; capable of cutting at any angle; all controls (choke, throttle, destroking port and ignition switch) conveniently positioned for operator control; maximum weight (less fuel and blade) 29¾ lbs; provided with enclosed V-Belt Guard with built-in provision for accepting a wet cutting attachment; built-in lock pin hole provided in arbor for safer blade removal. Non-tilt base stand; 12″ saw blade capacity.

SUPERIOR PIPE TONGS

F-4966 Pipe Tongs

For easier, faster and safer handling of cast iron pipe. Grip pads and linings of tough, long-wearing, woven, brake lining; arches and main levers of high quality steel; grip on pipe is released automatically when lift on tong is slacked off.

F-4966 Pipe Tongs
Shown Gripping the Pipe

F-4966 Pipe Tongs
In Released Position

Sizes and Weights

Size Number	Nominal Pipe Size Inches	Actual OD Inches	Approximate Shipping Weight Pounds
CT480	4	4.80	44
CT690	6	6.90	53
CT905	8	9.05	102
CT1110	10	11.10	122
CT1320	12	13.20	138
CT1530	14	15.30	175
CT1740	16	17.40	189
CT1950	18	19.50	215
CT2160	20	21.60	245
CT2580	24	25.80	265
CT3174	30	31.74	460

CHINBRO PIPE GRAB

F-4963 Chinbro Pipe Grab

A low cost way to handle pipe safely, it clamps automatically when dropped over the pipe. Out-riggers help stabilize pipe and prevent slippage. Fabricated of high strength alloy steel, to handle most any kind of pipe within O.D. range of each model size. One grab is used for each nominal pipe size 4″ thru 20″.

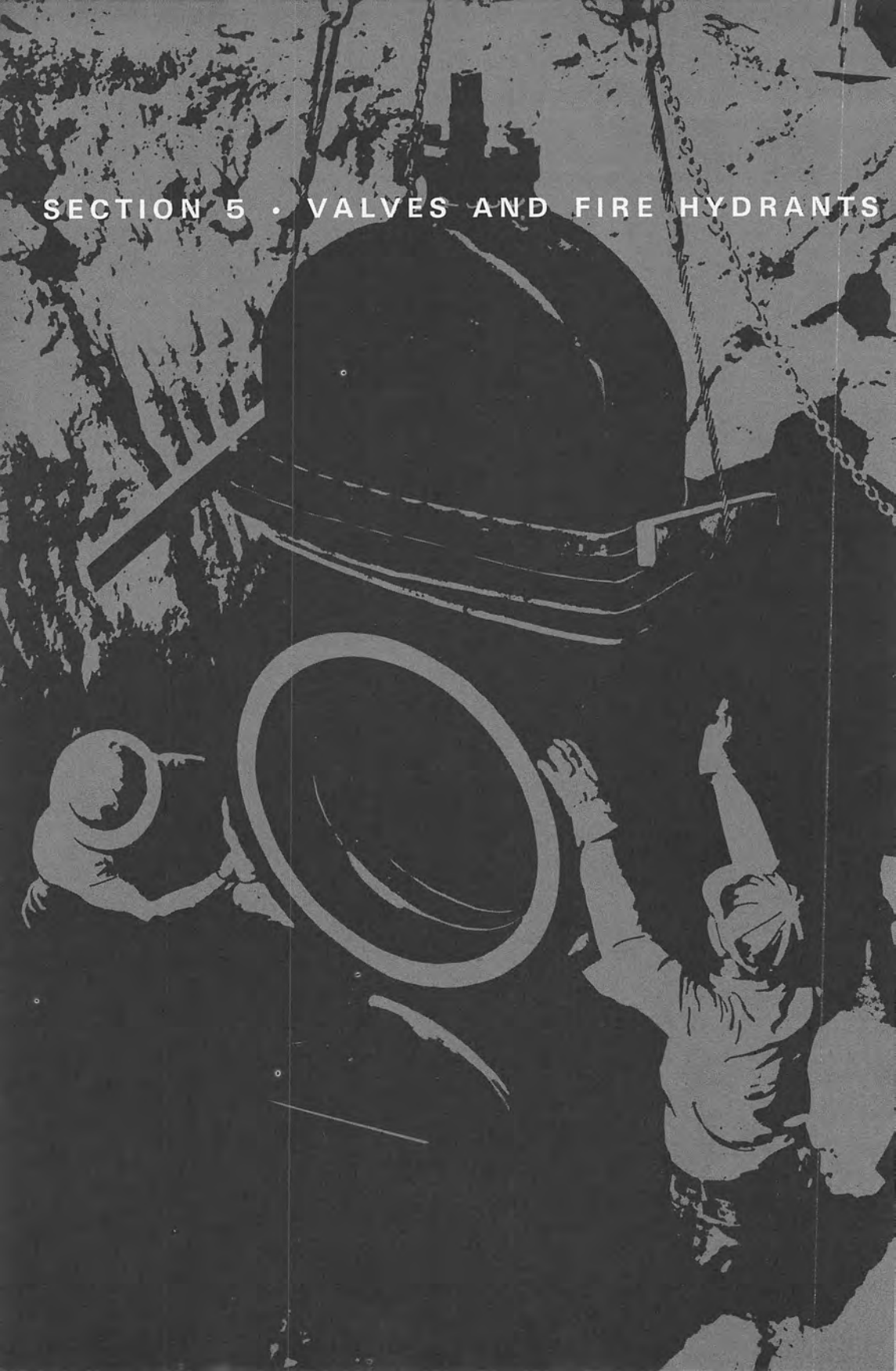
F-4963
Chinbro Pipe Grab

Model and Size Range

Model Number	Nominal Pipe Size Inches	O.D. Range Inches	Approx. Weight Pounds
C-4	4	4.8 to 5.0	9
C-6	6	6.9 to 7.38	12
C-8	8	9.05 to 9.6	20
C-10	10	11.1 to 11.84	35
C-12	12	13.2 to 14.08	50
C-14	14	15.3 to 16.32	64
C-16	16	17.4 to 18.54	77
C-18	18	19.5 to 20.78	90
C-20	20	21.6 to 23.02	110

Grabs for special sizes available. State type of pipe and exact O.D.

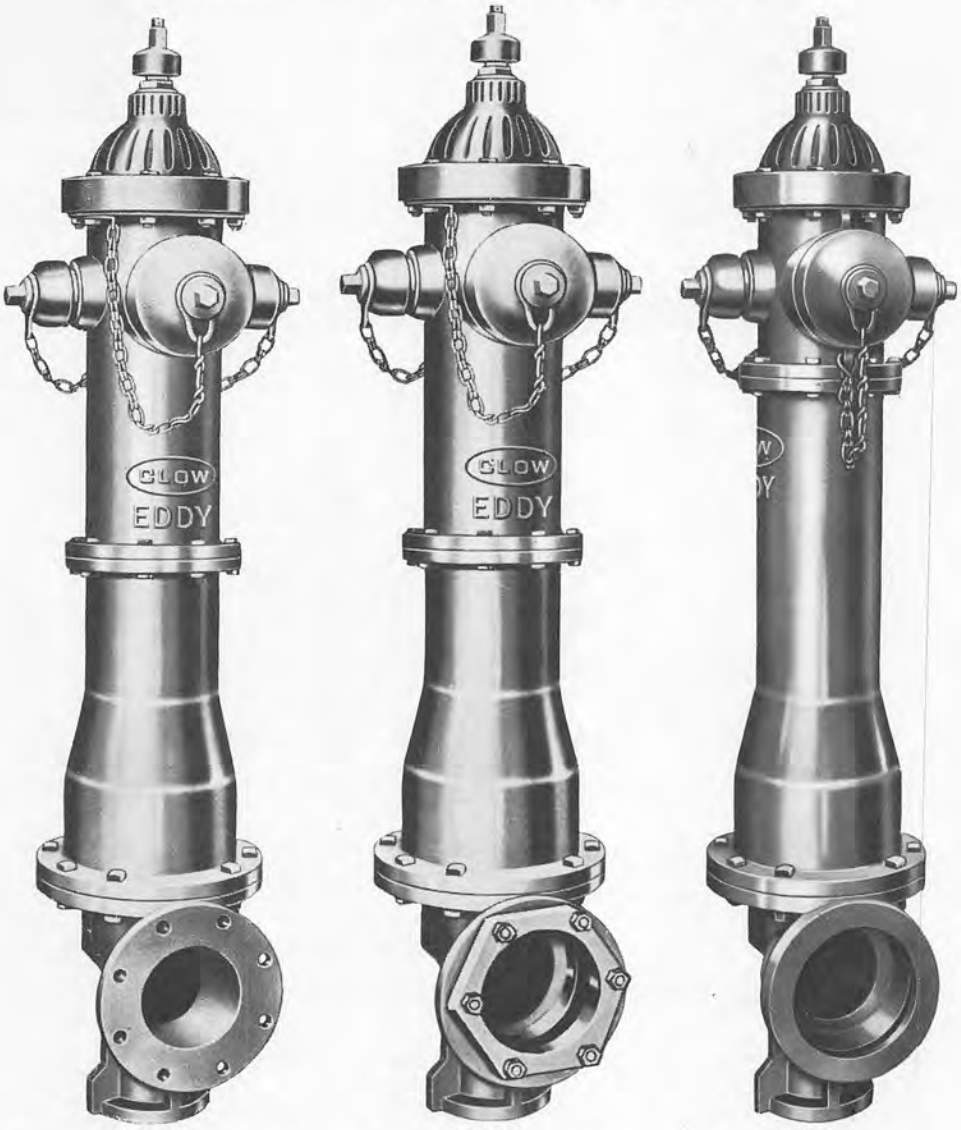
SECTION 5 • VALVES AND FIRE HYDRANTS



SECTION 5 • VALVES AND FIRE HYDRANTS

EDDY COMPRESSION-TYPE FIRE HYDRANTS

Tested to 300 Pounds Hydraulic Pressure
Recommended for 150 Pounds Water Working Pressure



F-2630
Ground Line Flange Construction

F-2640
Break Flange Construction

F-2645
Swivel Head Construction

GROUND LINE, BREAK FLANGE, OR SWIVEL HEAD CONSTRUCTION

Any type Hydrant can be furnished with Hub, Mechanical or Flanged Joint Inlet

Eddy Hydrants can be furnished in Swivel Head, Ground Line, or Break Flange construction, and with two 2½″ hose nozzles and pumper nozzle, or with hose nozzles only as shown on the opposite page.

Hydrant size is determined by the diameter of the hydrant valve opening. Eddy hydrants are available in 4¼, 4½, 4¾, and 5¼-inch size. For size and type of joint inlet connections, see page 132.

Hydrants are regularly furnished with conventional stuffing box with packing of treated braided asbestos. O-Ring packing or Rubber Self-sealing Ring packing can also be furnished. Order parts by number and repair assemblies by letter. See page 136.

For Underwriters and Factory Mutual Hydrant see page 164.

EDDY COMPRESSION-TYPE FIRE HYDRANTS

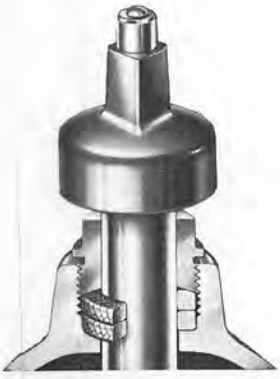
STANDARD NOZZLE ARRANGEMENTS

Two 2½"
Hose Nozzles

Two 2½" Hose Nozzles
One Pumper Nozzle

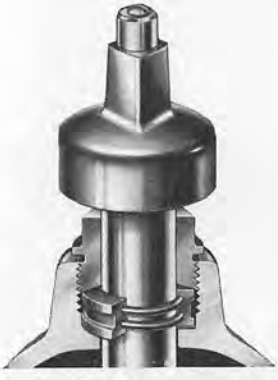
Hydrants can be furnished with one pumper and one hose nozzle, two pumpers, or other combinations of nozzles that may be required.

HYDRANT PACKING



1 Conventional
Asbestos Packing

2 Rubber Self-Sealing
Ring Packing



3 O-Ring
Packing

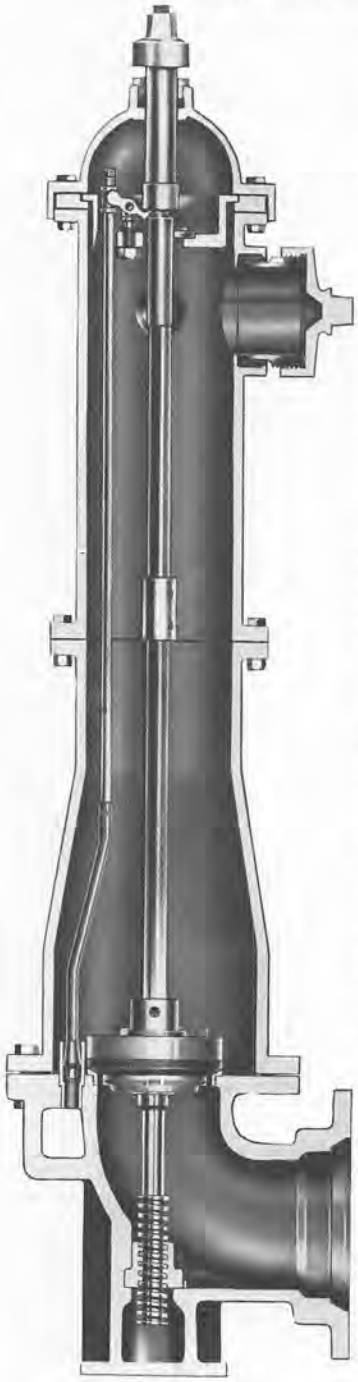
Eddy Hydrants can be furnished with any of three types of packing illustrated above and as follows: Conventional Asbestos packing, Rubber Self-Sealing Ring packing, or the O-Ring packing. Unless otherwise specified, hydrants are supplied with the conventional stuffing box with packing of treated braided asbestos.

1 The conventional stuffing box construction with the screwed bronze packing gland eliminates the need for follower bolts or nuts. It is so designed to permit repacking quickly and easily. Although normally furnished with treated braided asbestos packing, other materials, when specified, can be furnished.

2 The Rubber Self-Sealing Ring packing is a one piece rubber seal which fits over the stem and into the standard stuffing box. It requires no grooving of either the stem or the stuffing box. The higher the pressure the tighter the seal. This Rubber Self-Sealing Ring packing can be incorporated into any Eddy hydrant stuffing box no matter when the hydrant was installed.

3 The O-Ring stuffing box incorporates two rubber seal rings. The top ring is the dirt seal, the lower ring is the pressure seal. O-Rings can also be incorporated into existing Eddy hydrants.

EDDY COMPRESSION-TYPE FIRE HYDRANTS



F-2630
Ground Line Hydrant
Closed position

DESCRIPTION

Eddy Fire Hydrants are built for long lasting and dependable fire protection, and equal or exceed the specifications of the American Water Works Association in every respect.

Eddy Hydrants are furnished to open to the left by turning counter-clockwise or to the right by turning clockwise. Direction of opening is indicated by an arrow and legend cast on the cover.

Construction and Operation

The Eddy Fire Hydrant is a center stem type with a rising stem. The stem position provides a fast visual indication of the position of the valve.

The hydrant valve opens *with* the pressure. Water pressure in the main thus actually assists opening of the hydrant, providing instantaneous flow. The stem is supported from the top *and* the bottom of the hydrant and moves in direct line with the standpipe. There can be no misalignment of the valve with the seat, since the valve in the open position is above the seat and out of the flow of water entering the hydrant. The lower portion of the stem is threaded and engages a bronze stem nut in the base of the hydrant.

In closing, the hydrant valve is drawn gradually and smoothly to its solid bronze seat. Water hammer is eliminated because the valve closes against the pressure and cannot jump to its seat. The rubber faced valve seats perfectly on the bronze seat ring and remains stationary once it comes in contact with the seat. This prevents any scoring or marring of the valve face or seat ring.

In the closed position the hydrant valve is held in place from below by the threaded portion of the stem. Damage to the hydrant standpipe will not result in any loss of water.

The sturdy, independent drain rod provides complete, automatic drainage of the hydrant after use. The drain is closed quickly by one and one half opening turns of the operating nut which forces the drain valve to its seat and prevents any water from escaping through the drain opening while the hydrant is being used.

As the hydrant is closed, the drain mechanism is opened by the final one and one-half turns of the operating nut. The bronze drain cup extends through the base of the hydrant, eliminating danger of corrosion at the drain opening.

The drain rod can be removed through the top of the hydrant without shutting off the water in the main. This permits the drain to be rodded out at any time if it should become clogged with roots or other foreign matter.

Pipe Line Inlet Connections

Eddy hydrants can be furnished with 4-inch and 6-inch inlets in the joint or end types listed below. 4¼-, 4½-, and 4¾-inch are furnished with 4- or 6-inch inlets; 5¼-inch hydrants are furnished in 6-inch inlet size only. We do not furnish hydrants with inlet pipe sizes smaller than the nominal size of the hydrant valve opening.

Hub Inlets: furnished in accordance with details of specifications ANSI A21.10 (AWWA C110).

Mechanical Joint Inlets: furnished complete with accessories, in standardized Mechanical Joint to specifications ANSI A21.11 (AWWA C111), or Cutting-in Mechanical Joint to manufacturers specifications.

Flanged Inlets: furnished faced and drilled to 125 pound template in accordance with American National Standard ANSI B16.1.

Other Inlet Types: Can be furnished when specified.

For Underwriters and Factory Mutual Hydrant see page 164.

EDDY COMPRESSION-TYPE FIRE HYDRANTS

BENEFITS

Service

Hydrant valve opens with the pressure. Water pressure actually makes opening the hydrant easier.

No loss of water should the standpipe be damaged.

The large waterway around the valve, when opened, assures a full flow at maximum efficiency.

Hydrant valve is free to revolve on the stem and seats in different positions.

The extent of hydrant opening is positively shown by the position of the rising stem.

Water hammer is eliminated. The hydrant valve closes against the pressure, and the water flow is shut off gradually as the valve approaches its seat.

Positive seating of the valve is assured. The valve is drawn, not pushed, against its seat.

The hydrant is automatically and positively drained after every use.

The high velocity of water caused by the throttling ring washes the valve and its seat as the valve is closed. Foreign matter cannot lodge between valve and seat.

Construction

Swivel head or Ground Line design permits selection of any of eight different nozzle positions. Nozzle section of Break Flange Hydrant can be rotated to any one of 360 degrees.

Tapered barrel anchors the hydrant and prevents heaving by frost.

New nozzle arrangements can be provided at any time simply by replacement of the swivel head or nozzle section.

The protective shield around the drain minimizes clogging and prevents undermining.

Traffic damage to the standpipe will not result in any loss of water.

Balanced proportions and even distribution of weight make the Eddy Fire Hydrant easy to handle and install.

Maintenance

All working parts can be removed for inspection or replacement without digging, without a hoist or derrick, and without special tools by one man.

Removal of the hydrant cover or standpipe does not require the water to be shut off.

A damaged valve can be removed and replaced easily at little expense.

The hydrant valve is faced with specially selected rubber.

The drain rod is independent of the stem and can be easily adjusted or removed from the standpipe without shutting off the water.

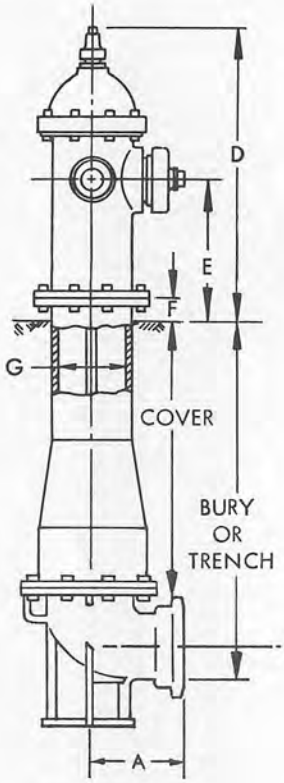
All Eddy Hydrant parts are fully interchangeable.

A complete line of hydrant parts is carried in stock for immediate shipment.

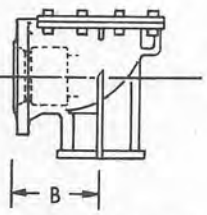
F-2630 Ground Line Hydrant
Open position

When Ordering or Inquiring About Hydrants, see "Ordering Information"—page 139.

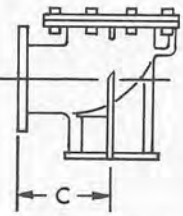
EDDY COMPRESSION-TYPE FIRE HYDRANTS



HUB INLET



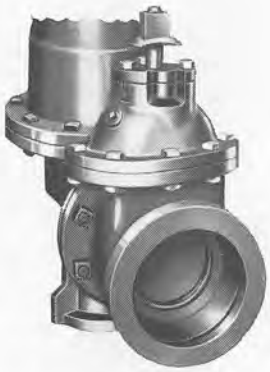
MECH. JOINT INLET



FLANGED INLET

Hydrant Dimensions—Inches

Dimensions	Size Main Valve Opening			
	4¼-and 4½-inch		4¾-inch	5¼-inch
	4-inch Inlet	6-inch Inlet	6-inch Inlet	6-inch Inlet
Groundline and Break Flange Hydrant				
A	9½	9¼	9¼	9¼
B	9¼	9¼	9¼	9¼
C	9¼	9¼	9¼	9¼
D	34	34	34	34
E	18	18	18	18
F	2¾	2¾	2¾	2¾
G	6½	6½	6½	7¼
Swivel Head Hydrant				
A	9½	9¼	9¼	9¼
B	9¼	9¼	9¼	9¼
C	9¼	9¼	9¼	9¼
D	30½	30½	30½	30½
E	14½	14½	14½	14½
F	9¼	9¼	9¼	9¼



F-5063

AUXILIARY VALVES

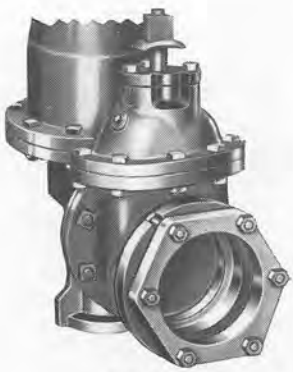
F-5063
Flanged and Hub
Auxiliary Valve

F-5066
Flanged and Mechanical Joint
Auxiliary Valve

(Not Illustrated)

F-5081
Flanged and Push-On

F-5082
Flanged and Super-Lock
(6″ only)



F-5066

Flanged and mechanical joint and flanged and hub end auxiliary valves are manufactured in 4 and 6-inch sizes. They are used with hydrants to provide an independent shut-off and make it unnecessary to interrupt water service for hydrant repairs or replacements.

Auxiliary valves are Clow AWWA Valves that bolt directly to flanged hydrant inlet. Flanges are drilled to 125 pound template. For description of the valve, see pages 148 thru 153.

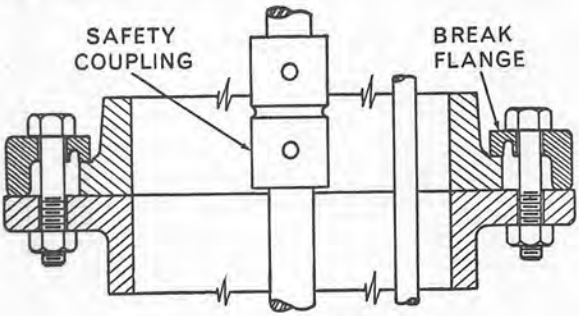
EDDY COMPRESSION-TYPE FIRE HYDRANTS

EDDY TRAFFIC MODEL HYDRANT with BREAK FLANGE CONSTRUCTION

The break flange model hydrant incorporates a ground line breakable flange and a cast iron safety stem coupling . . . so designed that when the hydrant is subjected to severe impact, the special break flange ring will shear off at the ground line.

The stem coupling is held on the stem by the same removable, reusable, non-corrosive, stainless steel Drive-lok pins used on extension stem couplings. Thus the stem coupling serves the dual purpose of severing on impact, and permitting easy extension of the hydrant. In all other details of construction, this break flange model hydrant is the same as the standard model, and has the same interchangeable working parts. The nozzle section of this hydrant can be rotated to any one of 360 degrees.

The break flange design gives added protection against flooding and eliminates the possible expense of digging up a damaged hydrant for repair or replacement. This model is particularly well suited for installations along busy roadways where the hazards of traffic damage are highest, and where excavation for repairs or replacements would be difficult, or costly.



Section Showing
Break Flange and Safety Coupling

Double Protection Against Flooding or Geysering

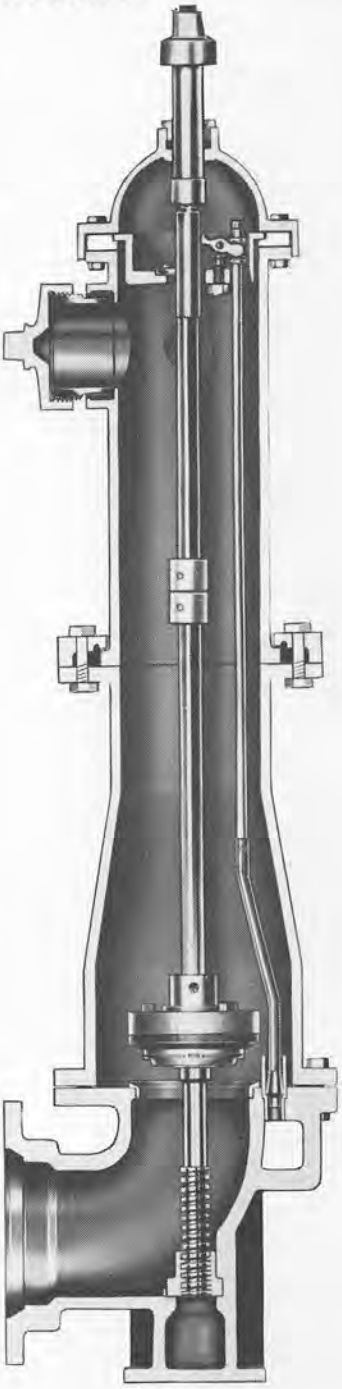
Because the Eddy operating stem is held in the bottom of the hydrant . . . below the main valve . . . the Eddy standard hydrant will not flood or geyser when the stand-pipe is damaged. Therefore, there is *double* protection when the Eddy break flange feature is used.

Identical Working Parts Save Costs

Because all the working parts of this hydrant are the same as for all Eddy Hydrants, there is no need for separate inventory of repair parts.

Tapered Barrel Anchors the Hydrant in the Ground

Because the Eddy tapered barrel firmly anchors the stand-pipe in the ground, there is greater resistance offered to impact, which assists the shearing action required for break-off.

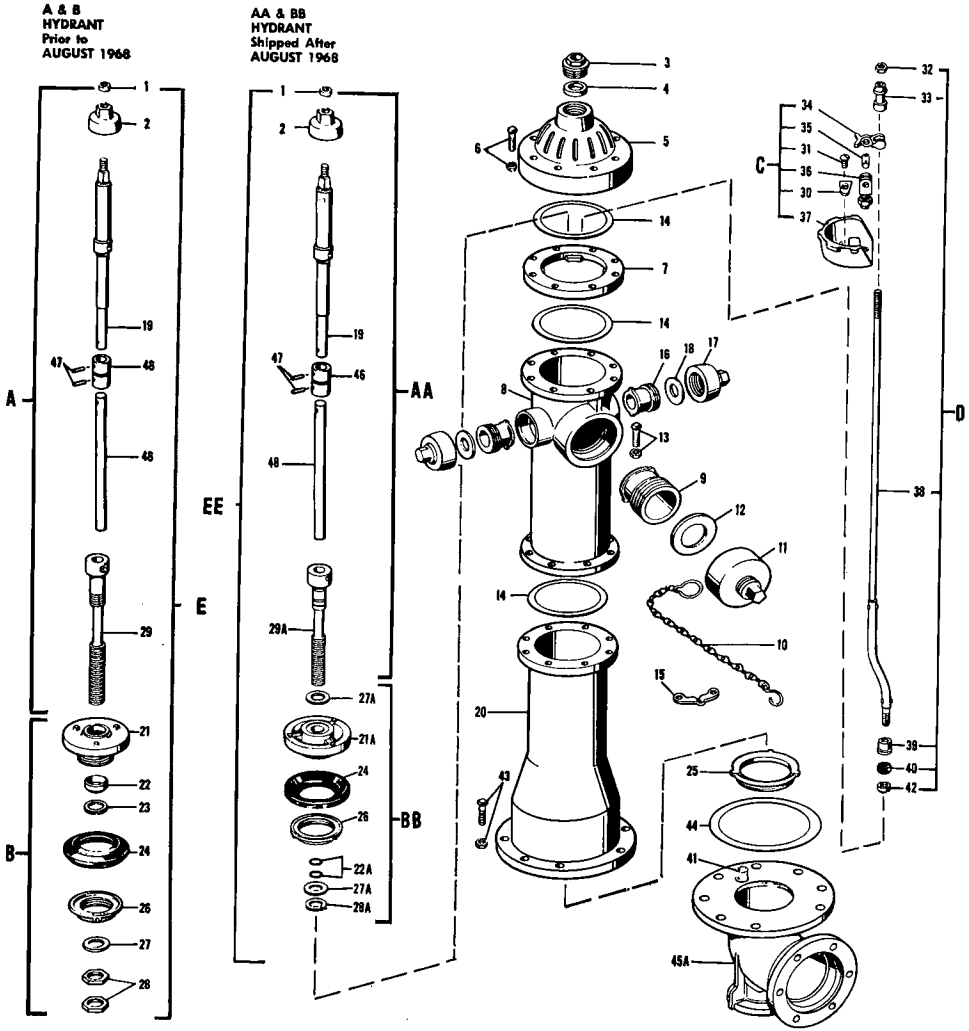


F-2640
Break Flange Hydrant
Open position

When Ordering or Inquiring About Hydrants, see "Ordering Information"—page 139.

EDDY FIRE HYDRANTS

PARTS LIST



Hydrant Repair Assemblies

	Assembly	Consisting of Parts
A	Main Stem	1-2-19-29-46-47-48
AA	Main Stem (New Style)	1-2-19-29A-46-47-48
B	Hydrant Valve	21-22-23-24-26-27-28
BB	Hydrant Valve (New Style)	21A-22A-24-26-27A-28A
C	Drain Support	30-31-34-35-36-37
D	Drain Valve	32-33-38-39-40-42
E	Complete Valve and Stem	ASSEMBLIES A & B
EE	Complete Valve and Stem	ASSEMBLIES AA & BB

NOTE

Hydrant Valve Assembly

O-Ring Style Valve Assembly BB *Will Not Fit* Old Style Lower Stem #29.
Old Style Packing Valve Assembly B *Will Fit* New Style Lower Stem #29A in 4½", 4¾" and 5¼" Hydrants.
Complete New Stem and Valve Assembly is Required for 4¼" Hydrant.

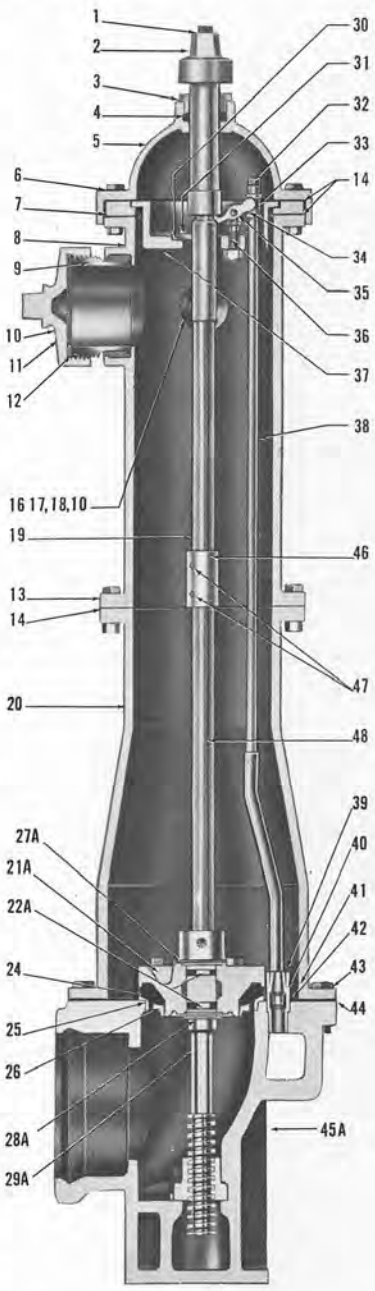
EDDY FIRE HYDRANTS

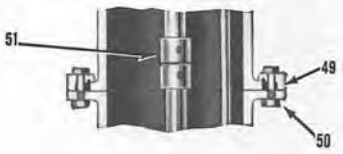
PARTS LIST

Part No.	Part	Number Required	Material
1	Hold Down Cap Screw	1	Stainless
2	Operating Nut	1	Cast Iron
3	Packing Nut	1	Bronze
4	Packing	1	Fibre
5	Cover	1	Cast Iron
6	Cover Bolts & Nuts	8	Steel
7	Swivel Ring	1	Cast Iron
8	Nozzle Section	1	Cast Iron
9	Pumper Nozzle	As Ordered	Bronze
10	Nozzle Chain Not shown	As Ordered	Steel
11	Pumper Nozzle Cap	As Ordered	Cast Iron
12	Pumper Cap Washer	As Ordered	
13	Flange Bolts & Nuts	8	Steel
14	Flange Gaskets	3	
15	Chain Anchor Not Shown	1	Steel
16	2½″ Hose Nozzle	As Ordered	Bronze
17	2½″ Hose Nozzle Cap	As Ordered	Cast Iron
18	2½″ Hose Cap Washer	As Ordered	Leather
19	Upper Stem	1	Stl. & Brz.
20	Standpipe	1	Cast Iron
21A	Valve Plate	1	Cast Iron
22A	O-Rings	2	Rubber
24	Valve Rubber	1	Rubber
25	Seat Ring	1	Bronze
26	Throttling Ring	1	Bronze
27A	Thrust Washer	2	Teflon
28A	Snap Ring	1	Stainless
29A	Lower Stem	1	Mang. Brz.
30	Stem Wedge	1	Bronze
31	Stem Wedge Screw	1	Bronze
32	Lock Nut	1	Bronze
33	Drain Spool	1	Bronze
34	Drain Lever	1	Bronze
35	Lever Pin	1	Bronze
36	Clevis & Nut	1	Bronze
37	Drain Support	1	Cast Iron
38	Drain Rod	1	Steel
39	Drain Valve Backer	1	Bronze
40	Drain Valve Rubber	1	Rubber
41	Drain Cup	1	Bronze
42	Retaining Nut	1	Bronze
43	Bottom Bolts & Nuts	4¼″— 6 4¾″— 6 5¼″— 8 6¼″—11	Steel
44	Bottom Gasket	1	
45	Bottom	1	Cast Iron
46	Stem Coupling	1	Cast Iron
47	Stem Coupling Pin	2	Stainless
48	Middle Stem	1	Steel

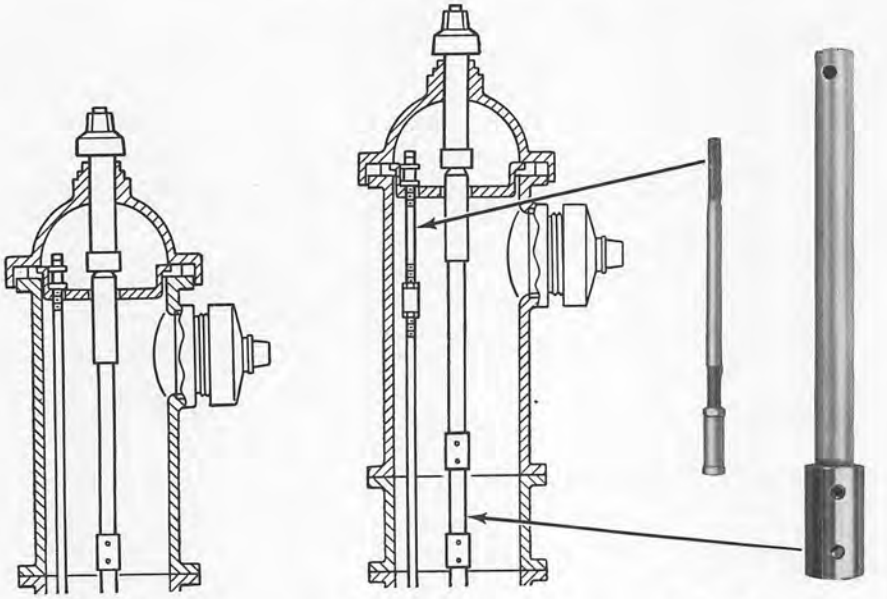
BREAK FLANGE MODEL ONLY

49	Break Flange	1	Cast Iron
50	Break Flange Bolts & Nuts	8	Steel
51	Break Coupling	1	Cast Iron





EDDY FIRE HYDRANTS



EXTENDING THE HYDRANT

The Eddy Hydrant can be extended easily without welding, and without excavation. The standpipe is extended in any 6-inch increment by installing a Hydrant Extension Section.

The stem is extended to any desired length by inserting a separate Stem Extension Piece, fitted with an iron coupling. The stem extension is pinned to the existing stem by non-corrosive, stainless steel, self-locking pins, which provide a vibration-proof connection.

To accommodate change in length, the insertion of the Stem Extension Piece requires only (1) removing the pin, (2) inserting the extension, and (3) replacing the pin through the coupling and stem to complete the extension.

Similarly, the drip rod is extended by an Extension Rod, threaded both ends, with threaded steel coupling and lock nuts. This is fitted into the existing drip rod in the manner shown in the illustration above.

Extension Sections

Eddy Fire Hydrants can be extended to any desired length with the use of intermediate extension sections. These sections are made in lengths from 6 to 60 inches, in 6-inch increments.

Two types of extension sections are available—the upper type, for bolting between the swivel head and the standpipe and the lower type for bolting between the standpipe and the hydrant bottom. When ordering, specify **type, size** and **length.**

F-2668
Upper Extension,
Swivel Head Hydrant

F-2669
Lower Extension,
All Eddy Hydrants

F-2671
Upper Extension, Ground
Line and Break Flange Hydrant

FIRE HYDRANTS

ORDERING INFORMATION

When placing orders or making inquiries, please furnish the following information. This information will enable us to answer your questions, prepare quotations, and fill your order promptly. Lack of essential information is almost sure to cause delays.

Use Figure Number wherever possible to identify the product wanted

ORDERING INFORMATION—HYDRANTS

1. Quantity.

2. Construction: whether Swivel Head, Ground Line, or Break Flange. Use Figure numbers on page 130 or 140.

3. Size of main valve opening: 4¼, 4½, 4¾, or 5¼-inch.

4. Number of 2½″ hose nozzles.

5. Number and size of pumper nozzles.

6. Type of inlet connection: Hub, flanged, mechanical joint, etc.

7. Size of inlet connection: 4-, or 6-inch.

8. Depth of trench: Distance from ground line to bottom of connecting pipe.

9. Direction of opening: Usually opens to left (counterclockwise); opens to right (clockwise), when specified.

10. Size and shape of operating nut: National Standard is 1½-inch pentagon measured from point to opposite flat.

11. Hose and pumper nozzle threads: If other than National Standard thread specification and nut size must be furnished in the following manner:

(a) Send sample nozzle or hose coupling; or
(b) Send drawing giving complete thread specification; or
(c) Refer us to previous hydrant order. Complete records are kept of all installations.

12. Color: Specify color of paint wanted.

13. Packing: Conventional, Special Rubber, or O-Ring Packing. See pages 131 and 141.

SPECIFICATIONS

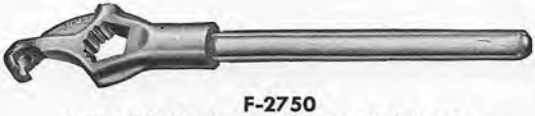
Eddy and Iowa Fire Hydrants meet or exceed the requirements of American Water Works Association Specification AWWA C502, Fire Hydrants for Ordinary Water Service.

HOSE AND HYDRANT WRENCHES

F-2730
Hydrant Wrench

F-2735
Throttling Ring and Check Nut Wrench

F-2740
Combined Spanner and Wrench



F-2750
Adjustable Hydrant Wrench with Spanner
Fits both Pin type and Rocker type hose couplings.

IOWA COMPRESSION-TYPE FIRE HYDRANTS

GROUND LINE OR BREAK FLANGE CONSTRUCTION

Can be furnished with Hub, Mechanical or Flanged Joint Inlets

F-5100
Ground Line Hydrant

Hydrostatic
Test Pressure
300 psi

Rated Working
Pressure
150 psi

F-5110
Break Flange Hydrant

Iowa Fire Hydrants are available with either Ground Line Flange or Break Flange construction. They can be furnished with two 2½" hose nozzles with pumper nozzle, or with two 2½" hose nozzles only. Unless otherwise specified, hose nozzle threads will be National Standard Hose Threads.

A variety of inlet types for pipe line connections can be furnished as indicated on page 142. Hydrants may have conventional or O-Ring packing. Unless otherwise specified, conventional packing of braided, graphited asbestos will be furnished.

Hydrant size is determined by the diameter of the main valve opening. Hydrants are available in 4¼-, 5¼-, or 6¼-inch valve opening.

For information required when ordering or requesting quotations, see page 139. When ordering parts or part assemblies, order by part number or letter designation shown on pages 146–147.

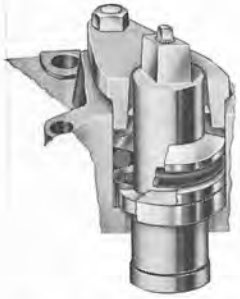
IOWA COMPRESSION-TYPE FIRE HYDRANTS

STANDARD NOZZLE ARRANGEMENTS

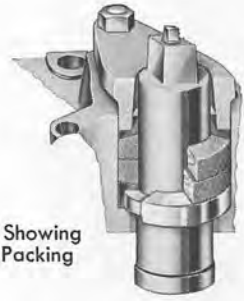
Two 2½-inch
Hose Nozzles

Two 2½-inch Hose Nozzles
One Pumper Nozzle

STUFFING BOX CONSTRUCTION



Cutaway View Showing
O-Ring Packing



Cutaway View Showing
Conventional Packing

Iowa Hydrants are available with either the Conventional stuffing box or the O-Ring type of stuffing box construction. Unless otherwise specified, hydrants are regularly furnished with the conventional packing, packed with a braided, graphited, asbestos packing which gives years of trouble-free service, and which can be quickly replaced whenever necessary.

The O-Ring packing incorporates two specially designed O-Ring seals. This construction provides an excellent seal, and can be made a part of any Iowa hydrant, no matter when it was installed.

Flanged and Hub
Auxiliary Valve

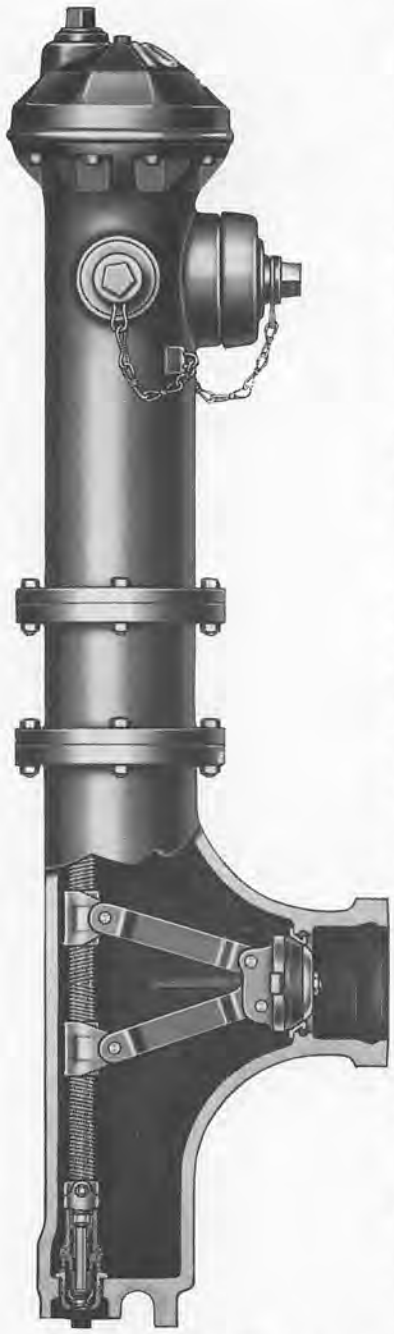
AUXILIARY VALVES

Auxiliary valves have either Flanged and Hub or Flanged and Mechanical Joint ends and are used in conjunction with flanged end fire hydrants to provide for independent shut-off. They meet AWWA valve requirements and are available in 4, 6 and 8-inch sizes.

The auxiliary valve bolts directly to the flanged inlet of the hydrant and, when the valve is closed, inspection and repairs of internal parts of the hydrant can be made without interrupting water service to consumers.

Flanged and
Mechanical Joint
Auxiliary Valve

IOWA COMPRESSION-TYPE FIRE HYDRANTS



Sectional View Showing Hydrant in Closed Position and Drain Valve Open

DESCRIPTION

Iowa Latest Improved Corey Type Fire Hydrants are designed and built for many years of rugged service, easy operation and maximum water delivery. Their advanced design assures minimum friction losses, positive drainage and easier maintenance. Their sound construction equals or exceeds specifications of the American Water Works Association in every particular.

As the hydrant is opened the main valve, fitted with a specially compounded valve rubber, is moved from its seat by two operating arms of strong cast iron. The operating arms provide solid support between the back of the hydrant and the main valve through the upper and lower stem nuts. Four full turns of the operating nut provide an opening equal to the area of the valve opening. When hydrant is opened all the way, the main valve is moved back entirely out of the waterway, and delivers a solid stream of water the full size of the valve opening.

In closing, the main valve is moved rapidly toward its seat with the first few turns of the operating nut. The movement of the valve is slowed as closing of the hydrant continues, providing a sure and gradual seating of the main valve and eliminating any chance of water hammer.

When the valve is closed, a mechanically actuated drain valve at the bottom of the hydrant opens and any water remaining in the hydrant drains out. The drain valve consists of a bronze barrel with a tapered seat and a cup-shaped rubber designed to assure positive closing of the drain when the hydrant is open. When the hydrant is closed, the drain rubber is out of contact with its seat. In opening the hydrant, the first two turns of the operating nut automatically close the drain valve. In closing the hydrant, the last two turns of the operating nut automatically open the drain valve. This eliminates any loss of pressure through the drain valve or any washing away of soil at the base of the hydrant.

PIPE LINE INLET CONNECTIONS

Iowa hydrants can be furnished with 4-inch or 6-inch inlets in the joint or end types listed below. The 4-inch hydrants (4¼-inch valve opening) are furnished with 4- or 6-inch inlets; the 5-inch (5¼-inch valve opening) with 6-inch inlet, and 6-inch hydrants (6¼-inch valve opening) are furnished with 6-inch or 8-inch inlets. We do not furnish hydrants with inlet pipe sizes smaller than the nominal size of the hydrant valve opening.

Hub Inlets: furnished in accordance with details of specifications ANSI A21.10 (AWWA C110).

Mechanical Joint Inlets: furnished complete with accessories, in standardized Mechanical Joint to specifications ANSI A21.11 (AWWA C111), or Cutting-in Mechanical Joint to manufacturers specifications.

Flanged Inlets: furnished faced and drilled to 125 pound template in accordance with American National Standard ANSI B16.1.

Other Type Inlets: can be furnished when specified.

IOWA COMPRESSION-TYPE FIRE HYDRANTS

BENEFITS

Iowa Fire Hydrants offer many advantages in design and are constructed of best quality materials.

Fire Protection and Service

The free and unobstructed flow of water through the hydrant assures maximum water delivery and minimum pressure loss.

Opening with the pressure permits water to enter the hydrant instantly and provide water at the nozzles in the shortest possible time.

Working parts are entirely clear of the waterway in the fully open position.

The fixed position of the arms in the closed position prevents flooding in case of standpipe breakage. The main valve is kept closed mechanically, not by water pressure.

The foolproof drain valve constructed entirely of bronze, will not rust or corrode. It is entirely automatic. It provides rapid drainage of the hydrant after use and closes securely when the hydrant is open.

The superior design of this hydrant guarantees gradual, sure closing against the pressure, eliminating water hammer.

Easy Maintenance and Repair

An ordinary wrench is the only tool required to remove all working parts.

All working parts can be removed from the top. There is no digging required to inspect, repair or replace any of the internal working parts.

All working parts rest on the bottom of the hydrant. No special adjustment is needed to align the main valve with its seat.

The simple and sturdy operating arms assure trouble-free service. They are designed for maximum strength and made of high strength cast iron.

A damaged top section can be replaced, or the hydrant nozzles raised, without digging. The flange at the ground line makes removal or raising easy.

Hose nozzles and pumper nozzles are threaded into the hydrant standpipe. They cannot blow out or leak. In the event of damage, they are easily replaced.

Removal of the single dome bolt and dome makes the Conventional packing immediately accessible for repacking. When the Iowa O-Ring packing is used, specially developed O-rings eliminate the need for conventional packing.

Materials, Construction and Design

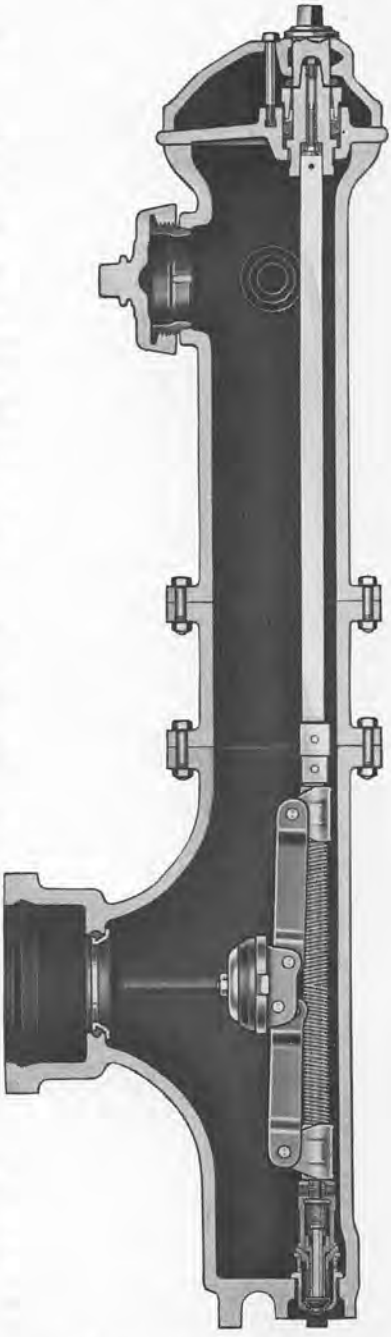
All cast iron used is of high strength and controlled quality.

The stem is stainless steel or Everdur bronze. Arm pins and gate pins are of Everdur bronze. All other bronze parts are of high strength cast bronze.

Specially produced rubber of the finest quality is used for the main valve and the drain valve.

The rod between the bronze stem and the operating nut is of high strength steel.

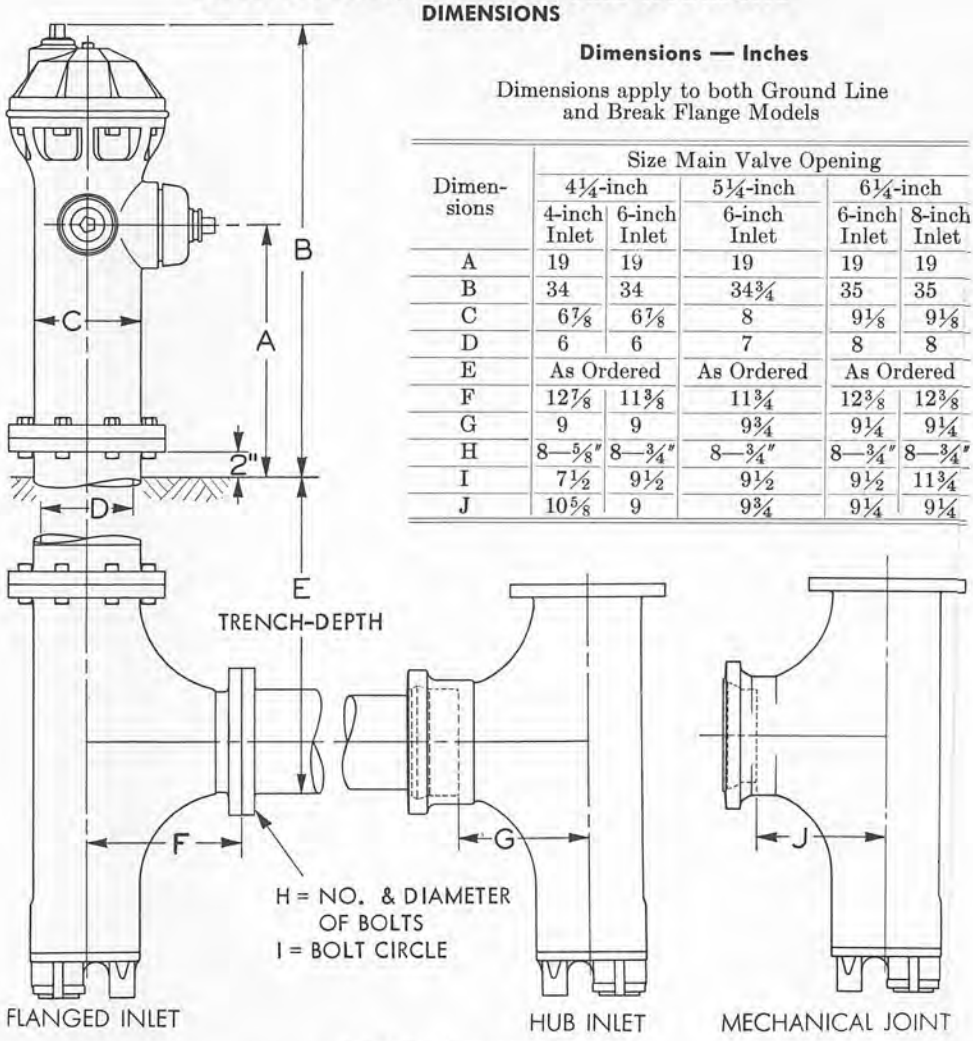
All materials used in Iowa Hydrants equal or exceed the requirements of the American Water Works Association in every detail.



Sectional View Showing Hydrant In Open Position and Drain Valve Closed

IOWA COMPRESSION-TYPE FIRE HYDRANTS

DIMENSIONS



Dimensions — Inches

Dimensions apply to both Ground Line and Break Flange Models

Dimensions	Size Main Valve Opening				
	4¼-inch		5¼-inch	6¼-inch	
	4-inch Inlet	6-inch Inlet	6-inch Inlet	6-inch Inlet	8-inch Inlet
A	19	19	19	19	19
B	34	34	34¾	35	35
C	6⅞	6⅞	8	9⅛	9⅛
D	6	6	7	8	8
E	As Ordered		As Ordered	As Ordered	
F	12⅞	11⅜	11¾	12⅜	12⅜
G	9	9	9¾	9¼	9¼
H	8—⅝"	8—¾"	8—¾"	8—¾"	8—¾"
I	7½	9½	9½	9½	11¾
J	10⅝	9	9¾	9¼	9¼

F-5130 Extension Sections

Iowa Fire Hydrants can be extended to any desired length, without interrupting the flow of water with the use of extension sections. These sections are made in varying lengths in 6-inch increments. Each section is flanged at both ends for bolting in place between the ground line flange and the nozzle section of the hydrant. Gaskets, bolts and nuts for one flange end are furnished with each extension section.

Extension rods, with coupling and pins, are also provided for lengthening the hydrant stem, which is drilled to receive the insert pin furnished with the extension rod.

F-5130
Extension Section

Adjustable Hydrant Wrench

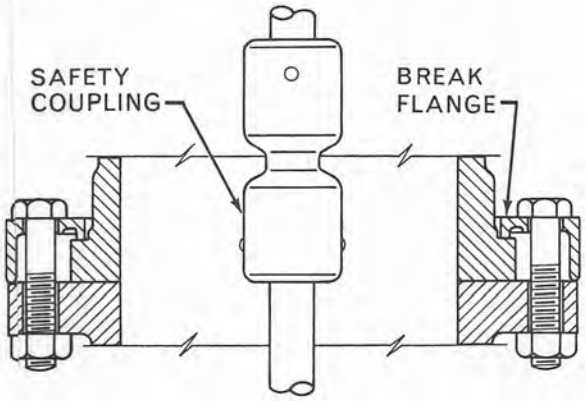
F-2750
Hydrant Wrench
Fits both Pin type and Rocker type hose couplings

The F-2750 Combination Hydrant Wrench combines hose spanner and serrated jaw (adjustable for size and shape) for the nuts on the operating stem and nozzle caps of fire hydrants. Effective length is 15 inches.

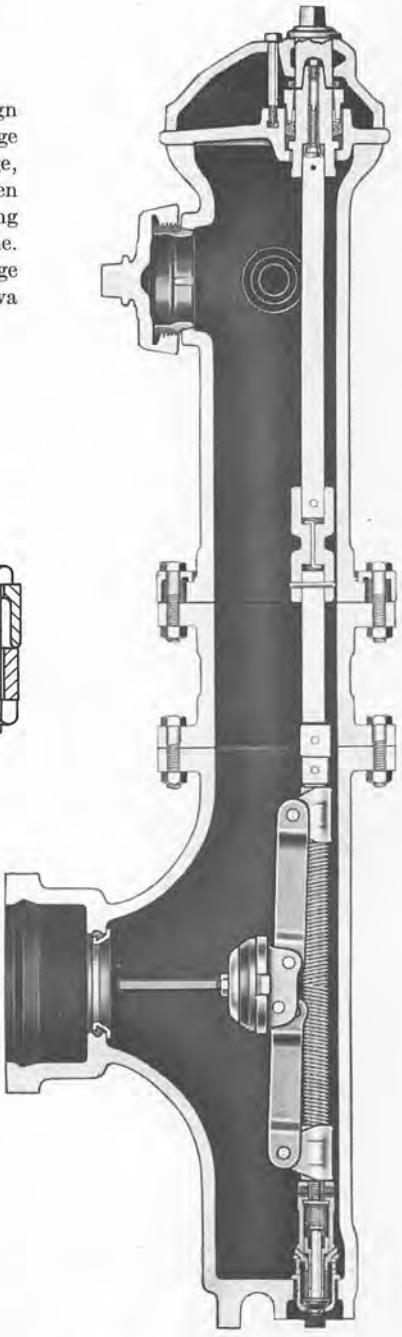
IOWA COMPRESSION-TYPE FIRE HYDRANTS

TRAFFIC MODEL HYDRANT with BREAK FLANGE CONSTRUCTION

The Iowa Traffic Model Hydrant is of the same design as the regular Iowa Hydrant, except that the Break Flange construction incorporates a breakable ground line flange, and a cast iron safety stem coupling, so designed that when the hydrant sustains severe impact, the break flange ring and breakable coupling will shear off at the ground line. In all other details of construction, the Break Flange Hydrant is the same as the regular Ground Line Iowa Hydrant, and has the same interchangeable parts.



Section showing detailed view of Break Flange and Safety Coupling



Sectional View showing Break Flange Construction

ADVANTAGES OF IOWA BREAK FLANGE HYDRANT CONSTRUCTION

The Break Flange design gives added protection against flooding, and eliminates the possible expense of digging up a damaged hydrant for repair or replacement. This hydrant is especially desirable for installation along busy roadways where traffic damage hazards are greatest, and where excavation for repairs would be either difficult or costly.

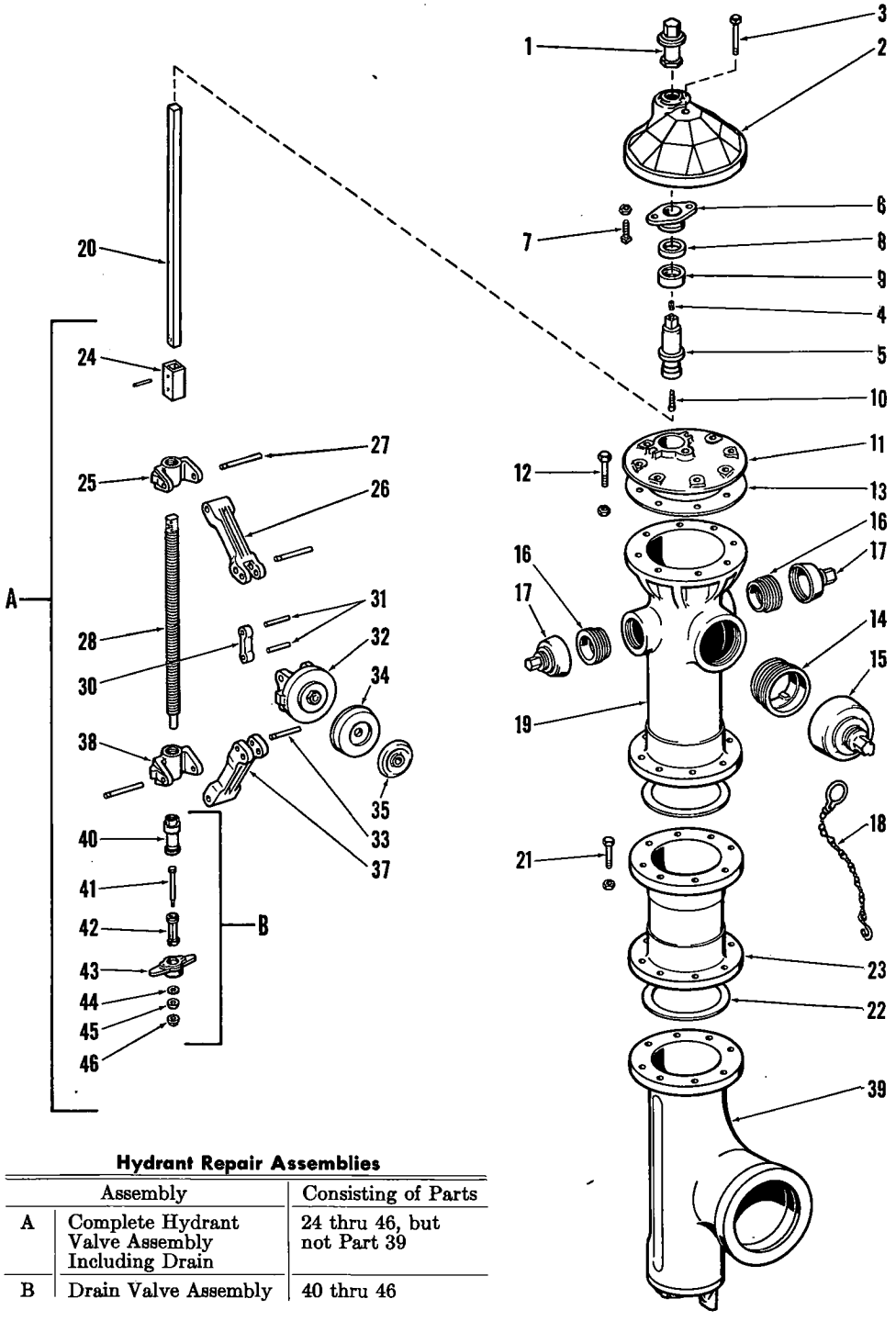
Break Flange Repair Kit

Although individual parts in the Break Flange Repair Kit may be ordered and furnished separately, we recommend that the Repair Kit be ordered, consisting of the following parts:

1 Breakable Flange
1 Breakable Coupling
1 Gasket
8 Flange bolts and nuts
2 Coupling pins
1 Coupling pin punch

IOWA FIRE HYDRANTS

PARTS



Hydrant Repair Assemblies

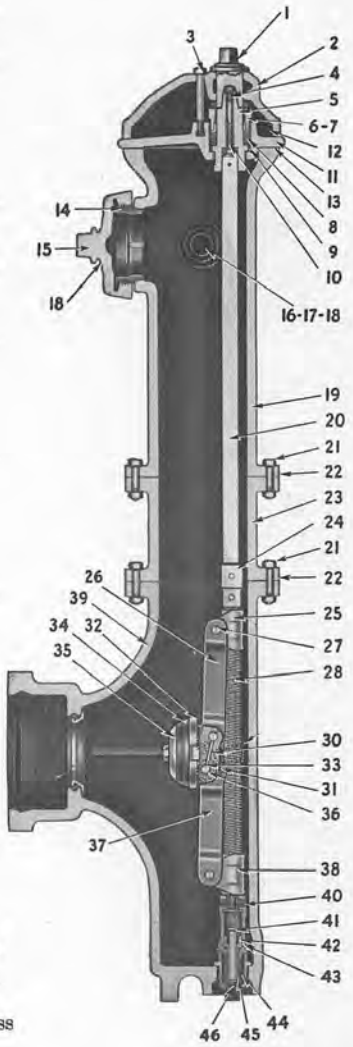
Assembly		Consisting of Parts
A	Complete Hydrant Valve Assembly Including Drain	24 thru 46, but not Part 39
B	Drain Valve Assembly	40 thru 46

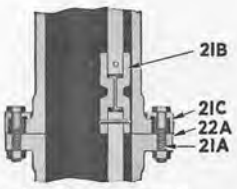
Parts 19, 21, 22 and 23 for Break Flange Hydrant have a suffix A. See page 147.

IOWA FIRE HYDRANTS

PARTS LIST

Part No.	Part	Number Required	Material
1	Operating nut and retaining ring	1	Cast iron and bronze
2	Dome	1	Cast iron
3	Dome bolt	1	Steel
4	Pipe plug	1	Bronze
5	Operating sleeve	1	Cast iron
6	Stuffing box follower and gland	1	Cast iron, bronze bushed
7	Follower bolts	2	Steel—nuts bronze
8	Stuffing box packing		Lubricated
9	Stuffing box packing ring	1	Bronze
10	Adjusting screw	1	Bronze
11	Head	1	Cast iron
12	Head bolts and nuts	8*	Steel
13	Head gasket	1	
14	Pumper nozzle	1	Bronze
15	Pumper nozzle cap	1	Cast iron
16	Hoze nozzle	1	Bronze
17	Hose nozzle cap	1	Cast iron
18	Nozzle chain	1 Set	Steel
19	Stand pipe	1	Cast iron
19A	Stand pipe, break flange	1	Cast iron
20	Square operating rod	1	Steel
21	Flange bolts and nuts	8*	Steel
21A	Break flange bolts & nuts	8	Steel
21B	Stem coupling	1	Cast iron
21C	Break flange	1	Cast iron
22	Flange gasket	2	
22A	Break flange gasket	1	
23	Extension piece	1	Cast iron
23A	Extension piece, break flange model		Cast iron
24	Coupling and pin	1	Bronze
25	Top stem nut	1	Bronze
26	Upper operating arm	1	Cast iron
27	Operating arm pins and cotter pins	2	Everdur bronze
28	Threaded stem	1	Stainless Steel or Everdur bronze
30	Connecting link	1	Bronze
31	Connecting link pins	2	Everdur bronze
32	Gate, cap screw and nut	1	Cast iron—stainless
33	Gate pins	2	Everdur bronze
34	Main valve	1	Rubber
35	Gate washer	1	Cast iron
36	Cotter pins for gate	2	Brass
37	Lower operating arm	1	Cast iron
38	Bottom stem nut	1	Bronze
39	Bottom, seat ring, and drain barrel	1	Cast iron—bronze
40	Drain valve holder	1	Bronze
41	Drain valve lifter stem	1	Bronze
42	Drain valve lifter	1	Bronze
43	Drain valve lifter guide	1	Bronze
44	Drain valve washer	1	Bronze
45	Drain rubber valve	1	Rubber
46	Drain valve lifter washer nut	1	Bronze





Section showing parts in Break Flange Construction

* Except 4¼" hydrant, which requires 4.

Specify both part number and size of main valve opening when ordering.

CLOW AWWA GATE VALVES

IRON BODY, BRONZE MOUNTED
DOUBLE DISC, PARALLEL SEAT

F-5062 Hub Ends
Non-Rising Stem
2″ thru 48″

Pressure Ratings

Valve Size Inches	Working Pressure psi	Hydrostatic Test Pressure psi
	Non-Shock Cold Water	
2 thru 12	200	400
14 thru 48	150	300

For
Cutting-In Valves, See Page 156
Tapping Valves, See Page 154

F-5065 Mech. Joint
Non-Rising Stem
2″ thru 42″

F-5080* Push-On Ends
For Cast Iron Pipe
4″ thru 12″ NRS

F-5063 Flanged
and Hub Ends, NRS
4″ thru 36″

F-5066 Flanged and
Mechanical Joint, NRS
4″ thru 36″

F-5081* Flanged and
Push-On Ends, NRS
4″ thru 12″

F-5070 Flanged Ends
Non-Rising Stem
2″ thru 48″

F-5068 Threaded Ends
Non-Rising Stem
2″ thru 4″

* For cast iron pipe. Can also be furnished for other sizes and types of pipe.

CLOW AWWA GATE VALVES

IRON BODY, BRONZE MOUNTED
DOUBLE DISC, PARALLEL SEAT

F-5071 Flanged Ends
Quick Opening, Sliding Stem
4″ thru 12″

Pressure Ratings

Valve Size Inches	Working Pressure psi Non-Shock Cold Water	Hydrostatic Test Pressure psi
2 thru 12	200	400
14 thru 48	150	300

F-5072 Flanged Ends
O S & Y
2″ thru 48″

F-5310, Flanged, NRS
Square Bottom
4″ thru 12″

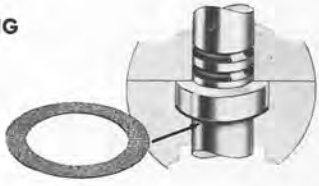
For **F-2531** Super-Seal valve, see page 125

For Underwriters and Factory Mutual listed valves see page 162

F-5085 PVC
Push-On Ends
2″ thru 10″

LOW TORQUE THRUST BEARING

Valves 4″ through 12″ are fitted below the stem collar with an exclusive Low Torque Thrust Bearing which provides high load capacity and low friction. This bearing reduces operating torque up to 50%, yet seals perfectly for repacking under pressure.



VALVE PACKING

Conventional Packing

Conventional packing is furnished on rising stem valves, cylinder valves, and all non-rising stem geared valves.

In this construction, the stuffing box has a two piece cast iron follower with bronze gland, and is packed with a braided, graphited, asbestos packing.

Valves with either conventional or O-Ring packing can be re-packed under pressure with the valve in fully open position.

O-Ring Packing

O-Ring packing is regularly furnished on all non-rising stem valves. This packing incorporates two specially designed rubber O-Ring seals: the top ring is the dirt seal; the lower ring is the pressure seal.

The O-Rings will not bind the stem, and provide an excellent seal which allows easy operation of the valves. O-Rings are not furnished for rising stem valves, or for valves equipped with cylinders or gear cases.

CLOW AWWA GATE VALVES

IRON BODY, BRONZE MOUNTED, DOUBLE DISC, PARALLEL SEAT

DESCRIPTION AND ADVANTAGES

Clow AWWA Gate Valves are double disc, parallel seat valves designed primarily for flow control of water in underground pipe lines. They equal or exceed the requirements established by specifications of the American Water Works Association and conform to Federal Specifications WW-V-58b, Type II, Class I.

Clow AWWA Gate Valves are specifically designed for heavy pressure service. Neck, flanges, and bell are made extra heavy to withstand pipe strain and possible shifting. Body, cover, gates, and stem are built for extra strength, with clean and simple internal construction, to assure long service and low maintenance.

All working parts are standardized and interchangeable.

The construction of Clow AWWA Gate Valves is clearly illustrated by the sectional view shown on the opposite page.

OPERATION OF THE VALVE

Turning the stem releases the wedging pressure on the gates allowing them to move away from their seats before starting upward travel. Further turning of the stem raises the gates into the fully opened position.

When closing the valve, the gates move freely downward without friction, to a position opposite their seats.

As the gates approach the bottom of the valve, the iron hooks come into contact with stops which prevent further downward movement of the hooks. The bronze wedges riding on these hooks spread the gates apart and force them against their seats.

CONSTRUCTION

Body: Cast Iron, bronze mounted. Sturdy proportions provide protection against damage.

Stem: Manganese bronze of high tensile and torsional strength, with accurate, perfectly machined threads. Ample diameters assure smooth valve movement.

Stem Nut: Solid bronze. Independent of hooks, gates, and wedges. Stem or stem nut will not bind or spring out of line, as can happen when stem nut is attached to wedges.

Wedges: Independent, solid bronze. 2-inch thru 3-inch valves have integral hook and wedge. 4-inch thru 8-inch have independent solid bronze wedges placed loosely in iron hooks, and are free to adjust to varying positions of the gates. See sectional view on opposite page.

In 10-inch and larger valves, each wedge has one long and one short surface. The bottom of each wedge forms a rocker bearing on the iron hooks, letting wedges adjust to varying positions of the gates in closing. The long side is used in closing the valve and the short side in opening it.

Low Torque Thrust Bearing: Valves 4″ through 12″ are fitted below the stem collar with an exclusive Low Torque Thrust Bearing which provides high load capacity and low friction. This bearing reduces operating torque up to 50%, yet seals perfectly for repacking under pressure.

Gates and Gate Rings: Gates 3-inch and smaller are bronze. Gates 4-inch and larger are high strength cast iron with bronze gate rings rolled into machined and dovetailed grooves under pressure to make gate and ring one inseparable unit. After fitting, gate rings are accurately machined.

Case Rings: Bronze case rings are screwed into place and machined to a watertight surface. They can be removed and replaced if necessary.

Packing: O-Ring packing is standard on all non-rising stem gate valves. Rising stem and geared valves are furnished with conventional packing. See page 149.

Operating Nut and Handwheel: All valves except flanged valves and outside screw and yoke valves are supplied with 2-inch square operating nuts of high strength cast iron unless otherwise specified. Flanged valves and outside screw and yoke valves are supplied with handwheels of high strength cast iron unless otherwise specified. Direction of opening is indicated by arrow cast on operating nut skirt or on the rim of the handwheel.

Yoke: Yokes for outside screw and yoke valves are of rugged cast iron. Careful machining assures accurate stem alignment.

Accessories: Valves may be fitted with any of a large number of accessories, detailed on pages 178 through 186: cylinders, electric motor operators, gearing, by-passes, etc.

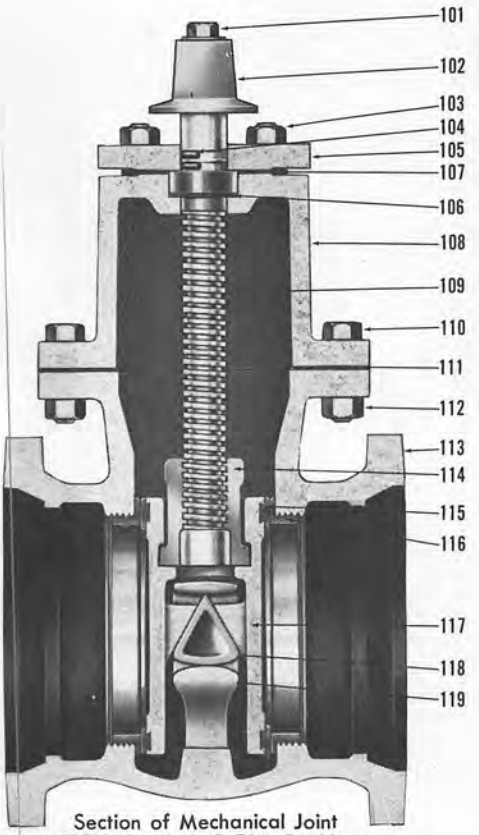
Rollers, Tracks and Scrapers: Recommended for 14″ and larger diameter valves to carry weight of the gates for valves installed in a horzontal line in horizontal position. See page 184.

Slides: Recommended for 14″ and larger valves installed horizontally in a vertical line. See page 184.

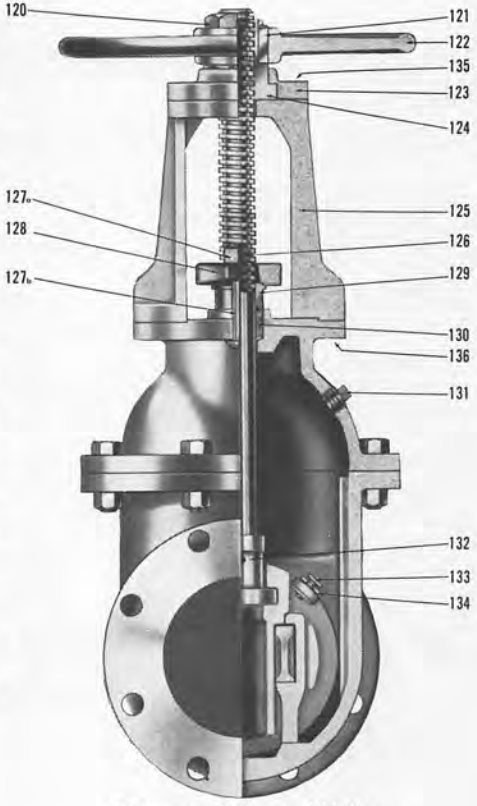
NOTE: All valves open to the left (counterclockwise) unless otherwise specified.

CLOW AWWA GATE VALVES

PARTS LIST



Section of Mechanical Joint
NRS Valve with O-Ring Packing

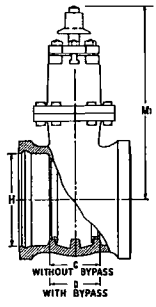


Cutaway of Flanged Valve
with Outside Screw and Yoke

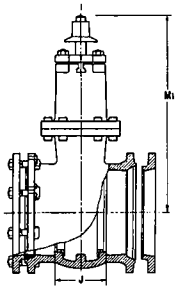
	Part	No.	Material
101	Cap Screw	1	Steel
102	Operating Nut	1	Cast Iron
103	O-Ring Plate Bolts & Nuts		Steel
104	O-Rings	2	Rubber
105	O-Ring Plate	1	Cast Iron
106	Low Torque Bearing	1	
107	Stuffing Box Gasket	1	
108	Cover	1	Cast Iron
109	Non-rising Stem	1	Bronze
110	Neck Flange Bolts		Steel—Rust-proofed
111	Neck Flange Gasket	1	Composition
112	Neck Flange Bolt Nuts		Steel
113	Body	1	Cast Iron
114	Gate Nut	1	Bronze
115	Gate Ring	2	Bronze
116	Case Ring	2	Bronze
117	Gate	2	Cast Iron
118	Wedge	2	Bronze
119	Hook	2	Cast Iron
120	Hold Down Nut	1	Bronze
121	Handwheel Key	1	Steel
122	Handwheel	1	Cast Iron
123	O.S.&Y. Retainer Plate	1	Cast Iron
124	O.S.&Y. Stem Nut	1	Bronze
125	O.S.&Y. Yoke	1	Cast Iron
126	Rising Stem	1	Stainless Steel
127a	Follower Nuts	2	Bronze
127b	Follower Studs	2	Steel—Rust-proofed
128	Follower Plate	1	Cast Iron
129	Follower Gland	1	Bronze
130	Packing		Braided Asbestos
131	Test Plug	1	Teflon-coated steel
132	Stem Nut Pin	1	Bronze
133	Pegs	4	Bronze or Nylon
134	Straps	2	Stainless
135	O.S.&Y. R.P. Cap Screws		Steel—Rust-proofed
136	O.S.&Y. Yoke Bolts & Nuts		Steel—Rust-proofed

CLOW AWWA NRS GATE VALVES

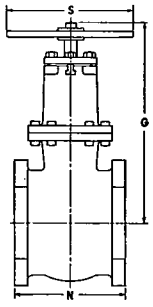
DIMENSIONS



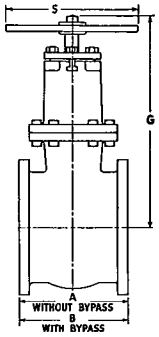
F-5062
Hub Ends



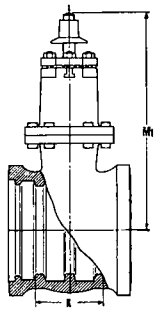
F-5065
Mechanical Joint



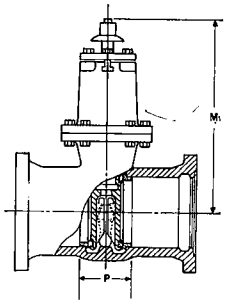
F-5068
Threaded Ends



F-5070
Flanged Ends

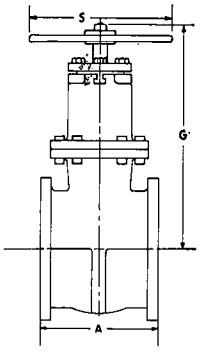


F-5080
Push-On Ends
For Cast Iron Pipe



F-5085
Push-On Ends
For PVC Pipe

Dimension M_1, center of port to top of nut, O-Ring Packing also apply to Tapping Valves, Cutting-in Valves and Auxiliary Valves.



F-5310
Square Bottom Flanged

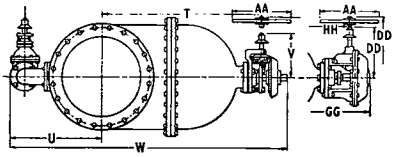
Dimensions—Inches

Valve Size Inches	Turns to Open	Diam. of Stem	A	B	C	D	G	H	J	K	M_1	N	P
2	5	7/8	7	....	3 1/4	....	10 1/4	3 1/8	3 1/4	...	10 1/4	5 1/4	3
2 1/4	5	7/8	....	....	3 1/4	....	10 1/4	....	3 1/4	...	10 1/4	...	...
2 1/2	6	7/8	7 1/2	....	....	....	11 3/8	....	....	...	11 3/8	5 3/4	...
3	7	7/8	8	....	3 3/8	....	12 1/4	4 5/8	3 1/2	...	12 1/4	6	3 1/8
4	15	1 1/8	9	....	4 3/4	....	14	5 3/4	4 3/4	5 1/4	14	9	4 1/2
5	18	1 1/8	10	....	....	....	15 1/2	....	....	...	15 1/2	...	...
6	21	1 1/4	10 1/2	....	5 1/2	....	18	7 7/8	5 1/4	6 1/2	18	...	5 1/4
8	27	1 3/8	11 1/2	....	6 1/2	....	22	10	6 1/2	7	22	...	...
10	33	1 1/2	13	....	6 3/4	....	25 5/8	12 1/8	6 3/4	7 1/4	25 5/8	...	...
12	39	1 1/2	14	....	6 3/4	....	29 1/8	14 1/4	7	7 3/4	29 1/8	...	...
14	45	1 7/8	15 3/4	23	7 3/4	13 3/4	36 1/2	16 3/8	7 1/4	...	39 3/4	...	...
16	52	1 7/8	17	23	9 1/8	13 3/4	40 3/4	18 3/4	9 1/4	...	43 1/2	...	...
18	58	2 1/8	19	24	9 1/4	14	43 1/4	20 3/4	9 1/4	...	46	...	...
20	64	2 1/8	20	24	10 1/4	14 1/2	47 1/4	23	10	...	50	...	...
24	76	2 1/2	23	28 1/2	10	16	55	27 3/8	16	...	56 3/4	...	...
30	63	2 3/4	25	32 1/2	12 1/2	20 1/4	64 3/4	33 3/4	12 1/2	...	66 1/2	...	...
36	75	3	27	36	23 3/4	23 3/4	75 3/8	40 1/8	23 3/4	...	77 3/8	...	...
72	88	3 1/2	34	34	20 3/4	20 3/4	....	46 1/2	20 3/4	...	....	...	...
48	100	4	45 1/2	45 1/2	28	28	....	52 7/8	28	...	....	...	...

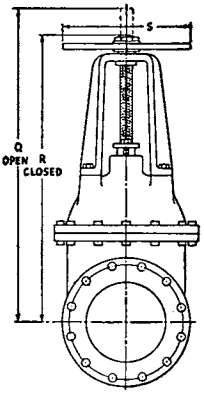
Turns to open are for valves without gearing.

CLOW AWWA GATE VALVES

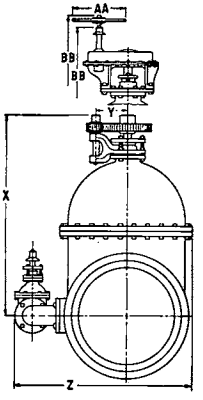
DIMENSIONS



F-5070
Flanged Ends, NRS
Bevel gearing, by-pass



F-5072
Flanged Ends
Outside Screw & Yoke



F-5062
Hub Ends, NRS
Spur gearing, by-pass

Dimensions—Inches

Valve Size Inches	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	DD	GG	HH
2	14	11½	7¼	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2¼	.....	.....	7¼	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2½	15½	12½	7¼	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	20¼	16¾	7¼	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4	24	19¾	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5	27¼	21¾	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6	31½	24¾	12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8	40½	31½	14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	47¼	36¼	18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12	58⅜	45⅜	18	27⅞	....	13	.....	36⅝	8	....	18	40¾	12	38½	31⅝
14	68	53	22	33	19¼	13	57½	41	8	31⅛	18	45	12	42¾	35⅞
16	75¾	58¾	22	36⅞	20½	13	62⅞	45	8	33⅜	18	49	12	46⅜	39¾
18	82½	63½	26	39⅞	22½	13	67¾	48	8	36⅜	18	52⅛	12	50	42⅞
20	90¼	69¼	26	43¾	24	13	73	51¾	8	40½	18	55¾	12	53⅝	46½
24	107	82	30	50½	28	13	83½	58⅝	8	46	18	62⅛	12	60	52⅞
30	128¼	97	30	62¼	31½	17½	100¼	71¼	10	54½	18	76¾	15½	72⅛	66
36	147½	110	36	70¼	40	23¾	120	87	13⅜	68⅛	22	88⅜	21½	81⅛	72⅜
42	.....	.....	30	92	47	17⅛	145⅛	102¾	10	77½	30	106⅜	27	105½	97
48	.....	.....	30	105⅞	54½	18 7/16	166	116⅝	11¼	87½	30	120⅝	27	119	108

Flanges are faced and drilled to ANSI 125 pound template, unless otherwise instructed.

CLOW TAPPING VALVES AND SLEEVES FOR CAST IRON AND PVC PIPE

DESCRIPTION AND ADVANTAGES

In use, tapping sleeves are bolted around the main, and the bolts tightened. The valve is bolted to the flanged outlet of the sleeve and with the valve open, the tapping machine is bolted on and the tap made. The cutter is then withdrawn, the valve closed, and the machine removed. Tapping is accomplished with no interruption of service.

Tapping sleeves are built in two sections for easy installation, and assembled around the main without halting service. Mechanical joint tapping sleeves are furnished complete with joint accessories.

Oversize seat rings on the tapping valves permit entry of the tapping machine cutters. One end of the Push-On tapping valve for either PVC or cast iron pipe has a standard flange for bolting to the sleeve; the other end has a regular Push-On bell with a flange for bolting to any standard tapping machine.

All mechanical joint tapping valves are provided with a standardized mechanical joint outlet for use with cast iron or ductile iron pipe. In all other respects these valves are similar to the Clow AWWA gate valves as regards operation and materials.

With one gasket
4″ thru 12″ Tapping Sleeves and Crosses fit all classes of Cast Iron Pipe.
For 14″ and 16″ specify either AB or CD pipe diameter.

F-5093
Mechanical Joint Valve
2″ thru 24″

MECHANICAL JOINT TAPPING VALVES AND SLEEVES

Not illustrated
F-5220
Mechanical Joint
Tapping Cross
4″x2″ thru 16″x12″

F-5205
Mechanical Joint Sleeve
4″x2″ thru 16″x12″

Pressure Ratings

Valve Size Inches	Working Pressure psi Non-Shock Cold Water	Hydrostatic Test Pressure psi
2 thru 12	200	400
14 thru 24	150	300

F-5082 Push-On Joint
Valve for PVC Pipe

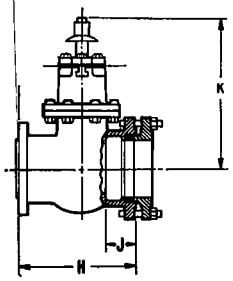
PUSH-ON JOINT TAPPING VALVES

Note
The **F-5082** Tapping Valve for PVC pipe is used with either the **F-5205** Sleeve or the **F-5212** Sleeve and Vegadrill shown on page 98.
The **F-5211** Valve is used with the **F-5205** Sleeve

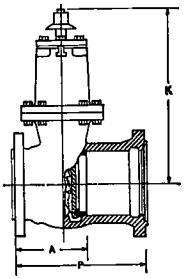
F-5211 Push-On Joint
Valve for Cast Iron Pipe

CLOW TAPPING VALVES AND SLEEVES

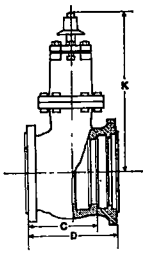
SIZES AND DIMENSIONS



F-5093
Mechanical Joint
Tapping Valve



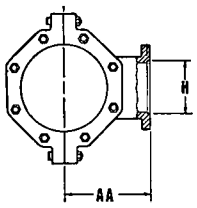
F-5082
PVC Push-On Joint Tapping
Valve for PVC Pipe

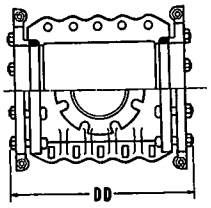


F-5211
Push-On Joint Tapping
Valve for Cast Iron Pipe

Dimensions—Inches

Dimensions	2	3	4	6	8	10	12	14	16	18	20	24
A	....	...	6 7/8	8	....	....	....	....	....	....	....	....
C	....	...	6 3/16	7 9/16	8 1/16	....	....	....	....	....	....	....
D	....	...	10 1/4	11 7/8	14	....	....	....	....	....	....	....
H	7 3/4	9 3/16	10 1/4	11 7/8	13 1/4	14 1/4	16	15 1/4	20 3/8	19 1/2	22 1/8	25 3/4
J	2 1/2	3 1/4	3 3/8	3 3/4	4 1/8	4 3/16	5 5/16	3 3/4	5	5 3/8	5 1/4	3 3/4
K	10 1/4	12 1/4	14	18	22	25 5/8	29 1/8	39 3/4	43 1/2	46	50	56 3/4
P	....	...	11 1/2	13 1/2	....	....	....	....	....	....	....	....
Turns to open	5	7	15	21	27	33	39	45	52	58	64	76





Dimensions—Inches F-5205 Mechanical Joint Sleeve

Sleeve Size	Fits Pipe O.D. Min.	Fits Pipe O.D. Max.	H*	AA	DD
4x 2	4.74	5.06	3 1/64	6 7/8	17
4x 3	4.74	5.06	4 1/64	8	17
4x 4	4.74	5.06	5 1/64	8	17
6x 2	6.84	7.16	3 1/64	8	16 7/8
6x 3	6.84	7.16	4 1/64	8	16 7/8
6x 4	6.84	7.16	5 1/64	8	16 7/8
6x 6	6.84	7.16	7 1/64	8	19 7/8
8x 2	8.99	9.36	3 1/64	8 7/8	16 3/4
8x 3	8.99	9.36	4 1/64	10	16 3/4
8x 4	8.99	9.36	5 1/64	10	16 3/4
8x 6	8.99	9.36	7 1/64	10	22 3/4
8x 8	8.99	9.36	9 1/64	10	22 3/4
10x 2	11.04	11.46	3 1/64	10	17 5/8
10x 3	11.04	11.46	4 1/64	10	17 5/8
10x 4	11.04	11.46	5 1/64	10	17 5/8
10x 6	11.04	11.46	7 1/64	10 7/8	26 1/8
10x 8	11.04	11.46	9 1/64	10 7/8	26 1/8
10x10	11.04	11.46	11 1/64	10 7/8	26 1/8

Sleeve Size	Fits Pipe O.D. Min.	Fits Pipe O.D. Max.	H*	AA	DD
12x 2	13.14	13.56	3 1/64	11 1/2	17 1/2
12x 3	13.14	13.56	4 1/64	12 1/4	17 1/2
12x 4	13.14	13.56	5 1/64	12 1/4	17 1/2
12x 6	13.14	13.56	7 1/64	12 1/4	23 1/2
12x 8	13.14	13.56	9 1/64	12 1/4	23 1/2
12x10	13.14	13.56	11 1/64	12 1/4	29 1/2
12x12	13.14	13.96	13 1/64	11 1/2	29 1/2
14x 4	See Note		5 1/64	13 1/2	26 1/4
14x 6			7 1/64	13 1/2	26 1/4
14x 8			9 1/64	13 1/2	26 1/4
14x10			11 1/64	13 1/2	26 1/4
14x12			13 1/64	13 1/2	26 1/4
16x 4	See Note		5 1/64	14 1/2	26 1/4
16x 6			7 1/64	14 1/2	26 1/4
16x 8			9 1/64	14 1/2	26 1/4
16x10			11 1/64	14 1/2	26 1/4
16x12			13 1/64	14 1/2	26 1/4

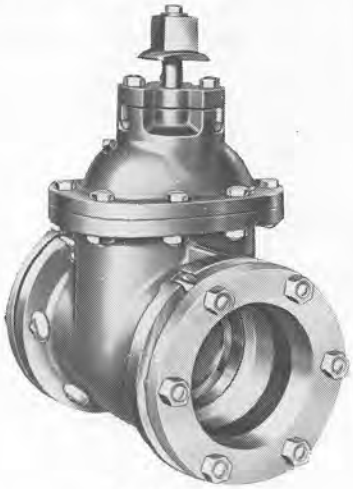
Note: 14" and 16" Sleeves are ductile iron, and are cast to both AB and CD diameters.

*Tongue and recess detail is in accordance with MSS SP-60.

CLOW CUTTING-IN VALVE AND SLEEVE

Fits	ANSI AWWA, Class A, B, C & D WW-P-421 WW-P-421a WW-P-421b WW-P-421c
All Classes of Cast Iron Pipe	

F-1220
Mechanical Joint
Cutting-In Sleeve



F-5067
Mechanical Joint
Cutting-In Valve

SIZES 4" THRU 12"

Clow Mechanical Joint Cutting-In Valves are AWWA valves of the parallel seat, double disc type used for installing gate valves in existing water lines. The mechanical joint is specially designed so that with *one* gasket it can be assembled on either sand cast or centrifugally cast iron pipe.

Installation is described below. Construction and parts of this valve are the same as shown on page 151. Valve and sleeve are furnished as one complete unit, with all joint accessories. A ratchet wrench is the only tool needed for installation.

Cutting-in valves are used for replacing worn out valves, adding valves for increased zone control, adding auxiliary valves for fire hydrants, and other purposes where valves must be installed in existing mains.

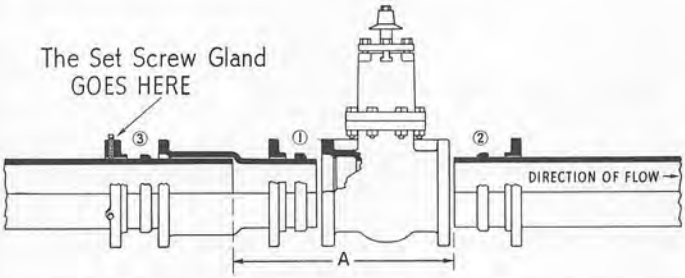
HOW THE VALVE IS INSTALLED

Joints should be installed in 1-2-3 order

1. From the existing line cut out exact length of pipe shown for dimension "A". Remove nuts, bolts, glands and gaskets from bell end joints of gate valve and from large end of sleeve. Slip glands and gaskets over cut ends of pipe and over small end of sleeve. Position sleeve and telescope it over end of the pipe.

2. Lower valve into position between pipe end and spigot end of sleeve. Push valve home and move sleeve along pipe until its spigot is seated in other bell of valve.

3. Tighten nuts gradually. To complete installation, tighten set screws in gland on sleeve against the pipe.



Length of pipe "A" to cut out = face to face of valve body plus 10 inches.

CLOW VALVES

ORDERING INFORMATION

Use Figure Number wherever possible to identify product wanted

When placing orders or making inquiries, please furnish the following information. This information will enable us to answer your questions, prepare quotations, and fill your order promptly. Lack of essential information is almost sure to cause delays.

1. Quantity.

2. Size.

3. Working pressure: Refer to tables of pressure ratings.

4. End type or types: Gate valves are furnished with any end types shown on pages 148, 149, 154, 156, 158, 160 and 162.

4A. Flanged valves: Normally furnished with ANSI 125 pound Standard flanges with bolt holes straddling center lines.

4B. Mechanical Joint valves: Normally furnished with standardized mechanical joints with plain rubber gaskets. Cutting-in type mechanical joints also available for use in existing cast iron pipe lines—see page 156.

5. Direction of opening: Must be specified. Open left (counterclockwise); or open right (clockwise).

6. Type of stem: State whether non-rising stem or rising stem with outside screw and yoke.

7. Installation position: Indicate position in which valve will be installed (vertically, horizontally, or otherwise).

8. Operating nut or handwheel: All flanged valves and all rising stem valves with outside screw and yoke are furnished with handwheels unless otherwise specified. Other valves are furnished with a 2-inch square operating nut unless otherwise specified.

9. Stuffing box: Whether conventional or O-Ring. Unless otherwise specified, we regularly furnish NRS valves with O-Ring packing; other valves are regularly furnished with conventional stuffing box packing.

10. Indicator posts and valves: State depth of trench (distance from ground line to bottom of the pipe line); size and shape of operating nut, if other than standard. For valves already in place, state whether valve is equipped with a flange for post support; if so, give flange dimensions, and distance from centerline of valve to top of flange. (See page 163.)

11. By-pass Valves: are furnished as indicated on page 178. State location, whether manually operated by-pass will have handwheel or operating nut, and any special instructions necessary.

12. Parts: Always order parts by number.

13. Valve boxes: Can be furnished.

SPECIFICATIONS

Clow AWWA gate valves are manufactured in accordance with American Water Works Association Specification AWWA C500, Gate Valves for Ordinary Water Service, and Federal Specifications WW-V-58b, for Type II, Class I, Valves.

CLOW LIST 12

MEDIUM PRESSURE GATE VALVES

IRON BODY, BRONZE MOUNTED, DOUBLE DISC, PARALLEL SEAT

Clow List 12 (Medium Pressure) gate valves are designed for use in water and sewage plants and for industrial installations where medium pressures are encountered. They are available with flanged, hub, or threaded ends as detailed in the table of dimensions on page 159.

All outside screw and yoke valves and flanged valves are normally supplied with handwheels unless otherwise specified. All other valves are normally supplied with a 2-inch square operating nut. Valves open to the left unless otherwise ordered.

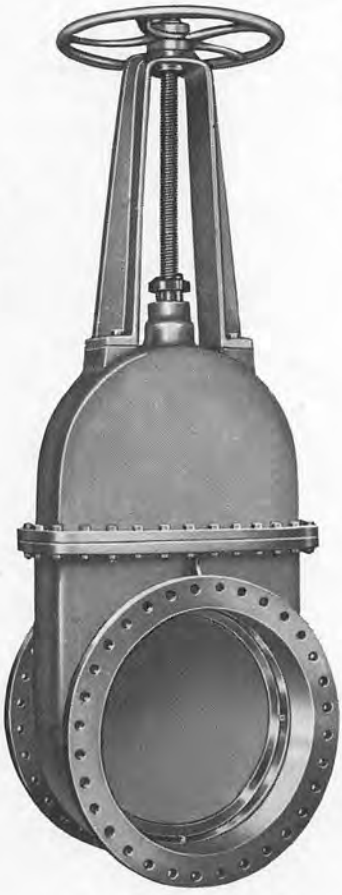
List 12 valves can be furnished with gearing and/or by-pass, equipped for cylinder or motor operation, or fitted with any of the accessories described on pages 178 thru 186.

Pressure Rating

Valves size ....Inches		4 thru 12	14 thru 24	30 and 36
Working Pressure psi	Non-Shock Cold Water	125	100	65
Hydrostatic Test Pressure psi		300	200	150

F-5270 Hub Ends
Non-rising Stem

F-5275 Threaded Ends
Non-rising Stem

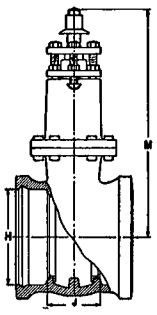


F-5285 Flanged Ends
Outside Screw and Yoke

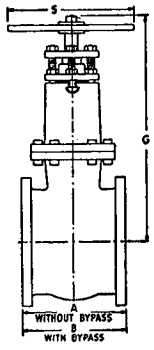
F-5280 Flanged Ends
Non-rising Stem

For illustration of quick opening gate valve, see page 149.

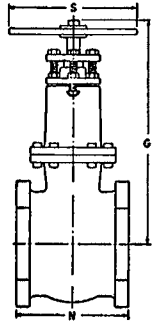
DIMENSIONS OF CLOW LIST 12 MEDIUM PRESSURE GATE VALVES



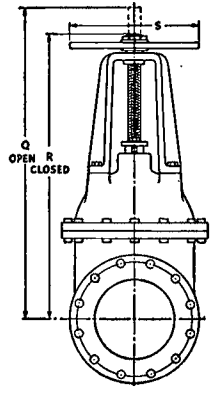
F-5270
Hub Ends, NRS



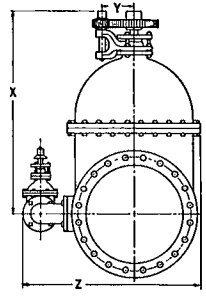
F-5280
Flanged Ends, NRS



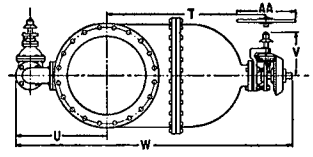
F-5275
Threaded Ends, NRS



F-5285
Flanged Ends, OS&Y



F-5280
Flanged Ends, NRS, with Spur Gears, By-pass



F-5280
Flanged Ends, NRS, with Bevel Gears, By-pass*

Dimensions—Inches

Size Inches	A	B	G	H	J	M	N	Q	R	S	T	U	V	W	X	Y	Z	AA	Turns to Open	Diam. of Stem
4	9	....	16¾	5¾	4¾	16½	9	24	19¾	10	....	....	....	.....	....	....	....	..	9	1
5	9½	....	19	....	...	19	..	27¼	21¾	10	....	....	....	.....	....	....	....	..	17	1⅛
6	9½	....	20⅝	7 15/16	5¼	20⅝	..	31¾	25⅛	10	....	....	....	.....	....	....	....	..	21	1⅛
8	10	....	23¾	10	5½	23¾	..	39¾	31	12	....	....	....	.....	....	....	....	..	27	1¼
10	11	....	28⅝	12⅛	6	28⅝	..	46¼	35¾	14	....	....	....	.....	....	....	....	..	33	1⅜
12	12	....	31⅞	14¼	6⅞	31⅞	..	54¾	41¾	18	....	....	....	.....	....	....	....	..	39	1½
14	14	....	35⅜	....	...	....	..	64¾	49¾	18	30⅝	....	13	.....	38⅝	8	....	18	45	1½
16	14	....	39¼	....	...	....	..	72¾	55¾	18	35¼	....	13	.....	43½	8	....	18	51	1⅝
18	15	....	43¼	....	...	....	..	80	61	18	38⅜	....	13	.....	46⅝	8	....	18	57	1¾
20	15	....	46⅞	....	...	....	..	88	67	22	41¼	....	13	.....	49½	8	....	18	64	1⅞
24	18	24	53¾	....	...	....	..	103¾	78¾	26	48½	26½	13	80¼	56½	8	43½	18	76	2
30	24½	24½	66¼	....	...	....	..	125½	94¼	30	61	29⅞	17½	97½	72½	10	50⅞	18	94	2½
36	27½	27½	79¾	....	...	....	..	147½	110	30	74⅝	37¾	23¾	120¾	88	13⅜	62¼	22	75	2¾

* Note: 24″ and 30″ Flanged Valves are furnished with 3″ by-pass; 36″ valve with 4″ by-pass. Turns to open are for valves without gearing.

Flanges are faced and drilled to ANSI 125 pound template, unless otherwise instructed.

CLOW

CLOW LIST 16
EXTRA HEAVY PRESSURE GATE VALVES
IRON BODY, BRONZE MOUNTED, DOUBLE DISC, PARALLEL SEAT

F-5290 Hub Ends
Non-rising Stem

List 16 (Extra Heavy Pressure) Gate Valves exceed the pressure of AWWA specifications. Their construction is extra heavy and ribbed to withstand the greater pressures at which they are intended to operate. Valves are made with flanged or hub ends. Flanges are regularly furnished Extra Heavy, faced and drilled to ANSI 250 pound template.

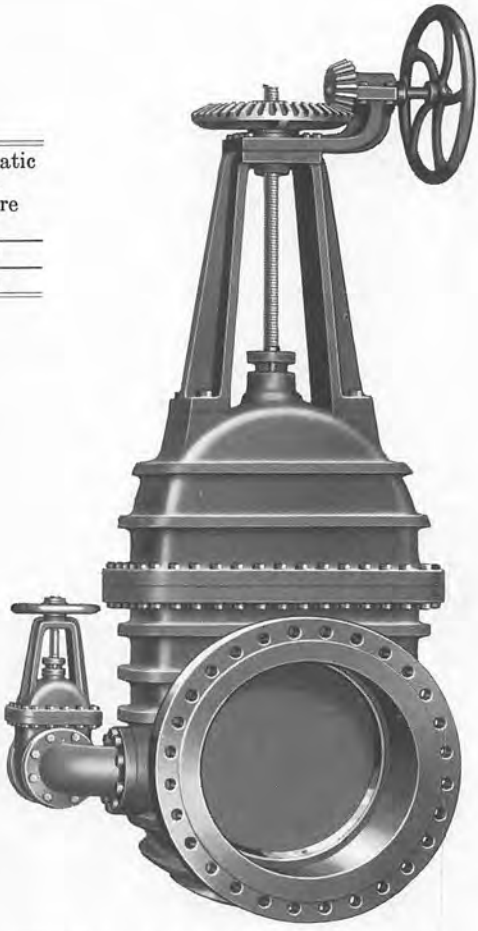
Square operating nuts or handwheels can be furnished as required. Direction of opening is indicated by an arrow cast on the operating nut skirt or on the rim of the handwheel.

List 16 valves can be furnished with gearing and/or by-passes; equipped for cylinder or motor operation; or fitted with any of the accessories on pages 178 thru 186.

Pressure Rating

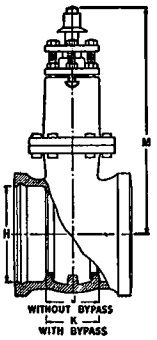
Valve Size Inches	Working Pressure psi	Hydrostatic Test Pressure psi
	Non-Shock, Cold Water	
2 thru 20	250	500
24 and 30	225	450

F-5300 Flanged Ends, Non-rising Stem, with **F-5585** Bevel Gears and **F-5625** By-pass

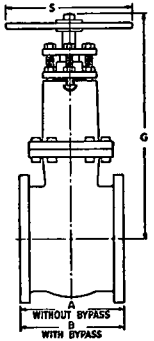


F-5305 Flanged Ends, Outside Screw and Yoke with **F-5595** Bevel Gears and **F-5630** By-pass

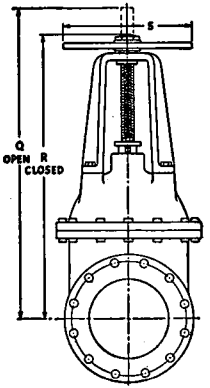
DIMENSIONS OF CLOW LIST 16 EXTRA HEAVY PRESSURE GATE VALVES



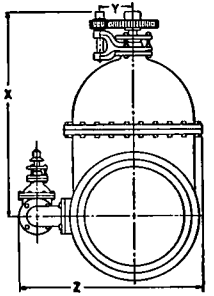
F-5290
Hub Ends, NRS



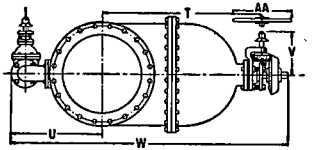
F-5300
Flanged Ends, NRS



F-5305
Flanged Ends, OS&Y



F-5290
Hub Ends, NRS, with Spur Gears, By-pass



F-5300
Flanged Ends, NRS, with Bevel Gears, By-pass

Dimensions—Inches

Size Inches	A	B	G	H	J	K	M	Q	R	S	T	U	V	W	X	Y	Z	AA	Turns to Open	Diam. of Stem
2	7½	...	11¾	...	...	...	11¾	14	11½	7¼	...	...	...	...	...	...	...	..	5	⅞
3	8¾	...	14	...	...	...	14	20¼	16¾	7¼	...	...	...	...	...	...	...	..	7	⅞
4	9⅝	...	17⅝	5¾	4¾	...	17⅝	24	19¾	10	...	...	...	...	...	...	...	..	15	1⅛
6	11½	...	20¾	8	5½	...	20¾	32½	25½	12	...	...	...	...	...	...	...	..	21	1¼
8	12½	...	25	10⅜16	6⅜	...	25	40½	31½	14	...	...	...	...	...	...	...	..	27	1⅜
10	14½	...	30¼	12⅜	6¾	...	30¼	47¼	36¼	18	25¼	...	13	...	33	8	...	10	33	1½
12	17	...	33	14⅝	7	...	33	58¾	45¾	18	27⅝	...	13	...	36⅛	8	...	18	39	1½
14	17½	26¼	38	16⅞	7	13¾	40½	67¾	52¾	22	33	21	13	58¼	41	8	31⅛	18	45	1⅞
16	19	27½	42¾	18¾	9⅛	13¾	42¾	74¾	57¾	26	36⅞	22	13	64	45	8	33⅜	18	52	2
18	21	27½	45½	21	9¼	14	49	82½	63½	26	39⅞	24	13	69¾	48	8	36⅜	18	58	2⅛
20	21½	28	47⅝	23¼	10¼	14½	51¾	90¼	69¼	30	43¾	24¾	13	74	51¾	8	40½	18	64	2¼
24	26	34	55	27⅝	10½	16	59⅝	105	79¾	30	52⅞	29½	17½	89	60⅝	10	46	18	51	2¾
30	30	34	69⅜	34⅞16	12½	20¼	71¼	128¼	97	36	64⅛	33½	23¾	105½	79⅛	13⅜	57½	22	63	3

Flanges are Extra Heavy faced and drilled to ANSI 250 pound template, unless otherwise instructed. Turns to open are for valves without gearing.

CLOW

CLOW UNDERWRITERS AND FACTORY MUTUAL GATE VALVES

4-inch thru 12-inch

Working Pressure
175 psi Non-Shock Cold Water

Hydrostatic Test Pressure
350 psi Shell

F-5702
Hub Ends
NRS

F-5707
Mechanical Joint
NRS

F-5705
Flanged Ends
NRS

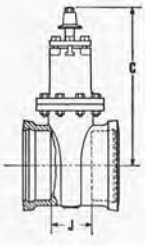
F-5733
Flanged Ends
Rising Stem, OS&Y

(Not Illustrated)

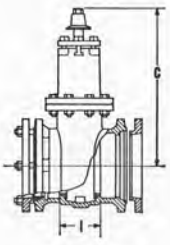
F-5715 Mechanical Joint Tapping Valve, NRS, and
F-5730, Flanged and Mechanical Joint Auxiliary Valve, NRS
Also
F-5737 Mechanical Joint, Rising Stem, O S & Y; and **F-5740**, Hub Ends, Rising Stem, O S & Y

Clow Underwriters and FM Valves are designed for use in industrial fire protection systems. They are constructed and tested to conform strictly to the specifications and test pressures of the Underwriters Laboratories, Inc., and Associated Factory Mutual Laboratories. Each valve is marked clearly with the letters UL & FM cast into the valve for instant identification. For Indicator Posts and Indicator Post Valves, see opposite page.

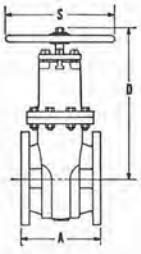
DIMENSIONS



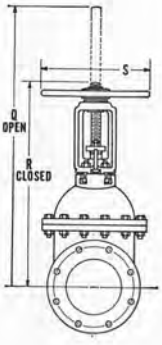
F-5702
Hub Ends
NRS



F-5707
Mechanical Joint
NRS



F-5705
Flanged Ends
NRS



F-5733
Flanged Ends
OS&Y

Dimensions—Without Gearing—Inches

Size of valve		4	6	8	10	12
A	Face to face of end flanges	9	10½	11½	13	14
C	Center of port to top of nut, O-Ring packing	14	18	22	25⅝	29⅛
D	Center of port to top of handwheel, O-Ring packing	14	18	22	25⅝	29⅛
I	Laying length, Mechanical Joint Valve	4¾	5¼	6½	6¾	7
J	Laying length, Hub End Valve	4¾	5½	6½	6¾	6¾
Q	Center of port to end of stem, OS&Y valve open	24	31½	40½	47¼	58⅜
R	Center of port to end of stem, OS&Y valve closed	19¾	24¾	31½	36¼	45⅜
S	Diameter of handwheel	10	12	14	18	18

Flanges are faced and drilled to ANSI B16.1 125 pound template, unless otherwise instructed.

UNDERWRITERS AND FACTORY MUTUAL INDICATOR POSTS AND VALVES

F-5750
Three-Way
Indicator Post

Indicator Post
Valve

CLOW THREE-WAY INDICATOR POST*

*Patented

Tells 3 Ways if Valve is Open or Shut

Clow Indicator Posts and Valves are used in industrial fire protection systems, or other installations where it is necessary to tell at a glance if the valve is open or shut.

The F-5750 Indicator Post indicates valve position in three ways: (1) the raised cap changes post profile to indicate "open"—and can be seen at a distance; (2) conventional target plate window reads "open" or "shut"; and (3) a yellow color band is exposed as the cap is raised.

Posts cover two separate ranges: one for 4-, 6- & 8-inch valves; another for 10-, 12- & 14-inch valves. Posts are not interchangeable between these two size ranges.

Operating nuts 1¼-inch square are furnished unless otherwise specified.

How to Order Indicator Posts

Specify (1) quantity (2) size (A, B, C, D, or E from table below) and diameter of valve on which it will be used. Individual posts will fit either 4″, 6″ or 8″ valves, or 10″, 12″ or 14″ valves, and are not interchangeable. Valve sizes which post will fit are cast onto the top of the operating nut, for identification. Posts are furnished red, with yellow exposed color band, and extension stems are furnished to deepest trench depth for post size, and must be cut to suit individual installation requirements.

ADJUSTABLE TRENCH DEPTHS

Valve Size	Trench Depth in Inches									
	Size "A"		Size "B"		Size "C"		Size "D"		Size "E"	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
4	30	40	36	46	43	62	50	74	62	86
6	34	44	40	50	48	66	55	78	67	90
8	38	48	44	54	52	70	59	82	71	94
10	42	52	49	59	56	75	63	87	75	99
12	47	57	54	64	61	80	68	92	80	104
14	53	63	60	70	67	85	74	97	86	109

Other Trench depths available on special order.

UL/FM INDICATOR POST VALVES

Indicator post valves of the same construction as other UL/FM valves except they are fitted with a 12-inch diameter bonnet flange onto which the Indicator Post bolts. When ordering, use the Figure Numbers below.

F-5720 Hub Ends, NRS
F-5722 Flanged Ends, NRS
F-5725 Mechanical Joint, NRS
F-5730 Flanged and Mechanical Joint, NRS

CLOW UNDERWRITERS AND FACTORY MUTUAL HORIZONTAL SWING CHECK VALVES

175 psi Non-Shock Cold Water Working Pressure

Mechanical Joint
F-5346-B
(Bronze-faced Gate)
F-5346-R
(Rubber-faced Gate)

Flanged Ends
F-5347-B
(Bronze-faced Gate)
F-5347-R
(Rubber-faced Gate)

The Clow Horizontal Swing Check Valves are listed and approved by the Underwriters Laboratories, Inc., and Associated Factory Mutual Laboratories. They are constructed and tested in strictest conformity with the provisions of this authority for use in industrial fire protection systems. For identification they are marked prominently on the cover with the letters UL & FM.

Valves are available with flanged or mechanical joint ends, as illustrated, and to dimensions shown below.

Dimensions in inches

Valve Size	4	6	8	10	12
Face to face of flanges	13	16	18	22	26
Diameter of end flanges	9	11	13½	16	19
Thickness of end flanges	15/16	1	1⅛	1 3/16	1¼
Diameter of bolt circle	7½	9½	11¾	14¼	17
Number and diameter of bolts	8-⅝	8-¾	8-¾	12-⅞	12-⅞
Centerline of port to top of valve	7 13/16	9¾	11½	14 1/16	15⅜
Outside diameter & MJ flange	9⅜	11 5/16	13⅝	15 13/16	18 1/16
End to end of MJ valve	14¼	17¾	20¾	24	27

UNDERWRITERS AND FACTORY MUTUAL FIRE HYDRANTS

F-5349 Eddy
Underwriters and
FM Hydrant
(Ground Line Flange)

5¼-INCH VALVE OPENING

The Eddy Underwriters and FM Fire Hydrant with 5¼′ valve opening is listed and approved by the Underwriters Laboratories, Inc., and Associated Factory Mutual Laboratories. The general description, dimensions, and operation of this hydrant is shown on pages 130 thru 139. For visual identification the Hydrant is marked prominently on the cover with the letters UL & FM.

F-5351 Eddy
Underwriters and
FM Hydrant
(Break Flange Model)

CLOW AWWA BUTTERFLY VALVE

Meets or exceeds all requirements of AWWA Specification C504, Class 150B

FOR THROTTLING OR BUBBLE-TIGHT SHUT-OFF SERVICE

F-5365 Butterfly Valve

Pressure Rating

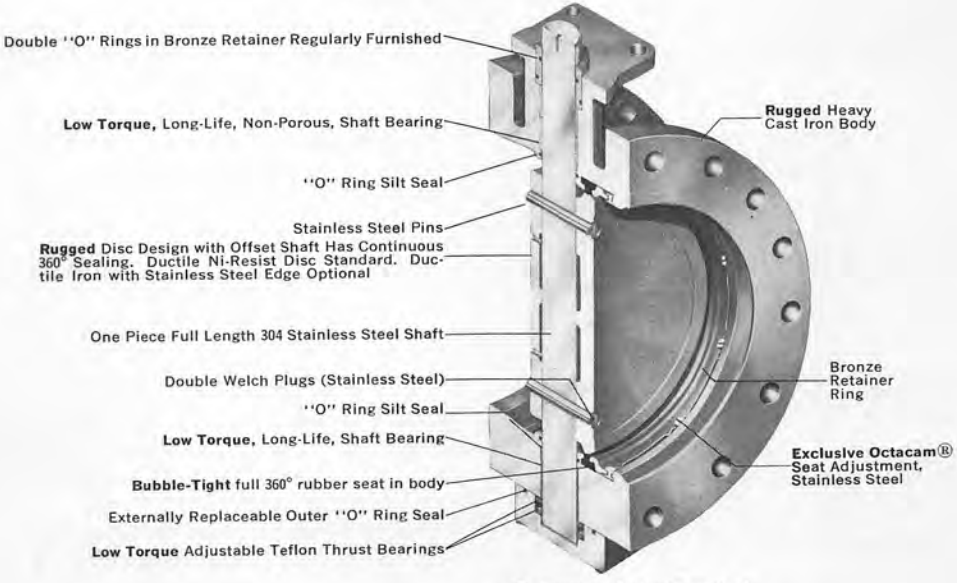
Valve Size Inches	Working Pressure psi	Bubble-Tight Test, psi	Hydrostatic Test, psi
14–48	150	150	300

Clow Butterfly Valves are designed to provide the maximum in smooth flow, tight closure and easy operation. Independent laboratory tests at velocities in excess of 50 feet per second have proved performance and reliability under the most severe conditions.

Valves are constructed with offset design and continous 360° rubber seat in the body as well as one piece full-thru shaft, and patented Octacam® seat adjustment. Low friction shaft bearings, Teflon adjustable thrust bearings, and operator with high load capacity bearings assure easy operation plus long life.

Butterfly valves can be furnished with a choice of operating devices, packings and joint end types in diameters 14″ thru 48″. See details of construction below, and ordering information on page 166 when making inquiries or requesting quotations. For information on butterfly valve operators, see page 167.

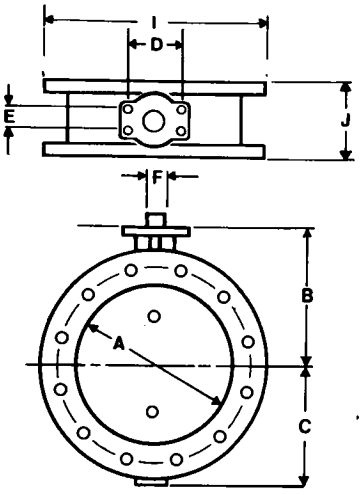
CONSTRUCTION FEATURES



Cutaway view of typical Butterfly valve.

CLOW AWWA BUTTERFLY VALVES

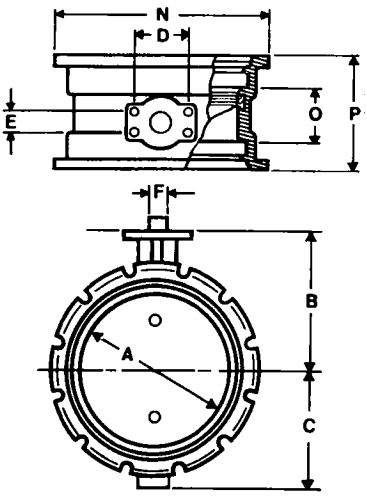
DIMENSIONS



Flanged Ends

For Dimensions of Operators see Page 167

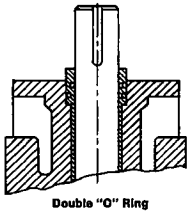
Flanges are Faced and Drilled ANSI B16.1 125 pound Standard



Mechanical Joint Ends

Dimensions—Inches

Nominal Pipe Size	A	B	C	D	E	F	I	J	N	O	P
14	13	12 5/8	14	6	2 1/2	2	21	8	20 1/4	5 7/8	12 7/8
16	15 1/16	13 7/8	15 1/8	6	6	2	23 1/2	8	22 1/2	5 7/8	12 7/8
18	17 1/8	14 5/8	16 3/8	6	6	2 1/4	25	8	24 3/4	6	13
20	19 1/8	15 7/8	17 3/4	6	6	2 1/2	27 1/2	8	27	6 1/4	13 1/4
24	23 1/4	18 1/8	20	6	6	3	32	8	31 1/2	6 1/2	13 1/2
30	29 1/8	23 3/8	23 13/16	8 1/2	8 1/2	3 5/8	38 3/4	12	39 1/8	9 1/2	17 1/2
36	35 1/8	27	27 3/4	8 1/2	8 1/2	4 3/8	46	12	46	10 3/8	18 3/8
42	41 1/16	30 1/2	31 1/32	8 1/2	8 1/2	5	53	12	53 1/8	11 1/4	19 1/4
48	47 1/16	33 3/4	34 23/32	8 1/2	8 1/2	5 5/8	59 1/2	15	60	12 1/2	20 1/2



Double "O" Ring

Butterfly Valve Packing

Clow Butterfly Valves are regularly furnished with double O-Ring packing. When specified, Pull-Down Gland packing or Split "V" packing can also be furnished.

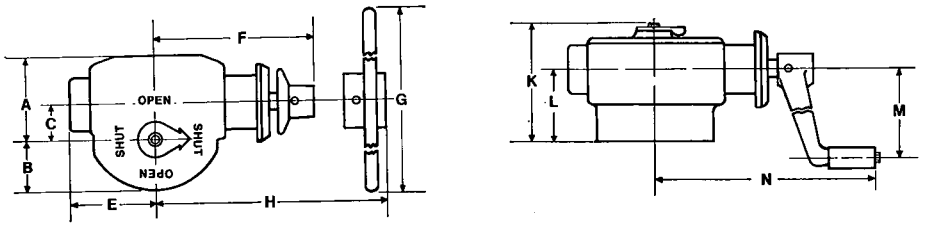
Ordering Information

When specifying or requesting quotations, please include the following information.

1. **Quantity.**
2. **Size.**
3. **End Type.**
4. **Direction of Opening** (Left or Right).
5. **Working Pressure:** AWWA Class 150 B, or less.
6. **Type of Operator:** for buried service with operating nut; above ground service with crank, handwheel or chainwheel (with position indicator) cylinder or motor operator, etc.
7. **Type of disc:** ductile ni-resist standard; or ductile iron with stainless steel edge, optional.
8. **Packing:** O-Ring standard. Pull-Down Gland or Split "V" packing optional.

CLOW AWWA BUTTERFLY VALVE OPERATORS

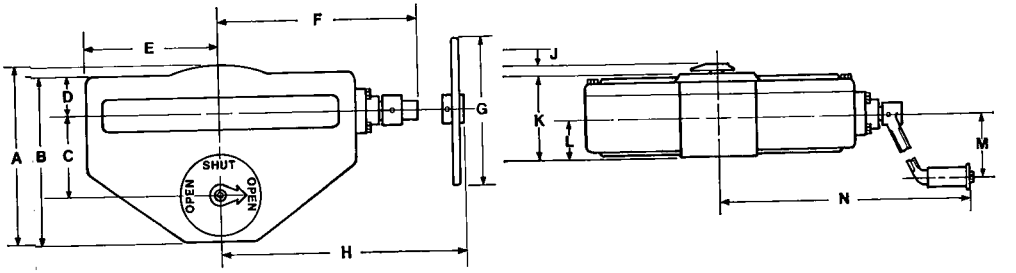
Manual Operator For 14" Valves



Dimensions—Inches

For Valve Size Inches	A	B	C	E	F	G	H	K	L	M	N
14	5¼	3 1/16	2⅛	5 7/16	9½	18	9⅞	7⅞	4½	10	15½

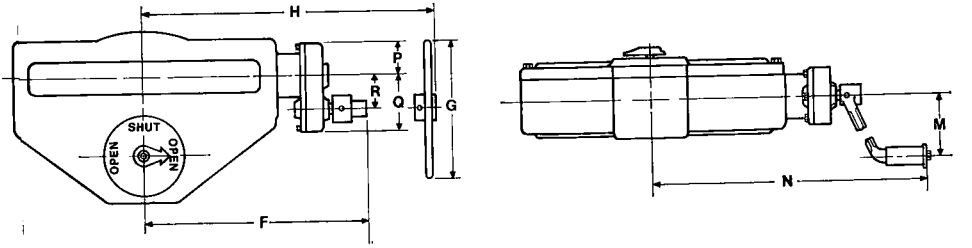
Manual Operator For 16" thru 48" Valves



Dimensions—Inches

For Valve Size Inches	A	B	C	D	E	F	G	H	J	K	L	M	N
16 thru 24	13⅛	12⅜	5⅜	3⅛	11	16⅜	18	16¾	1	8⅞	4	15	26⅜
30 thru 48	21	20	9¾	4¾	16¼	24⅞	18	22½	1	9⅞	4 13/16	15	32

Operator with Spur Gear Attachment For 16" thru 48" Valves



Dimensions—Inches

For Valve Size Inches	F	G	H	M	N	P	Q	R
16 thru 24	19⅝	18	20	15	29⅝	3⅝	6⅛	3¾
30 thru 48	28 1/16	18	25 11/16	15	35 3/16	3⅝	6⅛	3¾

CLOW HORIZONTAL SWING CHECK VALVES

IRON BODY, BRONZE MOUNTED

2″ THRU 24″

4-inch thru 12-inch Shown Below
(See Page 170 for other sizes and details)

DESCRIPTION

Clow horizontal swing check valves are used whenever fluid flow must be in only one direction and where any reverse flow must be prevented. These valves are suitable for installation in pumping stations, filtration plants, sewage plants, fire protection systems, industrial plants, and other installations where flow must be regulated. Clow check valves can be used in either horizontal or vertical installations and are designed with ample safety factor.

DESIGN AND CONSTRUCTION

End Types Available

Flanged	2″–24″
Mechanical Joint	4″–12″
Screwed	2″– 4″

Valves are regularly manufactured iron body bronze mounted and can be supplied plain, or with optional weight and lever or spring and lever. The optional weight or spring can assist gates in closing; allow a predetermined head to accumulate against the gate before it is opened; or to assist the gate in opening.

When required, special options are available on the Clow check valve including leather or rubber faced gates. Aluminum gates can be furnished for air service in certain sizes.

F-5385 Mechanical Joint
4 thru 12-inch

Pressure Rating

Valve Size Inches	Non-Shock Cold Water	Hydrostatic Test Pressure psi
4 thru 12	175	350

Not illustrated

F-5386—Mechanical Joint, Outside Spring and Lever

F-5387—Mechanical Joint, Outside Lever and Weight

F-5380 Flanged Ends
4 thru 12-inch

F-5381 Flanged Ends, with Outside Spring and Lever
4 thru 12-inch

F-5382 Flanged Ends, with Outside Lever and Weight
4 thru 12-inch

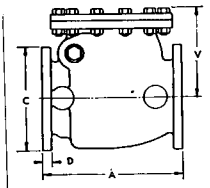
ORDERING INFORMATION

Please furnish all the information requested below:

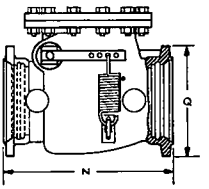
1. **Quantity.**
2. **Size.**
3. **Type:** Whether plain, outside lever and weight, or outside lever and spring.
4. **End Types:** Whether flanged, Mechanical Joint 102 screwed ends.
5. **Special Features:** Leather or rubber facings, aluminum or bronze gates, etc.

CLOW HORIZONTAL SWING CHECK VALVES

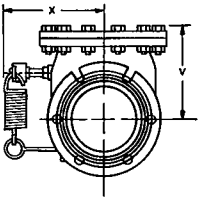
4" thru 12"
DIMENSIONS

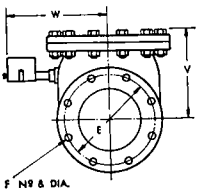


F-5380 Flanged Ends



F-5386 Mechanical Joint, showing typical dimensions of Outside Spring and Lever





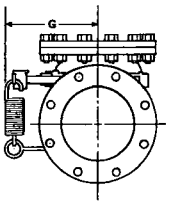
F-5382 Flanged Ends, showing Outside Lever and Weight

Dimensions—Inches

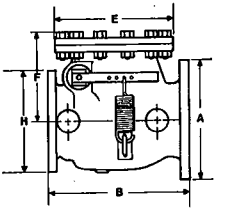
Valve Size in Inches		4	6	8	10	12
A	Face to face of flanges	13	16	18	22	26
C	Diameter of end flanges	9	11	13½	16	19
D	Thickness of end flanges	15/16	1	1⅛	1 3/16	1¼
E	Diameter of bolt circle	7½	9½	11¾	14¼	17
F	Number and diameter of bolts	8-⅝	8-¾	8-¾	12-⅞	12-⅞
N	Face to face of mechanical joints	14¼	17¾	20¾	24	27
Q	Outside diameter of mechanical joint end	9⅜	11 5/16	13⅝	15 13/16	18 1/16
V	Center line of port to top of cover	7 13/16	9¾	11½	14 1/16	15⅜
W	Center line of valve to end of hinge pin of valve with weight and lever	8	10⅜	11¾	13½	14⅝
X	Center line of valve to outside of spring	7½	9¾	11	12⅝	14⅛

Flanges faced and drilled to ANSI 125 pound template, unless otherwise instructed.

INCREASING HORIZONTAL SWING CHECK VALVES



F-5380 Flanged Ends, showing Outside Spring and Lever



F-5386 Side View Flanged Ends, showing Outside Spring and Lever

Dimensions—Inches

Valve Size Inches	A	B	E	F	G	H
4x6	11	13½	10½	7 13/16	7½	9
4x8	13½	15	10½	7 13/16	7½	9
6x8	13½	16¼	13⅛	9¾	9¾	11

CHECK VALVE ORDERING INFORMATION

Please furnish all the information requested below:

1. **Quantity.**
2. **Size.**
3. **Type:** Whether plain, outside lever and weight, or outside lever and spring.
4. **End Types:** Whether flanged or Mechanical Joint.
5. **Special Features:** Leather or rubber facings, aluminum or bronze gates, etc.

CLOW HORIZONTAL SWING CHECK VALVES

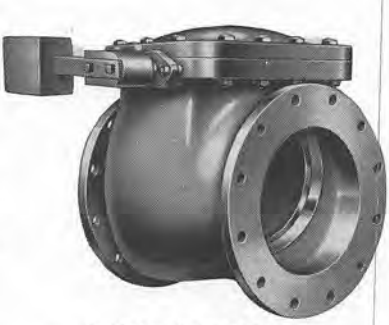
For Sizes Listed Below

Pressure Rating psi

Valve Size Inches	Non Shock Cold Water	Hydrostatic Test Pressure, psi
2 thru 5	175	350
14–24	175	350

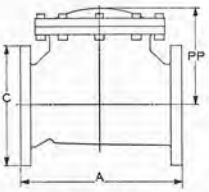
F-5335 Flanged Ends
Plain Type

F-5340 Flanged Ends
Outside Spring and Lever

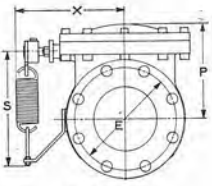


F-5345 Flanged Ends
Outside Weight and Lever

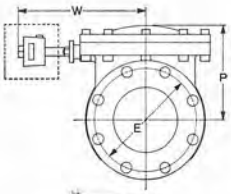
DIMENSIONS
(For Sizes Indicated in Table)



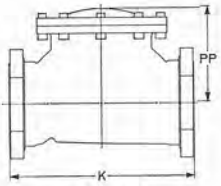
F-5335
Flanged Ends



F-5340
Outside Spring
and Lever



F-5345
Outside Weight
and Lever



F-5342
Threaded Ends

Dimensions—Inches

Dimensions	2	2½	3	4	5	6*	14	16	18	20	24
A	8	9½	10	. . .	14	15	28	26	26	28	33
C	6	7	7½	. . .	10	11	21	23½	25	27½	32
E	4¾	5½	6	. . .	8½	9½	18¾	21¼	22¾	25	29½
K	7½	8½	10	14	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
P	4¼	4¾	5¼	. . .	9	8½	16¼	18½	19½	21¼	25
PP	3⅝	4 3/16	4¾	7½	8½	8⅞	16⅛	18	19	20¾	24½
S	6¾	7	7½	. . .	10¾	11¼	20¾	23⅜	24½	26½	31¼
U	5½	6¾	7	. . .	10¼	11¾	22½	20½	21	23¼	27½
X	5	6¼	6	. . .	10	11¼	17½	20	20¾	23	25½

* Optional shorter face to face (15″) valve than that (16″) shown on page 169.

Flanges faced and drilled to ANSI 125 pound template, unless otherwise instructed.

CLOW SILENT CHECK VALVES

(formerly Williams-Hager)

Control Surge Pressures and Prevent Water Hammer

F-5390 Globe Type
Silent Check Valve
(Class 125 thru 600)

F-5394 Flat Type
Silent Check Valve
(Class 125 thru 2,500)

F-5397 Compact
Silent Check Valve
(Class 125 and 250)

Clow Silent Check Valves

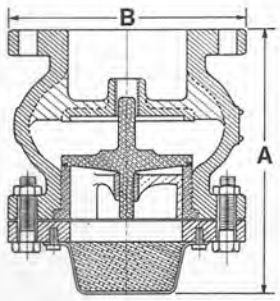
Silent check valves are installed in the discharge side of pumps to provide noiseless operation and prevent water hammer. By closing silently *the instant* flow reaches zero and *before* flow reversal takes place, these valves control dangerous surge pressures and eliminate resulting water hammer.

Clow valves can be furnished for pressures from vacuum to 2,500 psi. ANSI B16.1 Classes 125 and 250 valves have high tensile cast iron body and bronze trim. Higher pressure valves (ANSI Classes 300 thru 2,500) have steel bodies with stainless trim. Other materials can be provided for special specified service.

Dimensions*—Inches

Valve Size	Face to face of flanges			Maximum valve O.D.		
	F-5390	F-5394	F-5397	F-5390	F-5394	F-5397
1	....	2½	...	....	4¼	....
1¼	....	2½	...	....	4⅝	....
1½	....	2½	...	....	5	....
2	....	3	2⅝	....	6	4¼
2½	....	3	2⅞	....	7	5
3	7½	3	3⅛	7½	7½	5¾
4	8½	4¼	4	9	9	7
5	9½	4¼	4⅝	10	10	8⅜
6	11	5	5½	11	11	9¾
8	11¼	6½	6½	14¾	13½	14⅜
10	12½	...	...	17¼	....	....
12	18	...	...	19	....	....
14	21	...	....	22⅜	....	....
16	22½	...	...	25⅛	....	....
18	24	...	...	30¼	....	....
20	27	...	...	34¼	....	....
24	32	...	...	38½	....	....

* Dimensions shown are for Class 125 standard. Higher classes may increase slightly.



F-5398 Foot Valve

CLOW FOOT VALVES

Foot valves are used on the end of pump suction lines to maintain the prime. A bronze screen prevents foreign matter from being drawn into the pump.

Valves are constructed with cast iron bodies, fitted with bronze piston and seat ring. They are similar in construction to the F-5390 Silent Check valves, except they are not fitted with spring, and incorporate O-Rings in the piston. Valves can be furnished with ANSI B16.1 125 pound or 250 pound flanges and drilling.

Dimensions—Inches

Valve Size†	3	4	5	6	8	10	12
Dimension A	11¼	12¼	13¼	14¾	15	16¼	21¾
Dimension B	7½	9	10	11	13½	16	19

† Larger diameter valves available on application.

CLOW ECCENTRIC PLUG VALVES

Rated for 175 psi Working Pressure

F-5410
Flanged Eccentric
Plug Valve
4″ thru 12″

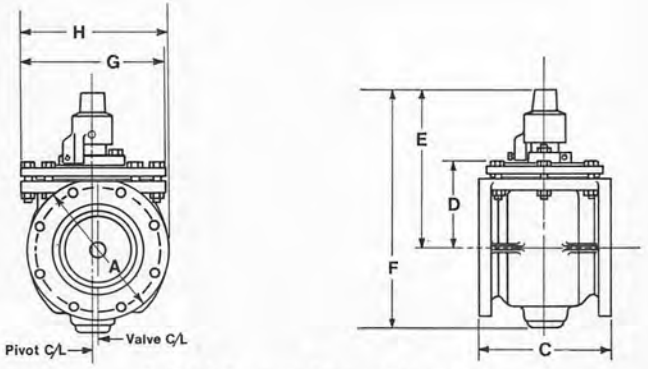
Pressure Rating

Valve Size Inches	Working Pressure psi	Hydrostatic Test Pressure psi
	Non-Shock Cold Water	
4–12	175	350

Eccentric Plug Valves are designed for use in water and sewage treatment plants for drip-tight shut-off or throttling service, and are rated for 175 psi working pressure. Clow Plug valves offer low torque operation, and all valves have port openings equal to 100% of the adjacent pipe area, thereby providing maximum passage of solids.

The cast iron valve plug is covered with Buna-N rubber providing corrosion- and wear-resistance. Seats are regularly furnished of bronze, but stainless steel or nickel-coated stainless steel can also be furnished. These seats are adjustable and replaceable.

4″ thru 12″ valves are available in flanged ends to ANSI B16.1 125 pound standard, or in mechanical joint ends to ANSI A21.11 specifications. A 2″ operating nut is furnished as standard. Lever, traveling nut or cylinder operation is also available when specified.



F-5410 Flanged Eccentric Plug Valve

Dimensions—Inches

Valve Size	A	C	D	E	F	G	H
4	9	9	5 7/8	11 1/4	16 1/2	7	8 1/4
6	11	10 1/2	6 15/16	12 3/8	18 3/4	11 3/8	11 1/2
8	13 1/2	11 1/2	7 15/16	13 5/16	20 5/8	13 3/8	13 7/8
10	16	13	10 3/16	15 1/2	24 7/8	14	14 1/2
12	19	14	11 1/2	16 1/16	27 1/2	15 3/8	17 13/16

Flanges are faced and drilled to ANSI B16.1 125 pound standard.

FLAP VALVES

IRON BODY, BRONZE MOUNTED
4" THRU 30"

F-3012
Flanged End

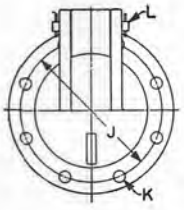
F-3014
Spigot End

F-3016
Hub End

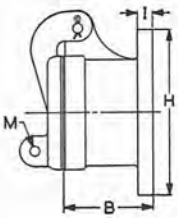
Clow Flap Valves are used for end closure of outfall lines, or in manholes, to prevent entrance of backwater. They swing open under direct pressure to release the outfall fluid and close tightly when the direct pressure is relieved. Back pressure serves to hold the valve tightly against its seat.

Clow Flap Valves are used in filtration and sewage disposal plants and in various industrial installations, and are regularly furnished fully bronze mounted, with bronze hinge pin, flap ring, and seat ring. Flap valves are available in sizes 4 thru 30 inches.

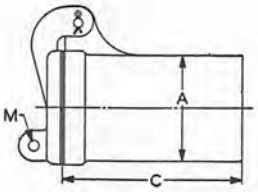
DIMENSIONS



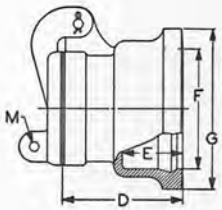
End View



F-3012
Flanged End



F-3014
Spigot End



F-3016
Hub End

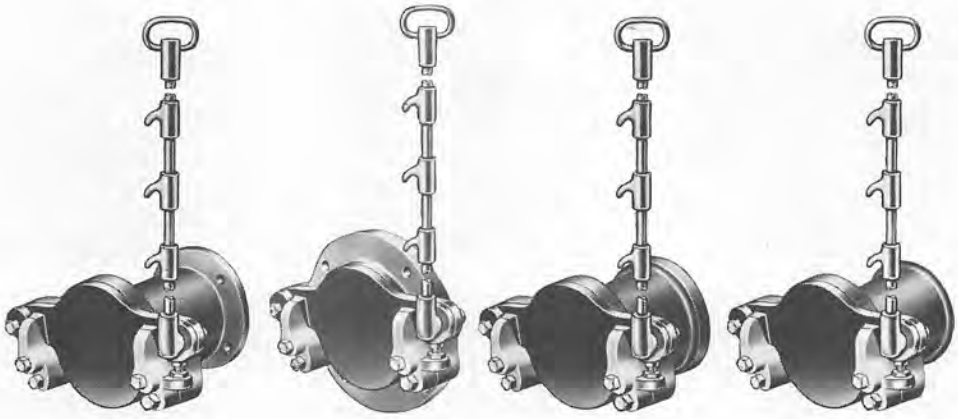
Dimensions—Inches

	Valve Size . . . . . Inches	4	6	8	10	12	14	16	18	20	24	30
A	Outside diameter of spigot	4 7/8	7	9	11 1/4	13 3/8	15 3/8	17 1/2	19 1/2	21 1/2	25 3/4	31 3/4
B	Face of seat to face of flange	4	6	8	8	8	10	10	10	10	10	10
C	Face of seat to end of spigot	12	12	12	12	12	12	12	12	12	12	11
D	Face of seat to end of hub . .	8	8	8	8	8	10	12	12	12	15	. . .
E	Depth of hub	4	4	4	4	4	4	4	4	4	4	. . .
F	Inside diameter of hub	5 3/4	7 7/8	10	12 1/8	14 1/4	16 3/8	18 1/2	20 1/2	23	27 1/4	. . .
G	Outside diameter of hub . . .	8	10 3/4	12 7/8	15	17 1/2	19 1/2	21 3/4	23 3/4	27 1/4	31 1/8	. . .
H	Diameter of end flange	9	11	13 1/2	16	19	21	23 1/2	25	27 1/2	32	38 3/4
I	Thickness of end flange	3/4	7/8	1	1	1 1/8	1 1/4	1 1/4	1 1/4	1 3/8	1 1/2	1 1/2
J	Diameter of bolt circle	7 1/2	9 1/2	11 3/4	14 1/4	17	18 3/4	21 1/4	22 3/4	25	29 1/2	36
K	Number and size of bolts . . .	8-5/8	8-3/4	8-3/4	12-7/8	12-7/8	12-1	16-1	16-1 1/8	20-1 1/8	20-1 1/4	28-1 1/4
L	Diameter of flap pin (bronze)	5/8	5/8	5/8	3/4	3/4	7/8	7/8	7/8	1	1	1 1/4
M	Diameter of flap lug hole . .	5/8	5/8	5/8	3/4	3/4	7/8	7/8	7/8	1	1	1

Flanges are faced and drilled to ANSI 125 pound template, unless otherwise instructed.

SHEAR GATES

IRON BODY, BRONZE MOUNTED
4″ THRU 30″



F-3000
Flanged End Frame

F-3002
Standard Frame

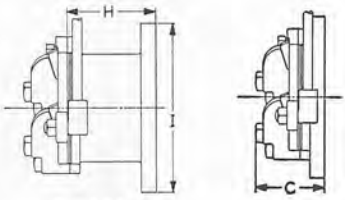
F-3004
Hub End Frame

F-3008
Spigot End Frame

Clow Shear Gates are designed for use in both water and sewage plants for filling or emptying tanks, for low pressure sludge discharge lines, and similar applications. They are recommended for use in lines of low seating pressure only, and can be furnished in any of the frame types shown above.

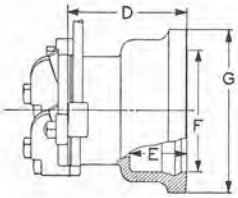
The wedges that seat the gate are bolted on to permit replacement without the expense of a new frame if the wedges should become worn. Standard length of lifting handles is 2 feet for all size gates. Extended handles can be furnished. State length required when ordering.

DIMENSIONS

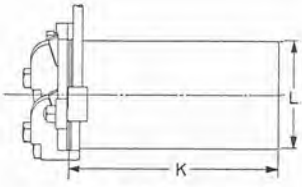


F-3000
Flanged End Frame

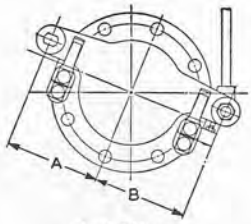
F-3002
Standard Frame



F-3004
Hub End Frame



F-3008
Spigot End Frame



End View of Shear Gates

Dimensions—Inches

Valve Size...In.	4	6	8	10	12	14	16	18	20	24	30
A	5	6 1/4	7 5/8	9	10 1/4	11 3/8	14	14 5/8	16	18	22
B	5	6 1/4	7 5/8	9	10 1/4	11 1/2	14	15	16 1/2	18 1/2	22
C	4 1/2	4 3/4	4 3/4	4 7/8	5	5 7/8	5 1/2	5 3/4	6 1/4	7 5/8	9 1/2
D	8	8	8	8	8	8 1/2	8 1/4	8 1/4	12 5/8	12 5/8	...
E	4	4	4	4	4	4	4	4	4	4	...
F	5 3/4	7 7/8	10	12 1/8	14 1/4	16 3/8	18 1/2	20 1/2	23	27 1/4	...
G	8	10 3/4	12 7/8	15	17 1/2	19 1/2	21 3/4	23 3/4	27 1/4	31 1/8	...
H	4	6	6	8	8	8 1/4	8 1/4	8 1/4	9 7/8	10 5/8	13 1/4
I	9	11	13 1/2	16	19	21	23 1/2	25	27 1/2	32	38 3/4
K	12	12	12	12	12	14 1/2	14 1/4	14 1/4	14 7/8	15 1/8	13 1/4
L	4 7/8	7	9	11 1/4	13 3/8	15 3/8	17 3/8	19 1/2	21 1/2	26	31 1/2

Flanges are faced and drilled to ANSI 125 pound template, unless otherwise instructed.

SLUICE GATES

MANUAL, HYDRAULIC, OR ELECTRIC MOTOR OPERATION

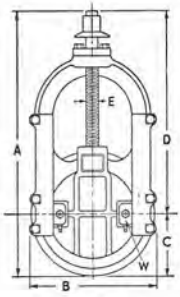
Clow Sluice Gates are cast iron, bronze mounted, and have solid bronze adjustable wedges. They are available in sizes 4-inch thru 14-inch, with circular opening, and can be installed in lines having both seating and unseating pressure. Sluice gates are suitable for low head applications only.

These sluice gates are available with non-rising stem or sliding stem with flanged end connection.

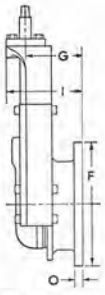
Complete specifications should accompany orders or requests for quotation. Unless otherwise specified, flanged connections will be faced and drilled to the ANSI 125 pound template.

F-5350
Flanged, Non-rising stem

DIMENSIONS



Front View



Side View

F-5350 Flanged, NRS

Dimensions in Inches

Valve Size Inches	A	B	C	D	E	F	G	I	O	W
4	18 7/8	8 1/4	4 1/2	14 3/8	1	9	4 3/8	6 3/16	3/4	Number of Side Wedges-2
6	24	11 1/4	5 1/2	18 1/2	1 1/8	11	5 1/2	6 1/4	7/8	
8	29	13 3/4	6 3/4	22 1/4	1 1/4	13 1/2	6	8 1/8	7/8	
10	32 7/8	15 1/2	8	24 7/8	1 3/8	16	6 1/4	8 7/16	1	
12	38 1/4	18 1/2	9 1/2	28 3/4	1 1/2	19	6 3/8	8 7/8	1	
14	43	20 1/2	10 1/2	32 1/2	1 1/2	21	6 7/8	9 3/8	1	

ORDERING INFORMATION

1. **Size of openings.**
2. **State** whether gate connects directly to pipe, wall casting, or masonry. Anchor or connecting bolts are not furnished unless specified.
3. **Give maximum head** of water in feet on center of opening, and whether direct or back pressure. Direct, or seating pressure forces the valve to its seat. Back, or unseating pressure forces the valve away from its seat.
4. **Give distance** from center of gate to base of floor stand or cylinder. In the case of gates with extended stems, give distance from center of gate opening to top of extension stem.
5. **Method of operation,** whether manual, hydraulic, or electrical.
6. **Type and material of stem.** State whether non-rising or sliding, and whether stem shall be of steel, bronze, etc.
7. **Direction of opening.** Unless otherwise specified, sluice gates are opened by turning stem to left (counterclockwise).

MUD VALVES

IRON BODY BRONZE MOUNTED 4" thru 24"

F-3075 Flanged Ends
Non-rising Stem

F-3085 Flanged Ends
Rising Stem

F-3088 Spigot Ends
Rising Stem

F-3080 Spigot Ends, Non-rising Stem also available (not illustrated)

Can also be Furnished with Sliding Stem (not illustrated)

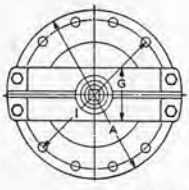
Clow Mud Valves are designed for settling basin drain lines, sump blow-offs, swimming pool drains, waterworks, sewage and filtration plants, irrigation systems, and industrial installations. They are recommended for use in lines of low seating or unseating pressures only.

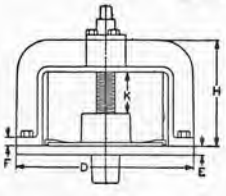
Clow Mud Valves are either rising stem, non-rising stem or sliding stem type. Bodies are cast iron. The stem, stem nut, disc ring, and seat ring are bronze. Bolts and nuts are rust-proofed steel.

Clow Mud Valves can be furnished with handwheel or operating nut as required. They can also be furnished with extension stem, with plain or indicating floor stand, and can be furnished for cylinder operation if required.

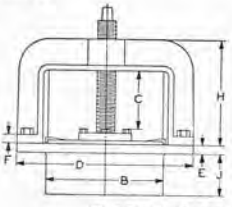
When ordering extension stem, state length, and give distance from bottom face of flange to top of handwheel or nut, or to base of floor-stand. Spigot end valves are available in any desired length up through 12 inches.

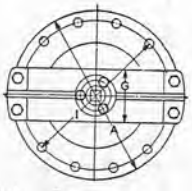
DIMENSIONS





F-3075, F-3080 Non-rising Stem





F-3085, F-3088 Rising Stem

Dimensions—Inches

Valve Size.....Inches		4	6	8	10	12	14	16	18	20	24
A	Diameter of body flange.....	9	11	13½	16	19	21	23½	25	27½	32
B	Outside diameter of spigot.....	4⅞	7	9	11¼	13⅜	15¼	17⅝	19¾	21¾	25¾
C	Travel of gate (rising stem).....	1⅞	2½	4½	4¼	4¾	6⅝	7	8 11/16	8⅝	10⅜
D	Overall width at yoke.....	10	12¼	14½	17	19¾	23	25¾	29	29½	37
E	Thickness of body flange.....	⅞	⅞	⅞	⅞	1	1¼	1¼	1¼	1½	1⅞
F	Thickness of yoke flange.....	⅝	¾	⅞	⅞	1	1¼	1⅜	1½	1⅜	1⅝
G	Width of yoke.....	2¼	2½	3	3½	4	6	6	6½	7	7
H	Height of yoke.....	5⅝	6	8	8	9	11⅛	14	15½	16⅞	20
I	Diameter of bolt circle.....	7½	9½	11¾	14¼	17	18¾	21¼	22¾	25	29½
J	Length of spigot.....	12	12	12	12	12	12	12	12	12	12
K	Travel of gate (non-rising stem)..	1⅞	2½	4½	4¼	4¾	5⅛	5	5¼	6½	10

CAST IRON PRESSURE RELIEF VALVES

F-1492
Floor Type
Pressure Relief Valve

4″ Diameter only

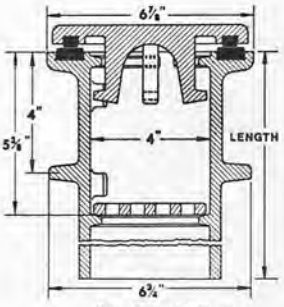
FLOOR TYPE

Must be installed in Vertical Position

Body Lengths

Minimum is 6 inches
Maximum is 24 inches
Specify length when ordering

Dimensions shown on line illustration are "fixed" dimensions



Sectional View

Standard body length.....Inches	6	8	10	12	14	16	18	20	22	24
Weight, complete.....Pounds	25	27	29	32	35	38	41	44	47	50

Pressure relief valves are for placing in the bottom of concrete tanks to keep empty tanks from floating when there is an excess of ground-water underneath and around them. When this condition exists, the outside water pressure will raise the cover of the valve and allow the water to enter the tank to equalize pressures inside and outside of tank and, thus, prevent the tank from floating.

The valves can be furnished in any body length from 6 inches thru 24 inches in increments of one inch. Standard body lengths are listed above.

The Clow Pressure Relief Valves are so constructed that neither the cover or strainer can become separated from the body of the valve, due to ground-water pressure around the tank. However, when necessary, both may be easily removed by turning them to right or left to free them from the locking lugs cast on inside of body. Lead is poured, peened, and machined into grooves on underside of cover and top of body, forming a non-corroding lead to lead contact when cover is in closed position. The cover weighs approximately 6 pounds and starts to open at a head of approximately 9″ of water.

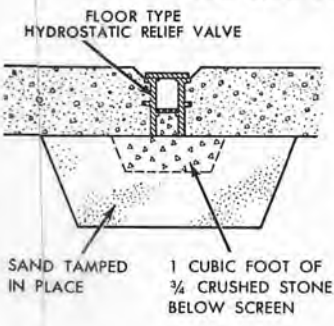
F-1494
Wall Type
Pressure Relief Valve

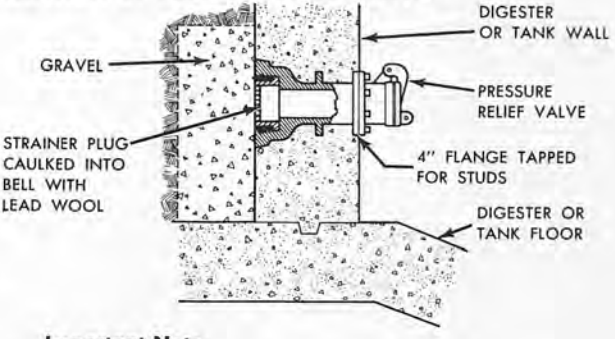
WALL TYPE

4″ Diameter Only

The Wall Type Pressure Relief Valve is for side wall installation in tanks and digesters. The valve has a 4″ flanged end for connection to a 4″ flanged wall pipe. Iron body, bronze mounted, it is equipped with a soft, composition rubber seat, so that if particles of grit lodge on it, the head of liquid in the tank will still force the flap closed tightly, and prevent seepage of liquid out into the ground. The seating material has been chosen for its resistance to the deteriorating effect of the sewage.

SUGGESTED INSTALLATION OF PRESSURE RELIEF VALVES





Important Note

In order for the wall-type valve to operate correctly, it must be installed so that the bolt holes straddle the center line. Unless specifically ordered, the Wall Pipe and Strainer Plug are not furnished with the Wall-Type Relief Valve.

See pages 114 and 116 for Strainer Plugs and Wall Pipe.

BY-PASS VALVES

for AWWA, List 12 and List 16 Valves

F-5625 By-pass
Non-rising Stem

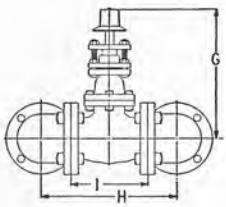
F-5630 By-pass
Rising Stem, OS&Y

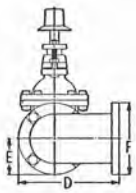
By-pass valves fitted to gate valves make valve operation easier by equalizing the pressure on both sides of the gates. They may be rising stem or non-rising stem type, and are normally the same type as the main valve to which they are fitted, and have the same operating device, handwheel or operating nut, as the main valve.

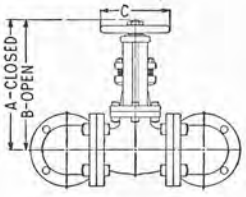
For AWWA and List 16 valves, by-pass valves are furnished in the sizes recommended by the American Water Works Association, as follows:

F-5625 and F-5630

For size of valve.....Inches	14	16	18	20	24	30	36
By-pass valve, size for AWWA and List 16 valves....Inches	2	3	3	3	4	4	6
By-pass valve size for List 12 valves.....Inches	..	..	..	..	3	3	4







F-5625 and F-5630

Size of By-pass Inches	Type of Valve By-pass Used on	Size of Elbows Inches	Dimensions—Inches								
			A	B	C	D	E	F	G	H	I
2	Flanged	2 x 2	11½	14	7¼	9½	3	6	11¾	10¾	7
	Hub	2 x 2	11½	14	7¼	9½	3	6	11¾	10¾	7
3	Flanged	3 x 3	16¾	20¼	7¼	9⅛	3¾	7½	14	12⅞	8
	Hub	3 x 3	16¾	20¼	7¼	9⅛	3¾	7½	14	12⅞	8
4	Flanged	4 x 4	19¾	24	10	11	4½	9	17½	14	9
	Hub	4 x 4	19¾	24	10	11	4½	9	17½	14	9
6	Flanged	6 x 6	24¾	31½	12	14⅛	5½	8⅛ x 13½	20¾	17½	10½
	Hub	6 x 6	24¾	31½	12	14⅛	5½	8⅛ x 13½	20¾	17½	10½

Note: By-pass dimensions for 42″ and 48″ valves on application.

CYLINDER OPERATED GATE VALVES

DESCRIPTION AND ORDERING INFORMATION

Clow Double Disc Parallel Seat Gate Valves can be equipped with cylinders for hydraulic or pneumatic operation.

The cylinders are seamless bronze tubing or bronze-lined cast iron, and are furnished with a stainless steel tail rod extending through the top of the cylinder head to show the position of the gate.

For oil or water operation, pistons for cylinders of 4- thru 8-inch diameter are of one piece rubber construction. For pneumatic operation, pistons for cylinder size 4- thru 12-inch are also of one piece rubber construction. All other pistons are of cast iron fitted with specially designed cup leathers. Construction details and dimensions furnished on request.

Flanged End with **F-5450**
Solid Bronze Tube Cylinder

Flanged End with **F-5455**
Cast Iron, Bronze Lined
Cylinder

ORDERING INFORMATION

Please provide the information called for below when making inquiries or placing orders for cylinder operated valves.

1. **Quantity.**
2. **Size.**
3. **Working pressure:** use List number.
4. **End Type:** hub, flanged, etc.
5. **Type of cylinder:** whether bronze tubing or cast iron, bronze lined.
6. **Maximum pressure** against gates.
7. **Minimum pressure** available for operating cylinder.
8. **Cylinder operating medium:** whether hot or cold water, oil, air, etc.
9. **Installation position** of valve.
10. **Accessory equipment:** by-passes, etc.

ELECTRIC MOTOR OPERATED VALVES

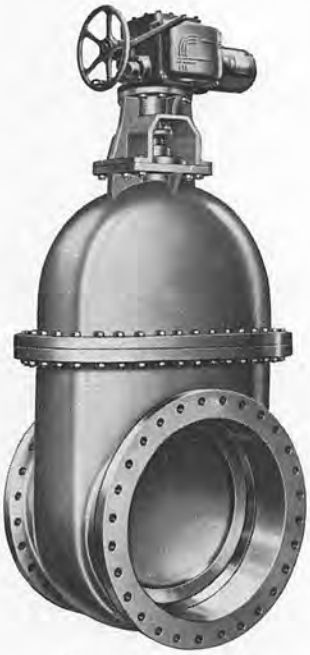
Clow Double Disc Gate Valves can be equipped with standard motor operating units to provide automatic and positive valve operation.

Motor operation saves time and labor wherever large diameter valves require considerable power to open and close, and wherever valves are operated frequently. Where valves are widely spaced, as they often must be, motor operation saves time and permits rapid series operation from a central point. Provision is made for manual operation in the event of power failure.

The motor operator unit is normally furnished in a weather-tight enclosure. Explosion-proof or submersible enclosures can be furnished if required. Reversing controllers and push button stations are available with general purpose, weather-tight, water-tight, or explosion-proof enclosures as required.

All motor operated units can be equipped with local or remote type position indicators.

Motor operators made by major manufacturers can be adapted to Clow Valves.



Non-rising Stem Valve with Motor Operator

Outside Screw and Yoke Valve with Motor Operator

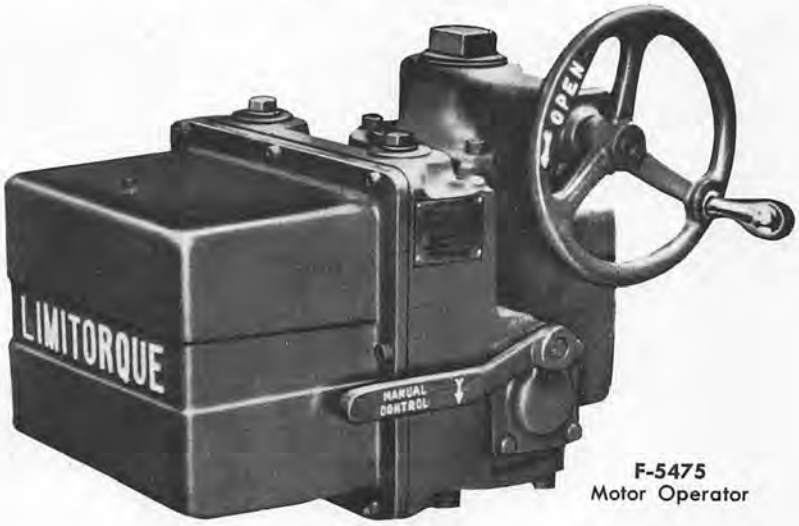
ORDERING INFORMATION

Please provide the following information on inquiries and orders:

1. **Valve size,** quantity and end connections.
2. **Rising or Non-rising stem.**
3. **Installation position** of valve.
4. **Maximum differential pressure.**
5. **Type of service**—water, gas, or oil.
6. **If the valve** is to be used for throttling, this fact should be stated.
7. **Maximum temperature** at location of valve control.
8. **Closing or opening time** in minutes.
9. **Electrical characteristics:** voltage, type of current (alternating or direct), and phase and cycle if alternating current.
10. **Control voltage.**

ELECTRIC MOTOR OPERATED VALVES

MOTOR OPERATORS AND EQUIPMENT



F-5475
Motor Operator

OPERATION

The electric motor control unit is mounted directly on the valve. For certain applications motor operated floor stands can be furnished.

A geared limit switch connected to the unit through gearing, governs the opening travel of the gates and may be set to stop valve travel at any desired point. This switch is always in step during both power and manual operation.

When the valve is closed, a positive mechanical torque cut-out assures correct valve seating, and the tightness of valve closing is controlled by a torque limit switch with micrometer adjustment. This switch eliminates any risk of damage to stem or gates if any obstruction should be encountered during the closing travel.

The handwheel does not turn during electric operation, and there is no possibility of injury to anyone operating the valve if power should be applied during manual operation.

Reversing Controllers

A reversing contacter panel is required for each motor operator unit. These controllers are especially designed for valve operation and consist of two mechanically interlocked contacters, each equipped with two auxiliary electrical contacts.

F-5470
Reversing Controller

Pushbutton Station

Pushbutton control stations are available for remote operation. They can be furnished in several types, but are normally furnished with three buttons (open, close, stop) and red and green indicating lights.

F-5460
Surface Mounted
Push Button Station

F-5465
Close Coupled
Push Button Station

Enclosures

The motor operator unit is normally furnished in a weathertight enclosure. Explosion-proof or submersible enclosures can be furnished if required. Reversing controllers and push-button stations are available with general purpose, weathertight, watertight, or explosion-proof enclosures as required.

FLOOR AND BENCH STANDS

DESCRIPTION AND DIMENSIONS

Standard Pattern
F-5500 Non-Rising Stem
F-5505 NRS, Indicating
F-5510 Rising Stem

Heavy Pattern
F-5520 Non-Rising Stem
F-5515 NRS, Indicating
F-5525 Rising Stem

Extra Heavy Geared Pattern
F-5535 Non-Rising Stem
F-5540 NRS, Indicating

Floor Stands are available in Standard, Heavy, and Extra Heavy Geared Patterns with either rising or non-rising stems. Non-rising stem floor stands can be equipped with indicators to show valve position.

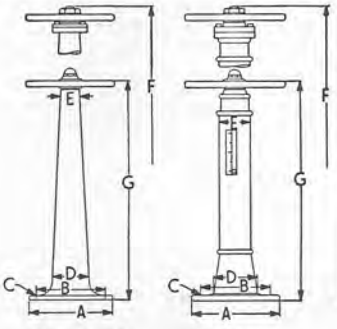
Floor Stands are of high strength cast iron, and are provided with extension stems of steel, stainless steel, or bronze as specified.

Gearing and enclosed gear cases can be furnished for floor stand operation of large valves. For non-rising stem valves, we recommend that the gearing be installed on the valve rather than on the stand.

Cranks are furnished on geared floor stands when specified. The use of cranks rather than handwheels is recommended on all Extra Heavy Pattern Floor Stands. Handwheels can be furnished if specified.

Ball thrust bearings and motor operated floor stands can be furnished when specified.

Stem covers are furnished, when specified, for rising stem floor stands. Brass name plates can be furnished for floor stands as specified.



Standard Pattern | Heavy Pattern | Extra Heavy Pattern

Dimensions—Inches

Dimen.	Standard Pattern	Heavy Pattern	Ex. Heavy Geared Pattern
A	13¼	14	16 Sq.
B	11½	12	13½
C	4-½	4-⅝	4-⅞
D	6	7	11
E	3	5	6
F	38	38	...
G	36	36	...
H	...	...	38¾
I	...	...	36
J	...	...	12
K	...	...	21

B = Diameter of bolt circle. C = Number and size of bolts.

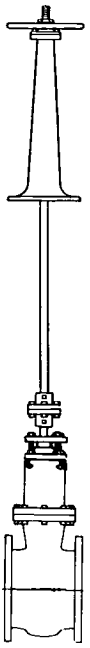
F-5545
Bench Stand
Rising Stem

F-5545 Rising Stem Bench Stands

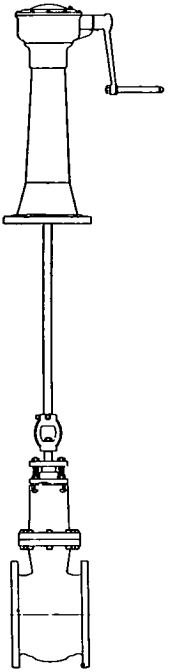
Bench Stands are similar in operation to the floor stands described above. They can be mounted on any upright surface such as tank walls and in most uses eliminate the need of stem guides or special brackets, depending upon length of stem. Bench Stands are furnished for rising stem valves only. We regularly furnish the F-5660 Stem Guide for NRS valves.

FLOOR STAND ARRANGEMENTS

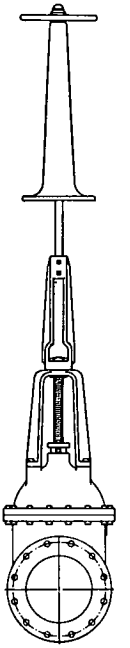
NRS Floor Stand with NRS Valve



Rising Stem Floor Stand with Sliding Stem Gate Valve

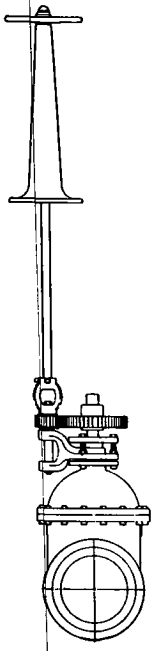


NRS Geared Floor Stand with NRS Valve

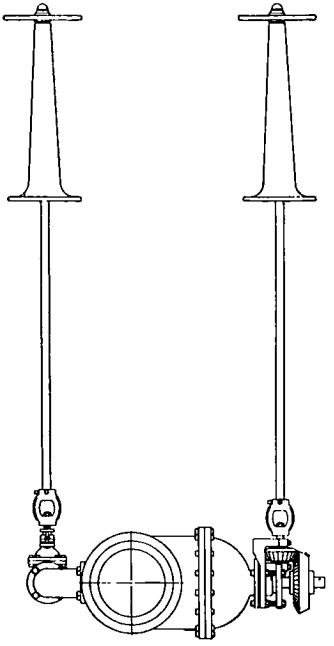


NRS Floor Stand with OS&Y Valve

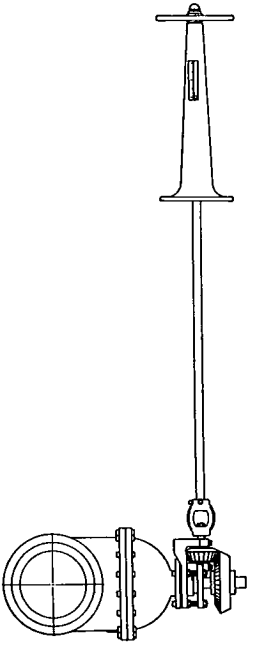
Note: Rising Stem Floorstands cannot be used with OS&Y valves. When position of OS&Y valve must be known, use the NRS indicating Floorstand with special yoke attachment.



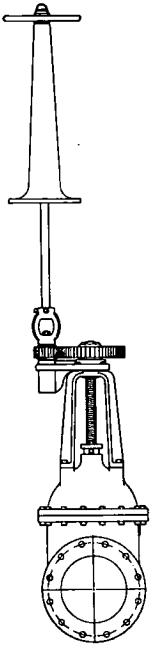
NRS Floor Stand with NRS Spur Geared Valve



NRS Floor Stand with NRS Bevel Geared Valve, and NRS Floor Stand for By-pass Valve



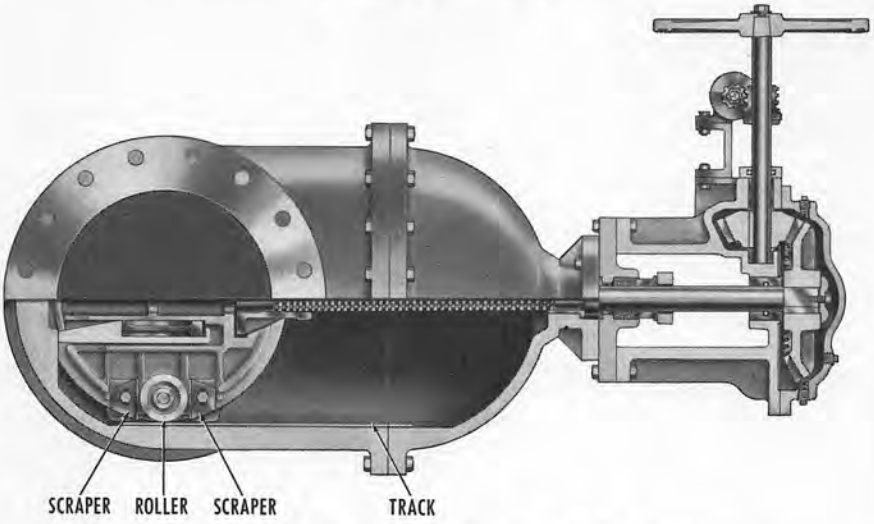
NRS Indicating Floor Stand with NRS Bevel Geared Valve



NRS Floor Stand with OS&Y, Spur Geared Valve

ROLLERS, TRACKS AND SCRAPERS • SLIDES

For 14-inch and Larger Diameter Gate Valves Installed Horizontally



Cutaway view of valve showing rollers, tracks, and scrapers

Slides

Valves 14″ and larger installed in vertical pipe lines with their stems horizontal should be fitted with slides to assist the travel of the gate assembly.

As the valve is opened, shoes fastened to lugs cast integrally at the center line on the lower gate, contact the tapered end of the tracks on which the gates slide for their entire travel. In closing, the shoes carry the gates down the tracks to a point opposite their seats, where the wedging mechanism operates to close the valve.

Slides, tracks and shoes are bronze.

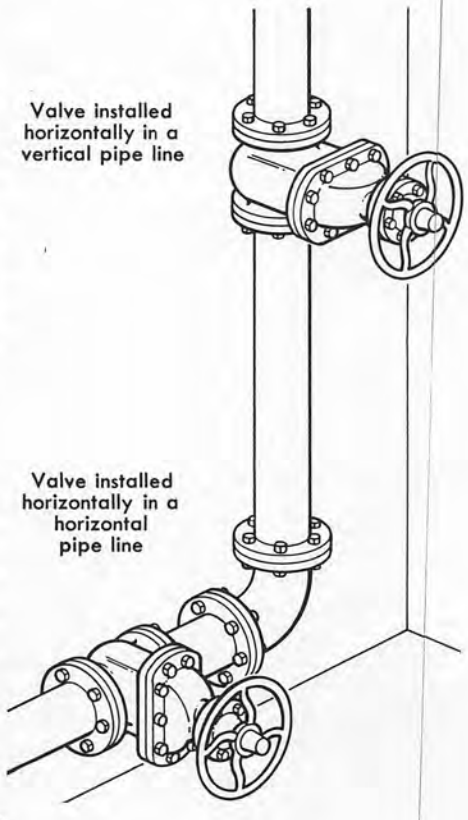
Valve installed horizontally in a vertical pipe line

Rollers, Tracks and Scrapers

Valves 14″ and larger installed in a horizontal pipe line with their stems horizontal should be equipped with rollers, tracks and scrapers, as illustrated. The rollers assist the travel of the gate assembly along tracks set into the valve body, retaining it in alignment, and promoting ease of operation, not otherwise possible. Scrapers are provided ahead of the rollers to clear the track of obstruction or foreign matter.

When required, rollers, tracks and scrapers are bronze.

Valve installed horizontally in a horizontal pipe line



GEARING, GEAR CASES, AND POSITION INDICATORS

For Gate Valves

F-5580 Spur Gears
Non-rising Stem

F-5585 Bevel Gears
Non-rising Stem

F-5590 Spur Gears
Outside Screw & Yoke

F-5595 Bevel Gears
Outside Screw & Yoke

F-5600 Spur Gears
Extended Gear Case

F-5610 Bevel Gears
Extended Gear Case

F-5650 Indicator
Needle and Slot Type

F-5655 Indicator
Barrel Type

Gearing

Cut tooth cast steel gears are normally furnished on AWWA gate valves unless otherwise specified. Cast iron gears are normally furnished on all other valves. However, cut tooth cast steel gears or cast tooth cast iron gears can be furnished on all valves if specified. Pinion shafts are made of rolled bronze.

Extended Gear Cases

Extended gear cases can be furnished for all non-rising stem valves. The case is mounted on distance pieces which hold it above the valve cover and make the valve stuffing box easily accessible. Side plates can be furnished to cover stem and stuffing box where required for buried service.

Gear Cases

Gear cases are made of high strength cast iron and designed for easy refilling. The use of gear cases keeps foreign matter out of the gearing and provides easy operation, by keeping the gears lubricated.

Position Indicators

Indicators, to show the valve position in non-rising stem gate valves can be furnished for valves in sizes 2 thru 48 inches.

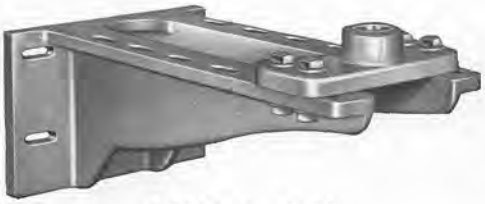
Needle and Slot Type (Navy Type)

Valve position is indicated by a bronze pointer attached to a threaded collar, which moves on the valve stem as the handwheel is operated. A slotted bronze plate, with raised figures is attached to the valve stuffing box and the pointer moves within the slot to show valve position. All parts of the indicator are of bronze.

Barrel Type

Barrel type indicators are made of high strength cast iron, with bronze working parts and are of the worm gear type. They are used on valves with bevel or spur gearing. A bronze pointer moves along a bronze plate on which figures indicate valve position.

STEM GUIDES, STEM PROTECTORS, CHAIN WHEELS AND FLOOR BOXES



F-5660 Stem Guide

Adjustment From Wall—Inches

Size.....Number	1	2	3	5	6
Minimum .Inches	1⅞	2¼	6½	15	15
Maximum .Inches	5	12½	16¾	25	35

F-5680 Chain Wheel on NRS Valve

F-5670 Valve Stem Protector

F-5675 Floor Stand Stem Protector

F-5690 Floor Box Plain Type

F-5695 Floor Box Bushing Type

Stem Guides

Stem Guides are installed as wall brackets to support extension stems. They are fully adjustable and are made of high strength cast iron. The guide is bronze bushed where the extension stem passes through. They should be installed at a height which does not permit the stem to be unsupported through a length of more than 10 feet.

Stem Guides are available in five sizes. When ordering state distance from center line of operating stem to face of wall, or give the size number as shown in table.

Chain Wheels

Chain Wheels are normally used for operation of valves located overhead. They are provided with chain guides to prevent the chain from slipping off the wheel. Chains can be furnished rust proofed if specified. Chain Wheels are mounted directly on the handwheel, and are of approximately the same diameter.

In ordering please state distance from floor to center line of wheel, or give the exact number of feet of chain required.

Stem Protectors

Stem Protectors are available for the protection of stem threads on outside screw and yoke valves. Their use guards the stem against damage and dirt.

Stem Protectors are available in two types. The upper type protects the stem above the handwheel, and the lower type protects the stem within the yoke.

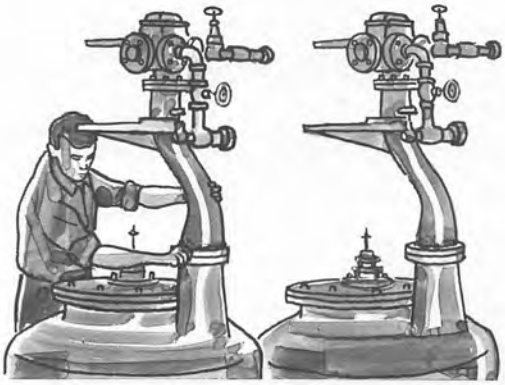
Stem Protectors are also furnished for rising stem floor stand, and can be equipped with slots for indicators.

Floor Boxes

Floor Boxes are designed for installation in concrete floors or slabs to provide support for extension stems of the non-rising type, and to provide a cover for the operating nut on the extension stem. The F-5690 plain type is available in any length up to 12″. The Bushing Type can be furnished a minimum of 7″ thru 12″ maximum length.

The F-5695 bushing type floor boxes are similar in design and construction with the F-5690 Floor Boxes, but are fitted with bronze bushings to preserve stem alignment.

In ordering, state size of extension stem, length required or thickness of floor.



SECTION 6 • WASTEWATER COLLECTION, AND PUMPING, WASTEWATER TREATMENT, AND CHEMICAL WATER TREATMENT

CLOW

VITRIFIED CLAY PIPE AND FITTINGS

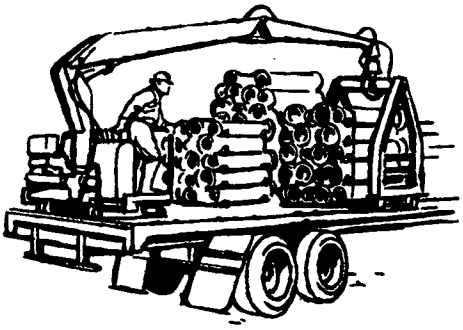
for Sewers, Drains and Industrial Wastes

Vitrified clay pipe is the standard, preferred piping for gravity sewer and waste collection systems. This is because it is chemically inert, structurally strong and has an indefinitely long life. Compression type joints eliminate root problems and control infiltration to specified low levels.

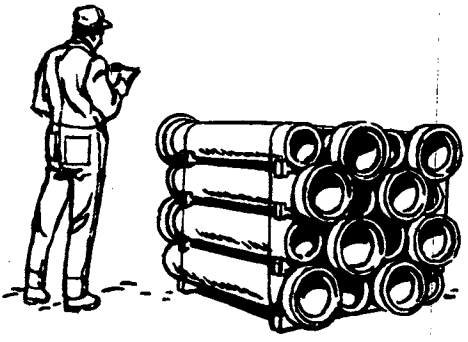
Through its Clay Products Division, Clow is a major producer of vitrified clay pipe products in the northeastern states and the middle west. A network of yards and dealer stocks provide prompt service for all construction requirements. Factories are located at Pottstown, Pennsylvania, and Carol Stream (suburban Chicago), Illinois.

A complete line of fittings, accessories and related sewer piping products are also furnished from supply yards at the locations shown below. Self-unloading trucks and palletized loads simplify handling, reduce breakage, and speed deliveries.

Requests for quotations and inquiries should be addressed to the General Sales Office, Clow Corporation, Clay Products Division, P. O. Box 20, West Chicago, Illinois 60185 (312) 231-8000, or for yard shipments to any of the stocking locations shown on the map below.

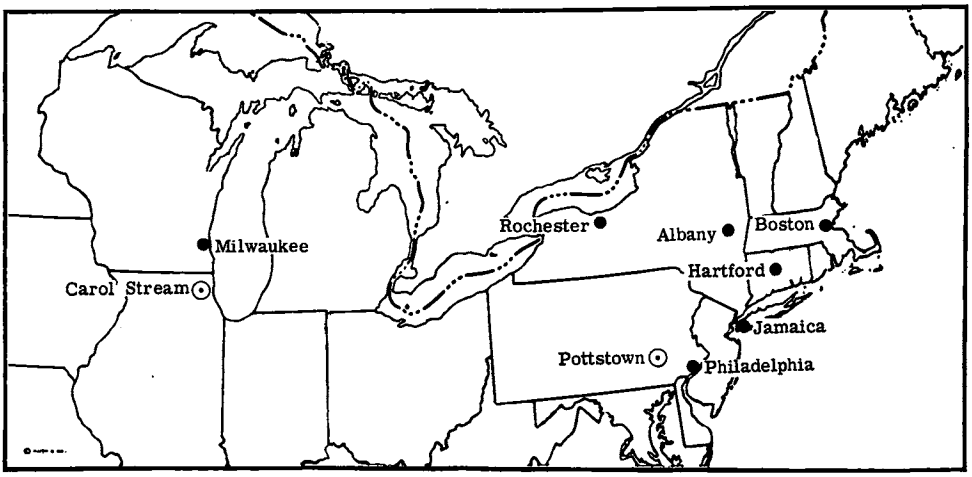


Pipe shipped by self-unloaders.



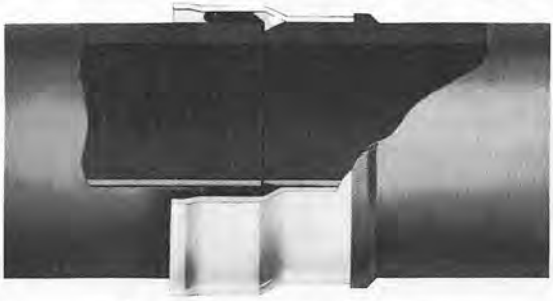
Palletized loads save time and labor.

A complete clay pipe service, with factories ⊙ and yards ●
in the northeast and the middle west



CLOW NO·BEL® JOINT
VITRIFIED CLAY PIPE AND FITTINGS

Meets the Performance Requirements of ASTM C-425



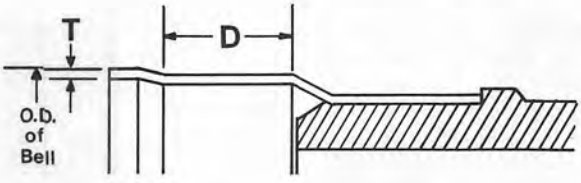
Clow No•Bel® Joint Clay Pipe

Clow No•Bel pipe is a vitrified clay pipe with a PVC (polyvinyl chloride) external collar using the elastomeric qualities of polyurethane as the compression seal. Because of its low profile, it reduces possible problems caused by inadequate or missing bell holes.

No•Bel joint pipe provides a tight system which combines the strength, acid and abrasion resistance of vitrified clay pipe with the tensile strength and impact resistance of a PVC collar.

No•Bel pipe, is formed with the PVC collar securely positioned at one end of the pipe, and a molded band of urethane on the opposite end, with both operations completed at the factory. This exclusive design concept makes it easier to install sewer lines which will pass required infiltration, exfiltration, air or TV tests.

Pipe is available in 4″ thru 12″ diameters, with a full line of fittings, and meets ASTM specification C-700 for Standard and Extra Strength Clay Pipe. The PVC collar material conforms to ASTM D1784, Class 12454-B. No•Bel meets or exceeds the performance requirements of ASTM C-425 for clay pipe joints.



Dimensions—Inches

Pipe Size	Bell O.D.	D	T
4	5.96	2.0	0.130
6	8.30	2.0	0.150
8	10.82	2.5	0.180
10	12.95	2.5	0.210
12	15.38	2.5	0.240

Installation of No•Bel® Pipe is fast and simple

1. Wipe the surfaces of the joint clean.

2. Apply Clow lubricant to the joint surfaces.

3. Push the spigot end into the "bell" until home.

CLOW

CLOW-YEOMANS CUSTOM ENGINEERED PUMPS

For Municipal Utility and Industrial Installations

Sizes 4″ thru 20″ Capacities 50 to 12,000 GPM

GENERAL INFORMATION ON CUSTOM ENGINEERED PUMPS

Since 1898, the name Yeomans has identified well-designed, well-made pumps—the kind that perform quietly, efficiently and steadily. Yeomans custom engineered centrifugal sewage pumps are designed to meet a variety of needs. In countless sewage treatment plants and pumping stations they are giving the dependable, trouble-free service demanded of them.

In municipal work, Yeomans custom engineered pumps are functioning for: Sewage Lift Stations, in low-level or isolated areas; delivering sewage to treatment and disposal plants; pumping sewage from one stage to the next in disposal plants; and for pumping sludge.

In utility and industrial fields, as well as in many manufacturing processes, custom engineered pumps are widely used. Pumping liquids in which large quantities of solids are held in suspension is easily handled by these heavy duty pumps. Such installations have been made in paper mills, handling paper stock, sugar refineries, pumping unstrained sugar juices, etc. All these units have been noted for their high operating efficiencies and unusual service records, as well as their freedom from mechanical difficulties.

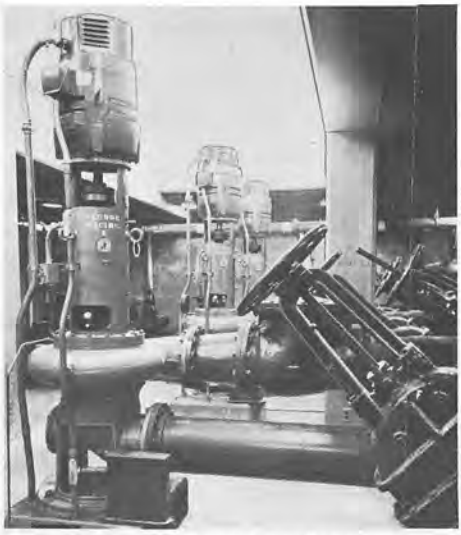
These custom engineered pumps are available in a wide range of sizes from 4″ to 20″ and for capacities of 50 to 12,000 gpm. They can operate against pressures of 10 to 180 feet. For higher heads, pumps placed in series can develop additional pressure with installations up to 275 feet.

Although Pneumatic Ejectors are often preferred for smaller installations, centrifugal pumps are the logical choice in the handling of large capacities, not only in booster stations, but in raising and pumping raw sewage at treatment plants.

Shown below are two typical installations; at left, one in a municipal pumping station, at right, in an industrial plant.

For specific data on this equipment, consult Clow, Waste Treatment Division.

75 HP, 580 RPM, 6000 GPM Yeomans Raw Sewage Pumps in Municipal Pumping Station



Typical industrial installation of Yeomans custom engineered pumps

For specific data, Address
Clow Corporation, Waste Treatment Division, 56 Industrial Road
P. O. Box 324, Florence, Kentucky 41042

CLOW-YEOMANS NON-CLOG DRY PIT PUMPS

For Sewage, Sludge, Slurries, Drainage and Process Wastes
In Lift Stations, Treatment Plants and Industrial Applications

Capacities to 15,000 GPM, Heads to 200 Feet

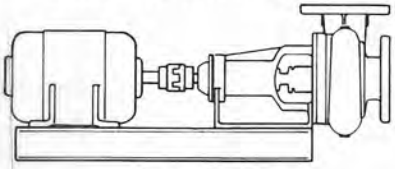
Volute casing, hydraulically designed to narrow limits for streamlined flow and most efficient conversion to kinetic energy. Specially developed for sewage service. Heavy cast iron foundation base.

Pump shaft design minimizes deflection—large diameter, high tensile strength, cold finished, annealed alloy steel. Impeller and coupling keyed and locked on shaft. Double row heavy duty ball bearings, provide long life; placed outside pump casing, safe from grit and water. Integral seals keep out dust and moisture.

Fully enclosed non-clog easily adjustable impeller—hydraulically and mechanically balanced. Large passageways. Bearing housing readily permits axial adjustment of shaft and impeller assembly, making possible close and accurate running clearance—preventing leakage losses.

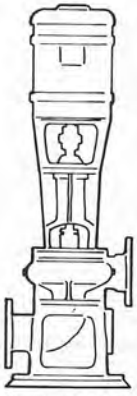
Yeomans Series 6000
Non-Clog Dry Pit Pump

FOUR STANDARD STYLES

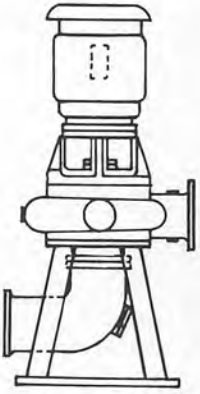


Series 6150
Horizontal Mounting

Series 6250
Flexible Shafting Type



Series 6260
Motor Supporting Type



Series 6235
Close Coupled Type

CLOW

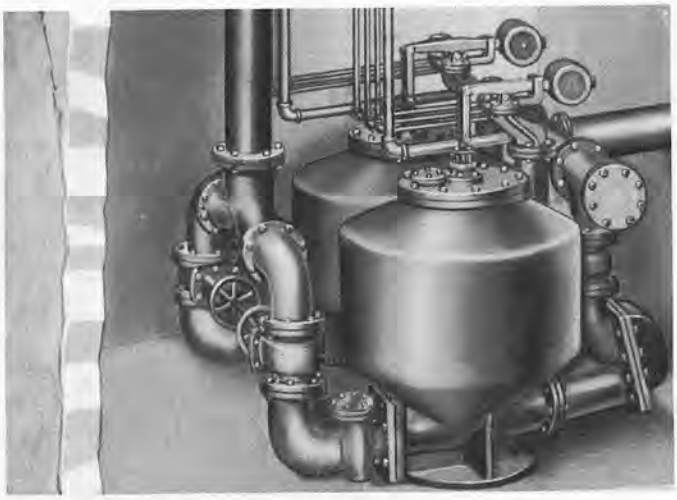
SHONE® PNEUMATIC EJECTORS

Capacities 30 to 600 Gallons, Heads to 50 Feet and Higher

Pneumatic Ejectors

Pneumatic sewage ejectors are suitable for flows up to 600 gpm, the range in which centrifugal pump impellers are too small to pass entrained solids. They are clog-proof, and pass solids up to the size of the inlet and discharge valves (4" minimum) Maintenance is negligible.

A Pneumatic Ejector consists of a sealed receiver with check valves on the inlet and discharge; an air control device actuated either mechanically or electrically and the source of air—(a rotary compressor, an existing air supply, or steam may be used). Waste liquid flows into the receiver and raises to the level at which the air control is actuated. Compressed air is admitted, forcing the liquid out of the receiver and through the discharge line.



SHONE® Pneumatic Ejector

Shone is the original Pneumatic Ejector, designed for extreme dependability in pumping jobs where gallonage is limited but solids are not. It is clogproof, has no rotating pump parts, no airtight floats, no high speed shafts or bearings—nothing to restrict the flow through the receiver. Completely sanitary and safe, it is hermetically sealed—can't expose liquids to the atmosphere. There is no release of noxious or toxic gases, no wastes retention, no sludge accumulation. Shone Ejectors are available in 30 to 600 gallon sizes.

25 Year Warranty

Mechanically controlled units—Types SDV and S for stored air systems, and SAC for tankless systems—are warranted for 25 Years.

The Clow-Yeomans Shone Ejector is the only unit of its type carrying an extended warranty that does not incorporate "general purpose" components built by others and backed by the component manufacturer with a standard one-year warranty. Each part of the Shone Ejector is manufactured and tested to rigid quality standards.

Yeomans experience in the application, manufacture, and service of Pneumatic Ejectors is unequalled by any other manufacturer of this type of equipment in the world. Clow offers the oldest line, the broadest line, the most types and sizes of both special and standard units, and the largest number of Pneumatic Ejector installations—over 4,500.

All control valves and check valves are exclusive with Shone—designed to give the service which makes the life expectancy of a Shone still to be determined. ASK FOR BULLETIN 4008.

Type SEC Shone (electrically controlled) can be furnished for either stored air or tankless systems. The "Package" SEC, with compressor mounted on receiver, is available only for tankless installations. ASK FOR BULLETIN 4040.

For Bulletin 4008 and 4040, Address
Clow Corporation, Waste Treatment Division, 56 Industrial Road
P. O. Box 324, Florence, Kentucky 41042

CLOW-YEOMANS PNEUMATIC EJECTORS

For Simplicity, Effectiveness and Economy of Operation
Capacities 30–100 Gallons, Heads to 50 Feet
(Larger Sizes Also Available)

Benefits of Pneumatic Ejectors

- No screens or shredders needed
- No floats
- No float switches
- Operates on compressed air or steam
- Nothing to jam or clog
- Hermetically sealed system
- No fast-moving parts

Materials Pumped and Applications

Typical materials "pumped" include sewage, industrial wastes, cannery wastes, heavy slurries, packing house wastes and process materials. Uses for Pneumatic Ejectors include commercial and industrial buildings of all sizes and types, sewage lift stations for municipal, shopping centers and subdivisions, sewage treatment plants, passenger ships, tankers, freighters and barges, packing houses, canneries and fall-out shelters.

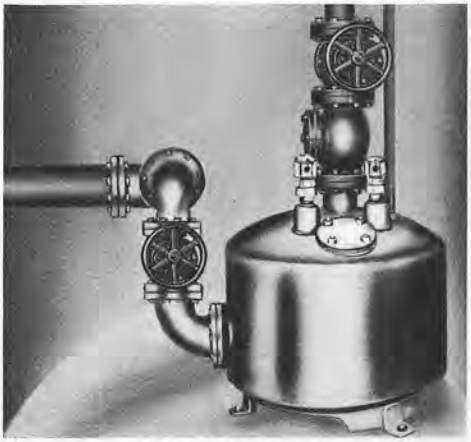
EXPELSOR® Pneumatic Ejector

The Expelsor Ejector affords the dependability and efficiency associated with the Shone at a first cost which is competitive with centrifugal pumps of equal capacity. Here the comparison ends, for in terms of simplicity, effectiveness, economy of operation and maintenance, the Expelsor excels.

The check valve, like that used in the Shone, is designed and built for sewage service. Control of the operating cycle is accomplished electrically.

Expelsors are available for either stored air or tankless system installations. Where space is limited, dual chamber models can be specified. Models are also available in a package design with a compressor mounted on the receiver.

ASK FOR BULLETINS 4408 AND 4040.



EXPELSOR Ejector

PACKEX® Ejector

For flows up to 20 GPM and heads up to 20 feet

The Packex Ejector is applicable where the sewage flow does not exceed 20 gpm, and the head is not over 20 ft. Packex is suitable for small apartments, offices, schools, to serve up to 30 fixture units; and in residential areas, up to 10 homes. The unit is factory-assembled, complete with rotary sliding vane air compressor, ready for inlet and discharge connections. Electrical elements are moisture proof.

ASK FOR LEAFLET 4422.

PACKEX Ejector

For additional data, Address
Clow Corporation, Waste Treatment Division, 56 Industrial Road
P. O. Box 324, Florence, Kentucky 41042

CLOW-YEOMANS WET PIT PUMPS

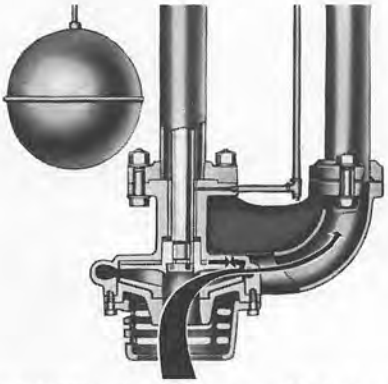
Pumping acids, alkalis and the many highly corrosive liquids common to the chemical process industries poses many unusual problems. It is a job for specialists—pumps of special construction to meet unique conditions; pumps engineered for their functional duties; designed by men who know how—men equipped by training and long experience to deal with special problems. These pump products reflect the careful attention to design and construction afforded by experienced engineers and craftsmen.

Over the years, long pump life and easier maintenance are just two of the many construction features that have brought increased acceptance of the Clow-Yeomans Wet Pit Pump. Customers tell us that there is no way of measuring the cost savings that have resulted from their installations.

The popularity of the Clow-Yeomans Wet Pit Pump is also a result of the unmatched service provided. No other single reason could be more important, over a period of years, than this one factor.

Rigid factory tests certify the ability of the units to deliver full rated capacity, to maintain the extra ordinary efficiency and service life for which Yeomans Wet Pit Pumps are known.

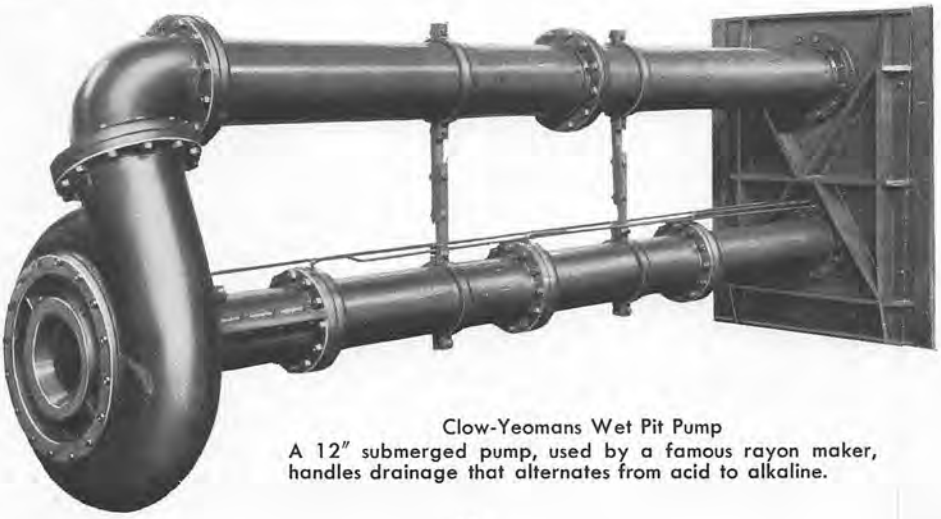
The most critical point in the design is protected with the Lubri-Vac system, a positive lube method which reduces main pump bearing failures 90–95% and increases pump life 10 to 12 times. The pump impeller, equipped with the new Lubri-Vac vanes insures a constant flow of lubricant, completely flushing the bearing surfaces, while the pump is in operation.



With Lubri-Vac there is the same kind of suction and pressure above the impeller as within. This equalized pressure prevents fluids from working back up to the bearing.

Impeller

Impeller, with Lubri-Vac vanes, insures constant flow of lubricant which completely flushes bearing surfaces.



Clow-Yeomans Wet Pit Pump
A 12″ submerged pump, used by a famous rayon maker, handles drainage that alternates from acid to alkaline.

CLOW-YEOMANS WET PIT PUMPS

Series 8000
Screenless Sewage Ejector
Capacities to 15,000 GPM
Heads to 200 Feet

Series 9000
Submersible Pump
Capacities to 1,000 GPM
Heads to 200 Feet

The Clow-Yeomans series 8000 heavy duty Wet-Pit Pumps are furnished as complete factory-assembled and -tested units; the pump casing, impeller, shaft, and suspension and discharge pipes, thrust bearing and flexible coupling, are all assembled on the suspension plate for field mounting of the basin cover, motor and automatic control equipment. The non-clog impeller will pass 2½-inch solids in the smallest size pump.

Mechanical design features include closely spaced intermediate bearings, 1-7/16 inch shaft size, elevated thrust bearing, stuffing box at float rod and at shaft, registered index fits at all points. The hydraulic design contributes to reduced operating and maintenance costs—minimizes vibration—extends the normal period of the pumps maximum efficiency. Stuffing box at floor plate prevents the escape of gases, moisture or vapors from suspension pipe. Coupling is flexible type, statically balanced. No whip or unbalanced condition to heat and wear bearings. Pump casing is of heavy close grained cast iron, streamlined to flow, and rigidly attached to suspension and discharge pipes. A renewable sleeve bearing is located in casing just above the impeller.

Clow-Yeomans heavy duty submersible pumps, Series 9000, are close-coupled units designed for submerged operation in handling sewage and drainage in commercial and industrial buildings, processing plants, utilities, sewage plants, water treatment facilities, recreation parks and pools.

Pump impeller is attached directly to the stainless steel motor shaft, eliminating many expensive components—couplings, shafting, intermediate bearings, special bases, etc. Maintenance costs are lower, for there are fewer parts to wear from vibration and friction. Performance is more efficient because of reduced power loss. Floor level space requirements are minimum. Installation costs lower.

For special capacities exceeding above stated figures, on both the 8000 and the 9000 Series Pumps, contact Clow, Waste Treatment Division. Pump selection data available in Bulletins 8008 and 9001.

For specific data, Address
Clow Corporation, Waste Treatment Division, 56 Industrial Road
P. O. Box 324, Florence, Kentucky 41042

CLOW-YEOMANS WET PIT SUMP PUMPS

For All Applications Up to 3,500 GPM

DRAIN-DRI® SUMP PUMPS

Drain-Dri® Sump Pump

THE DRAIN-DRI is a heavy-duty, dependable wet pit pump for small installations where positive protection against flooding must be assured. Suitable for handling drainage and seepage relatively free from grit. They are used in motels, schools, apartments, office buildings, residences, elevator pits, factories, septic tank effluent, sub-basement drainage, emergency dewatering service drainage, and similar applications.

Capacities to 85 GPM, Heads to 30 feet
Sump depths ranging from 2 to 10 feet

Standard Construction Specifications

Impeller: Non-clogging; moves any material passed by screen.

Pump Bearings: Sealed, self-lubricating sleeve bearings.

Shaft: Highly polished, stainless steel, turned and ground, of liberal size.

Coupling: Flexible type.

Motor: Ball bearing, grease lubricated; heavy duty; drip-proof; built-in overload protection.

Control: Enclosed, butt contact, heavy duty float switch.

Float: Float switch actuated by heavy copper float with guided float rod and stops adjustable to liquid level.

ASK FOR BULLETIN 3032 FOR ADDITIONAL INFORMATION AND SELECTION DATA.

Top Suction Pump

TOP SUCTION PUMP
For Drainage and Light Slurries

The Series 3000 pumps are used for handling liquids free of large solids, for drainage service, transfer of materials and removal of wastes. The top suction design reduces bearing wear and lubricant washout to provide added years of efficient pumping. Pump comes as a complete unit; casing, impeller, shaft, suspension and discharge pipes, thrust bearing, and flexible coupling, all assembled to the suspension plate, together with motor and automatic control.

Capacities to 3,500 gpm,
at heads up to 200 feet.

ASK FOR LEAFLET 3015 FOR FURTHER INFORMATION AND SELECTION DATA.

CLOW-YEOMANS COMPRESSORS

Multi-purpose Rotary Units for High Volume Low Pressure Requirements

for:

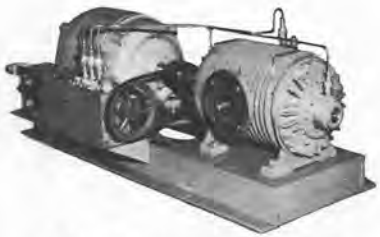
Central Air and Vacuum Systems for Buildings
Instrument Air Applications
Natural Gas Boosters in Low Pressure Systems
Industrial Oil Burner Service
Marina De-Icing
Vapor Recovery Service

WHERE AND WHEN TO USE ROTARY COMPRESSORS

Power Plants · Food Packaging · Chemical Plants · Textile Mills · Petroleum Refineries · Packaging Plants · Paper Mills · Atomization · Gas Transmission · Testing · Painting · Boiler Tube Cleaning · Pneumatic Conveying · Instrument Air · Central Air Supply for Schools, Hospitals, Office Buildings, Hotels, Laboratories, Factories · Refrigeration and Air Conditioning Systems · Vacuum Systems · Pneumatic Tool Operation · Special Applications.

Rotary Compressors Type and Capacity

There are three basic rotary air and gas compressors; air cooled, fan cooled and water cooled. The capacity of these units extends up to 300 c.f.m. and pressures up to 50 p.s.i. or for moderate vacuums up to 27″ of mercury (or 95% of barometric pressure).



Rotary Compressor, Air-cooled

Rotary Compressor, Fan-cooled

Rotary Compressor, Water-cooled

Features of Rotary Design

Continuous Flow . . . No Discharge Pulsations of reciprocating equipment. Operation is quiet.

Efficient Performance Never Varies—As the rotor turns, the vanes are forced out to the cylinder wall by centrifugal force. Any wear is continuously compensated for automatically.

Economical First Cost . . . Operation, Maintenance—Simplicity of design results in lower initial cost and minimum operating and maintenance costs.

Stuffing Box Problems Eliminated—All Yeomans compressors are supplied with mechanical seals to insure positive sealing.

Automatic Lubrication Without Waste—Yeomans compressors and vacuum pumps have grease or oil lubricated anti-friction bearings and oil lubricated cylinders and vanes. Oil flow is adjustable—eliminates waste.

Construction and Operation

Assembly consists of a cylinder with inlet and discharge ports on opposite sides and a circular rotor mounted eccentrically so its surface runs close to one side of the cylinder wall. Rotor shaft is carried by anti-friction bearings in the two cylinder heads.

Radial slots milled along the full length of the rotor carry the composition vanes inserted in them. When operating, centrifugal force causes the vanes to follow the inside contour of the cylinder. Since the cylinder contour is not concentric with the rotor, the vanes are continuously being forced in and out. The cell space between vanes is contracted with each revolution, trapping the gas and compressing it before discharging to the exhaust port. There are no springs and compensation for any wear of the vane is automatic.

For complete selection data or special applications consult Clow, Waste Treatment Division.

Accessories

Accessory equipment includes Air Filter, Silencers, Low-Level cut-off, High Temperature Shut-off Switches, Water Flow Rate Regulator, Water Control Valve, Automatic Start-Stop, Dual Extended Shaft, Unloading System, Belt Guards.

For specific data, Address
Clow Corporation, Waste Treatment Division, 56 Industrial Road
P. O. Box 324, Florence, Kentucky 41042

CLOW

MUNICIPAL AND INDUSTRIAL WASTEWATER TREATMENT SYSTEMS

Clow Waste Treatment Division manufactures a complete line of equipment designed to meet or exceed current water quality standards in modern municipal and industrial wastewater treatment systems where activated sludge processes are employed. This equipment includes mechanical surface aerators, primary clarifiers, secondary clarifiers, sludge collectors, prefabricated steel plants, and field erected plants—all described on the following pages.

Twelve 75-H.P. Sigma Aerators treat difficult waste in a lagoon.

MECHANICAL AERATION

During recent years, consulting engineers for both municipal and industrial waste treatment plants have accelerated the swing to mechanical surface aerators. Further, the modern approach to aeration is with fewer—but larger—mechanical aerators.

Some of the more obvious reasons:

Efficiency—Each aeration device must be evaluated by its oxygenation capacity and the power required per pound of oxygen absorbed by the liquid.

Performance-Proved—Hundreds of municipal waste treatment plants are equipped with Clow-Yeomans mechanical surface aerators—some have been in operation for over 40 years, including small, medium and large communities.

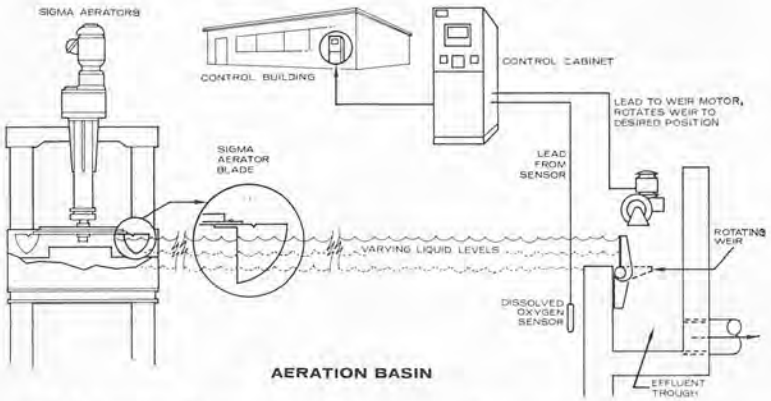
Liquid Velocities—All Sigma mechanical surface aerators assure bottom scouring velocities of the liquid in the aeration basins.

Low Speed—Sigma aerators operate at a slow speed (generally less than 50 rpm), which means longer life for all moving parts as well as minimal floc shearing and misting.

Adaptable—Sigma aerators can be utilized in conventional plants (without any special and costly concrete work), aerated lagoons, and river aeration—in both platform and float-mounted units.

Maintenance—Sigma mechanical surface aerators minimize the normal amount of maintenance required; eliminate the need for tank draining and the constant cleaning of subsurface equipment.

CONTROLLED AERATION SYSTEM



The Controlled Aeration System is a development by Clow for automatically controlling the dissolved oxygen level in aeration basins utilizing mechanical surface aerators.

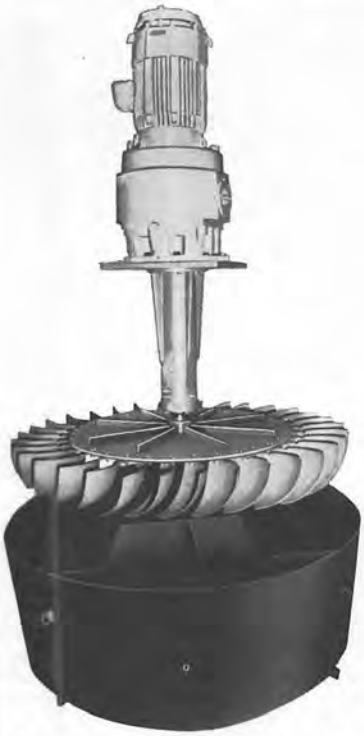
A total systems approach to wastewater treatment when used in combination with Clow Sigma surface aerators, it achieves optimum efficiency and reduced costs by conserving the horsepower needed to operate the aerators during low oxygen demand periods.

As diagrammed above, the amount of dissolved oxygen in the aeration basin is continuously monitored and kept at the optimum level by variation of the liquid level in the basin. As the liquid level varies the aerator blades are exposed to more or less waste water, thus controlling aeration. Since power demand is a function of blade depth, less power is required during low loading periods, resulting in attractive savings in large surface aeration systems.

MUNICIPAL AND INDUSTRIAL WASTEWATER TREATMENT PLANTS

SIGMA® AERATOR

The Total Performance Concept—The Sigma Aerator combines four important factors to achieve *maximum total performance.* These factors are: (1) surge prevention which eliminates serious power fluctuations and unstable operation; (2) operating flexibility to absorb variable loads; (3) complete mixing which distributes oxygen throughout the liquid and scours tank bottoms, and (4) high oxygen transfer efficiency for *shorter retention times* and for high BOD removals.



Sigma Aerator—Platform Mounted
5 to 150 hp

ENGINEERED FOR TOTAL PERFORMANCE—Some of the fine points include low drag, high "pumping rate" blades, removable for operating flexibility . . . skirt and cross-baffle that prevents vortexing and liquid rotation . . . up and down adjustment for different water levels . . . gear box protected from radial loads.

TESTED FOR TOTAL PERFORMANCE—Clow-Yeomans can tell you exactly what to expect from the Sigma because testing at our Rockford, Illinois test facility has been conducted on full scale systems of up to 150 horsepower. This rules out errors due to scaling up data from conventional, small test systems.

FIELD PROVED FOR TOTAL PERFORMANCE—No matter what type of waste is involved in the project, chances are Sigma has already handled it. Prolonged field evaluation has been conducted on numerous installations including stationary and float-mounted units, in domestic and industrial wastes.

ASK FOR BULLETIN 13,005.

Sigma-Pac Low Speed
Floating Aerator
5 to 25 hp

Tough paper waste
aerated with
float-mounted Sigma

High Speed Floating Aerator
3 to 75 hp

MUNICIPAL SEWAGE AND INDUSTRIAL WASTEWATER TREATMENT EQUIPMENT

YEOFLO CLARIFIERS

Yeoflo is a clarifier of radically different design. Offers complete removal of settleable solids, greater removal of fine divided particles, positive removal of grease, oil and scum. Needs no underground piping, concrete effluent troughs, or mechanical skimmers.

Yeoflo Clarifiers are also available as a rapid sludge removal unit up to 95 feet diameter. Design incorporates multiple take off points—each easily adjustable for variable pumping rates for practically immediate removal of settled solids. Pump suspended from bridge.

Center drive conventional type clarifiers for circular tanks available with or without surface skimming. Can be furnished with design for fast sludge removal. ASK FOR BULLETINS 12,021 and 12,051.

Typical installation of Yeoflo Clarifier in Municipal Treatment Plant

STREAMLINE SLUDGE COLLECTORS

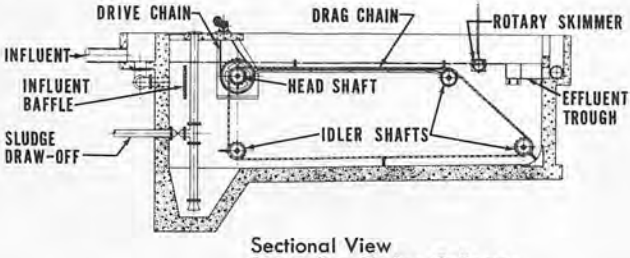
The STREAMLINE Sludge Collector is a conveyor type unit suitable for either primary or secondary settling, for single or multiple rectangular clarifier installations. The ruggedness and built-in durability of these units have earned it a reputation for reliability and performance in accordance with the engineers' requirements—sustained efficiency but with minimum maintenance.

Job demands dictate which of the two types of Streamline Collectors is best suited for the application: the Type "NL" for standard duty and normal loadings or, the Type "MS" for severe loadings and special applications.

Streamline Collectors in the Type "NL" series are well suited to community, institutional, and industrial plant installations. This high-quality mechanism can be provided at low first cost, yet does not sacrifice serviceability.

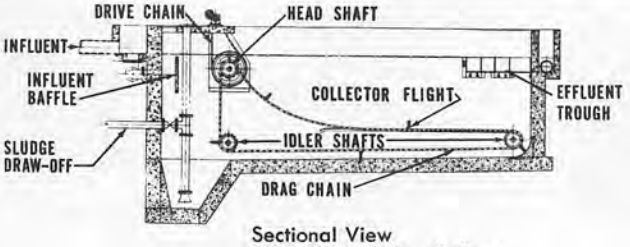
The low first cost of the "NL" makes it possible for use in multiple installations for larger community plants at an over-all completed cost comparable to that of a large single settling tank. Multiple tank installation offers the most flexibility in plant operation; and, common wall construction results in less expensive collector equipment.

In the heavy duty Streamline series, the Type "MS", offers collectors built to handle the most severe loadings, designed to maximum engineering specifications. They are particularly suited to very large settling tanks. As with the Type "NL" units, the "MS" series collectors are available for both primary and secondary service, with both individual and dual drives.



FOR PRIMARY TREATMENT

Sectional View
Streamline Sludge Collector



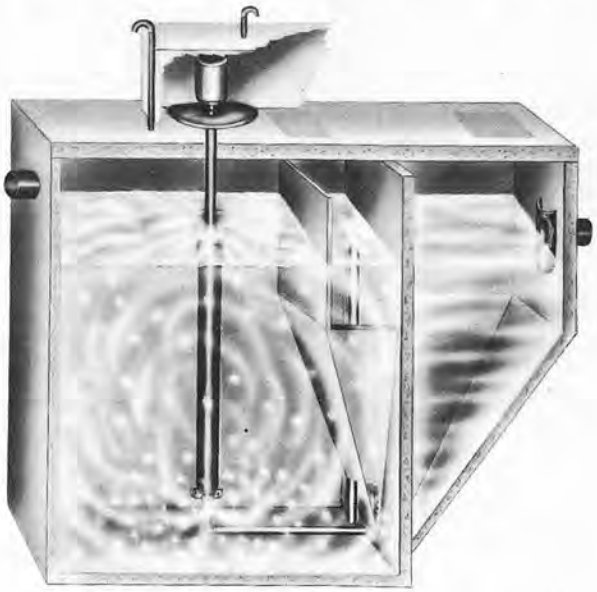
FOR SECONDARY TREATMENT

Sectional View
Streamline Sludge Collector

CLOW

YEOMANS CAVITETTE® PACKAGE TREATMENT PLANTS

Sewage Treatment for Homes and Small Commercial Applications



The Clow-Yeomans Cavitette

The Cavitette is a self-contained complete sewage treatment plant designed to serve a single family residence or small commercial type applications. Cavitette Systems are being used in areas where community sewage facilities are unavailable and where a septic system might cause trouble.

In operation, all household wastes—including garbage grinder and automatic washers—flow into the aeration compartment of the specially designed tank. Here, the unique Cavitette aerator breaks down the solids and forces large volumes of oxygen into the liquid. In the settling section, solids drop to the bottom and are automatically pumped back into the aeration compartment for further treatment. An odorless, clear, treated liquid flows by gravity from the settling compartment to discharge.

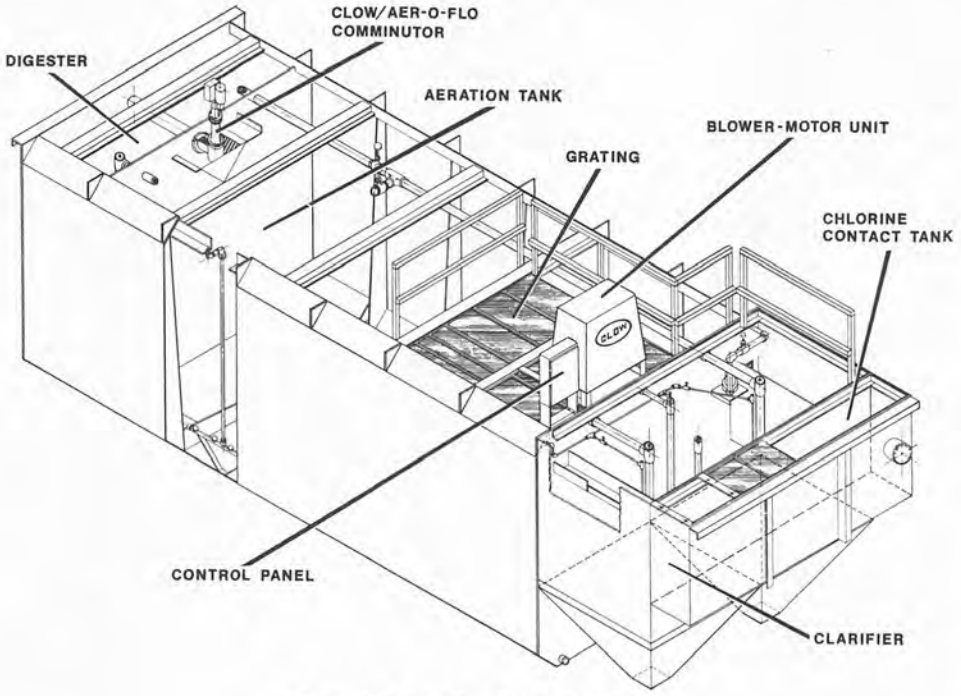
Consider these very real advantages!

- Totally different from a septic tank—uses biological process identical to community treatment plants.
- Handles all wastes—including all modern appliances.
- Completely odorless—no "rotten egg" smell.
- Automatic pre-set operation—power consumption comparable to such home appliances as a deep freeze unit.
- Improves property and resale value.
- Improves environmental health conditions.
- Eliminates septic system nuisances and hazards—provides "city type" treatment before effluent is released.
- Systems for all home sizes.
- Performance proved by independent outside agencies.

Available in 750, 1000 and 1250 gallon systems. Cavitette's available in most areas in both specially coated steel tanks and in tanks of precast concrete. For additional information write for Bulletin 2223.

For specific data, Address
Clow Corporation, Waste Treatment Division, 56 Industrial Road
P. O. Box 324, Florence, Kentucky 41042

CLOW AER-O-FLO PACKAGE SEWAGE TREATMENT SYSTEMS



Extended Aeration Secondary Plant

SPECIALIZED COMPONENTS

BLOWERS, CONTROLS

The motor-blower unit with motor, "V" belt drive, and blower controls is delivered complete and ready to operate. The electric control system is pre-wired at the factory, and includes all magnetic starters, circuit breakers and switches to automatically control all plant equipment.

CHLORINATION UNIT

Chlorination unit has housing of molded fiberglass construction. It has separate solution fill and equipment sections to prevent accidental spilling or overflow of solution on the equipment. It is simple to service, easily maintained.

SPRAY NOZZLES

Nozzles are of the weighted, cantilever type having flip open cap for quick flush cleaning of the full throat, one-half inch nozzle orifice. This non-clog nozzle produces a sharp foam-control spray, extends pump life by its virtually maintenance-free operation.

Note: For detailed description of Comminutor see page 206.

AER-O-FLO PACKAGE SEWAGE TREATMENT SYSTEMS

Aer-O-Flo Package Systems provide secondary and tertiary treatment of domestic sewage. These are factory-built prefabricated steel modules which require minimal installation and are available in a large selection of sizes from 3,000 to 150,000 gallons per day capacity.

The Aer-O-Flo secondary system utilizes either the extended aeration or contact stabilization process; it may also be converted from extended aeration at initial low flows to contact stabilization for ultimate high flows. Supplemental units can be easily added to expand the treatment facility for growing developments.

A typical secondary system includes comminution and screening, aeration, secondary clarification, aerobic digestion of waste sludge, and chlorination. Gravity or mechanical collection type clarifiers, with circular or rectangular configuration, are available.

Simple to operate and maintain, Aer-O-Flo Package Systems are especially suited for use by subdivisions, multi-family developments, mobile home parks, motels and truck stops, and similar installations. Clow field erection specialists are available to install or supervise installation of these systems.

For quotations and detailed specifications, address Clow Corporation, Waste Treatment Division, 56 Industrial Road, Florence, Kentucky 41042.

Truck Stop duplex system—20,000 GPD capacity each plant.

Subdivision duplex system—100,000 GPD capacity each plant.

Mobile Home Park system—100,000 GPD capacity

CLOW

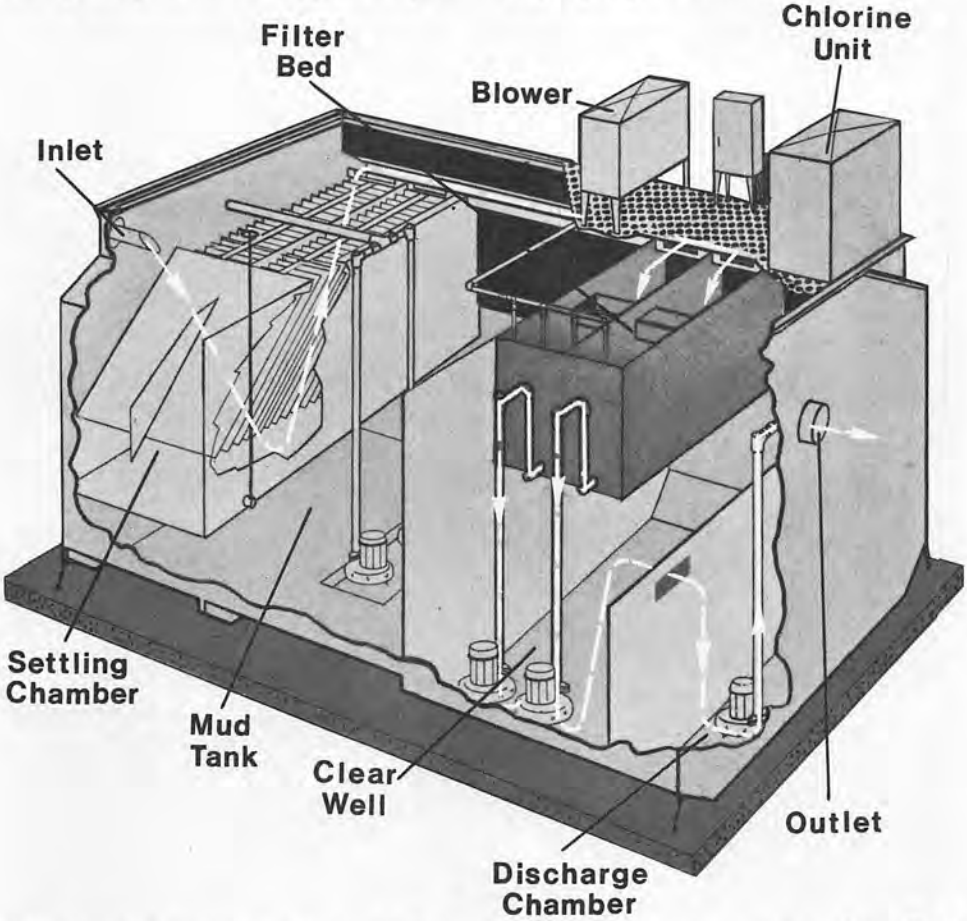
AER-O-FLO PACKAGE SEWAGE TREATMENT SYSTEMS

Tertiary Treatment Plants

The growing concern in the United States for the preservation of water resources has raised demands for higher degrees of treatment of wastewater before discharge back to natural water courses, and treatment beyond conventional methods must at times be provided.

The easiest and surest way to improve the biological treatment effluent is by reducing the residual suspended solids passing through the settling basin and escaping with the effluent. These are light and sometimes flocculent particle concentrations which can be removed from the final discharge of the treatment system by incorporation of a supplementary tertiary filtration process before final discharge into the waterway.

The Aer-O-Flo Tertiary Treatment System provides the high filtration removals necessary to meet today's strict effluent standards. Completely automated, dependable and safe, these self-contained steel units utilize low rate, gravity filtration through sand media to remove the majority of the suspended solid material remaining. Automatic backwashing periodically cleans the sand, returning the backwash water to the secondary plant for further treatment. Units may be modified to effect flow equalization, or phosphate removal, if required.



Flow pattern through tertiary system is illustrated with arrows above—secondary plant effluent enters settling chamber from inlet at left, moves to sand filtration media bed where suspended solids are trapped as the liquid passes through to the clear well. The clear water overflows a weir to the discharge chamber, and pumped through the outlet to the receiving stream. Automatic backwash to clean filter media is accomplished by pumps located in the clear well. Chlorination is performed integrally within the tertiary unit.

For additional information, Address
Clow Corporation, Waste Treatment Division, 56 Industrial Road
P. O. Box 324, Florence, Kentucky 41042

CLOW FIELD ERECTED SEWAGE TREATMENT PLANTS

100,000 to 1,500,000 Gallons Per Day Capacity

Aer-O-Flo field erected steel sewage treatment plants are specifically designed to meet the requirements of growing communities and expanding industries.

The steel components are custom designed and fabricated at the factory. They are shipped to the job site complete, where the fabricated unit may be quickly and inexpensively field erected on a concrete pad.

The tank is constructed of steel plate, factory primed and finish painted after erection. Extra corrosion protection is added through the use of magnesium anode packages on below grade installations. Blowers provide a minimum of 1800 cubic feet of air per pound of B.O.D. entering the unit.

The system can utilize a variety of activated sludge processes—extended aeration, contact stabilization, step aeration. The unit may be designed to initially operate on the extended aeration process and easily converted to contact stabilization as the flow increases. Comminution, aerobic sludge digestion, and chlorination may be included as required.

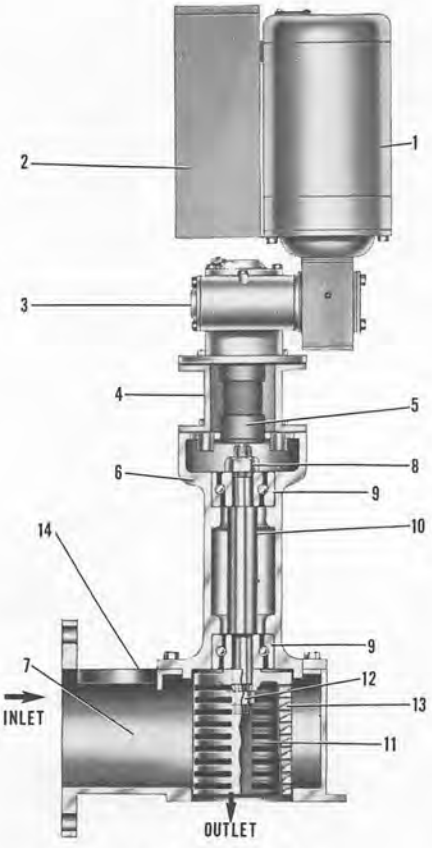
The Clow field erected systems provide for rapid expansion or upgrading of municipal facilities, and onsite treatment for large development projects serving communities of up to 15,000 population.

For quotations and detailed specifications address: Clow Corporation, Waste Treatment Division, P.O. Box 324, 56 Industrial Road, Florence, Kentucky 41042.

CLOW AER-O-FLO TYPE A COMMINUTOR

Patented Overload Reversing and Recycling Operation

6″, 8″, and 12″ Sizes



Aer-O-Flo Type A
Overload Reversing and
Recycling Comminutor

The Aer-O-Flo Type A Comminutor is a compact and sturdy unit designed for sewage treatment plants and other industrial applications where large solids must be eliminated from a continuous liquid flow. It has an automatic control system with automatic motor starter reset (in event of power failure) and an automatic drive motor reversal with time delay recycle in the event that objects which would jam an ordinary comminutor are encountered.

In operation, raw sewage enters thru the open top inlet trough, flows into the housing, and then passes thru the ¼″ slots in the rotating drum. Solids too large for the slots are caught up by the projecting teeth on the rotating drum and carried to the fixed cutter comb where the intermeshing of the projecting teeth with the slotted comb cut, shear, and shred the solids until they are small enough to be carried through the slots in the rotating drum by the sewage flow.

If exceptionally hard or tough objects jam the cutting teeth, the automatic control system reverses the rotation of the drum approximately one revolution, then forward direction is resumed. This operating cycle is repeated until the jamming object is small enough to pass thru the rotating drum.

PARTS AND DESCRIPTION

1. Weather-proof motor—56C flange frame
2. Weather-proof enclosure containing all comminutor control circuitry
3. Vertical flanged mounted reduction triple worm gear unit with splined output shaft
4. Spacer
5. Lovejoy coupling U-100
6. Communitor shell
7. Comminutor inlet trough
8. Hexagon jam nut
9. Sealed ball thrust bearing
10. Comminutor drum drive shaft
11. Revolving cylindrical sewage screen with cutter teeth mounted
12. Elastic stop nut
13. High carbon-chrome steel cutter teeth and cutter bar
14. Overflow trough

Engineering Data

Model Number	Inlet Size Inches	Capacity gals/min	HP	Speed RPM	Torque In. lbs	Rotation Direction	Inlet Area Sq. In.	Screen Outlet Area Sq. In.	Weight Pounds
A-5	6	140	½	29	855	Clockwise	28	11	160
A-8	8	300	½	29	855	Clockwise	50	35	200
A-12	12	850	¾	17.5	2530	Clockwise	113	78	325

For additional Information, Address
Clow Corporation, Waste Treatment Division, 56 Industrial Road
P. O. Box 324, Florence, Kentucky 41042

CLOW AER-O-FLO PACKAGE SEWAGE LIFT STATIONS

Prefabricated Steel or Concrete

Clow Package Sewage Lift Stations are completely factory-assembled, ready for operation and service when delivered. Installation requires less than a day after the excavation is completed. Dual, heavy duty Clow-Yeomans centrifugal sewage pumps or pneumatic ejectors give top performance when handling large solids, rags, or stringy material.

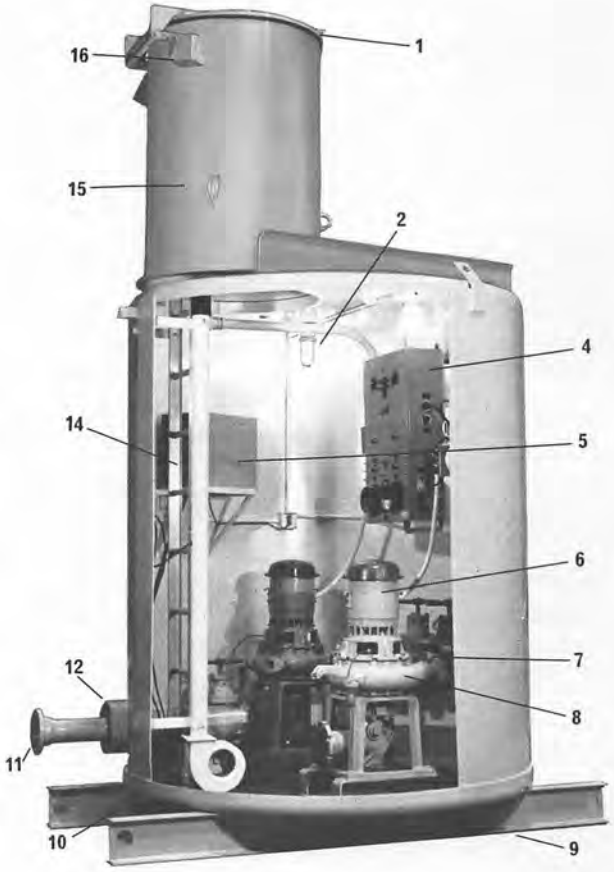
Automatic control system operates pumps singularly to meet peak conditions, and together during periods of abnormal flow. Automatic alternate pump or compressor operation provides uniform wear and provides stand-by operation.

Bitumastic or epoxy coatings, together with cathodic protection and normal maintenance assure maximum durability. A cutaway below illustrates typical construction and equipment. For specific job data, address Clow Corporation, Waste Treatment Division, 56 Industrial Road, Florence, Kentucky 41042.

Capacities and Heads

Centrifugal Pumps
Capacities: 50 to 4,000 GPM
Heads: 3 to 180 Feet

Pneumatic Ejectors
Capacities: 50 to 300 GPM
Heads: to 100 Feet



Centrifugal Pump Steel Lift Station, same typical arrangement available in concrete structure.

PARTS AND DESCRIPTION

1. Entrance Hatch
2. Control Chamber Light
3. Pump Discharge(Not Ill.)
4. Control Panel
5. Dehumidifier
6. Non-clog Sewage Pump
7. Valving and Piping
8. Pump Volute
9. I-Beam Floor Supports
10. Sump Pump
11. Pump Intake
12. Grouted Wall Sleeve
13. Magnesium Anode Package (Not Ill.)
14. Access Ladder
15. Entrance Tube
16. Screened Vent Opening

CLOW—VULCAN CHEMICAL WATER TREATMENT

Vulcan Laboratories Division

Chemical Water Treatment and Application Equipment serving Engineers and Architects for boiler and cooling water systems

CLOW—VULCAN LABORATORIES

Chemical Water Treatment and Application Equipment serve engineers and architects for boiler and cooling water systems.

Vulcan Laboratories provides a chemical water treatment service, selling equipment and offering technical knowledge and proprietary treatment products for engineered water quality control.

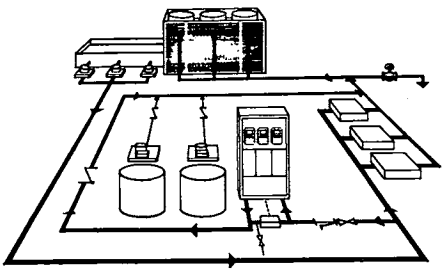
Vulcan chemical treatment is designed to prevent scale and corrosion in water handling equipment such as boiler, cooling water systems, process water equipment, steam, potable water and closed-water systems.

Related products include scale removers, oil and grease removers, microbiological treatments, condensate treatments and similar chemical treatment products.

Vulcan complete application systems automatically control water quality by dispensing custom built chemical formulations.

THE HYDROSYSTEMATIC© ENGINEERING APPROACH

Hydrosystematic/Engineering is Vulcan's approach for a completely automatic water treatment application system, custom designed for individual plant requirements. It provides a system-compatible water treatment designed to be fed directly from the shipping container, prefabricated, skid mounted and unitized for terminal connections. Hydrosystematic assures positive control for uninterrupted plant operation—without a measuring of liquids, a weighing of powders or counting balls.



The Total Program Is A Three Phase Procedure—

1. Properly engineered application systems
2. Custom formulated chemical treatments
3. Proper field service and testing control which will insure coordination of the system and chemical programs with the owners personnel.

Hydrosystematic Solves These Problems—

Constituents In Water	*Related Problems*
Dissolved solids	Scale-corrosion
Dissolved gases	Fouling factors
Microbiological growth	(algae, slime, fungi)
Suspended solids	Mud, silt, flyash

All these constituents are factors in forming deposits which retard heat transfer and water flow.

The Vulcan Hydrosystematic approach is offered with a variety of application controls. In all specifications, however, the three-problem areas are considered. In addition, testing equipment and field service support provide the complete control.

Vulcan's field service includes complete training of operating personnel and a continuous service program as part of the specifications. Vulcan Laboratories, Inc. services all locations throughout the country.

The consulting engineer and Vulcan work together to write performance specifications and provide a single source responsibility to insure the intent of that specification fulfills the complete needs of the owner.

For specific information, address
Clow Corporation, Vulcan Laboratories Division, 408 Auburn Avenue, Pontiac, Michigan 48058
(313) 334-4747

CLOW—VULCAN CHEMICAL WATER TREATMENT

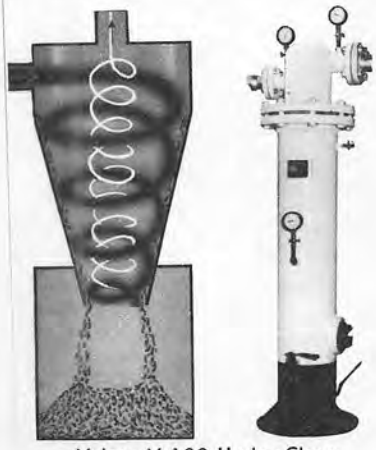
Vulcan Treatment Equipment

Vulcan V-5 Function Control

The Vulcan V-5, a new electro chemical analyzer controller, is a significant advancement toward a totally integrated water control system. It provides continuous, instantaneous measurement, analysis and automatic controlled treatment to eliminate formation of scale, corrosion and biological growth. In addition it maintains pH and dissolved solid concentrations below harmful levels. An alarm sounds if any malfunction occurs.

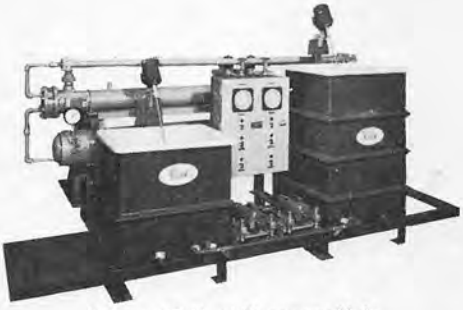
Vulcan FCA-1 Function Controller

Vulcan FCA-1 provides function controls and annunciator circuits to monitor and control chemical pumps, control valves, detect chemical levels and produce a maintenance record of each operational function. As a central control station for cooling water treatment it maintains the water in an open recirculating system free of scale, corrosion, and microbiological growths.



Vulcan V-100 Hydro-Clone

HYDRO-CLONE is a side stream separator that will remove suspended solids from water flowing through it. Mud, sand, silt, dead algae or other material is removed from the flow, collects in the bottom for easy removal. Not a filter, requires no backwashing, operates continuously. Particularly effective for use on recirculating and once-through cooling systems in any domestic or industrial water system.



Vulcan HR Heat Recovery Unit

A Vulcan boiler water blowdown, heat recovery and chemical feed system. Totally integrated, corrective chemical compounds are precisely and automatically added to the fresh "make up" water during introduction into the boiler process water. System includes a heat exchanger, feed pumps, chemical storage tanks and agitators, master control panel, sample cooler.

SECTION 7 · SPECIFICATIONS AND ADDENDA

SECTION 7 · SPECIFICATIONS AND ADDENDA

APPLICABLE SPECIFICATIONS FOR GRAY CAST IRON AND DUCTILE IRON PRESSURE PIPE AND FITTINGS

All the specifications covering the different types of Clow gray cast iron and ductile iron pipe and fittings are listed below, by product. The requirements of each specifying body listed for each product are identical. We list them all so that you can choose the authority you prefer. The latest revisions to the following specifications govern our manufacture.

Note

Pipe should not be specified by pressure class, because this ignores depth of cover and laying conditions. Specify thickness by the ANSI thickness designation number, such as Class 2, 3, 4, etc. (ductile cast iron), or Class 22, 23, 24, etc. (for gray cast iron) to cover the actual conditions for the project.

SPECIFICATION REFERENCE

Product Specified	Specifying Body and Specification Number		
	American Water Works Association **AWWA** Specification	American National Standards Institute **ANSI** Specification	United States Government **FEDERAL** Specification
Ductile Iron Super Bell-Tite Joint Pipe 3″ thru 24″	AWWA C151	ANSI A21.51	WW-P-421c, Type II Grade C
Gray Iron Super Bell-Tite Joint Pipe 3″ thru 24″	AWWA C106	ANSI A21.6	WW-P-421c, Type II Grades A & B
Super Bell-Tite Joint Detail	AWWA C111	ANSI A21.11	WW-P-421c, Type II
Ductile Iron Mechanical Joint Pipe 3″ thru 24″	AWWA C151	ANSI A21.51	WW-P-421c, Type III Grade C
Gray Iron Mechanical Joint Pipe 3″ thru 24″	AWWA C106	ANSI A21.6	WW-P-421c, Type III Grades A & B
Mechanical Joint Detail	AWWA C111	ANSI A21.11	WW-P-421c, Type III
Cement Lining	AWWA C104	ANSI A21.4	WW-P-421c
Polyethylene Encasement	AWWA C105	ANSI A21.5	No Standards. See AWWA or ANSI specification.
Ductile Pipe Wall Thickness Determination	AWWA C150	ANSI A21.50	WW-P-421c. See AWWA or ANSI specification.
Gray Iron Pipe Wall Thickness Determination	AWWA C106, Table 6.3. For Depths of cover not included in this table, determine thickness in accordance with AWWA C101 based on internal pressure, depth of cover and laying condition.	ANSI A21.6, Table 6.3. For depths of cover not included in this table, determine thickness in accordance with ANSI A21.1 based on internal pressure, depth of cover and laying condition.	WW-P-421c, for pipe laid without blocks in a flat bottom trench with tamped back-fill under 5-ft. of cover. See ANSI or AWWA specification.

APPLICABLE SPECIFICATIONS FOR GRAY CAST IRON AND DUCTILE IRON PRESSURE PIPE AND FITTINGS

SPECIFICATION REFERENCE (Continued)

Product Specified	Specifying Body and Specification Number		
	American Water Works Association **AWWA** Specification	American National Standards Institute **ANSI** Specification	United States Government **FEDERAL** Specification
Ductile Iron Flanged Joint Pipe 3" thru 24"	AWWA C151 for physical and chemical requirements of pipe barrel and AWWA C110 for flanges.	ANSI A21.51 for physical and chemical requirements of pipe barrel and ANSI A21.10 for flanges.	WW-P-421c, for physical and chemical requirements of pipe barrel. See AWWA or ANSI specification for flanges.
Gray Cast Iron Flanged Joint Pipe 3" thru 24"	AWWA C106 for physical and chemical requirements of pipe barrel and AWWA C110 for flanges.	ANSI A21.6 for physical and chemical requirements of pipe barrel and ANSI A21.10 for flanges.	WW-P-421c, for physical and chemical requirements of pipe barrel. See AWWA or ANSI specifications for flanges.
Gray iron and Ductile iron Fittings	AWWA C110	ANSI A21.10	No Standards. See AWWA or ANSI Specification.
Mechanical Joint Fittings	AWWA C110 and AWWA C111	ANSI A21.10 and ANSI A21.11	No Standards. See AWWA or ANSI Specification.
Super Bell-Tite Fittings	AWWA C110 and AWWA C111	ANSI A21.10 and ANSI A21.11	No Standards. See AWWA or ANSI Specification.
Flanged Fittings	AWWA C110	ANSI A21.10, or B16.1 where A21.10 is not applicable.	No Standards. See AWWA or ANSI Specification.
Ductile Cast Iron Pipe for Gas	No Standards.	ANSI A21.52	No Standards. See ANSI Specification.
Mechanical Joint Fittings for Gas	No Standards	ANSI A21.14	No Standards. See ANSI Specification.

Following are titles of the above specification numbers:

ANSI Spec. A21.1 and AWWA Spec. C101:
Thickness Design of Cast Iron Pipe.

Federal Specification WW-P-421c: Pipe, Cast Gray and Ductile Iron, Pressure (For Water and Other Liquids). 3" thru 24" size.

ANSI Spec. A21.4 and AWWA Spec. C104: Cement Mortar Lining for Cast Iron and Ductile Iron Pipe & Fittings for Water.

ANSI Spec. A21.5 and AWWA Spec. C105: Polyethylene Encasement for Gray and Ductile Cast Iron Piping for Water and Other Liquids.

ANSI Spec. A21.6 and AWWA Spec. C106:
Cast Iron Pipe Centrifugally Cast in Metal Molds, for Water or Other Liquids.

ANSI Spec. A21.10 and AWWA Spec. C110:
Gray Iron and Ductile Iron Fittings, 2" through 48", for Water and Other Liquids.

ANSI Spec. A21.11 and AWWA Spec. C111:
Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings.

ANSI Spec. B16.1: Cast Iron Pipe Flanges and Flanged Fittings, Class 125.

ANSI Spec. A21.50 and AWWA Spec. C150. Thickness Design of Ductile Iron Pipe.

ANSI Spec. A21.51 and AWWA Spec. C151: Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

ANSI A21.52. Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Gas.

ANSI A21.14: Gray Iron and Ductile Iron Fittings—3" thru 24"—for Gas.

THE DESIGN OF GRAY CAST IRON PIPE

A Digest of ANSI Standard A21.1 (AWWA C101) for the Thickness Design of Cast Iron Pipe

The American National Standards Institute, sponsored by American Water Works Association. American Gas Association, and New England Water Works Association have published Specification ANSI A21.1 (AWWA C101) Standard for the Thickness Design of Cast Iron Pipe. Federal Specification WW-P-421c is based on these results for 5′ of cover, laying condition B; for other conditions the ANSI Specifications should be used. This ANSI Standard provides a method for computing the thickness required for cast iron pipe when subjected to various internal pressures, depths of cover, and methods of laying. In addition, other factors are considered in determining the thickness of cast iron pipe, as mentioned below. Formerly, only the internal pressure was considered in determining the thickness of cast iron pipe.

CALCULATING THE THICKNESS OF CAST IRON PIPE

A formula was developed by ANSI Sectional Committee A21 to determine the pipe thickness taking into account both the bursting pressure and external load. The results of these formulae permit the plotting of curves of internal pressures and external loads based on definite assumed metal thicknesses, and the thicknesses for the desired combinations of internal pressure and external load can then be interpolated. Since this procedure is quite laborious, the Committee has constructed nomograms for the quick reading of pipe thickness for various combinations of internal pressure and external load. Curves of external load per linear foot of pipe for different laying conditions, trench dimensions and depths of cover have been constructed and values read from these curves must be converted to the three edge bearing, or laboratory test basis, by means of a factor in an appropriate table. With the resulting external load and the internal water pressure determined, these two fundamental factors in pipe wall thickness determination can be referred to the appropriate nomogram for reading the metal thickness required.

ADDITIONAL FACTORS FOR PIPE WALL THICKNESS DETERMINATION

In addition to external earth load and internal water pressure, the following additional allowances are made in order to insure that all applicable stresses are accounted for:

1. Allowance for Water Hammer

This allowance is read from a table showing the additional internal pressure equivalent to water hammer for different sizes of pipe and varies from 70 to 120 psi.

2. Allowance for Truck Load

The impact of trucks crossing over a pipe line is read from curves and tables and is added to the earth load. It is assumed highly improbable that a pipe line would be subject to water hammer and truck load at the same time, so the most severe condition of either water hammer and no truck load, or truck load and no water hammer is chosen in determining pipe wall thickness.

3. Factor of Safety

A factor of safety of 2.5 is applied to both the internal pressure plus water hammer and to the external earth load plus truck load. This safety factor is based on long time experience in pipe design.

4. Allowance for Foundry Tolerance

After reading the required pipe wall thickness from the nomograms, the maximum foundry thickness tolerance permitted by the ANSI Specifications is added to the required thickness.

5. Allowance for Corrosion

A corrosion allowance of .08 inches is also added to the thickness determined from the nomograms and the foundry tolerance.

To simplify pipe wall thickness determination, numerous calculations were made to produce tables covering the most common internal pressures and depths of cover for the different laying conditions, so that pipe wall thickness can be read directly from the tables without any calculation.

ANSI STANDARD PIPE WALL THICKNESS CLASSES

For convenience of reference, the Committee set up a system of class numbers for wall thicknesses for the various sizes of pipe, for instance, class 22, class 23, etc. For any pipe size, the thickness class designates a definite wall thickness.

It will be found that the standard thicknesses for the smaller sizes of pipe are appreciably in excess of the calculated thicknesses because certain minimum thicknesses were established to provide extra strength against possible damage from handling and shipping.

For a complete discussion of the ANSI Specification A21.1, together with the formulae and graphs referred to in this Digest, see the Standard.

The pipe tables on pages 216 through 219 are based on cast iron pipe of 18,000 and 21,000 psi tensile strength, although the method of computation applies to irons of any strength.

WALL THICKNESS OF GRAY CAST IRON PIPE CENTRIFUGALLY CAST IN METAL MOLDS

American National Standards Institute Specification A21.6 (AWWA C106)

To Find Thickness of Pipe Required to Meet Specific Conditions

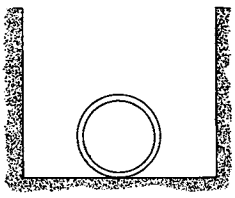
1. From the tables on pages 216 and 217, Standard ANSI Class Thickness, determine the Class Number of the Pipe by diameter, working pressure, laying condition, and depth of cover. Specific laying conditions applicable to cast iron pipe are illustrated below.

2. If actual wall thickness in decimals of an inch is desired, consult the table of Class Thickness below, and read off the required wall thickness corresponding to the correct Class Thickness number.

3. The use of table on pages 216 and 217, in connection with the Class Thickness Table below, gives correct wall thickness for a wide variety of service requirements. When these tables do not provide thickness for some other service requirement, consult the Standard for the Thickness Design for Cast Iron Pipe, ANSI Specification A21.1 (AWWA C101).

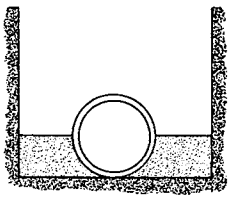
If pipe is designated as Class 150 or Class 250, this is the thickness determined for 5 ft. of cover, laying condition B per Federal Specification WW-P-421c only.

LAYING CONDITIONS



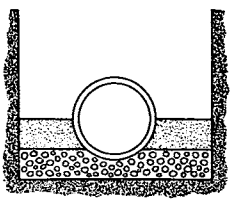
A

Flat bottom trench untamped backfill



B

Flat bottom trench tamped backfill



F

Pipe laid in sand or gravel, tamped backfill

CLASS THICKNESSES

Nominal Diameter Inches	Standard Class Numbers for Thickness of Pipe									
	No. 20	No. 21	No. 22	No. 23	No. 24	No. 25	No. 26	No. 27	No. 28	No. 29
	Pipe Thickness in Inches									
3	..	..	.32	.35	.38	.41	.44	.48	.52	.56
4	..	.32	.35	.38	.41	.44	.48	.52	.56	.60
6	..	.35	.38	.41	.44	.48	.52	.56	.60	.65
8	.35	.38	.41	.44	.48	.52	.56	.60	.65	.70
10	.38	.41	.44	.48	.52	.56	.60	.65	.70	.76
12	.41	.44	.48	.52	.56	.60	.65	.70	.76	.82
14	.43	.48	.51	.55	.59	.64	.69	.75	.81	.87
16	.46	.50	.54	.58	.63	.68	.73	.79	.85	.92
18	.50	.54	.58	.63	.68	.73	.79	.85	.92	.99
20	.53	.57	.62	.67	.72	.78	.84	.91	.98	1.06
24	.58	.63	.68	.73	.79	.85	.92	.99	1.07	1.16

STANDARD ANSI CLASS THICKNESSES OF 18/40 STRENGTH GRAY CAST IRON PIPE 3" THRU 10"

ANSI A21.1 (AWWA C101) Table 1-1 (Modified to show Thickness Class)

Nominal Inside Diameter Inches	Working Pressure psi	2½ Feet of Cover			3½ Feet of Cover			5 Feet of Cover			8 Feet of Cover			12 Feet of Cover			16 Feet of Cover		
		Laying Condition			Laying Condition			Laying Condition			Laying Condition			Laying Condition			Laying Condition		
		A	B	F	A	B	F	A	B	F	A	B	F	A	B	F	A	B	F
		ANSI Class Thickness*																	
3	50	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	100	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	150	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	200	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	250	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	300	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	350	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
4	50	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	100	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	150	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	200	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	250	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	300	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	350	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
6	50	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
	100	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	23	22	22
	150	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	23	22	22
	200	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	23	23	22
	250	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	23	23	22
	300	22	22	22	22	22	22	22	22	22	22	22	22	23	22	22	24	23	22
	350	22	22	22	22	22	22	22	22	22	22	22	22	23	23	22	24	24	23
8	50	22	22	22	22	22	22	22	22	22	22	22	22	23	22	22	24	23	22
	100	22	22	22	22	22	22	22	22	22	22	22	22	23	22	22	24	23	22
	150	22	22	22	22	22	22	22	22	22	22	22	22	23	23	22	24	24	22
	200	22	22	22	22	22	22	22	22	22	22	22	22	24	23	22	24	24	23
	250	22	22	22	22	22	22	22	22	22	23	22	22	24	24	23	25	24	23
	300	22	22	22	22	22	22	22	22	22	23	23	22	24	24	23	25	25	24
	350	22	22	22	22	22	22	23	22	22	24	23	23	25	24	24	25	25	24
10	50	22	22	22	22	22	22	22	22	22	22	22	22	24	23	22	24	24	23
	100	22	22	22	22	22	22	22	22	22	23	22	22	24	23	22	25	24	23
	150	22	22	22	22	22	22	22	22	22	23	22	22	24	24	23	25	24	23
	200	22	22	22	22	22	22	22	22	22	23	23	22	25	24	23	25	25	24
	250	22	22	22	22	22	22	23	22	22	24	23	23	25	25	24	26	25	24
	300	23	22	22	23	22	22	23	23	23	24	24	23	26	25	24	26	26	25
	350	23	23	23	23	23	23	24	24	23	25	24	24	26	26	25	26	26	25

* Thickness class includes allowances for foundry practice, corrosion, and either water hammer or truck load, whichever is greater.

STANDARD ANSI CLASS THICKNESSES OF 18/40 STRENGTH GRAY CAST IRON PIPE 12″ THRU 24″

ANSI A21.1 (AWWA C101) Table 1-1 Modified to show Thickness Class

Nominal Inside Diameter Inches	Working Pressure psi	2½ Feet of Cover			3½ Feet of Cover			5 Feet of Cover			8 Feet of Cover			12 Feet of Cover			16 Feet of Cover		
		Laying Condition			Laying Condition			Laying Condition			Laying Condition			Laying Condition			Laying Condition		
		A	B	F	A	B	F	A	B	F	A	B	F	A	B	F	A	B	F
		ANSI Class Thickness*																	
12	50	22	22	22	22	22	22	22	22	22	23	22	22	24	23	22	25	24	23
	100	22	22	22	22	22	22	22	22	22	23	22	22	24	24	22	25	24	23
	150	22	22	22	22	22	22	22	22	22	23	23	22	25	24	23	25	25	23
	200	22	22	22	22	22	22	22	22	22	24	23	22	25	24	23	26	25	24
	250	23	22	22	23	22	22	23	23	22	24	24	23	25	25	24	26	25	24
	300	23	23	22	23	23	23	24	23	23	25	24	24	26	25	25	26	26	25
14	50	22	21	21	22	21	21	22	21	21	24	23	22	25	24	23	26	25	24
	100	22	21	21	22	21	21	23	22	21	24	23	22	25	24	23	26	25	24
	150	23	22	21	23	22	21	23	22	21	25	24	23	26	25	24	26	25	24
	200	23	22	21	23	22	22	23	23	22	25	24	24	26	25	24	27	26	25
	250	24	23	22	24	23	23	24	24	23	25	25	24	26	26	25	27	26	25
	300	24	24	24	24	24	24	25	24	24	26	25	25	27	26	25	27	27	26
16	50	22	21	21	22	21	21	23	22	21	24	23	22	25	24	23	26	25	24
	100	23	22	21	22	22	21	23	22	21	24	23	22	25	24	23	26	25	24
	150	23	22	21	23	22	21	23	22	22	25	24	23	26	25	24	27	26	24
	200	23	23	22	23	23	22	24	23	23	25	24	24	26	25	24	27	26	25
	250	24	23	23	24	23	23	24	24	23	26	25	24	27	26	25	27	27	26
	300	24	24	24	24	24	24	25	25	24	26	26	25	27	27	26	28	27	26
18	50	22	21	21	22	21	21	22	21	21	24	23	22	25	24	23	26	25	23
	100	22	22	21	22	21	21	23	22	21	24	23	22	25	24	23	26	25	24
	150	23	22	21	23	22	21	23	22	22	25	24	23	26	25	24	27	26	24
	200	23	22	22	23	22	22	24	23	22	25	24	23	26	25	24	27	26	25
	250	24	23	23	24	23	23	24	24	23	26	25	24	27	26	25	27	27	26
	300	24	24	24	24	24	24	25	25	24	26	26	25	27	27	26	28	27	26
20	50	22	21	21	22	21	21	23	21	21	24	23	22	25	24	23	26	25	23
	100	23	21	21	22	21	21	23	22	21	24	23	22	25	24	23	26	25	24
	150	23	22	21	23	22	21	23	22	22	25	24	23	26	25	24	27	26	24
	200	24	23	22	23	22	22	24	23	22	25	24	23	26	25	24	27	26	25
	250	24	23	22	24	23	23	25	24	23	26	25	24	27	26	25	27	26	26
	300	25	24	24	25	24	24	25	25	24	26	26	25	27	26	26	28	27	26
24	50	22	21	21	22	21	21	23	21	21	24	23	22	25	24	23	26	25	24
	100	23	21	21	23	21	21	23	22	21	25	23	22	26	25	23	27	25	24
	150	23	22	21	23	22	21	24	23	22	25	24	23	26	25	24	27	26	25
	200	24	23	22	24	23	22	24	24	23	26	25	24	27	26	25	28	26	25
	250	25	24	23	24	24	23	25	24	24	26	25	25	27	26	25	28	27	26
	300	25	25	24	25	25	25	26	25	25	27	26	26	28	27	26	28	28	27

* Thickness class includes allowances for foundry practice, corrosion, and either water hammer or truck load, whichever is greater.

STANDARD ANSI CLASS THICKNESSES OF 21/45 STRENGTH GRAY CAST IRON PIPE

American National Standards Institute Specification A21.1 (AWWA C101)

To Find Thickness of Pipe Required to Meet Specific Conditions

The tables below are similar to those of page 216 and 217 except that they are computed for metal of 21,000 psi minimum bursting tensile strength and 45,000 psi minimum modulus of rupture. Because of the higher strength metal, class thickness for any given condition may be somewhat less than the class thickness on pages 216 and 217, which are for pipe of metal 18,000 psi minimum bursting tensile strength, and 40,000 psi minimum modulus of rupture.

Class thickness and equivalent actual wall thickness in inches is reproduced from Standard ANSI A21.1 (AWWA C101), and apply to pipe of any strength metal.

Laying Conditions

A—Flat bottom trench, untamped backfill.
B—Flat bottom trench, tamped backfill.
F—Bedded in gravel or sand, backfill tamped.

Nominal Inside Diameter Inches	Working Pressure psi	2½ Feet of Cover			3½ Feet of Cover			5 Feet of Cover			8 Feet of Cover		
		Laying Condition			Laying Condition			Laying Condition			Laying Condition		
		A	B	F	A	B	F	A	B	F	A	B	F
		ANSI Class Thickness*											
3	50	22	22	22	22	22	22	22	22	22	22	22	22
	100	22	22	22	22	22	22	22	22	22	22	22	22
	150	22	22	22	22	22	22	22	22	22	22	22	22
	200	22	22	22	22	22	22	22	22	22	22	22	22
	250	22	22	22	22	22	22	22	22	22	22	22	22
	300	22	22	22	22	22	22	22	22	22	22	22	22
	350	22	22	22	22	22	22	22	22	22	22	22	22
4	50	22	22	22	22	22	22	22	22	22	22	22	22
	100	22	22	22	22	22	22	22	22	22	22	22	22
	150	22	22	22	22	22	22	22	22	22	22	22	22
	200	22	22	22	22	22	22	22	22	22	22	22	22
	250	22	22	22	22	22	22	22	22	22	22	22	22
	300	22	22	22	22	22	22	22	22	22	22	22	22
	350	22	22	22	22	22	22	22	22	22	22	22	22
6	50	21	21	21	21	21	21	21	21	21	21	21	21
	100	21	21	21	21	21	21	21	21	21	21	21	21
	150	21	21	21	21	21	21	21	21	21	21	21	21
	200	21	21	21	21	21	21	21	21	21	21	21	21
	250	21	21	21	21	21	21	21	21	21	21	21	21
	300	21	21	21	21	21	21	21	21	21	21	21	21
	350	21	21	21	21	21	21	21	21	21	21	21	21
8	50	20	20	20	20	20	20	20	20	20	20	20	20
	100	20	20	20	20	20	20	20	20	20	21	20	20
	150	20	20	20	20	20	20	20	20	20	21	20	20
	200	20	20	20	20	20	20	20	20	20	21	21	20
	250	20	20	20	20	20	20	20	20	20	22	21	20
	300	21	20	20	20	20	20	21	21	20	22	22	21
	350	21	21	20	21	21	20	21	21	21	23	22	21
10	50	20	20	20	20	20	20	20	20	20	21	21	20
	100	20	20	20	20	20	20	20	20	20	22	21	20
	150	21	20	20	20	20	20	21	20	20	22	22	21
	200	21	20	20	21	20	20	21	21	20	23	22	21
	250	21	21	20	21	21	20	22	21	21	23	23	22
	300	22	21	21	22	21	21	22	22	21	23	23	22
	350	22	22	22	22	22	22	23	23	22	24	23	23
12	50	21	20	20	20	20	20	21	20	20	22	21	20
	100	21	20	20	21	20	20	21	20	20	22	22	21
	150	21	21	20	21	20	20	21	20	20	23	22	21
	200	22	21	20	21	21	20	22	21	20	23	22	22
	250	22	22	20	22	21	20	22	22	21	24	23	22
	300	22	22	21	22	22	21	23	22	22	24	23	23
	350	23	22	22	23	22	22	23	23	22	24	24	23

* Thickness class includes allowances for foundry practice, corrosion, and either water hammer or truck load, whichever is greater.

STANDARD ANSI CLASS THICKNESSES OF 21/45 STRENGTH GRAY CAST IRON PIPE

American National Standards Institute Specification A21.1 (AWWA C101)

Nominal Inside Diameter Inches	Working Pressure psi	2½ Feet of Cover Laying Condition			3½ Feet of Cover Laying Condition			5 Feet of Cover Laying Condition			8 Feet of Cover Laying Condition		
		A	B	F	A	B	F	A	B	F	A	B	F
		ANSI Class Thickness*											
14	50	21	21	21	21	21	21	21	21	21	23	22	21
	100	22	21	21	21	21	21	22	21	21	23	23	21
	150	22	21	21	22	21	21	22	21	21	24	23	22
	200	23	22	21	22	21	21	23	22	21	24	24	23
	250	23	22	21	23	22	21	23	23	22	25	24	23
	300	23	23	22	23	23	22	24	23	23	25	24	24
	350	24	23	23	24	24	23	24	24	24	25	25	24
16	50	22	21	21	21	21	21	22	21	21	23	22	21
	100	22	21	21	22	21	21	22	21	21	24	23	22
	150	22	21	21	22	21	21	23	22	21	24	23	22
	200	23	22	21	23	22	21	23	22	22	24	24	23
	250	23	22	22	23	22	22	23	23	22	25	24	23
	300	24	23	22	23	23	23	24	23	23	25	25	24
	350	24	23	23	24	24	23	25	24	24	26	25	25
18	50	22	21	21	21	21	21	22	21	21	23	22	21
	100	22	21	21	22	21	21	22	21	21	23	22	22
	150	22	21	21	22	21	21	23	22	21	24	23	22
	200	23	22	21	22	22	21	23	22	22	24	23	23
	250	23	22	21	23	22	22	23	23	22	25	24	23
	300	24	23	22	23	23	23	24	24	23	25	25	24
	350	24	23	23	24	24	24	25	24	24	26	25	25
20	50	21	21	21	21	21	21	22	21	21	23	22	21
	100	22	21	21	22	21	21	22	21	21	23	22	21
	150	22	21	21	22	21	21	23	22	21	24	23	22
	200	23	22	21	23	22	21	23	22	21	24	23	22
	250	23	22	21	23	22	22	24	23	22	25	24	23
	300	24	23	22	24	23	23	24	24	23	25	24	24
	350	24	24	23	24	24	24	25	24	24	26	25	25
24	50	22	21	21	22	21	21	22	21	21	23	22	21
	100	22	21	21	22	21	21	23	21	21	24	23	21
	150	23	21	21	22	21	21	23	22	21	24	23	22
	200	23	22	21	23	22	21	24	22	22	25	24	23
	250	24	23	22	24	22	22	24	23	23	25	24	24
	300	24	23	23	24	23	23	25	24	24	26	25	24
	350	25	24	24	25	24	24	25	25	25	26	26	25

* Thickness class includes allowances for foundry practice, corrosion, and either water hammer or truck load, whichever is greater.

STANDARD THICKNESS CLASS FOR GRAY CAST IRON PIPE

Nominal Diameter Inches	Standard Class Thickness									
	20	21	22	23	24	25	26	27	28	29
3	..	..	.32	.35	.38	.41	.44	.48	.52	.56
4	..	.32	.35	.38	.41	.44	.48	.52	.56	.60
6	..	.35	.38	.41	.44	.48	.52	.56	.60	.65
8	.35	.38	.41	.44	.48	.52	.56	.60	.65	.70
10	.38	.41	.44	.48	.52	.56	.60	.65	.70	.76
12	.41	.44	.48	.52	.56	.60	.65	.70	.76	.82
14	.43	.48	.51	.55	.59	.64	.69	.75	.81	.87
16	.46	.50	.54	.58	.63	.68	.73	.79	.85	.92
18	.50	.54	.58	.63	.68	.73	.79	.85	.92	.99
20	.53	.57	.62	.67	.72	.78	.84	.91	.98	1.06
24	.58	.63	.68	.73	.79	.85	.92	.99	1.07	1.16

GRAY CAST IRON AND DUCTILE CAST IRON PIPE THICKNESSES REQUIRED FOR DIFFERENT TAP SIZES

Pipe thickness in inches required for different tap sizes with 2, 3, or 4 full threads (ANSI A21.51 Appendix)

Nominal Pipe Size Inches	Number of Full Threads	Tap Size with ANSI B2.1 Standard Taper Pipe Threads										Tap Size with AWWA C800 Standard Corporation Stop Threads						
		½	¾	1	1¼	1½	2	2½	3	3½	4	½	⅝	¾	1	1¼	1½	2
3	2	.18	.21	.28								.21	.24	.25	.33			
3	3	.26	.29	.37								.29	.32	.33	.41			
3	4	.33	.36	.46								.36	.39	.40	.49			
4	2	.17	.19	.26	.31							.19	.22	.23	.30	.36		
4	3	.25	.27	.35	.40							.27	.30	.31	.38	.45		
4	4	.32	.34	.44	.49							.34	.37	.38	.46	.54		
6	2	.17	.18	.23	.27	.30						.18	.20	.20	.26	.30	.35	
6	3	.25	.26	.32	.36	.39						.26	.28	.28	.34	.39	.44	
6	4	.32	.33	.41	.45	.48						.33	.35	.35	.42	.48	.53	
8	2	.16	.17	.22	.24	.27	.33					.17	.18	.19	.24	.27	.31	.39
8	3	.24	.25	.31	.33	.36	.42					.25	.26	.27	.32	.36	.40	.48
8	4	.31	.32	.40	.42	.45	.51					.32	.33	.34	.40	.45	.49	.57
10	2	.15	.17	.21	.23	.25	.30	.44				.17	.17	.18	.23	.25	.28	.35
10	3	.23	.25	.30	.32	.34	.39	.56				.25	.25	.26	.31	.34	.37	.44
10	4	.30	.32	.39	.41	.43	.48	.69				.32	.32	.33	.39	.43	.46	.53
12	2	.15	.16	.20	.22	.24	.28	.40	.48			.16	.17	.17	.22	.24	.26	.32
12	3	.23	.24	.29	.31	.33	.37	.52	.60			.24	.25	.25	.30	.33	.35	.41
12	4	.30	.31	.38	.40	.42	.46	.65	.73			.31	.32	.32	.38	.42	.44	.50
14	2	.15	.16	.20	.22	.23	.26	.38	.45	.51	.58	.16	.17	.17	.21	.23	.25	.30
14	3	.23	.24	.29	.31	.32	.35	.50	.58	.64	.70	.24	.25	.25	.29	.32	.34	.39
14	4	.30	.31	.38	.40	.41	.44	.63	.70	.76	.83	.31	.32	.32	.37	.41	.43	.48
16	2	.15	.16	.20	.21	.22	.25	.37	.43	.48	.54	.16	.16	.17	.21	.22	.24	.28
16	3	.23	.24	.29	.30	.31	.34	.50	.56	.60	.66	.24	.24	.25	.29	.31	.33	.37
16	4	.30	.31	.38	.39	.40	.43	.62	.68	.73	.79	.31	.31	.32	.37	.40	.42	.46
18	2	.15	.15	.19	.21	.22	.24	.35	.41	.46	.51	.15	.16	.16	.20	.21	.23	.27
18	3	.23	.23	.28	.30	.31	.33	.48	.54	.58	.64	.23	.24	.24	.28	.30	.32	.36
18	4	.30	.30	.37	.39	.40	.42	.60	.66	.71	.76	.30	.31	.31	.36	.39	.41	.45
20	2	.15	.15	.19	.20	.21	.23	.34	.39	.44	.49	.15	.16	.16	.20	.21	.23	.26
20	3	.23	.23	.28	.29	.30	.32	.46	.52	.56	.62	.23	.24	.24	.28	.30	.32	.35
20	4	.30	.30	.37	.38	.39	.41	.59	.64	.69	.74	.30	.31	.31	.36	.39	.41	.44
24	2	.14	.15	.19	.20	.21	.22	.32	.37	.40	.45	.15	.15	.16	.19	.21	.22	.24
24	3	.22	.23	.28	.29	.30	.31	.44	.50	.52	.58	.23	.23	.24	.27	.30	.31	.33
24	4	.29	.30	.37	.38	.39	.40	.57	.62	.65	.70	.30	.30	.31	.25	.39	.40	.42

STANDARD THICKNESS SELECTION TABLE FOR DUCTILE CAST IRON PIPE

Laying Conditions

A—Flatbottom trench, untamped backfill B—Flatbottom trench, tamped backfill
S—Special bedding and backfill as specified in ANSI A21.50 (AWWA C150)

LAYING CONDITIONS A AND B

ANSI A21.51 (AWWA C151) TABLE 51.2 (Modified To Show Thickness Class)

Size In.	Laying Condition	Rated Working Pressure* psi	Depth of Cover in Feet							
			2½	3½	5	8	12	16	20	24
			Thickness Class**							
3	A or B	350	2	2	2	2	2	2	2	2
4	A or B	350	2	2	2	2	2	2	2	2
6	A or B	350	2	2	2	2	2	2	2	2
8	A or B	350	2	2	2	2	2	2	2	2
10	A or B	350	2	2	2	2	2	2	3	3
12	A	350	2	2	2	2	2	2	3	4
12	B	350	2	2	2	2	2	2	3	3
14	A	350	1	1	1	1	2	3	4	4
14	B	350	1	1	1	1	1	3	3	4
16	A or B	350	1	1	1	1	2	3	4	5
18	A	300	1	1	1	1	2	4	5	6
18	A	350	2	2	2	2	2	4	5	6
18	B	300	1	1	1	1	2	3	4	6
18	B	350	2	2	2	2	2	3	4	6
20	A	250	1	1	1	1	3	4	6	...
20	A	300	2	2	2	2	3	4	6	...
20	A	350	3	3	3	3	3	4	6	...
20	B	250	1	1	1	1	2	4	5	...
20	B	300	2	2	2	2	2	4	5	...
20	B	350	3	3	3	3	3	4	5	...
24	A	250	2	1	1	2	4	6	...	...
24	A	300	3	3	3	3	4	6	...	...
24	A	350	4	4	4	4	4	6	...	...
24	B	250	1	1	1	1	3	5	...	...
24	B	300	3	3	3	3	3	5	...	...
24	B	350	4	4	4	4	4	5	...	...

LAYING CONDITION S

ANSI A21.50 (AWWA C150) Table 11

The classes listed below for Laying Condition "S" apply only to ductile iron pipe for water when laying conditions meet the bedding and backfill requirements of Section 50-6 of ANSI A21.50 (AWWA C150). Consult the specification before use.

Size In.	Laying Condition	Rated Working Pressure* psi	Depth of Cover in Feet											
			16	20	24	28	32	36	40	44	48	52	56	60
			Thickness Class**											
14	S	350	1	1	1	1	1	1	1	2	3	3	4	4
16	S	350	1	1	1	1	1	1	2	3	4	4	5	6
18	S	300	1	1	1	1	1	2	3	4	4	5	6	7
18	S	350	2	2	2	2	2	2	3	4	4	5	6	7
20	S	250	1	1	1	1	2	3	4	4	5	6	7	8
20	S	300	2	2	2	2	2	3	4	4	5	6	7	8
20	S	350	3	3	3	3	3	3	4	4	5	6	7	8
24	S	250	1	1	2	3	4	5	5	6	7	8	9	10
24	S	300	3	3	3	3	4	5	5	6	7	8	9	10
24	S	350	4	4	4	4	4	5	5	6	7	8	9	10

* For working pressures less than those listed above, use the minimum class listed in the table for the required depth of cover.

** The classes listed above equal or exceed the thickness required to withstand rated working pressure (plus a surge allowance of 100 psi) and trench load (including truck superload) for the indicated depths of cover.

See page 15 for the nominal wall thicknesses of Classes 1 thru 6 and Table 11 in ANSI A21.50 (AWWA C150) for Classes 7 thru 10.

CAST IRON PIPE DEFLECTION DATA

USEFUL TABLES

The tables below provide data for determining the amount of deflection permitted in varying distances for a given pipe line. When it is known what degree of deflection is applicable to the diameter and joint type of pipe, the table permits reading off the deflection measurement in feet, and readily establishes whether or not the pipeline requires fittings to pass around obstructions or to conform to required layout.

Example

Assume an 8″ Mechanical Joint pipe line must be offset 15 feet in a distance of 100 feet. The question arises whether this offset can be accomplished by deflecting the pipeline, or whether fittings are required.

First, from Table I, determine maximum deflection in degrees that is permissible for 8″ Mechanical Joint pipe, which is 5° - 21′. Choose the *whole number* of degrees *below the maximum*, which for this pipe is 5 degrees.

If the pipe line is to be brought back parallel to its original position, one half of the offset is required in one half of the distance, or 7½ feet in 50 feet. Referring to the 5 degree column of Table II, it is indicated that the pipe line can be deflected 9.35 feet in 54 feet. Hence the required offset can be made by deflecting the pipe joint, without the use of fittings.

On the other hand, if the pipe line is to be merely deflected, instead of offset, it can be determined from Table II that with 5 degrees deflection, the line can be deflected 32.12 feet in a distance of 108 feet, satisfying the requirement.

TABLE I
Maximum Deflection of Cast Iron Pipe*

Type of Pipe Joint	Pipe Size in Inches										
	3	4	6	8	10	12	14	16	18	20	24
Super Bell-Tite	5°	5°	5°	5°	5°	5°	3°	3°	3°	3°	3°
Mechanical Joint	8°-18′	8°-18′	7°-7′	5°-21′	5°-21′	5°-21′	3°-35′	3°-35′	3°-0′	3°-0′	2°-23′
Locked M.J.	3°	2°-45′	2°	1°-30′	1°-15′	1°	0°-45′	0°-45′	0°-30′	0°-30′	0°-30′
Super-Lock	...	...	4°	4°	4°	4°	3°	3°	3°	3°	3°
River Crossing	...	...	15°	15°	15°	15°	15°	15°	15°	15°	15°

* Sound engineering dictates that to accommodate unknown field conditions, the "design" deflection of any joint be limited to 80 per cent of the maximum value shown in the table above.

Also see detailed data on pages 36, 55, and 86.

TABLE II
Total Deflection of Pipe in Feet for Different Angles of Deflection and Number of Lengths of Pipe

Total Length of Pipe in Feet	Number of Lengths of Pipe	Degrees of Deflection Per Joint							
		1°	2°	3°	4°	5°	6°	12°	15°
18	1	.31	.63	.94	1.26	1.57	1.88	3.74	4.66
36	2	.94	1.88	2.82	3.76	4.69	5.62	11.06	13.66
54	3	1.88	3.77	5.64	7.50	9.35	11.19	21.64	26.39
72	4	3.14	6.27	9.38	12.47	15.51	18.51	35.02	41.97
90	5	4.71	9.40	14.04	18.62	23.12	27.51	50.61	59.36
108	6	6.59	13.14	19.60	25.94	32.12	38.09	67.73	....
126	7	8.79	17.49	26.05	34.39	42.44	50.13	85.63	....
144	8	11.29	22.45	33.37	43.93	54.01	63.51	....	....
162	9	14.11	28.02	41.54	54.51	66.74	78.07	....	....
180	10	17.23	34.17	50.54	66.08	80.53	93.66	....	....
Approx. Radius in feet of curve produced by a succession of joints		1034	514	343	258	206	172	86	68
Approx. number of 18 foot lengths of pipe required to make a 90 degree bend		90	45	30	23	18	15	8	6

SAND CAST—BELL AND SPIGOT CAST IRON PIPE—FOR WATER

Meeting American Water Works Association Specifications of May 12, 1908

NOW OBSOLETE—FOR INFORMATION ONLY

Classes A, B, C, D

Most cast iron pipe installed in water distribution systems in our country prior to 1927 was made to the above specifications. Considering that most of these installations are still in service, we include these data in our catalog for information only. We do not now manufacture this pipe.

Outside Diameter—inches

Nominal Pipe Size Inches	4	6	8	10	12	14	16	18	20	24
Class "A"	4.80	6.90	9.05	11.10	13.20	15.30	17.40	19.50	21.60	25.80
Class "B"	5.00	7.10	9.05	11.10	13.20	15.30	17.40	19.50	21.60	25.80
Class "C"	5.00	7.10	9.30	11.40	13.50	15.65	17.80	19.92	22.06	26.32
Class "D"	5.00	7.10	9.30	11.40	13.50	15.65	17.80	19.92	22.06	26.32

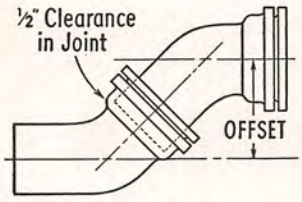
THICKNESSES AND WEIGHTS*

Nominal Inside Diameter Inches	CLASS "A" 100-Foot Head 43 Pounds Pressure					CLASS "B" 200-Foot Head 86 Pounds Pressure				
	Thickness Inches	Weight of 12-Foot Length Pounds Per		Weight of 16-Foot Length Pounds Per		Thickness Inches	Weight of 12-Foot Length Pounds Per		Weight of 16-Foot Length Pounds Per	
		Foot	Length	Foot	Length		Foot	Length	Foot	Length
4	.42	20.0	240	19.7	315	.45	21.7	260	21.2	340
6	.44	30.8	370	30.3	485	.48	33.3	400	32.5	520
8	.46	42.9	515	42.2	675	.51	47.5	570	46.6	745
10	.50	57.1	685	55.9	895	.57	63.8	765	62.5	1000
12	.54	72.5	870	71.2	1140	.62	82.1	985	80.6	1290
14	.57	89.6	1075	...	...	.66	102.5	1230	...	...
16	.60	108.3	1300	...	...	.70	125.0	1500	...	...
18	.64	129.2	1550	...	...	.75	150.0	1800	...	...
20	.67	150.0	1800	...	...	.80	175.0	2100	...	...
24	.76	204.2	2450	...	...	.89	233.3	2800	...	...

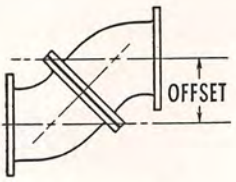
Nominal Inside Diameter Inches	CLASS "C" 300-Foot Head 130 Pounds Pressure					CLASS "D" 400-Foot Head 173 Pounds Pressure				
	Thickness Inches	Weight of 12-Foot Length Pounds Per		Weight of 16-Foot Length Pounds Per		Thickness Inches	Weight of 12-Foot Length Pounds Per		Weight of 16-Foot Length Pounds Per	
		Foot	Length	Foot	Length		Foot	Length	Foot	Length
4	.48	23.3	280	22.8	365	.52	25.0	300	24.4	390
6	.51	35.8	430	35.0	560	.55	38.3	460	37.5	600
8	.56	52.1	625	50.9	815	.60	55.8	670	54.7	875
10	.62	70.8	850	69.4	1110	.68	76.7	920	75.3	1205
12	.68	91.7	1100	90.0	1440	.75	100.0	1200	98.4	1575
14	.74	116.7	1400	...	...	.82	129.2	1550	...	...
16	.80	143.8	1725	...	...	.89	158.3	1900	...	...
18	.87	175.0	2100	...	...	.96	191.7	2300	...	...
20	.92	208.3	2500	...	...	1.03	229.2	2750	...	...
24	1.04	279.2	3350	...	...	1.16	306.7	3680	...	...

*All weights are approximate. The difference in weight per foot between the 12 and 16 foot lengths is accounted for by the fact that the weight of the bell in the longer length is spread over a greater number of feet. The weight per foot of pipe without bell is the same in both lengths.

MAKING OFFSETS ON THE JOB



Mechanical Joint



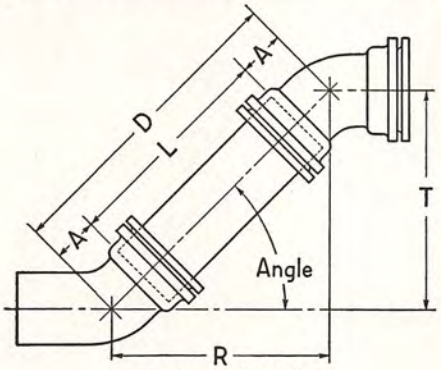
Flanged Joint*

Using Two Bends—Offset in Inches

Nominal Diameter Inches	ANSI A21.10 Mechanical Joint			Flanged ANSI A21.10 or B16.1			
				Short Radius			Long
	90°	45°	22½°	90°	45°	22½°	90°
3	19.50	10.25	5.56	11.00	4.24	2.30	15.50
4	21.50	11.69	6.31	13.00	5.66	3.06	18.00
6	24.50	13.06	7.06	16.00	7.07	3.83	23.00
8	26.50	13.75	7.50	18.00	7.78	4.21	28.00
10	30.50	15.19	8.25	22.00	9.19	4.98	33.00
12	32.50	16.62	9.00	24.00	10.61	5.74	38.00
14	36.50	16.62	8.99	28.00	10.61	5.74	43.00
16	38.50	17.32	9.38	30.00	11.31	6.12	48.00
18	41.50	18.03	9.76	33.00	12.02	6.51	53.00
20	44.50	19.45	10.52	36.00	13.44	7.27	58.00
24	52.50	21.57	11.67	44.00	15.56	8.42	68.00

* No allowance is made in offset figures for gasket thickness.

DETERMINING LENGTH OF PIPE IN OFFSET JOINTS



Mechanical Joint

Angle	D Equals	R Equals	L† Equals
45°	T x 1.414	T x 1.000	D-2A
22½°	T x 2.613	T x 2.414	D-2A
11¼°	T x 5.126	T x 5.027	D-2A

† Cut the pipe somewhat shorter than theoretical to allow for some slight clearance in the joints.

Problem

A 14-inch Mechanical Joint line is to be offset 14 feet on an angle of 45-degrees using two Mechanical Joint bends. What is the laying length (L) of pipe required to make the connection between the two bends?

Solution

D(14′0″x1.414) = 19.796′ R(14′0″x1.000) = 14.000′ A(7.5″) = .625′ A+A = 1.250′
L(19.796′ − 1.250′) = 18.546′ or approximately 18′6 9/16″, laying length of connecting pipe.

SECTION 8 · USEFUL INFORMATION

RESTRAINING THRUSTS

General Information

The information below and on page 227 is provided to assist you in designing a restrained joint system subject to thrusts.

Thrust forces in water mains are created when the pipeline changes directions (at bends and tees), stops (at dead ends) or changes in size (at reducers). In order to keep the pipeline intact, there are several methods of restraint available—involving concrete thrust blocks, steel tie rods or restrained joint pipe. Both thrust blocks and tie rods present problems to both the designer and the installer.

Concrete, when used for thrust blocks, must be of good quality with a compressive strength at 28 days of at least 2,000 pounds. Care must be taken to assure that the joint itself will be accessible and it is imperative that the block is constructed so that the force is transmitted to undisturbed soil.

Tie rods and clamps have virtually no "one best way" of installation. There exist a wide variety of possible types. Most tie rod systems have one thing in common—they are made of steel. If tie rods are used, it is essential that all steel material be coated with a suitable, permanent rust inhibitor to prevent rusting and subsequent deterioration.

Rapidly replacing these two old-fashioned methods for restraining thrusts is the Clow Super-Lock restrained joint system described on pages 86–88.

Super-Lock is a boltless push-on restrained joint of advanced design that combines the fast, easy installation of Super Bell-Tite push-on pipe and fittings with a simple, positive locking system which prevents joint separation. The design provides for joint deflection after assembly and for easy disassembly should the need arise.

Thrust at Fittings at 100 PSI Water Pressure

Total Pounds

Nom. Pipe Dia. In.	Dead End	90° Bend	45° Bend	22½° Bend	11¼° Bend
4	1,810	2,559	1,385	706	355
6	3,739	5,288	2,862	1,459	733
8	6,433	9,097	4,923	2,510	1,261
10	9,677	13,685	7,406	3,776	1,897
12	13,685	19,353	10,474	5,340	2,683
14	18,385	26,001	14,072	7,174	3,604
16	23,779	33,628	18,199	9,278	4,661
18	29,865	42,235	22,858	11,653	5,855
20	36,644	51,822	28,046	14,298	7,183
24	52,279	73,934	40,013	20,398	10,249

NOTE: To determine thrust at pressures other than 100 psi, multiply the thrust obtained in the table by the ratio of the pressure to 100.

For example, the thrust on a 12 inch, 90° bend at 125 psi is $19{,}353 \times \frac{125}{100} = 24{,}191$ pounds.

Restrained Joint Design Data

This design applies to soil mechanics involved in resolving the applied thrust forces (PA) resisted by the combination of lateral and friction forces on the restrained section of pipe. The lateral soil resistance F_N is a function of the length to be restrained L and the horizontal force F_H due to the passive soil pressure P_p. Taking the free body diagram and solving for L results in the equation (1). The frictional resistance f_s, resisting axial movement, is a function of the normal force W, pipe friction δ and pipe-to-soil cohesion C. Design based on a constant diameter bend and static forces.

The following formulas, tables and examples give the designer sufficient information to design a ductile iron pipe restrained joint system. Space does not permit a detailed discussion of the derivation of formulas and tables.

Formulas:

1) $L = \dfrac{S_f\,KPA}{KF_s + DP_p}$ 2) $K = 4\,\mathrm{Tan}\,\Theta/2$ (Calculation Coefficient)
S_F = safety factor P = design pressure (psi)
Θ = pipe bend (degrees) D = O.D. of pipe (ft)

3) $F_s = ApC + WTan\delta$ frictional resistance (lb/lf)

4) $Pp = wH\alpha N_\phi + 2C_s\sqrt{N_\phi}$

5) $N_\phi = \mathrm{Tan}^2\,(450 + \phi)$ ratio

6) $W = RW\pi HD$
$A = \dfrac{\pi d^2}{4}$ ∴ d = O.D. pipe (in) Θ = pipe bend (degrees)
Ap = area of pipe surface ft²/lf

7) $C = f_cC_s$ (psf)

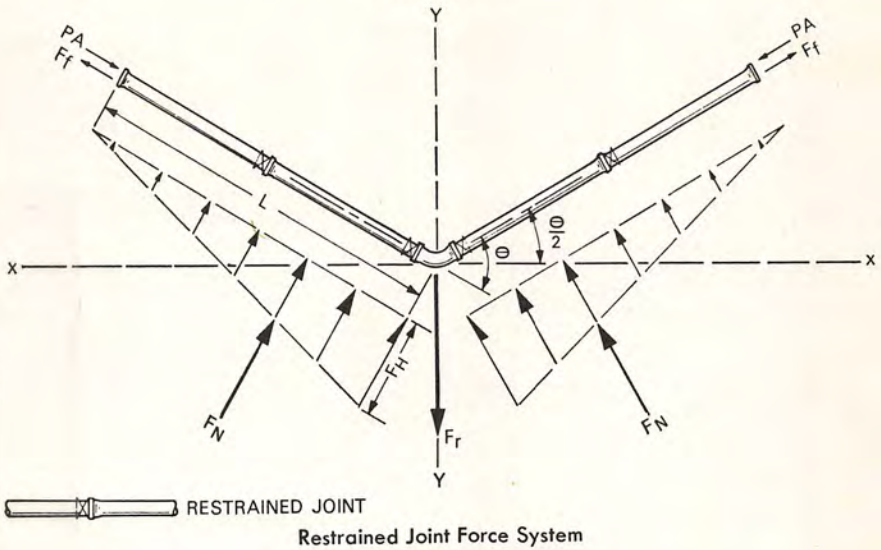
8) $\delta = f_\phi\phi$ (degrees)
w = soil wt. (lb) H_c = soil depth pipe ℄ (ft)
C_s = soil cohesion (lb/ft²) ϕ = internal soil friction angle (degrees)
H = depth of cover (ft) R = reduction factor
f_c = ratio (pipe cohesion/soil cohesion)
f_ϕ = ratio (pipe friction angle/soil friction angle)

TABLE I
(Equation 8)

Existing Condition	Reduction Factor, R
1. General construction—Backfill soils compacted to critical void ratio	⅔
2. Well-compacted backfill and select backfill	¾
3. Shallow cover—depth of cover less than ½ of the outside diameter.	½

Design data continued on next page

RESTRAINING THRUSTS
(Continued)



Restrained Joint Force System

TABLE II

SOIL FRICTION AND COHESION FACTORS
(Source: Potyondy) (Equation 8)

Soil Description	Friction Angle ϕ (Degrees)	Cohesion C (psf)	f_ϕ	f_α
Well graded sand (dry)	44.5	0	0.76	0
(sat.)	39	0	0.80	0
Silt (passing 200 sieve) (dry)	40	0	0.95	0
(sat.)	32	0	0.75	0
Cohesive granular soil (wet to moist)	13–22	385–920	0.65	0.35
Clay (wet to moist)	11.5–16.5	460–1,175	0.50	0.50
(at max. comp.)			0.50	0.80

Design Example

Calculate:

Restrained length (L) for a 12-inch diameter ductile iron pipeline using restrained joints for horizontal bends of 45° and 90°.

Project Data

D = 13.2 inch = 1.10 feet $A = \frac{\pi D^2}{4}$ = 136.85 inch²

P = 250 psi (operating plus surge pressure)

PA = 250 (136.85) = 34,212 lbs.

H = 5 feet and $H_c = 5 + 1.10/2 = 5.55$ feet

Θ = 45° and 90° use $S_f = 1.25$ C_s = 500 psf

W = 120 pcf, laying condition "B", nominal length = 18 feet

Cohesive—moist granular soil from Table II $\phi = 17°$

From Table II = $f_c = 0.35$ $f\phi = 0.65$

From Table I = R = ⅔

Computations

1. Θ = 45° *2) K = 1.657 *5) $N_\phi = 1.826$

*3) $F_s = \pi$ (1.10) [(.35 × 500) + 120 (⅔) 5 Tan (.65 × 17)°] = 874.7 psf

*4) $Pp = (120)(5.55)(1.826) + (2)500\sqrt{1.826}$ = 2567.4 psf

*1) $L = \frac{1.25\ (1.657)\ 34{,}212}{1.657\ (874.7) + 1.10\ (2567.4)} =$ 16.58 feet

Restrain one length of pipe (18 feet) on each side of bend

2. Θ = 90° K = 4

Use F_s and P_p from above

$L = \frac{1.25\ (4)\ (34{,}212)}{(4)\ (874.7) + 1.10\ (2567.4)} = 27.05$ feet

Restrain two lengths of pipe (36 feet) on each side of bend

* Note: (equation no.)

FLOW OF WATER IN CAST IRON PIPE

The flow of water in cast iron pipe is governed by many factors, chief among them being smoothness of the interior, the ability to stay smooth and the *actual inside* diameter. A reduction of flow in a pipe line can occur after a line is installed for any of the reasons discussed below.

All of these difficulties can be taken care of by proper construction practices, proper design and proper operation. The following comments on these factors are reprinted from the Handbook of Cast Iron Pipe, published by the Cast Iron Pipe Research Association.

Sedimentation

Transmission mains that carry raw water from rivers or lakes are subject to heavy deposits of silt and sand whenever the rivers are at flood stage, or the lakes turbulent. Many of the older distribution systems were supplied with raw water for years before the construction of treatment plants. During the low consumption periods at night, these waters settled out a layer of mud along the bottom of the pipe. Sand may enter the raw water lines at most any time and it may enter the distribution lines whenever the filters become defective or when the beds are abused by inexpert operation. If sedimentation has occurred, the remedy is either to flush the mains or when this is not effective, to carry on a pipe cleaning operation.

Obstructions in Pipe

Modern pipe laying specifications require that each length of pipe be cleaned out before installation in the line. They also require that the end of the pipe be closed with a plug after each day's work. In spite of these provisions it is a fact that at times stones thrown into the pipe by children, or pieces of wood, tools, boots, and other things placed in the last pipe by workmen, who expect to remove them before the work continues, are sometimes left in the pipe. Good laying practice should eliminate this difficulty.

Partly Closed Valves

In the ordinary operation of a water works system, it becomes necessary from time to time to close valves to carry on maintenance and extension work and in many of the systems, valves are throttled for pressure control purposes. Care should be taken to the end that closed valves be opened after the construction work is completed and the location of throttle valves properly recorded so that in the event that future operation requires a full opening, these valves may be opened. The opening and closing of valves is an important part of distribution system operation and records should be kept in such a fashion that no valves are accidentally left closed or partly closed.

Accumulation of Air at Summits

In supply lines in hilly country, there is occasionally an opportunity for air to accumulate at a summit to the point where the water occupies only a portion of the total area of the pipe. In extreme cases, water may even be shut off completely by the accumulation of air. The remedy for this difficulty is to provide air valves at summits in installations of this nature.

Tuberculation

In certain parts of the United States, uncoated or unlined cast iron water mains may develop a nodular growth on the interior of the pipe. These growths are called tubercules and their accumulation will materially affect the capacity of the pipe line. These growths can only occur where the water comes in contact with the metal of the pipe and the remedy for the difficulty is the use of cement linings wherever "active" waters are to be transported.

Slime Growths

Some water supplies are troubled with organic growths in the mains. Many of the growths may be due to the use of surface water containing microscopic organisms. Some of these may cause tastes and odors, and others, while having little effect on the quality of the water, cling to the walls of the pipe reducing the rate of flow in the line. These growths may be removed by the use of chlorine, a combination of chlorine and ammonia, or copper sulfate. The nature of the treatment depends on each individual case and the application of chemicals should usually be started by the use of small dosages with gradual increase until the required effect results. A sudden change in chemical dosage is liable to cause complaints of tastes or odors.

Mineral Deposits

In rare cases, waters are highly mineralized. These minerals are picked up from the rock formations through which the water seeps in its underground passage. Some waters are supersaturated and the minerals only loosely held in solution. A small amount of air mixed with water in the pumping operation may cause the mineral to deposit out, or the water may change temperature and in this manner cause precipitation. Natural lime waters usually form a hard, smooth deposit on the entire wall of the pipe and do not increase the friction loss to an appreciable extent until the diameter of the pipe is materially reduced. Mineral deposits in mains are difficult to remove, usually requiring special cleaning tools. Lime deposits that result from softening and filtration processes are sometimes carried out into the mains. As a rule, these deposits are relatively soft and may be removed by ordinary pipe cleaning operations.

(Continued on next page)

FLOW OF WATER IN CAST IRON PIPE

Almost all gray and ductile cast iron pipe for water transmission and distribution are cement-mortar-lined in accordance with ANSI Standard A21.4 (AWWA C104) or Federal specifications WW-P-421c.

The flow of water through this pipe is usually computed by the widely used Williams-Hazen formula:

$Q = 0.006756 \times CD^{2.63}H^{.54}$

Where:

Q = discharge in gallons per minute
C = Williams-Hazen flow coefficient
D = actual inside diameter
H = head loss in feet per 1,000 feet

The flow coefficient "C" (or C factor) in the Williams-Hazen formula is in effect a measure of the condition of the pipe interior and is sometimes known as a friction coefficient. Tests employing this formula show that cement-mortar-lined gray or ductile cast iron pipe has a C factor of 140. Unlined pipe exposed to aggressive waters will suffer loss in C factor due to tuberculation.

Both gray and ductile cast iron pipe have flow advantages resulting from their greater than nominal internal diameters. For example, Class 2, 12-inch unlined ductile iron pipe has an inside diameter of 12.46 inches. Standard cement-lined pipe of this same class has an inside diameter of 12.34 inches.

Tables on pages 230–231 are based on a Williams-Hazen C factor of 140 and are computed for actual inside diameters of Class 1 and 2 cement-mortar-lined ductile iron pipe.

The nomogram on page 232 may be used to determine discharge or loss of head for any assumed C factor.

EXAMPLES FOR USE OF NOMOGRAM

Example 1—Maximum Delivery

To find the maximum delivery of an 8-inch, Class 2, cement-mortar-lined ductile iron pipe, 7,500 feet in length under 150 feet of head. The loss of head per 1,000 feet is $\frac{150}{7.5} = 20$ feet per 1,000 feet. By use of the nomogram on page 232, the result is 1,200 gallons per minute or 1.73 million gallons per day. (20.00 ft. loss per 1,000 ft. and 8-inch diameter pipe)

Example 2—Determination of Diameter

To find the diameter of pipe necessary to deliver 3,000,000 gallons per day through a pipeline 25,000 feet long under 150 feet of head. The loss of head per 1,000 feet is $\frac{150}{25} = 6$ feet per 1,000 feet. By use of the nomogram on page 232, the result is 12-inch, Class 2, cement-mortar-lined ductile iron pipe. (6.00 ft. loss per 1,000 ft. and 3,000,000 ÷ 1440 minutes per day = 2,083 gals. per min.)

Example 3—Friction Loss

To find the loss of head through a 10-inch, Class 2, cement-mortar-lined ductile iron pipeline 4,000 feet long, delivering 1,400,000 gallons per day, using a C factor of 140. By use of the nomogram on page 232, the head loss is 4 feet per 1,000 feet, or 16 feet for the pipeline. (10-inch diameter pipe and 1,400,000 ÷ 1440 minutes per day = 972 gallons per min.) If water is delivered at a point 100 feet above the pump, total head against the pump is 100 feet (static) plus 16 feet (friction), or a total of 116 feet.

Example 4—Delivery Determined from Pressure Reduction

Two accurate pressure gauges should be placed at a known distance apart and measurement of the difference in elevation recorded. If on a 12-inch pipeline the pressure gauges are 500 feet apart and show a difference in pressure of 2 psi (4.6 feet of head) while one gauge is 1.8 feet above the other, the actual loss of head will be 4.6 plus or minus 1.8 = 6.4 or 2.8 feet per 500 feet or 12.8 or 5.6 feet per 1,000 feet, depending on whether the downstream gauge is higher or lower than gauge nearest the pump. Assuming that the downstream gauge is at the higher elevation, head loss due to friction is 5.6 feet per 1,000 feet. By use of the nomogram on page 232, the result is 1,900 gallons per minute, or 2.74 million gallons per day. (12-inch diameter pipe and 5.60 ft. loss per 1,000 ft.)

FLOW OF WATER IN DUCTILE IRON PIPE

WILLIAMS–HAZEN C=140

Loss of Head per 1,000 feet for diameters of class 2 ductile iron, standard cement mortar lined pipe*

Flow in Gallons per 24 Hours	4" Pipe		6" Pipe		8" Pipe		10" Pipe		12" Pipe	
	Vel. in ft. per Sec.	Loss of Head in ft.	Vel. in ft. per Sec.	Loss of Head in ft.	Vel. in ft. per Sec.	Loss of Head in ft.	Vel. in ft. per Sec.	Loss of Head in ft.	Vel. in ft. per Sec.	Loss of Head in ft.
20,000	0.34	0.15								
30,000	0.51	0.32								
40,000	0.68	0.55								
50,000	0.85	0.82	0.37	0.11						
60,000	1.02	1.16	0.45	0.16						
70,000	1.18	1.54	0.52	0.21						
80,000	1.35	1.97	0.60	0.27						
90,000	1.52	2.45	0.67	0.34						
100,000	1.69	2.97	0.75	0.41						
110,000	1.86	3.55	0.82	0.49						
120,000	2.03	4.17	0.90	0.57						
140,000	2.37	5.55	1.05	0.76						
160,000	2.71	7.11	1.20	0.98						
180,000	3.05	8.83	1.35	1.21						
200,000	3.38	10.74	1.50	1.48	0.83	0.35				
220,000	3.72	12.81	1.65	1.76	0.91	0.42				
240,000	4.06	15.05	1.80	2.07	1.00	0.49				
260,000	4.40	17.45	1.95	2.40	1.08	0.57				
280,000	4.74	20.02	2.10	2.75	1.16	0.65				
300,000	5.08	22.75	2.25	3.13	1.25	0.74	0.81	0.26	0.56	0.11
320,000					1.33	0.84	0.86	0.29		
340,000					1.41	0.94	0.91	0.32		
360,000					1.50	1.04	0.97	0.36		
380,000					1.58	1.15	1.02	0.40		
400,000	6.77	38.76	3.00	5.33	1.66	1.27	1.07	0.44	0.75	0.18
450,000					1.87	1.58	1.21	0.55		
500,000	8.46	58.59	3.74	8.05	2.08	1.92	1.34	0.66	0.93	0.27
550,000					2.28	2.29	1.48	0.79		
600,000			4.49	11.29	2.49	2.69	1.61	0.93	1.12	0.38
650,000					2.70	3.11	1.75	1.08		
700,000			5.24	15.02	2.91	3.57	1.88	1.24	1.31	0.51
750,000					3.11	4.06	2.02	1.41		
800,000			5.99	19.23	3.32	4.58	2.15	1.58	1.49	0.65
900,000			6.74	23.91	3.74	5.69	2.42	1.97	1.68	0.81
1,000,000			7.49	29.06	4.15	6.92	2.69	2.40	1.86	0.98
1,100,000					4.57	8.25	2.96	2.86	2.05	1.19
1,200,000					4.98	9.69	3.22	3.36	2.24	1.38
1,300,000					5.40	11.25	3.49	3.89	2.42	1.60
1,400,000					5.81	12.90	3.76	4.47	2.61	1.83
1,500,000					6.23	14.65	4.03	5.08	2.80	2.08
1,600,000					6.64	16.51	4.30	5.72	2.98	2.35
1,700,000									3.17	2.63
1,800,000					7.48	20.54	4.84	7.11	3.36	2.92
1,900,000									3.54	3.23
2,000,000					8.31	24.97	5.37	8.65	3.73	3.55
2,200,000									4.10	4.24
2,400,000					9.97	34.99	6.45	12.12	4.47	4.98
2,600,000									4.85	5.78
2,800,000									5.22	6.62
3,000,000							8.06	18.32	5.59	7.53
3,500,000									6.53	10.01
4,000,000									7.46	12.82
4,500,000									8.39	15.94
5,000,000									9.32	19.38
5,500,000									10.25	23.13
6,000,000									11.19	27.17
7,000,000									13.05	36.14

* For other inside diameter of pipe, see note on page 231.

FLOW OF WATER IN DUCTILE IRON PIPE

WILLIAMS–HAZEN C=140

Loss of Head per 1,000 feet for diameters of class 1 ductile iron, standard cement mortar lined pipe

Flow in Gallons per 24 Hours	14" Pipe		16" Pipe		18" Pipe		20" Pipe		24" Pipe	
	Vel. in ft. per Sec.	Loss of Head in ft.	Vel. in ft. per Sec.	Loss of Head in ft.	Vel. in ft. per Sec.	Loss of Head in ft.	Vel. in ft. per Sec.	Loss of Head in ft.	Vel. in ft. per Sec.	Loss of Head in ft.
300,000	0.41	0.050								
400,000	0.55	0.085	0.42	0.044	0.33	0.025				
500,000	0.68	0.129								
600,000	0.82	0.180	0.63	0.093	0.49	0.052	0.40	0.031		
700,000	0.96	0.240								
800,000	1.10	0.307	0.84	0.159	0.66	0.089	0.53	0.053		
900,000	1.23	0.382								
1,000,000	1.37	0.464	1.05	0.241	0.82	0.135	0.67	0.080	0.46	0.033
1,100,000	1.51	0.55								
1,200,000	1.64	0.65	1.25	0.337	0.99	0.189	0.80	0.113	0.55	0.046
1,300,000	1.78	0.75								
1,400,000	1.92	0.87	1.46	0.448	1.15	0.251	0.93	0.150	0.65	0.061
1,500,000	2.05	0.98								
1,600,000	2.19	1.11	1.67	0.57	1.32	0.322	1.07	0.192	0.74	0.078
1,700,000	2.33	1.24								
1,800,000	2.47	1.38	1.88	0.71	1.48	0.400	1.20	0.239	0.83	0.098
1,900,000	2.60	1.52								
2,000,000	2.74	1.68	2.09	0.87	1.65	0.486	1.33	0.290	0.92	0.119
2,200,000	3.01	2.00	2.30	1.04	1.81	0.58				
2,400,000	3.29	2.35	2.51	1.22	1.98	0.68				
2,500,000							1.67	0.438	1.15	0.179
2,600,000	3.56	2.72	2.72	1.41	2.14	0.79				
2,800,000	3.83	3.12	2.93	1.62	2.31	0.91				
3,000,000	4.11	3.55	3.14	1.84	2.47	1.03	2.00	0.61	1.38	0.251
3,500,000	4.79	4.72	3.66	2.45	2.88	1.37	2.33	0.82	1.62	0.334
4,000,000	5.48	6.05	4.18	3.13	3.30	1.76	2.67	1.05	1.85	0.428
4,500,000	6.16	7.52	4.70	3.90	3.71	2.18	3.00	1.30	2.08	0.53
5,000,000	6.85	9.14	5.23	4.74	4.12	2.65	3.33	1.58	2.31	0.65
5,500,000	7.53	10.91	5.75	5.65	4.53	3.17	3.67	1.89	2.54	0.77
6,000,000	8.22	12.81	6.27	6.64	4.94	3.72	4.00	2.22	2.77	0.91
6,500,000			6.80	7.70	5.36	4.32	4.33	2.57	3.00	1.05
7,000,000	9.59	17.05	7.32	8.83	5.77	4.95	4.66	2.95	3.23	1.21
7,500,000			7.84	10.04	6.18	5.62	4.99	3.34	3.46	1.37
8,000,000			8.36	11.31	6.59	6.34	5.33	3.78	3.69	1.54
8,500,000			8.89	12.66	7.01	7.09	5.66	4.23	3.92	1.73
9,000,000			9.41	14.07	7.42	7.89	6.00	4.70	4.15	1.92
9,500,000			9.93	15.55	7.83	8.71	6.33	5.19	4.38	2.12
10,000,000			10.45	17.10	8.24	9.59	6.64	5.71	4.62	2.33
11,000,000			11.50	20.40	9.07	11.43	7.33	6.82	5.08	2.79
12,000,000			12.55	23.97	9.89	13.43	8.00	8.00	5.54	3.27
13,000,000							8.66	9.28	6.00	3.79
14,000,000							9.33	10.65	6.46	4.35
15,000,000							10.00	12.10	6.92	4.95
16,000,000							10.66	13.64	7.38	5.57

Note

The tables above and on page 230 are based on actual inside diameter of ductile iron pipe in the classes indicated. To calculate the exact flow, for other inside diameters, the figures in the tables must be modified by the ratio of nominal to actual diameter to the 2.63 power, since, as explained on page 229, the

$$\text{Quantity of Flow is proportional to } \frac{\text{Diameter}^{2.63}}{\text{Diameter}^{2.63}}$$

FLOW OF WATER IN DUCTILE IRON PIPE

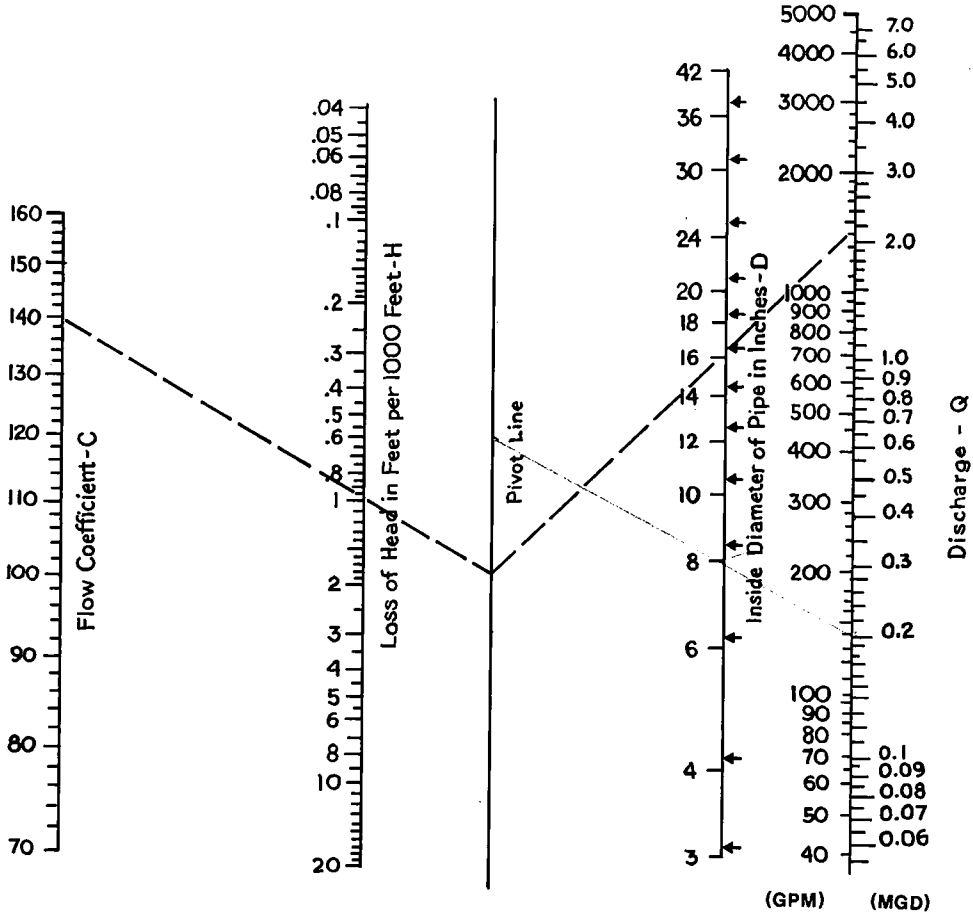


Diagram for Calculating Cast Iron Pipe

The above nomograph is based on the Williams-Hazen flow formula and shows relationships between flow coefficient, head loss, internal pipe diameter and discharge rate. If any three of these factors are known, the fourth may be determined by locating a point on the pivot line, which point lies on a common line with two of the known factors. Once the pivot point is established, the unknown factor will lie on a straight line between the pivot point and the third known factor. Arrows (←) on the inside diameter line represent actual inside diameter of cement-mortar-lined ductile iron pipe Class 2, three inches through 12 inches, and Class 1, 14 inches and larger.

It is frequently desired to know what number of pipe of a given size are equal in carrying capacity to one pipe of a larger size. At the same velocity of flow the volume delivered by two pipe of different sizes is proportional to the squares of their diameters; thus one 4-inch pipe will deliver the same volume as four 2-inch pipe. With the same head, however, the velocity is less in the smaller pipe, and the volume delivered varies about as their diameter ratio to the 2.65 power. This table is calculated on this basis. The figures opposite the intersection of any two sizes is the number of the smaller-sized pipe required to equal one of the larger; thus one 6-inch equals 2.9 four-inch.

Equation of Pipe

Diam. Inches	½	¾	1	2	3	4	5	6	7	8	10	12	14	16	18	20	24	30	36	42	48
2	39.4	13.5	6.3	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	115.	39.4	18.4	2.9	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4	247.	84.4	39.4	6.3	2.1	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5	447.	153.	71.2	11.3	3.9	1.8	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6	724.	247.	115.	18.4	6.3	2.9	1.6	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
7	1,090.	372.	174.	27.7	9.4	4.4	2.4	1.5	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8	.....	530.	247.	39.4	13.5	6.3	3.5	2.1	1.4	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	.....	957.	447.	71.2	24.3	11.3	6.3	3.9	2.6	1.8	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11	.....	.....	575.	91.6	31.3	14.6	8.1	5.0	3.3	2.3	1.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12	.....	.....	724.	115.	39.4	18.4	10.2	6.3	4.2	2.9	1.6	1.0	.....	.....	.....	.....	.....	.....	.....	.....	.....
13	.....	.....	895.	143.	48.7	22.7	12.6	7.8	5.2	3.6	2.0	1.2	.....	.....	.....	.....	.....	.....	.....	.....	.....
14	.....	.....	1,090.	174.	59.3	27.7	15.3	9.4	6.3	4.4	2.4	1.5	1.0	.....	.....	.....	.....	.....	.....	.....	.....
15	.....	.....	1,308.	208.	71.2	33.2	18.4	11.3	7.5	5.3	2.9	1.8	1.2	.....	.....	.....	.....	.....	.....	.....	.....
16	.....	.....	.....	247.	84.4	39.4	21.8	13.5	8.9	6.3	3.5	2.1	1.4	1.0	.....	.....	.....	.....	.....	.....	.....
17	.....	.....	.....	290.	99.2	46.3	25.6	15.8	10.5	7.4	4.1	2.5	1.7	1.2	.....	.....	.....	.....	.....	.....	.....
18	.....	.....	.....	338.	115.	53.8	29.8	18.4	12.2	8.6	4.7	2.9	1.9	1.4	1.0	.....	.....	.....	.....	.....	.....
19	.....	.....	.....	390.	133.	62.1	34.4	21.2	14.1	9.9	5.5	3.4	2.2	1.6	1.2	.....	.....	.....	.....	.....	.....
20	.....	.....	.....	447.	153.	71.2	39.4	24.3	16.2	11.3	6.3	3.9	2.6	1.8	1.3	1.0	.....	.....	.....	.....	.....
22	.....	.....	.....	575.	196.	91.6	50.7	31.3	20.8	14.6	8.1	5.0	3.3	2.3	1.7	1.3	.....	.....	.....	.....	.....
24	.....	.....	.....	724.	247.	115.	63.8	39.4	26.2	18.4	10.2	6.3	4.2	2.9	2.1	1.6	1.0	.....	.....	.....	.....
30	.....	.....	.....	.....	.....	.....	.....	.....	.....	33.2	18.4	11.3	7.5	5.3	3.9	2.9	1.8	1.0	.....	.....	.....
36	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	29.8	18.4	12.2	8.6	6.3	4.7	2.9	1.6	1.0	.....	.....
42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	44.8	27.7	18.4	12.9	9.4	7.1	4.4	2.4	1.5	1.0	.....
48	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	63.8	39.4	26.2	18.4	13.5	10.2	6.3	3.5	2.1	1.4	1.0

CONTENTS OF PIPE

Capacities in Cubic Feet and in United States Gallons (231 Cubic Inches)

Per Foot Length

Diameter Inches	Diameter Feet	For 1 Foot Length		Diameter Inches	Diameter Feet	For 1 Foot Length	
		Cubic Feet, Also Area in Sq. Feet	U.S. Gals. (231 Cu. In.)			Cubic Feet. Also Area in Sq. Feet	U.S. Gals. (231 Cu. In.)
1/4	.0208	.0003	.0026	11.25	.9375	.6 903	5.163
5/16	.0260	.0005	.0040	11.50	.9583	.7213	5.395
3/8	.0313	.0008	.0057	11.75	.9792	.7530	5.633
7/16	.0365	.0010	.0078	12.00	1.000	.7854	5.876
1/2	.0417	.0014	.0102	12.50	1.042	.8523	6.375
9/16	.0469	.0017	.0129	13.00	1.083	.9218	6.895
5/8	.0521	.0021	.0159	13.50	1.125	.9940	7.435
11/16	.0573	.0026	.0193	14.00	1.167	1.069	7.997
3/4	.0625	.0031	.0230	14.50	1.208	1.147	8.578
13/16	.0677	.0036	.0270	15.00	1.250	1.227	9.180
7/8	.0729	.0042	.0312	15.50	1.292	1.310	9.801
15/16	.0781	.0048	.0359	16.00	1.333	1.396	10.44
1.00	.0833	.0055	.0408	16.50	1.375	1.485	11.11
1.25	.1042	.0085	.0638	17.00	1.417	1.576	11.79
1.50	.1250	.0123	.0918	17.50	1.458	1.670	12.50
1.75	.1458	.0168	.1250	18.00	1.500	1.767	13.22
2.00	.1667	.0218	.1632	18.50	1.542	1.867	13.97
2.25	.1875	.0276	.2066	19.00	1.583	1.969	14.73
2.50	.2083	.0341	.2550	19.50	1.625	2.074	15.52
2.75	.2292	.0413	.3085	20.00	1.666	2.182	16.32
3.00	.2500	.0491	.3673	20.50	1.708	2.292	17.15
3.25	.2708	.0576	.4310	21.00	1.750	2.405	17.99
3.50	.2917	.0668	.4998	21.50	1.792	2.521	18.86
3.75	.3125	.0767	.5738	22.00	1.833	2.640	19.75
4.00	.3333	.0873	.6528	22.50	1.875	2.761	20.65
4.25	.3542	.0985	.7370	23.00	1.917	2.885	21.58
4.50	.3750	.1105	.8263	23.50	1.958	3.012	22.53
4.75	.3958	.1231	.9205	24.00	2.000	3.142	23.50
5.00	.4167	.1364	1.020	25.00	2.083	3.409	25.50
5.25	.4375	.1503	1.124	26.00	2.166	3.687	27.58
5.50	.4583	.1650	1.234	27.00	2.250	3.976	29.74
5.75	.4792	.1803	1.349	28.00	2.333	4.276	31.99
6.00	.5000	.1963	1.469	29.00	2.416	4.587	34.31
6.25	.5208	.2130	1.594	30.00	2.500	4.909	36.72
6.50	.5417	.2305	1.724	31.00	2.583	5.241	39.21
6.75	.5625	.2485	1.859	32.00	2.666	5.585	41.78
7.00	.5833	.2673	1.999	33.00	2.750	5.940	44.43
7.25	.6042	.2868	2.144	34.00	2.833	6.305	47.17
7.50	.6250	.3068	2.295	35.00	2.916	6.681	49.98
7.75	.6458	.3275	2.450	36.00	3.000	7.069	52.88
8.00	.6667	.3490	2.611	37.00	3.083	7.468	55.86
8.25	.6875	.3713	2.777	38.00	3.166	7.876	58.92
8.50	.7083	.3940	2.948	39.00	3.250	8.296	62.06
8.75	.7292	.4175	3.125	40.00	3.333	8.728	65.29
9.00	.7500	.4418	3.305	41.00	3.416	9.168	68.58
9.25	.7708	.4668	3.492	42.00	3.500	9.620	71.96
9.50	.7917	.4923	3.682	43.00	3.583	10.084	75.43
9.75	.8125	.5185	3.879	44.00	3.666	10.560	79.00
10.00	.8333	.5455	4.081	45.00	3.750	11.044	82.62
10.25	.8542	.5730	4.286	46.00	3.833	11.540	86.32
10.50	.8750	.6013	4.498	47.00	3.916	12.048	90.12
10.75	.8958	.6303	4.714	48.00	4.000	12.566	94.02
11.00	.9167	.6600	4.937	.....	....	.....	.....

1 Cubic foot of water weighs 62.35 pounds; 1 gallon (U. S.) weighs 8.335 pounds.

CONVERSION FACTORS

Unless designated otherwise, the English measures of capacity are those used in the United States, and the units of weight and mass are avoirdupois units.

The word gallon, used in any conversion factor, designates the U.S. gallon. To convert into the Imperial gallon, multiply the U. S. gallon by 0.83267. Likewise, the word ton designates a short ton, 2,000 pounds.

The figures 10^{-1}, 10^{-2}, 10^{-3}, etc. denote 0.1, 0.01, 0.001, etc. respectively.

The figures 10^{1}, 10^{2}, 10^{3}, etc. denote 10, 100, 1000, etc. respectively.

In the conversion factors given below using the properties of water, calculations are based on water at 39.2° F. in vacuum, weighing 62.427 pounds per cubic foot, or 8.345 pounds per U. S. gallon. Water freezes at 32° F., and is at its maximum density at 39.2° F.

"Parts Per Million," designated as P.P.M., is always by weight. As used in the Sanitary field, P.P.M. represents the number of pounds of dry solids contained in one million pounds of water, including solids. In this field, one part per million may be expressed as 8.345 pounds of dry solids to one million U. S. gallons of water.

MULTIPLY	BY	TO OBTAIN
Acres	43,560	Square feet
"	4047	Square meters
Acre-feet	43,560	Cubic feet
" "	325,851	Gallons
" "	1233.49	Cubic meters
Atmospheres	76.0	Cms. of mercury
"	29.92	Inches of mercury
"	33.90	Feet of water
"	14.70	Lbs./sq. inch
Barrels-cement	376	Pounds-cement
Bags or sacks-cement	94	Pounds-cement
British thermal units	0.2520	Kilogram-calories
" " "	777.5	Foot-lbs.
" " "	3.927×10^{-4}	Horse-power-hrs.
" " "	107.5	Kilogram-meters
" " "	2.928×10^{-4}	Kilowatt-hrs.
B.t.u./min	12.96	Foot-lbs./sec.
" / "	0.02356	Horse-power
" / "	0.01757	Kilowatts
Centimeters	0.3937	Inches
"	0.01	Meters
"	10	Millimeters
Centimtrs. of mercury	0.01316	Atmospheres
" " "	0.4461	Feet of water
" " "	27.85	Lbs./sq. ft.
" " "	0.1934	Lbs./sq. inch
Centimeters/second	1.969	Feet/min.
" / "	0.03281	Feet/sec.
" / "	0.6	Meters/min.
" / "	0.02237	Miles/hr.
" / "	3.728×10^{-4}	Miles/min.
Cubic centimeters	3.531×10^{-5}	Cubic feet
" "	6.102×10^{-2}	Cubic inches
" "	10^{-6}	Cubic meters
" "	2.642×10^{-4}	Gallons
" "	10^{-3}	Liters
" "	2.113×10^{-3}	Pints (liq.)
" "	1.057×10^{-3}	Quarts (liq.)

MULTIPLY	BY	TO OBTAIN
Cubic feet	2.832×10^{4}	Cubic cms.
" "	1728	Cubic inches
" "	0.02832	Cubic meters
" "	0.03704	Cubic yards
" "	7.48052	Gallons
" "	28.32	Liters
" "	59.84	Pints (liq.)
" "	29.92	Quarts (liq.)
Cubic feet/minute	472.0	Cubic cms./sec.
" " / "	0.1247	Gallons/sec.
" " / "	0.4720	Liters/sec.
" " / "	62.43	Pounds of water/min.
Cubic feet/second	0.646317	Million gals./day
" " / "	448.831	Gallons/min.
Cubic inches	16.39	Cubic centimeters
" "	5.787×10^{-4}	Cubic feet
" "	1.639×10^{-5}	Cubic meters
" "	2.143×10^{-5}	Cubic yards
" "	4.329×10^{-3}	Gallons
" "	1.639×10^{-2}	Liters
" "	0.03463	Pints (liq.)
" "	0.01732	Quarts (liq.)
Cubic meters	10^{6}	Cubic centimeters
" "	35.31	Cubic feet
" "	61.023	Cubic inches
" "	1 308	Cubic yards
" "	264.2	Gallons
Cubic meters	10^{3}	Liters
" "	2113	Pints (liq.)
" "	1057	Quarts (liq.)
Cubic yards	7.646×10^{5}	Cubic centimeters
" "	27	Cubic feet
" "	46,656	Cubic inches
" "	0.7646	Cubic meters
" "	202.0	Gallons
" "	764.6	Liters
" "	1616	Pints (liq.)
" "	807.9	Quarts (liq).
Drams	27.34375	Grains
"	0.0625	Ounces
	1.771845	Grams

Courtesy Dorr Company, Inc.

Continued on the next page

CONVERSION FACTORS

Continued from preceding page

MULTIPLY	BY	TO OBTAIN
Fathoms	6	Feet
Feet	30.48	Centimeters
"	0.3048	Meters
Feet of water	0.02950	Atmospheres
" " "	0.8826	Inches of mercury
" " "	304.8	Kgs./sq. meter
" " "	62.43	Lbs./sq. ft.
" " "	0.4335	Lbs./sq. inch
Feet/min	0.01667	Feet/sec.
" / "	0.01829	Kilometers/hr.
" / "	0.3048	Meters/min.
" / "	0.01136	Miles/hr.
Feet/sec	30.48	Centimeters/sec.
" / "	18.29	Meters/min.
" / "	0.6818	Miles/hr.
Foot-pounds	1.286×10^{-3}	British thermal units
" "	5.050×10^{-7}	Horse-power-hrs.
" "	3.241×10^{-4}	Kilogram-calories
" "	0.1383	Kilogram-meters
" "	3.766×10^{-7}	Kilowatt-hrs.
Foot-pounds/min	1.286×10^{-3}	B.t. units/min.
" " / "	0.01667	Foot-pounds/sec.
" " / "	3.030×10^{-5}	Horse-power
" " / "	3.241×10^{-4}	Kg.-calories/min.
" " / "	2.260×10^{-5}	Kilowatts
Foot-pounds/sec	7.717×10^{-2}	B.t. units/min.
" " / "	1.818×10^{-3}	Horse-power
" " / "	1.945×10^{-2}	Kg.-calories/min.
" " / "	1.356×10^{-3}	Kilowatts
Gallons	3785	Cubic centimeters
"	0.1337	Cubic feet
"	231	Cubic inches
"	3.785×10^{-3}	Cubic meters
"	3.785	Liters
"	8	Pints (liq.)
"	4	Quarts (liq.)
Gallons, Imperial	1.20095	U. S. gallons
" U. S.	0.83267	Imperial gallons
Gallons water	8.3453	Pounds of water
Gallons/min	2.228×10^{-3}	Cubic feet/sec.
" / "	0.06308	Liters/sec.
" / "	8.0208	Cu. ft./hr.
Gallons water/min	6.0086	Tons water/24 hrs.
Grains (troy)	1	Grains (avoir)
" "	0.06480	Grams
Grains/U. S. gal	17.118	Parts/million
" /U S. gal	142.86	Lbs./million gal.
" /Imp. gal	14.254	Parts/million

MULTIPLY	BY	TO OBTAIN
Grams	980.7	Dynes
"	15.43	Grains
"	0.03527	Ounces
Grams/liter	58.417	Grains/gal.
" / "	8.345	Pounds/1000 gals.
" / "	1000	Parts/million
Hectares	2.471	Acres
Horse-power	42.44	B.t. units/min.
" "	33,000	Foot-lbs./min.
" "	550	Foot-lbs./sec.
" "	0.7457	Kilowatts
" "	745.7	Watts
Horse-power (boiler)	33,479	B.t.u./hr.
Inches	2.540	Centimeters
Inches of mercury	0.03342	Atmospheres
" " "	1.133	Feet of water
" " "	70.73	Lbs./sq. ft.
" " "	0.4912	Lbs./sq. inch
Inches of water	0.002458	Atmospheres
" " "	0.07355	Inches of mercury
" " "	0.5781	Ounces./sq. inch
" " "	5.202	Lbs./sq. foot
" " "	0.03613	Lbs./sq. inch
Kilograms	2.205	Lbs.
Kilogram-calories/min	51.43	Foot-pounds/sec.
" " / "	0.09351	Horse-power
" " / "	0.06972	Kilowatts
Kgs./sq. meter	3.281×10^{-3}	Feet of water
" / " "	1.422×10^{-3}	Lbs./sq. inch
Kilometers	3281	Feet
"	0.6214	Miles
"	1094	Yards
Kilometers/hr	27.78	Centimeters/sec.
" /"	54.68	Feet/min.
" /"	0.9113	Feet/sec.
" /"	0.6214	Miles/hr.
Kilowatts	56.92	B.t. units/min.
"	4.425×10^{4}	Foot-lbs./min.
"	737.6	Foot-lbs./sec.
"	1.341	Horse-power
"	14.34	Kg.-calories/min.
Liters	0.03531	Cubic feet
"	61.02	Cubic inches
"	0.2642	Gallons
Liters/min	5.886×10^{-4}	Cubic ft.-sec.
" / "	4.403×10^{-3}	Gals./sec.

Continued on the next page

CONVERSION FACTORS

Continued from preceding page

MULTIPLY	BY	TO OBTAIN
Meters	3.281	Feet
"	39.37	Inches
"	1.094	Yards
Miles	5280	Feet
"	1.609	Kilometers
Miles/hr	88	Feet/min.
" / "	1.467	Feet/sec.
Miles/min	88	Feet/sec.
" / "	60	Miles/hr.
Milligrams/liter	1	Parts/million
Million gals./day	1.54723	Cubic ft./sec.
Miner's inches	1.5	Cubic ft./min.
Ounces (fluid)	1.805	Cubic inches
" "	0.02957	Liters
Parts/million	0.0584	Grains/U.S. gal.
" / "	0.07016	Grains/Imp. gal.
" / "	8.345	Lbs./million gal.
Pounds	16	Ounces
"	256	Drams
"	7000	Grains
"	0.0005	Tons (short)
"	453.5924	Grams
"	1.21528	Pounds (troy)
"	14.5833	Ounces (troy)
Pounds (troy)	5760	Grains
" "	240	Pennyweights (troy)
" "	12	Ounces (troy)
" "	373.24177	Grams
" "	0.822857	Pounds (avoir)
" "	13.1657	Ounces (avoir)
" "	3.6735×10^{-4}	Tons (long)
" "	4.1143×10^{-4}	Tons (short)
" "	3.7324×10^{-4}	Tons (metric)
Pounds of water	0.01602	Cubic feet
" " "	27.68	Cubic inches
" " "	0.1198	Gallons
Pounds of water/min.	2.670×10^{-4}	Cubic ft./sec.
Pounds/cubic foot	0.01602	Grams/cubic cm.
" / " "	16.02	Kgs./cubic meter
" / " "	5.787×10^{-4}	Lbs./cubic inch
Pounds/inch	178.6	Grams/cm.
Pounds/sq. foot	0.01602	Feet of water
" / " "	4.883	Kgs./sq. meter
" / " "	6.945×10^{-3}	Pounds/sq. inch
Pounds/sq. inch	0.06804	Atmospheres
" / " "	2.307	Feet of water
" / " "	2.036	Inches of mercury
" / " "	703.1	Kgs./sq. meter
Quarts (liq.)	57.75	Cubic inches
Quires	25	Sheets
Reams	500	Sheets
Square centimeters	1.076×10^{-3}	Square feet
" "	0.1550	Square inches
Square feet	2.296×10^{-5}	Acres
" "	144	Square inches
" "	0.09290	Square meters
" "	3.587×10^{-8}	Square miles
Square inches	6.452	Square centimeters
" "	6.944×10^{-3}	Square feet
Square kilometers	247.1	Acres
" "	10.76×10^{6}	Square feet
" "	0.3861	Square miles
Square meters	10.76	Square feet
" "	1.196	Square yards
Square miles	640	Acres
" "	27.88×10^{6}	Square feet
" "	3.098×10^{6}	Square yards
Square yards	2.066×10^{-4}	Acres
" "	9	Square feet
" "	0.8361	Square meters
" "	3.228×10^{-7}	Square miles
Temp. (°C.) + 273	1	Abs. temp. (°C.)
" " + 17.78	1.8	Temp. (°F.)
" (°F.) + 460	1	Abs. temp. (°F.)
" " −32	5/9	Temp. (°C.)
Tons (long)	1016	Kilograms
" "	2240	Pounds
" "	1.12000	Tons (short)
Tons (metric)	10^{3}	Kilograms
" "	2205	Pounds
Tons (short)	2000	Pounds
" "	907.18486	Kilograms
" "	0.89287	Tons (long)
Tons of water/24 hrs.	83.333	Pounds water/hour
" " " / " "	0.16643	Gallons/min.
" " " / " "	1.3349	Cu. ft./hr.
Watts	0.05692	B.t. units/min.
"	44.26	Foot-pounds/min.
"	1.341×10^{-3}	Horse-power
"	0.01434	Kg.-calories/min.
Yards	91.44	Centimeters
"	3	Feet
"	36	Inches
"	0.9144	Meters

PROPERTIES OF NUMBERS

DECIMAL EQUIVALENTS — SQUARES — SQUARE ROOTS

CIRCUMFERENCES AND AREAS OF CIRCLES

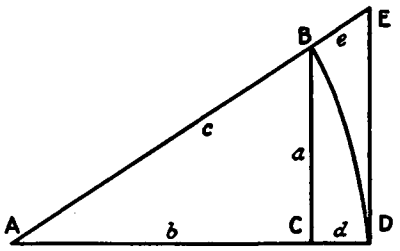
Number, N		N^2	$\sqrt{N}$	Circle (N = Dia.)		N	N^2	$\sqrt{N}$	Circle (N = Dia.)	
Fraction	Decimal			Circum.	Area				Circum.	Area
1/64	.015625	0.000244	.1250	0.04909	.00019	1.	1.0000	1.0000	3.1416	0.7854
1/32	.03125	.000977	.1768	.09818	.00077	1.125	1.2656	1.0606	3.5343	.9940
3/64	.046875	.002197	.2165	.14726	.00173	1.25	1.5625	1.1180	3.9270	1.2272
1/16	.0625	.003906	.2500	.19635	.00307	1.375	1.8906	1.1726	4.3197	1.4849
5/64	.078125	.006104	.2795	.24544	.00479	1.5	2.25	1.2247	4.7124	1.7671
3/32	.09375	.008789	.3062	.29452	.00690	1.625	2.6406	1.2748	5.1051	2.0739
7/64	.109375	.01196	.3307	.34361	.00939	1.75	3.0625	1.3229	5.4978	2.4053
1/8	.125	.01563	.3536	.39270	.01227	1.875	3.5156	1.3693	5.8905	2.7612
9/64	.140625	.01978	.3750	.44179	.01554	2.	4.0000	1.4142	6.2832	3.1416
5/32	.15625	.02441	.3953	.49087	.01917	2.125	4.5156	1.4577	6.6759	3.5466
11/64	.171875	.02954	.4146	.53996	.02320	2.25	5.0625	1.5000	7.0686	3.9761
3/16	.1875	.03516	.4330	.58905	.02761	2.375	5.6406	1.5411	7.4613	4.4301
13/64	.203125	.04126	.4507	.63814	.03241	2.5	6.2500	1.5811	7.8540	4.9087
7/32	.21875	.04785	.4677	.68722	.03758	2.625	6.8906	1.6202	8.2467	5.4119
15/64	.234375	.05493	.4841	.73631	.04314	2.75	7.5625	1.6583	8.6394	5.9396
1/4	.250	.0625	.5000	.78540	.04909	2.875	8.2656	1.6956	9.0321	6.4918
17/64	.265625	.07056	.5154	.83448	.05542	3.	9.0000	1.7321	9.4248	7.0686
9/32	.28125	.07910	.5303	.88357	.06213	3.125	9.7656	1.7678	9.8175	7.6699
19/64	.296875	.08813	.5449	.93266	.06922	3.25	10.5625	1.8028	10.2102	8.2958
5/16	.3125	.09766	.5590	.98175	.07670	3.375	11.3906	1.8371	10.6029	8.9462
21/64	.328125	.10767	.5728	1.0308	.08456	3.5	12.2500	1.8708	10.9956	9.6211
11/32	.34375	.11816	.5863	1.0799	.09281	3.625	13.1406	1.9039	11.3883	10.3206
23/64	.359375	.12915	.5995	1.1290	.10143	3.75	14.0625	1.9365	11.7810	11.0447
3/8	.375	.14063	.6124	1.1781	.11045	3.875	15.0156	1.9685	12.1737	11.7932
25/64	.390625	.15259	.6250	1.2272	.11984	4.	16.0000	2.0000	12.5664	12.5664
13/32	.40625	.16504	.6374	1.2763	.12962	4.125	17.0156	2.0310	12.9591	13.3640
27/64	.421875	.17798	.6495	1.3254	.13979	4.25	18.0625	2.0616	13.3518	14.1863
7/16	.4375	.19141	.6614	1.3744	.15033	4.375	19.1406	2.0916	13.7445	15.0330
29/64	.453125	.20532	.6732	1.4235	.16126	4.5	20.2500	2.1213	14.1372	15.9043
15/32	.46875	.21973	.6847	1.4726	.17257	4.625	21.3906	2.1506	14.5299	16.8001
31/64	.484375	.23462	.6960	1.5217	.18427	4.75	22.5625	2.1795	14.9226	17.7205
1/2	.50	.2500	.7071	1.5708	.19635	4.875	23.7656	2.2079	15.3153	18.6655
33/64	.515625	.26587	.7181	1.6199	.20881	5.	25.0000	2.2361	15.7080	19.6350
17/32	.53125	.28223	.7289	1.6690	.22166	5.125	26.2656	2.2638	16.1006	20.6289
35/64	.546875	.29907	.7395	1.7181	.23489	5.25	27.5625	2.2913	16.4933	21.6475
9/16	.5625	.31641	.7500	1.7671	.24850	5.375	28.8906	2.3184	16.8860	22.6906
37/64	.578125	.33423	.7604	1.8162	.26250	5.5	30.2500	2.3452	17.2787	23.7583
19/32	.59375	.35254	.7706	1.8653	.27688	5.625	31.6406	2.3727	17.6714	24.8505
39/64	.609375	.37134	.7806	1.9144	.29165	5.75	33.0625	2.3979	18.0641	25.9672
5/8	.625	.39063	.7906	1.9635	.30680	5.875	34.5156	2.4238	18.4568	27.1085
41/64	.640625	.41040	.8004	2.0126	.32233	6.	36.0000	2.4495	18.8495	28.2743
21/32	.65625	.43066	.8101	2.0617	.33824	6.125	37.5156	2.4749	19.2422	29.4647
43/64	.671875	.45142	.8197	2.1108	.35454	6.25	39.0625	2.5000	19.6349	30.6796
11/16	.6875	.47266	.8297	2.1598	.37122	6.375	40.6406	2.5249	20.0276	31.9190
45/64	.703125	.49438	.8385	2.2089	.38829	6.5	42.2500	2.5495	20.4203	33.1831
23/32	.71875	.51660	.8478	2.2580	.40574	6.625	43.8906	2.5739	20.8130	34.4716
47/64	.734375	.53931	.8570	2.3071	.42357	6.75	45.5625	2.5981	21.2057	35.7847
3/4	.750	.56250	.8660	2.3562	.44179	6.875	47.2656	2.6220	21.5984	37.1223
49/64	.765625	.58618	.8750	2.4053	.46038	7.	49.0000	2.6458	21.9911	38.4845
25/32	.78125	.61035	.8839	2.4544	.47937	7.125	50.7657	2.6693	22.3838	39.8712
51/64	.796875	.63501	.8927	2.5035	.49874	7.25	52.5625	2.6926	22.7765	41.2825
13/16	.8125	.66016	.9014	2.5525	.51849	7.375	54.3906	2.7157	23.1692	42.7183
53/64	.828125	.68579	.9100	2.6016	.53862	7.5	56.2500	2.7386	23.5619	44.1786
27/32	.84375	.71191	.9186	2.6507	.55914	7.625	58.1406	2.7613	23.9546	45.6635
55/64	.859375	.73853	.9270	2.6998	.58004	7.75	60.0625	2.7839	24.3473	47.1730
7/8	.875	.76563	.9354	2.7489	.60132	7.875	62.0156	2.8063	24.7400	48.7069
57/64	.890625	.79321	.9437	2.7980	.62299	8.	64.0000	2.8284	25.1327	50.2655
29/32	.90625	.82129	.9520	2.8471	.64504	8.125	66.0156	2.8504	25.5254	51.8485
59/64	.921875	.84985	.9601	2.8962	.66747	8.25	68.0625	2.8723	25.9181	53.4562
15/16	.9375	.87891	.9683	2.9452	.69029	8.375	70.1406	2.8940	26.3108	55.0883
61/64	.953125	.90845	.9763	2.9943	.71349	8.5	72.2500	2.9155	26.7035	56.7450
31/32	.96875	.93848	.9843	3.0434	.73708	8.625	74.3906	2.9368	27.0962	58.4262
63/64	.984375	.96899	.9922	3.0925	.76104	8.75	76.5625	2.9580	27.4889	60.1320
						8.875	78.7656	2.9791	27.8816	61.8623

PROPERTIES OF NUMBERS

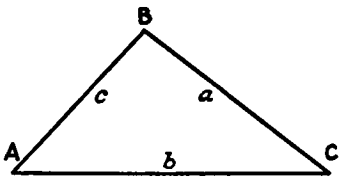
(Continued from preceding page)

N	N^2	$\sqrt{N}$	Circle (N = Dia.)		N	N^2	$\sqrt{N}$	Circle (N = Dia.)	
			Circum.	Area				Circum.	Area
9.	81.0000	3.0000	28.2743	63.6172	66	4356	8.1240	207.3449	3421.194
9.125	83.2656	3.0207	28.6670	65.3966	67	4489	8.1854	210.4865	3525.652
9.25	85.5625	3.0414	29.0597	67.2006	68	4624	8.2462	213.6281	3631.680
9.375	87.8906	3.0619	29.4524	69.0291	69	4761	8.3066	216.7697	3739.280
9.5	90.2500	3.0822	29.8451	70.8822	70	4900	8.3666	219.9113	3848.450
9.625	92.6406	3.1024	30.2378	72.7597	71	5041	8.4261	223.0529	3959.191
9.75	95.0625	3.1225	30.6305	74.6619	72	5184	8.4853	226.1945	4071.503
9.875	97.5156	3.1425	31.0232	76.5886	73	5329	8.5440	229.3361	4185.386
10	100	3.1623	31.4159	78.5398	74	5476	8.6023	232.4777	4300.839
11	121	3.3166	34.5575	95.0332	75	5625	8.6603	235.6193	4417.864
12	144	3.4641	37.6991	113.0973	76	5776	8.7178	238.7608	4536.459
13	169	3.6056	40.8407	132.7323	77	5929	8.7750	241.9024	4656.625
14	196	3.7417	43.9823	153.9380	78	6084	8.8318	245.0440	4778.361
15	225	3.8730	47.1239	176.7146	79	6241	8.8882	248.1856	4901.669
16	256	4.0000	50.2654	201.0619	80	6400	8.9443	251.327	5026.547
17	289	4.1231	53.4070	226.9801	81	6561	9.0000	254.469	5152.998
18	324	4.2426	56.5486	254.4690	82	6724	9.0554	257.610	5281.016
19	361	4.3589	59.6902	283.5287	83	6889	9.1104	260.742	5410.607
20	400	4.4721	62.8318	314.1593	84	7056	9.1652	263.894	5541.770
21	441	4.5826	65.9734	346.3606	85	7225	9.2195	267.035	5674.501
22	484	4.6904	69.1150	380.1327	86	7396	9.2736	270.177	5808.805
23	529	4.7958	72.2566	415.4756	87	7569	9.3274	273.318	5944.679
24	576	4.8990	75.3982	452.3893	88	7744	9.3808	276.460	6082.124
25	625	5.0000	78.5398	490.8739	89	7921	9.4340	279.602	6221.138
26	676	5.0990	81.6813	530.9292	90	8100	9.4868	282.743	6361.725
27	729	5.1962	84.8229	572.5553	91	8281	9.5394	285.885	6503.882
28	784	5.2915	87.9645	615.7522	92	8464	9.5917	289.026	6647.610
29	841	5.3852	91.1061	660.5198	93	8649	9.6437	292.168	6792.909
30	900	5.4772	94.2477	706.8583	94	8836	9.6954	295.309	6939.778
31	961	5.5678	97.3893	754.7676	95	9025	9.7468	298.451	7088.219
32	1024	5.6569	100.5309	804.2477	96	9216	9.7980	301.593	7238.230
33	1089	5.7446	103.6725	855.2986	97	9409	9.8489	304.734	7389.812
34	1156	5.8310	106.8141	907.9203	98	9604	9.8995	307.876	7542.962
35	1225	5.9161	109.9557	962.1127	99	9801	9.9499	311.017	7697.688
36	1296	6.0000	113.0972	1017.8760	100	10000	10.0000	314.159	7853.982
37	1369	6.0828	116.2388	1075.2101	101	10201	10.0499	317.301	8011.85
38	1444	6.1644	119.3804	1134.1149	102	10404	10.0995	320.442	8171.28
39	1521	6.2450	122.5220	1194.5906	103	10609	10.1489	323.584	8332.29
40	1600	6.3246	125.6636	1256.6371	104	10816	10.1980	326.725	8494.87
41	1681	6.4031	128.8052	1320.2543	105	11025	10.2470	329.867	8659.01
42	1764	6.4807	131.9468	1385.4424	106	11236	10.2956	333.009	8824.73
43	1849	6.5574	135.0884	1452.2012	107	11449	10.3441	336.150	8992.02
44	1936	6.6332	138.2300	1520.5308	108	11664	10.3923	339.292	9160.88
45	2025	6.7082	141.3716	1590.4313	109	11881	10.4403	342.433	9331.32
46	2116	6.7823	144.5131	1661.9025	110	12100	10.4881	345.575	9503.32
47	2209	6.8557	147.6547	1734.9445	111	12321	10.5357	348.716	9676.89
48	2304	6.9282	150.7963	1809.5574	112	12544	10.5830	351.858	9852.03
49	2401	7.0000	153.9379	1885.7410	113	12769	10.6301	355.000	10028.75
50	2500	7.0711	157.0795	1963.500	114	12996	10.6771	358.141	10207.03
51	2601	7.1414	160.2211	2042.820	115	13225	10.7238	361.283	10386.89
52	2704	7.2111	163.3627	2123.716	116	13456	10.7703	364.424	10568.32
53	2809	7.2801	166.5043	2206.183	117	13689	10.8167	367.566	10751.31
54	2916	7.3485	169.6459	2290.221	118	13924	10.8628	370.708	10935.88
55	3025	7.4162	172.7875	2375.829	119	14161	10.9087	373.849	11122.02
56	3136	7.4833	175.9290	2463.008	120	14400	10.9545	376.991	11309.73
57	3249	7.5498	179.0706	2551.758	121	14641	11.0000	380.132	11499.01
58	3364	7.6158	182.2122	2642.079	122	14884	11.0454	383.274	11689.86
59	3481	7.6811	185.3538	2733.970	123	15129	11.0905	386.416	11882.29
60	3600	7.7460	188.4954	2827.433	124	15376	11.1355	389.557	12076.28
61	3721	7.8102	191.6370	2922.466	125	15625	11.1803	392.699	12271.84
62	3844	7.8740	194.7786	3019.070	126	15876	11.2250	395.840	12468.98
63	3969	7.9373	197.9202	3117.245	127	16129	11.2694	398.982	12667.68
64	4096	8.0000	201.0618	3216.990	128	16384	11.3137	402.124	12867.96
65	4225	8.0623	204.2034	3318.307	129	16641	11.3578	405.265	13069.81

SOLUTION OF RIGHT AND OBLIQUE TRIANGLES



Right Triangles



Oblique Triangles

SOLUTION OF RIGHT TRIANGLES

$\sin A = \frac{a}{c} = \cos B$ $\qquad$ $\cos A = \frac{b}{c} = \sin B$

$\tan A = \frac{a}{b} = \cot B$ $\qquad$ $\cot A = \frac{b}{a} = \tan B$

$\sec A = \frac{c}{b} = \operatorname{cosec} B$ $\qquad$ $\operatorname{cosec} A = \frac{c}{a} = \sec B$

$\operatorname{vers} A = \frac{c-b}{c} = \frac{d}{c}$ $\qquad$ $\operatorname{exsec} A = \frac{e}{c}$

$a = c \sin A = b \tan A = c \cos B = b \cot B = \sqrt{(c+b)(c-b)}$

$b = c \cos A = a \cot A = c \sin B = a \tan B = \sqrt{(c+a)(c-a)}$

$d = c \operatorname{vers} A$ $\qquad$ $e = c \operatorname{exsec} A$

$c = \frac{a}{\cos B} = \frac{b}{\sin B} = \frac{a}{\sin A} = \frac{b}{\cos A} = \frac{d}{\operatorname{vers} A} = \frac{e}{\operatorname{exsec} A}$

SOLUTION OF OBLIQUE TRIANGLES

Given	Required	Formulas
A, B, a	b, c	$b = \frac{a}{\sin A} \cdot \sin B$, $\qquad c = \frac{a}{\sin A} \sin (A+B)$
A, a, b	B, c	$\sin B = \frac{\sin A}{a} \cdot b$, $\qquad c = \frac{a}{\sin A} \cdot \sin C$
C, a, b	$A-B$	$\tan \frac{1}{2}(A-B) = \frac{a-b}{a+b} \tan \frac{1}{2}(A+B)$
a, b, c	A	Let $s = \frac{1}{2}(a+b+c)$; $\sin \frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{bc}}$
		$\cos \frac{1}{2}A = \sqrt{\frac{s(s-a)}{bc}}$; $\tan \frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}$
		$\sin A = \frac{2\sqrt{s(s-a)(s-b)(s-c)}}{bc}$
		$\operatorname{vers} A = \frac{2(s-b)(s-c)}{bc}$
	area	$\text{area} = \sqrt{s(s-a)(s-b)(s-c)}$
A, B, C, a	area	$\text{area} = \frac{a^2 \sin B . \sin C}{2 \sin A}$
C, a, b	area	$\text{area} = \frac{1}{2} ab \sin C$

NATURAL TRIGONOMETRICAL FUNCTIONS

Deg.	Min.	Sine	Cosine	Tangent	Cotangent	Secant	Cosecant	Min.	Deg.
0	0	0.00000	1.0000	0.00000	Infinite	1.0000	Infinite	0	90
	10	0.00291	0.99999	0.00291	343.77	1.0000	343.77	50	
	20	0.00582	0.99998	0.00582	171.88	1.0000	171.89	40	
	30	0.00873	0.99996	0.00873	114.59	1.0000	114.59	30	
	40	0.01163	0.99993	0.01164	85.940	1.0001	85.946	20	
	50	0.01454	0.99989	0.01454	68.750	1.0001	68.757	10	
1	0	0.01745	0.99985	0.01745	57.290	1.0001	57.299	0	89
	10	0.02036	0.99979	0.02036	49.104	1.0002	49.114	50	
	20	0.02326	0.99973	0.02327	42.964	1.0003	42.976	40	
	30	0.02618	0.99966	0.02618	38.188	1.0003	38.201	30	
	40	0.02908	0.99958	0.02910	34.368	1.0004	34.382	20	
	50	0.03199	0.99949	0.03201	31.241	1.0005	31.257	10	
2	0	0.03490	0.99939	0.03492	28.636	1.0006	28.654	0	88
	10	0.03781	0.99928	0.03783	26.432	1.0007	26.450	50	
	20	0.04071	0.99917	0.04075	24.542	1.0008	24.562	40	
	30	0.04362	0.99905	0.04366	22.904	1.0009	22.925	30	
	40	0.04652	0.99892	0.04657	21.470	1.0011	21.494	20	
	50	0.04943	0.99878	0.04949	20.205	1.0012	20.230	10	
3	0	0.05234	0.99863	0.05241	19.081	1.0014	19.107	0	87
	10	0.05524	0.99847	0.05532	18.075	1.0015	18.103	50	
	20	0.05814	0.99831	0.05824	17.169	1.0017	17.198	40	
	30	0.06105	0.99813	0.06116	16.350	1.0019	16.380	30	
	40	0.06395	0.99795	0.06408	15.605	1.0020	15.637	20	
	50	0.06685	0.99776	0.06700	14.924	1.0022	14.958	10	
4	0	0.06976	0.99756	0.06993	14.301	1.0024	14.335	0	86
	10	0.07266	0.99736	0.07285	13.727	1.0026	13.763	50	
	20	0.07556	0.99714	0.07577	13.197	1.0029	13.235	40	
	30	0.07846	0.99692	0.07870	12.706	1.0031	12.745	30	
	40	0.08136	0.99668	0.08163	12.250	1.0033	12.291	20	
	50	0.08426	0.99644	0.08456	11.826	1.0036	11.868	10	
5	0	0.08715	0.99619	0.08749	11.430	1.0038	11.474	0	85
	10	0.09005	0.99594	0.09042	11.059	1.0041	11.104	50	
	20	0.09295	0.99567	0.09335	10.712	1.0043	10.758	40	
	30	0.09584	0.99540	0.09629	10.385	1.0046	10.433	30	
	40	0.09874	0.99511	0.09922	10.078	1.0049	10.127	20	
	50	0.10163	0.99482	0.10216	9.7882	1.0052	9.8391	10	
6	0	0.10453	0.99452	0.10510	9.5144	1.0055	9.5668	0	84
	10	0.10742	0.99421	0.10805	9.2553	1.0058	9.3092	50	
	20	0.11031	0.99390	0.11099	9.0098	1.0061	9.0551	40	
	30	0.11320	0.99357	0.11393	8.7769	1.0065	8.8337	30	
	40	0.11609	0.99324	0.11688	8.5555	1.0068	8.6138	20	
	50	0.11898	0.99290	0.11983	8.3449	1.0071	8.4046	10	
7	0	0.12187	0.99255	0.12278	8.1443	1.0075	8.2055	0	83
	10	0.12476	0.99219	0.12574	7.9530	1.0079	8.0156	50	
	20	0.12764	0.99182	0.12869	7.7703	1.0082	7.8344	40	
	30	0.13053	0.99144	0.13165	7.5957	1.0086	7.6613	30	
	40	0.13341	0.99106	0.13461	7.4287	1.0090	7.4957	20	
	50	0.13629	0.99067	0.13757	7.2687	1.0094	7.3372	10	
8	0	0.13917	0.99027	0.14054	7.1154	1.0098	7.1853	0	82
	10	0.14205	0.98986	0.14351	6.9682	1.0102	7.0396	50	
	20	0.14493	0.98944	0.14648	6.8269	1.0107	6.8998	40	
	30	0.14781	0.98901	0.14945	6.6911	1.0111	6.7655	30	
	40	0.15068	0.98858	0.15243	6.5605	1.0115	6.6363	20	
	50	0.15356	0.98814	0.15540	6.4348	1.0120	6.5121	10	
9	0	.15643	.98769	.15838	6.3137	1.0125	6.3924	0	81
Deg.	Min.	Cosine	Sine	Cotangent	Tangent	Cosecant	Secant	Min.	Deg.

For functions from 81° to 90° read from bottom of table upward.

NATURAL TRIGONOMETRICAL FUNCTIONS

Deg.	Min.	Sine	Cosine	Tangent	Cotangent	Secant	Cosecant	Min.	Deg.
9	0	0.15643	0.98769	0.15838	6.3137	1.0125	6.3924	0	81
	10	0.15931	0.98723	0.16137	6.1970	1.0129	6.2772	50	
	20	0.16218	0.98676	0.16435	6.0844	1.0134	6.1661	40	
	30	0.16505	0.98628	0.16734	5.9758	1.0139	6.0588	30	
	40	0.16791	0.98580	0.17033	5.8708	1.0144	5.9554	20	
	50	0.17078	0.98531	0.17333	5.7694	1.0149	5.8554	10	
10	0	0.17365	0.98481	0.17633	5.6713	1.0154	5.7588	0	80
	10	0.17651	0.98430	0.17933	5.5764	1.0159	5.6653	50	
	20	0.17937	0.98378	0.18233	5.4845	1.0165	5.5749	40	
	30	0.18223	0.98325	0.18534	5.3955	1.0170	5.4874	30	
	40	0.18509	0.98272	0.18835	5.3093	1.0176	5.4026	20	
	50	0.18795	0.98218	0.19136	5.2257	1.0181	5.3205	10	
11	0	0.19081	0.98163	0.19438	5.1445	1.0187	5.2408	0	79
	10	0.19366	0.98107	0.19740	5.0658	1.0193	5.1636	50	
	20	0.19652	0.98050	0.20042	4.9894	1.0199	5.0886	40	
	30	0.19937	0.97992	0.20345	4.9151	1.0205	5.0158	30	
	40	0.20222	0.97934	0.20648	4.8430	1.0211	4.9452	20	
	50	0.20506	0.97875	0.20952	4.7728	1.0217	4.8765	10	
12	0	0.20791	0.97815	0.21256	4.7046	1.0223	4.8097	0	78
	10	0.21076	0.97754	0.21560	4.6382	1.0230	4.7448	50	
	20	0.21360	0.97692	0.21864	4.5736	1.0236	4.6817	40	
	30	0.21644	0.97630	0.22169	4.5107	1.0243	4.6201	30	
	40	0.21928	0.97566	0.22475	4.4494	1.0249	4.5604	20	
	50	0.22211	0.97502	0.22781	4.3897	1.0256	4.5021	10	
13	0	0.22495	0.97437	0.23087	4.3315	1.0263	4.4454	0	77
	10	0.22778	0.97371	0.23393	4.2747	1.0270	4.3901	50	
	20	0.23061	0.97304	0.23700	4.2193	1.0277	4.3362	40	
	30	0.23344	0.97237	0.24008	4.1653	1.0284	4.2836	30	
	40	0.23627	0.97169	0.24316	4.1126	1.0291	4.2324	20	
	50	0.23910	0.97099	0.24624	4.0611	1.0299	4.1824	10	
14	0	0.24192	0.97029	0.24933	4.0108	1.0306	4.1336	0	76
	10	0.24474	0.96959	0.25242	3.9616	1.0314	4.0859	50	
	20	0.24756	0.96887	0.25552	3.9136	1.0321	4.0394	40	
	30	0.25038	0.96815	0.25862	3.8667	1.0329	3.9939	30	
	40	0.25319	0.96741	0.26172	3.8208	1.0337	3.9495	20	
	50	0.25601	0.96667	0.26483	3.7759	1.0345	3.9061	10	
15	0	0.25882	0.96592	0.26795	3.7320	1.0353	3.8637	0	75
	10	0.26163	0.96517	0.27107	3.6891	1.0361	3.8222	50	
	20	0.26443	0.96440	0.27419	3.6470	1.0369	3.7816	40	
	30	0.26724	0.96363	0.27732	3.6059	1.0377	3.7420	30	
	40	0.27004	0.96285	0.28046	3.5656	1.0386	3.7031	20	
	50	0.27284	0.96206	0.28360	3.5261	1.0394	3.6651	10	
16	0	0.27564	0.96126	0.28674	3.4874	1.0403	3.6279	0	74
	10	0.27843	0.96045	0.28990	3.4495	1.0412	3.5915	50	
	20	0.28122	0.95964	0.29305	3.4124	1.0420	3.5559	40	
	30	0.28401	0.95882	0.29621	3.3759	1.0429	3.5209	30	
	40	0.28680	0.95799	0.29938	3.3402	1.0438	3.4867	20	
	50	0.28959	0.95715	0.30255	3.3052	1.0448	3.4532	10	
17	0	0.29237	0.95630	0.30573	3.2708	1.0457	3.4203	0	73
	10	0.29515	0.95545	0.30891	3.2371	1.0466	3.3881	50	
	20	0.29793	0.95459	0.31210	3.2041	1.0476	3.3565	40	
	30	0.30070	0.95372	0.31530	3.1716	1.0485	3.3255	30	
	40	0.30348	0.95284	0.31850	3.1397	1.0495	3.2951	20	
	50	0.30625	0.95195	0.32171	3.1084	1.0505	3.2653	10	
18	0	0.30902	0.95106	0.32492	2.0777	1.0515	3.2361	0	72
Deg.	Min.	Cosine	Sine	Cotangent	Tangent	Cosecant	Secant	Min.	Deg.

For functions from 72° to 81° read from bottom of table upward.

NATURAL TRIGONOMETRICAL FUNCTIONS

Deg.	Min.	Sine	Cosine	Tangent	Cotangent	Secant	Cosecant	Min.	Deg.
18	0	0.30902	0.95106	0.32492	3.0777	1.0515	3.2361	0	72
	10	0.31178	0.95015	0.32814	3.0475	1.0525	3.2074	50	
	20	0.31454	0.94924	0.33136	3.0178	1.0535	3.1792	40	
	30	0.31730	0.94832	0.33459	2.9887	1.0545	3.1515	30	
	40	0.32006	0.94740	0.33783	2.9600	1.0555	3.1244	20	
	50	0.32282	0.94646	0.34108	2.9319	1.0566	3.0977	10	
19	0	0.32557	0.94552	0.34433	2.9042	1.0576	3.0715	0	71
	10	0.32832	0.94457	0.34758	2.8770	1.0587	3.0458	50	
	20	0.33106	0.94361	0.35085	2.8502	1.0598	3.0206	40	
	30	0.33381	0.94264	0.35412	2.8239	1.0608	2.9957	30	
	40	0.33655	0.94167	0.35739	2.7980	1.0619	2.9713	20	
	50	0.33928	0.94068	0.36068	2.7725	1.0630	2.9474	10	
20	0	0.34202	0.93969	0.36397	2.7475	1.0642	2.9238	0	70
	10	0.34475	0.93869	0.36727	2.7228	1.0653	2.9006	50	
	20	0.34748	0.93769	0.37057	2.6985	1.0664	2.8778	40	
	30	0.35021	0.93667	0.37388	2.6746	1.0676	2.8554	30	
	40	0.35293	0.93565	0.37720	2.6511	1.0688	2.8334	20	
	50	0.35565	0.93462	0.38053	2.6279	1.0699	2.8117	10	
21	0	0.35837	0.93358	0.38386	2.6051	1.0711	2.7904	0	69
	10	0.36108	0.93253	0.38720	2.5826	1.0723	2.7694	50	
	20	0.36379	0.93148	0.39055	2.5605	1.0736	2.7488	40	
	30	0.36650	0.93042	0.39391	2.5386	1.0748	2.7285	30	
	40	0.36921	0.92935	0.39727	2.5171	1.0760	2.7085	20	
	50	0.37191	0.92827	0.40065	2.4960	1.0773	2.6888	10	
22	0	0.37461	0.92718	0.40403	2.4751	1.0785	2.6695	0	68
	10	0.37730	0.92609	0.40741	2.4545	1.0798	2.6504	50	
	20	0.37999	0.92499	0.41081	2.4342	1.0811	2.6316	40	
	30	0.38268	0.92388	0.41421	2.4142	1.0824	2.6131	30	
	40	0.38537	0.92276	0.41762	2.3945	1.0837	2.5949	20	
	50	0.38805	0.92164	0.42105	2.3750	1.0850	2.5770	10	
23	0	0.39073	0.92050	0.42447	2.3558	1.0864	2.5593	0	67
	10	0.39341	0.91936	0.42791	2.3369	1.0877	2.5419	50	
	20	0.39608	0.91822	0.43136	2.3183	1.0891	2.5247	40	
	30	0.39875	0.91706	0.43481	2.2998	1.0904	2.5078	30	
	40	0.40141	0.91590	0.43827	2.2817	1.0918	2.4912	20	
	50	0.40408	0.91472	0.44175	2.2637	1.0932	2.4748	10	
24	0	0.40674	0.91354	0.44523	2.2460	1.0946	2.4586	0	66
	10	0.40939	0.91236	0.44872	2.2286	1.0961	2.4426	50	
	20	0.41204	0.91116	0.45222	2.2113	1.0975	2.4269	40	
	30	0.41469	0.90996	0.45573	2.1943	1.0989	2.4114	30	
	40	0.41734	0.90875	0.45924	2.1775	1.1004	2.3961	20	
	50	0.41998	0.90753	0.46277	2.1609	1.1019	2.3811	10	
25	0	0.42262	0.90631	0.46631	2.1445	1.1034	2.3662	0	65
	10	0.42525	0.90507	0.46985	2.1283	1.1049	2.3515	50	
	20	0.42788	0.90383	0.47341	2.1123	1.1064	2.3371	40	
	30	0.43051	0.90258	0.47697	2.0965	1.1079	2.3228	30	
	40	0.43313	0.90133	0.48055	2.0809	1.1095	2.3087	20	
	50	0.43575	0.90006	0.48414	2.0655	1.1110	2.2949	10	
26	0	0.43837	0.89879	0.48773	2.0503	1.1126	2.2812	0	64
	10	0.44098	0.89751	0.49134	2.0352	1.1142	2.2676	50	
	20	0.44359	0.89623	0.49495	2.0204	1.1158	2.2543	40	
	30	0.44620	0.89493	0.49858	2.0057	1.1174	2.2411	30	
	40	0.44880	0.89363	0.50222	1.9912	1.1190	2.2282	20	
	50	0.45140	0.89232	0.50587	1.9768	1.1207	2.2153	10	
27	0	0.45399	0.89101	0.50952	1.9626	1.1223	2.2027	0	63
Deg.	Min.	Cosine	Sine	Cotangent	Tangent	Cosecant	Secant	Min.	Deg.

For functions from 63° to 72° read from bottom of table upward.

NATURAL TRIGONOMETRICAL FUNCTIONS

Deg.	Min.	Sine	Cosine	Tangent	Cotangent	Secant	Cosecant	Min.	Deg.
27	0	0.45399	0.89101	0.50952	1.9626	1.1223	2.2027	0	63
	10	0.45658	0.88968	0.51319	1.9486	1.1240	2.1902	50	
	20	0.45917	0.88835	0.51687	1.9347	1.1257	2.1778	40	
	30	0.46175	0.88701	0.52057	1.9210	1.1274	2.1657	30	
	40	0.46433	0.88566	0.52427	1.9074	1.1291	2.1536	20	
	50	0.46690	0.88431	0.52798	1.8940	1.1308	2.1418	10	
28	0	0.46947	0.88295	0.53171	1.8807	1.1326	2.1300	0	62
	10	0.47204	0.88158	0.53545	1.8676	1.1343	2.1185	50	
	20	0.47460	0.88020	0.53919	1.8546	1.1361	2.1070	40	
	30	0.47716	0.87882	0.54295	1.8418	1.1379	2.0957	30	
	40	0.47971	0.87742	0.54673	1.8291	1.1397	2.0846	20	
	50	0.48226	0.87603	0.55051	1.8165	1.1415	2.0735	10	
29	0	0.48481	0.87462	0.55431	1.8040	1.1433	2.0627	0	61
	10	0.48735	0.87320	0.55812	1.7917	1.1452	2.0519	50	
	20	0.48989	0.87178	0.56194	1.7795	1.1471	2.0413	40	
	30	0.49242	0.87035	0.56577	1.7675	1.1489	2.0308	30	
	40	0.49495	0.86892	0.56962	1.7555	1.1508	2.0204	20	
	50	0.49748	0.86748	0.57348	1.7437	1.1528	2.0101	10	
30	0	0.50000	0.86603	0.57735	1.7320	1.1547	2.0000	0	60
	10	0.50252	0.86457	0.58123	1.7205	1.1566	1.9900	50	
	20	0.50503	0.86310	0.58513	1.7090	1.1586	1.9801	40	
	30	0.50754	0.86163	0.58904	1.6977	1.1606	1.9703	30	
	40	0.51004	0.86015	0.59297	1.6864	1.1626	1.9606	20	
	50	0.51254	0.85866	0.59691	1.6753	1.1646	1.9510	10	
31	0	0.51504	0.85717	0.60086	1.6643	1.1666	1.9416	0	59
	10	0.51753	0.85566	0.60483	1.6534	1.1687	1.9322	50	
	20	0.52002	0.85416	0.60881	1.6425	1.1707	1.9230	40	
	30	0.52250	0.85264	0.61280	1.6318	1.1728	1.9139	30	
	40	0.52498	0.85112	0.61681	1.6212	1.1749	1.9048	20	
	50	0.52745	0.84959	0.62083	1.6107	1.1770	1.8959	10	
32	0	0.52992	0.84805	0.62487	1.6003	1.1792	1.8871	0	58
	10	0.53238	0.84650	0.62892	1.5900	1.1813	1.8783	50	
	20	0.53484	0.84495	0.63299	1.5798	1.1835	1.8697	40	
	30	0.53730	0.84339	0.63707	1.5697	1.1857	1.8611	30	
	40	0.53975	0.84182	0.64117	1.5596	1.1879	1.8527	20	
	50	0.54220	0.84025	0.64528	1.5497	1.1901	1.8443	10	
33	0	0.54464	0.83867	0.64941	1.5399	1.1924	1.8361	0	57
	10	0.54708	0.83708	0.65355	1.5301	1.1946	1.8279	50	
	20	0.54951	0.83549	0.65771	1.5204	1.1969	1.8198	40	
	30	0.55194	0.83388	0.66188	1.5108	1.1992	1.8118	30	
	40	0.55436	0.83228	0.66608	1.5013	1.2015	1.8039	20	
	50	0.55678	0.83066	0.67028	1.4919	1.2039	1.7960	10	
34	0	0.55919	0.82904	0.67451	1.4826	1.2062	1.7883	0	56
	10	0.56160	0.82741	0.67875	1.4733	1.2086	1.7806	50	
	20	0.56401	0.82577	0.68301	1.4641	1.2110	1.7730	40	
	30	0.56641	0.82413	0.68728	1.4550	1.2134	1.7655	30	
	40	0.56880	0.82247	0.69157	1.4460	1.2158	1.7581	20	
	50	0.57119	0.82082	0.69588	1.4370	1.2183	1.7507	10	
35	0	0.57358	0.81915	0.70021	1.4281	1.2208	1.7434	0	55
	10	0.57596	0.81748	0.70455	1.4193	1.2233	1.7362	50	
	20	0.57833	0.81580	0.70891	1.4106	1.2258	1.7291	40	
	30	0.58070	0.81411	0.71329	1.4019	1.2283	1.7220	30	
	40	0.58307	0.81242	0.71769	1.3933	1.2309	1.7151	20	
	50	0.58543	0.81072	0.72211	1.3848	1.2335	1.7081	10	
36	0	0.58778	0.80902	0.72654	1.3764	1.2361	1.7013	0	54
Deg.	Min.	Cosine	Sine	Cotangent	Tangent	Cosecant	Secant	Min.	Deg.

For functions from 54° to 63° read from bottom of table upward.

NATURAL TRIGONOMETRICAL FUNCTIONS

Deg.	Min.	Sine	Cosine	Tangent	Cotangent	Secant	Cosecant	Min.	Deg.
36	0	0.58778	0.80902	0.72654	1.3764	1.2361	1.7013	0	54
	10	0.59014	0.80730	0.73100	1.3680	1.2387	1.6945	50	
	20	0.59248	0.80558	0.73547	1.3597	1.2413	1.6878	40	
	30	0.59482	0.80386	0.73996	1.3514	1.2440	1.6812	30	
	40	0.59716	0.80212	0.74447	1.3432	1.2467	1.6746	20	
	50	0.59949	0.80038	0.74900	1.3351	1.2494	1.6681	10	
37	0	0.60181	0.79863	0.75355	1.3270	1.2521	1.6616	0	53
	10	0.60413	0.79688	0.75812	1.3190	1.2549	1.6552	50	
	20	0.60645	0.79512	0.76271	1.3111	1.2577	1.6489	40	
	30	0.60876	0.79335	0.76733	1.3032	1.2605	1.6427	30	
	40	0.61107	0.79158	0.77196	1.2954	1.2633	1.6365	20	
	50	0.61337	0.78980	0.77661	1.2876	1.2661	1.6303	10	
38	0	0.61566	0.78801	0.78128	1.2799	1.2690	1.6243	0	52
	10	0.61795	0.78622	0.78598	1.2723	1.2719	1.6182	50	
	20	0.62023	0.78441	0.79070	1.2647	1.2748	1.6123	40	
	30	0.62251	0.78261	0.79543	1.2572	1.2778	1.6064	30	
	40	0.62479	0.78079	0.80020	1.2497	1.2807	1.6005	20	
	50	0.62706	0.77897	0.80498	1.2423	1.2837	1.5947	10	
39	0	0.62932	0.77715	0.80978	1.2349	1.2867	1.5890	0	51
	10	0.63158	0.77531	0.81461	1.2276	1.2898	1.5833	50	
	20	0.63383	0.77347	0.81946	1.2203	1.2929	1.5777	40	
	30	0.63608	0.77162	0.82434	1.2131	1.2960	1.5721	30	
	40	0.63832	0.76977	0.82923	1.2059	1.2991	1.5666	20	
	50	0.64056	0.76791	0.83415	1.1988	1.3022	1.5611	10	
40	0	0.64279	0.76604	0.83910	1.1917	1.3054	1.5557	0	50
	10	0.64501	0.76417	0.84407	1.1847	1.3086	1.5503	50	
	20	0.64723	0.76229	0.84906	1.1778	1.3118	1.5450	40	
	30	0.64945	0.76041	0.85408	1.1708	1.3151	1.5398	30	
	40	0.65166	0.75851	0.85912	1.1640	1.3184	1.5345	20	
	50	0.65386	0.75661	0.86419	1.1571	1.3217	1.5294	10	
41	0	0.65606	0.75471	0.86929	1.1504	1.3250	1.5242	0	49
	10	0.65825	0.75280	0.87441	1.1436	1.3284	1.5192	50	
	20	0.66044	0.75088	0.87955	1.1369	1.3318	1.5141	40	
	30	0.66262	0.74895	0.88472	1.1303	1.3352	1.5092	30	
	40	0.66479	0.74702	0.88992	1.1237	1.3386	1.5042	20	
	50	0.66697	0.74509	0.89515	1.1171	1.3421	1.4993	10	
42	0	0.66913	0.74314	0.90040	1.1106	1.3456	1.4945	0	48
	10	0.67129	0.74119	0.90568	1.1041	1.3492	1.4897	50	
	20	0.67344	0.73924	0.91099	1.0977	1.3527	1.4849	40	
	30	0.67559	0.73728	0.91633	1.0913	1.3563	1.4802	30	
	40	0.67773	0.73531	0.92170	1.0849	1.3600	1.4755	20	
	50	0.67987	0.73333	0.92709	1.0786	1.3636	1.4709	10	
43	0	0.68200	0.73135	0.93251	1.0724	1.3673	1.4663	0	47
	10	0.68412	0.72937	0.93797	1.0661	1.3710	1.4617	50	
	20	0.68624	0.72737	0.94345	1.0599	1.3748	1.4572	40	
	30	0.68835	0.72537	0.94896	1.0538	1.3786	1.4527	30	
	40	0.69046	0.72337	0.95451	1.0476	1.3824	1.4483	20	
	50	0.69256	0.72136	0.96008	1.0416	1.3863	1.4439	10	
44	0	0.69466	0.71934	0.96569	1.0355	1.3902	1.4395	0	46
	10	0.69675	0.71732	0.97133	1.0295	1.3941	1.4352	50	
	20	0.69883	0.71529	0.97700	1.0235	1.3980	1.4310	40	
	30	0.70091	0.71325	0.98270	1.0176	1.4020	1.4267	30	
	40	0.70298	0.71121	0.98843	1.0117	1.4060	1.4225	20	
	50	0.70505	0.70916	0.99420	1.0058	1.4101	1.4183	10	
45	0	0.70711	0.70711	1.00000	1.0000	1.4142	1.4142	0	45
Deg.	Min.	Cosine	Sine	Cotangent	Tangent	Cosecant	Secant	Min.	Deg.

For functions from 45° to 54° read from bottom of table upward.

LINEAR EXPANSION OF CAST IRON PIPE

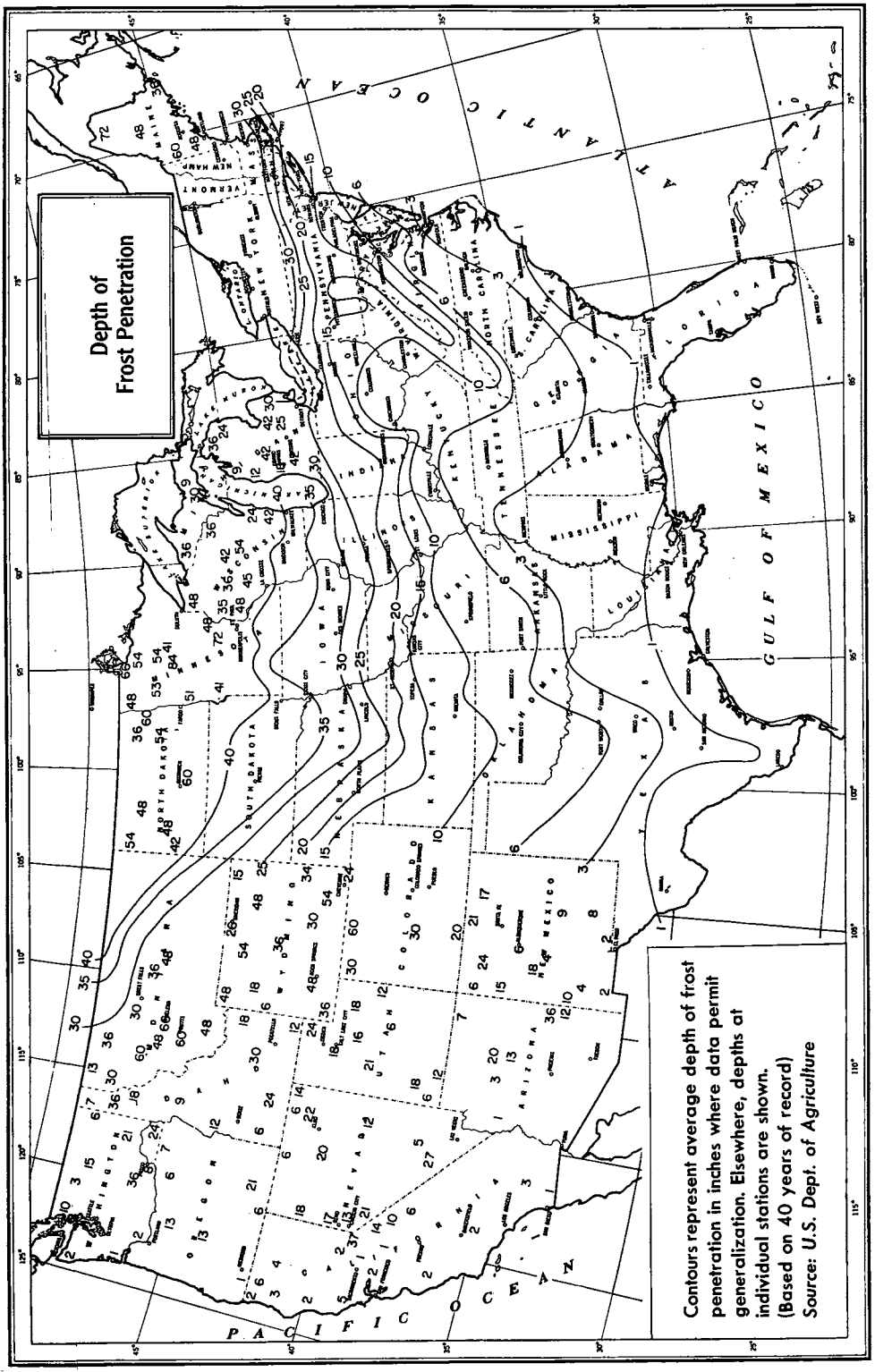
The coefficient of linear expansion of cast iron may be taken as 0.0000058 per degree Fahrenheit. The expansion or contraction in *inches* that will take place in a line of given length with various temperature changes is shown in the following table:

Temperature Difference °F	Length of Line in Feet			
	100	500	1000	5280
	Expansion and Contraction in Inches			
5	0.035	0.17	0.35	1.83
10	0.070	0.35	0.70	3.67
20	0.139	0.70	1.39	7.34
30	0.209	1.04	2.09	11.01
40	0.278	1.39	2.78	14.70
50	0.348	1.74	3.48	18.35
60	0.418	2.09	4.18	22.04
70	0.487	2.44	4.87	25.72
80	0.557	2.79	5.57	29.39
90	0.626	3.13	6.26	33.05
100	0.696	3.48	6.96	36.71
120	0.835	4.17	8.35	44.10
150	1.043	5.22	10.43	55.10

INCHES CONVERTED TO DECIMALS OF A FOOT

Inches		Decimal of a Foot	Inches		Decimal of a Foot
	1/8	.010416		1/8	.510416
	1/4	.020833		1/4	.520833
	3/8	.031250		3/8	.531250
0	1/2	.041666	6	1/2	.541666
	5/8	.052083	.50	5/8	.552083
	3/4	.062500		3/4	.562500
	7/8	.072916		7/8	.572916
	1/8	.093750		1/8	.593750
	1/4	.104166		1/4	.604166
	3/8	.114583		3/8	.614583
1	1/2	.125000	7	1/2	.625000
.083333	5/8	.135416	.583333	5/8	.635416
	3/4	.145833		3/4	.645833
	7/8	.156250		7/8	.656250
	1/8	.177083		1/8	.677083
	1/4	.187500		1/4	.687500
	3/8	.197916		3/8	.697916
2	1/2	.208333	8	1/2	.708333
.166666	5/8	.218750	.666666	5/8	.718750
	3/4	.229166		3/4	.729166
	7/8	.239583		7/8	.739583
	1/8	.260416		1/8	.760416
	1/4	.270833		1/4	.770833
	3/8	.281250		3/8	.781250
3	1/2	.291666	9	1/2	.791666
.250	5/8	.302083	.750	5/8	.802083
	3/4	.312500		3/4	.812500
	7/8	.322916		7/8	.822916
	1/8	.343750		1/8	.843750
	1/4	.354166		1/4	.854166
	3/8	.364583		3/8	.864583
4	1/2	.375000	10	1/2	.875000
.333333	5/8	.385416	.833333	5/8	.885416
	3/4	.395833		3/4	.895833
	7/8	.406250		7/8	.906250
	1/8	.427083		1/8	.927083
	1/4	.437500		1/4	.937500
	3/8	.447916		3/8	.947916
5	1/2	.458333	11	1/2	.958333
.416666	5/8	.468750	.916666	5/8	.968750
	3/4	.479166		3/4	.979166
	7/8	.489583		7/8	.989583

FROST PENETRATION CHART



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